CONTROLLING WEED RECRUITMENT IN ISOLATED AREAS OF CAPE YORK PENINSULA

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ABSTRACT

Sicklepod (*Senna obtusifolia*) is a serious weed of many parts of Queensland, from Cape York to Mackay, and in many situations, including pastures, crops, road and power line corridors, clearings and creek banks. Sicklepod can occur as a monoculture and is predominately an invader of grazing pastures and unmanaged lands in north Queensland. Many areas of the remote far north Queensland affected by sicklepod are inaccessible for critical periods of the plants reproductive cycle every year. Treatment options allowing the pre-emergent control of new recruits to break this cycle would be greatly beneficial. This paper outlines the preliminary results of a pot trial conducted to identify effective pre-emergent herbicides for sicklepod control.

Keywords: Sicklepod, *Senna obtusifolia*, pre-emergent herbicide, post-emergent herbicide.

INTRODUCTION

Many area of Cape York Peninsula are inaccessible for many months due to heavy 'wet-season' rainfall. This can cause serious problems for weed control, particularly for species with short lifecycles such as Sicklepod (*Senna obtusifolia*) which was estimated to infest approximately 600,000 hectares in north and far-north Queensland (Mackey *et al*. 1997). This experiment investigates the use of pre-emergent herbicides to help control sicklepod in these difficult to access situations. If this approach succeeds, there are many other weeds and situations that may also benefit from use of pre-emergent herbicides.

The Biosecurity Act (2014) lists sicklepod as Category 3 restricted biosecurity matter. There are clear linkages to the current Pest Management Plans of the following councils, who all rate sicklepod among their top fifteen priority weeds: Cook, Douglas, Mareeba, Tablelands, Cairns, Hinchinbrook, Charters Towers, Burdekin, Whitsundays and Mackay. The Napranum and Lockhart River Aboriginal Shire Councils also note sicklepod as a priority weed, however their current ranked weed priority lists are unavailable. Several other Local Government and Aboriginal Shire Councils are also affected by sicklepod, but do not have available Pest Management Plans detailing particular weed species. The Cape York NRM and Burdekin Dry Tropics NRM both have active projects involving management of sicklepod infestations. Osunkoya *et al*., (2018) place sicklepod at number twenty in the most highly ranked pest plant species in Queensland while in 1997 it was regarded as the most serious exotic weed of Cape York Peninsula grasslands (Neldner *et al.* (1997).

Sicklepod has a relatively short lifecycle, and is able to produce seed within 6-10 months of seedling emergence (Dunlop, 2007). It produces up to eight thousand seeds per plant annually (Retzinger, 1984) with seed remaining viable in the soil for at least three years (Setter *et al*. unpublished data), and possibly up to ten years or more, e.g. Anon (1989).

Many infestations of sicklepod are inaccessible for months due to floods and associated road closures during the northern wet season. This confines control activities to a short window, and can allow seeding to occur. The control of adult sicklepod plants using current registered post-emergent herbicides has proven effective during the early-mid dry season i.e. winter, period of the year. However, this control usually occurs when plants have largely finished most of their seeding resulting in the perpetuation of the weed invasion cycle. With sicklepod having a large and persistent seed bank, the ability to minimise recruitment will likely make a difference to land managers trying to break the infestation cycle. Thus, pre-emergent herbicides that can be applied pre-wet season could provide an effective tool allowing control of the seed/seedling bank during the "wet" season.

A pot trial was conducted at South Johnstone to identify effective herbicides and application rates, which will then be used to refine control recommendations and techniques. Some herbicides tested have a known pre-emergent effect, while others are already widely used for weed control, with potential pre-emergent effect on sicklepod.

METHODS AND MATERIALS

Seed collection and preparation

Fresh sicklepod seeds were collected in July 2018, from multiple individuals at a single location near Cooktown in far north Queensland. The seeds were stored in the lab, pooled, processed and randomly sampled into lots of 30. Preliminary testing showed approximately 98% viability from field-collected seeds. Lots of 30 seeds were placed one cm below the surface of a 22 cm pot containing a commercial 1:2 mix of white river sand to black sand. After treatment, emerged live seedlings were counted weekly and left in the pot until the conclusion of the trial.

Shade house conditions

The pot trial site is located at the Centre for Wet Tropics Agriculture (CWTA) South Johnstone.
Pots were watered to field capacity for initial treatment then seeds/pots, after treatment they were given a light water (5.5mm) twice daily with overhead sprinklers.

The experiment consisted of a completely randomised design with 17 treatments each consisting of a herbicide and application rate replicated three times. Treatments were randomly allocated to individual pots with treated pots placed randomly on shade house benches for grow-out.

Herbicide treatments were applied in October 2018 as per rates tabled in Figure 3. Liquid herbicide solutions were applied using a boom spray (custom gantry) delivering a spray volume of 300 L ha^{-1} at 3 bar pressure as per Vogler *et al.*, (2014), nozzles were Teejet® XR tapered fan nozzles (Nozzle code XR11002-VP). There was no requirement for the use of a wetter or dye for the spray applications. Graslan®, which is a granular herbicide, was mixed with 10 g sand to aid even application on the soil surface.

Germination/viability measurements/statistical analysis

Total number of emerged seedlings were recorded on a weekly basis and left in the pots. It was expected that the emerged seedlings would either look green and healthy or chemically affected. The chemically affected seedlings would have perished by next count or remain. Analysis of variance was calculated using the statistical software Genstat 19th Edition.

Figure 1. Sicklepod seed collection via Cooktown in winter, note relatively clear access to soil surface beneath dead adult plants

Figure 2. Applying the herbicides in the pot trial at South Johnstone Research Centre.

Treatments

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

Grp	Trade name	Active	Low	Med	High
B	Mako	sulfometuron methyl 750g/Kg	0.4 kg/Ha	0.6 kg/Ha	0.8 kg/Ha
B	Arsenal	imazapyr 250g/L as isopropylamine salt	1 L/Ha	1.5 L/Ha	2 L/Ha
C	Bobcat	hexazinone 250g/L	3 L/Ha	9 L/Ha	15 L/Ha
C	Metribuzin 750 WG	metribuzin 750g/Kg	0.5 kg/Ha	1.25 kg/Ha	2 kg/Ha
C	Graslan	Tebuthiuron 200g/Kg	5 kg/Ha	7.5 kg/Ha	10 kg/Ha
D	Treflan	Trifluralin 480 g/L	1 L/Ha	2 L/Ha	3 L/Ha
G	Valor WG	flumioxazin 500g/kg	0.4 kg/Ha	0.7 kg/Ha	1 kg/Ha
I	Stuka flexi	picloram 240 g/L as potassium salt	0.93 L/Ha	1.25 L/Ha	1.57 L/Ha
I	Grazon extra	triclopyr 300g/L + picloram 100g/L as hexyloxypropylamine salt+ aminopyralid 8 g/L	2.25 L/Ha	3 L/Ha	3.75 L/Ha
I	Conqueror	triclopyr 300g/L + picloram 100g/L as hexyloxyproplamine salt	2.25 L/Ha	3 L/Ha	3.75 L/Ha
I	Tordon 75-D	2,4-D 300g/L + picloram 75 g/L as triisopropanolamine salt	3 L/Ha	4 L/Ha	5 L/Ha
B	Brushoff	metsulfuron -methyl 600 g/kg	0.03 kg/Ha	0.075 kg/Ha	0.12 kg/Ha
H	Balance	isoxaflutole 750 g/Kg	0.1 kg/Ha	0.2 kg/Ha	0.3 kg/Ha
I+B	Stinger	aminopyralid 375 g/kg + metsulfuron-methyl 300 g/kg	0.06 kg/Ha	0.15 kg/Ha	0.24 kg/Ha
G	Goal Tender	oxyfluorfen 480 g/L	1 L/Ha	2 L/Ha	3 L/Ha
I	Tordan regrowth master	triclopyr 200g/L + picloram 100g/L as triisopropanolamine salt+ aminopyralid 25 g/L	2.25 L/Ha	3 L/Ha	3.75 L/Ha

RESULTS

There were significant treatment effects ($P<0.05$) at four months after treatment with the herbicides containing Picloram including Conqueror®, Grazon Extra®, Stuka flexi®, Tordon 75-D® and Tordon Regrowth Master® causing high levels of control. Figure 3 shows examples of some treatments. The herbicide Pledge® was also effective in controlling seedling establishment with the high application rate treatment resulting in no live sicklepod seedlings at four months after treatment (Figure 4).

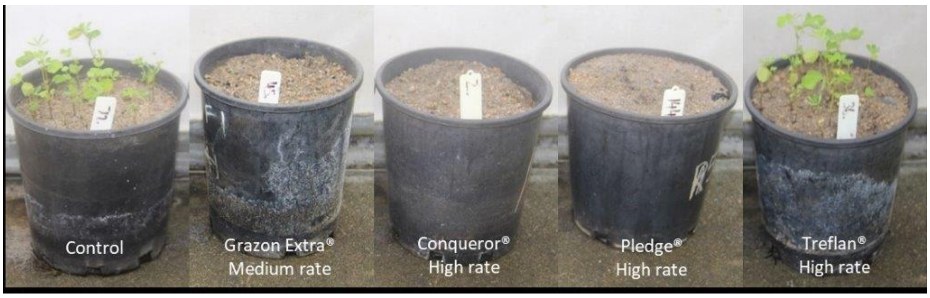

Figure 3: Pots at 4MAT, showing a few example treatments

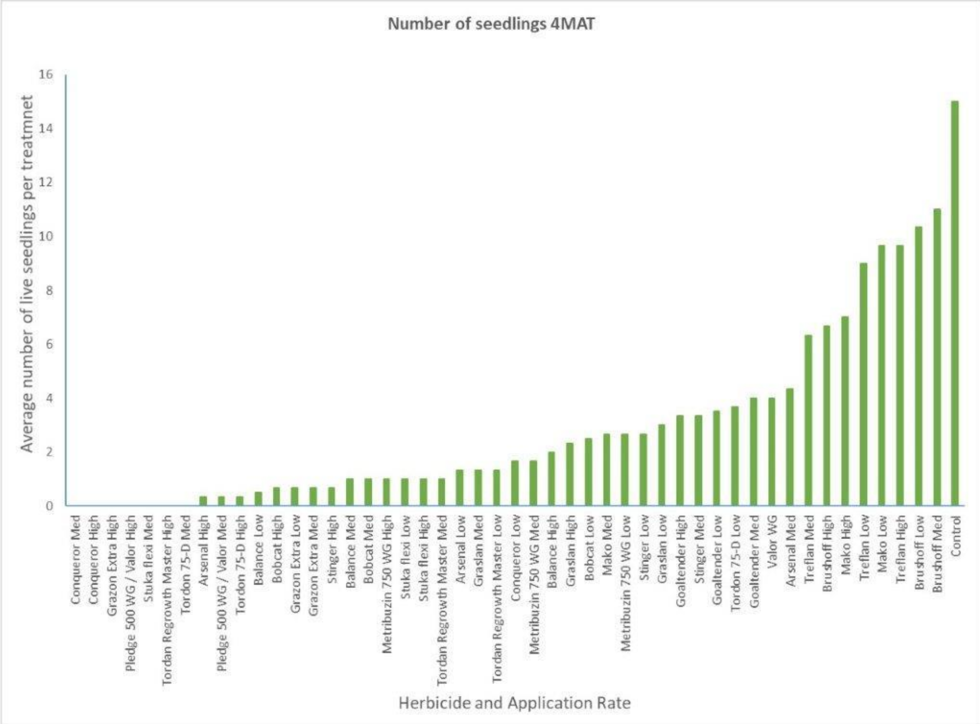

Figure 4: The average number of live sicklepod seedlings in each treatment approximately four months after treatment. The Least significant difference between treatments is 4.569 at $P<0.05$)

DISCUSSION

On Cape York Peninsula, Sicklepod seedlings generally begin emerging within a few weeks (Darryn Higgins, Pers. Comm.) of the first storm rains of the wet season during December/January period. Over several months in the wet season, the seedlings develop into mature flowering and seeding adults. This short timeframe, along with the inability to access and apply herbicide to the sicklepod infestations due to the wet season, makes it impossible for land managers to control sicklepod prior to seed set. Once adult plants have established, reproduced and set seed they remain as tall free-standing plants often occurring as a monoculture. Ablin (1990) notes that monospecific populations of up to 339 plants per square metre have been recorded in north Queensland.

During the mid to late dry season the adult plants wither and die releasing the next generation of seed into the soil. The adults although dead remain as sentinels to the legacy they have left in the soil below. This free-standing biomass although dry and withered remains where the seedbank is concentrated. When the land manager is able to access plants in late autumn/ early winter it is already too late to kill the seeds on the adult plant and there is little benefit in spraying adult plants.

Control options

Option one: Ideally, a herbicide treatment would kill the adult plant in summer, before the seed sets in autumn, and when applied with a high enough volume, result in a residual effect for next seasons recruitment, e.g. Conqueror® and Grazon Extra®.

Option two: If this scenario is unachievable then the herbicide can be applied directly to the soil long after the adults have naturally senesced and still have the effect of reducing the next season's recruitment. Figure 1 shows adult plants in senescent stage, note clear access to soil surface at this stage.

Some of the effective trialled herbicides containing Picloram are also registered for the post-emergent control of adult sicklepod at similar rates to those tested, e.g. Conqueror®, Grazon Extra®, and Tordon 75-D®. Of these, Conqueror® and Grazon Extra®. Grazon Extra® is currently the most frequently used herbicide for post-emergent control of sicklepod in the Cape York area (Pers. Com Darryn Higgins).

The results of this trial show several herbicides have a pre-emergent effect on sicklepod seedling emergence. Other factors such as the period the herbicides can remain intact prior to incorporation into the soil by rainfall, expense, safety, application method, and potential off-target damage will also need to be considered as part of any control recommendations. A follow up field trial to test effects in the real-world situation is planned. A rate refinement trial may occur pending the results of the field trial. At this stage this would most likely be using those herbicides currently registered for sicklepod control such as Conqueror®, Grazon Extra®, and Tordon 75-D®.

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