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TESTS WITH A CDA TECHNIQUE AND VARIOUS FOLIAGE-APPLIED HERBICIDES

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Summary

Preliminary tests were conducted with standard formulations of foliage-active herbicides to devise techniques and make comparisons of controlled drop application (CDA) with conventional spraying. As measured by the effect on fresh weight of mustard (*Sinapis alba*), CDA was generally not significantly less efficient than boom spraying at a much higher volume.

INTRODUCTION

Controlled drop application (CDA) research has gained momentum during the past 5 years and probably represents the first radical attempt to change ground crop spraying methods for herbicides since the original introduction of hydraulic jets. A recent literature review (Cox 1980) shows that, so far, CDA techniques have been put to use mainly in cereal growing with a limited range of herbicides. Prospects for other cropping situations and herbicides have not yet been widely explored. This report describes preliminary field tests with a number of foliage-applied herbicides commonly used selectively in vegetable production. Tests with glyphosate were also included.

METHODS

Equipment used

The CDA sprayer was tractor-mounted and consisted essentially of a single, electrically driven 'spinning cup' unit manufactured by Micron Sprayers Ltd (Bals 1978) fed with herbicide solution at a constant pressure. The characteristics of this spray unit, known as the "Battleship" or "Micromax", at various disc speeds and flow rates have been described (Heijne 1978).

Our unit was mounted on a triangular frame connected to the tractor three-point linkage arms. Its 12v DC electric motor was driven from the tractor battery. A small voltage regulator was designed and fitted to the circuit so that speed of revolution could be varied as necessary. Herbicide solutions were fed from a 2 litre, pressurised, stainless steel tank to two outlets at the cup. The tractor was also equipped with mid-mounted experimental boom spraying equipment basically as described previously (Cox and Wilson 1976) but with an improved compressed air source. This gave the opportunity of selecting CDA or conventional boom spraying by means of appropriate control valves and switches. In other comparisons, boom spraying was carried out with an operator-carried, propane-powered experimental sprayer. In each case the booms were made up of fan pattern Spraying Systems Ltd Teejets No. 730231 spaced 33 cm apart.

Calibration of 'spinning-cup' unit

Within the accepted definitions of CDA, spray drop sizes should fall within the range 150-350 μm diameter. Heijne's work with this unit shows that disc speeds of 1,000 or 2,000 revs/min and flow rates up to 1,200 ml/min have little effect on the drop sizes generated. For example, at a flow rate of 500 ml/min a disc speed of 1,000 revs/min resulted in a median drop size of approximately 280 μm and, at 2,000 revs/min, a median drop size of approximately 210 μm . Using these data as a guide we calibrated our equipment as follows.

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At a disc speed of 2,000 revs/min and a flow rate of 500 ml/min a mean swathe width of 1.52 m was measured by observing the wetting of absorbent paper strips laid on dry concrete. At forward speeds of 1 and 2 m/sec spray volumes of 54.8 and 27.4 litres/ha, respectively, were calculated. For comparison, the chosen output of the conventional boom was 350 litres/ha. Details are given in Table 1.

TABLE 1: Calibration details of spinning cup and fan jet spraying techniques

Spray technique	Forward speed m/sec	Spray pressure kPa	Flow rate ml/min	Spray volume litres/ha
Spinning cup, Micron "Battleship"	1	70	500	54.8
	2	70	500	27.4
Fan jets, Spraying Systems Teejets No. 730231	1	210	787 per jet	350

Test procedures

Comparisons of the CDA technique and conventional boom spraying were made with a number of herbicides as listed in Table 2 using mustard as an indicator plant. Fresh weights of mustard were taken one to two weeks after spraying. Two experimental methods were used. In Method 1 plants were grown in five-row beds 1.5 m wide. Each spray plot was 9 m long and duplicated. Paired 1m² sampling sub-plots were chosen on areas of uniform plant growth, four per treatment. One of each pair, chosen at random, was covered at spraying time with a sheet of fibreboard on short legs to provide untreated control comparisons. Method 2 differed in that 1.5 m wide strips, 12 m long, were marked out at right angles to the plant rows and control comparisons were provided by alternating treated and untreated strips across the experimental area. Three 30 cm lengths of row were sampled, five per treatment, each with an adjacent control. At spraying time the mustard plants had approximately five expanded leaves and an average height of 20 cm in Method 1, 3 weeks after sowing in early February 1980, and slightly less in Method 2, 5 weeks after sowing in early March 1980.

TABLE 2: Comparisons of CDA and conventional spraying of a number of selective herbicides using two different sampling methods

Herbicide and formulation	Rate kg/ha	Fresh weight of mustard plants, as % of untreated					
		Method 1			Method 2		
		CDA	Conv.	CV%	CDA	Conv.	CV%
chlormethazole 75% WP	1.5	64	52	14.6	80	43	41.4
desmedipham/phenmedipham							
16.5% EC	0.4/0.4	67	58	10.9	98	82	39.0
desmetryn 25% WP	0.5	87	81	4.6	-	-	-
desmetryn 25% WP	1.0	-	-	-	65	67	40.1
dinoseb acetate 50% EC	1.5	47	34	27.5	21	4*	73.0
ioxynil 25% EC	0.6	53	40	27.8	13	10	44.7
linuron 20% EC	0.5	57	48	11.1	23	15	61.4
metamitron 70% WP	4.0	-	-	-	147	56	64.1
metribuzin 70% WP	0.5	-	-	-	10	4	66.0

* denotes significant difference between application techniques by this method of assessment at 5% level

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CDA spraying on the area sampled by Method 1 was carried out at a spray volume of 27.4 litres/ha and for Method 2 the spray volume was 54.8 litres/ha.

RESULTS AND DISCUSSION

Excluding desmetryn which had little effect, plant fresh weight percentages obtained by Method 1 were 9% to 13% higher from CDA than from conventional spraying (Table 2). None of these differences were significant statistically. Surprisingly little effect was obtained from desmedipham/phenmedipham and metatitron gave an inexplicable value in Method 2 tests. Differences in favour of conventional spraying were not significant except for dinoseb acetate.

Results obtained from glyphosate applications (Table 3) show that CDA can give results comparable to conventional spraying.

TABLE 3: Effects of glyphosate (36% AC) applied by CDA and conventional spraying by two methods

Rate of glyphosate kg/ha	Fresh weight of mustard plants, as % of untreated		
	CDA	Conventional	CV%
0.5 (Method 2)	22	22	41.5
0.75 (Method 2)	26	17	47.5
1.0 (Method 2)	9	7	36.9
1.5 (Method 1)	37	26*	15.0

* denotes significant difference between application techniques at 5% level

Sampling by Method 1, involving a rather laborious procedure of covering and uncovering sample areas throughout the spraying operation, nonetheless resulted in more accurate data than did Method 2 which made use of adjacent untreated areas as control treatments. This is readily shown by the CV% values in Table 2.

It is fairly certain that the sensitivity of the results obtained in these tests was adversely affected by uneven plant growth; the accuracy was greater in the matched-pair sampling method. CDA spray volume was confounded with sampling method but it does seem likely that there would usually be a greater herbicidal effect with the higher volume, at least with herbicides of primarily contact action. The general level of phytotoxicity obtained was usually not significantly less from CDA than from conventional spraying. Mustard was arbitrarily chosen as a convenient general indicator species and, as expected, was affected more by some herbicides than others. Methods of assessment need further refinement. The fact that a range of available formulations of selective herbicides were applied without trouble through simple, existing CDA equipment at much lower than normal spray volumes in itself is interesting and has implications of reductions in spray operational costs. Specific areas of use in annual row crops will now be investigated.

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