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RASPBERRY CANE DESICCATION WITH SODIUM MONOCHLOROACETATE

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Summary: Sodium monochloroacetate was evaluated as a raspberry cane desiccant over a number of years and on three cultivars. Effective and reliable results were obtained using a 2% w/v spray concentration plus an adjuvant. This treatment had an ample margin of safety to the crop and was repeated on the same plots over 3 years without adverse effects on fruit or cane production, when compared with removal of young vegetative canes by cutting. The availability of a new cane desiccant to replace dinoseb-in-oil will allow growers to reinstate cane vigour control as a management technique.

INTRODUCTION

The banning of dinoseb-in-oil in 1987 removed the only desiccant available to raspberry growers. Cane desiccation was widely used as an annual treatment to control vegetative cane vigour in cv Glen Clova, but it was also a valuable means of removing vegetative canes in the final year of any cultivar or in the fruiting phase of biennial cropping (Lawson & Wiseman, 1992 a). These techniques fell into abeyance after 1987 for lack of a suitable alternative desiccant. This paper reports research at the Scottish Crop Research Institute to establish the safety and efficacy of sodium monochloroacetate (SMA) as a cane desiccant in a range of cultivars and to assess the cumulative effects of repeated annual usage for cane vigour control.

METHODS AND MATERIALS

The experiments were carried out at Invergowrie in established plantations of cvs Glen Clova, Glen Moy and Glen Prosen. Plots consisted of single rows 9 m long and 2 m apart, each containing 12 raspberry stools. In the four experiments treated only once in 1988 or 1989 the plots were arranged in three randomised complete blocks, each containing two controls in which canes were removed by cutting. In the long-term experiment which commenced in 1990, there was only one cut control in each of six replicates. Scores were taken of efficiency of overall desiccation of young canes (0 = no effect, 10 = complete kill of both leaves and stems) and records were made of yield of fruit and of numbers and heights of young canes at the end of the growing season. Plots were assessed regularly for signs of translocation of the chemical to fruiting laterals or into replacement canes produced after the first flush of young canes had been removed.

A wide range of spray concentrations of SMA was evaluated to establish lower limits of efficacy and upper limits of crop safety. Only a selection of the results is presented in this paper, to illustrate these points and to indicate reliability of performance of these treatments in different cultivars and over

several years. SMA was applied as Croptex Steel, Hortichem Ltd (95% a.i. w/w sodium monochloroacetate). Spray concentrations are presented as weight of product per unit volume of spray solution, expressed as a percentage. For the majority of treatments a fatty amine ethylene oxide condensate (as Wayfarer, Hortichem Ltd) was added at 0.5% v/v to the final spray solution. Desiccant treatments were applied by Oxford Precision Sprayer to a 30 cm band on either side of the crop row when the young canes were 10-20 cm tall in spring. All young cane growth below the bottom wire (60 cm) was treated, including any low laterals on fruiting canes. In the 1988 and 1989 trials application was made in a spray volume of 1000 l of water per treated ha, using 50-06 nozzles at 220 kPa pressure. In the long-term experiment the volume was increased to 1500 l of water per treated ha, using 50-10 nozzles at 160 kPa, to ensure complete spray coverage and to avoid any risk that inadequate desiccation could affect the cumulative response of the crop.

Experience has shown that an overall desiccation score of at least 7 out of 10 is required within 3 weeks after application if the treatment is to be successful. With inadequate desiccation a proportion of the treated canes will recover and a full second flush may not emerge (Lawson & Wiseman, 1981).

RESULTS

SMA by itself was slow-acting and required a spray concentration of 4% to achieve an acceptable level of cane desiccation (Table 1). Blackening of the leaves and stem tips was followed by gradual death of the stems from the top downwards. The adjuvant improved the speed and thoroughness of desiccation at all spray concentrations of SMA in cv Glen Prosen in 1988 and Glen Clova in 1989 and under these conditions there was little benefit from raising the spray concentration above 2%. The adjuvant was included in all other experiments as a standard part of the desiccant treatment. In the 1989 experiment with Glen Prosen heavy rain fell shortly after spray application. This was the only occasion on which the 2% concentration plus adjuvant gave less than adequate desiccation (Tables 1 and 2) and was visibly less effective than the 3% concentration.

With one exception, SMA treatments applied at up to 4% spray concentration produced no significant adverse effect on yield of fruit, when compared with cut controls. Yield was reduced on plots where the 2% concentration had been applied to cv Glen Moy in 1989 (Table 3). No such effect was recorded on plots treated on the same day in the same trial with 3% and 4% concentrations and there was no visible evidence of chemical injury to fruiting laterals on the affected plots. The yield loss is thought to have been due to factors other than the experimental treatment. The adjuvant had no effect on yield of fruit in the year of treatment, but in Glen Clova in 1989 mean cane height at the end of the growing season was greater without the adjuvant, due to inadequate control of first-flush canes. The higher cane numbers on plots of Glen Prosen treated with the 2% concentration in 1989 also reflected inadequate desiccation. Otherwise there was no indication that cane records showed any dose response to SMA. There was no evidence of translocation of SMA up the fruiting canes to the higher laterals or of residual effects on second-flush canes following any of the spray treatments imposed. Mean cane heights were usually greater at the end of the growing season on sprayed than on cut plots. Fruit yields (not presented) were recorded on all four experiments in the year following treatment and showed no adverse effects of earlier spray treatments.

Table 1

Mean overall desiccation scores (0-10)* approximately 3 weeks after treatment of four different experiments

SMA spray concentration (w/v product) ± adjuvant	G. Prosen 1988	G. Clova 1989	G. Moy 1989	G. Prosen 1989
1% -	2.8			
+	4.8			
2% -	3.0	5.0		
+	7.2	8.2	7.2	6.7
3% -		5.3		
+		8.3	7.5	7.7
4% -	7.2	7.2		
+		8.5	7.3	
S.E. mean ±	0.52	0.43	0.27	0.60

Table 2

Mean overall desiccation scores (0-10)* approximately 3 weeks after treatment of a Glen Clova plantation successively in 3 years

SMA spray concentration (w/v product) + adjuvant	Year 1990	1991	1992
2%	8.3	8.4	9.1
3%	8.2	8.6	9.1

* 0 = No effect, 10 = leaves and stems completely killed.

Table 3

Fruit yield and cane production in four experiments after a single cane vigour control treatment

SMA spray concentration (w/v product) ± adjuvant	G. Prosen 1988 Yield t/ha	No. canes /plot	Mean ht (cm)	G. Clova 1989 Yield t/ha	No. canes /plot	Mean ht (cm)	G. Moy 1989 Yield t/ha	No. canes /plot	Mean ht (cm)	G. Prosen 1989 Yield t/ha	No. canes /plot	Mean ht (cm)
Cut by hand	12.6	146	113	9.3	131	104	10.9	114	97	10.9	119	87
S.E. mean ±	0.33	5.9	2.9	0.54	10.6	3.8	0.40	7.6	2.8	0.57	7.9	2.6
2% -	12.2	159	124*	8.9	177*	129***						
+	12.3	147	123	8.2	119	113	8.8**	112	105	10.8	159**	94
3% -				7.9	166	123***						
+				10.0	172*	115	9.6	124	106	10.2	128	87
4% -	12.3	155	122	8.7	142	125***						
+				8.5	165	115	9.6	124	100			
S.E. mean ±	0.46	8.3	4.1	0.76	15.0	5.3	0.57	10.7	3.9	0.81	11.2	3.6

Table 4

Fruit yield and cane production in a Glen Clova plantation given cane vigour control successively in 3 years

SMA spray concentration (w/v product) + adjuvant	1990 Yield t/ha	No. canes /plot	Mean ht (cm)	1991 Yield t/ha	No. canes /plot	Mean ht (cm)	1992 Yield t/ha	No. canes /plot	Mean ht (cm)
Cut by hand	16.1	156	114	11.0	170	123	15.6	117	88
2%	16.5	170	121	12.4**	166	131*	16.2	124	95
3%	16.2	170	125**	12.8***	164	131*	15.7	130*	97
S.E. mean ±	0.54	5.5	2.5	0.23	9.8	2.5	0.63	3.4	3.0

*,**,*** Significantly different from Cut by hand at the 5%, 1% or 0.1% level.

Treatments repeated over a 3-year period showed no harmful effects of SMA applied at 2% or 3% spray concentrations on yield of fruit or cane productivity (Table 4). Cane production was greater on sprayed plots than on cut plots in 1990, which led to increased yield of fruit in 1991 on sprayed plots. Canes were also taller on sprayed plots in 1991, though no greater in number, but yield in 1992 was not affected. The effect on cane numbers was again evident in 1992, when a prolonged dry period in June reduced cane heights on all plots. There were no significant differences between the two concentrations of SMA over the 3 years.

DISCUSSION

Spray treatment never removes young canes as effectively as cutting, so more and taller canes are often present on sprayed plots at the end of the growing season. The nearer the cane records resemble those on cut plots the better the standard of desiccation. If substantially less cane growth were to be recorded on sprayed than on cut plots, that would indicate injury by the desiccant. No such effects occurred in these experiments.

Records of desiccation and cane production confirmed the need for an effective adjuvant to enhance the performance of SMA (Lawson & Wiseman, 1992 b). There was little improvement in performance by increasing the spray concentration of SMA above 2% when the adjuvant was present and the crop appeared tolerant to twice this concentration. There was no adverse effect, when compared with cutting, of three annual applications of a 3% concentration to the same plots.

The results of these experiments, suggest that the 2% concentration of SMA plus adjuvant is the optimum treatment for commercial application, that it can safely be repeated over several years without adverse effect on the crop, and that it has an ample margin of safety to the crop. No residues of SMA have been found in representative samples of fruit from these experiments (R J Makepeace, personal communication). The results reported in this paper formed the basis of an application for Off-label Approval for the use of SMA as a cane desiccant, which was granted in March 1992. Details of the Approved recommendations have been summarised by Lawson (1992). In general, SMA may be used as a cane desiccant at the same stages of growth, at the same total spray volumes and pressures, and with the same equipment as those used for dinoseb-in-oil (Lawson & Wiseman, 1981). It is slower-acting and less rain-fast than dinoseb-in-oil and this should be taken into account when applications are planned.

Commercial evaluation by growers in 1992 produced favourable results (D. Morrison, personal communication). Cane desiccation has again become an integral part of raspberry plantation management.

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