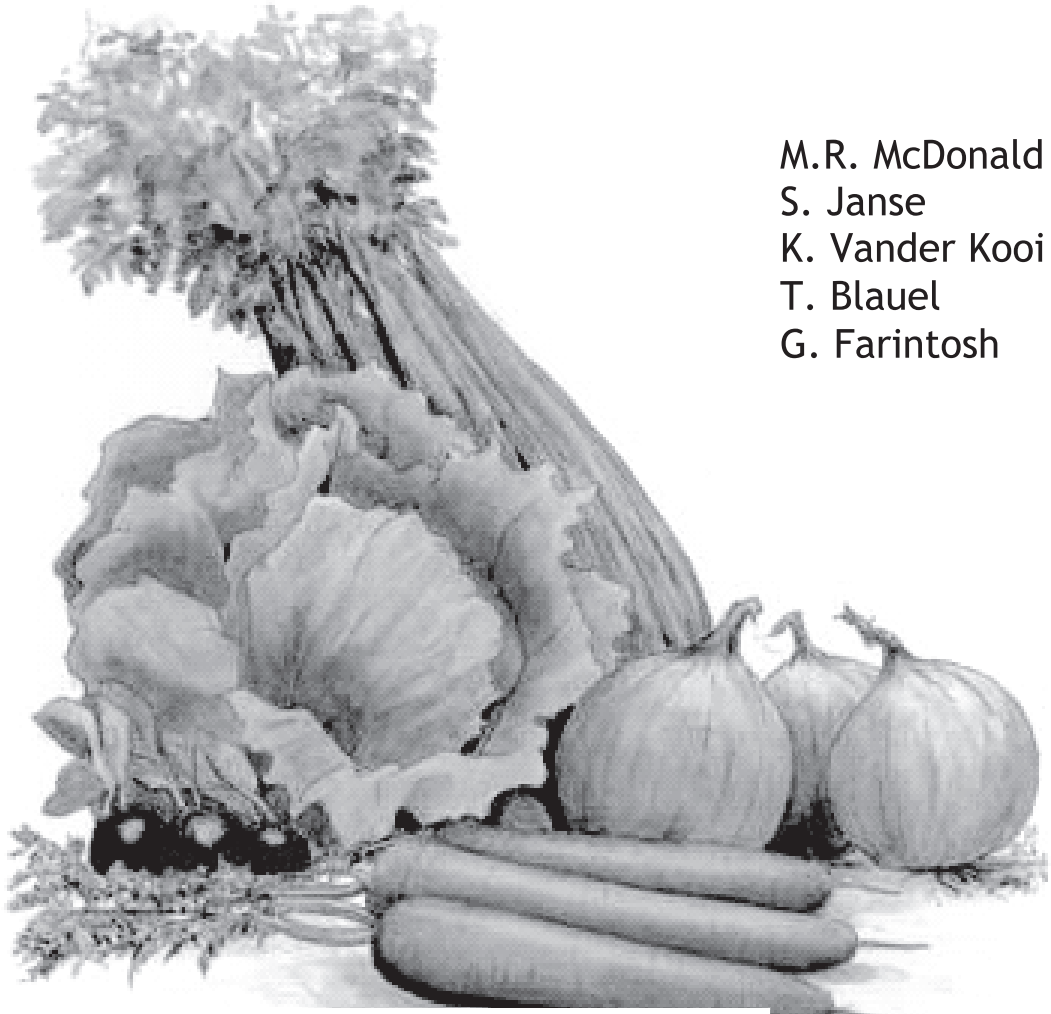
Muck Vegetable Cultivar Trial & Research Report 2024



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K. Vander Kooi
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G. Farintosh

UNIVERSITY of GUELPH

Office of Research &
Dept. of Plant Agriculture
Report No. 74

Ontario Crops
Research Centre
Bradford, Ontario

Research and Cultivar Trial Report for 2024

University of Guelph
Ontario Crops Research Centre - Bradford
Office of Research &
Department of Plant Agriculture
Muck Crops Research Station

1125 Woodchoppers Lane
King, Ontario L7B 0E9
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Web Site: https://bradford-crops.uoguelph.ca/
X Account: @MuckIPM
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RESEARCH PROJECTS – continued

Cole Crops

Miscellaneous

Integrated Pest Management

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CULTIVAR TRIALS **Page**

STAFF - 2024

UNIVERSITY OF GUELPH
Ontario Crops Research Centre - Bradford
Office of Research and
Department of Plant Agriculture

MUCK CROPS RESEARCH STATION

Staff:

Shawn Janse	Research Station Manager
Mary Ruth McDonald, Ph.D., P.Ag.	Research Scientist
Kevin Vander Kooi	Agricultural Technician
Geoff Farintosh	Agricultural Technician
Tyler Blauel	IPM Supervisor / Facility Technician
Afsaneh Sedaghatkish	Post Doctoral Fellow

IPM Scouts:

Domenic Blass	Eriel Strauch

Seasonal Contracts:

Kieran Farhall	Summer Assistant
Solana Jimenez Vasquez	Summer Assistant
Madison Sirois	Summer Assistant
Ryan Tan	Summer Assistant
James Watt	Summer Assistant
Maia Davey	Summer Assistant
Adriana Verkaik	Summer Assistant

Graduate Students:

Ifesinachi Ezeh	Department of Plant Agriculture
Umbrin Ilyas	Department of Plant Agriculture
Julia Scicluna	Department of Plant Agriculture
Michael Kooy	Department of Plant Agriculture
Kelly Ruigrot	Department of Plant Agriculture
Kirsten Holy	Department of Plant Agriculture

CO-OPERATING COMPANIES 2024

CO-OPERATING RESEARCH STAFF - EDUCATION/RESEARCH/GOVERNMENT

Phil Simon	USDA/ARS, Madison, WI, USA
Dennis Van Dyk	Ontario Ministry of Agriculture, Food and Agribusiness, Guelph, ON, Canada
Kristen Obeid	Ontario Ministry of Agriculture, Food and Agribusiness, Harrow, ON, Canada

CO-OPERATING RESEARCH STAFF - INDUSTRY/PRIVATE SECTOR

Matt Sheppard	Bradford Cooperative Storage Ltd, Bradford, ON, Canada
Alan Butterfield	California Fresh Carrot Advisory Board, Dinuba, CA, USA
Dan Brotslaw	California Garlic & Onion Research Advisory Board, Clovis, CA, USA
Norm Charbonneau	Fresh Vegetable Growers of Ontario, Ridgetown, ON, Canada
Marinda DeGier	Syngenta Canada Inc., Plattsville, ON, Canada
Jen Foster	Syngenta Canada Inc., Plattsville, ON, Canada
Chuck Baresich	Haggerty Creek Ltd, Bothwell, ON, Canada
Jason Gharibo	Haggerty Creek Ltd, Bothwell, ON, Canada
Cheryl Truemen	Syngenta Canada Inc., Guelph, ON, Canada
Sherri Tedford	Bayer Crop Science, ON, Canada
Julian Golec	Corteva Agriscience, Grover Beach, CA, USA
Xavier Hebert-Couturier	Picketa Systems Inc, Fredricton, NB, Canada
Marija Zivanovic	ISK Biosciences, Concord, OH, USA

SEED SOURCES - 2024 - CULTIVAR TRIALS

Bejo **Bejo Seeds Inc.**, 1088 Healey Road, Geneva, New York, 14456, U.S.A.
Tel: (308) 789-4155

CF **Clifton Seed Company**, P.O. Box 206, Faison, North Carolina, 28341, U.S.A.
Tel: (800) 231-9359

Cro **Crookham Company**, P.O. Box 520, Caldwell, Idaho, 83606, U.S.A.
Tel: (208) 459-7451

EZ **Enza Zaden**, 360 St Patrice, Sherrington, Quebec, J0L 2N0, Canada
Tel: (518) 390-2837

Haz **Hazera Seeds**, 3155 SW 10th Street, Suite 6L, Deerfield Beach, Florida, 33442, U.S.A.
Tel: (954) 429-9445

ILL **Illinois Foundation Seeds Inc**, 1083 County Road 900N, Tolono, IL, 61880, U.S.A.
Tel: (217) 485-6260

Nor **Norseco**, 2914 Boul. Cure-Labelle, Laval, Quebec, H7P 5R9, Canada
Tel: (514) 332-2275

RZ **Rijk Zwaan**, 701 La Guardia Street, Suite A, Salinas, California, 93905, U.S.A.
Tel: (831) 455-3000

Sem **Seminis Vegetable Seeds,** 2700 Camino Del Sol, Oxnard, California, 93030, U.S.A.
Tel: (866) 334-1056

SN **Seminova,** 20 rue de l'Industrie, C.P. 3640, St-Remi, Quebec, J0L 2N0, Canada
Tel: (450) 454-5155

Sto **Stokes Seed Ltd.**, 296 Collier Rd, Box 10, Thorold, Ontario, L2V 5E9, Canada
Tel: (800) 396-9238

Tak **American Takii Inc.**, 301 Natividad Rd., Salinas, California, 93906, U.S.A.
Tel: (408) 443-4901

Vil **Vilmorin Inc.**, 2551 N Dragoon Street # 131, Tucson, Arizona, 85745, U.S.A.
Tel: (520) 884-0011

We would like to thank our seed suppliers for the various cultivar trial submissions in 2024.

LEGEND OF SEED SOURCES

Bejo Bejo Seeds Inc.

BCSVS Bayer Crop Science Vegetable Seeds

CF Clifton Seed Company

Cro Crookham Company

EZ Enza Zaden

Haz Hazera Seeds Inc

HM Harris Moran Seeds

ILL Illinois Foundation Seeds

Pure Pure Line Seeds

Nor Norseco Inc.

Rog Rogers Seed

RZ Rijk Zwaan Export B.V.

Sak Sakata Seed America Inc.

Sem Seminis Vegetable Seeds

Sieg Siegers Seed Co.

Sol Solar Seed Co.

Sto Stokes Seeds Ltd.

SN Seminova

Swy Seedway Inc.

Toz Tozer Seeds America

Tak American Takii Inc.

UNF Co-op Uniforce

Vil Vilmorin Inc.

INTRODUCTION AND ACKNOWLEDGMENTS

The Ontario Crops Research Centre – Bradford, as part of the Department of Plant Agriculture and the Office of Research, University of Guelph, is responsible for conducting and coordinating research projects to solve problems in the production of vegetables grown in organic soils.

In 2024, Ontario Crops Research Centre – Bradford staff conducted, and/or co-operated on research projects with researchers from the Department of Plant Agriculture at the University of Guelph; researchers from OMAFRA, Agriculture and Agri-Food Canada, the USDA, and Cornell University; research departments of the Crop Protection Chemical Industry, numerous seed companies, growers' organizations and growers.

This report consists of two sections: the first contains highlights of research projects which were conducted in 2024 under the supervision of Professor Mary Ruth McDonald and other researchers at the University of Guelph. The second section contains highlights of various muck crops cultivar evaluations in 2024 in-field and storage trials, under the supervision of the Research Station Manager, Shawn Janse. The results published in this report should be treated as a progress report. Some of the chemicals used in the trials are not registered for use on the crops they were applied to. Additional trials may be necessary before firm conclusions and recommendations can be made.

The Research Centre is an active participant in the training of new researchers on muck vegetables through the Graduate Student Program of the University of Guelph. Presently the Ontario Crops Research Centre – Bradford has five M.Sc. and one Ph.D. graduate students working on muck vegetables.

The Research Centre continues to conduct research to assist in the future registration of chemicals for muck vegetables. Recently, research programs have aided in the registration of Chateau herbicide for onions (Dr. Clarence Swanton) and the registration of Delegate and Movento for thrips on onions and Evergol Prime (penflufen) for onion smut (Dr. Mary Ruth McDonald). While not a common muck vegetable, research also supported the registration of Velum Prime (fluopyram) for the control of stem and blub nematode on garlic.

We would like to take this opportunity to express our sincere appreciation to the staff for their efforts in conducting these research projects, cultivar evaluation trials and producing this report. Many thanks also to all the co-operating researchers, technicians, industry personnel, and growers for their continued support and interest in muck crops.

Mary Ruth McDonald, Ph.D., P.Ag.
Professor
Department of Plant Agriculture

Shawn Janse
Research Station Manager
Office of Research

Weather Data 2024

PRECIPITATION

Month	2014		2015		2016		2017		2018		2019	
	Rain mm	Snow cm	Rain mm	Snow cm	Rain mm	Snow cm	Rain mm	Snow cm	Rain mm	Snow cm	Rain mm	Snow cm
January	28	19	0	15	23	2	61	14	34	14	52	25
February	19	45	0	32	29	12	28	23	28	14	43	32
March	9	16	10	5	80	30	54	8	21	39	17	14
April	82	2	48	0	22	18	87	12	117	89	0	12
May	58	0	40	0	45	0	120	0	82	77	0	0
June	88	0	171	0	39	0	209	0	59	100	0	0
July	92	0	36	0	51	0	74	0	104	93	0	0
August	63	0	79	0	58	0	53	0	109	80	0	0
September	113	0	27	0	25	0	38	0	20	61	0	0
October	67	0	54	0	41	0	99	0	69	74	0	0
November	24	5	40	0	40	5	22	11	63	27	31	31
December	11	22	39	3	20	65	2	32	44	44	40	10
Annual	**654**	**109**	**544**	**55**	**473**	**132**	**847**	**100**	**750**	**124**	**712**	**183**
Total Precip.	**763**		**599**		**605**		**947**		**874**		**895**	

LTA = Long Term Average for U of Guelph, Dept. of Plant Agriculture - Kettleby
1125 Woodchoppers Lane, King, ON, L7B 0E9 50 Years (1975-2024)

PRECIPITATION

Month	2020		2021		2022		2023		2024		LTA	
	Rain mm	Snow cm	Rain mm	Snow cm	Rain mm	Snow cm	Rain mm	Snow cm	Rain mm	Snow cm	Rain mm	Snow cm
January	84	24	4	22	1	46	38	33	69	32	22	28
February	0	44	5	44	25	41	45	24	18	9	20	27
March	42	5	34	3	21	21	17	35	32	20	31	15
April	30	0	44	4	44	5	28	0	128	0	57	4
May	38	3	22	0	50	0	52	0	83	0	71	0
June	77	0	56	0	90	0	82	0	79	0	81	0
July	58	0	105	0	74	0	113	0	85	0	85	0
August	140	0	41	0	82	0	61	0	54	0	79	0
September	65	0	173	0	43	0	4	0	21	0	77	0
October	61	0	77	0	30	0	35	0	20	0	66	1
November	27	22	24	13	43	10	42	2	38	0	50	10
December	29	39	36	21	43	12	52	15	39	34	28	28
Annual	**651**	**138**	**621**	**107**	**546**	**135**	**569**	**109**	**666**	**95**	**666**	**111**
Total Precip.	**789**		**728**		**681**		**678**		**761**		**777**	

LTA = Long Term Average for U of Guelph, Dept. of Plant Agriculture - Kettleby
1125 Woodchoppers Lane, King, ON, L7B 0E9 50 Years (1975-2024)

MEAN TEMPERATURE (°C)

	2014		2015		2016		2017		2018		2019	
Month	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**
January	-3.9	-14.7	-3.2	-13.1	0.4	-7.8	0.8	-5.2	3.3	-3.2	-3.7	-12.3
February	-2.2	-17.3	-8.2	-19.8	1.9	-8.3	3.7	-5.0	1.7	-7.7	-0.4	-9.9
March	1.9	-12.2	2.7	-7.4	6.6	-2.8	3.4	-5.0	2.9	-4.5	2.8	-6.0
April	11.9	0.3	13.0	0.8	10.3	-1.7	14.4	3.4	7.0	-1.9	5.8	1.3
May	20.9	6.6	23.5	8.3	21.2	6.3	17.3	7.2	23.4	9.0	16.5	6.3
June	27.1	11.6	23.8	11.8	26.2	11.1	24.1	12.8	25.1	12.2	23.5	11.6
July	25.9	12.5	28.1	13.3	28.8	15.3	26.4	14.9	28.4	15.0	29.3	15.4
August	25.8	12.5	25.7	13.2	29.6	15.5	25.2	12.6	27.8	16.9	26.3	12.4
September	22.8	8.5	25.9	12.1	24.8	10.0	25.0	9.6	23.7	11.3	21.6	9.6
October	15.3	5.5	14.6	3.9	15.9	5.9	17.2	5.8	12.2	3.8	14.8	4.3
November	5.2	-1.0	10.8	0.6	11.5	0.9	7.3	-1.8	3.3	-3.2	4.0	-3.9
December	2.0	-2.9	6.9	-0.1	1.3	-5.8	-2.0	-11.6	1.7	-4.3	2.2	-6.7
Mean	**12.7**	**0.8**	**13.6**	**2.0**	**14.9**	**3.2**	**13.6**	**3.1**	**13.4**	**3.6**	**11.9**	**1.8**

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MEAN TEMPERATURE (°C)

	2020		2021		2022		2023		2024		LTA	
Month	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**
January	0.9	-6.5	-0.5	-6.9	-4.1	-16.0	1.0	-3.6	-0.9	-5.4	-2.2	-10.6
February	-0.1	-8.3	-1.6	-11.6	-0.5	-10.5	1.8	-7.9	3.7	-5.0	-1.0	-10.3
March	6.6	-1.6	8.7	-3.7	4.3	-3.4	4.3	-4.8	7.2	-1.4	3.6	-5.3
April	10.0	0.0	12.6	2.3	11.0	1.0	15.1	2.6	12.7	3.0	11.4	1.1
May	17.4	5.7	19.9	5.2	22.1	8.0	20.5	4.1	21.4	9.4	19.3	6.8
June	26.4	12.0	27.0	15.2	25.7	10.8	24.4	11.8	24.7	13.7	24.3	11.7
July	29.6	16.9	25.2	14.2	27.7	12.6	26.8	15.0	28.0	14.6	26.8	14.2
August	26.8	14.3	28.9	15.5	27.3	13.9	24.7	13.1	26.2	12.9	25.7	13.1
September	21.3	8.7	22.1	9.5	22.3	10.7	26.9	9.5	24.9	10.2	21.5	9.2
October	12.6	3.6	16.8	8.7	16.9	2.1	16.0	7.0	18.0	3.1	14.1	3.9
November	10.7	1.5	7.5	-1.6	9.8	-0.1	6.9	-1.7	9.5	0.8	7.0	-0.9
December	1.7	-4.0	3.8	-3.0	1.7	-4.7	4.0	-0.6	1.3	-5.0	0.7	-6.3
Mean	**13.7**	**3.5**	**14.2**	**3.7**	**13.7**	**2.0**	**14.4**	**3.7**	**14.7**	**4.2**	**12.6**	**2.2**

LTA = Long Term Average for U of Guelph, Dept. of Plant Agriculture - Kettleby
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EXTREME TEMPERATURE (°C)

	2014		2015		2016		2017		2018		2019	
Month	**H**	**L**	**H**	**L**	**H**	**L**	**H**	**L**	**H**	**L**	**H**	**L**
January	8.3	-30.4	5.3	-21.4	10.3	-19	7.2	-16.8	11.4	-28.6	6.6	-23.5
February	7.6	-30.2	-1.8	-30.8	15.4	-28.8	16.7	-14.8	14.7	-21.7	11.2	-23.4
March	12.9	-27.8	12.9	-26.3	18.5	-14.7	14.8	-17.3	10.3	-11.7	11.6	-18.7
April	23.4	-7.3	22.7	-5.1	26.2	-15.3	26.6	-1.6	18.8	-8.3	14.4	-6.4
May	31.9	-0.1	30.8	-1.2	33.2	-1.6	31.5	1.1	30.6	-1.0	24.2	-0.3
June	32.7	2.8	29.1	4.1	34.2	3.1	32.6	4.5	33.2	5.9	31.4	2.8
July	31.4	6.5	34.2	7.2	35.1	8.4	30.8	10.5	35.3	8.6	34	9.3
August	32.6	5.7	32.8	6.9	34.8	9.8	30.4	5.3	33.1	10.9	30.8	6.8
September	32.1	0.1	34.1	4.3	34.2	1.2	34.6	1.1	33.4	1.9	29.9	1.0
October	24.4	-1.5	23.9	-3.1	25.8	-3.5	26.0	-1.6	28.7	-3.3	27.2	-2.4
November	16.6	-10.3	22.1	-6.8	19.1	-6.5	22.6	-14.4	14.5	-25.3	11.5	-19.1
December	10.5	-11.1	15.4	-8.1	9.1	-15.9	12.1	-29.0	11.0	-12.4	8.9	-21.6
Annual High & Low	**32.6**	**-30.4**	**34.2**	**-30.8**	**35.1**	**-28.8**	**34.6**	**-29.0**	**35.3**	**-28.6**	**31.4**	**-23.5**

Extreme Temperatures for U of Guelph, Dept. of Plant Agriculture - Kettleby
1125 Woodchoppers Lane, King, ON, L7B 0E9 50 Years (1975-2024)

EXTREME TEMPERATURE (°C)

	2020		2021		2022		2023		2024		EXTREME TEMPERATURES			
Month	**H**	**L**	**H**	**L**	**H**	**L**	**H**	**L**	**H**	**L**	**H**	**Year**	**L**	**Year**
January	10.5	-24.1	7.3	-22.3	3.7	-28.4	4.1	-18.5	5.1	-17.3	15.8	2005	-36.0	1977
February	8.9	-25.4	6.4	-24.9	9.3	-19.9	13.0	-27.4	15.0	-18.3	16.7	2017	-33.0	1979
March	17.4	-18.7	21.0	-15.8	19.2	-12.2	11.9	-16.0	18.0	-11.5	26.4	2012	-29.0	1984
April	17.2	-5.6	23.0	-5.5	20.2	-3.9	29.9	-7.7	22.0	-2.9	30.0	1990	-15.3	2016
May	33.3	-5.4	32.2	-0.8	33.7	-0.3	30.5	-3.2	31.0	2.4	34.6	2006	-5.4	2020
June	33.6	3.6	34.0	4.6	36.1	3.8	31.9	5.5	35.4	6.5	36.1	2022	-2.0	1977
July	35.1	11.5	31.3	7.9	32.9	6.7	33.1	9.6	32.1	9	36.3	2011	2.5	1984
August	32.3	8.0	33.1	7.9	33.6	5.8	29.5	6.6	32.4	7.5	36.3	2001	0.5	1982
September	28.0	-1.3	26.7	4.6	31.7	1.5	34.8	1.6	29.7	4.3	35.3	2013	-6.5	1991
October	24.4	-6.1	27.0	-0.6	29.2	-3.4	30.6	-3.6	27.4	-4.0	30.6	2023	-9.0	1975
November	24.0	-7.4	19.2	-13.2	24.5	-8	15.8	-9.2	22.6	-6.2	24.5	2022	-25.3	2018
December	8.6	-13.1	16.9	-14.9	11.5	-17.5	12.1	-7.1	10.2	-22.4	20.0	1982	-31.5	1980
Annual High & Low	**35.1**	**-25.4**	**33.1**	**-24.9**	**36.1**	**-28.4**	**34.8**	**-27.4**	**35.4**	**-22.4**	**36.3**		**-36.0**	

Extreme Temperatures for U of Guelph, Dept. of Plant Agriculture - Kettleby
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GROWING DEGREE DAYS (5°C Base)

Month	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	LTA
January	9	0	0	1	0	2	0	1	0	0	0	0	**1**
February	0	0	0	8	8	7	2	0	0	0	3	7	**1**
March	8	0	1	31	12	0	2	17	41	15	1	23	**15**
April	78	63	79	56	123	25	19	42	102	62	125	96	**77**
May	304	271	337	273	220	348	200	220	234	310	226	311	**245**
June	405	431	390	409	404	410	375	426	483	397	394	427	**389**
July	507	443	480	528	486	518	535	567	455	470	493	486	**478**
August	450	438	456	543	431	531	446	483	533	484	432	436	**444**
September	306	320	419	372	368	375	323	300	324	344	396	376	**309**
October	177	171	141	188	203	108	142	109	240	141	205	159	**135**
November	28	30	72	67	20	11	2	80	20	78	19	50	**33**
December	4	4	22	2	1	2	2	0	10	5	9	1	**4**
Annual	**2276**	**2171**	**2397**	**2478**	**2276**	**2338**	**2048**	**2245**	**2442**	**2306**	**2323**	**2372**	**2132**

LTA = Long Term Average for U of Guelph, Dept. of Plant Agriculture - Kettleby
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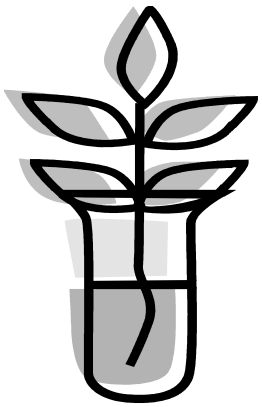

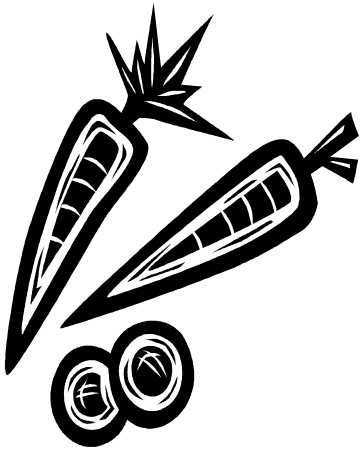

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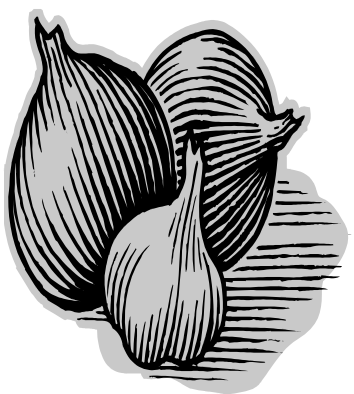

CROP: Carrot (*Daucus carota* subsp. *sativus* (Hoffm.) Arcang.), cv. Envy
PESTS: Cavity spot, stunting, forking (*Pythium intermedium* de Bary, *Pythium irregulare* Buisman, *Pythium sulcatum* Pratt & Mitchell, *Pythium sylvaticum* W.A. Campbell & J.W. Hendrix, *Pythium ultimum* Trow and *Pythium violae* Chesters & C.J. Hickman)

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TITLE: EVALUATION OF SOIL APPLIED WOLLINSTONITE TO CONTROL PYTHIUM DISEASES IN CARROTS, 2024

MATERIALS: PHOSTROL (Mono-and dibasic sodium, potassium, and ammonium phosphites 53.6%), WOLLASTONITE (silicon 27%, calcium 14%, magnesium 4%)

METHODS: The trial was conducted at the Ontario Crops Research Centre – Bradford, Ontario in muck soil (organic matter ≈ 71.7%, pH ≈ 5.8) known to be infested with *Pythium* spp. The trial was arranged as a factorial in a randomized complete block with four replicates per treatment. One factor was WOLLASTONITE and the other factor was fungicide. Each experimental unit consisted of 2 rows, 86 cm apart and 5 m in length. Treatments were WOLLASTONITE at 7 t/ha (factor one) and PHOSTROL at 3 L/ha and an untreated check (factor two). Carrots, cv. Envy, were direct seeded at 70 seeds/m into raised beds using a Stanhay Precision seeder on 8 June. WOLLASTONITE was broadcast over the treatment plots and incorporated into the soil prior to seeding. Two assessment plots 1.16 m in length were set up in the middle of the two rows of each replicate. PHOSTROL sprays were applied on 1 and 15 September as foliar sprays using a CO2 backpack sprayer equipped with four TeeJet 8002 fan nozzles calibrated to deliver 500L/ha at 275 kPA. On 24 October, carrots from the two staked out 1.16 m sections of row were harvested by hand and placed into storage. On 25 January, carrots were removed from storage and graded for size into the following categories: jumbo (>4.4 cm), medium (1.9-4.4 cm), and forked/stunted (<1.9 cm). Compared to the previous 10-year average, air temperatures in 2024 were above average for May (15.4°C) and average for June (19.2°C), July (21.5°C), August (19.6°C), September (17.6°C) and October (10.6°C). The 10-year average temperatures were: May 13.4°C, June 18.6°C, July 21.1°C, August 20.4°C, September 16.8°C and October 10.1°C. Monthly rainfall was below the 10-year average for June (79 mm), August (54 mm), September (21 mm) and October (20 mm) and above average for May (83 mm) and July (85 mm). The 10-year rainfall averages were: May 58 mm, June 95 mm, July 75 mm, August 74 mm, September 57 mm and October 62 mm. Data were analyzed using the General Analysis of Variance function of Statistix V.10. Means separation was obtained by using Fisher's Protected LSD test at P = 0.05 level of significance.

RESULTS: as presented in Table 1

CONCLUSIONS: Cavity spot incidence and severity were relatively low in this trial and percent forking was low. There were no differences in percent of forked or stunted carrots and no interaction. No significant difference in marketable yield was found among the treatments.

Table 1. Marketable yield and size distribution for carrots cv. Envy, treated with soil amendments and fungicides and grown at the Ontario Crops Research Centre - Bradford, Ontario, 2024.

Treatment	WOLLASTONITE	Mkb Yield (t/ha)	Size Distribution[1] (%)		
			% Jumbo (>4.4 cm)	% Medium (1.9 – 4.4 cm)	% Forked or stunted (<1.9 cm)
PHOSTROL	Yes	46.6 ns[2]	6.4 ns	87.2 ns	6.4 ns
PHOSTROL		46.9	3.7	85.7	10.5
Untreated	Yes	47.6	2.8	91.6	5.7
Untreated		44.2	6.3	87.1	6.6

[1] Size distribution was based on the total weight of each yield sample.
[2] ns indicates no significant differences were found among the treatments, P=0.05.

Funding for this project was provided by the Ontario Agri-Food Innovation Alliance and the Bradford Cooperative and Storage Ltd.

CROP: Carrot (*Daucus carota* subsp. *sativus* (Hoffm.) Arcang.)
PEST: Cavity spot (*Pythium intermedium* de Bary, *Pythium irregulare* Buisman, *Pythium sulcatum* Pratt & Mitchell, *Pythium sylvaticum* W.A. Campbell & J.W. Hendrix, *Pythium ultimum* Trow and *Pythium violae* Chesters & C.J. Hickman)

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TITLE: EVALUATION OF CARROT BREEDING LINES FOR SUSCEPTIBILITY TO CAVITY SPOT, 2024

MATERIALS: USDA experimental carrot breeding lines, commercial cultivars Cellobunch, Envy, CV2384 (Seminis Vegetable Seeds), Atomic Red (OSC Seeds), Navedo, Deep Purple, (Bejo Seed Inc.), Maverick, UpperCut (Nunhems USA), Bolero, Brillyance, Triton (Stokes Seeds)

METHODS: The trial was conducted on organic soil (pH ≈ 5.7, organic matter ≈ 70.8%) naturally infested with *Pythium* spp. at the Ontario Crops Research Centre - Bradford, Holland Marsh, Ontario. Carrots were direct seeded (≈70 seeds/m) onto raised beds using a push cone seeder on 31 May. A randomized complete block design with four replicates per treatment was used. Each experimental unit consisted of one row, 6 m in length, spaced 66 cm apart. On 24 July stand was rated on a 0-5 scale were 0 = ≤ 9 carrots, 1 = very poor, 2 = poor, 3 = good, 4 = very good, 5 = excellent. On 30 September, plots were visually assessed for: leaf blight, (0-5 scale where 0= no blight to 5= leaf/ petiole necrosis), and bolting, (0-3 scale where 3 = more than 50% flowering, 2 = 5 to 49%, 1 = <5% and 0 = no flowering). On 31 October - 3 November, 50 carrots from each replicate were harvested, placed into cold storage. Carrots were assessed for cavity spot from 11-28 November. Carrots were washed in a small drum washer, visually examined for cavity spot lesions, and sorted into classes based on the size of the largest lesion (measured as horizontal width). The six classes were: 0 = no disease, 1 = very light (< 1 mm), 2 = light (1-2 mm), 3 = medium (3-5 mm), 4 = heavy (6-10 mm), and 5 = very heavy (> 10 mm). The disease severity index (DSI) was determined using the above classes and the following equation:

$$DSI = \frac{\sum [(\text{class no.})\ (\text{no. of carrots in each class})]}{(\text{total no. carrots per sample})\ (\text{no. classes } -1)} \times 100$$

Compared to the previous 10-year average, air temperatures in 2024 were above average for May (15.4°C) and average for June (19.2°C), July (21.5°C), August (19.6°C), September (17.6°C) and October (10.6°C). The 10-year average temperatures were: May 13.4°C, June 18.6°C, July 21.1°C, August 20.4°C, September 16.8°C and October 10.1°C. Monthly rainfall was below the 10-year average for June (79 mm), August (54 mm), September (21 mm) and October (20 mm) and above average for May (83 mm) and July (85 mm). The 10-year rainfall averages were: May 58 mm, June 95 mm, July 75 mm, August 74 mm, September 57 mm and October 62 mm.
Data were analyzed using the General Analysis of Variance function of Statistics V.10. Means separation was obtained using Fisher's Protected LSD test with P = 0.05 level of significance.

RESULTS: as presented in Tables 1 and 2

CONCLUSIONS: In 2024, rainfall From August to October was below average and irrigation was applied in September to assist in disease development. Overall disease development in the trial was similar to previous years. The incidence of cavity spot in cv. Cellobunch was 15% in 2024 compared to 26% in 2023. Significant differences in cavity spot incidence were observed among the lines tested, ranging from 0 - 47%. Disease severity was low in the trial and ranged from 0 – 21. The orange line crosses 23'S1361-4, 23'S1361-5, 23'S1361-1 and 22'S1380-1had cavity spot incidence less than 7.0% and very small cavity spot lesions. These 2023 lines contain parent groups which have shown lower disease incidence in previous trials. Overall stand in the trial was higher than in previous years. Leaf blight was also higher in 2024 compared to previous years. Several carrot lines had leaf blight ratings higher than 3.0 (Table 2). Very little bolting was observed in the trial, only nine carrot lines had carrots with seeders (data not shown).

Table 1. Cavity spot incidence and severity index (DSI) and percent forked for carrot breeding lines from the USDA/U of Wisconsin breeding program, grown at the Ontario Crops Research Centre -Bradford, Ontario, 2024.

Name/Seed source	Pedigree	Incidence (%)	DSI[1]	% Forked
Deep Purple		0.0 a[2]	0.0 a	6.5 e
23'S1361-4	(Nb8524AxF7385B)xNbh2306B	6.0 ab	1.7 ab	1.0 a
23'S1361-5	(L2574AxL1408B)xNbh2306B	6.5 abc	2.2 ab	2.5 abc
Brillyance		7.0 abc	2.5 ab	2.5 abc
23'S1361-1	Nbh2306B	7.0 abc	2.7 abc	1.0 a
22'S1380-2	F7738A	7.0 abc	2.5 ab	1.5 ab
23'S1361-3	(Nb2159AxU9237)xNbh2306B	8.5 a-d	2.5 ab	1.0 a
22'S1380-3	(B2144AxF5494B)xF7738B	9.5 a-e	3.6 a-e	1.5 ab
21'B123-2	F7738A	9.5 a-e	4.2 a-e	1.5 ab
22'B120-2	F7285A	10.5 a-f	3.3 a-d	1.0 a
N220062	F7119A	10.5 a-f	3.9 a—e	1.5 ab
22'S1380-1	F7738B	11.5 a-f	3.3 a-d	1.5 ab
N220061	F7119B	11.5 a-f	3.5 a-e	0.5 a
23'B121-1	Nbh2306B	11.5 a-f	3.4 a-e	2.5 abc
22'S1380-4	(2566AxF9924B)xF7738B	12.0 a-f	4.2 a-e	2.0 abc
22'S1379-2	F7737A	12.0 a-f	4.0 a-e	1.5 ab
22'S1379-1	F7737B	12.0 a-f	3.8 a-e	1.5 ab
	Bolero	12.3 a-f	4.0 a-e	1.5 ab
22'S1380-5	(Nbh2306AxU7393)xF7738B	12.5 a-g	3.6 a-e	3.0 a-d
N220074	(Uber-AxF7738B)xF9041	12.5 a-g	3.3 a-d	2.5 abc
22'S1379-4	(B2144AxF5494B)xF7737B	13.0 a-h	3.8 a-e	3.0 a-d
22'B120-5	(Nbh2306AxU7393)xF7385B	13.5 a-i	4.3 a-e	1.5 ab
22'B125-5	(2566AxF9924B)xNb8524B	14.0 a-i	5.2 a-f	2.5 abc
N220065	(Uber-AxF7738B)xF7119B	14.5 b-j	4.9 a-f	0.5 a
22'S1379-5	(Uber-AxF7738B)xF7737B	15.0 b-k	4.2 a-e	2.5 abc
	Cellobunch	15.0 b-k	5.7 a-f	2.0 abc
22'B121-5	(B2144AxF7142B)xU7393B	15.0 b-k	5.0 a-f	1.0 a
	Maverick	15.5 b-k	5.8 a-f	2.5 abc
23'B121-2	Nbh2306A	15.5 b-k	6.3 a-h	3.0 a-d
22'B120-3	Nb8524AxF7285B	16.0 b-l	5.2 a-f	0.5 a
21'B123-1	F7738B	16.1 b-l	5.9 a-f	2.0 abc

	Navedo	16.5 b-l	5.2 a-f	1.0 a
23'S1361-2	(U8277AxNb3271B)xNbh2306B	16.5 b-l	5.6 a-f	1.0 a
22'B120-1	F7285B	17.5 b-m	5.3 a-f	0.5 a
19'B113-1	F5367B	18.2 b-m	5.5 a-f	0.5 a
	SV2384	19.0 b-n	7.0 b-h	3.0 a-d
	Uppercut	19.5 b-n	7.0 b-h	4.5 cde
22'B125-3	(6274AxF7737B)xNb8524B	20.5 c-o	6.7 a-h	1.0 a
23'365-1	F7737B	21.3 d-o	6.1 a-g	2.0 abc
	Triton	21.5 d-p	7.3 b-h	2.5 abc
22'B125-2	Nb8524A	21.5 d-p	7.5 b-h	1.5 ab
23'S1364-5	(Uber-AxF7738B)xNb8524B	21.5 d-p	6.5 a-h	1.0 a
N220072	(B2144AxF7142B)xF9041	22.0 d-p	7.3 b-h	1.5 ab
23'365-2	F7737A	22.5 d-p	7.6 b-h	2.0 abc
22'B121-4	(6274AxF7737B)xU7393B	22.5 d-p	7.1 b-h	2.0 abc
23'S1364-4	(B2144AxNb2159B)xNb8524B	23.0 e-p	7.6 b-h	3.0 a-d
N220075	(Nbh2306AxU7393)xF9041	24.0 f-p	7.9 b-i	2.5 abc
19'B113-4	(2566XF7737) X F5347B	24.0 f-p	7.4 b-h	0.5 a
N220064	(B2144AxF5494B)xF7119B	24.5 f-p	8.0 b-i	2.0 abc
	Envy	24.5 f-p	7.5 b-h	1.5 ab
19'B113-3	(6274XF7737) X F5367B	26.5 g-q	8.3 b-i	2.0 abc
22'B121-1	U7393B	27.0 h-q	9.4 c-j	4.5 cde
22'B125-4	(Nbh2306AxU7393)xNb8524B	27.5 i-q	9.9 d-j	1.0 a
N220073	(B2144AxF5494B)xF9041	28.5 j-q	10.2 e-j	2.0 abc
22'B121-3	Nbh2306AxU7393B	29.0 k-q	10.0 d-j	2.5 abc
22'B125-1	Nb8524B	30.0 l-r	12.8 g-k	5.5 de
23'B125-6	(R8201AxR6220)xR5647)	30.0 l-r	13.0 h-k	2.5 abc
22'B121-2	U7393A	31.5 m-r	11.2 f-j	3.0 a-d
23'S1364-2	Nb8524A	32.5 n-s	15.5 jkl	2.0 abc
B23'125-7	(R8201AxR5646)xR5647)	34.5 o-t	14.5 i-l	0.5 a
23'S1364-3	(U8277AxNb3271B)xNb8524B	35.5 p-t	15.6 jkl	4.0 b-e
23'B125-1	R5647B	40.0 q-t	19.2 kl	2.5 abc
N220071	F9041	43.7 rst	16.0 jkl	1.0 a
	Atomic Red	46.0 st	21.1 l	2.5 abc
23'S1364-1	Nb8524B	47.0 t	19.4 kl	2.5 abc

[1] Disease Severity Index (DSI) was determined using the following equation:

$$DSI = \frac{\sum [(\text{class no.})\ (\text{no. of carrots in each class})]}{(\text{total no. carrots per sample})\ (\text{no. classes } -1)} \times 100$$

[2] Numbers in a column followed by the same letter are not significantly different at P= 0.05, Fisher's Protected LSD test

Table 2. Stand (24 July) and leaf blight ratings (30 September) of carrot breeding lines from USDA/U of Wisconsin breeding program grown at the Ontario Crops Research Centre -Bradford, Ontario, 2024.

Name/Seed source	Pedigree	Stand Rating[1]	Leaf Blight Rating[2,3]
	Navedo	5.0	3.8
	Triton	5.0	2.8
	Envy	5.0	2.3
	SV2384	5.0	2.8
	Deep Purple	5.0	3.5
	Brillyance	5.0	1.3
23'S1364-3	(U8277AxNb3271B)xNb8524B	5.0	2.5
23'S1364-4	(B2144AxNb2159B)xNb8524B	5.0	2.5
23'S1364-5	(Uber-AxF7738B)xNb8524B	5.0	3.5
N220064	(B2144AxF5494B)xF7119B	5.0	4.3
22'B121-3	Nbh2306AxU7393B	5.0	2.0
22'B121-4	(6274AxF7737B)xU7393B	5.0	4.3
22'B125-4	(Nbh2306AxU7393)xNb8524B	5.0	2.8
22'S1379-4	(B2144AxF5494B)xF7737B	5.0	4.5
22'S1380-3	(B2144AxF5494B)xF7738B	5.0	4.8
23'S1361-2	(U8277AxNb3271B)xNbh2306B	5.0	2.5
23'S1361-3	(Nb2159AxU9237)xNbh2306B	5.0	2.0
23'S1361-4	(Nb8524AxF7385B)xNbh2306B	5.0	3.0
23'S1361-5	(L2574AxL1408B)xNbh2306B	5.0	1.5
23'S1364-2	Nb8524A	4.8	3.5
B23'125-7	(R8201AxR5646)xR5647)	4.8	3.5
19'B113-3	(6274XF7737) X F5367B	4.8	4.8
19'B113-4	(2566XF7737) X F5347B	4.8	5.0
22'B120-5	(Nbh2306AxU7393)xF7385B	4.8	3.8
22'B121-5	(B2144AxF7142B)xU7393B	4.8	3.5
22'B125-5	(2566AxF9924B)xNb8524B	4.8	2.5
22'S1379-1	F7737B	4.8	5.0
22'S1380-4	(2566AxF9924B)xF7738B	4.8	4.8
22'S1380-5	(Nbh2306AxU7393)xF7738B	4.8	4.0
N220074	(Uber-AxF7738B)xF9041	4.8	3.0
	Cellobunch	4.8	4.8
23'S1364-1	Nb8524B	4.5	4.3
N220062	F7119A	4.5	4.8
N220065	(Uber-AxF7738B)xF7119B	4.5	4.8
23'B125-1	R5647B	4.5	2.8
22'B120-2	F7285A	4.5	5.0
22'S1379-5	(Uber-AxF7738B)xF7737B	4.5	4.8
22'S1380-1	F7738B	4.5	5.0
N220073	(B2144AxF5494B)xF9041	4.5	3.0
	Maverick	4.5	2.3
	Uppercut	4.5	2.0
	Atomic Red	4.5	5.0
23'B125-6	(R8201AxR6220)xR5647)	4.3	2.3
22'B120-1	F7285B	4.3	4.3
22'B120-3	Nb8524AxF7285B	4.3	4.5
22'B125-2	Nb8524A	4.3	3.8
22'B125-3	(6274AxF7737B)xNb8524B	4.3	4.0
22'S1379-2	F7737A	4.3	5.0

N220071	F9041	4.3	4.0
N220075	(Nbh2306AxU7393)xF9041	4.3	2.0
N220061	F7119B	4.0	4.3
21'B123-2	F7738A	4.0	5.0
22'S1380-2	F7738A	4.0	5.0
23'S1361-1	Nbh2306B	4.0	1.8
	Bolero	4.0	3.5
23'B121-2	Nbh2306A	4.0	2.5
21'B123-1	F7738B	3.8	5.0
N220072	(B2144AxF7142B)xF9041	3.8	3.0
23'B121-1	Nbh2306B	3.8	3.0
22'B121-1	U7393B	3.8	3.8
22'B121-2	U7393A	3.8	2.3
19'B113-1	F5367B	3.5	5.0
22'B125-1	Nb8524B	3.5	4.0
23'365-2	F7737A	2.5	4.5
23'365-1	F7737B	2.3	4.8

[1] Stand (carrot emergence) was rating on 17 July using a 0-5 scale where 0 = <5 carrots, 1 = very poor, 2 = poor, 3 = good, 4 = very good, 5 = excellent.

[2] Leaf blight was rated on a 0-5 scale where 0 = no blight, 1 = 1-10% leaf area blighted, 2 = 11-25% leaf/petiole blighted, 3 = 26-50% leaf/petiole blighted, 4 = >75% leaf/petiole area blighted, 5 = leaf/petiole necrotic.

[3] Leaf blight ratings 2.8 or higher (the rating for Cellobunch) are noted in bold.

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CROP: Carrot (*Daucus carota* subsp. *sativus* (Hoffm.) Arcang.), cvs. Cellobunch and SV2384
PEST: Annual broadleaf weeds

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TITLE: EFFICACY OF DIFLUFENICAN FOR WEED CONTROL IN CARROTS, 2024

MATERIALS: diflufenican 500 g/L, LOROX L (linuron 480 g/L)

METHODS: Carrots, cvs. Cellobunch and SV2384, were direct seeded (25 seeds per 30 cm of row) on May 29 into muck soil (organic matter ≈ 55.6%, pH ≈ 7.3) at the Ontario Crops Research Centre - Bradford, Ontario. The site location was known to have a high weed seedbank. A randomized complete block design with four replicates per treatment was used. Each replicate consisted of two raised hills, east hill seeded with Cellobunch and west hill seeded with SV2384, spaced 85 cm apart and 5 m in length. Herbicide treatments were applied using a CO_2 backpack sprayer with four TeeJet 8002 fan nozzles calibrated to deliver 200 L/ha at 206 kPa. Herbicide treatments are listed in Table 1. An unweeded check was also included. Treatments were applied to carrots on 4 June (pre-emergence), 24 June (bunny ear) and 12 July (2-3 leaf). Stand counts, weed coverage and herbicide phytotoxicity were assessed until the end of July. Lorox was applied to the entire trial in August. Carrots were grown using best agronomic practices for nutrients and pest management. Carrots were harvested on October 23 and 24 from a 1.16 m section of row of each cultivar per plot. Yield samples were assessed on December 10. Data were analyzed using the General Analysis of Variance function of the Linear Analysis section of Statistix V.10. Means separation was obtained using Tukey's HSD test with $P = 0.05$ level of significance.

RESULTS: Data are presented in Tables 2 & 3 and Figures 1 & 2. Unweeded checks also had a decrease in the number of carrots harvested compared to stand counts earlier in the year (p=0.007).

CONCLUSIONS: The diflufenican treatments, especially at the 120 g ai/ha rate, applied at the bunny ear stage provided the longest suppression of weeds when compared to all other diflufenican treatments and the unweeded control (Figure 1). The diflufenican treatments applied at the bunny ear stage also suppressed pigweed germination through July (Figure 2). The diflufenican 120 g ai/ha rate treatment also had the highest marketable yield (Table 2). The main weeds observed in the study included pigweed, lambs quarters, goosefoot, chickweed, marshcress, purslane and nutsedge. To maximize diflufenican efficacy, it was important to apply the herbicide when weeds where between the emerging to 2-3 leaf stage. Some herbicide damage was observed in each cultivar after each treatment application of diflufenican and Lorox. Future studies should investigate possible herbicide rotation programs.

Table 1. Herbicide treatment list and application timing

Treatment	Product Rate (g ai/ha)	Application at Crop Stage
Lorox	1080 g ai/ha	2-3 leaf
Diflufenican	60 g ai/ha	Pre emergence
Diflufenican	90 g ai/ha	Pre emergence
Diflufenican	120 g ai/ha	Pre emergence
Diflufenican	60 g ai/ha	Bunny ear
Diflufenican	90 g ai/ha	Bunny ear
Diflufenican	120 g ai/ha	Bunny ear
Diflufenican	60 g ai/ha	2-3 leaf

Diflufenican	90 g ai/ha	2-3 leaf
Diflufenican	120 g ai/ha	2-3 leaf
Diflufenican	180 g ai/ha	2-3 leaf
Unweeded Check	-	-

Table 2. Carrot, cv. Cellobunch, yield results after a single herbicide application, 2024.

Treatment	Rate (g ai/ha)	Application Timing	Yield (bu/ac)		
			Marketable	Jumbo	Culls
Diflufenican	60	Pre	338.9 b[1]	18.5 ns[2]	307.9 ns
Diflufenican	90	Pre	790.1 a	41.1	163.4
Diflufenican	120	Pre	613.8 ab	93.4	130.4
Diflufenican	60	Bunny ear	725.3 ab	127.6	136.9
Diflufenican	90	Bunny ear	740.7 ab	75.4	135.8
Diflufenican	120	Bunny ear	859.3 a	154.8	76.8
Diflufenican	60	2-3 leaf	602.7 ab	51.1	217.2
Diflufenican	90	2-3 leaf	635.9 ab	33.4	119.5
Diflufenican	120	2-3 leaf	549.4 ab	148.1	194.0
Diflufenican	180	2-3 leaf	737.4 ab	27.4	198.0
Lorox	1080	2-3 leaf	782.9 a	63.9	163.8
Unweeded	-	-	433.9 ab	51.5	109.9

[1] ns indicates no significant differences were found among the treatments at P = 0.05, Tukey's HSD test
[2] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Tukey's HSD test

Table 3. Carrot, cv. SV2384, yield results after a single herbicide application, 2024.

Treatment	Rate (g ai/ha)	Application Timing	Yield (bu/ac)		
			Marketable	Jumbo	Culls
Diflufenican	60	Pre	503.5 ns[1]	47.5 ns	139.3 ns
Diflufenican	90	Pre	475.6	117.3	128.5
Diflufenican	120	Pre	694.3	103.0	114.3
Diflufenican	60	Bunny ear	646.0	53.9	154.2
Diflufenican	90	Bunny ear	805.1	49.0	108.5
Diflufenican	120	Bunny ear	714.8	72.5	203.7
Diflufenican	60	2-3 leaf	734.2	77.3	94.2
Diflufenican	90	2-3 leaf	412.9	64.4	130.0
Diflufenican	120	2-3 leaf	489.8	70.8	68.0
Diflufenican	180	2-3 leaf	751.9	49.5	99.0
Lorox	1080	2-3 leaf	641.6	124.8	156.2
Unweeded	-	-	376.3	35.8	66.8

[1] ns indicates no significant differences were found among the treatments at P = 0.05, Tukey's HSD test

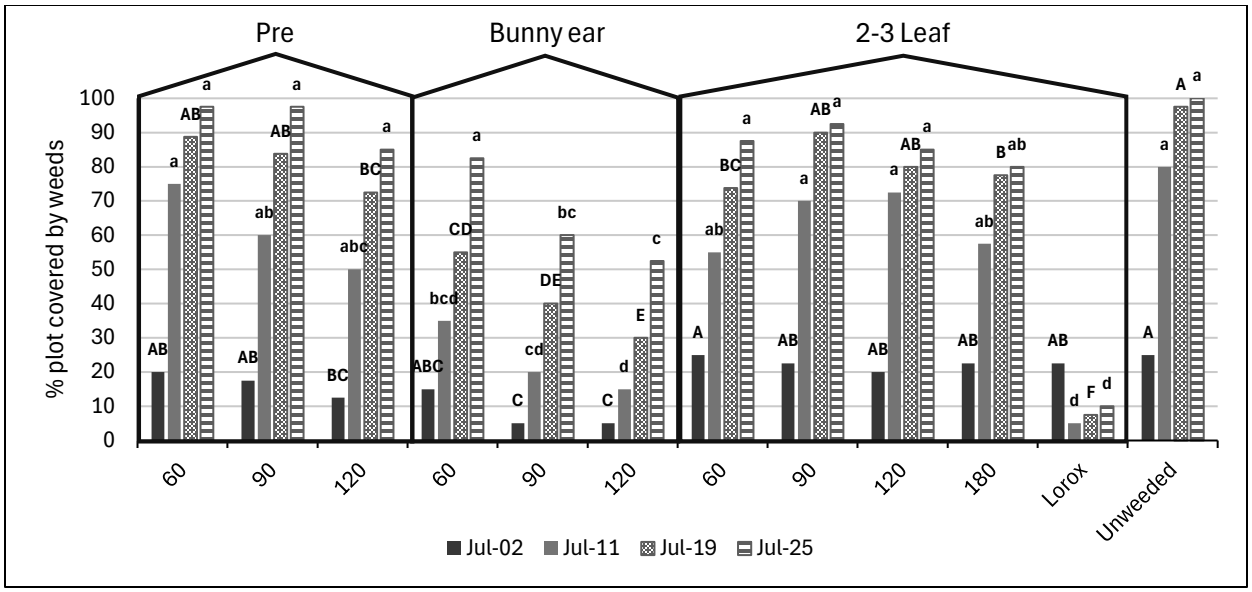

Figure 1. Average percent weed coverage in each treatment plot throughout July, 2024.
Bars of the same colour followed by the same letter are not significantly different at P = 0.05, Tukey's HSD test.

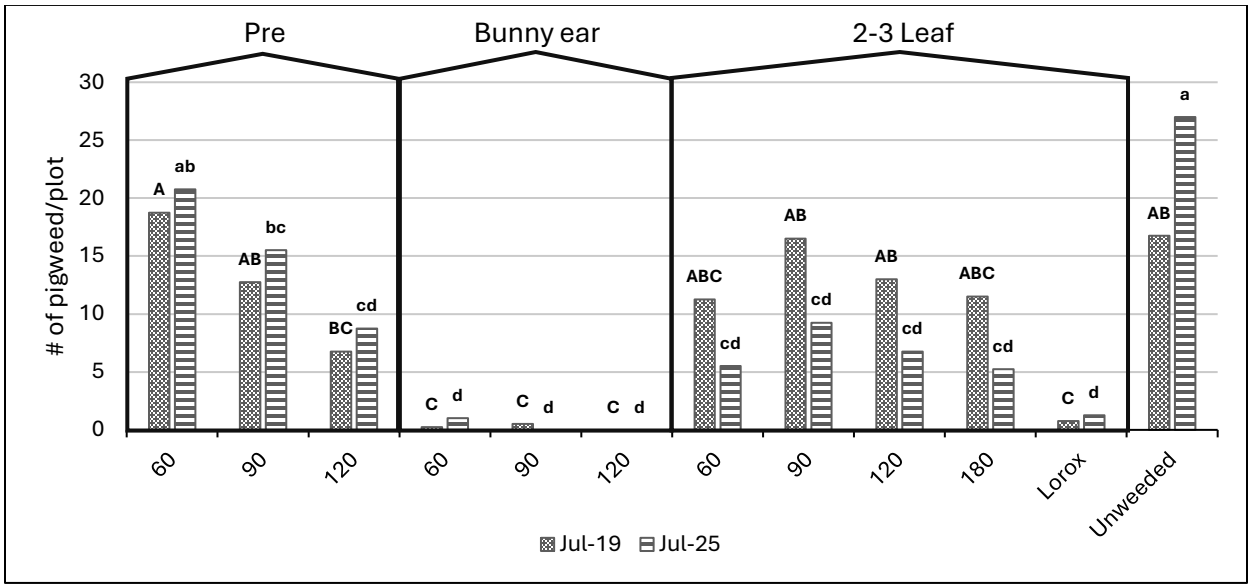

Figure 2. Average number of pigweed plants per treatment during assessment on 19 and 25 July, 2024.
Bars of the same colour followed by the same letter are not significantly different at P = 0.05, Tukey's HSD test.

Funding for this project was provided by the Bradford Co-operative.

CROP: Carrot (*Daucus carota* subsp. *sativus* (Hoffm.) Arcang.), cvs. Cellobunch and SV2384
PEST: Annual broadleaf weeds

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TITLE: EFFICACY OFAPPLYING VARIOUS WATER RATES OF TOUGH AND ZIDUA FOR WEED CONTROL IN CARROTS, 2024

MATERIALS: LOROX L (linuron 480 g/L), TOUGH 600 EC (pyridate 600 g/L), ZIDUA (pyroxasulfone 500 g/L)

METHODS: Carrots, cvs. Cellobunch and SV2384, were direct seeded (25 seeds per 30 cm of row) on May 29 into muck soil (organic matter ≈ 55.6%, pH ≈ 7.3) at the Ontario Crops Research Centre - Bradford, Ontario. The site location was known to have a high weed seedbank. A randomized complete block design with four replicates per treatment was used. Each replicate consisted of two raised hills, east hill seeded with Cellobunch and west hill seeded with SV2384, spaced 85 cm apart and 5 m in length. Herbicide treatments were applied using a CO_2 backpack sprayer with four TeeJet 8002 fan nozzles calibrated to deliver various water/treatment rates at 206 kPa. Herbicide treatments are listed in Table 1. A unweeded check was also included. Treatments were applied to carrots on 24 June (bunny ear) and 12 July (2-3 leaf). Stand counts, weed coverage and herbicide phytotoxicity were assessed until the end of July. Lorox was applied to the entire trial in August. Carrots were grown using best agronomic practices for nutrients and pest management. Carrots were harvested on October 24 and 25 from a 1.16 m section of row of each cultivar per plot. Yield samples were assessed on December 10. Data were analyzed using the General Analysis of Variance function of the Linear Analysis section of Statistix V.10. Means separation was obtained using Tukey's HSD test with $P = 0.05$ level of significance.

RESULTS: Data are presented in Tables 2 & 3 and Figures 1 & 2.

CONCLUSIONS: The efficacy of Zidua and Tough for weed control and related carrot yield showed mixed results. There were no significant difference among the three different water rates applied at the bunny ear stage for weed control or yield for either Zidua or Tough (Table 2 & 3 and Figure 1 & 2). The Lorox application at the 2-3 leaf stage had the highest yield and best weed control. The Zidua and Tough treatments applied at both the bunny ear and 2-3 leaf stage provided similar weed control to the Lorox treatment (Figure 1). The Zidua bunny ear treatments and Tough 2-3 treatment significantly reduced weed coverage compared to the unweeded check. All herbicide treatments exhibited some level of phytotoxicity, which included symptoms like leaf burn, curling and stunting. The main weeds observed in the study included pigweed, lambs quarters, goosefoot, chickweed, marshcress, purslane and nutsedge. This trial also shows the importance of applying herbicides when weeds are emerging to 2-3 leaf for the most success. During the trial it was observed that Zidua provided good control of chickweed in particular.

Table 1. Herbicide treatments, water rates and application timing

Treatment	Product Rate (g ai/ha)	Water Rate (L/ha)	Application at Crop Stage
Zidua	89	281	Bunny ear
Zidua	89	375	Bunny ear
Zidua	89	468	Bunny ear
Tough	450	281	Bunny ear
Tough	450	375	Bunny ear
Tough	450	468	Bunny ear

Zidua	89	200	Bunny ear + 2-3 leaf
Zidua	89	200	2-3 leaf
Tough	450	200	Bunny ear + 2-3 leaf
Tough	450	200	2-3 leaf
Lorox	1080	200	2-3 leaf
Unweeded	-	-	-

Table 2. Carrot, cv. Cellobunch, yield results after herbicide application, 2024.

Treatment	Rate (g ai/ha)	Water Rate (L/ha)	Application Timing	Yield (bu/ac)		
				Marketable	Jumbo	Culls
Zidua	89	281	Bunny ear	421.8 b	46.7 ab	124.8 ab
Zidua	89	375	Bunny ear	398.5 b	73.3 ab	117.9 b
Zidua	89	468	Bunny ear	476.2 ab	42.7 ab	146.9 ab
Tough	450	281	Bunny ear	611.8 ab	197.6 ab	137.3 ab
Tough	450	375	Bunny ear	457.6 ab	109.9 ab	115.1 b
Tough	450	468	Bunny ear	422.2 b	105.9 ab	109.9 b
Zidua	89	200	Bunny ear + 2-3 leaf	420.2 b	17.3 ab	113.5 b
Zidua	89	200	2-3 leaf	358.2 b	0.0 b	319.9 a
Tough	450	200	Bunny ear + 2-3 leaf	509.2 ab	205.7 ab	63.9 b
Tough	450	200	2-3 leaf	429.1 b	36.6 ab	210.9 ab
Lorox	1080	200	2-3 leaf	924.9 a	226.6 a	109.1 b
Unweeded	-	-	-	460.1 ab	14.1 ab	171.9 ab

Table 3. Carrot, cv. SV2384, yield results after herbicide application, 2024.

Treatment	Rate (g ai/ha)	Water Rate (L/ha)	Application Timing	Yield (bu/ac)		
				Marketable	Jumbo	Culls
Zidua	89	281	Bunny ear	681.8 ab	122.8 ns	58.4 ns
Zidua	89	375	Bunny ear	927.8 a	91.8	119.1
Zidua	89	468	Bunny ear	871.8 a	107.9	114.7
Tough	450	281	Bunny ear	677.0 ab	150.5	159.4
Tough	450	375	Bunny ear	471.7 ab	210.9	156.2
Tough	450	468	Bunny ear	605.8 ab	74.9	102.6
Zidua	89	200	Bunny ear + 2-3 leaf	596.9 ab	18.5	41.1
Zidua	89	200	2-3 leaf	599.7 ab	24.9	73.3
Tough	450	200	Bunny ear + 2-3 leaf	405.7 b	203.7	41.1
Tough	450	200	2-3 leaf	853.3 ab	70.8	127.9
Lorox	1080	200	2-3 leaf	888.7 a	171.1	90.9
Unweeded	-	-	-	767.2 ab	85.7	99.4

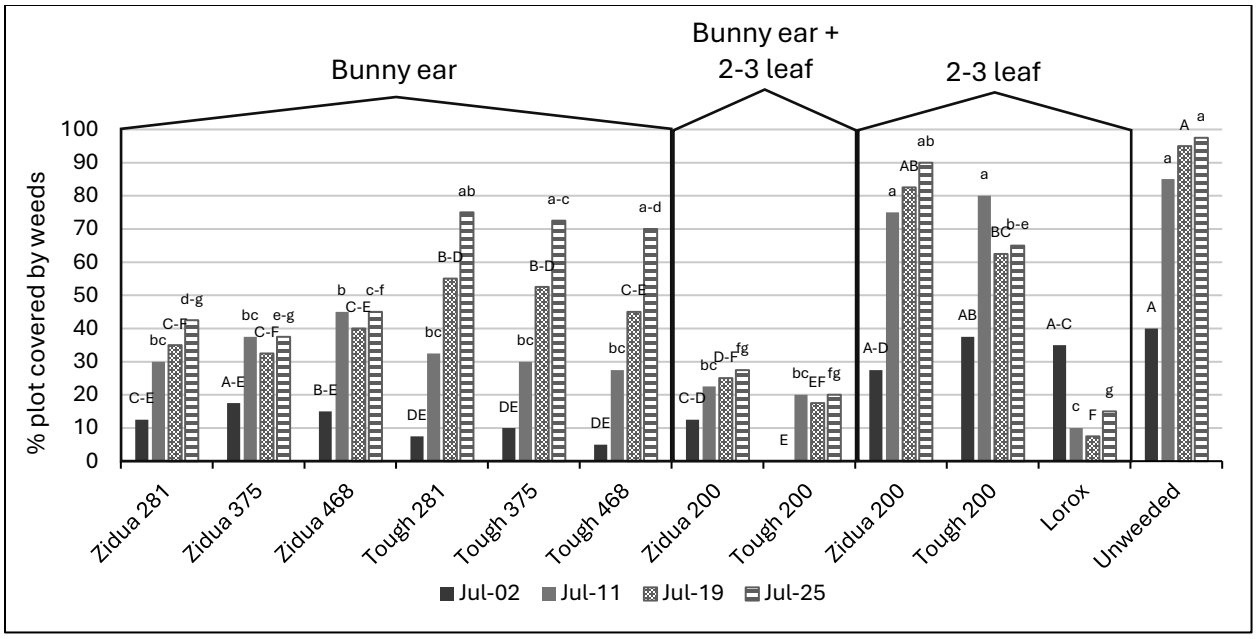

Figure 1. Average percent weed coverage in each treatment plot throughout July, 2024

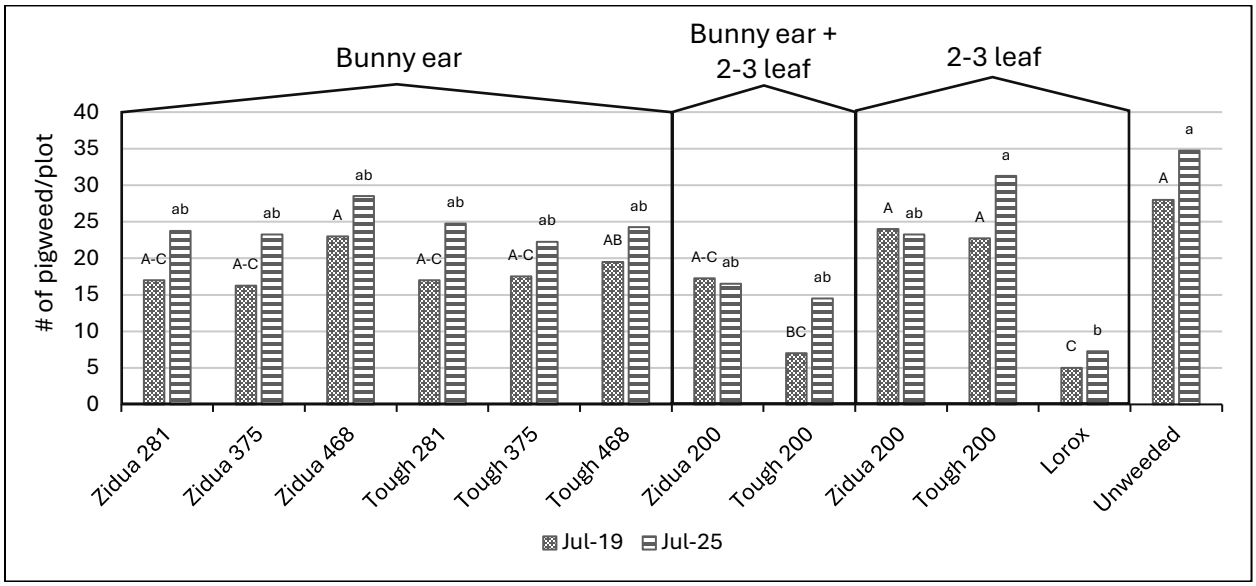

Figure 2. Average number of pigweed plants per treatment during assessment on 19 and 25 July, 2024

Funding for this project was provided by the Bradford Co-operative.

CROPS: Carrot (*Daucus carota* subsp. *sativus*), cvs. Navedo (muck) and SV2384 (mineral)
Table beet (*Beta vulgaris* subsp. *vulgaris*), cv. Zeppo

AUTHORS: EZEH IN, FARINTOSH G, VANDER KOOI K and MCDONALD MR
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TITLE: COMPARISON OF WEED MANAGEMENT BY THE NAÏO ORIO ROBOT AND TRACTOR IN BEET AND CARROT IN HIGH ORGANIC MATTER AND MINERAL SOILS IN THE HOLLAND MARSH 2024

MATERIALS: BETAMIX EC (desmedipham-15%, phenmedipham-15%), LIBERTY 200 SN (glufosinate ammonium 24.5%), LOROX L (linuron 48%), ASSIST OIL (paraffin-based mineral oil-83%, surfactant blend-17%), ROUNDUP (glyphosate 48.8%), S-tine cultivator, rolling cultivator, hooded sprayers, wick herbicide applicator.

METHODS: The study was conducted at two sites: a high organic matter (muck) soil site and a mineral soil site near the Holland Marsh. At the muck site, the carrot field had 66.4% organic matter (pH 7.1), while the beet field had 52.5% organic matter (pH 7.4), both trials were 300 m. At the mineral site, the carrot field had 2.6% organic matter (pH 7.6) and the beet field had 3.4% organic matter (pH 7.5), with field lengths of 220 m and 175 m, respectively. Carrots and beets were direct-seeded on raised beds. Beets were seeded between May 16–23 at both sites, while carrots were seeded on May 23 (muck) and May 31 (mineral). Trials followed a completely randomized design, with two replicates on muck soil and three on mineral soil. Each replicate consisted of four rows spaced 86 cm apart.
The two treatments were the tractor and Naïo Orio robot The Naïo Orio autonomous tool carrier robot performed the same operations as a tractor throughout the growing season. However, the robot also made straight lines that were followed for seeding for the tractor treatment. The weed management strategies were the S-tine cultivator, rolling cultivator, and herbicide sprayer with 3D printed hoods designed to apply the herbicide only between the rows and reduce drift.
Weeds were sampled from six representative sections per crop at muck site. and four at the mineral site. Sampling occurred between the two middle hills in each section. In each round, three points were sampled on muck. and two on mineral. Initial sampling points were set 10 paces from the section start, with each subsequent round adding 10 paces to the previous point. Weeds within a 0.5 × 0.5 m quadrat were counted, identified, scanned using the Canopeo app to assess vegetative cover, and cut at ground level for biomass measurement. Identification followed the Weed Identification Guide for Ontario Crops (Cowbrough et al., 2016).
The weed density and biomass density were calculated using the formula:

$$\text{Weed density } (weed/m^2) = \frac{Total\ number\ of\ weeds\ counted\ in\ a\ quadrat}{Area\ of\ the\ quadrat}$$

and

$$\text{Weed biomass density } (g/m^2) = \frac{Total\ weight\ of\ weeds\ within\ a\ quadrat}{Area\ of\ the\ quadrat}$$

The Naïo Orio robot applied herbicides using a band sprayer equipped with TeeJet AIXR 11003-VS flat fan nozzles (0.3 GPM at 40 PSI) and 3D hollow cones covering TeeJet XR 11002-VS nozzles (0.2 GPM at 40 PSI), controlled by a Raven Industries field computer. It operated with two 55-gallon tanks, spraying at 275 kPa with a water application rate of 200 L/ha. Tractor applications used a mounted sprayer with TeeJet 800-VS flat fan nozzles. The robot sprayed at 2 km/h, while cultivation speeds ranged from 5 to 5.5 km/h, depending on field conditions. Herbicide treatments included BETAMIX EC (1.5 L/ha) for beets, LIBERTY (2 L/ha) for banded applications on beets, and LOROX + Assist (750 ml/ha + 1.5 L/ha) for carrots. Early-season cultivation in beets and carrots was performed by the Orio using S-tine cultivators, as rolling cultivators were incompatible. At slower speeds, cultivators buried weeds without cutting roots, while faster

speeds either buried and cut roots or uprooted weeds entirely. Overgrown weeds were managed with a wick applicator using ROUNDUP (50% concentration), but herbicide dripping caused significant beet plant damage at both sites.

Beet yield samples were taken on 30 July and 1 August from 1.16 m sections of the two middle hills. Samples were graded for size and yield between 6 and 8 August. Carrot yield samples were taken between 8 and 10 October from 1.16 m sections of the two middle hills. Samples were graded for size and yield between 22 and 24 October. Compared to the previous 10-year average, air temperatures in 2024 were above average for May (15.4°C) and average for June (19.2°C), July (21.5°C), August (19.6°C) and September (17.6°C). The 10-year average temperatures were: May 13.4°C, June 18.6°C, July 21.1°C, August 20.4°C and September 16.8°C. The monthly rainfall was below the 10-year average for June (79 mm), August (54 mm) and September (21 mm) and above average for May (83 mm) and July (85 mm). The 10-year rainfall averages were: May 58 mm, June 95 mm, July 75 mm, August 74 mm, and September 57 mm. Data analyses for weed metrics were conducted using the PROC GLIMMIX procedure of SAS version 9.4 (SAS Institute, Cary, USA) as a repeated measures mixed model. Treatment (robot vs. tractor) and sampling date (June 13, June 20, June 26) were included as fixed effects, with repeated observations modeled using a random effect for sampling within replications. Each field was analyzed separately since sampling was conducted at different time points. Yield of each crop was analyzed using the SAS PROC GLIMMIX procedure in a factorial design, where the soil type was one factor and the treatments another factor, as fixed effects. Replication nested within soil type was included as a random effect, but its variance estimate was negligible. Pairwise differences were assessed using the Tukey-Kramer test in all analyses. Correlation analysis for yield and biomass was performed using the SAS PROC CORR procedure, applying Pearson correlation.

RESULTS: as presented in Tables 1 to 10.

CONCLUSIONS: In the muck beet field, weed density remained high in robot-treated plots, while tractor-treated plots significantly reduced density by June 20 and 26 (Table 1). Weed biomass in robot plots increased significantly on June 20 and remained high, with consistently greater vegetative cover across sampling dates. In the muck carrot field, robot-treated plots initially had higher weed density and biomass, but both declined significantly by July 2, reaching levels similar to the tractor treatment. Vegetative cover peaked on June 26 before dropping to near zero by July 2 (Table 2).

In the mineral beet field, weed density declined in both treatments, but robot-treated plots had significantly higher biomass by July 25. Vegetative cover was initially greater in robot plots but declined over time, contrary to trends in other fields (Table 3). In the mineral carrot field, weed density was similar between treatments, but robot-treated plots had higher biomass on both sampling dates. Vegetative cover increased slightly in both treatments by July 25, suggesting fewer new weeds but greater biomass accumulation (Table 4).

A significant interaction between soil type and implement type was observed for beet yield, with tractor-treated muck soil plots yielding the highest (Table 5). While robot-treated muck plots had numerically higher yields than robot-treated mineral plots, the difference was not statistically significant. In carrot fields, no significant interaction between soil type and implement type was found (Table 6). However, soil type alone significantly affected robot-treated yields, with higher yields in muck soil. Both treatments performed similarly within each soil type. Weed biomass and yield showed no significant correlation, except for beets in muck soil, where a significant negative relationship was observed at the late June weed assessments (Table 7).

Table 1. Effect of weed management conducted by two implements on weed density, biomass, and canopy cover in beets at the muck site, 2024

Treatment	Sampling date	Density[1] (plant m^{-2})	Biomass (g m^{-2})	Vegetative cover (%)
Naïo Orio robot	13 June	160 a[2]	26.9 b	1.4 c
Tractor		165 a	17.7 b	0.6 c
Naïo Orio robot	20 June	184 a	116.8 a	10.1 a
Tractor		46 b	18.5 b	2.6 b
Naïo Orio robot	26 June	155 a	190.9 a	14.1 a
Tractor		48 b	37.6 b	5.7 b

[1] Weed counts were taken within 0.25m^2 wooden quadrat.
[2] Means in a column followed by the same letter are not significantly different ($p > 0.05$), as determined by the Tukey-Kramer test.

Table 2. Effect of weed management conducted by two implements on weed density, biomass, and canopy cover in carrots at the Jane St muck soil site, 2024

Treatment	Sampling date	Density[1] (plant m^{-2})	Biomass (g m^{-2})	Vegetative cover (%)
Naïo Orio robot	13 June	207 a[2]	30.7 b	1.9 b
Tractor		138 a	23.3 b	1.5 b
Naïo Orio robot	20 June	132 a	57.9 a	3.1 a
Tractor		111 a	71.9 a	3.8 a
Naïo Orio robot	26 June	15 b	17.0 c	0.3 c
Tractor		9 b	7.1 c	0.0 c

[1] Weed counts were taken within 0.25m^2 wooden quadrat.
[2] Means in a column followed by the same letter are not significantly different ($p > 0.05$), as determined by the Tukey-Kramer test.

Table 3. Effect of weed management conducted by two implements on weed density, biomass, and canopy cover in beets at the Bajar mineral soil site, 2024

Treatment	Sample date	Density[1] (plant m^{-2})	Biomass (g m^{-2})	Canopy cover (%)
Naïo Orio	21 June	31 a[2]	21.2 b	1.9 b
Tractor		37 a	19.6 b	1.5 b
Naïo Orio	25 July	15 b	250.5 a	5.6 a
Tractor		10 b	156.7 a	7.9 a

[1] Weed counts were taken within 0.25m^2 wooden quadrat.
[2] Means in a column followed by the same letter are not significantly different ($p > 0.05$), as determined by the Tukey-Kramer test.

Table 4. Effect of weed management conducted by two implements on weed density, biomass, and canopy cover in carrot at the Bajar mineral soil site, 2024

Treatment	Sample date	Density[1] (plant m^{-2})	Biomass (g m^{-2})	Vegetative cover (%)
Naïo Orio robot	2 July	16 ns[2]	22.8 b[3]	2 b
Tractor		11	9.8 b	1 b
Naïo Orio robot	25 July	21	178.9 a	7 a
Tractor		17	113.4 a	4 a

[1] Weed counts were taken within 0.25m^2 wooden quadrat.
[2] ns = no significant differences at P = 0.05 in this analysis.
[3] Means in a column followed by the same letter are not significantly different (p > 0.05), as determined by the Tukey-Kramer test.

Table 5. Effect of weed management strategies on beet yield 2024

Soil type	Treatment	Marketable yield (t/ha)	Size distribution % by weight		
			Jumbo (> 7.62 cm)	Medium (3.18 – 7.62 cm)	Small (< 3.18 cm)
Muck	Naïo Orio	24.8 b[1]	12 ab	78 ns[2]	10 ns
	Tractor	40.7 a	24 a	69	7
Mineral	Naïo Orio	20.1 bc	9 ab	79	12
	Tractor	13.2 c	2 b	80	18

[1] Means in a column followed by the same letter are not significantly different at P > 0.05, as determined by the Tukey-Kramer test.
[2] ns = no significant differences at P = 0.05 in this analysis.

Table 6. Effect of weed management strategies on carrot yield 2024

Soil type	Treatment	Marketable yield (t/ha)	Size distribution (%)[1]		
			Jumbo (> 4.4 cm)	Medium (1.9 – 4.4cm)	Stunted, forked or split (< 1.9 cm)
Muck	Naïo Orio	54.3 a[2]	2 ns[3]	91 a	7 b
	Tractor	47.6 a	3	87 ab	10 ab
Mineral	Naïo Orio	36.8 b	7	77 c	17 a
	Tractor	38.6 ab	2	82 bc	16 a

[1] Percentage was determined by weight.
[2] Means in a column followed by the same letter are not significantly different at P > 0.05, as determined by the Tukey-Kramer test.
[3] ns = no significant differences at P = 0.05 in this analysis.

Table 7. Correlation coefficients and p-values between weed biomass and total beet yield at Jane site, 2024

Yield (t ha^{-1})	13 June	20 June	26 June
Total weight	-0.094 (0.77)	**-0.752 (0.005)**	**-0.681 (0.015)**

Table 8. Correlation coefficients and p-values between weed biomass and total beet yield at Bajar site, 2024

Yield (t ha^{-1})	21 June	25 July
Total weight	-0.15 (0.54)	0.27 (0.29)

Table 9. Correlation coefficients and p-values between weed biomass and total carrot yield at Jane St, 2024

Yield (t ha^{-1})	20 June	26 June	2 July
Total weight	0.54 (0.07)	-0.012 (0.97)	0.26 (0.42)

Table 10. Correlation coefficients and p-values between weed biomass and total carrot yield at Bajar site, 2024

Yield (t ha^{-1})	2 July	25 July
Total weight	-0.11 (0.66)	0.18 (0.48)

Funding for this project was provided by the Fresh Vegetable Growers of Ontario, Haggerty AgRobotics Inc., the Ontario Agri-Food Innovation Alliance, and Innovation Farms powered by AgExpert.

CROPS: Carrot (*Daucus carota* subsp. *sativus*), cvs. Navedo (muck) and SV2384 (mineral)
Table beet (*Beta vulgaris* subsp. *vulgaris*), cv. Zeppo

AUTHORS: EZEH IN, FARINTOSH G, VANDER KOOI K and MCDONALD MR
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TITLE: ACTIVITY SUMMARY OF THE NAÏO ORIO ROBOT IN THE HOLLAND MARSH 2024

MATERIALS: Naïo Orio autonomous tool carrier, BETAMIX EC (desmedipham-15%, phenmedipham-15%), LIBERTY 200 SN (glufosinate ammonium 24.5%), LOROX L (linuron 48%), ASSIST OIL (paraffin-based mineral oil-83%, surfactant blend-17%), ROUNDUP (glyphosate 48.8%), S-tine cultivator, rolling cultivator, hooded sprayer

METHODS: The study was conducted at four field sites: two high organic matter (muck) fields within the Holland Marsh and two mineral soil sites at its edge. The muck fields had organic matter contents of 66.4% (pH 7.1) and 52.5% (pH 7.4), while the mineral sites had 2.6% (pH 7.6) and 3.4% (pH 7.5). Field lengths were 300 m for both muck fields, and 220 m (carrot) and 175 m (beet) for the mineral soil fields. Beds were spaced 1.75 m center-to-center. The experiment followed a completely randomized design with two treatments: tractor and Naïo Orio robot. Each treatment had two replicates in muck soil and three in mineral soil.
The Naïo Orio autonomous tool carrier robot performed weed management operations similar to a tractor, including S-tine and rolling cultivation, as well as herbicide spraying with hooded sprayers to minimize drift and target application between rows. The robot was also used for field preparation tasks such as mapping, lining, and bed-making. Uptime and downtime activities were recorded over 22 operational days during the three-month growing season (June–August). Uptime activities included mapping, lining, bed-making, and weed management, while downtime was classified as charging, maintenance, and troubleshooting. Herbicide treatments included BETAMIX EC (1.5 L/ha) for beets, LIBERTY (2 L/ha) with 3D-printed hoods for precision application and drift reduction in beets, and LOROX + Assist (750 ml/ha + 1.5 L/ha) for carrots.

RESULTS: as presented in Tables 1, Figure 1 and 2.

DISCUSSION/CONCLUSIONS: The robot and tractor operated for the same duration on both soil types (Table 1), despite the robot's additional tasks, including mapping, bed-making, and lining. The robot's uptime, just over half of its total operating time, involved mapping, weeding, and spraying, while downtime was primarily for charging and troubleshooting GPS and sensor malfunctions. Mapping defined operational boundaries and paths for spraying and cultivation, guiding both the robot and tractor. At the muck beet field, two ranges were mapped for robot paths and sprayer boundaries using the Raven system. The mineral beet field was re-mapped for spraying. Overall, mapping took approximately 7.5 hours but may not be needed in subsequent years. Weed management relied primarily on the S-tine cultivator across all fields. The rolling cultivator, operating at 5–5.5 km/h, was used mainly in muck fields, particularly for carrots, with effectiveness varying by field conditions. Spraying was conducted at 2 km/h to ensure precise chemical application. The robot required about 30 of its 32 downtime hours for charging. GPS and SIM card connectivity issues disrupted operations on June 27–28. Despite these challenges, the Naïo Orio robot successfully performed all field operations under the same conditions as the tractor. Additional tasks—mapping, lining, and bed-making—took approximately 8, 7, and 5 hours, respectively, benefiting both the tractor and robot.

Table 1. Season operational activities (in hours) comparison between Naïo Orio robot and tractor across soil types in Holland Marsh 2024

Activity	Naïo Orio robot		Tractor	
	High Organic Matter Soil	Mineral Soil	High Organic Matter Soil	Mineral Soil
Cultivating	4	4	4	4
Spraying	5	2	5	2

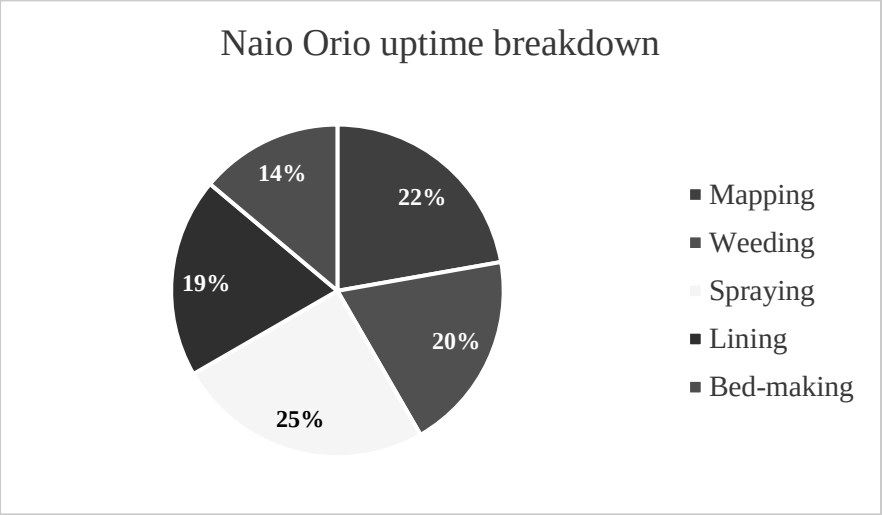

Figure 1. Proportional overall activity (hours) of Naïo Orio working in the four fields on high organic matter and mineral soils, Holland Marsh, 2024

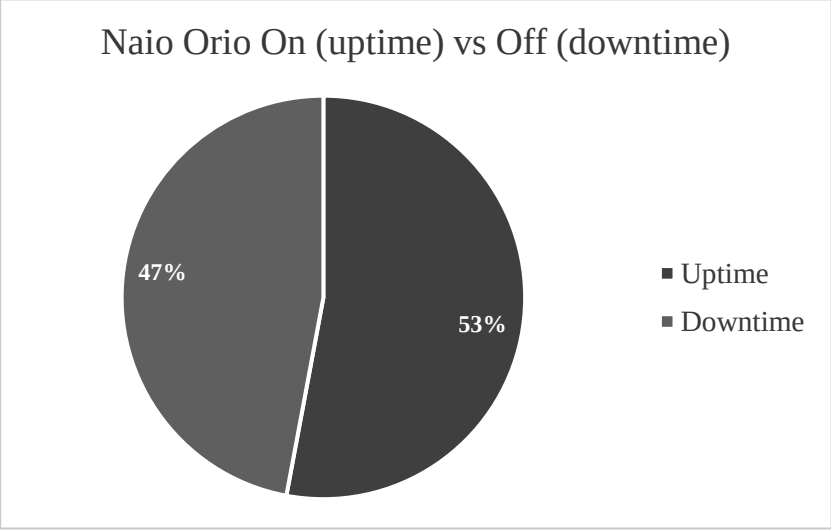

Figure 2. Overall activity uptime and downtime (in hours) of Naïo Orio while working in the four fields of carrots and beets on high organic matter and mineral soils, Holland Marsh, 2024

Funding for this project was provided by the Fresh Vegetable Growers of Ontario, Haggerty AgRobotics Inc., the Ontario Agri-Food Innovation Alliance, and Innovation Farms powered by AgExpert.

CROP: Onion (*Allium cepa* L.), cv. Catskill
PEST: Onion downy mildew (*Peronospora destructor* (Berk.) Casp. in Berk.)

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TITLE: EVALUATION OF FUNGICIDES FOR CONTROL OF DOWNY MILDEW ON DRY BULB ONIONS, 2024

MATERIALS: ORONDIS ULTRA (mandipropamid, oxathiapiprolin), XIVANA (fluoxapiprolin)

METHODS: Onions, cv. Catskill, were direct seeded on 7 May into organic soil (organic matter ≈ 68.3%, pH ≈ 6.4) using Stanhay precision seeder at the Ontario Crops Research Station – Bradford, Holland Marsh, Ontario. A randomized complete block arrangement with four replicates per treatment was used. Each replicate consisted of four rows spaced 43 cm apart, and 5 meters in length. Treatments were applied as foliar sprays using a CO_2 backpack sprayer equipped with four TeeJet 8002 fan nozzles calibrated to deliver 500L/ha at 275 kPA.
Treatments were: ORONDIS ULTRA at 400 mL/ha, XIVANA at 750 mL/ha and XIVANA at 1000 mL/ha. An untreated check was also included. Treatments were applied on 9, 16, 23, 31 July based on disease forecasting and disease risk. On 16 and 29 July, onions in a two-meter section of row were visually examined for the presence of downy mildew (DM) lesions. On 8 August, 20 onions randomly chosen from the inner rows of every replicate were pulled. Leaves were removed and sorted into five classes based on the percentage of the leaf area infected with downy mildew. The five classes were: 0 = no disease, 1 = 1-10%, 2 = 11-25%, 3 = 26-50%, 4 = 51-100% with symptoms of disease. These classes were used to determine the disease severity index (DSI) using the following formula:

$$\text{DSI} = \frac{\sum[(\text{class no.})(\text{no. of leaves in each class})]}{(\text{total no. leaves assessed})(\text{no. classes} - 1)} \text{ x } 100$$

On 28 August, onions in two, 2.32 meter sections of row (2 x 1 m^2) per replicate were pulled. On 3 October, onions were graded, sorted into size categories, weighed and counted to determine yield. Compared to the previous 10-year average, air temperatures in 2024 were above average for May (15.4°C) and average for June (19.2°C), July (21.5°C), August (19.6°C) and September (17.6°C). The 10-year average temperatures were: May 13.4°C, June 18.6°C, July 21.1°C, August 20.4°C and September 16.8°C. Monthly rainfall was below the 10-year average for June (79 mm), August (54 mm) and September (21 mm) and above average for May (83 mm) and July (85 mm). The 10-year rainfall averages were: May 58 mm, June 95 mm, July 75 mm, August 74 mm and September 57 mm. Data were analyzed using General Analysis of Variance function of Statistix V.10. Means Separation was obtained by using Fisher's Protected LSD test at P = 0.05 level of significance.

RESULTS: as presented in Tables 1 & 2.

CONCLUSIONS: The weather in 2024 was conducive to the development of downy mildew in onions, with lesions detected in July. Significant differences were found among the treatments in the disease severity index at the destructive assessment (Table 1). All fungicide treatments significantly reduced DSI compared to the check. The ORONDIS ULTRA treatment significantly increased yield compared to the check (Table 2). There were no significant differences among the treatments in the size distribution of the onions.

Table 1. Downy Mildew (DM) incidence for onions, cv. Catskill, treated with fungicides and grown at the Ontario Crops Research Centre – Bradford, Holland Marsh Ontario, 2024

Treatment	Rate (per ha)	DM Lesions/2 meter row[1]		Leaf Assessment[2]	
		16 July	July 29	%DM	DSI
ORONDIS ULTRA	400 mL	0.0 ns[3]	13.0 ns	55.3 ns	33.6 a[4]
XIVANA High Rate	1000 mL	1.0	24.5	55.6	32.6 a
XIVANA Low Rate	750 mL	1.3	16.8	64.5	39.4 a
Check	-	1.5	40.3	89.6	68.1 b

[1]Two meter of row per plot was visually examined for DM lesions and numbers recorded.
[2] 20 plants per plot were chosen and assessed for Downy Mildew infection and severity on 8 August.
[3] ns = no significant differences were found among treatments at P = 0.05, Fisher's Protected LSD test.
[4] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD test.

Table 2. Yield and size distribution for onions, cv. Catskill, treated with fungicides and grown at the Ontario Crops Research Centre – Bradford, Ontario, 2024.

Treatment	Yield (t/ha)	% Mkb	Size distribution (%)[1]		
			Jumbo (>76 mm)	Large (76-64 mm)	Medium (63-45 mm)
ORONDIS ULTRA	63.7 a[2]	90.0 ns[3]	0.3 ns	13.4 ns	81.9 ns
XIVANA High Rate	44.5 ab	74.9	0.0	4.2	81.7
XIVANA Low Rate	44.9 ab	77.1	0.0	5.3	82.9
Check	42.0 b	72.4	0.0	4.8	80.2

[1] Percentage was determined by weight.
[2] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD test.
[3] ns = no significant differences at P = 0.05, Fisher's Protected LSD test.

Funding for this project was provided by Bayer Crop Science

CROP: Onion (*Allium cepa* L.), cv. Catskill
PEST: Onion downy mildew (*Peronospora destructor* (Berk.) Casp. in Berk.)

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TITLE: EVALUATION OF FUNGICIDES FOR CONTROL OF DOWNY MILDEW ON DRY BULB ONIONS, 2024

MATERIALS: ORONDIS ULTRA (oxathiapiprolin 30 g/L, mandipropamid 250 g/L), ZAMPRO SC (ametoctradin 300 g/L, dimethomorph 225 g/L). SERIFEL (Bacillus amyloliquefaciens strain mbi 600), PRISTINE (boscalid 25.2%, pyraclostrobin 12.8%)

METHODS: Onions, cv. Catskill, were direct seeded on 7 May into organic soil (organic matter ≈ 68.3%, pH ≈ 6.4) using Stanhay precision seeder at the Ontario Crops Research Station – Bradford, Holland Marsh, Ontario. A randomized complete block arrangement with four replicates per treatment was used. Each replicate consisted of four rows spaced 40 cm apart, and 5 meters in length. Treatments were applied as foliar sprays using a CO_2 backpack sprayer equipped with four TeeJet 8002 fan nozzles calibrated to deliver 500L/ha at 275 kPA. Treatments were: ORONDIS ULTRA at 400 mL/ha, ZAMPRO at 1.0 L/ha, SERAFIL at 1.0 Kg/ha, PRISTINE at 1.3 Kg/ha and ZAMPRO at 1.0 L/ha alternated with ORONDIS ULTRA at 400 mL/ha. An untreated check was also included. Treatments were applied on 9, 16, 23, 31 July based on disease forecasting and disease risk. On 18 and 29 July, onions in a two meter section of row were visually examined for the presence of downy mildew (DM) lesions. On 9 August, 20 onions randomly chosen from the inner rows of every replicate were pulled. Leaves were removed and sorted into five classes based on the percentage of the leaf area infected with downy mildew. The five classes were: 0=no disease, 1 = 1-10%, 2 = 11-25%, 3 = 26-50%, 4 = 51-100% with symptoms of disease. These classes were used to determine the disease severity index (DSI) using the following formula:

$$\text{DSI} = \frac{\sum[(\text{class no.})(\text{no. of leaves in each class})]}{(\text{total no. leaves assessed})(\text{no. classes} - 1)} \text{ x } 100$$

On 28 August, onions in two, 2.32 meter sections of row (2 x 1 m^2) per replicate were pulled. On 3 October, onions were graded, sorted into size categories, weighed and counted to determine yield. Data were analyzed using General Analysis of Variance function of Statistix V.10. Means Separation was obtained by using Fisher's Protected LSD test at P = 0.05 level of significance.

RESULTS: as presented in Tables 1 & 2

CONCLUSIONS: The weather in 2024 was conducive to the development of downy mildew in onions, with lesions detected in July. No significant differences in the number of downy mildew lesions among treatments were observed in the trial (Table 1). Additionally, there were no significant differences in disease incidence and severity among treatments. Finally, there was no significant difference in onion size distribution, yield, or proportion of marketable onions produce among trials (Table 2.).

Table 1. Downy Mildew (DM) incidence for onions, cv. Catskill, treated with fungicides and grown at the Ontario Crops Research Centre – Bradford, Holland Marsh Ontario, 2024

Treatment	Rate (per ha)	DM Lesions/2 m row[1]		Leaf Assessment[2]	
		18 July	29 July	%DM	DSI
ORONDIS ULTRA	400.0 mL/ha	0.0 ns[4]	2.8 ns	15.7 ns	5.6 ns
ZAMPRO	1.0 L/ha	0.0	6.3	24.6	10.2
SERAFIL	1.0 Kg/ha	0.0	7.0	46.1	33.3
PRISTINE	1.3 Kg/ha	0.0	3.3	32.6	20.1
ZAMPRO alt/w ORONDIS ULTRA[3]	1.0 L/ha or 400.0 mL/ha	0.0	2.0	10.7	3.8
Check	-	0.0	4.3	36.5	22.6

[1]Two meter of row per plot was visually examined for DM lesions and numbers recorded.
[2] 20 plants per plot were chosen and assessed for Downy Mildew infection and severity on 9 August.
[3] ZAMPRO was applied on 9 and 23 July, ORONDIS ULTRA was applied on 16 and 31 July.
[4] ns = no significant differences were found among treatments at P = 0.05, Fisher's Protected LSD test.

Table 2. Yield and size distribution for onions, cv. Catskill, treated with fungicides and grown at the Ontario Crops Research Centre – Bradford, Ontario, 2024.

Treatment	Yield (t/ha)	% Mkb	Size distribution (%)[1]		
			Jumbo (>76 mm)	Large (76-64 mm)	Medium (63-45 mm)
ORONDIS ULTRA	47.7 ns[2]	87.1 ns	0.0 ns	9.1 ns	78.0 ns
ZAMPRO	49.2	89.9	0.5	8.9	80.5
SERAFIL	43.4	81.7	0.0	9.6	72.0
PRISTINE	44,9	78.8	0.0	6.1	72.7
ZAMPRO + ORONDIS ULTRA[3]	49.0	88.4	0.0	9.2	79.1
Check	42.6	79.6	0.5	5.4	73.7

[1] Percentage was determined by weight
[2] ns = no significant differences at P = 0.05, Fisher's Protected LSD test.

CROP: Onion (*Allium cepa* L.), cv. Catskill
PEST: Onion downy mildew (*Peronospora destructor* (Berk.) Casp. in Berk.)

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TITLE: EVALUATION OF FUNGICIDES FOR CONTROL OF DOWNY MILDEW ON DRY BULB ONIONS, 2024

MATERIALS: Experimental 1 (EXP 1), Experimental 2 (EXP 2), LI700 (surfactant blend 80%), AGRAL 90 (nonylphenoxy polyethoxy ethanol 92%)

METHODS: Onions, cv. Catskill, were direct seeded on 7 May into organic soil (organic matter ≈ 68.3%, pH ≈ 6.4) using a Stanhay precision seeder at the Ontario Crops Research Station – Bradford, Holland Marsh, Ontario. A randomized complete block arrangement with four replicates per treatment was used. Each replicate consisted of four rows spaced 40 cm apart, and 5 meters in length. Treatments were applied as foliar sprays using a CO_2 backpack sprayer equipped with four TeeJet 8002 fan nozzles calibrated to deliver 500L/ha at 275 kPA.
Treatments were: EXP 1 at 1.54 L/ha, EXP 1 at 1.54 L/ha + LI700 at 0.5% v/v, EXP 1 at 1.54 L/ha + AGRAL 90 at 0.5% v/v, and EXP 2 at 1.54 L/ha + LI700 at 0.5% v/v. An untreated check was also included. Treatments were applied on 9, 16, 23, 31 July based on disease forecasting and disease risk. On 16 and 29 July, onions in a two-meter section of row were visually examined for the presence of downy mildew (DM) lesions. On 8 August, 20 onions randomly chosen from the inner rows of every replicate were pulled. Leaves were removed and sorted into five classes based on the percentage of the leaf area infected with downy mildew. The five classes were: 0 = no disease, 1 = 1-10%, 2 = 11-25%, 3 = 26-50%, 4 = 51-100% with symptoms of disease. These classes were used to determine the disease severity index (DSI) using the following formula:

$$\text{DSI} = \frac{\sum[(\text{class no.})(\text{no. of leaves in each class})]}{(\text{total no. leaves assessed})(\text{no. classes} - 1)} \text{ x } 100$$

On 28 August, onions in two 2.32 meter sections of row (2 x 1 m^2) per replicate were pulled. On 3 October, onions were graded, sorted into size categories, weighed and counted to determine yield. Compared to the previous 10-year average, air temperatures in 2024 were above average for May (15.4°C) and average for June (19.2°C), July (21.5°C), August (19.6°C) and September (17.6°C). The 10-year average temperatures were: May 13.4°C, June 18.6°C, July 21.1°C, August 20.4°C and September 16.8°C. Monthly rainfall was below the 10-year average for June (79 mm), August (54 mm) and September (21 mm) and above average for May (83 mm) and July (85 mm). The 10-year rainfall averages were: May 58 mm, June 95 mm, July 75 mm, August 74 mm and September 57 mm. Data were analyzed using General Analysis of Variance function of Statistix V.10. Means Separation was obtained by using Fisher's Protected LSD test at P = 0.05 level of significance.

RESULTS: as presented in Tables 1 & 2

CONCLUSIONS: The weather in 2024 was conducive to the development of downy mildew in onions, with lesions detected in July. Significant differences in the number of downy mildew lesions were observed in the trial on the 29 July assessment (Table 1). All treatments had significantly fewer lesions when compared to the check. In the destructive leaf assessment treatments of EXP 1 + AGRAL 90 and EXP 2 + LI700 significantly reduced disease incidence compared to the check. All fungicide treatments reduced DSI compared to the check, the EXP 2 + LI700 treatment had the lowest DSI of any treatment. There were no significant differences in t/ha among the treatments, however the EXP 1 + LI700 treatment had significantly more onions in the large size category compared to check (Table 2).

Table 1. Downy Mildew (DM) incidence for onions, cv. Catskill, treated with fungicides and grown at the Ontario Crops Research Centre – Bradford, Ontario, 2024.

Treatment	Rate (per ha)	DM Lesions/2 m row[1]		Leaf Assessment[2]	
		16 July	July 29	%DM	DSI
EXP 1 + LI700	1.54 L + 0.5%v/v	0.0 ns[3]	1.8 a[4]	56.3 ab	28.1 ab
EXP 1 + AGRAL90	1.54 L + 0.5%v/v	0.0	2.0 a	41.7 a	20.9 ab
EXP 1	1.54 L	0.0	8.0 a	71.0 ab	46.2 bc
EXP 2+ LI700	1.0 L + 0.5%v/v	0.0	1.5 a	50.3 a	17.9 a
Check	-	1.5	40.3 b	89.6 b	68.1 c

[1]Two meter of row per plot were visually examined for DM lesions.
[2] 20 plants per plot were chosen and assessed for Downy Mildew infection and severity on 8 August.
[3] ns = no significant differences were found among treatments at P = 0.05, Fisher's Protected LSD test.
[4] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD test.

Table 2. Yield and size distribution for onions, cv. Catskill, treated with fungicides and grown at the Ontario Crops Research Centre – Bradford, Ontario, 2024.

Treatment	Yield (t/ha)	% Mkb	Size distribution (%)[1]		
			Jumbo (>76 mm)	Large (76-64 mm)	Medium (63-45 mm)
EXP 1 + LI700	65.0 ns[2]	89.1 ns	0.0 ns	18.5 a[3]	77.2 ns
EXP 1 + AGRAL90	49.1	76.1	0.0	7.9 ab	78.5
EXP 1	53.7	79.0	0.4	15.0 ab	71.9
EXP 2+ LI700	49.8	80.1	0.7	11.3 ab	77.4
Check	42.0	72.4	0.0	4.8 b	80.2

[1] Percentage was determined by weight
[2] ns = no significant differences at P = 0.05, Fisher's Protected LSD test.
[3] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD test.

CROP: Yellow cooking onions (*Allium cepa* L.), cv. Catskill
PEST: Stemphylium leaf blight (*Stemphylium vesicarium* (Wallr.))

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TITLE: EVALUATION OF FUNGICIDES FOR CONTROL OF STEMPHYLIUM LEAF BLIGHT ON ONIONS, 2024

MATERIALS: ALLEGRO 500 (fluazinam), MIRAVIS DUO (pydiflumetofen 75 g/L, difenoconazole 125 g/L), SERCADIS (fluxapyroxad 300 g/L), FOLPAN (folpet)

METHODS: Onions, cv. Catskill, were direct seeded (≈ 35 seeds/m) on 7 May into organic soil (organic matter ≈ 68.3%, pH ≈ 6.4) at the Ontario Crops Research Centre - Bradford, Ontario. A randomized complete block arrangement with four replicates per treatment was used. Each replicate consisted of eight rows spaced 40 cm apart, and 6 m in length. Fungicide sprays were applied on 24 June, 5, 12, 22 and 31 July using a tractor-mounted sprayer fitted with D-3 hollow-cone nozzles at 620 kPa to deliver 500 L/ha. Fungicide treatments were: MIRAVIS DUO at 1.0 L/ha, ALLEGRO at 1.17 L/ha, MIRAVIS DUO alternated with ALLEGRO, FOLPAN at 2.0 L/ha and SERCADIS at 666 mL/ha. An untreated check was also included. On 7August, 20 onions randomly chosen from the inner rows of every replicate were pulled. Leaves were removed and green leaves sorted into seven classes based on the percentage of the leaf area infected with *Stemphylium*. The seven classes were: 0= no disease, 1 = 1-4%, 2 = 5-10%, 3 = 11-25%, 4 = 26-50%, 5 = 51-75%, 6 > 75% with symptoms of SLB. These classes were used to determine the disease severity index (DSI) using the following formula:

$$DSI = \frac{\sum [(\text{class no.})\ (\text{no. of leaves in each class})]}{(\text{total no. leaves assessed})\ (\text{no. classes } -1)} \times 100$$

On 29 August, the onions in two 2.32 m sections of row were pulled from the inner rows for a yield sample. Onions were weighed and graded for size on 22 September to determine yield**.** Compared to the previous 10-year average, air temperatures in 2024 were above average for May (15.4°C) and average for June (19.2°C), July (21.5°C), August (19.6°C) and September (17.6°C). The 10-year average temperatures were: May 13.4°C, June 18.6°C, July 21.1°C, August 20.4°C and September 16.8°C. Monthly rainfall was below the 10-year average for June (79 mm), August (54 mm) and September (21 mm) and above average for May (83 mm) and July (85 mm). The 10-year rainfall averages were: May 58 mm, June 95 mm, July 75 mm, August 74 mm and September 57 mm. Data were analyzed using the General Analysis of Variance function of Statistix V.10. Means separation was obtained by using Fisher's Protected LSD test at P = 0.05 level of significance.

RESULTS: as presented in Tables 1-2

CONCLUSIONS: Stemphylium incidence was moderate in 2024 and increased through July. Significant differences in disease severity were observed among fungicide treatments when plants were destructively sampled and assessed on Aug. 7 (Table 1). Onions sprayed with ALLEGRO or MIRAVIS DUO had significantly lower disease severity than onion treated with FOLPAN, SERCADIS or the untreated check. Onions treated with ALLEGRO or MIRAVIS DUO had fewer diseased leaves all the other fungicides and the untreated check. There were no significant differences in the number of green leaves per plant. No ssignificant differences in yield were observed among the treatments (Table 2).

Table 1. Stemphylium leaf blight (SLB) incidence and severity for onions, cv. Catskill, sprayed with various fungicides and destructively sampled on Aug. 7, at the Ontario Crops Research Centre - Bradford, Holland Marsh, Ontario, 2024.

Treatment	% Leaves rated 0 or 1[1]	SLB incidence	DSI	Green leaves/plant
ALLEGRO	28.2 a[2]	94.7 ns[3]	42.8 a	6.3 ns
MIRAVIS/ALLEGRO	28.0 a	93.9	44.2 a	6.4
MIRAVIS	20.2 ab	96.0	49.9 ab	5.8
FOLPAN	13.1 b	98.0	54.7 b	5.7
SERCADIS	11.0 b	87.0	56.8 b	6.2
Check	10.8 b	97.4	57.5 b	6.0

[1] On 7 August the leaves of 20 plants were sorted into classes: 0= no disease, 1 = 1-4%, 2 = 5-10%, 3 = 11-25%, 4 = 26-50%, 5 = 51-75%, 6 > 75% based on the percentage of leaf area infected with Stemphylium.
[2] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD test.
[3] ns = no significant differences at P = 0.05, Fisher's Protected LSD test.

Table 2. Yield of onions, cv. Caskill, sprayed with various fungicides at the Ontario Crops Research Centre - Bradford, Holland Marsh, Ontario, 2024.

Treatment	Yield (t/ha)	% Mkb	Size distribution (%)		
			Jumbo (>76mm)	Large (76-64 mm)	Medium (>64-45 mm)
ALLEGRO	73.1 ns[1]	93.4 ns	0.0 ns	25.5ns	72.4 ns
MIRAVIS/ALLEGRO	74.2	94.3	0.4	26.4	71.2
MIRAVIS	68.1	92.1	0.0	15.8	81.0
FOLPAN	65.7	91.4	0.4	18.9	77.5
SERCADIS	64.6	90.3	0.0	15.1	81.3
Check	68.7	92.3	0.3	17.8	78.8

[1] ns = no significant differences at P = 0.05, Fisher's Protected LSD test.

Funding for this project was provided the Fresh Vegetable Growers of Ontario

CROP: Yellow cooking onions (*Allium cepa* L.), cv. Catskill
PEST: Stemphylium leaf blight (*Stemphylium vesicarium* (Wallr.))

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TITLE: EVALUATION OF DISEASE FORECASTING MODELS FOR MANAGEMENT OF STEMPHYLIUM LEAF BLIGHT IN YELLOW COOKING ONIONS, 2024

MATERIALS: DITHANE RAINSHIELD WG (mancozeb 75.0%), MIRAVIS DUO (pydiflumetofen 7.5%, difenoconazole 12.5%), ALLEGRO (fluazinam 40.0%), EVERGOL PRIME (penflufen 22.7%)

METHODS: Onion cv. Catskill treated with EVERGOL PRIME seed treatment was seeded on organic soil (organic matter ~68%, pH ~ 6.2) at the Ontario Crops Research Centre – Bradford on 07 May 2024 using a Stanhay precision seeder. The trial was arranged in a randomized complete block design (RCBD) with seven fungicide timing treatments and one nontreated control. Each plot consisted of a 6-m-long segment of two adjacent beds, seeded with four double rows per bed with each double row spaced 40 cm apart. The treatments were: i) calendar sprays of ALLEGRO alternated with MIRAVIS DUO (A + M) applied every 7–10 days beginning at the 3–4 true leaf stage), ii) calendar sprays of MIRAVIS DUO alternated with DITHANE (M+ D) applied every 7–10 days beginning at the 3–4 true leaf stage) iii) TOMcast with a threshold of 15 disease severity values (DSVs), iv) conidia threshold of 20 conidia/rod per sampling date of a rotorod spore trap, v) increasing conidia thresholds of 10 (2–5 true leaf stage), 25 (6–8 true leaf stage) and 200 (9+ true leaf stage), vi) STEMcast 2.0 (a modified version of TOMcast) with a threshold of 15, vii) STEMcast 2.0 with a threshold of 10 conidia until the 5th true leaf stage and a threshold of 15 DSVs after the 5th true leaf stage and viii) an nontreated control. The STEMcast 2.0 model increases the leaf wetness period required to get higher disease severity values (DSVs) compared to TOMcast and eliminates DSVs for temperatures lower than 18°C. Fungicide application was triggered using disease forecasting models based on weather data or conidia counts.

For almost all treatments, ALLEGRO (1.16 L/ha) and MIRAVIS DUO (1 L/ha) were applied alternately using a tractor-mounted sprayer with D-3 spray nozzles at 620 kPA delivering 500 L/ha. The only exception was the calendar spray with MIRAVIS DUO (1 L/ha) and DITHANE (2.5 kg/ha). The treatments were sprayed 1-6 times throughout the season. Stemphylium leaf blight (SLB) severity was assessed in each plot on 25 June, 02, 09, 17, 25 July, and 01 August. The three oldest green leaves of 20 plants per plot (10 plant from the middle rows of each bed) were rated and placed into classes based on a 0-4 scale for percentage leaf dieback where 0= no symptoms, 1 = 1–10% dieback, 2 = 11–25% dieback, 3 = 26–50% dieback and 4 > 50% dieback. Total SLB severity out of 12 was calculated for each plant by adding the rating of each of the three leaves. A disease severity index (DSI) was calculated for each plot using the following formula:

$$\text{DSI} = \frac{\sum [(\text{class no.})\ (\text{no. of leaves in each class})]}{(\text{total no. of leaves assessed})\ (\text{no. of classes} - 1)} \times 100$$

The area under the disease progress curve (AUDPC) was calculated with the following formula:

$$\text{AUDPC} = \sum_{j=1}^{Nj-1} \left(\frac{y_j + y_{j+1}}{2}\right)(t_{j+1} - t_j)$$

where $_j$ is the order index for the assessments over time, n_j is the number of assessments, y_j is the average rating at day t_j, y_{j+1} is the average rating at day t_{j+1} and (t_{j+1}-t_j) is the number of days between the assessments.

On 06 August, 10 consecutive plants within a row from the two inner rows of each bed (total of 20) were pulled. The green leaves of all 20 plants were removed, rated for percentage leaf dieback and placed into a class based on a 0-6 scale where 0= no symptoms, 1 = 1–4% dieback, 2 = 5–10% dieback, 3 = 11–25% dieback, 4 = 26–50% dieback, 5 = 51–75% dieback and 6 > 75% dieback. DSI was calculated based on this assessment. Yield was estimated by removing the onion plants from a 2.3-m-long section of two inner rows of each plot on 26 August. The onion bulbs were left to dry in the field. On 24 September, the bulbs were sorted into classes: jumbo (> 76 mm), large (76–64 mm), medium (64–45 mm) and culls (< 45 mm) and weighed to calculate marketable yield.

Compared to the previous 10-year average, air temperatures in 2024 were above average for May (15.4°C) and average for June (19.2°C), July (21.5°C), August (19.6°C) and September (17.6°C). The 10-year average temperatures were: May 13.4°C, June 18.6°C, July 21.1°C, August 20.4°C and September 16.8°C. Monthly rainfall was below the 10-year average for June (79 mm), August (54 mm) and September (21 mm) and above average for May (83 mm) and July (85 mm). The 10-year rainfall averages were: May 58 mm, June 95 mm, July 75 mm, August 74 mm and September 57 mm.

Data analysis was a mixed model analysis of variance (ANOVA) calculated using PROC GLIMMIX in SAS and means separation using Tukey's HSD at a significance level of $P = 0.05$.

RESULTS: As presented in Tables 2–4.

CONCLUSIONS: In 2024, SLB severity was moderate (63%) in the nontreated control. The AUDPC was lower in the calendar spray (A + M) and TOMcast 15 models than the control, Conidia 20 and Conidia IT models. The calendar spray (A + M) and TOMcast 15 models also reduced the DSI and percentage of leaves rated 0 or 1 compared to the nontreated control. The calendar spray (A + M) was the only treatment that increased the number of green leaves per plant compared to the nontreated control. TOMcast 15 was the only forecasting model to reduce SLB severity, but it triggered more fungicide applications than the calendar spray. None of the treatments that involved numbers of conidia reduced disease severity compared to the control. None of the treatments increased marketable yield compared to the control. There was a moderate negative correlation between the AUDPC and marketable yield (r = -0.43, $P = 0.0008$) and final DSI and marketable yield (r = -0.43, $P = 0.0009$).

Table 1: Dates of application of the fungicides ALLEGRO (A), MIRAVIS DUO (M) and DITHANE (D) for each treatment in an onion trial at the Ontario Crops Research Centre – Bradford in 2024.

Model	11 Jun	24 Jun	27 Jun	05 Jul	12 Jul	22 Jul	26 Jul	31 Jul
TOMcast 15	A	M	-	A	M	A	-	M
Calendar (A + M)	-	A	-	M	A	M	-	A
Calendar (M + D)	-	M	-	D	M	D	-	M
STEMcast 2.0 15	A	-	M	-	A	-	M	-
STEMcast 2.0 Conidia	-	-	A	-	M	-	A	-
Conidia IT	-	-	A	-	-	-	-	-
Conidia 20	-	-	-	-	-	-	A	-
Control	-	-	-	-	-	-	-	-

Table 2: Effect of fungicide application timing according to forecasting models for Stemphylium leaf blight (SLB) on disease severity index (DSI), area under the disease progress (AUDPC) in an onion trial at the Ontario Crops Research Centre – Bradford in 2024.

Model	# Sprays	DSI						AUDPC
		25 June	2 Jul	9 Jul	17 Jul	25 Jul	1 Aug	
TOMcast 15	6	14 ab[1]	11 ns[2]	22 ns	30 a	34 a	45 a	944 a
Calendar (A + M)	5	13 ab	11	22	36 ab	33 a	46 ab	979 a
STEMcast 2.0 Conidia	3	15 ab	13	21	37 ab	39 ab	52 a-d	1065 ab
STEMcast 2.0 15	4	12 a	11	21	40 b	41 ab	47 ab	1069 ab
Calendar (M + D)	5	14 ab	12	22	36 ab	41 ab	50 abc	1069 ab
Conidia 20	1	14 ab	11	23	40 b	43 b	60 d	1153 b
Conidia IT	1	13 ab	12	24	40 b	45 b	56 bcd	1161 b
Control	0	16 b	12	23	41 b	44 b	57 cd	1169 b

[1] Means in a column followed by the same letter do not differ at $P = 0.05$ based on Tukey's HSD.
[2] ns = not significant at $P = 0.05$.
[3]AUDPC calculated based on the DSI for 25 June, 02, 09, 17, 25 July and 01 August.

Table 3: Assessment of disease forecasting models for Stemphylium leaf blight (SLB) on the incidence, disease severity index (DSI), leaves rated 0 or 1 (%) and green leaves per plant based on the destructive assessment at the Ontario Crops Research Centre – Bradford in 2024.

Model	# Sprays	Incidence	DSI	% Leaves Rated 0 or 1	Green leaves/plant
TOMcast 15	6	97 ns[1]	45 a[2]	23 a	6 ab
Calendar (A + M)	5	98	46 a	23 a	7 a
STEMcast 2.0 Conidia	3	98	57 ab	12 ab	6 ab
STEMcast 2.0 15	4	97	54 ab	14 ab	6 ab
Calendar (M + D)	5	98	57 ab	11 ab	6 ab
Conidia 20	1	98	64 b	6 b	5 b
Conidia IT	1	99	60 b	8 ab	6 ab
Control	0	99	63 b	7 b	5 b

[1] ns = not significant at $P = 0.05$.
[2] Means in a column followed by the same letter do not differ at $P = 0.05$ based on Tukey's HSD.

Table 4: Effect of fungicide application triggered by disease forecasting models on marketable yield (t/ha), percentage marketable (%Mkb) and size distribution of onion bulbs in a field trial at the Ontario Crops Research Centre – Bradford in 2024.

Treatment	Yield (t/ha)	% Mkb	Size distribution (%)			
			Jumbo (> 76 mm)	Large (76–64 mm)	Medium (64–45 mm)	Cull (< 45 mm)
TOMcast 15	72 ns[1]	91 ns	1 ns	21 a[2]	70 ns	9 ns
Calendar (A + M)	73	91	1	15 ab	75	9
STEMcast 2.0 Conidia	67	90	1	15 ab	74	11
STEMcast 2.0 15	70	93	0	15 ab	78	7
Calendar (M + D)	70	93	0	12 ab	80	8
Conidia 20	65	88	1	11 ab	77	12
Conidia IT	65	90	0	10 b	80	10
Control	64	90	0	11 ab	79	11

[1] ns = not significant at $P = 0.05$.
[2] Means in a column followed by the same letter do not differ at $P = 0.05$ based on Tukey's HSD.

Funding for this project was provided by the Ontario Agri-Food Innovation Alliance, the Bradford Cooperative Storage Ltd. and the Fresh Vegetable Growers of Ontario.

CROP: Yellow cooking onions (*Allium cepa* L.) cv. Traverse
PEST: Stemphylium leaf blight (*Stemphylium vesicarium* (Wallr.))

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TITLE: EFFECT OF TEMPERATURE AND LEAF WETNESS DURATION ON INFECTION OF ONION BY *STEMPHYLIUM VESICARIUM*, GROWTH ROOM STUDY, 2024

METHODS: The effect of combinations of temperature and leaf wetness duration were evaluated on infection in onion leaves inoculated with conidia *Stemphylium vesicarium*, based on lesion counts. The experiment was laid out in a split-plot design with a factorial arrangement of temperature (main plots = growth chambers) and subplots of leaf wetness duration, with eight replicates (single onion plants) per treatment combination. The two factors were temperature (13, 18, and 23°C) and leaf wetness duration (0, 6, 12, 24, 48, and 72 hr). The selected ranges represented the minimal to optimal conditions identified in previous studies for development of Stemphylium leaf blight (SLB) symptoms. Controls for each combination were mock-inoculated with water. The experiment was repeated.

Onions were seeded individually in each pot on 13 November (initial study) and 12 December 2023 (repetition) into BM6 soilless mix (All-purpose HP, Berger Peat Moss Ltd, Saint Modeste, QC) and grown in a greenhouse at the Ontario Crops Research Centre - Bradford. Seedlings were transplanted at the three-leaf stage on 12 December 2023 (initial study) and 15 January 2024 (repetition) and then moved to and maintained in a growth room set at to 24°C / 21°C day night cycle, a 17-hour photoperiod and 50% humidity.

Inoculum of *S. vesicarium* was produced from three isolates collected from lesions on onion leaves (two from the 2023 field season and one from the 2022 field season) and grown on V8 agar grown under alternating 12 hr UV light and darkness for 7 days. Dishes filled with an actively growing colony of *S. vesicarium* were flooded with deionized water to dislodge conidia, and the suspension was filtered through cheesecloth to remove mycelial fragments. The final concentration was adjusted to 2×10^5 spores/mL, with 0.01% Tween 20 added to every 10 mL of solution.

When the onions reached the 4–5 leaf stage, plants were sprayed with the inoculum until runoff. Control plants were mock-inoculated with water until runoff. Immediately after inoculation, plants were placed in water-filled trays and covered with plastic bags to maintain high humidity (90% relative humidity) in temperature-controlled growth chambers. This setup ensured high leaf wetness duration immediately following inoculation. Growth cabinets were not reassigned in the repetition because of technical limitations. Lesions were counted at 14 days post-inoculation and visually identified as characteristic tan, water-soaked lesions of SLB on all leaves of each plant.

There was no repetition × treatment interaction when the data combined over repetition were analyzed, so the data were combined for subsequent analysis. Data were analyzed using a mixed-model ANOVA in PROC GLIMMIX in SAS (version 9.4, SAS Institute, Cary, ID), which accounted for random factors (repetition, replication, and growth chamber nested within trial) and fixed effects (temperature and leaf wetness duration). A regression approach was used to model lesion count, and the interaction of temperature × leaf wetness duration was significant ($p < 0.05$). The regression equation describing lesion count as a function of temperature and leaf wetness duration was: $Y = 0.1182 + (0.0014 \times Temp) + (-0.049 \times Time) + (0.0051 \times Temp \times Time$; $R^2 = 0.76$).

RESULTS: As presented in Fig. 1.

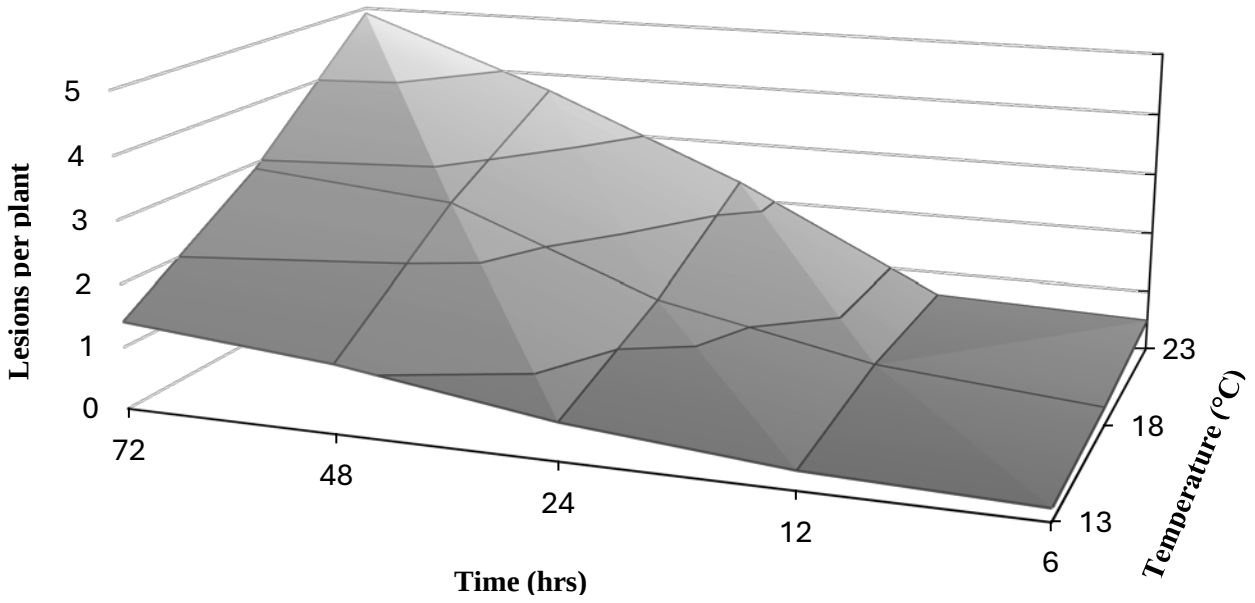

Figure 1: Effect of combinations of temperature and leaf wetness duration on lesions per plant on onion plants inoculated with conidia of *Stemphylium vesicarium.* Different shades of blue indicate integer categories for lesions.

CONCLUSIONS: The number of lesions per plant increased with higher temperatures and longer leaf wetness duration, as expected. The highest lesion count was observed at 23°C and 72 hr of leaf wetness, while the lowest lesion count occurred at 13°C and 6 hr of leaf wetness. Lesion counts were low across all temperatures when leaf wetness lasted 12 hr or less (Fig. 1).

These results support the valuations in existing disease forecasting models, such as TOMcast. However, TOMcast assigns the highest possible Daily Disease Severity Value (4) at 23+ hr of leaf wetness and 18°C, but the most severe disease conditions in the current study occurred at 23°C and 72 hr of leaf wetness. This may indicate that TOMcast (and other forecasting models) are over-predicting SLB severity and so could be improved by more accurately identifying the suitability of infection conditions for SLB on onion.

Funding for this project was provided by the Ontario Agri-Food Innovation Alliance, the Fresh Vegetable Growers of Ontario, and the Bradford Cooperative Storage Ltd.

CROP: Yellow cooking onions (*Allium cepa* L.) cv. Catskill

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TITLE: **EVALUATION OF PRE-PLANT AND FOLIAR FERTILIZER ON NUTRIENT STATUS AND STEMPHYLIUM LEAF BLIGHT SEVERITY IN ONIONS IN HIGH ORGANIC MATTER SOILS, 2024**

METHODS: A field trial was conducted at a muck soil site in the Holland Marsh (organic matter 52.5 – 66.4%, pH 7.1 – 7.4). Onion cv Catskill (Stokes Seeds, Thorold, ON) was transplanted between 21 and 24 May. Each replicate plot consisted of two beds, 10 m in length. Each bed had four rows of onions, spaced 40 cm apart, for a width of 3.5 m. The experiment was a two-factor factorial in a randomized complete block with three replications. There were six treatment combinations (Table 1). Factor one was preplant fertilizer (No NPK vs. recommended NPK) and factor two was foliar fertilizer (no foliar, manganese sulfate, or complete foliar fertilizers applied based on tissue testing) (Table 2). The experimental plan was to apply foliar fertilizer based on tissue test results from the Picketa LENS assessment or tissue test results from SGS Labs. However, in practice, both plots received the same foliar fertilizers each application and the data from the two treatments were averaged for each replicate plot.

The nutritional status of the plants was assessed using the most recently mature leaf (usually the third leaf from the center) from 10 plants per row within the 2 center rows from each replicate plot. These were sampled three times during active growth, 18 and 30 July and 13 August (Table 3, 4 and 5 respectively). These leaves were scanned using the Picketa LENS technology and the same leaves were sent to the SGS laboratory (Guelph) for tissue analysis. Both methods gave results for 11 nutrients: nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg), calcium (Ca), zinc (Zn), manganese (Mn), copper (Cu), boron (B), sulfur (S), and iron (Fe). The results of Picketa LENS technology were immediately available on display through the Picketa cloud-based 'Fieldbook', while the SGS lab results were received five days later. The sufficiency ranges for nutrient concentration were from the OMAFA Vegetable Guide 839, adapted from Hochmuth, et al. 2018 (Plant Tissue Analysis and Interpretation for Vegetable Crops in Florida. University of Florida IFAS Extension. HS964).

On 17 July, 25 July and 1 August, 20 representative onion samples (10 plants in a row for each of the two inner rows) of each replicate were visually examined for symptoms of Stemphylium leaf blight **(**SLB) on the three oldest leaves per plant. Each plant was rated and placed into classes based on percent leaf dieback using a 0 – 4 scale, where 0 = no disease, 1 = 1 – 10%, 2 = 11 – 25%, 3 = 26 – 50%, and 4 = >50% dieback.

On 13 August, 20 representative samples, 10 plants from each of the two inner rows of each replicate were pulled. Leaves were removed and sorted into seven classes based on the percentage of the leaf area with symptoms of SLB. The seven classes were: 0 = no disease, 1 = 1 – 4%, 2 = 5 – 10%, 3 = 11 – 25%, 4 = 26 – 50%, 5 = 51 – 75%, and 6 = >75%. These classes were used to determine the disease severity index (DSI) using the following formula:

$$DSI = \frac{\sum[(class\ no.)(no.of\ leaves\ in\ each\ class)]}{(Total\ no.of\ leaves\ assessed)(no.classes - 1)} \times 100$$

On 28 August, yield samples were taken from 2.32 m sections of the two middle rows in an area different from where the tissue test samples were taken. Samples were graded for size to determine yield and marketable yield on 17 September using size grades jumbo (>76 mm), large (76-64 mm), medium (64-45 mm), and cull (<45 mm). All size grades except cull were grouped as marketable yield.

The data were analyzed as a factorial experiment in a randomized complete block design (RCBD) using the PROC GLIMMIX procedure of SAS version 9.4 (SAS Institute, Cary, USA). All analyses were a two-way factorial except for the tissue nutrient assessment which had tissue analysis method as a third factor. Replication was a random effect. Pairwise comparisons of least squares means were adjusted using Tukey's HSD method.

Compared to the previous 10-year average, air temperatures in 2024 were above average for May (15.4°C) and average for June (19.2°C), July (21.5°C), and August (19.6°C). The 10-year average temperatures were: May 13.4°C, June 18.6°C, July 21.1°C, and August 20.4°C. Monthly rainfall was below the 10-year average for June (79 mm), and August (54 mm) and above average for May (83 mm) and July (85 mm). The 10-year rainfall averages were: May 58 mm, June 95 mm, July 75 mm, and August 74 mm.

RESULTS: as presented in Tables 3 to 8**.**

CONCLUSIONS: The tissue analysis results showed that nutrient levels for all treatments and testing methods were generally within or above the sufficiency range, with some exceptions. The Picketa LENS reported higher values than the SGS lab for most of the nutrients across sampling dates.
Preplant NPK application increased N concentration compared to no-NPK treatments on the 30 July assessment and for the SGS results on 13 August. There were no differences in nutrient levels with foliar fertilizer application, compared to no foliar fertilizer on 18 July and 13 August and for all nutrients except Zn on 30 July. Interaction effects between preplant and foliar treatments were generally not significant.
Preplant NPK plots produced onions with higher total and marketable yields and more jumbo and large onions (Table 6). There were no differences among foliar treatments.
The severity of SLB increased steadily from 17 July to 13 August (Table 7). The preplant NPK application had no effect on DSI except on 25 July when SLB severity was slightly lower in treatments with no preplant fertilizer. There was no effect of foliar fertilizer treatments. The correlation between the SLB severity index (DSI) and onion yield was analyzed for the four SLB assessment dates (17 July, 25 July, 01 August, and 13 August). There was a negative correlation between severity on 25 July and yield. There was a positive correlation between SLB severity at the final destructive assessment and yield, which was unexpected.
Across all parameters, preplant NPK had the most influence on macronutrient levels and overall yield, as expected, while foliar treatments were particularly effective at modifying micronutrient concentrations.

Table 1: Treatment combinations

S/N	Treatment
1	No NPK fertilizer and no foliar fertilizer
2	No NPK fertilizer with manganese foliar application
3	No NPK fertilizer with foliar nutrients based on tissue test (foliar A and B)
4	NPK preplant fertilizer and no foliar fertilizer
5	NPK fertilizer with manganese foliar application
6	NPK fertilizer with foliar nutrients based on tissue test (foliar A and B)

Table 2: Summary of fertilizer types, and application rates

Category	Product	Rate (kg/ha)	Amount applied (g)	Comment
Pre-Plant Fertilizers	Nitrogen (21-0-0)	90	1500	-
	Phosphorus (MESZ 10-40-0)	50	438	-
	Potassium (Aspire 0-0-58)	100	603	-
	Potassium (0-0-22)	60	1050	-
	Copper sulfate (25%)	7	98	-
	Sulfur Chips	30 kg per 1000 m^2	1050	-
Foliar Fertilizers	Calcimax	-	160 mL in 40 L of water	Applied twice during the trial on 27 June and 26 July
	Alexin	-	160 mL in 40 L of water	
	Magmax	-	160 mL in 40 L of water	
	Zincmax	-	160 mL in 40 L of water	
	TruPhos Platinum	-	160 mL in 40 L of water	
	NPK 20-20-20	-	160 g in 40 L of water	
Manganese foliar fertilizers	Manganese sulfate	-	500 g in 25 L of water	

Table 3: Nutrient levels of key elements in onion leaves, Jane St. site and sufficiency range, 18 July 2024

Sampling method	Treatments	N	P (%)	K (%)	Mg (%)	Zn (ppm)	Mn (ppm)	S
SGS lab	No NPK	2.8 e[1,2]	0.33 ns[3]	2.9 ns	0.14 b	12.9 b	32.4 b	0.71 c[2]
	No NPK + Mn foliar	3.1 cde	0.34	3.1	0.16 b	17.8 b	46.9 b	0.71 c
	No NPK + tissue test-based foliar	2.9 de	0.36	3.1	0.15 b	17.3 b	43.9 b	0.75 bc
	NPK	3.3 cde	0.35	3.2	0.15 b	16.8 b	41.7 b	0.84 a
	NPK + Mn foliar	3.6 bc	0.32	3.6	0.18 b	16.0 b	50.1 b	0.76 abc
	NPK + + tissue test-based foliar	3.5 cd	0.35	3.4	0.17 b	18.6 b	50.0 b	0.83 ab
Picketa LENS	No NPK	4.4 ab[4]	0.37	3.1	0.28 a	39.3 a	78.7 a	0.48 d[4]
	No NPK + Mn foliar	4.5 a	0.38	3.7	0.29 a	39.7 a	78.0 a	0.47 d
	No NPK + + tissue test-based foliar	4.3 ab	0.38	3.1	0.26 a	35.7 a	75.5 a	0.49 d
	NPK	4.5 a	0.36	3.3	0.32 a	42.3 a	81.7 a	0.45 d
	NPK + Mn foliar	4.7 a	0.37	3.9	0.31 a	45.3 a	83.0 a	0.44 d
	NPK + + tissue test-based foliar	4.6 a	0.37	3.3	0.29 a	42.2 a	80.0 a	0.45 d
Sufficiency range		2-3	0.2–0.5	1.5 – 3	0.15 – 0.3	15 – 20	10 – 20	0.2 – 0.6

[1] Means in a column followed by the same letter are not significantly different at P > 0.05, based on the Tukey-Kramer multiple comparison test. Means were approximated to two decimal places.
[2] The nutrient was reported as “as is” for all lab measurements. This means that the content was measured in the sample as it is, without any adjustments for moisture.
[3] ns = no significant interactions were found among treatments
[4] The nutrient was reported in ‘percentage’ for the Picket LENS measurements.

Table 4: Nutrient levels of key elements in onion leaves, Jane St. site and sufficiency range, 30 July 2024

Sampling method	Treatment combinations	N	P (%)	K (%)	Mg (%)	Zn (ppm)	Mn (ppm)	S
SGS lab	No NPK	2.2 d[1, 2]	0.34 a	2.2 e	0.13 b	20.0 b	59.7 b	0.59 b[2]
	No NPK + Mn foliar	2.2 d	0.33 ab	2.4 e	0.13 b	15.6 b	139.8 ab	0.61 ab
	No NPK + tissue test-based foliar	2.2 d	0.36 a	2.4 e	0.13 b	60.0 a	153.4 a	0.63 ab
	NPK	2.8 c	0.26 c	2.6 de	0.14 b	15.2 b	64.9 b	0.66 ab
	NPK + Mn foliar	2.8 c	0.27 bc	2.6 de	0.14 b	15.8 b	126.0 ab	0.62 ab
	NPK + tissue test-based foliar	2.8 c	0.27 bc	2.6 de	0.15 b	45.2 ab	126.0 ab	0.67 a
Picketa	No NPK	4.4 b[3]	0.37 a	3.3 a-d	0.26 a	37.0 ab	74.3 ab	0.49 c[3]
	No NPK + Mn foliar	4.5 ab	0.36 a	3.2 bcd	0.25 a	38.3 ab	74.3 ab	0.48 c
	No NPK + tissue test-based foliar	4.3 b	0.37 a	3.1 cd	0.27 a	39.3 ab	77.5 ab	0.47 c
	NPK	4.8 a	0.37 a	3.9 a	0.29 a	47.3 ab	81.7 ab	0.43 c
	NPK + Mn foliar	4.7 a	0.37 a	3.4 abc	0.29 a	47.0 ab	81.0 ab	0.44 c
	NPK + tissue test-based foliar	4.8 a	0.37 a	3.8 ab	0.26 a	45.7 ab	79.0 ab	0.44 c
Sufficiency range		2-3	0.2–0.5	1.5 – 3	0.15 – 0.3	15 – 20	10 – 20	0.2 – 0.6

[1] Means in a column followed by the same letter are not significantly different at P > 0.05, based on the Tukey-Kramer multiple comparison test. Means were approximated to two decimal places.

[2] The nutrient was reported as “as is” for all lab measurements. This means that the content was measured in the sample as it is, without any adjustments for moisture

[3] The nutrient was reported in ‘percentage’ for the Picket LENS measurements.

Table 5: Nutrient levels of key elements in onion leaves, Jane St. site and sufficiency range, 13 August 2024

Sampling method	Treatment combinations	N	P (%)	K (%)	Mg (%)	Zn (ppm)	Mn (ppm)	S
SGS lab	No NPK	2.5 b[1, 2]	0.45 a	2.4 c	0.15 c	15.0 b	28.8 ns[3]	0.62 ab[2]
	No NPK + Mn foliar	2.7 b	0.44 ab	2.6 c	0.15 c	15.8 b	37.9	0.70 a
	No NPK + tissue test-based foliar	2.8 b	0.46 a	2.6 bc	0.15 c	39.4 a	90.4	0.71 a
	NPK	3.0 b	0.28 abc	2.5 c	0.15 c	15.4 b	64.4	0.63 ab
	NPK + Mn foliar	3.0 b	0.25 bc	2.5 c	0.15 c	12.5 b	77.8	0.62 ab
	NPK + tissue test-based foliar	3.0 b	0.23 c	2.4 c	0.14 c	34.7 a	81.6	0.57 bc
Picketa LENS	No NPK	4.2 a[4]	0.36 abc	3.0 ab	0.24 b	36.3 a	75.7	0.48 cd[4]
	No NPK + Mn foliar	4.0 a	0.35 abc	3.0 ab	0.27 ab	36.0 a	78.0	0.46 d
	No NPK + tissue test-based foliar	4.0 a	0.35 abc	3.0 a	0.26 ab	36.5 a	77.0	0.48 cd
	NPK	4.3 a	0.36 abc	3.2 a	0.26 ab	38.0 a	77.3	0.47 d
	NPK + Mn foliar	4.5 a	0.38 abc	3.1 a	0.27 ab	41.0 a	80.0	0.46 d
	NPK + + tissue test-based foliar	4.3 a	0.35 abc	3.1 a	0.27 a	41.7 a	80.8	0.46 d
Sufficiency range		2-3	0.2–0.5	1.5 – 3	0.15 – 0.3	15 – 20	10 – 20	0.2 – 0.6

[1] Means in a column followed by the same letter are not significantly different at P > 0.05, based on the Tukey-Kramer multiple comparison test.
[2] The nutrient was reported as “as is” for all lab measurements. This means that the content was measured in the sample as it is, without any adjustments for moisture.
[3] ns = no significant interactions were found among treatments
[4] The nutrient was reported in ‘percentage’ for the Picket LENS measurements.

Table 6. Main effects of pre-plant NPK and foliar treatments on yield and size distribution of onions at the Jane St. site, 2024

Treatment	Total yield (t ha^{-1})	Marketable yield (t ha^{-1})	Size distribution (%)[1]			
			Jumbo (>76 mm)	Large (76-64 mm)	Medium (64-45 mm)	Cull (<45 mm)
Pre-plant fertilizer						
No NPK	34.1 b[2]	27.9 b	0.9 b	12.8 b	65.7 ns[3]	20.6 a
Preplant NPK	48.0 a	45.3 a	4.3 a	29.0 a	60.9	5.8 b
Foliar fertilizer						
No application	43.7 ns	39.0 ns	2.9 ns	17.9 ns	66.8 ns	12.5 ns
Manganese sulphate	38.9	34.7	2.1	23.2	61.5	13.2
Application based on tissue tests results	40.6	36.2	2.7	21.6	61.7	13.9

[1] Percentage values were determined using weight.
[2] Means in a column with the same fertilizer grouping followed by the same letter are not significantly different at P > 0.05, based on the Tukey-Kramer multiple comparison test.
[3] ns=no significant differences were found among treatments for values in a column with the same fertilizer grouping

Table 7. Main effects of fertilizer applications on the disease severity index (DSI) of Stemphylium leaf blight at the Jane St site, Holland Marsh, 2024.

Treatment combinations	17 July	25 July	1 August	13 August
Pre-plant fertilizer				
No NPK	21 ns[1]	36 b[2]	45 ns	61 ns
Preplant NPK	20	41 a	44	66
Foliar fertilizer				
No foliar application	21 ns	39 ns	43 ns	63 ns
Manganese sulphate	20	38	46	63
Application based on tissue tests results	21	38	45	64

[1] ns=no significant differences were found among treatments for values in a column with the same fertilizer grouping
[2] Means in a column within the same fertilizer grouping followed by the same letter are not significantly different at P > 0.05, based on the Tukey-Kramer multiple comparison test.

Table 8. Correlation between Stemphylium leaf blight disease severity index and onion yield

Yield (t ha^{-1})	17 July	25 July	1 August	13 August
Marketable weight	-0.26 [1] (0.3062) [2]	-0.73 **(0.0007)**	-0.44 (0.071)	0.60 **(0.0084)**
Total weight	-0.25 (0.3271)	-0.70 **(0.0014)**	-0.42 (0.0848)	0.60 **(0.0086)**

Funding for this project was provided by the Fresh Vegetable Growers of Ontario, Picketa Systems Inc., Corteva Agriscience, the Ontario Agri-Food Innovation Alliance and Innovation Farms powered by AgExpert.

CROP: Yellow cooking onions (*Allium cepa* L.), cv. Catskill and Milestone
PEST: Stemphylium leaf blight (*Stemphylium vesicarium* (Wallr.))

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[2]Agriculture & Agri-Food Canada, Saskatoon Research & Development Centre

TITLE: SPORE TRAPPING AND BARLEY AS INDICATORS OF EARLY SEASON INFECTION OF ONION BY *STEMPHYLIUM VESICARIUM*, 2024

METHODS: Yellow cooking onion cv. Catskill and barley were seeded in two field trials with four replicates in 6-m-long plots with four double rows spaced 40 cm apart at the Ontario Crops Research Centre – Bradford on 07 May 2024. Also, seedlings of onion cv. Milestone were transplanted on 22 May 2024 in two separate trials. The 10 oldest leaves that were at least 50% green in each plot were sampled and assessed for infection of *Stemphylium vesicarium* from the flag leaf stage until the 3rd–4th true leaf stage. Seeded onion, transplanted onion and barley were assessed for infection on 30 May, 06, 09, 13, and 20 June. The collected leaves of onion and barley were placed in humid chambers for 7–14 days and assessed for the presence of *S. vesicarium* sporulation on the leaves using a dissecting microscope. Infection (%) was calculated based on the proportion of plants that sporulated.

Two spore traps, the Burkard 7-day recording volumetric spore trap and the Rotorod (rotating arm impactor) sampler, were placed in the onion plots from April-August 2024. The Burkard trap was placed facing west (into the prevailing wind) with the sampling orifice 0.7 m off the ground. It collected spores 24 hr per day on 'Melinex' tape coated with silicone grease at an air sampling rate of 10 L/min. The Rotorod trap was set directly above the onion canopy. It collected spores with an air sampling rate of 20.65 L/min/rod from 6:00 am -12:00 pm daily on two silicone grease coated 1.52 mm wide x 3.15 cm long polystyrene rods. The rods were collected each Monday, Wednesday and Friday. Ascospores and conidia of *S. vesicarium* were counted using a compound microscope and converted to spores/m^3 of air.

Compared to the previous 10-year average, air temperatures in 2024 were above average for May (15.4°C) and average for June (19.2°C), July (21.5°C), August (19.6°C) and September (17.6°C). The 10-year average temperatures were: May 13.4°C, June 18.6°C, July 21.1°C, August 20.4°C and September 16.8°C. Monthly rainfall was below the 10-year average for June (79 mm), August (54 mm) and September (21 mm) and above average for May (83 mm) and July (85 mm). The 10-year rainfall averages were: May 58 mm, June 95 mm, July 75 mm, August 74 mm and September 57 mm.

Data analysis for the infection of seeded onion, transplanted onion and barley was a mixed model analysis of variance (ANOVA) calculated using PROC GLIMMIX in SAS and means separation using Tukey's HSD at a significance level of $P = 0.05$. Correlations between the spore trap counts and infection of barley and onions were calculated in PROC CORR using Kendall's Tau-B at $P = 0.05$.

RESULTS: Data are presented in Figures 1 and 2. There was no correlation between spores captured by the Rotorod and Burkard traps from April – June or from April – August. There was also no correlation between spores captured by the Burkard or Rotorod and maximum temperature, minimum temperature and rainfall in 2024. There was no correlation between spores captured by the Burkard or Rotorod and infection of seeded or transplanted onion. There was also no correlation between the infection of barley and seeded or transplanted onion.

CONCLUSIONS: Infection of seeded onion was initially detected at the flag–1st true leaf stage (30 May), which indicated that infection of onion occurs before the 3rd–4th true leaf stage. There was more infection of transplanted onion than seeded onion and barley. Infection of barley remained low (< 20%) and was not

correlated with infection of onion and may not be useful for forecasting SLB. Conidia captured by the Rotorod or Burkard spore traps were not correlated with infection of onion, which indicates they did not predict *S. vesicarium* infection of onion early in the growing season. However, conidia counts remained low throughout the growing season. Research is continuing to determine if conidia captured by spore traps are useful for SLB forecasting.

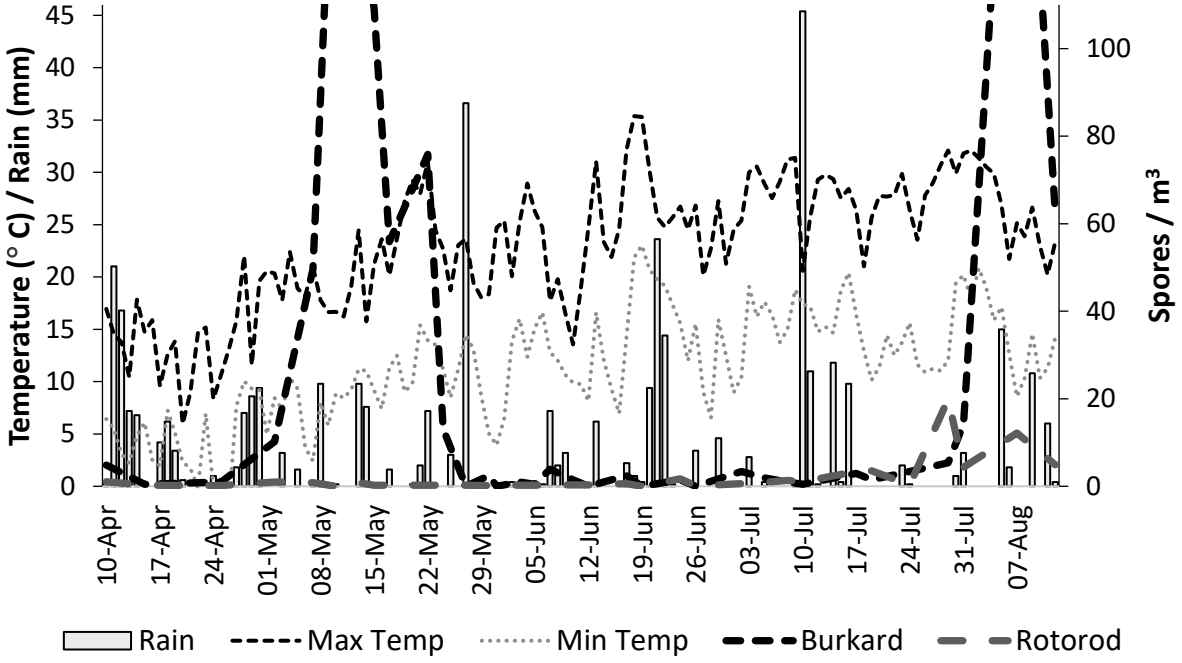


Figure 1: Concentration of conidia and ascospores captured by a Rotorod and Burkard spore trap at the Ontario Crops Research Centre – Bradford and rain (mm), minimum and maximum air temperature (°C) in 2024. Data points over 110 spores / m^3 are not shown due to scale.

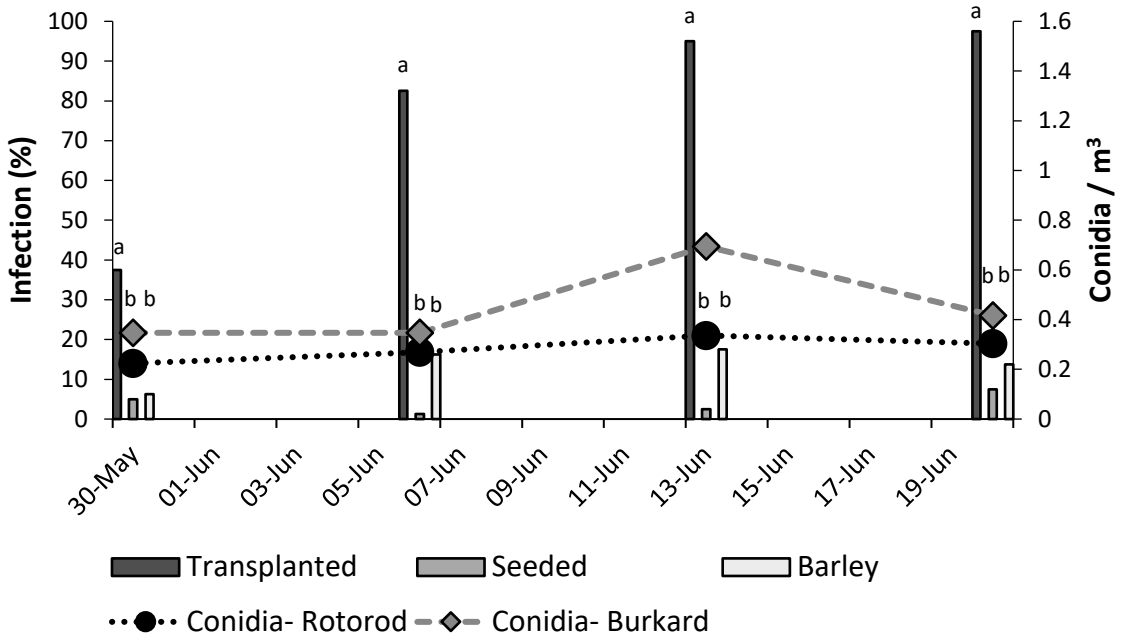


Figure 2: Frequency of *Stemphylium vesicarium* infection (%) of leaves of transplanted and seeded onion seedlings or barley from 30 May to 20 June and the 7-day average of conidia / m^3 captured by the Burkard and Rotorod spore traps in 2024. Means with the same letter do not differ at P= 0.05 based on Tukey's HSD.

Funding for this project was provided by the Ontario Agri-Food Innovation Alliance, the Bradford Cooperative Storage Ltd. and the Fresh Vegetable Growers of Ontario.

CROP: Yellow cooking onions (*Allium cepa* L.)
PESTS: Onion maggot (*Delia antiqua* (Meigen))
Seed corn maggot (*Delia platura* (Meigen))

AUTHORS: MCDONALD MR, VANDER KOOI K & FARINTOSH G
U of Guelph, Dept. of Plant Agriculture, Ontario Crops Research Centre

TITLE: EVALUATION OF SPINOSAD INSECTICIDE SEED TREATMENTS FOR CONTROL OF MAGGOTS IN YELLOW COOKING ONIONS, 2024

MATERIALS SPINOSAD (spinosad 80 %), SEPRESTO 75 WS (clothianidin 56.25%, imidacloprid 18.75%)

METHODS: The trial was conducted on organic soil (pH ≈ 6.1, organic matter ≈ 69.8%) naturally infested with *Delia antiqua* and *D. platura* pupae at the Ontario Crops Research Centre - Bradford, Ontario. A randomized complete block design with four replicates per treatment was used. Each experimental unit consisted of four rows, spaced 40 cm apart, 6 m in length. Onions were seeded (≈ 32 seeds/m) on 7 May using a Stanhay precision seeder. A no-insecticide check was also included. Two randomly chosen 2 m sections of row for damage plots, plus a 2.32 m section for a yield sample, were staked out in each replicate. Crop tolerance, vigor, plant emergence ratings and stand counts were conducted within the 2 m staked sections on 22, 27 May, 3 and 10 June. Onions were monitored weekly for visual signs of maggot feeding, onion plants within the 2 m sections were examined for loss due to maggot damage or damage caused by other pests. Damaged onions were counted and removed, with the cause of damage recorded. The remaining onions within the assigned 2 m sections were removed and visually examined for maggot damage on 8 July (first generation damage) and after lodging on 30 August (total season assessment). On 30 August, onions from the 2.32 m yield section of row were pulled, windrowed to dry. On 17 September onions were topped and yield samples were placed in bags. On 26 September, onions were sorted by size and weighed to determine yield. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.10. Means separation was obtained using Fisher's Protected HSD Test at P = 0.05 level of significance.

RESULTS: as presented in Tables 1 - 6

CONCLUSIONS: Maggot damage was moderate in the trial. Significant differences in the number of onion lost due to maggot damage were found among the treatments following the first generation assessment and in the season total maggot damage (Table 1). SPINOSAD treatments with 0.2, 0.25, 0.3 and 0.4 mg active had significantly lower damage than the untreated check on both assessment days. Several SPINOSAD treatments also had higher marketable yield than the untreated check. The was no visible impact of the seed treatments on pythotoxicity, plant vigor or plant emergence.

Table 1. Percentage of onions lost due to maggot damage, treated with SPINOSAD, and grown at the Ontario Crops Research Centre - Bradford, Ontario, 2024

Treatment	Rate (mg ai/seed)	% Onions lost due to maggot damage	
		1st Generation	Total Season
SPINOSAD	0.05 mg	15.2 ab[1]	7.0 a
SPINOSAD	0.1 mg	12.9 ab	9.9 ab
SPINOSAD	0.2 mg	8.3 a	7.7 ab
SPINOSAD	0.25 mg	4.0 a	6.2 a
SPINOSAD	0.3 mg	3.9 a	4.7 a
SPINOSAD	0.4 mg	7.2 a	2.5 a
SEPRESTO	0.265 mg	4.4 a	4.6 a
CHECK	---	29.8 b	18.3 b

[1] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected HSD test.

Table 2. Yield and size distribution for onions, cv. Catskill, treated with SPINOSAD and grown at the Ontario Crops Research Centre, Bradford Ontario, 2024.

Treatment	Rate (mg ai/seed)	% Mkb	Yield (t/ha)	Size Distribution (%)[1]			
				Jumbo (>76 mm)	Large (76-64 mm)	Medium (64-45 mm)	Cull (<45 mm)
SPINOSAD	0.4	98.8 ns[2]	68.4 ab[3]	1.7 ns	38.6 ns	58.5 ns	1.2 ns
SPINOSAD	0.3	98.0	70.0 ab	0.7	32.3	65.0	2.0
SPINOSAD	0.25	98.4	74.3 a	4.7	47.0	46.8	1.6
SPINOSAD	0.2	98.6	70.2 ab	1.5	36.6	60.4	1.4
SPINOSAD	0.1	97.8	62.3 ab	0.0	34.7	65.0	2.2
SPINOSAD	0.05	98.3	80.4 a	3.5	46.4	48.4	1.7
SEPRESTO	0.265	97.4	68.2 ab	0.0	32.4	65.1	2.6
Check	-	98.6	48.2 b	11.3	38.6	48.4	1.4

[1] Percentage values were determined using weight

[2] ns= no significant differences were found at *P*= 0.05, Tukey's HSD test.

[3] Numbers in a column followed by the same letter are not significantly different P = 0.05, Fisher's Protected HSD test.

Table 3. Phytotoxicity ratings of onions treated with SPINOSAD, and grown at the Ontario Crops Research Centre - Bradford, Ontario, 2024

Treatment	Rate (mg ai/seed)	Phytotoxicity Ratings[1]			
		7 DAE[2]	14 DAE	21 DAE	28 DAE
SPINOSAD	0.05 mg	0 ns[3]	0	0	0
SPINOSAD	0.1 mg	0	0	0	0
SPINOSAD	0.2 mg	0	0	0	0
SPINOSAD	0.25 mg	0	0	0	0
SPINOSAD	0.3 mg	0	0	0	0
SPINOSAD	0.4 mg	0	0	0	0
SEPRESTO	0.265 mg	0	0	0	0
CHECK	---	0	0	0	0

[1] Percent of crop response compared to the untreated check, 0 = no crop response, 100 = crop response observed on all plants in plot
[2] DAE = Days after emergence
[3] No statistical analysis preformed on data, ns = no significant differences were found among the treatments

Table 4. Plant vigor ratings of onions treated with SPINOSAD, and grown at the Ontario Crops Research Centre - Bradford, Ontario, 2024

Treatment	Rate (mg ai/seed)	Plant Vigor Ratings[1]			
		7 DAE[2]	14 DAE	21 DAE	28 DAE
SPINOSAD	0.05 mg	5 ns[3]	5	5	5
SPINOSAD	0.1 mg	5	5	5	5
SPINOSAD	0.2 mg	5	5	5	5
SPINOSAD	0.25 mg	5	5	5	5
SPINOSAD	0.3 mg	5	5	5	5
SPINOSAD	0.4 mg	5	5	5	5
SEPRESTO	0.265 mg	5	5	5	5
CHECK	---	5	5	5	5

[1] Seedling vigor using a 1-9 scale, compared to the commercial standard,
Vigor rating scale

9 Significantly stronger and faster growth compared to commercial standard.
7 Stronger and faster growth compared to commercial standard.
5 commercial standard.
3 Weaker and slower growth compared to commercial standard.
1 Significantly weaker and slower growth compared to commercial standard.

[2] DAE = Days after emergence
[2] No statistical analysis preformed on data, ns = no significant differences were found among the treatments

Table 5. Emergence rating of onions treated with SPINOSAD, and grown at the Ontario Crops Research Centre - Bradford, Ontario, 2024

Treatment	Rate (mg ai/seed)	Plant Emergence Ratings[1]			
		7 DAE[2]	14 DAE	21 DAE	28 DAE
SPINOSAD	0.05 mg	8.8 ns[3]	8.5 a[4]	8.0 ab	8.0 ns
SPINOSAD	0.1 mg	8.8	8.0 ab	8.0 ab	8.0
SPINOSAD	0.2 mg	8.5	8.3 ab	8.5 ab	8.5
SPINOSAD	0.25 mg	9.0	8.4 a	8.8 a	8.8
SPINOSAD	0.3 mg	9.0	8.5 a	8.8 a	8.8
SPINOSAD	0.4 mg	8.8	8.5 a	8.8 a	8.8
SEPRESTO	0.265 mg	8.8	7.8 ab	8.3 ab	8.5
CHECK	---	8.3	7.3 b	7.8 ab	7.8

[1] Visual rating of stand emergence, using a 1-9 scale, compared to the commercial standard

Scale 9 Nearly perfect stand.
8 Excellent stand, at most a couple small gaps.
7 Very good stand, some small gaps evident.
6 Less than 5% plot area missing plants.
5 Thin stand with up to 10% missing plants.
4 11-25% missing plants.
3 26-50% missing plants.
2 51-75% missing plants.
1 Greater than 75% missing plants

[2] DAE = Days after emergence

[3] No statistical analysis preformed on data, ns = no significant differences were found among the treatments

[4] Numbers in a column followed by the same letter are not significantly different P = 0.05, Fisher's Protected HSD test.

Table 6. Stand counts of onions treated with SPINOSAD, and grown at the Ontario Crops Research Centre - Bradford, Ontario, 2024

Treatment	Rate (mg ai/seed)	Stand Counts[1]							
		OM1				Season Total			
		7 DAE[2]	14 DAE	21 DAE	28 DAE	7 DAE	14 DAE	21 DAE	28 DAE
SPINOSAD	0.05 mg	31.8 ns[3]	49.8 ns	46.0 ns	51.2 ns	25.8 ns	43.8 ns	46.8 ns	48.3 ns
SPINOSAD	0.1 mg	30.3	48.3	48.5	50.8	27.8	45.8	49.0	53.0
SPINOSAD	0.2 mg	30.8	48.8	50.0	51.8	30.5	48.5	51.0	52.0
SPINOSAD	0.25 mg	32.8	50.8	52.2	53.5	31.0	49.0	51.3	52.5
SPINOSAD	0.3 mg	33.5	51.5	49.0	53.3	31.3	49.3	51.8	53.0
SPINOSAD	0.4 mg	31.8	49.8	47.3	50.8	31.8	49.8	52.3	53.0
SEPRESTO	0.265 mg	30.5	48.5	52.8	54.5	22.0	40.0	48.0	51.3
CHECK	---	26.3	44.3	46.0	46.3	22.3	40.3	45.3	45.8

[1] Stand counts taken from a 2 meter section of row

[3] ns= no significant differences were found at *P*= 0.05, Tukey's HSD test.

CROP: Yellow cooking onions (*Allium cepa* L.), cv. Safrane
PESTS: Onion maggot (*Delia antiqua* (Meigen))
Seed corn maggot (*Delia platura* (Meigen))

AUTHORS: MCDONALD MR, VANDER KOOI K & FARINTOSH G
U of Guelph, Dept. of Plant Agriculture, Ontario Crops Research Centre

TITLE: EVALUATION OF VARIOUS INSECTICIDE SEED TREATMENTS FOR CONTROL OF MAGGOTS IN YELLOW COOKING ONIONS, 2024

MATERIALS: LUMIVERD (spinosad 80%), CRUISER 70 WS (thiamethoxam 70%), TRIGARD (cyromazine 75%), SEPRESTO 75 WS (clothianidin 56.25%, imidacloprid 18.75%), PLINAZOLIN (experimental), FARMORE F300 ((APRON XL (metalaxyl-M and S-iromer 33.3%), MAXIM 4 FS (fludioxonil 40.3%), DYNASTY (azoxystrobin 9.6%)), EVERGOL PRIME **(**penflufen)

METHODS: The trial was conducted on organic soil (pH ≈ 5.8, organic matter ≈ 80.1%) naturally infested with *Delia antiqua* and *D. platura* pupae at the Ontario Crops Research Centre - Bradford, Ontario. A randomized complete block design with four replicates per treatment was used. Each experimental unit consisted of four rows, spaced 40 cm apart, 6 m in length. Onions, cv. Safrane, were seeded (≈ 32 seeds/m) on 8 May using a Stanhay precision seeder. Insecticide seed treatments as listed in Table 1.
A no-insecticide check was also included. All treatments included EVERGOL PRIME for onion smut control and FARMORE 300 to prevent damping off. Three randomly chosen 2 m sections of row for damage plots, plus a 2.32 m section for a yield sample, were staked out in each replicate. Emergence counts were conducted within the 2 m staked sections on 7 June to determine initial stands. Beginning on 10 June and continuing weekly, onion plants within the 2 m sections were examined for loss due to maggot damage or damage caused by other pests. Damaged onions were counted and removed, with the cause of damage recorded. The remaining onions within the assigned 2 m sections were removed and visually examined for maggot damage on 5 July (first generation damage) and after lodging on 29 August (total season assessment). On 15 September, onions from the 2.32 m yield section of row were pulled, windrowed to dry and placed in storage. On 3 October, onions were sorted by size and weighed to determine yield. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.10. Means separation was obtained using Fisher's Protected LSD Test at P = 0.05 level of significance.

RESULTS: as presented in Tables 2 and 3

CONCLUSIONS: Onion maggot damage was relatively low in this trial. All insecticide treatments provided excellent maggot control in the first generation damage assessment and had lower maggot damage than the nontreated check in the season totals. Significant differences in the number of onions lost to maggot damage were found among the treatments in the season total losses (Table 2). Treatments of TRIGARD + CRUSIER and PLINAZOLIN + CRUISER + SEPRESTO and PLINAZOLIN + TRIGARD had lower maggot damage in the season total assessment, compared to CRUISER alone and the nontreated check. Significant differences in yield were found among the treatments in marketable t/ha (Table 3). Treatments with PLINAZOLIN + SEPRESTO and SEPRESTO alone had higher yields than the nontreated check, TRIGARD and LUMIVERD alone and PLINAZOLIN + CRUSIER + SEPRESTO .

Table 1. Seed treatments label rates for onion seed, cv. Safrane, pelleted by Kamterter and grown at the grown at the Ontario Crops Research Centre - Bradford, Ontario, 2024

Treatment	Insecticide Active Ingredients and Rates
No insecticide9 Check)	N/A
TRIGARD 75WP	0.225 mg ai/seed
LUMIVERD	0.2 mg ai/seed
PLINAZOLIN tech (PLIN)	0.0909 mg ai/seed
CRUISER 5 FS	0.2 mg ai/seed
SEPRESTO 75WS	0.32 mg ai/seed
TRIGARD + CRUISER	0.225 mg ai/seed + 0.2 mg ai/seed
TRIGARD + SEPRESTO	0.225 mg ai/seed + 0.32 mg ai/seed
LUMIVERD + CRUISER	0.2 mg ai/seed + 0.2 mg ai/seed
LUMIVERD + SEPRESTO	0.2 mg ai/seed + 0.32 mg ai/seed
PLIN + CRUISER	0.0909 mg ai/seed + 0.2 mg ai/seed
PLIN + SEPRESTO	0.0909 mg ai/seed + 0.32 mg ai/seed
PLIN + CRUSIER + SEPRESTO	0.0909 mg ai/seed + 0.2 mg ai/seed + 0.32 mg ai/seed
PLIN + TRIGARD	0.0909 mg ai/seed + 0.225 mg ai/seed

Table 2. Percentage of onions, cv. Safrane lost due to maggot damage, treated with various insecticides, and grown at the Ontario Crops Research Centre - Bradford, Ontario, 2024

Treatment	Rate (mg ai/seed)	% Onions lost due to maggot damage	
		1st Generation	Total Season
Product(s)	**Rate**		
Check	N/A	32.1 b[1]	36. 9 c
CRUISER 5 FS	0.2 mg ai/seed	5.0 a	10.6 b
LUMIVERD	0.2 mg ai/seed	6.4 a	4.8 ab
PLINAZOLIN tech (PLIN)	0.0909 mg ai/seed	5.9 a	4.8 ab
TRIGARD 75WP	0.225 mg ai/seed	2.4 a	4.5 ab
SEPRESTO 75WS	0.32 mg ai/seed	4.6 a	3.8 ab
PLIN + CRUISER	0.0909 mg ai/seed + 0.2 mg ai/seed	4.3 a	6.3 ab
TRIGARD + SEPRESTO	0.225 mg ai/seed + 0.32 mg ai/seed	3.9 a	4.5 ab
PLIN + SEPRESTO	0.0909 mg ai/seed + 0.32 mg ai/seed	3.1 a	3.6 ab
TRIGARD + CRUISER	0.225 mg ai/seed + 0.2 mg ai/seed	0.5 a	3.2 a
LUMIVERD + CRUISER	0.2 mg ai/seed + 0.2 mg ai/seed	7.5 a	3.2 a
PLIN + CRUSIER + SEPRESTO	0.0909 mg ai/seed + 0.2 mg ai/seed + 0.32 mg ai/seed	5.6 a	2.9 a
PLIN + TRIGARD	0.0909 mg ai/seed + 0.225 mg ai/seed	3.1 a	2.8 a

[1] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD test.

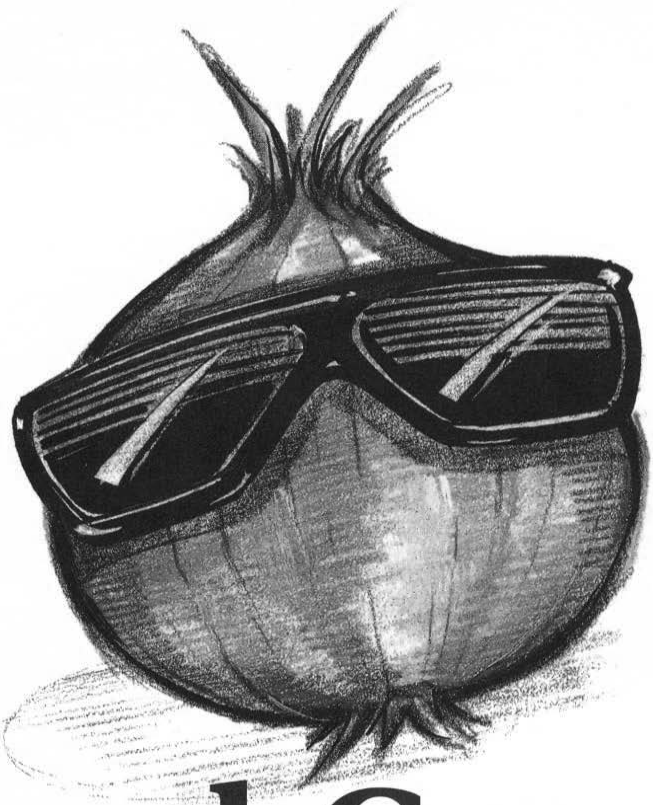
NOTE: All seed was treated with penflufen (EverGol Prime) and FarMore F300 (mefenoxam, Apron XL® seed treatment fungicide; fludioxonil, Maxim® 4FS seed treatment fungicide; and azoxystrobin, Dynasty® seed treatment fungicide).

Table 3. Yield and size distribution for onions, cv. Safrane, treated with various insecticide seed treatments, and grown at the Ontario Crops Research Centre - Bradford, Ontario, 2024

Treatment	Yield (t/ha)	Size Distribution[1] (%)		
		Jumbo (>76 mm)	Large (76-64 mm)	Med (>64-45 mm)
Check	32.1 cd[2]	10.5 ns[3]	59.4 ns	28.7
TRIGARD 75WP	26.4 d	13.1	43.4	42.4
LUMIVERD	29.0 d	14.4	47.0	37.4
PLIN + CRUSIER + SEPRESTO	32.5 bcd	4.2	46.2	47.3
TRIGARD + CRUISER	34.1 abc	5.2	41.4	49.3
TRIGARD + SEPRESTO	34.7 abc	3.1	46.9	47.3
LUMIVERD + CRUISER	35.1 abc	7.2	44.7	46.8
PLIN + TRIGARD	35.3 abc	7.0	44.4	47.1
CRUISER 5 FS	35.7 abc	3.6	54.2	40.8
PLIN + CRUISER	36.2 abc	7.6	51.4	40.0
LUMIVERD + SEPRESTO	36.8 abc	7.4	47.2	43.7
SEPRESTO 75WS	37.3 ab	9.3	51.4	38.4
PLINAZOLIN tech (PLIN)	37.6 a	5.8	52.5	40.8
PLIN + SEPRESTO	38.3 a	13.0	45.6	40.5

[1] Size distribution was based on weight.
[2] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD test
[3] ns = no significant differences were found among treatments.

Funding was provided by the California Garlic and Onion Research Advisory Board



MarshGrown Cooks!

CROP: Yellow cooking onions (*Allium cepa* L.), cv. Catskill

AUTHORS: MCDONALD MR, VANDER KOOI K & FARINTOSH G
U of Guelph, Dept. of Plant Agriculture, Ontario Crops Research Centre - Bradford

TITLE: EFFECTS OF NITROGEN FIXING BACTERIA ON ONIONS, 2024

MATERIALS: UTRISHA N (3% *Methylobacterium symbioticum* SB23, 3 x 10^7 CFU/g)

METHODS: Onions, cv. Catskill, were transplanted between 21 to 24 May into organic soil (pH ≈ 6.1, organic matter ≈ 69.8%) near the Ontario Crops Research Centre - Bradford, Ontario. Treatments were arranged in a complete block design with three replicates per treatment. Each experimental unit consisted of two beds of onions containing eight rows, ten meters in length. Treatments consisted of onion plants that received: only pre-plant fertilizer, UTRISHA alone, pre-plant fertilizer + UTRISHA N, and an untreated check that received neither pre-plant fertilizer nor UTRISHA N. Pre-plant fertilizer consisted of 21-0-0 at a rate of 90 kg/ha, MESZ (10-40-0) at a rate of 50 kg/ha, Aspire (0-0-58) at 100 kg/ha, 0-0-22 at 60 kg/ha, copper sulfate (25%) at 7 kg/ha, and sulfur chips at 300 kg/ha. On 27 June and 8 July, UTRISHA N was applied at 336 g/ha using a tractor-mounted sprayer fitted with D-3 hollow-cone nozzles at 620 kPa to deliver 500 L/ha. On 30 August, the onion plants from 2.32 m sections of the two inner rows of each plot were pulled for yield assessment. On 18 September, the onion bulbs were weighed and graded for size to determine yield.
Compared to the previous 10-year average, air temperatures in 2024 were above average for May (15.4°C) and average for June (19.2°C), July (21.5°C), August (19.6°C), September (17.6°C) and October (10.6°C). The 10-year average temperatures were: May 13.4°C, June 18.6°C, July 21.1°C, August 20.4°C and September 16.8°C. Monthly rainfall was below the 10-year average for June (79 mm), August (54 mm) and September (21 mm) and above average for May (83 mm) and July (85 mm). The 10-year rainfall averages were: May 58 mm, June 95 mm, July 75 mm, August 74 mm and September 57 mm.
Data were analyzed using the General Analysis of Variance function of Statistix V.10. Means separation was obtained by using Fisher's Protected LSD test at P = 0.05 level of significance.

RESULTS: as presented in Table 1.

CONCLUSIONS: Onions that received pre-plant fertilizer had significantly greater yield than the untreated check (Table 1). Onions treated only with UTRISHA N had numerically greater yields and larger onions compared to the check, but more work needs to be done to better understand the benefits of the product.

Table 1. Yield and size distribution for onions, cv. Catskill, grown with combinations of a nutrient efficiency biostimulant and fertilizer near the Ontario Crops Research Station - Bradford, Holland Marsh, Ontario, 2024.

Treatment	% Mkb	Yield (t/ha)	Size Distribution (%)[1]			
			Jumbo (>76 mm)	Large (76-64 mm)	Medium (64-45 mm)	Cull (<45 mm)
Fertilizer + UTRISHA N	96.5 ns[2]	84.0 a[3]	5.4 ns	37.6 ns	53.5 ns	3.5 ns
Fertilizer only	86.1	86.4 a	2.0	37.3	46.8	13.9
UTRISHA N only	93.1	76.1 ab	3.1	22.9	67.1	6.9
Check	87.3	62.9 b	2.9	21.7	62.6	12.7

[1] Percentage values were determined using weight

[2] ns = no significant differences at P = 0.05, Fisher's Protected LSD test

[3] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD test.

Funding for this project was provided by the Ontario Agri-Food Innovation Alliance

CROP: Yellow cooking onions (Allium cepa L.) cv. Catskill

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TITLE: EVALUATION OF SEEDING TECHNIQUES AND SPEED OF THE FARMDROID FD20 IN ONIONS, 2024

METHODS: The FarmDroid FD20, a solar-powered agricultural robot originally designed for organic sugar beet production, has been adapted for onion production in high organic matter soils (organic matter 62-80%, pH 6.4 – 7.2). Two trials were conducted at the Ontario Crops Research Centre – Bradford.
A seeding configuration trial was conducted to evaluate the performance of FarmDroid compared to conventional methods for stand establishment and yield**.** The seeding configurations were FD20 single row (seeds 3.4 cm apart, speed 225 m/hr), FD20 cluster (groups of 3 seeds, 9.5 cm apart, speed 550 m/hr), and tractor standard (double row, seeds 5 cm apart). All configurations had a 40 cm row spacing, 4 rows per bed, ~20 m long. The onions were direct seeded on 16 May. The trial was arranged in a randomized complete block with three replications per treatment. Stand counts were taken on 30 May and 6 June. Data from the third replication of the cluster (triples) configuration was omitted from the statistical analysis due to a watercourse running along it.
Another trial to assess different seeding speeds using the FarmDroid was conducted on 26 July. Six beds of onions were seeded in groups of 3 seeds spaced 9.5 cm apart within the row. Treatments were: 550 m/hr with and without the seed valve active, 650 m/hr with the valve active, 750 m/hr with and without the valve active, and 950 m/hr without the valve active. Each treatment was applied to a bed 30 m in length, with four rows (40 cm apart) of onions. The emergence of onions was recorded from eight 1 m sections within the 2 inner rows of each pass on 12 August. Data analyses were conducted using the SAS PROC GLIMMIX procedure for stand count and yield, with treatment and replication as fixed and random effects, respectively. Tukey-Kramer tests assessed pairwise differences.
Compared to the previous 10-year average, air temperatures in 2024 were above average for May (15.4°C) and average for June (19.2°C), July (21.5°C), August (19.6°C) and September (17.6°C). The 10-year average temperatures were: May 13.4°C, June 18.6°C, July 21.1°C, August 20.4°C and September 16.8°C. The monthly rainfall was below the 10-year average for June (79 mm), August (54 mm) and September (21 mm) and above average for May (83 mm) and July (85 mm). The 10-year rainfall averages were: May 58 mm, June 95 mm, July 75 mm, August 74 mm, and September 57 mm.

RESULTS: as presented in Tables 1, 2, and 3.

CONCLUSIONS: There was a higher emergence in the standard seeding configuration, followed by the triple cluster and the single row. There were no differences in total or marketable yield among the three seeding configurations, but the triple cluster had more onion bulbs (115 bulbs) than the standard configuration (103 bulbs).
Emergence was significantly higher at the lowest speed of 550m/hr, with or without the seed valve active (Table 2). As the speed increased, the emergence decreased, regardless of seed valve activity. There was a strong significant negative correlation between speed and emergence. The correlation was negatively strong with either the valve active or not, but not significant.

Table 1. Effect of seeding configuration on onion stand and yield of onions cv. Catskill, grown at the Ontario Crops Research Centre - Bradford, Ontario, 2024.

Treatment	Onion/m	Marketable yield (t/ha)	Size distribution (%)[1]			
			Jumbo (>76 mm)	Large (76-64 mm)	Medium (64-45 mm)	Cull (<45 mm)
Single Row	49.7 c[2]	58.3 ns[3]	2.7 ns	36.5 ns	58.2 ns	2.6 ns
Double Row (Conventional)	61.7 a	63.0	9.6	48.7	39.0	2.7
Triple Cluster	53.1 b	54.1	3.5	31.0	61.3	4.2

[1] Percentage was determined by weight.
[2] Means in a column followed by the same letter are not significantly different at P > 0.05, as determined by Tukey's (HSD) test.
[3] ns = no significant differences at P = 0.05 in this analysis.

Table 2. Emergence of onions cv. Catskill, seeded by the FarmDroid FD20 in clusters of three at various speeds and seed valve settings at the Ontario Crops Research Centre - Bradford, Ontario, 2024.

Speed (m/hr)	Seed Valve Active	Emergence (Onion/m)
550	No	26.6 a[1]
550	Yes	25.6 ab
650	Yes	22.9 b
750	No	17.1 cd
750	Yes	19.0 c
950	No	16.2 d

[1] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD test.

Table 3. Correlation between speed and emergence under different seed valve conditions

Variable	Pearson correlation (r)	P-value
Speed x Emergence	**-0.929**	**0.007**
Seed valve condition		
Valve Active (Yes)	-0.995	0.07
Valve Active (No)	-0.902	0.28

Funding for this project was provided by the Fresh Vegetable Growers of Ontario, Haggerty AgRobotics Inc., the Ontario Agri-Food Innovation Alliance, and Innovation Farms powered by AgExpert.

CROP: Yellow cooking onions (*Allium cepa* L.), cv. Highlander

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TITLE: EVALUATION OF THE FARMDROID FD20 SEEDING AND WEEDING IN A COMMERCIAL ONION FIELD

METHODS: The FarmDroid FD20 was used to seed and weed 7 acres (2.83 ha) of onions in a commercial field. Onions, cv. Highlander, were direct seeded on 6 May by the FD20 into organic soil in Keswick, Ontario. The robot seeded 21 beds ~800 m long, with 4 rows in each bed (seeded in clusters of three, 9.5 cm apart within the row) at 550 meters per hour. After seeding, the FD20 was switched into weeding mode, using custom steel knives to remove weeds growing between the rows it had seeded, also at a speed of 550 meters per hour. A student counted 100 weeds in sections, then recounted immediately after the FD20 had passed through to assess how many had been removed. Yield was compared to onions (cv. Saddleback) seeded conventionally and to transplant onions (cv. Highlander) in a plot directly beside the FD20 plot. On 12 September, onions in two 2.32 m sections of row were pulled from 4 random locations from each treatment for a yield sample. Onions were weighed, graded for size, and counted on 21 October to determine yield.

Compared to the previous 10-year average, air temperatures in 2024 were above average for May (15.4°C) and average for June (19.2°C), July (21.5°C), August (19.6°C) and September (17.6°C). The 10-year average temperatures were: May 13.4°C, June 18.6°C, July 21.1°C, August 20.4°C and September 16.8°C. Monthly rainfall was below the 10-year average for June (79 mm), August (54 mm) and September (21 mm) and above average for May (83 mm) and July (85 mm). The 10-year rainfall averages were: May 58 mm, June 95 mm, July 75 mm, August 74 mm and September 57 mm. Data were analyzed using the General Analysis of Variance function of Statistix V.10. Means separation was obtained by using Fisher's Protected LSD test at $P = 0.05$ level of significance.

RESULTS: Yield results are presented in Table 1. Weed efficacy results are a rough initial test as the student counted weeds that were buried as removed when they would likely return. On average, the FD20 was able to reach 72.7% of weeds, with the rest out of reach within the onion row. It was able to remove, cut, or bury 78.0% of weeds within its reach and 56.2% of total weeds within each section.

CONCLUSIONS: The transplant and onions seeded by the FD20 yielded significantly more than the tractor-seeded onions, although they were also a different cultivar. The custom weeding tool was more effective at removing weeds than the tines that are included with the FD20, but undulations in the field could drastically affect the height and efficacy of the tooling. The FD20 was able to seed much faster with the speed increased from 200 m/hr last year to 550 m/hr this year. More work needs to be done to improve weeding tooling and further optimize seeding speed and efficacy to suit commercialization.

Table 1. Yield and size distribution for onions seeded and weeded by the FarmDroid FD20 compared to conventional methods in a grower field located in the Keswick Marsh, Ontario, 2024.

Treatment	% Mkb	Yield (t/ha)	Size Distribution (%)[1]			
			Jumbo (>76 mm)	Large (76-64 mm)	Medium (64-45 mm)	Cull (<45 mm)
FD20	97.3 ns[2]	70.7 a[3]	6.2 b	39.5 ns	51.6 a	2.7 ns
Transplanted[4]	98.3	79.4 a	26.9 a	44.5	26.9 b	1.7
Tractor[5]	98.2	58.9 b	2.9 b	43.2	52.1 a	1.8

[1] Percentage values were determined using weight.
[2]ns= no significant differences were found at *P*= 0.05, Fisher's Protected LSD test.
[3] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD test.
[4] The transplants were seeded and transplanted before the other treatments were seeded.
[5] The onions seeded with a tractor were a different cultivar.

Funding for this project was provided by the Fresh Vegetable Growers of Ontario, Haggerty AgRobotics Inc., the Ontario Agri-Food Innovation Alliance, and Innovation Farms powered by AgExpert.

CROP: Yellow cooking onions (*Allium cepa* L.)

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TITLE: EVALUATION OF ONION LEAF NUTRIENT LEVELS IN GROWER FIELDS USING THE PICKETA LENS AND LABORATORY TISSUE ANALYSIS, 2024

METHODS: The study was conducted in five grower fields (A–E), labelled for privacy. Onion plants were sampled from July 19 to August 21, beginning after the 4–5 leaf stage. All fields were sampled in the first round (July 15–19), fields A, B, and C in the second round (August 2–6), and field C in a third round (August 21). Each sampling event involved collecting 20 plants from five locations per field, with samples taken near each corner and the center.

At each location, the most recently mature leaf (typically the third from the center) was collected from 10 plants per row in two center rows of a bed. Leaves were scanned using the Picketa Leaf Evaluated Nutrient System (LENS), with results immediately available via the cloud-based Picketa 'Fieldbook.' The same leaves were sent to SGS Laboratory (Guelph, ON) for tissue analysis, with results received five days later. Nutrient assessments included nitrogen (N as is), phosphorus (P%), potassium (K%), magnesium (Mg%), calcium (Ca%), zinc (Zn, ppm), manganese (Mn, ppm), copper (Cu, ppm), iron (Fe, ppm), boron (B, ppm), and sulfur (S as is). Results were compared to sufficiency ranges from the OMAFA Vegetable Guide 839, adapted from Hochmuth et al. (2018), Plant Tissue Analysis and Interpretation for Vegetable Crops in Florida (University of Florida IFAS Extension, HS964).

Data were analyzed using a factorial design with a mixed-effects model in SAS 9.4 (SAS Institute, Cary, USA). For each sampling date, a generalized linear mixed model (PROC GLIMMIX) was used, with treatment (Picketa LENS vs. SGS Lab) as a fixed effect and field as a random effect. The five sampling locations per field were treated as subsamples. Pairwise comparisons of least squares means were adjusted using Tukey-Kramer's method. Pearson correlation coefficients were calculated using PROC CORR, and regression analysis was conducted using PROC REG, pooling data across sampling dates.

RESULTS: as presented in Tables 1 and 2, Figures, 1, 2, 3, 4 and 5.

CONCLUSIONS: The tissue test results from both assessments were within or above the sufficiency ranges for all nutrients. The results from SGS Lab mostly stayed within sufficiency limits while results from the Picketa LENS were higher and sometimes exceeded the sufficiency ranges (Table 1).

The SGS lab results reported a gradual decline in N levels over time but remained within the sufficiency range, while Picketa LENS consistently reported significantly higher values. A similar pattern was observed with K values. The P from both methods remained within the sufficiency range, however the Picketa LENS recorded consistently higher levels compared to SGS. One notable deviation from this trend was Ca. SGS Lab initially recorded a high Ca level, which then steadily declined, transitioning from above the sufficiency range to within it. In contrast, Picketa LENS reported a more constant but lower Ca concentration throughout the sampling periods.

For micronutrients, both methods reflected a general decline in Zn, Mn, B, and Fe over time. However, Mn levels in SGS Lab started well above sufficiency but dropped significantly, whereas Picketa LENS reported relatively high Mn concentrations. The Cu levels fluctuated widely in SGS Lab results, while Picketa LENS measurements remained consistent. The B values from SGS Lab were higher than Picketa LENS, staying above the sufficiency range, whereas Picketa LENS results remained within sufficiency. The S concentrations remained steady across both methods and were within the sufficiency range throughout the sampling period.

The variations in absolute values and declining trends observed in N, P, K, Zn, Mn, and B correspond with plant development stages, where nutrient uptake is typically higher during early growth and decreases as plants mature.

There were no trends in correlations between the results from Picketa and SGS. There was a negative correlation in calcium content in the 15-19 July assessment and positive correlations for N and K for the 2-6 Aug assessment.
The best agreement between the methods was observed for N and P on 2–6 August. Calcium showed a strong negative correlation on 15–19 July, suggesting discrepancies between the two methods. Other nutrients had weak correlations across dates (Table 2).
Only Ca and Mg showed significant regression results, but the prediction strength for Mg was weak (Fig. 3 and 5). Other nutrients had no meaningful predictive relationship.

Tissue test results from both assessments were within or above sufficiency ranges for all nutrients. SGS Lab results mostly remained within sufficiency limits, whereas Picketa LENS tended to report higher values, sometimes exceeding these ranges (Table 1).

SGS Lab showed a gradual decline in N levels over time while remaining within sufficiency, whereas Picketa LENS consistently reported significantly higher values. A similar trend was observed for K. Both methods recorded P within sufficiency, though Picketa LENS reported consistently higher levels. A notable exception was Ca: SGS Lab initially recorded high Ca levels, which then declined into the sufficiency range, whereas Picketa LENS reported lower but relatively stable concentrations.

For micronutrients, both methods showed a general decline in Zn, Mn, B, and Fe over time. Mn levels in SGS Lab started well above sufficiency but dropped significantly, while Picketa LENS reported consistently high Mn concentrations. Cu levels fluctuated in SGS Lab results but remained stable in Picketa LENS measurements. B values were higher in SGS Lab, staying above sufficiency, while Picketa LENS results remained within the range. S concentrations were steady across both methods.

The observed declines in N, P, K, Zn, Mn, and B align with plant development stages, where nutrient uptake is higher during early growth and decreases as plants mature.

Correlation trends between Picketa LENS and SGS Lab were inconsistent. A negative correlation in Ca content was observed during the July 15–19 assessment, while positive correlations were found for N and K during August 2–6. The strongest agreement between methods occurred for N and P on August 2–6, whereas Ca showed a strong negative correlation on July 15–19, indicating discrepancies between methods. Other nutrients showed weak correlations across dates (Table 2).

Only Ca and Mg showed significant regression results, though Mg had weak predictive strength (Fig. 3 and 5). Other nutrients exhibited no meaningful predictive relationships.

Table 1: Nutrient levels in onion leaves from various grower fields from the Picketa LENS and SGS Labs, and sufficiency range,

Tissue testing procedure and sample dates	N	P (%)	K (%)	Mg (%)	Ca (%)	Zn (ppm)	Mn (ppm)	Cu (ppm)	B (ppm)	S
15-19 July										
SGS lab	3.1 b[1,3]	0.3 b	2.9 b	0.3 a	2.1 a	41.0 ns[4]	65.9 ns	5.8 b	38.2 a	0.6 a
Picketa LENS	4.6 a[2]	0.4 a	3.5 a	0.2 b	1.0 b	42.2	77.5	7.4 a	23.3 b	0.5 b
2-6 Aug										
SGS lab	2.8 b	0.2 b	2.9 b	0.2 b	1.3 a	22.9 b	39.7 b	22.0 a	32.5 a	0.7 a
Picketa LENS	4.7 a	0.4 a	4.3 a	0.3 a	1.1 b	45.2 a	80.5 a	7.1 b	24.0 b	0.5 b
21 Aug										
SGS lab	2.5 b	0.2 b	2.4 b	0.2 b	1.0 ns	17.0 b	17.0 b	7.8 ns	26.6 ns	0.6 a
Picketa LENS	4.5 a	0.4 a	3.9 a	0.3 a	1.1	43.2 a	74.0 a	7.2	25.0	0.5 b
Sufficiency range	**2 – 3**	**0.2– 0.5**	**1.5 – 3**	**0.15 – 0.3**	**0.6 – 0.8**	**15 – 20**	**10 – 20**	**5 – 10**	**10 – 25**	**0.2 – 0.6**

[1] The nutrient was reported as "as is" for all lab measurements without any adjustments for moisture.
[2] The nutrient was reported as a 'percentage' for the Picket LENS measurements.
[3] Means for each date in a column followed by the same letter are not significantly different at $p > 0.05$, based on the Tukey-Kramer multiple comparison test.
[4] ns - no significant difference among the treatments

Table 2: Correlation coefficients and p-values between SGS laboratory tissue analysis and Picketa LENS for each nutrient at different sampling dates

Nutrient	15–19 July	2–6 August	21 August
Nitrogen	0.19 [1] (0.36) [2]	**0.56 (0.03**)	0.21 (0.74)
Phosphorus	-0.15 (0.48)	0.31 (0.27)	-0.83 (0.08)
Potassium	-0.01 (0.95)	**0.57 (0.03)**	-0.54 (0.34)
Magnesium	-0.18 (0.39)	0.06 (0.84)	0.25 (0.69)
Calcium	**-0.59 (0.002)**	0.28 (0.31)	-0.23 (0.71)
Zinc	0.14 (0.51)	0.15 (0.61)	-0.59 (0.30)
Manganese	-0.05 (0.80)	0.39 (0.15)	-0.25 (0.69)
Copper	0.28 (0.18)	0.33 (0.23)	0.37 (0.54)
Iron	0.02 (0.93)	0.17 (0.55)	0.61 (0.28)
Boron	0.01 (0.96)	-0.06 (0.84)	-0.17 (0.79)
Sulfur	-0.25 (0.23)	0.34 (0.21)	0.39 (0.52)

[1] Pearson correlation coefficient (r).
[2] The p-value.

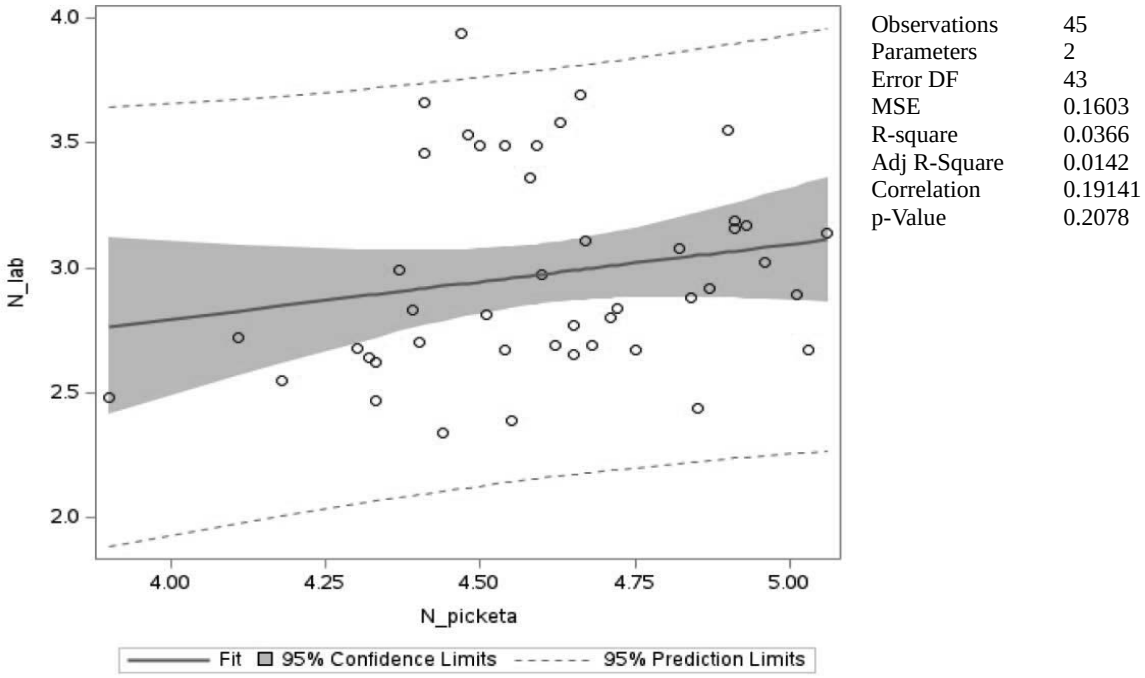
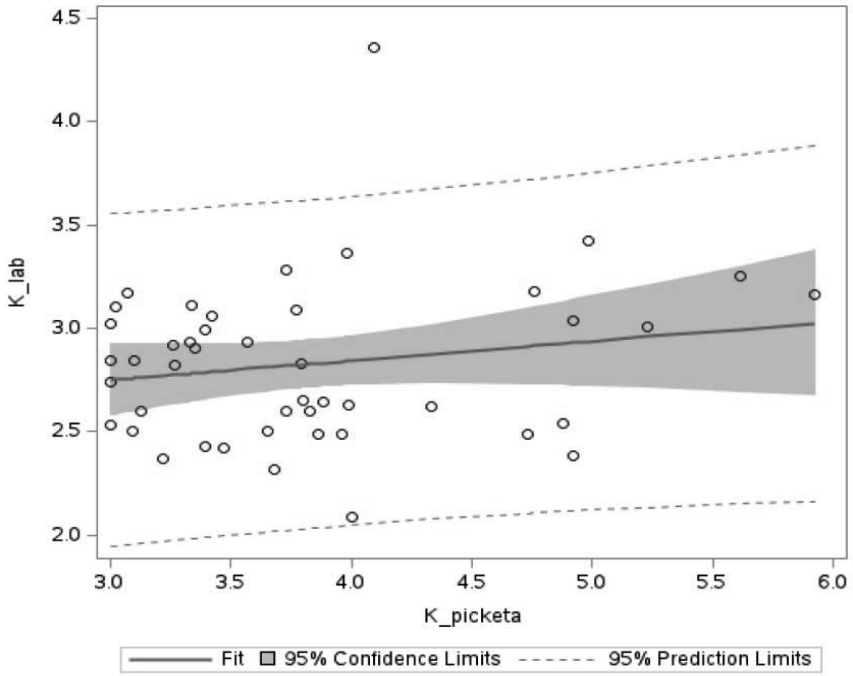
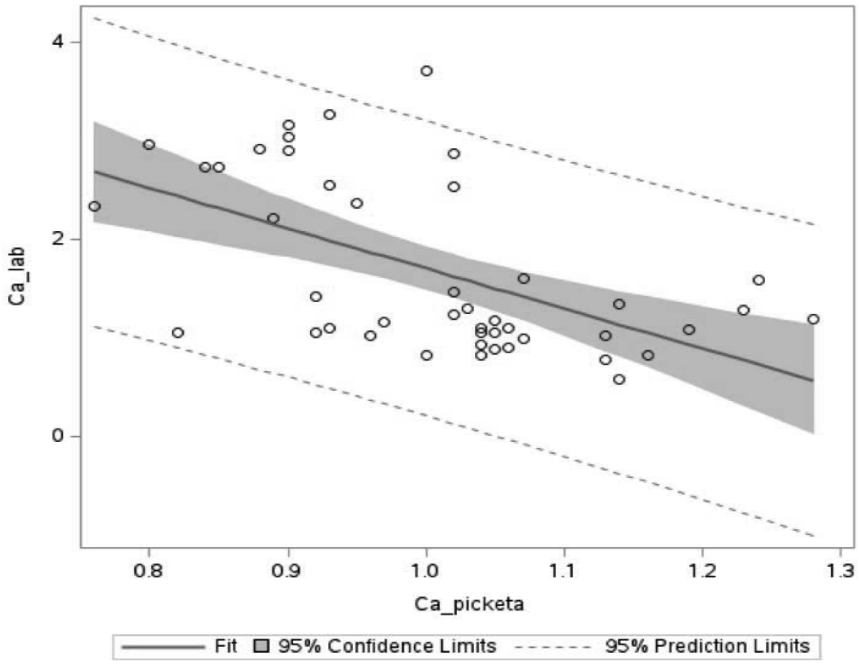


Figure 1: Relationship between all nitrogen values in leaf tissue collected from growers' fields measured by SGS labs and the Picketa LENS, 2024



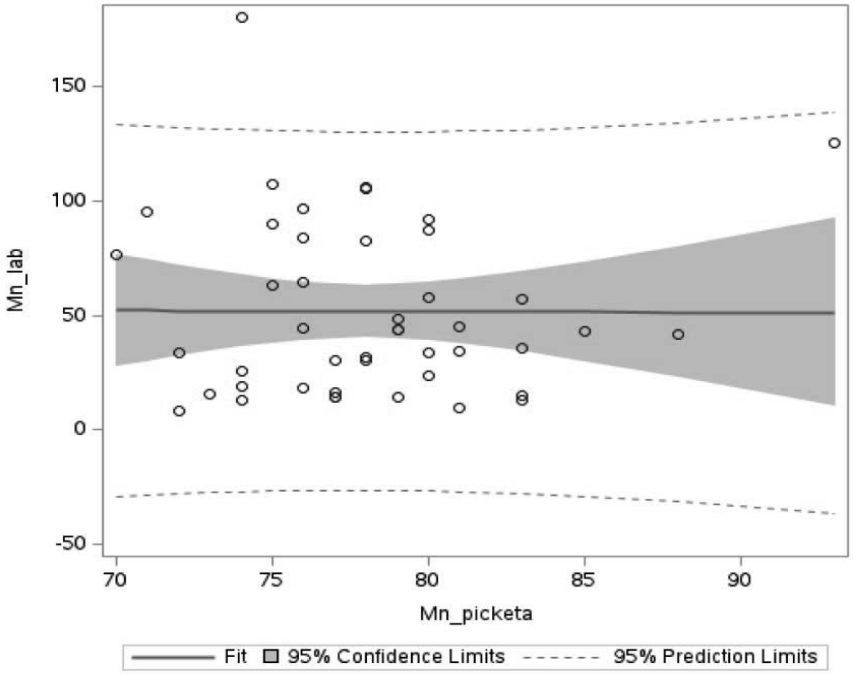
Observations	45
Parameters	2
Error DF	43
MSE	0.1519
R-square	0.032
Adj R-Square	0.0095
Correlation	0.17895
p-Value	0.2395

Figure 2: Relationship between all potassium values in leaf tissue collected from growers' fields measured by SGS labs and the Picketa LENS, 2024



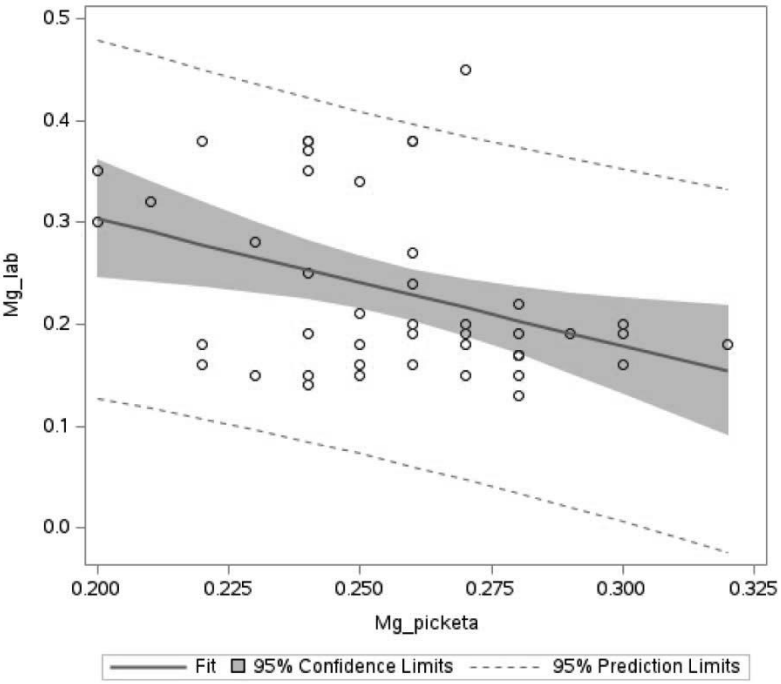
Observations	45
Parameters	2
Error DF	43
MSE	0.5388
R-square	0.3071
Adj R-Square	**0.291**
Correlation	-0.55414
p-Value	**<0.0001**

Figure 3: Relationship between all calcium values in leaf tissue collected from growers' fields measured by SGS labs and the Picketa LENS, 2024



Observations	45
Parameters	2
Error DF	43
MSE	1472.1
R-square	212E-7
Adj R-Square	-0.023
Correlation	-0.00461
p-Value	0.9760

Figure 4: Relationship between all manganese values in leaf tissue collected from growers' fields measured by SGS labs and the Picketa LENS, 2024



Observations	45
Parameters	2
Error DF	43
MSE	0.0068
R-square	0.1449
Adj R-Square	0.125
Correlation	-0.38067
p-Value	0.0099

Figure 5: Relationship between all magnesium values in leaf tissue collected from growers' fields measured by SGS labs and the Picketa LENS, 2024

Funding for this project was provided by the Fresh Vegetable Growers of Ontario, Haggerty AgRobotics Inc., the Ontario Agri-Food Innovation Alliance, and Innovation Farms powered by AgExpert.

CROP: Broccoli (*Brassica oleracea*) cv. Diplomat
PEST: Swede Midge (*Contarinia nasturtii*)

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TITLE: CONTROL OF SWEDE MIDGE IN BRASSICAS WITH ISOCYCLOSERAM, 2024

MATERIALS: A21377 [X], CORAGEN 200 SC (Chlorantraniliprole 18.4%), HASTEN NT

METHODS: Broccoli plants, cv. Diplomat, were transplanted by hand on 26 June into organic soil, (pH ≈ 6.1, organic matter ≈ 69.8%) naturally infested with *Contarinia nasturtii* pupae at the Ontario Crops Research Centre - Bradford, Ontario. A randomized complete block arrangement with four replicates per treatment was used. Each experimental unit consisted of two rows spaced 86 cm apart and 7 m in length. Treatments were applied as foliar sprays using a CO_2 backpack sprayer equipped with four TeeJet 8002 fan nozzles calibrated to deliver 500 L/ha at 275 kPa. Treatments were: CORAGEN 200 SC at 250 mL/ha, A21377 at 100 mL/ha, 150 mL/ha, and 200 mL/ha. An untreated check was also included. Treatments were applied on 9 and 31 July. On Sept 11, all plants in each experimental unit were visually rated on a scale from 0 to 3. Classes were: 0 = no damage, 1 = mild twisting of stem, 2 = severe twisting of stem and crumpling of leaves, 3 = death of meristem. On 13 September, mature broccoli heads were harvested and sorted based on marketability before being weighed. Plants without any heads (blinds) were counted and removed during harvest as well.
Compared to the previous 10-year average, air temperatures in 2024 were average for June (19.2°C), July (21.5°C), August (19.6°C) and September (17.6°C). The 10-year average temperatures were: June 18.6°C, July 21.1°C, August 20.4°C and September 16.8°C. Monthly rainfall was below the 10-year average for June (79 mm), August (54 mm) and September (21 mm) and above average July (85 mm). The 10-year rainfall averages were: June 95 mm, July 75 mm, August 74 mm and September 57 mm.
Data were analyzed using the General Analysis of Variance function of Statistix V.10. Means separation was obtained by using Fisher's Protected LSD test at P = 0.05 level of significance.

RESULTS: as presented in Tables 1-2.

CONSCLUSIONS: There were no significant differences in the visual damage assessments, or in the ability of the products to reduce the incidence and severity of swede midge damage numerically compared to the check (Table 1). Additionally, there was no significant difference between the various rate of A21377 in reducing incidence and severity compared to CORAGEN. All products significantly increased the weight of marketable yield compared to the untreated check (Table 2). However, there was no significant difference between treatments in marketable yield as a percent of total yield, or the number of blinds observed (Table 2).

Table 1. Swede midge damage incidence and severity for broccoli, cv. Diplomat, sprayed with various fungicides at the Ontario Crops Research Centre - Bradford, Ontario, 2024.

Treatment	Rate (mL/ha)	DSI[1,2]	Incidence (%)
A21377 + HASTEN NT[3]	200	1.3 ns[4]	3.4 ns
A21377	150	2.2	3.8
A21377 + HASTEN NT	150	1.3	2.7
A21377 + HASTEN NT	100	1.4	2.8
CORAGEN + HASTEN NT	250	1.1	2.0
Check	-	1.5	2.5

[1] On 11 September, all plants were visually assessed using the following classes: 0 = no damage, 1 = mild twisting of stem, 2 = severe twisting of stem and crumpling of leaves, 3 = death of meristem.
[2] Disease severity (DSI) was calculated using the following formula:

$$DSI = \frac{\sum [(\text{class no.})\ (\text{no. of plants in each class})]}{(\text{total no. plants assessed})\ (\text{no. classes } -1)} \times 100$$

[3] HASTEN NT was applied at 0.25% v/v.
[4] ns = no significant differences were found among treatments.

Table 2. Yield and marketability of broccoli, cv. Diplomat, sprayed with various fungicides for control of swede midge at the Ontario Crops Research Centre - Bradford, Ontario, 2024.

Treatment	Rate (mL/ha)	Blinds[1]	Marketable[2] Yield (%)	Marketable Weight (kg)	Unmarketable Weight (kg)
A21377 + HASTEN NT[3]	200	9.5 ns[5]	45.7 ns	2.2 ab[4]	2.9 ns
A21377	150	10.5	55.8	3.0 ab	2.5
A21377 + HASTEN NT	150	6.5	57.0	3.4 a	2.5
A21377 + HASTEN NT	100	13.0	62.9	2.0 ab	1.1
CORAGEN + HASTEN NT	250	9.0	46.5	2.3 ab	3.2
Check	-	13.0	54.1	1.9 b	2.1

[1] Blinds are plants that did not produce any heads.
[2] Percentage values were determined using weight.
[3] HASTEN NT was applied at 0.25% v/v.
[4] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD test.
[5] ns = no significant differences were found among treatments.

Funding for this project was provided by Syngenta Crop Protection.

CROP: Cabbage (*Brassica oleracea* var. *capitata* L.) cv. Bronco
PEST: Clubroot (*Plasmodiophora brassicae* Woronin)

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TITLE: EVALUATION OF A FUNGAL ENDOPHYTE FOR SUPPRESSION OF CLUBROOT ON CABBAGE IN A CONTROLLED ENVIRONMENT, 2024

MATERIALS: BIOCERES EC (*Beauveria bassiana* strain ANT-03 > 1 x 10^{10} spore/mL) (Anatis Bioprotection, QB, Canada) BOTANIGARD ES (*B. bassiana* strain GHA, 11.3%) (LAM International Corporation, MT, USA)

METHODS: A controlled environment study was conducted using the white cabbage cultivar Bronco (*Brassica oleracea* L. var. *capitata*), which is susceptible to all pathotypes of clubroot. The study was arranged in a randomized complete block with four replicates and 10 plants per experimental unit. The 12 treatments were arranged in a factorial design with two factors. One factor was treatments with *B. bassiana* endophyte: non-treatment check (water), BOTANIGARD at 10 mL/L water, and BIOCERES at 8 mL/L water. The other factor was inoculation with pathotype 2 of *Plasmodiophora brassicae*: low (1 x 10^5 spores/mL water), medium (1 x 10^6 spores/mL water) and high (1 x 10^7 spores/mL water) concentrations and a non-treatment control (water).

Seed of Bronco F1 (Bejo Seeds Inc, Geneva, NY) was planted in 128-cell plug trays at ~5 mm depth (Koro Products, Toronto, ON) in soilless mix (L4A Sunshine Mix; Sun Gro Horticulture, Agawam, MA). Plants were grown in the growth room set to 24°C / 19°C day/night with a 17-hr photoperiod. Plants were watered by hand with alkaline tap water that was pH adjusted to 6.0–6.3 with 5% acetic acid (household vinegar). Liquid fertilizer consisting of 0.1% nitrogen, phosphate, and potassium (20-20-20) was applied weekly. When the cabbage seedlings reached the cotyledon stage, the *B. bassiana* formulations were applied as a soil drench with water at 500 mL/tray. Three weeks after seeding, the young plants were transplanted singly into tall, narrow plastic pots (conetainers, Stuewe and Sons Inc. Oregon, USA).

Inoculum was prepared and each plant was manually inoculated with resting spore suspension. Briefly, 30 g of frozen clubs of pathotype 2 (collection source: Ontario Crops Research Centre - 2022) were defrosted for 2 days. The clubs were soaked in 300 mL of sterile water in a commercial blender and homogenized for 2 min. The suspension was filtered through eight layers of cheesecloth to remove any plant material. The concentration of resting spores in the suspension was determined using a haemocytometer and adjusted to the desired concentrations. Seedlings were inoculated with 5 mL of 0 (water control), 1x10^5, 1x10^6, and 1x10^7 resting spores mL^{-1} at 6 weeks after seeding. The application time of 6 weeks after seeding was chosen to mimic the commercial situation where transplants are first exposed to the pathogen when they at put out into the field. Inoculation of plants was repeated, one week apart to ensure good symptom development.

Clubroot severity was assessed 6 weeks after inoculation using the following scale: 0 = no clubs, 0.2 = single very small club (≤ 2 cm), 1 = small clubs on < 1/3 of roots, 2 = small or intermediate clubs on 1/3 to 2/3 of roots, and 3 = clubs on > 2/3 of roots adopted from Crete et al. (1963). A disease severity index (DSI) value was calculated for each plot using the following formula:

$$\mathrm{DSI} = \frac{\Sigma\,[\,(\text{class no.})(\text{no. roots in each class})]}{(\text{total no. roots per sample})\;(\text{no. class} - 1)}\; x\; 100$$

Fresh and dry weight of the above-ground plant material in each experimental unit was collected at the final disease assessment. The fresh top weight was dried at 60°C for 4 days to obtain dry top weight.

Colonization by *B. bassiana* in plant tissue was assessed at two separate times over the course of the experiment: 4 weeks after seeding (before inoculation with *P. brassicae*) and 12 weeks after seeding (termination of the experiment). For the first assessment, a total of 40 plants per *B.bassiana* treatment (BIOCERES, BOTANIGARD, check) were assessed, with plants randomly pulled from the seedling trays (40 plants/treatment x 1 leaf/plant x 4 tissue samples/leaf = 160 tissue samples/treatment). Colonization assessment at this time confirmed the endophyte was present before exposure to the pathogen. At the termination assessment, a sampling unit of four random plants out of ten plants per experimental unit was used for assessment (4 plants/experimental unit x 1 leaf/plant x 4 tissue samples/leaf = 16 tissue samples/ experimental unit). This was completed for every experimental unit in a block. Leaves were sterilized before plated on PDA. Briefly, each plant had the newest true leaf removed and was rinsed under tap water to remove debris. Under a laminar flow hood, the leaves were surface sterilized in 70% ethanol for 2 min and 0.5% sodium hypochlorite (household bleach) for 2 min, and triple rinsed in sterile deionized water. Each leaf was cut into four 1 cm^2 leaf sections using a sterile blade and left to dry on Kimwipes. Tissue samples were plated four at a time (all from the same leaf) on standard potato dextrose agar (PDA) medium in a 9.0 cm petri dish and covered in parafilm. The agar contained 0.125 g/L streptomycin sulphate salt (Sigma-Aldrich, Missouri, USA) and 0.25 g/L ampicillin sodium salt (Mediatech Inc. Virginia, US) antibiotics to reduce contamination. This was completed on all four blocks of the experiment. The endophyte formulations, BIOCERES and BOTANIGARD, were also plated to check for viability by streaking on PDA. The samples were incubated at 21°C in the dark and checked for fungal growth every few days for up to 2 weeks. The growth room study was repeated.

Statistical analysis for the controlled environment was a two-factor factorial ANOVA in PROC GLIMMIX using SAS Statistical Software. Means separation was obtained using the Tukey test at $P = 0.05$ level of significance.

RESULTS: As presented in Figures 1 and 2. There was an interaction between *P. brassicae* inoculum concentration and *B. bassiana* treatment. As expected, clubroot severity in the control was highest with the highest concentration of *P. brassicae* and declined with a reduction in resting spore concentration. The drench application of BOTANIGARD reduced clubroot severity substantially at the highest concentration of *P. brassicae,* but was not different from the control at other inoculum concentrations. BIOCERES reduced clubroot (numerically) at all concentrations of *P. brassicae* but was not significantly different from the control. Colonization of leaves by *B. bassiana* growth was 67% for BOTANIGARD and 33% for BIOCERES at the final assessment (data not shown). There was no colonization by *B. bassiana* in the non-inoculated control. Both *B. bassiana* formulations showed fungal growth after plating on agar, which demonstrated their viability. Application of either formulation of *B. bassiana* to cabbage seedlings increased above-ground biomass numerically, although it was not significantly different from the non-treatment control, except in the case of BIOCERES at the highest rate of inoculum (fresh and dry weight, Fig. 3).

CONCLUSIONS: BOTANIGARD only reduced clubroot severity on cabbage at the highest inoculum concentration in these studies. There was a numerical trend of lower DSI with BIOCERES but it was not statistically different from the control. BIOCERES may have lower efficacy than BOTANIGARD because of differences in fungal strains or product formulations which may be related to lower colonization rates.

BOTANIGARD and BIOCERES both increased plant fresh and dry weight top weight compared to the control numerically, but the treatments were not significantly different from the control in most cases. Endophyte growth was observed in leaf tissue samples pre-*P. brassicae* inoculation and at the time of disease assessment. This demonstrated that the endophyte grew, survived, and spread within the plant.

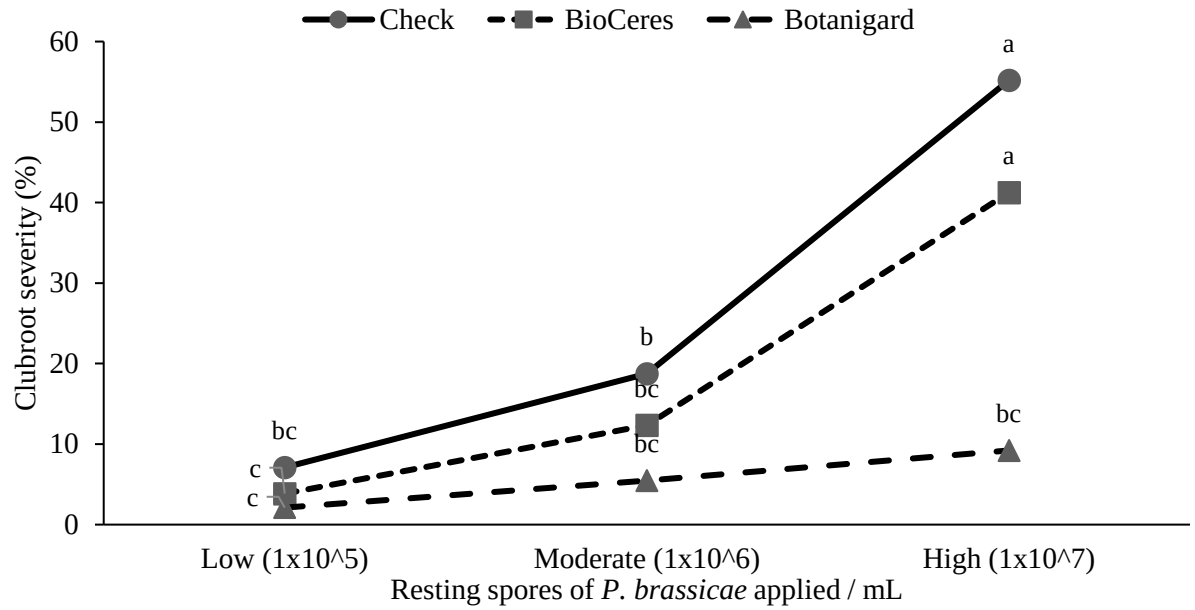

Figure 1. Clubroot severity (disease severity index) on cabbage treated with two commercial formulations of *Beauveria bassiana* (BIOCERES or BOTANIGARD) and inoculated with three concentrations of *Plasmodiophora brassicae* resting spore suspension (@ 5 mL per plant). Pooled data of two runs. Means with the same letter do not differ at $P = 0.05$.

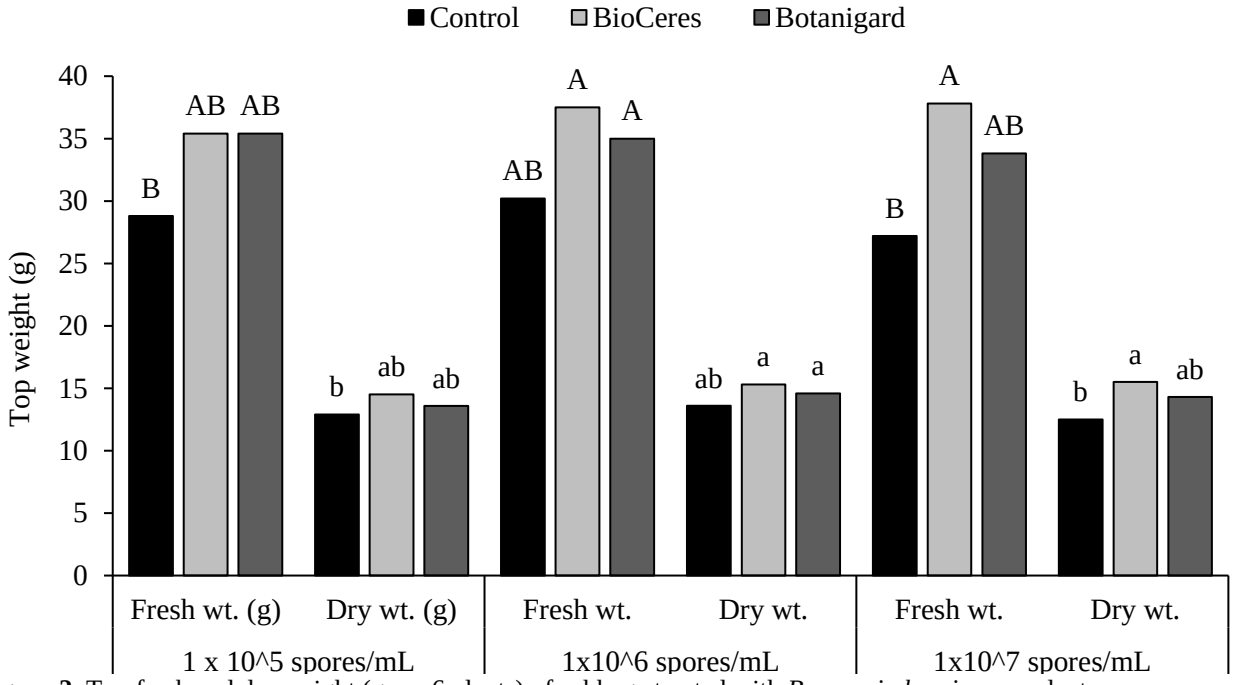

Figure 2. Top fresh and dry weight (g per 6 plants) of cabbage treated with *Beauveria bassiana* products, BIOCERES and BOTANIGARD, and inoculated with resting spore of *Plasmodiophora brassicae* at three concentrations in a controlled environment. Means followed by the same letter do not differ at $P = 0.05$ based on Tukey's test, capitalized letters are in the same Tukey's test for fresh weight, and lowercase are in a separate Tukey's test for dry weight.

Funding for this project was provided by the Ontario Agri-Food Innovation Alliance, the Fresh Vegetable Growers of Ontario, and NSERC.

CROP: Cabbage (*Brassica oleracea* var. *capitata* L.) cv. Bronco
PEST: Clubroot (*Plasmodiophora brassicae* Woronin)

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TITLE: EVALUATION OF THE FUNGAL ENDOPHYTE *BEAUVERIA BASSIANA* FOR SUPPRESSION OF CLUBROOT ON CABBAGE IN THE FIELD, 2024

MATERIALS: BIOCERES EC (*Beauveria bassiana* strain ANT-03 @ > 1 x 10^{10} spore/mL) (Anatis Bioprotection, QB, Canada); BOTANIGARD ES (*B. bassiana* strain GHA, 11.3%) (LAM International Corporation, MT, USA)

METHODS: Two field trials of cabbage were conducted on muck soil (pH 6.3, organic matter 70%) at the Ontario Crops Research Centre – Bradford, Ontario. One field trial was placed in an area naturally infested with *Plasmodiophora brassicae* Woronin pathotype 2, while the other was in a non-clubroot area of the research centre. Cultivar Bronco was assessed because it is highly susceptible to all pathotypes of *P. brassicae*. The two trials were seeded and planted at the same time. On 25 July, seeds were planted into 128 cell plug trays, 5 mm depth (Koro Products Toronto) in L4A Sunshine Mix (Sun Gro Horticulture, Agawam, MA). Plants were grown in a greenhouse and watered by hand as needed.

The treatments were: BOTANIGARD at 10 mL/L water, BIOCERES at 8 mL/L water, and a non-treated control (water). When the seedlings reached the cotyledon stage, each treatment was applied as a soil drench at 500 mL/ seedling tray. On 07 September, the cabbage plants were transplanted to the field. The trial was arranged as a randomized complete block with four replicates. Each plot was 1.5 m x 5 m, with 2 rows of cabbage per plot and 20 cm between plants for the clubroot trial and 40 cm for the non-clubroot trial. The non-clubroot trial was provided more space to allow the cabbage to grow until harvest. On 13 November, clubroot assessment occurred 10 weeks after transplanting. Clubroot is normally assessed after six weeks of exposure to the pathogen, but disease pressure was low early on. The roots were visually assessed for symptoms of clubroot and sorted into classes based on the following scale: 0 = no clubs, 0.2 = 1 very small club (≤ 2 cm), 1 = small clubs on less than 1/3 of roots, 2 = small or intermediate clubs on 1/3 to 2/3 of roots, and 3 = clubs on over 2/3 of roots, as adopted from Crete et al. (1963). The ratings were used to calculate clubroot incidence (CI) and the disease severity index (DSI) was calculated using the following formula:

$$DSI = \frac{\Sigma\,[\,(\text{class no.})(\text{no. roots in each class})]}{(\text{total no. roots per sample})\,(\text{no. class} - 1)}\; x\; 100$$

Colonization by *B. bassiana* in plant tissue was assessed at two separate times over the course of the experiment: 4 weeks after seeding (before inoculation with *P. brassicae*) and 12 weeks after seeding (termination of the experiment). At the first assessment, a total of 40 plants per *B.bassiana* treatment (BIOCERES, BOTANIGARD, check) were assessed, randomly pulled from the seedling trays (40 plants/ treatment x 1 leaf/plant x 4 tissue samples/leaf = 160 tissue samples/treatment). Colonization assessment at this time confirmed the endophyte was present before exposure to the pathogen. At the termination assessment, a sampling unit of ten consecutive plants per plot were used for assessment (10 plants/plot x 1 leaf/plant x 4 tissue samples/leaf = 40 tissue samples/plot). This was completed for every plot in a block. Leaves were sterilized before plating on PDA. Briefly, each plant had the newest true leaf removed and was rinsed under tap water to remove debris. Under a laminar flow hood, the leaves were surface sterilized in 70% ethanol for 2 min and 0.5% sodium hypochlorite (household bleach) for 2 min, and triple rinsed in sterile deionized water. Each leaf was cut into four 1 cm^2 leaf sections using a sterile blade and left to dry

on Kimwipes. Tissue samples were plated four at a time (all from the same leaf) on standard potato dextrose agar (PDA) medium in a 9.0 cm petri dish and covered in parafilm. The agar contained 0.125 g/L streptomycin sulphate salt (Sigma-Aldrich, Missouri, USA) and 0.25 g/L ampicillin sodium salt (Mediatech Inc. Virginia, US) antibiotics to reduce contamination. This was completed on all four blocks of the experiment. The endophyte formulations, BIOCERES and BOTANIGARD, were also plated to check for viability by streaking on PDA. The samples were incubated at 21°C in the dark and checked for fungal growth every few days for up to 2 weeks.

For the field trial that had no clubroot, the presence of pests and the extent of feeding damage were assessed. The cabbage aphid (*Brevicoryne brassicae* L.) infestation assessment took place on 08 October but was not repeated because insect pressure was low. The total number of aphids per plant was counted on 10 plants per plot. Leaf sampling was conducted by visually inspecting the upper/lower leaf surface for aphid presence. In cases of high infestation, counts were conducted using a hand lens. Furthermore, caterpillar feeding damage was also assessed on the same days. In each plot, ten plants were randomly selected and three leaves per plant were rated for feeding damage: 0 = no damage, 1 = 1–10%, 2 = 11–5%, 3 = 26–50%, 4 > 50% of leaf area consumed. Damage assessment focused on outer leaves, as they are more susceptible during early growth stages. Caterpillar presence was confirmed by searching for larvae on leaves and surrounding soil during sampling.

The fresh weight of ten plants per plot of the above-ground biomass was collected at harvest. Statistical analysis for the aphid counts and feeding damage scores were analyzed using mixed model ANOVA in PROC GLIMMIX (SAS 9.4, SAS Institute, Cary, IN) with means separation using the Tukey test at $P = 0.05$ level of significance.

Compared to the previous 10-year average, air temperatures in 2024 were slightly above average for September (17.6°C) and October (10.6°C). The 10-year average temperatures were: September 16.8°C and October 10.1°C. Monthly rainfall was substantially below the 10-year average for September (21 mm) and October (20 mm), The 10-year rainfall averages were: September 57 mm and October 62 mm.

RESULTS: As presented in Table 1, 2, and 3. Clubroot pressure was moderate in the trial on infested soil and there were no differences among the *B. bassiana* formulations and the control for incidence and clubroot severity. There was a substantial difference in plant biomass (fresh and dry top weights) between *B. bassiana* treatments and the control in both trials; BOTANIGARD had the greatest biomass overall (Table 1 and 2). In the colonization assessment, the endophyte was found to colonize the leaf tissue in the pre-transplant assessment at a rate of 62.5% for both BIOCERES and BOTANIGARD (Table 3). No endophyte growth was observed in the newest plant tissue during the final assessment at harvest in November.

CONCLUSIONS: Neither *B. bassiana* product reduced the incidence or severity of clubroot. Both *B.bassiana* products resulted in a substantial increase in above-ground biomass compared to the control in both clubroot and non-clubroot trials, suggesting plant growth promotion. The endophyte colonized the youngest leaf tissue before transplanting but was not found in the post-harvest assessment. The endophyte may not have been able to keep up with the rate of growth or there may be an influence by weather during the field trial that was not encountered during controlled environment studies. There was a light frost on the plants during the trial harvest that may have killed the endophyte. The *B. bassiana* product treatments, BIOCERES and BOTANIGARD, did not have a noticeable effect on insect presence and feeding damage compared to the non-treated control. While *B. bassiana* formulations are registered for the control of several insect species, those are for foliar applications. This trial is taking it off-label and looking at the products as an endophyte. No colonization of *B. bassiana* at trial harvest probably related to the lack of insect control and clubroot suppression in these trials.

Table 1. Effect of *Beauveria bassiana* products, BIOCERES and BOTANIGARD, on incidence, clubroot severity (disease severity index, DSI), and fresh and dry top weight of cabbage grown on muck soil naturally infested with *Plasmodiophora brassicae* at the Ontario Crops Research Centre – Bradford, Ontario, 2024.

Treatment	Incidence	DSI	Fresh wt.[1] (g)	Dry wt.[1] (g)
Control	73 ns[2]	47 ns	511 c[3]	75 c
BIOCERES	65	45	784 b	107 b
BOTANIGARD	69	36	1086 a	142 a

[1] Mean top weight of ten plants per plot.
[2] ns = no significant differences at P= 0.05
[3] Means in a column followed by the same letter do not differ based on Tukey's test at P =0.05.

Table 2. Effect of commercial *Beauveria bassiana* treatments, BIOCERES and BOTANIGARD, on cabbage as an endophyte for insect control and plant growth promotion.

Treatment	Caterpillar feeding incidence (%)[1]	Damage severity (% leaf area)[1]	Avg. aphid count/plant	Fresh wt. (kg)[2]
Control	14 ns[3]	4.0 ns	6.0 ns	0.78 b[4]
BIOCERES	22	5.6	4.7	1.71 a
BOTANIGARD	7	4.2	4.1	1.54 a

[1] 30 leaves were assessed per plot.
[2] Mean fresh top weight of 10 plants per plot.
[3] ns = no significant differences at P= 0.05
[4] Means followed by the same letter do not differ based on Tukey's test at P = 0.05.

Table 3. Average percent colonization of the endophyte, *Beauveria bassiana*, in field cabbage treated with commercial formulations, BIOCERES (8 mL/L) or BOTANIGARD (10 mL/L), as a soil drench at 500mL per seedling tray during the cotyledon stage. Colonization pre-transplant was assessed 4 weeks after seeding and post-harvest was assessed at trial harvest (10 weeks post-transplant).

Treatment	Colonization (pre-transplant)[1]	Colonization (post-harvest)[2]
Control	0 %	0 %
BIOCERES	63 %	0 %
BOTANIGARD	63 %	0 %

[1] Colonization assessed on 40 plants per *B. bassiana* treatment.
[2] Colonization assessed on 10 plants per plot.

Funding for this project was provided by the Ontario Agri-Food Innovation Alliance and the Fresh Vegetable Growers of Ontario.

CROPS: Cabbage (*Brassica oleracea* L.) cvs. Jersey Queen, Lodero, Danish Ballhead, Badger Shipper, and Shanghai Pak Choy (*B. rapa subsp. chinenesis var. communis*)
PEST: *Plasmodiophora brassicae* Woronin, pathotypes 2, 3x, 5x, and 6

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TITLE: REVISING HOST OPTIONS FOR IDENTIFICATION OF CLUBROOT PATHOTYPES: REPLACING JERSEY QUEEN

METHODS: Plastic pots (19 cm tall conetainers, Stuewe and Sons Inc., OR) were filled with LA4 Sunshine Mix (SunGro Horticulture, USA) saturated with 0.1% solution of nitrogen, phosphorus, potassium (20-20-20 Plant Products, ON, Canada) and magnesium sulfate (K + S Kali GmbH, Kassel, Germany). One seed was planted per pot in a controlled environment with a 16-h photoperiod, 25ºC/20ºC day/night temperature, and ~70% humidity. Each treatment was applied to 10 plants and there were four repetitions of each treatment.

Plants were watered daily with a deionized water adjusted to pH 6.0 with 5% acetic acid and fertilized weekly. After one week, each pot was inoculated with 5 mL of resting spore suspension containing 1 x 10^6 spores/mL and re-inoculated with the same concentration a week later. Resting spores were extracted by soaking 30 g of frozen clubbed roots in 300 mL sterilized water, blending for 2 min, filtering through eight layers of cheesecloth, and quantifying spores using a hemocytometer. A 1 x 10^6 spores/mL solution was produced by diluting the stock solution with sterilize deionized water.

The response of four clubroot pathotypes (2, 3x, 5x, and 6) of *P. brassicae* were assessed. Clubroot symptoms were evaluated at 6 weeks post-inoculation. Clubroot incidence and disease severity index (DSI) were calculated based on a 0–3 scale (0 = no symptoms, 3 = severe clubbing), using the methods of Horiuchi (1980) and Strelkov et al. (2006).

$$DSI(\%) = \frac{\sum\big((class\ no.)(no.\ plants\ in\ each\ class)\big)}{(total\ no.\ plants\ per\ sample)(no.\ classes - 1)}\ x\ 100\%$$

Data was analyzed using ANOVA in PROC GLIMMIX and means were separated using Tukey's test at P = 0.05 in SAS 9.4 (SAS Institute, Cary, IN).

RESULTS: As presented in Table 1. Danish Ballhead cabbage showed extremely poor germination, so it was omitted from the trial.

CONCLUSIONS: Clubroot incidence showed a similar pattern of response to severity, so only severity (DSI) is presented. Cultivars Badger Shipper and Lodero shared similar reactions to inoculation with each of the four pathotypes. Jersey Queen and Lodero were susceptible (DSI > 50) when inoculated with clubroot pathotype 2 but resistant (DSI <_50) when inoculated with pathotype 5x. These two cultivars did not share the same response against pathotype 3x or 6. These inconsistencies show that Badger Shipper is not a suitable replacement for Jersey Queen in the William's Differential Set. (Table 1).

Table 1: Disease severity index (DSI) of four cabbage cultivars inoculated with field collections of *Plasmodiophora brassicae* pathotypes 2, 3x, 5x, and 6 under a controlled environment assessed 6 weeks after inoculation.

Cultivar	Pathotype 2	Pathotype 3x	Pathotype 5x	Pathotype 6
Jersey Queen	54 bc [1, 2]	55 bc	6 f	98 a
Badger Shipper	72 b	12 ef	2 f	1 f
Lodero	43 cd	25 de	0 f	7 ef
Pak Choy	97 a	92 a	67 bc	95 a

[1] Values followed by the same letter do not differ at $P = 0.05$ Tukey's Test.
[2] DSI > 50% indicates susceptibility, DSI < 50% indicates resistance.

Funding for this project was provided by the Ontario Agri-Food Innovation Alliance, Natural Sciences and Engineering Research Council of Canada (NSERC), and the Ontario Canola Growers Association.

HOST: Cabbage (*Brassica oleracea* L. var. *capitata*) cv. Bronco
PEST: Clubroot (*Plasmodiophora brassicae* Woronin)

AUTHORS: SEDAGHATKISH A, GOSSEN BD & MCDONALD MR
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TITLE: EFFECT OF TWO SOILLESS MIXES ON DEVELOPMENT OF CLUBROOT (*Plasmodiophora brassicae*) IN CABBAGE IN THE FIELD

MATERIAL: Soilless mix LA4 (Sunshine mix #4, SunGro horticulture, USA), Soilless mix BM6 HP (Berger, Quebec)

METHODS: A field trial to evaluate the efficacy of two soil-less mixes to reduce clubroot incidence and severity in cabbage cultivars in the field was conducted at the Ontario Crops Centre – Bradford on muck soil (pH ≈ 6.3, organic matter 70%) naturally infested with *Plasmodiophora brassicae* pathotype 2. The trial was arranged as a randomized complete block design with four replicates. Cabbage was seeded on 07 June, 2024 into 128-cell plug trays filled with BM6 or LA4 soilless mixes and grown in a greenhouse. On 20 June, the cabbage plants were hand-transplanted into the field. Each plot consisted of five rows, 5 m long, spaced 55 cm apart, with 30 cm between rows.

On 18 August, the tops were cut from 10 consecutive plants pulled from each row (50 total) and weighed to determine the top fresh weight. The roots were visually assessed for symptoms of clubroot and sorted into classes based on the following scale: 0 = no clubs, 1 = small clubs on less than 1/3 of roots, 2 = small or intermediate clubs on 1/3 to 2/3 of roots, and 3 = intermediate or large clubs on over 2/3 of roots. The proportion of roots in classes 0-3 was used to calculate clubroot incidence (CI). The disease severity index (DSI) was calculated using the following formula:

$$DSI = \frac{\sum [(\text{class no.})\,(\text{no. of plants in each class})]}{(\text{total no. plants per sample})\,(\text{no. classes} - 1)} \times 100$$

Compared to the previous 10-year average, air temperatures in 2024 were above average for May (15.4°C) and average for June (19.2°C), July (21.5°C), August (19.6°C) and September (17.6°C). The 10-year average temperatures were: May 13.4°C, June 18.6°C, July 21.1°C, August 20.4°C and September 16.8°C. Monthly rainfall was below the 10-year average for June (79 mm), August (54 mm) and September (21 mm) and above average for May (83 mm) and July (85 mm). The 10-year rainfall averages were: May 58 mm, June 95 mm, July 75 mm, August 74 mm and September 57 mm.

Data were analysed using the General Analysis of Variance function of the Linear Models section of Statistix V10.0. The fixed effect in the study is the type of soilless mix (BM6 vs. LA4), and the random effect is the block (replicate) in the randomized complete block design. Means separation was obtained using Tukey test at P = 0.05 level of significance.

RESULTS: as presented in Table 1.

CONCLUSIONS: There was high disease pressure in the trial. Clubroot incidence and severity and cabbage fresh weight did not differ in plants seeded in BM6 and Sunshine LA4 soil-less mixes in 2024. Even though distinct differences in the effect of soilless mix on clubroot development are found under controlled conditions, this effect did not continue under field conditions.

Table 1. Effect of the soilless mix on clubroot incidence and severity (disease severity index, DSI), and fresh weight of the foliage of cabbage on a muck soil naturally infested with *Plasmodiophora brassicae* at the Ontario Crops Research Centre – Bradford, Ontario, 2024.

Endophyte	Incidence[2] (%)	DSI[2] (0-100)	Fresh wt / plant[1] (g)
BM6	100 [ns]	83.3 [ns]	20.6 [ns]
Sunshine LA4	100	80.8	15.2

[1] Average fresh top weight of 10 plants before head formation.

[2] ns = no significant differences among the treatments.

Funding for this project was provided by the Ontario Agri-Food Innovation Alliance and the Fresh Vegetable Growers of Ontario.

CROP: Canola (*Brassica napus*) breeding line ACS N39
PEST: Clubroot *(Plasmodiophora brassicae* Woronin)

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TITLE: EFFECT OF FREEZE-THAW CYCLES ON THE SURVIVAL OF SPORES OF PLASMODIOPHORA BRASSICAE OVER WINTER

MATERIALS: EVANS BLUE DYE (T-1824)

METHODS: A field trial was conducted over the winter of 2023–2024 to evaluate the survival of *Plasmodiophora brassicae* resting spores in clubbed roots on muck soil (pH ~ 6.4, organic matter ~ 70%) at the Ontario Crops Research Centre – Bradford, ON. The trial was arranged in a randomized complete block design with six blocks and two treatments: clubs left on the soil surface, and clubs buried at a depth of 10–15 cm. A replicated control consisting of clubs in a freezer at -20°C was also included. On 08 November, 2023, about 50 g of clubbed canola roots (pathotype 2, Williams' system) were placed in bags constructed of a fine Hitex Monifil polyester mesh material (SaatiPrint Canada, Mississauga, ON). This material was selected because it is non-insulating and allows the movement of water and microbes while containing the clubs. Hourly air and soil temperatures were taken using two RX3000 Remote Monitoring Station (HOBO Data Loggers, Bourne, MA). On 06 April, 2024, the bags were removed from the field and frozen at -20°C until assessment. Resting spores were extracted and suspended at a concentration of 1×10^6 spores/mL for Evans Blue viability assessments, and at 5×10^5 spores/mL for bioassay inoculation.

Evans Blue vital stain (20 mg/mL) was mixed in equal parts with resting spore suspension in 1.5 mL Eppendorf tubes and left for 24 hr. Spores in the solution were counted using the 40x objective (500x magnification) of a compound microscope. At least 300 resting spores per sample were assessed and the ratio of stained (non-viable) to unstained (viable) was calculated.

A bioassay using the clubroot-susceptible canola breeding line ACS N39 (provided by Dr. S Vail, Agriculture and Agri-Food Canada, Saskatoon) was conducted in a growth room set to 24°C / 19°C day / night with a 17-hr photoperiod. LA4 Sunshine soil mix (Sun Gro Horticulture, MA) was packed tightly into plastic trays (12 x 6 cells, cell dimension 1 1/2" L & W x 2 1/4" H, William Dam Seeds, Dundas, ON) to support clubroot development. Seeds were planted just below the soil surface and covered with soil. There were four treatments: 1) inoculation using spore suspensions from clubs left on the soil surface, 2) inoculation using spores buried at 10 cm, 3) inoculation using spores maintained in the freezer (-20°C), and 4) a non-inoculated control. Forty plants per experimental unit were inoculated with 5 mL of spore suspension (5×10^5 spores/mL) one week after emergence. Plants were watered with water adjusted to pH 6.0 using commercial vinegar and fertilized once a week with a 0.1% solution of nitrogen, phosphate, potassium (20-20-20, Plant Products Classic, Brampton, ON) + magnesium sulfate. At six weeks post inoculation 40 plants per experimental unit were assessed for clubroot severity and placed into classes using a 0–3 scale where: 0 = no clubbing, 1 = clubs on 1/3 of the root, 2 = clubs on 1/3 to 2/3 of the root, and 3 = clubs on more than 2/3 of the root. A disease severity index (DSI%) was calculated with the following equation:

$$DSI = \frac{\sum[(class\ no.)(no.\ plants\ in\ each\ class)]}{(total\ no.\ plants\ per\ sample)(no.\ class - 1)}\ x\ 100$$

Dry shoot weight was obtained by drying fresh shoot biomass at 60°C for 4 days.

Temperature during the 2023–2024 winter season fluctuated, with temperatures below the soil surface staying just above 0°C from January to March, while air temperature ranged from -10°–20°C. Tests on frozen clubs determined that it took ~5 hr for the root tissue to thaw at temperatures close to 0°C. The hourly temperature data were assessed manually to remove any fluctuations where the temperature held for less than 5 hr before switching to below or above 0°C. The count of temperature fluctuations capable of freezing / thawing clubs was divided in half to quantify the number of full freeze-thaw cycles that occurred through the season.

Data were analyzed using a mixed model ANOVA in PROC GLIMMIX in SAS (SAS Institute, Cary, IN) and means were separated using Tukey's test at $P = 0.05$. The fixed effect was treatment and the random effect was block.

RESULTS: as presented below in **Figures 1–3.**

CONCLUSIONS: As expected, temperatures fluctuated more at the soil surface than at the 10 cm depth (Fig. 1). It was estimated that clubs at the soil surface underwent 44 freeze-thaw cycles, while the buried clubs were not subjected to any freeze-thaw cycles. Spore viability decreased from 89% to 54% in clubs left on the surface, based on estimates from Evans Blue staining (Fig. 2). In the bioassay, the spores from buried and freezer-treated clubs caused similar levels of disease, 91 vs. 90 DSI, but declined to 72 DSI from surface clubs (Fig. 2). Plants inoculated with resting spores from the soil surface had higher shoot weight, while the buried and freezer treatment had lower shoot weight (Fig. 3). There is a negative correlation between DSI and shoot weight ($R^2 = -0.79$, $P < 0.0001$). Overall, freeze-thaw cycles overwinter reduced inoculum viability, but not enough to represent an effective management strategy.

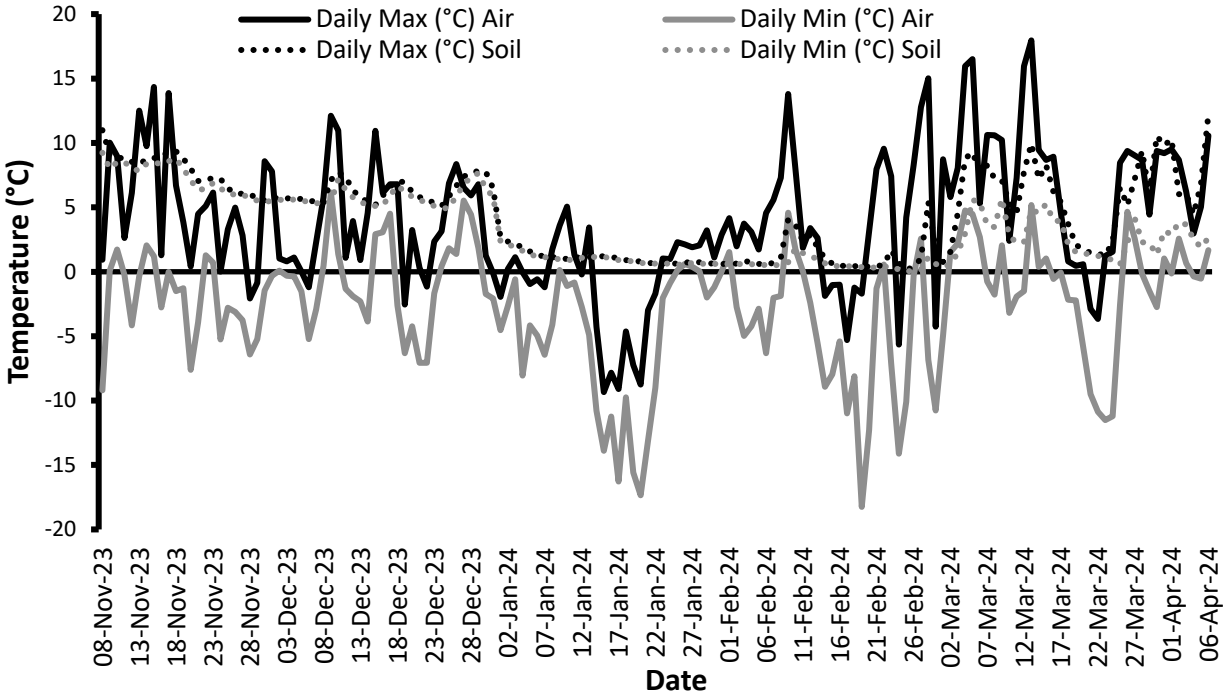

Figure 1. Maximum and minimum daily temperature (°C) at the soil surface and 10 cm below the soil surface from 08 November, 2023 to 06 April, 2024, at the Ontario Crops Research Centre – Bradford, ON.

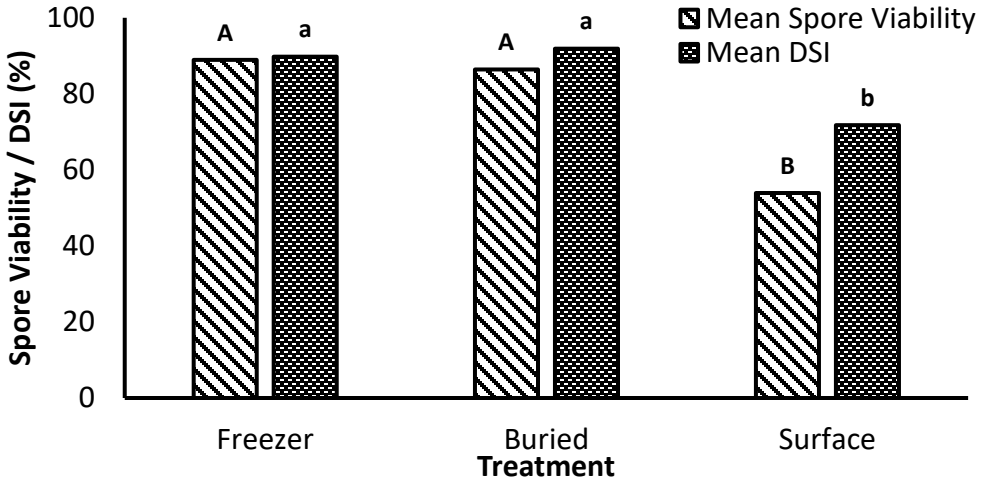

Figure 2. Disease severity index (DSI%) on canola and spore viability (%) from Evans Blue staining of clubs left on the soil surface, buried 10 cm below the soil surface, and in the freezer (-20°C) for 16 weeks at the Ontario Crops Research Centre – Bradford, ON in the winter of 2023–2024. Bars with the same letter and capitalization do not differ based on Tukey's test at $P = 0.05$.

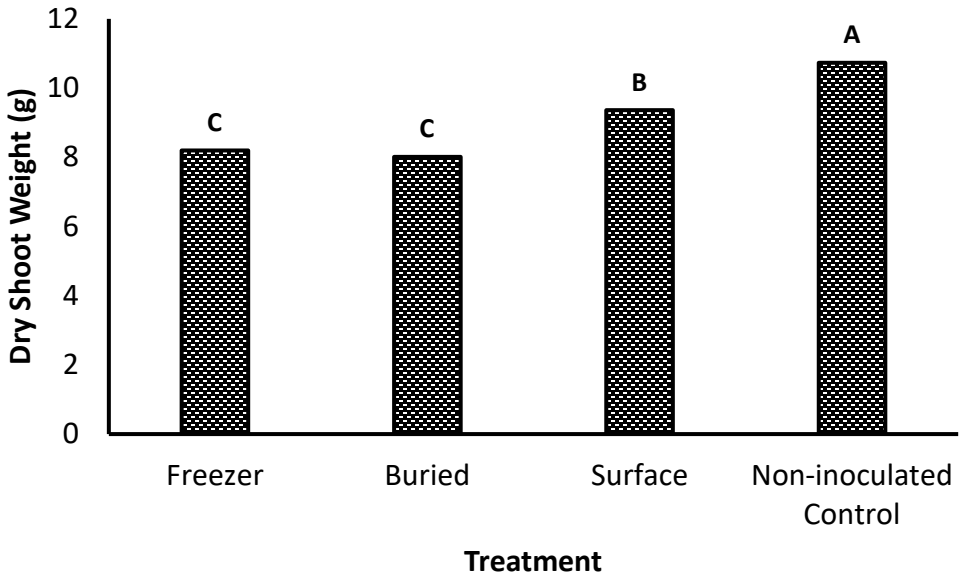

Figure 3. Mean dry shoot weight of canola inoculated with clubs left on the soil surface, buried 10 cm below the soil surface, and in the freezer (-20°C) for 16 weeks at the Ontario Crops Research Centre – Bradford, ON in the winter of 2023–2024. Bars with the same letter do not differ based on Tukey's test at $P = 0.05$.

Funding for this project was provided by the Ontario Agri-Food Innovation Alliance, the Ontario Canola Growers Association, and the National Science and Engineering Research Council and the Ontario Graduate Scholarship, Agriculture Development Fund of the Province of Saskatchewan, and the Canadian Agri-Food Partnership through AAFC and the Canola Council of Canada.

HOST: Canola (*Brassica napus* L.) ACS N39
PEST: Clubroot (*Plasmodiophora brassicae* Woronin)

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TITLE: EFFECT OF WETTING AGENTS ON DEVELOPMENT OF CLUBROOT ON SOILLESS MIXES, 2024

OBJECTIVES: To investigate the effect of selected wetting agents on clubroot development in three common soilless mixes and determine if the low levels of clubroot in some soilless mixes are associated with specific wetting agents.

MATERIALS: Soilless mixes: LA4 (Sunshine mix #4, SunGro Horticulture, USA), BM6 HP (Berger, Quebec), and Pro-Mix BX with Mycorrhizae (Premier horticulture Ltd, Quebec)

Wetting agents: AGRAL 90 (nonylphenoxy polyethoxy ethanol 92%, Plant Products, ON), TRANSFORMER (alcohol ethoxylate 19.4% + orange oil 10.0%, Revonsa Next, USA), THERMX-70 YUCCA EXTRACT (saponin extracted from *Yucca schidigera* 20%, Indoor Farmer, ON), PENTERRA (propylene glycol 5–7 %, Geoponics, USA), DURATION (polyalkylene glycol, Geoponics, USA).

METHODS: A growth room study was conducted to investigate the effect of five commercial wetting agents on clubroot symptom development in three soilless mixes. The study was in a growth room set to 24°/21°C day / night cycle, a 17-hr photoperiod and 50% relative humidity. The experiment design was a randomized complete block with four replicates and 10 plants per experimental unit. The study was conducted as a factorial with two factors: wetting agents and soilless mixes. The wetting agents treatments were: AGRAL 90, TRANSFORMER, THERMX-70 YUCCA EXTRACT, PENTERRA, DURATION and soilless mixes were LA4, BM6 HP, Pro-Mix BX with Mycorrhizae.

Soil wetting agents were applied at the recommended label rates per 4.5 L (US gallon) of water: 6 mL of TRANSFORMER or THERMX-70 YUCCA EXTRACT, 5 mL of PENTERRA or DURATION and 1 mL of AGRAL 90. The soilless mixes were saturated with wetting agent working solutions, then placed into tall narrow plastic pots (conetainers, Stuewe and Sons, Oregon) with light compaction to produce conditions conducive for clubroot infection. One day after filling, the pots were seeded with two seeds per pot of canola line ACS N39 (AAFC Saskatoon, clubroot susceptible) and thinned to one seedling per pot prior to inoculation. Plants were watered daily with water adjusted to pH 6.4. using commercial white vinegar and fertilized with N-P-K and $MgSO_4$ once a week. Each seedling was inoculated with 5 mL of 1×10^6 resting spores/mL of *P. brassicae* pathotype 2 at 7 and 12 days after seeding.

At 6 weeks after first inoculation, plants were uprooted and roots rated visually for clubbing severity and separated into classes using a 0–3 rating scale, where 0 = no clubbing, 1 < 1/3 clubbing of roots, 2 = 1/3 to 2/3 of root area with clubs, and 3 > 2/3 of root clubbed. A disease severity index (DSI) was calculated as follows:

$$\text{DSI} = \frac{\Sigma[(class\ no.)(no.\ plants\ in\ each\ class)]}{(total\ no.\ plants\ per\ sample)(no.\ class - 1)} \times 100$$

Data were analyzed using ANOVA in PROC GLIMMIX and means were separated using Tukey's test at $P = 0.05$ in SAS 9.4 (SAS Institute, Cary, IN). Wetting agents and soilless mixes were the fixed effects and replication was a random effect.

RESULTS: As presented in Fig. 1. Both soilless mix and wetting agent had a significant effect on clubroot. There was also a small soilless mix by wetting agent interaction. Incidence and severity showed the same pattern of response, so only severity is presented. LA4 soilless mix had higher clubroot severity than the other mixes for each wetting agent. Pro Mix with Mycorrhizae soilless mix and and Agral 90 wetting agent had the lowest clubroot incidence and severity of the LA4 treatments. Pro-Mix had low clubroot severity over all wetting agents but this was only significantly different from BM6 for YUCCA EXTRACT. All other treatments were intermediate.

CONCLUSIONS:

This study confirmed that LA4 was conducive to the development of clubroot and the other soilless mixes were not. Some wetting agents, such as AGRAL 90, had an additional negative effect on clubroot infection and development.

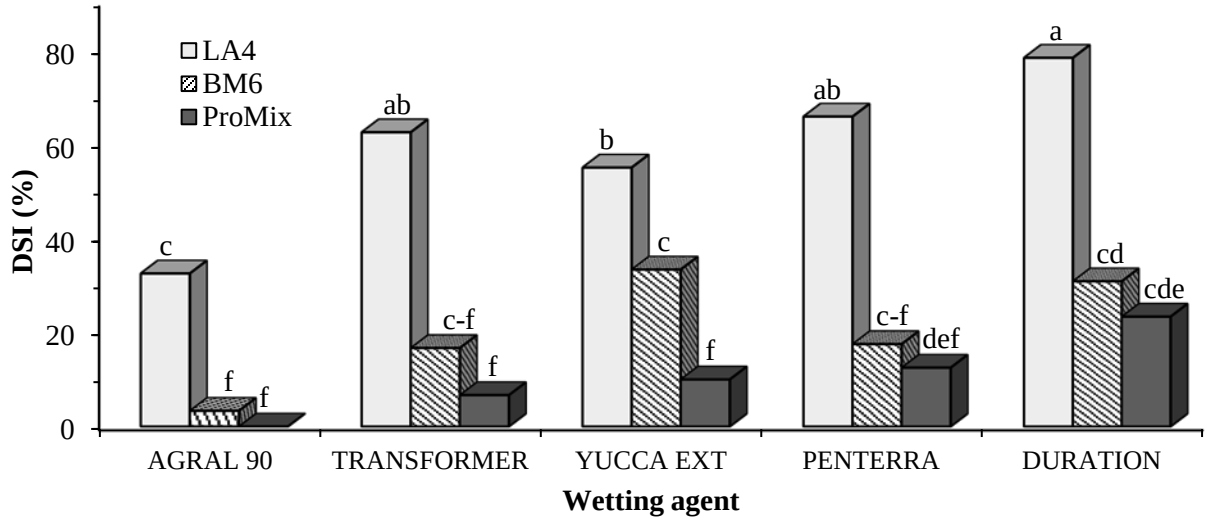

Figure 1. Interaction of soilless mix and soil wetting agent on clubroot severity (disease severity index, DSI) of canola ACS N39 inoculated with *Plasmodiophora brassicae*. Columns with the same letter do not differ at $P < 0.05$ based on Tukey's test.

Funding was provided by the Ontario Agri-Food Innovation Alliance, the Fresh Vegetable Growers of Ontario, the Ontario Canola Growers Association and the National Science and Engineering Research Council.

CROPS: Canola (*Brassica napus* L.) cv. L233P
Fall rye (*Secale cereale* L.)
Daikon radish (*Raphanus sativus* var. *longipinnatus*) cv. Eco Till
PEST: Clubroot (*Plasmodiophora brassicae* Woronin)

AUTHORS: RUIGROK K[1], GOSSEN BD[2] & MCDONALD MR[1]
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TITLE: EVALUATION OF CLUBROOT SUPRESSION IN CANOLA AFTER COVER CROP SPECIES

METHODS: A trial was conducted at the Ontario Crops Research Centre – Bradford, Ontario on a muck soil (pH 6.3, organic matter 70%) naturally infested with *Plasmodiophora brassicae* pathotype 2. The trial was arranged in a randomized complete block with 6 replicates. Each plot was 1.5m x 5 m, with six evenly spaced rows of cover crop treatment per plot. A bare soil treatment was included as a control. On 06 June, cover crop treatments of fall rye or daikon radish were seeded using an Earthway seeder fitted with a 1002-22 disc. The cover crops grew for 9 weeks and were hand weeded at regular intervals. On 07 August, ROUNDUP (glyphosate) was applied at 3 L ha^{-1} in 400 L ha^{-1} water to burndown the cover crops. The plots were mowed, and residue was manually removed from the field; no tillage was used.

The effect of treatments on populations of *P. brassicae* and subsequent effects on clubroot severity was assessed by seeding canola cv. L233P, susceptible to pathotype 2, across the entire trial on 13 August. The canola was seeded with an Earthway seeder fitted with a 1002-24 disc in 4 rows per plot. On 05 November, the trial was assessed by uprooting a sampling unit of 50 plants from the interior two rows of each plot. Clubroot incidence and severity were assessed by sorting the plants into classes using the standard 0-3 scale, 0 = no clubs, 0.2 = 1 very small club (≤2 cm), 1 = small clubs on less than 1/3 of roots, 2 = small or intermediate clubs on 1/3 to 2/3 of roots, and 3 = clubs on over 2/3 of roots as adopted from Crete et al. (1963). The proportion of roots in classes 1-3 were used to calculate clubroot incidence (CI). The disease severity index (DSI) was calculated for each plot using the following formula:

$$DSI = \frac{\Sigma\,[\,(\text{class no.})(\text{no. roots in each class})]}{(\text{total no. roots per sample})\,(\text{no. class} - 1)}\; x\; 100$$

Soil samples were taken at three time points over the trial: pre-plant, cover crop burndown, and at canola harvest. Samples were collected using a standard soil probe, taking six soils cores at a 22cm depth for every plot. Samples were stored at -20°C until ready for PMA-PCR. The fresh and dry weight of the above ground plant material in each experimental unit was assessed at final disease assessment for 10 plants per plot. Fresh tops were weighed and dried in an oven at 60°C for 4 days to determine top dry weight. Data were analyzed as a mixed model ANOVA with PROC GLIMMIX and means were separated using the Tukey's test at $P = 0.05$ in SAS 9.4 (SAS Institute, Cary, IN).

Compared to the previous 10-year average, air temperatures in 2024 were average for June (19.2°C), July (21.5°C), August (19.6°C), September (17.6°C) and October (10.6°C). The 10-year average temperatures were: June 18.6°C, July 21.1°C, August 20.4°C, September 16.8°C and October 10.1°C. Monthly rainfall was below the 10-year average for June (79 mm), August (54 mm), September (21 mm) and October (20 mm) and above average for July (85 mm). The 10-year rainfall averages were: June 95 mm, July 75 mm, August 74 mm, September 57 mm and October 62 mm.

RESULTS: As presented below in Table 1.

CONCLUSION: Cover crop treatments had no impact on any response variable. The DSI in this trial was very low, probably because the growing conditions were very dry and cool while the canola was growing. Rainfall was below average, and adequate soil moisture is important for infection of crops by *P. brassicae*. Also, resting spore germination has a threshold temperature of ~14°C (Gossen et al., 2017; Chupp, 1917) and symptom development has been shown to be optimal between 20–26°C (Sharma et al., 2011; Gossen et al., 2013). The trial experienced average temperatures below optimal in September, October, and November which likely relates to the low clubroot pressure in the trial.

PMA-PCR will be conducted to determine if there was an effect of the cover crops on the population of resting spores in the soil.

Table 1. Effect of cover crops on subsequent clubroot incidence and severity (Disease severity index, DSI) and top fresh and dry weight of canola on muck soil naturally infested with *Plasmodiophora brassicae* at the Ontario Crops Research Centre – Bradford, Ontario, 2024.

Cultivar	Incidence (%)	DSI (0-100)	Fresh wt. (g)[1]	Dry wt. (g)[1]
Control	5 ns[2]	3 ns	895 ns	175 ns
Fall rye	7	3	925	178
Daikon radish	6	2	939	183

[1] Mean top weight of 10 plants harvested at the time of disease assessment
[2] ns = no significant differences at $P = 0.05$

Funding for this project was provided by the Ontario Agri-Food Innovation Alliance and the Canola Council of Canada.

CROP: Canola (*Brassica napus*) cv. InVigor L233P
PEST: Clubroot *(Plasmodiophora brassicae* Woronin)

AUTHORS: HOLY KA[1], GOSSEN BD[2] & MCDONALD MR[1]
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TITLE: EFFECT OF SOIL PH, CALCIUM CONTENT, AND CALCIUM BASE SATURATION ON SEVERITY OF CLUBROOT IN CANOLA, 2024

MATERIALS: GPYSUM (calcium: 27%, sulfur: 22%, Secural), HYDRATED LIME (calcium hydroxide: 97.9%, magnesium oxide: 0.74%, silica: 0.71%, ferric oxide: 0.13%, alumina: 0.24%, Sylvite), POTASSIUM BICARBONATE (potassium bicarbonate 99%, Rich Grow), WOLLASTONITE (silicon: 27%, calcium: 14%, magnesium: 4%, nitrogen: 0.1%, potash: 0.1%, Canadian Wollastonite)

METHODS: A field trial was established on muck soil (pH ~ 6.4, organic matter ~ 70%), naturally infested with *Plasmodiophora brassicae* at the Ontario Crops Research Centre – Bradford, ON in 2024. The trial was organized as a randomized complete block design with four blocks. The fourth block on the far edge of the trial was removed from data analysis because clubroot development was inconsistent, which has also been necessary in several past studies. Each replicate plot was 1.75 m x 4 m. The treatments were: GYPSUM ($CaSO_4$: 1.2 t/ha) to add calcium without increasing the soil pH, POTASSIUM BICARBONATE ($KHCO_3$: 2.1 t/ha) to increase the pH without adding calcium, and a combination of GYPSUM and POTASSIUM BICARBONATE (GY: 1.2 t/ha + PB: 2.1 t/ha). WOLLASTONITE ($CaSiO_3$: 9.5 t/ha), and HYDRATED LIME ($CaOH_2$: 4.3 t/ha) were used to add both calcium and increase pH. A non-treated control was included.

Soil samples were taken to a depth of 10 cm from each block before treatments were applied to quantify the baseline soil pH (7.0), calcium concentration (5023 ppm), and calcium base saturation (CBS: 86%). Amendments application rates were calculated using the baseline soil characteristic values and formulas provided by Amanda Hermans (Crop Advisor, Holmes Agro). On 02 July treatments were applied in powder or granular form, and rototilled into the soil to a depth of ~15 cm. On 17 July, canola cv. InVigor L233P (BASF) was seeded in four rows per plot, approximately 40 cm apart, using an Earthway push-seeder with a 1002 – 10 seeding disk. On 7 August post treatment soil samples were taken to monitor changes in soil pH, calcium concentration, and CBS. Weeds were managed through hand weeding and one application of LIBERTY (BASF: glufosinate ammonium) herbicide.

On 27 August, 20 plants per plot were assessed for wilting using a 0 – 5 scale adopted from Dr. S. Cebula, where 0 = no signs of wilting, 1 = slight wilting in some leaves, 2 = wilting of half the plant (seen in mostly the leaves, but some stem wilting can be present), 3 = wilting of the whole plant (including stem and leaves), 4 = all leaves dead, but stem is alive, and 5 = plant is dead. After this, 50 plants per plot were assessed for clubroot severity and placed into classes using a standard 0 – 3 scale where class 0 = no clubbing, 1 = clubs on 1/3 of the root, 2 = clubs on 1/3 to 2/3 of the root, and 3 = clubs on more than 2/3 of the root (Crete et al. 1963).
A disease severity index (DSI%) value was calculated for each plot with the following equation:

$$DSI = \frac{\sum[(class\ no.)(no.\ plants\ in\ each\ class)]}{(total\ no.\ plants\ per\ sample)(no.\ class - 1)}\ x\ 100$$

Fresh and dry shoot weight was assessed from 10 plants per plot. The fresh shoots were weighed then dried at 60°C for 8 days to obtain dry shoot weight.

Conditions after seeding in the summer of 2024 were within the accepted range for clubroot development. Compared to the previous 10-year average, air temperatures in 2024 were near normal for July (21.5°C), and August (19.6°C). The 10-year average temperatures were: July 21.1°C, and August 20.4°C. Monthly rainfall was above the 10-year average in July (85 mm) and below average for August (54 mm). The 10-year rainfall averages were: July 75 mm, and August 74 mm.

Data were analyzed using a mixed model ANOVA in PROC GLIMMIX (SAS Institute, Cary, IN), and means were separated using Tukey's test at $P = 0.05$. The fixed effect was treatment, and the random effect was block. Dunnett's test was used to supplement Tukey's where there were significant effects of treatment that were not differentiated using Tukey's test.

RESULTS: as presented below in **Table 1.**

CONCLUSIONS: All treatments except GYPSUM resulted in a numerical increase in soil pH, the only significant differences in pH were between GYPSUM and POTASSIUM BICARBONATE. All treatments except GYPSUM and WOLLANSTONITE reduced clubroot severity and reduced plant wilting to low levels (Table 1). The combination treatment (GYPSUM plus POTASSIUM BICARBONATE), WOLLASTONITE, and HYDRATED LIME also resulted in an increase in fresh weight relative to the non-treated control, but dry weight was only higher in the combination treatment (GYPSUM plus POTASSIUM BICARBONATE) when compared to the GYPSUM treatment (Table 1). There was a negative correlation ($r = -0.84$, $P = < 0.0001$) between clubroot severity and soil pH, but no correlation between CBS or calcium concentration and clubroot severity.

The average CBS of the soil prior to application of treatments was 86% (Table 1), making it difficult to elevate further to test the effect of CBS on clubroot development. Some treatments had lower soil CBS (Table 1), which can be attributed to the addition of potassium (K^+) from POTASSIUM BICARBONATE that caused a decrease in the relative percentage of calcium (Ca^{2+}). The POTASSIUM BICARBONATE and HYDRATED LIME treatments elevated soil pH and reduced clubroot severity but had no effect on CBS. Only the HYDRATED LIME treatment increased soil calcium (Table 1). The results confirmed that soil pH over 7.2 was associated with reduced clubroot. There was no separate effect of calcium or high CBS on clubroot severity in highly organic soils.

Table 1. The effect of GYPSUM, WOLLASTONITE, HYDRATED LIME, and POTASSIUM BICARBONATE on soil pH, CBS (%), calcium concentration (ppm), wilting index (0 – 5), disease severity index (DSI%), and fresh and dry shoot weight for canola cv. InVigor L233P grown in muck soil naturally infested with *Plasmodiophora brassicae* at the Ontario Crops Research Centre – Bradford, ON.

Treatment	pH	CBS (%)	Ca (ppm)	Wilting index	DSI (%)	Fresh wt. (g)	Dry wt. (g)
Non-treated	7.0 ab	85 a	4870	0.7 a[1]	72 a	813 [2]	95 ab
GYPSUM	6.9 b	84 a	4737	0.4 ab	79 a	790	80 a
WOLLASTONITE	7.2 ab	86 a	5193	0.1 bc	53 ab	1431 *****	160 ab
HYDRATED LIME	7.2 ab	86 a	5847 *****	0.0 c	45 b	1347 *****	138 ab
GYPSUM + POTASSIUM BICARBONATE	7.5 ab	78 b	5057	0.1 bc	41 b	1356 *****	178 b
POTASSIUM BICARBONATE	7.6 a	78 b	5017	0.1 bc	38 b	1002	143 ab

[1]Means followed by the same letter in a column do not differ based on Tukey's test at $P = 0.05$.
[2]Means followed by ***** are significantly different than the non-treated control based on Dunnett's test at $P = 0.05$.

Funding for this project was provided by the Ontario Agri-Food Innovation Alliance, the Ontario Canola Growers Association, and the National Science and Engineering Research Council and the Ontario Graduate Scholarship, Agriculture Development Fund of the Province of Saskatchewan, and the Canadian Agri-Food Partnership through AAFC and the Canola Council of Canada.

Check out the Muck Crops Research Station's IPM X / Twitter Account

The Muck Crops Research Station launched a X / Twitter account in 2014. The account communicates brief updates of the Station's IPM program along with other information to our growers, industry reps and academic personnel. The tweets consist of important pest alerts, reminders of up and coming events and other information that we hope will be helpful to our followers. So take some time, follow us and stay informed.

@MuckIPM

CROP: Garden beet (*Beta Vulgaris*) cv. Zeppo

AUTHORS: MCDONALD MR, VANDER KOOI K & FARINTOSH G
U of Guelph, Dept. of Plant Agriculture, Ontario Crops Research Centre - Bradford

TITLE: PHYTOTOXICITY OF HERBICIDES ON GARDEN BEETS, 2024

MATERIALS: DUAL MAGNUM, METAMITRON, SPINAID

METHODS: Beets, cv. Zeppo, were direct seeded on 16 May into organic soil (pH ≈ 6.1, organic matter ≈ 69.8%) near the Ontario Crops Research Centre - Bradford, Ontario. Treatments were arranged in a complete block design with four replicates per treatment. Each experimental unit consisted of two five-meter-long rows spaced 86 cm apart. All applications were applied using a CO_2 backpack sprayer equipped with four TeeJet 8002 fan nozzles calibrated to deliver 500 L solution/ha at 275 kPa. Treatments are shown in Table 1. Plants in each experimental unit were visually rated on a scale from 0 to 100 for phytotoxicity on 5, 11, 20, and 26 June. On 5 June, each experimental unit was also assessed for weed control on a 0 to 5 scale.
Compared to the previous 10-year average, air temperatures in 2024 were above average for May (15.4°C) and average for June (19.2°C), July (21.5°C), August (19.6°C), September (17.6°C) and October (10.6°C). The 10-year average temperatures were: May 13.4°C, June 18.6°C, July 21.1°C, August 20.4°C and September 16.8°C. Monthly rainfall was below the 10-year average for June (79 mm), August (54 mm) and September (21 mm) and above average for May (83 mm) and July (85 mm). The 10-year rainfall averages were: May 58 mm, June 95 mm, July 75 mm, August 74 mm and September 57 mm.
Data were analyzed using the General Analysis of Variance function of Statistix V.10. Means separation was obtained by using Fisher's Protected LSD test at P = 0.05 level of significance.

RESULTS: as presented in Table 2.

CONCLUSIONS: Herbicides that were most effective at reducing weeds, such as DUAL MAGNUM, also tended to display the most phytotoxicity (Table 2). All treatments apart from the pre-emerge METAMITRON had significantly lower weed ratings than the untreated check. Further research should investigate the more concentrated form of METAMITRON and if adjusting application rates can improve weed control while minimizing crop injury.

Table 1. Treatment and application information

Treatment	Product	Rate (L/ha)	App. Stage	App. Dates
DUAL PRE	DUAL MAGNUM	1.25	Pre	17 May
META PRE	METAMITRON	2.0	Pre	17 May
DUAL META	DUAL MAGNUM METAMITRON METAMITRON	1.25 2.0 2.0	Pre Cotyledon 2-leaf	17 May 30 May 3 June
META 2	METAMITRON METAMITRON	2.0 2.0	Pre Cotyledon	17 May 30 May
META 3	METAMITRON METAMITRON METAMITRON	2.0 2.0 2.0	Pre Cotyledon 2-leaf	17 May 30 May 3 June
SPINAID	SPINAID SPINAID SPINAID	2.1 2.1 2.1	2-leaf 4-leaf 6-leaf	3 June 10 June 18 June
META SPINAID	METAMITRON SPINAID SPINAID	2.0 2.1 2.1	Pre 2-leaf 4-leaf	17 May 3 June 10 June
Check	-	-	-	-

Table 2. Phototoxicity ratings for garden beets, cv. Zeppo, treated with herbicides and near the Ontario Crops Research Centre - Bradford, Ontario, 2024.

Treatment	Phototoxicity Rating[1]				Weed Rating[2]
	5 June	11 June	20 June	26 June	5 June
DUAL PRE	22.5 c[3]	25.0 b	7.5 ns[4]	0.0 a	1.5 ab
META PRE	0.0 a	10.0 a	0.0	0.0 a	3.8 c
DUAL META	27.5 c	27.5 b	0.0	7.5 b	0.5 a
META 2	5.0 ab	10.0 a	0.0	7.5 b	1.2 ab
META 3	2.5 ab	10.0 a	0.0	2.5 ab	2.2 b
SPINAID	10.0 b	15.0 ab	0.0	0.0 a	1.8 b
META SPINAID	10.0 b	7.5 a	2.5	2.5 ab	1.8 b
Check	0.0 a	5.0 a	5.0	0.0 a	4.0 c

[1] Phytotoxicity rating 0-10, where 0 = no toxicity, 1 = 1-10% crop injury, 2 = 11-20% crop injury, 3 = 21-30% crop injury, 4 = 31-40% crop injury, 5 = 41-50% crop injury, 6 = 51-60% crop injury, 7 = 61-70% crop injury, 8 = 71-80% crop injury, 9 = 81-90% crop injury, 10 = 91-100% crop injury.

[2] Weediness rating 0-5, where 0 = no weeds, 1 = 1-10% ground cover with weeds, 2 = 11-25% ground cover with weeds, 3 = 26-45% ground cover with weeds, 4 = 46-65% ground cover with weeds, 5 = 66-100% ground cover with weeds.

[3] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD test.

[4] ns = no significant differences were found among treatments.

Funding provided by the Bradford Co-operative and Storage Ltd. and by the Ontario Agri-Food Innovation Alliance.

CROP: Garlic (*Allium sativum* L.), cv. Music
PEST: Stem and bulb nematode (*Ditylenchus dipsaci*) (Kühn, 1857) Filip'ev, 1936

AUTHORS: BLAUEL T, VANDER KOOI K and MCDONALD M R
U of Guelph, Dept. of Plant Agriculture, Ontario Crops Research Centre - Bradford

TITLE: EVALUATION OF NEMATICIDES FOR CONTROL OF STEM AND BULB NEMATODE IN GARLIC, 2023-2024

MATERIALS: EXPERIMENTAL Nematicide, VELUM PRIME (fluopyram 500 g/L)

METHODS: The field trial was conducted in a mineral soil field (organic matter 3.5%, pH 7.1) free of stem and bulb nematode (SBN) near Cookstown, Ontario. A randomized complete block design with four (4) replicates per treatment was used. Garlic cloves (seed) used were originally infested with 0.2 SBN/g of clove. Cloves were inoculated with a SBN suspension to try and produce a uniform level of SBN infestation. Nematode counts were determined at the University of Guelph Ontario Crops Research Centre - Bradford using the Baermann pan method. The treatments were: EXPERIMENTAL and VELUM PRIME applied as a soak (S) and/or drench (D). Seed soak treatments, and the associated soaking times, were: EXPERIMENTAL S at 2.2 mL/L for 1- and 4-hours and VELUM PRIME S at 1.7 mL/L for 1-hour. Soak treatments were applied by placing cloves in a mesh bag in 10 L of each treatment solution for each respective time period. Garlic were air dried following the soaking treatment. The drench treatments were EXPERIMENTAL D low rate at 500 mL/ha, EXPERIMENTAL D high rate at 667 mL/ha, VELUM PRIME D at 500 mL/ha using a water volume rate of 1000 L/ha. Drench treatments were applied directly over the cloves at planting at a rate of 90 mL/m using a beaker. An untreated check was also included. Each experimental unit consisted of 20 garlic cloves planted ~5 cm deep and 10 cm apart in 2 m long single rows spaced 40 cm apart. The trial was planted on 9 November 2023. Plant emergence and heights were recorded on 4 June 2024. Garlic was harvested on 30 July. Bulbs were counted, weighed, assessed for basal plate rot and sorted into classes using a 0-4 rating scale, where: 0 = no damage, 1 = 1-24% basal plate missing; 2 = 25-50% basal plate missing; 3 = > 50% basal plate missing and 4 = completely desiccated bulb. These data were used to calculate a disease severity index (DSI) using the formula below.

$$\text{DSI} = \frac{\sum [(\text{class no.})\ (\text{no. of garlic bulbs in each class})]}{(\text{Total no. of garlic bulbs assessed})\ (\text{no. classes } -1)} \times 100$$

Stem and bulb nematodes were extracted and quantified from a random five clove per treatment sample after harvest using the Baermann pan method.
Data were analyzed using the General Analysis of Variance function of the Linear Analysis section of Statistix V.10. Means separation was obtained using Tukey's HSD test with $P = 0.05$ level of significance.

RESULTS: Data are presented in Tables 1 and 2

CONCLUSIONS: No significant differences were found among the treatments for any assessment (Table 1 & 2). This is likely due to having too low of a SBN infestation in the cloves at planting, which means the inoculation method was not effective. Finding SBN infected cloves is proving to be harder each year as Velum Prime has done a great job of cleaning up SBN from seed cloves over the past couple years.

Table 1. Garlic counts and plant heights after nematicide application for stem and bulb nematode infested seed cloves near Cookstown, Ontario, 2023-24.

Treatment	App Method[1]	Soak Time (hours)	Emergence	Plant Height (cm)
EXPERIMENTAL HIGH	D	-	18.5 ns[2]	87.4 ns
EXPERIMENTAL	S	4	18.5	82.5
EXPERIMENTAL LOW	D	-	18.3	78.1
EXPERIMENTAL	S	1	18.0	83.3
Untreated	-	-	18.0	84.3
VELUM	D	-	17.5	86.0
VELUM	S	1	16.5	87.8

[1] Application Method: S = Soak; D = Drench.
[2] ns indicates that no significant differences were found among the treatments at P = 0.05.

Table 2. Percent marketable bulbs, nematode disease severity index (DSI), marketable yield and nematode counts from harvested garlic treated with various nematicides to control stem and bulb nematode (SBN) near Cookstown, Ontario, 2023-24.

Treatment	App. Method[1]	Soak Time (hours)	% Marketable Bulbs	DSI[2]	Marketable Yield (g/plot)	Harvest SBN Count (SBN/g clove)
EXPERIMENTAL HIGH	D	-	97.5 ns[3]	11.7 ns	2568.5 ns	0.04 ns
EXPERIMENTAL	S	4	94.0	11.5	2431.3	0.00
EXPERIMENTAL	S	1	91.8	14.1	2337.1	0.00
Untreated	-	-	91.2	17.1	2138.7	0.00
EXPERIMENTAL LOW	D	-	90.9	15.0	1972.0	0.00
VELUM	D	-	88.4	17.4	2338.3	0.01
VELUM	S	1	86.2	15.1	2396.1	0.02

[1] Application Method: S = Soak; D = Drench
[2] DSI was calculated using the following equation:

$$DSI = \frac{\sum [(\text{class no.})\ (\text{no. of garlic bulbs in each class})]}{(\text{total no. of garlic bulbs assessed})\ (\text{no. classes} - 1)} \times 100$$

[3] ns indicates that no significant differences were found among the treatments P = 0.05.

Funding for this project was provided by the California Garlic and Onion Research Advisory Board and the Fresh Vegetable Growers of Ontario representing the Ontario Garlic Growers Association.

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TITLE: COMPARSION OF SOIL TEST RESULTS FROM VARIOUS ACCREDITED SOIL TESTING LABORATORIES, 2024

OBJECTIVE: The objective of this study was to compare soil test phosphorus analysis results from multiple accredited laboratories using high-organic (muck) soil samples

METHODS: Soil sampling was conducted during the fall of 2024 on various grower fields throughout the Holland Marsh. The accredited method for determining soil test phosphorus in Ontario is the Olsen method. Approximately 2 kg of soil were collected from each field using soil probes. To guarantee that the samples were representative, fields—ranging in size from 10 to 15 acres—were sampled following an X-pattern across each field, sampling depth was0-15 cm. This design helped to ensure that the composite sample reflected field conditions. After collection, the soil samples were thoroughly mixed by hand to create a homogeneous composite sample. The composite sample was then subdivided into distinct sub-samples, each of which was sent to a different laboratory for analysis. The analyses were performed at three accredited facilities: SGS Labs (Guelph, ON), A&L Canada Laboratories Inc. (London, ON), and Brookside Laboratories Inc. (New Bremen, OH, USA). For statistical evaluation, data were analyzed using the General Analysis of Variance (ANOVA) function within the Linear Models section of Statistix V.10. To determine significant differences between treatment means, Fisher's Protected Least Significant Difference (LSD) test was applied at a $P = 0.05$ level of significance.

RESULTS: as presented in Tables 1 and 2.

CONCLUSIONS: The comparison between laboratories reveals significant differences in soil test phosphorus values. SGS Labs) reported the highest phosphorus levels (98.9 mg/kg), while both Brookside Laboratories and A&L Labs reported lower values (64.9 and 55.0 mg/kg, respectively). The differences suggest that both the extraction method and laboratory protocols can have a considerable impact on the reported nutrient values, highlighting the need for standardization or calibration among labs.
For potassium, Brookside reported significantly higher values than the other labs. Organic matter, Base Ca, and CEC also varied among the labs, with the highest organic matter content reported by SGS and the highest CEC values reported by Brookside. These differences underline the potential influence of extraction methods and laboratory-specific procedures on soil test outcomes.
The discrepancies between laboratories, especially in phosphorus measurements, underscore the importance of using a consistent analytical method when monitoring soil fertility. Growers and agronomists should be aware of these variations when interpreting soil test results, as they could affect nutrient management decisions.
Phosphorus levels ranged widely from 37 to 107 mg/kg, indicating substantial variability in soil fertility among the fields. Seventy-five percent of the tested fields exhibited crop responses indicating that additional phosphorus application would provide minimal crop benefit. Parameters, such as potassium, pH, Base Ca, Base K, and CEC, also had variability among fields, these differences reflect the soil management practices of various growers and soil properties across the fields.

Table 1. Comparison of various labs on soil parameters results from 15 grower field in the Holland Marsh, Ontario, 2024

Lab Name	Phosphorus Extraction Method	Phosphorus (ppm)	Potassium[1] (ppm)	pH	Organic Matter %[2]	% BaseCa[3]	CEC.[3]
SGS	Olsen	98.9 a[4]	258.6 b	6.34 ns[5]	67.6 a	76.4 a	37.7 b
Brookside	Olsen	64.9 b	303.6 a	6.24	63.9 b	74.4 a	49.7 a
A&L Labs		55.0 b	215.9 c	6.34	54.2 c	69.4 b	26.4 c

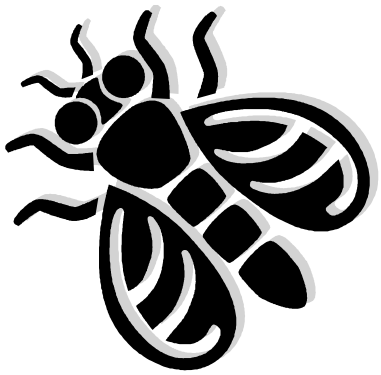
[1] Soil cation extraction using ammonium acetate
[2] % Organic matter determined using loss on ignition
[3] Base Ca = (ppm Ca ÷200 ÷CEC value) x 100
[4] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD test.
[5] ns = no significant differences were found among treatments at P = 0.05, Fisher's Protected LSD test.

Table 2. Combined soil tests results from 15 grower field in the Holland Marsh, Ontario, 2024 indicating expected crop response to P application according to OMAFA recommendations for carrots and onions.

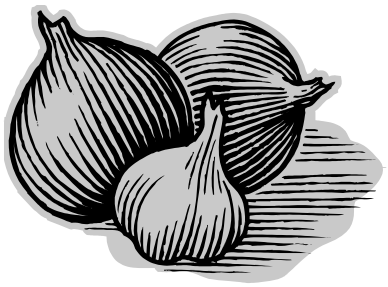
Grower	Phosphorus (ppm)	Crop response[1]	Potassium (K)[2] (ppm)	pH	% BaseCa[3]	BaseK[4]	CEC[1]
6	37 a[5]	LR	272.0 cd	6.0 h	70.7 de	1.81 de	39.8 bcd
10	41 ab	LR	150.0 a	6.4 ef	79.0 abc	1.33 gh	34.0 e
9	53 abc	LR	282.0 cd	6.5 de	76.7 bc	2.25 c	32.8 e
1	56 a-d	LR	223.3 abc	6.0 h	68.0 e	1.54 fg	38.2 cde
3	63 a-e	RR	147.5 a	6.6 cde	80.5 ab	1.48 g	31.0 e
13	65 b-e	RR	159.0 a	6.4 ef	78.0 abc	1.19 h	35.1 de
14	76 c-f	RR	322.3 de	6.7 bc	78.2 abc	2.25 c	37.2 cde
15	77 c-f	RR	253.3 cd	6.2 fg	76.1 bcd	1.84 d	36.1 de
5	78 c-g	RR	225.0 abc	5.5 i	52.4 f	1.78 def	36.7 cde
8	79 d-g	RR	204.3 abc	7.1 a	83.3 a	1.20 h	44.9 ab
11	82 d-g	NR	241.0 bc	6.9 ab	79.8 abc	1.58 efg	44.1 abc
12	83 efg	NR	366.3 e	6.0 gh	68.0 e	2.72 b	34.5 de
2	94 fg	NR	484.3 f	6.2 f	74.2 cd	3.57 a	35.6 de
4	102 fg	NR	165.0 ab	5.3 i	51.4 f	1.13 h	40.8 a-d
7	107 g	NR	395.5 e	6.7 bcd	82.2 ab	2.38 c	47.9 a

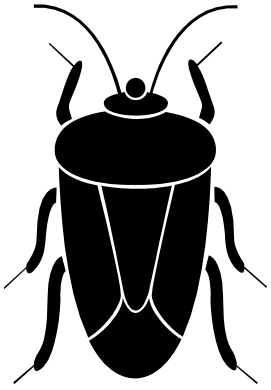
[1]Crops Response = MR = Medium response, LR = Low response, RR rare response, NR = no response - Publication 839 Guide to Vegetable Production in Ontario, Table 7-30. Carrot phosphorus requirements and 7-78 Onion phosphorus requirements
[2] Soil cation extraction using ammonium acetate
[3] Base Ca = (ppm Ca ÷200 ÷CEC value) x 100
[4] Base K = (ppm K ÷390 ÷CEC value) x 100
[5] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD test.

Funding was provided by the Ontario Ministry of Agriculture, Food and Agri-business, Lake Simcoe Project and Almack Agronomic Services.



Integrated Pest Management Report - 2024





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TITLE: THE INTEGRATED PEST MANAGEMENT PROGRAM SUMMARY FOR MUCK VEGETABLE CROPS, 2024

An Integrated Pest Management (IPM) program is provided to growers in the Holland/Bradford Marsh, Ontario, by the University of Guelph Ontario Crops Research Centre - Bradford. This project was funded in part through the Ontario Agri-Food Innovation Alliance. Funding was also provided in part by the Bradford Cooperative Storage Ltd., agrochemical companies and growers participating in the Research Centre's IPM Program. The main objectives of the project are: to scout growers' fields for diseases, weeds, and insect pests, to provide growers with disease and insect forecasting information, to identify and diagnose diseases, insect pests and weeds, and to implement roto-rod spore traps to trap and analyze spores of various vegetable crop pathogens.

SCOUTING

In 2024, 47 commercial vegetable fields, totalling 559 acres (onion 258 ac, carrot 224 ac, celery 67 ac and potato 10 ac), were intensively scouted for 18 growers. Fields were scouted twice per week during the growing season and growers received scouting reports after each field survey.

DIAGNOSTICS, EXTENSION & DISSEMINATION OF INFORMATION

Any grower, whether participating in the IPM program or not, may bring in samples (plant, insect, or weed) for diagnosis. The on-site tools available for diagnosis are visual inspection and laboratory inspection using a microscope and culturing. Diagnoses are made by comparison to known symptoms, published descriptions of pathogens, insect pests and weeds, and personal experience. Following assessment, the extension advice given was based on Ontario Ministry of Agriculture, Food and Agribusiness (OMAFA) recommendations for pesticides.

From 21 May to 25 October, 2024, the diagnostic laboratory of the OCRC-B received 129 samples for diagnosis. Of these, 63% were diagnosed with infectious diseases (82 samples), 8% with insect issues (10 samples) and 29% were diagnosed with an abiotic disorder (37 samples). These samples were associated with the following crops: onion (43%), carrot (43%), celery (7%) and other crops (7%). For extension services, data collected from growers' fields and research station plots were compiled twice per week, analyzed and summarized. The results were compiled in an 'IPM Report' and updated twice per week and circulated to participating growers, academia, industry, OMAFRA staff, posted on the OCRC-B website (https://bradford-crops.uoguelph.ca), and a copy was displayed at the Bradford Co-op.

PEST PREDICTIVE MODELS

The IPM program provides disease and insect forecasting based on spore traps, disease forecasting models: BOTCAST (for botrytis leaf blight of onion), DOWNCAST (for onion downy mildew), BREMCAST (for lettuce downy mildew), BSPCAST (for Stemphylium leaf blight of onion), an onion white rot model and a Sclerotinia white mold of carrot model, insect degree day models, and insect traps. These disease and insect forecasts alert growers by predicting the potential for disease and insect pest incidence.

CROP PEST SUMMARIES

At the end of the scouting program, samples were taken from each field for assessment. One hundred onions were examined after lodging and 100 carrot samples were collected. The samples were assessed for damage from insects, diseases and physiological disorders. The onion samples were examined by hand pulling 10 onions from 10 random locations throughout each field. The carrot samples were collected by hand pulling 20 carrots near each of the four corners and middle (5 locations total) of each field.

CARROT

Insects

In 2024, carrot fields were scouted for carrot weevil (*Listronotus oregonensis*), carrot rust fly (*Psila rosae*), aster leafhopper (*Macrosteles quadrilineatus*) and other insect pests. Degree day models were used to predict the occurrence of the various life stages of these insects. Carrot rust fly damage was high in a few fields in the central region (Table 1). There was no carrot weevil damage reported this year in the scouted carrot fields. Aster leafhoppers were found throughout the season, but aster yellows severity was lower than expected.

Table 1. Average percent carrot weevil and carrot rust fly damage on carrots at harvest in scouted fields in the Holland Marsh, 2024.

Location within Holland Marsh	% Damaged Carrots	
	Weevil damage	Rust fly damage
West	0.0	0.0
South	0.0	0.0
Central	0.0	9.1
North	0.0	0.5
East	0.0	1.0
Average	0.0	2.1

Carrot weevil adults were first found in wooden Boivin traps on 13 May in carrot fields (Fig. 1). Carrot weevils were found in 74% of scouted carrot fields. Overall, 16% of fields in the IPM program reached the 1.5 weevil/trap threshold, and 11% of fields reached the 5 weevil/trap threshold.

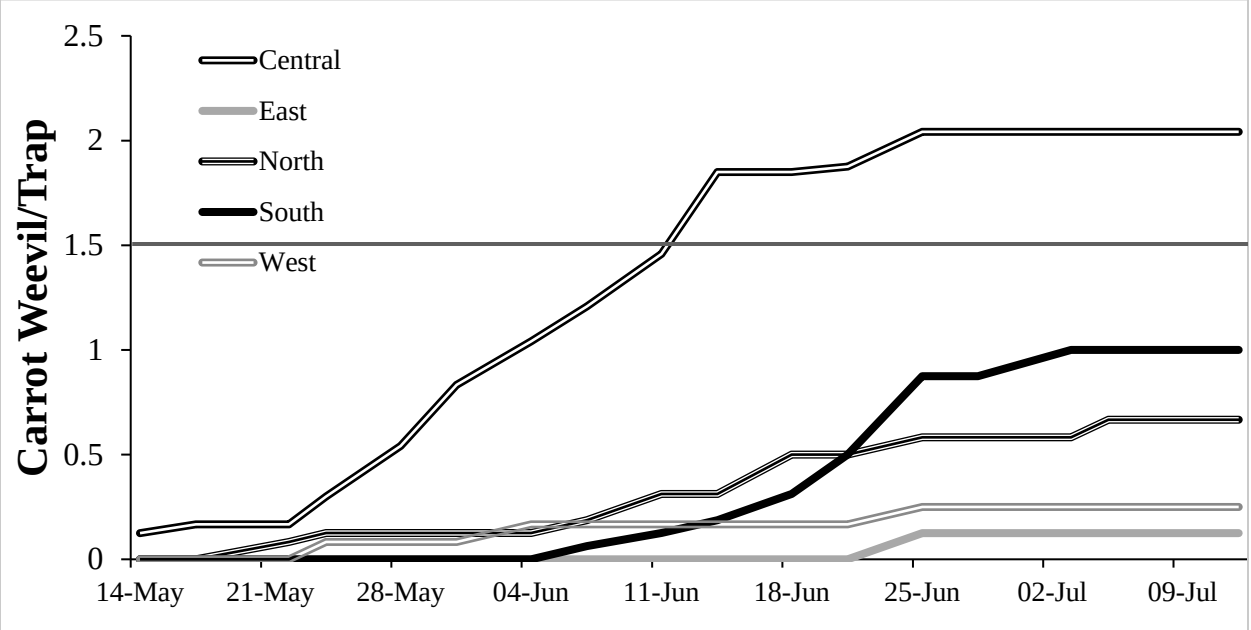


Figure 1. Average cumulative number of carrot weevils/trap in different regions of the Holland Marsh, 2024.

There was no carrot weevil damage observed this year in our harvest samples from scouted carrot fields. This is the first time no damage has been reported since monitoring for carrot weevils started. The increased uptake of growers now using Rimon and Exirel, which are very effective at controlling carrot weevil, has contributed to the steady decline, and now elimination, of carrot weevil damage.

Orange sticky traps and degree day models were used to monitor and estimate carrot rust fly (Fig. 2). Carrot rust flies were first found on sticky traps on 24 May, 7 days after the degree day model predicted first generation emergence (17 May). The first generation was very active throughout the marsh from mid-May to mid-June. Second generation activity peaked on 23 July and activity remained fairly high in some fields into mid-August during which 21% of scouted fields exceeded the 0.1 flies/trap/day threshold.

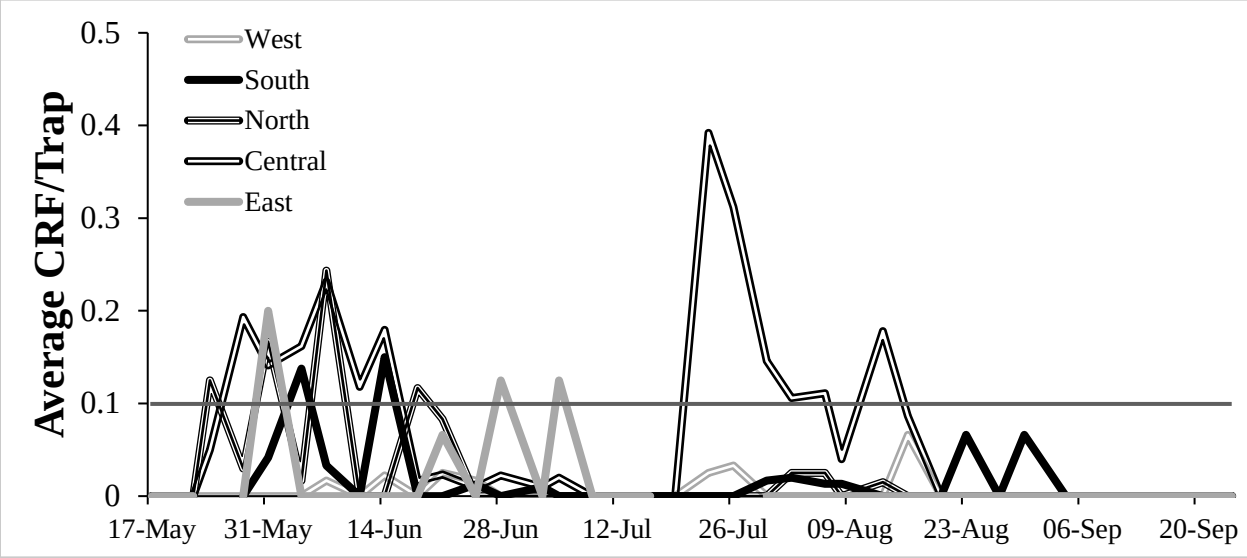


Figure 2. Average carrot rust flies (CRF)/trap/day in different regions of the Holland Marsh, 2024.

Aster leafhoppers are pests of carrots, celery, lettuce and leafy greens. Aster leafhoppers were first found on orange sticky traps on 23 May in carrots and celery (Fig. 3). Sticky traps and sweepnetting (100 sweeps per field) were used to estimate populations occurring within fields. Counts peaked around mid to end of June during which 37% of fields were above the 20 ALH/trap threshold at some point. Although most fields surpassed the threshold at some point during the season, harvested carrots with aster yellows was lower than expected.

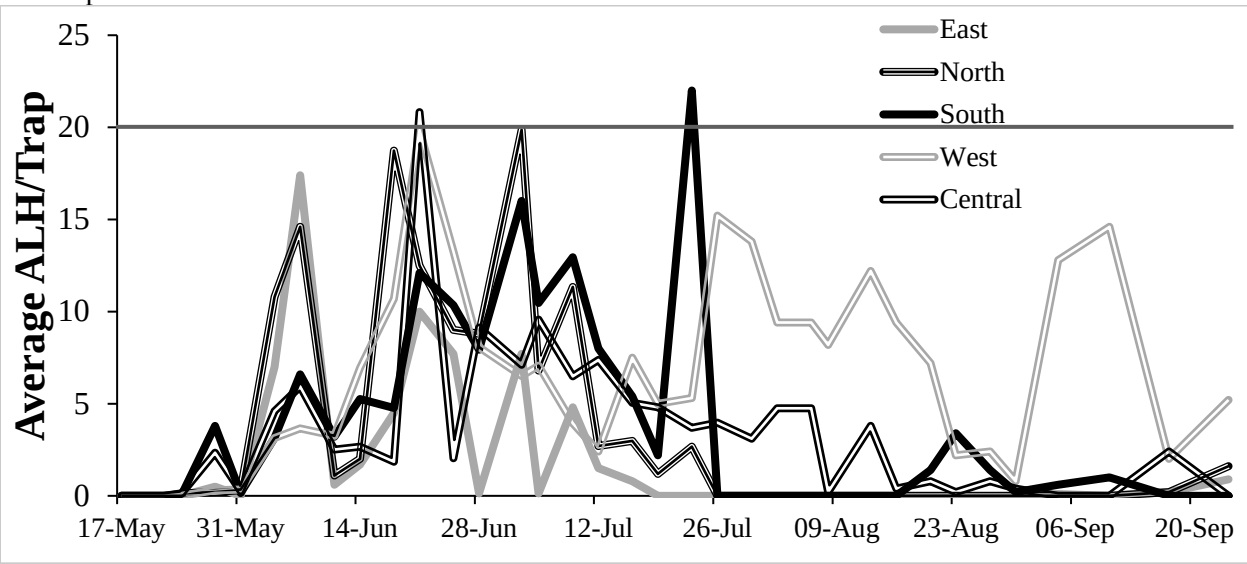


Figure 3. Average aster leafhoppers/trap in different regions of the Holland Marsh, 2024.

Diseases

Carrot fields were scouted for diseases throughout the growing season. Leaf blights, which are caused by the fungi *Alternaria dauci* and *Cercospora carotae*, were first seen on 8 July. Throughout the season, 21% of scouted carrot fields reached the leaf blight threshold of 25% of plants infected. Carrot leaf blight severity was generally low with the warm and dry conditions throughout the Fall.

Samples of 100 carrots were taken from each scouted field and roots were assessed for diseases (Table 2). All fields developed multiple diseases at varying levels of severity. Crater rot (*Rhizoctonia* spp.) was found in every carrot field and severity may have been amplified during storage. Cavity spot (*Pythium* spp.) was also found in every field; however, incidence and severity was lower than previous years, likely due to the dry fall. Forking, stubby, lesion nematode damage, Fusarium dry rot, aster yellows and crown gall were also present on harvested carrots.

Table 2. Disease incidence on carrot samples collected from commercial fields in the Holland Marsh, Ontario in 2024.

DISEASE	CAUSAL AGENT	FIELDS INFECTED (%)	INCIDENCE (%)
Crater Rot	*Rhizoctonia* spp.	100	10-44
Cavity Spot	*Pythium* spp.	100	2-23
Forking/Stubby	Nematodes and/or *Pythium* spp.	100	1-24
Fusarium Dry Rot	*Fusarium* spp.	80	0-9
Crown Gall	*Agrobacterium tumefaciens*	45	0-46
Aster Yellows	*Candidatus* Phytoplasma asteris	45	0-8

ONION

Insects

Onion fields were scouted for onion maggot (*Delia antiqua*) (Fig. 4), onion thrips (*Thrips tabaci*) (Fig. 5), cutworms and other insect pests.

The degree day model predicted first generation onion fly emergence on 10 May and first onion flies were found on yellow sticky traps that same day. Counts remained low overall, but some transplant onion fields experienced higher activity and damage from onion maggot feeding (Fig. 4).

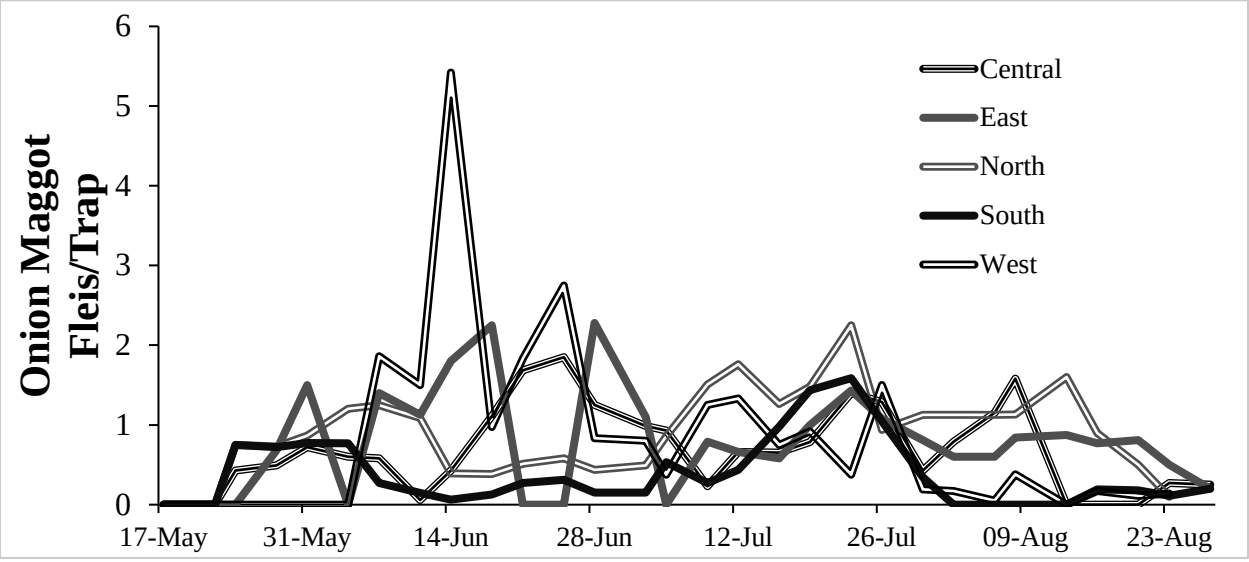


Figure 4. Average onion flies/trap/day in different regions of the Holland Marsh, 2024.

Thrips were first identified on 30 May and populations fluctuated throughout the season, but never surpasses the 3 thrips/leaf spray threshold. Thrips counts were highest from mid-July to mid-August. No onion fields surpassed the 3 thrips/leaf threshold.

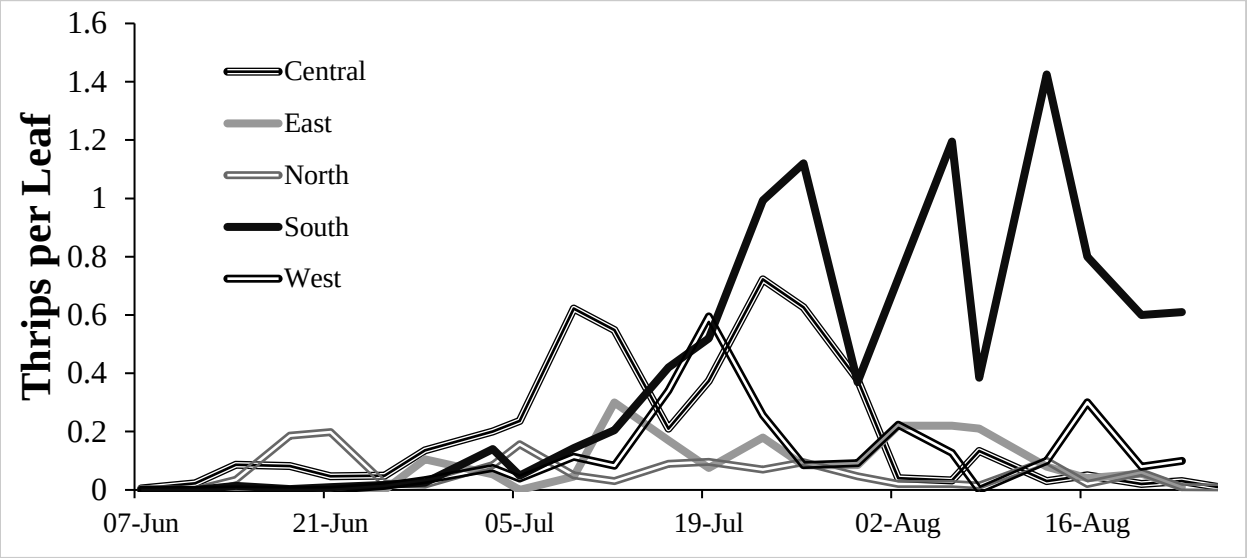


Figure 5. Average thrips/leaf in different regions of the Holland Marsh, 2024.

Diseases

Onion fields were scouted for botrytis leaf blight (*Botrytis squamosa*), downy mildew (*Peronospora destructor*), purple blotch (*Alternaria porri*), white rot (*Stromatinia cepivora*), pink root (*Setophoma terrestris*), stemphylium leaf blight (*Stemphylium vesicarium*) and other diseases.

Conditions were good for crop growth during the season with warm temperatures and sufficient precipitation throughout the end of June to July. There were dry periods during June which resulted in some heat canker, but this was generally prevented through widespread irrigation. The warm and wet conditions throughout most of the growing season resulted in longer leaf wetness periods and higher relative humidity which was favourable for disease development.

Stemphylium leaf blight continued to be the main disease on onions in 2024 (Table 3). First symptoms of Stemphylium leaf blight in scouted fields were seen on 22 June. Symptoms were fairly low in most transplant onion fields at harvest, but severity was high in most seeded fields by the end of the season. All scouted onion fields showed symptoms of the disease.

Conditions were also favourable for the development of onion downy mildew. Starting at the beginning of July, there were multiple sporulation-infection periods and sporangia were trapped in rotorod spore traps. Conditions were suitable for downy mildew development several times throughout July and August. Symptoms were first identified on 8 July and a total of seven scouted onion fields were found to have the disease. Most infected fields experienced minor onion downy mildew severity; however, a couple fields in the marsh had moderate severity.

Pink root was found in all onion fields, but disease severity was generally low. Bacterial rot was found in a number of fields due to the warm and wet conditions. Smut, white rot, purple blotch and fusarium basal rot were also present.

Table 3. Disease incidence on onion samples examined in commercial fields in the Holland/Bradford Marsh, Ontario in 2024.

DISEASE	CAUSAL AGENT	FIELDS INFECTED (%)	INCIDENCE (%)
Stemphylium leaf blight	*Stemphylium vesicarium*	100	80-100
Pink root	*Setophoma terrestris*	100	12-99
Purple blotch	*Alternaria porri*	72	0-80
Fusarium basal rot	*Fusarium oxysporum* f. sp. *cepae*	50	0-76
White rot	*Stromatinia cepivora*	50	0-6
Downy mildew	*Peronospora destructor*	38	0-8
Bacterial rot/soft rot	*Pectobacterium carotovorum* subsp. *carotovorum*	17	0-2

CELERY

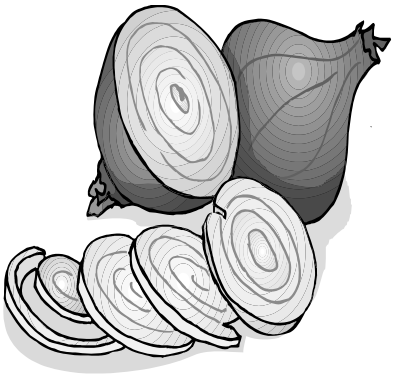
Insects

In 2024, three celery fields were scouted for carrot weevil, aster leafhopper, tarnished plant bug (*Lygus lineolaris*) and aphids. Insect traps and degree day models were used to predict the occurrence of the various life stages of carrot weevil, aster leafhopper and tarnished plant bug. Tarnished plant bugs were found in all fields but populations and damage remained very low. Aster yellows was very low this year. Only very minor cutworm, aphid and caterpillar activity was seen and no leaf miner damage was reported. No carrot weevil damage was found. Overall, insect activity in celery was very minimal in 2024.

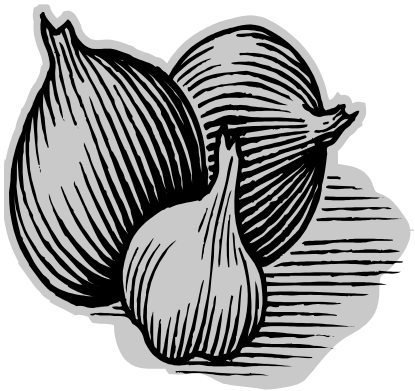
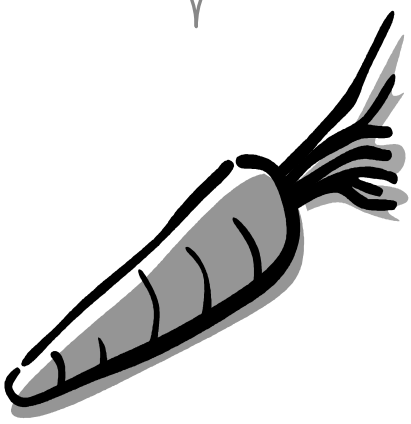
Diseases

Leaf blights (*Cercospora apii* and *Septoria apiicola*) were common but disease severity was kept at a low level. Celery leaf curl, or celery anthracnose (*Colletotrichum fioriniae*), was found in all fields but severity was very low overall with only a couple plants per field infected with the disease. The wet conditions in July allowed for some soil-borne disease to impact and stunt plant growth, but this was localized to lower lying areas.

This project was funded in part through the Knowledge Translation and Transfer (KTT) Funding Program, a program of the Ontario Agri-Food Innovation Alliance. Funding for the IPM program was also provided by the Bradford Co-operative Storage Ltd., growers participating in the program, FS Partners, Bayer Crop Science, BASF, Corteva and Syngenta Crop Protection.


Cultivar Trials 2024


CARROT CULTIVAR TRIAL SEASON SUMMARY – 2024

Daytime air temperatures in early May fluctuated between the teens to high twenties and nighttime air temperatures fluctuated in the low single digits. The first half of May received slightly below average rainfall. A total of 5/8 of an inch of rainfall occurred four days prior to seeding which provided good soil moisture for carrot hill formation and seeding. In the marsh, most of the carrot seeding occurred within the two-week period of 15-26 May. Compared to the previous 10-year average, air temperatures in 2024 were above average for May (15.4°C) and average for June (19.2°C), July (21.5°C), August (19.6°C), September (17.6°C) and October (10.6°C). The 10-year average temperatures were: May 13.4°C, June 18.6°C, July 21.1°C, August 20.4°C, September 16.8°C and October 10.1°C. Monthly rainfall was below the 10-year average for June (79 mm), August (54 mm), September (21 mm) and October (20 mm) and above average for May (83 mm) and July (85 mm). The 10-year rainfall averages were: May 58 mm, June 95 mm, July 75 mm, August 74 mm, September 57 mm and October 62 mm.

The carrot trial was seeded on 16 May. Soil moisture was sufficient for forming proper carrot hills. Ten days after seeding a significant rain fall of 1.5 inches of rain occurred. This rainfall provided good moisture conditions for seed germination and plant establishment. Emergence and plant vigour were good. Several light rain showers through out early June provide favourable conditions for plant establishment. Irrigation was needed during the dry conditions at the end of June to prevent heat canker.

The pre-emergence herbicide Gesagard was applied 18 May. Three small rain showers provided enough moisture to activate the Gesagard. The Gesagard gave moderate weed suppression. A heavy rainfall event on 27 May encouraged a weed flush of grasses. On 11 June a Select + Amigo application was applied that provided good control. Two applications of Lorox + Assist Oil were required on 18 and 28 June which did a moderate job of cleaning up the trial. The trial was hand weeded a few times through the growing season to keep it free of weeds.

Scouting for carrots began at the station on 6 May. The carrot weevil count on 6 May was 0.25 weevils/trap. By 27 May, weevil numbers had passed the first spray threshold with 2.5 cumulative weevils/trap. The cumulative weevils/trap for the season was 6.0 when the traps were removed on 15 July. The insecticide Rimon was applied twice on 6 and 27 June to prevent carrot weevil damage. There was limited weevil damage (dead carrot seedlings) observed in the variety trial. Only two varieties had any damage from carrot weevil at 0.3 and 0.5%. The trial average for carrot weevil damage at evaluation was 0%. Carrot rust flies were first found on 3 June. There were three rust fly peaks occurring on 20 June, 22 July and 19 August (0.26, 0.05 and 0.24 flies/trap/day, respectively). At evaluation, the trial average for carrot rust fly damage was 0.1%. This was comparable to the 2023 trial average of 0.15% rust fly damage.

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CARROT CULTIVAR TRIAL SEASON SUMMARY – 2024 – continued

Aster leafhoppers were first found on 17 May when scouting began. On 27 June, leafhopper numbers had peaked at 30 leafhoppers/trap. Leafhopper numbers peaked again at 13.6 leaf hoppers/trap on 22 July. The leafhopper population significantly decreased in August to below threshold levels. The moderate pressure of aster leafhoppers correlated with some noticeable aster yellows infection in the field, but at evaluation the number of carrots with the disease in yield samples was low.

Alternaria and Cercospora leaf blights were first found on 8 July and were controlled throughout the month of July and August with three applications of fungicides (see Cultivar Management Procedures). To observe cultivar tolerances to these pathogens, regular fungicide sprays were discontinued on 23 August. On 26 August leaf blight had reached the spray threshold. Throughout the months of September and October, leaf blight incidence did not increase in most cultivars. Leaf blight severity was low in most varieties at harvest in October. Differences in leaf blight incidence among cultivars were evaluated and noted. In the cello cultivars, the first replicate had a significantly higher incidence blight than the other two replicates. By Grower Field Week, starting on 5 September, some bolting was noted in a few cultivars in the trial. At harvest, twenty-one cultivars had no seeders present and for cultivars where seeders were present the total numbers were very low.

On 5 September, Grower Field Day, most carrot roots that were pulled appeared to be progressing well. Lengths were a bit short, but weight was surprisingly quite good considering the drier growing season. Unfortunately, the carrot lengths and additional weight did not improve much due to the below average total rainfall in September and October. Weather conditions in October were very favourable for the entire harvest period which began on 21 October. At harvest, carrots had good diameters and average lengths and were pretty good in quality. There were low to moderate numbers of forked and split carrots in the yield samples. Dryer conditions during the previous eight weeks before harvest appeared to discourage blight development. The carrot tops had low levels of leaf blight and strong petiole attachment. No pockets of sclerotinia were found in the trial at harvest. Some bacterial canker rot was noted. Carrot samples were placed in the Filacell storage immediately after harvest.

At evaluation in January, the trial average yield for cellos was fair with 1367 bu/A. The trial average yield for jumbos was good at 1574 bu/A. This is an increase of approximately 100 bu/A for both the cellos and jumbos compared to 2023. For both cellos and jumbos, the third replicate had significant, lower bu/A then the other two replicates. The cellos and jumbos had average to good root lengths with satisfactory widths. Overall quality was good in both cellos and jumbos with matured roots. It was noted at evaluation that all cultivars had several dried out (withered) roots present. In both the cellos and jumbos, the percentage of cull carrots was low to moderate with an average of 15.7% of the harvest yield. The percentage of culls dropped by approximately 5% compared to the 2023

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CARROT CULTIVAR TRIAL SEASON SUMMARY – 2024 – continued

carrot trial. Most of the culls in both the cellos and jumbos were forked carrots; however, these were at lower levels then 2023. Split carrots were the second most cull noted during evaluation with cello types having slightly higher incidence. In the jumbos, the number of undersized (small) culls decreased compared to the 2023 season. At evaluation a couple of cultivars had sclerotinia present but with very low percent infection. In the jumbos, several cultivars had canker or crater rot present with several lesions per root. There was very little tip rot found in the harvested yield samples. For cellos, the stand average was low at 15 carrots/foot compared to the desired trial seeding average of 25 carrots/foot. The third replicate was significantly lower then the other two replicates. The stand average for jumbos was 12 carrots/foot compared to the desired trial seeding average of 18 carrots/foot. The total number of carrots harvested in the third replicate of the jumbos were significantly lower than the other two replicates. The low stands for both cellos and jumbos were disappointing because the emergence and establishment of carrots in the spring appeared to be good. The trial average for cavity spot incidence was 23.2% a significant drop compared to the 60.5% levels of 2023 and 2022. Cavity spot incidence was low with one to two spots per infected root. The trial average for severity was only light to light/moderate-sized lesions. It appeared the drier conditions of the growing season from August till October harvest significantly decrease the percentage of incidence of cavity spot and lowered the severity compared to previous years. The uniformity of width and length rating was average for both the cellos and jumbos; however the jumbos were a bit more uniform in width and length then the cellos. Exterior colour for all cultivars was fair and slightly pale for all carrots within the samples with jumbo varieties having a slightly higher rating. Most of the jumbo cultivars only had a few visible lenticels. For appearance, the cellos and jumbos had a similar average rating for the trial. Most carrot samples had a smooth skin with only a few cello cultivars having a slightly ringy surface. Interior colour blending was good, with fewer carrots having any translucency in the core or red/green rings around the core than in 2023. Green shoulders were not present in most cello cultivars and, if found, were mostly in the jumbos and just starting to develop. There were no galls found on any carrots at evaluation. Seven cultivars had no aster yellow present in the harvest yield samples. The cellos had a trial average of 0.4% infection and the jumbos had a trial average of 0.5%. These trial percent averages of aster yellows infection were lower than anticipated. At evaluation, no significant differences were found in percentage of weevil or rust fly damage.

CARROT CULTIVAR TRIALS - 2024

MANAGEMENT PROCEDURES

Fertilizer:

20 kg/ha Nitrogen (Calcium Ammonium Nitrate 27-0-0) + 80 kg/ha Phosphorous (MESZ 10-40-0) + 175 kg/ha Potassium (ASPIRE 0-0-58) + 100 kg/ha of K-Mag (0-0-22) + 35 kg/ha of Manganese Sulfate and 3.5 kg/ha Boron (10%) was worked into the soil.

Seeded:

All trials were seeded on 16 May using a push cone seeder. If seed had a germination rate of 95 to 100%, a target of 26-22 seeds per foot was desired for Cello type carrots and 15-18 seeds per foot for Jumbo type carrots. All trials were seeded on beds 86 cm apart. The seeding rate was done according to percent germination. **RIDOMIL 1G** was applied at 25 kg/ha in the seed furrow. The Main Trial was replicated three times, and the Adaptation Trial was not replicated.

Weed Control:

Pre-emergence:	1 application: **GESAGARD 480** at 6.0 L/ha on 18 May.
Post-emergence:	1 application: **SELECT** at 375 ml/ha + **AMIGO** at 5 L/1000L H2O on 11 June.
	1 application: **LOROX L** at 300 ml/ha + **ASSIST OIL** at 1.0 L/ha on 18 June.
	1 application: **LOROX L** at 750 ml/ha + **ASSIST OIL** at 1.0 L/ha on 28 June.

Minor Elements:

Four foliar sprays: Epsom Salts on 12 & 19 July and 10 August (2.0 kg/ha) and 2 August (4.0 kg/ha).
Three foliar sprays: Maganese Sulfate on 12 & 19 July and 10 August (2.0 kg/ha).
Two foliar sprays: Suprafeed on 12 July and 10 August (2.0 kg/ha).
One foliar spray: Alexin on 11 August (4.0 L/ha).
One foliar spray: Mag Max on 2 August (4.0 L/ha).

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CARROT CULTIVAR TRIALS - 2024 - continued

Insect and Disease Control:

According to IPM recommendations.

RIMON at 820 ml/ha on 6 June.
RIMON at 820 ml/ha on 27 June.
CABRIO at 840 g/ha + **ALLEGRO 500F** 1.16 L/ha + **CLOSER** at 300 ml/ha and Minor Elements on 19 July.
SIVANTO PRIME at 750 ml/ha + **MIRAVIS DUO** at 1.0 L/ha + **QUADRIS TOP** 1.0 L/ha and Minor Elements on 2 August.
CABRIO at 840 g/ha and Minor Elements on 10 August.
SIVANTO PRIME at 750 ml/ha + **QUADRIS TOP** 1.0 L/ha and Minor Elements on 23 August.

Harvest:

The Main and Adaptation Trials were harvested on 21-28 October. All trials were immediately placed in a temperature and humidity controlled storage (1°C, 95 % RH) respectively.

Irrigation:

Irrigation water was applied 18 June at ¾" for heat canker protection.

EVALUATION PROCEDURES

The cultivars were evaluated on 6 – 23 January after 12 weeks in storage.

 # Carrots Harvested:

Total number of carrots harvested from 2.32 m of row.

Harvest Weight:

Weights from the harvested 2.32 m of row.

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Marketable Yield t/ha + B/A:

Marketable yield includes the packaging size, 2.0 cm to 4.4 cm (¾" to 1¾") as well as the oversize > 4.4 cm (> 1¾").

% Oversize:

The percentage of carrots > 4.4 cm (> 1¾ ") and greater.

Majority of Culls:

Sp = Splits F = Forked Sm = Small (< 2.0 cm) R = Rot A = Aster Yellows

Shape:

GP = Gold Pak N = Nantes Imp = Imperator Cyl = Cylindrical LD = Long Danver LO = Long Orange
B = Berlicum F = Flakkee K = Kuroda D = Danver SP = Spartan Bonus

Appearance:

Appearance is based on qualities of straightness of root and smoothness.
10.0 = very straight and smooth, 6.0 = a few rough carrots in mix, 1.0 = bends and curves in root with very rough surface.

Resistance to Greening:

The higher the number, the less green tissue on the crown of the carrot 10.0 = no green tissue, 6.0 = moderate green tissue, 1.0 = total green tissue.

External Colour:

DO = Dark Orange O = Orange BO = Bright Orange LO = Light Orange LY = Light Yellow

Internal Colour:

DO = Dark Orange O = Orange BO = Bright Orange LO = Light Orange YO = Yellow Orange

Blight Rating:

Regular fungicide applications were discontinued on 23 August to allow the cultivars to be evaluated for tolerance to leaf blights. Evaluation took place at harvest. 10.0 = Most Desirable, no lesions; 8.0 = Good, mild lesions on leaves, no lesions on petioles; 6.0 = Moderate, lesions on leaves, some lesions on petioles; 3.0 = Poor, numerous lesions on leaves, numerous lesions on petioles; 1.0 = Severe, tops completely rotted, crop cannot be harvested.

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CARROT CULTIVAR TRIALS - 2024 - continued

Score:

The average of the 9 marks from Uniformity of Shape to Blight Rating. 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average.

% Cavity Spot & Degree:

The number indicates the percentage of roots with cavity spots.
The letters indicate the degree to which the roots were infected.
VL = Very Light, cavity spots are few and barely visible. Lesion size < 1 mm.
L = Light, few small spots. Lesion size 1 - 2 mm.
M = Medium, roots borderline marketable. Lesion size 2 - 5 mm.
H = Heavy, large cavity spots, roots unmarketable. Lesion size 5 - 10 mm.
VH = Very Heavy, many large cavity spots, roots unmarketable. Lesion size > 10 mm.

Example: 50 H = 50% of the roots were heavily infected with cavity spots, roots unmarketable

Shape of Crown:

CV = Convex (no indentation around crown) CC = Concave (indentation around crown)

Root Length (cm):

Twenty centimetres is approximately eight inches.

Root Width (cm):

One inch is approximately two and a half centimetres.

Seeding Rate:

Number of seeds per foot as specified by seed company.

Stand per Foot:

Stand per Foot times 3.28 equals Stand per Metre.

Top Length (cm):

Small = 20-30 centimetres Medium = 30-45 centimetres Large = 45 centimetres and greater

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Leaf Colour:

LG = Light Green G = Green DG = Dark Green PG = Pale Green

Leaf Structure:

F = Fine leaf structure ST = Standard leaf structure C = Course heavy leaf structure

% Weevil & Rust Fly Damage:

Percent of carrot roots damaged by carrot weevil & carrot rust fly that were found in the 2.32 m harvest sample.

% Aster Yellows:

Percent of Aster yellows infected roots that were found in the 2.32 m harvest sample.

Average Number of Seeders:

Average number of seeders found in each cultivar of 15 m of row.

Zero			***One***	***Two***	***Three***	***Five***	***Nine***
Brillyance	Orange Fancy	EXP 3497	Orange Slice	Envy	Copperhead	Junction	Junction
SV 2384	Brava	Istanbul	Calindor	Cellobunch			
Naval	Belgrado	Silver Star	Baldio	Trallyance			
Navedo Jumbo	Berlin	Soneto					
Enterprise	Narvik	Arpeggio					
Fortedo	Canberra	Bastia					
Navedo Cello	Trophy Pak	Orchestro		*** Thirty Seven**	Tangerina		

Root Gall:

Root gall was not found in the 2024 carrot cultivar trial.

CARROT CULTIVAR MAIN TRIAL CELLO TYPES - 2024

Cultivar	Source	# Carrots Harvested	# > 4.4 cm	# 2.0 to 4.4 cm	Total Harvest Weight (kg)	Weight > 4.4 cm (kg)	Weight 2.0 to 4.4 cm (kg)	Marketable Yield t/ha	Marketable Yield B/A
NAVAL	Bejo	125 ab*	20 bcd	89 abc	20.65 a-e	6.22 b-g	12.60 ab	94.1	1515 ns**
SONETO	Vil	103 bcd	16 c-f	75 b-f	18.32 c-f	4.29 fgh	12.10 abc	82.0	1320
NAVEDO CELLO	Bejo	123 bc	23 bc	84 a-e	24.09 a	8.86 b	12.64 ab	107.5	1731
ARPEGGIO	Vil	110 bcd	24 bc	71 b-g	22.83 ab	8.22 bc	11.84 a-d	100.3	1615
BRILLYANCE	Sto	115 bcd	18 cde	81 a-f	22.74 abc	6.17 b-g	13.57 a	98.7	1590
ENVY	Sto	119 bc	42 a	60 c-g	23.61 a	12.84 a	7.75 ef	103.0	1657
SV 2384	Sto	93 bcd	22 bc	58 d-g	20.87 a-e	8.19 bcd	9.87 a-f	90.3	1454
NARVIK	Bejo	120 bc	8 f	96 ab	17.28 ef	2.39 h	12.30 abc	73.4	1182
CELLOBUNCH	Sto	118 bc	22 bc	74 b-f	20.39 a-e	7.60 b-e	9.78 a-f	86.9	1399

Listed in order of % Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

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** ns indicates that no significant differences were found among the cultivars at P = 0.05.

CARROT CULTIVAR MAIN TRIAL CELLO TYPES - 2024 - continued

Cultivar	Source	# Carrots Harvested	# > 4.4 cm	# 2.0 to 4.4 cm	Total Harvest Weight (kg)	Weight > 4.4 cm (kg)	Weight 2.0 to 4.4 cm (kg)	Marketable Yield t/ha	Marketable Yield B/A
FORTEDO	Vil	109 bcd*	30 b	55 efg	18.55 b-f	7.90 b-e	8.04 def	79.7	1283 ns**
ISTANBUL	Bejo	160 a	18 cde	106 a	21.91 a-d	5.35 c-h	12.65 ab	90.0	1449
TRALLYANCE	Sto	87 cd	20 bcd	52 fg	20.02 a-e	7.49 b-f	8.53 c-f	80.1	1289
ORANGE SLICE	Sem	79 d	23 bc	41 g	18.61 b-f	7.94 bcd	6.87 f	74.1	1192
ENTERPRISE	Sto	109 bcd	15 c-f	75 b-f	17.87 def	4.63 e-h	9.41 b-f	70.2	1130
JEFFERSON	Bejo	113 bcd	24 bc	59 c-g	20.09 a-e	8.10 bcd	7.44 ef	77.7	1251
COPPERHEAD	ILL	95 bcd	8 ef	66 b-g	15.53 f	2.66 h	9.22 b-f	59.4	956
JUNCTION	Bejo	115 bcd	11 def	77 a-f	18.26 def	3.51 gh	10.79 a-e	71.5	1151
ORANGE FANCY	Sem	127 ab	15 c-f	87 a-d	23.87 a	4.94 d-h	12.87 ab	89.0	1433
Trial Average		**112**	**20**	**73**	**20.30**	**6.52**	**10.46**	**84.9**	**1367**

Listed in order of % Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

... / continued

** ns indicates that no significant differences were found among the cultivars at P = 0.05.

CARROT CULTIVAR MAIN TRIAL CELLO TYPES - 2024 - continued

Cultivar	Source	% Marketable	% Oversize	Majority of Culls	Shape	Uniformity of Shape	Uniformity of Length	Uniformity of Width	Appearance	Resistance to Greening
NAVAL	Bejo	90.9 ns**	28.6 b-g*	SpFSm	N	6.3 ef	6.7 a-d	6.0 cde	7.3 abc	8.0 bcd
SONETO	Vil	89.6	23.4 fgh	R	N	8.3 bcd	7.8 a	7.3 ab	6.7 cde	8.0 bcd
NAVEDO CELLO	Bejo	89.1	37.0 b-f	F	ImpCyl	6.0 f	6.3 a-e	6.3 b-e	6.7 cde	8.3 a-d
ARPEGGIO	Vil	87.7	34.9 b-f	Sp	Cyl	9.0 ab	6.7 a-d	7.7 a	8.0 a	8.2 bcd
BRILLYANCE	Sto	87.0	27.0 c-h	F	Cyl	7.0 def	7.3 ab	6.7 a-d	7.7 ab	8.0 bcd
ENVY	Sto	86.9	54.4 a	F	Imp	6.3 ef	6.3 a-e	5.7 de	7.3 abc	8.7 abc
SV 2384	Sto	85.4	39.3 bcd	F	ImpCyl	6.0 f	6.0 b-f	6.0 cde	6.3 de	7.3 d
NARVIK	Bejo	84.6	13.1 h	F	N	8.7 abc	6.0 b-f	6.7 a-d	7.0 bcd	7.8 cd
CELLOBUNCH	Sto	83.4	38.0 b-e	F	ImpCyl	6.0 f	6.0 b-f	5.7 de	6.7 cde	7.7 cd

Listed in order of % Marketable. 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

** ns indicates that no significant differences were found among the cultivars at P = 0.05.

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CARROT CULTIVAR MAIN TRIAL CELLO TYPES - 2024 - continued

Cultivar	Source	% Marketable	% Oversize	Majority of Culls	Shape	Uniformity of Shape	Uniformity of Length	Uniformity of Width	Appearance	Resistance to Greening
FORTEDO	Vil	82.3 ns**	38.8 bcd*	F	N	7.7 b-e	6.7 a-d	7.0 abc	6.3 de	7.8 cd
ISTANBUL	Bejo	82.2	24.0 e-h	Sp	Imp	8.3 bcd	5.3 def	5.7 de	6.3 de	9.3 a
TRALLYANCE	Sto	80.6	39.1 bcd	F	N	8.3 bcd	7.0 abc	7.3 ab	7.0 bcd	7.3 d
ORANGE SLICE	Sem	79.3	42.6 ab	Sp	ImpCyl	6.3 ef	6.0 b-f	6.0 cde	6.0 e	8.5 abc
ENTERPRISE	Sto	77.3	24.9 d-h	F	Imp	7.3 c-f	5.0 efg	4.3 f	6.5 cde	8.0 bcd
JEFFERSON	Bejo	77.0	40.1 bc	Sp	Imp	7.3 c-f	6.3 a-e	4.3 f	6.0 e	9.0 ab
COPPERHEAD	ILL	75.5	16.3 gh	F	CP	10.0 a	3.7 g	4.3 f	4.3 f	9.0 ab
JUNCTION	Bejo	75.4	18.8 gh	Sp	Imp	6.3 ef	4.7 fg	5.3 ef	6.0 e	8.7 abc
ORANGE FANCY	Sem	73.7	20.3 gh	F	Cyl	7.0 def	5.7 c-f	6.0 cde	6.7 cde	7.3 d
Trial Average		**82.7**	**31.1**			**7.4**	**6.1**	**6.0**	**6.6**	**8.2**

Listed in order of % Marketable. 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

** ns indicates that no significant differences were found among the cultivars at P = 0.05.

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CARROT CULTIVAR MAIN TRIAL CELLO TYPES - 2024 - continued

Cultivar	Source	External Colour	External Colour Rating	Internal Colour	Internal Colour Rating	% Core of Total Width	Blight Rating	Score	% Cavity Spot & Degree	Shape of Crown
NAVAL	Bejo	O	6.7 bcd*	O	6.3 ns**	43.4 bcd	9.3 ns	6.76 b-h	22L abc	CC
SONETO	Vil	O	6.7 bcd	O	7.7	41.6 cd	8.3	7.50 ab	27LM bc	CC
NAVEDO CELLO	Bejo	O	6.7 bcd	O	6.7	41.8 cd	8.5	6.71 c-h	13L ab	CV
ARPEGGIO	Vil	O	8.0 a	O	7.7	47.9 b	9.3	7.88 a	30L bc	CC
BRILLYANCE	Sto	O	7.0 abc	O	7.7	54.3 a	9.0	7.33 abc	7LM a	CC
ENVY	Sto	O	6.3 b-e	O	7.0	48.2 b	8.7	6.81 b-g	33L c	CV
SV 2384	Sto	O	6.0 c-f	LO	7.0	43.8 bcd	8.7	6.38 e-h	15L ab	CV
NARVIK	Bejo	O	7.3 ab	O	6.3	39.8 d	8.0	7.12 b-e	25LM bc	CC
CELLOBUNCH	Sto	O	6.0 c-f	O	6.7	43.6 bcd	9.0	6.38 e-h	23LM abc	CC

Listed in order of % Marketable. 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

... / continued

** ns indicates that no significant differences were found among the cultivars at P = 0.05.

CARROT CULTIVAR MAIN TRIAL CELLO TYPES - 2024 - continued

Cultivar	Source	External Colour	External Colour Rating	Internal Colour	Internal Colour Rating	% Core of Total Width	Blight Rating	Score	% Cavity Spot & Degree	Shape of Crown
FORTEDO	Vil	LO	7.0 abc*	O	7.7 ns**	39.4 d	9.3 ns	7.17 a-d	53LM d	CC
ISTANBUL	Bejo	O	6.0 c-f	O	8.0	44.1 bcd	8.7	7.00 b-f	18L abc	CC
TRALLYANCE	Sto	LO	6.0 c-f	O	7.0	44.4 bcd	9.0	7.14 a-d	18L abc	CC
ORANGE SLICE	Sem	O	5.0 f	LO	6.7	41.8 cd	9.0	6.36 fgh	13L ab	CV
ENTERPRISE	Sto	DO	5.3 ef	O	5.7	46.9 bc	9.0	6.02 h	18L abc	CV
JEFFERSON	Bejo	O	5.0 f	LO	7.0	44.9 bcd	8.3	6.43 d-h	22LM abc	CV
COPPERHEAD	ILL	DO	5.0 f	LO	6.7	41.7 cd	9.0	6.14 gh	23L abc	CV
JUNCTION	Bejo	DO	5.7 def	O	6.3	42.7 bcd	8.3	6.14 gh	25LM bc	CV
ORANGE FANCY	Sem	O	7.3 ab	O	6.0	42.8 bcd	9.0	6.57 d-h	27L bc	CV
Trial Average			**6.3**		**6.9**	**44.1**	**8.8**	**6.77**	**23 LM**	

Listed in order of % Marketable. 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test. **... / continued**

** ns indicates that no significant differences were found among the cultivars at P = 0.05.

CARROT CULTIVAR MAIN TRIAL CELLO TYPES - 2024 - continued

Cultivar	Source	Root Length (cm)	Root Width (cm)	Seeding Rate	Stand per Foot	Top Length (cm)	Leaf Colour	Leaf Structure	% Weevil Damage	% Rust Fly Damage	% Aster Yellows
NAVAL	Bejo	18.9 g*	3.7 abc	25	16 ab	53.7 fgh	G	ST	0.0 ns**	0.0 ns	0.0 ns
SONETO	Vil	19.4 fg	3.8 ab	25	14 bcd	52.4 gh	G	ST	0.0	0.3	0.6
NAVEDO CELLO	Bejo	22.4 cd	3.6 bcd	25	16 bc	60.8 c	G	ST	0.0	0.0	0.3
ARPEGGIO	Vil	19.3 g	3.6 abc	25	14 bcd	54.7 e-h	LG	ST	0.3	0.0	0.3
BRILLYANCE	Sto	20.6 d-g	3.7 abc	25	15 bcd	53.7 fgh	G	F	0.0	0.0	1.2
ENVY	Sto	19.6 fg	3.6 abc	23	16 bc	63.0 bc	G	ST	0.0	0.0	1.1
SV 2384	Sto	24.4 b	3.6 b-e	23	12 bcd	60.4 cd	G	ST	0.0	0.0	0.4
NARVIK	Bejo	18.9 g	3.6 a-d	25	16 bc	49.8 h	DG	ST	0.0	0.0	0.3
CELLOBUNCH	Sto	22.0 cde	3.3 def	23	16 bc	57.8 c-f	G	ST	0.0	0.0	0.6

Listed in order of % Marketable.

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** ns indicates that no significant differences were found among the cultivars at P = 0.05.

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CARROT CULTIVAR MAIN TRIAL CELLO TYPES - 2024 - continued

Cultivar	Source	Root Length (cm)	Root Width (cm)	Seeding Rate	Stand per Foot	Top Length (cm)	Leaf Colour	Leaf Structure	% Weevil Damage	% Rust Fly Damage	% Aster Yellows
FORTEDO	Vil	16.9 h*	3.8 a	25	14 bcd	52.6 fgh	DG	F	0.0 ns**	0.0 ns	1.5 ns
ISTANBUL	Bejo	21.5 cde	3.4 def	25	21 a	59.8 cde	G	ST	0.0	0.0	0.0
TRALLYANCE	Sto	20.2 efg	3.8 ab	23	11 cd	54.2 fgh	LG	ST	0.0	0.0	0.0
ORANGE SLICE	Sem	24.5 b	3.5 c-f	25	10 d	68.5 a	G	ST	0.0	0.4	0.4
ENTERPRISE	Sto	21.8 cde	3.4 def	25	14 bcd	60.3 cd	G	ST	0.0	0.3	0.0
JEFFERSON	Bejo	22.5 c	3.3 ef	25	15 bcd	66.4 ab	DG	ST	0.0	0.0	0.3
COPPERHEAD	ILL	29.4 a	3.3 f	23	13 bcd	55.4 d-g	G	ST	0.0	0.0	0.3
JUNCTION	Bejo	24.6 b	3.5 b-f	25	15 bcd	59.6 cde	LG	FST	0.0	0.0	0.3
ORANGE FANCY	Sem	21.1 c-f	3.5 b-f	25	17 ab	69.9 a	G	ST	0.0	0.0	0.3
Trial Average		**21.5**	**3.5**	**24**	**15**	**58.5**			**0.0**	**0.1**	**0.4**

Listed in order of % Marketable.

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CARROT CULTIVAR MAIN TRIAL JUMBO TYPES - 2024

Cultivar	Source	# Carrots Harvested	# > 4.4 cm	# 2.0 to 4.4 cm	Total Harvest Weight (kg)	Weight > 4.4 cm (kg)	Weight 2.0 to 4.4 cm (kg)	Marketable Yield t/ha	Marketable Yield B/A
ORCHESTRO	Vil	127 a*	52 a	65 a	24.97 ns**	14.93 bcd	8.50 ab	117.1	1886 a
BRAVA	Bejo	74 cde	50 ab	16 def	22.88	18.77 ab	2.17 efg	104.7	1686 abc
NAVDEO JUMBO	Bejo	95 bcd	25 d	61 ab	22.73	9.47 f	10.95 a	102.1	1644 abc
CANBERRA	Bejo	66 e	49 ab	5 f	19.63	17.08 abc	0.62 g	88.5	1425 bcd
CALINDOR	ILL	106 ab	38 a-d	53 abc	23.62	13.12 c-f	8.02 abc	105.7	1702 abc
TROPHY PAK	Sto	109 ab	36 bcd	56 abc	19.01	10.11 ef	6.57 bcd	83.4	1343 cd
BALDIO	Bejo	71 de	31 cd	32 cde	22.71	15.85 a-d	4.01 def	99.3	1598 abc

Listed in order of % Marketable.

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CARROT CULTIVAR MAIN TRIAL JUMBO TYPES - 2024 - continued

Cultivar	Source	# Carrots Harvested	# > 4.4 cm	# 2.0 to 4.4 cm	Total Harvest Weight (kg)	Weight > 4.4 cm (kg)	Weight 2.0 to 4.4 cm (kg)	Marketable Yield t/ha	Marketable Yield B/A
BELGRADO	Bejo	98 bc*	43 abc	39 bcd	25.73 ns**	16.05 a-d	5.98 bcd	110.1	1773 ab
BERLIN	Bejo	73 cde	49 ab	13 ef	26.57	20.45 a	2.03 efg	112.4	1810 ab
BASTIA	Bejo	103 ab	48 ab	36 cde	23.23	14.85 b-e	4.72 de	97.9	1576 abc
EXP 3497	Bejo	92 b-e	40 a-d	32 cde	21.43	13.27 c-f	5.10 cde	91.8	1478 a-d
SILVER STAR	Sem	75 cde	36 bcd	25 def	21.69	13.22 c-f	4.81 de	90.2	1451 bcd
TANGERINA	Tak	91 b-e	30 cd	21 def	19.69	12.14 def	1.32 fg	67.3	1084 d
Trial Average		**91**	**41**	**35**	**22.61**	**14.56**	**4.98**	**97.7**	**1574**

Listed in order of % Marketable.

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... / continued

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CARROT CULTIVAR MAIN TRIAL JUMBO TYPES - 2024 - continued

Cultivar	Source	% Marketable	% Oversize	Majority of Culls	Shape	Uniformity of Shape	Uniformity of Length	Uniformity of Width	Appearance	Resistance to Greening
ORCHESTRO	Vil	94.0 a*	59.2 de	F	F	5.0 c	7.7 abc	6.3 b	5.7 ns**	3.7 g
BRAVA	Bejo	91.6 ab	82.1 ab	F	F	6.3 abc	6.7 bcd	7.0 cde	6.7	7.5 abc
NAVDEO JUMBO	Bejo	89.6 ab	42.0 f	F	B	7.7 a	8.7 a	8.7 a	8.0	7.0 bcd
CANBERRA	Bejo	89.5 ab	86.1 a	F	MIX	4.7 c	5.7 de	6.0 f	6.3	7.0 bcd
CALINDOR	ILL	89.5 ab	55.5 e	Sp	MIX	4.7 c	8.0 ab	7.3 bc	6.7	5.0 f
TROPHY PAK	Sto	87.7 ab	53.3 ef	Sp	LO	7.3 ab	7.0 bcd	7.7 b	6.3	8.7 a
BALDIO	Bejo	87.4 ab	70.1 bcd	F	B	7.7 a	7.0 bcd	7.0 bcd	7.3	5.5 ef

Listed in order of % Marketable. 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

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CARROT CULTIVAR MAIN TRIAL JUMBO TYPES - 2024 - continued

Cultivar	Source	% Marketable	% Oversize	Majority of Culls	Shape	Uniformity of Shape	Uniformity of Width	Uniformity of Length	Appearance	Resistance to Greening
BELGRADO	Bejo	86.0 ab*	62.5 de	F	F	6.3 abc	6.3 cd	6.7 cde	6.7 ns**	6.7 cde
BERLIN	Bejo	84.6 ab	77.0 abc	F	F	7.3 ab	6.7 bcd	6.0 ef	7.3	6.2 def
BASTIA	Bejo	84.3 ab	64.1 cde	F	F	8.3 a	7.0 bcd	7.0 bcd	7.0	8.0 ab
EXP 3497	Bejo	83.2 b	58.8 de	F	F	5.0 c	4.7 e	6.3 def	6.0	6.3 cde
SILVER STAR	Sem	81.5 b	57.9 de	Sp	MIX	5.3 bc	5.7 de	7.3 bc	6.7	6.0 def
TANGERINA	Tak	67.7 c	61.2 de	R	D	7.3 ab	6.0 de	5.7 f	6.7	5.0 f
Trial Average		**85.9**	**63.8**			**6.4**	**6.7**	**6.8**	**6.7**	**6.3**

Listed in order of % Marketable. 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

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CARROT CULTIVAR MAIN TRIAL JUMBO TYPES - 2024 - continued

Cultivar	Source	External Colour	External Colour Rating	Internal Colour	Internal Colour Rating	% Core of Total Width	Blight Rating	Score	% Cavity Spot & Degree	Shape of Crown
ORCHESTRO	Vil	O	7.3 ns**	BO	5.7 ns	50.9 a*	9.7 ns	5.90 e	13LM ns	CC
BRAVA	Bejo	O	7.7	O	5.7	62.0 e	9.0	6.79 bcd	33L	CC
NAVDEO JUMBO	Bejo	O	8.3	LO	6.3	52.3 a	8.3	7.81 a	15L	CC
CANBERRA	Bejo	O	7.0	O	7.3	59.7 cde	9.0	6.29 de	30L	CC
CALINDOR	ILL	O	7.7	O	5.3	53.6 ab	8.7	6.38 cde	18LM	CV
TROPHY PAK	Sto	O	6.3	O	6.7	53.9 ab	8.7	7.14 abc	15L	CC
BALDIO	Bejo	LO	7.7	O	5.7	59.2 b-e	9.3	6.83 bcd	25LM	CC

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CARROT CULTIVAR MAIN TRIAL JUMBO TYPES - 2024 - continued

Cultivar	Source	External Colour	External Colour Rating	Internal Colour	Internal Colour Rating	% Core of Total Width	Blight Rating	Score	% Cavity Spot & Degree	Shape of Crown
BELGRADO	Bejo	O	6.7 ns**	O	6.3 ns	60.4 de*	9.3 ns	6.52 cde	22LM ns	CV
BERLIN	Bejo	O	7.3	O	4.7	63.3 e	9.0	6.50 cde	33M	CC
BASTIA	Bejo	O	7.0	O	8.0	53.9 ab	8.7	7.48 ab	27LM	CC
EXP 3497	Bejo	O	6.7	O	6.3	58.2 b-e	9.0	5.90 e	22L	CC
SILVER STAR	Sem	O	6.3	O	5.7	54.2 abc	8.7	6.14 de	23L	CC
TANGERINA	Tak	O	7.0	LO	5.7	54.8 a-d	9.3	6.19 de	30LM	CC
Trial Average			**7.2**		**6.1**	**56.6**	**9.0**	**6.61**	**24 LM**	

Listed in order of % Marketable. 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

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CARROT CULTIVAR MAIN TRIAL JUMBO TYPES - 2024 - continued

Cultivar	Source	Root Length (cm)	Root Width (cm)	Seeding Rate	Stand per Foot	Top Length (cm)	Leaf Colour	Leaf Structure	% Weevil Damage	% Rust Fly Damage	% Aster Yellows
ORCHESTRO	Vil	20.5 c*	5.3 bc	25	17 a	61.6 b	G	F	0.0 ns**	0.0 ns	1.8 ns
BRAVA	Bejo	22.3 bc	5.8 a	18	10 cde	62.4 b	G	ST	0.0	0.0	0.4
NAVDEO JUMBO	Bejo	25.6 a	5.0 d	18	13 bcd	61.6 b	G	ST	0.0	0.0	0.0
CANBERRA	Bejo	20.4 c	6.0 a	12	9 e	54.6 c	LG	ST	0.0	0.0	0.0
CALINDOR	ILL	22.4 bc	5.1 cd	20	14 ab	61.0 b	G	ST	0.0	0.0	0.3
TROPHY PAK	Sto	23.9 ab	5.2 bcd	23	14 ab	62.8 b	G	ST	0.0	0.4	0.3
BALDIO	Bejo	23.8 ab	5.5 b	18	9 de	57.9 bc	G	F	0.0	0.0	0.9

Listed in order of % Marketable.

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CARROT CULTIVAR MAIN TRIAL JUMBO TYPES - 2024 - continued

Cultivar	Source	Root Length (cm)	Root Width (cm)	Seeding Rate	Stand per Foot	Top Length (cm)	Leaf Colour	Leaf Structure	% Weevil Damage	% Rust Fly Damage	% Aster Yellows
BELGRADO	Bejo	22.3 bc*	5.4 bc	18	13 bc	59.3 bc	G	ST	0.0 ns**	0.3 ns	0.3 ns
BERLIN	Bejo	23.9 ab	5.8 a	18	10 cde	59.2 bc	G	ST	0.0	0.0	0.9
BASTIA	Bejo	22.2 bc	5.3 bcd	20	14 ab	57.1 bc	LG	F	0.0	0.0	0.6
EXP 3497	Bejo	22.5 bc	5.2 bcd	18	12 b-e	57.4 bc	G	F	0.0	0.3	0.4
SILVER STAR	Sem	22.3 bc	5.2 bcd	18	10 cde	68.8 a	G	ST	0.5	0.0	0.4
TANGERINA	Tak	17.8 d	5.9 a	23	12 b-e	70.1 a	G	F	0.0	0.3	0.0
Trial Average		**22.3**	**5.4**	**18**	**12**	**61.1**			**0.0**	**0.1**	**0.5**

Listed in order of % Marketable.

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CARROT CULTIVAR MAIN TRIAL CELLO TYPES EVALUATION NOTES – 2024

Naval: *Bejo sample,* Nantes carrot, Average to good length slightly uneven, Okay to good width uneven, Uniformity of shape even, Full tips matured, Average to nice appearance, Odd carrot slightly ringy, Average to good weight a little uneven, Good smoothness, Fair to good exterior colour even, 1 to 2 cavity spots per root, Average interior blending slightly uneven, White in cores (10-20%), Translucent throughout core (10-20%), Red ring around core (20-90%), Average core size, Odd carrot with mouse damage, Average to good Packer, Okay to good Jumbo, Jumbos are an oversized nantes and a bit short.

Soneto: *Vilmorin sample,* Nantes carrot, Average length even, Average to good width slightly even, Uniformity of shape very even, Full tips matured, Average to good appearance, Odd ringy carrot, Odd noticeable lenticle, Average to good weight even, Fairly good smoothness, Fair exterior colour even, Odd noticeable cavity spot, 1 to 2 cavity spots per root, Average to nice interior blending even, Translucent core dead center (20%), Green ring around core (20%), Small to average core size, Odd carrot with mouse damage, Lots of crater rot a concern, Average to good Packer, Okay to average Jumbo bit more weight.

Navedo: *Bejo sample,* Average to good length slightly uneven, Okay to good width uneven, Uniformity of shape a little even, Odd carrot with bends and curves, Full slightly tapered tips matured, Average to good appearance, Odd ringy carrot, Average to good weight a little uneven, Fairly smooth, Fair exterior colour a little even, 1 to 2 cavity spots per root, Average to good interior blending slightly even, White in cores (10-20%), Translucent core dead center (10-20%), Red ring around core (10-30%), Average core size, Average to good Packer, Average to good Jumbo bit more weight.

Arpeggio: *Vilmorin sample,* Larger carrots have slicer potential, Average to good length slightly uneven, Average to good width slightly uneven, Uniformity of shape very even, Odd carrot with bends and curves, Full tips matured, Good to nice appearance, Odd carrot with slightly noticeable lenticles, Average to good weight a little uneven, Good to nice smoothness, Fair to good exterior colour slightly pale even, 1 to 2 or 2 to 3 cavity spots per root, Average to nice interior blending even, Translucent throughout core (10-40%), Red or green ring around core (10-40%), Average to large core size, Average to nice Packer, Good Jumbo bit more weight.

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CARROT CULTIVAR MAIN TRIAL CELLO TYPES EVALUATION NOTES – 2024 - continued

Brillyance: *Stokes sample,* Nantes blood, Average length a little even, Average to good width a little even, Uniformity of shape even, Odd carrot with bends and curves, Full tips matured odd one immature, Good appearance, Odd noticeable lenticle, Average to good weight a little uneven, Good smoothness, Fair to good exterior colour slightly uneven, 1 to 2 or 2 to 3 cavity spots per root, Good to nice interior blending a little even, White in cores (10%), Translucent throughout core (10%), Green ring around core (20%), Average to large core size, Crater rot common, Average to good Packer a few bit short, Okay to average Jumbo a few short or lacking weight.

Envy: *Stokes sample,* Okay to average length slightly even, Lengths a little short, Okay to average width uneven, Uniformity of shape a little even, Odd carrot with bends and curves, Tapered and full tips matured, Average to good appearance, Average weight uneven, Fairly good smoothness, Fair to good exterior colour even, 1 to 2 or 3 to 4 cavity spots per root, Average to good interior blending even, Translucent core dead center (10%), Red ring around core (50-60%), Average to large core size, Packer/Jumbo split of 65/35, Okay to average Packer some a bit short or thin, Average to good Jumbo.

SV 2384: *Stokes sample,* Good length a little uneven, Average to good width uneven, Uniformity of shape slightly even, Odd carrot with bends and curves, Tapered and full tips matured odd one immature, Average to good appearance, Some carrots ringy, Average to good weight a little uneven, Fairly smooth, Fair exterior colour slightly uneven, Odd noticeable cavity spot, 1 to 2 cavity spots per root, Average to nice interior blending slightly uneven, Green in cores (10%), Translucent core dead center (10%), Red ring around core (30-70%), Average to large core size, Odd carrot with mouse damage, Odd carrot with crater rot, Average to good Packer, Jumbos are an oversized packer.

Narvik: *Bejo sample,* Nantes carrot, Average to good length slightly even, Okay to average width slightly uneven, Uniformity of shape very even, Odd carrot with bends and curves, Full tips matured, Average to good appearance, Odd ringy carrot, Average to good weight a little uneven, Fairly good smoothness, Fair exterior colour slightly pale even, 1 to 2 or 2 to 3 cavity spots per root, Average to good interior blending slightly uneven, Translucent core dead center (10%), Red or green ring around core (10-40%), Average core size, Odd carrot with mouse damage, Okay to average Packer, Okay to average Jumbo bit short some need weight.

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CARROT CULTIVAR MAIN TRIAL CELLO TYPES EVALUATION NOTES – 2024 - continued

Cellobunch: *Stokes sample,* Average to good length a little uneven, Poor to good width a little uneven, Uniformity of shape a little uneven, Odd carrot with bends and curves, Tapered and full tips matured, Average to good appearance, Some ringy carrots, Average to good weight a little uneven, Fairly smooth, Fair exterior colour slightly uneven, 1 to 2 or 2 to 3 cavity spots per root, Poor to good interior blending slightly even, White or green in core (10-20%), Translucent throughout core (10%), Red or green ring around core (20%), Small to average core size, Packer/Jumbo split of 60/40, Average to good Packer, Average to good Jumbo, Jumbos are an oversized packer.

Fortedo: *Vilmorin sample,* Nantes carrot, Poor to average length slightly even, Some lengths a bit short, Average to good width slightly even, Uniformity of shape even, Odd carrot with bends and curves, Full tips matured some immature, Average to good appearance, Odd ringy carrot, Odd noticeable lenticle, Average to good weight even, Fairly smooth, Fair exterior colour slightly even, Some noticeable cavity spot, 1 to 2 through to 4 to 5 cavity spots per root, Average to nice interior blending, White in core (10%), Translucent core dead center (10%), Red to green ring around core (10-40%), Small to large core size, A lot of canker rot, Okay to good Packer, Okay to good Jumbo bit short.

Istanbul: *Bejo sample,* Average to good length uneven, Average to good width uneven, Uniformity of shape even, Odd carrot with bends and curves, Tapered tips matured, Average to good appearance, Odd ringy carrot, Average to good weight a little uneven, Fairly smooth, Fair to good exterior colour slightly uneven, Odd noticeable cavity spot, 1 to 2 cavity spots per root, Good interior blending even, Translucent throughout core (10%), Red ring around core (20-40%), Average core size, Odd carrot with mouse damage, Average to good Packer, Average Jumbo, Jumbos are an oversized packer.

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CARROT CULTIVAR MAIN TRIAL CELLO TYPES EVALUATION NOTES – 2024 - continued

Trallyance: *Stokes sample,* Nantes carrot, Longer carrots have slicer potential, Average to good length slightly even, Average width a little uneven, Uniformity of shape even, Full tips matured, Average to good appearance, Odd noticeable lenticel, Average weight a little uneven, Fairly good smoothness, Fair exterior colour slightly pale a little uneven, 1 to 2 cavity spots per root, Average interior blending, White in core (10%), Translucent core dead center (10%), Green ring around core (10-30%), Average core size, Average to good Packer, Average to good Jumbo needs a bit more weight.

Orange Slice: *Seminis sample,* Average to good length slightly uneven, Okay to good width slightly uneven, Uniformity of shape a little uneven, Tapered and full tips matured, A little rough appearance, Odd ringy carrot, Average to good weight a little uneven, Smoothness a little poor, Slightly poor to fair exterior colour uneven, 1 to 2 cavity spots per root, Average to nice interior blending slightly even, White in core (10%), Translucent core dead center (10%), Red ring around core (40-90%), Small to average core size, Odd carrot with mouse damage and bumpy lenticles, Okay to good Packer, Jumbos are an oversized packer.

Enterprise: *Stokes sample,* Average to good length uneven, Okay to average width very uneven, Uniformity of shape even, Odd carrot with bends and curves, Tapered and full tips matured, A little rough to average appearance, Odd ringy carrot, Average weight uneven, Fairly smooth some a little rough, Fair dark exterior colour slightly uneven, 1 to 2 cavity spots per root, Average interior blending a little uneven, White or green in core (10-20%), Translucent core dead center (10%), Red ring around core (50-60%), Average to large core size, Odd carrot with mouse damage, Average Packer, Okay Jumbo, Jumbos are an oversized packer.

Jefferson: *Bejo sample,* Average to good length uneven, Poor to good width very uneven, Uniformity of shape even, Odd carrot with bends and curves, Tapered tips matured, A little rough to average appearance, Weight uneven, Fairly good smoothness, Fair exterior colour uneven, 1 to 2 or 2 to 3 cavity spots per root, Average interior blending a little uneven, White in core (10%), Red ring around core (60-100%), Average core size, Packer/Jumbo split of 60/40, Okay to good Packer, Average Jumbo, Jumbos are an oversized packer.

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CARROT CULTIVAR MAIN TRIAL CELLO TYPES EVALUATION NOTES – 2024 - continued

Copperhead: *Illinois sample,* Cut & peel carrot, Good long length uneven, Poor to average width uneven, Some widths thin, Uniformity of shape even, A few carrots with bends and curves, Tapered tips matured, A little rough appearance, Some ringy carrots, Weight uneven, Smoothness rough, Fair exterior colour slightly uneven, 1 to 2 cavity spots per root, Average to good interior blending even, White in cores (10%), Red ring around core (60-100%), Average to large core size, Lumpy lenticles, Poor Jumbo.

Junction: *Bejo sample,* Cut & Peel blood, Good long length uneven, Okay to good width uneven, Uniformity of shape even, Odd carrot with bends and curves, Tapered tips matured odd one immature, A little rough to average appearance, Some ringy carrots slight concern, Average weight uneven, Smoothness a little rough, Fair dark exterior colour slightly uneven, 1 to 2 cavity spots per root, Average to good interior blending a little uneven, Translucent throughout core (20%), Red ring around core (30-60%), Average to large core size, Average to good Packer odd one thin, Jumbos are an oversized packer.

Orange Fancy: *Seminis sample,* Larger carrots have slicer potential, Average length slightly uneven, Okay to good width slightly uneven, Uniformity of shape a little even, Odd carrot with bends and curves, Full tips matured, Average to good appearance, Odd ringy carrot, Average to good weight uneven, Fairly good smoothness, Good exterior colour even, Odd noticeable cavity spot, 1 to 2 cavity spots per root, A little poor to average interior blending slightly uneven, White in core (20%), Translucent throughout core (40-60%), Red ring around core (40-60%), Average core size, Odd carrot with mouse damage, Okay to nice Packer, Okay to average Jumbo needs more weight.

CARROT CULTIVAR MAIN TRIAL JUMBO TYPES EVALUATION NOTES – 2024

Orchestro: *Vilmorin sample,* Okay to average length even, Okay to good width slightly uneven, Uniformity of shape uneven, Tapered and full tips matured, A few noticeable bumpy lenticles, Heavy shoulders, Average appearance, Average to good weight a little uneven, Fairly smooth, Fair to good exterior colour even, 1 to 2 cavity spots per root, Average interior blending uneven, Yellow in core (10%), Translucent throughout core and dead center (20-40%), Yellow and green ring around core (30-70%), Average to larger core size, Packer/Jumbo split of 35/65, Okay Packer bit short, Average Jumbo bit short and could have more weight.

Brava: *Bejo sample,* Average to good length slightly uneven, Average to good width slightly even, Uniformity of shape a little even, Full tips matured, A few noticeable lenticels, Average to good appearance, Odd carrot ringy, Good weight a little uneven, Smoothness a little rough to good, Fair to good exterior colour even, Odd noticeable cavity spot, 1 to 2 cavity spots per root, Slightly poor to average interior blending, White in core (10-30%), Translucent core dead center (10%), Red ring around core (10-90%), Large to extra-large core size, Poor Packer short, Good to nice Jumbo some bit short.

Navedo: *Bejo sample,* Good length very even, Good width very even, Uniformity of shape even, Full tips matured, A few noticeable lenticles, Good to nice appearance, Some ringy carrots, Average to good weight even, Fairly good smoothness, Good exterior colour even, 1 to 2 or 2 to 3 cavity spots per root, Average interior blending, White in cores (10%), Translucent throughout core (10-40%), Red ring around core (20-50%), Average to large core size, Odd carrot with mouse damage and Sclerotinia rot, Average to nice Packer some a bit short, Average to nice Jumbo needs a bit more weight.

Canberra: *Bejo sample,* Okay to average length uneven, Average to good width slightly uneven, Uniformity of shape a little uneven, Tapered and full tips matured, Heavy shoulders, A few noticeable lenticels, Average appearance, Carrots a touch ringy, Average to excellent weight a little uneven, A little rough to fairly smooth, Fair to good exterior colour even, Odd noticeable cavity spot, 1 to 2 or 2 to 3 cavity spots per root, Good to nice interior blending even, Large to extra-large core size, Poor to okay Packer, Average to good Jumbo a few short.

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CARROT CULTIVAR MAIN TRIAL JUMBO TYPES EVALUATION NOTES – 2024

Calindor: *Illinois sample,* Average to good length even, Average to good width slightly even, Uniformity of shape slightly even, Full tips matured, Odd noticeable lenticel, Average to good appearance, Average to good weight even, Fairly good smoothness, Fair exterior colour even slight marbling, Odd noticeable cavity spot, 1 to 5 cavity spots per root, Poor to good interior blending uneven, White or yellow in cores (10-30%), Translucent throughout core or dead center (20%), Red, yellow or green ring around core (10-40%), Large core size, Odd carrot with mouse damage, Lots of green shoulders, Okay to good Packer, Average to nice Jumbo.

Trophy Pak: *Stokes sample,* Average to good length even, Average to good width slightly even, Uniformity of shape even, Odd carrot with bends and curves, Tapered tips matured, Some with heavy shoulders, A few noticeable lenticels, Average appearance, Odd ringy carrot, Average weight a little uneven, Fairly smooth, Fair exterior colour slightly even, 1 to 2 cavity spots per root, Average to good interior blending even, White in cores (10%), Red ring around core (90-100%), Large core size, Odd carrot with mouse damage, Average to good Packer a bit short, Okay to average Jumbo, Jumbos are an oversized packer.

Baldio: *Bejo sample,* Average to good length even, Average to good width even, Uniformity of shape even, Full tips matured, Odd noticeable lenticel, Average to nice appearance, Odd ringy carrot, Good weight a little even, Fairly good smoothness, Fair exterior colour slightly pale even, 1 to 2 cavity spots per root, Poor to average interior blending a little uneven, White in cores (10-30%), Translucent throughout core or dead center (10%), Red or green ring around core (10-30%), Large to extra-large core size, Poor to average Packer a bit short, Good to nice Jumbo.

Belgrado: *Bejo sample,* Average to good length a little uneven, Average to good width slightly uneven, Uniformity of shape a little even, A few carrots with bends and curves, Full tips matured, Odd noticeable lenticels, Average to good appearance, Some ringy carrots, Average to good weight a little uneven, Fairly smooth, Fair exterior colour slightly pale even, 1 to 3 cavity spots per root, Poor to average interior blending slightly uneven, White in cores (10-20%), Red or green ring around core (10-50%), Large to extra-large core size, Odd carrot with mouse damage, Poor of okay Packer a bit short, Average to good Jumbo needs a bit more weight.

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CARROT CULTIVAR MAIN TRIAL JUMBO TYPES EVALUATION NOTES – 2024

Berlin: *Bejo sample,* Good to nice length slightly even, Average to nice width slightly uneven, Uniformity of shape even, Odd carrot with bends and curves, Full tips matured, Odd noticeable lenticel, Average to good appearance, Odd ringy carrot, Average to excellent weight a little uneven, Fairly smooth, Fair exterior colour even, Some noticeable cavity spot concern, 2 to 6 cavity spots per root, Poor interior blending uneven, White in cores (60-90%), Red or green ring around core (30-40%), Large to extra-large core size, Poor to okay Packer a bit short, Average to nice Jumbo.

Bastia: *Bejo sample,* Good length even, Average to good width slightly even, Uniformity of shape even, Odd carrot with bends and curves, Tapered and full tips matured, Odd noticeable lenticel, Average to good appearance, Odd ringy carrot, Average to good weight even, Fairly smooth, Fair to good exterior colour slightly even, Odd noticeable cavity spot, 1 to 2 or 3 to 4 cavity spots per root, Good to nice interior blending even, Red ring around core (10-40%), Large to extra-large core size, Odd carrot with mouse damage, Okay Packer a bit too short, Average to good Jumbo some need a bit more weight.

EXP 3497: *Bejo sample,* Poor to nice length uneven, Okay to good width slightly even, Uniformity of shape uneven, Odd carrot with bends and curves, Tapered and full tips matured, Noticeable lenticels, A little rough appearance, Some ringy carrots concern, Poor to good weight uneven, Smoothness a little rough, Fair exterior colour slightly even, Odd noticeable cavity spot, 1 to 2 or 2 to 3 cavity spots per root, Poor to average interior blending, White, yellow or green in core (10-40%), Translucent throughout core (30%), Red or green ring around core (10-50%), Large to extra-large core size, Poor to okay Packer a bit short, Poor to good Jumbo a little uneven.

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CARROT CULTIVAR MAIN TRIAL JUMBO TYPES EVALUATION NOTES – 2024

Silver Star: *Seminis sample,* Average to good length uneven, Average to good width slightly uneven, Uniformity of shape a little uneven, Odd carrot with bends and curves, Full tips matured some immature, Odd noticeable lenticel, Average to good appearance, Odd carrot ringy, Average to good weight a little even, Fairly nice smoothness, Fair to good exterior colour slightly uneven, 1 to 2 cavity spots per root, Average interior blending a little even, White in core (10-20%), Translucent throughout core (20-60%), Red ring around cores (20-60%), Average to extra-large core size, Odd carrot with mouse damage, A lot of split carrots, Okay to good Packer, Okay to good Jumbo

Tangerina: *American Takii sample,* Okay length short uneven, Good width slightly uneven, Uniformity of shape even, Tapered and full tips matured, Slightly noticeable lenticels, Average to good appearance, Odd ringy carrot, Average to good weight a little uneven, Good smoothness, Fair to good exterior colour even, Odd noticeable cavity spot, 1 to 2 cavity spots per root, Poor to good interior blending a little uneven, White in core (10-20%), Translucent throughout core (40%), Red ring around core (60-100%), Large to extra-large core size, Odd carrot with cracks, Sclerotinia rot and mouse damage, Poor Packer bit short, Okay to good Jumbo slightly short.

CARROT CULTIVAR ADAPTATION TRIAL - 2024

Cultivar	Source	# Carrots Harvested	# > 4.4 cm	# 2.0 to 4.4 cm	Total Harvest Weight (kg)	Weight > 4.4 cm (kg)	Weight 2.0 to 4.4 cm (kg)	Marketable Yield t/ha	Marketable Yield bu/A	% Marketable	% Oversize	Majority of Culls
CALANTIS	EZ	108	7	75	13.17	1.66	9.03	53.5	861	81.2	12.6	SM
CARIANA	EZ	102	4	66	12.97	1.13	8.15	46.4	747	71.5	8.7	SM
FCR 18765	ILL	90	11	49	14.18	3.23	6.63	49.3	794	69.5	22.8	SM
FCR 17650	ILL	62	18	12	13.47	5.22	1.85	35.4	569	52.5	38.8	Sp
CALIBRA	EZ	87	1	35	12.37	0.26	4.63	24.5	394	39.5	2.1	Sp

Listed in order of % Marketable.

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CARROT CULTIVAR ADAPTATION TRIAL - 2024 - continued

Cultivar	Source	Shape	Uniformity of Shape	Uniformity of Length	Uniformity of Width	Appearance	Resistance to Greening	External Colour	External Colour Rating	Internal Colour	Internal Colour Rating	Score	Blight Rating
CALANTIS	EZ	Cyl	6.0	6.0	6.0	6.0	9.0	O	7.0	O	7.0	6.71	8.0
CARIANA	EZ	MIX	3.0	5.0	6.0	4.0	8.0	DO	6.0	O	6.0	5.43	7.0
FCR 18765	ILL	N	6.0	6.0	6.0	6.0	8.0	O	6.0	O	7.0	6.43	8.0
FCR 17650	ILL	F	5.0	6.0	7.0	6.0	8.0	O	7.0	LO	5.0	6.29	9.0
CALIBRA	EZ	ImpCyl	8.0	6.0	7.0	5.0	8.0	DO	7.0	O	8.5	7.07	9.0

Listed in order of % Marketable. 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

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CARROT CULTIVAR ADAPTATION TRIAL - 2024 - continued

Cultivar	Source	% Core of Total Width	% Cavity Spot & Degree	Shape of Crown	Root Length (cm)	Root Width (cm)	Seeding Rate	Stand per Foot	Leaf Heights (cm)	Leaf Colour	Leaf Structure	% Weevil Damage	% Rust Fly Damage	Average # of Seeders	% Aster Yellows
CALANTIS	EZ	43.2	25L	CV	17.9	3.4	25	14	46.7	G	ST	0.0	0.0	0.0	0.0
CARIANA	EZ	46.2	5L	CV	18.1	3.6	25	13	50.3	G	ST	0.0	0.0	1.0	0.0
FCR 18765	ILL	46.7	20L	CC	16.3	3.6	20	12	50.5	G	ST	0.0	0.0	4.0	0.0
FCR 17650	ILL	60.1	50L	CC	18.3	5.1	20	8	49.2	G	ST	0.0	0.0	0.0	1.6
CALIBRA	EZ	48.7	5L	CV	20.8	3.5	25	11	50.4	G	ST	0.0	0.0	1.0	0.0

Listed in order of % Marketable.

ADAPTATION CARROT CULTIVAR TRIAL EVALUATION NOTES - 2024

Calantis: *Enza Zaden,* Okay to average length slightly uneven, Okay width slightly thin uneven, Uniformity of shape alittle even, Full tips matured 80%, Appearance a little rough, Carrots ringy a little concern, Weight a little poor, Smoothness a little rough, Fair exterior colour even, 2 to 3 cavity spots per root, Good interior blending even, White in cores (10%), Red ring around core (10%), Average core size mixed, Okay Packer some too short, Poor Jumbo.

Cariana: *Enza Zaden,* Okay length uneven, Average width slightly uneven, Uniformity of shape very uneven, Odd carrot with bends and curves, Tapered & full tips matured, Rough appearance, Carrots ringy a concern, Average weight, Smoothness a little rough, Slightly dark exterior colour slightly uneven, 1 to 2 cavity spots per root, Average interior blending, Translucent through core (20%), Red ring around core (20%), Large core size, Poor to okay Packer, Poor Jumbo.

FCR 18765: *Illinios sample,* Nantes, Okay length slightly uneven, Average to good width a little uneven, Uniformity of shape a little even, Full tips matured, Appearance a little rough, Carrots slightly ringy, Average weight a little uneven, Smoothness a little rough, Fair exterior colour slightly dark, 1 to 2 cavity spots per root, Average to good interior blending even, Red ring around core (20%), Average and large core size mixed, Okay packer, Poor to okay Jumbo uneven short needs weight.

FCR 17650: *Illinios sample,* Okay length slightly short and uneven, Average to good width even, Uniformity of shape a little uneven, Full tips matured (30%) immature (70%), Lenticels slightly noticeable, Appearance a little rough, Some carrots ringy, Good weight even, Smoothness a little rough, Fair exterior colour slightly uneven, 2 to 3 cavity spots per root, Poor to average interior blending slightly uneven, White in cores (10%), Translucent core dead center (10%), Red ring around core (80%), Large to extra large core size, Poor packer short, Okay Jumbo short.

Calibra: *Enza Zaden,* Average length slightly uneven, Okay width slightly even, Uniformity of shape even, Tapered & full tips matured (70%) immature (30%), Appearance a little rough, Ringy carrots, Average weight even, Smoothness a little rough, 1 to 2 cavity spots per root, Good interior blending even, Translucent through core (10%), Green ring around core (10%), Average to large core size, Okay Packer, Poor Jumbo, Rough sample, a lot of potential lesion nematode damage.

Check out the Muck Crops Research Station's You Tube Account

The Muck Crops Research Station launched a YouTube channel in 2021. The account communicates brief videos of the Station's IPM program, variety trial results, past Muck Conferences and other information to our growers, industry reps and academic personnel. We hope the information will be helpful to our followers. So take some time, check out our channel and stay informed.

Simply type in:

"Muck Crops IPM" on YouTube to find us we're the first result.

or follow this link www.youtube.com/@muckcrops

LONG TERM AVERAGES OF CARROT CULTIVAR TRIALS

CULTIVAR	SOURCE	# Years Tested	Length (cm)	Length (Inches)	Width (cm)	Marketable t/ha	Martketable bu/A	% Marketable	Avg Leaf Length (cm)
ACHIEVE	Sto	7	23.8	9.4	5.2	98.0	1578	82.8	53.6
ORANGE PAK	Nor	7	23.7	9.3	3.5	85.1	1369	87.1	--
ENTERPRISE	Sto	20	23.2	9.1	3.4	76.7	1241	79.2	52.1
CANADA SUPER X	Sol	14	23.3	9.2	3.4	80.8	1376	82.7	--
SV 2384	Sem	13	23.1	9.1	3.3	77.2	1250	78.6	50.1
SIX PAK	HM	20	23.0	9.1	3.5	79.0	1273	85.5	--
SUNRISE	Cro	15	23.0	9.1	3.5	86.0	1438	85.6	--
CELLOBUNCH	Sem	35	22.4	8.8	3.5	90.0	1472	81.7	49.0
FONTANA	Bejo	13	22.4	8.8	5.1	108.7	1750	88.5	46.9
ENVY	Sem	18	22.0	8.7	3.9	90.2	1453	82.1	52.3
OLYMPUS	Sto	5	21.8	8.6	3.4	73.8	1188	73.9	45.8
BASTIA	Bejo	20	21.7	8.5	5.3	94.3	1518	82.4	48.2
ISTANBAL	Bejo	8	21.5	8.5	3.5	68.2	1098	72.0	50.5
ORANGE SHERBET	Sto	10	21.2	8.3	--	73.4	1310	84.0	--

Listed in order of length.

* 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

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LONG TERM AVERAGES OF CARROT CULTIVAR TRIALS - continued

CULTIVAR	SOURCE	# Years Tested	Length (cm)	Length (Inches)	Width (cm)	Marketable t/ha	Martketable bu/A	% Marketable	Avg Leaf Length (cm)
VOLCANO	Vil	6	21.0	8.3	4.5	73.3	1181	85.9	49.3
CAROPAK	Sem	8	20.9	8.2	--	74.1	1323	85.0	--
BELGRADO	Bejo	17	20.9	8.2	5.4	102.7	1654	80.1	468.8
BLANES	Bejo	5	20.7	8.1	5.3	93.9	1512	80.2	48.2
PARAMOUNT	Sem	7	20.6	8.1	--	82.1	1467	85.0	--
ORANGE BLAZE	Sem	5	20.6	8.1	3.5	62.2	1001	80.6	56.0
NAVEDO	Bejo	6	20.5	8.1	3.6	90.8	1462	78.1	53.7
BRAVA	Bejo	6	20.4	8.0	5.7	89.0	1432	81.1	56.6
BERLIN	Bejo	13	20.2	8.0	5.6	99.6	1608	79.1	48.5
DOMINATOR	Nun	13	19.7	7.8	--	63.9	1141	85.0	--
BRILLYANCE	Sto	5	19.3	7.6	3.7	89.9	1448	81.0	52.3
NEW HALL - Cello	Bejo	9	18.7	7.4	3.5	66.6	1071	70.9	46.0
NARVIK	Bejo	5	18.1	7.1	3.6	76.9	1238	78.5	45.7
NAVAL	Bejo	14	18.0	7.1	3.6	82.0	1321	79.3	44.8

Listed in order of length.

* 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

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LONG TERM AVERAGES OF CARROT CULTIVAR TRIALS - continued

CULTIVAR	SOURCE	# Years Tested	Blight Rating *	% Cavity Spots	SCORE *	% Weevil Damage	% Rust Fly Damage	Avg # of Seeders
ACHIEVE	Sto	7	7.4	74.1	6.74	4.3	4.7	2.8
ORANGE PAK	Nor	7	6.9	--	6.82	--	--	--
ENTERPRISE	Sto	20	8.1	57.0	6.57	8.1	6.5	0.5
CANADA SUPER X	Sol	14	7.0	--	6.95	--	--	--
SV 2384	Sem	13	8.3	65.0	6.21	9.5	7.1	0.3
SIX PAK	HM	20	7.9	--	6.98	--	--	--
SUNRISE	Cro	15	8.4	--	6.82	--	--	--
CELLOBUNCH	Sem	35	7.4	57.3	6.49	7.4	5.4	2.0
FONTANA	Bejo	13	5.6	51.0	6.33	4.8	3.8	1.3
ENVY	Sem	18	7.7	71.2	6.57	7.7	9.3	1.1
OLYMPUS	Sto	5	8.3	86.0	6.31	15.8	4.5	1.1
BASTIA	Bejo	20	7.7	77.6	6.81	5.9	5.7	1.2
ISTANBAL	Bejo	8	7.4	62.0	6.80	5.8	15.6	0.0
ORANGE SHERBET	Sto	10	--	--	6.75	--	--	--

Listed in order of length.

* 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

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LONG TERM AVERAGES OF CARROT CULTIVAR TRIALS - continued

CULTIVAR	SOURCE	# Years Tested	Blight Rating *	% Cavity Spots	SCORE *	% Weevil Damage	% Rust Fly Damage	Avg # of Seeders
VOLCANO	Vil	6	8.6	28.0	7.08	12.2	13.9	0.4
CAROPAK	Sem	8	--	--	6.85	--	--	--
BELGRADO	Bejo	17	7.2	71.0	6.37	7.1	6.6	1.3
BLANES	Bejo	5	8.3	59.0	6.41	10.7	22.0	0.0
PARAMOUNT	Sem	7	--	--	6.75	--	--	--
ORANGE BLAZE	Sem	5	8.2	68.0	6.03	1.7	14.2	7.5
NAVEDO	Bejo	6	7.7	51.7	6.66	1.6	15.8	0.1
BRAVA	Bejo	6	7.5	56.0	6.54	1.1	16.9	0.1
BERLIN	Bejo	13	8.4	71.0	6.45	7.1	9.4	0.5
DOMINATOR	Nun	13	--	--	6.80	--	--	--
BRILLYANCE	Sto	5	9.1	33.0	7.39	0.1	0.3	0.1
NEW HALL	Bejo	9	7.7	66.0	6.29	11.7	10.6	2.7
NARVIK	Bejo	5	8.5	44.6	7.43	0.4	0.4	0.2
NAVAL	Bejo	14	8.1	51.6	7.14	8.5	7.7	0.2

Listed in order of length.

* 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

CARROT CULTIVAR STORAGE TRIAL - 2023 - 2024

Cultivar	Source	% Marketable	% Weight Loss	% Decay	Degree of Rot **	% Root Sprouts	% Top Sprouts
TRALLYANCE	Sto	73.1 a*	8.0 bcd	26.8 g	7.2 a-d	30.0 c-h	66.7 a-e
CARAVEL	ILL	71.9 ab	8.1 bcd	28.0 fg	8.3 ab	21.7 d-h	63.3 a-f
ORCHESTRO	Vil	70.8 abc	27.0 a	27.8 fg	8.2 ab	43.3 a-f	78.3 abc
RESISTAFLY	SN	67.7 a-d	6.7 d	32.4 d-g	7.3 a-d	45.0 a-e	75.0 a-d
RESISTAFLY IMPROVED	SN	67.6 a-d	8.4 bcd	32.4 d-g	8.7 a	31.7 c-h	76.7 a-d
NAVEDO-CELLO	Bejo	67.5 a-d	8.1 bcd	32.4 d-g	7.3 a-d	40.0 b-g	81.7 ab
SONETO	Vil	65.2 a-e	10.9 bcd	36.2 c-g	7.7 abc	5.0 h	88.3 a
JEFFERSON	Bejo	62.7 a-f	8.1 bcd	37.4 b-g	8.0 ab	75.0 a	81.7 ab
SVDN 5934	Sem	61.8 a-f	9.7 bcd	38.2 b-g	7.0 a-d	45.0 a-e	55.0 b-g
CA20-2008	ILL	50.3 a-f	9.0 bcd	49.9 b-g	6.3 a-d	8.3 gh	73.3 a-e
JUNCTION	Bejo	59.9 a-f	9.9 bcd	40.1 b-g	7.0 a-d	33.3 c-h	81.7 ab
CALTONA	SN	57.1 a-f	8.1 bcd	43.1 b-g	5.0 de	2.3 h	5.3 j
NARVIK	Bejo	56.2 a-f	7.6 d	43.8 b-g	6.5 a-d	51.7 a-d	63.3 a-f
NAVEDO JUMBO	Bejo	55.4 a-f	7.4 d	44.6 b-g	7.5 abc	26.7 c-h	76.7 a-d
BRILLYANCE	Sto	55.2 a-f	7.8 cd	44.8 b-g	6.8 a-d	11.0 fgh	43.3 e-i
FORTEDO	Vil	53.7 a-f	6.8 d	46.3 b-g	6.0 bcd	9.0 gh	43.3 e-i
BELGRADO	Bejo	51.8 a-f	7.3 d	48.3 b-g	6.7 a-d	4.7 h	33.3 f-j

Listed in order of % Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

** 10.0 = No Disease, 6.0 = Moderate, 1.0 = Severe (liquified)

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CARROT CULTIVAR STORAGE TRIAL - 2023 - 2024 continued

Cultivar	Source	% Marketable	% Weight Loss	% Decay	Degree of Rot **	% Root Sprouts	% Top Sprouts
BALDIO	Bejo	50.7 a-f*	7.5 d	49.1 b-g	7.5 abc	26.7 c-h	66.7 a-e
BRAVA	Bejo	50.5 a-f	10.5 bcd	33.2 d-g	6.7 a-d	43.3 a-f	75.0 a-d
SIRKANA	Sto	50.5 a-f	9.9 bcd	49.4 b-g	7.5 abc	1.7 h	50.0 c-i
CA20-2011	ILL	60.2 a-f	9.2 bcd	39.9 b-g	7.3 a-d	15.0 e-h	53.3 b-h
ENVY	Sto	49.8 a-f	8.8 bcd	50.3 b-g	6.0 bcd	68.3 ab	75.0 a-d
CELLOBUNCH	Sto	49.6 a-f	8.5 bcd	49.2 b-g	7.0 a-d	28.3 c-h	75.0 a-d
NAVAL	Bejo	47.2 a-f	8.4 bcd	52.7 b-g	7.5 abc	55.7 abc	58.3 a-f
SV 2384	Sto	45.5 a-g	11.2 bcd	54.7 a-f	5.5 cd	29.3 c-h	23.3 hij
ARPEGGIO	Vil	43.7 b-g	10.8 bcd	56.2 a-e	6.2 bcd	21.7 d-h	46.7 d-i
BASTIA	Bejo	42.8 c-g	13.6 b	57.2 a-e	6.7 a-d	6.0 h	24.0 hij
ISTANBUL	Bejo	40.7 d-g	9.5 bcd	30.9 efg	8.3 ab	9.0 gh	70.0 a-e
ENTERPRISE	Sto	40.4 d-g	11.8 bcd	59.5 a-d	6.0 bcd	9.0 gh	21.0 ij
BERLIN	Bejo	39.0 efg	8.2 bcd	61.1 abc	6.7 a-d	48.3 a-e	56.7 b-g
85193	Sto	37.3 efg	10.2 bcd	62.7 abc	5.3 cd	5.7 h	65.0 a-e
SVDN 5904	Sem	35.8 fg	10.8 bcd	64.2 ab	5.3 cd	32.3 c-h	55.0 b-g
TROPHY PAK	Sto	18.9 g	13.6 bc	81.0 a	2.7 e	3.0 h	26.7 hij
Trial Average		**53.0**	**9.7**	**45.6**	**6.8**	**26.9**	**58.4**

Listed in order of % Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

** 10.0 = No Disease, 6.0 = Moderate, 1.0 = Severe (liquified)

MAIN CARROT CULTIVAR STORAGE TRIAL EVALUATION NOTES 2023-2024

Trallyance: *Stokes sample,* Top sprouts just starting to moderate 0-5cm, Tops sprouts uneven lengths, Root sprouts light to moderate 1-2.5cm, Mostly tip rot, A few canker rot, Rot is just starting to moderately established, Rot is dry or moist, Type of rot sclerotinia or botrytis, Stored okay to good.

Caravel: *Illinois sample,* Top & root sprouts just starting to light 0-2.5cm, Majority canker rot, Odd tip rot, Rot is just starting to lightly established, Rot is dry, Stored excellent.

Orchestro: *Vilmorin sample,* Top sprouts light 1-2.5cm, Root sprouts just starting to light 0-1cm, Majority canker rot, Odd tip rot, Rot is just starting to slightly moderately established, Rot is dry, Type of rot sclerotinia, Stored good to excellent.

Resistafly: *Seminova sample,* Top sprouts just starting to moderate 0-5cm, Top sprouts are a slight concern, Root sprouts just starting 0-1 cm, Majority canker rot, A few tip rot, Rot is just starting to lightly established, Rot is dry or moist, Rot is a slight concern, Type of rot sclerotinia, Stored good to excellent.

Resistafly: **Improved** *Seminova sample,* Top sprouts light to moderate 1-2.5cm, Top sprouts slightly uneven lengths, Root sprouts just starting to light 0-1cm, Majority tip rot, A few canker rot, Rot is just starting, Rot is dry or moist, Stored good to excellent.

Navedo: **Cello** *Bejo sample,* Top sprouts light to moderate 1-2.5cm, Root sprouts just starting 0-1cm, Majority canker rot, A few tip rot, Rot is just starting to moderately established, Rot is dry or moist, Type of rot sclerotinia or botrytis, Stored good to excellent.

Soneto: *Vilmorin sample,* Top sprouts moderate 1-5cm, Top sprouts are a slight concern, Root sprouts just starting to light 0-2.5cm, Majority canker rot, A few tip rot, Rot is just starting to moderately established, Rot is dry, Type of rot sclerotinia, Stored okay to excellent.

Jefferson: *Bejo sample,* Top sprouts just starting to moderate 0-2.5cm, Root sprouts moderate 1-2.5cm, Root sprouting is a concern, Majority tip rot, Odd canker or crown rot, Rot is just starting to slightly established, Rot is dry or moist, Stored fair to excellent.

.../continued

MAIN CARROT CULTIVAR STORAGE TRIAL EVALUATION NOTES 2023-2024 - continued

SV DN 5934: *Seminis sample,* Top sprouts just starting to light 0-2.5cm, Tops sprouts uneven lengths, Root sprouts light to moderate 0-2.5cm, Majority tip rot, A few canker rot, Rot is lightly to moderately established, Rot is dry or moist, Rot is a concern, Type of rot sclerotinia or botrytis, Stored fair to good.

CA 20-2008: *Illinois sample,* Top sprouts light to moderate 1-5cm, Top sprouts slightly uneven lengths, Root sprouts just starting 0-1cm, Majority canker rot, Odd tip rot, Rot is just starting to moderately established, Rot is dry or moist, Stored poor to good.

Junction: *Bejo sample,* Top sprouts just starting to light 0-2.5cm, Root sprouts just starting 0-1cm, Majority tip rot, Odd crown rot, Rot is just starting to moderately established, Rot is dry or moist, Type of rot sclerotinia or botrytis, Stored fair to excellent.

Caltona: *Seminova sample,* Top & root sprouts just starting 0-1cm, Majority tip rot, Odd crown rot, Rot is lightly to heavily established, Rot is moist, Type of rot sclerotinia or botrytis, Stored poor to very good.

Narvik: *Bejo sample,* Top sprouts just starting to light 0-2.5cm, Root sprouts just starting to moderate 0-5cm, Majority tip rot, Odd canker or crown rot, Rot is just starting to moderately established, Rot is dry or moist, Rot is a slight concern, Type of rot sclerotinia or botrytis, Stored fair to good.

Navedo: *Bejo sample,* Top & root sprouts just starting to moderate 0-2.5cm, Majority tip rot, A few canker rot, Rot is just
Jumbo starting to heavily established, Rot is dry or moist, Rot is a concern, Type of rot sclerotinia or botrytis, Stored a little poor to good.

Brillyance: *Stokes sample,* Top sprouts just starting to moderate 0-5cm, Root sprouts just starting to light 0-2.5cm, Majority tip rot, A few canker rot, Odd crown rot, Rot is just starting to moderately established, Rot is dry or moist, Type of rot sclerotinia or botrytis, Stored a little poor to good.

Fortedo: *Vilmorin sample,* Top & root sprouts just starting 0-1cm, Majority tip rot, A few canker rot, Rot is light to moderately established, Rot is moist, Rot is a concern, Type of rot sclerotinia or botrytis, Stored fair.

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MAIN CARROT CULTIVAR STORAGE TRIAL EVALUATION NOTES 2023-2024 - continued

Belgrado: *Bejo sample,* Top sprouts just starting to light 0-1cm, Root sprouts are just starting 0-1cm, Majority tip rot, Odd canker rot, Rot is just starting to established, Rot is dry or moist, Type of rot sclerotinia or botrytis, Stored good.

Baldio: *Bejo sample,* Top sprouts just starting to moderate 1-2.5cm, Top sprouts uneven lengths, Root sprouts just starting to light 0-2.5cm, Majority canker rot, Odd tip rot, Rot is just starting to lightly established, Rot is dry, Type of rot sclerotinia, Stored fair to good.

Brava: *Bejo sample,* Top sprouts light to moderate 1-5cm, Root sprouts just starting to moderate 1-2.5cm, Majority tip rot, Odd canker rot, Rot is just starting to moderately established, Rot is dry or moist, Rot is a concern, Type of rot sclerotinia, Stored a little poor to good.

Sirkana: *Stokes sample,* Top & root sprouts just starting 0-1cm, Majority canker rot, A few tip rot, Rot is just starting to moderately established, Rot is dry, Type of rot sclerotinia or botrytis, Stored okay to excellent.

CA 20-2011: *Illinois sample,* Top & root sprouts just starting to light 0-2.5cm, Top sprouts slightly uneven lengths, Majority canker rot, Odd tip rot, Rot is just starting to moderately established, Rot is dry or moist, Stored fair to excellent.

Envy: *Stokes sample,* Top sprouts just starting to light 0-2.5cm, Root sprouts just starting to moderate 0-5cm, Majority tip rot, A few crown or canker rot, Rot is just starting to moderately established, Rot is dry or moist, Type of rot sclerotinia or botrytis, Stored okay to fair.

Cellobunch: *Stokes sample,* Top & root sprouts just starting to light 1-2.5cm, Majority tip rot, A few canker rot, Rot is just starting to slightly established, Rot is dry, Type of rot sclerotinia or botrytis, Stored good.

Naval: *Bejo sample,* Top sprouts just starting to light 0-2.5cm, Root sprouts just starting to heavy 0-5cm, Root sprouting is a concern, Majority canker rot, A few tip rot, Rot is just starting to moderately established, Rot is dry or moist, Rot is a concern, Type of rot sclerotinia or botrytis, Stored a little poor to good.

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MAIN CARROT CULTIVAR STORAGE TRIAL EVALUATION NOTES 2023-2024 - continued

SV 2384: *Stokes sample,* Top sprouts just starting 0-1cm, Root sprouts just starting to moderate 0-2.5cm, Tip and canker rot, Odd crown rot, Rot is lightly to moderately established, Rot is dry or moist, Rot is a concern, Type of rot sclerotinia, Stored poor to fair.

Arpeggio: *Vilmorin sample,* Top & root sprouts just starting to light 0-2.5cm, Majortiy tip rot, A few canker rot, Rot is just starting to moderatlely established, Rot is dry or moist, Rot is a concern, Type of rot sclerotinia or botrytis, Stored poor to fair.

Bastia: *Bejo sample,* Top sprouts just starting to moderate 0-5cm, Root sprouts just starting 0-1cm, Majority canker rot, A few tip rot, Rot is slightly to heavily established, Rot is dry or moist, Type of rot sclerotinia or botrytis, Stored poor to good.

Istanbul: *Bejo sample,* Top sprouts just starting to light 0-2.5cm, Root sprouts just starting 0-1cm, Majority canker rot, A few tip rot, Odd crown rot, Rot is just starting to establish, Rot is dry or moist, Stored good to excellent.

Enterprise: *Stokes sample,* Top & root sprouts just starting 0-1cm, Mostly tip rot, A few canker rot, Rot is just starting to moderately established, Rot is dry or moist, Type of rot sclerotinia or botrytis, Stored a little poor to good.

Berlin: *Bejo sample,* Top sprouts just starting to light 0-2.5cm, Top sprouts uneven lengths, Root sprouts just starting to moderate 0-2.5cm, Majority canker rot, A few tip rot, Rot is just starting to moderately established, Rot is dry or moist, Rot is a concern, Type of rot sclerotinia or botrytis, Stored a little poor to fair.

85193: *Stokes sample,* Top sprouts just starting to moderate 0-2.5cm, Root sprouts just starting 0-1cm, Tip and canker rot, Odd crown rot, Rot is moderately established, Rot is moist, Rot is a concern, Type of rot sclerotinia, Stored poor.

SV DN 5904: *Seminis sample,* Top & root sprouts just starting to moderate 1-5cm, Tops sprouts uneven lengths, Tip or canker rot, Rot is just starting to moderately established, Rot is moist, Rot is a concern, Type of rot sclerotinia or botrytis, Stored poor to fair.

Trophy Pak: *Stokes sample,* Top sprouts just starting to light 0-2.5cm, Root sprouts just starting 0-1cm, Tip, crown and canker rot, Rot is heavily established, Rot is moist or liquefied, Rot is a concern, Type of rot sclerotinia or botrytis, Stored poor.

LONG TERM AVERAGES - CARROT CULTIVAR STORAGE TRIALS

CULTIVAR	SOURCE	# YEARS TESTED	% MARKETABLE	% WEIGHT LOSS IN STORAGE	% DECAY	DEGREE* OF DECAY
SPARTAN CLASSIC 80	Sto	4	97.6	6.8	2.4	5.5
PAK MOR	HM	6	93.5	11.5	6.5	4.2
ORANGETTE	Sto	5	92.4	16.8	7.6	6.3
ORANGE SHERBET	Sto	6	91.9	9.0	8.1	4.5
AVENGER	Sem	7	91.3	11.5	8.7	7.0
CANADA SUPER X	Sol	14	90.8	11.9	9.2	5.5
CARO-CHIEF	Sem	5	89.0	10.1	11.0	5.0
ISTANBUL	Bejo	6	88.9	14.6	6.4	7.3
ORLANDO GOLD	Sto	6	87.9	12.7	12.1	4.2
NEW HALL	Bejo	10	87.8	11.5	4.2	7.6
SIX PAK II	HM	15	87.7	12.3	12.3	5.5
VOLCANO	Vil	5	87.2	12.6	10.9	8.4
CHANCELLOR	Sem	7	86.7	11.3	13.3	4.2
CROFTON	RZ	6	84.8	11.5	3.0	7.5
INFINITY	Bejo	5	83.4	11.4	4.9	7.8
BRADFORD	Bejo	5	82.1	10.0	7.9	7.8
ENTERPRISE	Sem	17	80.8	11.3	11.9	6.6
2384	Sem	12	80.4	13.6	11.8	6.6

Listed in order of % Marketable.

Storage period is approximately 9 months.

* 10.0 = No Disease, 6.0 = Moderate, 1.0 = Severe (liquified)

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LONG TERM AVERAGES - CARROT CULTIVAR STORAGE TRIALS - continued

CULTIVAR	SOURCE	# YEARS TESTED	% MARKETABLE	% WEIGHT LOSS IN STORAGE	% DECAY	DEGREE * OF DECAY
NAVAL	Bejo	12	79.8	10.8	13.7	7.5
SIX PAK	HM	20	79.8	11.5	8.6	5.8
BELGRADO	Bejo	14	78.9	10.7	14.8	7.0
WARMIA	RZ	5	79.1	13.6	6.9	7.1
ORANGE PAK	Nor	8	78.6	13.2	8.1	6.8
SUNRISE	Cro	15	78.6	12.8	8.2	6.8
CELLOBUNCH	Sem	31	78.4	13.2	8.5	6.8
BERLIN	Bejo	11	75.8	12.2	18.0	7.0
INDIANA	Bejo	7	75.7	15.4	8.5	7.0
FONTANA	Bejo	14	75.5	11.2	13.0	6.7
DOMINION	Sem	4	74.9	13.7	11.1	5.8
BLANES	Bejo	5	73.4	12.3	22.1	6.3
ACHIEVE	Sem	8	73.0	13.0	13.6	6.4
BASTIA	Bejo	18	72.4	13.6	17.7	6.5
SIX SHOOTER	HM	5	71.5	11.0	17.5	6.0
ENVY	Sem	17	70.9	12.4	18.6	6.6
NEVADA	Bejo	4	69.1	16.5	14.2	5.8
EXTREMO	Vil	5	65.6	16.0	31.6	5.9

Listed in order of % Marketable. Storage period is approximately 9 months.

* 10.0 = No Disease, 6.0 = Moderate, 1.0 = Severe (liquified)

ONION CULTIVAR TRIAL SEASON SUMMARY – 2024

Compared to the previous 10-year average, air temperatures in 2024 were above average for May (15.4°C) and average for June (19.2°C), July (21.5°C), August (19.6°C) and September (17.6°C). The 10-year average temperatures were: May 13.4°C, June 18.6°C, July 21.1°C, August 20.4°C and September 16.8°C. Monthly rainfall was below the 10-year average for June (79 mm), August (54 mm) and September (21 mm) and above average for May (83 mm) and July (85 mm). The 10-year rainfall averages were: May 58 mm, June 95 mm, July 75 mm, August 74 mm and September 57 mm.

Above seasonal temperatures in April allowed for the ground frost to thaw and by the end of April the soil was satisfactory for seeding. Light rainfall on 27 to 30 April (26.8 mm) prior to seeding slowed land preparation but created good soil moisture levels. Onion seeding in the Holland Marsh began the last week of April and was pretty much completed by the 11th of May. The trial was seeded on 6 May. Day time air temperatures were in the high teens to low twenties, with a mix of sun and cloud and nighttime air temperatures were in the high single digits. Soil temperatures were in the low teens before and after seeding. A couple of light rain showers on 13 and 14 May aided in good emergence, plant vigor and stand. A soaking rainfall of 1 3/8 inch on 27 May encourage strong onion seedling growth. By 31 May the first true leaf was fully grown, and the second true leaf was approximately 1 inch in length. Two low herbicide applications of Goal and Pardner were applied at the recommended rate on 31 May and 4 June to cleaned up broadleaf weeds. A heavy weed flush of grasses remained and required a grass herbicide application on 11 June. Timely Prowl herbicide applications with good soil moisture provided additional weed control. Weed pressure decreased as the season progressed, however a couple of hand weeding events were required to keep the trial free from weeds. Even with the below average rainfall amount in June and average rainfall in July, the onions maintained steady growth. When leaf lengths were recorded in the week of 17 July, the average leaf length was 68.6 cm, a 2.8 cm increase in length compared to the 2023 trial average heights.

On-station monitoring for onion maggot fly emergence began on 10 May with 0.68 flies/trap/day. There were no distinctive peaks in onion maggot fly numbers during the monitoring period. The highest count was reached on 22 July of 1.69 flies/trap/day. For the entire monitoring period onion maggot fly numbers continually had small waves of increasing and decreasing populations. Onion maggot populations were extremely low for the entire season. At evaluation there was a trial average of 0.8% onion maggot damage. This was a record low for damage in the main onion variety trial. The onions with the Sepresto seed treatment has certainly lowered onion maggot damage.

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ONION CULTIVAR TRIAL SEASON SUMMARY - 2024 – continued

Thrips were first found on 10 June and were present throughout the growing season. Onion thrips numbers in the variety trial never reached above 1 thrips/leaf, well below the spray threshold of 3.0 thrips/leaf. The highest thrips count was 0.71 thrips/leaf on 22 August. An insecticide application of Movento on 19 July kept the thrips numbers low for the following 4 weeks. An additional Delegate applications keep thrips below 1.0 thrips/leaf for the rest of the season. Environmental conditions were moderate for fungal diseases to develop in June and July with above average seasonal precipitation. Stemphylium leaf blight was found early in the cultivar trial on 20 June and several fungicide applications (see Onion Management Procedures) kept severity low until late July. When tip burn began in late July the percentage of leaf damage increase each week in August. A rating of tip burn was evaluated and recorded on 31 July. Tip burn was at an elevated level for a second season in a row. Botrytis was not observed in the trial. Fungicide applications were applied to protect from downy mildew when the downy mildew forecast was moderate to high in July. No downy mildew developed in the trial but was found on the research station.

Bulb development started as expected in late July. Most bulb sizing occurred in early August. Cultivars Highlander (24 July) and Switchback (29 July) were the first to lodge. It took approximately three weeks for 75% of the cultivars to reach 85% lodged. Approximately half of the cultivars reached full maturity by 15 August when at least 85% of the onions had lodged. The average days to harvest (102 days) decreased 8 days compared to the 2023 season. The onion tops dried down in a satisfactory time frame. Three cultivars had seeders present, but in very low numbers. On 5 September, a sample from each cultivar was pulled for judging and comparison during Grower Field Day. By this time, most cultivars had lodged but leaves were 60-100% desiccated. All cultivars matured naturally resulting in acceptable neck finishes when yield samples were harvested on 18 and 19 September. Harvest samples from each cultivar were placed in storage on 17 October and cured artificially for approximately 48 hours.

At evaluation in late November, quality was good in most of the cultivars and yields varied between a high of 1387 to a low of 793 bushels per acre. The trial yield average was 1080 bu/A. This is a slight increase of approximately 100 bu/A from last year. The majority of the cultivars (61%) had the highest number of onions in the 3-2½" size range.

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ONION CULTIVAR TRIAL SEASON SUMMARY - 2024 – continued

The trial average for the percentage of jumbos (>3" diameter) was 13.3%, which is an increase from 2023 (10%) and comparable to the 2022 trial. A third of the cultivars had a percentage of jumbos greater then 15%. Uniformity of size rating was only an average 6.2. Cultivar Milestone received the best uniformity of size rating of 7.7, while a third of the cultivars had a below average rating. The uniformity of shape had a below average rating of 5.6. During evaluation shapes were highly variable within the individual samples. Only three cultivars had a rating of 7.0 or greater for uniformity of shape and 50 % of the cultivars had a rating below average for uniformity of shape. The average stand count was 7.0 plants/ft down from 8.4 plants/ft in 2023. Stand counts were below 6.0 plants/ft for six cultivars. The vast majority of unmarketable onions (culls) were undersized onions (peewees). The trial average for marketable onions was 94%, which is a 6.7% increase from the 2023 trial. Only one cultivar had a percent marketable below 90%. Skin quality improved compared to the previous year. Skin thickness had a average trial rating of 6.0. Skin attachment had a good rating of 8.0 with only the odd one having skin cracking in most cultivars. There was no skin rot found in the trial. Exterior colour was good in most cultivars with 17 cultivars having a good or higher rating (7.0+). There was very low amount of onions with mechanical damage. Greening of the outer scales and yellow or white speckling on the outer skins was present but very limited. When onions were cut in half for interior colour evaluation, it was noted that 73.4% of the cultivars had a high percentage of double or multiple centers which was a decrease of approximately 10% from 2023. Cultivars Hamilton, Bronstone and Yakama had the highest percentage of single centers at 80, 70 and 66.7%, respectively. Neck finish was good with a trial average of 7.5. There were limited rough finishes and most were found in the longer to mature cultivars. Cultivars Trial Blazer, Highlander and Yakama had the best neck finish ratings of 9.0, 9.0 and 8.7, respectively. At evaluation all cultivars had maintained good firmness and cultivars Lodestar, Safrane and Skyline had the best firmness with a rating of excellent, (9.7). Maggot damage in the evaluation samples ranged from 0 – 4.9% with a trial average of 0.8%. This is lowest average percent onion maggot damage ever. Seven cultivars had no onion maggot damage. Cultivar Haeckero had the highest percentage of onion maggot damage. The seed treatment of Sepresto has significantly increased onion maggot control and decreased damage. When the onions were cut in half horizontally, a very small hole was observed near the heart of the onion. Center hollowness was found in all cultivars, with a trial average of 42.8%. This was a 10% increase compared to the 2023 trial. A significant difference was found between the second and third replicate which had 17% fewer onions with hollowness in the center.

ONION CULTIVAR TRIAL – 2024

MANAGEMENT PROCEDURES

Fertilizer:

90 kg/ha Nitrogen (Calcium Ammonium Nitrate 27-0-0) + 100 kg/ha Phosphorous (MESZ 10-40-0) + 200 kg/ha Potassium (ASPIRE 0-0-58) + 125 kg/ha K–Mag (0-0-22) + 35 kg/ha Manganese + 7 kg/ha Copper (99% Cu) + 3.5 kg/ha Boron was worked into the soil on 1 May.

A side dressing blend of 12 kg/ha Nitrogen + 10 kg/ha Phosphorous + 75 kg/ha Potassium was applied on 18 July.

Seeded:

All trials were seeded on 6 May. Pelletized onion seed was seeded with a Stanhay Precision Seeder. Raw onion seed was seeded with a V-Belt seeder equipped with a 5 cm wide scatter shoe. Row spacing was 43 cm. The Main Trial was replicated three times.

Weed Control:

Pre-emergence:	1 application: **PARDNER** at 140 ml/ha and **GOAL** at 210 ml/ha and Manganese at 1.0 kg/ha on 10 May.
Post-emergence:	2 applications: **PARDNER** at 70 ml/ha and **GOAL** at 100 ml/ha and Manganese at 1.0 kg/ha on 31 May & 4 June. 2 applications: **PROWL H2O** 6.0 L/ha on 23 May and 8 June. 1 application: **SELECT** at 375 ml/ha and **AMIGO** at 3.0 L/ha on 11 June. 1 application: **GOAL** at 140 ml/ha + **PARDNER** at 140 ml/ha and Manganese at 2.0 kg/ha on 13 June.

Minor Elements:

Nine foliar sprays: Mag Max on 6, 15, 24 & 28 June (2.0 L/ha) and 12, 19 & 25 July and 2 &10August (4.0 L/ha)
Seven foliar sprays: Calcimax on 15, 24 & 28 June (2.0 L/ha) and 12, 19 & 25 July and 2 August (4.0 L/ha)
Seven foliar sprays: Zinc Max on 6, 15 & 24 June (2.0 L/ha) and 12, 19 & 25 July and 10 Aug (4.0 L/ha)

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ONION CULTIVAR TRIAL - 2024 - continued

Minor Elements continued:

Six foliar sprays: Manganese Sulfate on 6 June (1.0 kg/ha) and 15 & 28 June, 12 & 25 July and 10 August (2.0 kg/ha)
Six foliar sprays: Alexin on 12, 19 & 25 July and 2, 10, & 15 August (4.0 L/ha)
Six foliar sprays: Suprafeed on 12 July (2.0 kg/ha) and 19 July (3.0 kg/ha) and 25 July and 2, 10 & 15 August (4.0 kg/ha)
Six foliar sprays: Copper Max 15 August (1.0 L/ha) and 12, 19 & 25 July and 2 & 10 August (2.0 L/ha)
Four foliar sprays: 20-20-20 on 6 June (1.0 kg/ha), and 15, 24 & 28 June (2.0 kg/ha)
Four foliar sprays: Nutri Bor on 19 July (500 ml/ha) and 15 August (1.0 L/ha) and 2 & 10 August (2.0 L/ha)

Insect and Disease Control:

According to IPM recommendations.

ALLEGRO 500F at 1.16 L/ha and Minor Elements on 28 June.
APROVIA TOP at 750 ml/ha + **RIDOMIL MZ** 2.25 kg/ha and Minor Elements on 12 July.
ALLEGRO 500F at 1.16 L/ha + **ZAMPRO** at 1.0 L/ha + **MOVENTO** at 365 ml/ha and Minor Elements on 19 July.
MIRAVIS DUO at 1.0 L/ha + **DELEGATE** at 336 g/ha and Minor Elements on 25 July.
SERCADIS at 666 ml/ha + **ORONDIS ULTRA** at 400 ml/ha and Minor Elements on 2 August.
RIDOMIL MZ 2.25 kg/ha + **MIRAVIS DUO** at 1.0 L/ha + **DELEGATE** at 336 g/ha and Minor Elements on 10 August.
ORONDIS GOLD at 1.0 L/ha + **APROVIA TOP** at 750 ml/ha and Minor Elements on 15 August.

Harvest:

The Main Trial was pulled on 18 and 19 September and topped. The trial was placed in a forced air and temperature-controlled storage on 17 October. The trial was cured for 48 hours (25^{o}C, minimum 65% RH). After curing the temperature was lowered 5^{o}C per week until 0^{o}C was attained.

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Sprout Inhibition:

Royal MH 30 XTRA at 8.63 L/ha in 550 L/ha water on:

August 7	August 15			August 22	August 29	September 4
Highlander	Hamilton	Fortress	Sumo	Stanley	Crockett	Copperstone
Switchback	37 346B	Killington	Lodestar SN	Skyline		
Gunnison	Catskill	Venecia	Frontier	Haeckero		
Trail Blazer	La Salle	Yakama	Y 604	Milestone		
	Safrane	Overlook	Braddock			
	37 293C	Bronstone	Lodestar			
	Thunderstone SN	Saddleback	Oneida			
	Ridge Line	Mountaineer	Powell			

EVALUATION PROCEDURES

The cultivars were evaluated 25 November through 3 December after 6 weeks in storage.

 # Bulbs Harvested:

Total number of onions harvested from 4.66 m of row.

Harvest Weight:

Weights from the harvested 4.66 m of row.

Average Weight/Bulb (g):

The total weight in grams of all bulbs divided by the total number of bulbs. A bulb 51 mm (2") in diameter weighs approximately 70 g. A bulb 57 mm (2¼") in diameter weighs approximately 100 g. A bulb 64 mm (2½") in diameter weighs approximately 135 g.

Marketable Yield bu/A:

Number of onions > 76 mm (> 3"), 76 mm to 64 mm (3" to 2 ½") and 64 mm to 32 mm (2 ½" to 1¼").

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ONION CULTIVAR TRIAL - 2024 - continued

Majority of Culls:
D = Double PW = Pee Wee R = Rot OC = Off Colours S = Seeders SP = Sprouts

Shape:
HG = High Globe FG = Flattened Globe G = Globe Sp = Spindle TD = Tear Drop T = Top

Skin Thickness:
10.0 = Most Desirable 7.5 = Good 6.0 = Average

Skin Attachment:
10.0 = Most Desirable, skins well attached 7.5 = Good, skins have a few small cracks 6.0 = Average, skins have cracks but still attached

Neck Finish:
10.0 = Most Desirable, small tight neck 6.0 = Average, neck closed, 4.0 = Poor, neck bit rough and open

Overall Score:
Based on quality and general appearance.

Score:
The average of eight evaluation ratings taken from Uniformity of Shape to Firmness.

Firmness:
10 = Desirable (solid and firm), 6.0 = Average (firm but some elasticity) 1.0 = Poor (spongy)

Interior Colour:
G = Green W = White C = Cream R = Red DR = Dark Red

Exterior Colour:
LG = Light Golden G = Golden DG = Dark Golden LC = Light Copper C = Copper DC = Dark Copper

.../continued

ONION CULTIVAR TRIAL - 2024 - continued

Days to Harvest:
Numbers of days from seeding until 85% of the tops were down.

Seed Treatments:

SE = Sepresto & Evergol Prime	SP = Spinosad	SF = FI400 & Spinosad	LD = Lorsban & Dithane
S = Sepresto	F = Fungicide	TP = Trigard & ProGro	TF = Trigard FI500

Percent Onion Maggot Damage:
Percentage of onions damaged by onion maggot ranging from pin hole to completely unmarketable that were found in the 4.66 m harvest sample.

Seeders:
Average number of seeders found in each cultivar of 20 m of row.

% Single Centers:
Percentage of onions with only one heart.

% Double Centers:
Percentage of onions with two hearts.

% Multiple Centers:
Percentage of onions with three or more hearts.

% Hollowness in Centers:
Percentage of onions with a small hollow pocket at the heart of the onion.

Top Height (cm):
The average length of 20 randomly chosen onion tops from all three replicates from the ground to the tips as taken on 17 July. 50 cm is equal to 20 inches.

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ONION CULTIVAR TRIAL - 2024 - continued

Leaf Shape:

B = Leaves are bent or hanging U = Up right leaves, straight

Leaf Colour:

LG = Light Green, G = Green, BG = Blue Green, DG = Dark Green

Tip Burn:

VL = Very light L = Low M = Moderate H = Heavy S = Severe

Irrigation:

No irrigation water was applied for the 2024 season:

ONION CULTIVAR MAIN TRIAL - 2024

Cultivar	Source	# Bulbs Harvested	# Bulbs Jumbos > 89 mm	# Bulbs Lrg 89 - 76 mm	# Bulbs Med 76 - 64 mm	# Bulbs Small 64 - 32 mm	Stand/Foot	Average Weight/Bulb (g)
MILESTONE	Sto	89 i-l*	3 abc	25 ab	44 a-h	15 kl	5.8 i-l	170.9 a-d
YAKAMA	Bejo	137 a	0 e	9 f-l	58 a	65 a-d	9.0 a	121.6 i-m
KILLINGTON	Sem	106 b-j	3 a-d	25 ab	48 a-g	27 g-l	7.0 b-j	166.2 a-e
BRONSTONE	Haz	99 f-j	4 a	22 a-d	46 a-g	23 i-l	6.5 f-j	161.3 b-g
RIDGE LINE	Tak	100 e-j	2 a-e	25 ab	43 a-i	27 g-l	6.6 e-j	171.4 abc
CATSKILL	Sto	117 a-g	1 cde	13 c-j	51 a-e	46 b-i	7.7 a-g	163.9 b-f
COPPERSTONE	Haz	86 jkl	4 ab	27 a	35 f-i	16 kl	5.6 jkl	181.7 ab
THUNDERSTONE	SN	108 b-j	0 e	6 h-l	55 abc	43 d-k	7.1 b-j	131.4 g-l
SKYLINE	Tak	86 jkl	0 e	5 i-l	41 b-i	37 e-l	5.6 jkl	131.3 g-l
SADDLEBACK	Sto	117 a-g	1 b-e	15 b-h	48 a-g	47 b-i	7.7 a-g	137.9 e-l
MOUNTAINEER	Tak	91 h-l	0 e	11 e-l	43 a-i	33 e-l	6.0 h-l	138.7 d-k
SWITCHBACK	Tak	103 c-j	0 e	8 g-l	46 a-g	44 c-j	6.7 c-j	127.6 h-m

Listed in order of % Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

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ONION CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	# Bulbs Harvested	# Bulbs Jumbos > 89 mm	# Bulbs Lrg 89 - 76 mm	# Bulbs Med 76 - 64 mm	# Bulbs Small 64 - 32 mm	Stand/Foot	Average Weight/Bulb (g)
HAECKERO	Haz	71 l*	1 de	14 c-i	34 ghi	18 jkl	4.6 l	164.0 b-e
LODESTAR	SN	121 b-j	0 e	6 h-l	50 d-i	59 a-e	7.9 a-f	131.2 g-l
LA SALLE	Sto	102 e-j	0 e	8 f-l	53 a-d	35 e-l	6.7 e-j	138.0 e-l
HIGHLANDER	Tak	111 b-i	0 e	12 e-k	45 a-g	48 b-i	7.3 b-i	131.5 f-l
SAFRANE	Bejo	102 d-j	0 e	7 g-l	44 a-h	45 b-j	6.7 d-j	127.5 h-m
OVERLOOK	Sto	113 b-h	1 de	18 a-f	51 a-e	38 e-l	7.4 b-h	142.1 c-k
FRONTIER	Tak	73 kl	0 e	12 d-j	41 c-i	15 kl	4.8 kl	152.4 b-i
37 293C	Haz	127 ab	1 b-e	17 b-g	48 a-g	53 a-g	8.3 ab	138.2 e-l
LOSESTAR	Tak	106 b-j	0 e	2 kl	39 d-i	59 a-e	7.0 b-j	115.4 j-m
HAMILTON	Bejo	126 a-d	0 e	9 f-l	52 a-e	57 a-f	8.2 a-d	126.0 i-m
FORTRESS	Sto	128 ab	0 e	1 l	40 c-i	79 a	8.4 ab	112.7 j-m
POWELL	Bejo	123 a-e	0 e	2 kl	42 b-i	71 ab	8.1 a-e	110.6 klm

Listed in order of % Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

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ONION CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	# Bulbs Harvested	# Bulbs Jumbos > 89 mm	# Bulbs Lrg 89 - 76 mm	# Bulbs Med 76 - 64 mm	# Bulbs Small 64 - 32 mm	Stand/Foot	Average Weight/Bulb (g)
GUNNISON	Bejo	114 a-h*	1 cde	9 f-l	45 a-g	52 a-h	7.5 a-h	123.2 i-m
STANLEY	CF	74 kl	4 a	23 abc	28 i	14 l	4.9 kl	197.7 a
BRADDOCK	Bejo	114 a-h	0 e	7 g-l	47 a-g	52 a-h	7.5 a-h	128.4 h-m
CROCKETT	Bejo	116 a-g	0 e	11 e-l	49 a-f	47 b-i	7.6 a-g	143.3 c-j
SUMO	CF	95 g-k	1 cde	18 a-f	44 a-h	25 h-l	6.2 g-k	159.9 b-h
Y 604	SN	104 b-j	2 a-e	20 a-e	43 a-i	31 f-l	6.8 b-j	149.9 b-i
TRAIL BLAZER	Sto	126 abc	0 e	3 jkl	45 a-g	65 a-d	8.2 abc	106.1 lm
ONEIDA	Bejo	101 e-j	3 a-d	17 b-g	37 e-i	34 e-l	6.6 e-j	151.4 b-i
VENECIA	Bejo	127 ab	0 e	13 c-j	56 ab	44 b-j	8.3 ab	141.6 c-k
37 346B	Haz	116 a-g	0 e	1 l	29 hi	70 abc	7.6 a-g	96.6 m
TRIAL AVERAGE		**107**	**1**	**12**	**45**	**42**	**7.0**	**140.9**

Listed in order of % Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

.../ continued

ONION CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	Total Harvest Weight (kg)	Wgt. Jumbo > 89 mm (kg)	Wgt. Large 89 - 76 mm (kg)	Wgt. Medium 76-64 mm (kg)	Wgt. Small 64-32 mm (kg)	Marketable Yield bu/A	% Marketable	Majority of Culls
MILESTONE	Sto	15.01 b-l*	1.08 abc	6.30 ab	5.89 ns	1.64 jk	1124 b-i	98.1 ns**	PW
YAKAMA	Bejo	16.63 a-f	0.00 d	1.89 g-p	8.75	5.82 abc	1241 a-d	96.2	PW
KILLINGTON	Sem	17.56 abc	1.07 abc	5.84 a-d	7.64	2.50 g-k	1285 ab	96.2	DPWR
BRONSTONE	Haz	15.84 b-i	1.59 a	5.15 a-e	6.86	2.03 h-k	1179 a-g	96.2	PW
RIDGE LINE	Tak	17.13 a-e	0.76 a-d	6.11 abc	7.37	2.66 g-k	1274 abc	95.9	PW
CATSKILL	Sto	19.19 a	0.36 cd	3.67 c-k	8.88	5.48 a-e	1387 a	95.9	PW
COPPERSTONE	Haz	15.56 b-j	1.33 ab	6.62 a	5.86	1.45 k	1151 b-i	95.7	PW
THUNDERSTONE	SN	14.19 f-n	0.00 d	1.37 j-p	8.44	4.23 b-i	1059 c-k	95.7	PW
SKYLINE	Tak	11.35 no	0.00 d	1.12 l-p	6.55	3.58 c-k	848 klm	95.6	PW
SADDLEBACK	Sto	16.00 b-h	0.41 cd	3.76 c-k	7.31	4.27 b-i	1188 a-g	95.6	PW
MOUNTAINEER	Tak	12.54 k-o	0.11 d	2.50 f-p	6.67	3.11 e-k	934 i-m	95.4	PW
SWITCHBACK	Tak	12.86 j-o	0.00 d	1.70 h-p	7.16	3.85 b-k	958 h-m	94.9	PW

Listed in order of % Marketable.

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.../ continued

** ns indicates that no significant differences were found among the cultivars at P = 0.05.

ONION CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	Total Harvest Weight (kg)	Wgt. Jumbo > 89 mm (kg)	Wgt. Large > 76 mm (kg)	Wgt. Medium 76-64 mm (kg)	Wgt. Small 64-32 mm (kg)	Marketable Yield bu/A	% Marketable	Majority of Culls
HAECKERO	Haz	11.57 mno*	0.23 cd	3.49 d-l	5.77 ns	1.74 ijk	847 klm	94.8 ns**	PW
LODESTAR	SN	15.84 b-i	0.00 d	1.33 k-p	8.23	5.95 abc	1169 a-h	94.7	PW
LA SALLE	Sto	13.95 f-o	0.00 d	1.94 g-p	8.61	3.25 d-k	1041 d-l	94.7	PW
HIGHLANDER	Tak	14.45 e-m	0.12 d	2.68 f-o	6.88	4.43 b-h	1064 c-k	94.6	PW
SAFRANE	Bejo	13.03 i-o	0.00 d	1.58 i-p	7.18	4.09 b-j	969 g-m	94.5	PW
OVERLOOK	Sto	16.07 b-h	0.24 cd	4.15 b-h	7.96	3.55 c-k	1199 a-f	94.4	PW
FRONTIER	Tak	11.16 o	0.11 d	2.81 e-n	6.60	1.54 jk	835 lm	94.2	PW
37 293C	Haz	17.43 a-d	0.51 bcd	3.83 c-j	8.00	4.53 b-h	1273 abc	94.0	PW
LOSESTAR	Tak	12.08 l-o	0.00 d	0.42 mop	6.06	5.32 a-f	890 j-m	94.0	PW
HAMILTON	Bejo	15.80 b-i	0.00 d	2.06 g-p	8.13	5.29 a-f	1168 a-h	93.9	PW
FORTRESS	Sto	14.37 e-m	0.00 d	0.21 p	6.12	7.73 a	1060 c-k	93.8	PW
POWELL	Bejo	13.52 h-o	0.00 d	0.39 mop	6.47	6.35 ab	996 f-m	93.7	PW

Listed in order of % Marketable.

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.../ continued

** ns indicates that no significant differences were found among the cultivars at P = 0.05.

ONION CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	Total Harvest Weight (kg)	Wgt. Jumbo > 89 mm (kg)	Wgt. Large > 76 mm (kg)	Wgt. Medium 76-64 mm (kg)	Wgt. Small 64-32 mm (kg)	Marketable Yield bu/A	% Marketable	Majority of Culls
GUNNISON	Bejo	13.68 g-o*	0.35 cd	2.06 g-p	6.65 ns	4.40 b-h	1014 e-l	93.7 ns**	PW
STANLEY	CF	14.20 e-n	1.57 a	5.85 a-d	4.86	1.33 k	1026 d-l	92.8	PW
BRADDOCK	Bejo	14.55 d-l	0.00 d	1.52 j-p	7.60	4.88 b-g	1055 c-l	92.4	PW
CROCKETT	Bejo	16.58 a-g	0.00 d	2.76 e-o	8.36	4.76 b-g	1197 a-f	92.4	PW
SUMO	CF	15.09 b-k	0.36 cd	4.34 a-g	7.29	2.50 g-k	1092 b-j	92.4	PW
Y 604	SN	15.46 b-k	0.78 a-d	4.79 a-f	6.67	2.80 f-k	1134 b-i	92.1	PW
TRAIL BLAZER	Sto	13.36 h-o	0.00 d	0.70 m-p	6.47	5.81 a-d	979 f-m	90.5	PW
ONEIDA	Bejo	14.77 c-l	1.10 abc	4.01 b-i	5.88	2.92 e-k	1049 d-l	90.2	PW
VENECIA	Bejo	17.82 ab	0.12 d	3.13 e-m	8.89	4.23 b-i	1234 a-e	90.0	D
37 346B	Haz	11.13 o	0.00 d	0.30 op	4.20	6.01 abc	793 m	87.2	PW
TRIAL AVERAGE		**14.70**	**0.36**	**2.95**	**7.07**	**3.94**	**1080**	**94.0**	**PW**

Listed in order of % Marketable.

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.../ continued

** ns indicates that no significant differences were found among the cultivars at P = 0.05.

ONION CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	Shape	Uniformity of Shape	Uniformity of Size	Skin Thickness	Skin Attachment	Neck Finish	Overall Score	Score
MILESTONE	Sto	G	5.7 a-f*	7.7 a	6.7 abc	7.7 efg	7.0 def	6.8 b-e	7.10 efg
YAKAMA	Bejo	G	5.7 a-f	6.3 bcd	5.3 de	6.0 ij	8.7 ab	5.3 gh	6.25 j-m
KILLINGTON	Sem	TPG	4.0 fg	6.7 abc	5.7 cde	5.7 j	7.7 b-e	5.3 gh	6.00 lmn
BRONSTONE	Haz	FG	5.3 b-f	5.0 e	5.3 de	7.3 fgh	7.3 cde	5.7 fgh	6.08 klm
RIDGE LINE	Tak	G	4.7 d-g	5.7 cde	7.3 a	6.3 hij	7.3 cde	6.3 def	6.33 j-m
CATSKILL	Sto	G	6.0 a-e	5.7 cde	7.0 ab	8.3 c-f	7.2 de	6.8 b-e	6.92 fgh
COPPERSTONE	Haz	G	6.3 a-d	5.7 cde	5.0 e	9.0 a-d	6.7 ef	6.3 def	6.42 i-l
THUNDERSTONE	SN	G	5.0 c-f	6.3 bcd	5.3 de	8.3 c-f	7.0 def	7.0 bcd	6.54 h-k
SKYLINE	Tak	G	7.0 ab	6.0 cde	5.7 cde	9.3 abc	8.3 abc	8.0 a	7.83 a
SADDLEBACK	Sto	G	5.0 c-f	5.0 e	5.5 de	6.0 ij	6.7 ef	6.0 efg	5.90 mn
MOUNTAINEER	Tak	G	6.7 abc	6.7 abc	6.7 abc	7.3 fgh	8.3 abc	7.7 ab	7.42 a-e
SWITCHBACK	Tak	G	6.0 a-e	6.3 bcd	6.3 a-d	7.0 ghi	8.0 a-d	6.3 def	6.56 hij

Listed in order of % Marketable. 10.0 = Most Desirable, 8.0 = Good, 6.0 = Average

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

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ONION CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	Shape	Uniformity of Shape	Uniformity of Size	Skin Thickness	Skin Attachment	Neck Finish	Overall Score	Score
HAECKERO	Haz	G	5.3 b-f*	6.7 abc	6.0 b-e	8.0 d-g	7.0 def	7.0 bcd	7.04 efg
LODESTAR	SN	G	5.0 c-f	6.0 cde	7.3 a	7.3 fgh	7.0 def	7.0 bcd	6.96 e-h
LA SALLE	Sto	HG	4.7 d-g	5.8 cde	6.3 a-d	8.3 c-f	7.7 b-e	7.0 bcd	6.85 ghi
HIGHLANDER	Tak	MIX	3.0 g	5.7 cde	5.0 e	4.3 k	9.0 a	5.0 h	5.54 n
SAFRANE	Bejo	G	6.0 a-e	6.0 cde	6.3 a-d	9.3 abc	7.3 cde	8.0 a	7.63 a-d
OVERLOOK	Sto	G	4.3 efg	5.7 cde	5.7 cde	8.3 c-f	7.0 def	6.3 def	6.33 j-m
FRONTIER	Tak	FG	7.3 a	7.3 ab	6.0 b-e	8.7 b-e	7.7 b-e	7.3 abc	7.42 a-e
37 293C	Haz	FG	5.0 c-f	5.3 de	6.0 b-e	7.0 ghi	7.7 b-e	5.3 gh	5.92 mn
LOSESTAR	Tak	G	6.0 a-e	6.5 a-d	6.3 a-d	9.3 abc	7.7 b-e	8.0 a	7.75 ab
HAMILTON	Bejo	G	5.7 a-f	6.0 cde	5.3 de	9.7 ab	7.7 b-e	8.0 a	7.27 c-g
FORTRESS	Sto	HG	5.7 a-f	6.3 bcd	6.3 a-d	9.0 a-d	7.0 def	7.3 abc	7.21 d-g
POWELL	Bejo	G	6.3 a-d	6.7 abc	5.3 de	10.0 a	6.7 ef	7.3 abc	7.25 c-g

Listed in order of % Marketable. 10.0 = Most Desirable, 8.0 = Good, 6.0 = Average

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

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ONION CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	Shape	Uniformity of Shape	Uniformity of Size	Skin Thickness	Skin Attachment	Neck Finish	Overall Score	Score
GUNNISON	Bejo	FG	6.0 a-e*	6.3 bcd	5.8 cde	9.7 ab	7.3 cde	7.3 abc	7.35 b-f
STANLEY	CF	G	5.7 a-f	6.0 cde	6.3 a-d	8.3 c-f	6.7 ef	7.0 bcd	6.98 e-h
BRADDOCK	Bejo	G	4.7 d-g	6.3 bcd	6.0 b-e	9.7 ab	7.3 cde	6.7 cde	6.98 e-h
CROCKETT	Bejo	G	5.3 b-f	6.2 b-e	6.3 a-d	9.7 ab	6.0 f	7.7 ab	7.33 b-f
SUMO	CF	MIX	4.0 fg	6.7 abc	6.0 b-e	6.3 hij	7.3 cde	5.7 fgh	6.04 lm
Y 604	SN	FG	6.0 a-e	5.3 de	6.3 a-d	6.3 hij	8.0 a-d	5.7 fgh	6.21 j-m
TRAIL BLAZER	Sto	FG	6.3 a-d	7.3 ab	6.0 b-e	8.3 c-f	9.0 a	7.7 ab	7.71 abc
ONEIDA	Bejo	FG	6.7 abc	5.0 e	6.0 b-e	9.0 a-d	7.7 b-e	8.0 a	7.38 a-f
VENECIA	Bejo	G	7.0 ab	6.3 bcd	6.0 b-e	8.7 b-e	8.3 abc	7.3 abc	7.38 a-f
37 346B	Haz	FG	6.7 abc	6.7 abc	6.0 b-e	8.3 c-f	7.7 b-e	7.0 bcd	7.13 efg
TRIAL AVERAGE			**5.6**	**6.2**	**6.0**	**8.0**	**7.5**	**6.8**	**6.85**

Listed in order of % Marketable. 10.0 = Most Desirable, 8.0 = Good, 6.0 = Average

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

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ONION CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	Firmness at Harvest	Firmness at Evaluation	Interior Colour	Exterior Colour	Exterior Colour Rating	Days to Harvest	Seed Treatment	% Onion Maggot Damage	% Jumbo > 76 mm
MILESTONE	Sto	10.0 a*	8.0 def	W	G	7.3 b-e	108 bcd	SE	0.0 c	29.0 bcd
YAKAMA	Bejo	9.2 c	6.7 hi	W	LG	6.0 f-i	101 e-h	SE	0.5 bc	6.7 j-o
KILLINGTON	Sem	9.2 c	7.0 gh	W	LG	6.0 f-i	99 f-i	SE	0.0 c	23.6 b-e
BRONSTONE	Haz	9.7 ab	7.7 efg	W	G	5.0 ijk	104 c-f	SE	1.4 bc	22.9 b-f
RIDGE LINE	Tak	9.7 ab	7.0 gh	W	G	6.0 f-i	101 d-h	SE	1.0 bc	42.4 a
CATSKILL	Sto	9.8 ab	7.7 efg	W	G	6.7 d-g	102 c-h	SE	0.0 c	12.1 f-o
COPPERSTONE	Haz	9.8 ab	8.0 def	W	G	4.3 jk	120 a	SE	0.8 bc	31.9 ab
THUNDERSTONE	SN	9.8 ab	8.0 def	CW	G	5.3 hij	97 g-j	SE	0.9 bc	5.6 j-o
SKYLINE	Tak	10.0 a	9.7 a	W	DG	8.7 a	107 b-e	SE	0.9 bc	5.5 j-o
SADDLEBACK	Sto	9.7 ab	7.3 fgh	CW	G	5.7 ghi	100 e-i	SE	0.6 bc	14.0 e-l
MOUNTAINEER	Tak	9.8 ab	8.0 def	W	G	8.0 abc	101 d-h	SE	0.3 bc	12.7 e-n
SWITCHBACK	Tak	9.5 bc	6.8 h	W	G	5.7 ghi	90 jk	SE	0.6 bc	7.8 i-o

Listed in order of % Marketable. 10.0 = Most Desirable, 8.0 = Good, 6.0 = Average

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

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ONION CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	Firmness at Harvest	Firmness at Evaluation	Interior Colour	Exterior Colour	Exterior Colour Rating	Days to Harvest	Seed Treatment	% Onion Maggot Damage	% Jumbo > 76 mm
HAECKERO	Haz	10.0 a*	9.0 abc	C	G	7.3 b-e	106 b-f	SE	4.9 a	20.8 b-g
LODESTAR	SN	9.8 ab	9.0 abc	W	DG	7.0 c-f	102 c-h	SE	0.8 bc	4.7 k-o
LA SALLE	Sto	9.5 bc	8.0 def	W	G	7.0 c-f	99 f-i	SE	0.6 bc	8.5 h-o
HIGHLANDER	Tak	9.2 c	6.0 i	W	LG	6.3 e-h	86 k	SE	0.3 bc	10.9 g-o
SAFRANE	Bejo	10.0 a	9.7 a	W	G	8.3 ab	102 c-h	SE	0.3 bc	6.8 i-o
OVERLOOK	Sto	9.5 bc	7.0 gh	W	G	6.3 e-h	103 c-g	SE	0.3 bc	16.0 e-k
FRONTIER	Tak	10.0 a	8.3 cde	WG	DG	6.7 d-g	104 c-g	SE	0.0 c	16.7 e-j
37 293C	Haz	10.0 a	7.0 gh	W	G	4.0 k	106 b-e	SE	1.1 bc	13.4 e-m
LOSESTAR	Tak	9.8 ab	9.5 ab	CW	G	8.7 a	100 e-i	SE	1.8 bc	2.1 mno
HAMILTON	Bejo	10.0 a	8.8 bc	W	DG	7.0 c-f	101 e-h	SE	0.5 bc	7.5 i-o
FORTRESS	Sto	9.8 ab	8.3 cde	W	G	7.7 a-d	99 f-i	SE	0.3 bc	0.8 o
POWELL	Bejo	10.0 a	8.3 cde	G	G	7.3 b-e	100 e-i	SE	0.0 c	1.4 no

Listed in order of % Marketable. 10.0 = Most Desirable, 8.0 = Good, 6.0 = Average

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

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ONION CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	Firmness at Harvest	Firmness at Evaluation	Interior Colour	Exterior Colour	Exterior Colour Rating	Days to Harvest	Seed Treatment	% Onion Maggot Damage	% Jumbo > 76 mm
GUNNISON	Bejo	9.8 ab*	8.7 cd	W	G	7.7 a-d	97 g-j	SE	1.1 bc	9.7 g-o
STANLEY	CF	9.8 ab	8.8 bc	W	G	7.0 c-f	112 b	SE	0.7 bc	31.6 abc
BRADDOCK	Bejo	9.8 ab	8.5 cd	C	G	6.7 d-g	99 f-i	SPE	0.0 c	6.0 j-o
CROCKETT	Bejo	10.0 a	8.8 bc	W	DG	8.7 a	109 bc	TF	0.0 c	9.7 g-o
SUMO	CF	9.7 ab	7.0 gh	W	G	5.3 hij	103 c-h	SE	1.9 b	19.4 d-h
Y 604	SN	10.0 a	6.7 hi	CW	G	5.3 hij	102 c-h	SE	1.3 bc	20.4 c-g
TRAIL BLAZER	Sto	10.0 a	8.7 cd	WG	G	8.3 ab	93 ij	SE	1.3 bc	2.7 l-o
ONEIDA	Bejo	9.8 ab	8.3 cde	W	G	8.3 ab	102 c-h	SE	0.9 bc	18.1 d-i
VENECIA	Bejo	9.7 ab	7.7 efg	CW	G	7.7 a-d	100 e-i	SE	0.2 bc	10.9 g-o
37 346B	Haz	10.0 a	8.0 def	CG	G	6.7 d-g	96 hij	SE	0.3 bc	1.2 o
TRIAL AVERAGE		**9.8**	**8.0**			**6.8**	**102**		**0.8**	**13.3**

Listed in order of % Marketable. 10.0 = Most Desirable, 8.0 = Good, 6.0 = Average

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

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ONION CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	Seeders	% Single Centers	% Double Centers	% Multiple Centers	% Hollowness in Centers	Top Height (cm)	Leaf Shape	Leaf Colour	Tip Burn Aug 14
MILESTONE	Sto	0.0 c*	13.3 d-g	70.0 a-d	16.7 cd	30.0 f-l	68.0 d-j	B	G	LM
YAKAMA	Bejo	0.0 c	66.7 a	33.3 f-i	0.0 e	30.0 f-l	69.4 b-h	B	LG	M
KILLINGTON	Sem	0.0 c	30.0 c-f	60.0 a-f	10.0 cde	90.0 ab	68.5 c-i	B	G	VL
BRONSTONE	Haz	2.7 a	70.0 a	26.7 hi	3.3 de	33.3 f-l	71.6 abc	B	BG	L
RIDGE LINE	Tak	0.0 c	20.0 d-g	66.7 a-e	13.3 cde	73.3 a-d	66.8 g-k	U	BG	M
CATSKILL	Sto	0.0 c	16.7 d-g	83.3 ab	0.0 e	23.3 h-l	72.3 ab	U	BG	M
COPPERSTONE	Haz	0.0 c	36.7 bcd	63.3 a-e	0.0 e	30.0 f-l	71.0 a-e	B	LG	VL
THUNDERSTONE	SN	0.0 c	60.0 ab	40.0 e-i	0.0 e	60.0 b-g	71.5 abc	B	G	LM
SKYLINE	Tak	0.0 c	10.0 d-g	80.0 ab	10.0 cde	20.0 i-l	61.8 m	U	BG	MH
SADDLEBACK	Sto	0.0 c	33.3 b-e	50.0 c-h	16.7 cd	63.3 b-f	70.0 b-g	U	G	MH
MOUNTAINEER	Tak	0.0 c	16.7 d-g	73.3 a-d	10.0 cde	13.3 kl	64.7 j-m	U	BG	LM
SWITCHBACK	Tak	0.0 c	3.3 fg	86.7 a	10.0 cde	76.7 abc	63.0 lm	U	BG	M

Listed in order of % Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

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ONION CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	Seeders	% Single Centers	% Double Centers	% Multiple Centers	% Hollowness in Centers	Top Height (cm)	Leaf Shape	Leaf Colour	Tip Burn Aug 14
HAECKERO	Haz	0.0 c*	16.7 d-g	73.3 a-d	10.0 cde	20.0 i-l	62.1 m	U	BG	LM
LODESTAR	SN	0.0 c	13.3 d-g	86.7 a	0.0 e	16.7 jkl	71.1 a-e	U	BG	MH
LA SALLE	Sto	0.0 c	26.7 c-g	70.0 a-d	3.3 de	46.7 c-k	67.4 f-j	U	BG	M
HIGHLANDER	Tak	0.0 c	0.0 g	46.7 d-i	53.3 a	100.0 a	63.4 klm	B	G	LM
SAFRANE	Bejo	0.0 c	23.3 d-g	66.7 a-e	10.0 cde	40.0 d-l	67.9 e-j	U	BG	M
OVERLOOK	Sto	0.0 c	36.7 bcd	56.7 b-g	6.7 cde	53.3 c-i	70.6 a-f	U	BG	M
FRONTIER	Tak	0.0 c	3.3 fg	76.7 abc	20.0 bc	26.7 g-l	65.7 i-l	U	BG	L
37 293C	Haz	1.7 b	36.7 bcd	60.0 a-f	3.3 de	23.3 h-l	70.0 b-g	B	G	M
LOSESTAR	Tak	0.0 c	13.3 d-g	80.0 ab	6.7 cde	36.7 e-l	63.4 klm	U	BG	H
HAMILTON	Bejo	0.0 c	80.0 a	20.0 i	0.0 e	13.3 kl	74.0 a	B	BG	L
FORTRESS	Sto	0.0 c	30.0 c-f	60.0 a-f	10.0 cde	70.0 a-e	71.1 a-e	U	BG	M
POWELL	Bejo	0.0 c	70.0 a	30.0 ghi	0.0 e	53.3 c-i	71.4 a-d	U	BG	M

Listed in order of % Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

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ONION CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	Seeders	% Single Centers	% Double Centers	% Multiple Centers	% Hollowness in Centers	Top Height (cm)	Leaf Shape	Leaf Colour	Tip Burn Aug 14
GUNNISON	Bejo	0.0 c*	53.3 abc	46.7 d-i	0.0 e	70.0 a-e	71.4 a-d	U	BG	LM
STANLEY	CF	0.0 c	6.7 efg	60.0 a-f	33.3 b	30.0 f-l	66.0 h-l	U	BG	L
BRADDOCK	Bejo	0.0 c	10.0 d-g	86.7 a	3.3 de	63.3 b-f	71.3 a-e	U	BG	LM
CROCKETT	Bejo	0.0 c	26.7 c-g	73.3 a-d	0.0 e	26.7 g-l	71.5 abc	B	BG	LM
SUMO	CF	0.0 c	20.0 d-g	60.0 a-f	20.0 bc	56.7 b-h	69.1 b-i	U	G	M
Y 604	SN	0.3 c	13.3 d-g	66.7 a-e	20.0 bc	53.3 c-i	70.0 b-g	U	BG	MH
TRAIL BLAZER	Sto	0.0 c	3.3 fg	83.3 ab	13.3 cde	50.0 c-j	68.4 c-i	U	BG	M
ONEIDA	Bejo	0.0 c	13.3 d-g	83.3 ab	3.3 de	16.7 jkl	68.6 c-i	U	G	L
VENECIA	Bejo	0.0 c	23.3 d-g	60.0 a-f	16.7 cd	10.0 l	71.4 a-d	U	G	LM
37 346B	Haz	0.0 c	6.7 efg	83.3 ab	10.0 cde	36.7 e-l	68.9 b-i	U	BG	LM
TRIAL AVERAGE		**0.1**	**26.6**	**63.6**	**9.8**	**42.8**	**68.6**			

Listed in order of % Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

ONION CULTIVAR MAIN TRIAL EVALUATION NOTES – 2024

Milestone: *Stokes sample*, Average to good appearance, Average to great tight neck finish, Mixed sized necks, Average to thick skin thickness, Average to pretty good skin quality, Odd one with skin cracking, Good exterior colour even, Odd one with greening or white spots on skins, Interior colour white even, Good interior blending, Dead centers white, Good packer, Uniformity of shape a little uneven, Good firm onion, Firmness a little uneven, Medium to large run size a little uneven, Mid to long term storage onion.

Yakama: *Bejo sample*, Fair to average appearance, Good to great tight neck finish, Small sized necks, Thin skins, Fair skin quality, Some with skin cracking a concern, Exterior colour light a little uneven, Interior colour white fairly even, Average to good interior blending, Dead centers white or green, Okay packer, Uniformity of shape uneven, Average firmness, Firmness even, Small to medium run size uneven, Early term storage onion.

Killington: *Seminis sample*, Poor to fair appearance a bit rough, Good tight neck finish, Small to medium sized necks, Thinner skins, Poor to fair skin quality, A lot with skin cracking a concern, Odd one with skin rot, Lighter exterior colour uneven, Some with greening on skins, Interior colour white even, Interior blending average to good, Dead centers white, yellow or green with some green rings, Okay packer, Uniformity of shape uneven, Average firmness, Firmness uneven, Medium to large run size a little uneven, Odd one double onion, Suspicion of doubles, Odd one with mechanical damage, Early term storage onion.

Bronstone: *Hazera sample*, Fair to average appearance, Good tight neck finish, Small to large sized necks, Thin to average skins, Fair to average skin quality, A few with skin cracking a concern, Exterior colour uneven, Interior colour cream to white slightly uneven, Average to good interior blending, Dead centers white, yellow or green, Okay to average packer, Uniformity of shape a little uneven, Average firmness, Firmness uneven, Medium to large run size uneven, Early to mid term storage onion.

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ONION CULTIVAR MAIN TRIAL EVALUATION NOTES – 2024 – continued

Ridgeline: *American Takii sample*, Average appearance, Average to good tight neck finish, Odd neck finish a bit rough, Small to medium sized necks, Thin to average skin thickness, Fair to good skin quality, Some with skin cracking a concern, Exterior colour slightly uneven, Odd one with greening on skins, Interior colour white, Good interior blending even, Dead centers white some green, Average packer, Uniformity of shape uneven, Average firmness, Firmness uneven, Medium to large run size a little uneven, Mid-term storage onion.

Catskill: *Stokes sample*, Average to good appearance, Average to good tight neck finish, Small to large sized necks, Average to thick skins, Average to pretty good skin quality, Odd one with skin cracking, Odd one with neck rot, Exterior colour a little even, Odd one with greening on skins, Interior colour cream and white slightly uneven, Average to good interior blending even, Dead centers white, yellow or some green, Average to good packer, Uniformity of shape uneven, Average to good firmness, Firmness a little uneven, Small to large run size uneven, Mid-term storage onion.

Copperstone: *Hazera sample*, Average appearance, Average tight neck finish, Odd neck finish a bit rough, Small to large sized necks, Average to thick skins, Average to pretty good skin quality, Exterior colour slightly dark uneven, Interior colour white, Good interior blending even, Dead centers white some yellow, Okay to average packer, Uniformity of shape a little uneven, Good firm onion, Firmness even, Medium to large run size even, Long term storage onion.

Thunderstone: *Seminova sample*, Average to good appearance, Good tight neck finish, Small to large sized necks, Average skin thickness, Average to pretty good skin quality, Odd one with skin cracking, Exterior colour slightly uneven, Interior colour cream or white, Average to good interior blending, Dead centers white or green, Some with green rings, Average to good packer, Uniformity of shape uneven, Good firm onion, Firmness a little uneven, Small to medium run size, Mid-term storage onion.

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ONION CULTIVAR MAIN TRIAL EVALUATION NOTES – 2024 – continued

Skyline: *American Takii sample,* Good to nice appearance, Good to great tight neck finish, Small sized necks, Thicker skins, Nice skin quality, Good to nice exterior colour slightly dark even, Interior colour white or some slightly green, Average to good interior blending, Dead centers white or green, Good to nice packer, Uniformity of shape a little even, Nice solid onion, Firmness even, Small to medium run size a little uneven, Long term storage onion.

Saddleback: *Stokes sample,* Average to good appearance, Average to good tight neck finish, Small to medium sized necks, Thin to average skin thickness, Fair to average skin quality, A few with skin cracking some concern, Good slightly light exterior colour a little uneven, A few with greening on skins, Interior colour cream or white a little uneven, Average to good interior blending, Dead centers white or green, Okay to average packer, Uniformity of shape a little uneven, Average firmness, Firmness a little uneven, Small to large run size a little uneven, Mid-term storage onion.

Mountaineer: *American Takii sample,* Good to nice appearance, Good to great tight neck finish, Small sized necks, Thin to average skin thickness, Average to nice skin quality, Odd one with skin cracking, Good exterior colour a little uneven, Odd one with greening and a few with white spots on skins, Interior colour white, Poor to average interior blending, Dead centers mixed white or green, 10-50% with green rings, Good to nice packer, Uniformity of shape a little uneven, Good firm onion, Firmness even, Small to medium run size a little uneven, Mid to long term storage onion.

Switchback: *American Takii sample,* Average to good appearance, Good tight neck finish, Small to medium sized necks, Thin to average skin thickness, Average skin quality, A few with skin cracking, Exterior colour uneven, Some with greening and white spots on skins, Interior color white even, Average to great interior blending even, Dead centers white or some green, Average packer, Uniformity of shape a little uneven, Average firmness, Firmness a little uneven, Small to medium run size, Early to mid term storage onion.

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ONION CULTIVAR MAIN TRIAL EVALUATION NOTES – 2024 – continued

Haeckero: *Hazera sample*, Good appearance, Average to good tight neck finish, Odd neck finish a bit rough, Medium sized necks, Average to thicker skins, Average to pretty good skin quality, Odd one with skin cracking, Good exterior colour slightly even, Odd one with greening or white spots on skins, Interior colour cream even, Poor to good interior blending, Dead centers white, Good packer, Uniformity of shape uneven, Nice solid onion, Firmness even, Small to medium run size a little uneven, Odd double onion suspicion, Long term storage onion.

Lodestar: *Seminova sample*, Average to good appearance, Average to good tight neck finish, Odd neck finish a bit rough, Small to medium sized necks, Average to thicker skins, Average to pretty good skin quality, Odd one with skin cracking, Exterior colour slightly dark fairly even, Interior color white even, Average to great interior blending, Dead centers white or green, Odd one with green rings, Average to good packer, Uniformity of shape uneven, Nice solid onion, Firmness even, Small to medium run size a little uneven, Long term storage onion.

La Salle: *Stokes sample*, Average to good appearance, Good to great tight neck finish, Small to medium sized necks, Average to thick skin thickness, Pretty good skin quality, Odd one with skin cracking, Exterior colour slightly dark a little uneven, Some with greening on skins, Interior colour white or some greenish, Good interior blending, Dead centers white, 20-30% with green rings, Average to good packer, Uniformity of shape uneven, Good firm onion, Firmness a little uneven, Medium run size a little uneven, Mid to long term storage onion.

Highlander: *American Takii sample*, Poor to okay appearance, Great to perfect tight neck finish, Small sized necks, Thin skins, Poor skin quality, Most with skin cracking a big concern, Lightly pale exterior colour a little uneven, A lot with greening on skins, Interior colour white even, Good to great interior blending, Dead centers mainly white some green, 10-30% with green rings, Poor to okay packer, Uniformity of shape very uneven, Softer firmness, Firmness a little even, Small to medium run size uneven, Suspicion of doubles, Early storage onion.

…/continued

ONION CULTIVAR MAIN TRIAL EVALUATION NOTES – 2024 – continued

Safrane: *Bejo sample*, Good appearance, Average to good tight neck finish, Odd neck finish a bit rough, Medium sized necks, Average skin thickness, Pretty good to nice skin quality, Odd one with skin cracking, Fair to good exterior colour even, Odd one with greening on skins, Interior colour cream a little uneven, Average interior blending, Dead centers yellow or green, Good packer, Uniformity of shape a little even, Good firm solid onion, Firmness even, Smaller run size a little uneven, Mid to long term storage onion.

Overlook: *Stokes sample*, Average appearance, Good tight neck finish, Medium sized necks, Thin to average skin thickness, Average skin quality, Odd one with skin cracking, Exterior colour a little uneven, Some with greening on skins, Interior colour white, Good interior blending, Dead centers white and some yellow, Average packer, Uniformity of shape uneven, Average to good firmness, Firmness uneven, Medium run size a little uneven, Odd onion with mechanical damage, Early to mid-term storage onion.

Frontier: *American Takii sample*, Good to nice appearance, Average to good tight neck finish, Small to medium sized necks, Average to thick skins, Pretty good to nice skin quality, Odd one with skin cracking, Good exterior colour slightly dark, A few with greening on skins, Interior colour white, cream or slightly green, Average to good interior blending, Dead centers white or some green, Good to nice packer, Uniformity of shape even, Nice solid onion, Firmness even, Medium run size, Long term storage onion.

37 293C: *Hazera sample*, Poor to fair appearance, Average to great neck finish, Odd neck finish a bit rough, Small to medium sized necks, Thin to average skin thickness uneven, Fair to average skin quality, A few with skin cracking a little concern, Odd one with skin rot, Exterior colour uneven, Odd one with greening on skins, Interior colour white or some slightly green, Good interior blending, Dead centers white or some green, Okay to average packer, Uniformity of shape uneven, Average to good firmness, Firmness uneven, Small to medium run size uneven, Early to mid-term storage onion.

…/continued

ONION CULTIVAR MAIN TRIAL EVALUATION NOTES – 2024 – continued

Lodestar: *American Takii sample,* Good to nice appearance, Good to great tight neck finish, Small to medium sized necks, Thick skins, Nice skin quality, Very minimal skin cracking, Exterior colour slightly dark very even, Odd one with greening on skins, Interior color white or cream even, Average to good interior blending even, Dead centers white or green, Average to nice packer, Uniformity of shape a little even, Nice solid onion, Firmness even, Small to medium run size, Long term storage onion.

Hamilton: *Bejo sample,* Nice appearance, Average to great tight neck finish, Small to medium sized necks, Thicker skins, Pretty good to nice skin quality, Exterior colour slightly dark even, Interior colour white even, Good interior blending even, Dead centers white or odd one green, Good to nice packer, Uniformity of shape uneven, Nice firm onion, Firmness a little even, Small to medium run size even, Long term storage onion.

Fortress: *Stokes sample,* Average to nice appearance, Average to good tight neck finish, Medium sized necks, Average to thicker skins, Good skin quality, Odd one with skin cracking, Good exterior colour slightly dark a little uneven, A few with greening on skins, Interior colour white even, Average to good interior blending even, Dead centers white, 20-30% with green rings, Average to good packer, Uniformity of shape uneven, Good firm onion, Firmness a little uneven, Small run size a little uneven, Mid to long term storage onion.

Powell: *Bejo sample,* Good to nice appearance, Average to good tight neck finish, Odd neck finish a bit rough, Medium to large sized necks, Thicker skins, Pretty good to nice skin quality, Exterior colour slightly dark even, Odd one with greening or yellowing on skins, Interior colour white or cream, Mixed interior blending uneven, Dead centers white, Odd one with green rings, Average to nice packer, Uniformity of shape a little even, Good firm onion, Firmness a little uneven, Small to medium run size even, Long term storage onion.

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CULTIVAR MAIN TRIAL EVALUATION NOTES – 2024 – continued

Gunnison: *Bejo sample,* Good to nice appearance, Good tight neck finish, Medium sized necks, Average to thick skin thickness, Nice skin quality, Odd one with basal plate rot, Good exterior colour slightly dark even, Odd one with greening on skins, Interior colour white even, Good to great interior blending even, Dead centers white, 10-40% with green rings, Good to nice packer, Uniformity of shape a little uneven, Good solid onion, Firmness even, Small to medium run size even, Mid to long term storage onion.

Stanley: *Clifton sample,* Good appearance, Average to good tight neck finish, Odd neck finish a bit rough, Medium to large sized necks, Average to thicker skins, Average to pretty good skin quality, Odd one with skin cracking, Good exterior colour a little uneven, Odd one with greening on skins, Interior colour white or cream even, Average interior blending, Dead centers white or green, Average to good packer, Uniformity of shape a little uneven, Nice solid firm onion, Firmness even, Medium to extra large run size a little uneven, Odd one suspicion of doubles, Long term storage onion.

Braddock: *Bejo sample,* Average to good appearance, Good tight neck finish, Odd neck finish a bit rough, Small to medium sized necks, Average skin thickness, Pretty good to nice skin quality, Odd one with basal plate rot, Good to nice exterior colour even, Interior colour white, cream or green, Average to good interior blending even, Dead centers white or some green, Average to good packer, Uniformity of shape uneven, Nice solid firm onion, Firmness a little uneven, Small to medium run size, Mid to long term storage onion.

Crockett: *Bejo sample,* Good to nice appearance, Average tight neck finish, Neck finishes a bit rough, Medium to large sized necks, Thicker skins, Nice skin quality, Odd one with neck rot, Nice dark exterior colour even, Odd one with yellowing on skins, Interior colour white, Average to good interior blending even, Dead centers white or some green, Good to nice packer, Uniformity of shape a little uneven, Nice solid onion, Firmness a little uneven, Medium run size a little uneven, Odd double onion suspicion, Long term storage onion.

…/continued

ONION CULTIVAR MAIN TRIAL EVALUATION NOTES – 2024 – continued

Sumo: *Clifton sample*, Okay to average appearance some a bit rough, Average to good tight neck finish, Odd neck finish a bit rough, Small to medium sized necks, Thin to average skin thickness, Fair to average skin quality, Some with skin cracking a little concern, Odd one with skin rot, Slightly light exterior colour uneven, Odd one with greening on skins, Interior colour white, Average to good interior blending, Dead centers white or odd one green, 10-30% with green rings, Okay to average packer, Uniformity of shape very uneven, Average firmness, Firmness a little uneven, Medium to large run size a little uneven, Odd double onion suspicion, Early to mid-term storage onion.

Y 604: *Seminova sample*, Okay to average appearance some a bit rough, Average to great tight neck finish, Small to medium sized necks, Thin to average skin thickness, Poor to average skin quality, Some with skin cracking a little concern, Odd one with skin rot, Exterior colour fairly uneven, Some with greening on skins, Interior colour white or cream, Average to good interior blending, Dead centers white or some slightly green, Odd one with green rings, Okay to average packer, Uniformity of shape uneven, Average firmness, Firmness uneven, Medium to large run size a little uneven, Suspicion of doubles, Early to mid term storage onion.

Trail Blazer: *Stokes sample*, Good to nice appearance, Great tight neck finish, Small sized necks, Average skin thickness, Average to nice skin quality, Odd one with skin cracking a little concern, Good exterior colour even, Some with greening on skins, Interior colour white or slight green uneven, Average interior blending, Dead centers white or odd one green, Average to good packer, Uniformity of shape a little uneven, Good solid firm onion, Firmness even, Small to medium run size a little even, Mid to long term storage onion.

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ONION CULTIVAR MAIN TRIAL EVALUATION NOTES – 2024 – continued

Oneida: *Bejo sample,* Good to nice appearance, Good to great tight neck finish, Small to medium sized necks, Average to thicker skins, Nice skin quality, Odd one with skin cracking, Very odd one with basal plate rot, Good to nice exterior colour even, Odd one with greening on skins, Interior colour white or cream, Poor to average interior blending, Dead centers white or green, 10-20% with green rings, Nice packer, Uniformity of shape uneven, Good solid firm onion, Firmness even, Medium to large run size a little uneven, Odd one suspicion of doubles, Mid to long term storage onion.

Venecia: *Bejo sample,* Good to nice appearance, Good to great tight neck finish, Small sized necks, Average to thick skin thickness, Pretty good to nice skin quality, Odd one with skin cracking, Nice exterior colour slightly even, Very odd one with greening on skins, Interior colour white or cream, Average to good interior blending, Dead centers white or green, Good to nice packer, Uniformity of shape a little uneven, Average to nice firmness, Firmness a little even, Medium run size a little uneven, Suspicion of doubles an issue, Mid to long term storage onion.

37 346B: *Hazera sample,* Average to good appearance, Average to good tight neck finish, Small to medium sized necks, Average to thicker skins, Average to nice skin quality, Odd one with skin cracking, Good exterior colour a little even, Odd one with greening on skins, Interior colour white, cream or green, Average to good interior blending a little uneven, Dead centers white, yellow or green, Good packer, Uniformity of shape a little uneven, Good firm onion, Firmness even, Small run size a little uneven, Odd one suspicion of doubles, Mid to long term storage onion.

ONION CULTIVAR ADAPTATION TRIAL - 2024

Cultivar	Source	# Bulbs Harvested	# Bulbs Jumbos > 89 mm	# Bulbs Lrg 89 - 76 mm	# Bulbs Med 76 - 64 mm	# Bulbs Small 64 - 32 mm	Total Harvest Weight (kg)	Wgt. Jumbo > 89 mm (kg)	Wgt. Large 89 - 76 mm (kg)	Wgt. Medium 76-64 mm (kg)	Wgt. Small 64-32 mm (kg)	Marketable Yield bu/A	% Marketable	Majority of Culls
IROKO	EZ	72	10	29	17	12	14.11	3.26	6.60	2.74	1.06	1030	94.4	DPW
BAGGI	EZ	69	23	27	5	9	17.60	8.52	6.88	0.77	0.83	1282	92.8	D
TANNAT	EZ	108	0	12	49	33	13.20	0.00	2.86	7.16	2.77	964	87.0	PW
OLTH 13-372	Cro	78	0	4	20	39	8.03	0.00	0.93	3.27	3.31	566	80.8	PW
MEDUSA	SN	56	3	14	19	8	11.82	1.15	3.39	3.41	0.68	651	78.6	D
OLYX 12-990	Cro	107	0	4	12	62	8.77	0.00	1.01	1.83	5.10	599	72.9	PW
PLUTONUS	EZ	97	0	0	16	47	7.15	0.00	0.00	2.36	3.60	449	64.9	PW

Listed in order of % Marketable.

ONION CULTIVAR ADAPTATION TRIAL - 2024

		Shape	Uniformity of Shape	Uniformity of Size	Skin Thickness	Skin Attachment	Neck Finish	Overall Score	Firmness at Evaluation	Interior Colour	Exterior Colour	Exterior Colour Rating	Score	% Jumbo > 76 mm
IROKO	EZ	FG	6.0	4.0	7.0	9.0	7.0	6.0	8.0	W	G	5.0	6.50	40.3
BAGGI	EZ	FG	4.0	4.0	8.0	8.0	6.0	6.0	8.5	C	G	6.0	6.31	39.1
TANNAT	EZ	TP	6.0	5.0	6.0	9.0	8.0	8.0	7.5	DR	DR	6.0	6.94	11.1
OLTH 13-372	Cro	MIX	4.0	5.0	6.0	8.0	7.0	6.0	7.5	W	LG	6.0	6.19	5.1
MEDUSA	SN	G	7.0	3.0	8.0	10.0	6.0	7.0	9.0	W	DG	8.0	7.25	25.0
OLYX 12-990	Cro	SPG	6.0	6.0	6.0	9.0	8.0	7.0	8.0	WG	G	6.0	7.00	3.7
PLUTONUS	EZ	TDG	7.0	6.0	7.0	6.0	8.0	6.0	9.0	G	G	8.0	7.13	0.0

10.0 = Most Desirable, 8.0 = Good, 6.0 = Average

…/continued

ONION CULTIVAR ADAPTATION TRIAL - 2024 - continued

Cultivar	Source	Seeders	Stand/Foot	Average Weight/Bulb (g)	Days to Harvest	% Onion Maggot Damage	% Single Centers	% Double Centers	% Multiple Centers	% Hollowness in Centers	Top Height (cm)	Leaf Shape	Leaf Colour	Tip Burn July 31
IROKO	EZ	0.0	4.7	196.0	122	0.0	30	60	10	0	63.3	B	G	LM
BAGGI	EZ	0.0	4.5	255.1	122	1.4	30	70	0	0	68.7	U	G	LM
TANNAT	EZ	0.0	7.1	122.2	113	0.9	50	40	10	30	67.2	B	G	VL
OLTH 13-372	Cro	0.0	5.1	102.9	113	1.3	100	0	0	0	61.5	B	G	M
MEDUSA	SN	0.0	3.7	211.1	122	0.0	10	50	40	0	57.0	U	BG	LM
OLYX 12-990	Cro	0.0	7.0	82.0	99	0.9	100	0	0	20	66.0	U	BG	M
PLUTONUS	EZ	0.0	6.3	73.7	106	0.0	20	80	0	30	57.1	U	BG	H

ONION CULTIVAR ADAPATION TRIAL EVALUATION NOTES – 2024

Iroko: *Enza Zaden*, Average appearance, Good tight neck finish a little uneven, Odd neck finish bit rough, Small to medium neck size (40/60), A little thicker skins, Nice skin quality, Odd one with vertical skin cracking, Exterior colour uneven, Interior colour white even, Great interior blending even, Dead centers white, Green rings (10%), Average to good packer, Uniformity of shape a little even, Good firm onion, Firmness a little even, Medium run size uneven, Odd double onion, Odd one with mechanical damage, Mid-term storage onion.

Baggi: *Enza Zaden*, Average appearance, Good neck finish a little uneven, Odd neck finish bit rough, Small to medium neck size (20/80), Thicker skins, Pretty good skin quality, Odd one with vertical skin cracking, Exterior colour uneven, Interior colour cream even, Good interior blending even, Dead centers white, Green rings (10%), Average packer, Uniformity of shape uneven, Good firm onion, Firmness a little even, Large run size uneven mixed, Odd double onion, Mid to long term storage onion.

Tannat: *Enza Zaden*, Nice appearance, Good to great neck finish, Odd neck finish bit rough, Small neck size, Average skin thickness, Good skin quality, Odd one with skin cracking, Odd one with vertical skin cracking, Nice dark exterior colour even, Odd one with brown spots on skins, Interior colour fairly dark red even, Purplish tinge to interior tissue, Good interior blending, Dead centers white or red (50/50), Good packer, Uniformity of shape a little uneven, Good firm onion, Firmness a little even, Medium run size uneven, Mid to long term storage onion.

OLTH 13-372: *Crookham*, Average appearance, Good tight neck finish a little uneven, Small to medium neck size, Average skin thickness, Average skin quality, Odd one with vertical skin cracking, Fairly light exterior colour uneven, Some greening of scales, Interior colour white even, Good interior blending, Dead centers white or green (50/50), Okay packer, Uniformity of shape uneven, Average firmness, Firmness a little uneven, Small run size uneven, Odd double onion, Early to mid-term storage onion.

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ONION CULTIVAR ADAPATION TRIAL EVALUATION NOTES – 2024 – continued

Medusa: *Seminova*, Good appearance, Good neck finish a little uneven, Medium neck size, Thicker skins, Nice skin quality, Slightly dark exterior colour even, Copper shine on skins (40%), Odd one with white spots on skins, Interior colour white, Average interior blending even, Dead centers white or green (80/20), Average to good packer, Uniformity of shape even, Good to nice firm onion, Firmness a little even, Medium run size uneven, Doubles are an issue concern, Long term storage onion.

OLYX 12-990: *Crookham*, Good appearance, Good tight neck finish, Small to medium neck size (40/60), Average skin thickness, Nice skin quality, Good exterior colour even, Odd one with greening of scales, Interior colour white or green (50/50), Average interior blending a little uneven, Dead centers green, Green rings (40%), Good packer, Uniformity of shape a little even, Good firm onion, Firmness even, Small run size a little uneven, Odd one with mechanical damage, Early to mid-term storage onion.

Iroko: *Enza Zaden*, Average appearance, Good tight neck finish a little uneven, Odd neck finish bit rough, Small to medium neck size (40/60), A little thicker skins, Nice skin quality, Odd one with vertical skin cracking, Exterior colour uneven, Interior colour white even, Great interior blending even, Dead centers white, Green rings (10%), Average to good packer, Uniformity of shape a little even, Good firm onion, Firmness a little even, Medium run size uneven, Odd double onion, Odd one with mechanical damage, Mid-term storage onion.

Plutonus: *Enza Zaden*, Average appearance, Great tight neck finish, Small neck size, Average skin thickness, Fair skin quality, Some with skin cracking a little concern, A few with vertical skin cracking, Exterior colour fairly even, A few with greening of scales, Interior colour greenish even, Interior blending even, Dead centers white or green (70/30), Okay packer, Uniformity of shape a little uneven, Nice firm solid onion, Firmness even, Small run size a little uneven, Mid-term storage onion.

LONG TERM AVERAGES OF ONION CULTIVAR TRIALS

Cultivar	Source	# Years Evaluated	Yield bu/A	% Marketable	% Jumbos <3"	Days to Maturity	Firmness In*	Firmness out*	Neck Finish	Score	% Onion Maggot Damage	# of Seeders
HIGHLANDER	Tak	20	1000	85.5	12.8	93	8.6	6.0	9.2	6.19	3.2	0.0
ALPINE	Tak	11	1035	89.6	14.4	95	8.5	5.9	9.6	6.24	4.9	0.0
TREKKER	Tak	11	1084	92.9	8.8	100	9.8	8.3	7.5	7.51	3.3	0.0
NORSTAR	Tak	28	1079	91.2	12.5	102	8.2	5.9	8.6	6.34	4.2	0.0
SADDLEBACK	Sem	9	1157	91.2	17.0	103	9.6	7.2	7.3	6.45	2.4	0.1
ONEIDA	Bejo	7	1019	84.1	6.7	104	9.5	8.0	7.6	7.40	2.9	0.1
LA SALLE	Sem	15	1149	93.0	13.9	104	9.5	7.7	7.3	6.80	6.0	0.3
RICOCHET	Sem	9	1134	96.8	30.5	105	9.6	8.0	7.5	7.11	7.8	0.5
TRAILBLAZER	Tak	15	1043	91.9	15.0	105	9.8	8.3	8.0	7.45	4.1	0.0
ARSENAL	Sem	13	1232	97.6	15.0	106	9.6	8.1	7.6	7.16	5.2	1.7
FRONTIER	Tak	31	1087	93.1	9.4	106	9.9	8.1	8.0	7.59	4.4	0.0
MOUNTAINEER	Tak	13	1018	94.8	16.6	106	9.6	8.2	7.9	7.58	4.3	0.0
TRAVERSE	Tak	8	1163	94.7	12.2	106	9.6	8.1	7.4	7.45	2.2	0.0
HAECKERO	Haz	6	902	90.8	10.4	107	10	9.2	6.8	7.07	8.1	0.0
CATSKILL	Sem	10	1222	93.9	16.3	107	9.7	7.5	7.3	6.81	4.3	0.0

Listed in order of Days to Maturity. * 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

* Firmness: A = Evaluated at time of Harvest B = Evaluated in December

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LONG TERM AVERAGES OF ONION CULTIVAR TRIALS - continued

Cultivar	Source	# Years Evaluated	Yield bu/A	% Marketable	% Jumbos <3"	Days to Maturity	Firmness In*	Firmness out*	Neck Finish	Score	% Onion Maggot Damage	# of Seeders	Leaf Length (cm)
RIDGELINE	Tak	9	1219	93.5	24.2	108	9.8	7.6	7.2	6.88	3.7	0.0	64
CORONA	Bejo	23	1230	86.6	20.0	108	9.5	7.1	7.1	6.26	5.8	0.0	65
PATTERSON	Bejo	15	1181	93.7	13.6	108	9.8	8.7	6.9	7.43	5.7	0.7	67
TAHOE	Bejo	9	1214	95.0	20.0	108	9.6	8.2	7.1	7.32	6.5	1.9	66
DAWSON	Bejo	7	858	84.0	10.4	109	9.8	7.9	7.6	7.04	7.3	0.0	61
BRADDOCK	Bejo	17	1226	90.3	14.8	109	9.6	7.8	6.7	9.94	2.5	0.5	67
MILESTONE	Tak	23	1300	95.8	23.3	111	9.6	7.5	6.7	7.15	4.0	0.0	65
STANLEY	CF	26	1168	91.9	17.1	111	9.9	8.5	6.5	7.10	4.1	0.8	66
FORTRESS	Sem	31	1073	94.9	8.1	111	9.8	8.0	6.8	7.34	3.3	1.2	65
LIVINGSTON	Sol	14	1132	95.3	12.1	112	9.7	8.3	6.5	7.07	5.5	0.3	64
HAMLET	Sem	23	1230	94.1	13.3	112	9.8	8.1	7.1	7.19	8.1	0.2	65
TALON	Bejo	7	1192	96.7	14.9	112	9.6	8.7	6.9	7.42	4.8	1.7	66
SAFRANE	Bejo	19	1228	93.6	18.2	112	9.9	8.7	6.8	7.27	3.0	2.2	67
PRINCE	Bejo	24	1233	93.6	22.2	115	9.8	8.6	6.2	7.20	5.4	0.4	66
CROCKETT	Bejo	13	1209	91.1	16.3	117	9.9	8.7	5.4	7.13	5.2	1.0	72

Listed in order of Days to Maturity. * 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

* Firmness: A = Evaluated at time of Harvest B = Evaluated in December

MAIN ONION STORAGE TRIAL 2023 - 2024

Cultivar	Source	% Marketable	% Weight Loss	% Sprouts	% Rot	% Soft	Firmness In **	Firmness Out **	% Sprouting at Base	% Sprouting at Top
39 135	Haz	66.8 a*	3.8 p	26.6 l	2.1 cd	0.0 d	10.0 a	7.7 ab	26.0 jkl	22.3 m
GUNNINSON	Bejo	64.1 ab	4.7 l-p	28.6 kl	2.3 cd	0.0 d	10.0 a	6.7 c-g	27.3 jkl	26.7 lm
LA SALLE	Sto	58.5 abc	4.8 k-p	33.6 i-l	2.7 cd	0.0 d	10.0 a	6.2 e-i	27.3 jkl	27.7 klm
TRAVERSE	Tak	56.0 abc	5.8 i-o	34.0 h-l	3.7 cd	0.0 d	10.0 a	5.3 i-k	33.3 h-l	33.3 i-m
39 136	Haz	55.8 abc	4.5 m-p	39.2 g-l	0.3 d	0.0 d	10.0 a	6.8 b-f	30.0 i-l	41.7 g-m
SWITCHBACK	SN	53.9 a-d	4.6 m-p	32.4 i-l	7.7 cd	0.9 bc	9.5 bc	5.0 jkl	25.0 kl	38.3 h-m
SWITCHBACK	Tak	52.4 a-e	3.9 op	31.7 jkl	9.9 c	1.6 b	9.2 cd	5.2 jkl	12.7 l	30.0 j-m
CROCKETT	Bejo	46.7 b-f	7.4 b-i	42.2 g-l	3.2 cd	0.0 d	10.0 a	8.0 a	41.7 f-l	38.3 h-m
HAECKERO	Haz	45.9 b-g	6.3 i-m	44.7 g-l	2.6 cd	0.0 d	10.0 a	7.3 a-d	45.0 f-l	43.3 g-m
HAMILTON	Bejo	45.0 c-h	6.1 i-n	47.4 g-l	1.0 d	0.2 cd	10.0 a	7.7 ab	53.3 d-k	38.3 h-m
MOUNTAINEER	Tak	43.2 c-h	4.3 nop	49.6 f-k	2.1 cd	0.0 d	10.0 a	6.7 c-g	48.3 e-k	56.7 e-k
FORTRESS	Sto	40.9 c-h	5.5 i-p	52.7 e-j	0.5 d	0.0 d	10.0 a	6.5 d-h	58.3 b-j	53.3 f-l
BRADLEY	Bejo	36.8 d-i	9.2 abc	47.3 g-l	6.4 cd	0.0 d	10.0 a	6.5 d-h	41.7 f-l	51.7 f-m
BRADDOCK	Bejo	36.6 d-i	5.3 j-p	55.2 d-h	2.3 cd	0.2 cd	9.8 ab	6.5 d-h	65.0 a-h	55.7 e-l

Listed in Order of Percent Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05 Fisher's Protected LSD Test.

** 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

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MAIN ONION STORAGE TRIAL 2023 - 2024 continued

Cultivar	Source	% Marketable	% Weight Loss	% Sprouts	% Rot	% Soft	Firmness In **	Firmness Out **	% Sprouting at Base	% Sprouting at Top
STANLEY	CF	36.4 d-i*	6.2 i-n	53.3 e-i	3.6 cd	0.0 d	10.0 a	6.8 b-f	66.7 a-g	61.7 c-i
37-346 B	Haz	33.9 e-j	4.8 k-p	60.1 b-g	0.6 d	0.0 d	10.0 a	7.5 abc	24.3 kl	38.3 h-m
ONEIDA	Bejo	33.2 f-j	6.3 i-m	58.9 c-g	1.2 cd	0.0 d	10.0 a	7.0 b-e	57.7 c-j	65.0 b-h
SAFRANE	Bejo	32.3 f-k	6.4 h-m	59.0 c-g	2.0 cd	0.0 d	10.0 a	6.3 e-h	74.0 a-f	65.0 b-h
E61L.10959	EZ	31.3 f-l	6.0 i-n	57.8 c-g	4.5 cd	0.2 cd	9.5 bc	6.7 c-g	40.7 g-l	70.0 a-g
HIGHLANDER	Tak	28.1 g-m	5.2 j-p	28.0 l	30.1 a	6.7 a	8.5 e	4.3 l	27.3 jkl	26.7 lm
THUNDERSTONE	SN	27.9 g-m	9.0 a-d	60.7 a-e	2.3 cd	0.0 d	9.8 ab	6.2 e-h	73.3 a-f	64.0 a-e
E61L.10939	EZ	27.1 h-m	8.5 a-g	58.2 c-g	5.9 cd	0.0 d	9.5 bc	6.5 d-h	61.7 a-i	58.3 d-j
SV NY 1498	Sem	20.7 i-o	7.1 e-j	51.4 e-j	20.0 b	0.5 cd	8.8 de	5.0 kl	58.3 b-j	55.7 e-l
39 126	Haz	18.3 i-o	6.9 f-j	70.5 a-f	3.5 cd	0.0 d	9.8 ab	6.8 b-f	80.0 a-e	58.3 d-j
LODESTAR	SN	18.2 i-o	8.9 a	71.4 a-d	1.2 cd	0.0 d	10.0 a	6.5 d-h	90.0 a	86.7 a-d
FRONTIER	Tak	17.1 j-o	6.9 f-j	72.7 a-e	2.9 cd	0.0 d	10.0 a	6.7 c-g	74.0 a-f	79.0 a-f
MILESTONE	Tak	16.7 j-o	6.4 h-m	72.4 a-e	3.7 cd	0.4 cd	9.8 ab	5.7 h-k	85.0 a-d	88.3 abc
OVERLOOK	Sto	16.6 j-o	8.3 a-h	72.5 a-e	2.2 cd	0.0 d	9.7 ab	5.3 ijk	85.7 a-d	83.3 a-e

Listed in Order of Percent Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05 Fisher's Protected LSD Test.

** 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

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MAIN ONION STORAGE TRIAL 2023 - 2024 continued

Cultivar	Source	% Marketable	% Weight Loss	% Sprouts	% Rot	% Soft	Firmness In **	Firmness Out **	% Sprouting at Base	% Sprouting at Top
SADDLEBACK	Sto	16.1 j-o*	6.6 g-l	75.3 a-d	1.8 cd	0.0 d	9.7 ab	6.0 f-j	85.0 a-d	80.0 a-f
VENECIA	Bejo	16.0 j-o	7.1 d-j	76.2 a-d	1.7 cd	0.0 d	9.5 bc	5.8 g-k	80.0 a-e	88.3 abc
CATSKILL	Sto	14.5 k-o	6.1 i-n	77.8 abc	2.0 cd	0.0 d	9.7 ab	6.2 e-i	90.7 ab	86.7 a-d
THUNDERSTONE	Haz	14.4 k-o	8.7 a-f	72.3 a-e	4.3 cd	0.0 d	9.5 bc	6.3 e-h	91.7 ab	85.0 a-e
TTA 784	Tak	13.1 l-o	7.4 c-i	76.0 a-d	3.4 cd	0.0 d	9.5 bc	6.2 e-i	85.0 a-d	85.0 a-e
LODESTAR	Tak	11.1 mno	9.6 a	75.3 a-d	3.6 cd	0.0 d	10.0 a	6.0 f-j	92.3 a	87.3 a-d
SUMO	CF	9.1 no	6.8 f-k	82.4 a	1.6 cd	0.0 d	9.0 d	5.8 g-k	93.3 a	89.3 abc
39 293 C	Haz	6.9 o	9.4 ab	81.2 ab	2.3 cd	0.0 d	9.8 ab	7.0 b-e	93.0 a	94.3 ab
RIDGE LINE	Tak	5.1 o	8.7 a-f	79.3 abc	6.7 cd	0.0 d	9.8 ab	5.3 ijk	94.0 a	94.7 a
TRIAL AVERAGE		**31.5**	**6.6**	**57.0**	**4.3**	**0.3**	**9.7**	**6.3**	**60.5**	**60.8**

Listed in Order of Percent Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05 Fisher's Protected LSD Test.

** 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

ONION CULTIVAR STORAGE TRIAL EVALUATION NOTES - 2023-2024

37 135: *Hazera sample,* Top & root sprouts just starting to light 0-2.5 cm, Majority skin rot, Odd internal rot, Basal plates just starting to push out 5-15%, Firm onion, Late term storage onion, Stored nice to excellent.

Gunnison: *Bejo sample,* Top & root sprouts just starting to moderate 0-5 cm, Majority internal rot, A few skin rot, Basal plates just starting or pushing out 15-30%, Fairly firm onion, Mid to late term storage onion, Stored fair to excellent.

La Salle: *Stokes sample,* Top sprouts very uneven 0-5 cm, Root sprouts just starting to moderate 0-2.5 cm, Majority skin rot, Some internal rot, Basal plates just starting or pushing out 5-10%, Firmness slightly uneven, Early to mid-term storage onion, Stored good to nice.

Traverse: *American Takii sample,* Top sprouts just starting to moderate 0-2.5 cm, Root sprouts just starting to light 0-1 cm, Majority skin rot, Odd internal rot, Basal plates just starting or pushing out 10-15%, Firmness uneven, Early to mid-term storage onion, Stored good to nice.

37 136: *Hazera sample,* Top sprouts just starting to moderate 0-2.5 cm, Top sprouts slightly uneven, Root sprouts just starting to light 0-1 cm, Skin and internal rot, Basal plates just starting to push out 5-35%, Fairly firm onion, Firmness slightly uneven, Mid to late term storage onion, Stored good to nice.

Switchback: *Seminova sample,* Top sprouts light to moderate 1-5 cm, Root sprouts just starting 0-1 cm, Majority skin rot, Odd internal rot, Basal plates just starting to push out 5-15%, Soft onion, Firmness slightly uneven, Early to mid-term storage onion, Stored okay to good.

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ONION CULTIVAR STORAGE TRIAL EVALUATION NOTES - 2023-2024 -- continued

Saddleback: *Stokes sample,* Top sprouts light to heavy 1->5 cm, Top sprouts are a concern, Root sprouts just starting to heavy 1-5 cm, Majority internal rot, Some skin rot, Basal plates just starting to push out 5-20%, Okay firmness, Firmness slightly uneven, Mid-term storage onion, Stored fair to poor.

Crockett: *Bejo sample,* Tops sprouts just starting to light 0-2.5 cm, Root sprouts just starting to moderate 0-2.5 cm, Skin and internal rot, Basal plates just starting to push out 5-15%, Firm onion, Late term storage onion, Stored okay to good.

Haeckero: *Hazera sample,* Top sprouts just starting to moderate 0-5 cm, Root sprouts just starting to light 0-2.5 cm, Root sprouting is a concern, Majority skin rot, Some internal rot, Basal plates just starting to push out 5%, Firm onion, Firmness slightly uneven, Late term storage onion, Stored good to nice.

Hamilton: *Bejo sample,* Top sprouts just starting to light 0-2.5 cm, Root sprouts light to moderate 0-2.5 cm, Majority internal rot, Odd skin rot, Basal plates just starting or pushing out 10-20%, Firm onion, Late term storage onion, Stored good to nice.

Mountaineer: *American Takii sample,* Top sprouts light to heavy 1-5 cm, Top sprouts are a concern, Root sprouts just starting to moderate 0-2.5 cm, Majority skin rot, A few internal rot, Basal plates just starting to push out 5-10%, Fairly firm onion, Firmness uneven, Late term storage onion, Stored good to excellent.

Fortress: *Stokes sample,* Top & root sprouts just starting to moderate 0-5 cm, Top sprouts lengths uneven, Majority skin rot, Odd internal rot, Basal plates just starting to push out 5-10%, Fairly firm onion, Firmness uneven, Late term storage onion, Stored nice.

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ONION CULTIVAR STORAGE TRIAL EVALUATION NOTES - 2023-2024 -- continued

Bradley: *Bejo sample,* Top sprouts just starting to moderate 0-5 cm, Root sprouts just starting to light 0-2.5 cm, Majority internal rot, Odd skin rot, Basal plates just starting to push out 10%, Mid to late term storage onion, Stored fair.

Braddock: *Bejo sample,* Top & root sprouts just starting to moderate 0-2.5 cm, Top sprouts uneven, Internal and skin rot, Basal plates just starting to push out 10-15%, Firmness uneven, Mid to late term storage onion, Stored a little poor to good.

Stanley: *Clifton sample,* Top sprouts light to moderate 1-5 cm, Top sprouts uneven lengths, Root sprouts just starting to moderate 0-2.5cm, Majority skin rot, Some internal rot, Basal plates just starting to push out 5%, Firm onion, Firmness slightly uneven, Late term storage onion, Stored fair to good.

37 346 B: *Hazera sample,* Top sprouts just starting to moderate 0-2.5 cm, Root sprouts just starting to light 0-1 cm, Majority skin rot, Odd internal rot, Basal plates just starting to push out 5-20%, Firm onion, Firmness slightly uneven, Mid to late term storage onion, Stored nice.

Oneida: *Bejo sample,* Top sprouts light to heavy 1->5 cm, Root sprouts just starting to moderate 0-2.5 cm, Internal and skin rot, Basal plates just starting or pushing out 5-35%, Firm onion, Late term storage onion, Stored poor to good.

Safrane: *Bejo sample,* Top sprouts moderate to heavy 2.5-5 cm, Root sprouts light to heavy 1-5 cm, Top & root sprouting slight concern, Majority skin rot, Odd neck and internal rot, Basal plates just starting to push out 5-10%, Okay firmness, Mid to late term storage onion, Stored a little poor.

E61L 10957: *Enza Zaden sample,* Top sprouts just starting to light 0-2.5 cm, Root sprouts just starting 0-1 cm, Majority internal rot, A few skin rot, Basal plates just starting to push out 5-15%, Fairly firm onion, Firmness slightly uneven, Mid to late term storage onion, Stored poor to good.

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ONION CULTIVAR STORAGE TRIAL EVALUATION NOTES - 2023-2024 -- continued

Highlander: *American Takii sample,* Top sprouts light to moderate 1-5 cm, Root sprouts just starting to light 0-2.5 cm, Majority skin rot, Odd neck rot, Basal plates just starting or pushing out 5-10%, Soft onion, Early storage onion, Not a storage onion, Stored poor.

Thunderstone: *Seminova sample,* Top & root sprouts just starting to moderate 0-5 cm, Top & root sprouting a concern, Majority internal rot, A few skin rot, Basal plates just starting to push out 5-10%, Firmness slightly uneven, Mid-term storage onion, Stored poor to fair.

E61L 10937: *Enza Zaden sample,* Top & root sprouts just starting to light 0-2.5 cm, Majority internal rot, A few skin rot, Basal plates just starting to push out 5%, Firmness slightly uneven, Mid to late term storage onion, Stored poor to good.

SV NY 1496: *Seminis sample,* Top & root sprouts just starting to heavy 0-5 cm, Top sprout lengths uneven, Majority skin rot, A few internal rot, Odd neck rot, Basal plates just starting to push out 10-20%, Firmness soft, Firmness uneven, Early to mid-term storage onion, Stored poor to fair.

37 126: *Hazera sample,* Top & roots sprouts just starting to moderate 0-2.5 cm, Skin and internal rot, Basal plates just starting to push out 10-20%, Fairly firm onion, Firmness slightly uneven, Mid to late term storage onion, Stored poor to good.

Lodestar: *Seminova sample,* Top sprouts moderate to heavy 1->5 cm, Top sprouts uneven, Root sprouts light to heavy 1-5cm, Top & root sprouts a concern, Majority internal rot, A few skin rot, Basal plates just starting to push out 5-20%, Firmness slightly uneven, Mid term storage onion, Stored poor.

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ONION CULTIVAR STORAGE TRIAL EVALUATION NOTES - 2023-2024 -- continued

Frontier: *American Takii sample*, Top sprouts light to heavy 1->5 cm, Top sprouting a concern, Root sprouts just starting to moderate 0-2.5 cm, Majority internal rot, Some skin rot, Basal plates just starting to push out 5-10%, Fairly firm onion, Firmness uneven, Mid to late term storage onion, Stored poor to fair.

Milestone: *American Takii sample*, Top sprouts moderate to heavy 0-5 cm, Root sprouts light to moderate 1-2.5 cm, Majority internal rot, A few skin rot, Basal plates just starting or pushing out 5-25%, Firmness slightly soft, Firmness slightly uneven, Early to mid-term storage onion, Stored poor.

Overlook: *Stokes Seeds sample*, Top sprouts moderate to heavy 2.5-5 cm, Root sprouts just starting moderate 0-2.5 cm, Majority internal rot, Odd skin rot, Basal plates just starting to push out 10-15%, Firmness slightly uneven, Early to mid-term storage onion, Stored poor.

Switchback: *American Takii sample*, Top sprouts light to moderate 1-5 cm, Top sprouts uneven, Root sprouts just starting 0-1 cm, All skin rot, Basal plates just starting to push out 7-30%, Slightly soft onion, Firmness slightly uneven, Early to mid-term storage onion, Stored fair to good.

Venecia: *Bejo sample*, Top sprouts light to heavy 2.5->5 cm, Top sprouts are a concern, Root sprouts just starting to moderate 0-2.5 cm, Majority skin rot, Odd internal rot, Basal plates just starting to push out 5%, Mid to late term storage onion, Stored a little poor.

Catskill: *Stokes Seeds sample*, Top & root sprouts light to heavy 1-5 cm, Top & root sprouting a concern, Majority skin rot, Some internal rot, Basal plates just starting or pushing out 10-30%, Fairly firm onion, Firmness slightly uneven, Mid-term storage onion, Stored poor.

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ONION CULTIVAR STORAGE TRIAL EVALUATION NOTES - 2023-2024 -- continued

Thunderstone: *Hazera sample,* Top & root sprouts light to heavy 0-5 cm, Root sprouting a concern, Majority skin rot, A few internal rot, Basal plates just starting to push out 5-20%, Firmness uneven, Mid-term storage onion, Stored poor to okay.

TTA 782: *American Takii sample,* Top sprouts just starting to moderate 1-2.5 cm, Root sprouts just starting to light 0-1 cm, Majority skin rot, Some internal rot, Basal plates just starting to push out 10-25%, Firmness slightly uneven, Mid-term storage onion, Stored poor to okay.

Lodestar: *American Takii sample,* Top sprouts moderate to heavy 1->5 cm, Top sprouting a concern, Root sprouts light to moderate 1-2.5cm, Root sprouts a concern, Majority internal rot, Odd skin rot, Basal plates just starting to push out 5%, Firmness slightly uneven, Mid to late term storage onion, Stored poor.

Sumo: *Clifton sample,* Top sprouts moderate to heavy 1->5 cm, Root sprouts moderate 0-2.5 cm, Top & root sprouts lengths uneven, Top & root sprouts are a concern, Majority internal rot, A few skin rot, Basal plates just starting to push out 5-10%, Firmness uneven, Mid-term storage onion, Stored poor.

37 293 C: *Hazera sample,* Top sprouts moderate to heavy 1->5 cm, Top sprouts are a concern, Root sprouts moderate 1-2.5 cm, Majority internal rot, A few skin rot, Basal plates just starting to push out 5-10%, Fairly firm onion, Mid to late term storage onion, Stored poor.

Ridgeline: *American Takii sample,* Top sprouts moderate to heavy 2.5> cm, Root sprouts light to moderate 1-2.5 cm, Top & root sprouts are a concern, Majority skin rot, Some internal rot, Basal plates just starting to push out 5%, Firmness uneven, Early to mid-term storage onion, Stored poor.

Good things grow in Ontario

FOODLAND ONTARIO

LONG TERM AVERAGES OF ONION STORAGE TRIALS

CULTIVAR	SOURCE	# YEARS TESTED	% MARKETABLE	% WT LOSS IN STORAGE	% ROT, SOFT & SPROUT	FIRMNESS * IN	FIRMNESS * OUT
INFINITY	BCSVS	9	84.6	5.9	8.3	9.68	6.68
CANADA MAPLE	Sto	9	83.3	8.3	8.3	NA	7.40
TAURUS	Sem	9	82.9	7.3	9.8	NA	5.85
MILLENNIUM	BCSVS	8	82.8	6.6	10.5	4.95	6.85
TAHOE	Bejo	9	82.8	5.0	11.9	9.70	7.68
TRAILBLAZER	Tak	14	81.0	5.6	12.5	9.76	7.50
PATTERSON	Bejo	14	81.0	6.1	12.2	9.85	7.61
PULSAR	BCSVS	7	80.7	5.6	12.9	9.29	7.00
LA SALLE	Sem	14	80.3	6.1	13.1	9.51	6.60
TRAPPS #8	E.J.	9	79.9	8.9	11.3	NA	6.35
TREKKER	Tak	11	79.1	7.0	13.2	9.88	6.64
HAMLET	Sem	25	78.1	7.4	15.2	9.60	6.46
POWELL	Bejo	7	77.3	7.6	14.5	9.93	6.73
NEBULA	Nun	8	77.2	5.8	16.3	9.60	7.40
STANLEY	CF	26	77.2	6.8	15.3	9.87	7.24
LIVINGSTON	Sol	13	76.1	6.9	13.8	9.70	6.90
SCORPION	Cro	7	75.9	7.1	17.6	9.76	7.14
HAECKERO	Haz	5	75.5	7.0	16.8	9.96	7.44
BRADDOCK	Bejo	19	73.8	6.4	19.4	9.57	6.75
SAFRANE	Bejo	17	73.2	6.5	19.4	9.83	7.31

Listed in order of % Marketable. Storage period approximately 11 months.

* 10.0 = Most Desirable, 8.0 = Good, 6.0 = Average

LONG TERM AVERAGES OF ONION STORAGE TRIALS - continued

CULTIVAR	SOURCE	# YEARS TESTED	% MARKETABLE	% WT LOSS IN STORAGE	% ROT, SOFT & SPROUT	FIRMNESS * IN	FIRMNESS * OUT
ARSENAL	Sem	13	74.7	7.0	18.7	9.65	6.02
POCONO	Sem	7	74.7	6.4	18.0	9.66	6.66
FORTRESS	Sem	30	74.3	8.0	17.6	9.63	6.88
PRINCE	Bejo	24	73.9	8.9	17.9	9.70	6.92
PARAGON	BCSVS	10	73.5	11.2	17.1	9.00	6.90
TAMARA	Bejo	9	71.9	9.9	21.8	9.85	6.75
TARMAGON	Sto	6	70.5	10.1	19.1	8.25	5.25
MILESTONE	Tak	22	68.9	6.5	23.8	9.62	5.86
MOUNTAINEER	Tak	12	68.5	5.9	25.1	9.48	6.74
CROCKETT	Bejo	12	67.1	7.5	24.6	9.92	7.74
FRONTIER	Tak	29	66.7	7.6	26.4	9.84	7.08
HUSTLER	HM	11	64.1	9.9	27.8	8.00	5.30
CATSKILL	Sem	9	62.5	6.4	30.6	9.70	6.42
TRAVERSE	Tak	8	60.2	7.1	32.0	9.59	6.45
RIDGE LINE	Tak	8	56.1	7.1	36.1	9.86	5.85
RICOCHET	Sem	9	58.0	6.1	33.9	9.60	5.93
SADDLEBACK	Sem	8	56.4	6.5	36.6	9.61	6.04
CORONA	Bejo	23	55.4	9.6	37.0	9.47	5.56
NORSTAR	Tak	28	51.7	9.8	40.1	8.26	4.71
ONEIDA	Bejo	6	51.4	7.5	40.4	9.45	6.68

Listed in order of % Marketable. Storage period approximately 11 months.

* 10.0 = Most Desirable, 8.0 = Good, 6.0 = Average

RED ONION CULTIVAR TRIAL SEASON SUMMARY – 2024

Compared to the previous 10-year average, air temperatures in 2024 were above average for May (15.4°C) and average for June (19.2°C), July (21.5°C), August (19.6°C) and September (17.6°C). The 10-year average temperatures were: May 13.4°C, June 18.6°C, July 21.1°C, August 20.4°C and September 16.8°C. Monthly rainfall was below the 10-year average for June (79 mm), August (54 mm) and September (21 mm) and above average for May (83 mm) and July (85 mm). The 10-year rainfall averages were: May 58 mm, June 95 mm, July 75 mm, August 74 mm and September 57 mm.

Above seasonal temperatures in April allowed for the ground frost to thaw and by the end of April the soil was satisfactory for seeding. Light rainfall on 27 to 30 April (26.8 mm) prior to seeding which slowed land preparation but created good soil moisture conditions. Onion seeding in the Holland Marsh began the last week of April and was pretty much completed by the 11th of May. The trial was seeded on 6 May. Day time air temperatures were in the high teens to low twenties, with a mix of sun and cloud and nighttime air temperatures were in the high single digits. Soil temperatures were in the low teens before and after seeding. A herbicide application of Pardner and Goal on 10 May burned the onions. It was determined the trial was a loss. The trial was reseeded on 21 May. A soaking rainfall of 1 3/8 inch on 27 May provide moisture for seed germination and strong onion seedling growth. By 13 June the first true leaf was fully grown, and the second true leaf was approximately 1 inch in length. One herbicide application of Goal and Pardner was applied at the recommended rate on 13 June to cleaned up broadleaf weeds. A heavy weed flush of grasses remained and required a grass herbicide application on 27 June. A timely Prowl herbicide application with good soil moisture provided additional weed control. Weed pressure decreased as the season progressed, however a couple of hand weeding events were required to keep the trial free from weeds. Even with the below average rainfall amounts of June and average rainfall of July the onions maintained a steady growth.

On-station monitoring for onion maggot fly emergence began on 10 May with 0.68 flies/trap/day. There were no distinctive peaks in onion maggot fly numbers during the monitoring period. The highest count was reached on 22 July of 1.69 flies/trap/day. For the entire monitoring period, onion maggot fly numbers continually had small waves of increases and decreases in flies/trap/day counts. Onion maggot population was extremely low for the entire season. At evaluation, there was a trial average of 0.5% onion maggot damage. This was a record low for damage in the main red onion variety trial. The onion seed treatment Sepresto has certainly lowered onion maggot damage.

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RED ONION CULTIVAR TRIAL SEASON SUMMARY - 2024 – continued

Thrips were first found on 10 June and were present throughout the growing season. Onion thrips numbers in the variety trial never reached above 1 thrips/leaf well below the spray threshold of 3.0 thrips/leaf. The highest thrips count was 0.71 thrips/leaf on 22 August. An insecticide application of Movento on 19 July kept the thrips numbers low for the following 4 weeks. An additional Delegate application keep thrips below 1.0 thrips/leaf for the rest of the season. Environmental conditions were moderately favourable for fungal diseases to develop in June and July with average seasonal precipitation. Stemphylium leaf blight was found early in the cultivar trial on 20 June and several fungicide applications (see Onion Management Procedures) kept severity low until late July. When tip burn began in late July the percentage of leaf damage increased each week in August. A rating of tip burn was evaluated and recorded on 31 July. Tip burn was at an elevated level for a second season in a row. Botrytis was not observed in the trial. Fungicide applications were applied to protect from downy mildew when the downy mildew forecast was moderate to high in July. No downy mildew developed in the trial but was found on the research station.

Bulb development did not start till early August, as expected due to the late seeding date. Most bulb sizing occurred in mid to late August. Cultivars Barolo (2 August) was the first to lodge. It took approximately four weeks from 2 August for 75% of the cultivars to reach 85% lodged. Most of the cultivars reached full maturity by 28 August when at least 85% of the onions had lodged. The average days to harvest (98 days) decreased by 12 days compared to the 2023 season. The onion tops were slow to dry down. No seeders were present found in the trial. On 5 September a sample from each cultivar was pulled for judging and comparison during Grower Field Day. By this time, most cultivars had lodged but leaves were 40-60% desiccated. All cultivars matured naturally resulting in fair neck finishes when yield samples were harvested on 27 September. Harvest samples from each cultivar were placed in storage on 17 October and cured artificially for approximately 48 hours.

At evaluation in December, quality was fair and yields were well below the desired bushel per acre. Twelve of the thirteen cultivars had the highest number of bulbs in the 1 ¾-2½" (small) diameter size range. The trial average yield of 943 bu/A was surprisingly a 90 bu/A increase from last years trial average of 853 bu/A. However still well below the expected trial average. The first replicate had a significantly higher yield in bu/A compared to the other two replicates. The average percentage of jumbos (>3" diameter) was 2.8%. This is a decrease of 25% from 2022. Cultivars SV NT 4577 and Comrad had the most bulbs in the >3" category. Uniformity of shape was variable with approximately half the cultivars scoring below average (6.0). Culitvars Rubillion and Red Garcia having the best uniformity and Red Marley and Red Wing the poorest. Uniformity of size was rated average for most cultivars and no significant differences were found. Only three of the 13 cultivars evaluated had a very respectable 90% percent marketable or

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RED ONION CULTIVAR TRIAL SEASON SUMMARY – 2024 – continued

greater, and the average percent marketable for all cultivars was 85.3%. The first replicate was significantly higher in percent marketable (90.9%) then compared to the second and third replicate (83.5% and 81.2%). The majority of culls were peewee with doubles being the second most common cull. Skin quality was good at evaluation. The trial average for skin attachment was 7.8 and all cultivars had some minor cracking. The exterior colour appeared slightly lighter but was satisfactory on most varieties. Most cultivars had a very low incidence of skin blemishes. Interior ring colour was acceptable; however, some cultivars had several center rings lacking colour. When onions were cut in half for interior colour evaluation, it was noted that five cultivars had a high percentage of double or multiple centers. Cultivars E61L 10886 and Comrad had the highest percentage of single centers. There was limited mechanical damage found in all cultivars. Neck finishes were generally dry and tight and scored well; however, a few cultivars had some rough neck finishes. These rougher neck finishes confirmed that some onions had not matured naturally by the harvest date due to the late seeding date. The neck finish was significantly better in the third replicate then the first replicate. At evaluation all cultivars had maintained good firmness and cultivar Red Carpet had the best firmness with a rating of excellent (8.7). Maggot damage on onion bulbs in the evaluation samples ranged from 0-1.7% with a trial average of 0.5%. This is lowest ever in a red onion variety trial.

RED ONION CULTIVAR TRIAL – 2024

MANAGEMENT PROCEDURES

Fertilizer:

90 kg/ha Nitrogen (Calcium Ammonium Nitrate 27-0-0) + 100 kg/ha Phosphorous (MESZ 10-40-0) + 200 kg/ha Potassium (ASPIRE 0-0-58) + 125 kg/ha K–Mag (0-0-22) + 35 kg/ha Manganese + 7 kg/ha Copper (99% Cu) + 3.5kg/ha Boron was worked into the soil on 1 May.

A side dressing blend of 12 kg/ha Nitrogen + 10 kg/ha Phosphorous + 75 kg/ha Potassium was applied on 18 July.

Seeded:

All trials were seeded on 6 May. Pelletized onion seed was seeded with a Stanhay Precision Seeder. Raw onion seed was seeded with a V-Belt seeder equipped with a 5 cm wide scatter shoe. Row spacing was 43 cm. The trial was replicated three times.

Note Well: The trial was reseeded on 21 May due to herbicide damage.

Weed Control:

Pre-emergence:	1 application: **PARDNER** at 140 ml/ha and **GOAL** at 210 ml/ha and Manganese at 1.0 kg/ha on 10 May.
Post-emergence:	1 application: **PARDNER** at 140 ml/ha and **GOAL** at 140 ml/ha and Manganese at 1.0 kg/ha on 13 June. 1 application: **PROWL H2O** 6.0 L/ha on 8 June. 1 application: **SELECT** at 375 ml/ha and **AMIGO** at 3.0 L/ha on 27 June.

Minor Elements:

Nine foliar sprays: Mag Max on 6, 15, 24 & 28 June (2.0 L/ha) and 12, 19 & 25 July and 2 & 10 August (4.0 L/ha)
Seven foliar sprays: Calcimax on 15, 24 & 28 June (2.0 L/ha) and 12,19 & 25 July and 2 August (4.0 L/ha)
Seven foliar sprays: Zinc Max on 6, 15 and 24 June (2.0 L/ha) and 12, 19 & 25 July and 10 August (4.0 L/ha)

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RED ONION CULTIVAR TRIAL - 2024 - continued

Minor Elements continued:

Six foliar sprays: Manganese Sulfate on 6 June (1.0 kg/ha) and 15 & 28 June, 12 & 25 July and 10 August (2.0 kg/ha)
Six foliar sprays: Alexin on 12, 19 & 25 July and 2, 10 and 15 August (4.0 L/ha)
Six foliar sprays: Suprafeed on 12 July (2.0 kg/ha) and 19 July (3.0 kg/ha) and 25 July and 2, 10 & 15 August (4.0 kg/ha)
Six foliar sprays: Copper Max 15 August (1.0 L/ha) and 12, 19 & 25 July and 2 & 10 August (2.0 L/ha)
Four foliar sprays: 20-20-20 on 6 June (1.0 kg/ha), and 15, 24 & 28 June (2.0 kg/ha)
Four foliar sprays: Nutri Bor on 19 July (500 ml/ha) and 15 August (1.0 L/ha) and 2 & 10 August (2.0 L/ha)

Insect and Disease Control:

According to IPM recommendations.

ALLEGRO 500F at 1.16 L/ha and Minor Elements on 28 June.
APROVIA TOP at 750 ml/ha + **RIDOMIL MZ** 2.25 kg/ha and Minor Elements on 12 July.
ALLEGRO 500F at 1.16 L/ha + **ZAMPRO** at 1.0 L/ha + **MOVENTO** at 365 ml/ha and Minor Elements on 19 July.
MIRAVIS DUO at 1.0 L/ha + **DELEGATE** at 336 g/ha and Minor Elements on 25 July.
SERCADIS at 666 ml/ha + **ORONDIS ULTRA** at 400 ml/ha and Minor Elements on 2 August.
RIDOMIL MZ 2.25 kg/ha + **MIRAVIS DUO** at 1.0 L/ha + **DELEGATE** at 336 g/ha and Minor Elements on 10 August.
ORONDIS GOLD at 1.0 L/ha + **APROVIA TOP** at 750 ml/ha and Minor Elements on 15 August.

Harvest:

The trial was pulled and topped on 27 September. The trial was placed in a forced air and temperature controlled storage 17 October. The trial was cured for 48 hours (25^{o}C, minimum 65% RH). After curing the temperature was lowered 5^{o}C per week until 0^{o}C was attained.

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RED ONION CULTIVAR TRIAL - 2024 - continued

Sprout Inhibition:

Royal MH 30 XTRA at 8.63 L/ha in 550 L/ha water on.

August 22	August 29		September 4	
Red Marley	Red Eagle	Red Garcia	37 140	Red Carpet
Rubillion	E61L 10886	SV NT 4677	Ruby Ring	Red Wing
Barolo	Comrad		Red Mountain	

EVALUATION PROCEDURES

The cultivars were evaluated on 27 – 29 January after 14 weeks in storage.

 # Bulbs Harvested:

Total number of onions harvested from 4.66 m of row.

Seed Treatments:

SE = Sepresto & Evergol	SP = Spinosad	SF = FI400 & Spinosad	LD = Lorsban & Dithane
S = Sepresto	F = Fungicide	TP = Trigard & ProGro	TE = Trigard & Evergol

Harvest Weight:

Weights from the harvested 4.66 m of row.

Marketable Yield bu/A:

Number of onions > 76 mm (> 3"), 76 mm to 64 mm (3" to 2½") and 64 mm to 32 mm (2½" to 1¼").

Majority of Culls:

D = Double PW = Pee Wee R = Rot OC = Off Colours S = Seeders SP = Sprouts

Shape:

HG = High Globe FG = Flatten Globe G = Globe Sp = Spindle TD = Tear Drop T = Top

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RED ONION CULTIVAR TRIAL - 2024 - continued

Skin Thickness:
10.0 = Most Desirable 7.5 = Good 6.0 = Average

Skin Attachment:
10.0 = Most Desirable, skins well attached 7.5 = Good, skins have a few small cracks 6.0 = Average, skins have cracks but still attached

Neck Finish:
10.0 = Most Desirable, small tight neck 6.0 = Average, neck closed 4.0 = Poor, neck bit rough and open

Overall Score:
Based on quality and general appearance.

Score:
The average of nine marks at evaluation from Uniformity of Shape to Firmness.

Firmness:
10 = Desirable (solid and firm) 6.0 = Average (firm but some elasticity) 1.0 = Poor (spongy)

Interior & Exterior Colour:
LR = Light Red R = Red DR = Dark Red DDR = Deep Dark Red

Days to Harvest:
Numbers of days from transplant until 85% of the tops were down.

Percent Onion Maggot Damage:
Percent of onions damaged by onion maggot ranging from pin hole to completely unmarketable that were found in the 4.66 m harvest sample.

Average Weight/Bulb (g):
The total weight in grams of all bulbs divided by the total number of bulbs. A bulb 51 mm (2") in diameter weighs approximately 70 g. A bulb 57 mm (2¼") in diameter weighs approximately 100 g. A bulb 64 mm (2½") in diameter weighs approximately 135 g.

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RED ONION CULTIVAR TRIAL - 2024 - continued

Seeders:

The average number of seeders found in all three replicates of each cultivar.

% Single Centers:

Percentage of onions with only one heart.

% Double Centers:

Percentage of onions with two hearts.

% Mutiple Centers:

Percentage of onions with three or more hearts.

Top Height (cm):

The average length of 20 random onion tops from all three replicates from the ground to the tips of the leaves as taken on. 50 cm is equal to 20 inches.

Leaf Shape:

B = Leaves are bent or hanging U = Up right leaves, straight

Leaf Colour:

LG = Light Green, G = Green, BG = Blue Green, DG = Dark Green

Tip Burn:

VL = Very light L = Low M = Moderate H = Heavy S = Severe

Irrigation:

No irrigation water was applied for the 2024 season.

RED ONION CULTIVAR TRIAL - 2024

Cultivar	Source	# Bulbs Harvested	# Bulbs Jumbos > 100 mm	# Bulbs X-Large 89 -100 mm	# Bulbs Large 76 - 89 mm	# Bulbs Medium 64 - 76 mm	# Bulbs Small 32 - 64 mm	Stand/Foot	Seed Treatment
RED MARLEY	Sto	136 de*	0 ns**	1 ns	11 ab	44 ab	64 de	8.9 de	SE
RED EAGLE	Bejo	169 ab	0	0	0 c	16 def	128 a	11.0 ab	SE
RUBILLION	Tak	131 ef	0	0	1 c	10 ef	96 bc	8.6 ef	SE
RED WING	Bejo	146 b-e	0	0	1 c	26 cde	101 bc	9.6 b-e	SE
37-140	Haz	142 cde	0	0	0 c	15 def	105 abc	9.3 cde	SE
RUBY RING	Tak	142 cde	0	0	0 c	8 f	98 bc	9.3 cde	SE
RED CARPET	Bejo	147 b-e	0	0	0 c	30 bcd	100 bc	9.6 b-e	SE
E61L 10886	EZ	166 abc	0	0	1 c	30 bcd	121 ab	10.9 abc	SE
RED GARCIA	Sem	183 a	0	0	6 bc	29 bcd	115 ab	12.0 a	SE
RED MOUNTIAN	Bejo	157 bcd	0	0	0 c	24 c-f	105 abc	10.2 bcd	SE
COMRAD	CF	109 f	0	0	9 ab	39 bc	50 e	7.1 f	TE
BAROLO	EZ	137 de	0	0	2 c	21 def	87 cd	9.0 de	SE
SV NT 4677	Sem	137 de	0	1	15 a	56 a	54 e	9.0 de	SE
TRIAL AVERAGE		**146**	**0.0**	**0.2**	**3.7**	**26.8**	**94.2**	**9.6**	

Listed in order of % Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

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** ns indicates that no significant differences were found among the cultivars at P = 0.05.

RED ONION CULTIVAR TRIAL - 2024 - continued

Cultivar	Source	Total Harvest Weight (kg)	Wgt. Jumbo > 89 mm (kg)	Wgt. Large 76-89 mm (kg)	Wgt. Medium 76-64 mm (kg)	Wgt. Small 64-32 mm (kg)	Marketable Yield bu/A	% Marketable	Majority of Culls
RED MARLEY	Sto	16.39 a*	0.20 ns**	2.43 ab	6.75 ab	5.58 def	1129 ab	88.7 ns	DR
RED EAGLE	Bejo	13.95 abc	0.00	0.08 c	2.44 def	10.58 a	988 a-d	86.0	PW
RUBILLION	Tak	9.84 e	0.00	0.14 c	1.64 ef	7.30 bcd	685 e	81.2	PW
RED WING	Bejo	13.09 bcd	0.00	0.21 c	3.69 cde	8.59 abc	942 bcd	87.2	PW
37-140	Haz	11.45 cde	0.00	0.07 c	2.21 def	8.45 abc	810 de	84.3	PW
RUBY RING	Tak	10.25 de	0.00	0.00 c	1.06 f	8.13 abc	693 e	74.8	PWR
RED CARPET	Bejo	13.39 a-d	0.00	0.07 c	4.12 cde	8.61 abc	965 a-d	88.5	PW
E61L 10886	EZ	15.67 ab	0.00	0.29 c	4.33 bcd	10.58 a	1146 ab	91.8	PW
RED GARCIA	Sem	15.15 ab	0.13	1.18 bc	4.04 cde	8.77 abc	1065 abc	81.8	PW
RED MOUNTIAN	Bejo	14.09 abc	0.00	0.07 c	3.48 c-f	9.60 ab	992 a-d	82.6	PWSP
COMRAD	CF	11.95 cde	0.10	1.93 ab	5.41 bc	4.18 f	876 cde	90.5	PW
BAROLO	EZ	11.09 cde	0.00	0.40 c	2.96 c-f	6.79 cde	765 de	80.1	PWR
SV NT 4677	Sem	16.32 a	0.21	3.06 a	8.00 a	4.70 ef	1205 a	92.1	PW
TRIAL AVERAGE		**13.28**	**0.05**	**0.76**	**3.86**	**7.84**	**943**	**85.3**	

Listed in order of % Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

.../ continued

** ns indicates that no significant differences were found among the cultivars at P = 0.05.

RED ONION CULTIVAR TRIAL - 2024 - continued

Cultivar	Source	Shape	Uniformity of Shape	Uniformity of Size	Skin Thickness	Skin Attachment	Neck Finish	Overall Score	Score
RED MARLEY	Sto	T	4.3 f*	5.7 ns**	5.3 cd	5.7 c	8.0 a	5.7 d	6.00 g
RED EAGLE	Bejo	SpG	5.7 cde	6.7	5.0 d	8.7 ab	7.3 ab	7.7 a	6.89 bcd
RUBILLION	Tak	BG	8.0 a	7.0	7.3 a	8.0 b	8.0 a	7.0 abc	7.33 a
RED WING	Bejo	MIX	4.3 f	6.7	6.3 abc	8.3 ab	6.0 c	7.3 ab	6.69 c-f
37-140	Haz	G	5.0 def	6.0	5.7 bcd	8.0 b	6.7 bc	6.3 bcd	6.37 efg
RUBY RING	Tak	HG	5.7 cde	7.3	6.7 ab	8.0 b	6.3 bc	6.0 cd	6.56 def
RED CARPET	Bejo	MIX	4.7 ef	6.7	6.7 ab	9.3 a	5.8 c	7.0 abc	6.76 b-e
E61L 10886	EZ	SpG	5.7 cde	6.0	6.3 abc	7.7 b	6.7 bc	7.3 ab	7.00 abc
RED GARCIA	Sem	T	7.0 ab	5.7	5.0 d	7.7 b	6.0 c	6.3 bcd	6.07 g
RED MOUNTIAN	Bejo	SpG	5.7 cde	6.7	6.0 bcd	8.3 ab	7.0 abc	6.7 a-d	6.74 cde
COMRAD	CF	FG	6.3 bc	5.7	6.3 abc	8.7 ab	6.7 bc	7.3 ab	7.15 ab
BAROLO	EZ	G	6.0 bcd	5.7	6.3 abc	5.7 c	6.3 bc	5.8 d	6.31 fg
SV NT 4677	Sem	T	6.7 bc	6.3	6.0 bcd	7.7 b	6.7 bc	6.3 bcd	6.59 def
TRIAL AVERAGE			**5.8**	**6.3**	**6.1**	**7.8**	**6.7**	**6.7**	**6.65**

Listed in order of % Marketable. 10.0 = Most Desirable, 8.0 = Good, 6.0 = Average

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

.../ continued

** ns indicates that no significant differences were found among the cultivars at P = 0.05.

RED ONION CULTIVAR TRIAL - 2024 - continued

Cultivar	Source	Firmness at Harvest	Firmness at Evaluation	Interior Colour	Interior Colour Rating	Exterior Colour	Exterior Colour Rating	Days to Harvest	% Onion Maggot Damage	Average Weight/Bulb (g)
RED MARLEY	Sto	9.3 bc*	7.0 de	LR	6.0 de	LR	6.3 bc	89 d	1.7 ns**	120.6 a
RED EAGLE	Bejo	9.7 ab	8.0 abc	R	6.7 b-e	R	6.3 bc	101 ab	0.2	82.8 cd
RUBILLION	Tak	9.2 c	7.7 bcd	R	6.3 cde	R	6.7 b	90 cd	0.4	74.7 cd
RED WING	Bejo	9.5 abc	8.2 abc	R	6.3 cde	R	6.7 b	106+ a	1.3	89.2 cd
37-140	Haz	9.8 a	7.0 de	DR	7.3 abc	R	5.3 c	102 ab	0.2	80.6 cd
RUBY RING	Tak	9.7 ab	8.0 abc	R	5.7 ef	R	5.3 c	106 a	0.5	72.1 d
RED CARPET	Bejo	9.8 a	8.7 a	DR	5.7 ef	DR	6.3 bc	105 a	0.2	90.9 cd
E61L 10886	EZ	9.7 ab	8.0 abc	R	7.3 abc	DR	8.0 a	99 abc	0.2	94.3 bc
RED GARCIA	Sem	9.5 abc	6.7 e	R	4.7 f	DR	5.7 bc	93 bcd	0.2	82.7 cd
RED MOUNTIAN	Bejo	9.2 c	7.0 de	R	6.7 b-e	R	6.7 b	102 ab	0.7	90.5 cd
COMRAD	CF	9.7 ab	8.3 abc	R	8.3 a	DR	6.7 b	99 abc	0.0	110.7 ab
BAROLO	EZ	9.3 bc	7.3 cde	DR	7.7 ab	DR	6.0 bc	93 bcd	0.5	80.8 cd
SV NT 4677	Sem	9.3 bc	7.0 de	R	7.0 bcd	R	5.7 bc	97 a-d	0.0	118.8 a
TRIAL AVERAGE		**9.5**	**7.6**		**6.6**		**6.3**	**98**	**0.5**	**91.4**

Listed in order of % Marketable. 10.0 = Most Desirable, 8.0 = Good, 6.0 = Average

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

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** ns indicates that no significant differences were found among the cultivars at P = 0.05.

RED ONION CULTIVAR TRIAL - 2024 - continued

Cultivar	Source	Percent Single Centres	Percent Double Centers	Percent Multiple Centers	% Jumbo > 90 mm	% Jumbo > 76 - 90 mm	% Hollowness Centres
RED MARLEY	Sto	13 bc*	63 ns**	23 ab	0.5 ns	8.4 ab	87 a
RED EAGLE	Bejo	53 a	47	0 c	0.0	0.2 c	40 c
RUBILLION	Tak	57 a	43	0 c	0.0	0.5 c	97 a
RED WING	Bejo	57 a	40	3 c	0.0	0.7 c	83 ab
37-140	Haz	43 ab	53	3 c	0.0	0.2 c	40 c
RUBY RING	Tak	50 a	37	13 abc	0.0	0.0 c	80 ab
RED CARPET	Bejo	47 a	47	7 bc	0.0	0.2 c	67 abc
E61L 10886	EZ	67 a	30	3 c	0.0	0.8 c	70 abc
RED GARCIA	Sem	50 a	50	0 c	0.2	3.1 bc	40 c
RED MOUNTIAN	Bejo	57 a	43	0 c	0.0	0.2 c	53 bc
COMRAD	CF	63 a	37	0 c	0.3	8.6 a	77 ab
BAROLO	EZ	3 c	67	30 a	0.0	1.5 c	67 abc
SV NT 4677	Sem	40 ab	50	10 bc	0.5	10.8 a	77 ab
TRIAL AVERAGE		**46**	**47**	**7**	**0.1**	**2.7**	**67**

Listed in order of % Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

** ns indicates that no significant differences were found among the cultivars at P = 0.05.

RED ONION CULTIVAR MAIN TRIAL EVALUATION NOTES – 2024

Red Marley: *Stokes sample,* Okay appearance, Good tight neck finish, Small sized necks, Thin skins, Fair skin quality, A lot with skin cracking a concern, Slightly pale exterior colour slightly uneven, Odd one with brown spots on skins, Slightly pale red interior colour uneven, Dead centers white or yellow (60/40), Average interior blending, Okay packer, Uniformity of shape uneven, Average firmness, Firmness uneven, Medium run size, Run size a little even, Suspicion of doubles, Early to mid-term storage onion.

Red Eagle: *Bejo sample,* Good appearance, Average to good neck finish, Small to medium sized necks, Thicker skins, Nice skin quality, Exterior colour slightly uneven, Interior colour even, Dead centers white or yellow (70/30), Average interior blending, Good to nice packer, Uniformity of shape a little even, Good firm onion, Firmness even, Small run size, Run size a little uneven, Mid to long term storage onion.

Rubillion: *American Takii sample,* Average appearance, Good tight neck finish, Small to medium sized necks, Average skin thickness, Average skin quality, Odd one with skin cracking, Exterior colour a little uneven, Some with brown spots on skins, Interior colour a little even, Dead centers white or yellow (60/40), Average to good interior blending, Average to good packer, Uniformity of shape a little even, Good firm onion, Firmness a little uneven, Small run size, Run size a little uneven, Mid-term storage onion.

Red Wing: *Bejo sample,* Good appearance, Average tight neck finish, Medium sized necks, Average skin thickness, Pretty good skin quality, Odd one with skin cracking, Slightly dark exterior colour even, Interior colour even, Dead centers white or yellow (60/40), Average to good interior blending, Good packer, Uniformity of shape uneven, Firm onion, Firmness a little uneven, Small to medium run size, Run size a little uneven, Long term storage onion.

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RED ONION CULTIVAR MAIN TRIAL EVALUATION NOTES – 2024 continued

37 140: *Hazera sample,* Good appearance, Average tight neck finish, Medium sized necks, Average skin thickness, Average to pretty good skin quality, Odd one with skin cracking, Exterior colour uneven, Odd one with brown or white spots, Fairly dark interior colour even, Dead centers white or yellow (70/30), Good interior blending, Average packer, Uniformity of shape a little uneven, Average firmness, Firmness uneven, Small to medium run size, Run size a little uneven, Mid- term storage onion.

Ruby Ring: *American Takii sample,* Fair to average appearance, Mixed neck finish, Small to medium sized necks, Average to thick skin thickness, Average skin quality, Odd one with skin cracking slight concern, Exterior colour uneven, Some with brown spots on skins, Interior colour uneven, Dead centers yellow or white (60/40), Average interior blending, Okay to average packer, Uniformity of shape a little uneven, Good firm onion, Firmness a little uneven, Small run size, Run size even, Mid-term storage onion.

Red Carpet: *Bejo sample,* Average to good appearance, Average neck finish, Odd neck finish a bit rough, Medium sized necks, Average to thick skins, Nice skin quality, Slightly dark exterior colour even, Odd one with brown spots, Slightly dark interior colour uneven, Dead centers white or yellow (70/30), Average interior blending uneven, Good packer, Uniformity of shape uneven, Nice firm solid onion, Firmness even, Small to medium run size, Run size a little uneven, Odd one suspicion of doubles, Long term storage onion.

E61L 10886: *Enza Zaden sample,* Good to nice appearance, Average to good neck finish, Small to medium sized necks, Average skin thickness, Pretty good skin quality, Odd one with skin cracking, Odd one with vertical skin cracking, Fairly dark exterior colour even, Interior colour uneven, Dead centers white, Good interior blending even, Good packer, Uniformity of shape a little uneven, Good firm solid onion, Firmness even, Medium run size, Run size a little uneven, Mid to long term storage onion.

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RED ONION CULTIVAR MAIN TRIAL EVALUATION NOTES – 2024 continued

Red Garcia: *Seminis sample,* Average to good appearance, Average tight neck finish, Larger necks a bit rough, Mixed sized necks, Average skin thickness, Fair to pretty good skin quality, Some with skin cracking a little concern, Slightly dark exterior colour uneven, Interior colour a little uneven, Dead centers white, Poor to average interior blending uneven, Average to good packer, Uniformity of shape a little even, Average firmness, Firmness uneven, Small to medium run size, Run size uneven, Early to mid-term storage onion.

Red Mountain: *Bejo sample,* Average to good appearance, Average to good tight neck finish, Small to medium sized necks, Average skin thickness, Pretty good to nice skin quality, Odd one with skin cracking, Exterior colour a little uneven, Odd one with white spots on skins, Interior colour even, Dead centers white, Good interior blending, Good packer, Uniformity of shape uneven, Average firmness, Firmness a little even, Small run size, Run size uneven, Mid-term storage onion.

Comrad: *Clifton sample,* Good to nice appearance, Average to good tight neck finish, Medium sized necks, Average skin thickness, Pretty good to nice skin quality, Odd one with skin cracking, Fairly good exterior colour even, Odd one with brown spots on skins, Slightly dark interior colour even, Dead centers white, Good interior blending even, Good packer, Uniformity of shape a little even, Good firm solid onion, Firmness even, Medium run size, Run size a little uneven, Long term storage onion.

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RED ONION CULTIVAR MAIN TRIAL EVALUATION NOTES – 2024 continued

Barolo: *Enza Zaden sample,* Average appearance, Average tight neck finish, Odd neck finish a bit rough, Small to medium sized necks, Average skin thickness, Fair skin quality, A lot with skin cracking a concern, Fairly dark exterior colour a little even, Slightly dark interior colour even, Dead centers white, Good interior blending even, Okay to average packer, Uniformity of shape a little even, Good firm onion, Firmness a little even, Small run size, Run size uneven, Mid to long term storage onion.

SV NT 4677: *Seminis sample,* Average to good appearance, Average to good tight neck finish, Odd neck finish a bit rough, Small to medium sized necks, Average skin thickness, Fair to pretty good skin quality, Odd one with skin cracking, Odd one with skin rot, Exterior colour uneven, Odd one with brown spots on skins, Interior colour even, Dead centers white, Average to good interior blending, Okay to good packer, Uniformity of shape a little even, Average firmness, Firmness a little uneven, Medium run size, Run size a little even, Early to mid-term storage onion.

37 128: *Hazera sample,* Fair to good appearance, Poor to average neck finish, Neck finish a bit rough, Medium sized necks, Average to thick skin thickness, Average to pretty good skin quality, Skin and basel plate rot a little concern, Exterior colour a little uneven, Dark interior colour, Dead centers white 70% or yellow 30%, Average interior blending, Average to good packer, Uniformity of shape a little uneven, Good firm solid onion, Firmness even, Small run size, Run size uneven, Odd double onion, Long term storage onion.

LONG TERM AVERAGES OF RED ONION CULTIVAR TRIALS

Cultivar	Source	# Years Evaluated	Yeild bu/A	% Marketable	% Jumbos <3"	Days to Maturity	Firmness In*	Firmness out*	Neck Finish	Score	% Onion Maggot Damage	# of Seeders
RED SKY	Bejo	6	994	90.0	34.2	81	8.6	6.7	7.8	6.53	0.9	0.0
RED SPRING	Bejo	5	704	63.7	29.4	82	8.2	6.3	7.7	5.89	1.5	0.0
RED STONE	Haz	3	786	95.6	2.9	83	9.9	8.5	8.0	7.47	1.3	0.0
RUBILLION	Tak	8	872	92.5	17.6	89	9.1	7.0	8.0	7.07	2.1	0.0
SV 4643	Sem	7	1273	89.7	57.0	89	9.5	7.0	6.9	6.32	1.2	1.1
MERCURY	Sto	3	1173	86.1	47.5	91	8.8	6.8	6.7	6.07	0.0	0.2
RED HAWK	Bejo	7	1043	83.0	49.6	92	8.7	6.6	6.3	6.77	1.4	0.8
RED NUGENT	Sto	5	1344	89.4	56.5	94	9.4	6.8	6.9	6.07	2.1	0.1
RED BULL	Bejo	8	1128	93.2	42.4	97	9.6	8.0	6.6	6.90	1.1	0.2
RED MOUNTIAN	Bejo	6	1108	91.7	17.9	101	9.7	7.7	7.4	7.14	1.8	0.0
RUBY RING	Tak	11	936	93.0	19.4	101	9.7	7.5	6.9	6.77	1.2	0.0
RED CARPET	Bejo	8	1102	93.0	32.1	105	9.8	8.4	6.2	6.96	3.5	0.0
TANNAT	EZ	3	998	87.8	26.5	105	9.4	7.3	5.5	6.60	1.3	0.7
RED WING	Bejo	10	1244	95.4	43.3	110	9.7	8.3	6.5	7.14	0.8	0.0

All data based from 2011 season forward

Listed in order of Days to Maturity. * 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

* Firmness: In = Evaluated at time of Harvest Out = Evaluated in December

MAIN RED ONION STORAGE TRIAL 2023 - 2024

Cultivar	Source	% Marketable	% Weight Loss	% Sprouts	% Rot	% Soft	Firmness In **	Firmness Out **	% Sprouting at Base	% Sprouting at Top
RED MARLEY	Sem	37.4 a*	5.6 b	53.4 c	2.4 ab	0.8 a	9.3 bcd	5.3 e	48.3 bc	60.0 bcd
TANNAT	EZ	36.4 a	6.3 b	54.2 c	2.6 a	0.0 b	9.8 ab	6.2 b-e	10.0 d	50.0 d
COMRAD	CF	35.3 ab	3.9 b	59.7 bc	0.7 cd	0.0 b	9.8 ab	6.5 a-d	25.0 cd	53.3 cd
SVNT 1608	Sem	32.4 abc	5.9 b	61.9 bc	0.5 cd	0.5 ab	9.7 abc	5.8 cde	15.0 d	68.3 a-d
BAROLO	EZ	25.6 a-d	5.4 b	67.1 abc	1.6 abc	0.0 b	9.8 ab	7.0 ab	70.0 ab	65.0 a-d
SV NT 4677	Sem	25.2 a-d	4.9 b	68.5 abc	1.0 bcd	0.0 b	9.2 cd	5.3 e	18.3 cd	76.7 abc
RED WING	Bejo	25.1 a-d	4.8 b	69.2 abc	0.5 cd	0.0 b	10.0 a	7.3 a	76.7 ab	60.0 bcd
RED MOUNTAIN	Bejo	22.4 a-d	6.1 b	70.4 abc	0.7 cd	0.0 b	9.5 a-d	6.5 a-d	68.3 ab	78.3 ab
37-128	Haz	21.8 a-d	11.7 a	64.4 bc	1.7 abc	0.0 b	10.0 a	6.7 abc	75.0 ab	68.3 a-d
RED CARPET	Bejo	17.8 bcd	6.4 b	74.0 ab	1.4 a-d	0.0 b	10.0 a	6.7 abc	63.3 ab	71.7 a-d
RUBILLION	Tak	17.3 cd	5.8 b	76.4 ab	0.1 d	0.0 b	9.2 cd	5.7 de	75.0 ab	85.0 a
RUBY RING	Tak	9.1 d	6.3 b	84.2 a	0.1 d	0.0 b	9.3 bcd	6.8 ab	89.7 a	86.7 a
RED SPRING	Bejo	8.70 d	5.7 b	84.2 a	1.1 a-d	0.0 b	9.0 d	6.2 b-e	76.7 ab	88.3 a
TRIAL AVERAGE		**24.2**	**6.1**	**68.3**	**1.1**	**0.1**	**9.6**	**6.3**	**55**	**70**

Listed in Order of Percent Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05 Fisher's Protected LSD Test.

** 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average

RED ONION CULTIVAR STORAGE TRIAL EVALUATION NOTES - 2023-2024

Red Marley: *Seminis sample,* Top sprouts just starting to moderate 0-5 cm, Top sprouts are a concern, Root sprouts just starting to light 0-2.5 cm, Majority skin rot, Odd internal rot, Basal plates just starting to push out 5-10%, Slightly soft onion, Firmness uneven, Early term storage onion, Stored okay.

Tannat: *Enza Zaden sample,* Top sprouts just starting to light 0-2.5 cm, Root sprouts just starting 0-1 cm, Majority skin rot, Some internal rot, Basal plates just starting or pushing out 10-45%, Okay firmness, Firmness uneven, Early to mid-term storage onion, Stored a little poor to okay.

Comrad: *Clifton sample,* Top & root sprouts just starting to light 0-1 cm, Skin and internal rot, Basal plates just starting or pushing out 5-78%, Fairly firm, Mid to late term storage onion, Stored fair to good.

Red Garcia: *Seminis sample,* Top sprouts just starting to light 0-2.5 cm, Root sprouts just starting 0-1 cm, Skin and internal rot, Basal plates pushing out 80-85%, Firmness uneven, Early to mid-term storage onion, Stored okay.

Barlo: *Enza Zaden sample,* Top sprouts just starting to moderate 0-5 cm, Root sprouts just starting to light 0-2.5 cm, Majority skin rot, Some basal plate rot, Odd internal rot, Basal plates just starting to push out 10-40%, Fairly firm, Firmness uneven, Mid to late term storage onion, Stored a little poor to fair.

SVNT 4677: *Stokes sample,* Top sprouts light to moderate 1-2.5 cm, Top sprout lengths uneven Top sprouts are a concern, Root sprouts just starting 0-1 cm, Majority internal rot, Odd skin rot, Basal plates just starting to push out 5%, Onion slightly soft, Firmness slightly uneven, Early storage onion, Stored okay to fair.

Red Wing: *Bejo sample,* Top sprouts just starting to moderate 0-2.5 cm, Root sprouts light to moderate 1-2.5 cm, Root sprouts slightly concern, All internal rot, Basal plates just starting to push out 5-10%, Firm onion, Firmness slightly uneven, Mid to late term storage onion, Stored okay to good.

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RED ONION CULTIVAR STORAGE TRIAL EVALUATION NOTES - 2023-2024 - continued

Red Mountain: *Bejo sample,* Top sprouts just starting to heavy 0-5 cm, Root sprouts just starting to light 0-2.5 cm, Majority skin rot, Odd internal rot, Basal plates just starting to push out 5-20%, Okay firmness, Firmness slightly uneven, Mid to late term storage onion, Stored okay to fair.

37 128: *Hazera sample,* Top sprouts just starting to moderate 0-2.5 cm, Top sprout lengths uneven, Root sprouts light to heavy 1-5 cm, Majority internal rot, Odd skin and basal plate rot, Basal plates just starting to push out 5%, Fairly firm, Firmness uneven, Mid to late term storage onion, Stored okay to good.

Red Carpet: *Bejo sample,* Top sprouts just starting to light 0-2.5 cm, Root sprouts light to moderate 1-2.5 cm, Top & root sprouts are a concern, All internal rot, Basal plates just starting or pushing out 5-25%, Fairly firm, Mid to late term storage onion, Stored okay.

Rubillion: *American Takii sample,* Top & root sprouts light to moderate 1-2.5 cm, Top & root sprouts are a concern, Basal plates just starting to push out 5%, Okay firmness, Firmness slightly uneven, Early to mid-term storage onion, Stored a little poor to fair.

Ruby Ring: *American Takii sample,* Top & root sprouts moderate to heavy 2.5->5 cm, Top & root sprouting a concern, Majority internal rot, Odd skin rot, Basal plates just starting to push out 5%, Okay firmness, Firmness uneven, Early to mid-term storage onion, Stored a little poor.

Red Spring: *Bejo sample,* Top & root sprouts light to moderate 1-5 cm, Skin and internal rot, Basal plates just starting to push out 5%, Slightly soft onion, Firmness slightly uneven, Early term storage onion, Stored a little poor.

LONG TERM AVERAGES OF RED ONION STORAGE TRIALS

CULTIVAR	SOURCE	# YEARS TESTED	% MARKETABLE	% WT LOSS IN STORAGE	% ROT, SOFT & SPROUT	FIRMNESS * IN	FIRMNESS * OUT
RED MOUNTAIN	Bejo	7	58.3	5.7	35.4	9.67	7.04
RED BULL	Bejo	6	56.4	6.3	37.7	9.63	7.20
RUBY RING	Tak	9	53.9	6.6	36.7	9.59	6.49
RED WING	Bejo	7	53.9	5.8	40.5	9.67	7.04
RED MARLEY	Sto	6	49.8	6.2	42.7	9.63	5.83
RED HAWK	Bejo	5	49.7	6.5	45.0	8.58	6.10
RED NUGENT	Sto	5	48.4	7.0	43.3	9.35	5.44
RED CARPET	Bejo	7	47.8	6.3	46.0	9.70	7.20
RUBILLION	Tak	7	38.6	5.8	55.1	8.96	6.34
RED SKY	Bejo	4	30.7	5.4	64.1	8.58	6.28
RED SPRING	Bejo	5	2.5	12.1	85.1	8.00	3.72

Listed in order of % Marketable. Storage period approximately 11 months.

* 10.0 = Most Desirable, 8.0 = Good, 6.0 = Average

BEET CULTIVAR TRIAL SEASON SUMMARY – 2024

Compared to the previous 10-year average, air temperatures in 2024 were above average for July (21.5°C), August (19.6°C), September (17.6°C) and October (10.6°C). The 10-year average temperatures were: July 21.1°C, August 20.4°C, September 16.8°C and October 10.1°C. Monthly rainfall was below the 10-year average for August (54 mm), September (21 mm) and October (20 mm) and above average for July (85 mm). The 10-year rainfall averages were: July 75 mm, August 74 mm, September 57 mm and October 62 mm.

Good soil moisture levels were present before seeding and allowed for good bed formation. The trial was seeded on 2 July. Day time air temperatures were in the high twenties, with a mix of sun and cloud and nighttime air temperatures were in the high teens. Soil temperatures were in the low twenties at seeding. A pre-emergence herbicide of Dual was applied on 5 July. A soaking rain fall of 2 inches occurred 8 days after seeding. Plant emergence and plant vigor were good. At the 2 to 4 true leaf stage of growth the beets began to show damage and stunting of growth. The hills were still quite moist from the heavy rainfall in July and additional rain in early August saturated the soil root zone. This saturation stalled growth. The remainder of August was drier and the beets appeared to recover. Timely herbicide applications keep weed control at manageable levels; however, a couple of hand weeding events were required to keep the trial free from weeds. Even with the below average rainfall amounts in August through October the beets maintained a steady growth. When leaf lengths were recorded on the week of 8 October, the average leaf length was 55.6 cm. Beet development started in mid August. On 5 September a sample from each cultivar was pulled for judging and comparison during Grower Field Day. By this time, most cultivars were only one inch in diameter. Most of the cultivars had hairy tap roots and messy top growth. Harvest occurred on 30 and 31 October and samples from each cultivar were placed in storage.

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BEET CULTIVAR TRIAL SEASON SUMMARY - 2024 – continued

At evaluation in mid December, quality was fair in most of the cultivars and yields varied between a high of 400 to a low of 191 bushels per acre. The trial yield average was 304 bu/A. All of the cultivars had the highest number of beets in the 1-2" size range.The trial average for the percentage of jumbos (>3" diameter) was 8.2% but no significant difference was found. Uniformity of size rating was below average (5.4). Cultivar Manolo received the best uniformity of size rating of 7.0 while two thirds of the cultivars had a below average rating. The uniformity of shape had a below average rating of 5.2. During evaluation, shapes were highly variable within the individual samples. Cultivars Monty and Zeppo had a rating of 7.0 or greater for uniformity of shape and 76% of the cultivars had a rating below average for uniformity of shape. The average stand count was 3.6 plants/ft, significantly below the desired seeding rate of 12 to 15 plants/ft. The vast majority of unmarketable beets (culls) were undersized beets (peewees). The trial average for marketable beets was a disappointing 67.7%. Cultivar Roditi had the highest percent marketable (76.5%). The third replicate had a significantly higher percent marketability (70.9%) then the first replicate (63.6%). Most beets had a slightly rougher skin quality. Most of the cultivars had an average rating for the exterior and interior colour. The trial average for zoning was only 5.9 with significant difference between the cultivars. Exterior, interior and zoning had a significantly different (higher) rating average in the second replicate compared to the third replicate. Some brown scales were found on the outer skins and the trial average for smoothness was below average. Cultivar Zeppo had the best neck finish rating of 7.7. The majority of the beet cultivars had below average neck finishes. For the first season the beet cultivar trial had limited success, lessons learned.

BEET CULTIVAR TRIALS - 2024

MANAGEMENT PROCEDURES

Fertilizer:

40 kg/ha Nitrogen (Calcium Ammonium Nitrate 27-0-0) + 75 kg/ha Phosphorous (MESZ 10-40-0) + 100 kg/ha Potassium (ASPIRE 0-0-58) + 75 kg/ha of K-Mag (0-0-22) + 35 kg/ha of Manganese Sulfate + 3.5 kg/ha Boron (10%) and 30kg/ha of sulfur chips was worked into the soil.

Seeded:

The trial was seeded on 2 July using a push cone seeder. Seeding rate per foot was as instructed by the supplier. All trials were seeded on beds 86 cm apart. The seeding rate was done according to percent germination. The trial was replicated three times.

Weed Control:

Pre-emergence: 1 application: **DUAL** at 1.25 L/ha on 5 July.
Post-emergence: 1 application: **BETAMIX B** at 1.75 L/ha 19 July.

Minor Elements:

One foliar spray: Epsom Salts on 10 August (2.0 kg/ha).
One foliar spray: Maganese Sulfate on 10 August (2.0 kg/ha).
One foliar spray: Suprafeed on 10 August (2.0 kg/ha).

Insect and Disease Control:

According to IPM recommendations.

CABRIO at 840 g/ha and Minor Elements on 10 August.

Harvest:

The trial was harvested on 30 & 31 October. All trials were immediately placed in a temperature and humidity controlled storage (1°C, 95 % RH) respectively.

Irrigation:

No irrigation water was applied during the 2024 growing season.

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EVALUATION PROCEDURES

The cultivars were evaluated on 12 – 18 December after 7 weeks in storage.

 # Carrots Harvested:

Total number of beets harvested from 2.32 m of row.

Harvest Weight:

Weights from the harvested 2.32 m of row.

Seeding Rate:

Number of seeds per foot as specified by seed company.

Stand per Foot:

Stand per Foot times 3.28 equals Stand per Metre.

Marketable Yield bu/A:

Number of beets > 100 mm (> 4"), 100 mm to 75 mm (4" to 3"), 75 mm to50 mm (3" to 2") and 50 mm to 25 mm (2" to 1").

Average Weight/Beet (g):

The total weight in grams of all beets divided by the total number of beets.

% Oversize:

The percentage of carrots > 75 cm (> 3") and greater.

Majority of Culls:

Sp = Splits PW = Peewee (< 2.5 cm) R = Rot

External Colour:

DR = Dark Red R = Red PR = Purple Red LR = Light Red LY = Light Yellow

Internal Colour:

DR = Dark Red R = Red PR = Purple Red LR = Light Red LY = Light Yellow

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BEET CULTIVAR TRIALS - 2024 - continued

Zoning:

10 = No rings noticeable even colour throughout 7.0 = Rings slightly noticeable 5.0 = Distinct noticeable rings

Top Length (cm):

Small = 20-30 centimetres Medium = 30-45 centimetres Large = 45 centimetres and greater

Leaf Colour:

LG = Light Green G = Green DG = Dark Green PG = Pale Green

Alternaria Leaf Infection:

Evaluation took place on 8 October. 10.0 = Most Desirable, no lesions; 8.0 = Good, mild lesions on leaves, no lesions on petioles; 6.0 = Moderate, lesions on leaves, some lesions on petioles; 3.0 = Poor, numerous lesions on leaves, numerous lesions on petioles; 1.0 = Severe, tops completely rotted, crop cannot be harvested.

Shape:

G = Globe HG = High Globe Top = Top Cyl = Cylindrical FG = Flaten Globe OB = Oblong

Score:

The average of the 9 marks from Uniformity of Shape to Blight Rating. 10.0 = Most Desirable, 7.5 = Good, 6.0 = Average.

Check out the Muck Crops Research Station's Web Page

https://bradford-crops.uoguelph.ca/

Grower Field Day & Muck Conference Information

Integrated Pest Management Information

- IPM Report Updates
- Weather Data
- Insect & Disease Forecasting Data

Publications

- Cultivar Trial Results (1971-2024)
- Research Reports
- Research Documents

BEET CULTIVAR MAIN TRIAL - 2024

Cultivar	Source	# Beets Harvested	# Beets Jumbos > 100 mm	# Beets Lrg 100 - 75 mm	# Beets Med 75 -50 mm	# Beets Small 50 - 25 mm	Sprout Count	Seeds / Foot	Stand / Foot
RODITI	RZ	39 e*	1 ns**	2 ns	12 cde	14 ns	1.2	15	2.6 e
MONTY	RZ	60 bc	0	3	18 ab	24	1.2	15	3.9 bc
SCARLETT	SN	47 cde	2	6	10 de	17	1.5	12	3.1 cde
SCARLETT	Nor	41 de	2	5	10 cde	13	1.5	12	2.7 de
ZEPPO	RZ	65 ab	1	6	15 a-d	24	1.5	12	4.3 ab
RED TITAN	ILL	54 b-e	2	5	11 cde	19	1.5	12	3.5 b-e
RED CLOUD	Bejo	56 bcd	3	4	10 de	22	1.5	12	3.6 bcd
GRENADE	Nor	75 a	0	5	19 a	27	1.8	10	4.9 a
SCHRUTE	ILL	60 abc	1	4	15 abc	21	1.5	12	3.9 abc

Listed in order of % Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

.../ continued

** ns indicates that no significant differences were found among the cultivars at P = 0.05.

BEET CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	# Beets Harvested	# Beets Jumbos > 100 mm	# Beets Lrg 100 - 75 mm	# Beets Med 75 -50 mm	# Beets Small 50 - 25 mm	Sprout Count	Seeds / Foot	Stand / Foot
MANOLO	Bejo	47 cde*	0 ns**	3 ns	8 e	20 ns	1.2	15	3.1 cde
BOHAN	Bejo	53 b-e	2	6	13 b-e	15	1.5	12	3.5 b-e
H20 103 001	ILL	57 bc	2	8	12 cde	16	1.5	12	3.7 bc
RED ATLAS	ILL	62 abc	2	6	12 cde	20	1.8	10	4.0 abc
JOLIE	SN	47 cde	1	3	11 cde	16	1.5	12	3.1 cde
RED ACE	Sto	65 ab	1	5	9 e	24	1.7	10	4.3 ab
BULLOCK	Nor	51 b-e	1	3	9 e	16	1.5	12	3.4 b-e
BULLOCK	SN	56 bc	1	2	8 e	20	1.5	12	3.7 bc
TRIAL AVERAGE		**55**	**1**	**4**	**12**	**19**	**1.5**		**3.6**

Listed in order of % Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

.../ continued

** ns indicates that no significant differences were found among the cultivars at P = 0.05.

BEET CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	Total Harvest Weight (kg)	Wgt. Jumbo > 100 mm (kg)	Wgt. Large 100-75 mm (kg)	Wgt. Medium 75-50 mm (kg)	Wgt. Small 50-25 mm (kg)	Marketable Yield bu/A	Weight / Root	% > 75 mm
RODITI	RZ	3.26 de*	0.71 ns**	0.44 ns	1.49 cd	0.52 de	239 c-f	88.5 ns	4.0 ns
MONTY	RZ	4.17 a-e	0.00	0.83	2.28 ab	0.92 ab	304 a-e	71.8	5.6
SCARLETT	SN	4.66 a-d	1.23	1.64	1.03 d	0.65 b-e	344 a-d	101.8	12.2
SCARLETT	Nor	4.16 a-e	1.20	1.45	1.01 d	0.41 e	307 a-d	100.6	12.1
ZEPPO	RZ	5.10 ab	0.82	1.55	1.74 bc	0.84 a-d	373 ab	80.3	9.0
RED TITAN	ILL	4.20 a-e	0.80	1.32	1.27 cd	0.68 b-e	307 a-d	83.3	12.0
RED CLOUD	Bejo	4.81 abc	1.29	1.26	1.24 cd	0.83 a-d	349 abc	85.8	7.8
GRENADE	Nor	5.46 a	0.12	1.66	2.41 a	1.07 a	396 a	75.1	7.8
SCHRUTE	ILL	4.36 a-d	0.59	1.11	1.66 c	0.80 a-d	313 a-d	75.2	6.5

Listed in order of % Marketable.

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.../ continued

** ns indicates that no significant differences were found among the cultivars at P = 0.05.

BEET CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	Total Harvest Weight (kg)	Wgt. Jumbo > 100 mm (kg)	Wgt. Large 100-75 mm (kg)	Wgt. Medium 75-50 mm (kg)	Wgt. Small 50-25 mm (kg)	Marketable Yield bu/A	Weight / Root	% > 75 mm
MANOLO	Bejo	2.76 e*	0.25 ns**	0.62 ns	0.94 d	0.78 a-d	195 ef	59.5 ns	5.9 ns
BOHAN	Bejo	4.90 ab	1.03	1.74	1.44 cd	0.52 de	356 ab	92.1	11.3
H20 103 001	ILL	5.53 a	1.03	2.28	1.46 cd	0.54 de	400 a	98.7	13.4
RED ATLAS	ILL	4.94 ab	1.19	1.54	1.25 cd	0.76 a-d	357 ab	82.4	10.3
JOLIE	SN	3.42 cde	0.51	0.83	1.34 cd	0.57 cde	244 c-f	74.4	5.9
RED ACE	Sto	3.68 b-e	0.43	1.16	1.01 d	0.87 abc	262 b-f	56.4	7.3
BULLOCK	Nor	3.33 de	0.43	0.81	1.17 cd	0.70 b-e	234 def	65.2	5.9
BULLOCK	SN	2.77 e	0.45	0.43	0.93 d	0.72 b-e	191 f	49.2	3.0
TRIAL AVERAGE		**4.21**	**0.71**	**1.22**	**1.39**	**0.72**	**304**	**78.8**	**8.2**

Listed in order of % Marketable.

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

.../ continued

** ns indicates that no significant differences were found among the cultivars at P = 0.05.

BEET CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	%Marketable	Majority of Culls	Exterior Colour	Exterior Colour Rating	Interior Colour	Interior Colour Rating	Zoning	Leaf Lenghts cm	Leaf Colour	Alternia Leaf Infection Oct 8
RODITI	RZ	76.5 ns**	PW	R	5.0 efg*	R	7.3 bcd	7.3 a-d	54.1 cde	G/R	9.0
MONTY	RZ	76.1	PW	DR	8.3 a	DR	9.0 a	8.7 a	50.9 e	DG/R	7.7
SCARLETT	SN	74.6	PW	R	4.3 g	DR	5.3 fg	5.7 def	57.7 abc	G/R	8.3
SCARLETT	Nor	73.5	PW	R	5.3 d-g	R	4.7 g	4.7 fg	56.3 bcd	G/R	9.0
ZEPPO	RZ	71.1	PW	DR	7.3 ab	DR	8.7 ab	8.0 ab	53.6 cde	DG	8.7
RED TITAN	ILL	70.6	PW	R	6.0 cde	RP	5.7 efg	4.3 fg	54.0 cde	G/R	8.7
RED CLOUD	Bejo	69.4	PW	DR	6.7 bc	DR	6.7 def	6.0 c-f	55.9 b-e	G/R	9.0
GRENADE	Nor	68.7	PW	R	7.3 ab	R	7.0 cde	7.0 a-e	51.8 de	G/DR	8.7
SCHRUTE	ILL	67.3	PW	R	5.7 c-f	R	5.3 fg	4.7 fg	54.7 b-e	G/DR	8.3

Listed in order of % Marketable. 10.0 = Most Desirable, 8.0 = Good, 6.0 = Average

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

** ns indicates that no significant differences were found among the cultivars at P = 0.05.

BEET CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	%Marketable	Majority of Culls	Exterior Colour	Exterior Colour Rating	Interior Colour	Interior Colour Rating	Zoning	Leaf Lenghts cm	Leaf Colour	Alternia Leaf Infection Oct 8
MANOLO	Bejo	67.2 ns**	PW	DR	6.3 bcd*	DP	8.3 abc	7.7 abc	53.1 cde	G/R	9.0
BOHAN	Bejo	66.8	PW	DR	6.3 bcd	DR	5.0 g	5.3 ef	62.4 a	G	9.0
H20 103 001	ILL	66.8	PW	R	4.7 fg	R	7.0 cde	3.3 g	57.2 bc	G/R	8.0
RED ATLAS	ILL	66.7	PW	R	5.7 c-f	R	6.7 def	5.7 def	57.7 abc	G/R	8.7
JOLIE	SN	66.3	PW	DR	6.0 cde	R	6.7 def	5.3 ef	59.4 ab	G/DR	9.2
RED ACE	Sto	59.7	PW	DR	6.3 bcd	R	5.7 efg	5.7 def	55.9 b-e	G/R	7.3
BULLOCK	Nor	56.8	PW	R	5.7 c-f	R	4.7 g	4.7 fg	56.3 bcd	G/DR	9.2
BULLOCK	SN	53.1	PW	R	5.0 efg	DR	7.0 cde	6.7 b-e	54.4 b-e	G/DR	9.0
TRIAL AVERAGE		**67.7**			**6.0**		**6.5**	**5.9**	**55.6**		**8.6**

Listed in order of % Marketable. 10.0 = Most Desirable, 8.0 = Good, 6.0 = Average

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

** ns indicates that no significant differences were found among the cultivars at P = 0.05.

BEET CULTIVAR MAIN TRIAL - 2024 - continued

Cultivar	Source	Shape	Uniformity of Shape	Uniformity of Size	Smoothness	Neck Finish	Root Attachment	Overall Rating	Score
RODITI	RZ	Top	5.3 b-e*	5.3 a-e	5.3 a-e	6.0 bc	5.7 ab	5.3 bc	5.85 b
MONTY	RZ	G	7.0 ab	6.7 ab	6.3 abc	6.7 ab	6.3 a	7.0 a	7.33 a
SCARLETT	SN	FG	5.0 c-f	4.0 de	4.7 c-g	4.7 c-f	4.0 cd	5.0 cd	4.74 d-g
SCARLETT	Nor	FG	5.7 a-e	4.0 de	3.0 g	2.7 gh	3.7 cd	3.7 e	4.15 g
ZEPPO	RZ	G	7.3 a	5.3 a-e	6.7 ab	7.7 a	7.0 a	6.3 ab	7.15 a
RED TITAN	ILL	FG	4.7 def	5.3 a-e	4.7 c-g	2.7 gh	3.7 cd	3.7 e	4.52 fg
RED CLOUD	Bejo	MIX	3.3 f	3.7 e	4.3 d-g	3.3 fgh	4.3 bc	4.0 de	4.70 efg
GRENADE	Nor	HG	6.7 abc	6.7 ab	6.3 abc	5.7 bcd	7.0 a	6.7 a	6.70 a
SCHRUTE	ILL	MIX	4.3 ef	6.3 abc	4.7 c-g	4.3 def	4.3 bc	4.7 cde	4.93 c-f

Listed in order of % Marketable. 10.0 = Most Desirable, 8.0 = Good, 6.0 = Average

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

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ONION CULTIVAR MAIN TRIAL - 2023 - continued

Cultivar	Source	Shape	Uniformity of Shape	Uniformity of Size	Smoothness	Neck Finish	Root Attachment	Overall Rating	Score
MANOLO	Bejo	TOP	5.0 c-f*	7.0 a	3.7 efg	3.3 fgh	2.7 d	3.7 e	5.30 b-e
BOHAN	Bejo	G	5.3 b-e	5.3 a-e	7.0 a	4.7 c-f	4.7 bc	5.3 bc	5.44 bc
H20 103 001	ILL	MIX	3.3 f	4.7 b-e	5.0 b-f	4.7 c-f	5.7 ab	3.7 e	4.67 efg
RED ATLAS	ILL	MIX	5.0 c-f	5.7 a-e	4.0 d-g	5.3 b-e	4.3 bc	4.7 cde	5.22 b-e
JOLIE	SN	OB	4.3 ef	4.3 cde	4.3 d-g	2.3 h	3.3 cd	4.0 de	4.52 fg
RED ACE	Sto	FG	6.3 a-d	6.0 a-d	5.3 a-e	4.0 efg	4.7 bc	4.7 cde	5.41 bcd
BULLOCK	Nor	HG	5.7 a-e	5.3 a-e	5.7 a-d	4.3 def	3.7 cd	5.0 cd	4.96 c-f
BULLOCK	SN	G	4.3 ef	6.7 ab	3.3 fg	4.0 efg	3.3 cd	3.7 e	4.89 c-f
TRIAL AVERAGE			**5.2**	**5.4**	**5.0**	**4.5**	**4.6**	**4.8**	**5.32**

Listed in order of % Marketable. 10.0 = Most Desirable, 8.0 = Good, 6.0 = Average

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

RED BEET CULTIVAR MAIN TRIAL EVALUATION NOTES – 2024

Monty: *Rijk Zwaan sample,* Good appearance, Uniformity of shape even, Odd one with vertical cracks, Good neck finish, Medium sized necks even, Skins smooth a little uneven, Pretty good skin quality, Small to medium tap root width, Short tap root, Tap root a little hairy, Dark exterior colour even, A few with brown scales on top 1/4 of beet, Very dark interior colour, Great internal zoning even, Rings unnoticeable, Good packer, Medium run size a little uneven, Average firmness.

Bohan: *Bejo Seeds sample,* Fair to average appearance, Uniformity of shape uneven, Average neck finish bit rough, Medium to large sized necks even, Skins smooth even, Average skin quality, Medium tap root width, Long tap root, Tap root fairly hairy, Neck rot, Dark exterior colour a little even, Odd one with brown scales on top 1/3 of beet, Dark interior colour, White in centers (20-40%), A little poor internal zoning uneven, Rings noticeable (40-90%), Average to good packer, Medium run size a little uneven, Good firmness even.

Grenade: *Norseco sample,* Average appearance, Uniformity of shape even, Average to good neck finish, Medium sized necks even, Skins smooth a little even, Average skin quality, Small tap root width, Long tap root, Tap root a little hairy, Neck rot, Exterior colour even, Some with brown scales on top 1/3 of beet, Red interior colour, White in centers (20%), Good internal zoning even, Rings fairly unnoticeable, Average to good packer, Medium run size a little uneven, Average firmness even.

Scarlett: *Seminova sample,* Fair to average appearance, Uniformity of shape a little uneven, Odd one with vertical cracks, Average neck finish bit rough, Medium to large sized necks even, Skins a little scaly uneven, Fair skin quality, Medium tap root width, Short tap root, Tap root hairy concern, Neck rot, Exterior colour uneven, A lot with brown scales on top 1/3 of beet, Red interior colour uneven, White in centers (20-70%), A little poor internal zoning uneven, Rings somewhat noticeable (30-100%), Okay to average packer, Medium run size a little uneven, Good firmness even.

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RED BEET CULTIVAR MAIN TRIAL EVALUATION NOTES – 2024 continued

Red Titan: *Illinios Seeds sample,* Fair appearance a bit rough, Uniformity of shape uneven, Odd one with vertical cracks, A little poor neck finish bit rough, Medium to large sized necks uneven, Skins rough scaly uneven, Poor to fair skin quality, Medium tap root width, Short tap root, Tap root fairly hairy concern, Neck rot, Exterior colour a little uneven, Some with brown scales on top 1/3 of beet, Interior colour a little uneven, White in centers (40-50%), Average internal zoning uneven, Rings somewhat noticeable (40-100%), Okay packer, Small to medium run size a little uneven, Good firmness a little uneven, Odd one with mouse damage.

Red Ace: *Stokes Seeds sample,* Average appearance, Uniformity of shape a little uneven, Average neck finish bit rough, Medium sized necks uneven, Skins a little rough scaly uneven, Poor to average skin quality, Medium tap root width, Short tap root, Tap root hairy, Neck rot, Fairly dark exterior colour even, Some with brown scales on top 1/3 of beet, Interior colour a little uneven, White in centers (30-40%), Average internal zoning uneven, Rings a little noticeable (30-60%), Okay to average packer, Small run size uneven, Average to good firmness a little uneven.

Zeppo: *Rijk Zwaan sample,* Average to good appearance, Uniformity of shape a little uneven, Good neck finish, Small to medium sized necks even, Skins a little smooth a little uneven, Average to good skin quality, Small & medium tap root width, Short tap root, Tap root a little hairy, Neck rot, Dark exterior colour a little uneven, Some with brown scales on top 1/3 of beet, Dark red interior colour, Great internal zoning even, Rings unnoticeable, Average to good packer, Run size uneven, Average to good firmness.

Manolo: *Bejo Seeds sample*, Poor appearance bit rough, Uniformity of shape uneven, Poor neck finish rough concern, Large sized necks even, Skins rough scaly uneven concern, Poor skin quality, Large tap root width, Short tap root, Tap root very hairy concern, Neck rot, Exterior colour a little uneven, Most with brown scales on top 1/2 of beet, Dark purple interior colour, Good internal zoning a little even, Odd one with rings noticeable (10-20%), Poor packer, Small run size even, Average to good firmness even.

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RED BEET CULTIVAR MAIN TRIAL EVALUATION NOTES – 2024 continued

Bullock: *Norseco sample,* Okay to average appearance, Uniformity of shape a little uneven, A little poor neck finish rough, Medium to large sized necks uneven, Skins rough scaly uneven concern, Poor to average skin quality, Medium to large tap root width, Short tap root, Tap root very hairy concern, Neck rot, Exterior colour uneven, Some with brown scales on top 1/3 of beet, Dark red interior colour uneven, White in centers (20-80%), Good internal zoning somewhat uneven, Odd one with rings noticeable (30-80%), Okay to average packer, Medium run size a little uneven, Average firmness uneven.

Red Atlas: *Illinois Seeds sample,* Fair appearance, Uniformity of shape very uneven, Odd one with vertical cracks, Average neck finish odd one bit rough, Medium sized necks uneven, Skins a little rough scaly uneven, Poor to fair skin quality, Medium tap root width, Short tap root, Tap root very hairy concern, Neck rot, Exterior colour uneven, A lot with brown scales on top 1/2 of beet, Red interior colour a little uneven, White in centers (40-60%), Average internal zoning somewhat uneven, A few rings noticeable (20-40%), Poor to okay packer, Small to medium run size uneven, Average firmness a little uneven.

Jolie: *Seminova sample,* Rough appearance, Uniformity of shape uneven, Odd one with vertical cracks, Poor neck finish rough, Large sized necks a little uneven, Skins rough scaly uneven, Poor to fair skin quality, Medium tap root width, Short tap root, Tap root hairy concern, Neck rot, Dark exterior colour uneven, Most with brown scales on top 1/2 of beet, Dark red interior colour uneven, White in centers (30-80%), A little poor internal zoning uneven, Rings fairly noticeable (40-80%), Poor to okay packer, Small to medium run size uneven, Average firmness a little uneven.

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RED BEET CULTIVAR MAIN TRIAL EVALUATION NOTES – 2024 continued

Red Cloud: *Bejo Seeds sample,* Okay appearance bit rough, Uniformity of shape uneven, Odd one with vertical cracks, Poor neck finish rough concern, Large sized necks uneven, Skins rough scaly uneven concern, Poor to fair skin quality, Medium tap root width, Uneven tap root length, Tap root fairly hairy, Neck rot, Fairly dark exterior colour uneven, Most with brown scales on top 1/2 of beet, Dark red interior colour a little uneven, White in centers (20%), Good internal zoning fairly even, Rings somewhat noticeable (20-80%), Poor to okay packer, Small to medium run size a little uneven, Average to good firmness a little uneven.

Roditi: *Rijk Zwaan sample,* Okay to average appearance, Uniformity of shape uneven, Good neck finish, Small to large sized necks even, Skins a little scaly uneven, Average skin quality, Small to medium tap root width, Short tap root, Tap root somewhat hairy, Exterior colour a little uneven, A lot with brown scales on top 1/2 of beet, Red interior colour, White in centers (20-70%), Good internal zoning even, Odd one with rings noticeable (20%), Average packer, Run size uneven, Average firmness, Odd one with mouse damage.

Bullock: *Seminova sample,* Bit rough appearance, Uniformity of shape uneven, Odd one with vertical cracks, Average neck finish bit rough, Medium to large sized necks even, Skins rough scaly uneven, Poor to fair skin quality, Medium & large tap root width, Short tap root, Tap root fairly hairy, Neck rot, Exterior colour uneven, Some with brown scales on top 1/3 of beet, Fairly dark interior colour a little uneven, White in centers (10-50%), Average to good internal zoning a little uneven, Odd one with noticeable (10-50%), Poor to okay packer, Small run size a little uneven, Average firmness even.

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RED BEET CULTIVAR MAIN TRIAL EVALUATION NOTES – 2024 continued

Scarlett: *Norseco sample,* Poor to fair appearance, Uniformity of shape a little even, Odd one with vertical cracks, Poor neck finish rough concern, Medium to large sized necks a little uneven, Skins rough scaly uneven concern, Poor to fair skin quality, Medium to large tap root width, Short tap root, Tap root hairy concern, Neck rot, Exterior colour a little uneven, Most with brown scales on top 1/2 of beet, Slightly dark red interior colour, White in centers (50-60%), Average internal zoning fairly uneven, Noticeable rings (50-80%), Poor to okay packer, Very uneven run size, Average firmness even.

Schrute: *Illinois Seeds sample,* Poor to average appearance, Uniformity of shape a little even, Average neck finish odd one bit rough, Medium to large sized necks a little uneven, Skins smooth even, Poor to pretty good skin quality, Small to large tap root width, Long tap root, Tap root very hairy concern, Neck rot, Exterior colour a little uneven, Some with brown scales on top 1/3 of beet, Red interior colour uneven, White in centers (10-60%), Average internal zoning uneven, A few rings noticeable (10-60%), Poor to good packer, Small to medium run size a little uneven, Average firmness a little even, Odd one with mouse damage.

H2O 103001: *Illinois Seeds sample,* Fair appearance, Uniformity of shape very uneven, Odd one with vertical cracks, Poor to average neck finish rough, Medium to large sized necks uneven, Skins scaly rough uneven concern, Poor skin quality, Medium tap root width, Short tap root, Tap root hairy, Neck rot, Exterior colour uneven, Most with brown scales on top 1/3 of beet, Red interior colour uneven, White in centers (40-60%), Poor to average internal zoning uneven, Rings fairly noticeable (50-70%), Poor to okay packer, Medium run size uneven, Average to good firmness even.