

Weeds at risk of developing herbicide resistance in the different cropping systems of the northern region

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Summary Herbicide resistance is an increasing concern in the northern grain region with 10 weed species confirmed resistant in the last decade. A new project is identifying additional weeds and cropping systems that are at risk of developing resistance in the near future. This is being achieved by collating information and calculating a risk score for each main weed based on herbicide use patterns for the different crop rotations across the region. Several examples are presented for the main in-crop and fallow weeds of southern Queensland.

Keywords Herbicide resistance, risk assessment.

INTRODUCTION

Herbicide resistance is a major problem in southern and western farming systems of Australia, and is an emerging issue in the many cropping systems of the northern region. In the last decade, 10 weed species were identified as resistant to Group A (acetyl coA carboxylase inhibitors), B (acetoactate synthase inhibitors), C (photosystem II inhibitors) and M (EPSP synthase inhibitors) herbicides in the northern region (Adkins *et al.* 1997, Storrie and Walker 1999, and Storrie 2001). At the same time, an extension campaign increased awareness on herbicide resistance and promoted general preventive strategies to growers and agronomists across the region.

Due to the increasing problem, the grains industry decided that a more focused campaign was needed to develop and promote preventive strategies for the weeds and cropping systems that are at risk of developing herbicide resistance. GRDC recently funded a large project to cover this issue for the northern region.

SURVEY

The situation in the northern region is complex due to the diversity of the weed spectrum and cropping systems. To address this, the first part of the new project aims to identify the main weeds and systems at risk of developing resistance to the main herbicide groups.

This is being achieved by collating information on crop rotations, general use of chemical and non-chemical weed management practices for each main crop and fallow, as well as specific information on herbicide use for each key weed in crop and fallow. This information has been obtained from 242 growers and agronomists throughout central Queensland (74), southern Queensland (94) and northern NSW (74).

The crop rotation of the northern region consisted of barley (*Hordeum vulgare* L.), chickpea (*Cicer arretinum* L.), cotton (*Gossypium hirsutum* L.), mungbean (*Vigna radiata* (L.) R. Wilczek), oats (*Avena sativa* L.), sorghum (*Sorghum bicolor* (L.) Moench), sunflower (*Helianthus annuus* L.), and wheat (*Triticum aestivum* L.). The main crops in southern Queensland were wheat (32%), sorghum (20%), cotton (13%), barley (11%) and chickpea (10%).

Eighty-one weed species were listed in the southern Queensland surveys, indicating the diversity of the weed spectrum.

The most common in-crop and fallow weeds in southern Queensland are listed in Table 1. Common sowthistle (*Sonchus oleraceus* L.) was by far the most widespread weed in both crops and fallows. Turnip weed (*Rapistrum rugosum* (L.) All), wild oats (*Avena* spp.), black bindweed (*Fallopia convolvulus* (L.) A. Love), liverseed grass (*Urochloa panicoides* P. Beauv.), barnyard grass (*Echinochloa* spp.), bladder ketmia (*Hibiscus trionum* L.), pigweed (*Portulaca oleracea* L.), and caltrop (*Tribulus terrestris* L.) were similar in ranked importance in both crops and fallows. Mustards (*Sisymbrium* spp.), thornapples (*Datura* spp.), and burrs (*Xanthium* spp.) were more important in crop than in fallow, and cow vine (*Ipomoea lonchophylla* J.M. Black) and wire weed (*Polygonum aviculare* L.) were more important in fallows. As well, fleabane (*Coryza* spp.) was an important weed in fallow but rarely mentioned as a weed of importance in crops.

Agronomists in southern Queensland were concerned with paradox grass (*Phalaris paradoxa* L.) and wild oats developing resistance to Group A herbicides,

Table 1. The most common weeds in southern Queensland listed in the agronomist and grower surveys, in order of importance.

In-crop weeds	Fallow weeds
Common sowthistle	Common sowthistle
Turnip weed	Barnyard grass
Wild oats	Liverseed grass
Liverseed grass	Turnip weed
Black bindweed	Black bindweed
Barnyard grass	Wild oats
Bladder ketmia	Bladder ketmia
Mustards	Cow vine
Thornapple	Wireweed
Pigweed	Pigweed
Caltrop	Fleabane
Burrs	Caltrop

black bindweed, common sowthistle, mustards and turnip to Group B herbicides, barnyard and liverseed grass to Group C, black bindweed to Group I, and barnyard grass and common sowthistle to Group M herbicides (Table 2).

RISK ASSESSMENT

A database was designed for collating the survey information, and to calculate a herbicide resistance risk score for each weed to the main herbicide groups in each of the grain areas across the northern region.

This risk score for resistance was calculated based on the history of weed species for developing resistance elsewhere, the herbicide mode of action group used, and paddock history. Information for paddock history includes herbicide use frequency, herbicide efficacy, use of tank mixtures and follow-up spraying, weed infestation level, and use of tillage and other non-chemical options. Preliminary weightings have been used for each of these factors, but will be assessed and refined in the future following further consultation.

Some examples of the preliminary risk assessment scores for the most common weeds in southern Queensland are presented in Table 3. In general, the weeds assessed to be at risk were consistent with those rated by the agronomists to be at risk. These assessments indicate that wild oats have a high risk for resistance to Group A herbicides, common sowthistle and black bindweed to Group B, and barnyard grass and common sowthistle to Group M herbicides.

The assessment scores for these weeds range considerably. This indicates that the risk for herbicide resistance varies greatly with the different cropping and weed management systems. The next phase will be identifying these systems to devise preventive

Table 2. Number of populations of different weeds suspected by the agronomists in southern Queensland to be resistant to the different herbicide groups.

	Herbicide group				
	A	B	C	I	M
Barnyard grass			5		6
Bladder ketmia			1	2	3
Black bindweed		7		5	3
Common sowthistle		16		1	15
Liverseed grass			9		3
Mustards		6			2
Paradoxa grass	6	1			
Turnip weed		5			2
Wild oats	9				

Table 3. Preliminary risk assessment scores for several main weeds, averaged from agronomist and grower surveys in southern Queensland with the range of scores in brackets.

Weed	Herbicide group	Mean score (range)
Barnyard grass	M	73 (50–100)
Black bindweed	B	71 (45–85)
	I	64 (45–83)
	C	64 (45–83)
Common sowthistle	B	72 (48–88)
	C	57 (40–80)
	I	65 (45–88)
	M	74 (40–115)
Wild oats	A	76 (48–90)

strategies to reduce the risk of resistance developing in the future.

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