ANNUAL REPORT

MUCK RESEARCH STATION
HOLLAND MARSH
R.R.-1 KETTLEBY, LOG 1JO
ONTARIO, CANADA

Ontario Ministry of Agriculture and Food
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FOREWORD

This report deals with a part of the research under way at the Muck Research Station.

Some projects are conducted by our own staff whereas many more are carried out in cooperation with the Ontario Agricultural College of the University of Guelph and Agriculture Canada. Since not all projects are finalized and results may only be preliminary, the author(s) should be consulted before publishing any of the data in this publication.

The Muck Research Station is one of three research stations under the direction of the Horticultural Research Institute of Ontario. The research and service programs at M.R.S. have as their major purpose the improvement of the Ontario Muck Vegetable Industry. The result of these programs is the adoption of improved cultivars, cultural practices and techniques by the muck crop producer, with ultimate benefit to the Ontario consumer.

Recently the Ontario Muck Crops Committee was established. This committee has an objective to provide relevant information through research leading to recommendations on production and marketing of muck crops in Ontario. The committee also acts as a research advisory body for the Muck Research Station (see Page 6 for summary of research, recommendations and priorities for 1975 research).

Extension services include the publication of a monthly newsletter, Muck Crops News, and the Annual Variety and Adaptation Trials reports. The Annual Open House is usually held in the latter part of August.

A daily recorded message is prepared during the summer months which is available by calling 775-3493 (area code 416). This message includes information on weather forecasts, insect and disease development, spray recommendations, market outlook etc.

The Annual Muck Vegetable Growers Conference is held in March. During this Conference, speakers are invited from all sectors of the Industry to review research results, discuss production and marketing problems and exchange technical information with researchers and industry people from other parts of Canada and the U.S. Proceedings of the 24th Conference are available; please ask.

The 25th Annual Conference will be held at Bradford on March 9 and 10, 1976.

I take this opportunity to thank all those who cooperated with research and extension projects during the past year. With your interest and continued support, Ontario's Muck Crop producers will continue to be well informed and kept up-to-date with the latest technology in Muck Crop Production.

Matthew Valk, P.Ag.,
Senior Muck Crops Specialist.

October 31, 1975

Muck Research Station,
R.R.#1, Kettleby, Ont.,
LG 1JO
(416) 775-3783

* * * * * * * * *
MUCK RESEARCH STATION
STAFF

DECEMBER, 1974

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M. Walk, B.S.A.
E.N. Knibbe, Dip.Agr.
E. Wall
M. Evans
F. Weening
A. Vanderkooij
J. Vonk
T. Beach

Director
Officer in Charge
Extension and Research
Coordination
Assistant - Muck Crop
Research and Production
Secretary
Secretary
Farm Staff

* * * * * * * *

VISITING GROUPS

The Holland Marsh has attracted many people from all walks of life. Elementary and Secondary School students are often asked to write essays on the organic soils in the area. Teachers plan school tours in spring and fall to help students with their studies of the development of Marshes and their exploitation for agriculture.

The Ontario Ministry of Agriculture and Food has produced a set of slides with tape recorded script which is shown at the Muck Research Station to visiting groups. Forty-five groups with a total of 2032 persons visited the Station in 1974. Anyone wishing to pay us a visit should call the office - (416) 775-3783.

* * * * * * * *
EDO N. KNIBBE

Edo joined the staff of the Muck Research Station in April 1974.

He has a long association with muck crop farming, first as a grower on his own farm and later as a farm production manager for the largest farm corporation in the Holland Marsh.

Edo is a native of the Netherlands where he received his elementary and secondary education. He attended the Agricultural College in Haarlemmermeer and graduated with high honours in 1943. He also has to his credit several diplomas in specialized agriculture and agricultural mechanics.

The twenty-seven years of accumulated farming experience in newly reclaimed polders in Holland and on muck farms in the Bradford area makes him a very valuable asset to the Muck Crop Research team. Edo is in charge of the research program, the greenhouse facilities and all farming activities at the Muck Research Station.

He knows his onions!
5. THE WEATHER

January - December 1974

The January to May period was quite normal. There were two days with rain in January, two in February and two in March. January was the snowiest month with 13.2" which fell in eleven days. There were only 7 days with snow in February and six days in March. April was quite mild with much sunshine and 2.78" of rain which fell on eleven days.

May was wet and cool. There were sixteen days with rain accumulating to 4.09". June followed with good growing weather although there were quite a number of dull days. The highest temperature was on the 9th with 29°C. Rain fell regularly with a total of 2.62". July commenced with a violent thunderstorm on the 3rd dumping 2.65" of rain in a few hours. The balance of the month was very dry with temperatures averaging only 26°C. August was also cooler than normal. There were nineteen days with precipitation for a total of 3.21" which is just above normal. It remained cooler than normal in September but as it was dry, most of the time, harvesting continued without interruptions. On the 24th of September, the Marsh area was hit by a severe groundfrost (-12°C) which damaged onions which were pulled and in windrows on the field. October was cold with frequent groundfrost ranging from 0°C to -15°C on 23 days. Precipitation was below normal.

November and December were near normal in temperature, well above normal rainfall in November but December was quite dry with very little snow.

As a whole, 1974 was marked by a wet spring, a cool summer and above normal number of below freezing nights in September and October. Accumulated growing degree days were much below normal also.

WEATHER DATA 1972 - 1974

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<thead>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>27.7</td>
<td>28.5</td>
<td>*</td>
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<td>*</td>
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<td>9.0</td>
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<td>35.6</td>
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<td>43.0</td>
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<td>50.0</td>
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<td>58.0</td>
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<td>71.0</td>
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<td>46.0</td>
<td>46.0</td>
<td>44.6</td>
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<td>52.0</td>
<td>62.0</td>
<td>59.0</td>
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* Data not available
## Precipitation (Inches)

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<td>Jan.</td>
<td>*</td>
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<td>*</td>
<td>1.38</td>
<td>13.2</td>
<td>0.69</td>
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<td>Feb.</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>0.80</td>
<td>8.5</td>
<td>0.75</td>
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<td>1.11</td>
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<td>*</td>
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<td>2.62</td>
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<tr>
<td>July</td>
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<td>*</td>
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<td>3.70</td>
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<td>1.67</td>
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<td>3.22</td>
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<td>2.20</td>
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<tr>
<td>Nov.</td>
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<td>*</td>
<td>*</td>
<td>3.38</td>
<td>1.2</td>
<td>1.46</td>
<td>8.2</td>
</tr>
<tr>
<td>Dec.</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>0.57</td>
<td>6.7</td>
<td>0.97</td>
</tr>
</tbody>
</table>

26.80 | 36.0      | 24.08     | 67.5     |

* Data not available.

**Notes:**
1. Readings are taken at 8:30 a.m. and 4:30 p.m.
2. Averages used in these tables are long term for Beeton weather station.

## Growing Degree Days

(above 5.5°C)

<table>
<thead>
<tr>
<th></th>
<th>1974 (MRS)</th>
<th>1901-1970 Long Term (Av. Celsius)</th>
<th>Extremes °C</th>
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<tr>
<td></td>
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<td>Highest 1974</td>
</tr>
<tr>
<td>Jan.</td>
<td>0</td>
<td>0</td>
<td>8°</td>
</tr>
<tr>
<td>Feb.</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Mar.</td>
<td>0</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>Apr.</td>
<td>80.0</td>
<td>36.0</td>
<td>26</td>
</tr>
<tr>
<td>May</td>
<td>137.0</td>
<td>205.0</td>
<td>28</td>
</tr>
<tr>
<td>June</td>
<td>357.0</td>
<td>354.0</td>
<td>29</td>
</tr>
<tr>
<td>July</td>
<td>444.0</td>
<td>447.0</td>
<td>33</td>
</tr>
<tr>
<td>Aug.</td>
<td>417.5</td>
<td>410.0</td>
<td>22</td>
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<tr>
<td>Sept.</td>
<td>223.5</td>
<td>290.0</td>
<td>28</td>
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<tr>
<td>Oct.</td>
<td>91.5</td>
<td>110.0</td>
<td>23</td>
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<tr>
<td>Nov.</td>
<td>27.0</td>
<td>6.0</td>
<td>22</td>
</tr>
<tr>
<td>Dec.</td>
<td>0.0</td>
<td>0</td>
<td>5</td>
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</tbody>
</table>

**Annual** 1777.5 | 1867.0 | 33 | -26 | 41 | -36

**Notes:** A temperature of at least 5.5°C (42°F) is considered necessary for plant growth. Accumulated temperature (degree days) above 5.5°C are a measure of plant growth during the month.
6. ONTARIO MUCK CROPS COMMITTEE


Crop Values

<table>
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<tbody>
<tr>
<td>Carrot</td>
<td>$2,924,900</td>
<td>$3,857,000</td>
<td>$7,266,800</td>
<td>$6,045,000</td>
</tr>
<tr>
<td>Onion</td>
<td>3,925,100</td>
<td>9,855,300</td>
<td>7,784,600</td>
<td>5,198,000</td>
</tr>
<tr>
<td>Lettuce</td>
<td>1,408,200</td>
<td>1,539,500</td>
<td>2,531,400</td>
<td>2,531,000</td>
</tr>
<tr>
<td>Celery</td>
<td>752,700</td>
<td>1,045,000</td>
<td>1,464,700</td>
<td>1,465,000</td>
</tr>
<tr>
<td>Parsnips</td>
<td>334,300</td>
<td>334,800</td>
<td>273,500</td>
<td>274,000</td>
</tr>
</tbody>
</table>

$9,345,200   $16,631,600   $19,321,000   $15,513,000

Source: (Seasonal Fruit and Vegetable Report, Annual Summary)

Membership:

M. Valk - Chairman, HRIO, Muck Research Station, Holland Marsh
I.L. Nonnecke - Secretary, Dept. of Hort. Science, University of Guelph
A.B. Stevenson - Agriculture Canada, Research Station, Vineland Station
L.V. Edginton - Dept. of Environ. Biology, OAC, University of Guelph
E.L. Chudleigh - Ont. Food Council, CMAF, Parliament Buildings, Toronto
G.E. Framst - Economics Branch, CMAF, Parliament Buildings, Toronto
A.E. Maitland - Soils & Crops Branch, CMAF, Hort. Exp. Station, Simcoe
H.G. Henderson - General Manager, Ontario Produce Co., Bradford
M. Crawski - Grower, Leamington
C.H. Sokosz - Grower, Grand Bend
P.J. Smith - Grower, Newmarket
G. Groetselaars - Grower, Port Colborne

Review of Research:

a) Breeding and Cultivar Trials. Producers of onion seed have been plagued by poor crops for several years. The seed supply for 1975 will be inadequate to satisfy the demand. This is in all the more reason for continuing an active cultivar evaluation program. Fortunately there is now a fairly long list of onion cultivars which can be recommended to growers. Some of these are high yielding, others are good storage types, with somewhat lower yields. Highest yield obtained was with cv. Summit - (1642 x 50 pound bags/A) at Point Pelee Marsh. Highest yield in the Holland Marsh was obtained from Prospector (1122 bags/A).

Sweet Spanish onions are difficult to grow from seed in our climate. Most cultivars produce less than 350 bags/A. However cv. Cima produced 895 bags/A of 3 inch bulbs and over.

Baby Carrots are becoming more popular with the consumer public. Processors are also inquiring about availability, production methods, quality, yield, etc. With solid bed planting and a plant population of about 50 plants per square foot, cv. Little Finger produced 20 Tons/A "baby" size carrots-(\(\frac{1}{2} - \frac{1}{4}\) inch. diam. and 1\(\frac{1}{2} - 3\) inches in length). Other cultivars producing good yields and acceptable shape, color, good uniformity etc, include Amsterdam Minicore, Amsterdam Foram, Coreless Amsterdam, Sweetheart, Nanta and Mini-Fek. After lye peeling and processing by the Horticultural Product Laboratory, at Vineland Station, Ontario, Little Finger was again found to be the best with Amsterdam Foram and other Amsterdam types running a close second.
The evaluation of Dr. Baker's carrot breeding work continued in 1974. Thirty-five growers cooperated by testing seventeen M.S.U. hybrids on their farms. The results are very encouraging. Several cultivars show a consistent tolerance to the "rusty root" disease. This program will be continued in 1975 since growers have increased their demand for seed of the "5988" crosses. Three of these will be named shortly.

b) Pests and Pesticide Evaluations.

Pythium has been identified as a contributing factor for rusty root. However one of the Pythium species was found in other areas in Ontario and Quebec, where the disease is unknown. This problem continues to baffle plant pathologists, nematologists etc. Researchers are starting to shy away from the program, which was given top priority by this committee from its beginning. Regardless of what may be the causal agent, research on any possible control measures must continue. Precision seeding has given favourable results. Further studies will be conducted to probe deeper into the question why this seeding method improves carrot quality.

One investigation probed into the problem of "horizontal cracking" in carrots. Chelated trace elements applied to the soil reduced these horizontal lesions. Zinc appears to give a greater response than manganese.

Several research programs were designed to study methods of disease and insect monitoring in order to improve pesticide efficiency. It was shown that for maximum effect and to avoid waste, fungicidal sprays must be applied at critical stages in the disease development, depending on the weather conditions. Six sprays applied to carrot foliage, timed by weather conditions, controlled blights better than weekly sprays. This will save the grower about $16.00 per acre on spray materials and increase the yield by an additional $16.00 per acre.

Carrot Rust Fly was monitored to time sprays. Results of the monitoring program again showed that a substantial reduction in the amount of insecticide required can be achieved by trapping adults in certain locations to time sprays against the second generation. Carrot weevil is becoming more prevalent in the Holland Marsh. This insect appears about May 10, and reaches a peak during the first week of June. No damage occurred to carrots planted later than July 3. Celery was also severely attacked. Chemical control was best with carbofuran as a granular treatment and chlorpyrifos as a foliar spray.

Control of the Onion Maggot by the sterile male approach appears feasible. A small marsh, the Keswick Marsh, containing approximately 200 acres of onions was utilized for this study. Over six million sterilized flies were released coincident to emergence of first and second generation adults in the fields. Plant damage appeared to be very small compared to the control area in a nearby marsh.

Control of Onion Smut and onion maggot with chemicals is still essential as far as growers are concerned. It was found that Birlane was ineffective at Leamington. The standard treatment Ethion-thiram G plus Pro-Gro gave the best control and the highest yield.

c) Field Management Trials.

The size of carrot seed influenced germination. The smallest seeds (\(\frac{1}{4}/64\) inch) and the largest seeds (\(\frac{3}{4}/64\) inch) produced 50% and 30% lower yield respectively.

The source and rates of Nitrogen had an influence on the amount of tipburn in head lettuce; urea caused an increase whereas ammonium nitrate and sulphate of ammonia produced a much lower incidence of this physiological disease.
Rates up to 90 lbs. N/A also produced considerably more tipburned heads than 120 and 180 lbs. N/A.

d) Post Harvest Physiology Studies.
Onion drying is usually done by leaving the crop in the field to dry before moving it into storage. For several years, experiments have shown that artificial drying with heat speeds up the curing process, and eliminates the weather hazards. A conventional air-cooled storage equipped with automatic ventilation controls and heat can be used to heat dry freshly harvested onions in 25 bushel pallet boxes. A heat source of at least 15 Btu per ft³ space is recommended to maintain 90°F. Fan capacity should be large enough to supply 1.5 cfm per ft³ space.
Storage trials with onions showed that several of our recommended cultivars will keep remarkably well during twelve months under environmental conditions of 33°F and 72% RH. To be able to do this, onions must be treated with 30% maleic hydrazide when 50% of the tops are down and still green.
Three types of storages were tested with three carrot cultivars. It seems that all the cultivars do not react the same to the storage environment or treatments with Benlate. In general, there was more rot but less weight loss in the jacketed storage than in common or cold storage.

Recommendations for 1975 Research.
1. The Committee endorses the present research programs for muck crops. Present programs should continue particularly in the area of pest and disease control, herbicides and storage environments.

2. The Committee recommends that a smut and maggot trial on onions be conducted in the Thedford-Grand Bend Marshes in the light of the experience in the Leamington area in 1974 when one of the recommended materials was ineffective. There is a need to investigate proper pesticide rates to be used for silverskin onions and other pickling types.

3. The Committee recommends that pesticide residues, in particular the herbicide Linuron, be monitored in the Bradford and Grand Bend areas. It is feared that continuous applications of this herbicide on carrots and potatoes is having an effect on the growth of onions in rotation with these crops.

4. The Committee recommends that a study be initiated to evaluate the effectiveness of the presently recommended adulticides for onion maggot (parathion-diazinon, dibrom, malathion). This work can be done in the laboratory.

5. The onion cultivar screening trials for Fusarium rot should be continued in the Fort Colborne marshes. Ultimately the cultivars recommended in Publication #363 will be listed as to their susceptibility to Fusarium rot as soon as the results are available.

5a. Baby Carrots trials should continue in 1975. Evaluation of cultivars should be carried out on different types of muck and mineral soils. Processors should be included in the evaluation of results. Engineering assistance is required to evaluate bed harvesting equipment.

6. The Committee recommends that the Storage Project team continue with its investigations into storage problems. Growers should make better use of the technology adequately documented for vegetable storage.
No new research work is required except for further studies into the fact that not all cultivars react the same to the storage environment.

7. The reasons for an increase in storage rots in bulk onion storages should be investigated. The effect of fungicidal fumigants should be studied.

8. There is a problem with registration of pesticides on minor crops, e.g. endive, oriental crops etc. The Committee recommends that a study be made of pesticides required for these crops with the objective that registrations be obtained so that recommendations to growers can be made.

Priorities for Research

**Carrots**
- #1 Continue research on Rusty Root and Horizontal cracking problems in carrots.
- #2 Continue studies on carrot weevil and carrot rust fly.
- #3 Baby carrot development project.

**Onions**
- #1 Continue research on onion maggot control.
- #2 Research on storage rots.
- #3 Linuron residues in soil.

**Lettuce**
- #1 Collect residue data on minor salad crops, e.g., endive, escarole, cos lettuce, leaf lettuce and pursue the registration of pesticides on these crops.

**Celery**
- #1 Continue studies on carrot weevil and carrot rust fly.
- #2 Search for new materials for control of aphids, looper and leafhopper.

Resolutions:
The Committee passed the following resolutions at the Annual Meeting on December 9th, 1974.

1. Resolved that once again a plea be made, as in 1973, regarding the critical state of insulated containers for overseas shipping of onions. The correspondence of a year ago be activated with copies to the Hon. Wm. A. Stewart, Minister of Agriculture and Food, and the Hon. Eugene Whelan, Minister of Agriculture.

2. Resolved that data be collected on residues of pesticides for registration on minor crops and that a study be made on the safe re-entry period for the various chemicals used on muck crops.

Matthew Valk, P.Ag.,
Chairman, Ontario Muck Crops Committee
December 16, 1974.
MUCK RESEARCH STATION, 1974

7. BREEDING AND VARIETY TRIALS

The following are abstracts and summaries of Variety Trials, conducted at the Muck Research Station and on Grower's farms. A more detailed report on the performance of these muck crops is available. Ask for the Muck Vegetable Variety Trials, 1974.


Comparison of performances - long term averages compared to last year's averages - of some of the available varieties tested in our trials.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Source</th>
<th>#</th>
<th>Long Term Ave.</th>
<th>Ave. Days to Maturity</th>
<th>Firmness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Gladiator  Keystone  5  1108  1199  117  117  4-  4-
Summit      Harris    3  1099  1160  121  123  3+  3+
Exporters   Stokes   5  1066  984   113  119  3+  4-
Ontario L   Asgrow    3  1045  *    111  *   4-  *
Bronze Age  F. Morse 2  1030  1141  117  123  3+  3+
Spartan Era - 3  1024  1415  116  132  4+  4+
Northern Oak Stokes  4  991   1292  116  132  4   3+
Nutmeg      Harris    3  972   876   109  113  4+  4
Golden Laker F. Morse 4  937   *    113  *   4   *
Garnet      Asgrow    4  920   991   108  115  3+  4-
Trapp's #6  Trapp's  4  920   1004  110  113  4   4-
Mustang     Harris    5  913   1076  106  118  4   4-
Paydirt     N. & King 3  909   661   119  125  4+  4-
Rocket      Asgrow    5  901   1030  108  108  4-  4-
Canada Maple Stokes  5  894   1025  112  116  4+  4-
Buccaneer   Harris    5  892   923   111  105  4   4
Fawn Preview F. Morse 2  870   976   107  113  4   4
Copper Cache F. Morse 2  867   907   110  113  4   4-
Ace Globe    Twilley  2  839   *    109  *   4   *
Muck Master Twilley 3  838   957   107  113  4+  4
Sunburst    Asgrow    4  833   917   110  113  4   4-
Imp. Aut. Spice Stokes  5  758   707   107  117  4-  3+
Canada Granite Stokes  2  753   616   108  132  4   4-
Aut. Spice  Asgrow    5  751   616   107  108  4+  4
Aut. Bronze F. Morse  2  713   *    115  *   4   *


Maturity
Early  102 - 109 days  Firmness 1 - 5
Medium 110 - 114 "  5 being very hard bulb, also it
Late Med. 115 - 119 "  indicates storage ability
Late  120 - up


## D. Summary of Carrot Varieties - 1969 - 74

Comparison of performances - long term averages compared to last year's averages - of some of the available carrot varieties tested in our trials.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Source</th>
<th>Long Term Average</th>
<th>Yield (Bushel/Acre)</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spartan Sweet</td>
<td>M.S.U.</td>
<td>1299</td>
<td>1550</td>
<td>1001</td>
</tr>
<tr>
<td>Spartan Delite</td>
<td>M.S.U.</td>
<td>1246</td>
<td>1204</td>
<td>1034</td>
</tr>
<tr>
<td>Hipak Elite</td>
<td>Harris</td>
<td>1232</td>
<td>1358</td>
<td>1124</td>
</tr>
<tr>
<td>Scarlet Nantes</td>
<td>-</td>
<td>1217</td>
<td>1169</td>
<td>963</td>
</tr>
<tr>
<td>Grenadier</td>
<td>Harris</td>
<td>1195</td>
<td>1343</td>
<td>991</td>
</tr>
<tr>
<td>Spartan Fancy</td>
<td>M.S.U.</td>
<td>1166</td>
<td>1512</td>
<td>976</td>
</tr>
<tr>
<td>Highlight</td>
<td>Asgrow</td>
<td>1163</td>
<td>1292</td>
<td>-</td>
</tr>
<tr>
<td>Pioneer 318</td>
<td>Harris</td>
<td>1137</td>
<td>1538</td>
<td>1040</td>
</tr>
<tr>
<td>Carousel</td>
<td>Asgrow</td>
<td>1103</td>
<td>1230</td>
<td>1150</td>
</tr>
<tr>
<td>Gold Pak 26</td>
<td>F.Morse</td>
<td>1090</td>
<td>1136</td>
<td>952</td>
</tr>
<tr>
<td>Dominator</td>
<td>Keystone</td>
<td>1053</td>
<td>1362</td>
<td>1049</td>
</tr>
<tr>
<td>Canuck</td>
<td>Stokes</td>
<td>1037</td>
<td>1338</td>
<td>1044</td>
</tr>
<tr>
<td>Gold Pak 61</td>
<td>Keystone</td>
<td>1001</td>
<td>996</td>
<td>972</td>
</tr>
<tr>
<td>King Imperator</td>
<td>N. &amp; King</td>
<td>949</td>
<td>1097</td>
<td>963</td>
</tr>
<tr>
<td>Trophy (9160AN)</td>
<td>Harris</td>
<td>-</td>
<td>1261</td>
<td>1087</td>
</tr>
<tr>
<td>Spartan Winner</td>
<td>M.S.U.</td>
<td>-</td>
<td>1538</td>
<td>1155</td>
</tr>
<tr>
<td>Spartan Premium</td>
<td>M.S.U.</td>
<td>-</td>
<td>1661</td>
<td>1217</td>
</tr>
<tr>
<td>Spartan Classic</td>
<td>M.S.U.</td>
<td>-</td>
<td>1661</td>
<td>1434</td>
</tr>
<tr>
<td>Processing</td>
<td>M.S.U.</td>
<td>1219</td>
<td>1531</td>
<td>1502</td>
</tr>
<tr>
<td>G1958</td>
<td>-</td>
<td>1212</td>
<td>1506</td>
<td>1410</td>
</tr>
</tbody>
</table>

**Score:** The average of the evaluations - uniformity, resistance to greening, color, ringing, straightness and core sizes, i.e.  
1 = very poor variety  
5 = a very acceptable variety for the trade
C. Sweet Spanish Onion Variety Trial. Valk, M., Knibbe, E.N.
Thirty regular Sweet Spanish and Spanish type cultivars were compared as transplanted and direct seeded crops. The transplants were seeded in the greenhouse on March 26 and transplanted to the field on May 23. The direct seeded crop was sown on May 3. The cold spring and slow growing season delayed the maturing of many of the cultivars in this trial. The harvesting date - Oct. 2. The most outstanding selections were:

<table>
<thead>
<tr>
<th>Marketable Yield</th>
<th>3 inches and over</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transplanted</td>
<td>Direct Seeded</td>
</tr>
<tr>
<td>(50 lbs./A)</td>
<td>(50 lbs./A)</td>
</tr>
<tr>
<td>Cima (Keystone)</td>
<td>430</td>
</tr>
<tr>
<td>Fiesta (Stokes)</td>
<td>533</td>
</tr>
<tr>
<td>Onion Sweet (Harris)</td>
<td>468</td>
</tr>
<tr>
<td>Chieftain</td>
<td>384</td>
</tr>
<tr>
<td>Spanish Beauty</td>
<td>277</td>
</tr>
</tbody>
</table>

The total yield of cv. Cima was 1947 bags per acre (1¾" and up), direct seeded. (Muck Research Station, Holland Marsh, R.R.#1, Kettleby, Ontario)

D. Muck Crop Trials of Onions and Baby Carrots. Nuttall, V.W.
Yields of hard, yellow storage onions tested under grower management in the Point Pelee Marsh surpassed the best yield from any variety in the three previous seasons. In 50-pound bags/A, the top 6 cvs in the replicated trials were Summit (1642), Harvestmore (1545), Northern Oak (1527), Trapp’s #8 (1230), Trapp’s #6 (1250) and Mustang 613 (1192). Autumn Spice, the standard for earliness produced 909 bags. Maturity was concentrated due to extended drought and comparatively warm weather. Sunburst and Trapp’s #6 scored best for overall appearance and neck cure. Promising observation varieties, yield-wise, were Bronze Age, Gambler and Super Elite.

During 12 months of storage at 33°F and 72% R.H., 8 of the 12 1973 cultivars kept remarkably well. Ranging from 92 to 80% marketable on October 8, 1974, in descending order, were Northern Oak, Rockct, Buccaneer, Trapp’s #6, Ontario L, Autumn Spice, Spartan Banner and Exporter. These onions were treated with 30% maleic hydrazide in August 1973 when 50% of the tops were down, but still green.

A spring crop of baby carrots in Point Pelee Marsh was seeded on May 16 at the rates of "A"(50), "B"(80), and "C"(100 seeds per square foot). They were harvested on July 25 with the centre 10 feet and 4 rows of the 12-foot 6-row beds used for yield data. Tops were first sheared off close to the crown with a lawn mower. Roots were graded into baby size (1/2" to 7/8") and into under and over sizes. Amsterdam Coreless Forcing "A" rate yielded 7.1 T/A, "B" 8.9 and "C" 6.7 tons; Mini-Pak "A" 7.3, "B" 7.9 and "C" 7.5 tons; Little Finger "A" 4.7, "B" 7.0 and "C" 2.8 tons per acre.

An August 2 seeding of the same varieties and the same rates was severely damaged by unusually strong ground frosts on September 23 and October 2, eliminating any chance of reliably estimating a harvest date. Research with baby carrots merits continued investigation, emphasizing precision seeding, population densities, possibly solid-bed planting, new varieties and succession cropping. (Agriculture Canada, Research Station, Harrow, Ont.)
E. Baby Carrot Variety Trials. Valk, M., Knibbe, E.N.

Much interest continues to be shown by processors in baby carrots. Grower interest in this crop is increasing. For this crop to be commercially feasible requires improved harvesting equipment capable of harvesting solid bed planted crops. This experiment was designed to study baby carrots sown in solid beds. Ten cultivars were seeded on June 4 in rows 3 inches apart with a wide shoe Planet Jr. seeder to simulate "broadcast" seeding. Seeding rate was adjusted to obtain a desired plant population of 72 plants per square foot. The actual plant density obtained was 50 plants (square foot).

Roots were harvested August 20-30. Carrots were graded into two sizes:
(A) - "baby" size: 1/2 - 2/4 inch diameter, 1 1/2 - 3 inches long; and
(B) - "finger" size: 3/4 - 7/8 inch diameter, 3 - 5 inches long.

cv Little Finger received the highest score for uniformity, short tops, crowns, shape etc. It produced 20 T/A "baby" size carrots. Next in line were: Amsterdam Minicore (16 T/A); Amsterdam Foram (15 T/A) and Coreless Amsterdam (15 T/A). Amsterdam Minicore received top marks for color. This cultivar produced an additional 10 T/A of "finger" sized roots.

Roots were lye peeled and processed into tins and glass jars by the Horticultural Products Laboratory, Vineland Station. Processor and consumer comments were: Best color in order of preference: Amsterdam Minicore, Coreless Amsterdam, Amsterdam Foram and Little Finger. Best uniformity of size and shape in order of preference: Little Finger, Amsterdam Foram, Amsterdam Minicore and Amsterdam Coreless.

An observation trial with eight cultivars were seeded in a similar manner as the replicated trial above. The most promising selections in this trial were: Sweetheart (23.5 T/A); Nanta (17 T/A); Amsterdamse (18 T/A) and Amsterdam Minicore (20 T/A). (Muck Research Station, Holland Marsh, R.R.#1, Kettleby, Ontario).


The three cultivars Baby Finger, Sweetheart and Bunny Bite were seeded in a commercial carrot field in the Grand Bend marsh on May 18. A Planet Junior seeder was employed to produce three planting densities for each cultivar. Seed plate holes #4, 5 and 6 were used for Baby Finger, #5, 6 and 7 for Sweetheart and #6, 7 and 8 for Bunny Bite. Four rows per 48" bed were planted. On August 5, plant tops were removed with a Bradley 722 forage harvester and the roots were then lifted by a homemade digger developed for pickling onions. Only the highest density plantings were harvested since all other populations were too sparse to produce adequate yields. Recorded yields were 3.8, 11.1 and 7.4 T/A for Baby Finger, Sweetheart and Bunny Bite respectively. Further tests with plant spacing and varieties should be continued since processor interest is evident. Yields can be increased by solid bed planting since the harvester used was capable of handling this type of system. (RCAT and OMAF Ridgetown and London).
G. Breeding for resistance to leaf blights, rusty root and horizontal cracking in carrots. Baker, L.R., Valk, M.

This project, which started in 1971, has been very beneficial for carrot growers in Ontario. Many thousands of dollars are lost annually by a disorder in carrots called "rusty root", a term first coined by the late C.C.(Conny) Filman. The Ontario Muck Crops Committee decided to give this problem a high priority for research.

It is fortunate that Dr. Larry R. Baker of Michigan State University agreed to cooperate with the Committee. For four years, hundreds of hybrid, inbred and commercial carrot cultivars have been included in a series of screening trials on a severely rusty root infested plot at the Muck Research Station.

Many of these inbred parent lines and hybrid cultivars have responded in a predictable manner to this disease. Some are susceptible, others show a tolerance or a resistance to the disease. It is felt that this resistance is phenotypically stable.

Several breeding lines have been developed which are homozygous resistant to rusty root through selections over the four years of testing. They are:

- MSU 5988 - Nantes type
- MSU 5986 - Pre-pack type
- MSU 1322 - Processing type
- MSU 1302 and 1304 - Imperator types

In order to make sure that any of the hybrids, developed from a combination of crosses between breeding lines showing rusty root resistance, are commercially acceptable, seed was made available to growers for testing since 1972. In 1974, thirty-five growers cooperated in a commercial trial on individual farms. Seventeen MSU hybrids were tested.

On the basis of these tests, three experimental hybrids will be released shortly. These hybrids are derived from a combination of acceptable inbred lines using MSU 5983 as a common type. The suggested "commercial" names for these hybrid carrots are as follows:

- (872 x 5931) 5988 Spartan Classic
- (5931 x 5986) 5933 Spartan Premium
- (5931 x 6000) 5988 Spartan Winner

The above hybrids have shown a consistent tolerance to rusty root even under high disease pressures in the field.

Selection against "horizontal cracking" is also practiced. To date, very little is known about this disorder which shows up as small non-pathogenic lesions on carrot roots in the later stages of maturity in the field. Genetic gain is also apparent against this presumed physiological disorder.

Concurrent with the selection for rusty root and horizontal cracking, the experimental material is also screened for foliar blights, e.g. Alternaria dauci and Cercospora carotae.

There is no doubt that considerable benefit has been derived by commercial carrot growers from the MSU carrot breeding program by Dr. Larry R. Baker. These screening trials will be continued at the Muck Research Station in 1975. From time to time, selections from this research program will be made available on an experimental basis to interested growers. (Dept. of Horticulture, M.S.U., East Lansing, Michigan, U.S.A. and M.R.S., Holland Marsh, R.R. #1, Kettleby, Ont. Canada, LOG IJO)
Twenty head lettuce cultivars were tested four times during the growing season. The first was seeded in the greenhouse on April 3, transplanted into soil blocks and transplanted to the field May 14. The second was direct seeded on April 30, third on June 3 and fourth on July 4th.

The most outstanding cultivar for quality was Minetto, although it does not make good size, particularly in cold seasons. The top five cultivars were:
1. Portage – a flat head type, fast growing, good tolerance to tipburn and bottom rot.
2. Ithaca – excellent in early season, slightly affected by bottom rot in mid-season.
3. Fairton – good size, matures somewhat unevenly, affected by bottom rot.
4. Fulton – matures more evenly than Fairton, also susceptible to bottom rot – a standard cultivar in the Bradford area.
5. Minilake – very good early variety, slightly susceptible to tipburn in mid-season.

Other varieties worth noting were: Spartan Lakes, good tolerance to bottom rot, slightly susceptible to tipburn in mid-season; Mesa 659 and Mesa 409 for late season only. (Muck Research Station, Holland Marsh, R.R.#1, Kettleby, Ontario).

Eighteen cultivars were transplanted from the greenhouse on May 17 and harvested August 2 to 13. cv Tall Green Light was the only cultivar which developed a few seed stalks, although weather conditions were favourable for this condition.

The earliest maturing cultivars were Calmarco and Florida 683K. They produced the highest trimmed yield for the processing market, however, the stalks were too short for fresh market purposes. The best early market types were: #H26 (Harris), Utah 52-70 (Keystone) and #3036 (Ferry Morse).

The later maturing cultivars were: #8190 (Ferry Morse), Utah 52-70-213 (Keystone), Florida 2-13 (Keystone), #H26 (Harris), #H30 (Harris). Twenty-three cultivars were transplanted from the greenhouse on July 2. Harvesting dates were taken between Sept. 11 and Sept. 30. Calmarco and Florida 683 again produced the highest trimmed yield, but Florida 683 cannot be recommended for fresh market because of the short stalks. The best five cultivars in this late season trial were: Junebelle (Keystone), #8190 (Ferry Morse), Florida 2-14 (Keystone), #H30 (Harris), and #3036 (Ferry Morse).

A third direct seeded trial was planted on May 8, harvested Sept. 30. Twenty-three cultivars were placed into storage. Storage quality data will be available early in 1975. (Muck Research Station, Holland Marsh, R.R.#1, Kettleby, Ontario).
8. PESTS AND PESTICIDE EVALUATIONS

A. Pythium spp. produce rusty-root in muck-grown carrots in Ontario. Sutton, J.C.
   Rusty root has been widespread and severe in muck-grown carrots for several years. In 1972, the OVRG decided that rusty root should be given top priority in vegetable disease research. There was much controversy regarding the cause of the disorder which became the subject of the present investigation. The rusty-root incitant was shown to be a living agent, greater than 3 μm and smaller than 53 μm in size, and capable of spread in sterilized soil. Because it was found that rusty root was controlled effectively in pot-grown carrots by the fungi-toxicants Dexon, PP 395 and thiram, but not by several other fungitoxicants, oomycetous fungi were considered as the possible cause. Several species of Pythium were recovered from affected roots and shown to be capable of producing rusty root in carrots. These included P. coloratum, P. irregulare, P. sulcatum, P. myriotylum and P. namillatum. (Department of Environmental Biology, University of Guelph, Guelph, Ontario.).

B. Carrot rusty root problem. Kemp, W.G., Barr, D.
   Pythium sulcatum implicated by some in the root-forking and browning of muck-grown carrots (rusty root disease) was isolated (Barr) not only from muck soils from the Bradford Marsh but also from other muck soils in Ont. and Quebec where the disease is unknown. Current tests indicate that Pythium sulcatum does induce some root necrosis in seedling carrots. A preliminary experiment where the pathogenicity of Olpidium brassicae (carrot), Pythium sulcatum and tobacco necrosis virus (carrot) was compared in all possible combinations, was unsatisfactory because the Olpidium brassicae isolate used in the tests became contaminated with virus during the work. (Agriculture Canada, Research Station, Vineland Station, Ontario).

C. Rusty Root of Carrots (Lateral root dieback). Coffin, R., Nonnecke, I.L.
   The most serious carrot production problem of the Bradford-Holland Marshes is the phenomenon known as rusty root (lateral root dieback). It manifests itself in many forms all of which reduces the marketability of a given crop of carrots. There are many explanations as to what rusty root is, ranging from being a reaction to over generous quantities of various chemicals to strains of fungal root organisms called pythium. Regardless of what may be the causal agent, it was found a couple of years ago that seeding carrots to an optimum stand of approximately 1-1/2 inches between plants, using a Stanhay precision seeder, greatly lowered the incidence of unmarketable carrots. The mere fact that carrots grown without competitive plant stress somehow escaped serious inroads of rusty root greatly improved the carrot production situation. Yet the answers as to why this seeding method worked remains a mystery. This year an intensive study was set up to find answers to why precision seeding made carrot growing better. Variables included highly infected soil, different varieties and various methods and rates of seeding. The preliminary results indicate that:
1) varieties do indeed play a part but resistance may be due to inherent
vigor of varieties as much as to any particular disease resistance;
2) precision seeded carrots can in fact recover from lateral root damage
more easily than standard seeded carrots resulting in more uniform,
marketable carrots;
3) hitherto unknown was the fact that all carrots, regardless of how they
are seeded or bred, suffer from sporadic attacks on the feeder roots
and that the combination of varieties and methods of seeding, to a
large measure, will determine the severity or permanence of damage
due to such attacks. Further studies will be conducted to probe
deepen into this problem. (Department of Horticultural Science,
University of Guelph, Guelph, Ontario).

D. Effect of Zinc and Manganese on the incidence of horizontal lesions in
carrots. Willis, A.L.
Zn and Mn, as chelates, were applied to the soil previous to seeding on
three growers' farms in the Holland Marsh. When carrots were six inches
in height and again 3 weeks later, a foliar spray was applied with the
same chelated materials. At harvest time, the carrots were washed, and
examined, for horizontal lesions and culls (forked, split etc). The 1973
and 1974 results were as follows:

<table>
<thead>
<tr>
<th></th>
<th>1973</th>
<th></th>
<th>1974</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Horlings</td>
<td>Gasko</td>
<td>Horlings</td>
<td>Gasko</td>
</tr>
<tr>
<td>Yield = Bushels/acre</td>
<td>Zn &amp; Mn</td>
<td>Check</td>
<td>Zn &amp; Mn</td>
<td>Check</td>
</tr>
<tr>
<td>Total Yld.</td>
<td>1575</td>
<td>1612</td>
<td>1102</td>
<td>1139</td>
</tr>
<tr>
<td>Lesions</td>
<td>125</td>
<td>239</td>
<td>102</td>
<td>229</td>
</tr>
<tr>
<td>Culls</td>
<td>171</td>
<td>236</td>
<td>149</td>
<td>144</td>
</tr>
</tbody>
</table>

There was a much more marked reduction in lesions in 1973 than in 1974.
Only the Zn treatment of Frantzen shows a significant reduction in lesions
due to treatment in 1974. In 1973, the results show significant reduc-
tions in every instance, where a treatment was applied. (Department of
Land Resource Science, University of Guelph, Guelph, Ontario).

E. Evaluation of Fungicides on an "indexed" spray program for carrot foliage
blight control. Maitland, A.E., Valk, M.
The effectiveness of combinations of fungicides applied according to an
"index" program for controlling Alternaria and Cercospora foliage blight
of carrots was evaluated. The cultivar Spartan Sweet, which is susceptible
to foliage blight was seeded on May 22nd, using a Planet Junior planter.
Fertilizer and herbicide and insecticide applications were done according to standard recommendations for commercial carrot production. Fungicides and rates used were as indicated in Table 2. A small plot sprayer developing about 50-60 p.s.i. was used for applying the fungicides. The equivalent of about 75 gallons per acre was applied. Fungicides were applied on July 24th, August 15th, 21st and 29th and on September 10th. Sprays were timed according to an assumed infection severity index based on relative humidity, moisture and temperature. There were four replications of each treatment in a randomized complete block design.

Foliation blight from natural infections was assessed, using the improved Horsfall and Barratt grading system for measuring plant diseases. Forty leaves taken randomly from twenty plants in the centre two of four rows for each treatment constituted a sample for blight assessment. Samples were taken on August 21st, 29th, Sept. 10th, 19th and on Oct. 9th. Alternaria and Cercospora were not assessed separately. Results are summarized in Table 1.

Table 1. Foliation Blight Assessment for Spartan Sweet Carrots—
Muck Research Station, 1974

<table>
<thead>
<tr>
<th>Percent Blight</th>
<th>Aug. 21</th>
<th>Aug. 29</th>
<th>Sept. 10</th>
<th>Sept. 19</th>
<th>Oct. 9</th>
<th>Mean-all dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatments</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3.7 b</td>
<td>6.1 b</td>
<td>8.9 bc</td>
<td>6.5 bc</td>
<td>10.7 d</td>
<td>7.2 c</td>
</tr>
<tr>
<td>2</td>
<td>3.9 b</td>
<td>7.0 b</td>
<td>10.0 bc</td>
<td>6.2 bc</td>
<td>11.9 cd</td>
<td>7.8 bc</td>
</tr>
<tr>
<td>3</td>
<td>3.8 b</td>
<td>6.0 b</td>
<td>7.9 c</td>
<td>5.5 c</td>
<td>13.8 bcd</td>
<td>7.4 c</td>
</tr>
<tr>
<td>4</td>
<td>4.6 b</td>
<td>8.0 b</td>
<td>10.7 b</td>
<td>&gt; 7 b</td>
<td>14.3 bc</td>
<td>8.9 b</td>
</tr>
<tr>
<td>5</td>
<td>4.1 b</td>
<td>6.1 b</td>
<td>8.8 bc</td>
<td>5.7 bc</td>
<td>13.6 bcd</td>
<td>7.9 bc</td>
</tr>
<tr>
<td>6</td>
<td>3.8 b</td>
<td>7.3 b</td>
<td>10.0 b</td>
<td>6.5 bc</td>
<td>15.7 b</td>
<td>8.7 b</td>
</tr>
<tr>
<td>7</td>
<td>3.8 b</td>
<td>8.3 b</td>
<td>10.8 b</td>
<td>6.7 b</td>
<td>13.2 bcd</td>
<td>8.6 b</td>
</tr>
<tr>
<td>8</td>
<td>8.0 a</td>
<td>11.1 a</td>
<td>13.9 a</td>
<td>8.1 a</td>
<td>15.9 a</td>
<td>11.4 a</td>
</tr>
</tbody>
</table>

Values followed by similar letters are not significantly different.
(Duncan's Multiple range test; 5% level)
1. Treatments indicated in Table 2.

Table 2.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Materials and Rates per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bay Dam 16654 - 3/4 lb.</td>
</tr>
<tr>
<td>4</td>
<td>Bravo 7.2F - 24 fl.oz.</td>
</tr>
<tr>
<td>5</td>
<td>Bravo 7.2F - 24 fl.oz. + Dithane M45 - 3 lbs.</td>
</tr>
<tr>
<td>6</td>
<td>Dithane M45 - 3 lbs.</td>
</tr>
<tr>
<td>7</td>
<td>Dithane M45 - 3 lbs. + Bay Dam 18654 - 3/4 lb.</td>
</tr>
<tr>
<td>8</td>
<td>Check</td>
</tr>
</tbody>
</table>
F. Reduction of Fungicide usage on Vegetable Crops by Scheduling Sprays according to weather data. Gillespie, T.J., Sutton, J.C., Langenberg, W.J. Carrot leafblights, caused by the fungi Alternaria dauci and Cercospora Carotae vary in severity from year to year largely depending on the influence of weather. Severe blight does not usually appear until mid-August or later. This late season development of blight weakens the foliage, such that mechanical harvesters leave much of the crop in the ground. This is especially the case if blighted foliage is further weakened by frost.

Carrot loss due to severe blight was examined on a commercial carrot field in the Bradford Marsh, in the fall of 1974, and showed the following results:

<table>
<thead>
<tr>
<th>% leaf area blighted</th>
<th>% carrots left in the ground</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>40</td>
<td>6</td>
</tr>
<tr>
<td>80</td>
<td>17</td>
</tr>
</tbody>
</table>

Carrot plots grown at the Ontario Ministry of Agriculture and Food, Muck Research Station, Holland Marsh, in the 1974 season were given either no fungicidal sprays, weekly sprays or sprays on a reduced schedule. On the reduced spray program, the decision to spray was based on controlled environmental studies along with microclimate and blight data gathered in 1972 and 1973.

On October 8th, the following data were obtained for a highly susceptible carrot cultivar:

<table>
<thead>
<tr>
<th>Fungicide spray applications</th>
<th>Number of sprays</th>
<th>Estimated % blight</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0</td>
<td>31.2</td>
</tr>
<tr>
<td>Weekly</td>
<td>11</td>
<td>16.6</td>
</tr>
<tr>
<td>Fungicide timed by weather</td>
<td>6</td>
<td>11.8</td>
</tr>
</tbody>
</table>

The data shows that 6 sprays applied, timed by weather conditions, controlled blight better than weekly sprays.

What are the economic losses inflicted by blight and how much will the farmer save in terms of dollars if they were to follow the reduced spray program? From observations of the disease development at our plots at the Muck Research Station and the harvest operations on a commercial carrot field, we found that as a result of a reduced spray program, percentage of blight reduced from 16.6% to 11.8% and the amount of loss (carrots left in the field) from 3.5% to 3.0%. This will result in an increased yield of 1/2 bushels or $16.00 per acre. With the reduced spray program, the reduction in the number of sprays was 5. This will save the grower an additional $16.00 per acre.

Conclusion:
For maximum effect and to avoid waste, fungicidal sprays must be applied at critical stages in the disease development, depending on the weather conditions. (Dept. of Land Resource Science and Dept. of Environmental Biology, O.A.C., University of Guelph, Guelph, Ontario).

Preliminary studies initiated in 1971 and done in both the laboratory and the field have indicated that it may be possible to utilize the sterile male approach for controlling the onion maggot. In 1974, the mass rearing technique for onion maggot was improved and production over a period of 7 months was increased to 1,000,000 pupae per month. Studies were also initiated to determine the feasibility of utilizing a chemo-sterilant, rather than radiation, to induce sterilization with promising results. However, pupae produced in 1973 were sterilized by radiation utilizing a cobalt source. A small marsh, the Keswick Marsh, containing approximately 200 acres of onions was utilized for the release program. Over 6,000,000 sterilized flies were released coincident to emergence of first and second generation adults in the field. Plant damage assessments indicated very little damage to onions in the experimental area, although onion maggot damage was high in control plots in the nearby Bradford marsh. Attempts to collect eggs in the experimental area were made with only limited success. Percent hatch was 22.4% contrasting with a normal field hatch averaging 88%. (Department of Environmental Biology, Univ. of Guelph, and Research Institute, Agriculture Canada, London, Ontario).

H. Microplot studies on control of the carrot weevil, Listronotus oregonensis (LeConte) attacking carrots and celery grown in organic soils. Harris, C.R., Svec, H.J.

Since restrictions were placed on the use of DDT, the carrot weevil has been a problem of minor importance in Ontario and of major importance in Quebec. Studies conducted over several years both in the laboratory and the field have indicated that several insecticides show promise. However, timing of spray applications is critical. In 1974, emphasis was placed on method, timing, and number of applications using the 3 most promising insecticides, carbofuran, chlorpyrifos and tetrachlorvinphos. Appearance of the adults in the field was proven difficult to predict with any degree of accuracy. Also adults survive and lay eggs over an extended period. Single applications of an insecticide timed to the approximate time of adult migration into the field have not provided adequate control in previous studies. These results were confirmed again in 1974 when single applications of carbofuran, chlorpyrifos, and tetrachlorvinphos timed to the appearance of the adults, and applied at 2 lbs. AI/acre did not provide adequate control. Three applications each of 2 lbs. AI/acre of carbofuran and chlorpyrifos + carrot oil gave excellent control, while 3 applications of tetrachlorvinphos and chlorpyrifos alone at 2 lbs. AI/acre provided adequate control. Excellent protection was obtained with carbofuran granular applied at 2 lbs. AI/acre in the furrow at seeding.

Carrot weevil also damages celery and a preliminary study indicated that only the carbofuran at 1/8 lbs. AI/acre applied in a planting water treatment was effective. However, this treatment caused phytotoxicity in the early stages of plant development. (Research Institute, Agriculture Canada, London, Ontario.).
I. Biology and control of carrot insects. Stevenson, A.B.

Results of the monitoring program for carrot rust fly in the Holland Marsh again showed that a substantial reduction in the amount of insecticide required can be achieved by trapping adults in certain locations to time sprays against the 2nd generation. In an unsprayed plot maintained to study the seasonal development of the rust fly, 2nd generation adults were present for about 2 months, a period during which at least 7 sprays would be applied. On 4 plots of at least 0.1 acre, which growers sprayed only when trapping catches indicated it was required, 0, 0, 1 and 2 sprays were recommended. The first two growers, however, applied 1 spray each in error or anxiety. Rust fly damage in the plots at harvest was 3, 5, 0, 4, and 6.8%, respectively, but all of the damage was very light and caused an insignificant crop loss.

Field studies on the seasonal development of the carrot weevil in the Marsh showed that adult weevils were present in carrot fields by May 10. They began laying eggs in transplanted second-year carrots and celery transplants about May 24, and in seedling carrots early in June (usually not before the 2nd true leaf stage). The peak of attack on second-year carrot and celery transplants was during the first week of June. When carrots were planted at two-week intervals from May 2 to July 30, the most severely damaged plantings were May 14 to 28; no damage occurred to carrots planted later than July 3. Celery transplanted May 14 to 28 were more extensively attacked than June transplantings. Damage in unsprayed carrot plantings was as high as 66%.

First-generation damage by the rust fly was so low that no results were obtained from control experiments. In the second generation, 5 weekly sprays of Furadan 4.8F at 1 lb a.i./acre gave better control than parathion or diazinon at the standard rates of application, and did not leave significant residues in the carrots.

Furadan 10G applied for rust fly control with the seed protected carrots against carrot weevil injury for about 2 months in small plots, but protection did not last throughout the complete egg laying period. Six weekly sprays of Furadan 4.8F, Lorsban, Garona, Imidan, and to a lesser degree, parathion, gave good control of carrot weevil damage to carrots. Furadan 10G appeared promising for weevil control on celery, but damage was not severe enough to make firm conclusions. (Agriculture Canada Research Station, Vineland Station, Ontario).

J. Control of onion maggot. Hylemya antiqua (Meig) and onion smut. Urocystis cepulce (Frost) by seed and granular treatments. Edginton, L.V., McEwen, F.L., Kelly, C.B., Bruin, G.C.A.

The currently registered pesticides were applied at the Muck Research Station near Bradford, Ontario, and on two growers fields in the Leamington muck area. Plots were replicated 4 times in an RCB design. The chemicals performed similarly at the three locations. The rates used were those recommended, generally 1 lb. a.i. insecticide/acre for single shoe and 1.5 lbs. for split shoe. The loss in stand for untreated checks was 30 to 50% and maggot counts were similar. Pesticides ranked in terms of stand count and effective control of maggots were: ethion-thiram G with thiram or with Pro-Gro seed treatment (ST) >> Dyfonate-thiram G with thiram ST = Dasanit-thiram G with thiram ST = Carbofuran G with Pro-Gro ST >> Birlane G with Pro-Gro ST. Birlane was ineffective at Leamington - but gave very
good control of maggot at the Holland Marsh. Smut averaged 79% of untreated plants and 52 and 87% in the growers field using dasanit-thiram with thiram ST and diazinon G with thiram ST respectively. Where Pro-Gro was used as a ST the average number of plants infected was 28%, where thiram G plus thiram ST was used the % infected was 39% and where thiram G plus a Pro-Gro ST was employed only 13% of plants were diseased. Yield response was correlated closely with prevention of stand loss and control of maggot with Ethion thiram G combined with thiram or Pro-Gro seed treatment giving the highest yields. Here again, Birlane plots were very high yielding at Holland Marsh. (Dept. of Environmental Biology, Univ. of Guelph, Guelph, Ontario).

K. Yield reduction of lettuce in Bradford muck soil infested with northern root-knot nematode. Potter, J.W., Olthof, Th.H.A. Lettuce cv Pennlake were grown to market size in clay-tile microplots filled with northern root-knot nematode-infested Bradford muck soil. Nematode-free soil for check plots was prepared by air-drying. Average losses in weight of marketable lettuce heads were 32%, 46%, 54% and 55% respectively at preplant densities of 300, 2600, 15000 and 27000 nematode larvae/liter of soil. Lettuce roots were heavily galled at all preplant nematode densities; however, final soil larval populations were less than initial densities. (Research Station, Agriculture Canada, Vineland Station, Ontario).

L. Celery mosaic virus in Ontario. Kemp, W.G. A virus isolated from stunted celery plants with vein clearing and leaf mottling has been identified as celery mosaic virus, a member of the Potyvirus group. It has hitherto been unreported in Canada. The virus caused significant yield reduction in the celery cultivars, Utah 52-70, Utah 15, Greenlight, Stokes' Golden Plume and Cornell 619, but not in Slowbolt, Summer Pascal or Salt Lake. Purified virus from Ontario celery reacted with antiserum to an authentic celery mosaic virus isolate from Britain. (Research Station, Agriculture Canada, Vineland Station, Ont.).

M. Insecticide Residues – Holland Marsh. Miles, J.R.W., Harris, C.R. Analyses for insecticide residues in farm soil and the water of the Holland Marsh have been conducted to assess the environmental impact of insecticide usage in the Marsh. Average residues found in the soil of 13 farms were – total DDT 28.9 parts per million; ethion 4.4 ppm; dieldrin 1.3; parathion 0.5,- chlorpyrifos, diazinon, aldrin and VC13, all 0.1 ppm, with traces of endrin, lindane, heptachlor, heptachlor epoxide, chlordane thiodan, chlorfenvinphos, fonfos, and leptoophos. The weights of insecticides transferred from the marsh have been calculated by combining the concentration found, with the amount of water pumped. This data is given in Table 1. Weights transferred were lower in 1973 than in 1972 because of the combined effect of lower concentrations and less pumping. Insecticide residues in fish from Cooks Bay continue at a very low level. Total DDT concentrations were 0.5 ppm or less, and dieldrin 0.02 ppm or less in perch, rock bass, pumpkinseed and sucker.
Table 1. Concentrations of insecticides in water, and their transfer from Holland Marsh.

<table>
<thead>
<tr>
<th></th>
<th>Average concentration in water</th>
<th>Pounds per week pumped out of the marsh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total DDT</td>
<td>0.117</td>
<td>0.085</td>
</tr>
<tr>
<td>Dieldrin</td>
<td>0.026</td>
<td>0.030</td>
</tr>
<tr>
<td>Diazinon</td>
<td>0.309</td>
<td>0.149</td>
</tr>
<tr>
<td>Ethion</td>
<td>0.023</td>
<td>0.030</td>
</tr>
<tr>
<td>Parathion</td>
<td>0.024</td>
<td>0.006</td>
</tr>
</tbody>
</table>


9. FIELD MANAGEMENT TRIALS

A. Effect of seed size on emergence and yield of carrots. Valk, M., Knibbe, E.N.

The question of seed vigor in relation to size of seed is often discussed but hardly ever resolved. Does large carrot seed produce stronger seedlings and a greater yield than small seeds? What is the effect of seed size on germination?

In this trial, an unnamed hybrid carrot MSU (5931 x 6000) 1302 was chosen because of the variability in the size of seeds in this particular lot.

The seed was screened into 5 sizes:
1. Smaller than 4/64 inches
2. 4/64 - 5/64
3. 5/64 - 6/64
4. 6/64 - 7/64
5. 7/64 inches and over

One hundred and eighty seeds of each size were sown in 10 foot rows, replicated six times, on May 23, 1974. Counts on emergence were made June 13.

<table>
<thead>
<tr>
<th>Size</th>
<th>Emergence</th>
<th>Weak Plants</th>
<th>Strong Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 4/64</td>
<td>24.8%</td>
<td>0.8%</td>
<td>24.0%</td>
</tr>
<tr>
<td>4/64 - 5/64</td>
<td>47.3%</td>
<td>1.7%</td>
<td>45.6%</td>
</tr>
<tr>
<td>5/64 - 6/64</td>
<td>54.2%</td>
<td>1.6%</td>
<td>52.6%</td>
</tr>
<tr>
<td>6/64 - 7/64</td>
<td>49.4%</td>
<td>1.6%</td>
<td>47.8%</td>
</tr>
<tr>
<td>&gt; 7/64</td>
<td>33.1%</td>
<td>1.7%</td>
<td>31.4%</td>
</tr>
</tbody>
</table>

On August 18 - harvest date, notes were made on the stand of mature carrots, and yield was measured.

<table>
<thead>
<tr>
<th>Size</th>
<th>% Stand</th>
<th>Yld (Bu/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 4/64</td>
<td>29</td>
<td>465</td>
</tr>
<tr>
<td>4/64 - 5/64</td>
<td>49</td>
<td>644</td>
</tr>
<tr>
<td>5/64 - 6/64</td>
<td>57</td>
<td>908</td>
</tr>
<tr>
<td>6/64 - 7/64</td>
<td>49</td>
<td>744</td>
</tr>
<tr>
<td>&gt; 7/64</td>
<td>36</td>
<td>620</td>
</tr>
</tbody>
</table>

Conclusion: Yield is directly related to emergence and final plant population as can be expected. On the basis of this experiment, the 5/64-6/64 size seeds produced the largest number of strong plants and the highest yield.
GRAPH I.

Stand & Emergence

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4</td>
<td>5-6</td>
</tr>
<tr>
<td></td>
<td>6-7</td>
<td>&gt;7/6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>10</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

- Yield
- Emergence
- Stand
B. Effect of Rates and Sources of Nitrogen on Yield and Quality of Head Lettuce.

Valk, M., Knibbe, E.N.

Various sources of Nitrogen are used in the production of muck crops. Ammonium Nitrate and Ammonium Sulfate are most commonly used in commercially mixed fertilizers. Urea may also be included.

In this experiment, Urea, Ammonium Nitrate and Ammonium Sulfate were applied just before time of seeding (May 6). **Cultivar: Ithaca**

The soil test showed no requirement for either Phosphorus or Potassium; hence neither were applied.

The rates used were as follows: Check = 0, 30,60,90,120 and 180 lbs.N/acre

**Harvest dates:** 12 July to 22 July (67 - 77 days)

**Results:**

1. As in a similar experiment conducted in 1973, none of the rates of nitrogen had a significant effect on size of head. The increase was 4% over the check with Ammonium nitrate and 8% with Ammonium sulfate and Urea.
2. Marketable yield increased slightly with Urea at the 60 to 90 and 120 lb. rates.
3. There was a significant increase in the amount of tipburn with all rates of Urea except the 120 lb. rate.

**Conclusion:**

On the basis of two year's results, it appears that head lettuce can be grown on a deep sedge type peat soil in the Holland Marsh with any amount of Nitrogen applied prior to seeding. The recommended rate is 80 to 100 lbs. of Nitrogen per acre. The best sources of nitrogen for lettuce appear to be Ammonium nitrate and Ammonium sulfate. Urea is a slower acting form of nitrogen and may have a tendency to increase the incidence of tipburn.

(Muck Research Station, Holland Marsh, R.R.#1, Kettleby, Ontario)

C. Direct seeded lettuce into soil blocks. **Knibbe, E.N., Valk, M.**

The purpose of this experiment was to find out the best method of direct seeding lettuce into soil blocks made of muck. Methods of shading and watering were studied. Coated seed of cultivar Ithaca was used.

**Seeding date - April 4, 1974**

**Weather conditions - April 5 - cloudy. April 6 - sunny, April 7 - cloudy**

**Emergence - April 8.**

**Types of soil blocks:**

1) Hand pressed: hole 1-1\(\frac{1}{2}\) inches deep, size - 2" x 2" square
2) Machine pressed: hole 1\(\frac{1}{2}\) inch deep, size 1\(\frac{2}{3}\)" x 1\(\frac{2}{3}\)" square

**Treatments:**

a) Complete shade and cool temperature for one week
b) No shading and a light watering after seeding
c) Covered with newspaper
d) Seed covered with vermiculite
e) No shading - no watering after seeding.

**Results:**

Emergence of seedlings was tabulated on April 10 and again on April 19. Only well developed, strong seedlings were counted.

1) Best results were obtained with the machine pressed, shallow hole soil blocks. After placing the seed in the hole, there was no cover applied, and no watering. The germination was 100%. 
2) Poorest results were obtained with the hand pressed, deep hole, soil blocks which were not covered but lightly watered at seeding time. The germination was 27%.
3) Most rapid emergence occurred when the seed was covered with vermiculite.
4) Keeping blocks cool and shaded after seeding slows down emergence significantly.

The lettuce in blocks were transplanted to the field on May 15. Harvest was June 28 to July 2.

Results were as follows:
1) Best overall results were obtained from the shallow hole blocks, which were not covered after seeding and not watered. 100% of planted seeds produced marketable heads.
2) Larger heads were obtained from the larger, hand pressed soil blocks which were also earlier maturing by about 3 days. (Muck Research Station, Holländ Marsh, R.R. #1, Kettleby, Ontario).

D. Effect of Spacing and Irrigation on Yield of Potato (cv Abnaki). Valk, M. Knibbe, E.N.

Abnaki, an introduction from the U.S.A. has been found to be well adapted on muck in Ontario. It is a white skinned, shallow eyed, round, fairly uniform potato. Yields have been acceptable but slightly less on average than the cultivar Ontario, which was the standard potato on muck in the Bradford area for many years. The cooking quality of Abnaki is far superior to Ontario and growers are advised to try and compare Abnaki with any white cultivar.

In 1973, the effect of spacing, rates of fertilizer and irrigation was studied. The results showed that:
1. Irrigation had a highly beneficial affect on yield.
2. Fertilizer is not required when a soil test shows that an adequate supply of nutrients is present in the soil at planting time.
3. A ten-inch spacing produced the highest yield.

In 1974, the effect of spacing and irrigation was studied:
The spacings in the row were 6, 8 and 10 inches.
The spacing between rows was 34 inches.

Irrigation was applied as follows:
Approximately 1 1/2" of water per week, less normal rainfall.
Approximately 1" of water per week, less normal rainfall.
Normal rainfall, no irrigation.
Irrigation was commenced at time of first tuber set (July 15).

The season was variable as far as rainfall was concerned. The first three weeks of June received below normal rainfall. The first week of July was abnormally wet due to a severe rainstorm which dumped close to 3 inches of water in less than 5 hours. The balance of the growing season was drier than normal except the week ending Aug. 3rd, 17th, and 31st.

Planting Date: May 29
(Actual requirements according to soil test)

Harvesting: Oct. 8: 30 foot of row in centre of plot.
Results: The data in Table 1 shows that the highest yield occurred with 6" spacing and irrigation "B". Second best treatment was 8" spacing with irrigation "A" or "B".
As in 1973, irrigation was highly beneficial, increasing the yield by an average of 19.4%.
Table 1. Marketable yield (55 lb. bu/acre) of Abnaki potato under irrigation and at 6, 8, and 10 inch spacings.

---

Spacings

\[ \begin{array}{c}
460 \\
450 \\
400 \\
390 \\
300 \\
20 \\
10 \\
60 \\
70 \\
80 \\
90 \\
100 \\
\end{array} \]

Irrigation

\[ \begin{array}{c}
"A" = 1.42 \text{ inches irrigation/week, less rainfall} \\
"B" = 1.09 \text{ inches irrigation/week, less rainfall} \\
"C" = \text{normal rainfall - no irrigation} \\
\end{array} \]

On the basis of two year's results, it appears that:

1. Significantly increased yields of Abnaki potato will be obtained with irrigation. The benefit from irrigation is greater in a dry year than in a year with normal rainfall.

2. Although the 6 inch spacing produced the highest yield, there was no difference in yield with the 8 inch spacing under either 1.5 inch or 1.0 inch irrigation (less rainfall) per week.

(Muck Research Station, Holland Marsh, R.R. #1, Kettleby, Ontario).

E. Pre-emergence weed control in Lettuce. Walk, M., Knibbe, E.N.

Ithaca head lettuce was sown on April 30, 1974. Treatments were applied May 8th just prior to emergence.

Treatments:

1. Check
2. Vegadex 5 lbs. a.i.
3. Vegadex 8 lbs. a.i.
4. C.I.P.C. 4 lbs. a.i.
5. C.I.P.C. 6 lbs. a.i.
6. C.I.P.C. + Vegadex 2 lbs. + 4 lbs. a.i.
7. Paraquat 1/2 lb. a.i.

The lettuce emerged very slowly due to cold wet weather. Most weeds emerged after May 8th, resulting in poor control with Paraquat.

Weed population observations were made on June 5th and June 12th. Hand weeding and shallow rotovation was done on June 12th.

Harvest Dates: July 15 to 19.
Results:

1. Check - no treatment
   Hand weeding and rotovating damaged roots and checked the growth of the crop
   Cost of Hand Weeding and thinning/acre: $106.00

2. Vegadex (5 lbs. a.i.)
   Weed control fair to good, slight damage to the crop due to treatment
   $85.00

3. Vegadex (8 lbs. a.i.)
   Weed control slightly better than treatment #2. Much more crop damage than #2.
   $85.00

4. C.I.P.C. (4 lbs. a.i.)
   Fair weed control, no control of grasses. No damage to the crop
   $85.00

5. C.I.P.C. (6 lbs. a.i.)
   Good weed control, except grasses. No crop damage. Best yield
   $64.00

6. Vegadex + C.I.P.C. (4 lbs. a.i. + 2 lbs. a.i.)
   Poor grass control and broad leaf weed control. Crop damage severe. Leaves curled and twisted. High weeding and thinning cost (equal to #1, check). 18% reduction in yield, compared to check
   $106.00

7. Paraquat (1/2 lbs. a.i.) (1 qt. Gramoxone/acre)
   No crop damage - weed control poor due to weeds emerging after treatment
   $85.00

Conclusions:

1. Vegadex at more than 5 lbs. a.i. is dangerous to use.
2. C.I.P.C. at 6 lbs. a.i. is a good herbicide if no grasses are present.
3. Paraquat only effective if weeds have emerged prior to emergence of the crop. Suggest stale seed bed technique if possible.

F. Weed Control in Carrots. Waywell, C.G.

Hipak carrots were sown on May 22, 1974 in a muck soil at Bradford, Ontario. Plots were 5 rows, spaced 17 inches apart, and 20 feet long. A simple randomized block design was used with 6 replicates. All treatments were applied with a 4-nozzle CO₂ powered sprayer at 35 psi delivering 26 gpm water. Pre-emergence applications were made on 24 May, 1974 when the soil was moist and the air temperature 15.5°C (60°F). The post-emergence application was made 25 June. All plots were harvested 28 August, 1974. Weeds growing on the test area were: - red root pigweed, wild potato (Solanum sarachoides), barnyard grass, purslane, groundsel, and wormwood.
<table>
<thead>
<tr>
<th>Treatment</th>
<th>lb/Aai</th>
<th>Weed Control (1)</th>
<th>12 June</th>
<th>25 June</th>
<th>Yield (2)</th>
<th>kg./plot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linuron</td>
<td>pre</td>
<td>1</td>
<td>6.3</td>
<td>2.7</td>
<td>23.04</td>
<td></td>
</tr>
<tr>
<td>Linuron</td>
<td>pre</td>
<td>2</td>
<td>6.3</td>
<td>5.0</td>
<td>23.02</td>
<td></td>
</tr>
<tr>
<td>Check</td>
<td>post</td>
<td>*</td>
<td>0.0</td>
<td>7.0</td>
<td>20.29</td>
<td></td>
</tr>
<tr>
<td>Prometryn</td>
<td>pre +</td>
<td>2</td>
<td>6.8</td>
<td>7.0</td>
<td>20.07</td>
<td></td>
</tr>
<tr>
<td>+ Linuron</td>
<td>post</td>
<td>1</td>
<td>7.0</td>
<td>4.7</td>
<td>17.81</td>
<td></td>
</tr>
<tr>
<td>Chlorbromuron</td>
<td>pre</td>
<td>2</td>
<td>7.0</td>
<td>4.7</td>
<td>17.81</td>
<td></td>
</tr>
<tr>
<td>Chlorbromuron</td>
<td>pre</td>
<td>1</td>
<td>5.8</td>
<td>3.0</td>
<td>13.30</td>
<td></td>
</tr>
</tbody>
</table>

(1) Weed control 0 = none; 10 = complete average 6 plots. (2) Yield = kilograms per plot average 6 plots. * herbicidal oil post emergence.

Reduced yields seemed to be related to poor weed control on some plots as no injury was recorded on the crop plants although the stand was thin. Wild potato and barnyard grass were the most important surviving weeds. (Department of Horticultural Science, O.A.C., University of Guelph, Guelph).

G. Pre-Emergence Weed Control in Onions. Waywell, C.G.

Autumn Spice onions were seeded 2 May 1974 at the Muck Research Station, Bradford, Ontario. A simple randomized block design was used with 6 replications. Plots were 3 rows spaced 17 inches apart and 20 feet long. All treatments were applied with a 2-nozzle CO2 powered sprayer fitted with HSS800L orifice tips using 26 gpa water. Weeds on the area were: red root pigweed (rrp), oak leaf goosefoot, wild potato (wp) (Solanum sarachoides), barnyard grass (byg), groundsel, wormwood (w), and purslane. Two observational strip tests were used which were not replicated.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>lb/Aai</th>
<th>Weed(1) Control</th>
<th>Crop(1) Injury</th>
<th>Weed(2) Control</th>
<th>Crop(2) Injury</th>
<th>Weeds Remaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>check</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>wp,byg,w,rrp</td>
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<tr>
<td>allidochlor</td>
<td>6</td>
<td>6</td>
<td>0</td>
<td>3.8</td>
<td>0</td>
<td>wp,byg,rrp,w</td>
</tr>
<tr>
<td>propachlor</td>
<td>6</td>
<td>8</td>
<td>0</td>
<td>6.6</td>
<td>0</td>
<td>wp</td>
</tr>
<tr>
<td>propachlor</td>
<td>10</td>
<td>8.1</td>
<td>0</td>
<td>7.5</td>
<td>0</td>
<td>wp</td>
</tr>
<tr>
<td>C7019</td>
<td>1.5+1.5 post</td>
<td>6.1</td>
<td>0</td>
<td>7.1</td>
<td>0</td>
<td>wp</td>
</tr>
<tr>
<td>C7019</td>
<td>3</td>
<td>6.7</td>
<td>0</td>
<td>4.8</td>
<td>0</td>
<td>wp,rrp,byg</td>
</tr>
<tr>
<td>allidochlor</td>
<td>6+1</td>
<td>6.0</td>
<td>0</td>
<td>6.9</td>
<td>0</td>
<td>wp,rrp,byg</td>
</tr>
<tr>
<td>+Bentazone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bifentox</td>
<td>2</td>
<td>6.2</td>
<td>0</td>
<td>4.3</td>
<td>0</td>
<td>wp,rrp,byg,w</td>
</tr>
<tr>
<td>oxadiazon</td>
<td>1</td>
<td>8.2</td>
<td>1</td>
<td>6.3</td>
<td>0</td>
<td>byg,wp,rrp,w</td>
</tr>
<tr>
<td>oxadiazon</td>
<td>2</td>
<td>8.9</td>
<td>4.2</td>
<td>8.2</td>
<td>2</td>
<td>byg</td>
</tr>
<tr>
<td>RP23465(3)</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>wp,byg,rrp,w</td>
</tr>
<tr>
<td>allidochlor</td>
<td>6+7.5</td>
<td>8</td>
<td>0</td>
<td>8.5</td>
<td>4</td>
<td>wp,byg,rrp</td>
</tr>
</tbody>
</table>

The only treatments which caused crop injury were oxadiazon at 2 lb/Aai and the post-emergence treatment of ioxynil. The last assessment of weed control was made on 5 July. C7019 at 1.5 pre + 1.5 post was rated 8 while propachlor at 10 was 5.5. All of the other plots were weeded. (Department of Horticultural Science, O.A.C., University of Guelph, Guelph).

H. Post-Emergence Weed Control in Onions. Waywell, C.G.
Autumn Spice onions were sown in the muck soil at Bradford, Ontario at the same time and in the same way as in the pre-emergence trial. A similar experimental design was used. A pre-emergence application of alilochlor 3 + chlorpropham 3 lb/Aai was applied. Post-emergence treatments were applied with a 2-nozzle CO2 powered sprayer 12 June 1974 when the onions were in the 2 true-leaf stage. The second post-emergence treatment on the bromoxynil and C7019 plots was applied 25 June. The principle weeds found on the area were: red root pigweed (rrp), wild potato (wp), barnyard grass (byd), wormwood (w) and groundsel (gr).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Weed(1) Control</th>
<th>Crop (1) Injury</th>
<th>Weed(2) Control</th>
<th>Crop(2) Injury</th>
<th>Weeds Remaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>check</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>wp, byg, rrp,</td>
</tr>
<tr>
<td>CNP</td>
<td>1.2</td>
<td>7.5</td>
<td>tr(3)</td>
<td>4.3</td>
<td>wp, byg, w</td>
</tr>
<tr>
<td>CNP</td>
<td>1.8</td>
<td>7.5</td>
<td>tr</td>
<td>2.3</td>
<td>wp, byg, rrp</td>
</tr>
<tr>
<td>bromoxynil</td>
<td>.5</td>
<td>9.2</td>
<td>4.2</td>
<td>6.8</td>
<td>wp, byg, rrp</td>
</tr>
<tr>
<td>bromoxynil</td>
<td>.75</td>
<td>8.9</td>
<td>3.5</td>
<td>5.6</td>
<td>wp, byg</td>
</tr>
<tr>
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<td>8.0</td>
<td>tr</td>
<td>5.3</td>
<td>wp, byg</td>
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<td>0</td>
<td>7.0</td>
<td>byg</td>
</tr>
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<td>C7019</td>
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<td>8.6</td>
<td>tr</td>
<td>6.2</td>
<td>wp, byg</td>
</tr>
<tr>
<td>FMC25213</td>
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<td>5.7</td>
<td>0</td>
<td>3.0</td>
<td>wp, gr</td>
</tr>
<tr>
<td>FMC25213</td>
<td>4</td>
<td>6.7</td>
<td>1</td>
<td>4.3</td>
<td>wp, gr</td>
</tr>
</tbody>
</table>

(1) 5 July assessment. (2) 16 July assessment. (3) tr = trace

Bromoxynil provided the best weed control but injured the crop. Minor foliar injury was noted on C7019, CNP, FMC25213, and propachlor plots but this was not apparent after 10 days. C7019 was effective on most weed species but barnyard grass was not controlled. FMC25213 did not control wild potato.

(Department of Horticultural Science, O.A.C., University of Guelph, Guelph).

All preplant incorporated (ppi) treatments were applied on May 10. Riverside onions were transplanted into a Berrien sandy loam on May 14. Pre-emergence (pre) and directed treatment were sprayed on May 21. Post-emergence (post) treatments were applied on June 17. Plots (3ft x 20ft) were replicated three times. Onions were harvested on September 17.
<table>
<thead>
<tr>
<th>Treatments</th>
<th>Rate (lb/A)</th>
<th>Time</th>
<th>Weed Control No/ft² (June 26)</th>
<th>Yield Wt/fr. (lbs)</th>
<th>T/A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>BIW</td>
<td>GRASS</td>
<td></td>
</tr>
<tr>
<td>Chlorthal (WP)</td>
<td>10</td>
<td>pre</td>
<td>3</td>
<td>0</td>
<td>.24</td>
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<tr>
<td>Chlorthal (FL)</td>
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<td>&quot;</td>
<td>6</td>
<td>1</td>
<td>.12</td>
</tr>
<tr>
<td>Diuron/ClPC</td>
<td>10</td>
<td>directed</td>
<td>1</td>
<td>1</td>
<td>.38</td>
</tr>
<tr>
<td>Chlorpropham+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FG-124</td>
<td>3</td>
<td>pre</td>
<td>3</td>
<td>1</td>
<td>.20</td>
</tr>
<tr>
<td>Perfluidone</td>
<td>2</td>
<td>&quot;</td>
<td>4</td>
<td>1</td>
<td>.22</td>
</tr>
<tr>
<td>Liquid Cyanamid</td>
<td>4 gal</td>
<td>post</td>
<td>7</td>
<td>1</td>
<td>.11</td>
</tr>
<tr>
<td>CNP</td>
<td>1.2</td>
<td>&quot;</td>
<td>6</td>
<td>3</td>
<td>.16</td>
</tr>
<tr>
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<td>pre</td>
<td>0</td>
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<td>.28</td>
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<td>2</td>
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<td>1.2</td>
<td>&quot;</td>
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<td>3</td>
<td>.20</td>
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<td>.35</td>
<td>ppi</td>
<td>5</td>
<td>2</td>
<td>.20</td>
</tr>
<tr>
<td>Butralin</td>
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<td>&quot;</td>
<td>4</td>
<td>1</td>
<td>.16</td>
</tr>
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<td>Bentazon</td>
<td>1</td>
<td>post</td>
<td>5</td>
<td>1</td>
<td>.18</td>
</tr>
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<td>Oxadiazon</td>
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<td>pre</td>
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<td>0</td>
<td>.49</td>
</tr>
<tr>
<td>&quot; + ioxynil</td>
<td>1.5-2pt.</td>
<td>pre-post</td>
<td>0</td>
<td>0</td>
<td>.43</td>
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<td>Chlorophen (G)</td>
<td>30 product</td>
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<td>0</td>
<td>.22</td>
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<td>Dimexan</td>
<td>1 qt. product pre</td>
<td>11</td>
<td>4</td>
<td>.10</td>
<td>.8</td>
</tr>
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<td>11</td>
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</tr>
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<td>&quot;</td>
<td>1.5</td>
<td>post</td>
<td>13</td>
<td>1</td>
<td>.09</td>
</tr>
<tr>
<td>Weed check</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.45</td>
</tr>
</tbody>
</table>

Pigweeds, shepherd's purse, ragweed, lamb's-quarters and crabgrass were predominant in the plots. Oxadiazon provided full season weed control. Yields in oxadiazon treated plots are comparable with weeded checks. (Horticultural Experiment Station, Simcoe, Ontario).

J. Nutrient Content of Drainage Water from Organic Soils. Miller, M.H.
The nutrient content of tile drainage water from four sites in the Erieau Marsh has been measured during 1972 and 1973. The concentration of nutrients particularly nitrate - nitrogen and soluble orthophosphate varied widely throughout the year. In general, the concentrations were highest in the spring when the major portion of the drainage occurred, were lower during the summer months and increased again in the fall. Rather large quantities are being lost in the drainage water. The drainage water from these sites exceeded the accepted safe level of nitrate-nitrogen (10 mg NO₃-N per litre) for livestock in almost every sample. The loss of phosphorus is of concern from the pollution standpoint. The average loss of soluble orthophosphate was well above the 0.1 mg/l level which will cause excessive algae growth. The value in terms of plant nutrients of the N, P, and K lost from the four sites average $30.00 per acre at today's fertilizer prices. Based on research conducted at Bradford, Ontario, fertilizer rates, particularly phosphorus and potassium in the Erieau Marsh could be reduced drastically without impairing yield and quality of the crop. (Department of Land Resource Science, University of Guelph, Guelph).
10. POST HARVEST PHYSIOLOGY STUDIES

A. Storage Quality of Onions. Nuttall, V.W.

Fifty pounds of twelve "advanced" trial and twenty-four "observation" trial cultivars were placed in storage at the Harrow Research Station (Agriculture Canada) on October 11, 1973.


Onions were treated with Maleic Hydrazide as per recommendations in publication #363 (Vegetable Production Recommendations, Ontario Ministry of Agriculture and Food).

Storage Conditions: Temperature 33°F ± 1°
Relative Humidity 72%

The bulbs were examined periodically for sprout and other unmarketable bulbs.

Percent Marketable throughout 12 month storage period
(Grading dates for discarding sprouted or other unmarketable bulbs)

<table>
<thead>
<tr>
<th>Variety</th>
<th>24/1</th>
<th>20/3</th>
<th>29/4</th>
<th>18/5</th>
<th>26/7</th>
<th>7/10</th>
<th>No. Sprouts</th>
<th>No. Bot.</th>
<th>No. Slippery</th>
</tr>
</thead>
<tbody>
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<td>Northern Oak</td>
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<td>98</td>
<td>98</td>
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<td>0</td>
<td>4</td>
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<tr>
<td>Rocket</td>
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<td>100</td>
<td>98</td>
<td>98</td>
<td>92</td>
<td>86</td>
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<td>4</td>
<td>1</td>
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<tr>
<td>Buccaneer</td>
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<td>90</td>
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<td>88</td>
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<td>Trapp's #6</td>
<td>94</td>
<td>94</td>
<td>94</td>
<td>92</td>
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<td>84</td>
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<td>100</td>
<td>98</td>
<td>92</td>
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<td>100</td>
<td>100</td>
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<td>88</td>
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<td>98</td>
<td>98</td>
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<td>(Hyb.DL44351)</td>
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<td>96</td>
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<td>98</td>
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<td>62</td>
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<td>11</td>
<td>2</td>
</tr>
<tr>
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<td>100</td>
<td>100</td>
<td>100</td>
<td>98</td>
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<td>98</td>
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(Agriculture Canada, Research Station, Harrow, Ontario).
STORAGE OF CARROTS

E. W. Franklin, Department of Horticultural Science, University of Guelph

HARVESTING

Carrots for fresh market are often harvested before reaching full maturity and marketed immediately. But carrots for storage should be fully mature to provide the longest storage life. They are less prone to oxidative browning of the surface than younger roots and thus surface abrasions appear less prominent after storage.

Carrots are usually harvested mechanically. All cut, broken, misshappen and otherwise injured roots should be sorted out at harvest. Their presence in storage favors the development of two serious diseases of stored carrots — bacterial soft rot and *Sclerotinia* soft rot.

Figure 1. Mechanical harvesting of carrots. Note pallet bin in foreground filled with high-quality carrots.

STORING

Pallet bins are widely used for holding carrots in storage although bulk handling — piling the carrots as high as 10 feet in a large bin — has given reasonable results, provided the storage is equipped with a system of forced-air circulation through the pile.

Carrots grown on mineral soils in Alberta and Nova Scotia appear to store better when washed prior to storing. Carrots grown on muck soils in Ontario are usually not washed before storing.

RAPID COOLING

After harvesting, successful storage requires that the roots be cooled as quickly as possible to 32°F and held at this temperature, together with very high (95%) relative humidity (RH) throughout their storage life. Rapid cooling ensures that disease organisms will not have an opportunity to become active, minimizes undesirable metabolic changes which occur rapidly at high temperatures and lessens the period during which excessive moisture loss may occur.

STORAGE TEMPERATURE

A storage temperature of 32°F is best. Carrots freeze at 29.5°F. At 32°F undesirable changes (aging, toughening and loss of flavor) are minimized and sprouting does not occur. Ethylene, given off by many stored products, can cause bitterness in carrots. With carrots stored at 32°F the production of ethylene has been reported as negligible.

RELATIVE HUMIDITY

A carrot is approximately 88% water. Typical of all root crops, its epidermis is a very poor barrier to the loss of water by evaporation. Excessive water loss results in wilted, and tough carrots that have lost their characteristic succulence and crispness. From the time of harvest, it is imperative to take all possible steps to retain maximum water content. The roots should be moved into storage immediately, cooled as quickly as possible, and maintained at a very high RH in the storage. The pallet bins usually take up considerable moisture at the beginning of the storage period, increasing the difficulty of maintaining very high RH. The development of disease organisms is encouraged by hosing water over the pallet bins and carrots and is not recommended. However, the floor should be kept wet at all times.

Other methods have been tried, with varying success, to reduce water loss from carrots stored in a cold storage. For example, after the carrots in pallet bins have been cooled to 32°F, polyethylene sheets are draped over and around stacks of bins. In other instances, the roots are stored in large, perforated ‘poly’ bags.

Ensuring that the surface area of the cooling coils (evaporators) is sufficient to maintain a very high RH is a most important factor in a cold storage. A relatively large cooling coil has a large surface area for heat transfer. It will operate at a temperature only slightly below that of the storage room, thus markedly reducing the amount of moisture condensed out of the storage atmosphere.
COMPATIBILITY AND CONTAMINATION

One might consider storing carrots in the same room with other root crops (beets, parsnips and rutabagas) which have similar storage requirements of 32°F and very high RH. However, it is not advisable to store carrots with any other vegetable. There is the possibility of cross-contamination, affecting flavor and odor, as well as the distinct possibility of causing bitter carrots from ethylene produced by the other stored crops. Carrots should never be stored with fruit crops. Fruit crops usually produce more ethylene than do vegetable crops.

TYPES OF STORAGES

It is sometimes said that the value of carrots does not justify storing them in a relatively expensive cold storage or jacket storage. The alternate is to use a less expensive common, air-cooled storage.

Air-Cooled Storage

An air-cooled storage depends on cold outside air to operate effectively. Unfortunately, at harvest and for some weeks following, and also towards spring, cold air is often lacking. As a result, it may be several weeks or longer after harvest before the temperature of the carrots in the air-cooled storage can be reduced to near 32°F. During this interval, disease organisms have an excellent opportunity to develop and sprouting often occurs. Experience has demonstrated that good storage results may be difficult to obtain when carrots are held in an air-cooled storage.

Cold Storage

Cold storages are commonly used for storing carrots. They usually satisfy the temperature requirements for proper storage conditions by cooling the carrots quickly and maintaining their temperature at 32°F. However, it has been observed that many of the cold storages used for carrots have undersize cooling coils. To handle the heat load satisfactorily, the undersize coils must be set to operate at a temperature considerably below that of the storage room. Because of this difference in temperature, the amount of moisture condensed out of the storage atmosphere is too high, resulting in a constant lower-than-desired RH. The carrots suffer by losing too much moisture to the storage atmosphere.

Provided the cold storage has been equipped with proper coil capacity for operating at very high RH, it should be reasonably satisfactory for storing carrots.

Jacket Storage

A jacket type of cold storage is recommended by some authorities as particularly effective for storing carrots. Its special feature is that the cooling coil is located outside the storage room and the cooling air is circulated through the walls and ceiling of the room and does not contact the roots. This eliminates the drying effect of moisture continually being condensed out of the air by undersize cooling coils located within the storage room. In a jacket storage, it is easier to maintain the RH at a high level. However, the special design requirements of a jacket storage increase construction costs considerably and the value of the crop may not warrant it.

Filacell System

Another type of cold storage recommended for storing produce that must be maintained at very high RH is called the Filacell system. It maintains high humidity in the room by using a special type of cooling coil in which water, externally cooled by refrigeration, is the cooling medium. Here again, the higher cost of this system may preclude its use for storing carrots.
Figure 4. A “jacketed” storage is considered particularly effective for storing carrots.

**Controlled Atmosphere (CA) Storage**

Storing carrots in CA storage (used commercially to extend the storage life of apples) invariably results in increased rotting. Therefore, this method cannot be recommended for carrots.

**INTERRELATIONSHIP OF TEMPERATURE AND HUMIDITY**

It should be emphasized that a condition of very high RH must always be associated with a cool temperature, ideally 32°F, but at least no higher than 36° to 38°F. If the storage temperature exceeds 38°F, very high RH can be harmful, resulting in increased sprouting at the crown, the growth of small white side roots and the possibility of rots becoming rampant. Fortunately, sprouting can be inhibited in storage by applying maleic hydrazide (MH 30). Information on its application is contained in Ontario Ministry of Agriculture and Food Publication 363, *Vegetable Production Recommendations*.

**SUMMARY**

Recommended practices for storing carrots include harvesting mature roots, sorting out undesirable roots, cooling as quickly as possible in storage, and maintaining a temperature of 32°F together with very high RH. Under these conditions, the roots should keep well for four to five months. Longer storage may be possible, but the quality of the roots will gradually deteriorate and wastage will increase.
C. Storage of Celery. Valk, M., Knibbe, E.N.

Successful cold storage of celery commences in the field. A cold storage is not a magician's box where one can place poor quality produce and have it turn out as first quality. The crop should be well sprayed to keep it free from diseases and insects.

Harvesting should be followed immediately by precooling and storage.

Precooling can be done with cold water (hydrocooling) or by vacuum cooling. Celery keeps best at 32°F with a relative humidity of 95-98%. In Ontario celery storage was a common occurrence some 20 years ago. Since the demand for storage celery disappeared in the early 60's, very little research has been done on the subject. Recently, more interest has been shown by the industry to again hold celery in storage for several months after harvesting in late September.

Ten of the most commonly grown celery cultivars were stored under controlled conditions in a refrigerated storage at the Muck Research Station. This experiment was a preliminary study and will be repeated in 1975.

Five different methods of storage were investigated.

1. In a pallet bin (4' x 4' x 3') with stalks lying flat (horizontally).
2. In a pallet bin with stalks standing up (vertical).
3. In celery crates and dipped in a Benlate solution - (2 lbs. per 100 gallons of water).
4. In celery crates dipped in a Benlate solution (1 lb. per 100 gallons of water).
5. In celery crates - no dipping.

Temperature was maintained between 32°F - 34°F. Humidity controlled between 95% - 98%.
Harvest Date: September 30. Celery was slightly overmature, some stalks were pithy. Some ground frost had occurred just prior to harvesting.

Results:
In early December, celery which had not been treated with Benlate, started to show some decay.
At the end of December, the untreated celery was 90% unmarketable due to rot (primarily Botrytis).

On January 6th, the Benlate treated celery was still free from decay, however, the hearts of most stalks showed a black-grey discoloration in the vascular bundles. This condition is presently under investigation, the cause is not known at this time.

Cultivar Florida 683 was least affected by the black-grey discoloration of the vascular bundles.
Cultivar Processor was least affected by Botrytis rot.
Cultivars Florida 214 and 213, 52-70 Improved, and Beacon scored most points all-round when treated with Benlate.

Conclusions:
1. Celery can be stored successfully if all factors are taken into consideration, e.g. proper stage of maturity, freedom from disease, insects, frost damage etc.
2. There are differences in varietal response to storage conditions.
3. Celery dipped in a Benlate solution significantly improves storage quality.
(Muck Research Station, R.R.1, Kettleby, Ontario).

D. Onion Drying. Franklin, E.W., Lougheed, E.C.
The purpose this year was to investigate the practicability of heat-drying newly harvested Autumn Spice onions using a conventional air-cooled storage equipped with automatic ventilation controls and, in addition, thermostated heat. The differential thermostat was removed from the ventilation system and a humidistat set at 70% RH plus a thermostat set at 92°F actuated the ventilation dampers, i.e. the dampers opened should the RH rise above 70% RH and/or the temperature above 92°F. The thermostat controlling the electric heat source was set at 90°F. A 3000 cfm fan operated continuously for either circulation or ventilation depending upon damper position.

All onions had their tops removed at harvest and were stored in 25-bu. pallet bins. There were two harvests: (a) immediately for drying and (b) windrowed for 13 days, then dried.

The weather at harvest was sunny and dry, thus the onions were harvested under ideal conditions, being low in moisture and free of disease. Under all treatments including controls, which were air dried in the field, the quality of the onions was excellent. Except for speeding up the drying (curing) process, it was not essential in 1974 that the onions be heat-dried.

Operating the conventional storage for drying provided some interesting information.
1. An adequate heat source is required to maintain a suitable drying temperature. In the present instance, 10 kw (34,000 Btu/ft³) was used for a 4800 ft³ room, i.e. 7 Btu per ft³ input. This was barely adequate and at least 15 Btu per ft³ space is recommended.
2. Air circulation (3000 cfm fan) was inadequate (0.63 cfm/ft³). Lower
bins which were more directly in the air movement rose to drying
temperature faster than upper ones. Supplementary fans are recommended
to increase air movement to 1.5 cfm/ft³.

3. Thermostats in the 20°F to 85 or 90°F range which are usually installed
are not satisfactory. At this range limit they perform poorly. A
thermostat with a top limit of at least 120°F is necessary.

4. The normal circuitry of the automatic ventilation system is modified by
shorting out the differential thermostat and placing a humidistat and
thermostat in series to operate the ventilation dampers. We found that
there was conflict between the damper thermostat (ventilation at 92°F)
and heater thermostat set at 90°F. It was resolved by shorting out the
damper thermostat. Thereafter, the temperature and RH of the drying
room was more constant using only two controls - a damper humidistat
set at 70% RH and a heater thermostat set at 90°F. (Department of
Horticultural Science, University of Guelph, Guelph).

E. Carrot Storage Trials. Smith, R.B., Valk, M.
Three carrot cultivars, Nantes, Hipak and Spartan Delight were used in the
carrot storage trials. Samples of carrots, left unwashed, washed and washed
and dipped in Benlate (1.0 lb/100 gal.Imp) were stored in a refrigerated
cold storage, and in a common storage. A split-split plot analysis of
variance was done on the data for percent weight loss and percent rot.

This analysis indicated that all the cultivars did not react the same to the
storage environment or to the treatments. In general, there was less
weight loss but more rot in the jacketed storage. Washing appeared to
increase the amount of rot in two of the three cultivars. Dipping in Benlate
did not reduce the amount of rot below that found in the unwashed samples.
(Horticultural Research Institute of Ontario, Vineland Station, Ontario.)

11. AIR POLLUTION STUDIES

The Relationship of Ozone Air Pollution to "Blast" on Onions. Hofstra, G.

Symptoms of leaf fleck and tipburn, known as "blast", have been recognized on
onions for many years. It has been assumed that this disease was caused by the
fungus Botrytis and treatment programs have been geared to controlling the fungus
alone. The use of maneb, zineb, or mancozeb has sometimes resulted in yield
increases, but usually there is no effect on the expression of symptoms or on
yield. It was thought, therefore, that the micronutrients Manganese and Zinc, which
are sometimes deficient in muck soils, may have been responsible for occasion-
ally increased yields, since they are present in the fungicides previously
mentioned. If such is the case, applying fungicides can be an overly expensive
way to correct micronutrient problems.

It has also been observed that the appearance of blast coincides closely with
air pollution episodes, the disease symptoms appearing often within 24-48 hours
after high ozone levels were recorded. Blast symptoms have also been reproduced
in the lab by fumigating onions with ozone.
Experiments were conducted at the Muck Research Station to try and determine the roles of Botrytis and ozone in causing blast. Autumn Spice and Rocket varieties were treated throughout July and August with foliar sprays and soil applications of either fungicides effective against Botrytis or with antioxidants to protect the onions from ozone. Various combinations of these chemicals and/or the micronutrients, manganese and zinc, were also tested to determine what effect the micronutrients have on the disease symptoms and resulting onion yield.

Several problems were encountered. During the summer of 1974, air pollution episodes were few and not severe. No blast symptoms developed on any of the plots, and thus no progress was made on the problem. Furthermore, a pelting rain storm in early August bruised and flattened much of the stand, making any injury assessment difficult.

Hence, the experiment will be repeated in 1975 to try and determine the cause(s) and the best method of preventing blast on onions. (Department of Land Resource Science, University of Guelph, Guelph.)

12. GREENHOUSE TOMATO TRIALS

Trough Culture of Greenhouse Tomatoes in Muck and Soilless Mixture with Regular and Slow Release Fertilizers. Valk, M., Lowndes, T.F.

The objective of this investigation was to find out if greenhouse tomatoes would produce better yields and quality of fruit when grown in troughs filled with muck to a 6 inch and 8 inch depth as compared to tomatoes grown straight in muck (ground beds). Six inch troughs with a peat and vermiculite mixture was also used as a comparison. A regular weekly feeding schedule with conventional fertilizer materials was compared with a slow-release fertilizer applied at planting time. The cultivars used in this experiment were Michigan Ohio and Vendor. Planting date - January 25th, date of first picking - April 9th, date of last picking - July 26th.

After 4 weeks of picking, the 8 inch troughs produced the highest yields (3.93 lbs. Michigan Ohio; 3.50 lbs. Vendor). The lowest yield was obtained from the ground beds treatment (regular fertilizer).

Michigan Ohio produced the best yield (13.87 pounds per plant) with the regularly fertilized ground beds. Vendor produced the best yield (13.19 pounds per plant) with the slow-release fertilizer, ground bed treatment.

The troughs filled with muck and treated with regular fertilizer produced an average of 3.15 pounds less than the ground beds. The soilless mix yielded 3.28 pounds less than the ground beds. A large amount of unmarketable fruit, 1.31 pounds (Michigan Ohio) showed up in the soilless mix treatment. This was mainly due to blossom end rot. Vendor also produced the highest amount of blossom end rot affected fruit in the soilless mix, although to a lesser extent than Michigan Ohio. The ground beds produced the largest number and also the largest sized fruit. (Muck Research Station, R.R.1, Kettleby, Ontario).