ROTHAMSTED RESEARCH

Report for 1959

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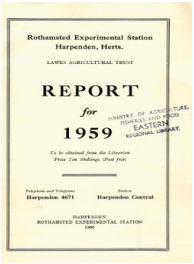

The Use of "simazine" to Control Weeds in Field Beans and Potatoes : Preliminary Report

J. R. Moffatt and M. J. Hill

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Implements

This was the first year in which the Woburn farm had its own combine-harvester and baler, and all cereal and bean crops were harvested with them. When the drier is installed the farm will be equipped with all except the most specialised machinery.

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

Preliminary report

J. R. Moffatt & M. J. Hill

Field beans are rather a " dirty " crop, as they do not grow vigorously enough to smother weeds; though inter-row cultivations can control the weeds between the rows, expensive hand hoeing is needed to kill those in the rows. The many cultivations that make potatoes a good cleaning crop are similarly expensive, and there seems evidence that they may harm the crop. The triazine derivatives, " Simazine " and " Atrazine ", which showed promise as pre-emergence herbicides with these two crops, were tested in experiments at Rothamsted and Woburn.

Both substances are poorly soluble in water, " Simazine " only 5 p.p.m. and " Atrazine " 70 p.p.m., so they are not readily washed down into the soil. Crops whose roots draw water from below the surface soil are unlikely to be affected, and whether seedlings growing in the surface soil take up toxic doses depends largely on the amount of water there.

Experimental details

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 King Edward VII on a sandy loam at Woburn. All crops were treated as usual up to planting, but shortly after weed-killer was sprayed on the soil by a tractor-mounted sprayer. The soil was left undisturbed by surface cultivations through the growing season.

All the experiments were in a single randomised-block design with threefold replication. The treatments consisted of three levels of " Simazine " ($\frac{1}{2}$ lb., 1 lb., and $1\frac{1}{2}$ lb. active material/acre), one level of " Atrazine " (1 lb. active material/acre), and plots on which weeds were not controlled. Difficulties in the layout prevented the inclusion of plots given customary cleaning operations, but the yield to be expected from such plots could be estimated from the surrounding potato crop at both Rothamsted and Woburn.

Full agricultural details of these experiments are given in Results of Field Experiments 1959.

Discussion

Weeds were counted and identified on 6 random sample areas of 180 sq. in. on each plot in June, except on the Woburn potato

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experiment, where the chemicals did not affect the weeds. Tables 1 and 2 list only the most prevalent weeds in the bean crops.

TABLE 1

Tick Beans—Rothamsted—mean weed numbers per sq. yd.

	Fat hen (*C. album*)	Meadow grass (*P. annua*)	Slender Foxtail (*A. myosuroides*)	Chickweed (*S. media*)	Black bindweed (*P. convolvulus*)	Cleavers (*G. aparine*)	Total annual weeds	Wild * oats
O	24·30	132·60	3·60	4·50	5·70	2·70	177·60	0·164
S_1	1·20	—	—	—	2·40	1·60	7·20	0·078
S_2	—	—	—	—	0·40	0·40	0·79	0·010
S_3	—	—	—	—	—	0·40	0·40	0·012
A_2	—	—	—	—	—	1·20	1·20	0·007

* Counted on whole plots in July.

TABLE 2

Tick Beans—Woburn—mean weed numbers per sq. yd.

	Fat hen (*C. album*)	Meadow grass (*P. annua*)	Redshank (*P. persicaria*)	Chickweed (*S. media*)	Black bindweed (*P. convolvulus*)	Mayweed (*M. inodora*)	Total annual weeds	Wild * oats
O	93·20	8·80	304·00	93·60	71·59	16·39	558·06	6·51
S_1	0·79	1·20	68·80	5·20	57·60	—	138·79	0·71
S_2	—	1·60	33·19	4·00	12·40	—	46·93	0·97
S_3	—	0·79	6·79	—	5·59	—	13·20	0·06
A_2	—	0·40	6·79	—	7·60	—	16·00	0·98

* Counted on whole plots in July.

TABLE 3

Tick Beans—Mean yield cwt./acre

	O	S_1	S_2	S_3	A_2	Mean
Rothamsted:						
Mean (±1·18) ...	17·9	21·1	19·6	18·5	17·7	18·8
Increase (±1·44) ...		+3·2	+1·7	+0·6	−0·2	
Woburn:						
Mean (±0·93) ...	13·5	17·3	19·1	16·0	15·2	16·2
Increase (±1·31) ...		+3·8	+5·6	+2·5	+1·7	

Sprays
S = Simazine
A = Atrazine

Levels
1 = ½ lb. active material in 40 gallons/acre
2 = 1 lb. ,, ,, 80 ,,
3 = 1½ lb. ,, ,, 120 ,,

At Rothamsted " Simazine " at ½ lb./acre (S_1) almost excluded weeds, and little further benefit was obtained from the two higher doses. At Woburn, where the initial weed infestation was higher, the weed numbers were decreased more as the doses increased; even at the highest level 1½ lb./acre (S_3), the kill was less complete than at Rothamsted. " Simazine " and " Atrazine " had similar herbidical effects.

Table 3 shows that the yield of beans was increased by controlling the weeds, but there is a suggestion that the highest levels of " Simazine " decreased yield. At Rothamsted this year, the optimum dose seemed to be about ½ lb./acre, and at Woburn 1 lb./acre.

The difference between the efficacy of the materials on the two farms can almost certainly be ascribed to the differences in rainfall during the period immediately after they were applied. At Rotham-

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sted 2·37 inches of rain fell in the four weeks after spraying, and at Woburn only 1·15 inches.

TABLE 4

Potatoes—Rothamsted—mean weed numbers per sq. yd.

	Fat hen (*C. album*)	Meadow grass (*P. annua*)	Redshank (*P. persicaria*)	Chickweed (*S. media*)	Black bindweed (*P. convolvulus*)	Cleavers (*G. aparine*)	Total annual weeds	Wild * oats
O	4·39	12·00	22·80	37·99	6·00	13·20	106·00	1·84
S_1	0·79	0·40	1·60	1·20	1·60	2·80	12·80	0·70
S_2	1·20	—	1·99	—	0·79	9·19	16·00	0·37
S_3	—	—	3·19	—	0·40	5·59	10·40	0·56
A_2	—	—	—	—	0·40	1·60	4·00	0·29

* Counted on whole plots in July.

TABLE 5

Potatoes—mean yield tons/acre

	O	S_1	S_2	S_3	Mean	A_2 *	Mechanical * weed control
Rothamsted: (±0·941)	4·55	11·91	11·81	11·16	9·86	12·40	13·66
Woburn: (±0·721) ...	3·16	3·96	4·57	3·60	3·82	3·64	9·59

* Yields from treated strips outside experimental area.

Sprays	*Levels*
S = Simazine	1 = ½ lb. active material in 40 gallons/acre
A = Atrazine	2 = 1 lb. ,, ,, 80 ,,
	3 = 1½ lb. ,, ,, 120 ,,

Table 4 shows that in the potatoes at Rothamsted all weeds except cleavers (*Galium aparine*) were controlled. "Simazine" at ½ lb./acre (S_1) dramatically decreased the population, and the two higher rates (S_2 and S_3) had no further effect. Table 5 shows the effect of weed competition on yields. As with the beans, "Simazine" at more than ½ lb./acre tended to lower the yield. The rainfall in the first 4 weeks after spraying was 1·79 inches and in the second 4 weeks 1·30 inches.

At Woburn neither weed-killer was effective, and the whole area became very weedy. The very low yields (Table 5) reflect the effect of intense competition with weeds in the dry light soil. The failure of the chemicals to control weeds at Woburn can be ascribed to the little rain, only 0·64 inch in the first 4 weeks and 0·51 inch in the second 4 weeks after spraying.

Yields of tubers from land adjoining the experimental areas on both farms suggest that "Atrazine", at 1 lb./acre behaved like "Simazine", and that controlling weeds by customary cultivations increased yield still further (Table 5). No errors can be given for these plots, however, and the figures can only be treated as a guide. The apparent superiority of mechanical cultivation over "Simazine" can be attributed to its greater success in controlling cleavers. By the end of the season this weed had formed an almost complete cover over the plots treated with "Simazine" or "Atrazine", for though the initial population of cleavers was small, the plants had no competition from other weeds and grew vigorously.

The combined effects of the drought and weed competition at Woburn led to a high proportion of partly shrivelled tubers. These amounted to 50% of the crop for the sprayed area but only 17% on plots where weeds were controlled by cultivations. A range of

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crops will be grown on the sprayed land in 1960 to observe any residual effects.

In addition to the above experiments, some trial strips of winter beans were treated with "Simazine" and "Atrazine" in March 1959 when the crop was 4–5 inches high. Weeds already present were affected but were not killed by the spray, but the treated plots contained very few weeds that germinate in spring. Mayweed (*Matricaria inodora*), which was plentiful on the unsprayed strips, was well controlled. Beans on strips treated with "Atrazine" at 1 lb./acre, were stunted and damaged, but those treated with "Simazine" at ½, 1 or 1½ lb./acre were not visibly affected. Table 6 shows no loss of yield from the two smaller doses of "Simazine".

TABLE 6

Winter beans—Rothamsted—cwt./acre from unreplicated trial strips

O	S_1	S_2	S_3	A_2
27·8	27·4	27·9	24·3	21·3

The results in 1959 experiments, a year of exceptional weather, are considered promising and interesting enough to warrant further study.

The effect of two plant-growth hormones on the pod set and yield of field beans

J. R. Moffatt & M. J. Hill

Despite many husbandry experiments, progress in improving the yield of the field bean (*Vicia faba*) has been small. The yield depends on the number of pods which come to harvest, the number of seeds per pod and the weight of the seeds. Between varieties the weight of the individual seed and the number of seeds in each pod differ considerably, but within one variety these two factors are little affected by changes in field conditions. Only a small proportion of the flowers set pods that survive to harvest. The proportion that sets on individual plants depends on conditions in the crop, particularly on plant density, but the proportion per unit area of land does not, except at extremes.

In 1955 and 1956 field experiments of the randomised block type tested the effect of two plant-growth hormones, 4-chlorophenoxyacetic acid and α-(2 : 4 : 5-trichlorophenoxy) propionic acid, on the set of pods by spring-sown tick beans. The hormones were applied as a fine spray at a concentration of 5 p.p.m. starting soon after the first flowers opened. One lot of plants was sprayed twice, the two sprayings approximately a week apart, and another was sprayed weekly throughout the flowering period.

In 1957 only 4-chlorophenoxyacetic acid was used and the spraying was superimposed on an irrigation experiment at Woburn which incorporated a dung treatment. The plots were sprayed three times.

In all years yields were taken with a combine-harvester and pods were counted. In 1956 the seeds per pod were counted and the

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