EVALUATING NEW HERBICIDES TO REPLACE DIURON

Research Topic 4: Pest Management

Trial number: SA04NQ-04

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INTRODUCTION

The Australian pineapple industry has struggled with weed infestations throughout its history. During this time there have been key herbicides that have controlled weed populations effectively. Diuron is one of these and plays an important role. Over the last 20 years there has been substantial focus on Diuron and its effects on the environment including the Great Barrier Reef and the Moreton Bay Marine Park. Across many commodities including pineapples, Diuron has been either de-registered or its use on-farm reduced by restrictions introduced by the Agricultural Pesticides and Veterinary Medicines Authority (APVMA).

It is critical for the Australian pineapple industry to find alternative herbicides to replace Diuron. This demonstration screened two experimental herbicides as possible replacements for Diuron in the pineapple industry.

HYPOTHESIS

New weedicide chemistry is needed to replace Diuron. The two experimental weedicides screened in this demonstration trial may show promise.

OBJECTIVE

Evaluate two new experimental herbicides as potential replacements for Diuron. Steps in this trial:

1) Observe weedicide efficacy in a pineapple production system.
2) Observe potential phytotoxic effects on a pineapple crop.
3) Identify product application rates, spray volumes and application methods to suit a pineapple production system.

METHOD

Location and grower

The demonstration was undertaken in collaboration with Accorsini Pines located in Mutarnee, North Queensland. The farm owner Tony Accorsini and his family have been growing pineapples in the area for three generations. Mutarnee is located on the Crystal Creek catchment which flows into the Great Barrier Reef Marine Park.

Dates

- March 2019 - planned the demonstration with Nufarm.
- April 2019 - site selected with grower.
- June 2019 - land prepared, pre-plant treatments applied, bed formed and planted.
- August 2019 - weed population counts and crop health assessments conducted.
- September 2019 - post plant foliar treatments applied.
- October 2019 – crop health observations conducted.

Crop details

The demonstration site was planted with 73-50 hybrid pineapple variety and followed a crop of the same variety which was taken to ratoon crop harvest. The soil was a sandy loam, prepared to a fine tilth, with no crop residue present and it had good soil moisture. Weather at treatment application and planting was ideal with temperatures ranging from 24 – 26°C.

Description

The block selected for this demonstration was located on Volk Rd, Mutarnee. The demonstration site consisted of the full width of one land consisting of fourteen beds that were thirty metres in length.

The demonstration included experimental herbicides NUL3398 and SCAL5045 at three different application rates (replicated twice) as a pre-plant incorporation into the soil and then applied once as a post-plant application over the crop, a control treatment (no herbicide) and an industry standard treatment (800 g/kg Bromacil @ 2.2kg/ha, tradename Hyvar or Uragan) were included as comparisons.

Pre-plant application
Each weedicide was applied in a water volume equivalent to 500L/ha and incorporated into the ground using a rotary hoe. The pre-plant treatments are as follows:

Table 1. Demonstration trial treatments

Treatment Number	Treatment	Rate (kg/ha)	Location (bed number)
1	Control - Nil	0	0
2	NUL3398	5	7, 14
3		12.5	3, 13
4		25	6, 9
5	SCAL5045	0.35	1, 10
6		0.7	2, 8
7		1.4	5, 11
8	Standard Bromacil	2.2	4, 12

The demonstration site was bed formed and planted with 73-50 slips.

The effect of the pre-plant applications were evaluated before the post-plant applications were made.

Post-plant application
The post-plant application was made as a foliar applied over the crop to observe weed efficacy and any phytotoxic effect on the crop. Foliar applications were done using drenching volumes with water at 4,000 L/ha three months after planting.

RESULTS

Pre-plant application
In August 2019, the pineapple plants were well established and the effects of the experimental herbicides, control treatment and industry standard treatment could be clearly observed. Weed efficacy assessments commenced by identifying and counting weeds as either grasses or broadleaf weeds. The main weed species identified in the demonstration site were blackberry nightshade and paspalum. Individual weed counts for each plot were undertaken across the entire demonstration site (see Table 2).

Table 2. Weed population assessment results for each pre-plant treatment (conducted three months after planting)

Replicate (bed No.)	**Treatment**	**Rate (kg/ha)**	**Weed counts**	
			Broadleaf	***Grass***
0	Control - Nil	0	347	213
1	SCAL5045	0.35	6	137
2	SCAL5045	0.7	11	23
3	NUL3398	12.5	123	0
4	Standard - Bromacil	2.2	0	0
5	SCAL5045	1.4	1	0
6	NUL3398	25	104	0
7	NUL3398	5	194	0
8	SCAL5045	0.7	3	4
9	NUL3398	25	108	0
10	SCAL5045	0.35	25	12
11	SCAL5045	1.4	2	0
12	Standard - Hyvar	2.2	3	3
13	NUL3398	12.5	205	0
14	NUL3398	5	246	0

Results were averaged over the replicates and each treatment ranked in order of weed efficacy (Table 3).

Table 3. Treatment results for the pre-plant applications averaged and ranked in order of efficacy.

Efficacy Ranking	Treatment	Rate (kg/ha)	Weed Counts	
			Broadleaf	Grass
1	SCAL5045	1.4	1.5	0
2	Standard - Bromacil	2.2	1.5	1.5
3	SCAL5045	0.7	7	13.5
4	SCAL5045	0.35	15.5	74.5
5	NUL3398	25	106	0
6	NUL3398	12.5	164	0
7	NUL3398	5	220	0
8	Control - Nil	0	347	213

Post-plant application

NUL3398 was applied as a post plant foliar application at three experimental rates (5, 12.5 and 25 kg/ha) but all rates resulted in poor weed control.

SCAL5045 was applied at three experimental rates (0.35, 0.7 and 1.4 kg/ha) three months after planting in a foliar spray volume of 4,000 L/ha. All three rates were phytotoxic to the pineapples and therefore cannot be used as a foliar application over pineapples.

Figure 1: Phytotoxic damage on a pineapple crop from SCAL5045 and NU3398 applied as a foliar spray at 3 months of age.

Control – Nil

SCAL 5045 – 1.4kg / ha

Standard – Hyvar

SCAL 5045 – 0.7kg / ha

SCAL 5045 – 0.35kg / ha

NU3398 – 25 kg / ha

NU3398 – 12.5 kg / ha

NU3398 – 5 kg / ha

Figure 2: Weed growth in each pre-plant treatment – three months after planting

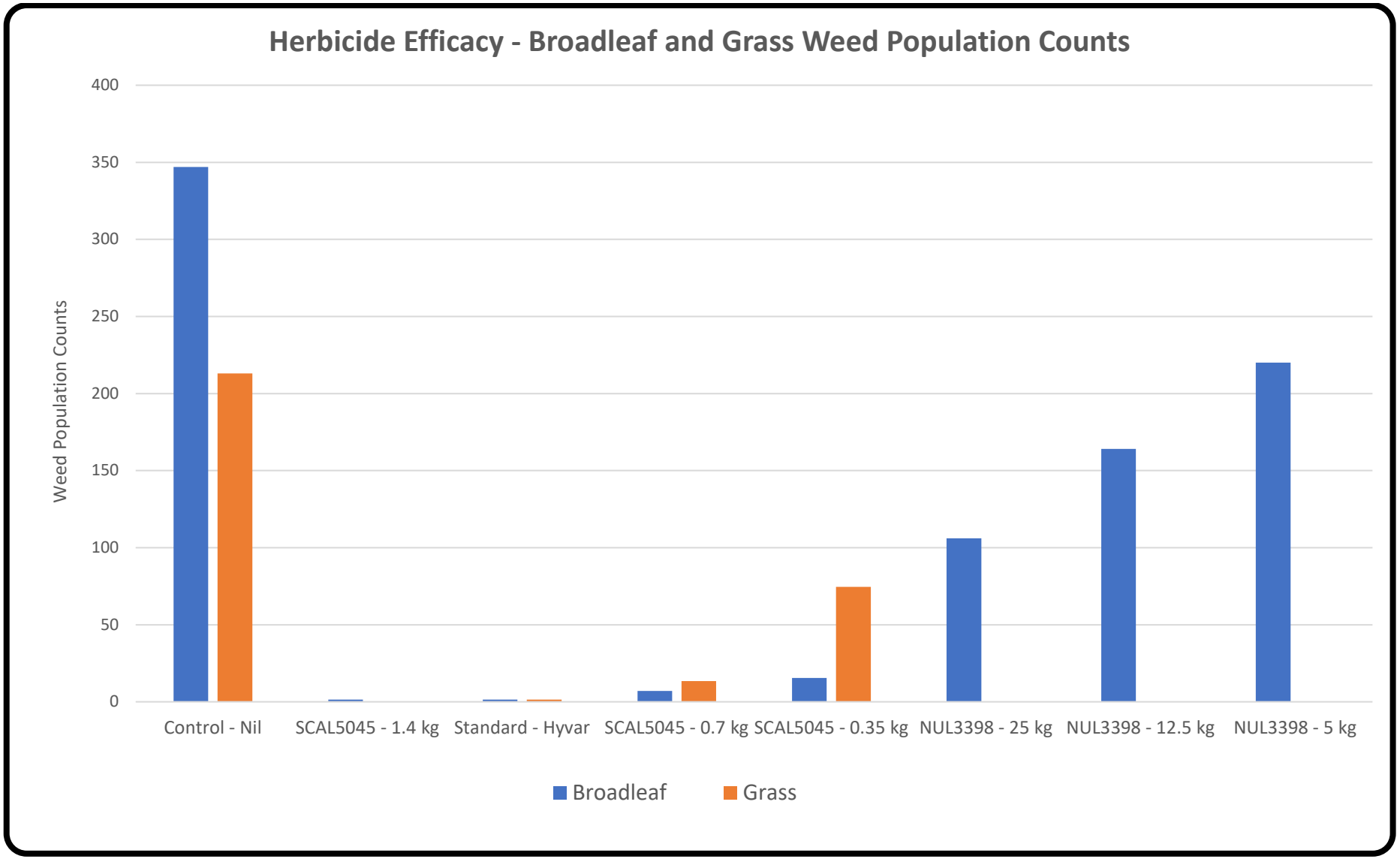

Figure 3: Weed population counts for each pre-plant treatment – three months after planting.

DISCUSSION

Pre-plant efficacy

The results from this demonstration trial showed that experimental herbicide SCAL5045 at an application rate of 1.4kg/ha has provided good weed control for both broadleaf and grass species when used as a pre-plant incorporated into the soil. When compared with the standard industry practice of 2.2 kg/ha of Bromacil, SCAL5045 at 1.4kg/ha produced equivalent weed control. SCAL5045 applied at lower rates (0.35 and 0.7 kg/ha) provided limited control of weeds. No crop phytotoxicity effects were observed across any pre-plant treatment.

Experimental herbicide NU3398 across all application rates (5, 12.5 and 25 kg/ha) provided good results in suppression of grass species, but poor control of broadleaf weed species.

It is important to recognise these results reflect a comparison of products and rates as a pre-plant incorporation into the soil prior to bed forming ONLY.

Post-plant efficacy

In September 2019 on the completion of the pre-plant evaluation of SCAL5045 and NU3398, both SCAL5045 and NU3398 were evaluated as a post plant application over pineapple plants. The SCAL5045 and NU3398 post plant treatments were applied over the existing SCAL5045 and NU3398 pre-plant plots at the same application rates. The experimental herbicide SCAL5045 was applied at 0.35, 0.7 and 1.4 kg/ha and NU3398 was applied at 5, 12.5 and 25 kg/ha. The post plant treatments were applied at an equivalent of 4,000L/ha water. Bromacil (tradename Hyvar or Uragan) was excluded as a post plant treatment as this product is a *known* pre-emergent herbicide without post plant 'knock-down' capabilities and registered use pattern recommends 'NOT TO BE APPLIED OVER PLANTS'.

All post plant application rates of SCAL5045 and NU3398 had severe phytotoxic effects on the pineapple plants. Therefore, experimental herbicide SCAL5045 and NU3398 cannot be applied as a post plant foliar application irrespective of weed control efficacy in a post plant situation.

ADOPTION AND IMPACT

In summary, there is potential for experimental herbicide SCAL5045 to become a useful herbicide in the management of weed populations in the pineapple industry. This will require further research and a collaborative effort from the chemical company and the relevant industry entity to gather the relevant data and support an application for a minor used permit to the APVMA. Until this process has been undertaken the industry will be unable to commercially use experimental herbicide SCAL5045.

Experimental herbicide NU3398 had no success as a pre-plant or post plant application and would recommend no further work with this chemistry in the pineapple industry.

CONCLUSIONS

Initial results for experimental herbicide SCAL5045 indicate that at an application rate of 1.4kg/ha as a pre-plant incorporation it is effective. Further research is needed to explore the possibility of getting a 'minor use permit' or registration.

NU3398 was ineffective at controlling weeds when incorporated as a pre-plant application.

Both SCAL5045 and NU3398 are unsuitable as post-plant weedicides as they were both phytotoxic to pineapples at all rates tested.

There is potential for new chemistry that can replace Diuron and other herbicides in the pineapple industry. It is important to keep evaluating new products and work with chemical companies to make these products commercially available for testing. This process will require resources including funding and time.

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