TOLERANCE OF CROPS AND WEEDS TO NEW CHEMICALS

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SUMMARY

MUCH experimental work is required to determine the tolerances of crops and weeds to the many new weedkillers. The logarithmic sprayer is proving useful in the preliminary screening of these materials. From trials with amiben, fenac, CDAA, CDEA, CDEC, EPTC, trietazine, and simazine (excluding trials with maize), it appears that amiben is the most promising new chemical. It gave good selective weed control in chou moellier, carrots, and lettuces. In carrot and fodder beet trials some weeds not satisfactorily controlled by CIPC proved very susceptible to amiben.

As a result of the widespread use which has been made of chemical weedkillers discovered during the 1940s, intensive research has been maintained overseas during the last 10 years in an endeavour to discover other chemicals with weedkilling properties. These endeavours have not been in vain. Some weedkillers discovered during this period are now in use in this country, but there are, in addition, many new materials which are still in the experimental stages. As an indication of the large number of new materials available, reference is made to the six compounds simazine, chlora-zine, propazine, trietazine, isodiazine, and atrazine which differ only in the alkylamino groups attached to two of the carbons in the triazine ring.

Experiments have to be carried out to determine whether any of the new chemicals are likely to be of any practical use in dealing with weed problems in New Zealand. When the materials are likely to be used as selective weedkillers it is necessary to determine both the minimum rates required to control the weeds and the maximum rates tolerated by the desirable plants. In view of the numerous combinations of chemicals, weeds and crop or pasture plants, and factors such as rates and times of applications, soil types, and weather conditions, all of which affect the results, a very extensive research programme would be required to investigate even those chemicals considered most likely to be of practical use.

This paper records results of preliminary trials to determine the tolerances of crops and weeds to some of these new materials. In planning these trials consideration was given to some current weed problems. For instance, sodium monochloroacetate (MCA), which has been recommended for the control of certain weeds in brassica crops, is of little use if fathen (*Chenopodium album*) or grassy weeds are present (1). There is still no satisfactory chemical for controlling weeds in sowings of fodder beet. The tolerance of redroot (*Amaranthus retroflexus*) to CIPC often detracts from the value of this chemical for weed control.

EXPERIMENTAL

The logarithmic sprayer described by Sweetman (2) has enabled considerable information to be obtained by spraying various crops before emergence. Thus in the one strip it was possible to determine the maximum rates of the chemical tolerated by the crops and the minimum rates required to give satisfactory control of the weeds present. It was frequently difficult in practice to state at what stage crop damage ceased and what was adequate weed control. In the sprayed strips there were sometimes zones in which the results were indefinite. In some instances where odd plants tolerated high rates of treatment, the surviving plants were found to be in positions corresponding to the footprints of the operator when spraying.

Some of the data were from replicated trials with various treatments in randomised blocks. Most of the trials were conducted on Horotiu sandy

loam, but some were on Rukuhia peat which had been adequately limed and fertilised.

The scope of the trials was limited by the restricted range of weeds in the trial areas. There was practically no fathen present and the susceptibility of this weed could not be determined. The choice of materials used was limited by those available when the trials were commenced. The amiben used was liquid material except in the winter lettuce trial in which granules were applied.

The rates of materials quoted in this paper refer to lb of active material per acre, except for trietazine and simazine, where the figures refer to the rates of actual material.

RESULTS

Amiben

Logarithmic sprayings indicated that 4 lb per acre gave almost complete weed control on both the sandy loam and the peat. Adequate control, except for grassy weeds, was obtained with 2 to 3 lb. Two troublesome weeds on peat, namely sorrel (*Rumex acetosella*) and portulaca (*Portulaca oleracea*), were considerably reduced by slightly less than 3 lb and 2 lb respectively.

In a replicated trial with carrots, amiben, CIPC, CDAA, and EPTC were each applied at 4 lb. Applications were made both before sowing and lightly worked into the soil and before emergence. Pointings of the degree of weed infestation made seven weeks after the treatments were applied are shown in Table 1. These show that amiben gave slightly better weed control than CIPC and much better control than any of the other treatments.

TABLE 1—POINTINGS OF WEED INFESTATION

Treatment	Pointings	
	Pre-emergent	Worked in
Amiben 4 lb	6	11
CIPC 4 lb	9	14
CDAA 4 lb	18	19
EPTC 4 lb	20	19
Hand-weeded		0
Unweeded		25

Table 2 which lists the degree of control of the various weeds present obtained with amiben and CIPC shows that the two materials were, to some extent, complementary. Amiben gave very good to excellent control of those weeds which were most resistant to CIPC, namely redroot and *Chenopodium pumilio* and to a less extent flat weeds. CIPC gave better control of spurrey (*Spergula arvensis*) and grasses. The carrots were equally resistant to both materials. Therefore it is possible that a mixture containing lower rates of each material may give better weed control in tolerant crops than higher rates of either material separately.

TABLE 2—CONTROL OF WEEDS OBTAINED WITH AMIBEN AND CIPC

Weed	Amiben	CIPC
Redroot	Excellent	Poor
Willow weed	Excellent	Excellent
Spurrey	Very good	Excellent
<i>C. pumilio</i>	Excellent	Poor
Flat weeds	Very good	Poor
Grasses	Poor	Good

In an observational trial in which amiben and CIPC were each applied at 4 lb immediately after planting fodder beet similar results were obtained except that the control of annual summer grasses was excellent and the crop was severely damaged. In these trials it was sometimes difficult to

assess the control of grasses because of the uncertainty regarding the infestation in the area. The prolific growth of willow weed (*Polygonum persicaria*) prevented grassy weeds from establishing on the unsprayed controls. In view of the excellent weed control obtained possibly lower rates of amiben would give sufficient weed control without being toxic to the fodder beet.

In a current replicated trial with winter lettuce, amiben in the granular form scattered over the beds immediately after planting at the rate of 4 lb of active material is giving as good weed control as CIPC at 4 lb sprayed immediately before planting. Neither material had more than a negligible effect on the lettuces.

In the logarithmic trials chou moellier was the most resistant crop treated before emergence. It tolerated up to 5½ lb of amiben, thus giving a considerable margin for selective weed control. Onions were more susceptible and there was some damage down to 3½ lb. Soft turnips, red beet, and fodder beet were more susceptible than many of the weeds.

The overall results from trials so far carried out, which include treatments applied in spring, mid summer, and late autumn, show that in each instance amiben gave very good control of a number of broad-leaved weeds and some control of grassy weeds. The susceptibility of fathen could not be determined, but in view of the excellent control of *Chenopodium pumilio*, it is possible that fathen may also be susceptible to amiben. Since fathen and grassy weeds limit the extent to which MCA can be successfully used for control of weeds in brassica crops, it is possible that amiben may prove a more satisfactory weedkiller for chou moellier at least. However, detailed yield trials are required with chou moellier and the other brassica crops.

Fenac

In the logarithmic sprayings practically complete weed control was obtained with 3.7 lb on both the sandy loam and peat soils. Adequate control was obtained with 2 lb. Rates down to 1.5 lb controlled spurrey and portulaca and gave some control of redroot and willow weed. On the peat soil the maximum rate tolerated by most of the crops was 2 to 3 lb. The evidence indicates that the crop tolerance is less on the sandy loam. Thus there is little margin for selective weed control on the peat and even less on the mineral soil.

The susceptibility of spurrey and portulaca is of interest in that low rates of fenac could possibly be used to control these weeds. However, even if these were the dominant weeds they could probably be controlled more satisfactorily with other materials which control a wider range of weeds and have a greater margin of selectivity, for example CIPC for spurrey, and possibly amiben or CDAA (if on a peat soil) for portulaca.

CDAA

On the peat soil complete weed control in the logarithmic series was obtained with 3 lb, but the corresponding rate on mineral soil was several lb higher. Redroot and portulaca were particularly susceptible on the peat and rates less than 2 lb gave adequate control. In these trials chou moellier and onions tolerated a maximum of 3 lb, which gives little margin for selectivity. Soft turnips and red beet were more susceptible. In trials in other districts CDAA was satisfactory for the control of grass in onions on peaty soils.

Table 1 shows that CDAA at 4 lb was much inferior to amiben or CIPC for weed control in carrots on sandy loam. CDAA also failed to give satisfactory results in a similar trial on onions. In the winter lettuce trial it is giving inferior weed control and more crop damage than CIPC or amiben.

CDEA

CDEA at 4 lb applied to onions before emergence gave practically no control of the main weeds present, namely spurrey, willow weed, and cress (*Coronopus didymus*). The same rate applied to lettuces before planting did not give satisfactory control of *Poa annua* or the broad-leaved weeds.

There was no evidence from logarithmic sprayings on a chou moellier crop that CDEA had any promise.

CDEC

In logarithmic trials on chou moellier even 8 lb of CDEC did not give control of broad-leaved weeds. However, low rates eliminated witch grass (*Panicum capillare*), but EPTC was better. In a lettuce trial CDEC at 4 lb caused more crop damage than either amiben or CIPC without giving as good control of the broad-leaved weeds.

EPTC

This material, like CDAA, failed to control broad-leaved weeds when applied before emergence in onion and carrot trials. Low rates gave good control of witch grass in chou moellier.

Trietazine

This was applied at 3 lb to fodder beet immediately after planting. The effects were somewhat similar to those of amiben in that the crop was rather severely affected and good control was obtained of redroot and *C. pumilio*. Trietazine, however, failed to control willow weed. Therefore, like amiben, trietazine is complementary to CIPC and low rates mixed with CIPC could possibly be used satisfactorily. However, since amiben gave better control of the same weeds than trietazine and some control of a wider range of weeds, it would probably be better to use amiben instead of trietazine in this respect.

Simazine

Pre-emergent applications of 4 lb were made in carrot and lettuce trials and post-planting applications of 3 lb on fodder beet. Though weed control was excellent, crop damage was severe.

Results with trietazine and simazine in maize trials are given in the paper by Mr Patterson.

Mixtures

In several trials mixtures of CIPC and either CDAA or CDEC were used. There was no evidence that the mixtures were any better than CIPC alone.

DISCUSSION AND CONCLUSIONS

In view of the extensive range of experimental work which could be carried out with the new chemical weedkillers now available, some selection is necessary in deciding what work to do. From the experimental work conducted with the eight new materials used in the trials described in this paper, it is considered that amiben is the most promising. Amiben has given good results in several crops.

- (a) The range of broad-leaved weeds which it controls and the tolerance of chou moellier suggests that it would be useful in this crop. Amiben appears to do all that MCA achieves and in addition it gives some control of grassy weeds. The tolerance of other brassica crops such as swedes and turnips has to be determined.
- (b) The tolerance of carrots indicates that amiben can be used with this crop as a pre-emergence application. Results indicate that amiben gives weed control equal to that obtained with CIPC.
- (c) Post-planting applications of amiben granules are promising for weed control in winter lettuce instead of CIPC.

However, more detailed trials are required to determine from yield data the tolerances of the crops concerned before specific recommendations can be made.

Amiben and CIPC are complementary. Amiben gives better weed control of redroot, *C. pumilio*, and flat weeds, whereas CIPC is better for willow weed, spurrey, and possibly grassy weeds. Therefore, mixtures containing about 2 lb of each material may prove more satisfactory than CIPC alone at 4 lb, provided that the two materials are not synergistic in their effects on the crops. The post-planting treatment of fodder beet is a particular case where such a mixture may prove satisfactory.

ACKNOWLEDGMENTS

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REFERENCES

1. Thompson, F. B., 1959. Proc. 12th N.Z. Weed Control Conf., pp. 99-105.
2. Sweetman, I. C., 1959. Proc. 12th N.Z. Weed Control Conf., pp. 11-16.

DISCUSSION

Q.—Have you compared diuron with atrazine and simazine?

A.—Have done work with diuron and simazine. Three to 4 in. rain in one week gave severe crop damage with diuron.

Comment: I gave fenac a fair trial at 3 lb per acre on spurrey. Fenac gave a good check but poor kill.

Q.—Have you compared granular and liquid amiben? Simazine and triazine were used at luxury rates, it should be able to get it down to 2 lb per acre.

A.—Have not tried the two in direct comparison, but have used both. Granules seem to be equal to liquid. I agree we could use lower rates of simazine and triazine. Amiben was superior to triazine.

Q.—At Invermay in a restricted number of trials chlorpropham was more effective than amiben in carrots where weed invasion was heavy.

A.—A number of trials, late spring, summer, and late autumn, each gave very good results with amiben. In trials at Rukuhia where there was heavy weed infestation amiben was equal to chlorpropham.