



Weedy Sporobolus grasses

BEST PRACTICE MANUAL

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The revised edition (2007) has been updated by Steven Bray and David Officer.

The original edition (1999, 2001) was compiled by the Giant Rats Tail team: Felicity McIntosh, Bill Schulke, Graeme Elphinstone, Steven Bray, Wayne Vogler, Col Paton, Bernie Shore, Michael Yee and Nigel Gallas.

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- capable rural communities achieving prosperity and self-reliance through successful rural businesses.

This publication has been compiled to offer best practice management options to land managers dealing with weedy *Sporobolus* grasses to optimise control strategy success and return on investment.

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Director-General,
Department of Primary Industries and Fisheries,
GPO Box 46,
Brisbane 4001.

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Preface

This manual provides practical information to help primary producers manage weedy *Sporobolus* grasses (WSG) – a group of weeds that includes giant rat’s tail grass and giant Parramatta grass.

The manual takes a strategic approach to weed management. A variety of common weed ‘situations’ are examined, and a ‘best bet’ strategy presented for each. These ‘best bet’ strategies are based on the latest research, and focus on achieving effective weed control in a cost-efficient way.

Weed management is tackled in an integrated way. Chemical control is combined with best practice land management techniques to effectively control current infestations and prevent the spread of weeds to ‘clean’ country.

The information presented in this manual is based on the outcomes of the latest research. Although the information is specific to WSG, the management and control principles presented can be applied to almost all invasive weeds.

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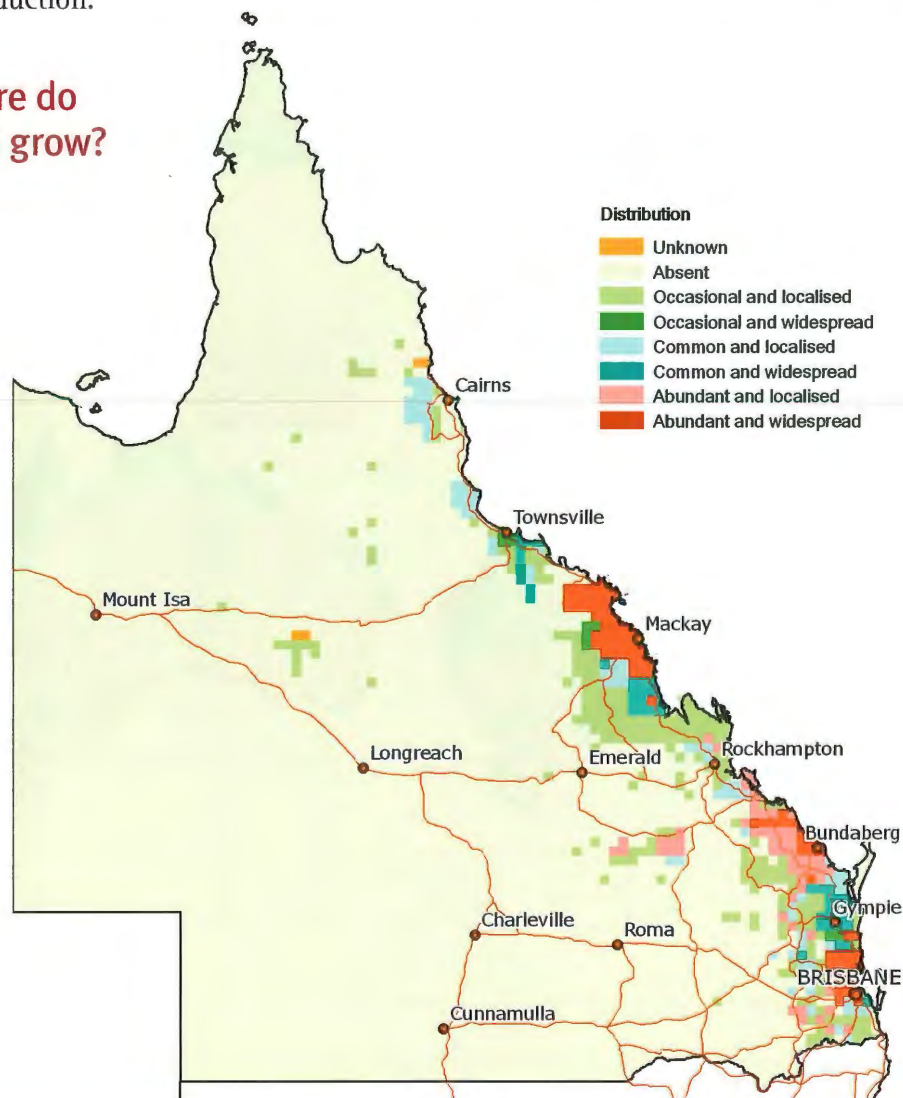
What are weedy Sporobolus grasses (WSG)?

Weedy Sporobolus grasses (WSG) are a group of related weeds that include giant rat's tail grass, American rat's tail grass, Parramatta grass and giant Parramatta grass.

WSG:

- Are robust, tufted, well-rooted perennial tussocks, with tougher leaf blades than most other grasses.
- Are exotic to Australia (non-native) and extremely aggressive.
- Produce large quantities of seed that disperse readily, the soil seed bank can build up quickly and seeds remain viable for a long time.
- Produce mature leaf blades that are tough and difficult for cattle to graze leading to reduced feed intake, in turn leading to reduced animal production.

Where do WSG grow?



Alien invaders

Some Sporobolus grasses are native to Australia, and these do not pose a weed problem. Weedy Sporobolus grasses are all exotic (non-native) species.

Giant rat's tail grass was introduced into Australia for pasture evaluation but was widely distributed as a contaminant of pasture seed between the 1960s and 1980s.

Giant Parramatta grass originated in Asia and is believed to have been introduced through hay used for packing in the early 1900s.

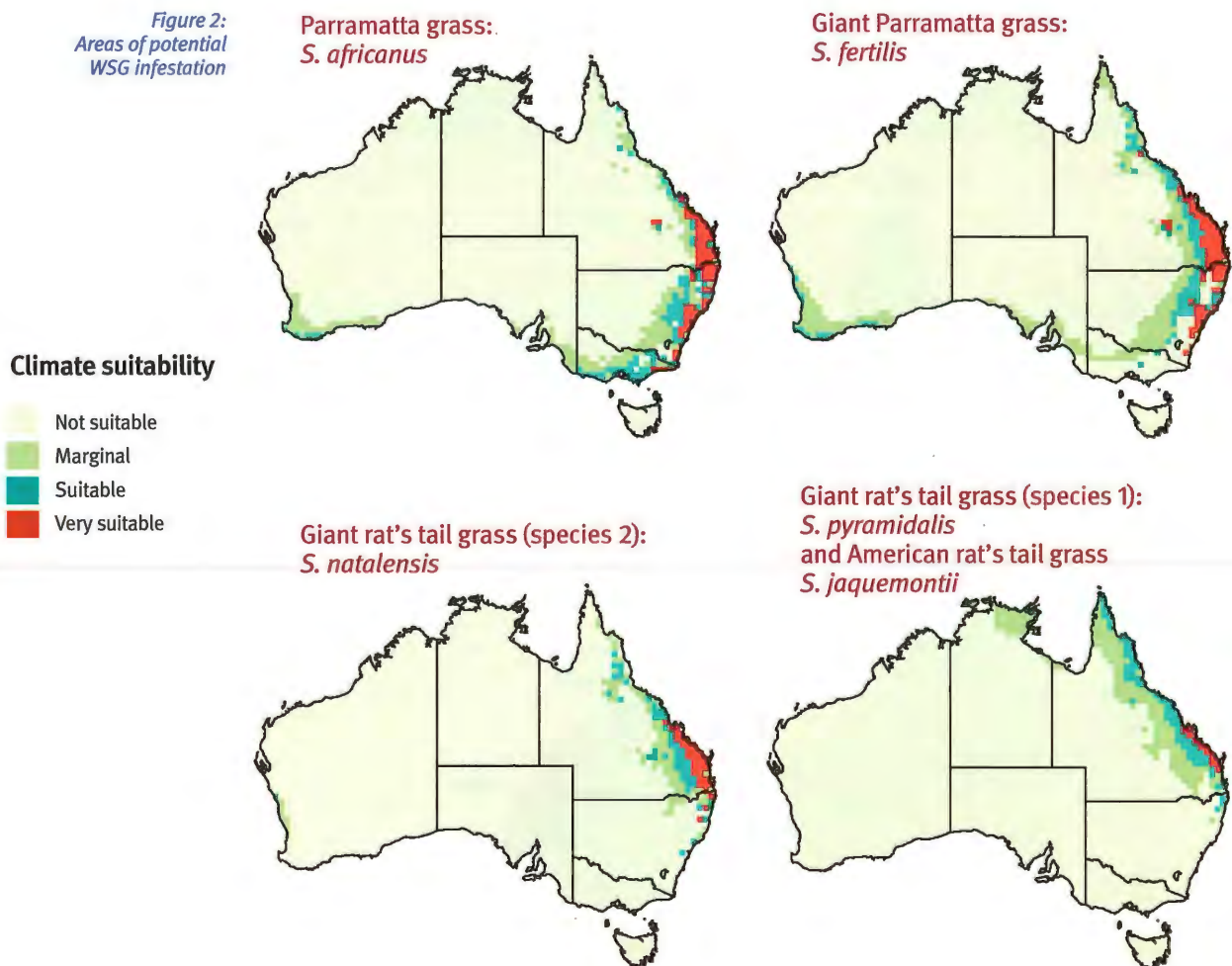
Source: Queensland Department of Natural Resources and Water, Annual Pest Distribution Survey 2006;
NSW Department of Primary Industries (National Land and Water Resource Audit Survey 2007)

Figure 1: Distribution of WSG in Queensland

WSG now infest an estimated 450 000 ha of grazing land in eastern Queensland and New South Wales. WSG grow in lower rainfall (600 mm average annual rainfall) areas, but are most common in areas with an average annual rainfall above 700 mm. Significant infestations occur in coastal and sub-coastal areas from the New South Wales border to Rockhampton, and areas near Moura, Mackay, Townsville, Ingham and Mareeba. Significant infestations also occur in the north coast region of New South Wales with smaller areas found south to the Victorian border.

WSG are adapted to a wide range of soils and climatic conditions in Australia, and have the potential to establish in areas receiving as little as 500 mm of annual rainfall, putting more than 60% of Queensland (108 million ha), and 30% of Australia (223 million ha), at risk (Figure 2).

Figure 2:
Areas of potential
WSG infestation



Why do we need to control WSG?

WSG infestations have, in some cases, dramatically decreased producers' economic viability and lowered land values. Current infestations are collectively costing the pastoral industry in the vicinity of \$60 million per year in lost production and control costs.

Invasive weeds such as WSG and parthenium now dominate large areas of Australia's sown pastures and native grazing land, posing a serious threat to the viability of many rural industries. Weeds such as fireweed, creeping lantana, Paterson's curse and serrated tussock have also gained a significant foothold in areas of eastern Australia.

Cattle grazing WSG dominated pastures can take up to 12 months longer to reach equivalent weights and stocking rates on these pastures need to be halved to maintain normal rates of production per animal.

A change in land management culture is required to effectively deal with WSG infestation. Experience has shown that herbicide control alone cannot stop the relentless progress of these invaders.

Improved land management practices are needed, both to control the current infestations and to prevent the spread of weeds to clean areas.

Long periods of poor ground cover or exposed soil provide the ideal environment for introduced weed seeds to germinate and establish. These conditions are frequent occurrences during the yearly dry season, during the droughts that characterise our climate, or as a result of fire or overgrazing.

Managing pastures to keep them in good health is therefore of key importance to managing weeds and preventing new infestations in clean areas.



*Poor management practice
resulting in weed infestation*

*Good management practice
resulting in healthy pasture
with few weeds*



What are your legal obligations?

In Queensland, WSG are a declared Class 2 pest which means they are established in Queensland and have, or could have, an adverse economic, environmental or social impact. Landholders must, by law, take reasonable steps to keep their land free of Class 2 pests.

In some areas of New South Wales, WSG have been declared noxious. Giant rat's tail grass is considered a Class 3 weed in areas where it is found, and must by law be fully and continuously suppressed and destroyed. Giant Parramatta grass has been declared in some areas as a Class 3 pest and in others as a Class 4 pest. By law, the growth and spread of Class 4 pests must be controlled according to measures set out by the local control authority.

Further information on declared weeds and your legal obligations

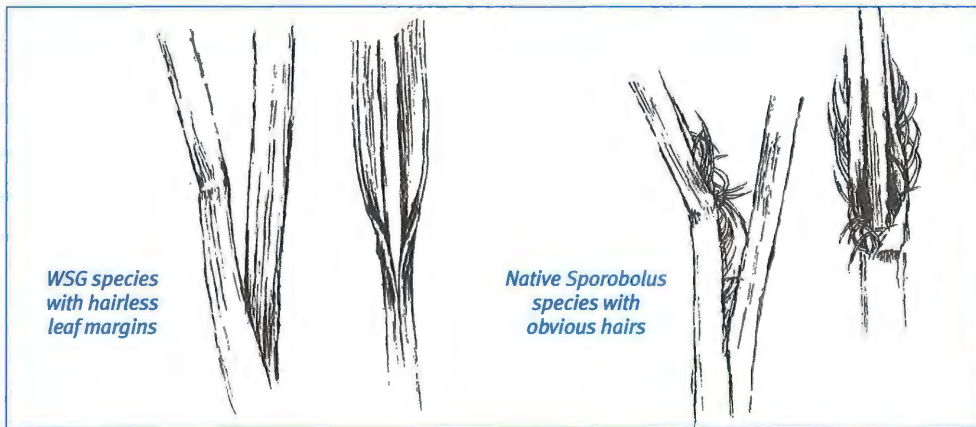
In Queensland, contact
Biosecurity Queensland on
13 25 23 or visit the website at
www.dpi.qld.gov.au and click
on the Biosecurity link.

In New South Wales, contact
the NSW Department of
Primary Industries on
(02) 6391 3100 or visit the
website at [www.dpi.nsw.gov.
au/agriculture/noxweed](http://www.dpi.nsw.gov.au/agriculture/noxweed)

2

How to identify WSG

WSG are similar in appearance to some native *Sporobolus* grasses. However, the WSG species generally have hairless leaf margins at the join between the leaf blade and leaf sheath, while native *Sporobolus* species often have obvious hairs. Native *Sporobolus* grasses also tend to be shorter than WSG, their seed heads are often less dense, and their leaves aren't as tough. Positive identification of small plants within a pasture is difficult until they produce a seed head.



Giant rat's tail grass commonly grows to 1.7 m tall when seeding. The seed heads are generally a 'rat's tail' spike when young, but may branch to an elongated pyramidal shape when mature. The seed head can range from 25 to 80 cm long and the side branches from 3 to 8 cm long.



American rat's tail grass looks like a short version of giant rat's tail grass, growing to 1.0 m tall.





Giant Parramatta grass grows up to 1.5 m tall when seeding and the seed heads are always a 'rat's tail' spike. Sooty spike disease sometimes develops on its seed heads.

Parramatta grass is similar to giant Parramatta grass, but only grows to 1.0 m tall.

Giant rat's tail grass (dark seed heads) growing amongst giant Parramatta grass



If you have any doubt about the identification of a *Sporobolus* grass:

In Queensland please contact your local council weeds officer, a Biosecurity Queensland Land Protection Officer (13 25 23) or the Queensland Herbarium (07) 3896 9326.

In NSW please contact your local catchment control authority, local council weeds officer or NSW DPI agronomist.

It is recommended to have a trained taxonomist identify specific WSG species.

Understanding the WSG infestation cycle allows producers and land managers to target the plants' weaknesses and bypass their strengths.

Introduction of seed

A new WSG infestation begins when seed spreads from an existing infestation into clean land. WSG seed coats become sticky when wet, allowing the seeds to stick to animals, vehicles and machinery. Animals grazing on WSG can also excrete viable WSG seed in their dung.

Preventing the spread of WSG seed into clean land is the single most effective action you can take to stop the infestation cycle. Chapter 5 outlines seed spread prevention measures in detail.

Germination and establishment

If seed transported into clean country germinates, the infestation moves to its next stage. Germination of WSG seed is stimulated by daily fluctuations of temperature and exposure to light. A good plant cover reduces these fluctuations, and helps prevent germination. Removing plant cover and exposing bare ground, increases seed germination.

Seedlings can emerge at any time of the year when soil moisture and temperature conditions are suitable. Generally most seedlings emerge in spring and summer. Newly-emerged seedlings require an area of low pasture competition to survive.

By the time seedlings reach approximately 5 cm in height they are tough. They can survive longer periods of moisture stress than most other pasture seedlings and are resistant to competition from surrounding plants.

In well managed, competitive pastures WSG seedlings may remain small and will not seed for years; a highly competitive pasture may even kill some small WSG seedlings, but usually many will survive.

Cattle will graze WSG (particularly giant Parramatta grass) early in the growing season when the regrowth is young and leafy. However, as plants mature, their leaves become tougher and less palatable to stock. This sets up a vicious cycle. Overgrazing of the more desirable grasses allows established WSG plants to increase in size and more WSG seedlings to establish.

Mature WSG plants are long lived (more than 10 years), and resistant to competition from the surrounding pasture; they are not usually killed by fire, slashing or grazing.

Mature WSG leaves are tough, resulting in livestock eating less forage, directly impacting on livestock production.

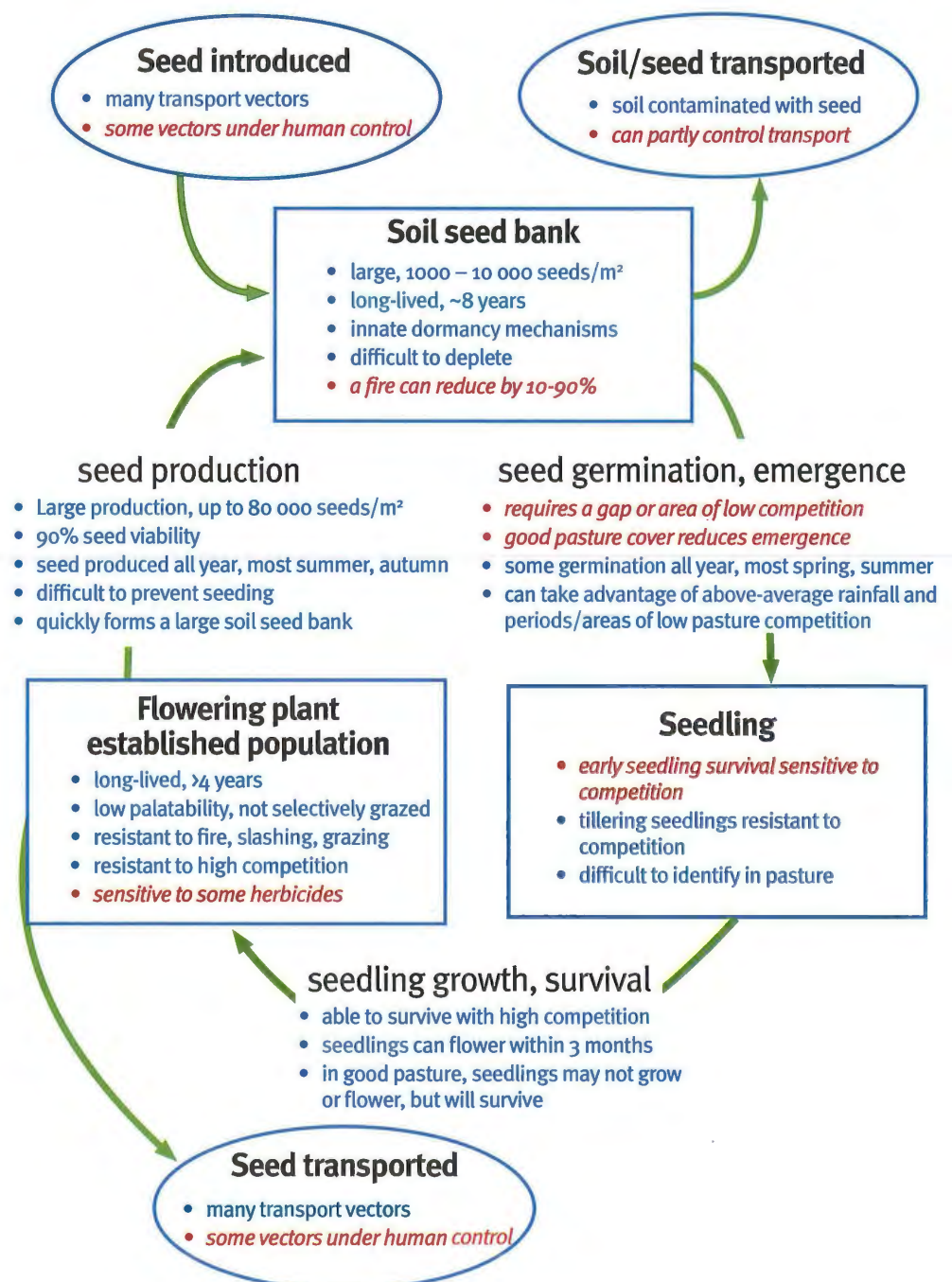


WSG seedling in area of low cover and competition

Development of a soil seed bank

WSG plants can quickly grow, flower and set seed whenever the pasture becomes less competitive through drought, overgrazing, fire or mechanical disturbance. Under the right conditions WSG plants can set seed within three months of emergence. Sub-lethal herbicide application may reduce seed production even if it does not kill the plant. High pasture competition also tends to reduce seed production.

Seed can be set throughout the year but most are produced during the warm season. Seed production is high with up to 80 000 seeds/m² produced per year, and most seed that falls is viable and can remain viable in soil for up to 10 years. A soil seed 'bank' quickly develops and up to 20 000 seeds/m² (or 2 seeds/cm²) can be present in the soil.



Once a soil seed bank has developed, management is more difficult. It is difficult to force the germination of all seeds contained in a soil seed bank. Although cultivation encourages seeds to germinate, seedlings will still emerge even after two years of continuous cultivation. Pre-emergent herbicides only kill germinating seed, and have no effect on dormant seed still in the soil. Seedlings can emerge from a maximum soil depth of 20 mm. Seed deeper than this can remain alive but dormant for extended periods.

The role of slashing and fire

Slashing tends to promote seed production, and is potentially a major seed transport mechanism with seed readily carried on the slasher. To stop seed production, a pasture would need to be slashed approximately every two weeks before immature seed reaches the early milk stage.

Exposure to temperatures of 125°C for as little as 15 seconds kills WSG seed. Pasture fires can kill 50% of the seed bank, and can play a useful role in reducing the WSG seed bank. However, fire has some disadvantages.

Some observations have indicated that fire encourages the development of dense WSG infestations. Research has indicated that fire alone does not significantly increase seedling emergence. However, if after burning, pasture competition is reduced or removed by herbicide or heavy grazing, the emergence of WSG seedlings is increased. Further, a fire that results in lower ground cover will encourage remaining seed to germinate. Fire followed by a wet year can result in many new seedlings emerging and establishing.

Fire with a fuel load of 4 t/ha kills moisture stressed or droughted seedlings up to 15 cm high and healthy, unstressed seedlings up to 3 cm high. Fire rarely kills mature tussocks but often reduces their size. Fire generally promotes seed production.

Despite some disadvantages, fire can play a useful role in reducing the WSG soil seed bank and encourage remaining seed to germinate further depleting seed reserves.



Burning may reduce the WSG soil seed but does not control mature plants



Debris on slashers can spread seed

Controlling established WSG infestations is expensive and time-consuming. Measures to prevent the initial establishment of WSG should be put in place by all land managers.

Maintaining healthy, competitive pastures is essential to preventing the establishment of WSG. Careful grazing management is required for pastures to achieve or remain in good condition, and high in perennial, productive and palatable species. A balance must be maintained between the needs of the pasture and the needs of the grazing animals. The following four principles are key to management:

1. Manage ground cover:

Minimise the creation of bare and disturbed areas, as these areas are likely to be suitable for the establishment of WSG and other weeds. Living plants compete with WSG seedlings for soil moisture and reduce the seedlings' chance of survival.

Litter (dead plant parts on the ground) is not waste. It covers bare soil and reduces the light that reaches the soil, thus limiting the germination of WSG. Litter also helps the soil retain moisture, improving pasture growth. Litter also encourages soil organisms which are essential for maintaining healthy soils.

2. Rest pasture periodically:

Continuous grazing weakens plants, reducing their competitiveness within the pasture. Pasture plants require periodic rest to build-up reserves and produce seed.

Current pasture condition determines the amount of rest required to achieve good condition. Some pastures may require other inputs (such as fertiliser, a selective weedicide, or re-sowing) before they can be considered to be in good condition.

3. Match forage production to animal consumption:

Overgrazing weakens a pasture's competitive ability and its resistance to weed invasion. Therefore it is important to match forage production and animal consumption (forage budgeting). Forage budgeting tools such as the Stocktake package in Queensland (www2.dpi.qld.gov.au/stocktake) can be useful.

4. Remain vigilant:

Keep a look out for invading weeds and quickly control before they become established.



Remain vigilant for invading WSG

Once WSG infestation has occurred, producers need to take measures to contain the infestation and prevent its spread to clean country. WSG are adapted to a wide range of environmental conditions. Weed seeds can be introduced from far away by vehicles, machinery, and feral animals, or through the purchase of hay, seeds or new livestock.

Follow these Do's and Don'ts to help prevent the spread of WSG seed:

Vehicles and machinery

Do

- Clean machinery suspected of carrying WSG seed before it enters and when it leaves your property.
- Provide a dedicated wash-down area.
- Regularly check machinery and vehicles for WSG and other weeds.
- Preferably work WSG-infested areas separately and clean machinery and vehicles with compressed air before moving to other areas.
- Work the clean areas before moving into the infested areas, if clean and infested areas cannot be worked separately.
- Stick to clean tracks when moving around the property. Ensure utility workers, contract workers and others entering your property understand any movement restrictions.
- Maintain a 10 m wide WSG-free buffer strip along roadways and machinery corridors. Keep laneways free of WSG.

Don't

- Drive machinery or vehicles through WSG if at all possible, especially in wet or dewy conditions.
- Slash WSG-infested pastures when they are wet or dewy. There is always a risk of spreading seed when slashing. The safest time to slash is in winter, when there is less seed on the seed heads.
- Carry WSG specimens loose in the cabin or in the tray of a ute; secure them in a bag.
- Allow off-farm vehicles to drive around your property without first knowing their WSG status.

Cattle

Do

- Minimise movement of cattle between infested and clean paddocks.
- Have a regularly monitored quarantine area where livestock can be 'cleaned-out' for a period (at least 5 days) before moving to clean areas (this includes newly purchased and sale cattle).

How the seeds of weedy *Sporobolus* grasses are spread

1. Seed and soil sticking to vehicles and machinery.
2. Seed and soil sticking to livestock and livestock manure.
3. Seed and soil sticking to native and feral animals and their dung.
4. Contaminated hay and seed.
5. Fast flowing water.



Weedy Sporobolus grass seed becomes sticky when wet. Avoid moving stock and driving through infested paddocks on wet, dewy mornings.

Quarantine areas for livestock

Quarantine areas can be yards (on WSG-free hay), laneways or small holding paddocks. Ensure holding paddocks have a good cover of competitive grasses and are checked regularly.

Weed Hygiene Declaration

WSG seed is indistinguishable from seed of other *Sporobolus* species (rat's tail type grasses). A bag of pasture seed with *Sporobolus* spp. listed on the seed analysis report could potentially contain WSG seed.



In Queensland, suppliers must by law provide written notice if the products they are selling, giving or supplying contain Class 2 declared weeds or seed, including WSG. New South Wales does not have a mandatory declaration system.

Landholders can request a Weed Hygiene Declaration to ensure the products they receive are free of weed reproductive material, and that vehicles are clean before entering their property. Weed Hygiene Declarations forms are available from Biosecurity Queensland offices in Queensland or from the website at www.dpi.qld.gov.au and click on the Biosecurity link.

- Maintain your fences, and improve their effectiveness by setting up and maintaining buffer strips along the inside of infested paddocks.
- Muster when pasture is dry in the afternoon.

Don't

- Muster on rainy days, when dew is present or in muddy conditions.
- Shift livestock directly from an infested to a clean paddock.
- Walk cattle from infested paddocks through clean paddocks.
- Purchase livestock without attempting to determine their WSG status. Always quarantine stock if their WSG status can't be determined.

Other livestock

Do

- Treat horses, goats etc. similarly to cattle, as similar quarantine strategies apply.
- Wash horses and dogs following their use in WSG-infested pastures.

Don't

- Allow horses into clean paddocks if there is a possibility they are carrying seed.
- Work horses or dogs in WSG pastures under wet conditions.
- Allow your dogs to roam WSG paddocks during wet weather or on dewy mornings.

Hay and pasture seed

Do

- Determine the origin of hay and treat as suspicious any hay from known WSG areas.
- Feed hay in a yard, feedlot or small holding paddock. Keep watch for any strange weeds or grasses.
- Check that pastures that are to be baled do not contain WSG. Avoid pastures with known WSG stands or at least stay well clear of any isolated patches of WSG.
- Purchase seed from a reputable seed merchant only. Check that the seed analysis report does not have *Sporobolus* spp. listed as a contaminant.
- Sow the recommended competitive pasture grasses when replanting WSG infested pastures.
- Request a Weed Hygiene Declaration if you are unsure of the WSG status of hay and pasture seed.

Don't

- Knowingly purchase hay contaminated with WSG.
- Buy seed that has *Sporobolus* spp. listed as a contaminant.
- Buy seed without knowing its origin.

How to clean vehicles and machinery

WSG seed sticks to wet objects, so it's important to remove as much seed as possible by scraping, brushing and blowing, before wetting down. Where possible, seal any cracks and crevices that collect seed with an appropriate inert sealant (e.g., liquid foam or similar substance). When cleaning vehicles and machinery follow this procedure:

1. Scrape and brush off soil and all organic material.
2. Use compressed air to blow out any seed collected in corners and crevices.
Pay particular attention to areas around radiators and sumps.



3. **Bulldozers and heavy machinery.** Check and clean radiators, track frames and adjusters, belly plates, cabin floors and air cleaner collectors.

Cars, utes and bikes. Check and clean chassis rails, inside mudguards, engine and transmission protector plates, radiator, inside engine bay, above the spare tyre and fuel tank, around the spring shackles and U-bolts, cabin floor and under seats of vehicles.



4. Wash the vehicle or machinery with high pressure water in a dedicated wash-down area.

Preventing spread by native and feral animals

Preventing the spread of seed by native and feral animals is difficult. The best strategies are to keep numbers of feral animals (e.g., pigs) under control, and to identify native and feral animal pads (e.g., areas close to watercourses and other bodies of water). These areas should be regularly patrolled to control isolated plants. Fencing these areas off from the main paddock can also be useful.

Finally, monitor your property carefully and regularly to identify and control isolated plants. If an isolated plant is found, make sure it is well marked so it can be found when you return.

Preventing spread by water and wind

WSG seed can be transported by fast-flowing water. If water is flowing fast enough to carry sediment and debris, it can transport seed. If water is flowing slowly (e.g. overland flow across a grassy paddock), WSG seed is more likely to sink and be trapped by vegetation.

WSG seed have no wind dispersal structures and even though the seed is small, most seed falls within 2 to 3 m of the seeding plant. A well maintained WSG-free 10 m wide buffer strip is an effective barrier to wind blown seed.

Watercourses in good condition are likely to filter seed out of the water flow. Settlement ponds or dams have been used by some landholders to manage water transport (check with the appropriate government agency before building dams and water diversion structures). Ensure the settlement pond walls, banks and surrounding area are kept free of WSG. Consider fencing off major watercourses from the main paddock and regularly check for invading plants in that area.

Preventing spread by public utility workers

Before allowing public utility workers onto your property, ensure their vehicles have been checked for WSG and are clean. Ensure that utility workers' vehicles are fitted with an air compressor and/or a water tank and pump for on-site vehicle cleaning. When travelling through the property, stick to clean tracks, and avoid WSG areas in wet weather. Make sure vehicles are cleaned before leaving infested sites.

Be vigilant!
Assume that vehicles, animals and persons passing through WSG infested paddocks have been contaminated with seed. Ensure all sources of weed seed are addressed before entering clean country.

Wind transport of seed is minimal. Here, the fence has acted as a barrier. Inserting a 10 m wide buffer strip would further reduce seed infesting the neighbouring paddock.



When planning how to manage WSG, follow these steps before taking action:

Step 1: Accurately identify areas of WSG infestation

On a paddock and land type basis, mark on a property map:

- Areas infested with WSG and the density of infestation or category of infestation (see Chapter 7 for more information on infestation categories).
- Watercourses with infestations upstream of clean areas.
- Paddocks that could be worth splitting into clean and infested areas.
- Pasture condition.
- Clean paddocks.
- A paddock to be used as a cattle quarantine paddock when moving livestock from infested to clean country, or to sale.

Step 2: Prevent the spread of weed seed to clean country

Preventing the spread of seed into clean land is the single most effective action you can take to stop the infestation cycle. A range of measures to prevent the establishment and spread of WSG are discussed in Chapters 4 and 5.

Before you think about other control measures, plan strategies that can be applied to stop seed movement. These might include:

- Ensure off-farm vehicles and machinery are clean when entering the property and restrict movement around the property.
- Set up a designated wash down area for vehicles.
- Minimise cattle movement between infested and clean areas and quarantine cattle.
- Maintain fences in good order to stop unplanned cattle movement.
- Install fences to separate infested areas from clean areas in larger paddocks.
- Create buffer strips along the inside fence line of infected paddocks to improve their effectiveness as a barrier.
- Implement good pasture management to restrict weed seedling survival.
- Monitor clean paddocks regularly.
- Ensure hay, feed and seed are not contaminated.

Step 3: Identify the most cost-effective, long-term management strategies

Preventing the invasion of clean areas will always be the most successful and high impact management strategy. That's why it is important to plan measures to prevent the spread of weed seed in Step 2 before spending money on tackling infestations.



WSG seedlings germinating from cattle manure. Prevent cattle movement between infested and clean country.

For the control of infested paddocks, consider the following:

Control takes time and money: The large long-lived seed bank of WSG means that controlling well-established infestations in large paddocks will be difficult and will require substantial dedication and financial commitment over many years to achieve success and make the investment worthwhile.

Broadacre strategies are more effective: Broadacre spraying controls the highest percentage of plants. Small plants are often missed using techniques like spot spraying. Spot spraying often requires many follow-up treatments which can be demoralising.

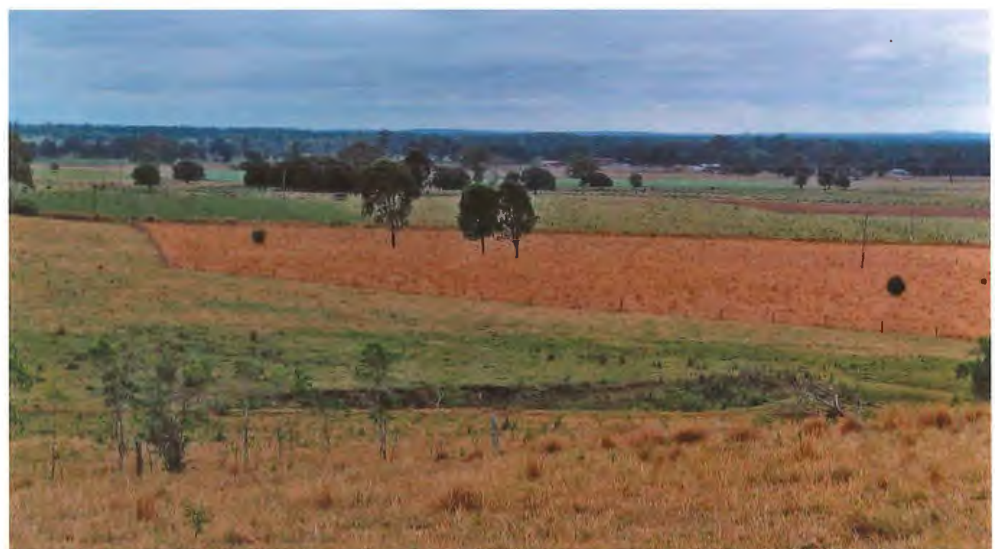
Treat the whole paddock at once: If it's not possible to treat the whole paddock at one time, work from scattered infestations towards dense infestations. Partially treating a paddock means that the untreated part will always be a source of seed to re-infest the treated part via seed movement by livestock.

Aim for healthy, vigorous pastures: The final outcome of any control strategy must be a well-managed competitive pasture otherwise control attempts will be futile. Paddocks that still contain good pasture species are often a good option for control efforts, as pasture seed costs and the risks of poor pasture establishment can be very high.

Points to consider when choosing the infested paddocks in which to undertake control strategies:

- Identify paddocks most likely to be a source of seed, contaminating clean areas, such as at the top of a catchment (higher priority).
- Identify paddocks with only a few widely scattered plants/clumps (high priority).
- Identify paddocks which are arable and /or accessible to machinery (broadacre control options are most likely to be financially and labour efficient) (higher priority).
- Identify paddocks most likely to be re-infested by seed movement from outside the paddock (lower priority).

Chapter 9 provides a case study on the use of the three-step planning process to manage WSG.



Identify the most cost-effective, long term management strategies. Healthy, vigorous pasture should be the final outcome of any control strategy.

Using the three-step planning process from Chapter 6 will give producers a firm idea of where infestations exist on their property and which management strategies are priorities.

Control measures to be implemented within each paddock will vary and should be assessed individually.

Most WSG infestations fall in to six main categories of infestation:

1. Occasional plants only.
2. Scattered plants and/or small clumps* on land accessible to machinery.
3. Scattered plants and/or small clumps* on land not accessible to machinery.
4. Dense infestations on arable land.
5. Dense infestations on non-arable land accessible to machinery.
6. Dense infestations on land not accessible to machinery.

*Situations 2 and 3 can occur as single plants scattered across a paddock or as clumps (groups of 3 or more plants) scattered across a paddock, or a combination of both, but overall density remains between 1 and 2 plants per 10 m².

For each of these situations, this Chapter provides:

- A brief description of the level of infestation.
- A photograph of the infestation.
- Its impact on production and priority in a control program.
- Best management practices.
- A list of possible control options.

Herbicides are referred to by the active ingredient. There are a number of commercial products with various product names that contain the active ingredient.

There can be differences between the States in herbicide application methods, species targetted and timing of application for a particular herbicide product.

Please check the current permit and/or label. If your situation is not consistent with the permit or label, a permit is required from the APVMA (Australian Pesticides and Veterinary Medicines Authority) prior to herbicide application (www.apvma.gov.au)

Chapter 8 provides detailed 'how-to' explanations for each of the main control practices.

1: Occasional plants only



Best management practices:

- Regularly look for WSG plants.
- Maintain pasture vigour and effective ground cover.
- Remove the entire plant with a mattock to reduce the risk of plants re-establishing.

Definition

- 100 plants/ha (1 plant/100 m²) or less.

Impact of infestation

- Nil on pasture and cattle production.

Priority

- Very high.
- A nucleus for major infestation (building up a soil seed bank).
- Cost-effective control options available.

Control options

- Chip out and bag (with minimal soil disturbance), or
- Spot spray with:
 - flupropanate herbicide
 - glyphosate herbicide.

Best bet options

- Chip out and bag because seed heads are removed and plants are instantly removed. Burn the bagged plants. Do not leave bagged plants in the back of a ute, as seeds are likely to escape.
- Low cost–high benefit (effective control).

Other considerations

- Mark locality and regularly check for newly established plants.
- Consider spraying the selective herbicide flupropanate in a 2 m buffer around the removed plants. This will control any seedlings you may have failed to identify.



2: Scattered plants and/or small clumps on land accessible to machinery

Best management practices:

- Maintain pasture vigour and effective ground cover.
- Control stock movement from this paddock to clean country.
- Spot spray, progressing from the lighter to the heavier populations (target isolated plants first).
- Broadacre application of flupropanate.
- Wick wipe in a package of three or more wipes over 18 months.
- Maintain clean buffer strips along fences and access tracks.

Definition

- Up to 1000–2000 plants/ha (1 to 2 plants/10 m²).

Impact of infestation

- Minimal on pasture and cattle production.
- Increased grazing pressure on the palatable pasture species.
- Source of contamination for the whole property.
- A soil seed bank is developing.

Priority

- Very high.
- Cost-effective control options available.

Control options

- Spot spray.
- Broadacre application of flupropanate.
- Wick wipe (Permit 9630 expiry 1 November 2011 for NSW).

Best bet options

- Fewer than 1000 plants/ha - Spot spray or use broadacre application of flupropanate.
- More than 1000 plants/ha - broadacre application of flupropanate as it is not cost-effective (time and herbicide) to spot spray denser infestations.
- Moderate cost—high benefit (effective control).

Other considerations

- Don't underestimate the density of plants. Include the number of seedlings and small difficult-to-identify plants.
- Consider trade-off between the time spot-spraying and effectiveness of finding and controlling small plants and the cost of broadacre control strategies.

3: Scattered plants and/or small clumps on land not accessible to machinery



Best management practices:

- Reduce stocking rate to maintain pasture vigour and ground cover.
- Control stock movement from this paddock to clean country.
- Spot spray, progressing from the lighter to the heavier populations (target isolated plants first).
- Spot spray along fences and access tracks to isolate the infestation.
- Aerial application of flupropanate herbicide if good pasture species are still present.

Definition

- Up to 1000–2000 plants/ha (1 to 2 plants/10 m²).
- Not accessible to tractor operations.

Impact of infestation

- Minimal on pasture and cattle production.
- Increased grazing pressure on the palatable pasture species.
- Source of contamination for the whole property.
- A soil seed bank is developing.

Priority

- High (but less than for accessible land).
- Failure to control at this level will lead to a dense infestation in country that is very difficult to clean up.

Control options

- Spot spray.
- Broadacre application of flupropanate herbicide (aerial application in NSW is weed specific – check label).

Best bet options

- Spot spray.
- Aerial application of flupropanate herbicide if good pasture species are still present.
- Moderate cost—high benefit (preventative).

Other considerations

- Don't underestimate the density of plants. Include the number of seedlings and small difficult-to-identify plants.
- Consider trade-off between the time spot-spraying and effectiveness of finding and controlling small plants and the cost of broadacre control strategies.



4: Dense infestation on arable land

- Maintain pasture vigour and effective ground cover.
- Spot spray headlands.
- Use broadacre control techniques.
- Scout regularly for surviving WSG after conducting control practices.

Best management practices:

Definition

- More than 2000 plants/ha (more than 2 plants/ 10 m²).
- Land capability suitable for short-term cropping.

Impact of infestation

- Declining pasture and cattle production.
- Severe grazing pressure on the palatable pasture species.
- Source of contamination for the whole property and neighbours.

Priority

- Very high, due to high-value country.
- Control options are very effective.
- Significant soil seed bank developed.

Control options

Marginally arable land:

- Fodder pre-crop before pasture replanting.
- Direct pasture replacement.
- Broadacre application of flupropanate herbicide if good pasture species are still present.
- Wick wipe (permit 9630 expiry 1 November 2011 for NSW).

Arable land:

- Crop with one of the following using pre-emergent herbicides:
 - summer grain or oilseed cash crop using conventional tillage techniques before replanting pasture.
 - soybean cash crop using zero tillage and direct drilling techniques before replanting pasture.

- summer fodder pre-crop before pasture replacement.
- winter crop with summer fallow rotation before replanting pasture.
- Broadacre application of flupropanate herbicide if good pasture species are still present.

Best bet options

Marginally arable land with poor pasture species composition:

- Fodder pre-crop before replanting pasture:
 - establishes a vigorous sown pasture.
 - increases animal production.
 - reduces the soil seed bank.
 - provides immediate cost-benefit (from increased animal production).

Marginally arable land with desirable pasture species still present:

- Broadacre application of flupropanate herbicide.

Arable land with poor pasture species composition:

- Plant a grain or oilseed cash crop because this -
 - provides greater flexibility in choice of crops and pre- and post-emergent herbicides.
 - reduces the soil seed bank.
 - provides immediate cost-benefit (from cash crops).
 - provides residual nitrogen from grain legume crops (e.g. soybean) which is available for following crops or pasture.

Arable land with desirable pasture species still present:

- Broadacre application of flupropanate herbicide.

Dense infestations result in severe grazing pressure on palatable pasture species and reduced livestock production.





5: Dense infestation on non-arable land accessible to machinery

Best management practices:

- Use a broadacre application of flupropanate herbicide if good pasture species are still present.
- Wick wipe using a package of three or more wipes over 18 months if good pasture species are still present.
- Maintain pasture vigour and effective ground cover by:
 - top-dressing with fertiliser
 - oversowing with pasture legumes.
- Control stock movement from this paddock to clean country.
- Maintain clean buffer strips along fences and access tracks.

Definition

- More than 2000 plants/ha (more than 2 plants/10 m²).
- Not suitable for cropping.

Impact of infestation

- Declining pasture and cattle production.
- Severe grazing pressure on palatable pasture species.
- Source of contamination for the whole property and neighbours.
- Significant soil seed bank developed.

Priority

- High.

Control options

- Broadacre application of flupropanate herbicide if good pasture species are still present.
- Wick wipe (permit 9630 expiry 1 November 2011 for NSW).
- Direct pasture replacement.

Best bet options

- Broadacre application of flupropanate herbicide if good pasture species are still present.
- Wick wiping if good pasture species are still present.
- Direct pasture replacement if no competitive pasture species are present.

6: Dense infestation on non-arable land not accessible to machinery



Best management practices:

- Aerial application of flupropanate herbicide if good pasture species are still present.
- Spot spray fence lines and tracks to isolate the infested paddock.
- Control stock movement from this paddock to clean country.

Definition

- More than 2000 plants/ha (more than 2 plants/10 m²).
- Not accessible to tractor operations.

Impact of infestation

- Declining pasture and cattle production.
- Severe grazing pressure on palatable pasture species.
- Source of contamination for the whole property and neighbours.
- Significant soil seed bank developed.

Priority

- Moderate to low, but may be high if a source of seed onto clean areas.
- Low-value land.
- Poor cost-benefit.

Control options

- Broadacre application of flupropanate herbicide (aerial application in NSW is weed specific – check label).
- Fence off and restrict stock movement to clean country (maintain a buffer strip and patrol regularly along fence lines and surrounding pasture).

Best bet options

- Aerial application of flupropanate herbicide if good pasture species are still present.
- Fence off and isolate because of the high cost-low benefit of other options (maintain a buffer strip and patrol regularly along fences and surrounding pasture).

Chipping out occasional plants

- Take action before WSG sets seed, i.e., before or as the seed head emerges.
- Chip out the plant, disturbing the soil as little as possible.
- Place the whole plant immediately in a sealed bag and remove the bagged plant from the paddock for destruction (e.g., by fire). Do not leave WSG plants loose in the back of a vehicle.
- Look for WSG that is not seeding and is therefore less obvious.
- Re-check the site regularly for new plants.

Consider spraying the selective herbicide flupropanate in a 2 m buffer around the removed plants. This will control any seedlings you may have failed to identify.

Spot spraying light infestations (scattered plants/small clumps)

Two herbicides can be used to spot spray WSG—flupropanate and glyphosate. The herbicides have different characteristics. Glyphosate herbicide is non-selective and reasonably fast acting, but can create bare patches suitable for seed to germinate and seedlings to establish. Flupropanate herbicide is selective in many pasture types, has some residual activity, but can take 6 to 12 months to kill WSG plants.

Flupropanate herbicide

- Read the product label before using, taking note of withholding periods, any land use restrictions and safety precautions.
- Check the label for restrictions on grazing lactating livestock and consider implications for your business.
- Carefully measure herbicide and water.
- Use flupropanate herbicide at 2 mL/L water (i.e., 1:500 of herbicide to water).
- Apply spray solution past the point of run-off and around the base of the plant.
- Do not use excessive spray volumes as the herbicide is only selective at the recommended rate (2 L/ha) and bare patches may allow WSG seeds to germinate and seedlings to establish.
- Add a dye marker or a chemical marker (e.g. paraquat at a rate of 1 mL/L water) to the spray solution to identify the sprayed plants (flupropanate is very slow acting).
- Look for WSG plants that are not seeding.
- The efficiency and effectiveness of spot spraying declines rapidly once the plant population threshold of 1000 to 2000 plants per hectare is exceeded (1 to 2 plants/10 m²).

Spot spray withholding period for flupropanate is two weeks. Always check label for current withholding period details, as they may change.





WSG seedlings establishing in area over-sprayed with Glyphosate

Glyphosate herbicide

Glyphosate products come in a range of concentrations. Take care when spraying, as glyphosate is a non-selective herbicide that will also kill other grasses. Over-spraying will result in bare ground that could allow WSG seeds to germinate and seedlings to establish.

- Read the product label before using, taking note of withholding periods, any land use restrictions and safety precautions.
- Use only clean water when mixing.
- Mix at a rate of 20 mL of glyphosate 360 herbicide/L of water (i.e. 1:50 of herbicide to water). If using glyphosate herbicide with 450 g/L of active ingredient (glyphosate) the recommended mixing rate is 16 mL of herbicide/L of water (i.e. 1:62.5 of herbicide to water). For other concentrations of active ingredient (e.g. 480 g/L), adjust the mixing rate appropriately (in NSW, only certain glyphosate products can be used – check label).
- Plants must be green and growing rapidly.
- Stand close to the plant and direct the spray nozzle downward to limit over-spray.
- Use low pressure spray equipment to reduce over-spraying.
- Ensure an even cover on the plant. Spray only to the point of run-off.
- Look for WSG that are not seeding.
- The efficiency and effectiveness of spot spraying declines rapidly once the plant population threshold of 1000–2000 plants per hectare is exceeded (1 to 2 plants/10 m²).

Mixing flupropanate and glyphosate

Research has shown that mixing flupropanate and glyphosate herbicides controls fewer plants than either herbicide by itself. A better strategy is to have two spray bottles—one with glyphosate to quickly kill and mark the observed plant and another with flupropanate to spray in a band around this plant to provide selective, residual control of seedlings and germinating seed.

Spraying large areas with glyphosate or high rates of flupropanate will create bare areas with no plant competition. These areas can become an ideal seedbed for new weed seedlings once any residual herbicide has become inactive. The resulting infestation can be denser than the original infestation.

Always check the product label and Material Safety Data Sheets before mixing herbicides.

Broadacre application of flupropanate

Broadacre flupropanate application can have significant benefits over spot spraying by selectively killing hard to find small plants (may be >50% of plants in the paddock) and labour savings. However, as with all broadacre herbicide applications, care should be taken to maximise success and minimise risks.

Do not spray when plants are dormant or stressed, i.e., in winter or during droughts.

- Read the product label or permit before using, taking note of withholding periods, any land use restrictions and safety precautions.
- Check the label for restrictions on grazing lactating livestock and consider implications for your business.
- WSG plants can be sprayed at any stage of growth and almost any time of the year, including winter. However, states vary in restrictions to application times. Permits can also have restrictions to application times which may be different to those on the label.
- Ensure desirable pasture plants are present to replace killed WSG, otherwise flupropanate application will not be successful.
- Ensure the desirable pasture is well established before flupropanate application, as young actively growing pasture seems to be occasionally sensitive to recommended flupropanate rates.
- It is a good idea to conduct a trial application in the year prior to major broadacre application to ensure the herbicide is selective on your particular land type and pasture species mix.
- Accurately measure herbicide.
- Check spray equipment to ensure in optimum working order (e.g. nozzles are working and provide a uniform spray pattern).
- Large droplet sizes (300 μm) are required.
- High rates of water and large droplets should be used for aerial application (minimum of 40 L/ha and 300 μm) and water rates of 150 L/ha should be used for boom spray application. Use only clean water.
- Correctly calibrate spray equipment to deliver required spray volumes.
- Even application at 2 L flupropanate/ha is crucial. Higher rates will kill or damage most pasture species, eliminating the significant benefits of selective control. Boom spray overlap (e.g., when avoiding stumps or trees) can kill desirable pasture species. A lower rate of 1.5 L flupropanate/ha has been proven effective for giant Parramatta grass (check product label and current state permits prior to application).
- Be patient, flupropanate can take 6 to 12 months to kill WSG in some circumstances.
- Growth of desirable pasture is sometimes 'checked' but it usually recovers fairly quickly.

Good grazing management following herbicide application is crucial for success.

- Any overgrazing following the herbicide application will encourage WSG re-infestation.
- Ideally the pasture should be rested beyond the with-holding period until the desirable pasture has recovered and set seed.
- Use moderate stocking rates to minimise WSG seedling establishment from the soil seed bank once the pre-emergent herbicide activity has dissipated.
- A second flupropanate application is probably required after 2 to 3 years with longer periods between subsequent applications. The heavier the grazing, the quicker the paddock will require re-treatment and financial outlay.

Broadacre withholding period for flupropanate is four months. Always check label for current withholding period details, as they may change.



Before



After

Tolerance to flupropanate

Many grasses are generally tolerant of flupropanate at recommended rates, including:

Aristida ramosa
Arundinella nepalensis
Bothriochloa bladii (forest blue grass)
Bothriochloa decipiens (pitted blue grass)
Bothriochloa insculpta (bisset creeping bluegrass)
Bothriochloa macra
Brachiaria decumbens (signal grass)
Brachiaria humidicola (Tully humidicola)
Cenchrus ciliaris (buffel grass)
Chloris divaricata
Chloris gayana (Rhodes grass)
Dichanthium sericeum (Queensland blue grass)
Eragrostis spp.
Eriochloa spp.
Heteropogon contortus (Black spear grass)
Paspalum dilitatum (common paspalum)
Paspalum notatum (bahia grass)
Pennisetum clandestinum (kikuyu)
Poa labillardieri (poa tussock)
Setaria sphacelata (setaria)
Themeda triandra (kangaroo grass)
Urochloa spp. (sabi grass)



WSG plants selectively killed
with flupropanate herbicide
in a buffel pasture

Even though these species are considered to be tolerant, they may be affected by flupropanate in some circumstances. For example, *Narok setaria* will show signs of chemical damage and some plant death at 1.5 L flupropanate/ha when actively growing.

Wallaby grass (*Austrodanthonia* spp) and weeping grass (*Microlaena stipoides*) are highly susceptible to flupropanate. Carpet grass (*Axonopus affinis*) is sensitive to 1.5 L flupropanate/ha and will brown out after application. However, carpet grass usually recovers to pre-spray levels over the next 12 to 18 months.

Most trees and forbs do not appear to be affected by flupropanate herbicide when applied at recommended rates (2 L flupropanate/ha). Flupropanate can generally be applied in timbered country.

Environmental influences on flupropanate efficacy

Environmental conditions can affect the speed at which sprayed WSG plants die. The longer the time period that flupropanate can be kept in the pasture root zone the greater the probability of achieving a good kill.

Heavy rain (100 mm or more falling in a short period of time) after spraying can reduce the effectiveness of flupropanate application on mature plants and germinating seedlings.

In very dry conditions, flupropanate can take 12 or more months to kill mature plants.

Extended dry periods after application can also result in significant damage to non-target pasture species.

Soils with good levels of organic matter and water holding capacity (clay soils) tend to produce more reliable control with flupropanate. The lower the water holding capacity of the soil (e.g. sandy soil) the greater the likelihood of large rainfall events reducing the efficacy of flupropanate.

Pasture recovery from flupropanate applications

Flupropanate can affect pasture growth for some time after application. In cases where WSG occupied a third or more of the ground cover before spraying, pastures may require two or more average rainfall summers to return to pre-spray ground cover. The dry matter production of plants not killed by the flupropanate application may be reduced for more than a year.

To improve pasture recovery, apply nitrogen fertiliser for grasses and phosphorous fertiliser for legumes. If there are too few desirable pasture species after application, broad-leaved weeds may colonise the area. If so, consider oversowing with suitable pasture species. Encouraging and maintaining healthy pastures will slow the re-establishment of the weed infestation.

Flupropanate resistance: BE AWARE

A small number of sites have been identified where giant Parramatta grass (a WSG) has been found to be resistant to flupropanate. Plants from these sites have been found to survive in excess of 4 L flupropanate/ha. In all cases where resistance has been identified flupropanate has been applied a number of times to the same site.

Individual tussocks which have survived two applications of correctly applied flupropanate should be removed by chipping or spot-spraying with glyphosate. Ensure all chipped plant material is burnt. Record the location of the problem plants and check the site regularly for new seedlings.

Wick wiping

- For effective control, wick wiping is a package of three or more wipes over 18 months, followed up with spot spraying of the surviving scattered plants.
- Wick wiping works by only applying herbicide to taller plants and avoiding shorter plants.
- Structure the WSG stand prior to wiping by burning or slashing all rank or dead growth. Grazing can reduce the height and bulk of the desirable pasture grasses to below wick wiper height.
- Timing guide for wick wiping is Christmas/ Easter/Christmas, depending on seasonal conditions. One wipe is ineffective and a waste of effort.

One wipe is ineffective and a waste of effort.



- Best results occur where there is a competitive pasture understorey.
- Each wipe should reduce the WSG population by more than 50%.
- An alternative to wick wiping is a broadcast application of flupropanate.

Getting started

- Wick wiping equipment may be available for loan from local Weeds Officers.
- Use glyphosate (360 g/L) herbicide.
- Mix at a rate of 500 ml/L (1:2) in water.
- Use only clean water.
- Optimum height of WSG for wick wiping is between 0.5 to 1 m.
- Optimum stage of plant growth is when green and growing rapidly, prior to seeding.

Wick wiper operation

- Herbicide application rates for the first wipe may range from 2 to 4 L/ha of glyphosate herbicide, depending on WSG density. Rates for subsequent wipes may be 2 L/ha or less of glyphosate herbicide (Permit 9630 expiry 1 November 2011 for NSW).
- Pre-wet the wick with water to ensure an even wetness.
- Set the flow rate to maintain optimum wetness of the wick and ensure nozzles are not blocked.
- Vary tractor operating speed around 5 km/hour in relation to the density of WSG in the area being treated.
- Operate the wiper height around 30 cm above the desirable pasture grasses.
- Stop regularly and check that the wick starts dripping within 30 seconds of stopping the vehicle.
- Re-wipe the first run when the paddock is completed (there is a time lag for the wick to reach full herbicide concentration).

Buffer strips

Maintain a WSG-free strip (5 to 10 m wide) using a boom spray with flupropanate or a pressurised wick wiper with glyphosate along fence lines, roads, farm tracks and drainage lines.

Boom spray with flupropanate

- See section 3 of this Chapter on broadacre flupropanate application.
- Two applications may be required in an 18 to 24 month period.

Wick wipe with glyphosate

- A program of three or more wipes over 18 months are required to ensure effective control of WSG (see section 4 of this Chapter on wick wiping).
- Spot spray (flupropanate or glyphosate herbicide) to control WSG under fence lines, around trees, along gullies and other inaccessible areas.



Fodder pre-cropping and pasture replanting

First summer

- Boom spray green and rapidly growing WSG with glyphosate herbicide at 4 L/ha to kill plants.
- Spot spray WSG on headlands.
- Allow 3 to 4 weeks for brown out and root death.
- Burn to remove heavy trash and to reduce seed bank in the soil.
- Either cultivate to prepare a seedbed or spray with glyphosate herbicide at 3 L/ha and soon after sow seed using a direct drill technique.
- Plant forage sorghum in December-January. Consider a pre-emergent herbicide to control weed seedlings.
- Graze with clean cattle only, so no new seed is brought in.
- Retain stubble cover on the ground over winter.

Second summer

- Boom spray with glyphosate herbicide at 1 to 2 L/ha to control WSG seedlings and the forage sorghum regrowth.
- Repeat the forage sorghum cropping cycle.

Third summer

- Boom spray with glyphosate herbicide at 1 to 2 L/ha to control WSG seedlings and forage sorghum regrowth.
- Replant the pasture using competitive pasture species recommended for your district.
- Spot spray or chip out any WSG plants that establish.

Pasture replanting

- Use minimum tillage techniques to avoid bringing WSG seed to the surface.
- Sow competitive pasture grasses at triple the standard sowing rate.
- Use starter nitrogen fertiliser at planting.
- Don't stock until the sown plant roots are strong enough to prevent the plants being pulled out by cattle.
- The pasture can be topped (upper 1/3 removed) with a slasher or mulcher, prior to grazing, to encourage pasture thickening.
- Graze leniently during establishment to achieve a dense pasture cover.
- Don't graze new pastures when the soil is wet. Plants are more easily damaged or uprooted at this time and WSG and broad-leaved weeds are more likely to germinate in the gaps.
- Scout for and spot spray weedy *Sporobolus* grass seedlings especially after rain that has kept the soil wet for 4 to 5 days.

Pasture management

- Use moderate stocking rates and annual maintenance fertiliser to maintain dense pasture cover.
- Scout for WSG seedlings regularly and spot spray or chip out.

Grain or oilseed cash cropping and pasture replanting

First summer

- Boom spray green and rapidly growing WSG with glyphosate herbicide at 4 L/ha to kill plants.
- Spot spray WSG on headlands.
- Allow three to four weeks for brown out and root death.
- Burn to remove heavy trash and to reduce the soil seed bank.
- Either cultivate to prepare a seedbed or spray with glyphosate herbicide at 3 l/ha and soon after sow seed using a direct drill technique.



Competitive pasture established after three forage sorghum crops

Crop options

- A maize, grain sorghum or soybean crop. Consider a pre-emergent herbicide to control weed seedlings.
- Graze the crop stubble with clean cattle only to avoid introducing new seed.
- Retain stubble cover on the ground over winter.
- A winter crop of oats and or ryegrass (consult your local agronomist) can be used to utilise the nitrogen produced by a soybean crop.

Second summer

- Boom spray with glyphosate herbicide at 1 to 2 L/ha to control WSG seedlings and crop regrowth.
- Repeat the cropping cycle. Spot spray WSG.

Third summer

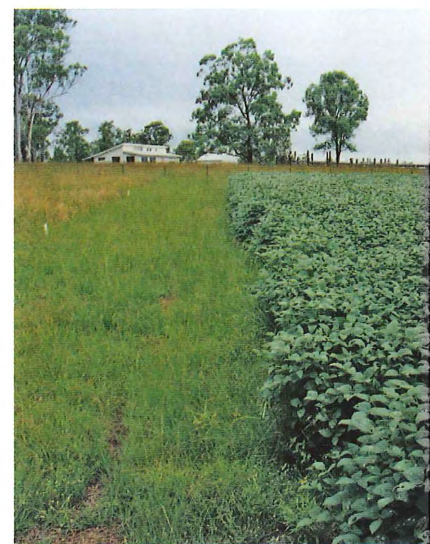
- Boom spray with glyphosate herbicide at 1 to 2 L/ha to control WSG seedlings and crop regrowth.
- Replant the pasture using competitive pasture species recommended for your district.

Pasture replanting

- Use minimum tillage techniques to avoid bringing WSG seed to the surface.
- Sow competitive pasture grasses at triple the standard sowing rate.
- Use starter nitrogen fertiliser at planting.
- Don't stock until the sown species roots are strong enough to prevent the plants being pulled out by cattle.
- The pasture can be topped (upper 1/3 removed) with a slasher or mulcher, prior to grazing, to encourage pasture thickening.
- Graze leniently during establishment to achieve a dense pasture cover.
- Don't graze new pastures when the soil is wet. Plants are more easily damaged or uprooted at this time and WSG and broad-leaved weeds are more likely to germinate in the gaps.
- Scout for and spot spray WSG seedlings especially after rain that has kept the soil wet for 4 to 5 days.

Pasture management

- Use moderate stocking rates and annual maintenance fertiliser to maintain dense pasture cover.
- Scout for WSG seedlings regularly and spot spray or chip out.



Soya bean cash cropping for two to three years reduces the WSG soil seed bank

Direct pasture replacement

This option has a high risk of poor pasture establishment. Fodder pre-cropping or grain and oilseed cash cropping are generally better options as some control of the WSG soil seed bank is achieved and there is generally a better seedbed to sow pasture seeds.

- Boom spray green and rapidly growing WSG with glyphosate herbicide at 4 L/ha to kill plants.
- Sow competitive pasture species known to have tolerance to flupropanate herbicide.

Pasture replanting

- Use minimum tillage techniques to avoid bringing WSG seed to the surface.
- Sow competitive pasture grasses at triple the standard sowing rate.
- Use starter nitrogen fertiliser at planting.
- Don't stock until the sown species roots are strong enough to prevent the plants being pulled out by cattle.
- The pasture can be topped (upper 1/3 removed) with a slasher or mulcher, prior to grazing, to encourage pasture thickening.
- Graze leniently during establishment to achieve a dense pasture cover.
- Don't graze new pastures when the soil is wet. Plants are more easily damaged or uprooted at this time and WSG and broad-leafed weeds are more likely to germinate in the gaps.
- Scout for and spot spray WSG seedlings especially after rain that has kept the soil wet for 4 to 5 days.

Pasture management

- Use moderate stocking rates and annual maintenance fertiliser to maintain dense pasture cover.
- Use a broadacre application of flupropanate herbicide once the new pasture is well established and seeded (young pasture plants can be sensitive to recommended rates of flupropanate), as new WSG plants will have established with the pasture.



Direct pasture replacement will result in many WSG plants establishing with the pasture, which will require control once the new pasture is well established.

Managing WSG on *Brig Plains*

Mr and Mrs Brigalow own *Brig Plains*. Weedy Sporobolus grass (WSG) was present on the property when it was purchased 20 years ago, but has increased significantly over the last 10 years.

They decide it's time to tackle the WSG problem as they feel it will eventually take over their whole property, reduce livestock production and lower the property value if they don't do something about it.

Step 1: Accurately identify areas of WSG infestation

Mr and Mrs Brigalow went around the property and made notes on their property map regarding the weed density, factors likely to affect the weed density and expected future spread for each paddock.

Rats paddock has thick WSG across the paddock. There are a few scattered plants in the neighbour's property over the fence. An infested gully runs through Rats paddock into Brig Creek in Giants paddock. There aren't many desirable pasture plants left in the paddock.

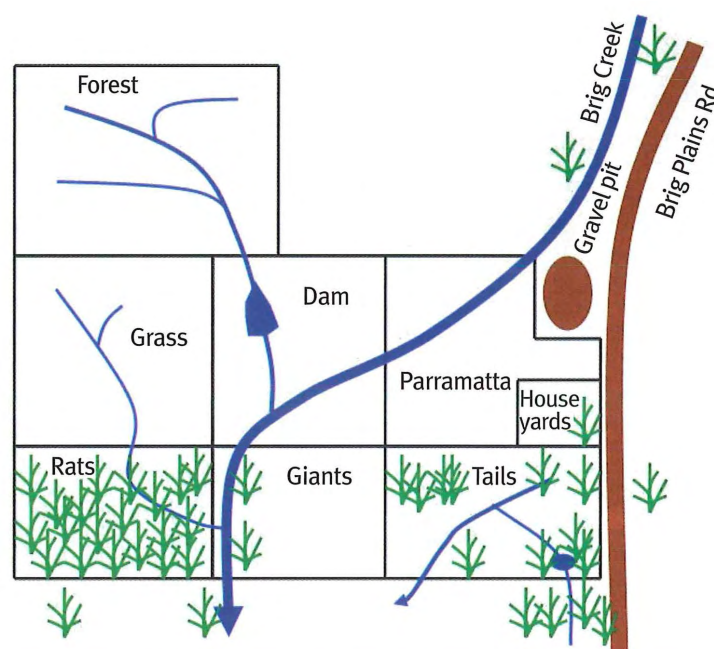
Giants paddock has scattered WSG plants along Brig Creek, otherwise the paddock appears clean. Pigs move along the creek. The pasture is in reasonable condition.

Tails paddock has scattered plants and clumps across the paddock. This paddock is used to finish cattle ready for sale. In the past, cattle have been moved straight from Rats paddock into Tails paddock and therefore probably spread the weed seed into this paddock. The neighbour also has an infestation of WSG and some seed has probably come through the fence, as the neighbour's paddock drains into Tails paddock. The pasture is in reasonable condition but is a bit 'eaten-out' at present.

House paddock has a couple of scattered plants, probably from moving cattle. This paddock may be a good paddock to clean-up and use as a cattle quarantine paddock before selling or moving cattle to clean paddocks.

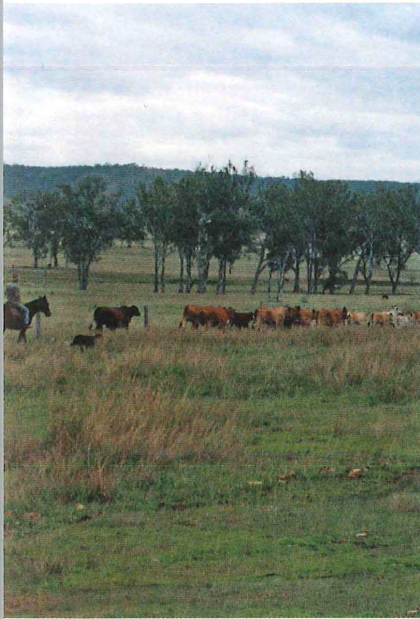
All the other paddocks appear to be currently clean. Their pastures are in reasonable condition although Parramatta paddock is a bit 'eaten-out' at present. However, there are a few properties upstream on Brig Creek that have infestations of WSG. Brig Creek runs through Parramatta, Dam and Giants paddocks.

Mr and Mrs Brigalow now have a clear picture of the WSG situation on *Brig Plains*.



Property map of 'Brig Plains'.

Step 2: Prevent the spread of weed seed to clean country



Regularly checked laneways can be good for moving stock from infested paddocks to yards and avoid depositing seed in clean paddocks on the way.

Mr and Mrs Brig use their notated property map to consider how best to stop or minimize the spread of weed seed into other clean areas of the property. They decide on the following strategies:

- Buffer strips.
- Improving existing fences and subdividing existing paddocks.
- Implementing vehicle movement guidelines.
- Installing a wash down site or sites.
- Having a prevention of weed seed entry plan which includes purchase of clean stock, feed and grain.
- Identifying and maintaining a clean quarantine area near the yards.
- Having a grazing management plan that includes minimising spread of weed seed from dirty to clean areas and has identified specific strategies for dealing with drought and enable the 'eaten-out' paddocks to recover.

Fortunately, four paddocks on *Brig Plains* are still free of WSG. Mr and Mrs Brigalow decide to restrict cattle movement from the infested paddocks into the clean paddocks unless they go through a five day quarantine period in the House paddock.

The fence between the clean Grass paddock and infested Rats paddock is getting a bit old in places and cattle are sometimes getting through. A priority will be to upgrade the poor parts of the fence and to also establish buffer strips along fence lines between infested and clean paddocks and along the property boundary to reduce seed movement across fence lines. They also decide to fence-off the creek in Giants paddock as the rest of the paddock appears clean.

Utility contractors and shooters come onto the property. Mr and Mrs Brigalow decide to develop vehicle movement guidelines including: all vehicles must call into the homestead; stopping vehicles moving between clean and infested paddocks; and requiring vehicles to wash down on arrival and leaving the property.

They designate a wash down area near the sheds where they have good water pressure and an area that can be closely monitored for weeds. They also identify that the vehicle tracks are a priority for control measures in the infested paddocks.

Sometimes weaners are purchased from saleyards. These weaners will now be held in the yards or in the House paddock for five days before moving them to other paddocks. Questions will be asked when purchasing hay to feed weaners to reduce the likelihood of purchasing contaminated hay.

One situation which will be extremely difficult to control is weed seed coming down Brig creek during floods. Their only option is to regularly patrol the creek line and quickly control any established plants. The infested creek lines in Giants and Rats paddocks have been identified as a priority for control.

Mr and Mrs Brigalow also decide to implement some new grazing management strategies to ensure the pasture is in good condition and therefore restrict establishment of weed seed, particularly in the clean paddocks adjacent to infested paddocks.

Using the above strategies, Mr and Mrs Brigalow feel it will be possible to keep weed seed movement under control.

Step 3: Identify the most cost-effective, long-term management strategies

Mr and Mrs Brigalow's highest priorities initially are to install buffer strips along fence lines, control the weed in the House paddock so it can be used as a quarantine paddock and to control the weed along the creek lines and tracks. These high priority activities will be commenced immediately. The fence repairs and installation of a new fence in Giants paddock will be commenced in the next few months.

Giants, Rats and Tails paddocks will still contain WSG.

Giants paddock is designated the highest priority as it will be worth controlling all of the WSG plants in this paddock while controlling the creek line. They opt to broadcast spray with flupropanate herbicide along the top of the creek bank and spot spray within the creek. They also decide to broadcast spray a buffer strip either side of the creek in Rats paddock and spot spray remaining plants within the creek line to minimise further seed transport along Brig creek. When considering the time and money they have available, they feel that applying these strategies and the follow-up will keep them busy for about two years.

Deciding on the next paddock to tackle was a bit more difficult. The densely infested Rats paddock is mostly arable, however the pasture is pretty rundown. The best option for control in this paddock would be the forage crop and pasture replanting option. This option will be expensive but has the advantage of realising some return from grazing the forage crop.

Tails paddock has scattered WSG plants and clumps across the paddock. This paddock is about 50% arable, while the other 50% is stony and fairly broken around the gullies. The pasture in this paddock is still in reasonable condition. The best option for this paddock is the broadcast flupropanate strategy, possibly using aircraft.

One issue with this paddock is that the gully drains out of the neighbour's paddock potentially carrying weed seed. They decided to talk to the neighbour to see if they can work together to control WSG in this area. The dam close to the neighbours fence will be useful as a settling pond to limit seed coming out of the neighbour's place during floods. In this case the neighbour decided to control the WSG adjacent to Tails paddock, so Tails paddock was given the higher priority over ploughing up Rats paddock.



A track through an infested paddock to be targeted for control to reduce the likelihood of vehicles transporting seed.

Contacts

For more information and advice on WSG contact:

Biosecurity Queensland

Phone 13 25 23

www.dpi.qld.gov.au

New South Wales Department of Primary Industries

Phone 02 6391 3100

www.dpi.nsw.gov.au

Your local council's weed officers may also be of assistance.