EFFECT OF FOLIAR HERBICIDES AND NEMO® WETTER ON ALEMAN GRASS (*ECHINOCHLOA POLYSTACHYA*) IN NORTH QUEENSLAND, AUSTRALIA.

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ABSTRACT

Aleman grass (*Echinochloa polystachya*) is a ponded pasture species that has become invasive in wetland areas of north Queensland. It often grows intermingled with Para grass (*Urochloa mutica*) and Hymenachne (*Hymenachne amplexicaulis*) and can colonise deeper water than either of those species (Hannan-Jones & Weber, 2016). Aleman grass is locally restricted in Cassowary Coast and Tablelands Regional Councils and is considered a priority invasive plant by Hinchinbrook and Mareeba Councils. We conducted a field trial near Ingham in north Queensland (Lat: 18.70713, Long:146.17411.) to identify effective herbicides for Aleman grass control. The trial tested five herbicides at three application rates each. The wetting agent Nemo® was also tested for its efficacy as a replacement for the aquatic wetter Bonus® which has been withdrawn from the Australian market. The herbicides were applied by land-based application methods (backpack sprayer) with the aim to provide approved land-based herbicide and wetter recommendations for Aleman grass in north Queensland.

Keywords: ponded pastures, invasive grasses, creeping river grass

INTRODUCTION

In the 1930's, a new agricultural practice of creating ponded pastures to prolong the availability of pasture to livestock resulted in the deliberate introduction of many exotic pasture species into Queensland (Abbott *et al*, 2020). Concerns have been raised about the potential of some of the more recent introductions to become invasive weeds in aquatic systems with the negative environmental impacts of these species becoming evident in years following their introduction (Abbott *et al*, 2020). Aleman grass was one of the species introduced into Queensland as a ponded pasture candidate in 1988 (Abbott *et al*, 2020) and has subsequently moved from intentional plantings into natural water ways and wetlands. Aleman grass is considered to be a high-impact environmental species in Australia (Van Klinken *et al*, 2018).

Wegscheidl & Layden (2011) note that "Ponded pasture species including olive hymenachne, Para grass and Aleman grass were introduced to specially constructed bunded areas (called ponded pastures) throughout Queensland's coastal fringe, to provide dry season fodder reserves". Challon & Long, (2004) add that "The development of the ponded pasture usually relies on three exotic grasses: Hymenachne (*Hymenachne amplexicaulis*), Para grass (*Brachiaria mutica*), and Aleman grass (*Echinochloa polystachya*); Fish movement and survival between freshwater, estuarine and marine

habitats, may be disrupted by all of these species." In India, Aleman grass was reported to yield much higher green biomass, dry matter and crude protein than Para grass (Dhar *et al* 2001). Eyles (1989) states that *Echinochloa polystachya* (Aleman grass) cv. Amity, Release number Q.C.63., Cultivar number 61147 was released by the Queensland Herbage Plant Liaison Committee in 1987 and described in The Australian Journal of Experimental Agriculture vol 29, 294 in 1989.

The ability of Aleman grass to grow into deeper water than either Hymenachne or Para grass has allowed it to occupy a previously unexploited niche. In many areas of north Queensland some fodder from all three of these ponded pasture species is inaccessible to stock even in the dry season in non-ponded pasture situations, because they grow in water too deep for stock to access. All of these species have however become problematic when they have encroached on the natural environment.

Figure 1 & 2. Aleman grass seedhead (L), and Aleman grass growing in water beside cane field near Ingham, north Queensland (R)

A field-based herbicide trial was conducted in the lower Herbert River basin with in-kind support from Hinchinbrook Shire Council. The trial investigated effective herbicide/wetter rates for the control of Aleman grass in field situations. The trial also tested the field efficacy and application of 'Nemo®' wetting agent as a replacement for the aquatic wetter 'Bonus®', which has been withdrawn from the Australian market. When concluded, if appropriate, the findings will be used to make recommendations for a minor use registration for Aleman grass control to the Australian Pesticides and Veterinary Medicines Authority.

METHODS AND MATERIALS

The trial site was a highly modified seasonally inundated flood plain adjacent to a permanently flowing freshwater creek; it had previously grown sugar cane but was unsuitable for this due to waterlogging. When no longer used for this purpose, grasses including Aleman and Para grass became the dominant species. At the time of application of herbicides, the trial area was an Aleman grass monoculture in a mixture of waterlogged soil and shallow standing water of less than 10 cm in depth. Dry weight biomass is a standard measure of potential pasture productivity. To determine this, six quadrats 50 cm

X 50 cm adjacent to the trial area were destructively sampled to determine dry weight biomass. All material within the quadrat was cut to soil level and a wet and subsequent dry weight taken. In the preceding year, and the year of the trial, the area received slightly below average (1943.4 mm) and well above average (3459.6 mm) rainfall, respectively, compared to the annual average of 2179 mm (Australian Bureau of Meteorology, 2023).

Within the monoculture, 5 m X 5 m plots were marked with a 2 m buffer between plots, as seen in Figure 4. Each treatment was allocated three replicate plots. The trial used a completely randomised design and tested five herbicides at three application rates each as in Table 1.

Table 1. Herbicides and application rates used in the trial.

Trade Name	Herbicide	Group	Application Rate (g a.i./ha)		
			Low	*Medium*	*High*
Weed master Duo®	glyphosate 360 g/L	9	1260	2520	5040
Poacher 750®	imazapyr 750 g/kg	2	750	1500	2250
Verdict 520®	haloxyfop 520 g/L	1	100	200	400
Nominee®	bispyribac-sodium 100 g/L	2	24	52	100
Valor 500 WG®	flumioxazin 500 g/kg	14	88	176	352

Herbicides were applied as an overall foliar spray using a Croplands Swissmex® 20 L backpack sprayer and hand-wand as seen in Figure 3. Each plot was sprayed until the total amount of the mixture was expended, to ensure correct dosage per area was achieved. All herbicide mixtures used water as a carrier and contained Nemo® wetter (at a rate of 2.92 mL/25 m^2. Herbicides were applied between 8:00 am and 1:15 pm and during this time, environmental conditions ranged from 26.5 – 35.5°C, 40–60% relative humidity, 15-70% cloud cover with winds of 1.1 – 1.7 km/h.

Assessments were conducted pre-treatment, then monthly post treatment for 4 months. At each assessment time the number of live stems, vegetation colour, average maximum height of live stems and presence of flowers/seeds was recorded, using four randomly placed 25 cm X 25 cm quadrats per plot. Live stems and vegetation colour are reported in this paper. ANOVA and Fisher's Protected LSD($P<0.05$) test were used to determine significant differences between treatments.

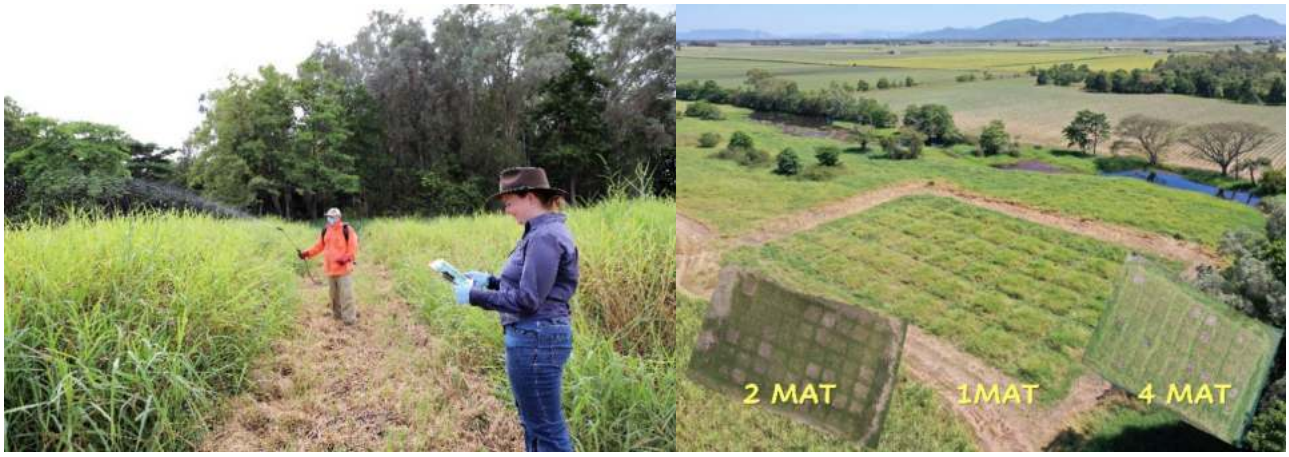

Figure 3. (L) Stephen Setter and Clare Warren applying herbicides,

Figure 4. **(R)** An aerial view of the trial site at 1, 2, and 4 Months after treatment (MAT), as labelled.

RESULTS

Within the dense monoculture area selected for the trial 165 live stems per m^2 were recorded on average across all plots initially. This equated to a wet weight biomass of 28.32 t/ha, and a dry weight biomass of 12.52 t/ha. This is comparable to other reported figures, e.g. Cook et al (2020) notes that "DM yield ranges of 8–50 t/ha/yr are reported from South America, and 10–20 t/ha/yr from northern Australia." The average height of Aleman grass foliage across plots for each treatment ranged from 120-170 cm with a maximum recorded height of 230 cm.

The trial showed haloxyfop (Verdict), imazapyr (Poacher) and glyphosate (Weedmaster Duo) to be effective herbicides for the control of Aleman grass, at the high (H) rate used, as seen in Table 2 and Figure 5. The suitability of the wetting agent Nemo (Cocamidopropyl betaine) for this situation was also confirmed.

Table 2. Comparison of herbicide treatments at 4 MAT presented as percentage green and reduction in alive stems from pre-treatment live stem numbers. L = low rate, M = Medium rate and H = high rate.

Herbicide	Green %	% Reduction in stems/m^2	
Control	87	17.33	a
Verdict® L	90	20.41	ab
Nominee® H	87	34.24	abc
Pledge® H	87	38.57	abcd
Nominee® L	85	39.25	abcd
Pledge® L	58	39.5	abcd
Pledge® M	87	47.16	bcde
Verdict® M	63	50.78	cdef
Nominee® M	47	52.28	cdef
Poacher® L	2	62.64	defg
Verdict® H	40	65.46	defg
Weedmaster® L	33	72.56	efg
Poacher® M	0	77.31	fgh
Weedmaster® M	13	85.17	gh
Poacher® H	0	93.41	h
Weedmaster® H	0	94.2	h
LSD		27.24	

Figure 5. L-R Example plots at 4 MAT: Poacher (high), Control, Weedmaster (high).

DISCUSSION

This experiment identified three herbicide treatments effective for the control of Aleman grass: Poacher at 2250 g a.i./ha, Weedmaster Duo at 5040 g a.i./ha and Verdict at 400 g a.i./ha. All of these are registered at similar rates for Hymenachne and/or Para grass. Verdict at 400 g a.i./ha is worthy of further consideration as it is currently registered for the control of hymenachne in terrestrial and aquatic situations at rates similar to that used in our trial, and for aerial application to control Hymenachne in aquatic situations. Nemo proved to be effective in this experiment and is already registered for some aquatic use, e.g. for control of Hymenachne with Verdict; it also has the potential to be used with many other aquatic herbicide applications. It is also worth noting that our trial was a one-off herbicide application. In reality, one or more follow up treatments may be required to provide effective control of Aleman grass.

CONCLUSION

This trial identified several herbicide treatments effective for Aleman grass control. It also showed Nemo to be effective as an aquatic wetting agent. Further investigation into alternative application techniques, such as aerial application via a drone has since been conducted, but not reported here.

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