Department of Primary Industries

primefact

Costs of Key Integrated Weed Management Tactics in the Northern Region

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Introduction

Broad-scale herbicide resistance is continuing to spread through the GRDC Northern Region. Growers can choose from a range of chemical and non-chemical integrated weed management tactics that delay or prevent resistance developing or control herbicide resistant weeds. Major weeds of the northern grains region include feathertop rhodes grass, windmill grass, flaxleaf fleabane, awnless barnyard and liverseed grasses, common sowthistle, wild oats and annual ryegrass.

Weeds cause economic losses in various ways, usually by reducing crop yields or contaminating harvested grain. Weeds use soil moisture during a fallow or cropping period, resulting in less moisture being available for the following crop. Weed competition for moisture may result in poor crop establishment and growth, therefore reducing crop yield potential. For example, chickpea seedlings are poor competitors and even relatively low densities of Group A-resistant wild oats in chickpeas can reduce yields significantly. Weed seed contamination of harvested grain can result in either seed grading being required or discounts on contaminated grain.

This Primefact provides cost estimates based on the weed control data provided in the cited sources.

The GRDC "Integrated weed management in Australian cropping systems" Manual (Storrie 2014) groups tactics for managing weed populations into the following categories according to the growth stage of the weed:

Tactic Group 1 – Deplete weed seed in the soil seedbank

- Burning residues, insect predation, inversion ploughing, autumn tickle, delayed sowing.

Tactic Group 2 – Kill weeds (seedlings)

- Fallow cultivation, herbicides (knockdown, double-knock, pre-emergent, post-emergent), wide rows (band spraying, inter-row cultivation), spot spraying, wick wipers, chipping, weed detector spraying, biological control.

Tactic Group 3 – Stop weed seed set

- In-crop weed management (spray-topping, crop-topping, wick wipers, desiccation and windrowing), pasture spray topping, silage and hay, manuring, mulching, hay freezing, grazing.

Tactic Group 4 – Prevent viable weed seeds being added to the soil seedbank

- Weed seed control at harvest (narrow header trail, chaff cart, bale direct), grazing residues.

Tactic Group 5 – On-farm hygiene

- Sow weed-free seed, manage weeds in non-crop areas, clean machinery, livestock movement, monitoring following flood events.

The GRDC IWM Manual (Storrie 2014) can be found at:
http://www.grdc.com.au/Resources/IWMhub/Integrated-Weed-Management-Manual

Double Knock

A double knock approach is where two weed control tactics with different modes of action are applied within a period of usually four to 14 days to a single flush of weeds to control survivors from the first application, thereby stopping seed set. The second tactic, or knock, may also include cultivation, heavy grazing or burning as an alternative to a herbicide (GRDC 2012). This tactic is commonly used in fallow situations, but could be used in-crop.

The most common double knock approach is to apply a systemic herbicide (for example, Groups A, I or M) when conditions are favourable for maximum translocation, followed by a contact herbicide (for example, Group L). The intervals for maximum effectiveness will depend on the type of herbicide used, weed species being targeted, the size and age of weeds, temperature and moisture conditions (GRDC, 2012). Higher water rates are often used for the second knock (100 L/ha). In all examples, the application cost assumption is for an $8/ha contract application cost for the first knock at 50 L/ha water and $12/ha for the second knock at 100 L/ha water. Double knock is more expensive than a single herbicide application and may not need to be applied every year. Conduct a paddock herbicide resistance risk assessment first.

Advantages:

- Minimises seed set.
- Delays the development of glyphosate and other mode of action herbicide resistance.
- Reduces the number of glyphosate resistant weeds to be controlled in-crop.
- May improve pre-sowing weed control, very useful for minimum or zero tillage systems.

Practicalities:

- Translocated herbicide should be applied first, followed by paraquat or a paraquat and diquat mixture.
- Time between applications will vary with the main target weed species.
- Identify the weed species being targeted to determine the most cost-effective chemistry.

Ryegrass double knock example

Results from a 2004 double knock herbicide trial priced at approximate 2015 prices are shown in Table 1 (adapted from AHRI, 2015). Rates applied were 1.5 L/ha for Spray.Seed® and paraquat and 1.2 L/ha for glyphosate. Product costs were calculated for this Primefact using $4.70/L for glyphosate (450g/L), $6.48/L for paraquat (250g/L) and $9.49 for Spray.Seed® (paraquat plus diquat).

Table 1: Double knock demonstration for glyphosate resistant ryegrass control (note the last three treatments are not considered double knock treatments and were included for comparison)

1st application 1.6.2004 (Ryegrass @ 2½ leaf stage)					
Glyphosate	None	Paraquat	100	$ 15.36	$ 35.36
Paraquat	None	Glyphosate	98	$ 15.36	$ 35.36
Glyphosate	None	Spray.Seed®	98	$ 19.88	$ 39.88
Spray.Seed®	None	Glyphosate	96	$ 19.88	$ 39.88
Paraquat	Paraquat	None	100	$ 19.44	$ 39.44
Spray.Seed®	Spray.Seed®	None	100	$ 28.47	$ 48.47
Glyphosate	None	None	62	$ 5.64	$ 13.64

Awnless barnyard grass double knock example

Table 2 shows costs and effectiveness of double knock options used to control awnless barnyard grass at Bellata in northern NSW (Cook *et al* 2013). Research has shown it is important that any survivors of glyphosate applications are controlled by a follow-up herbicide with a different mode of action to glyphosate. Product costs were calculated for this Primefact using approximate 2015 prices.

Table 2: Control of glyphosate resistant awnless barnyard grass using the double knock (Bellata NSW, 2007, GRDC Project DAN00079)

Herbicide	Knock 1 Rate L/ha	Knock 2 Rate L/ha	Control %	Product Cost/ha	Total Cost/ha (including application)
Glyphosate	1.5	n/a	90	$ 7.05	$ 15.05
Paraquat	1.6	n/a	99	$ 10.37	$ 18.37
Spray.Seed®	2.4	n/a	98	$ 22.78	$ 30.78
Glyphosate fb Paraquat	1.5	2.4	100	$ 22.60	$ 42.60
Glyphosate fb Paraquat	2	2.4	100	$ 24.95	$ 44.95
Glyphosate fb Spray.Seed®	0.5	2.4	100	$ 25.13	$ 45.13
Glyphosate fb Spray.Seed®	2	2.4	100	$ 32.18	$ 52.18

fb = followed by

Use of residuals in double knock

In fallows, residual herbicides may be used to either reduce the likelihood of herbicide resistance developing or to assist in the control of resistant populations. However, consideration should be given to plant-back periods when choosing a residual herbicide. Table 3 shows some research results using residuals as part of a double knock (Cook *et al* 2013). Herbicide rates used were glyphosate 1.6 L/ha, paraquat 1.6 L/ha, Flame® 0.2 L/ha and Dual® 2 L/ha. Product costs were calculated for this Primefact using approximate 2015 prices.

Table 3: Effect of using residual herbicides on 2-tiller stage grass weeds (St Ruth Qld, 2008, GRDC Project DAQ00136)

Knock 1	Knock 2 (7 days later)	Control % (visual assessment)		Plants/m² 50 days after Knock 1		Total Cost/ha (including application)
		Barnyard grass	Liverseed grass	Barnyard grass	Liverseed grass	
Glyphosate	Paraquat	99	99	27	14	$ 37.89
Glyphosate	Paraquat & Dual Gold®	99	99	1	1	$ 54.61
Glyphosate	Paraquat & Flame®	99	99	8	2	$ 46.28
Glyphosate & Dual Gold®	Paraquat	99	100	1	7	$ 54.61
Glyphosate & Flame®	Paraquat	99	100	10	1	$ 46.28

Fleabane double knock example

Fleabane control may require a mix of weed control tactics, including non-chemical options such as tillage. Double knock herbicide combinations in fallows have been shown to be effective in controlling fleabane compared to single applications (Cook *et al* 2013). The conclusion from the trial results in Table 4 were that applications in the later growth stages of the weeds required higher chemical rates, resulting in higher costs. Control figures given in Table 4 show the average percentage control, with the range in brackets. Product costs were calculated for this Primefact using approximate 2015 prices. Timely application of double knock combinations in the early growth stages of fleabane provides more effective control and is also cheaper. This fallow treatment requires high water volumes of 100 L/ha for paraquat products, especially where there are dense weed populations or high stubble levels.

The double knock options are more expensive, but more effective, especially for younger plants. Fleabane can produce an average of 100,000 seeds from a single mature plant. For a paddock with a fleabane density of ten plants per hectare, 84% control can mean 160,000 weed seeds/ha survive as opposed to 99% control, which would leave only 10,000 seeds.

Table 4: Efficacy of knockdowns on fleabane in a winter fallow (Darling Downs Qld, GRDC Project UQ00055)

Herbicide		% control for two weed age categories			
Knock 1	Knock 2	1 month	Product cost/ha	3 months	Product cost/ha
Glyphosate & 2,4-D	None	84 (62-100)	$ 17.37	76 (63-96)	$ 20.81
Glyphosate & Tordon 75-D®	None	93 (86-99)	$ 15.54	84 (62-98)	$ 19.18
Glyphosate & 2,4-D	Spray.Seed®	96 (93-100)	$ 31.61	93 (87-97)	$ 43.59
Glyphosate & Tordon 75-D®	Spray.Seed®	99 (97-100)	$ 29.78	97 (92-100)	$ 41.96
Glyphosate & 2,4-D	Alliance®	96 (92-99)	$ 44.87	90 (78-100)	$ 53.81
2,4-D	Spray.Seed®	97 (97-98)	$ 24.56	83 (68-97)	$ 36.54
2,4-D	None	88 (81-95)	$ 10.32	53 (48-57)	$ 13.76
Amitrole®	None	90 (84-95)	$ 51.60	96 (95-97)	$ 67.20
Spray.Seed®	None	84 (78-89)	$ 14.24	22 (13-30)	$ 22.78

Selective in-crop herbicides

Selective pre- and post-emergent herbicides control weeds that have emerged prior, with or after crop establishment. In the past, the decision to spray post-emergence herbicides was generally determined by threshold weed densities that would threaten crop yield. The cost of the treatment would be returned to the grower that year with increased crop yield compared to the untreated yield potential. It was common for this practice to be repeated over many seasons with success. However, since the development of herbicide resistance, this strategy is no longer relevant as the ability of the herbicide to maintain its effectiveness year-on-year is lost. Costs associated with in-crop weed control have increased due to the reliance on more applications of in-crop herbicides.

A recent trial at North Star in NSW showed that a combination of chemistries were more successful in controlling a Group A-resistant wild oat population (Cook *et al* 2014). The use of a post-emergence herbicide can be highly effective and a cost effective way to control many weed species in-crop.

To control Group A-resistant wild oats effectively by stopping seed set, farmers may have to spend an additional $25 to $60/ha, depending on the cost of the additional treatment. The Topik® and Wildcat® treatments in Table 5 had more wild oat seeds than the control treatment due to variation in the population via patches.

Although the additional cost to combat herbicide-resistant plants is less favourable, weeds such as wild oats have short-lived seed banks and stopping seed set in one year may prevent the need to spray for wild oats in the following year, so there are longer-term savings. Product costs were calculated for this Primefact using approximate 2015 prices.

Advantages:

- High levels of target weed control.
- Able to observe weeds and fine-tune application.
- Flexible timing.
- Some pre-emergent activity on next weed seed germination.

Practicalities:

- Post-emergent herbicides applied early and alone may miss later germinating weeds in-crop if no follow-up control is used.
- Application to stressed crops can cause crop damage.
- Effectiveness can be influenced by plant and environmental factors.
- Match mode-of-action to the intended use.
- Careful choice of herbicide, rate, additives and application technique are required.

Table 5: Costs of controlling Group A-resistant wild oats (North Star NSW, 2007)

Herbicide	Rate /ha	Herbicide group(s)	Wild oat seeds/m^2	Product Cost/ha	Total Cost/ha (including application)
Control - no treatment	-	-	90.7		
Achieve® (post-em)	380 g	A	43.8	$ 24.28	$ 32.28
Topik® (post-em)	65 mL	A	180.9	$ 3.80	$ 11.80
Wildcat® (post-em)	300 mL	A	123.3	$ 3.83	$ 11.83
Avadex® Xtra (pre-em)	1.6 L	J	9.4	$ 17.28	$ 25.28
Trifluralin® 480 (pre-em)	1.5 L	D	47.8	$ 9.00	$ 17.00
Mataven® 90 (SST)	1.875 L	Z	0.4	$ 30.56	$ 38.56
Hussar® (post-em)	220 g	B	2.3	$ 59.42	$ 67.42
Atlantis® (post-em)	330 mL	B	4.2	$ 26.41	$ 34.41
Crusader® (post-em)	500 mL	B	0.0	$ 33.00	$ 41.00
Avadex® Xtra (pre-em) + Hussar® (post-em)	1.6 L + 200 g	J + B	0.3	$ 71.30	$ 79.30
Avadex® Xtra (pre-em) + Atlantis® (post-em)	1.6 L + 330 mL	J + B	0.0	$ 43.69	$ 51.69
Avadex® Xtra (pre-em) + Mataven® 90 (SST)	1.6 L +1.875 L	J + Z	0.0	$ 47.84	$ 55.84
Atlantis® (post-em) + Mataven® 90 (SST)	330 mL +1.875 L	B + Z	0.0	$ 56.97	$ 64.97
Hussar® (post-em) + Mataven® 90 (SST)	200 g +1.875 L	B + Z	0.0	$ 84.58	$ 92.58

SST = Selective Spray Topping at late post-emergence to prevent seed production.

Post-harvest herbicide options

Residual and knockdown herbicides can be used as part of an immediate post-harvest double knock to remove any new weed seedlings (such as feathertop rhodes grass seedlings after a winter crop harvest).

Advantages:

- Controls seedlings at an early growth stage.
- May provide an extended period of control if residual herbicides are included, e.g. in a wet fallow phase.
- Provides alternative modes of action compared to glyphosate, which has lost some effectiveness due to herbicide resistance.

Practicalities:

- Adequate soil moisture essential.
- Length of herbicide activity is determined by the rate applied, soil type, the ensuing climatic conditions and location of the seed relative to the herbicide (root/shoot accessibility).
- Plant-back periods in a rotation.

Table 6 shows the approximate cost of some post-harvest control options. A combination of paraquat and Balance® (2.4 L + 100 g/ha) has shown good control of some glyphosate resistant species such as windmill grass, fleabane and common sowthistle. An option for grass weeds is Flame® at 200 mL/ha. If grass weeds as well as broadleaf weeds such as fleabane and sowthistle are a problem, then a mixture of Flame and Balance is more likely to offer a broad spectrum control. Product costs were calculated for this Primefact using approximate 2015 prices.

Table 6: Post-harvest options

Mixture	Weeds controlled	Product Cost/ha	Total Cost/ha (including application)
Paraquat + Balance® (2.4 L + 100 g/ha)	good control of species such as windmill grass, fleabane & common sowthistle	$ 49.69	$ 57.69
Flame® at 200 mL/ha	grass weed control	$ 8.39	$ 16.39
Flame® + Balance® (200 mL + 100 g/ha)	grass and broadleaf weeds	$ 42.53	$ 50.53

Weed detector sprayers

Weed detector sprayers (also called optical spot sprayers) are low volume spot spraying technology for the control of low density, scattered weeds in fallows. They allow the application of alternative and more expensive chemistries to problem weeds which cover up to 30% of the field area. The sprayer has detector units mounted to a boom, which detect the presence of weeds using infra-red reflectance. When each individual unit passes over a weed it activates a solenoid, which in turn switches on an individual even-fan nozzle spraying the weed (Storrie 2014).

Advantages:

- Reduction in the total cost of herbicide used.
- Improved ability to use a range of herbicide modes-of-action (MOA).
- Reduces the risk of herbicide drift.
- Ability to spray in the evening/night.

Practicalities:

- Preferred ground speed of up to 16 km/hour.
- Weeds must be large enough for the unit to detect (5 cm or above in diameter).
- Strong winds (above 15 km/hour) can reduce coverage.
- Night spraying must be avoided during temperature inversion conditions (Storrie 2014).

PER11163 (June 2011 to Feb 2019), issued by the APVMA, allows the minor use of specified chemicals in conjunction with Crop Optics Australia Pty Ltd WeedSeeker® technology. Table 7 shows the current label rates for controlling particular problem weeds with optical spot sprayer technology.

Table 7: Selected label rates for optical spot sprayer application

Product	Active	MOA Group	Rate/100L of water	Weeds
Nufarm Amitrole T	amitrole	Q	5 to 8 L	Fleabane
			5 to 10 L	Yellow vine (Caltrop) & Sowthistle
Nufarm Nuquat 250	paraquat	L	3 to 9 L	Yellow vine (Caltrop), Barnyard grass, Bladder ketmia
			6 to 9 L	Fleabane, Sowthistle, Turnip weed
			9 L	Australian bindweed
Nufarm Amicide Advance 700	2,4-D amine	I	4.8 L	Fleabane, Sowthistle, Yellow vine (Caltrop)
Nufarm Comet 400	fluroxypyr	I	1 to 3 L	Fleabane, Sowthistle, Yellow vine (Caltrop)
Nufarm Trooper 75-D	2,4-D amine + picloram	I	1 to 2 L	Yellow vine (Caltrop)
			2 L	Fleabane
			2 to 4 L	Sowthistle
Crop Care Alliance	amitrole & paraquat	L & Q	4 to 10 L	Fleabane, Yellow vine (Caltrop)
			7 to 10 L	Sowthistle, Barnyard grass, Bladder ketmia
			10 L	Turnip weed

Source: Product labels from nufarm.com.au and cropcare.com.au

There are potential cost savings in the longer term in terms of reducing the amount of chemical required per hectare when using a weed detector sprayer. Cost estimates calculated for this Primefact are presented in Table 8, based on average label application rates.

Table 8: Chemical cost savings

Product	Group	Assumed $/L	Weed detector L/ha	20% cover Cost/ha (b)	100% cover L/ha	100% cover Cost/ha (a)	Saving/ha using weed detector (a - b)
Nufarm Amitrole T	Q	$ 6.00	5.0	$ 6.00	2.8	$ 16.80	$ 10.80
Nufarm Nuquat 250	L	$ 5.10	6.0	$ 6.12	1.2	$ 6.12	-
Nufarm Amicide Advance 700	I	$ 8.40	4.0	$ 6.72	1.5	$ 12.60	$ 5.88
Nufarm Comet 400	I	$ 22.10	2.0	$ 8.84	0.5	$ 11.05	$ 2.21
Nufarm Trooper 75-D	I	$ 15.90	2.0	$ 6.36	0.7	$ 11.13	$ 4.77
Crop Care Alliance	L & Q	$ 13.70	4.0	$ 10.96	2.0	$ 27.40	$ 16.44

Note: Weed detector rate (L/ha) is the herbicide rate per treated hectare and does not include 80% of the paddock that is not treated.

Comparative costs example

Table 9, calculated for this Primefact, shows a simple example of a double knock herbicide treatment with a conventional boomspray covering 100% of the paddock, with a weed detector spraying 25% coverage. Prices used for various herbicides were $4.90/L for glyphosate (450g/L), $6/L for Surpass and $5.10/L for paraquat (250g/L). An owner application cost (fuel, oil and consumables) of $2.07/ha was assumed for the boomspray and $2.49 for the weed detector. The savings estimated for one double knock operation was $11.69/ha. This equates to $17,535 in chemical savings over 1,500 hectares. In this scenario, if a double knock operation was performed once per year, in simple terms (not including interest and maintenance costs) a $100,000 weed detector would pay for itself in 5.7 years.

Table 9: Cost comparison of double-knock comparing conventional boomspray to weed detector application to control a target weed infesting 25% of the paddock area

Knock 1	**Boomspray**	**Weed detector**
Glyphosate + Surpass® 1.5 L/ha each	$ 18.42	na
Glyphosate + Surpass® 3 L/ha each	na	$ 10.40
Knock 2		
Paraquat 1.5 L/ha	$ 9.72	na
Paraquat 3 L/ha	na	$ 6.05
Total Cost/ha	**$ 28.14**	**$ 16.45**
Saving/ha using weed detector		**$ 11.69**

Tillage

Conservation no-till farming relies heavily on herbicides for weed control, leading to a higher risk of developing herbicide-resistant weeds. GRDC-funded research to date has indicated that "*from an overall systems perspective, limited and strategically timed tillage could have a tactical role as part of a productive, sustainable system*" (GRDC 2014).

Tillage options include inversion ploughing, autumn tickle, fallow and pre-sowing cultivation and inter-row cultivation. Inversion ploughing and autumn tickle are both aimed at depleting weed seeds in the soil seedbank, while the other options are aimed at killing weed seedlings in the target area (Storrie 2014).

As a general rule of thumb, the best form of cultivation for weed control is one that disturbs the top 50 mm of soil without too much inversion. Weed seed that is buried beyond 50 mm is preserved for longer periods of time compared to seed near the soil surface.

Tillage may also be used to manage excess crop stubble to improve the effectiveness of pre-emergence herbicides. If stubble cover is reduced using tillage, pre-emergence herbicides will not be intercepted by crop residues and a more uniform distribution will be present on the soil surface, maximising herbicide effectiveness.

Autumn ticking or shallow cultivation can be used to stimulate weed seeds to emerge in a bigger flush by promoting more soil-seed contact, allowing oxygen and sunlight to break seed dormancy and by giving the weed seed coat an abrasion that assists with seed germination. Encouraging larger emergence of weeds prior to sowing a crop will allow pre-sowing weed control to kill a greater proportion of the seed bank.

Advantages:

- The combination of an autumn tickle (shallow cultivation to encourage weed germination) and delayed sowing (to allow time for a weed knockdown operation, either herbicide or another cultivation) provides a good opportunity to deplete the weed seed bank.
- Inter-row cultivation can assist in controlling small in-crop weeds without herbicides.

Practicalities:

- Weeds germinated by an autumn tickle must be controlled in a follow-up operation.
- Weeds with low dormancy that germinate in the top soil layer and/or in response to changing light exposure are ideal candidates for autumn tickle.
- Consider the impact of soil moisture loss and delayed planting date on subsequent crop yield.
- Should not be used if the soil is too wet due to weed transplantation and soil structure damage.

In order to calculate the minimum number of hectares covered per year that would make it worthwhile to own and operate an implement, you need to know the ownership (fixed) costs, the contract rate and the operating (variable) costs per year. The equation is:

Minimum hectares per year = ownership costs ($/yr) ÷ [contract rate ($/ha) - operating costs ($/ha)]

Ownership (fixed) costs per year for an implement, such as a disc harrow or prickle chain, will vary with the annual depreciation and interest (opportunity) costs, and if used, also insurance, shedding, workshop and registration costs. For implements, variable costs can be estimated as repair costs (grease, oil, repair or replacement of moving parts and discs or tynes). A rule of thumb for 'normal' use is 2% of an implement's replacement price per year.

Table 10,calculated for this Primefact, shows some examples based on a 12 m wide tillage implement, operated at an average speed of 10 km/hr (covering 10.5 ha/hr), kept for 5 years and traded-in at 45% of the purchase price.

Table 10: Minimum area to be cultivated per year to justify purchase price of implement

Purchase Price	Ownership Costs/yr	Operating Costs $/ha	Minimum ha/yr
$ 70,000	$ 9,730	$ 0.70	636
$ 80,000	$ 11,120	$ 0.80	732
$ 90,000	$ 12,510	$ 0.90	828
$100,000	$ 13,900	$ 1.00	927

Burning residues

Burning crop residues in the autumn can reduce weed seed densities (Storrie 2014). Burning residues in a windrow allows a higher temperature to be reached and a better seed kill.

For maximum effectiveness, the crop has to be cut short (<15 cm) at harvest to capture the weed seeds, and then the trash deposited in a defined, narrow windrow. A defined windrow assists in a high temperature burn, which will destroy any seeds and also assists with fire control. Tall weeds, such as ryegrass and wild radish that retain their seed, are the most effectively controlled with this method.

A windrow chute can be made to fit most harvesters to direct the chaff into a narrow windrow. Nitrogen in the residue will be lost due to burning, whilst potassium stays in the ash and will be returned to the soil. Cutting stubble to the low height required can slow harvest rates a little and marginally increase fuel usage.

The cost of windrow burning may include extra labour and extra harvester fuel. If managing windrow burning over 2,000 ha, with an estimated cost of $4,000 for extra labour plus $550 for extra harvester fuel, this is an extra $4,550/yr. If a header chute were added for $1,000 (to direct the chaff into narrow windrows) and amortised over 8 years at 6% interest, this would be an extra $158/yr. The total annual cost would be $5,258 or $2.63/ha. The value of nitrogen and other nutrients lost to the atmosphere from the burnt residue would be an additional cost. The cost of purchasing fire lighting gear and any fire control gear (e.g. extra tank and pump set) would be another cost.

Advantages:

- Non-chemical option.

Practicalities:

- Time and logistics.
- Cost of labour and required extra fire gear.
- Nitrogen, potassium, phosphorus and sulfur are lost from the burnt residue.

More information is available at the WeedSmart website at http://www.weedsmart.org.au/online-workshop-portal/harvest-weed-seed-control/part-a-narrow-windrow-burning-2/.

Conclusion

The development and implementation of a farm IWM plan is an essential tool to manage weed control measures and to prevent herbicide resistance developing or to manage existing resistance. Comparing costs is an important aspect of such a plan.

A number of IWM tactics may be combined to minimise weed escapes and maximise the likelihood of fully depleting the weed seed bank. Rotation of herbicide groups and use of non-herbicide options help to preserve herbicide longevity.

Grower case studies in the GRDC IWM Manual demonstrate the range of tactics that growers combine in their plans and also discuss how their plans have evolved in recent years.

More information

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For updates go to www.dpi.nsw.gov.au/factsheets and www.grdc.com.au.

Useful resources

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