OREGON VEGETABLE Digest

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Progress Report . . . Onion Storage Rot Control

Vegetable Insect Problems Summarized

At the annual meeting of The Pacific Northwest Vegetable Insect Conference, January 19-21, 1959, entomologists from the Pacific Northwest met and discussed insect problems and results of research of the 1958 season. Highlights of the Conference follow.

The open winter and prolonged warm growing season were credited with causing unexpected outbreaks of cutworms, beet armyworms, painted lady butterflies, corn earworms, loopers, and mites. Aphids and onion maggots were noticeably less abundant than usual.

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In This Issue . . .

Onion storage rots were studied in areas near Ontario, Vale, Weiser, and Nyssa. The investigations were similar to those in 1956 (Oregon Vegetable Digest Volume VI, No. 3) and 1957 (Oregon Vegetable Digest Volume VII, No. 2).

The growing season in 1958 was good and all onions matured well. Rains fell during the harvest season, wetting many onions during the critical field curing period. As a consequence there were significant differences in the keeping quality of onions from different areas.

ARTIFICIAL INOCULATION

All inoculations were made by spraying with a spore suspension on the evening prior to undercutting the onions. This method proved satisfactory and will be used in future tests to assure an adequate incidence of disease in test onions. The success of this procedure illustrates the importance of rainfall during the harvest period. In these tests 120 gallons of water, or of spore suspension per acre, were applied just before dark to allow moisture to remain on the plants for a maximum period of time. This is only 0.00442 inches of water--hardly enough to be recorded as a trace of rainfall but enough, if timed properly, to cause a decided increase in incidence of neck rot.

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Onion Storage Rot . . . (continued from page 1)

Table 1. Influence of type of inoculum on development of neck rot. Barlow Farm. 1958.

Inoculation method	Rotted after 3 months
	Percent
None	2.90
Sprayed with plain water, 120 gal/acre	8.31
Sprayed with suspension of fungus spores in water, 120 gal/acre	9.08

BRUISING

Increasing numbers of onions are being handled mechanically resulting in unavoidable jarring and bruising. A test was run to determine the influence of such injuries on development of rots during storage. The results indicated that while bruising does increase the incidence of rot, the degree of rotting is not in proportion to the amount of bruising. Apparently if outer scales are broken the number of times they are broken is of little significance. It is probable that repeated or severe bruising would affect the weight loss and quality of the onion. This test should be repeated before too many conclusions are reached.

Table 2. Influence of bruising on subsequent development of storage rot.

Degree of injury	Rotted after 3 months
	Percent
None	3.84
Mild 1/	6.24
Moderate 2/	7.14
Severe 3/	7.11

1/ Dropped once from sorting table onto concrete floor.
2/ Dropped 2 times from sorting table onto concrete floor.
3/ Dropped 3 times from sorting table onto concrete floor.

DRYING

Drying at 115° F. for 24 hours again resulted in decided reductions in incidence of neck rot. Tests of lower temperatures (105° and 95° F.) indicated that equally good results could be obtained if air in the drier moves rapidly.

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Onion Storage Rot . . . (continued from page 2)

Table 3. Influence of drying at 115° F. for 24 hours on development of storage rots. Barlow and Nagaki farms. 1958.

Treatment	Rotted after 3 months
	Percent
Not inoculated	
Dried	0.96
Not dried	3.97
Inoculated	
Dried	4.17
Not dried	10.27

When onions were dried at 115° F. for 24 or 48 hours, comparatively little rot developed during storage. When the drying period was increased to 72 hours, many onions were injured and rotted in storage. There was no evidence of injury when onions were dried at 95° or 105° F. for 24, 48, or 72 hours.

Table 4. Influence of drying period and temperature on development of neck rot in storage.

Drying temperatures	Drying period		
	24 hrs.	48 hrs.	72 hrs.
	Rotted after 3 months		
	Percent	Percent	Percent
95° F.	1.86	1.81	1.99
105° F.	2.26	2.57	2.27
115° F.*	5.40	4.11	45.19

*Onions dried at 115° F. were from a different field than those dried at 95° and 105° F.

Table 5. Weight lost in drying at various temperatures and for various periods of time.

Drying period	Drying temperature					
	95° F.		105° F.		115° F.	
	Relative humidity		Relative humidity		Relative humidity	
	Uncontrolled	50%	Uncontrolled	50%	Uncontrolled	50%
Hours	Percent	Percent	Percent	Percent	Percent	Percent
24	0.92	0.12	1.07	0.74	1.91	1.23
48	1.73	1.30	1.99	1.38	4.37	2.77
72	2.48	1.47	2.88	2.14	6.76	4.93

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Vegetable Note

The Geneva, New York Experiment station has announced the release of Red Skin, a new red-orange squash suitable for processing. Developed by W. T. Tapley from crosses involving Knobby Leviathan, Golden Delicious, and Boston Marrow, the new variety has orange-yellow, fine textured, moist flesh. The fruits, which average 12 to 15 pounds in weight, should require about one week longer than Boston Marrow to reach full maturity.

Onion Storage Rot . . . (continued from page 3)

FIELD CURING

Investigations were conducted at the Teramura farm near Cairo Junction to determine the influence of various field curing practices on development of rots in storage. Tops were left on onions cured on the ground, tops were removed from those cured in crates or bags. Some were cured on the ground for a few days with tops on and for additonal days in crates or bags after the tops were removed.

The data indicated that while 3 or 4 days curing on the ground before the tops are removed aids in prevention of neck rot, the length of this curing period is not critical, particularly if the onions are to be dried for 24 hours in a blast of warm air before storing. Combinations of curing with tops on and additional field curing with tops cut off apparently are not better than corresponding periods of curing by either method alone.

Table 6. Influence of field curing practices on development of rots in storage. Onions inoculated by spraying. Ontario. 1958.

Curing practices	Rotted after 3 months	
	Dried	Not dried
	Percent	Percent
No field curing	10.76	15.22
Cured on ground, tops on - 4 days	4.22	11.47
7 "	3.68	8.81
10 "	3.05	7.82
Field cured in crates only - tops off - 4 days	3.45	-
11 "	-	21.23
Field cured in bags only - tops off - 4 days	5.82	-
11 "	-	17.08
Field cured, tops on 4 days - in crates, tops off 3 days	2.87	-
7 "	-	7.92
Field cured, tops on, 4 days - in bags, tops off, 3 days	2.80	-
7 "	-	8.54
Field cured, tops on, 7 days - in crates, tops off, 3 days	5.24	-
4 "	-	9.49
Field cured, tops on, 7 days - in bags, tops off, 3 days	2.65	-
4 "	-	6.02

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Onion Storage Rot . . . (continued from page 4)

Freedom from or development of neck rot depends on moisture content of the neck when the onion is placed in storage. A test was conducted to determine the influence of presence or absence of tops during curing on moisture content of the necks. Ten lots of approximately 100 onions each were selected, all with tops still erect and green at the time of undercutting. Five lots were cured on the ground for 10 days with the tops on. The remaining 5 lots were topped 2 inches above the bulb and cured for 10 days in crates covered with burlap bags. At the end of the 10-day curing period all necks were removed and moisture contents determined.

The results indicated that presence or absence of tops had little influence on the rate at which the necks dried. A possible source of error occurred during this test, however. Rain fell during the curing period. Onions with tops removed were protected by bags laid on crate tops. Onions on the ground were not protected.

Table 7. Moisture content of onion necks[1/] following field curing for 10 days.

On ground with tops left on	In crates with tops cut off
Percent	Percent
83.7	81.7
82.4	81.2
83.4	81.8
81.1	81.0
82.6	79.2
Average 82.3	80.98

1/ First 2 inches above bulb.

STORAGE CONTAINERS

Onions from all treatments were stored in crates and bags. As in all past experiments, less rot (6.09%) developed in onions stored in slatted crates than in those stored in burlap bags (9.94%). Crates permit better ventilation.

INFLUENCE OF RAINFALL DURING THE CURING PERIOD

Rain fell the 5th, 6th, and 7th days after undercutting. While there was no record of exact amount at either location, much more rain fell at the Nagaki farm near Payette than at the Barlow farm near Malheur Butte. These rains provided an opportunity to observe the effect of moisture during this critical period and to check on the rot prevention value of drying onions before storage.

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Vegetable Note

Enation resistance in pea varieties and lines will be studied in the Northwest this year by Dr. D. W. Barton of the Geneva, New York Experiment Station. Dr. Barton, here on one year's sabbatical leave, will also be concerned with resistance to powdery mildew, pea streak, and other diseases. The states of Idaho, Washington, and Oregon, as well as pea processors and seed companies of the Northwest, are cooperating to make this work possible.

Onion Storage Rot . . . (continued from page 5)

Table 8. Influence of rainfall[1/] during the curing period.

Treatment	Rainfall (comparative)	
	Moderate (Barlow, Malheur Butte)	Heavy (Nagaki, Payette)
	Rotted after 3 months	
	Percent	Percent
Not inoculated		
Cured 1 day after undercutting		
Not dried	4.47	4.35
Dried 115° F. for 24 hrs.[2/]	0.48	2.34
Cured 10 days after undercutting		
Not dried	4.40	4.40
Dried 115° F. for 24 hrs.	0.00	1.04
Inoculated by spraying		
Cured 1 day after undercutting		
Not dried	9.56	6.46
Dried 115° F. for 24 hrs.	2.13	1.99
Cured 10 days after undercutting		
Not dried	13.32	26.69
Dried 115° F. for 24 hrs.	0.56	4.00

1/ Rainfall on 5th, 6th, and 7th days after undercutting.
2/ In all cases where onions were dried at 115° F. for 24 hours the percent of neck rot was very low. In onions not artificially dried there was an increase in storage rots following the longer period of curing on the ground with tops on. This is in direct contradiction to data accumulated in other experiments when no rain fell during the curing period.

In most cases more neck rot occurred following the 10-day curing period than after only one day of field curing. In other seasons, when there was no rainfall during the curing period, the incidence of storage rot has decreased following longer periods of curing. This provided a striking example of the influence of rainfall which prevents rapid drying of onion necks, and was particularly notable in the onions that had been inoculated.

In all cases where onions were dried at 115° F. for 24 hours, the percent of neck rot was low. Even under most unfavorable conditions (onions inoculated and left to cure 10 days, during which they received heavy rains) drying reduced incidence of neck rot by 85%.

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Onion Storage Rot . . . (continued from page 6)

FUTURE PLANS

In the future more harvesting and handling operations will be done by machines. Additional studies will be made in 1959 to determine possible influences of these practices on development of neck and other storage rots. It is hoped that investigations of onion storage rots in the Malheur area can be completed this year.

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-- Myron S. Cropsey
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Insect Problems . . . (continued from page 1)

1. Cruciferous pests

The alfalfa looper was serious on broccoli and cauliflower in the Mount Vernon area of Washington and growers had difficulty in controlling the worms with TEPP and Perthane. Experimental trials with parathion and DDT dusts gave satisfactory results.

In Multnomah County, Oregon, broccoli fields were invaded with large numbers of cabbage loopers. Growers were unable to control worms with the recommended insecticides. Satisfactory results were obtained when DDT, Phosdrin, Thiodan, and Dibrom were applied experimentally with a spray-duster, designed and built at the U.S. Department of Agriculture laboratory at Forest Grove, Oregon. This unit has been developed specifically for application of pesticides to row crops when it is important to contact under sides of leaves. These results point out the need for adequate equipment to apply pesticides.

Tests at Agassiz, British Columbia, showed that most systemic insecticides which were good for cabbage aphids on Brussels sprouts were ineffective on the imported cabbage worm, diamond back moth, and cabbage looper. Good results were obtained on both aphids and worms with Diazinon dusts.

At Puyallup, Washington, good control of cabbage maggots was obtained when granular formulations of aldrin, dieldrin, and heptachlor were used in the seed furrow at the time of planting radishes and rutabagas.

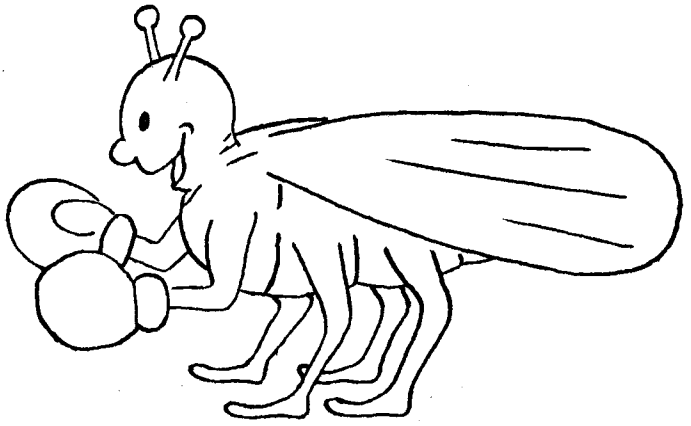
2. Carrot Pests

In muck soil of the Lake Sammanish area of Washington, the carrot rust fly can no longer be controlled with aldrin, dieldrin, or heptachlor. Promising results were obtained when a tobacco stem formulation of Diazinon was used in the furrow at time of seeding.

No difficulties have been experienced in controlling the carrot rust fly with the recommended total soil treatments in Oregon, but growers and cannery fieldmen should be alert for future difficulties.

Insect Problems . . . (continued from page 7)

Symphylids were found mining into mature carrots in 1958 in Lane County, Oregon. The internal damage to carrots closely resembles the mining characteristics of the carrot rust fly larvae. Outward injury is like that caused by small wireworms.



3. Onion Pests

Although onion maggots were less abundant in 1958, difficulties were encountered in the Pacific Northwest and elsewhere in obtaining adequate control with many chlorinated hydrocarbon insecticides.

Results with granular formulations of Ethion, Trithion, and Diazinon insecticides have been so promising that these three materials will be recommended this year.

Endrin was reported to give some degree of control, but it no longer warrants serious consideration in the Northwest because other materials are more promising.

To obtain satisfactory control of the onion maggot, growers in many areas are relying on repeated applications of DDT to the adult fly. At Corvallis, Oregon, laboratory tests showed that some strains of adult flies are resistant to both heptachlor and dieldrin but are still susceptible to DDT.

4. Soil Pests

Wireworms are no longer troublesome soil pests to growers who have used the recommended soil treatments of aldrin, dieldrin, heptachlor, or DDT. Reports from Walla Walla, Washington, and Corvallis, Oregon, show that wireworms have not reinfested soil treated 10 years ago.

Longevity tests at Corvallis show that aldrin, dieldrin, and heptachlor have protected potato tubers from the tuber flea beetle for a period of 6 to 10 years, depending on dosage used. Tests from Kamloops, British Columbia, confirm the Oregon recommendation that 2 pounds of actual insecticide be added to soil prior to each planting of a potato crop.

At Aberdeen, Idaho, these residual soil insecticides have also protected potato tubers from damage by the Western potato flea beetle.

Many complaints about the performance of parathion soil treatment for symphylid control appear to be justified and more interest is now being given to use of soil fumigants. Tests in Washington indicate that Telone may have some advantages over other fumigants for symphylid control. In Oregon, good control has been obtained in large scale field trials with such fumigants as D-D mixture, Telone, Nemagon, Fumazone, Vapam, ethylene dibromide, and chloropicrin. Adequate depth of application, proper equipment, and a good seedbed are necessary and are more important than dosage or type of fumigant used.

Four different field demonstrations were held in Oregon in 1958 so growers could observe application of fumigants for symphylid, and in one instance, nematode control. More efforts of this kind are needed. Since symphylids have increased 20 to 30 times in importance in the last 10 years, chemical companies, food processors, growers, research, and extension workers should make a combined effort toward symphylid control.

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Insect Problems . . . (continued from page 8)

5. Slugs

Metaldehyde baits, sprays, or dusts continue to be the most promising slug control recommendation. Since metaldehyde has a residual life of only 12 to 24 hours in moist soil, frequent applications are required for effective results. In laboratory tests at Corvallis, Oregon, certain dinitro compounds have been toxic to slugs and slug eggs. This finding may have possibilities in controlling this pest in the future.

6. Green Peach Aphid

As a result of warm weather in 1958, movement of the green peach aphid into potato fields was reduced in intensity. Laboratory tests have pointed out that certain strains of this aphid are resistant to malathion, with individuals having wing pads being more resistant than those without pads.

The reproductive rate of the green peach aphid has been increased with high nitrogen levels. Also low levels of nitrogen, phosphorous, and potassium nutrients seem to increase the resistance of the aphids to malathion.

Thiodan and endrin were effective in controlling the green peach aphid on potatoes in 1958. Only thiodan could be applied effectively by aircraft. It was not toxic to ladybird predators and also controlled the Colorado potato beetle.

7. Pea Aphids

In February 1958, with temperatures below 60° F. the fumigation action of granulated Thimet was demonstrated as being very effective on pea aphids on alfalfa.

Furrow applications of granular formulations of Thimet and Di-Syston have inhibited pea aphid development for one month. Di-Syston has shown a higher degree of pea aphid mortality and longer lasting effects than Thimet.

A wild pea (1629-M) has consistently showed resistance to pea aphid development. One selection of this variety was increased in 1958 and appears to be very promising. Two hybrid peas from the Oregon State College Horticulture Department also appear to be unfavorable for pea aphid reproduction.

Since greenhouse trials in 1958 at Walla Walla failed to show transmission of enation mosaic to peas from alfalfa by the pea aphid, it is now believed that the source of infection is closer to the pea fields and not from the alfalfa growing areas.

8. The Application of Insecticides by Sprinkler Irrigation Systems

At Corvallis, work with DDT wettable powders and emulsions indicated that either formulation could be applied through a sprinkler irrigation system with a uniformity about equal to that achieved in water distribution. Similar results were obtained when the insecticide was introduced both ahead of and after the irrigation pump. Although these conclusions are tentative and depend on possible variations in formulations of the insecticide, considerable savings in cost of materials can be obtained by the use of wettable powders.

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Costs for Handling Onions

Measuring handling costs alone, the field-bag method of handling onions is the least costly and the single-crate method is the most costly. When storage loss differences are considered, the bulk-box method has the lowest costs. Approximately 15 cents per hundredweight for the value of onions lost in storage should be added to the handling costs shown for field bags and skeleton boxes.

Five major methods of handling were studied--hand-bucked field bags, bulk boxes, skeleton (or pallet) boxes, palletized crates, and hand-bucked crates. When minor variations were found within these methods, the most efficient was selected and costs for the method based on it. For example, some growers use the palletized crate method to fill pallets on the ground, while others fill them on the truck. The latter method is less costly by over one cent per hundredweight. Hence the costs shown below for the palletized crate method are for this variation.

Table 1. Handling and Storage Costs, Field to Storage and Storage Through Dumping[1/]
(Malheur County, Oregon, 1958 Crop Year)

	Field bags	Bulk boxes	Skeleton boxes	Palletized crates	Single crates
	(Cents per hundredweight packed)				
Storage building	10.3	8.7	8.5	7.8	7.0
Containers	7.2	14.2	13.8	32.8	30.5
Labor	8.8	4.0	6.4	4.8	9.7
Handling equipment	-	3.1	2.0	.9	-
Trucking	4.3	5.6	8.2	6.5	7.0
Total	30.6	35.6	38.9	52.8	54.2

1/ Building and equipment costs based on 1958 prices of builders and equipment dealers; container costs on estimates of growers. Contract labor charged at $1.50 per hour, full-time labor at $1.20 per hour. Truck use charged at 18 cents per mile.

Assumptions:

1. No charge is made for management except when working.
2. Crew sizes are as commonly used for the type operation shown.
3. Round-trip distances; from field to storage, 2 miles; from storage to packing shed, 20 miles.
4. Eighty percent of field-run onions are packed.
5. Field-run onions delivered to packing shed at rate of 180 hundredweight per hour.

The totals shown are costs from topping through farm storage, and from farm storage through dumping. Costs include equipment operating costs and labor, interest, depreciation, taxes, maintenance and repairs, insurance, and other incidental costs of buildings, equipment, and containers.

The labor and equipment costs shown in the table do not represent the costs of any one grower, but are combinations of the most efficient operations at several stages within each method. Labor and equipment use for different growers on different days was measured. The most efficient performance was considered as a standard for the work being done, and a reasonable allowance was added for personal delay. These most efficient operations at each stage were combined to make a "model operation," within the capacity of commonly used crew sizes and equipment.

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Costs for Handling Onions . . . (continued from page 10)

Hourly labor charges, identical for all methods, and identical equipment charges when applicable, were applied to the physical inputs shown in the model operation to arrive at costs shown. It is recognized that much of the labor from field to storage is on a contract basis, with rates varying between methods, but application of a special wage rate to each method would distort the measure of efficiency of the operation. In any case, the difference is so small that it will not appreciably change the relationship between methods, as shown in table 1. (As can be seen in this table, the annual cost of the container itself is the most important part of total costs in all methods but that of field bags.)

Experiments conducted by the Department of Botany and Plant Pathology in 1957-58 and 1958-59 crop years have shown that storage rot in field bags is 3.8 pounds per hundredweight higher than that in crates. A limited number of investigations in the 1958-59 crop year show storage rot in bulk boxes to be about equal to that in crates.

Table 2. Initial Investment in Handling and Storing Facilities for a Grower with 30 Acres Yielding 25 Tons to the Acre.

	Field bags	Bulk boxes	Skeleton boxes	Palletized crates	Single crates
Farm storage	$14,606	$12,274	$12,058	$11,084	$ 9,842
Containers	2,000	11,374	8,770	18,436	16,250
Field equipment.	-	2,000	2,000	1,000	-
Storage equipment. . . .	300	7,700	7,700	7,700	300
Total investment . .	$16,906	$33,348	$30,528	$38,220	$26,392
Investment per acre	564	1,112	1,018	1,274	880

Initial investment required for each of the 5 methods is shown in table 2. All costs shown are for new buildings and equipment which can be charged exclusively to harvest and storage. Tractors are not included, but tractor-powered lifts and elevators are. Trucks are not shown--they also are multipurpose equipment and the number needed depends on distances from field to storage and from storage to packing. Lift trucks are of 2-ton capacity and are equipped with sliding forks. These figures assume a farm with no facilities for handling onions. The investment required to change from one method to another would of course be lower.

In summary, the bulk-box method appears to have these advantages: (1) When storage losses are considered, costs are over $40 per acre lower than for the field-bag method, and $70 lower than for the crate- or skeleton-box methods; (2) there is less dependence on availability and quality of labor; and (3) there is a possibility potatoes can be handled in bulk boxes as are apples, pears, and late potatoes in other areas--this would reduce container and equipment costs.

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