A COMPARISON OF DICHLOROFLUANID, DICHLORAN AND DAC 2787 WITH CAPTAN FOR FRUIT ROT CONTROL IN STRAWBERRIES

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Abstract

Continuing the spraying of captan through the picking period (8 sprays) gave increased yields of sound fruit over plots sprayed 5 times. Results with dichlofluanid were the same though the 8 sprays were not significantly different from 5 sprays. Two sprays of dichlofluanid, 2 lb./acre applied when the first flowers opened and again at full bloom, gave as good control as five sprays of the 1-lb. rate. The possibility that three sprays (6 lb./acre) during blossom to early fruit formation would give adequate protection is suggested. Five sprays of DAC 2787 at 1½ lb./acre proved as effective as eight sprays of captan or dichlofluanid. Dichloran was the least effective of the fungicides. Fruit size was not affected by captan, dichloran or DAC 2787. Dichlofluanid, on the other hand, caused a significant reduction in fruit size. It is suggested that this is a possible reason for lack of increase in total weight of sound fruits over that from captan-treated plants. The field sprays of dichlofluanid were slightly more effective than captan or DAC 2787 for postharvest control of fruit rot. Dichloran proved more effective in controlling latent infection of fruit than in reducing rot incidence in the field,

Introduction

A major concern of strawberry growers in coastal British Columbia is the high incidence of gray mold (Botrytis cinerea Pers.) which causes a serious fruit rot in most years,

On the basis of earlier research conducted at the Small Fruits Substation, Abbotsford, British Columbia, captan was recommended control of gray mold in strawberries **(3).** A schedule consisting of at least four sprays of captan at 1½ lb./acre applied at intervals of 7 to 10 days, starting when the first blooms open was recommended. Even though this spray schedule results in a marked increase of sound fruit (50 to 100%) there are still many rotted berries in the field (up to 15% of total yield).

In work conducted at the East Malling Research Station (4), dichlofluanid (N-(dichlorofluoromethylthio-N', N'-dimethyl-N-phenylsulfamide) was shown to be clearly superior to thiram, captan, DDCB and dichloran in reducing the amount of botrytis infection on two varieties of strawberry. The plants were sprayed first when 5% of the flowers were open and again at full bloom. These results suggested that even in seasons when botrytis infection is heavy, good commercial control of fruit rot might be achieved by using only two fungicidal sprays, provided they are applied thoroughly.

Clark et al. (2) found that the application of dichloran (2, 6-dichloro-4-nitroaniline) resulted in outstanding control of Botrytis cinerea on lettuce and that no check to the growth of the crop resulted.

Thus, an experiment was conducted in 1966 to obtain information on the effectiveness of various spray schedules with captan, DAC 2787 (tetrachloroisophthalonitrile), dichloran and dichlofluanid for field and postharvest fruit rot of strawberries.

Methods

'Northwest' strawberries were planted in a silt loam at the Small Fruits Substation, Abbotsford, British Columbia in 1965. The experiment was laid out in a randomized block design with *six* replications. Each plot consisted of a single 30-foot row. The plants were grown by the matted row system and good grower practices were followed in establishing the plantation. The planting was sprinkler-irrigated when necessary. In the spring of 1966 the entire planting was cleaned up by removing the dead leaves and cultivating lightly. On May 9, the planting received an application of 6-30-15 fertilizer at 500 pounds per acre. All fungicide treatments were begun at first bloom on May 7. Concentrate sprays (blossom application at high rate) of captan 3 lb./acre and dichlofluanid 2 lb./acre were tested by applying them on May 7 and again on May 12 when the strawberry plants were about in full bloom with some fruit forming. Captan 1½ lb./acre, DAC 2787 1½ lb./acre and dichlofluanid 1 lb./acre were begun May 7 and continued through the picking period, with the last spray being applied on June 30 for a total of 8 sprays.

Control of preharvest infection was determined by weighing all infected brrries from each plot at each picking. The crop was picked 6 times between June 18 and July 11.

In addition to weighing the infected fruit, the weights of marketable and cull fruit were also recorded. The size index of sound berries from each plot was determined at each picking. The effect of treatment on postharvest fruit rot was determined from a random sample of at least 7 pounds of sound berries picked on June 20, 26, July 4 and July 11 from each plot in each replicate. The berries were transported in shipping crates to Agassiz, 40 miles distant, and were placed in common storage. The percentage of sound berries was determined at 24, 48, and 72 hours after harvest.

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Table 1. Influence of various treatment schedules on preharvest fruit rot of 'Northwest' strawberries

Treatment (active ingredient) (sprays in 100 gal. water)	Number of sprays*	Rotted fruit lb./plot	Sound fruit lb./plot	Increase over unsprayed %
Unsprayed		17.56 a**	26.12 e	0
Captan 1½ lb./acre	8	6.47 d	44.72 a	71
Dichlofluanid 1 "	8	2.51 f	44.65 a	71
DAC 2787 1½ "	5	5.33 de	43.10 ab	65
Captan 1½ "	5	7.70 cd	38.56 bc	48
Dichlofluanid 1 "	5	3.43 ef	39.43 abc	51
Dichloran 2 "	5	9.72 bc	31.25 de	20
Concentrate sprays at blossom				
Captan 3 lb./acre	2	11.99 b	35.19 cd	35
Dichlofluanid 2 "	2	7.67 cd	38.33 bc	47
Mean		8.04	37.93	
S.E. Mean		0.88	1.84	

*1st spray - May 7 (firstbloom); 2nd spray - May 12 (about fullbloom, somefruit forming); 3rd spray - May 20; 4th spray - May 30; 5th spray - June 9 (last spray before harvest); 6th spray - June 18; 7th spray - June 24; 8th spray - June 30.

**Means not followed by the same letter are significantly different at the 5% level (Duncan's Multiple Range Test).

Results and discussion

The incidence of fruit rot in the unsprayed plots was 40% or more, apparently due to the unusually wet season. Rainfall was recorded on 39 days from May 7, at the beginning of flowering, to July 11, at the end of harvest. The results of past tests showed little advantage in carrying the spray programme through the picking period. However, in this test, continuing the spraying of captan through the picking period was definitely beneficial (Table 1). The results with dichlofluanid were the same though the 8 sprays were not significantly different from the 5 sprays.

The two sprays of dichlofluanid at 2 lb./acre gave as good control as five sprays at the 1-lb. rate. From these results it appears quite possible that three sprays (6 lb.) at blossom time would give adequate protection. **This** still would be considerably less than the amount used by Moore et al. (4) who used applications of up to 8 lb. active ingredient per acre. It is doubtful whether this amount would be tolerated by the 'Northwest' variety, since some leaf injury occured at the 2-lb. rate. The five sprays of DAC 2787 at 1½ lb./acre proved as effective as the eight sprays of captan or dichlofluanid. Dichloran was the least effective of the fungicides.

Dichlofluanid resulted in a significant reduction in the amount of rotted fruit produced per plot, yet the weight of sound fruit was not increased correspondingly over that from captan-sprayed plants. Similar results were reported by Moore et al. (4) who found that dichlofluanid was clearly superior to other treatments in reducing botrytis infection, but that in one test there was no increase in the total weight of sound fruits over that from thiram-sprayed plants and in another test there was only a slight increase.

Table 2. Influence of various treatment schedules on berry size and postharvest fruit rot of 'Northwest' strawberries

Treatment lb. a.i./acre with times sprayed	Size index gm/25 fruit	Percent sound fruit after picking 24 hr.	48 hr.	72 hr.
Unsprayed	212.5 a*	91	65	35
Captan 3 (2 3	210.3 a	92	74	55
Captan 1½ (8X)	206.5 a	96	89	70
Captan 1½ (5X)	203.7 ab	96	85	65
Dichloran 2 (5X)	201.8 abc	94	82	63
DAC 2787 1½ (5 3	201. 2 abc	96	87	66
Dichlofluanid 1 (8X)	185.8 bc	98	93	74
Dichlofluanid 2 (2X)	185.2 bc	94	84	68
Dichlofluanid 1 (5 3	184.2 c	97	90	75
Mean	199.0			
S.E. Mean	6.03			

*Means not followed by the same letter are significantly different at the 5% level (Duncan's Multiple Range Test).

In previous tests (3) fruit size was affected by treatment. Fruit tended to be larger from plots treated with the more efficient fungicides. In this test fruit size was not significantly affected by captan, dichloran or DAC 2787 (Table 2). However, dichlofluanid caused a significant reduction in fruit size. This may explain in part why there was little or no increase in the total weight of sound fruits over that from captan- or thiram-sprayed plots. In other words, there were more sound berries produced on the dichlofluanid-sprayed plants but they were smaller than those produced on captan- or thiram-treated plants. Powell (5) reported that strawberry plants benefitted nutritionally from captan and that fruit size was increased. The benefit is evidently lacking with dichlofluanid.

The data on postharvest control of fruit rot again showed the beneficial effect of the fungicide field sprays after 48 hours storage. Dichlofluanid was slightly more effective than captan or DAC 2787. Dichloran proved much more effective in controlling latent infection of fruit than reducing rot incidence in the field.

Literature cited

1. Anonymous. 1965. Stopping the rot in strawberries, Botrytis cinerea. New Scientist 28: 475.
2. Clark, N.G., A.F. Hams, D. J. Higgons and H.A. Stevenson. 1960. A new fungicide active against Botrytis Spp. Chem. and Jnd. pp. 572-573.
3. Moore, M. H., A. H. M. Kirby, and Margery Bennett. 1965. Experiments on controlling strawberry Botrytis rot by spraying. Proc. British Insecticide and Fungicide Conf. 1965 (Brighton) pp. 116-120.
5. Powell, D. 1954. The effect of captan on gray mold rot incidence and yield of strawberry. Plant Dis. Reptr. 38: 209-211.