Chapter 13

WEED MANAGEMENT

Bluetop / Blue billygoat weed *(Ageratum houstonianum)*

Version 3, 30 April 2023

Weeds compete directly with the crop for sunlight, moisture and nutrients. They also interfere with spray penetration into the crop, make working conditions harder and may harbour nematodes and insects such as Rutherglen bugs, thrips, mites and mealybugs. If it were not for today's herbicides it is unlikely that many farmers would be able to produce pineapples economically.

An 'integrated weed management' approach is recommended. This means managing not only the weeds inside the crop, but also the established weeds outside the crop, and the weed seedbank. Programs should be tailored to suit the type of weed, degree of weed establishment and stage of the pineapple crop.

An integrated approach to weed management has long term benefits of reducing weed numbers, stops replenishment of the seedbank and minimises the risk of developing herbicide-resistant weeds.

Successful weed management also relies on the application of best agronomic practices to optimise crop growth. These include improving crop health for competition, reducing weed populations in the surrounding area, using fallow phases and controlled traffic (to prevent spreading weed seed).

Management practices in pineapple are predominantly focused on preventative measures through the use of pre-emergent herbicides. Usually when weeds approach maturity their control will become increasingly difficult and of course if they go to seed the problem is soon multiplied.

Pre-emergent herbicides such as diuron and bromacil are designed to prevent weed establishment by killing the germinating plant as it emerges. They are primarily used immediately after planting. In the meantime work is underway to identify and register new pre-emergent weedicides to replace diuron.

Post-emergent herbicides target weed populations after establishment has occurred and are aimed at the post-plant phase of the pineapple cycle.

ALWAYS FOLLOW LABEL INSTRUCTIONS

We recommend you use this chapter in association with the Department of Agriculture and Fisheries book **"The pineapple problem solver field guide"** published in 2015. This book contains colour photographs and information to help you identify 35 common weeds in pineapples (see "References and further reading" at the end of this chapter).

Overall management program

Land preparation

Cultivation during land preparation is a highly effective means of general weed control before the crop is planted.

Plant crop

Plant crops require an initial post-plant spray applied immediately after planting; follow-up sprays are applied as necessary.

Initial spray

The initial post-plant spray is the most important spray for good weed management. It is applied as a blanket boom spray before plants begin to grow, preferably to moist

soil. Depending on the weed species present, either **diuron** or **bromacil** alone, or a combination of both can be used. If broadleaved weeds are a problem, **ametryn** can be added to this combination.

Follow-up sprays

Subsequent sprays are used, as required, at half the initial rates, and are applied at about 2- to 4-month intervals. **Ametryn can be boom sprayed over actively growing plants before flower initiation, but bromacil should not be used in this way**. However, the latter can be directed at the interrow areas minimising contact with the pineapple plants using a number of methods which can include spray jets surrounded by a shroud that keeps spray away from pineapple plants (see below), spray jets mounted on drop arms that hang from the boom into the interow only, or even a Wonder Winder or a knapsack sprayer. Herbicides should not be applied over plants after flower initiation – only interrow sprays can be used after this time. Treatments this late in the crop should not be necessary if early weed-control practices were satisfactory.

A weed spraying rig with shrouded spray jets to keep weedicide to the interow and away from the pineapple plants

Ratoon crop

Because harvesting disturbs the plants and exposes the soil surface to sunlight, it is essential to re-establish weed control by applying a full-strength pre-emergent herbicide spray as soon as harvesting is complete, and preferably after rain.

- Rates and treatments are the **same as for the plant crop**, and bromacil can be safely used in this initial post-harvest spray provided it is applied before active growth re-commences.

- One or more follow-up sprays with the lower rate of **ametryn** may be required, particularly after the autumn and winter plant-crop cycles.

Control of isolated weeds

Even if chemical spraying is done on time, and the right sprays have been properly applied, it is unlikely that every weed will be controlled using boom-spray applications. Spot spraying, hand chipping or rope-wick applications may be required as a ‘topping off’ exercise.

For spot spraying, avoiding pineapples, use a low strength, high volume combination of **ametryn (**effective spray for controlling broadleaved weeds), **fluazifop-P (**particularly effective on perennial grasses such as paspalums) and **bromacil**.

Destruction of pineapple plants

Pineapple plants can regenerate from bits of cut-up stalk material and volunteer pineapple plants can harbour pineapple pests and diseases. It is important to destroy the residual plant material thoroughly and incorporate it into the soil. This recycles nutrients and increases the organic-matter content of the soil.

Most crops are chopped in or slashed without using chemicals. Burning is no longer a recommended practice because of environmental reasons and because it lowers organic matter levels in the soil.

Fallow (intercycle period)

Weed and volunteer pineapple plant control during the fallow period is important.

- Cover crops will suppress weeds and help build up soil organic matter. Forage sorghum, maize and millet are poor hosts for root-knot nematode and therefore have the additional benefit of helping to reduce nematode levels. *Refer to chapter 3 'Ground preparation, fallow and bed formation' for more information on fallow crops species.* The cover crop should not be allowed to seed and it should be worked into the soil 6 to 8 weeks prior to commencement of final land preparation to allow plant material to break down.

- In the absence of cover crops, prevent weeds from growing and seeding by slashing or cultivating. However, cultivation may leave the land very prone to erosion, and should only be used where the erosion hazard is low.

- The herbicide **glyphosate** or **Glufosinate-ammonium** will control most weeds in fallow or on headlands. **Fluazifop** may be used against most grasses.

Fine tuning of the weed-control program can come from district and personal experience, as well as discussions with other growers and industry advisers.

Pre-emergent herbicides

Pre-emergent herbicides (herbicides which control weeds just before or just after they emerge from the soil) are by far the most widely used group of herbicides in pineapples. The aim of their application is to establish a continuous film of herbicide near the soil surface through which germinating weeds have to pass and thus come into contact with the chemical. **Diuron** and **bromacil** are the most common pre-emergent herbicides used. **Ametryn** (trade names Ametryn, Ametrex, Amesip) gives both pre-emergent and post-emergent control of some weeds. To ensure success with pre-emergent herbicides a few guidelines should be followed.

ALWAYS FOLLOW LABEL INSTRUCTIONS

Guidelines for using pre-emergent herbicides

1. The soil must have a fine tilth and be free of clods. An uneven soil surface will interfere with uniform herbicide coverage.

2. The field should be free of weeds at the time of application, although most pre-emergent herbicides will control weeds in the seedling stage.

3. To ensure a uniform suspension, it may be necessary to premix wettable powder herbicides in a small amount of water to obtain a smooth paste before adding to the spray tank with the agitator operating.

4. The spray equipment must have good agitation to ensure that the chemical is well mixed at all times during application.

5. The herbicide should be uniformly distributed over the entire surface of the field. Smooth access tracks alongside the pineapple fields minimises “boom bounce”.

6. The soil should be moist when the herbicide is applied. Follow-up rain or irrigation improves effectiveness.

7. The soil should be disturbed as little as possible after treatment so that the herbicide barrier is not broken.

8. Do not apply urea or nitram over herbicide-yellowed plants for approximately 5 - 6 weeks until heart leaves regain normal green.

9. Diuron and bromacil should be applied in very high volume sprays for better soil saturation of the bed.

10. Mature, flowering, woody or tap-rooted weeds e.g. blue top, goat weed, pig weed and groundsel are difficult to control and must be sprayed as early as possible in their growth.

11. Using higher label rates or including wetting agents can cause crop injury.

12. Charcoal in areas of the field where fire stacks were situated will reduce the effectiveness of pre-emergent herbicides and may need extra weed control measures.

Diuron

Diuron is a broad spectrum herbicide that has several different formulations: soluble concentrate, wettable granule, dry flowable, liquid and flowable. Two strengths of diuron are available, 500g/kg and 900g/kg. Care is needed when using this product given the potential environmental impacts it poses. Please read the permit before use, in particular the critical use comments and details about the mandatory buffer zones stated to ensure you are complying with the recommended practices.

Label registration for diuron no longer exists but Permit 81856, in force from 16 June 2016 till 31 July 2027, allows a maximum of <u>1.8 kg of diuron active ingredient</u> (equivalent to 3.6 L of a 500 g/L product and 2.0 kg of a 900 g/kg product) to be applied <u>per hectare over a 12 month period</u>.

The label restraint prohibiting use on slopes above 3% does not apply to use under this permit. For plant crops diuron must be applied in very high volumes of water, e.g. 3000 – 4000 L/ha, (the permit recommends a minimum water volume of 2000 L/ha) and should be combined with wetting agents. For ratoon crops the permit recommends a water volume of 1000 L/ha. It can be sprayed in combination with fertilisers but problems can occur if using high rates of fertiliser in the spray mixture.

Diuron will break down in sunlight. It is best sprayed onto moist soil in cool, overcast or showery weather; **it should not be sprayed when temperatures are in excess of 33º C, or if greater than 50mm rain is expected within one day of application**. As a general rule do not apply diuron to very soft or lush young plants due to potential herbicide chlorosis.

Diuron's residual capacity for most weed species under normal weather conditions is approximately 3 - 4 months.

Rate guidelines

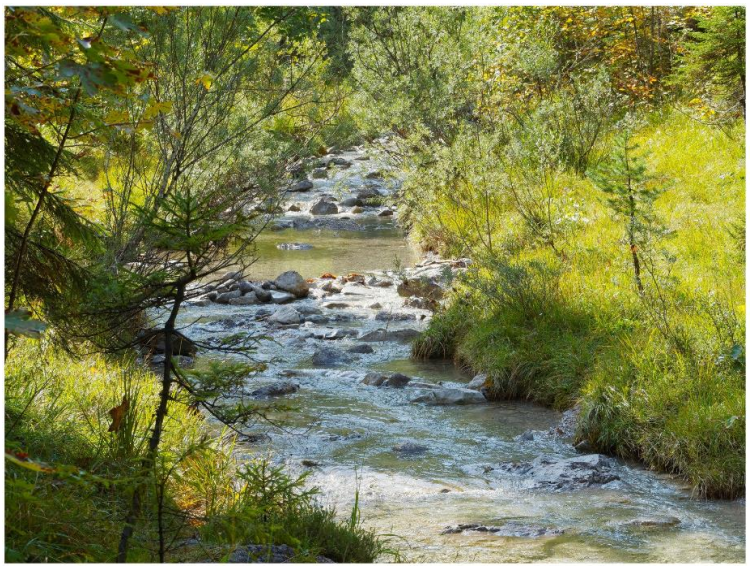
1. Diuron 500 g/kg

Immediately after planting but prior to weed emergence[1]	-	max 3.6 L/ha
After flower bud formation for inter row spaces only[1]	-	max 3.6 L/ha

2. Diuron 900 g/kg

Immediately after planting but prior to weed emergence[1]	-	max 2.0 kg/ha
After flower bud formation for inter row spaces only[1]	-	max 2.0 kg/ha

Case history: With the limited amount of diuron that can now be applied some growers rely on bromacil only for the initial spray and save their annual diuron allowance for follow up sprays since it is less toxic sprayed over actively growing pineapples than bromacil.



Mandatory buffer zones are a requirement when using diuron in pineapple.

[1] **Remember not to use more than 1.8 kg/ha of diuron active ingredient within a 12 month period.**

Bromacil

Bromacil 400g/kg (trade names Bromacil, Hyvar and Uragan) is a broad spectrum residual herbicide formulated as a wettable powder. General conditions of use are based upon the growth stage of the crop.

Bromacil should never be applied over the pineapple plants when they are actively growing, this includes after planted tops strike and after heart leaves begin to shoot.

The standard application rate is 2.2 kg/ha but it is recommended that a higher application rate of 4.5 kg/ha be applied on fields with a history of persistent weed problems. At these high rates it is very important to avoid overlapping spray applications since a double dose of herbicide will affect the growth of pineapples for some time. In situations where perennial weeds such as nutgrass are a problem, additional concentrations of herbicide are required depending on soil type.

In sandy soils a total of 6 kg/ha of active ingredient, and in clay soils a total of 8 kg/ha of active ingredient, are the maximum rate limits per crop before suppression of crop growth occurs.

This herbicide is <u>not</u> broken down by sunlight and will persist and become active when rain occurs. Use bromacil for weeds resistant to diuron, e.g. green panic and giant paspalum.

Krovar

Krovar is a blend of diuron 400g/kg and bromacil 400g/kg and is recommended as a pre-emergent or for application to weed seedlings only.

Note: Since Krovar contains diuron the amount used must be included in the annual diuron budget so that the total amount of diuron active ingredient does not exceed 1.8 kg per hectare per year.

In addition, it may not be used in the wet tropics and in other regions it can only be used outside of specified dates for each region that correspond to the summer wet season, these dates are stated on the label. Please read these and other restrictions described on the label.

A rate of 4.5 kg/ha in spray volumes of 2200 to 4400 L/ha is recommended as a blanket spray to moist soil prior to weed emergence after planting and before pineapple planting material starts to grow. Note that 4.5 kg of Krovar contains 1.8 kg of diuron active ingredient which is the total amount of diuron permitted per hectare per year.

As a direct interrow spray a rate of 2.2 to 4.5 kg/ha is recommended. **It should <u>not</u> be applied over the top of plants** (because of its bromacil content).

Post-emergent herbicides

Post emergent herbicides target weed populations after establishment has occurred, and are used in the post plant phase of the pineapple cycle.

ALWAYS FOLLOW LABEL INSTRUCTIONS

Commonly used post emergent herbicides are:

Ametryn

Ametryn 500 g/L and 800 g/kg (trade names Ametryn 500, Amestip 500, Ametryn 800 and Ametrex 800) can be used for the post-plant management of small soft broadleaf weeds and grasses. It provides knockdown and residual control particularly for those which are difficult to control with diuron, e.g. blue top, thickhead, pretty boy but is best used when weeds are small. **Do not apply over the top of pineapple plants after flower initiation.**

The recommended application rates for Ametryn 500 g/L are between 4 and 8 L/ha in 2000 L water. The rates for Ametryn 800 g/kg are between 2.5 and 5 kg/ha. The lower rate is for broadleaf weeds up to 15 cm high and for short residual control. The higher rate is for broadleaf weeds up to 30 cm high and seedling grasses, and where moderate residual control is required. Apply as a blanket spray when weeds are actively growing and good soil moisture is present. Ametryn can be mixed with regular fertiliser mixes, but **higher concentrations on soft pineapple plants can cause severe injury**.

Rates of more than 4 L/ha for 500 g/L products, or 2.5 kg/ha for 800 g/L products should not be applied at intervals of less than 4 months, and do not apply more than a total of 20 L/ha per plant crop for 500 g/L products, or 12.5 kg/ha per plant crop for 800 g/L products.

Note: Ametryn has a 14 <u>week</u> (98 day) withholding period.

Fluazifop-P, Haloxyfop and Quizalofop-P-ethyl

These are selective grass herbicides and have no effect on broadleaf plants. Significantly higher rates are required on older grass so there is a distinct advantage in spraying grass weeds when they are young. Rates and tradenames vary depending on the concentration of the product used (refer to *Chapter 34 "Registered chemicals and using them effectively"*) and the species and age of the grass. These herbicides can be applied over the pineapple plants with little or no damage to the crop. However in extreme hot or cold weather damage can occur although the culprit can be the solvents or wetting agents in the herbicide formulation.

Fluazifop-P

Fluazifop-P 128 g/L, Fluazifop-P 212 g/L, and Fluazifop-P 212 g/L (list of trade names in Chapter 34). There is a 14 day withholding period for these herbicides.

Haloxyfop

Haloxyfop 130g/L (list of trade names in Chapter 34).

Quizalofop-P-ethyl

Quizalofop-P-ethyl 100g/L, 200g/L, 250g/L and 99.5g/L (list of trade names in Chapter 34).

General comments on using herbicides

Herbicide toxicity

1. Some herbicides can have a toxic effect on crops.

2. Diuron, ametryn, and bromacil in particular, can be toxic to pineapple plants if used above the recommended rates. Always follow label recommendations.

3. Severe plant yellowing can result from boom sprays of diuron and ametryn at the high rate when plants are actively growing.

4. Bromacil should not be applied over the top of growing plant-crop plants. Directed interrow sprays which avoid contact with plants are acceptable.

5. Do not spray urea over herbicide-yellowed plants. Allow them to recover first, which may take from 4 to 6 weeks.

Spray volume

For good coverage, a volume of at least 1000 L to 2000 L per sprayed hectare is required depending on weed size. Up to 4400 L/ha is used with pre-emergent herbicides to get the chemical into the soil. Some growers have reported improved results by using two half-rate, full-volume sprays applied in opposite directions. If sprays must be applied during dry weather, use higher volumes, but it is better to wait till after rain has fallen.

Mixtures

Herbicides may sometimes be mixed with each other, or with other chemicals. Ensure that the ingredients are aimed at the same target – for example, soil-active herbicides such as diuron can be mixed with soil-targeted insecticides, while foliar-active herbicides such as fluazifop can logically be mixed with foliar-targeted materials like urea.

Urea mixed with diuron or ametryn will increase the risk of herbicide damage to the crop if it is sprayed over pineapple plants.

Equipment

Any equipment used for herbicide application must be accurately calibrated. Calibrated equipment ensures your spray is going where you want it to! Take care to ensure you know exactly how much chemical you are putting on which will also save you money. Seek professional advice if needed.

Boom sprayers

Boom sprayers are essential to any commercial operation. Truck or trailer-mounted rigs are used, with boom length varying from 10 to 15 m and tank capacities from 1000 L to 5000 L or more.

Wonder Winders/knapsack sprayers

The trailer-mounted Wonder Winder allows for spot or directed interrow herbicide application. Because the hose reel is spring-loaded, the operator does not have to handle the hose while spraying. The knapsack is really only suitable for spot application.

Rope-wick applicators

The wiper equipment applies systemic herbicides onto weeds by rubbing the weed with an absorbent wick containing the herbicide solution. Operate the hand-held wiper slowly and use two applications in opposite directions. Avoid contact with pineapple plants. Do not get soil on the rope-wick and always use clean water for mixing. Rainfall within 6 hours may reduce effectiveness, but there some additives like a sticker/penetrant that can minimise this problem.

Residual activity

Bromacil, diuron and ametryn are long-term residual herbicides and while this enhances their efficiency in the crop, soil residues can remain.

Some annual and perennial crops can be adversely affected by these residues when planted on soils previously used for pineapples.

Residual herbicides are broken down primarily by soil micro-organisms but residues of diuron in particular may persist for more than a year after application. All three chemicals persist longer in heavier clay soils than in light sandy soils.

Unintentional spraying, spray drift, and runoff of soil containing these residual herbicides cause environmental problems to waterways, nearby pastures and trees.

General weed management guidelines

- Use bare fallows, or ensure that cover crops grown during fallows are destroyed before going to seed.
- Spray out living mulch before it goes to seed.
- Frequently and thoroughly cultivate before planting to reduce infestations.
- Keep an eye on weed populations in the surrounding area (headlands and roadsides) which can contribute heavily to introducing weeds into your crop and topping up your weed seed bank.
- Use pre-emergent herbicide programs for effective control of germinating seedlings.
- For weeds that are not susceptible to pre-emergent herbicides (these include weeds that grow from vegetative parts such as stems, rhizomes and stolons e.g. nutgrass, couch grass, Johnson grass and oxalis) or have escaped treatment, remove manually or treat with an appropriate registered post-emergent selective herbicide.
- In-field infestations of grasses, which appear after planting, can be controlled with grass-specific systemic herbicides.
- For weeds that have got away and are going to seed despite weedicide programs, physically remove them from the field and destroy them e.g. by burning.
- As far as possible ensure that machinery, shoes and clothing are cleaned to remove seeds before entering fields.

References and further reading

Broadley, R.H., Wassman, R., Sinclair, E. (1993). Pineapple pests and disorders. Qld DPI.

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Notes