Nematode Resistance in Plums

various plum rootstocks found resistant to two widespread species of several recently classified root-knot nematodes

C. J. Hansen, B. F. Lownsbery, and C. O. Hesse

Earlier field trials indicated that certain plum rootstocks—Marianna 2623, Marianna 2624, and Myrobalan 29—are resistant to the one species of root-knot nematode recognized at the time the work was done. However, since then several species of root-knot nematodes have been classified. Two of these species—*Meloidogyne incognita* var. *acrita* and *M. javanica*—are known to cause serious trouble in California orchards, so additional work was necessary to find out if the rootstocks are resistant to both species.

At the time the original field trials were made it was not known that four strains of Myrobalan 29 were in general distribution. Therefore, the four types of Myrobalan 29—29C, 29G, 29D, and 29 (Sonoma)—were included in investigations to determine their resistance to nematodes.

Populations of each nematode species were established in galvanized iron greenhouse tanks filled with sterile soil. Nematode populations were increased by growing tomatoes, and a uniform population density was obtained by mixing the contents of each tank before planting the trees. Subsequent examinations indicated that nematode *M. incognita* var. *acrita* was the only species present in one tank. Similar examinations showed a small admixture of *M. hapla* in the *M. javanica* tank but the population density of *M. hapla* was comparatively low.

Relative Resistance of Several Kinds of Plum and Peach Rootstocks to Two Species of Root-Knot Nematodes

	M. incognita var. *acrita* tank		*M. javanica* tank	
	Trees	Av. grade of infection	Trees	Av. grade of infection
Marianna				
2623	4	0	5	0
2624	19	0	20	0
Myrobalan				
29C	5	0	7	0
29D	5	0	5	0
29G	9	0	7	0
29 (Sonoma)	6	0	4	0
Lovell	40	5.0	80	4.5
S-37	34	0	26	4.3
Shalil	39	0	40	4.5

Grades: 0—no galls; 1—very slight infection; 2—slight infection; 3—moderate infection; 4—severe infection; 5—very severe infection.

One of the greenhouse tanks used in the root-knot nematode experiments. The soil in this one has been infested with *Meloidogyne incognita* var. *acrita*.

All the plum trees used in the experiment were propagated by means of softwood cuttings. For commercial nursery propagation, these plum rootstocks are propagated by means of hardwood cuttings.

Seedlings of Shalil, Lovell and S-37 peaches were also planted in the tanks for comparative purposes. Earlier trials had shown how these three peach rootstocks reacted to each of the two nematode species. The rows of peaches were replicated, so there was always a row of peaches not more than a few rows away from each kind of plum.

The rooted cuttings and the peach seedlings which had been germinated in sterile sand were transplanted into the tanks in late May 1956. They were dug and graded in early November 1956, with the amount of infection ranked in six classes: *0*—no galls found; *1*—very slight infection, usually one or two galls only; *2*—slight infection, a few galls; *3*—moderate infection, galls plentiful, but the roots not appreciably distorted or limited; *4*—severe infection, many galls, the root system usually somewhat distorted or limited in growth; and *5*—very severe infection, the root system with many large galls, distorted, and usually much limited in growth.

The rooted cuttings of Marianna 2623, Marianna 2624, and the four strains of Myrobalan 29 were completely free of galls in both tanks. These various plum rootstocks are apparently immune or highly resistant to both *M. incognita* var. *acrita* and *M. javanica*.

The number of plum trees used in the experiment was in some cases rather small, but since the trees were propagated vegetatively, the results are considered to be conclusive.

All the highly susceptible Lovell peach seedlings in both tanks were severely infected, indicating that the nematodes were well distributed throughout the two tanks. As shown in previous trials, the seedlings of S-37 and Shalil peaches were immune or highly resistant to *M. incognita* var. *acrita*. The S-37 and Shalil peach seedlings in the *M. javanica* tank had a considerable number of galls on the roots, but in general they made better growth than the Lovell seedlings.

Earlier nursery and field observations

Concluded on page 13

FERTI-IRRIGATION

Continued from page 6

system each month. If two irrigations are applied each month, then 50 pounds of ammonium nitrate per acre can be added to the water during each irrigation.

The amount of fertilizer to dissolve in the tank at each sprinkler set can be decided by determining the area each sprinkler supplies with water which is equal to the distance between sprinklers along the lateral line multiplied by the distance the lateral lines are moved. The following table shows the area in acres irrigated by each sprinkler for different spacings of sprinklers and lateral lines. The sprinkled area, multiplied by the number of sprinklers operated at one time, gives the total area irrigated at that setting. The area irrigated multiplied by the desired application rate of the fertilizer in pounds per acre gives the amount of fertilizer that should be placed in the supply tank. This method of determining the correct amount of fertilizer is particularly useful where the number of sprinkler heads used varies from set to set.

Area Irrigated by One Sprinkler

Sprinkler and lateral spacings	Area in acres
20' x 40'	0.0183
30' x 40'	0.0276
40' x 40'	0.0367
20' x 50'	0.0230
30' x 50'	0.0344
40' x 50'	0.0459
20' x 60'	0.0276
30' x 60'	0.0413
40' x 60'	0.0550

Where the number of sprinklers operated at one time is fairly constant, the proper amount of fertilizer applied at each irrigation can be found by multiplying the length of the lateral line by the distance the lateral line is moved for each setting. This area in square feet divided by 43,560 gives the number of acres irrigated at one time.

The uniformity of ferti-irrigation will only be as good as the distribution of the water. Therefore, it is extremely important that the sprinkler system be properly designed and operated so that the irrigation distribution is as uniform as possible.

R. H. Sciaroni is Farm Advisor, San Mateo County, University of California.

L. J. Booher is Extension Irrigationist, University of California, Davis.

Bryan C. Sandlin is Farm Advisor, San Mateo County, University of California.

V. H. Scott, Associate Professor of Irrigation, University of California, Davis, cooperated on the report of these studies.

Oscar Lorenz, Professor of Vegetable Crops, University of California, Riverside, conducted the experiments on phosphate placement.

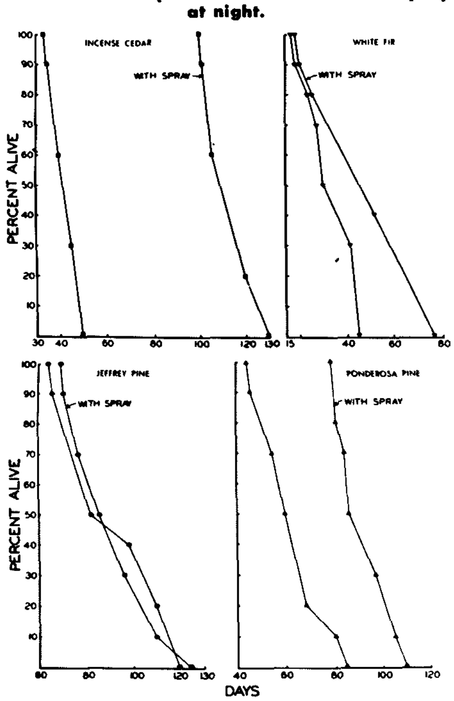
SURVIVAL

Continued from page 7

ments—with a larger sample—ponderosa pine seedlings probably would have shown a significant reduction of the soil moisture as would perhaps some of the other species. Actually the moisture content in only two of the 10 cans of ponderosa pine seedlings was out of line. Had it not been for the results with these two cans the average soil moisture reduction would have been highly significant.

When the seedlings were not exposed to spray at night, white fir died after 35 days, the incense cedar after 44 days, the ponderosa pine after 65 days, and the jeffrey pine after 95 days.

Survival in the presence and absence of spray at night.



When the seedlings were exposed to spray at night the picture changed. White fir again was the first to die although spray at night did prolong its life 20 days. Ponderosa and jeffrey pine died next at approximately the same time. This meant that the spray exposure was effective on ponderosa pine, prolonging its life 30 days, while it was not effective on jeffrey pine. Finally, the last to die was incense cedar whose life was prolonged 72 days.

Although the length of time the different species were able to survive after the sunflower had died was increased by exposure to spray at night, the exposure was not equally effective in prolonging the survival of the different species of seedlings.

The differential ability of the conifer seedling to survive after the sunflowers had died indicated a basic physiological difference in the drought resistance of white fir, incense cedar, ponderosa pine, and jeffrey pine. The experimental evidence indicates that white fir is the least resistant to drought and jeffrey pine is the most resistant with incense cedar and ponderosa pine somewhere in between. However, without additional testing it can not be assumed that the behavior of canned conifer seedlings, grown in the greenhouse, will be duplicated in the field. Only a small difference in the relative root growth rate of these species under field conditions would be required to alter the picture. For example, if white fir developed a more extensive root system in a particular soil than did jeffrey pine, then white fir might not be subjected to soil drought while jeffrey pine would.

Nevertheless most students of relationships between plants and their environment who are familiar with the distribution of these four species in California would probably rate jeffrey pine the most drought resistant, and white fir the least resistant since white fir is rarely found on dry sites and is particularly favored on northern exposures while jeffrey pine is often found on the very driest sites.

The relative response of these four species to spray at night was entirely unexpected. The lack of response of jeffrey pine and the very marked response of incense cedar can not be explained readily.

Edward C. Stone is Assistant Professor of Forestry, University of California, Berkeley.

The above progress report is based on Research Project No. 1577.

PLUMS

Continued from page 9

showed that some of the seedlings of myrobalan plums that are propagated by seed become infected when planted in soil containing root-knot nematodes. It is therefore important to use one of the vegetatively propagated rootstocks of known resistance in any soil that might be infested.

C. J. Hansen is Professor of Pomology, University of California, Davis.

B. F. Lownsbery is Assistant Nematologist, University of California, Davis.

C. O. Hesse is Professor of Pomology, University of California, Davis.

The above progress report is based on Research Project No. 1537.