Chemical Application

Chemical Compatibility

Two or more chemicals are sometimes mixed and applied together to save time and fuel. However chemical mixing should be approached with caution as some chemicals are incompatible. They either settle in the tank or interfere with each other, producing poor results in the crop.

Compatible chemicals can be mixed without adverse reactions. The known reactions of the chemicals most commonly used in pulses are listed on *Page 8 : 2*. Where no information is given it is advisable to check with the chemical manufacturers before trying combinations.

Compatibility Tests

As a guide for compatibility in the spray tank, small amounts of chemicals can be mixed in a test as follows:

1. Make up a known volume (e.g. 500ml) of correctly diluted spray in a clean bottle (glass stopped if available), according to the manufacturer's instructions on rates.
2. Tip the bottle upside down and back 100 times.
3. Allow to stand for 30 minutes.

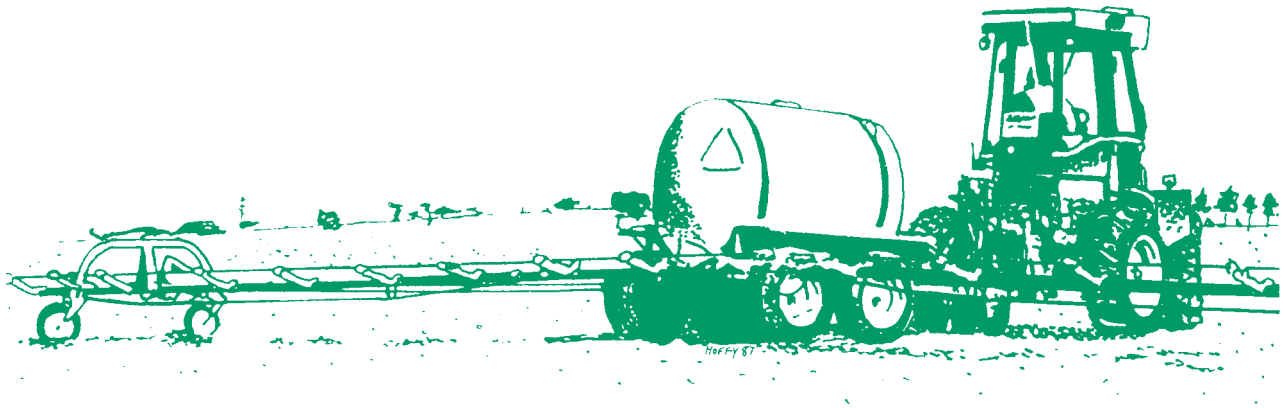
If the mixture forms a creamy sedimentation or separates into layers after standing it may not be compatible. Even if the two or more chemicals are physically compatible there may still be adverse effects on their pesticide activity.

General rules on mixing chemicals

Don't mix concentrates. Add water to the first product, then the second product, then the remainder of the water.

As a guide it is better to mix similar formulations - wettable powder with a wettable powder. Order of formulations should be wettable powders first, then dry flowables followed by suspension concentrates, water soluble formulations, surfactants, spraying oils and/or emulsifiable concentrates.

As a general rule, spraying out a mixture of chemicals straight away reduces the chance of antagonism and reduced activity of the chemicals.



Chemical Compatibility Chart

X = Not compatible
✓ = Compatible
D = Mixing selective grass herbicides with Brodal may cause crop damage.
C = Not all formulations of diuron completely compatible. Check with company.
A = Add crystaline ammonium sulphate at 2kg/100L water.
B = Diurex compatible with Touchdown, not Roundup.
M = Compatible with mancozeb not Manzate DF.

HERBICIDES Chemical	HERBICIDES Product	diuron	triallate	paraquat & diquat	glyphosate	simazine	pendimethalin	trifluralin	isoxaflutole	cyanazine	metribuzin	imazethapyr	imazamox	diflufenican	picolinafen	clethodim	flumetsulam	metosulam	MCPA sodium	butroxydim/fluazifop	quizalofop	fluazifop	diclofop methyl	sethoxydim	haloxyfop	propaquizafop	butrotydim
diuron	Various			C	B	✓	✓	✓				✓				✓	✓	✓				X			X		
Triallate	Avadex Xtra				✓	✓		✓																			
paraquat & diquat	SpraySeed	C			X	✓	✓	✓	✓	✓		✓					✓	✓									
glyphosate	Roundup, Touchdown	B	✓	X		✓A	✓			✓A		✓						✓									
simazine	Gesatop Simagranz	✓	✓	✓	✓A		✓	✓	✓	✓		✓			✓		✓	✓	✓	✓	✓	✓	✓		✓		✓
pendimethalin	Stomp	✓		✓	✓	✓						✓					✓									✓	
trifluralin	Treflan, Triflur	✓	✓	✓		✓			X	✓	✓	✓					✓	✓									
isoxaflutole	Balance			✓		✓		X																			
cyanazine	Bladex			✓	✓A	✓		✓				✓									X	X	X	X	X		
metribuzin	Lexone, Sencor							✓				✓		✓	✓		✓	✓			X		X		X		
imazethapyr	Spinnaker	✓		✓	✓	✓	✓	✓			✓			✓			✓										
imazamox	Raptor																										
diflufenican	Brodal					✓					✓	✓					✓	✓			✓D	✓D	✓D			✓D	X
picolinafen	Sniper					✓					✓					✓		✓			✓	✓					
clethodim	Select	✓													✓		✓				✓	✓	✓	✓	✓	✓	
flumetsulam	Broadstrike	✓		✓		✓	✓	✓			✓	✓		✓	✓	✓		✓	✓			✓	✓	✓	✓	✓		✓
metosulam	Eclipse	✓		✓	✓	✓		✓			✓			✓	✓		✓		✓				✓		✓		X
MCPA sodium	Various														✓		✓	✓			X		X	X	X	X	
butroxydim/fluazipfop	Fusion					✓	✓										✓	✓									✓
quizalofop	Targa, Pantera									X	X			✓D		✓	✓		X								✓
fluazifop	Fusilade					✓				X				✓D		✓	✓					✓		✓	✓	✓	✓
diclofopmethyl	Hoegrass	X				✓				X	X			✓D			✓	✓	X			✓		✓	✓		
sethoxydim	Sertin									X						✓	✓		X		✓	✓	✓	✓	✓	✓	
haloxyfop	Verdict, Appeal	X				✓				X	X					✓	✓		X		✓	✓	✓	✓	✓		✓
propaquizafop	Correct					✓					X			✓D			✓		X			✓		✓			
Butroxydim	Factor					✓								X			✓	X		✓	✓	✓		✓	✓		
INSECTICIDES																											
dimethoate	Rogor, Roxion, Saboteur			✓	✓						✓	✓		✓	✓	✓	✓	✓	X		✓	✓	✓	✓	✓	✓	✓
omethoate	Lemat	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
methidathion	Supracide			✓	✓						✓			✓						✓	✓	✓	✓	✓	✓	✓	
phosmet	Imidan			✓	✓	✓					✓		✓			✓				✓	✓	✓	✓	✓	✓	✓	✓
chlorpyrifos	Lorsban	✓		✓	✓	✓	✓	✓				✓				✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓
pirimicarb	Pirimor			✓															✓			✓			✓		✓
alphacypermethrin	Fastac, Dominex EC			✓	✓	✓	✓					✓	✓	✓	✓	✓			✓			✓			✓		✓
lamdacyhalothrin	Karate Zeon			✓	✓							✓				✓					✓	✓	✓		✓		
cypermethrin	Ripcord															✓					✓	✓	✓		✓		
permethrin	Ambush, Axe															✓						✓					
betacyfluthrin	Bulldock										✓						✓										
deltamethrin	Decis													✓		✓					✓		✓		✓		
esfenvalerate	Sumi-Alpha													✓		✓										✓	
endosulfan	Thiodan												✓														
thiometon	Ekatin																										
gamma-cyhalothrin	Trojan			✓	✓	✓		✓						✓		✓	✓				✓	✓	✓		✓		
FUNGICIDES																											
chlorothalonil	Barrack, Bravo, Elect																								✓		
cupric hydroxide	Various																										
mancozeb	Various																✓		✓M			✓	✓		✓	✓M	✓
procymidone	Fortress, Sumisclex																					✓	✓		✓		✓
tebuconazole	Folicur																										

HERBICIDES Chemical	HERBICIDES Product	FUNGICIDES Barrack, Bravo, Elect	cupric hydroxide	mancozeb	procymidone	TRACE ELEMENTS copper sulphate	iron sulphate	manganese sulphate	zinc sulphate	copper chelate	iron chelate	manganese chelate	zinc chelate	INSECTICIDES Rogor, Roxion, Saboteur	dimethoate	omethoate	Lemat	methidathion	Supracide	phosmet	Imidan	chlorpyifos	Lorsban	pirimicarb	Pirimor	alphacypermethrin	Fastac, Dominex EC	lamdacyhalothrin	Karate Zeon	cypermethrin	Ripcord	permethrin	Ambush, Axe	betacyfluthrin	Bulldock	deltamethrin	Decis	esfenvalerate	Sumi-Alpha	endosulfan	Thiodan	thiometon	Ekatin	gamma-cyhalothrin	Trojan
diuron	Various					✓		✓	✓	✓		✓	✓			✓						✓				✓																	
Triallate	Avadex Xtra					✓		✓	✓	✓		✓	✓			✓																											
paraquat & diquat	SpraySeed					X		X	X	X		X	X			✓	✓			✓		✓	✓		✓	✓	✓															
glyphosate	Roundup, Touchdown					X		X	X	X		X	X		✓	✓	✓			✓		✓	✓		✓	✓	✓															
simazine	Gesatop Simagranz					X		✓	✓	✓		✓	✓		✓	✓	✓			✓		✓	✓		✓	✓	✓															
pendimethalin	Stomp					✓		✓	✓	✓		✓	✓			✓						✓	✓			✓															
trifluralin	Treflan, Triflur					✓		✓	✓	✓		✓	✓			✓						✓																			
isoxaflutole	Balance					✓																																			
cyanazine	Bladex					✓										✓																									
metribuzin	Lexone, Sencor					✓		✓	✓	✓		✓	✓		✓		✓					✓													✓						
imazethapyr	Spinnaker														✓	✓	✓					✓				✓															
imazamox	Raptor															✓	✓			✓						✓															
diflufenican	Brodal														✓	✓	✓		✓							✓										✓		✓				✓
picolinafen	Sniper														✓	✓	✓									✓															
clethodim	Select															✓	✓					✓				✓															
flumetsulam	Broadstrike														✓	✓	✓			✓		✓	✓			✓															
metosulam	Eclipse														✓	✓	✓					✓				✓															
MCPA sodium	Various					✓		✓	✓	✓		✓	✓		X	✓	✓	✓		✓		X	✓		✓	✓															
butroxydim/fluazipfop	Fusion															✓	✓	✓		✓		X																			
quizalofop	Targa, Pantera							✓								✓	✓									✓															
fluazifop	Fusilade					✓		✓	✓	✓		✓	✓			✓	✓	✓		✓		X	✓		✓	✓															
diclofopmethyl	Hoegrass					✓	✓	✓	✓	✓	✓	✓	✓			✓				✓		✓														✓						
sethoxydim	Sertin															✓						✓																			
haloxyfop	Verdict, Appeal					✓		✓		✓		✓	✓			✓	✓			✓		✓				✓															
propaquizafop	Correct					✓		✓		✓		✓	✓			✓	✓	✓		✓		✓				✓															
Butroxydim	Factor					✓		✓	✓	✓		✓	✓			✓						✓				✓															
INSECTICIDES																																									
dimethoate	Rogor, Roxion, Saboteur					✓		✓	✓	✓		✓	✓			X				X		✓				✓															
omethoate	Lemat					✓		✓	✓	✓		✓	✓		✓		✓			✓		✓				✓															
methidathion	Supracide					✓		✓	✓	✓		✓	✓			✓						✓																			
phosmet	Imidan					✓		✓	✓	✓		✓	✓			✓						✓				✓															
chlorpyrifos	Lorsban					✓		✓	✓	✓		✓	✓			✓				✓						✓															
pirimicarb	Pirimor					✓		✓	✓	✓		✓	✓			✓						✓				✓															
alphacypermethrin	Fastac, Dominex EC					✓		✓	✓	✓		✓	✓			✓						✓																			
lamdacyhalothrin	Karate Zeon					✓		✓	✓	✓		✓	✓			✓						✓				✓															
cypermethrin	Ripcord					✓		✓	✓	✓		✓	✓			✓						✓				✓															
permethrin	Ambush, Axe					✓		✓	✓	✓		✓	✓			✓						✓				✓															
betacyfluthrin	Bulldock					✓		✓	✓	✓		✓	✓			✓						✓				✓															
deltamethrin	Decis					✓		✓	✓	✓		✓	✓			✓						✓				✓															
esfenvalerate	Sumi-Alpha					✓		✓	✓	✓		✓	✓			✓						✓				✓															
endosulfan	Thiodan					✓		✓	✓	✓		✓	✓			✓						✓				✓															
thiometon	Ekatin					✓		✓	✓	✓		✓	✓			✓						✓				✓															
gamma-cyhalothrin	Trojan					✓		✓	✓	✓		✓	✓			✓						✓				✓															
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cupric hydroxide	Various																								✓															
mancozeb	Various					✓		✓	✓	✓		✓	✓			✓	✓	✓		✓		✓				✓															
procymidone	Fortress, Sumisclex					✓																✓				✓															
tebuconazole	Folicur															✓																									

Formulations can vary between companies or may be changed without notice. Compatibilities are **A GUIDE ONLY.**

Aerial Spraying

A little pre-planning before using an aerial contractor can save both time and money.

Communication between the farmer and aerial contractor is essential for safe, effective spraying.

Any potential problems should be discussed with the agent or contractor and sorted out beforehand.

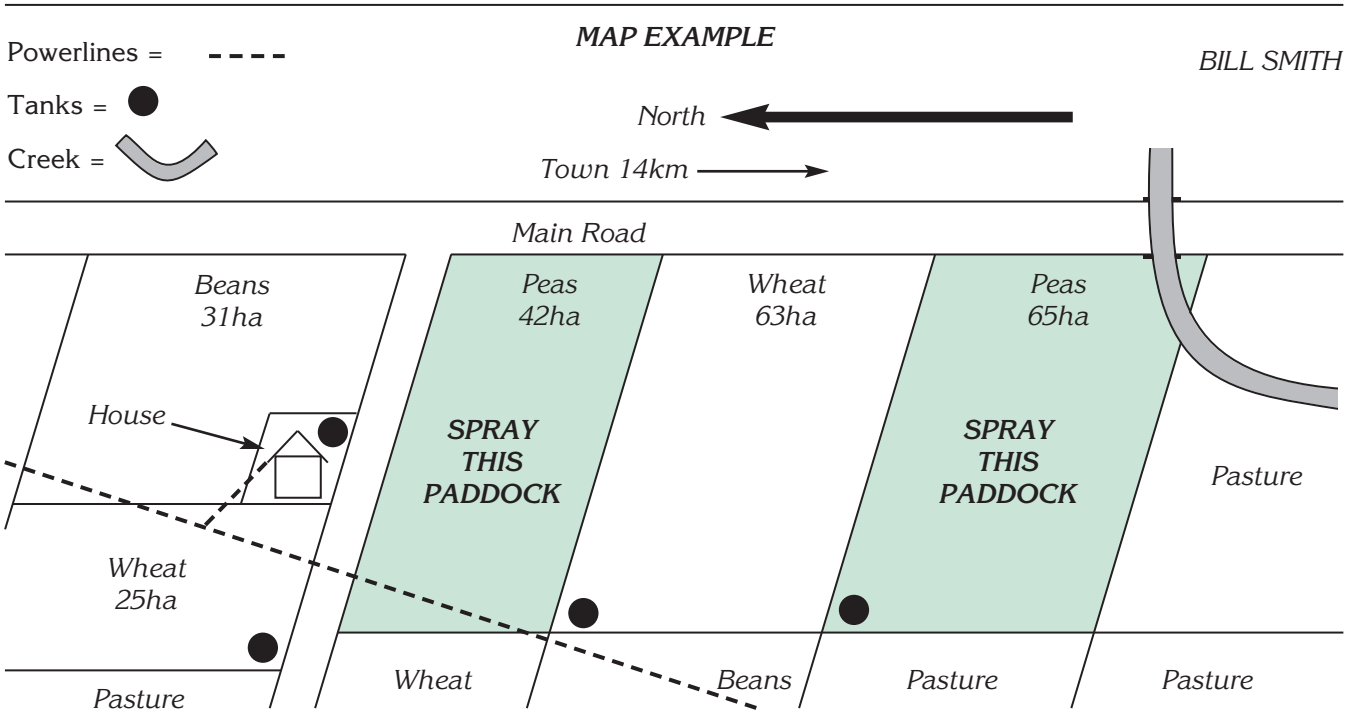
Preparations

1. Contact the spraying contractor in advance – at least three days but preferably longer.
2. Notify neighbours of your intention to spray and which chemical you plan to use.
3. Be aware of any nearby crops which may be affected by off-target damage and notify the contractor (indicate on the map).
4. Insecticides may affect or kill bees so notify the apiarist two to three days before spraying if there are hives nearby.
5. If possible combine your spraying programme with your neighbour's – this may save you both time and money. Discussions with neighbours before planting may allow similar crops to be planted close together to facilitate shared spraying programmes.

Maps

The pilot will need an accurate map of the area to be sprayed including the location of:

- nearby susceptible crops or organic farms
- powerlines
- houses, fences and roads
- sizes of areas to be sprayed
- dams (especially with yabbies) tanks and water courses
- distance from nearest town or settlement
- orientation (arrow indicating north)
- stock or people likely to be disturbed
- beehives
- gps reference where available



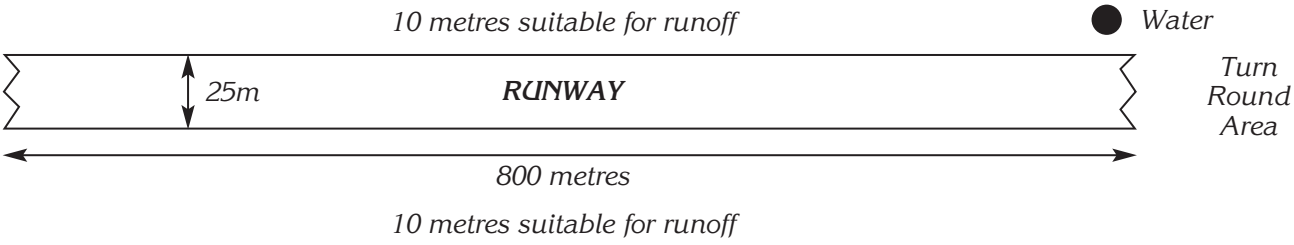
Airstrip

To keep costs to a minimum the airstrip should be located within 5 km of the area to be sprayed.

A water supply will be necessary at the strip.

The strip should be clear of trees and obstructions at the ends of the runway. The runway will need to be cleared a minimum 25 metres in width and 800 metres in length, with 10 metres either side of the runway clear for emergencies. If there is no permanent airstrip on the farm a paddock of 800 metres or more that can be driven over at 70 kph without serious discomfort is suitable.

If the airstrip is covered with long grasses or other weeds it should be slashed. Stock should be removed from the airstrip before the aircraft arrives.



Water quality

Be very careful about supplying water for aerial spraying in boomspray tanks. Any traces of herbicide remaining in the tank could contaminate the insecticide or fungicide and cause serious crop damage.

Chemical rates

The contractor must be supplied with details on the required chemical rates and volume of water.

Some treatments need up to 30L/ha, fungicides for beans for example, others require only 10 or 20L/ha.

Chemical Safety

Agricultural pesticides can affect people, livestock, wildlife, and other plants if handled carelessly.

This can be minimized or prevented by:

- selecting the most suitable chemical for the job.
- carefully storing and handling chemicals and disposing of containers and unwanted chemical.
- not spraying when it is likely to drift onto other areas.

The chemical

- refer to the product Material Safety Data Sheet (MSDS) for the **toxicity** of the chemical and its possible effects on animals and other crops nearby.
- refer to the product MSDS for the correct first aid measures in case of poisoning
- refer to the product label for the **withholding period** and likely persistence.
- Hazardous substance regulations require suppliers of hazardous substances to provide a copy of the MSDS. The MSDS should be provided on the first supply of the substance or should be available upon request. The manufacturer can be contacted for a copy of the MSDS if one is not available from the supplier.

Storage

Chemicals should be stored in a locked, bunded chemical storage shed where children cannot get access.

Store in the closed, original container in a dry, well-ventilated area, as cool as possible out of direct sunlight.

Appropriate signs should be placed on the outside of the building to warn fire-fighting personnel in the event of fire.

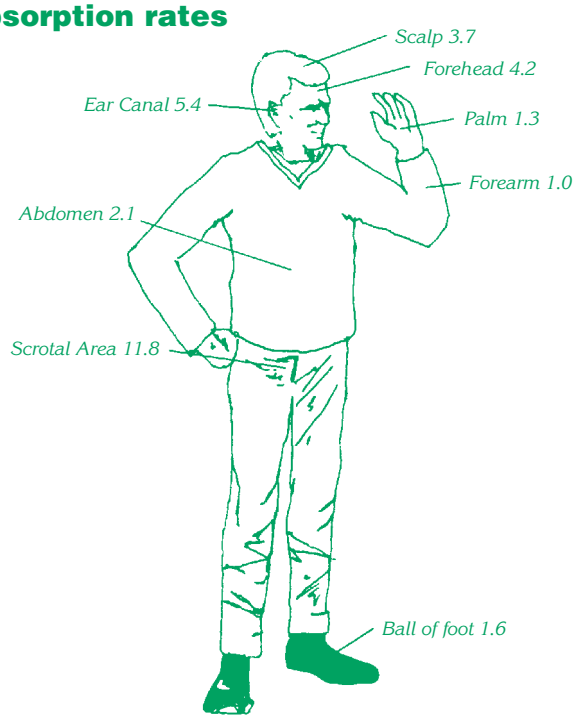
Comply with current chemical storage laws.

Handling

The absorption of a chemical by the skin or inhalation can normally be controlled by the use of protective clothing and equipment. Pesticides pass through the skin in some areas of the body more quickly than on other areas (see diagram).

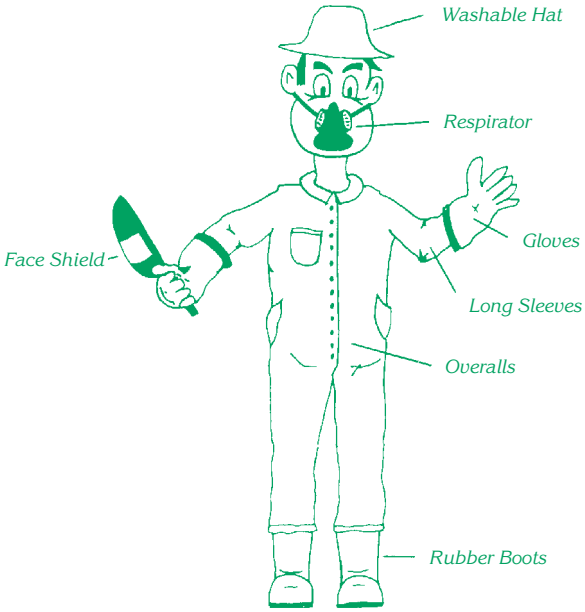
Cuts or scrapes allow pesticide to enter more easily.

Absorption rates



The numbers shown here represent the absorption rates through the skin compared to the forearm. For example, absorption through the forehead is 4.2 times as rapid as through the forearm.

Wear appropriate clothing *(see Table 8:A)*



Direct contact between skin and pesticides be harmful, so always wear protective clothing while spraying.

Prolonged skin contact with pesticides can cause illness. If you don't feel well during or after spraying, stop work and see a doctor.

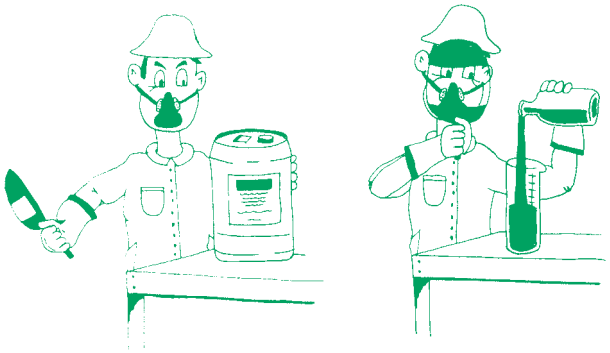
TABLE 8 : A

EQUIPMENT	MIXING	PILOT	GENERAL OPERATIONS	CONFINED SPACES	DRIFT AREAS	FUMIGATING
P.V.C. Gloves	R	–	R	R	R	R
washable hat	R	–	R	O	O	R
P.V.C. full hood	–	–	–	R	R	–
overalls - cotton	R	R	R	R	–	R
-P.V.C.	–	–	–	–	R	–
goggles/shield	R	–	S	O	O	–
rubber boots	R	R	R	R	R	R
*respirator - half	R	R	R	R	R	–
- full	–	–	–	–	–	R
P.V.C. apron	R	–	–	–	–	–

R = recommended; S = suggested (depending on spray drift); O = Optional (depending on other equipment worn)
* Ensure that respirator cartridges are the type necessary for the job.

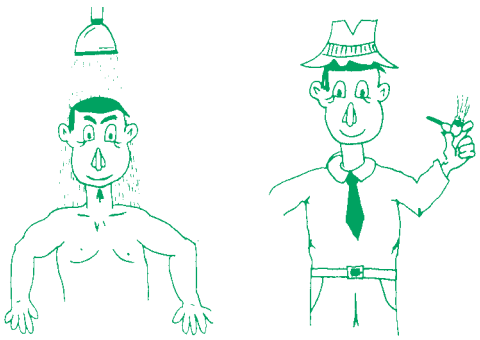
CAUTION: ALWAYS READ THE SAFETY DIRECTIONS ON THE LABEL

Open containers and measure out chemical in a well ventilated area.
Use chemical suction probes where possible when adding chemical to spray tank.
Wash or clean up any spillage.



For best results, and for safety, always read the label, follow mixing instructions and safety directions.

Don't eat, drink or smoke while spraying and wash your hands with soap before eating, drinking, smoking or using the toilet.



If your clothing becomes contaminated by chemicals, change and wash them thoroughly.

After spraying change out of the contaminated clothes and wash yourself thoroughly to remove all spray. Then change into clean clothes.

Disposal of Containers

Triple rinse empty containers and add to spray mix in tank. Leave caps off. Store upside down and deliver to a drum muster collection depot on collection days.

Bury small containers at least 50 cm deep in a disposal pit. If larger containers cannot be buried store them at a disposal site away from houses, livestock, trees and water courses.

Disposal of Unwanted Chemical in Spray Tank

Calculate spray quantities and operate equipment carefully to ensure that only small amounts remain in tank when finished. Dilute and spray out if possible. If not possible, run into a pit (at least 50 cm deep) away from houses, livestock, trees and water courses. A bag of lime spread over the bottom of the pit will help deactivate the pesticides. After water has soaked away, add a thin layer of soil.

Minimize Spray Drift

Do not spray on windy days (over 15 km/hour) or when temperature inversion layers may cause spray to drift onto other areas. If in doubt use a hand-held wind speed indicator or light a smokey fire to check the risk of drift (if fire restrictions do not apply).

Boom Sprayer Calibration

To apply the correct amount of chemical you must know the output of the boom sprayer. Applying too much pesticide can cause crop damage, increase any residues and cost more than is necessary. Too little pesticide will not control the problem. This can cause yield losses, harvest contamination or the extra cost of respraying.

To determine the boom output (for P.T.O. or engine driven pumps) follow these steps:

(Note use water only in spray tank)

1. **Select pressure** (usually between 200 and 300kPa)

2. **Check nozzle wear and measure boom output.**

   (a) Measure output of each nozzle (ml/min).

   (b) Replace any nozzle that exceeds manufacturer's recommended output by 25%. (Charts are available from manufacturer or reseller).

   (c) Measure output of new nozzles.

   (d) Calculate average output per nozzle

   $$= \frac{\text{total output of all nozzles}}{\text{number of nozzles}}$$

   (e) Replace any nozzle that delivers 10% more or less than the average.

   (f) Measure output of replacement nozzles.

   (g) Calculate total boom output of all nozzles (litres per minute).

3. **Determine speed of spraying**

   (a) Select gear that gives suitable ground speed and required r.p.m.

   (b) Measure time to travel over a measured distance (e.g. 100 metres).

   (c) Speed (Kilometres per hour).

   $$= \frac{\text{distance travelled (metres)} \times 3.6}{\text{time taken (seconds)}}$$

   Example: Time to travel 100 metres was 36 seconds

   $$\text{Speed} = \frac{100 \times 3.6}{36}$$

   $$= 10\text{km/hr}$$

4. **Calculate spray output** (litres/ha)

   $$= \frac{600 \times \text{boom output (litres/minute)}}{\text{spraying width (metres)} \times \text{speed (km/hour)}}$$

   (Spraying width = number of nozzles x distance between each nozzle)

   Example: Boom Output = 10 litres/min
   Width = 12 metres
   Speed = 10km/hour

   $$\text{Output} = \frac{600 \times 10}{12 \times 10}$$

   $$= 50 \text{ litres/ha}$$

5. To calculate amount of chemical to add to spray tank

   $$= \frac{\text{application rate (litres or kilograms/ha)} \times \text{volume of water in tank (litres)}}{\text{output (litres/ha)}}$$

   Example: application rate of chemical (0.5 litres/ha [= 500ml/ha])
   volume of water in tank (2,000 litres)
   output (50 litres/ha)
   Amount of chemical to add

   $$= \frac{0.5 \times 2{,}000}{50}$$

   $$= 20 \text{ litres}$$

Spray Records

Keep records of chemical applications for each paddock. These can be referred to the following year when deciding chemical strategies or for when application has not been effective in controlling weeds or has caused some crop damage.

EXAMPLE:

HERBICIDE SPRAY RECORD

DATE & TIME	PADDOCK	CROP AND GROWTH STAGE	WEEDS AND GROWTH STAGES OR PEST	CHEMICAL	RATE per ha	WATER per ha	WEATHER Showers, Overcast, Light Cloud, Clear Skies	WIND Direction & Speed	TEMP. °C	SOIL Wet, Moist, Dry
3/8/88 3p.m.	West	Peas 15cm	Mustard 6 Leaf	MCPA – Sodium	700ml	60 Litres	Overcast	SW – 7kph	16	Dry