MALLEE CATCHMENT
TECHNICAL BULLETIN

Technical Bulletin # 16

Summer weed control strategies

Above: Summer weed control field trial. Photo: Ivan Mock

This technical bulletin summarises the findings of field research conducted in 2010 to evaluate summer weed control strategies and their related impacts on soil health within the Victorian Mallee.

Weed species that establish over the period from summer to autumn can be detrimental to grazing and the following winter crop. Cultivation and herbicides used to control these weeds reduce ground cover and may increase the risk of soil erosion by wind.

To assist landholders with information on effective, low risk options for summer weed control, four herbicide strategies and a nil control were evaluated in a replicated large plot trial near Piangil. Data was collected over a 14 month period on weeds controlled, soil health implications and the productivity of the following wheat crop.

Background

Summer weeds are an inherent problem within most Mallee cropping systems and difficulties in controlling them will be compounded by the predicted increase over time in the proportion of rainfall outside the winter crop period.

At a glance

- Five summer weed control strategies were evaluated in a replicated field trial to determine the impact on both crop productivity and soil health indicators.
- Conventional best practice of spraying in early December and repeated applications as required provided good summer weed control and crop yields.
- Sensor sprayers such as Weedit® provided comprehensive summer weed control and are potentially more cost effective on low-density weeds.
- Single herbicide applications provided economical options in 2010 although crop yields of 2.1 t/ha or less were low for the season, indicating constraints may have limited yield responses to soil factors impacted by summer weed treatments.
- Summer weed control strategies evaluated were not detrimental to soil health, although impacts on ground cover may be important on other soils.

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mallee catchment management authority

Common practice is to commence summer weed control after harvest which is usually too late for optimum soil water and nitrogen conservation. The established weeds then encourage more extreme control measures that exacerbate the risk of erosion.

Alternative management options for summer weed control include herbicide selection, the timing and frequency of application, and newer technologies that selectively apply chemical to weedy areas only.

There is, however, limited information currently available on the effectiveness of these options in relation to both crop production and soil health implications.

This study aimed to evaluate a range of summer weed control strategies and assist landholders to select options which optimise the potentially conflicting objectives of crop productivity and the protection of the soil resource.

Methods

The evaluation site was located between Piangil and Manangatang on a typical Central Mallee cropping paddock with sandy loam – light sand soil and with a mixed population of summer weeds. The five summer weed strategies evaluated were:

1. No control over the summer weed period.
2. District practice – spray late, commencing after harvest (18/12 and 3/2).
3. Current best practice – spray early December and as required (4/12, 18/12 and 3/2).
4. Weedit® and Weedseeker® sensor technology to selectively spray weeds (4/12, 18/12 and 3/2).
5. Spray early but once only (4/12).

Spray applications and seeding were done with commercial scale equipment on plots 16m wide x 50m long, with four replications of each treatment. The site was sown to Yitpi wheat and in-season crop management applied to the paddock by the farmer.

Results

(a) Rainfall

Rainfall exceeded the long-term mean for the site by:

- 80% for the 2009/10 summer weed period from November to March;
- 166% for the winter crop season (April–October);
- 286% during November and December 2010, which delayed harvest.

Total rainfall for 2010 was 629.7mm, the highest annual total ever recorded at this site.

Figure a: Skeleton weed Chondrilla Juncea. Photo: Mallee CMA

Figure c: Melons *Cucumis myriocarpus.* Photo: Ivan Mock

(b) Summer weed control

Summer growing species recorded were summer grass, skeleton weed, melons and caltrop (Figure 1), with caltrop confined to the treatment where no herbicide was applied.

Weed densities of each species present were recorded prior to the application of pre-seeding herbicides (Figure 2). Their combined density of 28 plants /m2 on the nil control was significantly more (P=0.05) than for any of the four herbicide strategies evaluated.

Current best practice was effective at reducing summer weed populations although new sensor technology that applied herbicide where weeds were detected eliminated three of the four summer weed species and reduced the remaining Skeleton Weed to 1.2 plants/m2. The late start and single application treatments were intermediate in their control of summer weeds.

Figure b: Summer grass *Poa spp.* Photo: Mallee CMA

Figure d: Caltrop *Tribulus terrestris.* Photo: Mallee CMA

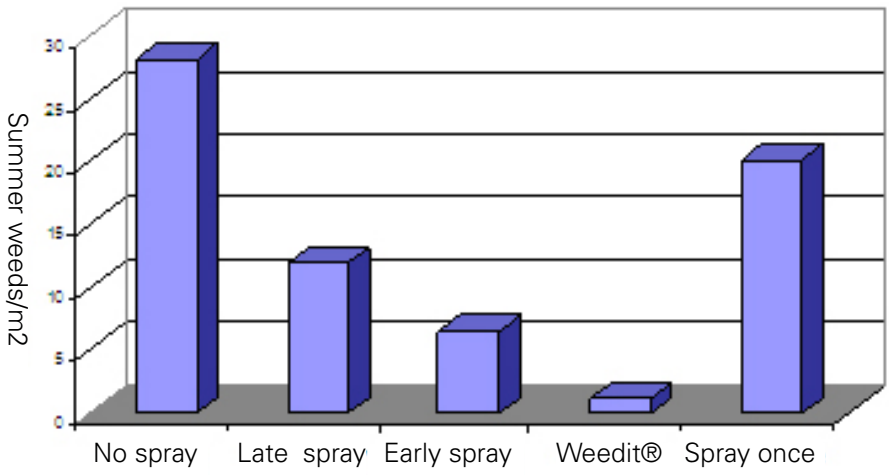

Figure 1: Weed density in April 2011 with 5 control strategies.

(c) Soil health

All treatments had a low soil erosion risk when assessed by Leys method prior to cropping. Stable dry soil aggregates exceeded 60% and were largely responsible for the low erosion risk as ground cover only ranged from 16 - 28%. Soil water content in early May in the 0-60cm profile was inversely correlated with the population of summer weeds on the treatments. There was a similar but not significant trend with nitrate (N) in the 0-30cm profile.

(d) Crop production and economic returns

There were significant differences (at P=0.10) in grain yield between the "current best practice", Weedit® and "spray once" treatments compared to the "no spray" treatment.

Total herbicide used for the best practice was costed at $36/ha, plus three applications @$6/ha. Herbicide cost was less using Weedit® technology but application cost was more @ $11/ha. Herbicide for the "spray once" and "late spray" was approximately $20/ha plus $6/ha application. For the purpose of these comparisons wheat was valued at $200/t.

Summer weed strategy	Crop biomass (t/ha)	Grain yield (t/ha)
No spray	5.06	1.705
Late spray	4.46	1.898
Best practice	5.30	2.107
Weed It	5.47	2.077
Spray once	5.62	2.118
L.s.d. (P=0.10)	**n.s.**	**0.372**

Figure 1: Weed density in April 2011 with 5 control strategies.

Discussion

(a) Herbicide treatment effect on weed populations

Above average rainfall after the 2009 harvest provided soil moisture for weed germination and four common summer weed species established where no control was applied. The herbicide treatments all had significantly lower total summer weed populations than the control and eliminated caltrop as one of the four species.

The spatially targeted treatment with Weed Seeker® and Weed It® technology controlled all summer weed species other than skeleton weed, which was reduced to of 1.2 plants/m2. It was also effective against an early germination of broadleaf crop weeds (wild turnip and Indian hedge mustard) that emerged in the autumn.

Current best practice of starting early and repeated applications reduced, but did not eliminate, summer grass, although was not significantly worse than spatially targeted applications except for broadleaf weed control. A single application of summer weed spray applied early was less effective against summer weeds, particularly summer grass, than a single application applied later despite containing residual herbicide. Heavy rain between the early and late applied herbicide may have reduced its longer-term effectiveness.

(b) Soil health

The potential for herbicides to expose soil to wind erosion by killing and accelerating the breakdown of vegetative cover on the soil surface was not observed. Soil erosion potential was assessed using Leys method and found to be low across all treatments despite variations in vegetative cover as soil dry aggregates > 0.85mm exceeded 60%. No til farming practices may have assisted in preserving soil aggregates in the sandy textured soil.

Soil water content prior to sowing the 2010 crop was greater when summer weed control was more effective. Although this was significant at a profile depth of 60cm, the greatest difference measured in soil water content was between 90 -120cm. At this depth the control treatment, which was the only one with caltrop and had at least 2.5 times more melons than any other treatment, contained less than half the soil water of other treatments.

(c) Crop viability

The conventional best practice, sensor technology and early start treatments had a wheat grain yield of approximately 2.1 t/ha, which was significantly (P=0.10) more than the nil control at 1.7 t/ha. Higher yield from the treatment with one herbicide application early compared to late was not significant. Yields of 2.1 t/ha or less in a high rainfall season represent poor crop water use efficiency, indicating other constraints to yield that may have limited yield response.

The $80/ha increase in the grain harvested (0.4 t/ha x $200/t) more than covered the $36 of herbicide and 3 applications @ $6/ha in the best practice treatment. Sensor technology reduced herbicide use but the exact reduction was difficult to calculate in a plot trail although can be up to 70% with low populations typical of summer weeds. More sophisticated equipment used increased application cost to approximately $11/ha/application. In this trial, the spray early and once treatment had the best economic return as yield was equivalent or better than other treatments and herbicide and application costs lower.

The wetter than average growing season may have reduced the potential advantage to the crop on treatments where a reduction in summer weeds increased stored soil water at sowing. Similarly, any increase in available soil N related to weed control was less beneficial to the trial crop as increased in-season N mineralisation occurs with higher rainfall and farmer applied post-emergent N fertiliser nullified treatment differences in available soil N at sowing.

Recommendations

- Sensor sprayers are evaluated more extensively as a technology to reduce herbicide use and associated factors including management of herbicide resistance and ground cover degradation.
- Results of the 2010 trial are promoted and validated at additional sites to encompass varied soil types and more average rainfall.

Acknowledgements

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The trial site was provided, sown and managed by Neville Taylor and his cooperation is gratefully acknowledged.

Further Information

The information for this bulletin has been taken from *'Summer Weed Control Strategies and Related Impacts on Soil Health'*, a report for the Mallee CMA by Dodgshun Medlin Agricultural Management.

A copy of the report can be downloaded from the Mallee CMA website:
www.malleecma.vic.gov.au

Project Partners

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