ACCUMULATED CROP RESPONSE TO BLACK CURRANT LEAF SPOT CONTROL

W.T. McLAUGHLAN, G.W. KERSE and K.A. McINTOSH*

The New Zealand Farmers' Fertilizer Co. Ltd, Christchurch,
Eden Berry Fruits, Edendale

SUMMARY

A trial in black currants (*Ribes nigrum*) conducted during the 1981-82 growing season recorded significant crop responses to the control of leaf spot (*Mycosphaerella ribis*). Fungicide treatment programmes based on thiram, triforine, prochloraz and folpet were continued on the same plots in the 1982-83 season and provided high levels of disease control, crop yield response, cane growth increment and a delay of post-harvest defoliation. The benefits of leaf spot control during 1981-82 had an accumulated effect on crop production in the 1982-83 season.

INTRODUCTION

A trial in black currants by McLaughlan and Litchfield (1982) showed that the fungal disease black currant leaf spot (*Mycosphaerella ribis* con. stat. *Septoria ribis*) can cause severe crop damage. Programmed applications of the fungicides triforine (Saprol 19EC), prochloraz (Sportak 45EC), or thiram (Thirospray 80WP) pre-petal fall and post-harvest, with folpet (Phaltan 50WP) over the fruit bearing period, provided high levels of disease control. The benefits of disease control were measured in significant crop yield responses, cane growth increments and a delay of post-harvest defoliation.

This trial located at Edendale, Southland, on cv. Magnus bushes in their 4th year, was continued in the 1982-83 growing season. The trial was conducted alongside a concurrent research project in which the Plant Diseases Division, DSIR, monitored the over-wintering and primary inoculum levels of *M. ribis* (R.I. Mulholland unpublished). The objective of continuing the trial was:

(a) to confirm the optimum times of fungicide application for maximum disease control, and

(b) to measure the accumulated crop response to leaf spot control over two growing seasons.

METHOD

Details of fungicide treatment programmes are shown in Table 1. Treatments 1-4 had received the same basic programme during 1981-82. Treatments 5, in which prochloraz WP (Sportak 50WP) replaced the EC formulation, and 6 which was untreated, were superimposed on plots that were sprayed the previous season with a programme based on prochloraz followed by triforine.

Choice and timing of fungicide application was determined by the acceptability of products for use on export crops. The three spray periods differed slightly from the previous season with the first period extending from early green tip to 10% flowering. This change was necessitated by the detection of triforine residues (McLaughlan unpublished) and prochloraz fruit taint (McLaughlan and Litchfield 1982) after these treatments were applied at the end of flowering in 1981. Iprodione (Rovral Flo 250) was applied to treated plots over flowering for *Botrytis* control. Therefore the second period extended from 20% flowering up to 28 days before harvest. Subsequent spray applications did not resume until 25 days post-harvest.

*Present address: Department of Horticulture, Landscape and Parks, Lincoln College, Canterbury.

The trial was conducted on one continuous length of row which was divided into 8 m long plots of approximately 32 bushes each. Treatment programmes were randomised within four replicated blocks and applied through a motorised pump and hand-gun. Spray volume, applied to point of run-off, ranged from 1500-2000 litres/ha depending on the amount of leaf on the bushes. Rows each side of the trial row were left untreated.

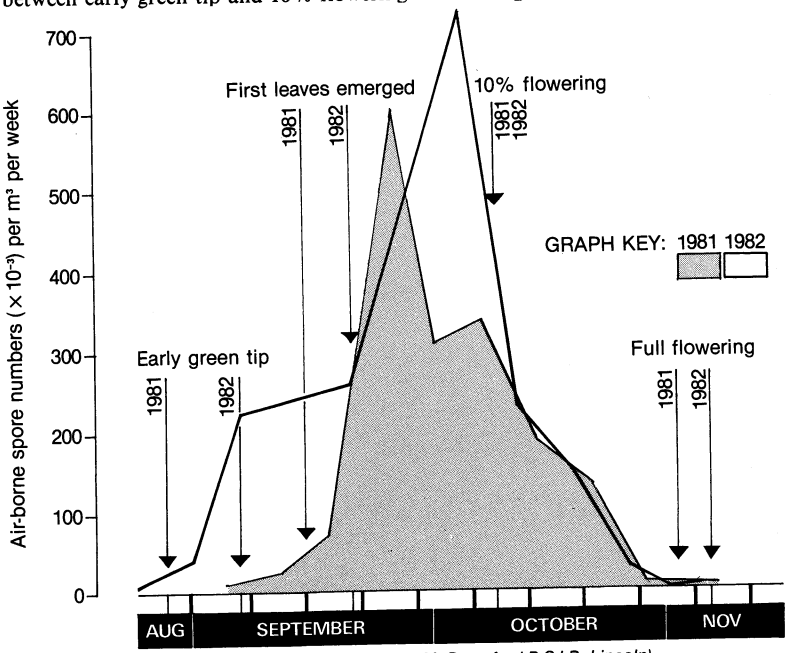
Leaf spot infection was visually assessed on a sample of 25 leaves per plot picked systematically from the top, middle and bottom of the bushes. Assessment dates corresponded approximately to those of the previous season.

Pre-harvest fruit drop was measured over 1 m of row/plot. Plots were harvested on 14 January 1983 with a Smallford double sided harvester. All plots were sub-sampled for measurement of 100 berry weights, percent green berries, fruit taint tests, vitamin C and fungicide residue analysis. Measurement of the season's cane growth increment was made on 10 canes/plot on 25 April 1983.

Insecticides and miticides were applied with a Smallford crossflow straddle sprayer when required.

RESULTS AND DISCUSSION

DSIR spore trap recordings (Fig. 1) showed that the airborne ascospore release, which commenced on 23 August 1982, exerted higher inoculum pressure on the crop between early green tip and 10% flowering than during the previous season.



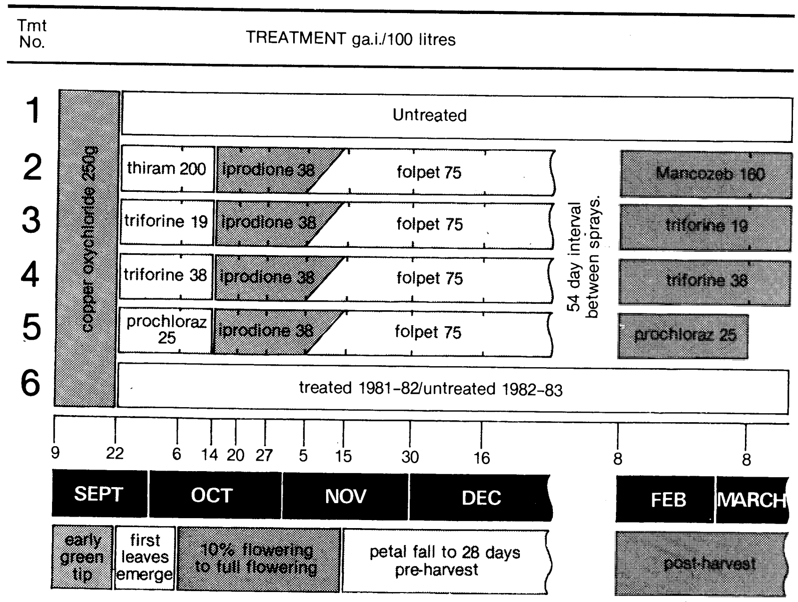
(data by courtesy R. I. Mulholland and R. M. Beresford D.S.I.R. Lincoln)

Fig. 1: Number of air-borne *Mycosphaerella* spores on a Southland property in Spring 1981 and 1982 relative to the early crop stages.

The results in Table 2, however, show that the mean percent leaf area infected on all plots at the first assessment (17 November 1982) was approximately 50% lower than at the same time in 1981, as were the number of leaves infected. Consequently the disease development on untreated plants was very slow, reaching a mean of 6% leaf area infected immediately pre-harvest on 14 January 1983. This disease level was only one third of that recorded immediately pre-harvest on 3 January 1982. Conversely, the disease levels declined on fungicide treated plots with the approach of harvest. All fungicide treatment programmes provided high levels of disease control over the early and important stages of crop development and suppressed secondary infection from a relatively low number of leaves infected. Therefore the last pre-harvest treatments were applied on 16 December 1982.

Crop yields from all treatments (Table 2) were reduced below potential by hail damage early in the season. In spite of the yield loss, significant yield differences were measured between treatments. The effects of high leaf spot infection on untreated plots during 1981-82 which were measured in low crop yield, premature defoliation and a small cane growth increment in that season (Table 2), were reflected for most of the 1982-83 season, in lower bush height and an open and less vigorous appearance than treated plots. Therefore there is a clear indication that the 1981-82 crop response had an effect on the 1982-83 yields. Several authors including Thomas and Wilkinson (1962) and Webb (1976) have shown that vegetative growth and flower initiation, as components of potential yield, are determined in the year before fruiting. It is suggested that post-harvest leaf retention plays an important role in accumulating energy reserves during the autumn (Wilson and Jones 1980) and would presumably influence flower development and fruit set in the following season.

TABLE 1: Fungicide treatment programmes 1982-83, application dates and crop stages.



NOTE : Treatments No 1-4 were identical to previous seasons and were applied to the same plots.

Pre-harvest fruit drop which accounted for yield losses of 6.5-11% of the "actual" crop on Treatments 2-4, and 15 and 17.5% loss on Treatments 6 and 1 respectively, were higher than the acceptable level of 3-5% (Teaotia and Luckwill 1955). This loss was compounded by adverse climatic conditions close to harvest. 100 berry mean weights ranged from 51.5 g to 55.7 g and the proportion of green fruit means from 3.7% to 6.2%, with no significant differences between treatments in either assessment. Vitamin C and fruit taint results were not completed in time for publication.

TABLE 2: Leaf spot infection, crop yield, percent leaves retained and cane growth increments for 1981-82 and 1982-83 seasons.

	1981-82			1982-83							
Trt No.	Crop yield t/ha	% leaves retained 22 Apr 82	Cane growth increment % of untreated	Mean % leaf area infected* 17.11.82	Mean % leaf area infected* 12.12.82	Mean % leaf area infected* 14.1.83	Crop yield t/ha	Mean % leaf area infected 25.2.83	% leaves retained 25.2.83	% leaves retained 25.4.83	Cane growth increment % of untreated
1.	4.72 b (100%)	6.0 c	100 c 151 mm	2.6 a *52 ab*	5.8 a *69 a*	6.0 b *89 a*	1.22 e (100%)	14.5 b *98 a*	38.8 c	0.8 d	100 b 130 mm
2.	7.58 a (161%)	75.0 b	130 b	1.2 c *46 ab*	0.7 b *30 bc*	0.5 c *26 bc*	2.52 d (206%)	4.5 c *88 b*	61.3 b	7.0 cd	138 a
3.	7.21 a (153%)	75.0 b	132 b	1.3 c *41 ab*	1.1 b *29 bc*	0.6 c *30 b*	3.05 bc (249%)	3.2 cd *84 b*	61.3 b	8.8 cd	125 ab
4.	7.06 a (150%)	81.2 ab	136 ab	0.8 c *32 b*	0.9 b *33 b*	0.4 c *16cd*	2.93 bc (240%)	3.0 cd *83 b*	62.5 b	10.0 bc	148 a
5.	6.94 a (147%)	82.5 ab	145 ab	0.3 c *11 c*	0.3 b *13 c*	0.3 c *13 d*	3.51 a (287%)	1.8 d *78 b*	80 a	22.5 a	146 a
6.	7.32 a (155%)	85.0 a	164 a	3.4 a *63 a*	6.3 a *80 a*	8.0 a *85 a*	2.66 cd (217%)	17.8 a *99 a*	28.8	0 d	145 a
CV%	9.0	12.4	12.2	62.6 *37.2*	62.8 *29.1*	63.5 *21.2*	10.5	15.2 *7.0*	4.9	46.8	12.8

NOTE: 1) Means followed by the same letter do not differ significantly at P = 0.05 (Duncans multiple range test for both seasons).
2) * *Figures in italics = % leaves infected*
3) Yield in brackets expressed as a % of untreated

Secondary infection by conidia of the *Septoria* state built up rapidly within the bushes post-harvest. Fungicide treatments were resumed on 8 February 1983 after a 54 day interval, with mancozeb (Mancozeb 80WP) replacing thiram in Treatment 2 (Table 1). Table 2 shows a correlation between post-harvest leaf spot infection levels and leaf retention. This confirms the importance of keeping the black currant bushes relatively free of disease for the duration of the growing season.

Fungicide treatment programmes based on prochloraz achieved a high level of performance in this trial, but the use of prochloraz during the pre-flowering period remains in doubt until the fruit taint tests have been completed. Treatment programme No. 4 based on triforine 38 g ai/100 litres and folpet 75 g ai/100 litres, applied at 10-14 day intervals within the pre-harvest period, was the most effective treatment that was acceptable for use on export crops.

CONCLUSIONS

The black currant crop must be protected with an effective fungicide treatment programme against primary infection by *Mycosphaerella* ascospores during the period of air-borne inoculum pressure, (ie. approx 1 September to 31 October under Southland conditions). Fungicide applications should continue for protection against secondary infection by conidia of the *Septoria* state if the disease continues to develop in the crop. High levels of leaf spot control will provide significant black currant yield and cane growth responses that contribute to an accumulated increase of crop production in the following season.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the co-operation of Eden Berry Fruits throughout the two and a half year duration of this trial. Our special thanks to Messrs R.I. Mulholland and R.M. Beresford, Plant Diseases Division, DSIR, Lincoln, for their invaluable assistance and permission to publish their data.

REFERENCES

McLaughlan, W.T. and Litchfield, D., 1982. Control of black currant leaf spot. *Proc. 35th N.Z. Weed and Pest Control Conf.*: 39-43.

Teaotia, S.S. and Luckwill, L.C., 1955. Fruit drop in black currants: 1. Factors affecting "running off". *Ann. Rep. Long Ashton Res. Station,* 1955: 64-75.

Thomas, G.G. and Wilkinson, E.H., 1962. Vegetative growth and flower initiation in the black currant in the field. *Proc. 16th Intern. Hort. Congress, 3:* 363-369.

Webb, R.A., 1976. The influence of yield components on cultivar differences in black currants. *Scientia Hort., 5:* 119-126.

Wilson, S.J. and Jones, K.M., 1980. Responses of black currant bushes to post-harvest moisture stress. *Scientia Hort., 12:* 307-312.