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DEPARTMENT OF AGRICULTURE, SOUTH AUSTRALIA

Agronomy Branch Report

THE USE OF HERBICIDES FOR WEED CONTROL IN PASTURE SEED CROPS

PART II - GRASSES

P.M. KLOOT

Research Officer (Weeds)

and

J.H. DAWES

formerly

Field Officer (Weed Control)

Report No. 29

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THE USE OF HERBICIDES FOR WEED CONTROL IN PASTURE SEED CROPS

PART II - GRASSES

A report of work carried out by the Department of Agriculture from 1966 to 1971 mainly in the South-east of South Australia

by

P.M. KLOOT

Weeds Research Officer

and

J.H. DAWES

formerly

Field Officer (Weed Control)

Adelaide

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INTRODUCTION

This report completes the publication of work carried out by Mr. P.M. Kloot, Research Officer and Mr. J.H. Dawes, formerly Field Officer (Weed Control) on weed control in pasture seed crops over the last few years. Studies on grass seed crops, an index for chemicals, and a list of botanical names of plants in both parts of the report are included.

Unfortunately, due to staff changes, it was not possible to develop this programme to its anticipated extent. However, the work carried out and reported here is a considerable step forward and it is hoped that others in the seed and/or chemical industry will find it useful either for checking current recommendations or as a base on which to do further work.

It is planned that the Department should take up this work again at the earliest opportunity.

A.F. TIDEMAN
Acting Chief Agronomist.

WEED CONTROL IN ESTABLISHED PASTURE GRASS SEED CROPS

In grass seed crops, the weed problems are somewhat different to those in other pasture seed crops. In legumes, the weeds are from other families in the vast majority of cases. There is a sufficiently great distance botanically, between the weeds and the crop that a range of selective herbicides is available. With grass crops a different situation arises. Broadleafed weeds are no problem but grassy weeds are of most concern. Selectivity needs to be very fine as removal is required of members of the same family (all grass crops), the same genus (e.g. Wimmera ryegrass out of Medea ryegrass) and even the same species (e.g. Demeter fescue seedlings out of an established stand of the same crop).

It is necessary to define what is meant by "established" compared to "seedling" grass crops. In our experience a crop which has survived one summer (regardless of when it was planted) can be considered as "established".

As far as herbicide usage is concerned, the use of soil-acting residual herbicides is confiend to established crops and the necessary root development required to tolerate such applications, appears to take place during the search for water in the first summer.

Prior to the commencement of the series of trials reported here, some preliminary work had been carried out by members of the Pasture Section. This work will be referred to at the appropriate points in the following pages.

WEED CONTROL IN ESTABLISHED PHALARIS SEED CROPS

In 1966, members of the Pasture Section screened a number of chemicals on a two year old stand of Seedmaster phalaris near Naracoorte. The chemicals and their respective rates of application were

Diuron	8	16	32	64oz. a.i./acre
Linuron	4	8	16	32oz. a.i./acre
Prometryne	4	8	16	32oz. a.i./acre
Simazine	8	16	32	64oz. a.i./acre
Atrazine	4	8	16	32oz. a.i./acre

The weeds had just germinated and included capeweed, sorrel, sub-clover, storksbill and annual grasses. The soil was a medium loam and the plots sprayed about a weed after a "starter" irrigation had been applied in mid-autumn to break the drought. The crop was well-established and even.

It was found that linuron and prometryne at all rates gave unsatisfactory and inconsistent weed control but the crop was not affected in any way. Atrazine at the highest rate initially gave good control but the effect wore off during the season. The crop suffered greatly from chlorosis but no plant deaths were recorded. Diuron and simazine at the highest rate both maintained weed free plots throughout the year. Some initial chlorosis was recorded especially from the diuron but this was transient.

It was concluded that diuron and simazine showed promise for established phalaris.

The opportunity did not present itself for further work to be carried out on phalaris until 1970.

In that year a trial was laid on a stand of ten month old Sirocco phalaris at Bordertown. The soil was a light sandy loam. The crop was sprayed on May 26th 1970 with the following three chemicals at the rates shown:

Fluometuron	32	48	64oz. a.i./acre
Diuron	16	32	64oz. a.i./acre
Propazine	32	48	64oz. a.i./acre

The chemicals were applied with a portable CO_2 sprayer. The treatments were replicated three times. It was intended that the plots be harvested and the seed yields compared, however the dry finish to the season in the area made this rather pointless. The following seasonal observations are of interest.

At spraying seedlings of capeweed, sub-clover, storksbill, barley grass and toad rush were present. Six weeks later on the unsprayed plots, these weeds had developed into an even infestation. It was found that at the lowest rate, the control exerted by diuron was not satisfactory. At the other rates, some to many phalaris plants appeared to be dead. The two highest rates gave complete weed control.

Fluometuron gave complete weed control at all rates; at the two higher rates apparent crop deaths were recorded. At this time propazine did not adversely affect the crop but the control of weeds, especially clover, was poor.

After another two months i.e. at mid-season, it was found that many of the apparently dead plants noted earlier were recovering. The lowest rate of diuron did not give satisfactory weed control but at the other rates as well as all rates of fluometuron, weed control was generally satisfactory and except for the highest rates of both chemical the crop had obviously tolerated the chemicals quite well. On the other hand propazine at all rates, had caused delayed crop damage. At the same time weed control was not complete.

Towards the end of the season, in early November, the crop was running up to head. The recovery of apparently dead plants was almost complete except at the highest rates of diuron and fluometuron. The severe retardation however would not lead to a satisfactory seed yield because only a few leaves had been produced instead of the vast quantities of leaves and tillers as on other plants. The second highest rate of diuron and the middle rate of fluometuron gave most satisfactory weed control with minimal crop damage. Below these rates, severe invasions of weeds especially barley grass and wireweed, had occurred.

The delayed effects of propazine were further aggravated and the crop was severely thinned. Weed control was not satisfactory.

Conclusions:

From these results it would appear that 2-3lb. product of diuron or fluometuron is satisfactory. There would appear to be less tolerance in phalaris than in Demeter fescue or Currie cocksfoot to higher rates of these chemicals. It would seem advisable to keep the rates of chemical as low as possible even within the range stated above. The earlier work on Seedmaster phalaris leads to a similar conclusion for that cultivar.

WEED CONTROL IN ESTABLISHED DEMETER FESCUE SEED CROPS

In crops of Demeter fescue (*Festuca arundinacea cv. Demeter*) crop cleanliness is important not only from the usual points of view of removing competition and purity of the seed sample but also because of the unacceptability of first generation seedlings. These seedlings result from seed falling to the ground before or during a previous harvest. The seed from these plants (i.e. second generation) causes the crop to be down graded.

The contact herbicide paraquat, applied with hooded sprays, and inter-row cultivation is useful but do not take out the seedlings within the rows. An overall spray is therefore required, and this experiment was undertaken to provide a recommendation for this.

Experimental

The trial area (at Hynam) was sown in May 1966 and the experiment was sprayed on May 29th, 1968. In May 1967 the whole crop had been treated with diuron at the rate of 2.4lb. a.i./acre. The soil was a sandy loam and at the time of spraying was estimated to be at field capacity. Trash lay on the surface from the previous harvest; its distribution was not random but to a large degree confined to certain rows.

At the time of spraying the temperature was 56°F and there was a slight cross-wind. The crop was growing vigorously and small fescue seedlings to two inches in height had appeared. Other seedlings present were milk thistle, mallow, burr medic and wireweed.

The chemicals used were diuron, fluometuron, norea and 2,6-dichloro thiobenzamide (Prefix (R)). These are all wettable powders of 80% concentration except for the last which is a wettable powder of concentration 75%.

They were applied with a portable carbon dioxide, pressure spraying system applied through a single jet at 30psi. The four chemicals were each applied at five rates: 32, 48, 64, 96 and 128oz. a.i. per acre.

The plots were one-thousandth of an acre and the experiment was replicated twice in a randomised design.

Observations were made during the season and seed yields were taken from a square metre quadrat at harvest. Samples from the yields were subjected to standard germination tests as required for certification by the Seed Testing Section of the S.A. Department of Agriculture.

Results

After six weeks (July 2nd, 1968) it was obvious that Prefix (R) - at all rates was adversely affecting the crops. Growth was markedly depressed and new leaves were turning yellow. Fluometuron at all rates was giving substantial weed control which ranged from "promising" at the lowest rate through to complete control at the highest. Diuron and norea were giving good weed control at the highest rates but only fair control at the lower rates.

At fifteen weeks (September 18th, 1968) the effects of the Prefix (R) at all rates had intensified and was causing considerable crop damage at the lowest rate. Its control of weeds and seedlings was however, excellent. The effect of norea even at the highest rate was breaking down and wireweed was emerging. Weediness was even greater at lower rates.

Diuron gave very satisfactory control at the two highest rates but some crop damage was noted. At lower rates weeds and seedlings were reappearing. Fluometuron was giving similar results except that there was a greater interference by surface trash.

At harvest (December 17th, 1968) it was found that at all rates of norea, unsatisfactory weed invasion had occurred. At all rates of Prefix (R) crop damage was very severe but weed control was good.

Fluometuron continued to give good control with slight crop damage at 128oz. At 64oz. and below the interaction with surface trash was obvious by the distribution of the weeds. Diuron gave a similar result with less interference by trash.

After harvest, the seed samples were cleaned and weights per plot measured. These figures are shown in Table 1. The seed underwent germination tests which showed no significant differences between treatments in the percentage of dead seed, abnormal seedlings and seed not germinated at the end of the tests. Figures for percentage germination are given in Table 2.

TABLE 1. YIELD OF DEMETER FESCUE SEED AS INFLUENCED BY HERBICIDE TREATMENTS (gms/sq. meter)

Herbicide	Ounces a.i. per acre					Av.
	32	48	64	96	128	
Diuron	149.6	138.5	148.3	133.2	91.2	132.6
Fluometuron	153.4	167.0	114.4	104.1	56.5	119.1
Norea	138.0	109.7	142.2	132.2	86.5	121.9
Prefix (R)	79.8	40.6	33.1	21.2	11.7	37.3
Handweeded						155.9
Control						115.5

TABLE 2. GERMINATION OF DEMETER FESCUE SEED AS INFLUENCED BY HERBICIDE TREATMENTS OF THE PARENT CROP
(% Seeds Germinating)

Herbicide	Ounces a.i. per acre					Av.
	32	48	64	96	128	
Diuron	91	87	86	80	91	87
Fluometuron	88	93	86	86	80	87
Norea	87	87	87	89	92	88
Prefix (R)	75	65	71	88	One sample 92	78
Handweeded						95
Control						85

Discussion

Prefix (R) is quite obviously not suitable. Its drastic effect on plant growth isreflected in the yield (Table 1) and possibly in the germination (Table 2).

Norea at all rates does not provide satisfactory control for the season. The yields, allowing the figure for 48oz. application to be anomalous, are quite satisfactory.

The yields for fluometuron are highest at the low rates of application, however, at the rates where weed control was judged satisfactory, the yields drop sharply. The effect of diuron is similar but the effect on yield is not as marked. At lower rates it acted more slowly.

There appears to be no obvious trend in percentage germination caused by herbicide application apart from the case mentioned above. It is possible that there is a downward trend caused by increasing rates of application of fluometuron. The lowest figure (80%) is still well within the limit for certification i.e. 70%.

Conclusions

None of the chemicals tested was completely satisfactory. Fluometuron and diuron are useful until a better chemical is available. Diuron is to be preferred as double spraying will not be as harmful as with fluometuron. A working recommendation could well be 4lb. a.i./acre of diuron.

It was found subsequently in commercial practice that this rate was unnecessarily high and that 2-3lb. of diuron (or fluometuron) was sufficient. The higher rates are necessary on heavy soil or where much surface trash is present.

WEED CONTROL IN ESTABLISHED CURRIE COCKSFOOT SEED CROPS

It appeared from work carried out in 1966 by the Pasture Section as well as general farmer experience that established Currie cocksfoot was relatively tolerant to herbicides. It seemed that this crop was close to Demeter fescue in its behaviour. The studies reported here were in two parts. The first was a seed yield trial to establish weed control recommendations. The other part was to investigate herbicides that could possibly be used for controlling annual brome species which had started to become a problem in established grass crops. The brome grass problem arose as a result of that species tolerance of diuron. It was assumed that the same herbicide for brome grass control, found suitable for Currie cocksfoot would be useful on Demeter fescue and possibly phalaris crops.

General Weed Control in Established Currie Cocksfoot

The trial was laid down on a two year old stand of Currie cocksfoot at Wrattonbully on May 11th, 1970. The soil type was a sandy loam. A series of these herbicides was laid down at various rates, replicated three times. The details were as follows

Fluometuron	32 (F1)	48 (F2)	64 (F3)		oz. a.i./acre
Diuron	16 (D1)	32 (D2)	48 (D3)	64 (D4)	oz. a.i./acre
Propazine	32 (P1)	48 (P2)	64 (P3)		oz. a.i./acre

Application was by means of a portable CO_2 sprayer.

The trial was observed from time to time and the plots harvested, the seed yields measured and submitted for analysis.

Observations

The main weeds in the crop seedlings between the rows, wireweed, annual ryegrass, winter grass, toad rush and odd clover plants. Later in the season, wireweed and the annual grasses grew rank between the rows in unsprayed plots, Over most of the crop the grower had used 3lb. product of diuron and the crop was generally weed free.

On the plots, two months after spraying, it was noticed that the two higher rates of each chemical were providing complete weed control. The worst damage was on the plots D4 and P3. At the lower rates D1 and P1 did not provide complete control, but F1 and D2 provided satisfactory control which persisted until harvest.

Towards the end of the season D1, P1 and P2 had lost to a decreasing extent respectively any weed control exerted earlier. The treatments D2, D3, F1, F2 and P3 were generally quite clean but a slight crop depression was observed except on the treatment F1. The highest rate of diuron (D4) still appeared to depress the crop.

At harvest the treatments D3 and F2 were still quite clean and no adverse crop effects remained. It is of interest that the yield (as shown in the table) of the F2 treatment was significantly greater than the control, however, the yields obtained from the treatments of D1 and D2 which were not weed free are slightly higher again.

Effect of herbicide treatment on the pure seed yield of Currie cocksfoot
(gms/quadrat)

D1	D2	D3	D4	P1	P2	P3	F1	F2	F3	Cont.
48.8*	48.0*	32.9	32.0	38.8	37.7	34.4	29.8	47.3*	26.0	28.0

*Differs significantly from the mean at the 5% level.

Upon testing by the Seed Testing Station of the Department, no differences were found in any of the properties tested.

It is concluded that 1¼-2½lb. product of diuron of fluometuron would be a satisfactory recommendation for weed control in this crop. If total weed control is desired then the higher rates should be used and fluometuron is possibly safer. This is not clearcut from the results presented here.

Four logarithmic strips were applied to the crop adjacent to the main trial. They were sprayed with a portable Chesterford mini-logarithmic sprayer on May 22nd, 1970. The herbicides and their respective peak dosages were as follows:

Asulam	P.d.	4lb.a.i./acre
Atrazine		5lb.a.i./acre
Lenacil		5lb.a.i./acre
Methabenzthiazuron		2lb.a.i./acre

Asulam was initially very severe on the crop along the full length of the plot. By mid season, the crop had recovered to about 1½lb. a.i./acre. However, at these rates weed control was poor. Atrazine had no adverse effects at all and gave complete weed control for the whole season down to 2lb. a.i./acre. Below this rate down to 1¼lb. a.i./acre control was acceptable but some weeds appeared just before harvest. They would have caused little, if any interference, to the crop. Lenacil was severe on the crop initially and even at harvest, in the vicinity of 4-5lb. a.i./acre, the cocksfoot had not recovered. However, at lower rates 1-2lb. a.i. crop recovery was rapid and complete. This chemical is definitely worth further investigation in this situation. Methabenzthiazuron was tolerated by the crop at all rates and gave some weed control. However, the annual grasses and the wireweed recovered.

As a herbicide for possible use in grass seed crops, picloram is of interest. It would be useful in various breadleafed weeds which may prove resistant to other treatments. Some plots were laid out at Cadgee of picloram (in the commercial formulation of Tordon 5D-D(R)) at the rate of 10fl. oz. per acre, corresponding to 0.5oz. a.i. of picloram. The yields were measured and the seed submitted for germination tests. The latter were considered most vital because of the translocation of this herbicide and its effects seen in other plants.

The yield of the sprayed plots was slightly more than the control as shown below. Germination was not affected one way or the other.

Pure Seed Yield of Currie Cocksfoot
(gms/quadrat-mean of 3 reps)

Unsprayed	17.7
10fl. oz. Tordon 50-D	21.5

Difference is not significant.

It is concluded that under the conditions of this trial, picloram does not have any adverse effects.

Control of Brome Grass in Established Currie Cocksfoot

In the last few years a problem emerged in stands of perennial grass crops which have been treated with diuron or fluometuron. Annual brome grass species, being resistant to these commonly used herbicides, are beginning to cause severe infestation which choke out the crop.

At two sites, Cadgee and Koppamurra, a series of mini-logarithmic strips were laid down on Currie cocksfoot stand which were infested with brome grass. These strips were observed throughout the season.

At Cadgee, the strips were laid down on May 19th, 1970. The soil type in the crop is a sandy loam. The paddock had a history of diuron and fluometuron usage. In the previous year, heavy infestations of brome grass had appeared. The herbicides and their respective peak dosages were as follows:

Atrazine	P.d.	4lb. a.i./acre
Prometryne		4lb.
Simazine		4lb.
Ametryne		4lb.
Diuron		5lb.
Linuron		5lb.
Fluometuron		5lb.
Propazine		5lb.
RH315		3lb.

At the other site at Koppamurra where the soil was a heavy clay loam the strips were applied on May 20th, 1970. The paddock had also had severe infestations of brome grass in the previous years and adjacent paddocks were also affected. The chemicals applied were as above and in addition

Diuron	5lb. a.i./acre + Wetter 0.1%
Methabenzthiazuron	2lb.
Paraquat	1lb.
Asulam	4lb.

The observations on the two sites were virtually identical, although there was a great difference of soil type. For brevity, the sites may be considered together.

It was found that no herbicides other than the triazines or RH315 gave any lasting effect on the brome grass. RH315 while controlling the brome most satisfactorily caused a build up of storksbill and capeweed at Koppamurra and Cadgee respectively.

Of the triazines, atrazine performed best. Complete control of all weeds including brome grass was obtained with rates as low as $1\frac{1}{4}$lb. a.i./acre throughout the season. The other in order of performance were propazine, ametryne, prometryne and simazine.

In an adjacent paddock at Koppamurra, strips of atrazine applied at $1\frac{1}{4}$lb. a.i./acre were laid down on areas both treated and untreated with diuron 3lb. product per acre. Brome grass was growing equally well on both areas. The strips were very clearly distinguished by the complete absence of brome grass. No adverse effects were noted on the crop even where the atrazine was applied over the earlier application of diuron.

A suggested scheme for removing brome grass would be to change between annual applications of atrazine and diuron as required. This system should be satisfactory for Currie cocksfoot and Demeter fescue and possibly for phalaris crops. It is not suitable for Medea ryegrass as atrazine is toxic to that crop. An application of propazine at the rate of $1-1\frac{1}{2}$lb. a.i./acre may be useful in this case.

WEED CONTROL IN ESTABLISHED MEDEA RYEGRASS SEED CROPS

Medea ryegrass (*Lolium perenne cv. Medea*) is rapidly gaining popularity as a pasture grass for those areas where summer is too severe for the older varieties of perennial ryegrass. The demand for seed has resulted in more crops being planted and the certification standards required have called for efficient weed control. The most unwelcome weeds are other species and cultivars of *Lolium*. However, general weed control is very important also.

It soon became apparent that this crop must be considered in a different light to the other perennial grass crops as it was so much more sensitive to the herbicides usually used. American work over the last five years or so has shown quite clearly that their cultivars of perennial ryegrass are quite sensitive to diuron and if used annually residues of this chemical would build up and completely ruin the stand.

Because of these points our work over the last few years has been concentrated on this crop. A trial consisting of logarithmic strips was carried out in 1968 and in subsequent years, a number of replicated trials were performed.

In 1968, a trial was laid down on a stand of Medea ryegrass south of Lucindale that had been sown on virgin land in July 1967. The logarithmic strips were laid with a Landrover mounted Chesterford mini-logarithmic sprayer on April 9th, 1971. The soil was quite damp. Generally the ground was clear of weeds but rosettes of spear thistle was common. Later in the season, milk thistle became prevalent. Seedlings of Medea ryegrass arising from fallen seed in the last season were also present. The plots were sprayed at 35 psi. The chemicals, which were applied in 28 g.p.a. and their respective peak dosages were as follows -

Asulam P.d.	8lb. a.i./acre
Prefix (R)	8lb. a.i./acre
Fluometuron	8lb. a.i./acre
Diuron	8lb. a.i./acre
Simazine	8lb. a.i./acre
Linuron	8lb. a.i./acre

Observations towards the end of the season revealed that simazine damaged the crop at rates giving satisfactory weed control. On the other hand, Prefix, linuron and asulam while not apparently harming the crop did not satisfactorily control the weeds or ryegrass seedlings. It is noteworthy that whereas Prefix was so severe on Demeter fescue, it appeared to be tolerated by the Medea ryegrass.

The other chemicals appeared promising and were taken forward to 1969 for further investigation.

Weed Control in Medea Ryegrass 1969

This trial yielded information about weed control in a first year stand, but which is "established" by the definition used here.

Experimental

The trial area at Keppoch was sown in October 1968 and the experiment was laid down on June 5th, 1969. The area had been treated with diuron (2.41b. a.i./acre) in May 1967. The sites was on a clay loam which at the time of spraying was quite moist, but less than field capacity.

At spraying the temperature was about 60^{o}F and a slight crosswind was blowing. The crop which was sown in 14 inch rows, was growing vigorously. The plants were about four inches and generally the second tiller stage had been attained. There was a general infestation of burr medic and scattered plants of subterranean clover, capeweed, wireweed and dock. The first three of these were three to four inches diameter at the four to six leaf stage. The last two were smaller, two to three inches in diameter with two to four leaves. No weedy grasses were apparent on the plots.

The chemicals used were fluometuron, diuron and propoazine. They are wettable powders of 80%, 80% and 75% concentration resepctively. They were applied with a portable carbon dioxide pressure spraying system through a single jet at 30 p.s.i. The three chemicals were applied at the following rates:

		lb.a.i./ac					= lb.product/ac
Fluometuron	(F1)	2	(F2)	3	(F3)	5	$2\frac{1}{2}$, $3\frac{3}{4}$, $6\frac{1}{4}$
Diuron	(D1)	2	(D2)	3	(D3)	5	$2\frac{1}{2}$, $3\frac{3}{4}$, $6\frac{1}{4}$
Propazine	(P1)	4	(P2)	6	(P3)	5	8, 12, 16
Control	(C)						

The plots were one-thousandth of an acre and the experiment was replicated four times in a randomised block design.

Oberservations were made during the season and seed yields were taken from square metre quadrats. Samples from the yields were submitted for standard germination tests as required for certification by the Seed Testing Section of the South Australian Department of Agriculture.

Results

Observations during the growth of the crop following spraying indicated that propazine and fluometuron at their respective lowest rates (P1 and F1) had no apparent affect on the vigour of the crop. Some medic and clover was left on these plots. The odd docks and thistles present were virtually unaffected. The middle rates of propazine and fluometuron, as well as the lowest rate of diuron (P2, F2 and D1) resulted in varying amounts of crop damage. Weed control was satisfactory. The remaining treatments P3, F3, D2 and D3 gave most satisfactory weed control, but were unacceptably severe on the ryegrass crop. It should be noted that all plots treated with herbicide had by the end of the trial, at least one weed growing upon them. The control plots were not very weedy, species present included medic, clover, capeweed, crucifers and storksbill. The yield of the plots is shown in Table 3. Regardless of the apparent damage suffered by the crop, there was no effect, with one exception that carried through to effect the final yield. The best yield was obtained from the treatment D1 which is approaching a significant increase above the untreated plots.

TABLE 3. EFFECT OF HERBICIDE TREATMENT ON THE SEED YIELD OF MEDEA RYEGRASS

Treatment	F1	F2	F3	D1	D2	D3	P1	P2	P3	C
Wt. in grams[I] per quadrat	65.9	69.1	76.1	86.6	58.5	18.9**	72.2	72.4	56.1	67.2

[I] Mean of four replicates
L.S.D. (5%) = 25.8 L.S.D. (1%) = 38.1
** Differs significantly from the control at the 1% level

Table 4 displays the percentage of normal seed as determined by a standard germination test. No treatment significantly altered the proportion of this seed which is the desired product.

TABLE 4. EFFECT OF HERBICIDE TREATMENT ON THE PERCENTAGE OF NORMAL SEED OF MEDEA RYEGRASS

Treatment	F1	F2	F3	D1	D2	D3	P1	P2	P3	C
% Normal Seed[I]	93.5	92.0	90.3	91.3	86.8	87.3	91.8	91.5	86.3	93.0

[I] Mean of four replicates
No treatment mean differs significantly from that of the control.

The remainder of the seed is classified into "dead", "abnormal" and "fresh underminated", i.e. living. In Table 5, it amy be seen that the two heavier diuron applications (D2 and D3) significantly increased the proportion of dead and abnormal seed.

TABLE 5. EFFECT OF HERBICIDE TREATMENT ON THE PERCENTAGE OF DEAD AND ABNORMAL SEED OF MEDEA RYEGRASS

Treatment									
F1	F2	F3	D1	D2	D3	P1	P2	P3	C
% Dead and[I] abnormal seed									
4.5	6.3	6.8	7.3	9.8*	9.8*	5.5	4.8	8.0	5.0

[I] Mean of four replicates.
L.S.D. (5%) = 4.1
* Differs significantly from the control at the 5% level

Discussion

It is well known to weed science workers that transient crop damage or less than complete weed control detracts from the acceptability of a herbicide to the user. It is generally to no avail to produce figures, as may be done in this trial, which indicates that these effects are of no consequence to the final yield. Thus an acceptable herbicide must not damage the crop, must kill all the weeds, increase crop yields and be cheap. In the case of a pasture seed crop there must be no effect on seed quality.

It was found in this trial that the treatments which left the crop undamaged gave only fair weed control. More complete control was only obtained at rates which caused crop damage. It may be seen from Table 3 however, that with the exception of the highest rate of diuron (D3 the effect was merely transient. On the basis of yield, F1, F2, F3, D1, P1 and P2 are acceptable treatments. However, apart from F1 and P1 and perhaps D1, growers would be wary of the apparent severity of the damage to the crop.

No treatment appreciably affected the proportion of normal seed, (Table 4) and all figures are above the limit for certification requirements.

Diuron at all levels increased the amount of dead and abnormal seed produced (Table 5), the higher rates significantly so. Fluometuron at the highest rate also increased this proportion, but not significantly. There is a general trend in Tables 4 and 5 indicating that increased rates of herbicide decreased slightly although not significantly the proportion of normal seed set and increased the amount of dead and abnormal seed.

Conclusions

None of the chemicals tested is completely satisfactory. Diuron and fluometuron are both useful at low rates. The sensitivity of ryegrass towards diuron requires that care must be taken to avoid double spraying. It is also possible that annual use of diuron could build up soil levels to a point that crops would suffer from chronic toxicity. Fluometuron although more expensive, could be useful here. On the basis of this trial recommendations for the control of annual weeds in Medea ryegrass are,

Fluometuron	2lb. a.i. per acre	($2\frac{1}{2}$lb. product)
Diuron	2lb. a.i. per acre	($2\frac{1}{2}$lb. product)

Another trial was planned for the crop used in 1968. However, in the summer of 1968-69, the crop was burnt to remove stubble etc. This treatment caused a fair percentage (25-50%) of plant deaths in the area. When the remaining plants were treated with herbicide they were severely damaged and heavy crop deaths ensued. The trial was then abandoned.

Weed Control in Medea Ryegrass 1970

Because of the uncertainty produced in the previous trial, two further trials were carried out. One trial was laid at Mingbool on a sandy loam, the other was at Keppoch on a clay loam. The results from both trials showed the same trends but all effects were magnified on the lighter soil type at Mingbool.

Experimental

At each site the trials were basically the same. The chemicals and their respective rates were as follows:

Diuron	16 (D1)	32 (D2)	48 (D3)	64oz. (D4)	a.i. per acre
Propazine		32 (P1)	48 (P2)	64oz. (P3)	a.i. per acre
Fluometuron		32 (F1)	48 (F2)	64oz. (F3)	a.i. per acre
Control					

Both crops were two years old. The Mingbool plots were sprayed on April 28th, 1970, and those at Keppoch on May 7th, 1970. In both cases, the herbicides were applied with a portable CO_2 sprayer. The treatments were replicated three times. Observations were made during the season and quadrats were harvested to measure seed yield. The seed was submitted for routine germination tests.

Observations and Results

At Mingbool, the weeds present were capeweed, barley grass, winter grass, sub. clover, sorrel and a few dock and storksbill. Initially the crop was markedly affected by all treatments except the lowest rate of each chemical. Later, by mid-spring all plots except the two highest rates of diuron had recovered. The weed control obtained by the propazine treatments was very variable and sub. clover in particular withstood this herbicide. Fluometuron and diuron gave adequate control except at the lowest rates.

Upon inspection of the pure seed yields it is apparent that except for the highest rate of diuron which removed over 95% of the crop plants, all treatments significantly increased the yield over that obtained on unsprayed plots. It is concluded that 1-2lb. a.i. of fluometuron or diuron is satisfactory. As was noted previously with ryegrass, fluometuron is to be preferred because of the definite toxic effects obtained with high rates of diuron.

Effect of herbicide treatment in the pure seed yield of Medea Ryegrass - Mingbool 1970 (gms/quadrat)

Treatment	D1	D2	D3	D4	P1	P2	P3	F1	F2	F3	Cont
Yield (gm)	10.8**	13.3**	6.7*	2.0	12.3**	10.1**	10.5**	11.3**	9.4*	10.4**	3.4

* Treatment differs significantly from the control 5% level
** Treatment differs significantly from the control 1% level

At Keppoch a different set of weeds were the problem. Sowthistle, wireweed, medic, sub. clover and winter grass with odd dock and capeweed plants formed a thick mat between the rows.

About two months after spraying, the two highest rates of all chemicals had given virutally total control of weeds in all cases. However, except for the middle rate of fluometuron (F2), crop damage had been severe. The lowest rate of fluometuron (F1) and the second rate of diuron (D2) gave very acceptable weed control with little or no damage to the crop. The lowest rate of propazine (P1) gave variable results.

Later in the season weed control effects were off in almost all instances except on the propazine plots which in the case of P2 and P3 remained weed free all season. The latter rate appeared to affect the crop throughout the season. The higher rates of fluometuron remained fairly clean as did the highest rate of diuron.

Upon consideration of the seed yields, it may be seen that checks to the crop early in the season did not affect any yields significantly. In fact the highest yielding treatment appeared particularly severely damaged early in the season.

<u>Effect of herbicide treatment on the pure seed yield of Medea Ryegrass - Keppoch 1970</u>
(gms/quadrat)

Treatment	D1	D2	D3	D4	P1	P2	P3	F1	F2	F3	Cont
Yield (gm)	38.1	21.2	27.5	32.4	37.1	39.5	30.6	27.9	40.1	49.4*	28.5

*Treatment differs significantly from the control at the 5% level.

As found in earlier work, while diuron at high rates did not adversely affect the crop, increasing rates of fluometuron were significantly beneficial.

By pooling the results of the three experiments reported here (i.e. Mingbool 1970, Keppoch 1969 and 1970) and expressing the pooled yields on scale where the pooled control is 100, the following table is derived.

D1	D2	D3	D4	P1	P2	P3	F1	F2	F3
195	186	108	87	201	183	167	178	175	199

(Pooled Control = 100)

It is noteworthy that whereas for diuron and propazine there is a definite decrease in yield with increasing rates of chemical applied, this is not so for fluometuron. It is concluded that fluometuron is therefore safer to use on Medea ryegrass as a precaution against double spraying and similar mishaps. However, considering that with 1lb. a.i. of diuron, a highly satisfactory result may be obtained, and that even by doubling the rate, the yield is still almost as satisfactory, then allowing for the lower cost of diuron, it is probably better to use this chemical. It would be necessary however to ensure that diuron residues do not build up form year to year. A practical assessment of this possibility is derived from examination of yield figures from year to year. Where a sudden drop in yield occurs, not attributable to other causes, it is possible that a toxic level of diuron has been reached.

Adjacent to the Keppoch plots four logarithmic strips were applied with a Chesterford portable mini-logarithmic sprayer. The herbicides and their respective peak dosages were as follows:

Methabenzthiazuron	P.d.	2lb. a.i./acre
Atrazine		5lb. a.i./acre
Lenacil		5lb. a.i./acre
Asulam		4lb. a.i./acre

In brief it was found that atrazine was too severe on the crop at weed killing rates. Methabenzthiazuron did not adversely affect the crop but its control of weeds was not good. Its lack of activity on wireweed caused this weed to dominate in the plot. Asulam initially damaged the crop severely, but by the end of the season recovery appeared complete. However, for the same reason as the previous herbicide, wireweed dominated.

Lenacil was extremely promising at rates of 2-3lb. a.i. Even at higher rates, crop tolerance was excellent but below this rate, weeds especially wireweed had reinfested the plot by mid-season. This chemical is definitely worth pursuing on this crop.

THE TOLERANCE OF ESTABLISHED CURRIE COCKSFOOT TO HORMONE HERBICIDES

A comprehensive programme to study the tolerance of grass crops of various ages and histories to a range of chemicals was planned but did not eventuate. As a preliminary to this, in order to establish suitable methods and standards it was decided to study the tolerance of an established grass to a herbicide considered likelyto have a large effect on seed yield. Ester 2,4-D at the rate of 1lb. a.e./acre was chosen and as a suitable crop of Currie cocksfoot was available, this combination of chemical and crop was tried in two years, 1969 and 1970.

In both years, the standard rate was sprayed approximately each fortnight from June, when the plants began active growth through to early flowering. Each time of spraying was replicated three times. Seed yields were samples at the end of the season and in 1970 tiller numbers per unit length of rows sampled were assessed.

In 1969, the whole area had been treated with 3lb. product per acre of fluometuron. An invasion of brome grass appeared about midway through the season and some trial plots were unharvestable. In 1970 the area was treated with diuron but the plots remained quite clean throughout the season.

The seed from both years was submitted for the usual germination tests to determine whether the herbicide had affected the quality of the seed.

In 1969 the dates of spraying and the pure seed yield from the respective plots were as follows:

June 17th	26.7 gms/plot
July 8th	(48.0)
July 14th	(34.5)
July 28th	52.4
August 11th	38.3
August 25th	(29.4)
September 15th	(26.5)
September 29th	10.4
October 8th	13.1
October 20th	32.9
Unsprayed	42.7

The bracketed figures are means of two replicates only. The other figures are means of three values.

Because of the missing data, these figures do not lend themselves to analysis. However, compared to the unsprayed treatment, it would appear that the earliest spraying (June 17th) and spraying towards the end of the season especially September-October reduced yield relative to unsprayed plots or those treated in July-August. The crop was noted as being just at the beginning of stem elongation on September 15th.

Upon submission for analysis it was found that time of spraying had no effect on germination percentage or numbers of abnormal seedlings in dead seeds. In all treatments, the germination percentage was over 90%. This is quite satisfactory for certification purposes.

In the following year, the dates of spraying and the pure seed yields from the respective plots were as follows:

June 19th	12.3 gms/plot	cd
July 2nd	10.1	cd
July 28th	21.9	ab
August 14th	20.1	abc
August 24th	21.8	ab
September 23rd	19.8	abc
October 6th	27.8	a
October 20th	21.0	ab
November 13th	25.1	ab
Unsprayed	17.7	bcd

Mean of 3 replicates. Figures followed by the same letter do not differ significantly at the 5% level (Duncan's multiple range test).

The results here support the tentative conclusions from 1969. The detrimental effect of early spraying appears even more strongly in these results. July-August sprayings are again beneficial but not significantly so. Towards the end of the season in 1970 the results diverge markedly. This could be reasonably attributed to seasonal differences. September 1969 was cold and wet for the first half followed by five weeks of unseasonably warm and dry weather. The season in 1970 was much more even and little or no moisture stress would have occurred in the trial period.

To try and determine what factors influence seed yield, the number of fertile tillers per sample (unit length of three rows) were counted.

These are as follows:

	Fertile tillers/ row length		
June 19th	258.7	d	
July 2nd	352.0	cd	
July 28th	488.3	abc	Mean of 3 replicates.
August 14th	558.3	abc	Figures followed by
August 24th	445.3	abcd	the same letter do not
September 23rd	425.7	abcd	differ significantly
October 6th	654.7	a	at the 5% level.
October 20th	373.0	bcd	(Duncan's multiple
November 13th	584.0	ab	range test).
Unsprayed	443.0	abcd	

By linear regression of seed yield against tiller number, ($r = 0.84$) a relationship was derived as follows:

$$Y = 0.038N + 2.0$$ where Y = pure seed yield in grams
N = tiller number.

This formula indicates that each fertile tiller produces 38 mgm of pure seed. This figure compared well with unpublished results of Messrs. Boyce and Watts of the Pasture Section, whose studies indicate 45 mgm to be the yield of pure seed per fertile tiller in a more favourable environment.

It would appear that tiller number is the critical component of seed yield. Herbicide applications closer to anthesis could possibly have been harmful but under normal conditions, spraying at such a late stage is not carried out. Again, analysis of this year's harvest indicated no effects on seed quality.

Thus, these results should be interpreted in the light of timely applications and possible effects on yield. It would appear that at the beginning of seasonal growth, when tiller initials are being laid down, spraying with ester 2,4-D at the rate of 1lb. a.e. per acre (if not lower) must be avoided. This is analogous for the situation for cereals where the recommendation is for spraying hormone herbicides after tillering has commenced. In the conditions of this experiment, i.e. in the South-east of South Australia the appropriate time to spray these herbicides would be July-August.

For best results early removal of competition is desirable. This is achieved by applying residual herbicides at or just after the break of the season. If this is not possible or perhaps economical, then broadleafed weed control using hormone-type herbicides must be put off until after tillering has commenced. Within this limitation spraying should still be as early as possible to minimize weed competition.

WEED CONTROL IN SEEDLING GRASS CROPS

As defined at the beginning of this report, seedling grasses are those crops prior to their first summer. Thus in the case of autumn sowings the crops are only up to about seven months old and for spring sowings up to four months old.

The relationship between weeds and grass plants of these ages is completely analagous to the weed/cereal relationships. It is appropriate to look at the latter situation, in which much experience has been gained in this State, to provide guides to dealing with seedling grass seed crops.

In the cereal situation, fine degrees of control may be obtained. Broadleafed weeds may be controlled early using the well known post-emergent sprays, or later (during tillering) using the hormone type herbicides. It is possible to control grassy weeds as well either prior to emergence (diallate, triallate and trifluralin) or post-emergence (barban).

Broadleafed weed control relies on differences in plant morphology and biochemistry between cereals and weeds. Most of these differences still apply between weeds and grass crop plants. However, the difficulty is with grassy weed control as the difference which is exploited is mainly in seed size, which is associated with differences in food reserved for the seedling. This differentiating feature is not present between grass crop seeds and grassy weed seeds. As will be shown later, this problem is unsurmountable at present.

The work recorded here was carried out in 1966, 1968 and 1970.

It was found in some trials laid down in 1966 that diuron, simazine and atrazine (the usual herbicides for established crops) were "very toxic to the crop seedlings when rates were applied which would give satisfactory weed control". The parallel to cereal crops (as outlined above) was also noticed and a second conclusion was that "linuron and prometryne are worth further investigation". Also, it was noted, although no details are given that demeter fescue has the most tolerant seedlings to residual herbicides. This last point is of some importance.

In Demeter fescue crops, it is important that seedlings developing from fallen seed of the previous crop be removed. This is because the presence of F1 seeds which such seedlings would ultimately yield, will downgrade the seed. If seedlings are relatively resistant then it indicates that careful application of herbicides is required in established crops to ensure correct application rates which will completely remove such seedlings.

During 1968, the Pasture Section investigated weed control in seedling Demeter fescue and Currie cocksfoot at Mingbool near Mt. Gambier. Both crops had been sown on May 10th, 1968 and by mid-spring a severe capeweed problem had developed. A number of other annual weeds were also present. Originally no weed control measures were envisaged but it was recognized that this was a very real problem and the opportunity to screen herbicides was taken.

On each crop, the following treatments were applied on October 10th, 1968. The capeweed was at early flowering and very advanced according to usual standards.

Ester 2,4-D (80%)	½, 1pt. product
Diquat	1, 2pt. product
Diquat	1, 2pt. product plus surfactant
Linuron	1, 2lb. product
Prometryne	1, 2lb. product
Methabenzthiazuron	2, 4lb. product
Bromoxynil/MCPA (Buctril MA (R))	2, 4pt. product
Picloram/2,4-D (Tordon 50-D (R))	1, 2pt. product
Handweeded	
Unsprayed	

In December when the demeter fescue was visually assessed it was found that the diquat at 1 pt. per acre with or without surfactant was not effective and at the higher rate results were variable. Methabenzthiazuron at both rates and Buctil MA (R) at the rate of 4 pt. per acre had quite obviously retarded the crop. The other herbicides generally gave satisfactory control of capeweed with no apparently detrimental effects to the crop. On a cost basis ester 2,4-D at a rate of between ¾-1pt. 80% product per acre would be the most satisfactory.

The Currie cocksfoot did not appear to have the same degree of tolerance as the previous crop and rates at which crop damage occurred overlapped with rates providing satisfactory weed control.

Diquat and Buctil MA (R) were as before but in this case linuron and prometryne at the higher rates damaged the crop. Again in summary, ester 2,4-D was probably the most suitable herbicide on a cost/effectiveness basis. Again the rate to be used would be ¾-1pt. 80% product per acre.

It must be stressed that in this case the spraying was very late and therefore the herbicides designed to be applied at early post-emergence were at a great disadvantage.

In the same year, a trial was started at Kybybolite Research Centre in which animal production off pure grass swards of various species was to be assessed. In establishing these stands, wireweed was a seriojs problem. Bromoxynil/ MCPA (Buctril MA (R)) was applied to all grasses at the time equivalent to its use in cereals, i.e. early post-emergence and wireweed control was in all cases, better than 99% with no apparent effects on any of the grasses. The species involved were virtually all the recognized pasture grasses used in South Australia.

<u>Weed Control in Seeding Grass Crops 1970</u>

A trial was laid down on each of the following seedling grass crops, Demeter fescue, Medea ryegrass and Currie cocksfoot. A trial on phalaris, although planned, did not eventuate.

<u>Medea Ryegrass</u>

The crop near Naracoorte was sown in June 1970. It was sprayed on July 28th, 1970 with a portable CO_2 sprayer. The crop plants at that stage had 4-5 leaves. The plots were 1/1000th acre and were replicated three times.

The chemicals and their respective rates were:

Prometryne	8	16	32oz. a.i./acre
Linuron	8	16	32oz. a.i./acre
Control			

The paddock was not very weedy. Some capeweed, clover cotula and some weedy grasses were noted.

Seven weeks after treatment, it was found that the lowest rate of prometryne and linuron gave satisfactory weed control without seriously affecting the crop. At the higher rates of both chemicals damage to the crop ranged from 50% to 100%.

Later observations in the season confirmed the early findings and it was concluded that $\frac{1}{2}$lb. a.i. of prometryne or linuron (1lb. product in both cases) was the highest dose that could be recommended at this stage. Because of the necessity to use a low rate, application should be as early as possible to increase the chance of success. Grassy weeds would still be a problem.

Currie cocksfoot

The crop near Kalangadoo was sown in July 1970. The treatments were applied when the crop had $1\frac{1}{2}$-2 leaves on August 10th, 1970. All other details as for the preceding trial on Medea ryegrass.

The paddock had not been well prepared and the surface was uneven. The crop was heavily infested with capeweed, barley grass and annual ryegrass.

Five weeks after spraying it was found that the crop had tolerated both chemicals at all rates very well. Weed control was generally poor at the lower rates, but at the higher rates of both chemicals it was satisfactory. The herbicides were at a disadvantage as the poor seedbed preparation had enabled older weeds to survive and these recovered from the effects of the herbicides.

In November, i.e. towards the end of the season, it was found that more effective weed control had been obtained with prometryne than linuron, but this is not meaningful in view of the facts given previously.

It appeared from this trial, that up to 2lb. a.i./acre of either herbicide could be recommended, but from other experience with the herbicides, if the seedbed preparation is adequate then 1lb. a.i. should be adequate.

Demeter fescue

This trial near Naracoorte was larger than those previously described. Apart from the replicated trial, a number of herbicides were investigated in mini-logarithmic strips.

The crop was sown in May 1970. At the time of spraying the fescue plants had 1½-2 leaves and the capeweed which was the main problem, was 3-6 inches across. Other weeds were ryegrass, barley grass, winter grass, clover and toadrush. The plots were sprayed on June 19th 1970 with a portable CO_2 sprayer. The plots were 1/1000th acre and the treatments replicated three times.

The herbicides and their rates of application were as follows:

Prometryne	8	16	32oz. a.i./acre
Linuron	8	16	32oz. a.i./acre
Asulam		16	32oz. a.i./acre (60% formulation)

During the course of the trial, the unsprayed crop surrounding the experimental area was so thickly infested with capeweed resulting in such poor crop establishment that the crop was abandoned with a view to trying again the following year.

The asulam treatments were not successful as the only weeds effectively removed were toadrush and winter grass. The other chemicals gave satisfactory results on toadrush and capeweed at all rates and at higher rates barley grass was also controlled. Linuron was more consistent on capeweed, but prometryne performed better on annual grass.

At the highest rate of prometryne and linuron, although no immediate effects were apparent on the crop, about mid-season some transient damage occurred. The following table illustrates the herbicidal effects referred to.

Plant numbers per square metre quadrat (13.11.70)

Mean of two quadrats

		Crop			Grassy weeds			Capeweed		
		Rep I	Rep II	Rep III	Rep I	Rep II	Rep III	Rep I	Rep II	Rep III
Prometryne	8	5.5	7.5	7.0	5.5	7.5	6.5	0.5	2.5	0.5
	16	5.0	5.5	7.5	5.0	9.0	4.5	0.5	0.5	0.5
	32	9.5	8.0	7.5	1.0	3.0	3.5	0	0	0
Linuron	8	7.5	6.5	5.5	4.5	5.0	3.0	0	0	0
	16	8.5	8.5	7.0	3.5	6.0	3.5	0	0	0
	32	9.0	14.0	9.5	4.5	0.5	0	0	0	0
Control		3.0	3.5	6.5	5.0	4.5	2.0	9.0	6.0	7.5

Mini-logarithmic strips of the following herbicides at their respective peak dosages as shown were applied adjacent to the trial:

Bromoxynil	P.d.	1lb. a.i./acre
Diquat		0.5lb. active ion/acre (2pt. product)
Propazine		6lb. a.i./acre
Methabenzthiazuron		3lb. a.i./acre
Lenacil		5lb. a.i./acre

Diquat naturally gave only temporary capeweed control and reinfestation occurred rapidly. Propazine and lenacil were severe on the crop and in the latter case, capeweed was quite tolerant. Bromoxynil and methabenzthiazuron at rates of $1\frac{1}{2}$pt. 20% product and 1lb. product per acre respectively appeared quite promising as crop tolerance and weed control were both satisfactory.

In summary, it appears that Demeter fescue and Currie cocksfoot possess a tolerance to linuron and prometryne to that of cereals. Broadleafed weed control obtained with the herbicides (especially capeweed) is a very useful step forward. Unpublished work by the Pasture Section would indicate that Seedmaster phalaris of similar age to the crops as given above does not have as great a tolerance as dees these crops. Medea ryegrass is obviously the most sensitive and consequently the latitude between effective weed killing rates and the upper levels of tolerance is smallest.

The outstanding problem is that of grassy weed control, although high rates of linuron and prometryne may be some help. Bromegrass which is becoming such a problem in certain situations would not be controlled and furthermore the rates of linuron and prometryne required are too high for Medea ryegrass.

GENERAL CONCLUSIONS

Apart from the actual herbicide recommendations for weed control in the various crops which are published elsewhere, a number of points are worthy of mention at this stage. Some of the following has been noted in the reports, but it is felt that they are worth assembling and presenting as general conclusions to the work.

1. Deficiencies of small plot work.

Regardless of how successful or otherwise a treatment appears on a small plot i.e. one, two or three thousandths of an acre as used in these trials, the result obtained on broad acres with full size equipment generally gives a more favourable impression of chemical treatments. The problem caused by small plot work seem to be related to

- prostrate crops - plots of legume crops and even prostrate grass crops especially ryegrass are difficult to define because of the spread of material over the ground. Samples must be taken very carefully to avoid harvesting material from adjacent plots.

- soil acting herbicides - great precision is required to ensure correct spraying. Water movement across or through the soil can nullify careful placement of herbicides.

- soil incorporated herbicides - the movement of soil as a result of incorporation can obliterate the original plot edges and effectively move the whole plot sideways. If all the plots move to the same degree less problems arise, but where a plot of incorporated herbicide adjoins a plot which does not require this treatment, the two plots can get caught up with each other. This problem is due to using full size (incorporation) machinery in small plot work. But will any other scaled down method of incorporation be relevant in interpreting the behaviour of the herbicide under normal farming conditions?

- threshing legumes - it is difficult to thresh legumes, in particular medic burr, in small samples. It is not feasible to use commercial seed cleaning equipment. As cleaning percentage is a vital factor in assessing yields, considerable errors in estimating increases are likely to arise. This is even more acute if the use of a particular herbicide has altered the hardness of the burr.

These problems of small plots lead to a disappointing lack of significance in the results. This ensures that erring will be on the side of safety but it explains why farmers have been able to get good results with lower rates of recommended herbicides or in other cases with economical rates of unrecommended herbicides.

2. <u>Generalisations among crops.</u>

It is encouraging to find that upon assessment of the results certain generalisations may be seen. Thus at this stage, in all experience to which we have access, all varieties of lucerne behave similarly, so that simple recommendations may be issued. This also applies for all cultivars of subterranean clover. Amongst grasses, phalaris, Demeter fescue and Currie cocksfoot may be grouped, but Medea ryegrass is less tolerant to herbicides and must be dealt with separately. This division applies to both seedling and established crops. In the case of seedling crops, it is possible that phalaris must be placed midway between Medea ryegrass and the other crops.

3. <u>Generalisations among chemicals.</u>

Not many that are certain have been found but it would appear that benefin, trifluralin, and RH315 can be used safely on all legume crops. Also diuron appears to be safe on all perennials, both grasses and lucerne. Strawberry clover and perhaps Medea ryegrass should not be included but compared to lucerne and the other grasses, these are not very significant.

4. <u>Generalisations among weeds.</u>

There are no generalisations about weeds.

5. Relationship of weed control to yield.

It is readily apparent that the degree of control exerted on the weeds is not reflected in the yields. At high rates of chemicals, definite toxic effects may be seen and although weed competition would be non-existent, yields are not the highest.

At low rates which sometimes yielded the highest, the weed control would be considered unacceptable by the average seedgrower. In the case of wireweed in legumes, which should no longer be a problem any weeds left or invading will cause harvesting problems, so that all of these plants in this situation must be eliminated.

However in most other cases it appears that as long as no weeds are present whose seed would contaminate the harvest, weed control may not be really worthwhile. Certainly, complete weed control is not necessary.

6. Safety to seed quality.

Most herbicides used here move into the crop plants one way or another. It appears that although at high rates reduction in yields may occur, no reduction takes place in seed quality as measured by standard germination procedures. This statement is based on germination tests carried out on legume and grass seed treated with a wide range of herbicides over three years.

It is of interest to note that the South Australian recommendations as published in "Herbicides for Weed Control 1971-72", the S.A. Journal of Agriculture and elsewhere are comparable to overseas findings. In the case of terbacil for lucerne and trifluralin for pasture legumes, the South Australian work was prior to that overseas.

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Again, we are glad to express our thanks to the co-operating growers without whose assistance this work would have been much more difficult.

Also, to our colleagues in industry and the Department of Agriculture we reiterate our appreciation for the practical help and the many discussions and critical assessments they have made over the years.

P.M. KLOOT

J.H. DAWES

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	Phalaris (est.)	II 3-4
	Ryegrass (est.)	II 13-20
	Strawberry clover	I 16-17

BOTANICAL NAMES OF PLANTS MENTIONED

Barley grass	Hordeum spp. (usually H. leporinum Link)
Brome grass	Bromus spp.
Capeweed	Arctotheca calendula (L) Levyns
Chickweed	Cerastium glomeratum Thuill.
Clover	Trifolium spp.
Cocksfoot, Currie	Dactylis glomerata L. cv. Currie
Cotula	Cotula australis (Less) Hook. f.
Dock	Rumex spp.
Fathen	Chenopodium album L.
Fescue, Demeter	Festuca arundinacea Schreb. cv. Demeter
Fumitory	Fumaria muralis Sond.
Lovegrass	Eragrostis sp.
Lucerne, Hunter River	Medicago sativa L. cv. Hunter River
Du Puits	______ ______ cv. Du Puits.
Mallow	Malva sp.
Medic, Burr	Medicago polymorpha L.
Harbinger strand	______ littoralis Rhode cv. Harbinger
Jemalong barrel	______ truncatula Gaertn. cv. Jemalong
Paragosa gema	______ rugosa Desr. cv. Paragosa
Tornafield disc	______ tornata (L) Mill cv. Tornafield
Mustard	Sisymbrium spp.
Nettle, Stinging	Urtica urens L.
Phalaris, Seedmaster	Phalaris tuberosa L. cv. Seedmaster
Sirocco	______ ______ cv. Sirocco
Poppy	Papaver spp.
Ryegrass, Annual	Lolium rigidum Gaud.
Medea	
perennial	Lolium perenne L. cv. Medea
Salvation jane	Echium lycopsis L.
Silver grass	Vulpia spp.
Sorrel	Rumex acetosella L.
Soursob	Oxalis pes-caprae L.
Storksbill	Erodium spp.
Sub. clover	Trifolium subterraneum L.
Sub-clover, Howard	______ ______ cv. Howard
Clare	______ ______ cv. Clare
Thistle, Milk	Sonchus oleraceous L.
Spear	Cirsium vulgare Ten.
Toadrush	Juncus bufonis L.
Winter grass	Poa annua L.
Wireweed	Polygonum aviculare L.