WEEDS OF NON-CEREAL CROPS - A REVIEW

W.L. FELTON

Department of Agriculture
Agricultural Research Centre
Tamworth N.S.W. 2340

Summary. This review covers a wide range of broadacre and intensively cultivated crops. The limited work being undertaken in Australia is reflected by the isolated pieces of information available in the literature and the lack of contributions to this Conference. Papers on lupins, vegetables, turf, crop tolerance and conservation tillage are included in this review.

INTRODUCTION

Non-cereal crops occupy a small portion of the cropped area (Table 1) which limits the potential herbicide market. Chemical companies have little commercial incentive to engage in development programmes for minor crops. Even in many high value horticultural and irrigated crops there is insufficient potential for the volume of product required to make it economically viable.

Table 1. Australian production statistics 1979-80.

Crop	Area (ha x 10^6)	Percent of total	Value ($ x 10^6)	Percent of total
Wheat	11.2	62	2179	42.3
Other cereals	4.3	24	734	14.2
Cereal hay	1.1	6	-	-
Grain legumes	0.2	1	49	9.5
Oilseeds	0.4	2	185	3.6
Fruit (incl. grapes)	0.2	0.9	630	12.2
Vegetables	0.1	0.8	547	10.6

In the past, many crops were grown in rows and weeds were controlled by interrow cultivation - historically a low cost operation. With the rise in machinery, fuel and labour costs, there is an increasing need for chemical control to be integrated into the management programme. However, since 1965 there has been a decline in the publication of the results of herbicide trials. It is to the detriment of weed control generally that these trials are regarded as unfashionable or somewhat less scientific than studies on the biology of weeds and the relationships of weeds in cropping or pasture systems. All are important in developing effective control programmes.

The spectrum of weeds occurring in non-cereal crops in Australia is probably similar to that outlined in the reviews presented for each State at the Australian Weeds Conference in 1970. However, with the changes in control strategies available, many weeds which were a problem then can now be controlled. Significant examples are:

1. Wimmera ryegrass (*Lolium rigidum*) is a major weed of winter crops in southern Australia (Levick 1969) which was controlled in lupins by the pre-emergence application of diallate, trifluralin or simazine until the release of diclofop methyl. Diallate and

trifluralin require incorporation and simazine requires good moisture conditions for effective control. The advent of a post-emergence control measure for this weed with diclofop methyl (Anderson 1978) overcame the incorporation requirement and allows lupins to be direct drilled.

2. Thornapples (*Datura* spp.) are a problem in most summer crops in northern New South Wales and southern Queensland. In soybeans, thornapples can substantially reduce yield and the seed is a prohibited grain contaminant at harvest. Prior to the availability of bentazone satisfactory chemical control was not available (Felton 1978). More recently acifluorfen has also been recommended (Rawson *et al.* 1980) and tank mixing acifluorfen with bentazone has been found to give more effective weed control than either compound applied alone (Kapusta *et al.* 1978).

LUPINS

The introduction of lupins as a successful alternative winter crop in southern regions is reflected by two papers submitted to this Conference.

At Rutherglen, Code and Reeves screened 22 herbicides in lupins in 1979 and further evaluated the most promising (atrazine, propazine, metribuzin and oxyfluorfen) in 1980. In this work both the reduction in wild radish (*Raphanus raphanistrum*) numbers and in weed seed production were assessed. The current recommendations of simazine at 2 kg ha^{-1} or simazine at 1.5 kg ha^{-1} + trifluralin at 0.4 kg ha^{-1} reduce radish density but do not decrease seed production sufficiently. Differential tolerance of lupins (cv Hamburg or Uniharvest) to the herbicides occurred in the treatments which reduced both weed number and seed production (Table 2).

Table 2. The tolerance of lupins to several herbicides (from paper by Code and Reeves).

Herbicide	Rate (kg ha^{-1})	Crop yield (compared with control) Hamburg	Uniharvest
Atrazine	2	Unchanged	Increase
	3	Unchanged	Decrease
	4	Decrease	Decrease
Propazine	2	Increase	Increase
	4	Decrease	Unchanged
Metribuzin	0.7	Unchanged	Unchanged
	1.05	Increase	Unchanged
Oxyfluorfen	0.48	Increase	Decrease
	0.96	Unchanged	Decrease

Fua outlined control recommendations in lupins for both wet and dry conditions and discussed the problems associated with direct drilling. Simazine applied pre-sowing and incorporated was better than applied post sowing pre-emergence. At both sites in 1979 weed control was similar with these treatments but crop yield lower with the post-sowing application (Table 3). Oryzalin, trifluralin and oxyfluorfen at sowing and diclofop methyl and PP009 post-emergence, all after a pre-planting treatment of paraquat/diquat, gave good results although grass control was unsatisfactory with oxyfluorfen. PP009 controlled bromegrass (*Bromus* spp.) as well as ryegrass and wild oats (*Avena fatua*). The lack of a suitable post-emergence broadleaf weed herbicide is identified as a problem. It was pleasing to see the control data for the various weeds presented as this can be valuable information for other situations.

Table 3. The effect of pre-sowing and post-sowing applications of simazine in direct drilled lupins (from paper by Fua).

Treatment[1]	Rate ($kg\ ha^{-1}$)	Lupin yield ($kg\ ha^{-1}$) N.S.W.		Lupin yield ($kg\ ha^{-1}$) Victoria
Nil		308		880
Simazine pre-sowing	1.2	343		1430
	1.8	324		1570
	2.4	291		1420
Simazine post-sowing	1.2	209		1340
	1.8	227		1140
	2.4	208		1340
Means for simazine:				
Rate	1.2		831	
	1.8		816	
	2.4		815	
Timing	Pre-sowing		896	
	Post-sowing		744	

[1] Paraquat/diquat at 0.25/0.15 $kg\ ha^{-1}$ applied pre-sowing in all treatments.

VEGETABLE CROPS

Two papers only were submitted on weed control in vegetable crops.

The methods available for controlling weeds in sugar beet were compared by Black in two trials in Northern Tasmania in 1978/79. The effectiveness of the various mechanical and chemical control measures and the poor competitive resistance of sugar beet is clearly evident. Failure to control weeds reduced yield by 75% at one site and 79% at the other.

In a high value crop the high cost of an effective weed control programme can be justified by relatively small increases in productivity. The discussion in this paper was not developed on cost effectiveness of the various treatments in relation to production. Nevertheless the economics of weed control were at least considered and related to the local situation. Costs and gross margins for the yields obtained, assuming a sugar beet price of $27 per tonne, are given in Table 4 (Black, personal communication, 1981).

Although the hand weeding cost is an estimate and the treatments used have been subsequently revised for commercial recommendation, the benefits of the various herbicide treatments in economic terms are demonstrated. In addition mechanical harvesting would have further disadvantaged the inter-row cultivation treatment due to size of the beet and weeds remaining in the rows blocking the

Table 4. The effect of method of weed control on sugar beet profitability (based on yield data from paper by Black).

Treatment	Treatment cost ($)	Other variable costs ($)	Total variable costs ($)	Forthside Gross income ($)	Forthside Gross margin ($)	Cressy Gross income ($)	Cressy Gross margin ($)
Weedy control	0	454	454	613	159	346	-108
Hand weeded control	800	454	1254	2449	1195	1623	369
Inter-row cultivation (IRC)	40	454	494	923	429	1018	524
IRC + Band spray A	113	454	567	1361	794	1085	518
Overall spray B + IRC	219	454	673	1823	1200	1396	723
Overall spray B + IRC + Band spray A	292	454	746	2174	1428	1426	680
Overall spray B + Overall spray A	363	454	817	2338	1521	1504	687

A. Phenmedipham 0.79 kg ha^{-1} + ethofumesate 1.0 kg ha^{-1}, applied post-emergence.

B. Ethofumesate 1.5 kg ha^{-1} + lenacil 0.64 kg ha^{-1}, applied pre-emergence.

equipment.

Wilson and Scheffer's paper reports the results of a comprehensive study on the control of many weeds which are a problem in onion growing in New Zealand. Details of control and crop tolerance support the current recommendation that choridazon/chlorbufam is an effective treatment. However, chlorthal-dimethyl applied pre-emergence followed by chlorpropham or propachlor post-emergence at the loop stage gave better control with less risk of crop damage. This was emphasised by the 2 x rate of chlorthal dimethyl.

TURF

The final paper in this section was a review by James on weeds of turf in eastern Australia and their control. The last such mention of turf weed control at an Australian Weeds Conference was in 1965 and I quote Mr. Kelvin Green - "the neglect of turf culture in Australia is evidenced by the failure to receive a single paper for this section". Most of the weeds that he outlined then are still a problem today. James' paper includes a discussion on management methods and chemical weed control. A feature was the summary on the tolerance of eight turf species to 32 different herbicides. Advisory Officers receive a considerable number of requests for information on the control of weeds in turf and in many cases the problem is in selecting a treatment that is not phytotoxic to the turf itself.

Organisations involved in turf research do exist and papers on their work would be a valuable contribution to an Australian Weeds Conference. At future Conferences an invited paper from one of them may be appropriate.

CROP TOLERANCE

As well as weed efficacy data it is important to know crop tolerance. Although covered in another section it is acknowledged that many non-cereal crops were included in the study on plant back periods after application of dicamba reported by Morrow and Murrie. These data are relevant to the lighter acid soils of southern Australia; it is hoped that further work is planned to cover other crops such as sunflower, soybean and faba bean, particularly on the heavier more alkaline soils of northern New South Wales and southern Queensland.

CONSERVATION TILLAGE

The effect of reduced or no fallow cultivation techniques on the persistence characteristics of residual herbicides should also be considered. Herron *et al.* in another session outline encouraging results obtained using mainly non-residual herbicides in no-till systems on the Darling Downs. Although weed control costs are variable and more expensive than is commercially attractive at this stage, and the management decisions more precise, this technology has enormous potential to stabilise, diversify and extend our cropping practices. On self mulching clay soils in the northern wheat belt it is certainly a better management system with respect to erosion control (Marston 1978).

CONCLUSION

We need a better system of documenting and reviewing new and existing weed control techniques in Australia so that data derived in Australia is more readily available. Direct contact between research, extension and company development staff has in the past been the major means of communication, but it is becoming increasingly difficult to keep up to date with changes in technology and some consideration must be given to changing our current system of communication. The procedure in the United States where annual regional conferences are convened with a citable proceedings has merit and would eliminate some of the extreme diversity of content which exists at Australian Conferences. It may also encourage many people working in weed control but who do not contribute to the present system to become involved and make available the results of their efforts.

LITERATURE CITED

Anderson, I.P. 1978. Proc. 1st Conf. Coun. Aust. Weed Sci. Soc., Melbourne. p. 64-66.

Felton, W.L. 1978. Proc. 1st Conf. Coun. Aust. Weed Sci. Soc., Melbourne. p. 189-196.

Kapusta, G., C.F. Steiker and P.J. McGinnity. 1978. Proc. N. Central Weed Control Conf. 33: 66.

Levick, G.R.T. 1969. M. Agr. Sc. thesis, Univ. of Melbourne.

Marston, D. 1978. J. Soil Conserv. Service N.S.W. 34 (4): 194.

Rawson, J.E., J.M.T. Marley and S.R. Walsh. 1980. Qld. Agric. Jour. 106: 369.