



Hormone herbicides : what you should know before you spray

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Weedicides and herbicides

Hormone herbicides have the potential to cause off-target spray damage. There are regulations which restrict the use of hormone herbicides. There is a 'duty of care' for landholders and spray contractors not to cause off-target spray damage.

Please read this document before you use hormone herbicides, especially if you intend to spray within a 10 km radius of a sensitive crop.

Symptoms of damage by hormone herbicides

Hormone herbicides are so called because they function in a similar way to plant growth regulators. They may also be called 'phenoxy' herbicides, as the most common are derivatives of phenoxy-acetic and phenoxy-butyric acids. Low dose rates can sometimes stimulate growth or assist fruit set. High dose rates can cause reduced and abnormal growth.



Figure 1. Hormone herbicide damaged leaf indicated by red arrow and a healthy leaf below.

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Figure 2. Hormone herbicide damaged shoots and leaves, indicated by red arrows, with healthy leaves below.

Hormone herbicides are translocated through plants after uptake through leaves and sometimes roots and concentrate in the growing points (meristematic tissue).

They interfere with cell division which results in the development of malformed leaves and stems. Adventitious roots are also often formed.

The leaf twisting caused by hormone herbicides means that off-target damage is very obvious, and can be noticed almost immediately (refer to photos).

Herbicides which fall under the category of a hormone are those which contain the active ingredients of the following:

- MCPA
- MCPB
- 2,4-D
- 2,4-DB
- Dicamba
- Picloram
- Triclopyr
- Clopyralid

Or combinations of these and other herbicides.

Note that neither triclopyr nor clopyralid are covered by the regulations covered under 'Restrictions on use of hormone herbicides' in this document, as they came into use after the regulations were gazetted, and no amendments have been made. Users of the chemicals are still bound by a 'duty of care' and are liable if they cause damage.

Hazards in using hormone herbicides

Off-target spray damage can occur by droplet drift or by vapour drift. Droplet drift is the movement in the wind of small droplets that fail to settle onto the target plants. This type of drift could result from misting by spray equipment and spraying in strong winds. All chemicals are subject to droplet drift. Vapour drift is caused by the herbicide evaporating (due to its volatility) and moving as a vapour with the wind. Evaporation occurs mainly from the soil and plants after the spray has landed but it can be from a droplet. Evaporation can occur several hours after the spraying activity and the evaporation rate will depend upon the volatility of the chemical (refer to 'Formulations of the hormone herbicides').

Formulations of the hormone herbicides

Hormone herbicides are amines and sodium and potassium salts and ester formulations. Amines are formed by the reaction of organic acids with organic bases, such as dimethyl amine. Sodium and potassium salts are formed by the reaction between organic acids and strong bases, such as sodium hydroxide. The esters are formed by the reaction between organic acids and organic alcohols. They can be segregated into low volatile and volatile categories. The degree of volatility of the ester formulations depends on the particular alcohol used to make the ester.

Table 1. Some common commercial hormone herbicides

Active ingredient	Commercial products®
MCPA	Davison MCPA 500 Selective Herbicide, Farmco MCPA - 500 Selective Weedkiller, Nufarm MCPA 500 Selective Herbicide, Tigrex Selective Herbicide (also contains diflufenican)
MCPB	Tropotox Selective Herbicide, Farmco MCPB - 400 Selective Herbicide
2,4 - D	Farmco D - 500 Selective Weedkiller, Amicide 500 Selective Herbicide, Davison 2,4 - D Amine 500, Nufarm Amicide GC - 500 Selective Herbicide, *National 2,4 - DLV Ester 600 Herbicide, **Farmco D - 800 Selective Weedkiller, ** Estercide 800 Herbicide, ** Davison 2,4 - D Ester 800, ** Rhone Poulenc 2,4 - D Ester 800 Herbicide
2,4 - DB	Buticide 2,4 - DB Herbicide, Davison 2,4 - DB Selective Herbicide, Legumex Herbicide
Dicamba	Banvel 200 Hebicide, Nufarm Dicamba 200 Herbicide
Picloram	DowElanco Tordon 50 - D Herbicide (Also contains 2,4-D), DowElanco Tordon 242 Herbicide (also contains MCPA). *DowElanco Grazon DS Herbicide (also contains triclopyr).
Triclopyr	*DowElanco Garlon 600 Herbicide, *DowElanco Grazon DS Herbicide (also contains picloram)
Clopyralid	DowElanco Lontrel L Herbicide

*Low volatile ester formulation. **Volatile ester formulation.

Some volatilities in comparison to air pressure, which is about 1000 Hpa or 105 Pa and other commonly used herbicides, simazine and trifluralin:

Amines and the sodium and potassium salts are non-volatile

Simazine	8.3×10^{-7} Pa	Known to be non-volatile
Trifluralin	7.3×10^{-3} Pa	Known for its volatility
MCPA iso-octyl ester	3.8×10^{-3} Pa	
2,4-D iso-octyl ester	2.3×10^{-3} Pa	
2,4-D butyl ester	5.4×10^{-2} Pa	
2,4-D ethyl ester	1.5×10^{-1} Pa	

The butyl and ethyl esters are the most dangerous because of their volatility.

Restrictions on use of hormone herbicides

Under the 'Agriculture and Related Resources Protection (Spraying Restrictions) Regulations 1979' the use of the restricted hormone herbicides is controlled within 10 km radius of commercial vineyards and tomato gardens (see 'Under the Regulations' below). Their use near other sensitive crops are not controlled by the Regulations, but landholders and spray contractors should exercise a 'duty of care' when spraying.

Under the Regulations

Within a 5 km radius of commercial vineyards or tomato gardens only amine and sodium and potassium salt formulations are approved for spraying under permit.

Between 5 and 10 km radius of these crops both amine, sodium and potassium salt and low volatile ester formulations can be used without permit.

Outside of a 10 km radius all formulations, that is amine, sodium and potassium salts, low volatile and volatile ester formulations can be used without permit.

Note: Landholders and spray contractors in the Geraldton, Swan Valley and Ord Irrigation Districts need to consult the Regulations for more precise information on restricted spraying areas. They vary in these districts from the above.

Permits

Permits are issued, with conditions, by Officers authorised on behalf of the Chief Executive Officer of Agriculture Western Australia, for the purpose of regulations 4 and 5 of the Regulations.

The permits take into account:

- Name of property owner, address and telephone number.
- Location numbers and area (ha) to be sprayed.
- Weed species.
- Herbicide, formulation and rate of application.
- Method of application.
- Approximate distance and direction to the nearest commercial vineyard or tomato garden.
- Wind velocity and direction.
- Period in which spraying is to be conducted.
- Special conditions required for safe application such as: water volume, operating pressure, operating speed and temperature. These are varied according to the time of the year, depending on the weather and stage of development of the sensitive crop. The most critical time when spray damage may occur is early growth to fruit development.

Future restrictions on use of hormone herbicides

The 'Agriculture and Related Resources Protection (Spraying Restrictions) Regulations 1979' is currently under review. It is expected that the regulations 4 and 5 of the Regulation will be repealed which means that there will be no requirement for permits. However, it is expected that the new legislation will focus on a 'duty of care' for all users of all chemicals in all situations.

In addition to this, in the Agriculture Chemical Spraying Review of 1997, the Review Committee recommended that, "The legislation provide for the mandatory notification of new and diversified crops by growers to a Register, created and maintained preferably by Local Government Authorities." If this eventuates, landholders and spray contractors could refer to this register to exercise 'duty of care'. It would be in the best interest of growers of all new and diversified crops to have them registered.