ARE PRE-EMERGENT WEED CONTROL AND ZERO TILLAGE COMPATIBLE IN REGIONS WITH LIMITED RAINFALL?

L. Streit
Ciba Australia, West End Q 4101, Australia

Summary. Consistent performance of pre-emergent herbicides requires good incorporation by rainfall. Since rain is unreliable, mechanical incorporation is often needed, which is not desirable in zero-tillage systems. Conservation of soil moisture is imperative under semi-arid conditions, where planting and herbicide application is often carried out simultaneously using one implement. Crop phytotoxicity may occur from heavy rainfall on light soils immediately after application. Alternatively, poor weed control may result from insufficient rainfall after application, failing to incorporate the herbicides into the soil profile. These problems are discussed with weed control in sorghum as an example. The requirement for careful planning is highlighted.

INTRODUCTION

Water is considered the major limiting factor affecting yields in rain-fed grain growing in Queensland. Zero-tillage has several advantages under the semi-arid conditions of these regions: It conserves moisture, reduces erosion, uses less fuel and ensures more consistent yields (1). The benefits of zero-tillage require efficient weed control, which most often depends on the use of herbicides in addition to crop rotation.

Pre-emergence residual herbicides are a cost-effective tool for ensuring ideal growing conditions for the crop. Consistent performance of pre-emergence herbicides requires good incorporation by rainfall. Since rain is unreliable, herbicide application behind the planter may result in poor weed control due to lack of incorporation. Alternatively, crop phytotoxicity may occur from heavy rainfall on light soils immediately after application. Volatile formulations are also unsuitable for zero-tillage, since they require mechanical incorporation.

Several problems are associated with pre-emergence herbicide use in zero-tillage cropping systems:

- poor results if no rain follows after the planting rain;
- reduced efficacy because of heavy stubble; and
- lack of flexibility, i.e. no "opportunity cropping" due to concern over herbicide residues in crop rotation.

Therefore, post-emergent weed control is often seen as the answer to these problems. However, careful planning on an individual paddock basis, together with early pre-plant herbicide application, is a recipe for a long-term, successful approach to weed control in a sustainable zero-tillage broad-acre cropping system. This shall be demonstrated with sorghum in a summer/winter crop rotation as an example (reasonable rainfall, e.g. Darling Downs region).

CROP ROTATIONS

By following a crop rotation, carefully planned for each paddock (Table 1), it can be decided in advance, which crop will be planted and what preparation is needed. Although climatic conditions may render some adjustments necessary, long-term success will rely on adherence to the plan.

Table 1. Winter Summer Crop Rotation.
Summer crops: Sorghum, Maize, Sunflower;
Winter crops: Wheat, Barley, Canary, Canola, Linseed.
OC: "Opportunity" Crop; Mungbean, Chickpea, Millet, Panicum.
Shaded areas: Possible use of atrazine for weed control.

Paddock	1	2	3	4	5
1st year	Fallow/OC	Fallow/OC	Summer		Summer
	Winter	Fallow/OC	Fallow/OC	Winter	
2nd year		Summer	Fallow/OC	Fallow/OC	Summer
	Winter		Winter	Fallow/OC	Fallow/OC
3rd year	Fallow/OC	Summer		Summer	Fallow/OC
	Fallow/OC	Fallow/OC	Winter		Winter
4th year	Summer	Fallow/OC	Fallow/OC	Summer	
		Winter	Fallow/OC	Fallow/OC	Winter
5th year	Summer		Summer	Fallow/OC	Fallow/OC
	Fallow/OC	Winter		Winter	Fallow/OC

In the case of a summer crop, sorghum is the most likely option, and atrazine the preferred pre-emergence herbicide. Since planting is preceded by a fallow period, it is best if atrazine is applied to the fallow in autumn/winter (April-July) at a rate of 1.8 kg a.i./ha to 3.25 kg a.i./ha, depending on weed pressure and crop rotation.

This will control weed growth in the fallow, and if weed pressure is low, no further herbicide will be needed. The low temperatures prevailing during this period will result in little loss of activity if incorporating rains fail. Alternatively, an early pre-plant application will achieve similar results, provided that it occurs before temperatures reach above 30 degrees C. If there is a high grass pressure, metolachlor may be used at planting with Concep II treated seed, or a proprietary mixture of atrazine + metolachlor. However, the latter option should only be used when rainfall is certain to occur within 10 days. The very early application has several benefits: It helps preserve moisture by controlling weeds germinating during the fallow, the chances of weed control failure are minimised, and plant back restrictions are avoided. The avoidance of atrazine residues is extremely important, as is demonstrated by ongoing research at the Queensland Department of Primary Industries (S. Walker, personal communication). A potential

disadvantage of residual herbicides may be a negative effect on mycorrhiza, which should be a focus of further research.

CONCLUSION

This example shows that the use of pre-emergent residual herbicides is a valuable tool in zero-tillage broad-acre cropping. Planning for crop rotation and herbicide use should be on a paddock by paddock basis, allowing maximum flexibility. Growers who commit themselves to zero-tillage are also committed to long-term, sustainable farming, and therefore include planning for herbicide use, enabling minimal reliance on herbicides for weed control.

REFERENCES

1. Radford, B.J., Thomas, G.A., Gibson, G., Nielsen, R.G.H. and Martin, W.D. 1992. Proc. 2nd Aust. Sorghum Conf. pp 390-394.