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Efficacy of pre-emergent herbicides on sicklepod (*Senna obtusifolia*) in the Dry Tropics of Cape York.

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Summary This study determined the efficacy of multiple herbicide treatments applied at a pre-emergent stage on field populations of sicklepod (*Senna obtusifolia* (L.) Irwin and Barneby) in the dry tropics of far north Queensland. The aim was to identify herbicide treatments that can be applied towards the end of the dry season and activated with the first substantial rains of the wet season, to produce more consistent control outcomes, particularly in situations where infestations are inaccessible due to the annual northern wet season. Field sites were established in dense sicklepod at three locations on Cape York: Oakey Creek, West Normanby River and Morehead River. The trial was established just prior to the wet season in 2019 (October) and monitored at approximately three-monthly intervals for three years. After the initial treatment, several of the herbicides showed high efficacy, with the most efficacious herbicides reapplied after 12 and 24 months to evaluate annual re-treatment effects on seedling regeneration numbers in the following wet seasons. High efficacy was achieved with Conqueror®, Grazon® Extra, Stuka Flexi® and Tordon® 75-D, all of which contained the active ingredient picloram. The complete absence of sicklepod after three years and replacement with grasses or other herbaceous species was observed in some plots. Pre-emergent herbicides have significant potential for future use, particularly for the strategic management of access to infrastructure such as rest stops, property access, and stock watering points.

Keywords germination, arsenic weed, Chinese senna, weed management, picloram

INTRODUCTION

Sicklepod (*Senna obtusifolia*) is a serious weed across much of Northern Queensland, from Cape York to Mackay, and in varied situations, including pastures, crops, and corridors such as road and power-line clearings and river/creek banks. A member of the Fabaceae family, it is closely related to other weedy species including *Senna hirsuta* (hairy senna), *Senna alata* (candle senna) and *Senna tora* (foetid senna). Sicklepod was regarded as the most serious exotic weed of Cape York Peninsula grasslands (Neldner *et al*. 1997). Sicklepod is an annual plant that can occur as a monoculture and is seen predominately as an invader of grazing pastures and unmanaged lands in North Queensland.

The control of adult sicklepod plants using current registered techniques has proven effective during the "Dry" i.e. winter, period of the year but this has congested control activities to a relatively short window of opportunity. For land managers including local councils, this places an unworkable strain on existing resources expected to treat a vast area of Cape York. An inability to break the reproductive life cycle of the plant was identified as the inhibitor to successful control especially around important infrastructure, such as roadsides, dams, stock holding/transport yards. An investigation into the use of pre-emergent herbicides for the selective control of sicklepod seedlings was undertaken to provide a new potential method of on ground control.

MATERIALS AND METHODS

An initial pre-emergent herbicide screening pot trial was conducted in 2018 under controlled shade house conditions which identified several effective herbicides (Setter *et al* 2019). A field trial to test the most effective herbicides and applications rates in real-world conditions was established in October 2019.

Figure 1. The three sicklepod pre-emergent herbicide trial sites in far north Queensland.

These herbicides and application rates can be seen in Table 1. Herbicides were applied as an overall ground spray using a Croplands Swissmex® 20 L backpack sprayer and hand-wand. Each plot was sprayed until the total amount of the mixture was used up, to ensure the correct dosage per area was achieved. Herbicides which showed less efficacy in the first year were removed from the remaining two years of the trial so that the trial could focus on refining control recommendations for the most efficacious herbicides.

Three locations were selected to represent varying soil types and situations with initial plant densities being relatively similar across all sites. A geospatial distribution between sites was preferred and the locations selected were all within Cape York Peninsula (Figure 1). The three sites were typical sicklepod infestation situations and were within or adjacent to seasonal flood plains of a river or creek.

To determine herbicide treatment efficacy permanent plots (2m x 2m) replicated three times were established and the number of sicklepod plants in each recorded over time. Multiple attributes pertaining to plant structure, species composition and off target damage within each plot were also recorded but are not reported here.

Experimental Design and Statistical Analysis
The experiment consisted of a randomised complete block design with eight herbicide treatments and an untreated control with three replicates of each treatment. Data was analysed by calculating the mean and standard error of the mean for each treatment and presented graphically for each of three years following the initial treatment.

RESULTS

The herbicide products Balance®, Valor® and Stinger® were removed from the trial after the first year as they showed comparatively less efficacy than the other herbicides in suppressing sicklepod. At Oakey Creek site (Figure 2a.), the first herbicide application in October 2019 was assessed nine months after treatment (MAT) and showed a reduction in plant numbers of between 100% (Grazon® Extra low) and 71% (Stuka Flexi® low). Nine months after the third application in October 2021, assessments showed a reduction between 100% to 98% at the higher rates and 98% to 93% at the lower rates.

Similarly at West Normanby River site (Figure 2b.) the initial assessments 9 MAT showed an overall reduction in plant numbers of 85% to 96%. The assessment nine months after the third treatment in October 2021 indicated that irrespective of herbicide or rate applied 100% of the plant population had been removed.

The Morehead River site (Figure 2c.) gave less conclusive results with the first assessment 9 MAT recording a reduction of between 63% (Tordon® 75-D high) and 19% (Conqueror® low). The assessments nine months after the third treatment in October 2021 also showed less effectiveness with a reduction in plant numbers between 61% (Grazon® Extra high and Tordon® 75-D high) and 44% (Grazon® Extra low).

Table 1. Herbicides and rates applied in first year of trial. Valor®, Balance® and Stinger® were removed from the trial after the first year.

Group	Trade name	Product Rate ha^{-1}	Active ingredient application rate (gms a.i. ha^{-1})
4	Grazon® extra	3 L (Low)	triclopyr + picloram as hexyloxypropylamine salt + aminopyralid (900 + 300 + 24)
4	Grazon® extra	3.75 L (High)	triclopyr + picloram as hexyloxypropylamine salt + aminopyralid (1125 + 375 + 30)
4	Conqueror®	3 L (Low)	triclopyr + picloram as hexyloxyproplamine salt (900 + 300)
4	Conqueror®	3.75 L (High)	triclopyr + picloram as hexyloxyproplamine salt (1125 + 375)
4	Stuka Flexi ®	0.93 L (Low)	picloram as potassium salt (223)
4	Stuka Flexi ®	1.25 L (High)	picloram as potassium salt (300)
4	Tordon® 75-D	4 L (Low)	2,4-D + picloram as triisopropanolamine salt (1200 + 300)
4	Tordon® 75-D	5 L (High)	2,4-D + picloram as triisopropanolamine salt (1500 + 375)
14	Valor® 500 WG	0.7 kg (Low)	flumioxazin (350)
14	Valor® 500 WG	1 kg (High)	flumioxazin (500)
27	Balance® 750 WG	0.1 kg	isoxaflutole (75)
4+2	Stinger®	0.24 kg	aminopyralid + metsulfuron-methyl (90 + 72)
NA	Untreated Control	Nil	

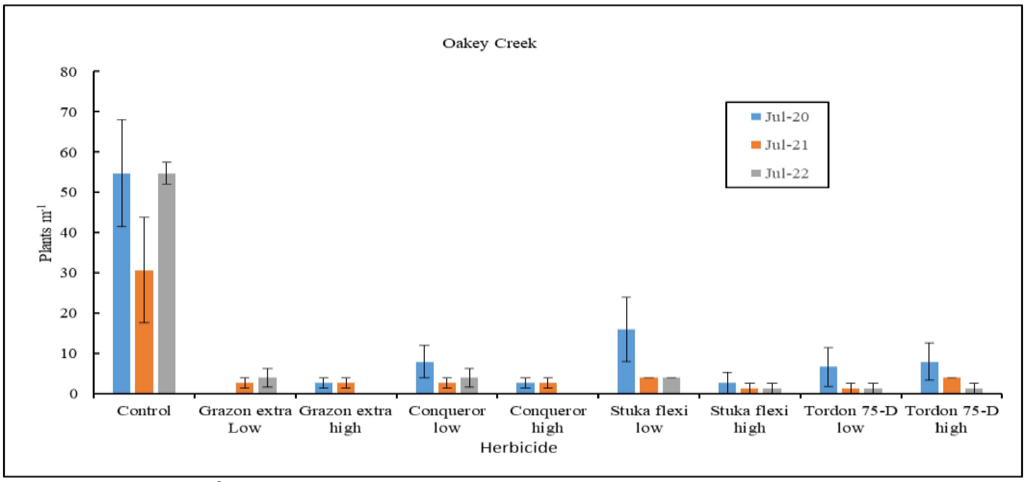

Figure 2a Sicklepod plants m^{-2} at Oakey Creek site. Treatment mean (+/- SEM) are shown for each treatment.

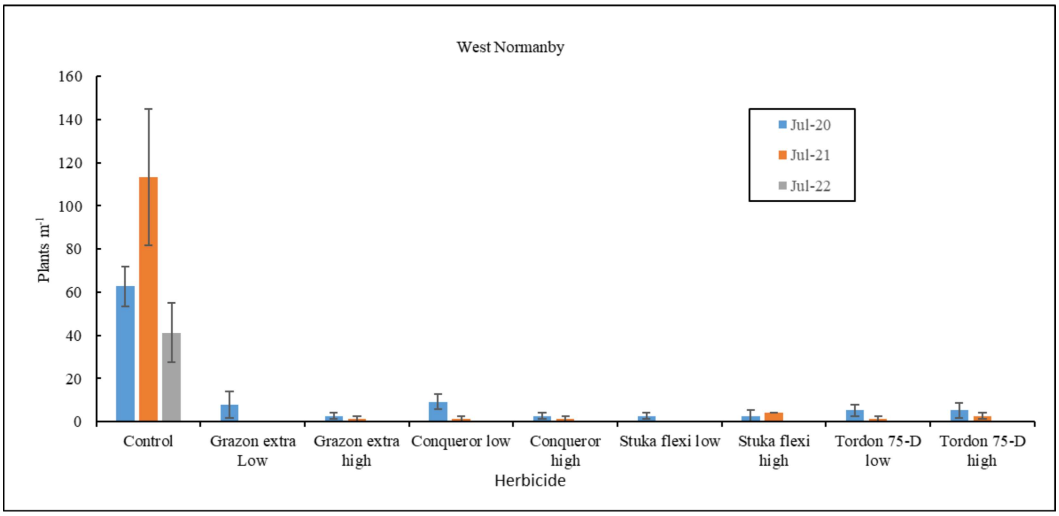

Figure 2b Sicklepod plants m^{-2} at West Normanby River site. Treatment mean (+/- SEM) are shown for each treatment.

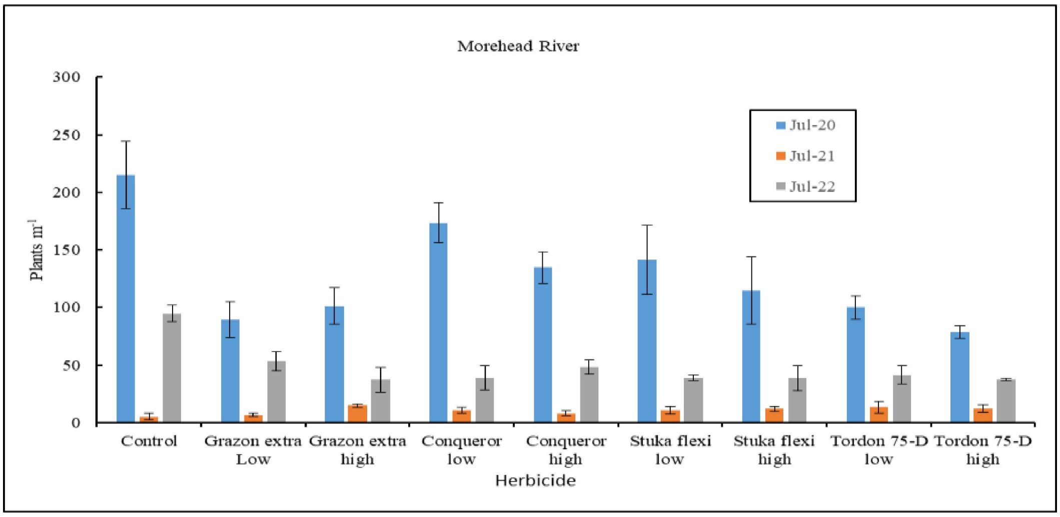

Figure 2c Sicklepod plants m^{-2} at Morehead River site. Treatment mean (+/- SEM) are shown for each treatment

DISCUSSION

During the "Wet" season many sicklepod infestations are inaccessible for months and consequently these areas cannot be treated using traditional methods. The need for effective pre-emergent herbicides which can be applied pre-wet season was identified as a tool which would allow control of the seed/seedling bank. This trial targeted the earliest stages of the plants life cycle which was the newly emerged seedlings.

Prior to treatment soil seed banks were assumed to be typically large with Ablin (1992) reporting seed numbers varied from 117 - 620 m^{-1} during 1990-1991 in an infestation at Mena Creek, in far north Queensland.

Sicklepod can produce seed within 6-10 months of seedling emergence (Dunlop, 2007). Retzinger, (1984) notes production of up to 8000 seeds per plant annually. Seed remains viable in the soil for at least seven years (Setter *et al*. unpublished data), and possibly up to ten years or more, e.g. Anon (1989).

The near elimination of seed production and the subsequent depletion of the sicklepod seed bank by using Conqueror®, Grazon® Extra, Stuka Flexi® and Tordon® 75-D all of which contained the active ingredient picloram proved to be a highly effective control method. The application rates being used are not believed to be high enough to affect native woody vegetation (Setter *et al*. unpublished data), and plots were chosen to avoid any native vegetation as much as possible.

The three sites were observed to have been inundated with flood waters within the study period as expected. Impacts of herbicide movement into adjoining areas was not observed and no movement of herbicide effect outside treated plots at any time in relation to seedling counts compared to controls was recorded. The movement of seeds between plots and from outside treated areas could not be discounted in this trial due to the inundation. Even with this factor there was still a significant reduction in seedling numbers in herbicide treated plots.

Triclopyr is also effective at controlling pre-existing sicklepod plants, i.e. as a post-emergent herbicide. If products containing triclopyr are applied when a pre-emergent herbicide is applied, they will also kill any existing sicklepod plants.

CONCLUSION

When a significant reduction was measured in these conditions it can be speculated that treated areas away from the influence of inundation would yield similar or better results. Infrastructure and management areas purposefully placed away from periodic inundation such as transport lanes, watering points and holding yards would benefit with the use of pre-emergent treatments to a greater extent than seen in our results.

Trials are underway to determine if the above results are transferrable to wetter regions where sicklepod is problematic and there is potential for label recommendations to be modified or a minor use permit to include pre-emergent chemicals to be used when application method and specific conditions are followed.

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REFERENCES

Ablin, M. 1990. Biological Control of Sicklepod. Unpublished report. Qld Dept. of Lands.

Ablin, M. 1992. Sicklepod “The Facts”. Unpublished report. Qld Dept. of Lands

Anon. 1989. Sicklepod – Another problem weed for the tropics. BSES Bulletin (No. 27): p18-19.

Dunlop, Elizabeth A. (2007) Mapping and modelling the invasion dynamics of *Senna obtusifolia* at different levels of scale in Australia. PhD thesis, Queensland University of Technology.

Neldner, V.J., Fensham, R.J., Clarkson, J.R. and Stanton, J.P. (1997). The natural grasslands of Cape York Peninsula. Description, distribution and conservation status. Biological Conservation 81: 121-136.

Retzinger, E. J. 1984. Growth and development of sicklepod (Cassia obtusifolia) selections. Weed Science 32: 608-611.

Setter, M.J., Setter, S.D., Higgins, D. and Vogler, W. (2019) Controlling weed recruitment in isolated areas of Cape York Peninsula, Proceedings of the 1st Queensland Pest Animal and Weed Symposium, Ed. T. Sydes, Weed Society of Queensland Pty. Ltd.