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Research Progress Report on Prune Diseases

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Incidences of diseases studied for the 1969 season were at a minimum but sufficient to obtain significant data on controls for Monilinia blossom blight, russet scab, leaf rust, and ripe fruit rot. The chemical Benlate, manufactured by E. I. du Pont de Nemours Company and now expected to have a temporary tolerance for the 1970 season, was found superior in blossom blight control to protectant fungicides currently recommended. Benlate applied as a dormant spray before sporodochial development suppressed formation of new sporodochia. With this information it may be possible in the future to apply a spray in December before orchards become too wet for ground spray equipment. Wet orchards have prevented application of sodium pentachlorophenate at the recommended time. In addition Benlate has been found to be very effective against the Botrytis organism which is part of the green fruit-rot fungus complex known to be involved in green-fruit-drop in early spring. Most interesting were the data showing that a combination of Benlate and Botran applied 20 days before harvest could provide protection of fruits from brown rot at harvest while fruits harvested from the same trees 6 days later after 1.57 inches of rain was not protected. Russet scab control was shown with captan or dichlone sprays applied at green bud or full bloom, but both sprays of wettable sulfur were necessary indicating that sulfur may be less effective as was shown in previous tests. Although leaf rust did not develop until the last week in September, sprayed trees were protected while the nonsprayed trees showed an abundance of disease. These trees had no macroscopic rust infections at the time the chemicals were applied.

Brown Rot Blossom Blight and Fruit rot Control.--Previous studies have established that protectant fungicides applied at green tip and full bloom stages of blossoming afforded the best control of brown rot and russet scab; with many brown rot strikes in the tree, winter application of sodium pentachlorophenate was required. The 1969 studies were done to determine the most effective use of Benlate for control of brown rot based on data obtained on prunes since 1967.

Table 1 presents the data on dormant and blossom applications of fungicides in reducing blossom and twig blight caused by M. laxa. on French prunes. The plot was located at the Minaglia orchard in Healdsburg (Sonoma County) and sprays were applied with hand gun equipment at dormant (2/4), green tip (3/19), and full bloom (3/27) stages of bloom. The order of treatments is listed according to decreasing effectiveness of disease control. The best control of brown rot was shown with dormant applications of Benlate followed by blossom sprays. A single dormant spray of sodium pentachlorophenate or two applications of captan failed to control the blossom blight in this test. Based on similar studies made on peaches, almonds, apricots and cherries during 1967, 68, and 69, Benlate in every instant has been most effective in reducing blossom blight. Furthermore, data on use of Benlate as a dormant spray show that sporodochia can be suppressed and spores produced are less viable even if sprays were applied in late November.

The study on longevity of residual activity of Benlate when sprayed on fruits before harvest is shown in Table 2. Fruits inoculated with M. fructicola 20 days after field treatment were still protected, but fruits harvested after 26 days were not. Between the first and second harvest 1.57 inches of rain was recorded.

Programs for 1970 will stress the use of Benlate as a dormant and blossom spray. The concentrations of Benlate for testing will be one half and one pound of the 50% material per 100 gallons of spray applied at 400 gallons (dilute) and 100 gallons (semi-concentrate) per acre. Cover sprays will include Difolatan, Benlate, and captan for comparisons (Difolatan is registered for use on prunes for the 1970 season). Data on Botrytis infections will be taken in the event of rain during petal fall to shuck fall stages of bloom and fruits will be observed for the currently unexplained drop in early spring. Preharvest sprays of Benlate at 4, 3, 2 and 1 week before harvest will determine the requirements for fruit protection in the field in the event of rain. Fruits harvested will be tested for protection against postharvest mold development caused by Penicillium, Aspergillus, Monilinia and other microorganisms. These studies should make it possible for definite registration of Benlate on prunes for the 1971 season.

Two fundamental aspects of Benlate will be investigated to support the data thus far obtained in the field trials. The first is to determine the mechanisms of action of Benlate on the Monilinia laxa fungus and second, the possible systemic action in the fungus and host.

Prune Leaf Rust and its Control.--Prune leaf rust has not been considered important on prunes except in years of summer rains, when trees may be defoliated during the summer and early fall. The manner in which the fungus overwinters has not been determined. Close observations during the 1969 season suggest that the fungus may overwinter on the tree as infections or as spores. The evidence being that field disease incidence does not show any definite patterns but was present on all orchards with young one to three year old replants after the fall rains in September. Spore trapping data in 1968 by Corbin has not yet been received and the 1969 spore collection data will not be analyzed until spring 1970. Research programs on disease control usually follow studies on ecology of the fungus but since the studies have not been completed tests were made with chemicals applied after the first show of rust spots.

Table 3 shows that 23% of the leaves on the non-sprayed trees was infected with rust. Dithane M-45, wettable sulfur and Dithianon sprayed trees had less than 3% infected leaves. These data reflect only results of late season infections, but provide a guide on treatments for the coming year.

Programs for 1970 will attempt to determine the source of rust inoculum. Leaves will be collected and left to weather in the orchard to determine if the rust spores can remain viable throughout the winter. Secondly, shoot samples from heavily infected trees will be collected and checked for presence of rust spores during the winter and growing seasons. These spores will be checked for viability. Prune leaves will be infected with rust spores to determine the time required for infection, disease development, and the manner of spore dispersal and survival. Greenhouse evaluations

of fungicides may possibly provide effective plans for the summer chemical protectant treatments in commercial orchards. Studies on dispersal of rust spores will continue in combination with studies on dispersal of Monilinia spores. Release of spores masses with fluorescent particles is planned in order that collections made on ground and from air can more effectively show the pattern of spread under the hot arid climates in California. Young trees will be planted in the experimental orchard at the University so closer observation can be made on disease development and spread of the pathogen.

Aircraft spray or dust applications may be compared with ground applicatinns for rust control.

Russet scab and its control.--Previous years research have shown that a full bloom spray of captan, dichlone, or Difolatan can effectively control russet scab. Studies made in 1969 compared control of russet scab from only green tip or full bloom sprays of captan, dichlone and wettable sulphur. Results (Table 4) show that when incidence of russet scab is low, captan and dichlone at green tip effect control, but with wettable sulfur both green tip and full bloom sprays are required.

The 1970 studies will attempt to determine the cause of russet scab through direct and indirect methods. First the hypothesis that Botrytis may play a part will be tested through control of Botrytis with Benlate. The hypothesis that presence of water or chilling are responsible also will be investigated. To find the actual cause may be quite difficult so studies on control with chemicals will take priority. Aircraft dusting and spraying are planned with captan, Difolatan, or dichlone because during years of rain when the spray is needed quick coverage of the field is essential.

Table 1. Effects of dormant and blossom applications of fungicides in reducing blossom and twig blight caused by M. laxa on French prunes

Treatment	lb/100 gal.	Date of application[1]	Avg. No. of blighted shoots/tree[2]
Benlate 50W in	1.0		
Superior oil	1.5	2/4	
Benlate 50W	0.5	3/27	0.17 a[3]
Benlate 50W	1.0	2/4	
Benlate 50W	0.5	3/19 3/27	0.17 a
Benlate + acid	1.0	2/4	
Benlate	0.5	3/19 3/27	0.33 a
Benlate 50W	0.5	3/19 3/27	1.00 a
Benlate 50W	1.0	2/4	
Benlate 50W	0.5	3/27	1.33 a
SPCP 37%	8.0	2/4	
Captan 50W	2.0	3/19 3/27	2.67 a
SPCP 37%	8.0	2/4	7.83 b
Captan 50W	2.0	3/19 3/27	9.00 b
Control	-	-	9.30 b

[1] Fungicides applied by hand gun to drip at dormant (2/4) green tip (3/19) and full bloom (3/27) stages.

[2] All strikes counted on each of six single-tree replications.

[3] Duncan's multiple-range test was used. Statistical groupings (P = 0.05) for vertical comparisons are shown by letters following numbers.

Table 2. Longevity of Benlate plus Botran on French Prunes - 1969

Treatment[1]	Days after spraying	No. fruits inoculated[2]	No. of fruits infected	% infected
Control	20	40	38	95.0
	26	40	39	97.5
Benlate plus Botran	20	40	4	10.0
	26	40	37	92.5

[1]Control - unsprayed check
Benlate 50W - 8 oz/100
plus
Botran 75W - 1 1/3 lbs/100

Trees were sprayed (9/19/69) to the drip stage with a handgun sprayer. Fruits from 3 single tree replications were sampled and inoculated 20 days (10/9/69) and 26 days (10/15/69) after spraying. Rainfall of 1.57 inches between 10/14/69 and 10/15/69.

[2]The fruit was inoculated by placing a drop of Monilinia fructicola spore suspension into a puncture on the epidermis.

Table 3. Reduction of Prune leaf rust (Tranzschelia punctata) with fungicide spray - 1969

Treatment[1]	Concentration lbs/100 gals.	No. of leaves with rust	% rust[2]
Control	-	470	23.50
Dithianon 75W	1.5	44	2.20
Wettable sulfur 95%	5.0	11	0.55
Dithane M-45 80%	1.5	5	0.25

[1] No visible symptom of rust on the leaves when the trees were sprayed (9/18/69) to the drip stage with a hand gun.

[2] Percentage is the average of 2,000 leaves collected on 11/5/69; 400 leaves from each of 5 single tree replication.

Table 4. Comparison of Fungicides for reduction of French prune russet scab.- 1969

Treatment[1]	lbs/100 gals	Plot I[4] No. russetted fruits/1000	Plot I[4] %	Plot II No. russetted fruits/500	Plot II %
Kolo 100 1 spray[2]	3.5	422	42.2	139	27.8
Kolo 100 2 sprays[3]	3.5	229	22.9	77	15.4
Phygon 50W 1 spray	0.75	235	23.5	63	12.6
Phygon 50W 2 sprays	0.75	198	19.8	58	11.6
Orthocide 50W 1 spray	2.0	198	19.8	50	10.0
Orthocide 50W 2 sprays	2.0	174	17.4	60	12.0

[1]Kolo 100 75.4% sulfur 3.5% dichlone
Phygon 50W 50% dichlone
Orthocide 50W 50% captan

[2]A single blossom spray with air blasting at green tip stage (3/19/69)

[3]Two blossom sprays with air blasting at green tip stage (3/19/69), 80 to 90% bloom (3/27/69)

[4]Plot I 10 single tree replications
Plot II 5 single tree replications