Annual Report, Research on Prunes, Department of Nematology

December 15, 1969

1. Description of research (Root and root zone problems).

a. Reaction of possible prune rootstocks to the root-lesion nematode, Pratylenchus vulnus.

(1) Greenhouse test. At the time of planting into two-gallon plastic pots 50,000 P. vulnus were added to each of ten replicates of twelve possible prune rootstocks. No nematodes were added to an equal number of controls. Nematode-infested, and uninfested plants were arranged in pairs in the greenhouse. After six months growth, plants were measured, weighed and photographed, and final nematode populations were determined. Growth of all of the possible rootstocks was reduced significantly by the nematodes (Table 1). All were good hosts for Pratylenchus vulnus. In this test Marianna UC 2624 was more tolerant of root-lesion nematodes than any of the other plants tested. Myrobalan 3J was particularly susceptible.

(2) Orchard test. Ten of the twelve plants tested in the greenhouse were planted in a Winters, Yolo County orchard infested with the root-lesion nematode, P. vulnus. They were planted in rows, half of which had been treated with Shell DD at the rate of 60 gallons per acre. After five months the growth in treated and untreated soil does not differ significantly (Table 2). A sampling of the nematode population in this plot indicates that the population is now generally low, and does not differ greatly in treated and untreated areas. We shall resample to confirm this result, and we may retreat the treated area with DBCP. Root-lesion disease was marked in the planting which was pulled before this experiment. We expect that root-lesion nematodes will return to a high level in the untreated areas, so that we can eventually obtain a root-lesion disease rating from this experiment.

A problem encountered in this investigation of prune rootstock reactions to root-lesion nematodes is lack of agreement between results obtained in the greenhouse and results of earlier orchard trials. For example, Day and Serr (1951; Proc. Am. Soc. hort. Sci. 57:150-154) noted no marked difference in the tolerance of Myrobalan 3J and Marianna UC 2624 to root-lesion disease in an orchard test at Riverside. Day and Serr did not report the population density of root-lesion nematodes in the Riverside test. It was probably lower than the 50,000 nematodes per plant which we employed to distinguish readily differences in reaction. With most of the plants tested, the nematodes multiplied to reach a final level much higher than the initial one (Table 1). This suggests that 50,000 nematodes is not an artificially high level. The greater precision, control and speed of greenhouse testing should make it a helpful adjunct to orchard observations. Tentatively we conclude that Marianna UC 2624 would be the best rootstock of those tested for use where the root-lesion nematode, Pratylenchus vulnus, is the principal factor limiting prune growth.

b. The effect of the ring nematode, Criconemoides xenoplax, on prunes.

A Colusa County prune orchard soil heavily infested with C. xenoplax (more than one per cc of soil) and containing lesser numbers of a pin nematode, Paratylenchus sp., a sheath nematode, Hemicycliophora sp., a dagger nematode, Xiphinema americanum, and a needle nematode, Longidorus sp., was thoroughly mixed and divided into two portions. One portion was treated

with a nematicidal fumigant, Dowfume W85, at the rate of 16 gallons per acre. The other portion was not treated. Myrobalan 3J plum seedlings were grown three months in three-gallon cans of the treated and untreated soil. Fourteen replicates of each treatment were paired in a lathhouse. Plant weights and nematode populations were determined at the end of the three-month growth period.

The Myrobalan seedlings grown in the fumigated soil were significantly larger (Table 3) than those grown in untreated soil. The ring nematode population in the untreated soil had increased to more than ten times the initial level. Populations of other nematodes initially present in this orchard soil had declined.

Criconemoides xenoplax is a common inhabitant of prune orchard soils. This is the first experiment to test its association with reduced prune growth. A better test could be run if large numbers of C. xenoplax could be obtained free from all other organisms, or, at least, all other plant parasitic nematodes. We are now working toward this end.

If the ring nematode C. xenoplax is a prune pathogen it might be easier to control by sidedressing with DBCP ("Nemagon" or "Fumazone") than the root-lesion nematodes. The ring nematodes are external parasites while the root-lesion nematodes are internal parasites.

c. The effect of pin nematodes, Paratylenchus spp., on prunes.

One or more species of pin nematodes are common inhabitants of prune orchards. Taxonomic study of the species involved is in progress. A Napa County prune orchard soil infested with pin nematodes has been mixed for uniformity and divided into two portions. One portion has been treated with Dowfume W85 at the rate of 16 gallons per acre and the other portion left untreated. Myrobalan 3J plum seedlings have been planted in the treated and untreated soil.

The host range of the pin nematode used in the experiment described above is also being investigated. The effort with the pin nematodes parallels that with the ring nematodes. Experiments with the pin nematodes were begun later, and have not progressed as far as those with the ring nematodes. The pin nematodes, like the ring nematodes, are external parasites.

d. Results from an orchard trial of DBCP sidedressing of prune trees in Butte County.

This is a report on a trial commenced before the contract with the California Prune Advisory Board. It is included because it is a continuing experiment, and is of interest.

Annual sidedressing of prune trees with DBCP (1,2 dibromo-3-chloropropane, sold as "Nemagon" and "Fumazone") is being tried at the William Harkey ranch in Gridley, Butte County. The trees are French prune on Myrobalan 29C, now seven years old. Annual sidedressing was begun when trees were two years old. DBCP was applied on two sides of the treated trees at the rate of 2.5 gallons per acre. Control rows were not treated. Root-lesion nematodes, Pratylenchus vulnus, pin nematodes, Paratylenchus sp., and dagger nematodes, Xiphinema americanum, infest this orchard. No

growth or yield response resulted from the first four applications. After the fifth application prune yields were nearly doubled in the treated rows (Table 4). This increase in yield is not sufficient to pay for the costs of the annual treatments to date (Table 5). If we continue to obtain this kind of results in future years, however, the annual sidedressing will be highly profitable at this location.

2. Personnel, title, and man days worked.

Mojtahedi, H., Laboratory Technician I

1/1/69 - 6/30/69	38 3/4 days
7/1/69 - 12/31/69	83 5/8 days

on root and root zone problems

Braun, A. L., Laboratory Technician I

7/1/69 - 12/31/69	52 1/4 days

on root and root zone problems

3. Expenditures

1/1/69 - 6/30/69

GA	1045.37
EB	3.34
S&E	409.10
E&F	219.49
Total	$1677.30

7/1/69 - 12/31/69

GA	3865.59
EB	20.61
S&E	1067.02
E&F	761.25
Total	$5714.47

4.

a. Research to be continued or initiated during the period 1/1/70 - 12/31/70

The orchard trial of possible prune rootstocks for resistance to root-lesion nematodes will be continued. DBCP retreatment of trees in the DD treated areas may, or may not be carried out, depending on results of the spring sampling of the nematode population. Another greenhouse trial will be run during this period only if we are able to find some new candidate plant materials for testing.

Effects of extraction and surface-sterilization procedures on ring nematodes will be examined in an effort to obtain large numbers of these nematodes, free from other organisms. This information is prerequisite to more precise study of the effect of ring nematodes on prunes.

The experiment on the effect of reduction in pin nematode populations on Myrobalan growth will be continued, and possibly completed during this period. Work on the species identity and host range of the pin nematodes in prune orchards will continue. We will begin a study of methods of extracting and surface-sterilizing pin nematodes.

The trial of annual applications of DBCP to prunes in Butte County will continue. This last item will be financed by regular university funds.

b. Cost estimates

1/1/70 to 6/30/70

GA	3322.24
EB	30.00
S&E	800.00
Total	$4152.24

7/1/70 to 12/31/70

GA	5037.57
EB	35.00
S&E	1300.00
E&F	300.00
	$6672.57

Table 1. Heights and weights of a number of possible prune rootstocks after 6 months growth in the greenhouse with, and without, 50,000 root-lesion nematodes. Numbers of nematodes at the end of this growth period.

Possible prune rootstocks	Final plant height in cm[a]		Final plant weight in grams[a]		Final number of *P. vulnus*/pot[a]	
	50,000 *P. vulnus* added	no *P. vulnus* added	50,000 *P. vulnus* added	no *P. vulnus* added	50,000 *P. vulnus* added	no *P. vulnus* added
Myrobalan 3J	9 ± 1**	113 ± 9	4 ± 1**	154 ± 16	588,140	0
Marianna UC 2624	99 ± 13**	147 ± 6	164 ± 25**	307 ± 18	3,895,040	0
White Damson	6 ± 4n.s.	13 ± 8	9 ± 5	28 ± 15	193,300	0
St. Julian	0 ± 0*	28 ± 11	1 ± 0.1**	49 ± 16	26,780	0
Idaho wild plum	0 ± 0**	78 ± 14	1 ± 0.2**	64 ± 14	68,340	0
Lovell peach	25 ± 3n.s.	32 ± 3	34 ± 8*	98 ± 22	5,402,020	0
Nemaguard peach	61 ± 8**	102 ± 3	47 ± 8**	258 ± 12	2,409,800	0
Rancho Resistant peach	42 ± 4**	116 ± 4	30 ± 5**	317 ± 19	661,820	0
40-A-17; 4-6-13 peach	25 ± 4**	88 ± 6	14 ± 5**	228 ± 33	2,090,580	0
40-A-17; 4-19-17 peach	38 ± 9**	112 ± 3	45 ± 19**	311 ± 16	4,208,120	0
H-62; 1-22-16 peach	50 ± 7**	103 ± 3	44 ± 10**	275 ± 14	2,326,940	0
Blenheim apricot	22 ± 5**	52 ± 6	42 ± 15**	135 ± 26	769,220	0

[a]Mean of 10 replicates. Standard errors of means are given for final plant heights. They have not yet been calculated for the other statistics.

*Less than the uninfested control ($P = > 0.01; < 0.05$)

**Less than the uninfested control ($P = < 0.01$)

n.s. Not significantly different from the uninfested control.

Table 2. Heights of a number of possible prune rootstocks after 5 months growth in a Yolo County orchard infested with root-lesion nematodes with, and without, preplanting soil fumigation with Shell DD at the rate of 60 gallons per acre.

Possible prune rootstocks	Height in cm[a]	
	In fumigated soil	In untreated soil
Myrobalan 3J	62 ± 5	49 ± 9
Marianna UC 2624	101 ± 5	91 ± 8
White Damson	18 ± 5	45 ± 15
St. Julian	28 ± 5	24 ± 8
Lovell peach	69 ± 5	62 ± 10
Nemaguard peach	78 ± 4	56 ± 13
Rancho Resistant peach	69 ± 5	59 ± 4
40-A-17; 4-19-17 peach	74 ± 4	55 ± 13
H-62; 1-22-16 peach	69 ± 4	56 ± 13
Blenheim apricot	41 ± 10	46 ± 7

[a]Mean of 8 replicates and the standard error of this mean.
Differences between means in fumigated and in untreated soil do not differ significantly from one another.

Table 3. Weights of Myrobalan 3J plum seedlings and nematode populations after 3 months growth in soil infested with ring nematodes with, and without preplanting soil fumigation with Dowfume W85 at the rate of 16 gallons per acre.

Treatment	Seedling weight[a] (grams)	Final number of ring nematodes per replicate[b]
Dowfume W85 16 gal/acre	287 ± 13	0 ± 0
Untreated control	174 ± 7	133,673 ± 7,339
L.S.D. (5%)	30	
L.S.D. (1%)	41	

[a]Mean of 14 replicates and the standard error of this mean.

[b]Mean of 14 replicates and the standard error of this mean. Initially there were 11,836 ± 1584 ring nematodes per replicate in the untreated soil, and no ring nematodes in the treated soil.

Table 4. Prune yields from DBCP treated and untreated trees at the William Harkey Orchard, Gridley, Butte County, 1969 crop.

Treatment	Fresh weight of prunes from 17 trees in pounds[a]
2.5 gallons DBCP per acre, sidedressed annually from 1965 to 1970	1,616 ± 208
No treatment	846 ± 48
L.S.D. at the 5% level	443
L.S.D. at the 1% level	602

[a]Mean of 12 replicates and the standard error of this mean.

Table 5. Economics of DBCP Treatments at the William Harkey Prune Block, Gridley, Butte County, 1969.

	Fresh weight of prunes (pounds)
204 DBCP treated trees (2.7 acres)	19,389
204 untreated trees (2.7 acres)	10,147
Increased yield from treatment	9,242

Dried weight of prunes = 9,242 X 0.33 = 3,080 lbs.

Increased return from treatment 3,080 X $0.16 = $492.80

Cost of DBCP treatments 1965-1969

DBCP - $50/acre

Application $10/acre

$60/acre X 2.7 acres X 5 applications = $810.00