



HERBICIDE RESISTANCE MANAGEMENT PLAN FOR GENETICALLY MODIFIED GLYPHOSATE TOLERANT COTTON CROPS

Nufarm is Australia's leading agricultural chemicals development, manufacturing and marketing company, with a presence here for over 50 years. Nufarm works alongside Australian farmers to provide a wide range of top quality crop protection products. Nufarm has an extensive team of agricultural specialists who offer local know how and support in delivering the results Australian farmers demand for their long term sustainability.

The resistance management plan for the use of weedmaster® DST® in Roundup Ready Flex* cotton ensures the sustainability of glyphosate and glyphosate tolerant crops by minimising the risk of developing glyphosate resistant weeds in the cropping system. The principles around the sustainability in the cropping phase should also be applied to the use of glyphosate in the fallow.

Prior to using weedmaster DST, a user or their advisor should conduct a herbicide risk assessment using online assessment tools such as - WeedSmart (www.weedsmart.org.au - an online tool or app can be downloaded to smart phones or tablets) or QDAFF's online Glyphosate Resistance Toolkit (<http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/weed-management-in-field-crops/herbicide-resistance/glyphosate-resistance-toolkit>).

These assessment tools allow the grower/advisor to assess the risk of developing resistance before the use of glyphosate, and to determine whether alternate strategies need to be included in their weed management plan. The continued use of one mode of action herbicide such as glyphosate will increase the risk of resistance developing. Using an alternate mode of action chemistry or other weed management methods should be encouraged.

Alternate methods may include strategic cultivation, alternate knockdown herbicides prior to planting or the use of residual herbicide – pre and post planting. Consideration should be given to crop rotation to allow a diverse use of weed management strategies including use of herbicides other than glyphosate (Group M).

The risk of developing resistance is significantly reduced if complete control of weeds present is obtained, this will include the control of surviving weeds. Preventing weeds from setting seed is critical for weed management and reducing the development of weed resistance. Auditing the level of control in sprayed paddocks and the control of survivors is essential for the sustainability of glyphosate and glyphosate tolerant crops. The herbicide resistance management plan includes the following key elements:

TRAINING AND ACCREDITATION

The technical service providers, growers and people making on farm weed management decisions in Roundup Ready Flex cotton are required to have completed a Monsanto Roundup Ready Cotton Accreditation Program. *Training in the correct use of weedmaster DST when applied to genetically modified (GM) glyphosate tolerant crops is also required.*

Suitable accreditation training is delivered through a program managed by Nufarm Australia Limited, and Nufarm's distribution partners. The training is applicable to growers and any people responsible for the application of weedmaster DST to genetically modified glyphosate tolerant crops.

Individuals and organisations that undertake this online training will receive relevant updates to label directions and use patterns. Nufarm ensures any recommendations are in accordance with the registered product label and this herbicide resistance management plan. Nufarm is one of the leading suppliers of products to the cropping industry, via our distribution partners, and will maintain detailed records of all growers who purchase the product for use in-crop.

MONITORING, REPORTING AND COMPLIANCE

Approval of the use of weedmaster DST on genetically modified glyphosate tolerant crops is provided by the Australian Pesticides and Veterinary Medicines Authority (APVMA). As a condition of registration, the APVMA requires detailed reports confirming successful management of this technology no later than 28 February of the season in which the crop is grown.

The information required for these reports is captured through the Weed Management Self Assessments and Audits.

Weed management self assessments surveys

Growers and or their agronomist must conduct their own paddock assessment surveys at the time of application and shortly thereafter. The information must be recorded, retained and supplied to Nufarm by the required date. Nufarm will review 100% returned surveys.

The resistance management self assessment survey should detail:

- Comments on level of weed control achieved through application of weedmaster DST and efficacy of any remedial actions to control surviving weeds;
- Actions taken, or planned to be taken to prevent seed set of any weeds remaining after in- crop application/s of weedmaster DST;
- Any adverse events (crop phytotoxicity) attributable to the application of weedmaster DST should be noted.

A weed self assessment survey form is attached below or is available on online (www.cottonwise.com.au).

Field samples

It is a requirement of the Weed management self assessment survey to assess weeds remaining 14 – 21 days after an application of weedmaster DST to cotton. To sample a field of genetically modified glyphosate tolerant cotton treated with weedmaster DST, the following procedure is required:

Field size	Assessment of surviving weeds
<50ha	4 x 100m linear row
51-100ha	6 x 100m linear row
101-151ha	8 x 100m linear row
>151ha	8 x 200m linear row

The minimum distance between each assessment (i.e. each 100 or 200 m linear row) must be 100 rows.

The Nufarm Weed Self Assessment Survey form must be used to report:

- Comments on level of weed control achieved through application of weedmaster DST.
- Any remedial actions taken to prevent seed set of any weeds remaining after an application of weedmaster DST (i.e. product, mode of action, rate, efficacy etc).
- Any adverse events attributable to the application of weedmaster DST.

Weed management audits

The Weed Management Audit will be completed by Nufarm annually, on a percentage (10%) of returned self assessment surveys. This audit will be conducted at a field level with the grower by Nufarm regional staff or in consultation with its distribution partner who is an approved TSP. The audit will be completed by 15th January of the season in which the crop is grown.

The audit data will be reported to the Australian Pesticides and Veterinary Medicines Authority by the 28th February and the TIMS Herbicide Tolerant Crops Technical Panel by 16th February of the season in which the crop is grown.

Growers will be considered compliant if the requirements of the herbicide resistance management plan are fulfilled.

Adverse Event Reporting

Growers are required to report any adverse events, such as crop phytotoxicity, suspected weed resistance to weedmaster DST, or a shift in weed spectrum (glyphosate tolerant weeds) as soon as identified. These incidents will be investigated and, where confirmed, a report will be generated.

In genetically modified glyphosate tolerant crops, weeds that are identified as surviving glyphosate applications must be controlled by an alternative strategy to prevent those weeds from setting seed.

Non-compliance

Growers who do not comply with the requirements of this herbicide resistance management plan and the correct use of weedmaster DST will jeopardize the benefits of the genetically modified glyphosate tolerant technology. A summary of the level of non-compliance will be reported and made available to the TIMS Herbicide Tolerant Crop Technical Panel.

CROP MANAGEMENT

Paddock identification

Paddocks where genetically modified glyphosate tolerant cotton crops are grown should be identified on farm maps. It is also recommended that the boundaries of the paddocks containing non-genetically modified glyphosate tolerant cotton are identified to prevent accidental glyphosate application to non-target crops.

In-crop management

To achieve best results, weeds should be sprayed when they are small and actively growing. Application of glyphosate should not be made when weeds are stressed, when rain is expected soon after application, or where temperature or wind conditions are unsuitable for spraying (consult Spraywise Decisions® – an online spray application decision tool).

Application of weedmaster DST must comply with all conditions described on the product label.

In crop management should be part of an integrated weed management strategy (IWMS) targeted to individual paddocks.

Integrated Weed Management Strategy

An Integrated Weed Management Strategy (IWMS) should minimize the likelihood of evolution of glyphosate resistant weeds in Australian farming systems.

Nufarm advises that the following guidelines will contribute to this objective:

1. Enter cropping phase with low weed numbers (use Weedsmart and QDAFF Glyphosate Risk Assessment Tool to identify resistance risk prior to sowing).
2. Paddocks where genetically modified glyphosate tolerant crops are grown should be checked before and after herbicide application. Weeds that are not controlled by the application of glyphosate must be controlled by some other method.
3. Crop management records and records of weed control methods must be maintained.
4. All weeds and particularly new weeds should be correctly identified.
5. Chemical and non-chemical weed control options should be implemented in both cropping and fallow phases. Suggested options are:
 - Application of herbicides with different modes of action, including appropriate residual herbicides
 - Rotation crops – for grain, hay or grazing
 - Tillage – strategic cultivation
6. Application of registered herbicides for target weed species, used at the registered rate.
7. Crop rotations should be applied to manage potential resistance development.
8. Farm hygiene: Growers should minimize the opportunities for new weeds to enter farms and fields. Vehicles and equipment should be cleaned between paddocks to avoid transfer of weed seeds. Weeds on irrigation infrastructure and roadways should be routinely monitored and actively managed.

Herbicide drift management

- Crop and environmental conditions must be suitable for spraying weedmaster DST onto genetically modified glyphosate tolerant crops (consult Spraywise Decisions® – an online spray application decision tool).
- Conditions should be monitored during spraying.
- It is important to adhere to the application guidelines of the registered herbicide label.
- In the event of unsuitable spraying conditions, spraying must cease.
- The spray applicator must be made aware of plant material in surrounding fields and of consequences of drift from glyphosate herbicide applications.

Post crop volunteer management

Glyphosate herbicides will not control volunteer genetically modified glyphosate tolerant plants and it is possible that volunteer cotton plants may occur in fallows and non-cropping areas of farms.

Control of volunteer cotton plants in cropping and non-cropping situations is encouraged. Control of these plants is best managed through cultivation and herbicides. Growers should develop an effective strategy to control these volunteer and plants.