

THE RESIDUAL TOXICITY OF MONURON, SIMAZINE, AND 2,3,6-TBA — FINAL RESULTS

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Summary

It was 12 to 15 months, 12 to 20 months and 18 to 24 months after application of 2,3,6-TBA, monuron and simazine, respectively, before normal crops of lettuce, turnips and perennial ryegrass could be grown in a silt loam soil. Cultivation hastened the disappearance of monuron as did the addition of fowl manure from a deep litter house to the soil before herbicide applications. The fowl manure had a similar effect on simazine and retarded the disappearance of 2,3,6-TBA. Cultivation had no effect on the life of 2,3,6-TBA or simazine.

INTRODUCTION

MONURON, SIMAZINE AND 2,3,6-TBA are typical of groups of herbicides used for the complete suppression of weed growth; for the control of pernicious weeds; or for selective weed control on tolerant crops. High rates of these materials are often used and it is important that the grower should know when treated land can be used for susceptible crops without fear of damage by the residual effects of these materials. The first year's results of an experiment designed to elucidate this problem as reported by Webster (1961) showed that simazine at 4 lb a.i. per acre was more persistent than monuron at 4 lb a.i. per acre, which, in turn, was more persistent than 2,3,6-TBA at 20 lb a.i. per acre.

Webster also showed that simazine had lost little of its potency in twelve months, while the potency of the monuron and the 2,3,6-TBA was greatly reduced. The persistence of monuron had been reduced by the addition of organic matter to the soil before its application and by cultivating the soil before sowing the susceptible crop. 2,3,6-TBA was less persistent in soil with a low organic content than in the same soil with a higher organic content.

This paper presents the results obtained during the second and final year of this experiment. Quantities of chemicals are expressed as active ingredient per acre.

EXPERIMENTAL DETAILS

Fowl manure from a deep litter house was spread over half the main plots at the rate of 20 tons per acre and the whole area rotavated 6 in. deep. Two months later, on March 17, 1960, the herbicides were applied to the sub-sub-plots:

- (1) Monuron: 4 lb in 40 gal water at 1 m.p.h.
- (2) Simazine: 4 lb in 40 gal water at 1 m.p.h.
- (3) 2,3,6-TBA: 20 lb in 40 gal water at 1 m.p.h.
- (4) HWC.

The cultivation treatments were:

- (C1) No cultivation
- (C2) Rotavated 6 in. deep before sowing seed.

In the later stages of the experiment it was necessary to cultivate the no "cultivation" plots to a depth of 1 in. with a hand hoe so that seeds could be sown.

The dates on which the cultivations were done and seeds sown and the period after application of the herbicide were:

TABLE 1: COMPARISON OF ORGANIC MATTER PRESENT AND ABSENT

(lb Fresh Weight of Produce; Totals of 18 Plots)

	Lettuce		Turnips		Ryegrass Scores	
	Absent	Present	Absent	Present	Absent	Present
Monuron	69.4 b	74.9 ab	—	—	24 d	49 abc
Simazine	43.9 c	91.4 a	—	—	41 c	56 a
2,3,6-TBA	67.7 b	74.0 ab	—	Not	44 bc	54 ab
HWC	67.9 b	78.3 ab	—	Signif-	48 abc	48 abc
Total	—	—	384.0 b	618.3 a		
C.V.	37%			32%		30%

TABLE 2: COMPARISON OF CULTIVATION WITH NO CULTIVATION — LETTUCE

(lb Fresh Weight of Produce; Totals of 18 Plots)

	No Cultivation		Cultivation	
Monuron	90.1 a	54.2 c
Simazine	74.5 ab	60.8 bc
2,3,6-TBA	65.0 bc	76.7 abc
HWC	78.9 ab	67.3 bc
C.V.				37%

(S1) April 11, 1960	1 month
(S2) August 8, 1960	5 months
(S3) December 8, 1960	9 months
(S4) May 1, 1961	14 months
(S5) October 27, 1961	19 months

One third (S1) of the plots received the cultivation treatment and were sown in April. Another third (S2) were treated and sown in August. In December, the rest of the plots (S3) were cultivated for the first time and the S1 and S2 plots received further cultivation treatments. On this and subsequent occasions, all plots were sown with seed. In May and October, 1961, all plots received further cultivation treatments and were sown with seed.

The seed used in the trial were:

Perennial ryegrass (*Lolium perenne*)
 Lettuce (*Lactuca sativa*) var. Great Lakes
 Turnip (*Brassica sativa*) var. Snowball.
 Peas (*Pisum sativum*) var. W. F. Massey

The size of the sub-sub-plots was 6 ft square. Single rows of each of the test plants were sown across each plot with a Planet Junior seed drill.

All the crops from the S3 sowing were cut off at ground level and weighed fresh, as were the lettuce and turnips from the S5 sowing. The growth of the ryegrass from the S5 sowing was scored on a pointing system with 1 = Very Poor to 5 = Very Good.

RESULTS

The results of the first three sowings were given in Webster (1961).

FOURTH SOWING

The crops sown in May, 1961 (S4), were so badly damaged by birds that it was not worth while weighing the produce. However, visual observations in mid June suggested that the herbicides were less potent than at the previous sowing five months earlier. There were no apparent differences between the hand-weeded and the 2,3,6-TBA plots. The monuron plots which had received organic matter were also very similar to the hand-weeded plots though the crops on the monuron plots without organic matter were affected and it is doubtful if they would have matured properly. The effects of the simazine could be seen on all plots to which it had been applied. Its effects were, however, much less severe on those plots which had received organic matter.

The crops on the cultivated (C2) monuron plots were similar to the hand-weeded plots while those on the uncultivated plots (C1) were affected by the monuron.

No discernible differences were apparent between plots first cultivated at different times (S1 to S3).

FIFTH SOWING

The turnips sown in October, 1961, were harvested and weighed on January 3, 1962, and the lettuces on February 21. The growth of the ryegrass was scored when the lettuces were harvested.

The effects which showed significant differences in crop yields were the materials, the presence and absence of organic matter and, in the cases of lettuce and ryegrass, the interaction between them. The interaction between materials and cultivations was significant only with lettuce. These results are given in Tables 1 and 2.

The organic matter comparisons show that the addition of organic matter before applying the herbicides increased yields. Part, if not all, of this increase would be due to the higher fertility of

the treated plot. The lettuce yield and the ryegrass scores show no significant differences when organic matter was added. When it was not added, however, lettuce gave a significantly lower yield after simazine compared with the other three treatments. Similarly, the ryegrass scores were significantly lower after monuron.

This suggests that ryegrass is particularly susceptible to small traces of monuron and lettuce to traces of simazine, and both these herbicides are inactivated more rapidly by soils higher in organic matter. This confirms the visual observations made following the May, 1961, sowing and the results obtained for monuron from the December, 1960, sowing. The amount of simazine in the soil when the last sowing was made must have been very small as the turnips grew well and indeed yielded higher than the other treatments.

There was no significant difference between herbicides in the no-cultivation plots nor in the cultivated plots, but the lettuce on the uncultivated monuron plots yielded significantly higher than on the cultivated monuron plots. This suggests that monuron is decomposed more quickly when the soil is left undisturbed. However, as there were no significant differences in this comparison for turnips and ryegrass, and as this is the reverse of the results obtained from the third and fourth sowings, this result could well be disregarded.

The weed growth after the fifth sowing was dense and healthy. There were no apparent differences between the weed populations on the 2,3,6-TBA, simazine and hand-weeded plots. On the monuron plots there was a slightly increased prevalence of *Veronica persica*, *Polygonum persicaria*, and *Plantago major*, especially on the uncultivated plots.

DISCUSSION

These results confirm the earlier findings that simazine is the most persistent herbicide in the trial, followed by monuron, with 2,3,6-TBA the least persistent; that cultivation and a high organic matter content decomposes monuron more quickly in the soil is also confirmed. The results show that simazine decomposes more rapidly in soils of high organic content.

In an experiment of this type, it is not possible to ascertain exactly when a material has completely disappeared. However, an examination of the results given above and previously does suggest approximately when this happened. For instance, 2,3,6-TBA applied at 20 lb, had probably completely disappeared from the no-organic-matter plots in 12 months and from the organic matter plots in 14 months after application. No other treatments appeared to have had any effect.

Simazine applied at 4 lb had probably disappeared from the no-organic-matter plots in 24 months and from the organic matter plots in 18 months. No other treatments appear to have had any substantial effects.

With monuron applied at 4 lb the situation is rather more complex. It appeared to disappear completely from cultivated organic matter plots in 12 months; from cultivated non-organic-matter and uncultivated organic matter plots in 15 months; and from uncultivated non-organic-matter plots in 20 months.

These suggestions apply to a silt loam soil. The materials may take longer or less time to decompose or otherwise disappear on heavier or lighter soils depending on their nature.

REFERENCE

- Webster, A. B. 1961: The residual toxicity of monuron, simazine and 2,3,6-TBA. *Proc. 14th N.Z. Weed Control Conf.*, p.87.