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RELATIVE EFFICIENCY OF A NUMBER OF HERBICIDES IN PEANUTS IN THE BURNETT AREA OF QUEENSLAND

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SUMMARY

The efficiency of a number of herbicides not used previously for peanuts in the South Burnett area of Queensland was compared with that of the current herbicide recommendations, 2,4-D (pre-emergence) and trifluralin (preplant incorporated).

The value of 2,4-D for broad-spectrum, short-season weed control was demonstrated. Nitralin, basically a grass-specific herbicide, controlled grasses as effectively as trifluralin, but also showed some control of broad-leafed weeds.

The contact herbicides dinoseb and nitrofen gave excellent control of certain broad-leafed weeds which are resistant to 2,4-D and trifluralin.

I. INTRODUCTION

Peanuts (*Arachis hypogaea L.*) are grown extensively on a variety of soils in the Burnett area of Queensland. Weeds are potentially a greater problem in peanuts than in many other crops because, apart from their competitive effects, their presence may physically hinder the harvest of the crop. In cases of heavy weed growth, harvest may be impossible.

In recent years, the use of herbicides has become increasingly important in overall crop management in the Burnett area. This has been due to such factors as increased costs of labour for hand-chipping and larger areas of crop being grown per labour unit. 2,4-D has long been recommended for use in peanuts as a pre-emergence herbicide (Rawson 1962). According to Saint-Smith *et al.* (1972), 2,4-D will control most common annual broadleafed and grass weeds for 3–4 weeks from planting. More recently, trifluralin has become well established in the Burnett area as a preplanting soil-incorporated herbicide, giving season-long control of annual grass weeds.

Not all weed species occurring in peanut crops are controlled by 2,4-D and trifluralin. In recent years, the chemical industry has been actively engaged in testing various other herbicides for this purpose, and peanut growers could be interested in treatments which control a wider range of weed species. The purpose of this trial was to evaluate a number of alternative herbicides to 2,4-D and trifluralin.

The experiment was carried out in the Crawford area about 5 km north-west of Kingaroy, Queensland, on a red clay loam "scrub" soil, typical of the peanut soils in the Burnett region.

II. METHODS AND MATERIALS

Basic treatment.—No herbicide suitable for use in peanuts is likely to provide complete protection from weeds for the life of the crop. The main aim of chemical weed control, therefore, may be seen as allowing the peanut plants to establish sufficiently well so as to over-shadow further weed growth (Woodroof 1966) and to be large enough to withstand inter-row cultivation when necessary. Thus the use of chemicals is only a part of overall crop management. Treatments therefore consisted of the appropriate chemical, and after assessment of weed growth, the minimum amount of inter-row cultivation necessary to permit successful harvest of the crop.

Herbicides.—The herbicides used were as follows:

Trifluralin as "Treflan E.C.", an emulsifiable concentrate containing 40% w/v.

Nitralin as "Planavin", a 75% W.P.

Alachlor as "Lasso", a 50% w/v emulsifiable concentrate.

Chlorthal as "Dacthal W", 75% W.P.

2,4-D as the 50% w/v amine salt.

Nitrofen as "Tok E-25", an emulsifiable concentrate containing 24% w/v.

Nitrofen + dinoseb applied as a mixture of the chemicals to permit application of 2·26 + 1·13 kg a.i. of nitrofen and dinoseb respectively per hectare.

Treatments.—The following treatments were applied. Dosages are acid equivalent for 2,4-D and active ingredient for all other herbicides.

Pre-emergence: preplanting incorporated

1. Trifluralin—1 kg/ha
2. Nitralin—1·05 kg/ha
3. No herbicide, shallow discing (8 cm)

Pre-emergence: post-planting, incorporated

4. Alachlor—2·25 kg/ha
5. Chlorthal—8·50 kg/ha

Pre-emergence: post-planting, unincorporated

6. 2,4-D—2·25 kg/ha
7. Alachlor—2·25 kg/ha
8. Chlorthal—8·50 kg/ha

Post-emergence

9. Nitrofen—3·40 kg/ha
10. Dinoseb—2·26 kg/ha
11. Nitrofen + dinoseb—2·26 + 1·13 kg/ha respectively

$\left.\begin{array}{l}12.\\13\\14.\end{array}\right\}$ Inter-row cultivation

General.—The experiment was laid out as a 14 x 4 randomized block. Plots comprised four rows 0·9 m apart and 27 m long. An 18 m section was used in the two centre rows for all data collection.

All herbicides were applied as aqueous sprays, through flat-fan nozzles, operated at a pressure of 210 kPa, with a volume of 260 *l*/ha.

Incorporation of herbicides, where applicable, was carried out as follows:—

1. Trifluralin—2 discings, about 8 cm deep
2. Nitralin—2 harrowings
3. Alachlor—1 harrowing
4. Chlorthal—1 harrowing

Dates of various treatments, etc., are given below:

Treatments	*Date*
1, 2, 3	22.x.71
Planting	8.xi.71
4, 5, 6, 7, 8	9.xi.71
9, 10, 11	16.xii.71
Complete weed count	5.i.72
Harvesting	11.iv.72

At planting, surface soil moisture was marginal, but subsurface moisture was adequate. With relatively deep-planted seed (8–10 cm), emergence and final plant stand were satisfactory.

Regular rainfall during the growing season, as follows, ensured adequate availability of moisture:

	mm
October, 1971	90
November prior to planting	10
November after planting	63
December	137
January 1972	73
February	97
March	39
April prior to harvest	85

III. RESULTS

Weed populations are shown in Table 3. The weed control obtained by using 2,4-D (treatment 6) was superior to that of any of the other herbicides in the number of species and also the number of plants per species controlled (Table 3.) The control obtained with 2,4-D was effective for 7 weeks, at which time rain encouraged a germination of weeds. This period of control was longer than the 3–4 weeks usually expected (Rawson 1962).

The grass-specific herbicides trifluralin and nitralin (treatments 1 and 2) controlled grass species, and in addition nitralin reduced to some extent the numbers of some of the broadleafed weeds present.

Grass weed populations appeared to be reduced by incorporated chlorthal and unincorporated alachlor (treatments 5 and 7 respectively), and by the post-emergence mixture of nitrofen and dinoseb (treatment 11). Alachlor and chlorthal had little effect on the broadleafed weed populations.

Excellent broadleafed weed control was obtained with the use of post-emergence chemicals dinoseb, nitrofen, and the mixture of both (treatments 9, 10, 11). The outstanding control was that of *Physalis minima,* the most common weed present at the site and one for which there is, to date, no consistently effective chemical control recommended in the Burnett.

The contact action of the two post-emergence herbicides caused damage to the peanut leaves, with nitrofen appearing to be more phytotoxic. The damage was obvious for about 14 days.

Although the control plots yielded less than most of the other treatments, there were no significant differences in yield between treatments (Table 4).

TABLE 1

COUNTS PER TREATMENT OF THE THREE MAJOR GROUPS* OF WEEDS PRESENT AT THE SITE

Treatment	Group 1		Group 2		Group 3	
No. Description	Plants/Plot	Transformed Means (log (x + 1))	Plants/Plot	Transformed Means $(\sqrt{x + 0{\cdot}5})$	Plants/Plot	Transformed Means $(\sqrt{x + 0{\cdot}5})$
1. Trifluralin	67·934	4·233 2	17·323	4·222	0·000	0·707
2. Nitralin	20·517	3·068 8	6·447	2·636	0·000	0·707
3. 8 cm discing	128·121	4·860 8	19·304	4·450	8·735	3·039
4. Alachlor	100·357	4·618 6	8·933	3·071	10·153	3·264
5. Chlorthal	32·947	3·524 8	6·790	2·700	1·903	1·550
6. 2,4-D	5·995	1·945 2	0·771	1·127	0·000	0·707
7. Alachlor unincorp ..	32·671	3·516 6	6·476	2·641	0·357	0·926
8. Chlorthal unincorp ..	29·346	3·412 6	28·145	5·352	5·798	2·510
9. Nitrofen	0·316	0·274 7	6·896	2·720	52·485	7·279
10. Dinoseb	0·000	0·000 0	0·433	0·966	16·249	4·093
11. Nitrofen + Dinoseb	0·000	0·000 0	0·707	0·000	1·086	1·259
12. Control (mean of 3 plots)	57·291	4·065 4	24·333	4·983	18·490	4·358
Sig. Diffs. (based on transformed Data)	9, 10, 11 $\ll$ 1, 2, 3, 4, 5, 6, 7, 12, 8; 6 $\ll$ 3, 4; 6 < 1, 12		6, 10, 11 $\ll$ 8, 12; 2, 7 < 12; 6, 10, 11 < 3, 1		1, 2, 5, 6, 7, 8, 11 $\ll$ 9; 3, 4, 12 < 9; 1, 2, 6, 7, 11 > 12	
Necessary differences—						
Comparison with control						
5%	..	1·610 8	..	2·313	..	2·841
1%	..	2·154 5	..	3·093	..	3·799
All other comparisons						
5%	..	1·972 8	..	2·833	..	3·479
1%	..	2·638 8	..	3·789	..	4·653

* For analytical purposes, the weed population has been divided into three groups:—

Group 1—*Physalis minima*—An important broadleafed weed which to date has been inconsistently controlled by chemical means in peanuts in the Burnett.

Group 2—*Euphorbia helioscopia*, *Hibiscus trionum*, *Raphanus raphanistrum*—A group of broadleafed weeds which generally pose fewer control problems than *P. minima*.

Group 3—*Urochloa panicoides*, *Echinochloa colonum*—the main grass species at the site.

** No. 12 is the average of control treatments 12, 13 and 14.

IV. DISCUSSION

Under the conditions of this trial, treatments involving mechanical weed control only suffered no significant yield disadvantage compared with treatments using chemical control methods. Weeds, however, were much more efficiently and easily controlled where an effective herbicide was used. Thus, with the use of 2,4-D, nitrofen, dinoseb, and nitrofen + dinoseb (treatments 6, 9, 10, 11), weed growth present at the time of detailed assessment was easily controlled by one mechanical cultivation. This was in marked contrast to the other treatments, which all required severe mechanical cultivation and intensive hand-chipping in order to permit satisfactory harvesting (Table 4). Costs of these operations may exceed the costs of the chemicals involved. Table 4 also details the estimated costs on a commercial basis of the various chemical and non-chemical weed control measures required per treatment.

TABLE 2

YIELD OF NUT-IN-SHELL PER TREATMENT (kg/ha); RECORD OF MECHANICAL AND MANUAL WEED CONTROL MEASURES REQUIRED PER TREATMENT; AND ESTIMATED COSTS OF WEED CONTROL ($/ha) ON A COMMERCIAL BASIS

Treatment	Yield*	No. of Inter-row Cultivations	No. of Hand Weedings	Cost of Product	Cost of Application	Cost of Inter-row Cultivation	Cost of† Hand Weeding	Total Cost
				$	$	$	$	$
1. Trifluralin	2,268	2	2 heavy	15.76	1.40	4.20	30.00	51.36
2. Nitralin	1,995	2	2 heavy	25.47	1.40	4.20	30.00	61.07
3. Shallow discing	2,123	2	2 heavy	..	..	4.20	30.00	34.20
4. Alachlor	1,835	2	2 heavy	19.90	1.40	4.20	30.00	55.50
5. Chlorthal	2,165	2	2 heavy	51.87	1.40	4.20	30.00	87.47
6. 2, 4-D	2,073	1	1 light	3.95	1.40	2.10	2.40	9.85
7. Alachlor	1,904	2	2 heavy	19.90	1.40	4.20	30.00	55.50
8. Chlorthal	2,274	2	2 heavy	51.87	1.40	4.20	30.00	87.47
9. Nitrofen	1,917	1	1 moderate	40.75	1.40	2.10	4.80	49.05
10. Dinoseb	1,790	1	1 light	12.34	1.40	2.10	2.40	18.24
11. ‡Nitrofen + Dinoseb	1,836	1	1 light	..	1.40	2.10	2.40	..
12. Control (mean of 3 plots) ..	1,809	2	2 heavy	..	..	4.20	30.00	34.20

* F value in analysis of variance not significant.
Necessary differences

Comparison with control	5%	355
	1%	475
All other comparisons	5%	435
	1%	582

† The amount, and therefore the cost of manual weed control, is dependent on weather conditions. Under the conditions of this experiment, these costs were higher than would have been expected in a drier season.

‡ Price unavailable.

The mixed weed population present demonstrated the limitations as well as the abilities of the various chemicals involved. For example, plots treated with trifluralin and nitralin, which controlled grass species adequately, required as much inter-row cultivation and hand-chipping as the controls because of the inability of these herbicides to control the major broadleafed weeds present.

Thus, in choosing a herbicide for a particular situation, care must be taken to select one which is effective against the weed population likely to be present.

The principle of post-emergence application of chemicals for weed control has been proven in the Burnett area. Its application, however, has been limited because to date only hormone-type chemicals have been available. These chemicals will control only a few species when applied at a rate low enough to minimize damage to the peanut plants (Saint-Smith *et al.* 1972). The contact herbicides in this experiment gave excellent control of a range of broadleafed weeds.

A potentially useful combination of chemicals for weed control is pre-emergence 2,4-D or trifluralin, as described above, followed by a contact herbicide at a stage when weed growth warrants it. Complete control of weeds for 10 weeks has been obtained by the author (Langford, unpublished) when pre-emergence 2,4-D was followed with dinoseb at 6 weeks.

Observations outside the trial area indicated that the post-emergence chemicals give excellent control of species of *Datura.* These weeds constitute a serious problem in many peanut-growing areas and experience has shown that pre-emergence 2,4-D has controlled them inconsistently.

Pre-emergence 2,4-D controls a broader range of annual weed species than any other chemical currently available for use in peanuts in the Burnett. This control may only be for four weeks. In situations where grass weeds predominate, however, chemicals such as trifluralin and nitralin may have a particular role, but because they control grasses only, care should be taken to ensure that broadleafed weeds are not allowed to become a major problem.

Dinoseb, nitrofen and dinoseb + nitrofen controlled broadleafed weeds, such as *Physalis minima* and species of *Datura* which to date have been difficult to control in peanuts by other chemicals.

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