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Rothamsted Experimental Station Report for 1965

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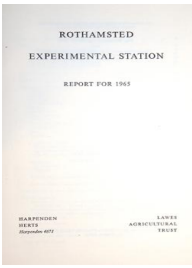

Cultivation Weedkiller Experiments

J. R. Moffatt

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Cultivation Weedkiller Experiment—Rothamsted and Woburn Report for Years 1961–65

By J. R. Moffatt

In 1961 an experiment was started at Rothamsted and Woburn to measure the immediate and residual effects of herbicides and to see how far weed control by chemicals can simplify field cultivations. The four-course rotation is wheat, potatoes, barley and beans; when conditions are suitable wheat and beans are sown in autumn.

The experiment tests three primary cultivations on each crop in each year:

P the land is mouldboard ploughed followed by seedbed-producing operations.
R the land is rotary cultivated once or twice, but is not mouldboard ploughed.
T the land is worked with a deep-tined cultivator two or three times followed by seedbed-producing operations; it is not mouldboard ploughed or rotary cultivated.

In combination with the primary cultivations there are three systems of post-planting weed control in beans and potatoes:

M mechanical cultivations.
Sx residual herbicides.
Sy residual herbicides differing from Sx in material or time of application.

The M plots get only mechanical operations appropriate to the crop. The Sx and Sy plots have no mechanical operations after planting unless they are done in conjunction with the spray.

In addition, there is a test of hormone herbicide (H) *v.* none (O) on wheat and barley. All treatments are cumulative; herbicide rates are given in terms of active ingredients.

The experimental area is divided into four series, one for each phase of the rotation. Each series consists of two randomised blocks of 12 whole plots, nine plots carrying the nine combinations of primary cultivations and weed control systems. The remaining three plots were "reserve" plots and had the PM treatments, but two are now used as follows:

Since 1964 one plot per block is ploughed in autumn for autumn-sown crops, and for spring crops is spring rotary cultivated only. The object is to see whether delaying cultivations for spring crops affects yields, and whether, in a dry spring, the moisture conserved by giving only one

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cultivation just before sowing is beneficial. So far yields are similar to those from conventional cultivations.

Starting in 1965/66 another plot per block will be used to compare existing treatments with a system of minimum cultivations, with sprays, for all four crops.

The effect of the primary cultivation treatments and the continued application of herbicides on soil conditions is being watched. The growing plants are considered to be the best indicators of physical soil conditions, and detailed studies will be undertaken should differences in yield appear between the primary cultivations. Samples of topsoil have been taken from two plots that have been sprayed twice with simazine and once with prometryne, and from one unsprayed plot. The soils will be compared to see whether the sprayed ones have developed a micro-flora adapted to decompose simazine. Soil samples (0–8 in.) taken in 1965 show that the percentage of organic carbon differs between main cultivation treatments. P 1·46, R 1·53, T 1·58

The experiment began on a field ploughed in December 1960. In the first year the R treatment for spring wheat, spring barley and spring beans was one rotary cultivation; the P and T plots were disc harrowed. Since then, all cultivations for winter-sown crops have been done shortly before drilling. For spring-sown crops treatment P is always done in autumn, and R and T are done some in autumn and some in spring. T treatments usually consist of two or three passes with a heavy cultivator, each at a different angle. The P treatment is about 8 in. deep, the T about 6–7 in. deep and the R treatment produces 8–10 in. of tilth for potatoes and 5–6 in. for cereals and beans.

The plots are 50 ft long by 42 ft wide. There is a 7-ft discard between them and each has a 7-ft sideland each side, making 21 ft for turning implements when working across the plots. The remaining 28-ft width is split for the test of hormone herbicides on cereals, and these sub-plots are harvested separately for all crops. Cereal rows are 7 in. apart, and 16 rows are combine-harvested on each sub-plot. Potato rows are 28 in. apart, and the four centre rows of each sub-plot are taken for yield. Spraying is done on a rounded surface left by a ridge roll. Until 1963 beans were drilled at 21-in. spacing; in 1964 the Sx and Sy plots were drilled at 10½ in., the M remaining at 21 in. to permit inter-row cultivations. At 21-in. spacing five rows per sub-plot were combine-harvested and 11 rows at 10½-in. spacing. In autumn 1964 the barley stubble would not pass between the drill coulters on the TSx and TSy plots, and these had to be drilled at 21-in. spacing. The only other operational difficulty encountered was the lack of suitable soil in most years for earthing up potatoes on the TM plots. Full agricultural details are given in "(Numerical) Results of Field Experiments" each year.

Each year weeds on sample areas of the potato and bean plots are identified and counted, and general observations are made on the weediness of the cereal blocks. Couch grass (*Agropyron repens*) has been present since the start of the experiment, and each year some areas have been sprayed to control it.

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1961/62 Stubble sprayed with dalapon for wheat, beans and potatoes.
1962/63 Stubble sprayed with dalapon for wheat.
1963/64 Stubble sprayed with dalapon for beans and potatoes.
Potato ground sprayed with TCA for barley.
1964/65 Stubble sprayed with aminotriazole for wheat and potatoes.
Potato ground sprayed with TCA for barley.

Beans. Winter beans were grown in 1963 and 1965. Each year the T plots had three main cultivations, and the R plots had two in 1962/63 and one in 1964/65. Some plots were sprayed with simazine at 2 lb/acre in autumn (Sx); others had 1 lb in autumn and 1 lb in spring (Sy). In both years the PM yield, despite more weeds, was significantly bigger than the PSx or PSy, but the TM and TSx yield was significantly less than the TSy, which had far fewer weeds. In 1965 the RM yield was significantly bigger than either spray treatment, but not because weeds were fewer.

TABLE 1

Winter beans 1963 and 1965

		P	R	T	Mean
		Grain at 85% DM cwt/acre			
	M (±2·57)	39·1	27·5	31·5	32·7 (±1·48)
1963	Sx (±2·57)	33·8	33·9	29·7	32·4 (±1·48)
	Sy (±2·57)	33·0	32·5	34·8	33·4 (±1·48)
Mean	(±1·48)	35·3	31·3	32·0	32·8
	M (±1·99)	28·5	29·4	24·6	27·5 (±1·15)
1965	Sx (±1·99)	23·4*	22·2*	24·3	23·3 (±1·15)
	Sy (±1·99)	21·3*	22·3*	28·6	24·1 (±1·15)
Mean	(±1·15)	24·4	24·7	25·8	25·0
Mean	M (±1·62)	33·8	28·4	28·1	30·1 (±0·94)
1963/5	Sx (±1·62)	28·6	28·1	27·0	27·9 (±0·94)
	Sy (±1·62)	27·2	27·4	31·7	28·8 (±0·94)
Mean	(±0·94)	29·8	28·0	28·9	28·9
		Non-gramineous weed numbers per sq yd			
	M	163 (260)	80 (153)	94 (166)	112·3 (193·0)
1963	Sx	71	99	125	98·3
	Sy	7	15	23	15·0
	M	68 (90)	88 (106)	152 (160)	102·7 (118·7)
1965	Sx	45	107	129	93·7
	Sy	4	7	11	7·3
Mean		59·7 (175)	66 (129·5)	89 (163)	71·6 (155·8)

M = inter-row cultivations
Sx = simazine in autumn
Sy = simazine ½ in autumn, ½ in spring
* = 10½-in. rows ( ) = weeds in rows

Although there were fewer weeds on each prime cultivation treatment from the divided spray, there was little effect on yield of the P and R treatments. The T treatment, however, gave a significantly bigger yield each year.

Spring beans in 1962 got three T cultivations in autumn and one R cultivation in autumn and one in spring; in 1964 there were two T cultivations in autumn and one R cultivation in autumn and one in spring. Simazine was applied each year in one dose at 2 lb/acre. This gave fewer

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TABLE 2

Winter beans—grain cwt/acre at 85% DM
Mean herbicide differences (autumn—divided dressing) 1963 and 1965

	P	R	T	Mean
1963 (±3·63)	0·8	1·4	−5·1	−1·0 (±2·10)
1965 (±2·81)	2·1	−0·1	−4·3	−0·8 (±1·62)
Mean (±2·30)	1·4	0·6	−4·7	−0·9 (±1·33)

weeds than the plots given inter-row cultivations, but the yields, which were very consistent within each year, differed little. There was no effect of the primary cultivation treatments.

TABLE 3

Spring beans 1961, 1962 and *1964*

			P	R	T	Mean
			Grain at 85% DM cwt/acre			
1961	M	(±1·97)	17·9	19·0	18·8	18·6 (±1·14)
	S	(±1·39)	18·9	19·7	17·7	18·8 (±0·80)
	Mean	(±1·14)	18·6	19·5	18·1	18·7
1962	M	(±2·72)	27·0	31·1	27·8	28·6 (±1·57)
	S	(±1·92)	29·4	30·0	28·1	29·2 (±1·11)
	Mean	(±1·57)	28·6	30·3	28·0	29·0
1964	M	(±1·53)	29·7	28·9	29·1	29·2 (±0·88)
	S	(±1·08)	27·0*	25·5*	26·6*	26·4 (±0·62)
	Mean	(±0·88)	27·9	26·6	27·4	27·3
1961,	M	(±1·23)	24·9	26·3	25·2	25·5 (±0·71)
62, 64	S	(±0·87)	25·1	25·1	24·1	24·8 (±0·50)
	Mean	(±0·75)	25·0	25·7	24·7	25·1
			Non-gramineous weed numbers per sq yd			
1961	M		24 (32)	50 (68)	47 (86)	40·3 (68·7)
	S		3	1	1	1·7
1962	M		4 (21)	5 (26)	16 (46)	8·3 (31·0)
	S		8	11	14	16·5
1964†	M		14 (7)	23 (12)	31 (20)	29·3 (13·0)
	S		2	3	8	6·5
Mean			9·2 (20)	15·5 (40·3)	19·5 (50·7)	18·8 (37·6)

M = inter-row cultivations
S = simazine
* = 10½-in. rows
( ) = weeds in rows
† = counts made after harvest

Wheat. For the 1962 crop of spring wheat three T cultivations were done in autumn; one R cultivation was done in autumn and another in spring. For the 1963 crop two T cultivations and one R cultivation were done all in spring. For winter wheat in 1963/64 there were two T and one R cultivations, and in 1964/65 three T and one R cultivations.

The herbicides used (at recommended rates and stage of growth) were:

1961 mecoprop
1962 and 1963 dicamba/MCPA
1964 and 1965 mecoprop/2,4-D

Their use made the yield of the P plots less in all years and of the T plots in 4 of the 5 years. In 1965 yield was significantly decreased by sprays

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with all cultivation treatments. Observations showed that the crops looked very uniform each year, but the hormone-sprayed plots had fewer weeds.

TABLE 4

Wheat—grain cwt/acre at 85% DM
Mean response to herbicides. Hormone—no spray

		P	R	T	Mean
Spring Wheat	1961 (±0·90)	−2·2	−1·9	−1·8	−2·0 (±0·52)
	1962 (±0·74)	−2·7	0·1	−2·9	−1·8 (±0·42)
	1963 (±1·15)	−2·3	0·8	0·3	−0·4 (±0·67)
Winter Wheat	1964 (±1·24)	−3·2	0·2	−0·3	−1·1 (±0·72)
	1965 (±0·82)	−3·5	−5·2	−3·9	−4·2 (±0·47)
Mean	(±0·44)	−2·8	−1·2	−1·7	−1·9 (±0·25)

The residual effects of herbicides applied to the preceding bean crop were generally small. The P plots show a slight benefit in 3 of the 4 years, the R plots show a slight benefit in 3 years and a significant benefit in 1965; the T plots show a slight depressing effect each year. Prime cultivation effects varied slightly from year to year, but the means over 4 years were very similar.

TABLE 5

Wheat—grain cwt/acre at 85% DM
Residual effects of treatments to beans 1961–64

Treatment to beans			P	R	T	Mean
1962	M	(±1·76)	32·5	33·2	35·1	33·6 (±1·02)
	S	(±1·24)	31·5	34·0	33·4	33·0 (±0·72)
1963	M	(±1·71)	35·4	36·4	36·4	36·1 (±0·99)
	S	(±1·21)	36·8	36·8	35·2	36·2 (±0·70)
1964	M	(±2·64)	44·6	45·0	43·5	44·3 (±1·52)
	S	(±1·87)	45·0	45·2	42·8	44·3 (±1·08)
1965	M	(±1·20)	47·6	45·9	48·9	47·5 (±0·69)
	S	(±0·85)	47·9	48·4	47·1	47·8 (±0·49)
Mean	M	(±0·95)	40·0	40·1	41·0	40·4 (±0·55)
	S	(±0·67)	40·3	41·1	39·6	40·3 (±0·39)
	Mean	(±0·55)	40·2	40·6	40·3	40·4

M = no spray
S = residual sprays

	P	R	T	Mean
1962–5 (M–S) (±1·16)	−0·3	−1·0	1·4	0·0 (±0·67)

Potatoes. Cultivation treatments for potatoes were very similar each year. Three T cultivations were given in the autumn for the crops of 1962 and 1965 and two for the years 1963 and 1964. The R plots were given one cultivation in autumn or winter and one in spring each year, except that in 1964 two spring cultivations were necessary to get the required depth.

Different herbicides or mixtures of herbicides, with some timing differences, were used. In 1961 simazine was applied to some plots immediately after planting, and to others in early June after inter-row cultivations. Simazine at 2 lb/acre lessened the yield on the R and T plots, more when applied early than late, though weed numbers were similar. The PM plots gave an unexplained small yield (10·40 tons/acre), and the simazine-sprayed plots yielded more. However, the mean of the reserve plots with

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the same PM treatment yielded considerably more (12·57 tons/acre) than the sprayed plots.

In 1962 a pre-emergent application of prometryne was compared with one after early cultivations. The pre-emergent spray lessened the yield of the P, R and T treatments; the late spray gave variable results. In 1961 and 1962 the late spraying on the R treatment did best.

TABLE 6

Potatoes 1961, 1962

			P	R	T	Mean
			Total tubers—tons/acre			
	M		10·40*	12·85	13·44	12·23
1961	Sx	(±0·893)	11·91	11·26	12·16	11·78 (±0·516)
	Sy		12·01	13·64	12·29	12·65
	Mean	(±0·516)	11·44	12·58	12·63	12·22
	M		14·97	15·44	14·44	14·95
1962	Sx	(±1·031)	14·09	12·63	12·15	12·95 (±0·595)
	Sy		13·11	15·51	14·29	14·30
	Mean	(±0·595)	14·06	14·53	13·62	14·07
	M		12·63	14·14	13·94	13·59
Mean	Sx	(±0·682)	13·00	11·94	12·16	12·37 (±0·394)
1961,2	Sy		12·56	14·58	13·29	13·48
	Mean	(±0·394)	12·75	13·55	13·13	13·15
			Mean non-gramineous weed numbers per sq yd			
	M		6	6	8	6·7
1961	Sx		6	10	7	7·7
	Sy		4	2	4	3·3
	M		1	2	2	1·7
1962	Sx		22	16	10	16·0
	Sy		1	1	3	1·7
	Mean		6·7	6·2	5·7	6·2

M = mechanical cultivations
Sx = simazine early 1961
prometryne pre-emergent 1962
Sy = simazine after early cultivations 1961
prometryne after early cultivations 1962
* = reserve plots with same treatment gave mean yield 12·57

In 1963 prometryne was mixed with paraquat (2 lb prometryne, 0·75 lb paraquat) and was used on all sprayed plots. In 1964 and 1965 mixtures of prometryne (2 lb/acre) + paraquat (0·75 lb/acre) and linuron (2 lb/acre) + paraquat (0·75 lb/acre) were compared when applied just before emergence. There was little difference in yield from the two mixtures, though linuron gave better weed control.

TABLE 7

Potatoes—total tubers tons/acre
Mean herbicide differences (x-y) 1964, 1965

		P	R	T	Mean
1964	(±1·083)	−0·48	0·27	−1·93	−0·71 (±0·625)
1965	(±0·590)	0·92	−0·35	0·71	0·43 (±0·341)
Mean	(±0·616)	0·22	−0·04	−0·61	−0·14 (±0·356)

x = prometryne plus paraquat
y = linuron plus paraquat

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The yield of the M, Sx and Sy plots, and the P, R and T plots for the years 1963–65 show little difference, but there is an indication that in 1964 the weeds on the unsprayed RM and TM plots lessened the yield. In 1964 one TSx plot had very many thistles (*Cirsium arvense*), and there were considerable numbers on one PSy and TM plot. These were pulled before

TABLE 8

Potatoes 1963–1965

			P	R	T	Mean
			Total tubers—tons/acre			
1963	M	(±0·532)	14·58	13·37	13·88	13·94 (±0·307)
	Sx	(±0·376)	13·40	13·90	13·84	13·71 (±0·217)
	Mean	(±0·307)	13·79	13·72	13·85	13·79
1964	M		10·60	9·11	7·73	9·15
	Sx	(±0·766)	10·61	10·35	10·30	10·42 (±0·442)
	Sy		11·09	10·08	12·23	11·13
	Mean	(±0·442)	10·77	9·84	10·09	10·23
1965	M		19·05	19·83	20·30	19·73
	Sx	(±0·417)	19·29	18·97	20·09	19·45 (±0·241)
	Sy		18·37	19·32	19·38	19·02
	Mean	(±0·241)	18·90	19·37	19·92	19·40
Mean 1964/5	M		14·82	14·47	14·02	14·44
	Sx	(±0·436)	14·95	14·66	15·20	14·94 (±0·252)
	Sy		14·73	14·70	15·80	15·08
	Mean	(±0·252)	14·83	14·61	15·01	14·82
			Mean non-gramineous weed numbers per sq yd			
1963	M		5	16	17	12·7
	Sx		1	5	1	2·3
1964*	M		29	53	59	47·0
	Sx		5	23	12	13·3
	Sy		3	14	5	7·3
1965	M		10	29	10	16·3
	Sx		10	20	7	12·3
	Sy		1	2	4	2·3
	Mean		8·0	20·3	14·4	14·2

M = mechanical cultivations
Sx = prometryne plus paraquat
Sy = linuron plus paraquat
* = thistles pulled before weeds counted

weeds were counted, and since then any big weeds in the M plots have been hand pulled, as is customary with unsprayed potatoes at Rothamsted. In 1964 there was a lot of couch grass (*Agropyron repens*) on both PSx plots, and one TM and TSx plot. In 1965 one PSx plot had a lot of couch.

TABLE 9

Potatoes 1963–65—total tubers tons/acre
Mean yield of cultivated and sprayed plots

		P	R	T	Mean
M	(±0·340)	14·74	14·10	13·97	14·27 (±0·196)
S	(±0·240)	14·36	14·42	14·95	14·58 (±0·139)
Mean	(±0·196)	14·49	14·31	14·62	14·44

M = mechanical cultivation
S = sprayed

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The mean yields of the sprayed plots for the 3 years 1963–65 are slightly bigger than those of the mechanically treated plots, and the P, R and T yields are very similar. There were no treatment differences in the percentage ware ($1\frac{1}{2}$-in. riddle) in any year.

Barley. The T plots were cultivated twice in autumn for the 1962, 1964 and 1965 crops, but only once in spring for the 1963 crop. R cultivations were done in autumn and again in spring for the 1962 and 1964 crops, but only once for the 1963 and 1965 crops.

The herbicides used (at recommended rates and stage of growth) were:

1961 mecoprop
1962 and 1963 dicamba/MCPA
1964 and 1965 mecoprop/2,4-D

The hormone spray decreased the 5-year mean yield on the P and R plots, but increased it on the T plots. Field observations were:

1961 None.
1962 No lodging, few weeds, no apparent plot differences.
1963 Leaning or laid, no other observations possible.
1964 Leaning or laid, many weeds on unsprayed plots, few on sprayed.
1965 Badly laid, sprayed plots worst. Many weeds on unsprayed plots, few on sprayed.

TABLE 10

Barley—grain cwt/acre at 85% DM
Mean response to herbicides. Hormone—no spray

		P	R	T	Mean
1961	(±1·03)	−0·9	−0·8	0·2	−0·5 (±0·59)
1962	(±0·92)	−2·0	−2·3	−0·9	−1·7 (±0·53)
1963	(±1·89)	0·2	−1·9	3·4	0·6 (±1·09)
1964	(±1·43)	0·8	1·0	5·9	2·5 (±0·83)
1965	(±0·57)	−0·6	−1·3	−1·8	−1·2 (±0·33)
Mean	(±0·56)	−0·5	−1·1	1·4	−0·1 (±0·32)

The residual effects of the herbicide to the preceding potatoes on yield were small, but positive each year on the P plots; the means of the R

TABLE 11

Barley—grain cwt/acre at 85% DM
Residual effects of treatments to potatoes 1961–64

Treatment to potatoes			P	R	T	Mean
1962	M	(±2·27)	40·5	41·0	38·3	39·9 (±1·31)
	S	(±1·61)	42·5	39·3	38·4	40·0 (±0·93)
1963	M	(±1·35)	42·8	39·2	43·6	41·8 (±0·78)
	S	(±0·95)	43·0	40·1	41·1	41·4 (±0·55)
1964	M	(±0·88)	50·6	50·8	48·1	49·8 (±0·51)
	S	(±0·62)	51·5	49·3	50·5	50·4 (±0·36)
1965	M	(±1·34)	38·1	39·4	40·7	39·4 (±0·77)
	S	(±0·95)	39·7	41·1	39·4	40·1 (±0·55)
Mean	M	(±0·77)	43·0	42·6	42·7	42·7 (±0·44)
	S	(±0·55)	44·2	42·4	42·3	42·9 (±0·32)
	Mean	(±0·44)	43·6	42·5	42·5	42·9

M = no spray
S = residual sprays

	P	R	T	Mean
1962–5 (M–S) (±0·95)	−1·2	0·2	0·4	−0·2 (±0·54)

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and T treatments were very similar and gave no indication of any residual effects. There was no difference in yield between the three prime cultivation treatments.

At Woburn an experiment was done in 1960 without prime cultivation treatments, to compare simazine applied at different rates and times to potatoes and a hormone spray with no spray to barley. The site was ploughed early in 1960. The potato treatments were:

0 No cultivation, no spray.
M Mechanical cleaning cultivations.
1 No cultivations, 1 lb/acre simazine.
2 No cultivations, 2 lb/acre simazine.
2E 2 lb/acre simazine, then grubbed and earthed up.
2L Grubbed and earthed up, then 2 lb/acre simazine before emergence.

TABLE 12

Potatoes 1960—total tubers tons/acre

	O	M	1	2	2E	2L	Mean
Mean	21·61 (±1·514)	24·24	19·56 (±1·071)	21·01	22·38 (±1·514)	19·15	21·42
Increase		+2·63	−2·05 (±1·906)	−0·60	+0·77 (±2·201)	−2·46	

Yields from M treatments exceeded those from any with simazine, three of which produced less than treatment O, although plots with this treatment became very weedy.

The barley was sprayed with TBA/MCPA at the recommended rate and stage of growth. There was little effect on yield.

TABLE 13

Barley 1960—grain cwt/acre 85% DM

O	Sprayed	Mean	Difference
21·9	22·6	22.3	0·7 (±0·47)

In 1961 the experiment was redesigned to include a comparison of prime cultivation treatments similar to those in the Rothamsted experiment (P, R and T). Similar spray treatments (Sx, Sy) were given to potatoes, but the site was so weedy that the O *v.* hormone spray test on barley was made dependent on the number of weeds, and herbicide was applied to all plots each year.

The limitations of the site imposed a two-course rotation, which until 1963 was potatoes and barley, and both crops were grown each year. Because of the presence of potato cyst-nematode (*Heterodera rostochiensis*), sugar beet replaced potatoes in 1964 and 1965 without herbicides. The soil is a light sandy loam.

The plot size is the same as at Rothamsted, but there is no discard area between the plots. Methods of cultivation, drilling and harvesting were the same. Weeds on sample areas of the potato and barley plots were identified and counted in 1962 and 1963.

Potatoes. In 1961 the P and R treatments were done once in spring and T cultivations twice. Simazine was applied either after planting or after

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early cultivations and earthing up. The crop was damaged by two frosts at the end of May, and because of the dry summer did not recover, so yields were small. The lack of rain also prevented the simazine applied early from acting fully, and the plots became so weedy that they were cultivated and ridged in late May and June; yields were measured, but they mean little. Applying simazine late gave larger yields than did M with each of the P, R and T treatments.

TABLE 14

Potatoes 1961—total tubers tons/acre

	P	R (±0·654)	T	Mean (±0·378)
M	6·86	7·54	7·46	7·28
Sx	2·37	2·61	1·28	2·08
Sy	9·33	8·14	7·89	8·45
Mean (±0·378)	6·18	6·09	5·54	5·93

M = mechanical cultivations
Sx = 1 lb/acre simazine early, after planting
Sy = 1 lb/acre simazine late, after cultivations

In 1962 prometryne replaced simazine; the first spray was given just before the crop emerged, when weeds were many, the late spray after early mechanical cultivations. T plots were cultivated three times in winter and the R plots once in spring. Weeds were counted on the Sx plots at the first spraying, and those surviving were counted on all plots at the end of June. There were few on the M and Sy plots but more on the Sx plots with all prime cultivation treatments, and the yield of the RSx and TSx plots was small. Prometryne after early cultivations controlled weeds almost as well as M, but gave less yield on all prime cultivation treatments.

TABLE 15

Potatoes 1962

	P	R	T	Mean
	Total tubers—tons/acre			
		(±1·245)		(±0·719)
M	11·51	12·88	13·15	12·52
Sx	11·81	8·99	8·21	9·67
Sy	10·36	11·37	12·31	11·35
Mean (±0·719)	11·23	11·08	11·23	11·18
	Mean weed numbers per sq yd			
M	0	1	2	1
Sx (at spraying)	778	1503	2227	1503
Sx (after spraying)	91	100	193	128
Sy (after spraying)	9	16	16	14
Mean (excluding Sx at spraying)	33·3	39·0	70·3	47·5

M = mechanical cultivation
Sx = 2½ lb prometryne—pre-emergent
Sy = 2½ lb prometryne—after early cultivation

In 1963 a mixture of prometryne (2½ lb/acre) and paraquat (0·75 lb/acre) was sprayed before the crop emerged. The T plots were deep cultivated twice in winter, and the R plots rotary cultivated in winter and again in spring. Weeds were few on all plots, but the sprayed plots yielded more than did M plots with all prime cultivation treatments, none of which affected yield.

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TABLE 16

Potatoes 1963

		P	R	T	Mean
		Total tubers—tons/acre			
M	(±1·204)	11·48	11·86	10·89	11·41 (±0·695)
S	(±0·851)	13·04	12·54	14·14	13·24 (±0·491)
Mean	(±0·695)	12·52	12·31	13·05	12·63
		Mean weed numbers per sq yd after spraying			
M		5	22	11	12·7
S		22	28	20	23·3
Mean		13·5	25	15·5	18·0

M = mechanical cultivations
S = prometryne (2½ lb) + paraquat (0·75 lb)

Sugar beet. In 1964 and 1965 sugar beet replaced potatoes. In each year the P plots were ploughed and the T plots twice deep cultivated in winter; the R plots were cultivated twice, once in winter and once in spring for the 1964 crop, and twice in spring for the 1965 crop. No sprays were used. In neither year did the P, R or T treatment have any appreciable effect on yield of roots, tops or total sugar.

TABLE 17

Sugar beet—total sugar cwt/acre
Mean yield 1964, 1965

		P	R	T	Mean
1964	(±1·79)	53·2	55·1	53·0	53·7
1965	(±2·88)	72·5	72·0	71·7	72·1
Mean	(±1·70)	62·8	63·6	62·4	62·9

Barley. As all the barley plots were sprayed with hormone herbicide each year, the only two factors under test were the prime cultivation treatments, and the residual effect of herbicides to the preceding potato crop.

Prime cultivation treatments had little effect on yields, which were very small in years 1961–64, when little N was given (64 units N 1961, 56 units N 1962, 1963 and 1964). In 1965, a wet year, there were three levels of N (60, 85 and 110 units), and the yields for 1965 are the mean of the three levels.

TABLE 18

Barley—grain cwt/acre at 85% DM
Mean responses 1961–65

		P	R	T	Mean
1961	(±0·72)	21·8	22·4	20·6	21·6
1962	(±1·28)	19·3	21·1	19·8	20·1
1963	(±0·67)	24·6	24·3	23·7	24·2
1964	(±1·70)	16·4	14·7	16·9	16·0
1965	(±0·57)	42·6	42·5	40·8	41·9
Mean	(±0·48)	24·9	25·0	24·4	24·8

There was a slight residual effect of the simazine in 1961 with R and T treatments but not with P. In 1962 simazine had a bigger residual effect on all treatments, perhaps on the RSx and TSx plots partly because of the

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