WEED CONTROL IN SOYA BEANS

B. BURNEY

Research Division, Department of Agriculture, Hamilton

Summary

Results from trials extending over a period of three years confirm the reliability of a number of herbicide combinations for weed control in soya bean (*Glycine max*) crops. In particular pre-emergent applications of linuron plus alachlor, linuron plus propachlor, and alachlor plus dinoseb as well as treatments combining linuron applied pre-emergence with vernolate or trifluralin as pre-plant soil-incorporated materials, have given excellent control of broadleaf weeds and grasses. Yield comparisons between chemical and manually weeded treatments indicate that crop tolerance to these herbicides is good although bean yields have not attained high levels in the Waikato district.

INTRODUCTION

THE soya bean (*Glycine max*), which as a farm product is a billion dollar business in the U.S.A. and a major industrial commodity in East European and oriental countries as well as Brazil, has good potential as a field crop in New Zealand. This legume has been the subject of extensive experimentation in this country for a considerable time but previous non-availability of effective weed control means has prevented its emergence on the agricultural scene.

Soya bean seedlings demand precise conditions for good growth. Optimum bean yields are dependent on a number of factors of which one is the degree of light distribution within the leaf canopy. This in turn is governed by plant spacing and the degree of competition presented by weed infestations.

Annual weeds contributing most to yield depression are grasses, such as summer grass (*Digitaria sanguinalis*) and witchgrasses (*Panicum* spp.) and broadleaf weeds of upright growth such as willow weed (*Polygonum persicaria*), redroot (*Amaranthus hybridus*), fathen (*Chenopodium album* agg.) and black nightshade (*Solanum nigrum* complex). Owing probably to the high organic matter content of most New Zealand soils and/or unpredictable rainfall, herbicides regarded as standards overseas have not always performed satisfactorily on these weeds.

EXPERIMENTAL

Four trials out of a total of twelve conducted are described in detail. These indicate the tolerance of soya beans to some herbicides and the degree of weed control obtained.

Experiments were located at Ngatea on a Kairanga silt loam cultivated directly from pasture and at Rukuhia on a previously cropped Horotiu sandy loam. Soil organic matter percentages were 11.3 and 12.5, respectively (according to Walkley-Black).

Trials were of randomized block design with six replications. Plot size was 25 ft by 6 ft. Soya bean seed (variety Grant) was sown by Stanhay precision seeder at 18 in. inter-row and 2 in. intra-row spacings. All herbicides were applied by Oxford precision sprayer delivering 40 gal of solution per acre. Pre-plant soil-incorporated (PPSI) herbicides were rotary-hoed 3 in. deep into the soil within five minutes of application.

Treatments consisted of a variety of single or combination herbicides, applied pre-emergence, and pre-plant soil-incorporated materials followed by secondary pre-emergent surface sprays as detailed in tables.

Herbicide effects on weeds were gauged through visual assessments of mature weed species as a percentage of the plot area and crop tolerance to herbicides was based on soya bean yields calculated at 12% moisture content.

RESULTS

Propachlor/linuron, alachlor/linuron and alachlor/dinoseb as pre-emergent combinations generally gave excellent control of grasses and broadleaf weeds in all trials throughout the critical open-ground period of soya bean establishment. Dinoseb (2.0 lb) (all rates in a.i./acre) in combination with alachlor proved less effective on willow weed in Trial B (Table 1) than the same material at the 4 lb rate in Trial C (Table 2) but still gave acceptable control of this weed. As an alternative to linuron the methoxy urea chlorbromuron gave almost parallel control of weeds when used in combination with alachlor.

Periodic observations on the crop in the vegetative stage revealed no toxic effects from any of these treatments. This was confirmed by figures

TABLE 1: WEED CONTROL AND SOYA BEAN YIELD

Treatment (lb)	Av. % Mature Weed Species per Treatment				Bean Yield (bu/ac)
	Annual Grasses	Red-root	Willow Weed	Fathen	
TRIAL A RUKUHIA 1969					
propachlor 3/fluorodifen 2	nil	nil	9.0	28.0	8.3 bC
propachlor 3/chlorbromuron 2	nil	nil	30.0	nil	7.9 bC
propachlor 3/linuron 2	nil	5.0	21.0	nil	8.7 bBC
alachlor 3/chlorbromuron 2	nil	nil	4.0	nil	12.7 aAB
alachlor 3/linuron 2	nil	nil	2.0	nil	12.5 aAB
Control	8.0	nil	76.0	6.0	nil
Hand-weeded	nil	nil	nil	nil	14.9 aA
CV					22.5%
TRIAL B RUKUHIA 1969					
propachlor 3/aziprotryne 2	nil	4.0	31.0	4.0	13.8 bcBC
propachlor 3/fluorodifen 2	nil	1.0	21.0	6.0	13.96 bcBC
propachlor 3/dinoseb-ammonium 2	nil	nil	29.0	4.0	12.2 cCD
propachlor 3/chlorbromuron 2	nil	nil	9.0	nil	16.5 abABC
propachlor 3/linuron 2	nil	nil	3.0	nil	19.7 aA
alachlor 3/chlorbromuron 2	nil	nil	1.0	nil	17.8 aAB
alachlor 3/linuron 2	nil	nil	nil	nil	17.8 aAB
alachlor 3/dinoseb-ammonium 2	nil	nil	4.0	nil	17.6 aAB
"C.P. 44939" 1	nil	2.0	65.0	4.0	8.8 dD
Control	4.0	5.0	75.0	7.0	nil
Hand-weeded	nil	nil	nil	nil	19.4 aA
CV					15.4%

for bean yields which did not differ significantly from hand-weeded treatment yields at the 1% level, except for propachlor/linuron results as shown in Trial A (Table 1).

Treatments incorporating vernolate or trifluralin performed almost as well for control of weeds as the pre-emergent combinations. In Trial D (Table 2) linuron (1.0 lb) gave generally less satisfactory control of black nightshade when combined with vernolate or trifluralin than when combined with propachlor or alachlor.

In the seedling stage of the crop, the high rates of vernolate and trifluralin produced a temporary check with a slight degree of leaf chlorosis but yields were not adversely affected and did not differ statistically from those of the hand-weeded plots at the 1% level.

The performance of propachlor plus either chlorbromuron, fluorodifen or aziprotrotyne and other singly applied treatments mentioned in the tables

TABLE 2: WEED CONTROL AND SOYA BEAN YIELD

Treatment (lb)	Av. % Mature Weed Species per Treatment					Bean Yield (bu/ac)
	Annual Grasses	Red Willow root	Night-Weed shade	Black Portulaca oleracea		
TRIAL C RUKUHIA 1970						
vernolate (PPSI) 1.5/linuron 2	2.0	3.0	nil	3.0	nil	14.1 abA
trifluralin (PPSI) 1/linuron 2	3.0	1.0	nil	1.0	nil	16.8 abA
trifluralin (PPSI) 2.0/linuron 2	nil	nil	nil	nil	nil	15.0 abA
trifluralin (PPSI) 2/chloramben 4	1.0	1.0	nil	3.0	nil	15.3 abA
propachlor 3/linuron 2	1.0	2.0	4.0	nil	nil	12.8 abA
alachlor 3/dinoseb-ammonium 4	nil	nil	nil	nil	nil	17.6 aA
dichlormate	3.0	2.0	5.0	3.0	nil	13.6 abA
Control	8.0	6.0	24.0	4.0	8.0	nil
Hand-weeded CV	nil	nil	nil	nil	nil	11.6 bA 27.1%
TRIAL D NGATEA 1971						
vernolate (PPSI) 1.5/linuron 1	nil	2.0	2.0	3.0		55.9 a
vernolate (PPSI) 3/linuron 1	1.0	2.0	1.0	2.0		53.9 a
trifluralin (PPSI) 1/linuron 1	1.0	1.0	nil	3.0		51.2 a
trifluralin (PPSI) 2/linuron 1	nil	1.0	nil	1.0		52.8 a
propachlor 3/linuron 1	nil	1.0	2.0	nil		56.2 a
alachlor 3/linuron 1	nil	nil	nil	nil		49.2 a
alachlor 3/dinoseb-acetate 4	nil	nil	nil	nil		56.3 a
dinoseb-acetate 4	nil	3.0	4.0	1.0		48.7 a
Control	2.0	12.0	6.0	9.0		nil
Hand-weeded CV	nil	nil	nil	nil		58.6 a 12%

proved marginal or was of suspect reliability. This was demonstrated by the evidence presented and from trial data not reported here.

DISCUSSION

The results achieved clearly show the effective overall weed kill obtained by combining herbicides having specific action against certain weed species.

The use of soil-incorporated herbicides vernolate and trifluralin, in combination with linuron as a pre-emergence secondary spray, provided control of grasses and broadleaf weeds with a good degree of crop tolerance even at rates as high as 3.0 lb and 2.0 lb respectively.

Although the use of the soil-incorporated materials requires extra cultivation and punctual soil-incorporation to avoid loss through photodecomposition and volatilization, their low dependency on soil moisture for activation could prove of considerable value under dry conditions. However field experience has shown that, in areas where soil organic matter content is high or indifferent methods of soil-incorporation exist, some reduction in their performance is likely. This could restrict the area of application.

Linuron (2.0 lb) combined with either alachlor or propachlor and alachlor plus dinoseb as pre-emergent surface sprays gave consistent control of weeds with very good crop tolerance. In soil freshly cultivated from pasture, linuron (1.0 lb) in combination with other materials performed well, but in previously cultivated areas where more weed germinations may be expected, the 2.0 lb rate may well be necessary for optimum weed control.

In conclusion, the information obtained from this research shows that a number of suitable herbicide treatments for weed control in soya bean crops now exists.

ACKNOWLEDGEMENTS

The author wishes to thank D. Duganzich and Biometrics Section staff in Wellington for statistical analyses of yield data, L. J. Matthews for original treatment suggestions, and Ruakura Agricultural Research Centre staff for assistance with trial work.