OREGON AGRICULTURAL EXPERIMENT STATION
Annual Progress Report, Fiscal Year Ending June 30, 1957

Date Report Submitted: April 15, 1957

Project Title: Dehydration and Other Processing of Oregon Field Crops

Sub-Project Titles:
Investigation of the Engineering Phases of Onion Neck Rot Control.
(See Project 65-6 Dept. of Botany and Plant Pathology).

Departments and Cooperating Agencies:
Department of Botany and Plant Pathology
Malheur Experiment Station
County Agent Malheur County
Malheur County Onion Growers Association

Personnel:
M. G. Cropsey
E. K. Vaughan
E. N. Hoffman
T. Bond
L. D. Calvin

Nature and Extent of Work Done This Year:
The first part of this year's work consisted of constructing and testing a dryer suitable for the drying of onions experimentally.

The second part of the experiment tested the effect of the following factors in controlling or preventing neck rot of onions in storage.

1. Excess nitrogen and water vs. onions grown normally.
2. Onions grown on three different farms (3 different plots)
3. Onions field dried 0 days, 3 days, 6 days, and 9 days after lifting.
4. Onions inoculated and not inoculated with neck rot organisms.
5. Onions dried and not dried after lifting.
6. Onions stored in crates and onions stored in bags.
Results of the Project: (Confidential information should be so marked)

Major Accomplishments or Progress of Project Since Its Inception:

This is the first year of this experiment consequently this section has been written up as Major Results for the year.

Major Results for the Year:

As electrically operated dryer of 36 crates capacity was constructed capable of maintaining a temperature range of \( \pm 1^{\circ} \text{F} \) with a difference between the coldest and warmest parts of the dryer of \( \pm 1.25^{\circ} \text{F} \).

The second part of the experiment consisted of testing various treatments in preventing neck rot of onions in storage. The treatments tested were as follows:

Onions grown on three different farms (3 different plots in the area).
Onions grown with excess nitrogen and water vs. normal growing.
Field curing of 0 days, 3 days, and 6 days, and 9 days after lifting.
Inoculation with neck rot organisms vs. no inoculation.
Drying at 115\(^{\circ}\text{F}\) for 24 hours vs. no drying before storage.
Storage in crates vs. storage in sacks.

The experiment was set up in a statistical design known as a factorial\(3 \times 2 \times 4 \times 2 \times 2 \times 2 \) with each pair of treatments triplicated.

Onions were harvested during the first two weeks in September, given the required treatment according to the previously mentioned experimental set up and placed in a well ventilated storage in Ontario. Those that had 0 and 9 days field curing were inspected for neck rot during the third week in November. A complete inspection was made during the second week in January. The percentage of rotted and healthy onions were determined both by number and weight.

Ordinarily, this experimental design lends itself well to analysis of variance; however, in this particular instance the November inspection interfered with the results. In handling the onions in November, knives were used to inspect the onions for the development of neck rot. Penetration by the knife was shown to spread neck rot infection to a healthy onion. As a result of this spread of infection by inspection only the 0 and 9 day field cured onions could be compared for the November inspection (the onions inspected in November) and the 3 and 6 day field cured onions.
Results of the Project: (Continued)

for the January inspection. Also, a few samples had lost their identity. These unknown samples make analysis of variance difficult.

The average of any one treatment was compared with the average of any one other treatment. The results are shown in Figures 1 to 5 and Tables 1 to 3. For the onions inoculated the following observations could be made:

1. Artificial drying resulted in a considerable reduction in neck rot compared with those not dried.
2. Onions stored in crates had less neck rot than onions stored in sacks although the results were not as spectacular as artificial drying and no drying.
3. Onions that had the most field curing developed the least neck rot, but the differences were not as great as those shown for storing in crates vs. bags and drying vs. not drying.
4. Excess nitrogen and water when compared with those grown normally had little influence on neck rot in storage.

By observation of Tables 1 to 3 and Figure 4 it can be seen that there was little difference in the treatments for those not inoculated. This seemed to indicate that the 1956 year was one in which natural infection of neck rot was not severe.

Also, differences in weight between onions before drying and after drying was observed. The results of these differences in losses of weight can be seen in Figure 5. Generally, the more field drying the onions had the less weight they lost in artificially drying. Also, it can be observed that the percentage loss in weight by artificial drying was not great.
Outlook:

The outlook appears promising that artificial drying, field curing when possible, and storage in crates helps reduce neck rot in storage to a reasonable level. These should be investigated further to find just how effective each treatment is. In so far as the engineering phases of the problem are concerned, different temperatures, humidities, length of drying time should be observed for optimum results in preventing neck rot.

Practical Application of Results or Public Benefits:

Onion neck rot occurs wherever onions are grown. It has caused minor losses in the Snake River Valley for many years. In 1954 approximately 1200 carloads (roughly 70 per cent of the entire crop) of onions were ruined by this disease in Malheur County and in 1955 the losses were almost as severe. Such losses are unbearable, and unless means are found to minimize them, the onion growing industry cannot survive.

Publications Issued or Manuscripts Prepared During the Year:

none

Other Pertinent Information on the Project:

none
Program for the Coming Year: (Proposed procedure for research during the coming (fiscal) year.)

The program for the coming year will be planned in cooperation with the departments of Botany and Pathology. The particular field treatments and storage treatments selected will be determined in cooperation with them.

One investigation that needs further study is drying. This should include lengths of drying time, drying temperatures and humidities needed for optimum control of neck rot.
Approved by:

[Signature: April 13, 1957]  A. G. Cropsey

Date: Project Leader

Date: Asst. Project Leader

Date: Director

Department Head

Disposition of Copies:

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Influence of field curing on development of neck rot in onions inoculated with Botrytis allii. 1956

![Graph showing the percentage of healthy onions after different days of field curing. The graph indicates that the percentage of healthy onions decreases as the curing period increases.]
Influence of field curing, artificial drying, and type of storage container on development of neck rot in onions inoculated with Botrytis allii. 1956

Figure 2
Influence of type of storage container on development of neck rot in onions inoculated with Botrytis allii. 1956

<table>
<thead>
<tr>
<th>0 days</th>
<th>3 days</th>
<th>6 days</th>
<th>9 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>47.87</td>
<td>47.38</td>
<td>50.39</td>
<td>61.27</td>
</tr>
<tr>
<td>37.89</td>
<td>38.51</td>
<td>42.25</td>
<td>57.78</td>
</tr>
</tbody>
</table>

Stored in crates

Stored in bags

FIGURE 3
Influence of field curing, artificial drying, and type of storage container on development of neck rot in onions. 1956

**FIGURE 4**

<table>
<thead>
<tr>
<th></th>
<th>Not Dried</th>
<th>Dried</th>
</tr>
</thead>
<tbody>
<tr>
<td>No field curing</td>
<td>98.28</td>
<td>97.26</td>
</tr>
<tr>
<td></td>
<td>98.58</td>
<td>97.18</td>
</tr>
<tr>
<td>9 days field curing</td>
<td>98.63</td>
<td>97.57</td>
</tr>
<tr>
<td></td>
<td>99.79</td>
<td>99.36</td>
</tr>
</tbody>
</table>

Not Inoculated

Per cent healthy onions
<table>
<thead>
<tr>
<th>Time of Inspection</th>
<th>November</th>
<th>January</th>
<th>November</th>
<th>January</th>
<th>November</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days of Curting</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Percent Healthy by Weight
Not Incubated

IN CHICKS AND IN BAGS
COMPARISON OF ONIONS STORED

<table>
<thead>
<tr>
<th>Bee</th>
<th>Crate</th>
</tr>
</thead>
<tbody>
<tr>
<td>98.8%</td>
<td>98.4%</td>
</tr>
<tr>
<td>95.2%</td>
<td>96.8%</td>
</tr>
<tr>
<td>92.6%</td>
<td>98.6%</td>
</tr>
</tbody>
</table>

TABLE 1
<table>
<thead>
<tr>
<th>Time of Inspection</th>
<th>Days of Field Cure Time</th>
<th>Percent Healthy by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>November</td>
<td>6</td>
<td>98.10%</td>
</tr>
<tr>
<td>January</td>
<td>6</td>
<td>96.6%</td>
</tr>
<tr>
<td>January</td>
<td>3</td>
<td>93.3%</td>
</tr>
<tr>
<td>November</td>
<td>0</td>
<td>97.7%</td>
</tr>
<tr>
<td>Died</td>
<td></td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>96.5%</td>
<td></td>
</tr>
<tr>
<td>January</td>
<td>95.9%</td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>97.8%</td>
<td></td>
</tr>
</tbody>
</table>

Table 2

Percent Healthy by Weight
Not inoculated
AND NOT DRIED BEFORE STORAGE
COMPARIISON OF ONIONS DRIED
<table>
<thead>
<tr>
<th></th>
<th>Grown Normally</th>
<th>Excess Nitrogen and Water</th>
<th>Time of Inspection</th>
<th>Days of Plant Cutting</th>
</tr>
</thead>
<tbody>
<tr>
<td>96.29%</td>
<td>96.57%</td>
<td>96.76%</td>
<td>November</td>
<td>6</td>
</tr>
<tr>
<td>98.67%</td>
<td>97.60%</td>
<td>96.22%</td>
<td>January</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>97.81%</td>
<td>January</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>November</td>
<td>0</td>
</tr>
</tbody>
</table>

Percent Heathy by Weight

Not Insculated

Comparison of Grown Normally with Excess Nitrogen and Water