

Buffel grass cover

Buffel grass cover measured in 1 m² quadrats was approximately 40 per cent across the sites prior to treatment in 2014 (Fig.6). The changes in buffel grass cover in the years following treatment differed among herbicide treatments ($p = 0.02$). In all but the Roundup H treatment, there was a decrease in cover one year following treatment and a subsequent increase in cover two years after treatment. Although herbicide treatments resulted in large changes in buffel grass cover in 2015 when tussocks were killed, by 2016 recruitment resulted in cover reaching the levels in untreated control plots.

Recommendations

All treated areas will require annual follow-up spraying to control new seedlings, mature tussocks that have regrown following spraying and plants grown from seed dispersed from outside treated areas. Roundup™ applications require regular follow-up after subsequent rains, whilst Taskforce™ (3 L/ha) and Roundup™ + Taskforce™ applications require follow-up of treated tussocks 18 months after initial treatment, depending on seasonal conditions.

Impacts on non-target species

Changes in the species composition of the vegetation at a site may be the result of either direct death of plants following herbicide contact, destruction of the seeds in the soil by residual herbicides, release from competition or allelopathic effects when the buffel grass tussocks are destroyed, or other unrelated drivers. For most native species, there were no significant differences in abundance between control and treated subplots. Abundance was probably more affected by seasonal conditions than herbicide treatments.

Two native species were significantly affected by herbicide treatments. *Maireana pyramidata*

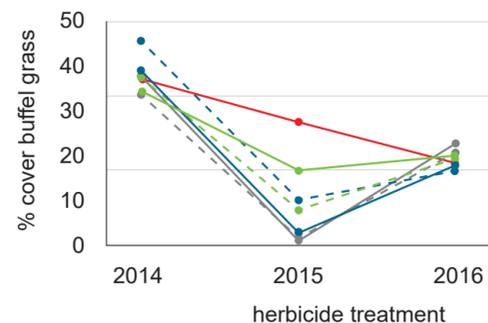


Figure 6: Mean % cover of buffel grass (juveniles and mature tussocks) in treatment quadrats in each monitoring year across all sites.

—●— Control —●— Roundup H —●— Roundup L —●— Roundup/Taskforce H —●— Roundup/Taskforce L —●— Taskforce H —●— Taskforce L

be particularly appropriate for isolated infestations where there is not a significant seed bank at the site and prevention of seed production is a priority. Taskforce™ applications may result in damage to some native grass species but is a better choice for boom spray situations where other native species are present (due to it being grass selective). Observations showed a decrease in native grasses in subplots sprayed with Roundup™ + Taskforce™ up to 18–20 months after spraying, but some recolonisation was observed in 2016.

shrubs did not survive in Roundup™ treated plots at ALBG. There was also a significant decrease in the abundance of the perennial grass *Aristida holathera* (Erect Kerosene Grass) in plots treated with Taskforce™ or Roundup™ + Taskforce™ in 2016 compared with untreated controls ($p < 0.025$). Three native annual species, *Erodium cygnorum*, *Calandrinia* sp. and *Crassula* sp., were more abundant in some treated plots than untreated plots.

Recommendations

Roundup is not recommended for boom-spraying where native perennial species are present although it is useful for spot-spraying. This herbicide would be a suitable choice where native vegetation is assessed as having lower conservation value and cost must be kept to a minimum. It may

Conclusions

Roundup™, Taskforce™ and mixtures of these two herbicides offer a variety of control options for buffel grass when used in conjunction with other approaches in an integrated weed management program. The treatment that was most effective in controlling mature tussocks was Roundup™ + Taskforce™ at a rate of 250 ml/ha + 3 L/ha.

For small infestations that cannot be followed-up in under one year then Roundup™ + Taskforce™ is a suitable choice. Mature tussocks will be controlled and prevented from setting seed in the short term and there will be suppression of juvenile recruitment for approximately 22 months following initial treatment.

Taskforce™ (3 L/ha) is recommended where there are high density populations containing native plants. Taskforce™ was less effective at the rate of 1.5 L/ha. The residual effects of this herbicide prevent recruitment from seed and minimal follow-up treatments will be required in the following season. This herbicide may not be a suitable choice for heavily sloping ground with sandy soils where the herbicide may be transported away from the plant roots. Native grasses may also be negatively impacted by this herbicide.

Careful spot application of Roundup™ is recommended where there are rare or endangered native grasses present as Taskforce™ is likely to suppress new germinations for almost two years. Roundup™ can also be used for broad-acre control in accessible areas where there are no native species present and use of a residual herbicide is not preferable. When applying Roundup™ it is important that plants are green and actively growing and that regular follow-up control takes place following subsequent rainfall events to achieve successful control. Roundup Biactive® (5 L/ha) is a suitable choice in close proximity to drainage lines. In areas that have been burnt, Roundup™ applied four to six weeks after burning achieves the most effective control of mature tussocks, provided plants have 15–20 cm of regrowth. Regular follow-up sprays are required to control new plants as Roundup™ does not suppress seedling emergence. Although particular commercial products were used in this trial it is important to note that a variety of products with the same active constituent can be used.

The one exception is the use of Roundup Biactive® which is the only glyphosate product registered for use in close proximity to standing water. In South Australia, the herbicides and rates of active constituent recommended in this fact sheet can be legally applied through on label directions for use. In other states, application of the herbicides within this fact sheet can be applied under permit PER9792 (for the control of tussock grasses).

For Further Information

For resources and state-wide buffel grass management visit Biosecurity SA – Buffel grass webpage: www.pir.sa.gov.au/buffel-grass

For buffel grass control advice contact your local Natural Resources SA office: www.naturalresources.sa.gov.au/home

For more information on on-label registrations and off-label permits visit: <http://apvma.gov.au/>

For resources on Integrated Weed Management visit: <http://www.environment.gov.au/biodiversity/invasive/weeds/management/integrated.html>

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Buffel Grass Herbicide Trials

Introduction

The efficacy of herbicides recommended for buffel grass control has not been formally tested under South Australian conditions. Herbicides with the active ingredients glyphosate and flupropanate have been effective in controlling other perennial tussock grasses. This series of trials was designed to trial the effectiveness of these herbicides, along with fluzifop-P, physical removal and burning in conjunction with glyphosate, for buffel grass control.

Aims

The aims of the research were to identify the herbicides and application rates most effective in:

- killing mature buffel grass tussocks
- suppressing buffel grass germination
- reducing buffel grass cover
- controlling buffel grass whilst minimising impacts on native vegetation.

Methods

Four trial sites were established across the latitudinal range of buffel grass in South Australia. The sites were located in the north eastern corner of the state (APY), an hour south of Coober Pedy (BB and NW) and at Port Augusta (ALBG). The main herbicide trial (comparing glyphosate and flupropanate) was conducted at three sites (BB, APY and ALBG).

A further trial at the NW site compared different rates of Roundup Biactive™ (glyphosate 360 g/L), Fusilade™ (fluazifop-P 212 g/kg) and the physical removal of tussocks.

A final trial at ALBG examined herbicide control after tussocks had been burnt. Roundup Powermax™ (glyphosate 540 g/L) was applied at a rate of 4 L/ha to tussocks two, four and six weeks after they had been burnt.



Figure 1: Buffel grass stand at ALBG site following application of treatments.



Figure 2: Roundup Powermax™ + Taskforce™ plots before treatment (left), one year later (centre) and two years after treatment (right). The herbicide has killed all mature tussocks but there are new juveniles appearing after two years.

Results

Control of mature tussocks

There were some differences among sites in the results obtained, possibly due to differences in topography and the amount and timing of rainfall over the course of the study. However, at all sites Roundup™ + Taskforce™ killed most mature tussocks at both application rates (Table 1).

Roundup™ alone and Taskforce™ alone varied in effectiveness across the sites. Taskforce™ applied at the higher rate (3 L/ha) killed more tussocks than the lower rate (1.5 L/ha) at the BB site.

Table 1. Percent mean survival of mature buffel grass tussocks in 2016. Dashes indicate the herbicide was not tested at that site. Within a site, the mean number of tussocks in 2014 did not differ significantly. Values in bold were significantly different to controls at that site (Dunnett's Test, $\alpha < 0.05$). Zero values indicate no live tussocks remaining in subplots (shown in bold although unable to be tested for statistical significance).

Treatment*	Rate	Application rate	Site		
			ALBG	APY	BB
Control			82 %	96%	91 %
Fusilade™ L	3.3 L/ha	300 L/ha	99 %	-	92 %
Fusilade™ H	6.6 L/ha	300 L/ha	98 %	-	93 %
Roundup™ L	4 L/ha	300 L/ha	1 %	54 %	0 %
Roundup™ H	4 L/ha	600 L/ha	0 %	36 %	24 %
Roundup™ + Taskforce™ L	250 ml + 3 L/ha	1000 L/ha	0 %	1 %	0 %
Roundup™ + Taskforce™ H	415 ml + 3 L/ha	1000 L/ha	0 %	5 %	0 %
Taskforce™ L	1.5 L/ha	1000 L/ha	0 %	8 %	88 %
Taskforce™ H	3 L/ha	1000 L/ha	0 %	1 %	37 %
Weedmaster Duo™ L	4.5 L/ha	300 L/ha	55 %	46 %	-
Weedmaster Duo™ H	4.5 L/ha	600 L/ha	-	52 %	-

*Fusilade™ (fluazifop-P 212 g/kg); Roundup Powermax™ (glyphosate 540 g/L); Taskforce™ (flupropanate 745 g/L); Weedmaster Duo™ (glyphosate 470 g/L).

Terminology:

Juveniles: new germinations or small plants not yet having set seed.

Allelopathy: production of one or more biochemicals that influence the germination, growth, survival, and reproduction of other organisms.

Outlier infestation: infestation a significant distance away from core or large scale populations, posing a high risk of seed dispersal and further establishment of buffel grass in uninfested areas.

Quadrat: gridded 1 m² metal mesh containing 100 10 cm x 10 cm cells used for estimating percentage cover.

BUFFEL GRASS HERBICIDE TRIALS

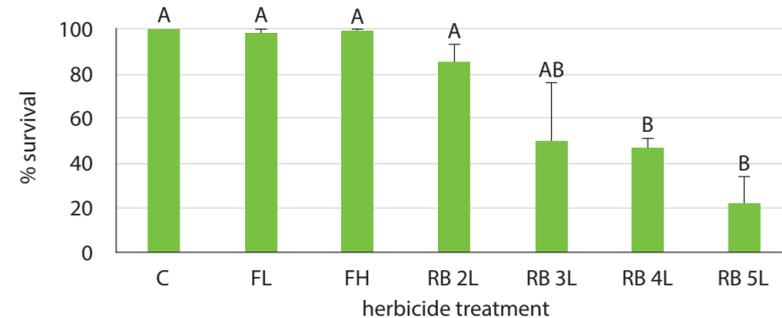


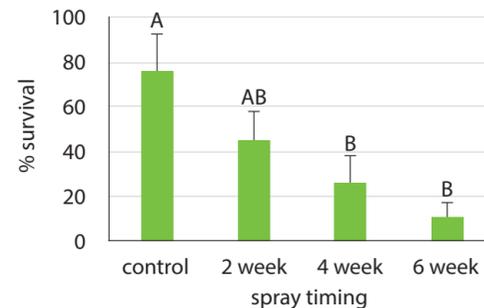
Figure 3: Survival of mature buffel grass tussocks two years after being treated with Roundup Biactive™ (RB) at different rates or Fusilade™ (low and high rates as per Table 1), and in untreated controls (c). Bars are means + 1 Standard Error. Bars labelled with different letters are significantly different (Student's t test, $\alpha < 0.05$).

Roundup Biactive™ applied at the rate of 4 or 5 L/ha significantly reduced the number of mature buffel grass tussocks within subplots (Fig. 3). Spraying plants with Roundup Powermax™ four to six weeks after burning gave better control of mature tussocks than spraying only two weeks after burning (Fig. 4). Burning reduced buffel cover in all treatments from 42 % to 8 % one year after the trial.

When applying herbicides, it's important to consider all of the variables that impact on the effectiveness of chemicals being used. Variations in the effectiveness between treatments could be explained by site variations, climatic conditions and the condition of the target species. Inconsistent control through Roundup™ treatments at APY (Table 1) may be explained by a lack of rain prior to treatment. Buffel tussocks were green at the time of treatment although there was evidence of some moisture stress (i.e. leaves starting to curl and a greater degree of dry leaf matter than other sites) which may have impaired effectiveness.

Inconsistent Taskforce™ results at BB are likely due to the sloping site, resulting in increased run off from the road washing some of the residual Taskforce™ out of the target area.

A number of options are effective in the control of mature buffel grass tussocks. The situation in which the infestation occurs and resources available for control should be the driving force in deciding which approach to take. Roundup™ is an affordable and effective method of controlling mature tussocks although there is



Recommendations

Figure 4: Percent survival of mature buffel grass tussocks treated with Roundup Powermax™ at different time intervals after burning. Bars are means + 1 standard error. Bars labelled with different letters are significantly different (Student's t test, $\alpha < 0.05$). Survival was measured one year after the burning treatment.

a requirement for significant follow-up and potential for off target impacts.

Monitoring shows that Roundup™ + Taskforce™ is most effective in the control of mature tussocks. Small to medium outlier infestations should be treated with the low rate of Roundup™ + Taskforce™ to control mature tussocks and prevent seed production in the short term. For control of medium to high density populations with significant native vegetation amongst buffel grass, treat with Taskforce™ alone at a rate of 3 L/ha to encourage re-establishment of native vegetation.

Follow-up treatments with Taskforce™ (3 L/ha) should be timed to enable three months prior to the growing season for herbicide to be washed into the root zone.

BUFFEL GRASS HERBICIDE TRIALS

When treating infestations in close proximity to water-courses, Roundup Biactive™ should be applied at the rate of 5 L/ha to provide the most effective control of mature tussocks. If it is desirable to burn biomass to reduce fire risk and/or protect assets, Roundup Powermax™ should be applied 4 to 6 weeks after burning depending on seasonal conditions. Plants should have from 15–20 cm of regrowth before spraying.

When treating with Roundup™ alone, appropriate surfactants and adjuvants should be used to improve the uptake of herbicide and combat poor water quality. No surfactants or adjuvants are required with treatments containing Taskforce™. LI 700® and Liase™ were used at label rates as part of this trial.

Suppression of juveniles

There was considerable variation in juvenile recruitment among plots, sites and years, resulting in large variation in numbers of juveniles amongst replicates.

At the BB and ALBG sites there were significant differences in numbers of juveniles among treatments in the year following herbicide application (2015, $p < 0.01$, Fig. 5).

At both sites in 2015, there were significantly more juveniles in the Roundup™ subplots than control and other treatment plots. No juveniles occurred in the Roundup™ + Taskforce™ H subplots. At the ALBG site, juveniles were also absent from the Taskforce™ H plots but not the Taskforce™ L subplots.

In 2016, juvenile recruitment occurred at both the BB and APY sites. Numbers of juveniles differed among treatments ($p = 0.02$), with fewer juveniles in untreated controls than herbicide treated plots (Student's t test $p < 0.025$, BB site Fig. 5).

Juvenile numbers were lower in controls in 2015 than 2014, suggesting that conditions for recruitment were less suitable in 2015 in the BB and ALBG sites. Death of tussocks in herbicide treated subplots created opportunities for recruitment of juveniles in 2015 due to lack of competition and allelopathic effects. Recruitment in 2015 was suppressed in plots treated with 3 L/ha of Taskforce™.

Recommendations

The presence of a single cohort of germinations in 2016 despite conditions in the lead up to monitoring being suitable to support multiple cohorts, suggests Taskforce™ (3 L/ha) may suppress germination for approximately 20 months following application. Some roundup alone plots had up to 250 new germinations in 2015, highlighting the importance of follow-up control when treating with this herbicide.

Taskforce™ (3 L/ha) is recommended for sites where there is a significant seed bank and native vegetation component within the infested area. A Roundup™ + Taskforce™ mixture is recommended for smaller outliers where the goal is to prevent seed set in addition to providing residual suppression of emergence from the seedbank. If Roundup™ is used exclusively then follow-up control after each subsequent rainfall event is required to control new seedlings.

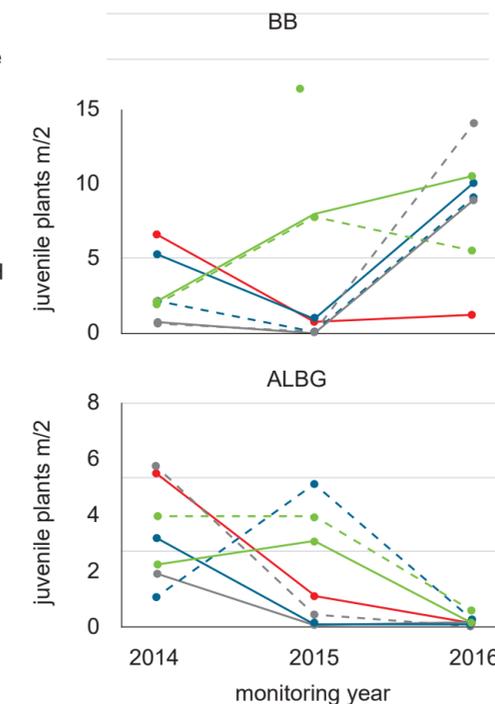


Figure 5: Change in average number of juvenile plants over time in herbicide treatment quadrats at

—●— Control
—●— Roundup H —●— Roundup/Taskforce H —●— Taskforce H
- - - ● - - Roundup L - - - ● - - Roundup/Taskforce L - - - ● - - Taskforce L