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## Report for 1960

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### The Use of "simazine" to Control Weeds in Field Beans and Potatoes

**J. R. Moffatt and M. J. Hill**

J. R. Moffatt and M. J. Hill (1961) *The Use of "simazine" to Control Weeds in Field Beans and Potatoes* ; Report For 1960, pp 204 - 208 - DOI: <https://doi.org/10.23637/ERADOC-1-93>

*Pigs*

Some of the older Large White sows were sold. The litter size and weight at weaning was low, and it is hoped to get better results in future. If so, the herd will be increased to its previous size of 20-25 sows. Most of the pigs were sold as pork.

### The use of "Simazine" to control weeds in field beans and potatoes

#### *Second Report*

J. R. Moffatt and M. J. Hill

The results of four experiments in 1959 on the effect of "Simazine" as a pre-emergence weed-killer on beans and potatoes were given in the 1959 Report. A range of crops was grown on the same sites in 1960 to determine any residual effects. Two further experiments on the use of "Simazine" on potatoes and two on beans were done in 1960.

#### *Residual effects of 1959 experiments*

Cappelle winter wheat, Proctor barley, Condor oats, Thousand-head kale and Kleine E sugar beet, were grown in 1960 in strips across the 1959 plots at Rothamsted and Woburn. Observations were made throughout the growing season and yields were taken. There was no room for replication on individual experiments, and Table 1 gives the mean yields of all sites. Birds did some damage

TABLE 1  
*Rothamsted and Woburn*

Test crops	Mean yields/acre over 4 experiments					
	O	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	A <sub>2</sub>	Mean
Winter Wheat (1), cwt. (at 85% D.M.)	46.6	47.8	46.7	46.4	48.5	47.2
Spring Barley (1), cwt. (at 85% D.M.)	34.9	35.1	36.6	33.8	34.2	34.9
Spring Oats (1), cwt. (at 85% D.M.)...	26.2	27.4	26.8	25.5	26.6	26.5
Kale (1), tons (total weight)	...	22.4	24.6	24.1	21.5	23.2
Sugar beet, tons (roots, washed)	...	17.2	18.7	15.6	17.1	17.0

Treatments applied 1959.

O = No weed control.

S<sub>1</sub> = Simazine.  $\frac{1}{2}$  lb. active material in 40 gallons/acre.

S<sub>2</sub> = Simazine. 1 lb. active material in 80 gallons/acre.

S<sub>3</sub> = Simazine.  $1\frac{1}{2}$  lb. active material in 120 gallons/acre.

A<sub>2</sub> = Atrazine. 1 lb. active material in 80 gallons/acre.

(1) = Mean of 3 experiments, the fourth was damaged by birds.

at Woburn, and damaged crops were not harvested for yield. No effects of the weed-killer were observed on germination or the subsequent growth of any of the crops. Yields of each crop were similar over all the experiments, except that on one, kale after the highest level of "Simazine" yielded 25% less than the control.

The yields of all crops except sugar beet were slightly higher where the two lower levels of "Simazine" had been given than

where weeds had been allowed to grow unchecked in 1959, and slightly lower where the highest level of the herbicide had been given. In three of the four experiments sugar beet yielded 1.6 tons/acre less on the  $S_2$  plots than on plots where weed-killer was not given in 1959.

"Simazine" is not normally used at more than 1 lb./acre of active material, and these results suggest that this rate will not damage the following crop, even autumn-sown wheat.

#### *Experiments on the use of "Simazine" in 1960*

Tick beans were grown on heavy loam soil at Rothamsted and Woburn and were drilled 3-4 inches deep; Ulster Supreme potatoes were grown on heavy soil at Rothamsted and on a sandy loam at Woburn.

For beans a randomised block design with four-fold replication was used. The treatments were: no weed control; normal inter-row cultivation; "Simazine" at three levels ( $\frac{1}{2}$  lb., 1 lb. and  $1\frac{1}{2}$  lb. active material/acre) without inter-row cultivation; "Simazine" at 1 lb./acre active material with inter-row cultivation. The herbicide was applied soon after drilling.

The potato experiments formed part of a rotation experiment and were in two randomised blocks. A cultivation treatment not introduced in 1960 gave replication of some treatments within blocks. The treatments were: no weed control; "Simazine" at  $\frac{1}{2}$  lb. and 1 lb. active material/acre applied immediately after planting with no inter-row cultivations; "Simazine" at 1 lb./acre as above with one final earthing up; early cultivations and "Simazine" at 1 lb./acre applied just before the crop emerged; normal cultivations without weed-killer.

Full agricultural details of these experiments are in Results of Field Experiments 1960.

#### *Discussion*

Weeds were counted and identified on four random sample areas of 180 sq. in. on all bean plots at the end of July. Tables 2 and 3 list the most prevalent weeds and the total annual weeds.

Tables 2 and 3 show that at neither farm did "Simazine" alone

TABLE 2

*Tick beans—Rothamsted—mean weed numbers/sq. yd.*

	O	$S_1$	$S_2$	$S_3$	N	$S_2N$
Chickweed ( <i>Stellaria media</i> ) ...	35.1	3.1	1.8	0.9	4.5	0.9
Cleavers ( <i>Galium aparine</i> ) ...	27.0	27.4	17.5	8.1	3.1	4.0
Black Bindweed ( <i>Polygonum convolvulus</i> ) ...	25.2	3.1	5.8	0.9	1.8	0.45
Orache ( <i>Atriplex patula</i> ) ...	18.0	29.7	9.9	11.7	0.4	0.9
Scarlet Pimpernel ( <i>Anagallis arvensis</i> )	19.8	5.4	2.7	0.9	2.7	—
Slender Foxtail ( <i>Alopecurus myosuroides</i> ) ...	15.3	4.0	3.1	0.9	1.3	1.3
Knotgrass ( <i>Polygonum aviculare</i> ) ...	9.4	3.6	0.4	0.4	—	—
Speedwell ( <i>Veronica</i> spp.) ...	5.4	—	0.4	—	0.9	—
Poppy ( <i>Papaver</i> spp.) ...	4.9	—	—	—	—	—
Mayweed ( <i>Matricaria inodora</i> ) ...	5.4	—	—	—	0.9	—
Total annual weeds ...	181.8	78.3	43.2	24.3	17.1	7.6

control weeds satisfactorily, although the total annual weeds became fewer with each additional dose of herbicide. The dominant weeds at Rothamsted were cleavers (*Galium aparine*), black bindweed (*Polygonum convolvulus*) and orache (*Atriplex patula*), and at Woburn were black bindweed, orache and knotgrass (*Polygonum aviculare*). Mechanical cultivation controlled all these satisfactorily,

TABLE 3

*Tick beans—Woburn—mean weed numbers/sq. yd.*

	O	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	N	S <sub>2</sub> N
Black Bindweed ( <i>Polygonum convolvulus</i> ) ...	65.4	50.4	6.6	2.4	6.0	—
Orache ( <i>Atriplex patula</i> ) ...	148.2	124.2	152.4	108.6	9.6	10.8
Knotgrass ( <i>Polygonum aviculare</i> ) ...	24.0	19.2	10.8	7.2	2.4	—
Chickweed ( <i>Stellaria media</i> ) ...	8.4	—	—	—	6.0	1.2
Redshank ( <i>Polygonum persicaria</i> ) ...	3.6	—	—	0.6	—	—
Mayweed ( <i>Matricaria inodora</i> ) ...	3.6	—	—	—	—	—
Total annual weeds ...	253.8	195.6	170.4	118.8	25.8	12.0

whereas "Simazine" controlled only bindweed satisfactorily. Where cleavers and orache were made fewer by the chemical the plants grew larger.

Individual plot yields show that the sites of both experiments were very uneven, probably from differences in pH, but this is under investigation. The irregularity ran across the blocks at Rothamsted and parallel to them at Woburn. The yield differences at Rothamsted (Table 4) are not significant. At Woburn, where the

TABLE 4

*Tick beans—mean yield cwt./acre*

	O	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	N	S <sub>2</sub> N	Mean
Rothamsted:							
Mean ( $\pm 2.0$ ) ...	25.0	23.6	26.2	26.6	23.8	23.3	24.7
Increase ( $\pm 2.9$ ) ...	—	-1.4	+1.2	+1.6	-1.2	-1.7	—
Woburn:							
Mean ( $\pm 0.9$ ) ...	11.3	13.0	12.1	12.6	17.0	16.0	13.6
Increase ( $\pm 1.3$ ) ...	—	+1.7	+0.8	+1.3	+5.7	+4.7	—

- O = No weed control.
- S<sub>1</sub> = Simazine.  $\frac{1}{2}$  lb. active material in 40 gallons/acre.
- S<sub>2</sub> = Simazine. 1 lb. active material in 40 gallons/acre.
- S<sub>3</sub> = Simazine.  $1\frac{1}{2}$  lb. active material in 40 gallons/acre.
- N = Normal inter-row cultivations.

effect of the uneven site was partly eliminated by the lay-out, the yields were considerably larger where weeds were controlled satisfactorily.

The mean yield of the worst block at Woburn was 9.5 cwt./acre and that of the best 21.3 cwt./acre. Table 5 gives the means of the

TABLE 5

*Tick beans—mean yield cwt./acre*

	O	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	N	S <sub>2</sub> N
2 poorer blocks ...	6.8	8.8	8.2	8.6	13.9	12.3
2 better blocks ...	15.6	17.0	15.7	16.6	20.1	19.7

two poorer and the two better blocks separately and shows that weed competition had a proportionately greater effect on the poorer crop.

Weeds on the potato experiment at Rothamsted were counted and their dry weights determined by the Botany Department; with results shown in Table 6. At Woburn weeds were fewer and

TABLE 6

*Potatoes—Rothamsted—mean dry weight and number of weeds/sq. yd.*

	O	N	S <sub>1</sub>	S <sub>2</sub>	S <sub>2</sub> E	S <sub>2</sub> L
Dry weight, gm. ...	88.4	8.2	63.4	31.9	7.1	1.9
Number ...	98.0	15.0	58.5	31.5	9.0	5.0

were not counted. The percentage weight of greened tubers was measured at Rothamsted and the percentage weight of blighted tubers at Woburn (Table 7).

“Simazine” alone had less effect than normal inter-row cultivations on the weed population (Table 6). Weed control was satisfactory on N and S<sub>2</sub>E treatments, but best on S<sub>2</sub>L. The weeds were counted after the S<sub>2</sub>E plots had been grubbed and earthed up, which explains why these had fewer weeds than the S<sub>2</sub> plots, though the two had similar yields.

TABLE 7

*Potatoes—mean yield tons/acre*

	O	N	S <sub>1</sub>	S <sub>2</sub>	S <sub>2</sub> E	S <sub>2</sub> L	Mean
Rothamsted:							
Yield (1) ...	8.7	14.2	9.9	11.9	11.8	12.1	11.6
% “greened” ...	8.2	16.2	13.6	13.8	10.9	6.6	12.5
Woburn: (2)							
Yield ...	21.6	24.2	19.6	21.0	22.4	19.2	21.4
% “blighted” ...	12.7	9.0	19.9	15.6	10.2	8.2	13.3

O = No weed control.

N = Normal inter-row cultivations.

S<sub>1</sub> = Simazine. ½ lb. active material in 40 gallons/acre.

S<sub>2</sub> = Simazine. 1 lb. active material in 40 gallons/acre.

S<sub>2</sub>E = Final grubbing and earthing up only after Simazine applied early.

S<sub>2</sub>L = Inter-row cultivations up to application of Simazine at emergence.

(1) = Treatments O, S<sub>2</sub>E, S<sub>2</sub>L (±0.44).

“ ” N, S<sub>1</sub>, S<sub>2</sub> (±0.31).

(2) = Treatments O, S<sub>2</sub>E, S<sub>2</sub>L (±1.51).

“ ” N, S<sub>1</sub>, S<sub>2</sub> (±1.07).

In both experiments, potatoes with normal cultivations yielded more than any of the “Simazine” treatments, even where “Simazine” was used with mechanical cultivations and weed control was good. The S<sub>2</sub>L plots were darker green in late July and August, but this difference was not reflected in the yield.

A possible explanation for the high percentage of greened tubers on the plots which had a final earthing-up, N and S<sub>2</sub>E, is that the soil loosened by this operation was later washed down by heavy rain. However, earthing-up decreased the percentage of diseased potatoes at Woburn.

In addition to the above experiments, “Simazine” was used on

early potatoes in an irrigation experiment at Woburn and on winter beans at both farms. Yields of potatoes were consistently less on the "Simazine"-treated plots, both with and without irrigation, and at two levels of nitrogen (Table 8). All plots had few weeds, which were not counted.

TABLE 8  
*Early potatoes—Woburn—mean yield tons/acre*

	ON <sub>1</sub>	CN <sub>1</sub>	ON <sub>2</sub>	CN <sub>2</sub>	Mean
Normal cultivations ...	9.1	10.9	10.4	13.1	10.8
Simazine ...	7.1	8.4	8.6	10.7	8.7
Difference ...	-2.0	-2.5	-1.8	-2.4	-2.1

O = No irrigation.

C = 2.2 inches of irrigation.

N<sub>1</sub> = 0.6 cwt. N/acre.

N<sub>2</sub> = 1.2 cwt. N/acre.

"Simazine" was applied at 1 lb. active material in 40 gallons/acre.

Yields were not taken from one winter-bean experiment because of damage by birds or from one of the two blocks of the other because of damage by acidity. The treatments included "Simazine" at 1 lb. of active material/acre applied in the autumn and 1 lb. divided equally between autumn and spring. Both controlled weeds reasonably at Woburn, but the split application was much the better at Rothamsted.

"Simazine" was less effective in 1960 than in 1959, probably because of the dry spring. The rainfall in 1960 during the 4 weeks after the beans were sprayed was 1.10 inches at Rothamsted and 1.02 inches at Woburn, and after the potatoes were sprayed was 1.52 inches and 1.15 inches. Weeds were better controlled in the potatoes than in the beans. In 1959 the weed control was excellent in the Rothamsted beans, when 2.37 inches of rain fell in the 4 weeks after spraying, moderate in the Rothamsted potatoes and Woburn beans with 1.79 inches and 1.15 inches of rain respectively, and very poor in the Woburn potatoes with only 0.64 inches. The figures suggest that rain plays a critical part in determining the effectiveness of "Simazine", which has a water solubility of only 5 p.p.m.