WEED CONTROL IN CERTAIN HORTICULTURAL CROPS

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SUMMARY

THE use of 2,4-D, MCPA, and monuron for weed control in asparagus is discussed in Section 1 of this paper. Section 2 deals with the use of the amine salt of dinoseb in green beans and reference is also made to the possible use of MCPB. Weed control in carrots with particular reference to a trial investigating the performance of monuron, fenuron, CIPC, and oktone and the effect on yield, weed populations, and the quality and flavour is discussed in Section 3.

INTRODUCTION

One of the difficulties associated with a rapidly expanding subject such as chemical weed control is that all too often experimental and practical experiences remain the exclusive property of those fortunate enough to be intimately involved. As a result techniques which in some areas are regarded as common practice remain virtually unheard of in others. In this paper I have attempted to add my small contribution to the general pool of knowledge in the hope that a more comprehensive understanding will result. What I have to say is based only on limited personal experience, and in view of this the paper which follows can best be likened to a boarding-house Irish stew, in as much as it contains but little meat in a conglomerate of vegetable matter.

SECTION 1: ASPARAGUS

When the asparagus crop is grown on a commercial scale weed control by conventional cultivation methods is not feasible during the period from spear emergence in the spring until the fern has reached maturity some 6 months later. During this long period hand-weeding and chemical control offer the only solutions to a problem which can be of disastrous proportions. With the ruling out of hand-weeding as being contrary to the professional interests of many of us here chemicals provide the only medium by which satisfactory control can be achieved.

Asparagus can be regarded as a crop which is only moderately tolerant to hormone-type weedkillers, and then only at certain stages of growth. Both overseas and local evidence indicates that water-based salts of 2,4-D and MCPA can be used to control broad-leaved weeds at certain times of the year. Spray treatments applied before the spears emerge have been recommended as satisfactory. (1) The main hazard associated with this treatment is that heavy rain immediately after application might well leach active spray material down to developing spears or even to the asparagus crown itself.

Hormone-type sprays applied after the cutting season are distinctly less dangerous, but here again marked damage to the plant can result if spraying of the fern accidentally occurs. The use of hormones then is a risky procedure and, in my opinion, is warranted only when circumstances dictate recourse to extreme measures.

Of the other chemicals suitable for this crop monuron appears outstandingly the best. As an example of what technique is involved and what results can be achieved, I propose to quote an area of 70 acres in the Motueka district which was treated with monuron this season. This stand

was a young one and was treated when it was coming into its second summer. The soil type was a free-draining sandy loam, particularly friable and free running. The final cultivation in the spring aimed at moulding the crowns, leaving a clean, even, clod-free surface. Monuron was applied at 2lb. per acre almost immediately after this operation. As the asparagus had been planted in rows 6ft. apart, only an 18in. band over the actual crowns was treated. It was decided that the between rows could be adequately maintained by mechanical means.

Results were entirely satisfactory throughout the period from application until the fern was removed in the late autumn. Not only was weed growth prevented, but seedling asparagus was killed as each succeeding generation appeared. This seedling asparagus can become a considerable embarrassment to growers if it becomes established. Apart from isolated docks (*Rumex* spp) the only weed growth to establish was scattered populations of Indian doud (*Cynodon dactylon*), which was satisfactorily controlled with spot applications of dalapon during the summer months. As only the actual rows of crowns were treated, the cost was modest, being approximately 28s. per acre.

To my mind two factors contributed to the outstanding success of the treatment. In the first place the friable, clod-free soil facilitated the forming of an unbroken film of monuron over the treated bands. Had the soil surface been lumpy and uneven, results would have been less satisfactory. It is my opinion that the completeness of the initial coverage is a criterion by which the success of the eventual result can be measured. Secondly, the area was virtually free of living rootstocks, which through regrowth, could have overcome the effect of the light rate of monuron. A fine seed-bed free from living perennial weeds is pre-requisite to the successful use of monuron for this type of pre-emergence treatment.

The hazards associated with the use of monuron are not great. As I see it the greatest risk is that improperly covered crowns might receive a direct spray. The possibility of damage from downward leaching is unlikely provided a minimum of 4in. of soil covers the crowns. The one problem which immediately comes to mind, however, is that successive yearly sprays could permit the build up of this virtually insoluble material to a stage where toxic residues accumulate. Fortunately, critical and exhaustive work by Hill and others shows that this is not possible because monuron is broken down by soil bacteria and other means. Their investigations show that monuron applied at 1lb. to 2lb. yearly disappears in from 4 to 8 months. Therefore, it appears that there is no likelihood of an accumulation of any practical significance (2).

SECTION 2: BEANS

During the past few years the spectacular expansion of the canning and quick-freezing industries has encouraged the growing of green beans on a hitherto unthought of scale. Despite this, practical experience in chemical weed control is extremely limited and factual experimental data are so meagre as to be almost nebulous. Of course, the range of chemicals suitable for use in this rather delicate crop is strictly limited and in my experience commercial usage has been confined to pre-emergence applications of the amine salt of dinoseb at about 3lb. phenol equivalent per acre. A fine seed-bed, low atmospheric temperature, and ample soil moisture are essential for optimum results, but when these requirements have been met in full, effective weed control can be achieved for 5 to 6 weeks.

Unfortunately, residual pre-emergence weedkillers have a frustrating habit of giving diametrically opposite results under what appear to be entirely similar conditions. The reasons for this are many, but the most important seems to me to stem from the fact that we must rely on the

soil to transport the killing principle to the weed. Unless optimum conditions obtain, this does not happen and inferior results occur. In fact, we really have singularly little control over the soil and must rely on nature to condition it for us. If residual materials are to be fully effective, certain conditions are essential. The seed-bed must be fine and level and adequately supplied with moisture. The soil temperature should be fairly low and the area must be free from established weeds. Strict as they are these demands can usually be met in the spring and autumn.

With this in mind, the use of the amine salt of dinoseb as a post-emergence spray for beans is worth investigating. In one instance this year runner beans were inadvertently sprayed at the loop stage. There was absolutely no evidence of crop damage and further work seems justified. It is obvious that if it can be used in this way, many of its limitations will be overcome.

The position of MCPB in respect of bean spraying is not at all clear. American recommendations for crop spraying include dwarf, stringless french beans and these recommendations are in no way qualified by ifs and buts. (3) English manufacturers, on the other hand, studiously avoid mention of green beans in any shape or form. One area of semi-runners in the Blenheim district was sprayed a month before flowering with 2lb. acid equivalent per acre of MCPB late last summer. The only outward effect this rather severe treatment had was to delay flowering temporarily. Subsequent pod formation and seed setting appeared quite equal to the unsprayed control.

However, I do not for one moment suggest that bean crops should be sprayed indiscriminately with MCPB or even post-emergence with the amine salt of dinoseb. I have merely introduced this unsupported information in the hope that it might stimulate some future research.

SECTION 3: CARROTS

The chemical control of weeds in carrots with kerosene-type weedkillers has for long been an established practice and requires no further description here. Kerosene and other aromatic oils, however, suffer the limitations of all contact herbicides, namely an inability to control many well-established weeds and a marked susceptibility to weather conditions both at and immediately following application. Added to this the ordinary kerosene available has been very variable in quality and this has introduced an element of risk to the treatment. Of recent years a proprietary weedkiller of consistent quality has been available, but the other deficiencies of contact materials are still retained. The need for a more comprehensive and versatile weedicide prompted the initiation of preliminary screening trials at Invermay Research Station, Otago, in the summer of 1954/55. As a result of these investigations more specific work was undertaken during the summer of 1955/56.

The materials used in the second series were monuron, fenuron (a near relation of monuron but a more soluble compound), CIPC, and oktone. Oktone is a non-selective desiccant with little or no residual action. All the materials were applied pre-emergence at two rates to an area of Chantenay carrots by a mechanical plot sprayer which simulated field spraying conditions. The residual materials were applied soon after sowing, but the oktone was not applied until 24 hours before the main emergence of the crop, the object for this being to permit the maximum possible weed

germination before the contact material was used. Four replications of each treatment were laid down in randomised blocks to permit statistical analysis of the results.

TABLE 1

No.	Treatment		Date applied	Spreader	
1.	Control (hand-weeded)		3/11/55	—	
		lb.			Gall.
2.	Monuron	2.5	26/9/55	Water	40.8
3.	Monuron	5.0	"	"	"
4.	Fenuron	2.5	"	"	"
5.	Fenuron	5.0	"	"	"
6.	CIPC	4.0	"	"	"
7.	CIPC	8.0	"	"	"
8.	Oktone	2.0	7/10/55	Kerosene	37.4
9.	Oktone	4.0	"	"	47.6

The soil type of the trial area was an alluvial silt loam high in organic matter but poor in texture and difficult to work to a fine tilth. At the time of application the soil was moist. The natural weed population was extremely high and comprised a wide range of species including wireweed (*Polygonum aviculare*), redshank (*Polygonum persicaria*), fat-hen (*Chenopodium album*), spurrey (*Spergula arvense*), *Poa annua*, and others.

Two separate factors were under investigation in this trial: first, the effect of the various weedkillers on the carrot crop and second, their efficiency in controlling the weed population present. Crop tolerance was determined by observation and yield data, but this later evidence was clouded by the complication of weed competition and is not wholly reliable. However, it was abundantly clear that fenuron caused severe crop mortality at both low and high rates and that the high rate of monuron was also too severe to warrant further consideration. Incidentally, this finding has not been supported by Thompson, whose work at Rukuhia has shown that monuron at 4lb. per acre gave an increased yield over untreated control. (4) In the Invermay trial, however, CIPC, oktone, and the low rate of monuron were the only practicable treatments in terms of crop tolerance.

Weed control efficiency was determined by counting the weed population some 2 months after spraying. Quadrat counts were taken at random and the data thus collected yielded much pertinent information, particularly in respect of the selectivity shown by the residual chemicals toward certain weed species.

TABLE 2—WEED COUNTS TAKEN ON 29/11/55
(Number of living plants per 16 square feet)

Treatment		Wireweed	Fat-hen	Spurrey	<i>Poa annua</i>
Unweeded		64	76	24	36
	lb.				
Monuron	2.5	37	3	9	—
Monuron	5.0	15	—	—	1
Fenuron	2.5	25	12	7	—
Fenuron	5.0	10	—	6	—
CIPC	4.0	—	154	—	—
CIPC	8.0	—	17	—	—
Oktone	2.0	17	88	11	8
Oktone	4.0	9	72	13	15

Throughout the period of the trial the level of weed control maintained by CIPC was of the highest possible order. At harvest only isolated unthrifty plants of fat-hen survived and complete suppression of all other weed species had been achieved. The over-all efficiency of the monuron treatment was nullified by its inability to control wireweed, which grew unhindered by other competition and eventually smothered the carrot crop. The short-lived activity of oktone permitted the establishment of later generations of weeds and because of the poor suppression exerted by the slow-growing carrots, these weeds later enjoined in severe competition with the crop.

Yield data show the unquestionable superiority of CIPC over all other treatments in this trial.

TABLE 3—RESULTS OF ANALYSIS OF YIELDS

Treatment		Yield (tons/acre)	Difference from control
Control (hand-weeded)		15.2	—
	lb.		
Monuron	2.5	4.5	—10.7†
Monuron	5.0	5.0	—10.2†
Fenuron	2.5	5.0	—10.2†
Fenuron	5.0	2.7	—12.5†
CIPC	4.0	14.8	0.4 N.S.
CIPC	8.0	19.5	4.3*
Oktone	2.0	5.3	—9.9†
Oktone	4.0	8.1	—7.1†

Difference for significance 5%* 4.1

1%† 5.6

An additional factor on which information was sought was the effect of weedkillers on the flavour and quality of the carrots. Quality and tasting tests on both raw and cooked carrots were conducted by a panel at the School of Home Science, University of Otago. These tests indicated that only oktone had no adverse effects on the carrots and both monuron and CIPC caused flavour faults, coarsening of texture, and paleness or discoloration of the flesh.

These findings are the result of but one trial, however, and it would be unwise to accept them unreservedly. Nevertheless, the inference must be accepted and there is an obvious need for further investigation to determine whether or not these deleterious side effects are to be expected under all conditions.

It would be idle to suggest that the excellent results obtained from CIPC in this trial will automatically be repeated whenever and wherever this material is applied. After all, CIPC is a residual pre-emergence weedkiller and like others of its kind demands suitable conditions before it can achieve maximum performance. At this stage, I should like to point out that this trial has done more than establish the value of CIPC as a chemical for use in carrot crops. There are numerous other vegetable crops which can be treated with CIPC (5) and I can only suggest that the horticultural industry has a very promising material at its disposal.

REFERENCES

1. Timbrol Limited. Bulletin No. 7012, Weed and Brush Control with 2,4-D and 2,4,5-T, 1956, p. 6.
2. G. D. Hill, et al. The Fate of Substituted Urea Herbicides in Agricultural Soils. Agron. Jour., Vol. 47, No. 2. 1955, p. 93.
3. W. C. Shaw. Jour. Agriculture and Food Chem., 4, 1956, p. 111.
4. F. B. Thompson. Weeds in Peas and Carrots. N.Z. Jour. Agric. Vol. 94, No. 1, 1957, p. 66.
5. L. J. Matthews. Chemical Methods of Weed Control. N.Z. Dept. of Agric., Bulletin No. 329, 1956, p. 23.

DISCUSSION

Q.—What is the control of speedwell (*Veronica arvensis*) in seedling and mature asparagus?

A.—It is controlled by pre-emergence spraying with monuron at rates mentioned in the paper.

Q.—What has been the effect of rain following use of CIPC in crop emergence? Has the chemical leached down to the root zone of the crop?

A.—Rain has always had a beneficial effect and has not leached the chemical down to the root zone of the crop.