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Arable Update

Maize: Issue 91

Management options for specific weeds in maize

Background

Weed related yield losses ranging from 15% to 56% for silage and 15% to 61% for grain have been observed in New Zealand maize systems. These losses, combined with herbicide costs, can be used to calculate illustrative gross margins for silage and grain production, with and without herbicide-based weed management (Tables 1 and 2). It is important to note that these gross margins are indicative, as production costs and market prices of maize silage and grain change from season to season.

Key points

- Effective weed management is an important contributor to maize profitability.
- Perennial weed control may require a number of strategies and take several seasons.
- FAR and AgResearch have developed management strategies for a number of annual and perennial weeds.

Table 1. Illustrative gross margin for maize silage with and without herbicide-based weed management with a resulting crop loss between 15% to 56%.

Weeded maize silage crop		Un-weeded maize silage crop (excluding herbicides)	
	No crop loss associated with weeds	15% crop loss	56% crop loss
Yield (t/ha)	22	18.7	9.68
Crop value ($/t)	$270	$270	$270
Income ($/ha)	$5,940	$5,049	$2,614
Field costs ($/ha)	$2,600	$2,200	$2,200
Gross margin ($/ha)	$3,340	$2,849	$414

Note. These are illustrative gross margins as production costs and particularly the price of maize silage and grain fluctuate.

Table 2. Illustrative gross margin for maize grain with and without herbicide-based weed management with a resulting crop loss between 15% to 61%.

Weeded maize grain crop		Un-weeded maize grain crop (excluding herbicides)	
	No crop loss associated with weeds	15% crop loss	61% crop loss
Yield (t/ha)	13.0 wet 10.5 dry	11.1 wet 9.0 dry	4.3 wet 3.5 dry
Crop value ($/t dry)	$500	$500	$500
Income ($/ha)	$5,265	$4,475	$1,745
Field costs ($/ha)	$2,600	$2,200*	$2,200
Cartage cost ($50/t/50 km wet)	$650	$553	$215
Drying cost ($46/t wet)	$598	$508	$198
Total cost ($/ha)	$3,848	$3,261	$2,614
Gross margin ($/ha)	**$1,417**	**$1,214**	**-$868**

Note. These are illustrative gross margins as production costs and particularly the price of maize silage and grain fluctuate.

Management options for maize weeds

FAR and AgResearch have developed the following management strategies for a number of common annual and perennial weeds of maize.

Perennial weeds

Perennial weeds can be spread by seed and/or vegetative material such as root fragments and bulbs (commonly spread by cultivation machinery). Remove all soil and plant material from cultivation equipment before entering cropping areas free of such weeds.

Successful control of perennial weeds may require a number of management strategies and take several seasons. Pre-emergence herbicides usually have little activity on perennial weeds; they are best managed with post-emergence herbicides or specific programmes (often using glyphosate or cultivation) after the crop has been harvested.

Field bindweed (*Convolvulus arvensis*). Field bindweed generally spreads from fence lines first into the headland and then the main crop area. Maintaining control in fence lines and headlands is a priority. Dicamba (Group 4) is the most effective post-emergence herbicide but generally is not 100% effective. Glyphosate (Group 9) may be applied with high clearance spray rigs in maize grain crops as they approach harvest, following black layer formation in the cob.

Oxalis (*Oxalis species*). No agrichemical is fully effective at controlling oxalis. At the FAR arable site in the Waikato an established oxalis population was reduced from a 90% infestation to 5% over a five year period through a targeted strategy. This involved applying post-emergence sprays of mesotrione (Group 27) including terbuthylazine (Group 5) + Synoil™ in the mix) and nicosulfuron (Group 2) in alternate years. It is important to alternate the herbicides to prevent herbicide resistance developing in grass weeds. A post-harvest clean-up spray with glyphosate (Group 9) can be useful if the oxalis still has green leaves.

Docks (*Rumex species*) and **buttercup** (*Ranunculus repens*). Use pre-cultivation and pre-plant clean up spray mixtures of glyphosate (Group 9) and thifensulfuron-methyl (Group 2) (e.g. Harmony) for killing docks and buttercups. Maize planting must be delayed for at least 14 days after treatment. Nicosulfuron (Group 2) has some activity against docks.

Couch / twitch (*Elytrigia repens*). Nicosulfuron Group 2 has good activity against couch but follow-up applications are often required to treat late emerging plants. Post-harvest clean-up sprays with glyphosate (Group 9) can be useful where the weed still has green leaf.

Mercer grass (*Paspalum distichum*) and **kikuyu** (*Cenchrus clandestinus* syn. *Pennisetum clandestinum*). As for couch, only a higher rate is recommended and treatment over at least two years will be required.

Californian thistle (*Cirsium arvense*). Nicosulfuron (Group 2), dicamba and clopyralid (both Group 4) effectively control this weed in maize.

Indian doab (*Cynodon dactylon*). Indian doab is the most difficult perennial weed to control in maize. It is tolerant to high rates of glyphosate Group 9 and nicosulfuron Group 2. Paraquat (Group 22) simply burns off the foliage for a short time. This weed is best managed by using harrows to drag the old stolons to the side of the field where they can be manually removed and destroyed. More research is required to develop successful control strategies for Indian doab.

Purple and yellow nutgrass (*Cyperus rotundus* and *Cyperus esculentus*). Herbicides are only partially effective, and the best post-emergence option is halosulfuron-methyl (Group 2) (Sempra®). Clean up post-harvest applications of glyphosate (Group 9) can be used if there is sufficient green leaf remaining on the nutgrass plants. A winter crop of oats or similar may reduce the incidence of these weeds in the following maize crop.

Annual weeds

Black nightshade (*Solanum nigrum*). Black nightshade is a summer annual, dying off with frosts in late autumn. It is generally controlled by cultivation and most herbicides, however it is resistant to some sulfonylurea herbicides, including metsulfuron (Group 2). It is not controlled by trifluralin (Group 3). Black nightshade populations known to be resistant to triazine herbicides such as atrazine (Group 5) have been identified in New Zealand. In maize, dicamba (Group 4) can be used to kill resistant plants.

Willow weed (*Persicaria maculosa*). Willow weed is a summer annual, dying off in late autumn. In bare areas willow weed will scramble along the ground, but it will grow upright within crops and other vegetation. Although it likes moist soils, willow weed also needs soil to be well-aerated for optimal growth. Willow weed is susceptible to cultivation and most herbicides. However, some herbicides such as 2,4-D amine (Group 4), clopyralid (Group 4) and acetochlor (Group 15) only suppress, and do not kill willow weed. In some areas where atrazine (Group 5) has been applied for many years in succession, willow weed resistant to atrazine and other triazines has evolved. Such resistant plants can currently be managed in maize with mesotrione (Group 27), dicamba (Group 4) and nicosulfuron (Group 2).

Fathen (*Chenopodium album*). Fathen is one of the most competitive cropping weeds in New Zealand. It is a summer annual, germinating from spring to early summer (but mostly in mid-spring), producing seeds over summer and autumn, and dying off with the first frosts in late autumn. It is generally controlled by most herbicide. However, fathen resistant to atrazine (Group 4) and some other commonly used herbicides from the triazine family (Group 5) has evolved in the Waikato and some other areas. Herbicides, including mesotrione (Group 27), topramezone (Group 27) and saflufenacil (Group 14) are currently able to control fathen with atrazine and dicamba (Group 4) resistance in maize.

Twin cress (*Lepidium didymium*). Twin cress is an annual weed that can germinate at any time of year, though it establishes mainly in spring and autumn. It initially forms a small rosette, but as it grows it can scramble over other plants. It is generally not a large problem in maize. Where it does occur in maize it is controlled well by a range of broadleaf herbicides, such as nicosulfuron (Group 2) used post-emergence and acetochlor (Group 15) used pre-emergence.

Shepherd's purse (*Capsella bursa-pastoris*). Shepherd's purse is a fairly small annual weed that can germinate at most times of the year and is common in crops throughout New Zealand. It can complete its life cycle very quickly, so can undergo several generations a year. Shepherd's purse tolerates quite a few different herbicides, including selective herbicides such as dicamba, clopyralid and picloram (all Group 4)and trifluralin (Group 3). Pre-emergence herbicides such as acetochlor Group 15 and terbuthylazine Group 5 provide control, while flumetsulam (Group 2) and metribuzin (Group 5) can control seedlings post-emergence.

Thorn apple (*Datura stramonium*). Thorn apple is an upright annual weed that grows up to 2m tall. It has a foul smell and produces flowers from spring to autumn. Herbicides for thorn apple in maize include atrazine (Group 4), dicamba (Group 4) and nicosulfuron (Group 2).

Summer grass (*Digitaria sanguinalis*). Summer grass is a warm-temperature (C4) annual grass weed that, as the name suggests, grows mostly over summer, usually dying off with the first autumn frosts. Herbicides for summer grass in maize including acetochlor (Group 15), atrazine (Group 5) and nicosulfuron (Group 2). A few cases of nicosulfuron (Group 2) resistant summer grass have been found in the North Island.

Smooth witchgrass (*Panicum dichotomiflorum*). Smooth witchgrass is an annual grass weed that is common in North Island maize crops, growing up to 1 m tall. Like other C4 grasses, it is well controlled by herbicides such as acetochlor (Group 15) and nicosulfuron (Group 2).

Barnyard grass (*Echinochloa crus-galli*). Another summer-active grass, barnyard grass is an annual weed that is common in North Island arable systems. This weed can build up in numbers when maize is continually cropped. Standard herbicide pre- and post-emergence programmes in maize are usually adequate to control barnyard grass.

Rough bristle grass (*Setaria verticillata*). Rough bristle grass, also known as bristly foxtail, is a C4 summer-active grass that can be quite aggressive, due to its ready dispersal from its sticky seeds and seed heads. It is susceptible to most herbicides used to control other C4 grasses, such as acetochlor (Group 15), dimethenamid-P (Group 15) and nicosulfuron (Group 2).

Crowfoot grass (*Eleusine indica*). Crowfoot grass (also known as goose grass) is another summer-active C4 grass. It is a tufted annual grass that can grow up to 40 cm high. Control as for other summer-active grasses.

Annual ryegrass (*Lolium multiflorum*). Annual ryegrass, while an important cultivated crop and a part of many New Zealand maize-growing systems, can become a very troublesome weed in maize, significantly reducing yield if uncontrolled. Weed surveys in the North Island in recent years have found herbicide-resistant ryegrass in low numbers, but not in maize crops. Pre-emergence herbicides such as propachlor (Group 15) and terbuthylazine (Group 5) provide some control.

Acknowledgements and further information

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PO Box 23133, Hornby, Christchurch 8441, New Zealand
Phone: +64 3 345 5783 • Email: far@far.org.nz • www.far.org.nz