WEED CONTROL IN SOYA BEANS UNDER DIFFERENT SOIL AND CLIMATIC CONDITIONS

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Summary

Several herbicide combinations were evaluated for weed control in soya beans (*Glycine max*) over two growing seasons in the main soya bean producing areas of New Zealand. Crop yield and the weed dry matter data suggest that combinations of trifluralin or alachlor with chloroxuron or linuron should provide good weed control in most situations. Combinations of trifluralin and metribuzin were inconsistent and metolachlor also gave poor weed control. The choice of herbicides will depend to a large extent on the main weeds of the area, although climatic and edaphic factors would have to be taken into account.

INTRODUCTION

Weed control is one of the most important agronomic considerations in the successful production of soya beans. Most soya bean production areas are infested with a variety of broadleaf as well as grass weeds. Combinations of herbicides are therefore necessary to provide broad spectrum weed control.

A number of herbicide combinations for weed control in soya beans has been available for several years (Matthews 1975; Wax 1973). Most of the weed control work in this crop in New Zealand has been done in the Waikato (Burney 1971) and in the Auckland districts (Piggot and Honore 1977), but no data on the comparative effectiveness of various treatments are available in all soya bean growing areas. The work reported here tested the available herbicides for soya beans over a 2 year period in the areas suitable for soya bean production in New Zealand.

MATERIALS AND METHODS

Eight field trials were conducted over two growing seasons between 1977 and 1979. The location of the trial sites, their soil properties and rainfall data are presented in Table 1. A randomised block design with four replications was used for all the trials. Individual plots were 6 x 2 m. Soya beans cv 'Amsoy' were planted at 60 kg/ha in rows 35 cm apart by a Stanhay precision seeder in November.

The herbicides were applied in a spray volume of 350 litres/ha at a pressure of 210 kPa. Immediately after application pre-plant soil incorporated (ppsi) treatments viz. trifluralin and vernolate, were rotary hoed to about 10 cm depth followed by a light rolling. The two post-emergence treatments were applied with 1 litre surfactant when the first trifoliate leaves had fully developed.

Number of soya bean plants per linear metre was counted 6 weeks after sowing at four randomly selected sites in each plot. Dry matter (DM) weights of the crop and weeds were determined from duplicate 0.1 m^2 samples from each plot. At maturity three 4-m rows were harvested from

Table 1. Details of trial sites.

Trial Location	Year Sown	Soil Type*	Sand %	Clay %	OM %	Rainfall (mm)** 1 month	5 months
1. Helensville	1977	Whanaki sand	54	19	10.5	110	365
2. Helensville	1978	Whanaki sand	54	19	10.5	60	385
3. Tuakau	1977	Patumahoe c.l.	22	29	8.6	130	465
4. Tuakau	1978	Patumahoe c.l.	22	29	8.6	120	550
5. Hamilton	1978	Horotiu s.l.	55	17	13.8	103	550
6. Hamilton	1978	Hamilton c.l.	31	32	8.2	110	540
7. Matamata	1977	Waihou s.l.	49	17	14.2	124	320
8. Gisborne	1977	Makaraka si.l.	16	38	4.8	112	405

* s.l. - sandy loam, si.l. - silt loam, c.l. - clay loam
** From the date of seeding.

each plot, threshed and the seed dried to 12% moisture content for yield determinations. Visual ratings on the growth and vigour of the crop and on weed control were also recorded two to three times during the growing season.

RESULTS AND DISCUSSION

The average yield of soya beans and the effectiveness of various treatments varied considerably between the eight trials (Table 2). Data on crop tolerance showed some burning of the crop from the post-emergence treatments (Treatments 3,8,9) in most trials and the damage was very noticeable in Trials 5 and 7. However, the crop recovered fully within a month after application and no signs of damage were apparent afterwards. Data on crop tolerance in the later growth stages and the weed dry matter indicated clearly that the reductions in seed yield, where noted, were largely due to the lack of weed control and not as a result of the crop damage. Soya beans also showed good tolerance to all the ppsi treatments and the pre-emergence herbicides in all trials.

As all the trials were located on land which had been cultivated and cropped in previous years, most sites had a fair infestation of both the grass weeds (mainly warm zone grasses) and broadleaf weeds. The main broadleaf weeds differed between sites and this appeared to be a major factor responsible for large variations in the efficacy of herbicides from one trial to another (Table 3). For example, the Gisborne trial (Trial 8) had very few Solanaceae weeds but large numbers of *Amaranthus* spp and *Polygonum* spp. Thus all the combinations of trifluralin gave excellent weed control on this site but treatments containing alachlor or metolachlor were not very effective. The situation was reverse in Trial 2 where due to greater proportion of Solanaceae weeds most trifluralin based mixtures were relatively ineffective and alachlor combinations proved the best.

Data on percentage cover of weeds showed that all the 'grass herbicides' viz. alachlor, metolachlor, trifluralin and vernolate provided acceptable control of grasses. It was the lack of control of one or more broadleaf weeds which led to a reduction in soya bean yields. Combinations of trifluralin and metribuzin proved particularly poor even where low to moderate infestations of Solanaceae weeds were present. A combination of chloroxuron and trifluralin appeared to overcome this problem. Treatment 1 did not perform particularly well in the 1977-78 season where large infestations of *Amaranthus* spp and *Polygonum* spp were present. As a result the treatment 10 was included in the 1978-79 trials where the rate of linuron was increased to 2 kg/ha. However, in these trials both treatments 1 and 10 did equally well but on at least one site (Trial 4) the higher rate of linuron also damaged the crop.

To summarise the soya bean yields in Table 2 the data were converted to percentages of treatment 1 (alachlor 3.0 + linuron 1.5), which is considered as the standard treatment in the Auckland and Waikato regions. The controls could not be used for comparison purposes due to the large variations and very low yields. Figures in Table 4 show that a combination of trifluralin and chloroxuron gave good yields over all the trials and was significantly better than all other treatments. Treatment 7, trifluralin + linuron, also produced high yields fairly consistently although it was not significantly better than others. These treatments were also found to provide the best weed control by Piggot and Honore (1977) in the North Auckland area.

Table 2. Effect of treatments on soya bean seed yield (t/ha)

Treatment No*	Trial number 1**	2	3	4	5	6	7	8
1.	2.9 bc	3.5 ab	1.4 bc	3.1 ab	4.0 a	2.4 a	2.3 a	3.0 a
2.	3.8 ab	2.8 cd	2.6 a	2.3 b	4.0 a	1.5 bc	2.3 a	2.4 ab
3.	3.3 bc	4.3 a	2.0 ab	2.5 ab	3.8 a	1.9 ab	2.2 a	2.6 ab
4.	3.4 bc	3.2 bc	1.3 cd	2.2 b	3.5 ab	1.8 ab	2.2 a	1.2 cd
5.	3.9 ab	3.4 bc	1.8 bc	2.5 ab	3.9 a	0.9 cd	2.1 a	2.5 ab
6.	3.6 bc	2.4 d	1.5 bc	2.8 ab	4.0 a	1.6 bc	2.5 a	2.9 a
7.	4.8 a	3.7 ab	1.8 bc	2.8 ab	4.3 a	2.2 ab	2.3 a	2.7 a
8.	3.3 bc	4.3 a	2.4 a	3.4 a	3.9 a	2.0 ab	2.3 a	3.1 a
9.	3.7 ab	2.7 cd	2.2 ab	2.5 ab	3.7 a	2.0 ab	2.5 a	1.9 bc
10.	–	4.0 ab	–	2.2 b	4.2 a	2.4 a	–	–
11.	3.2 bc	–	1.5 bc	–	–	–	2.4 a	1.3 cd
12.	–	–	–	–	3.6 ab	2.4 a	–	–
13.	2.7 c	0.8 e	0.9 d	1.3 c	2.3 b	0.4 d	1.6 b	0.9 d

* See Table 4 for treatments.
** DM yield of plants. Seed yield very low and erratic.
– Treatments not applied.

Table 3. Effect of treatments on weeds (DM yield as % of control)

Treatment No*	Trial number 1	2	3	4	5	6	7	8	Average
1.	43 b	3 d	70 ab	19 bc	0	2 c	24 b	43 bc	26
2.	11 c	9 cd	6 c	33 b	0	29 b	5 b	43 bc	17
3.	19 bc	3 d	2 e	6 c	0	3 c	14 b	39 bc	11
4.	32 bc	11 cd	26 b	37 b	0	25 b	11 b	59 ab	25
5.	22 bc	42 b	5 cd	17 bc	0	22 b	9 b	1 e	15
6.	9 c	38 b	41 ab	72 ab	0	30 b	6 b	3 de	25
7.	10 c	23 bc	24 b	22 bc	0	1 c	14 b	6 de	13
8.	17 bc	4 d	3 d	5 c	0	12 bc	16 b	6 de	9
9.	19 bc	33 b	4 d	17 bc	0	18 bc	7 b	12 cd	14
10.	–	3 d	–	18 bc	0	2 c	–	–	6
11.	22 bc	–	68 ab	–	–	–	10 b	73 ab	43
12.	–	–	–	–	0	12 bc	-	-	6
13.	100 a	100 a	100 a	100 a	100	100 a	100 a	100 a	100
control (t/ha)	8.8	8.0	5.4	0.9	1.3	8.5	2.9	12.7	

* See Table 4 for treatments.

Table 4. Average soya bean yield from eight trials (presented as % of the standard treatment, Treat 1)

Herbicides and rates (kg/ha)			Yield (%)	Range (%)
1. alachlor	3.0 + linuron	1.5	100	–
2. alachlor	3.0 + metribuzin	0.5	102	63-186
3. alachlor	3.0 + chloroxuron	1.5	102	81-143
4. metolachlor	3.0 + linuron	1.5	84*	40-117
5. trifluralin	1.0 + metribuzin†	0.5	98	67-134
6. trifluralin	1.0 + metribuzin†	0.75	92	38-124
7. trifluralin	1.0 + linuron	1.5	110	90-165
8. trifluralin	1.0 + chloroxuron	1.5	113*	83-171
9. trifluralin	1.0 + bentazone	1.0	99	63-157
10. alachlor	3.0 + linuron	2.0	98	71-114
11. alachlor	3.0 + cyanazine	1.5	91	43-110
12. vernolate	3.0 + linuron	1.5	95††	90-100
13. control			50**	17- 93

‡ Metribuzin pre-emergence (Treat 5); ppsi, tank mix (Treat 6)
†† Yields average of only two trials.
*,** Significantly different at 5% and 1% respectively.

Table 4 also shows that the controls and metolachlor treatments produced significantly lower yields than all other treatments. Yields from other nine treatments were statistically similar to the standard treatment but some of them, e.g., trifluralin + metribuzin were too inconsistent. It is the range of yield in Table 4 which depicts the consistency of the treatment and it should be emphasised more than the average. As mentioned earlier, the wide range of yield was mainly as a result of the resistant broadleaf weed(s) in the trial area. In the presence of Solanaceae weeds the trifluralin combinations did not perform well and the treatments containing alachlor were poor where *Amaranthus* and *Polygonum* spp were the major problem. Treatments which produced yields of 80% upwards in all trials should perform well in most situations.

The rainfall during the first month after the treatment and the soil properties, in particular the soil texture, of the trial sites had some effect on the performance of various herbicide combinations. However, it appears that the weed species prevalent in the area should be a major consideration in the choice of herbicides for weed control in soya beans.

ACKNOWLEDGEMENTS

Thanks are due to N.S. Brown and P. Brookfield for assistance with the Gisborne trial, C.B. Dyson for statistical analyses and the Ruakura Soil Testing Laboratory for the soil analyses.

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