

## DEVELOPMENT OF NET NECROSIS IN STORED

RUSSET BURBANK POTATOES<sup>1/</sup>

DONNIE M. POWELL AND W. T. MONDOR,

Entomology Research Division, Agr. Res. Serv.,  
USDA, Yakima, Washington 98902

The loss to the potato grower in Washington from leaf roll infection consists of both a reduction in yield and in quality of the crop. The greatest loss occurs in the Russet Burbank variety, where leaf roll infection is usually accompanied by net necrosis in the tubers. Net necrosis, or phloem necrosis, refers to a network of brown threadlike strands of dead phloem tissue in the tubers, originating at the stem end and extending with varying severity toward the apical end. Net necrosis follows infection of the potato plants with the leaf roll virus that is transmitted by the green peach aphid, *Myzus persicae* (Sulzer)<sup>2/</sup>. Rich (1) showed that the number of net necrotic tubers increased during the first 8 to 12 weeks of storage. After that time, the number of necrotic tubers did not increase, but the extent of damage within the affected tubers continued to increase.

There are many references to leaf roll and net necrosis, but only Rich (1) seems to have studied the progressive development of net necrosis in stored tubers. In 1966 large quantities of potatoes were collected from a field of Russet Burbank potatoes that was severely infected with leaf roll. In 1970 two other large samples of potatoes were collected from fields to study the severity and development of net necrosis in storage. The results of this study are presented here.

**Materials and Methods.**--In the autumn of 1966, approximately 2 tons of potatoes were harvested from a field near Othello, Wash. The potatoes were stored at 40 to 44° F. Tuber samples were removed from storage at intervals of 0 days and 1, 2, 4, 8, 16, 24, and 32 weeks after harvest. The tubers were segregated into 3 size groups: less than 2-1/2 in. long, 2-1/2 to 4 in. long, and over 4 in. long. The stem end of each tuber was cut off and the cut portion of the tuber examined for net necrosis. The severity of net necrosis was classified into 1 of 5 categories according to the depth of necrotic penetration from the stem end as follows: (1) trace (up to 3/8 in. deep), (2) 1/2 to 7/8 in., (3) 1 to 1-3/8 in., (4) 1-1/2 to 2 in., and (5) more than 2 in. deep. The number of tubers was recorded for each size group and also each depth category for each examination date.

In the autumn of 1970, approximately 2 tons of potatoes were harvested from a field in the Moses Lake area and also another 2 tons of potatoes were harvested from a field in the Yakima area. The tubers were stored, then segregated in size and examined in the same manner as described for the 1966 potatoes. The time intervals in storage were 0, 5, 6, 11, and 25 weeks for the Moses Lake potatoes, and 4, 11, 20, and 25 weeks for the Yakima potatoes. In 1970, we also recorded the weight of the net necrosis portion of the tuber, the weight of the clear portion of the tuber, the total weight of the necrotic tubers, and the weight of the total sample.

Potatoes were harvested with a 1-row potato digger-sacker combination and potatoes from a 15- to 25-ft section of a row were placed in 1 sack. Since leaf roll infection in a field is spotty, the number of tubers with net necrosis in a sack may be high or low. We randomly selected 3 to 5 of these sacks for a sample to examine for net necrosis.

1/ In cooperation with the College of Agriculture, Research Center, Washington State University, Pullman 99163, and the Washington State Potato Commission.

2/ Homoptera: aphididae.

Results.--Table 1 gives the number of tubers examined for net necrosis in each size group and the average size of the tubers for each storage time interval from the Othello, Moses Lake, and Yakima areas. Data presented in Figures 1, 2, and 3 are based on the number of tubers given in Table 1. Thus, simple calculations from Table 1 and any of the figures will give the number of tubers at any desired point. Column 5 in Table 1 shows that tubers from the 1966 Othello crop were much larger than tubers from the 1970 Yakima crop and that the Yakima potatoes were larger than the Moses Lake potatoes.

Table 1.--Number and size of Russet Burbank potato tubers examined for net necrosis after time intervals in storage. 1971.

net necrosis after time intervals in storage, 1971					
Weeks in storage	Number of tubers for indicated size <sup>a/</sup>				Avg. size in inches <sup>b/</sup>
	Small	Medium	Large	Total	
<u>Othello, Wash. 1966 crop</u>					
0	163	219	142	524	4.11
1	95	244	186	525	3.64
2	86	285	144	515	3.53
4	139	269	127	535	3.34
8	103	282	139	524	3.46
16	123	259	145	527	3.44
24	125	289	111	525	3.32
32	156	252	117	525	3.27
<u>Moses Lake, Wash. 1970 crop</u>					
0	146	251	13	410	2.86
5	252	432	72	756	3.00
6	125	423	85	633	3.24
11	239	437	20	696	2.87
25	186	415	23	624	2.94
<u>Yakima, Wash. 1970 crop</u>					
4	140	509	82	731	3.20
11	161	465	65	691	3.12
20	205	573	36	814	3.01
25	283	596	0	879	2.85

<sup>a/</sup> Small - under 2-1/2 in. long; medium - 2-1/2 to 4 in. long; large - over 4 in. long.

<sup>b/</sup> Calculated from the averages of: small tubers = 2.0 in. long; medium tubers = 3.25 in. long; and large tubers = 5.00 in. long.

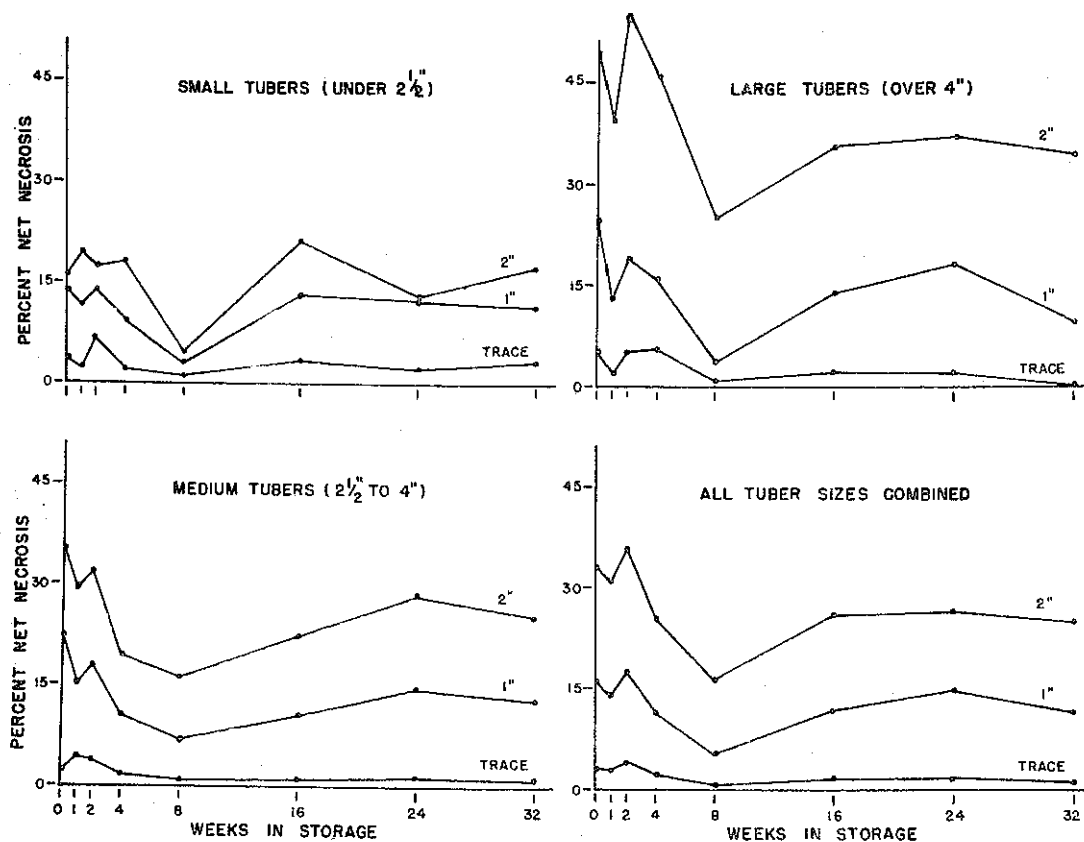


Figure 1: Cumulative percentage (tr. + 1 in. = 1 in. line; tr. + 1 in. + 2 in. = 2 in. or total) of tubers with net necrosis and the depth of net necrosis penetration in the tubers in relation to tuber size and weeks in storage. Lines for 1/2 in. and 1-1/2 in. were omitted. Othello, Wash., 1966

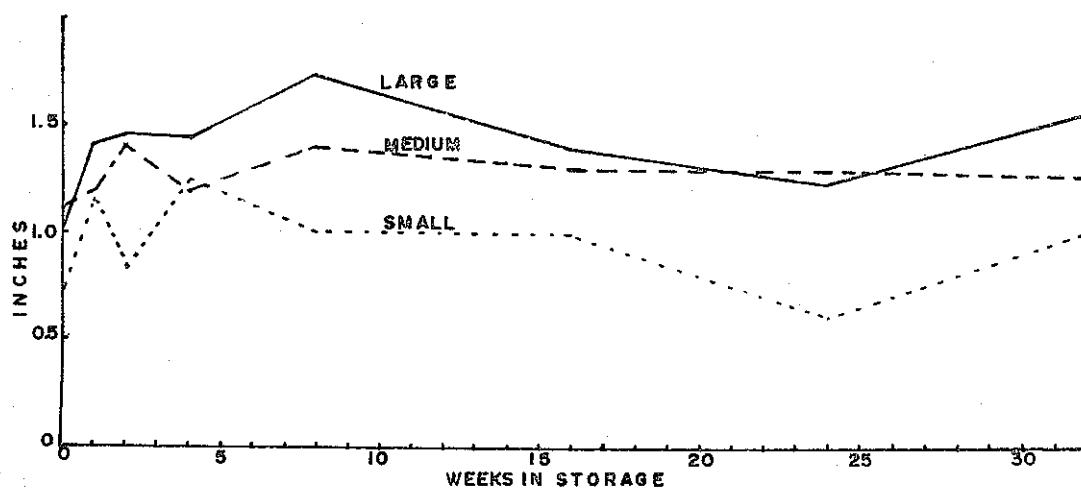


Figure 2: Average depth of net necrosis penetration in the tubers in relation to tuber size and weeks in storage. Othello, 1966.

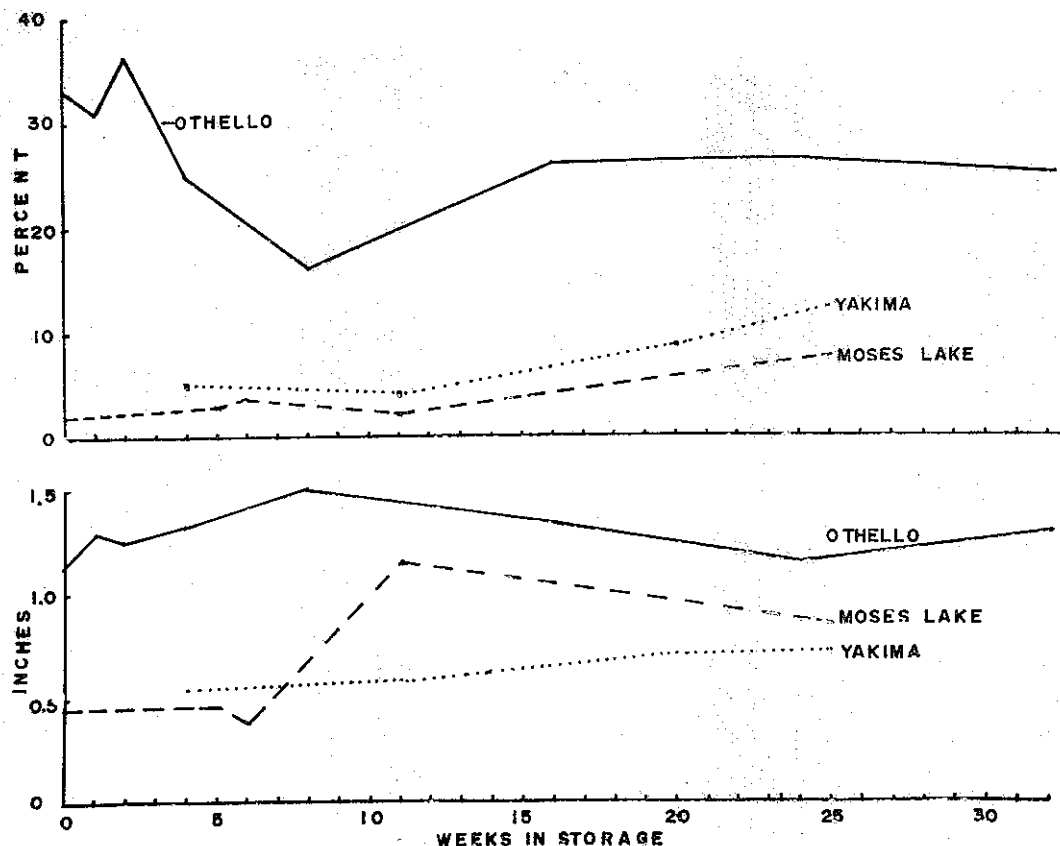


Figure 3: Percent of tubers with net necrosis and depth of net necrosis penetration in the tubers in relation to weeks in storage (Othello, 1966; Moses Lake and Yakima, 1970).

Potatoes from the Othello area were so severely infected with leaf roll net necrosis that they were unmarketable except for starch. At harvesttime, 33% of these tubers contained net necrosis (Fig. 1). The percentage of the tubers with net necrosis in samples examined 0, 1 and 2 weeks in storage was greater than in the tubers examined after 4 weeks in storage (Fig. 1). These results were not in agreement with Rich (1), since he found that the number of tubers with net necrosis increased for the first 12 to 16 weeks and remained about the same thereafter. However, our results may be an artifact or our sampling procedure in that the first 3 samples examined may have been harvested from a part of the field with a higher leaf roll infection than the other samples and so accounts for the high percentage of net necrosis at harvesttime and the lower percentage after 32 weeks in storage.

The percentage of tubers with net necrosis was consistently greater in large size tubers: small tubers ranged from 5 to 21% net necrosis, medium tubers ranged from 16 to 36% net necrosis, and large tubers ranged from 25 to 55% net necrosis (Fig. 1).

Figure 2 shows that the depth of net necrosis penetration in the tubers was greater in large size tubers than in smaller tubers. The increased storage time for the severely infected tubers from the 1966 Othello crop did not influence the development of deeper net necrosis penetration in the tubers.

Tubers sampled from the 1970 crop at Moses Lake and Yakima had less net necrosis than tubers from the 1966 Othello crop (Figure 3). The percentage of the tubers

with net necrosis showed little change from harvest time to 11 weeks in storage for Moses Lake or Yakima, then the percentage of tubers with net necrosis gradually increased for the remainder of the 25-week storage period (Fig. 3). The depth of net necrosis penetration in the tubers for the Yakima potatoes, and except for the 11-week storage sample of the Moses Lake potatoes, slightly increased as the time of storage increased (Fig. 3). The percentage and penetration of net necrosis in tubers from Yakima as related to storage periods are both in agreement with data presented by Rich (1).

The data obtained from the weight of both the netted portion and the clear portion of the necrotic tubers and also the weight of the total sample gave almost the same information as the data presented in Figures 1, 2, and 3 on the percent of tubers with net necrosis and the depth of net necrosis penetration in the tubers. Therefore, these data are omitted from this report.

Conclusion.--The development of net necrosis in Russet Burbank potatoes is related more to the time of infection with leaf roll virus than to the length of time the tubers were in storage. In potato plants infected with the leaf roll virus early in the growing season, as in 1966 at Othello, net necrosis development in the tubers was almost complete before the tubers were harvested and stored; thus, the storage time of the tubers had little effect on further development of net necrosis. In potato plants infected with the virus late in the growing season, as in 1970 at Moses Lake and Yakima, the time before harvest was not long enough to complete the development of net necrosis, and thus the percent of tubers with net necrosis and the depth of net necrosis penetration in the tubers increased as the storage time increased.

(1) Rich, Avery E. 1951. Studies on phloem necrosis in Irish potato tubers in Washington. Wash. Agr. Exp. Sta. Bull. 528. 49 p.