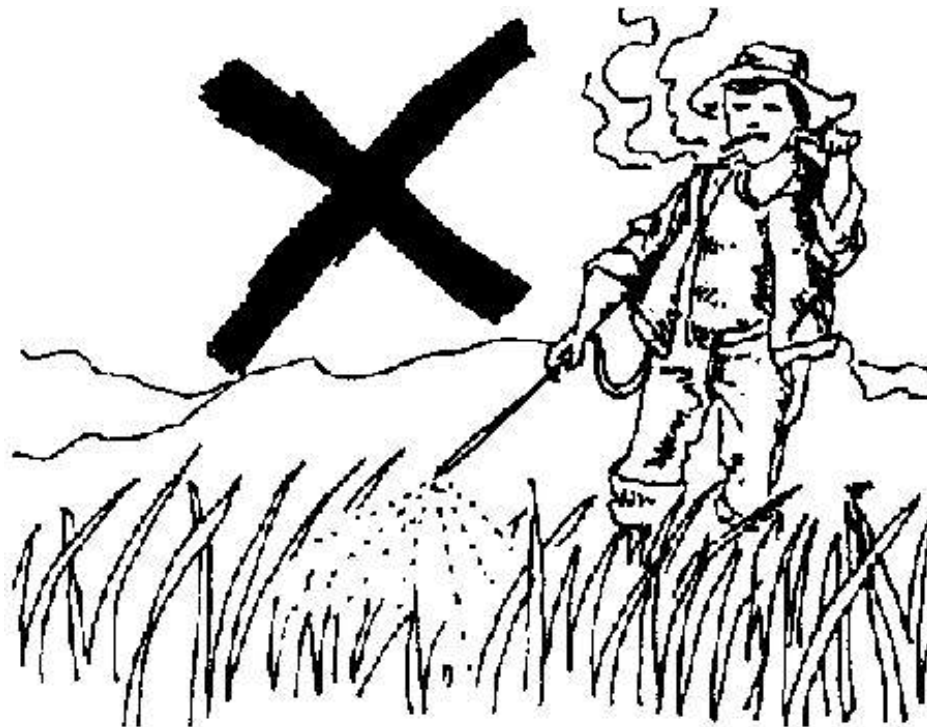


# Spray application methods



# Spray application methods

- Herbicides are commonly used for controlling weeds in agricultural and non-agricultural situations
- Numerous forms of application techniques and equipment are available to apply herbicides
- Appropriate option will be determined by:
  - size of the infestation
  - available resources
  - pesticide formulation
  - access
  - personal preferences
  - potential problems
    - drift
    - environmental contamination
    - loader mixer exposure (operator safety)
- Always remember to read the product label

# Spray application methods

## Foliar spraying

- Ground foliar spraying

- Boom spraying

- Aerial spraying

- Air-blast sprayers

- Splatter gun application

## Rope/wick wiper applications

- Basal bark spraying

- Stem injection application

- Drill and frill

- Axe cut method

- Tree spearing

- Cut stump application

- Brushcutter application

- Scrape and swab

- Ez-ject application

- Herbicide ballistic technology

- Granular herbicide application





# Spray application methods

## - Foliar spraying

- Foliar spraying is the use of herbicide diluted with water at a specific rate and sprayed over the foliage to the point of runoff (until every leaf is wetted)
- Most suited to shrubs, grasses and dense vines less than 6 m tall where complete coverage can be achieved
- Advantages include:
  - speed of application and economical
- Disadvantages include:
  - potential for spray drift and off-target damage
- Foliar spraying can be done a number of ways, depending on the size of the weed plant and/or the infestation



# Spray application methods

## - Foliar spraying

- Foliar spraying can be done a number of ways depending on the size of the weed plant and/or the infestation
- Blanket spraying using a boom spray from a tractor can be used to treat areas completely infested with weeds, especially with selective herbicides
- Large infestations needing targeted herbicide applications, a hose and handgun can be used to spray solution from a herbicide tank and pump carried by a tractor or vehicle
- Smaller infestations can be sprayed using a backpack/knapsack spray unit
  - Spot spraying is used to treat individual weed plants or areas that only have small clumps of weed infestations

# Spray application methods

## - Foliar spraying - Backpack/knapsack sprayers

- Sprayers consist of a herbicide tank up to 20 L capacity usually carried on the operators back, a pressurising system and a hand lance carrying one or more nozzles
- Nozzles are conventional like boom sprayers, flooding or adjustable nozzles
- Three systems available for pressurising the fluid
  - Lever operated piston or diaphragm pump mounted on the main container – pressure maintained by continuous pumping
  - Compression sprayers (12 volt) are equipped with a piston-action air pump or gas cylinder which pressurises the air space above the fluid prior to spraying
  - Power sprayer contain a small 2-stroke engine to pressurise the tank
- Smaller infestations can be sprayed using a backpack/knapsack spray unit. Spot spraying is used to treat individual weed plants, areas that have only small clumps of weed infestations, or regrowth areas



# Spray application methods

## - Foliar spraying - Backpack/knapsack sprayers



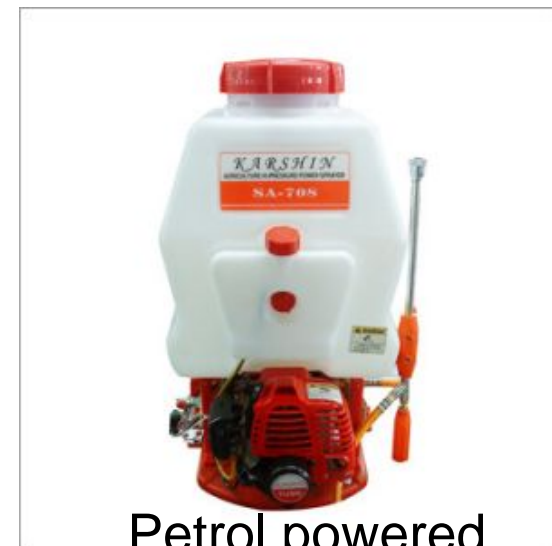
Hand sprayer



Knapsack



Battery powered



Petrol powered

# Spray application methods

## - Foliar spraying - High volume sprayer

- Method used for large infestations that need targeted applications of herbicide, a hose and handgun used to spray solution from a herbicide tank and pump (capable of delivering relatively high pressures) carried by a tractor or vehicle
- High pressure (5 to 15 bar ) necessary to penetrate dense foliage and cover tall bushes
- Spray pumps are either electric or petrol motors, or PTO driven
- Pumps require a pressure gauge and regulator to alter the pressure





# Spray application methods

## - Foliar spraying - High volume sprayer

- Adjustable hollow cone nozzles are popular. Tips give either a straight stream or a cone pattern. Tips available in a range of sizes to deliver finer and coarser droplets
- Choice of tip determined by the weed being sprayed and the herbicide applied. A straight stream, will throw 15 m (covering tall or wide bushes)
- Tips delivering finer droplets deliver 2.4 l/min at 14 bar in a cone pattern (normal pressure range 7 to 14 bar)
- Tips delivering coarser droplets deliver over 22 l/min at 14 bar in a cone pattern (penetrate dense foliage)
- Other hand guns come with a range of orifice discs. More versatile, as a change of orifice can deliver either a finer or a coarser spray
- Most common error in woody weed spraying is that larger bushes are under-sprayed due to their extensive surface area
- Spray volumes range 1000-5000 l/ha

# Spray application methods

- Foliar spraying - High volume sprayer





# Spray application methods

- Foliar spraying - High volume sprayer



# Spray application methods

## - Foliar spraying - High volume sprayer



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# Spray application methods

## - Foliar spraying - High volume sprayer



Adjusting the nozzle towards a straight stream gives good penetration to wet stems and canes within the canopy

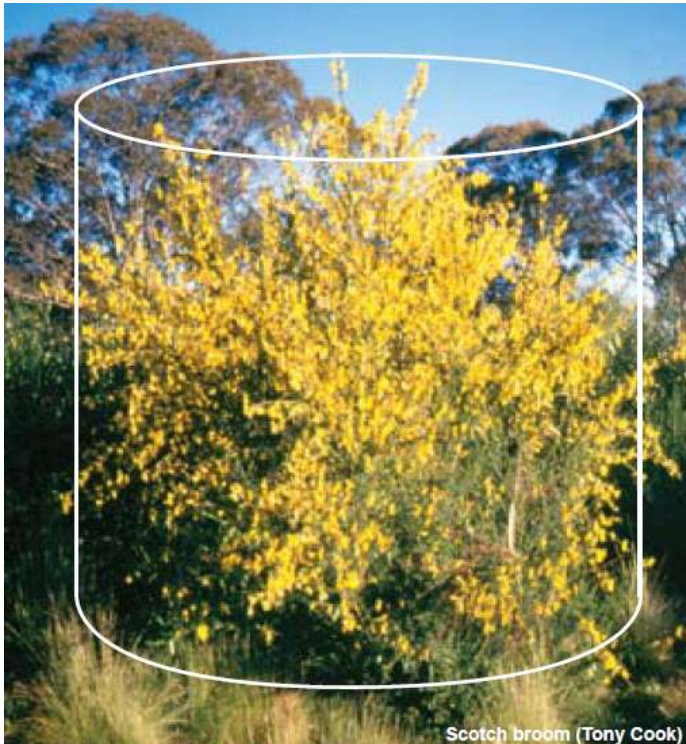
When hand gun adjusted back nozzle throws cone pattern to wet the foliage



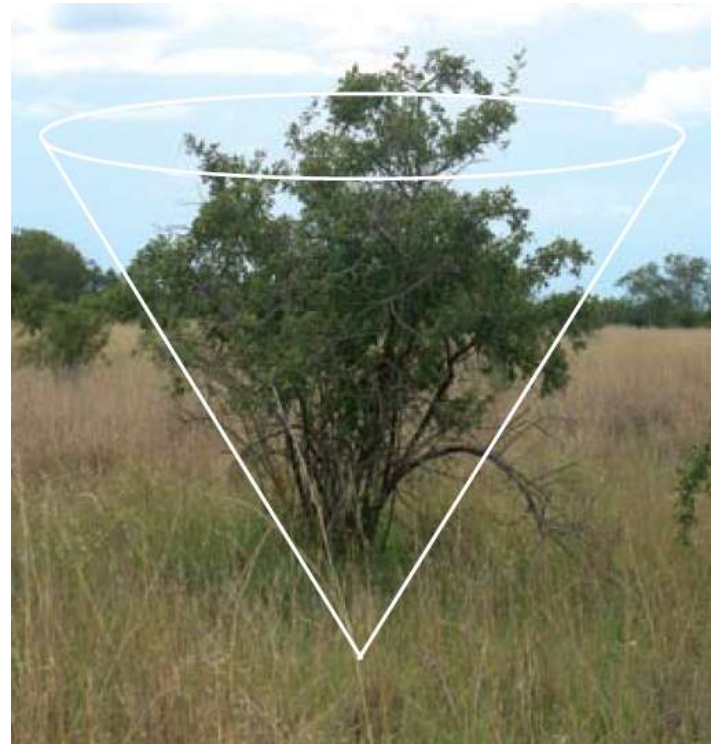
# Spray application methods

## - Foliar spraying - High volume sprayer

- To achieve good coverage, better to think of spraying the volume enclosed by the canopy rather than the area of the canopy
- Shrubs like sweet briar and African boxthorn have canopies shaped like cylinders or inverted cones



Scotch broom (Tony Cook)



# Spray application methods

## - Foliar spraying - High volume sprayer

Herbicide labels giving mixing rate, e.g. 500 mL/100 L water allows an applicator to spray the bush to the point of run-off

When spray rate are given, e.g. 1500-4000 L/ha, the rate is not particularly helpful, as you are not spraying a flat surface

Woody weeds have to be well wet, and with some weeds the stem or canes may also have to be wet

Volume needed to achieve good coverage for these plants is normally 50% more than if only the foliage had to be wetted

Volume of spray per bush in mL (multiply by bush height: in metres)				
Bush diameter (metres)	Spray rate on label			
	1500 L/ha	2000 L/ha	3000 L/ha	4000 L/ha
0.6	40	60	80	110
0.8	80	100	150	200
1	120	160	240	310
1.2	170	230	340	450
1.4	230	310	460	620
1.6	300	400	600	800
1.8	380	510	760	1000
2	470	630	940	1300
2.2	570	760	1100	1500
2.4	680	910	1400	1800
2.6	800	1100	1600	2100
2.8	920	1200	1900	2500
3	1100	1400	2100	2800
3.5	1400	1900	2900	3900
4	1900	2500	3800	5000
4.5	2400	3200	4800	6400
5	3000	3900	5900	7900
5.5	3600	4800	7100	9500
6	4200	5700	8500	11300
6.5	5000	6600	10000	13300
7	5800	7700	11600	15400
7.5	6600	8800	13300	17700
8	7500	10100	15100	20100
8.5	8500	11400	17000	22700
9	9500	12700	19100	25500



# Spray application methods

## - Foliar spraying - High volume sprayer

To determine spray volume per bush, estimate bush diameter and height

Label spray rate suggests spray volume of 3000-4000 L/ha

If bush diameter is 2 m, from table above a 2 m diameter bush sprayed with a product recommending 3000-4000 L/ha would require 940-1300 mL ( $A = \pi \times r^2$ ), depending on the density of the canopy

If bush were 3 m high, need to multiply the area rate by 3, giving a range of 2820-3900 mL per bush.

If bush were 0.5 m high, we multiply the area rate by 0.5, giving spray range of 470-650 mL per bush

Volume of spray per bush in mL (multiply by bush height: in metres)				
Bush diameter (metres)	Spray rate on label			
	1500 L/ha	2000 L/ha	3000 L/ha	4000 L/ha
0.6	40	60	80	110
0.8	80	100	150	200
1	120	160	240	310
1.2	170	230	340	450
1.4	230	310	460	620
1.6	300	400	600	800
1.8	380	510	760	1000
2	470	630	940	1300
2.2	570	760	1100	1500
2.4	680	910	1400	1800
2.6	800	1100	1600	2100
2.8	920	1200	1900	2500
3	1100	1400	2100	2800
3.5	1400	1900	2900	3900
4	1900	2500	3800	5000
4.5	2400	3200	4800	6400
5	3000	3900	5900	7900
5.5	3600	4800	7100	9500
6	4200	5700	8500	1130
6.5	5000	6600	1000	1330
7	5800	7700	1160	1540
7.5	6600	8800	1330	1770
8	7500	1010	1510	2010
8.5	8500	1140	1700	2270
9	9500	1270	1910	2550



# Spray application methods

## - Foliar spraying - High volume sprayer

- Dome shaped weeds, like blackberry, lantana and bitou bush

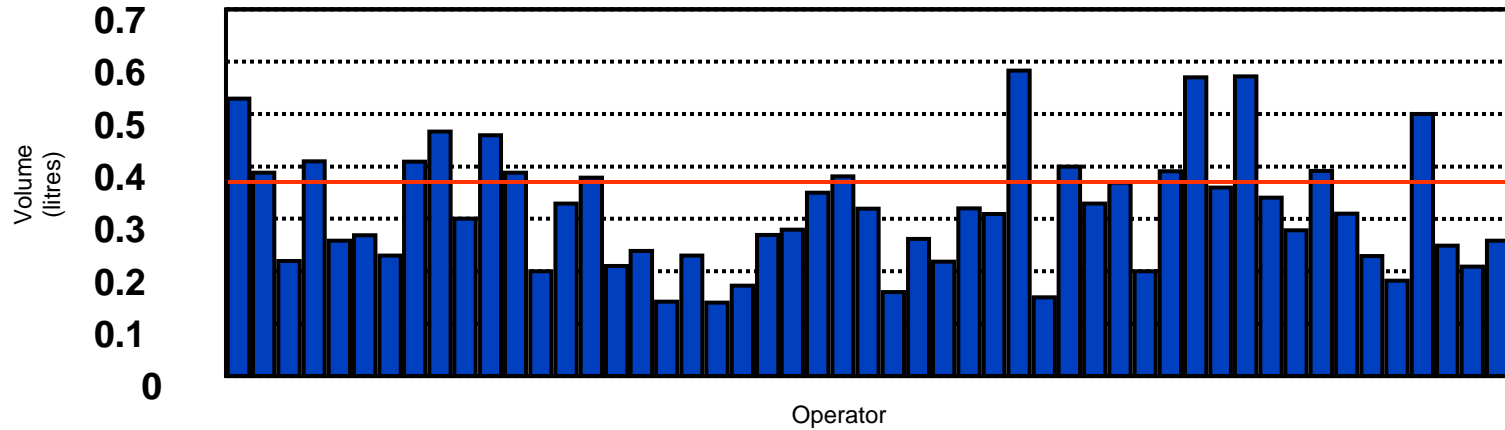


- Volume of the canopy is function of the area or bush diameter multiplied by the height (bush 5 m in diameter, 2 m high would need 14.9 L of spray)

Volume of spray per bush in L based on 3000-4000 L/ha			
Bush diameter (metres)	Bush height (metres)		
	1.5	2	2.5
4	7	10.5	15
4.5	8.6	13.6	17.6
5	10.4	14.9	20.6
5.5	12.3	17.6	23.8
6	14.4	20.4	27.3
6.5	16.8	23.5	31.1
7	19.3	26.8	35.3

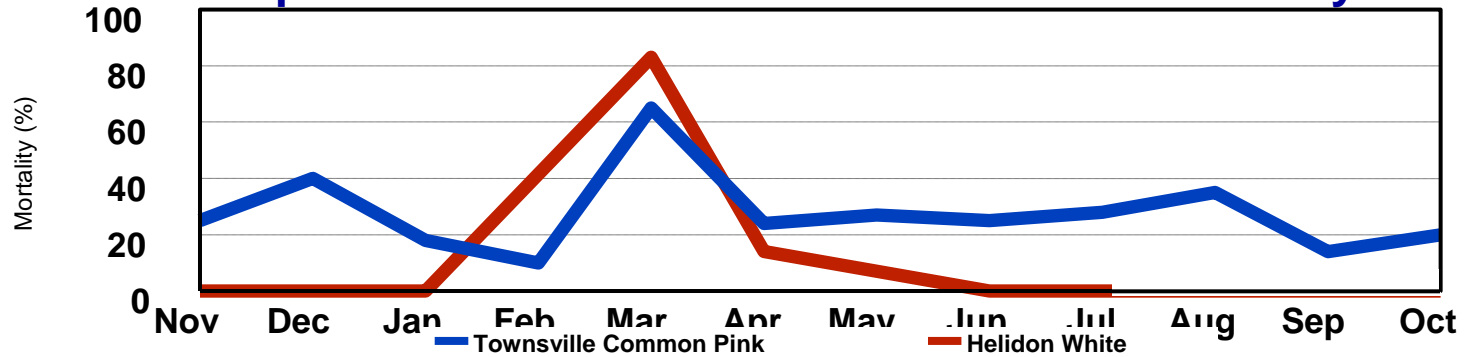
# Volume of herbicide per cubic metre of rubber vine

Application rate products have been registered on

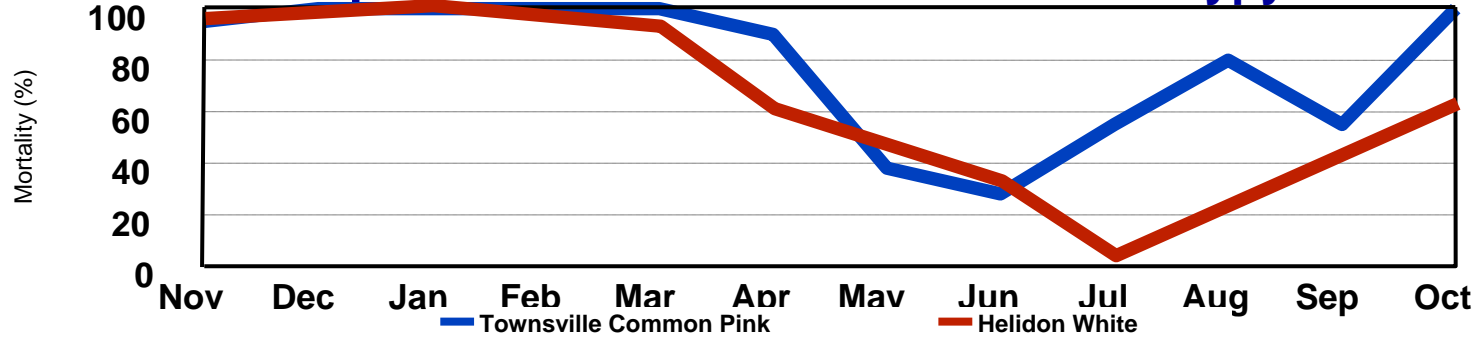


Calibration Chart for Spot Spraying Lantana						
Herbicide	Height of Lantana					
Glyphosate 1L/100 L	1 m	2 m	3 m			
*Grazon DS 750ml/100L						
Tordon 75-D 650ml/100L			1 m	2 m	3 m	
DP 600 500ml/100L						
*Brush-off 10g/100L						
Cut-out 95g/100						
Starane 200 1L/100L				1 m	2 m	3 m
2,4-D Amine 400ml/L						
Bush Diameter (Metres)	Spray Volume Per Bush (Litres or mls)					
1.0	80	120	160	240	310	390
1.2	110	170	230	340	450	570
1.4	150	230	310	460	620	770
1.6	200	300	400	600	800	1.0
1.8	250	380	510	760	1.0	1.3
2.0	310	470	630	940	1.3	1.6
2.2	380	570	760	1.1	1.5	1.9
2.4	450	680	910	1.4	1.8	2.3
2.6	530	800	1.1	1.6	2.1	2.7
2.8	620	920	1.2	1.9	2.5	3.1
3.0	710	1.1	1.4	2.1	2.8	3.5
3.5	960	1.4	1.9	2.9	3.9	4.3
4.0	1.3	1.9	2.5	3.8	5	6.2
4.5	1.6	2.4	3.2	4.8	6.4	7.9
5.0	2.0	3.0	3.9	5.9	7.9	9.8
5.5	2.4	3.6	4.8	7.1	9.5	11.9
6.0	2.8	4.2	5.7	8.5	11.3	14.1
<b>Equivalent Water Rate (Litres/Ha)</b>	1000	1500	2000	3000	4000	5000

## Response of *Lantana camara* to metsulfuron methyl



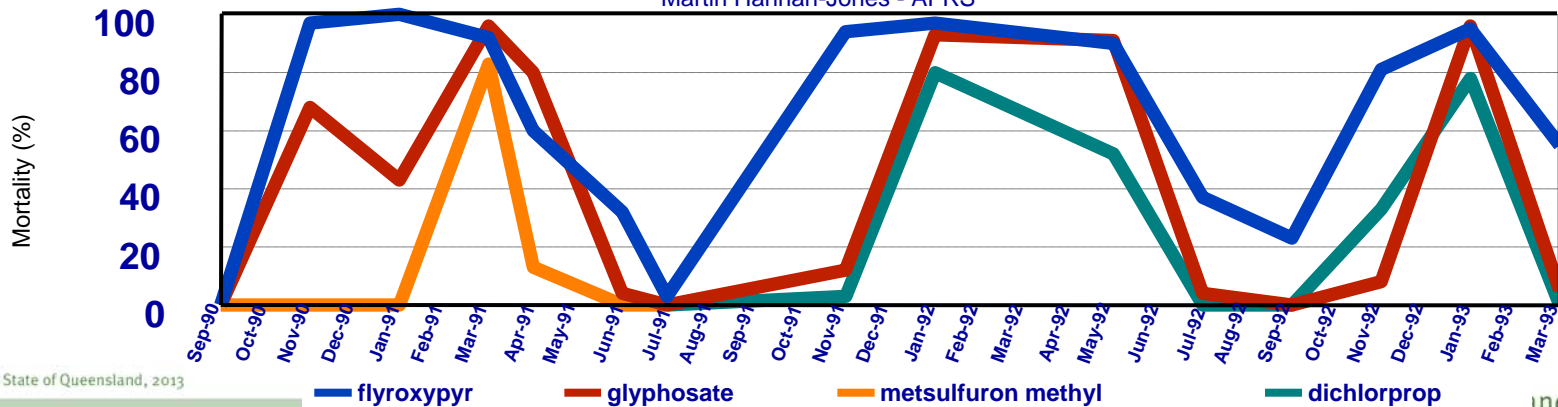
## Response of *Lantana camara* to fluroxypyr



## Seasonal effectiveness of herbicides on *Lantana camara* v.

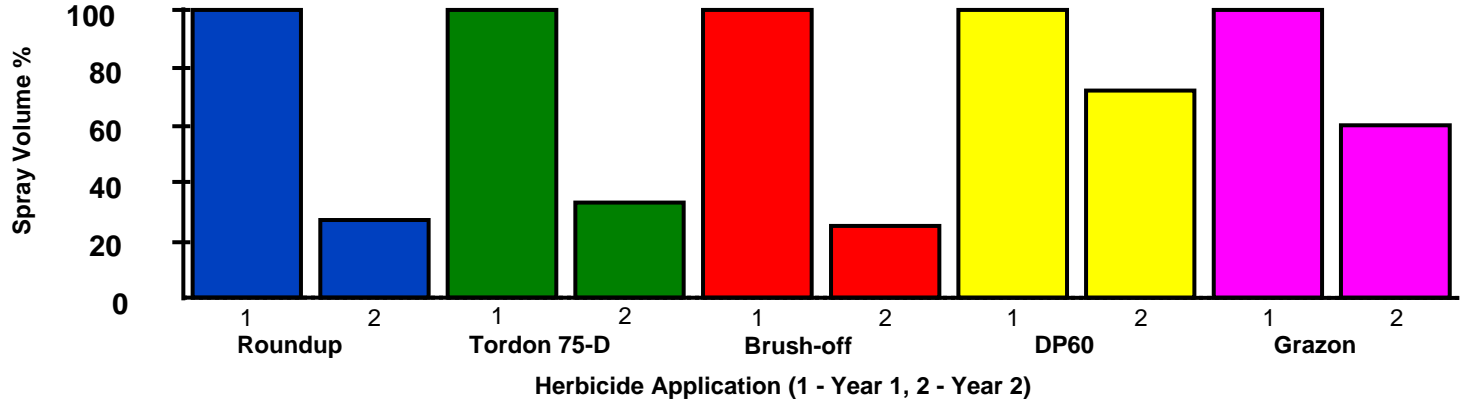
### “Helidon White”

Martin Hannan-Jones - AFRS

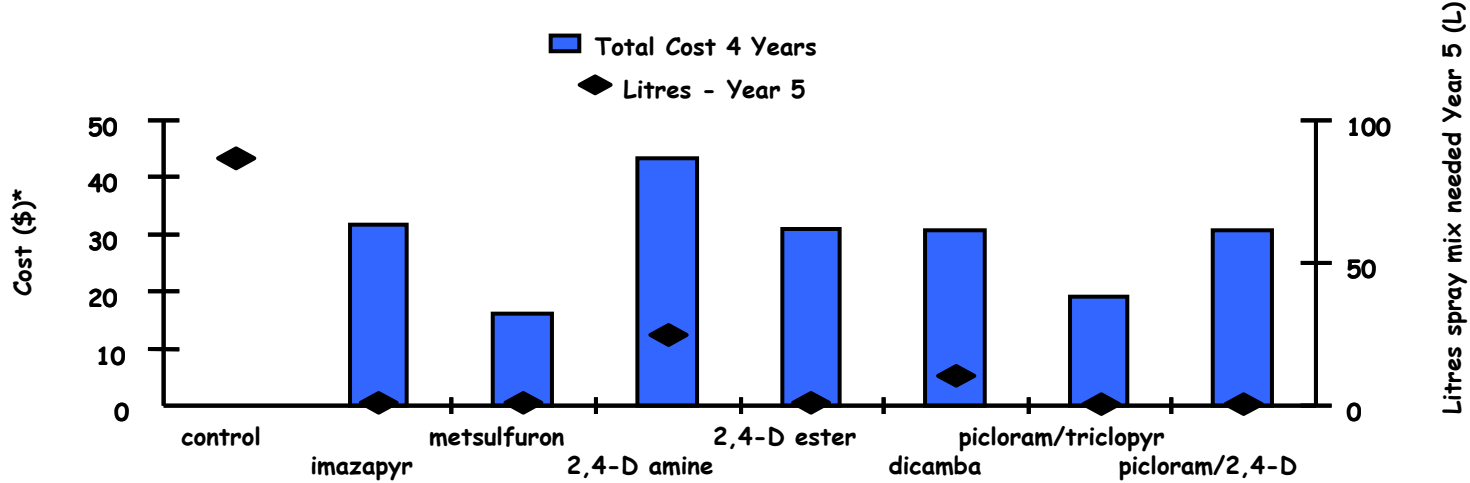


# Pink Lantana

Max McMillan - Glen Innes

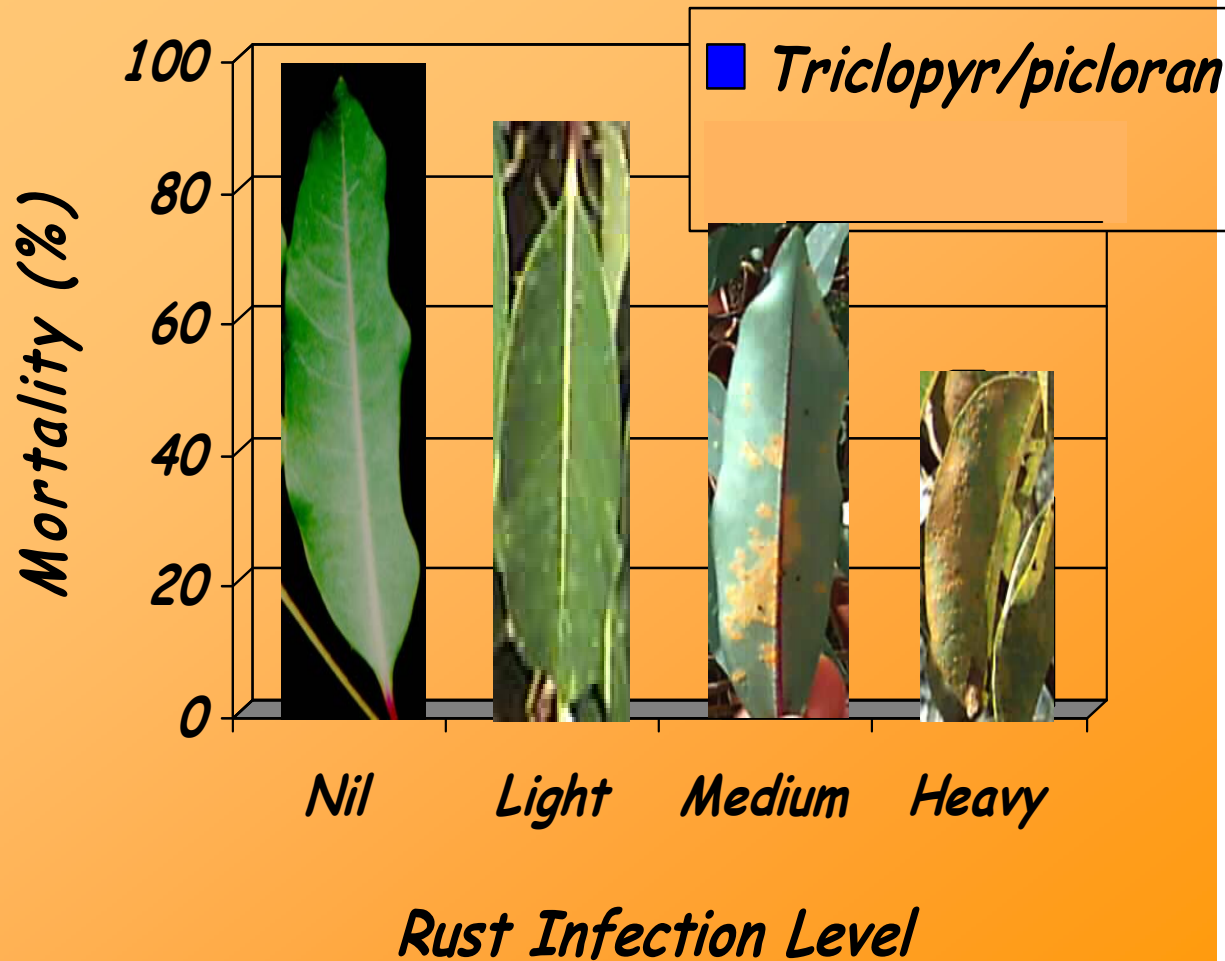


## Cumulative cost to treat 100 m<sup>2</sup> dense rubber vine

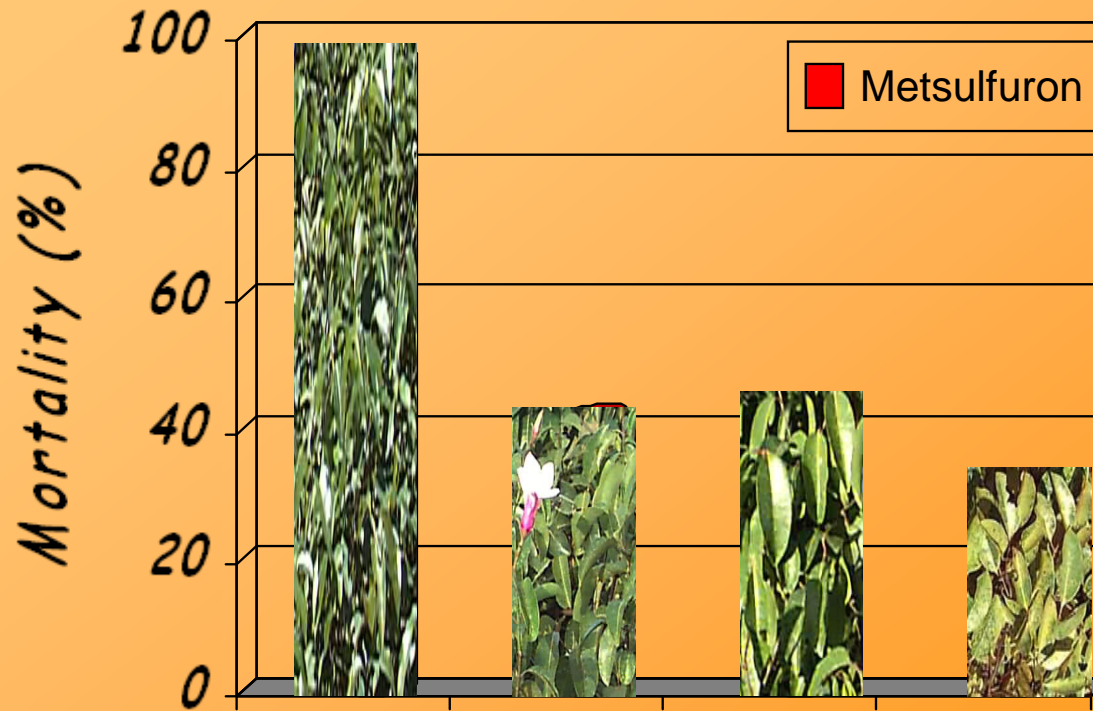




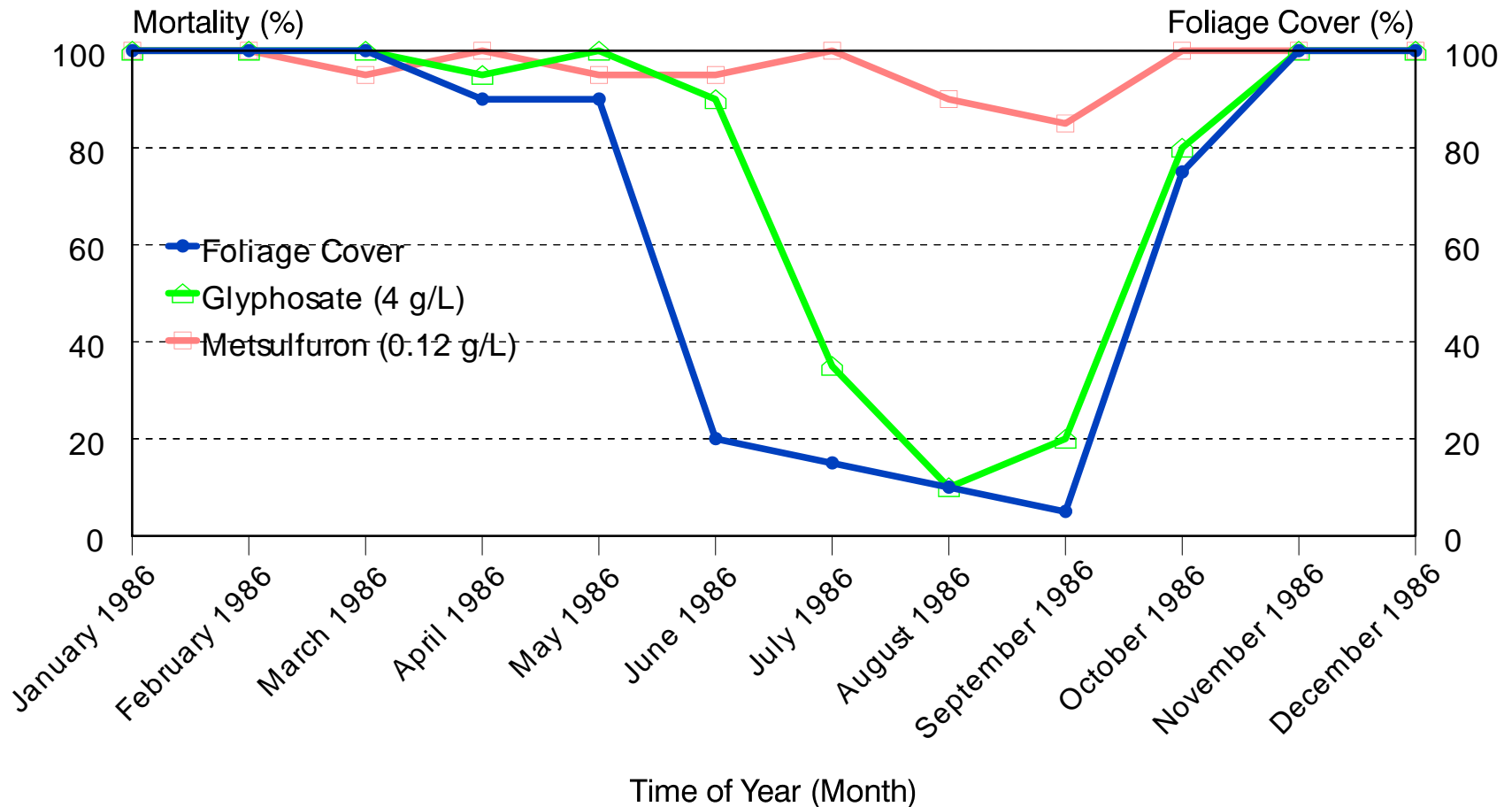
# *Efficacy of foliar applied herbicides on rust infected rubber vine plants*



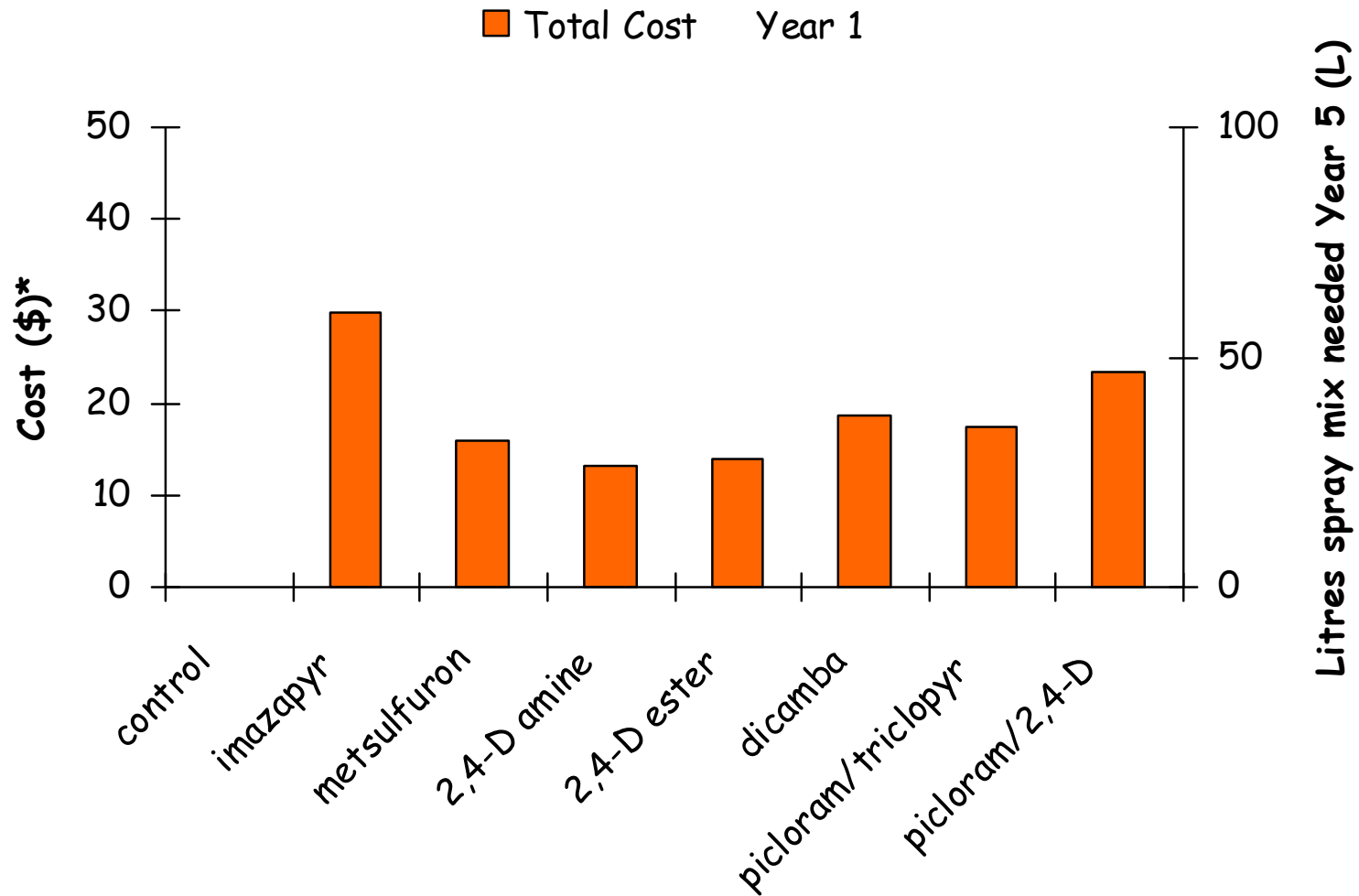
# *Efficacy of foliar applied herbicides on rust infected rubber vine plants*



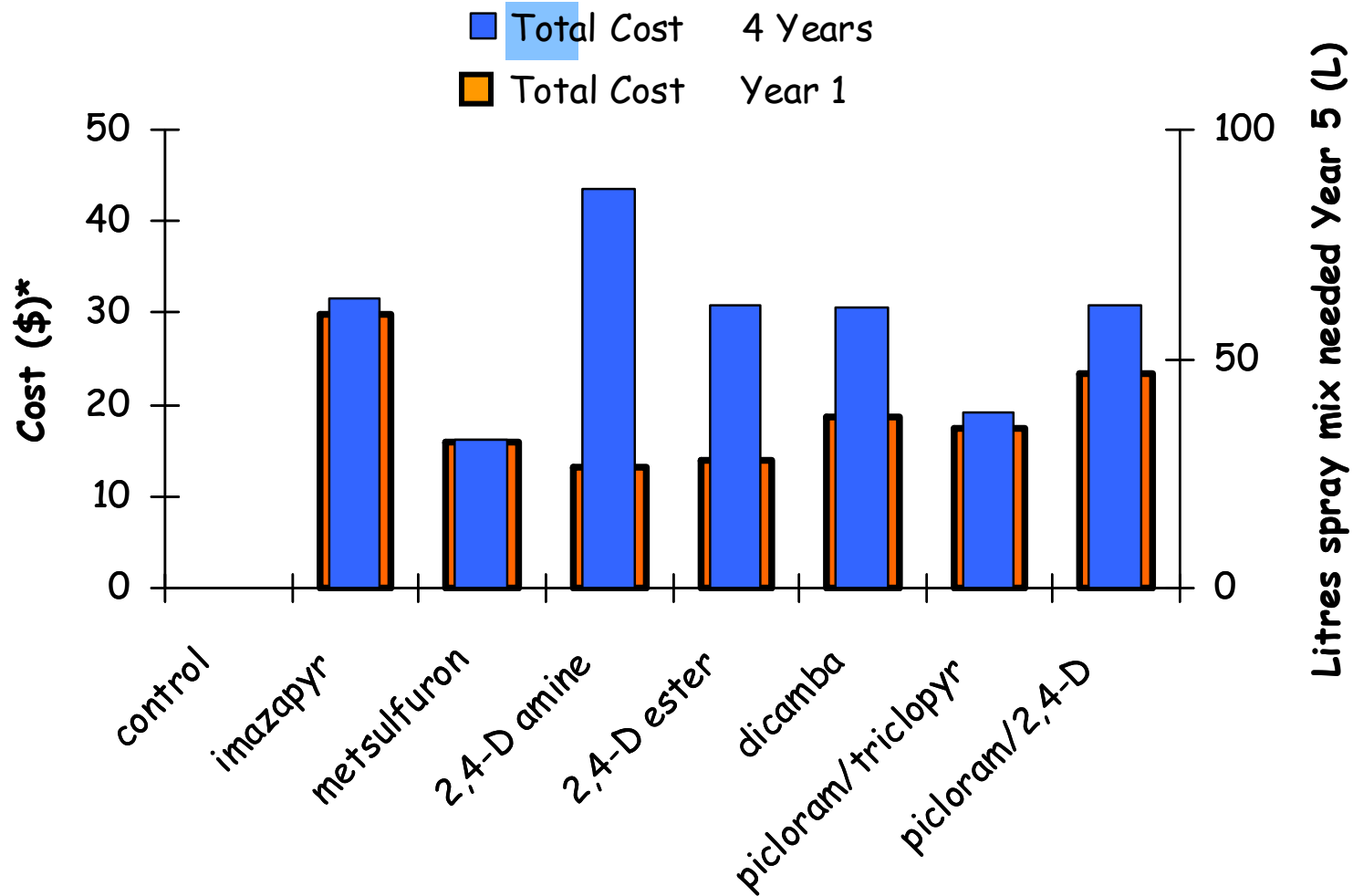
# Seasonal effects on herbicide efficacy for Bellyache bush control



Metsulfuron (0.12 g/L) and glyphosate (4.0 g/L) were applied as overall spray treatments at monthly intervals (Vitelli, JS; unpublished data)

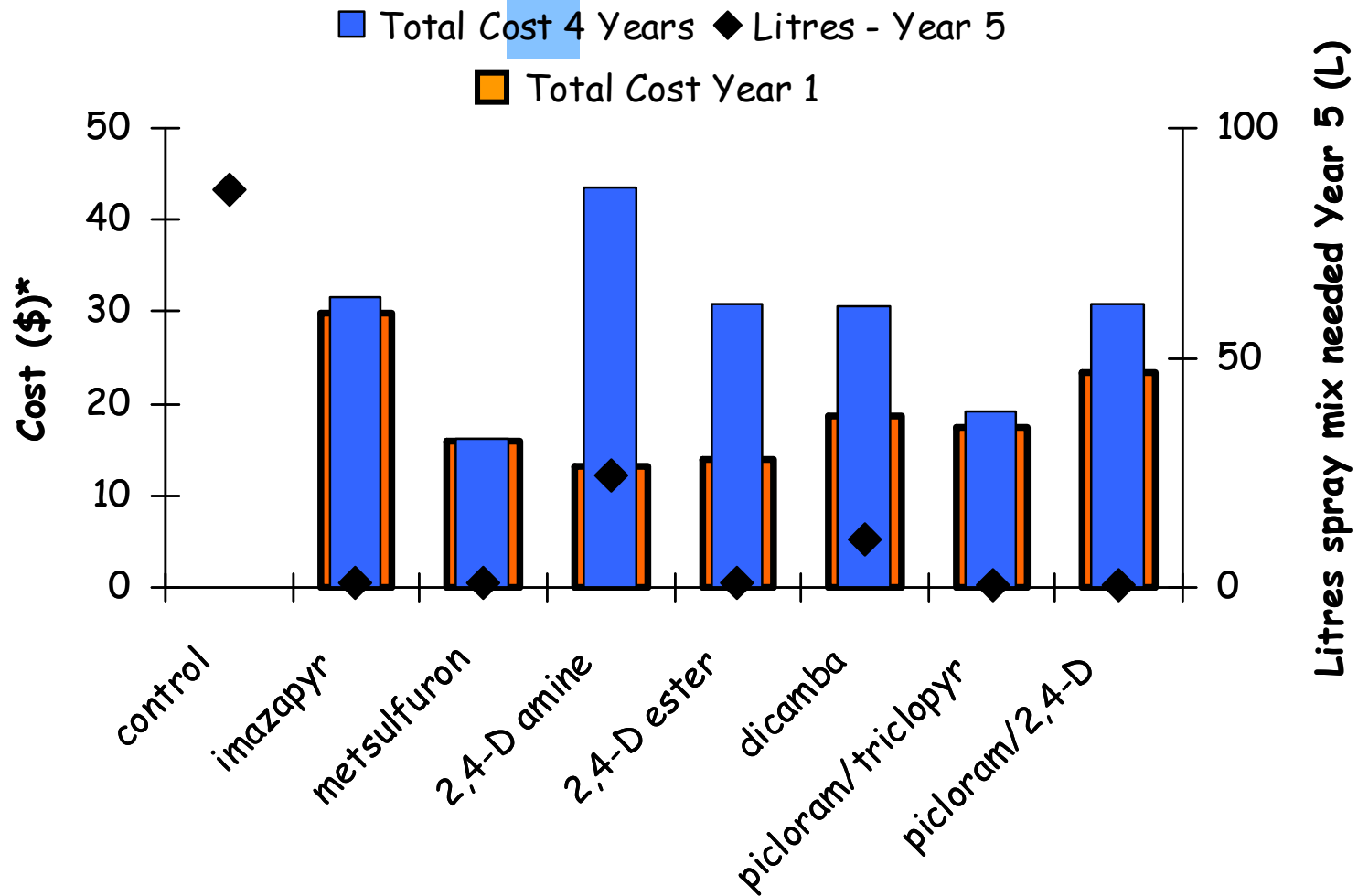


Cumulative cost to treat 100 m<sup>2</sup> dense rubber vine



Cumulative cost to treat 100 m<sup>2</sup> dense rubber vine





Cumulative cost to treat 100 m<sup>2</sup> dense rubber vine

# Spray application methods

## - Foliar spraying - Boom spraying

- Blanket spraying using a boom spray from a tractor or 4-wheel drive vehicle can be used to treat large areas completely infested with weeds up to approximately 1 m in height



# Spray application methods

## - Foliar spraying - Boom spraying

### Low pressure boom sprayers

- most common type equipment
- pulled or driven over field
- applies volumes of 50 to 450 l/ha, at pressures of 2 to 4 bar, producing a range of droplet sizes at low pressures
- deposits more spray in the centre of the spray swath, requiring overlap from adjacent nozzles for even coverage
- Nozzles normally offset  $10^{\circ}$ – $20^{\circ}$  so that the spray pattern of each is not affected by adjacent nozzles
- advantages
  - inexpensive
  - light weight
  - Adapted for many uses
- disadvantages
  - poor penetration dense foliage
  - cannot operate under adverse field conditions



# Spray application methods

## - Foliar spraying – Splatter gun

Splatter guns apply a low volume of high concentration, systemic herbicide to the foliage of an infestation

Herbicide squirted from a gas powered drench gun, places very large droplets onto leaves from 6–10 m away

Spray is arched over the top of a bush and down the front face, with splatters applied at specific intervals

Only a small portion of the foliage needs to be treated minimising off-target damage and reducing chemical usage

This technique allows for specific targeting of the herbicide and a marker dye is necessary to identify treated areas



# Spray application methods

## - Foliar spraying – Splatter gun



# Spray application methods

## - Foliar spraying – Splatter gun



1

# Spray application methods

## - Foliar spraying – Air blaster

- Designed to apply low to medium volumes of spray using small droplets between 30–350 microns in size
- Droplets of water and chemical are carried to the target plant in an air stream generated by the fan
- Airblast sprayer displaces the air in the target plant with the spray-laden air from the machine
- Most airblast sprayers have at least two fan speeds.
  - lower fan speed is used on smaller, less dense trees
  - higher fan speed (more air) is used on larger dense infestations

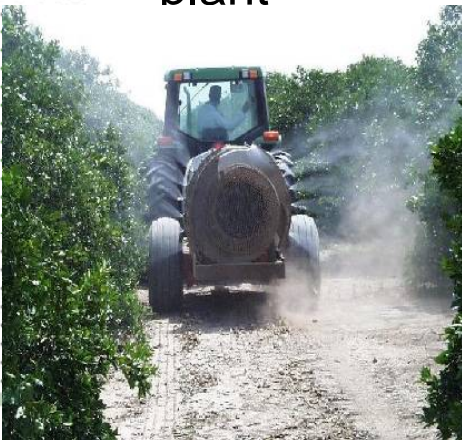
Rule of thumb if label for high volume spraying suggest 1:300, air blaster rate a factor of 10 more concentrated eg 1:30



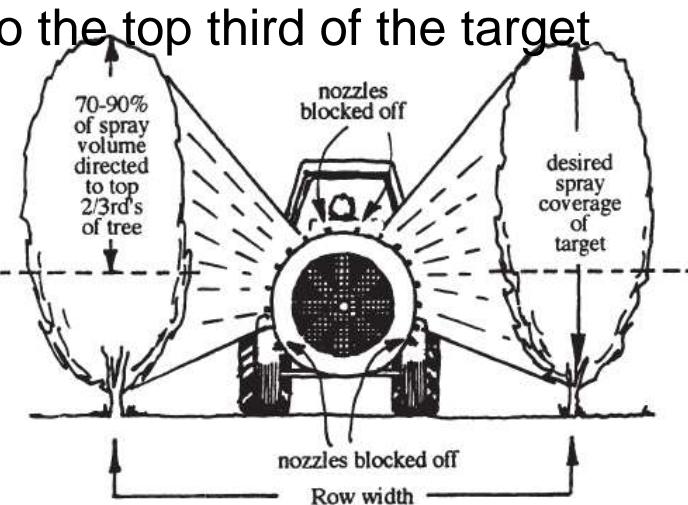
# Spray application methods

## - Foliar spraying – Air blaster

- Airblast sprayers generate their own wind, so spraying can be undertaken under calm conditions
- Slight breeze of 5–8 km/h improves spray penetration
- Air stream carrying the droplets plays no part in their production
- Droplet size controlled by nozzles used on the machine and the operating pressure
- Commonly used nozzles on airblast sprayers are hollow cones which produce small droplets
- Nozzles producing larger droplets are at the top and those producing smaller droplets are at the bottom
- Designed to apply 70% of the spray volume to the top third of the target plant



Position nozzles so that spray droplets cover the target plant from top to bottom. Nozzles directed into the air and onto the ground waste spray. Turn off nozzles that are not needed.





# Spray application methods

## - Foliar spraying – Aerial spraying

- Aerial spraying normally carried out by rotary (helicopter), fixed wing aircraft and UAV (unmanned aerial vehicles)
- Helicopters
  - Highly manoeuvrable capable of flying into areas inaccessible to fixed wing
  - Such manoeuvrability causes varying air streams resulting uneven distribution
- Most common nozzles used on aircrafts are disc core nozzles fitted with non-drip diaphragms (normally droplet sizes 225um)
- Hollow cone nozzles pointing backwards is often used for herbicides (D6-45, nozzle tilted 45o downwards and backwards; or raindrop nozzles)
- Rotary atomisers (Micronairs) are also used giving precise droplet sizes herbicide 200um



# Spray application methods

## - Foliar spraying – Aerial spraying

### Fixed wing aircraft

- advantages
  - fast timely
  - allow treatment under adverse field conditions
- disadvantages
  - difficult to operate hazard areas
  - drift
  - cost



# Spray application methods

## - Foliar spraying – Aerial spraying Helicopters

- advantages
  - slower speeds than aircraft
  - greater safety
  - accuracy of swath
- disadvantages
  - costly
  - higher maintenance

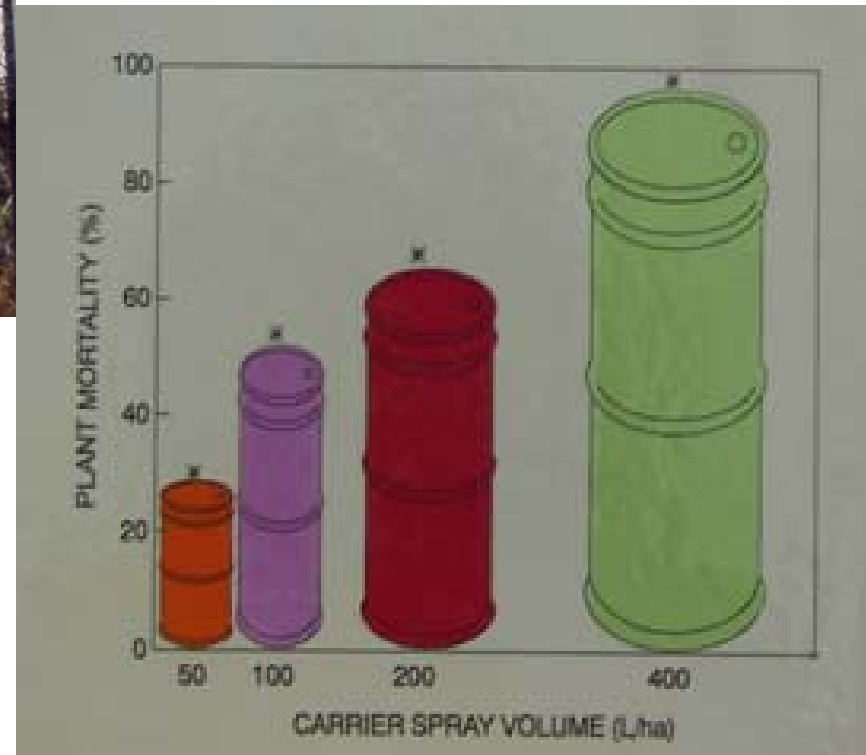


# Spray application methods

## - Foliar spraying – Aerial spraying



Trade off between efficacy and cost  
Rubber vine mortality increased as spray volume increased from 50 to 400 l/ha

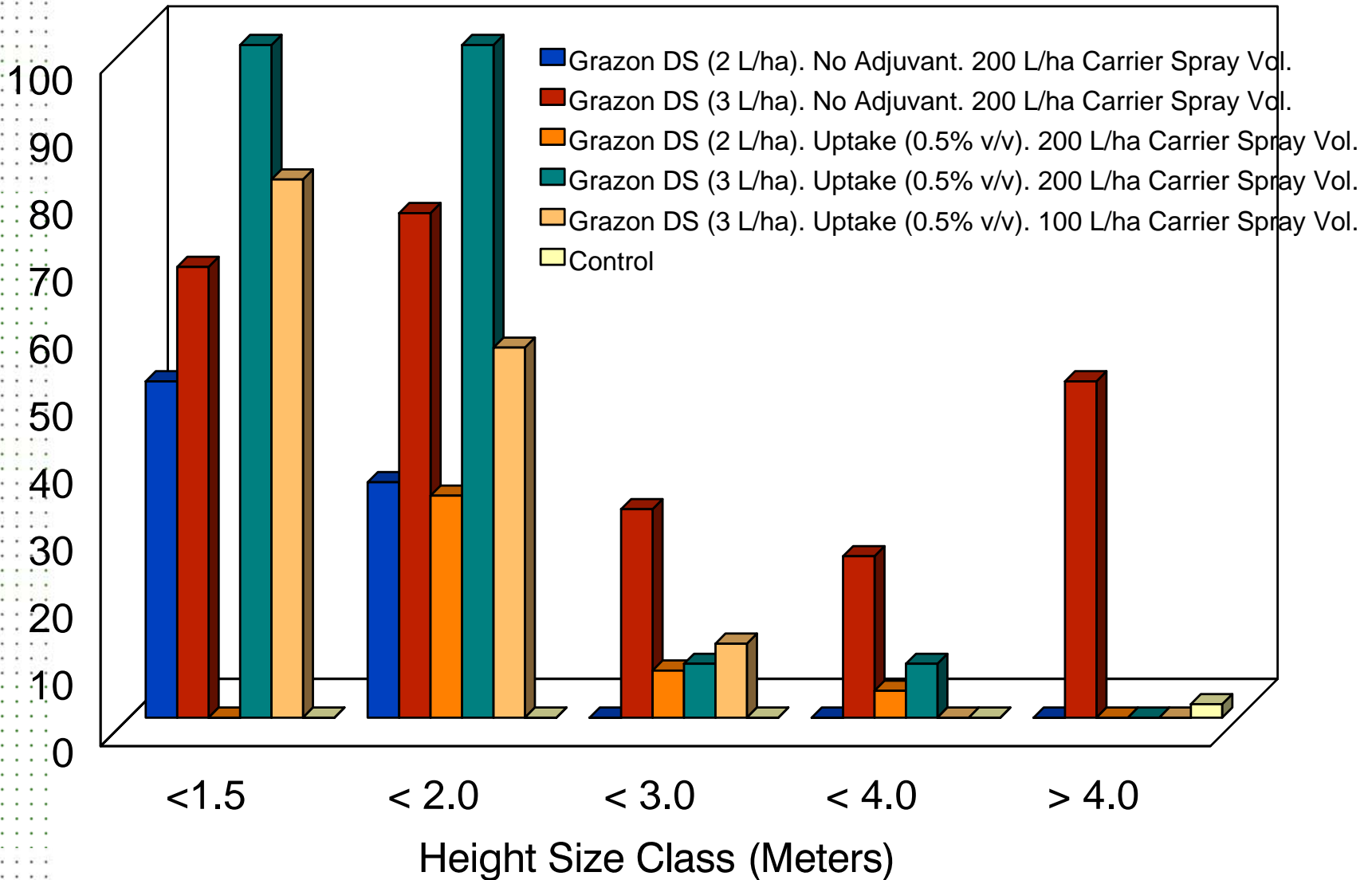




# Parkinsonia Aerial Trial

Effect of plant mortality on height size class.

Mortality (%)



Site sprayed 30/11/1996. Final assessment 22/7/1997. Bell Kawasaki Helicopter. Complete double overpass using XR Teejets (8008VB) nozzles.

© State of Queensland, 2013

# Spray application methods

## - Foliar spraying – Aerial spraying



2

# Spray application methods

## - Foliar spraying – Aerial spraying

### UAV - Yamaha RMAX

- Visual range up to 400 m
- Payload of 20 kg
- Agricultural uses include spraying, seeding, remote sensing, precision agriculture, frost mitigation and variable rate dispersal
- Main Rotor Diameter 3,130 mm
- Trail Rotor Diameter 535 mm
- Overall Length 2,750 mm / 3,630 mm (with rotor)
- Overall Width 720 mm
- Overall Height 1,080 mm

#### LIQUID SPRAYER

Cassette Tank Capacity	8 litres x 2 tanks
Discharge Method	Double-acting piston with flat nozzle
Discharge Rate	1.3-2.0/minute (speed-linking method)
Nozzle Pitch	1340 mm
Sprayer Weight	7.4 kg

#### GRANULAR SPRAYER

Hopper Capacity	13 litres x 2 tanks
Discharge Method	Impeller (300 mm dia.)
Discharge Rate	2.5 kg/minute (when spraying 1 kg/10 a)
Impeller Rotational Speed	800 rmp
Sprayer Weight	7.0 kg



# Spray application methods

## - Foliar spraying – Aerial spraying



1



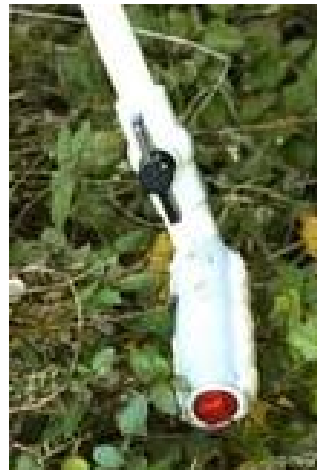
YAMAHA R-MAX



# Spray application methods

## - Rope wick wiper applicators

- Are selective applicators to control weeds growing above the non-target plant
- Method consists of a herbicide reservoir attached to a wiper made of absorbent material (cotton rope, carpet or sponge)
- Used primarily to selectively treat weeds that are taller than the non-target plant
- Several types have been developed:
  - recirculating sprayers
  - roller applicators
  - carpet wipers
  - rope wick applicators



# Spray application methods

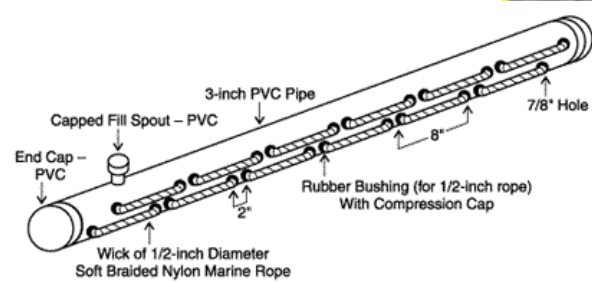
## - Rope wick wiper applicators

- Sizes ranging from hand held to vehicle or tractor mounted
- Chemical is wicked from a reservoir to the exposed portion of the rope
- Exposed portion of rope is then wiped against the weed to be controlled
- Herbicide is highly concentrated eg glyphosate (10 to 100% product)
- Reservoir should be kept full for maximum flow
- Reservoir must be vented to avoid vacuum lock
- Two applications, both in the same day, are recommended for best coverage, with second application applied opposite direction of the first
- Avoid wiping weeds when foliage is dusty or wet from dew or rain
- Wicks rarely practical for non-crop and range land situations since weeds grow at different heights



# Spray application methods

## - Rope wick wiper applicators





# Spray application methods

## - Basal bark spraying

- Involves mixing an oil soluble herbicide in diesel and spraying the full circumference of the trunk or stem of plants
- Normally only applied to plants with basal diameters up to 10 cm
- Application is to a plant height of 30 to 100 cm
- Diesel/powered kerosene/aviation fuel help the herbicide move through the bark
- Basal bark spraying suitable for thin-barked woody weeds, tree saplings, regrowth and multi-stemmed shrubs and trees
- Method works by allowing the herbicide to enter underground storage organs and slowly kill the targeted weed



Spray around base of each stem up to 100 cm

Application of 5% sump oil to the spray mix will help stain trunk for ease of marking treated trees



Low pressure



# Spray application methods

## - Basal bark spraying

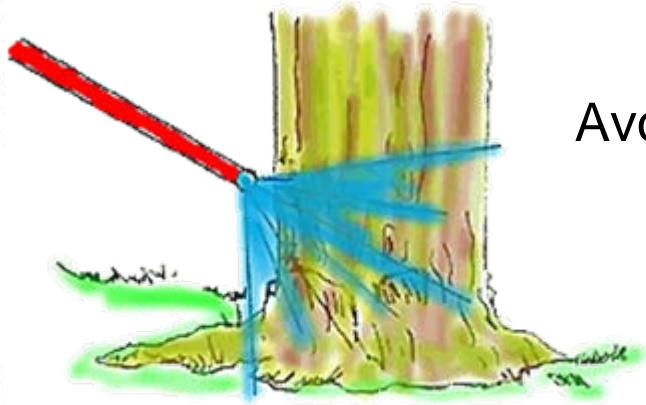
- Whole circumference of the stem or trunk must be sprayed or painted with herbicide solution from ground level to a height of 30 cm
- Need to saturate the full circumference of the trunk, treating every stem or trunk arising from the ground
- Basal bark spraying is an effective control method to tackle inaccessible areas such as steep banks
- Advantages
  - little or no drift
  - well-targeted form of spraying
  - method controlling difficult-to-kill weeds
  - applied at any time of the year
- Disadvantages
  - bark needs to be dry
  - diesel cannot penetrate plants with thick stems
  - Cost if diesel expensive



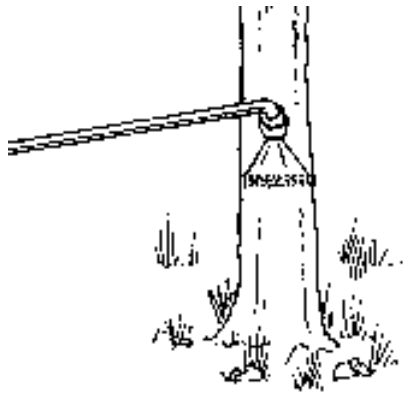
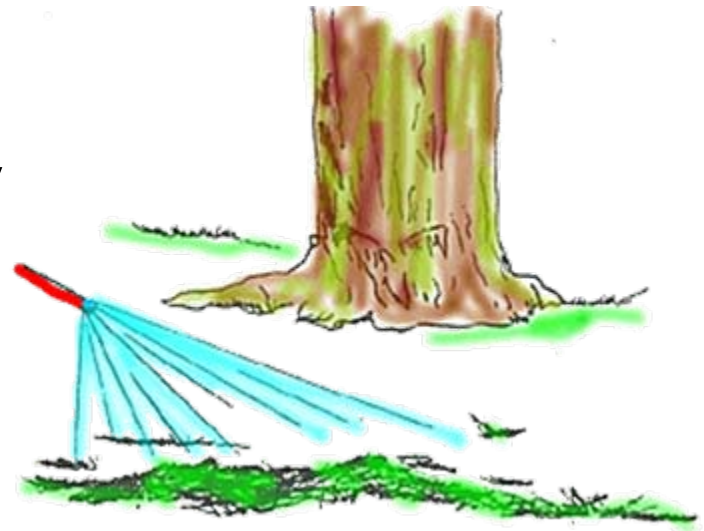
Access and Starane gave 100% mortality on Siam weed

# Spray application methods

## - Basal bark spraying



Avoid overspray



Correct method

3

# Spray application methods

## - Basal bark spraying - ThinLine technique

- Access™ Herbicide (picloram ester + triclopyr ester) registered for the control of woody weeds by basal bark and cut stump application
- Access formulated to only mix with diesel and not water
- ThinLine application is a modified version of basal bark application
- Same equipment is used for both techniques – the difference is the height of the stem that needs to be treated and the dilution rate
- For smooth stemmed species, Access rate 1:9 with diesel
- Treat the stem of the plant from ground level up to 5 cm high
- Technique uses less diesel and reduces the time required to treat each stem compared to conventional basal bark spraying



# Spray application methods

## - Basal bark spraying - ThinLine technique

**Table 1.** Trial 104003CL – Comparison of the amount of Access and diesel used and time taken to treat pretty wattle (*Acacia decora*) stems (2.5 cm diameter).

Application Technique	Standard Basal Bark	ThinLine
Height of stem treated (cm)	30	5
Access dilution rate with diesel	Mix 1 L of Access with diesel up to a total volume of 60 L (1:59 dilution)	Mix 1 L of Access with diesel up to a total volume of 10 L (1:9 dilution)
Amount of Access used (mL)	20	20
Amount of diesel used (mL)	1180	180
Number of stems treated	39	27
Amount of diesel per stem (mL)	30.3	<b>6.7 (78% reduction)</b>
Amount of Access/stem (mL)	0.5	0.75
Time to apply mixture (min)	11	4
Average time to treat each stem (sec)	17	<b>8.9 (48% reduction)</b>



# Spray application methods

## - Stem injection method

- Methods involve drilling or cutting through the bark into the sapwood tissue in the trunks of woody weeds and trees
- Herbicide is immediately placed into the hole or cut
- Aim is to reach the sapwood layer just under the bark (the cambium growth layer), which will transport the chemical throughout the plant
- Essential to apply the herbicide immediately (within 15 seconds of drilling the hole or cutting the trunk)
- Stem injection relies on the active uptake and growth of the plant to move the chemical through its tissues
- Stem injection methods kill the tree or shrub where it stands



# Spray application methods

## - Stem injection method - Drill and fill method

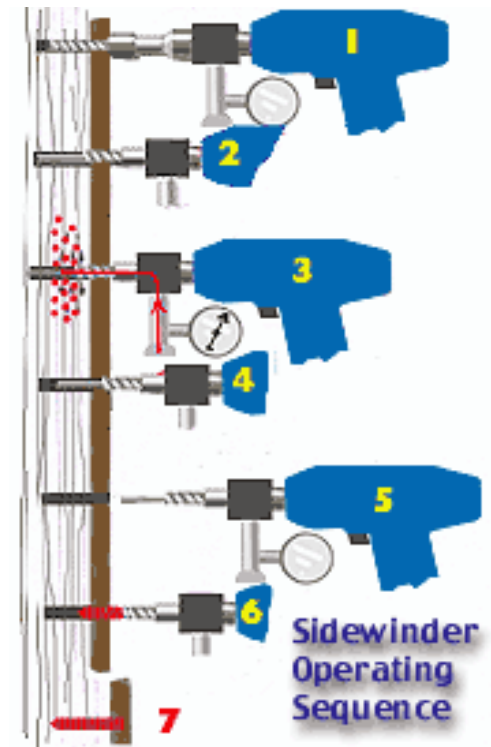
- Used for trees and woody weeds with stems or trunks greater than 5 cm in circumference.
- This method uses a battery-powered drill to drill downward-angled holes into the sapwood approximately 5 cm apart
- Herbicide placement into the hole is usually made using a backpack reservoir and syringe that can deliver measured doses of herbicide solution



# Spray application methods

## - Stem injection method - Sidewinder

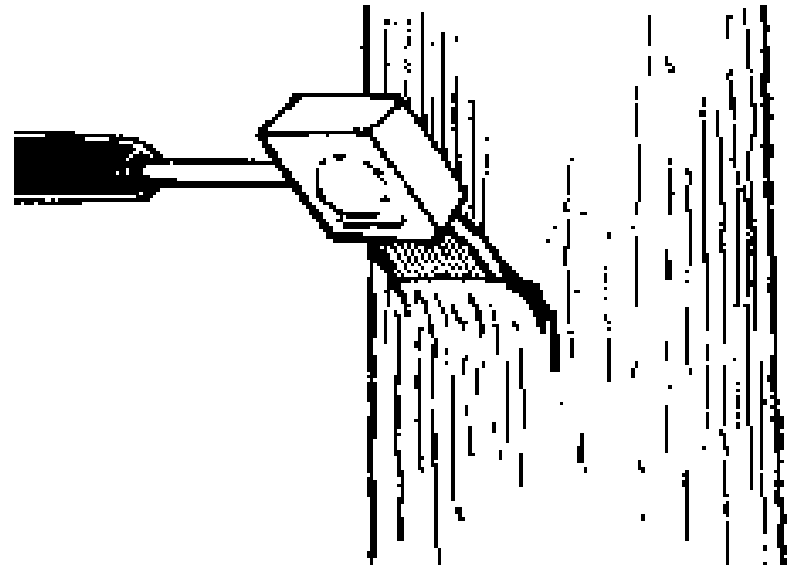
- Sidewinder consists of a backpack injector that uses an electric drill and screw nozzle to inject herbicide under high pressure, much like a hypodermic syringe for trees
- Trials have shown that Sidewinder Injectors reduce the amount of chemical used by up to 50 times compared to other similar stem injection methods



# Spray application methods

## - Stem injection method - Axe cut method

- Involves cutting through the bark into the sapwood tissue in the trunk, and immediately placing herbicide into the cut (sometimes referred to as frilling or chipping)
- Like the drill and fill method, the aim is also to reach the tissue layer just under the bark (the cambium layer), which will transport the chemical throughout the plant
- Axe cut method used for trees and woody weeds with stems or trunks greater than 5 cm in circumference





# Spray application methods

## - Stem injection method - Axe cut method

- Using an axe or tomahawk, horizontal cuts are made into the sapwood around the circumference of the trunk at waist height
- While still in the cut, the axe or tomahawk is leaned out to make a downward angled pocket which will allow herbicide to pool (1-4mls)
- Herbicide then immediately injected into the pocket
- Each cut should be 5 to 10 cm apart
- Important not to entirely ringbark the trunk, as will decrease herbicide uptake into the plant



# Spray application methods

## - Stem injection method - Axe cut method



1

# Spray application methods

## - Stem injection method – Tree spearing method

- Tree spearing is an alternative stem injection method to the use of an axe or drill
- Method uses a specifically designed tree spear and technique
- Spear is thrust into the tree at an angle of 30° to 40° from the vertical, opening a cut in the tree and applying the appropriate herbicide amount
- Process is repeated, forming a row of cuts approximately 50 mm apart

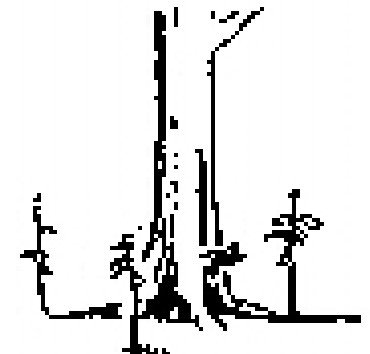




# Spray application methods

## - Cut stump method

- Involves cutting the plant off completely at its base (no higher than 15 cm from the ground) using a chainsaw, axe, brushcutter or machete (depending on the thickness of the stem/trunk)
- Herbicide solution is then sprayed or painted onto the exposed surface of the cut stump emerging from the ground, with the objective of killing the stump and the root system
- Herbicide mix must be applied as soon as the trunk or stem is cut
- Delays of >15 s for water-based herbicides and 1 min for diesel-soluble herbicides between cutting and applying the chemical will give poor results



Avoid cuts with angles, or cut resulting in multiple layers



# Spray application methods

## - Cut stump method – Brushcutter application

- Two operators working as a team can perform this method effectively
- Herbicide can be applied from a knapsack, or with a paint brush, drench gun or a handheld spray bottle
- Brightly coloured dye in water-based solution will help mark stumps that have been treated
- For trees with large circumferences, it is only necessary to place the solution around the edge of the stump (as the objective is again to target the cambium layer inside the bark)
- This method has the appeal of removing the weed immediately, and is used mainly for trees and woody weeds. This method is also referred to as cut and spray, or cut and paint.





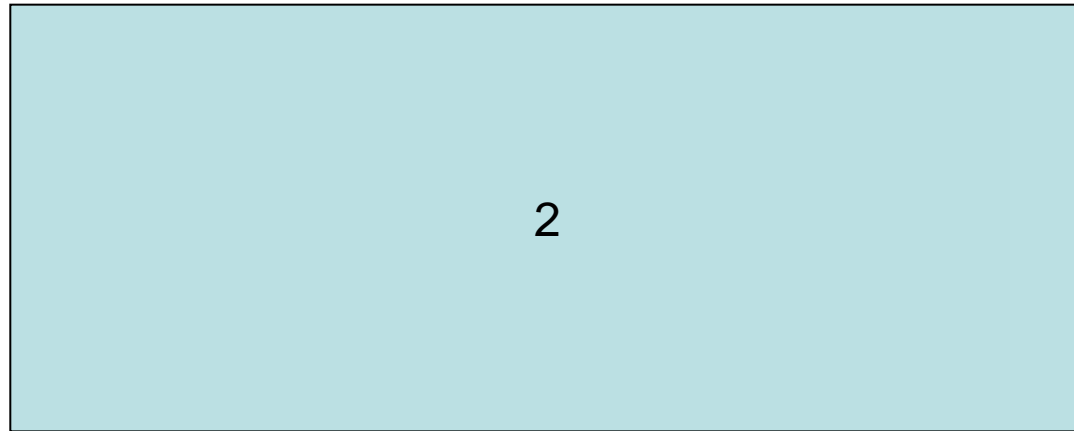
# Spray application methods

- Cut stump method – Brushcutter application



# Spray application methods

## - Cut stump method – Brushcutter application





# Spray application methods

## - Cut stump method – Brushcutter application



- Vigilant killed 100% of treated Siam weed
- ~ 5grams of gel per plant
- One 240g container treated 50 multi-stemmed plants (> 200 stems)





# Spray application methods

## - Cut stump method – Cut and swab

- Method similar to the cut stump method, suited to vines and multi-stemmed shrubs
- Plant stems are cut through completely, close to the ground
- Herbicide then applied immediately to the cut surface emerging from the ground, via spray or brush application
- Vines with aerial tubers (eg madeira vine) both ends of the cut stems must be treated with herbicide
- Hold both cut stems in a container of herbicide for 15 seconds after cutting, so that maximum translocation occurs to both ground and aerial tubers



1

# Spray application methods

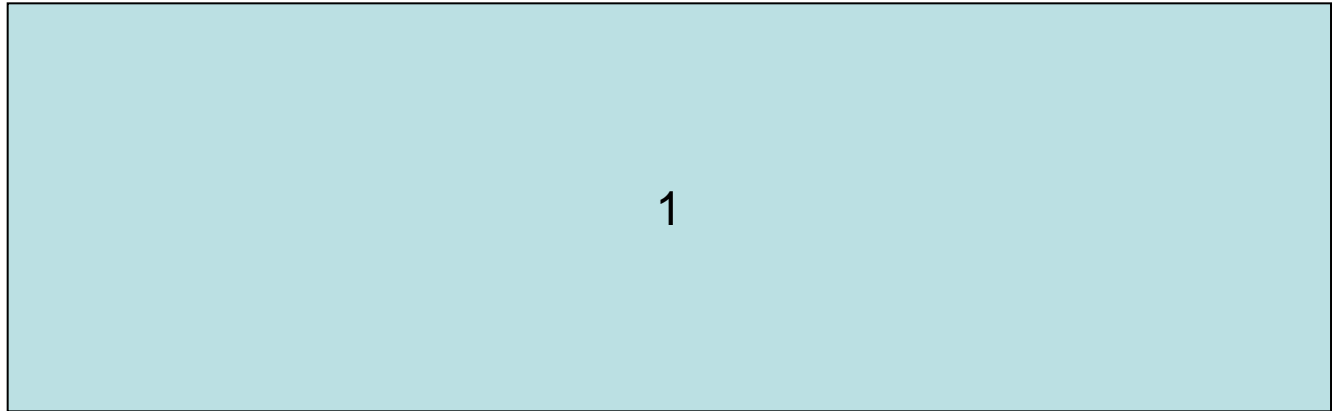
## - Cut stump method – Stem scrape

- Stem scraping used for plants and vines with aerial tubers
- Sharp knife used to scrape a very thin layer of bark from a 10 to 30 cm section of stem (careful not to cut through the vine)
- Removing a small portion of the bark allows the herbicide to penetrate into the plant's sap wood,
- Herbicide is then immediately applied to the exposed soft underlying green tissue (before the plant can seal)
- For large shrubs and vines several scrapes may be required
- Scrapes should be placed approximately 7.5cm apart completely circling around the stem
- Method also called bark stripping or stem painting
- With some woody weeds their bark surface can be peeled away and the exposed wood painted or sprayed with herbicide

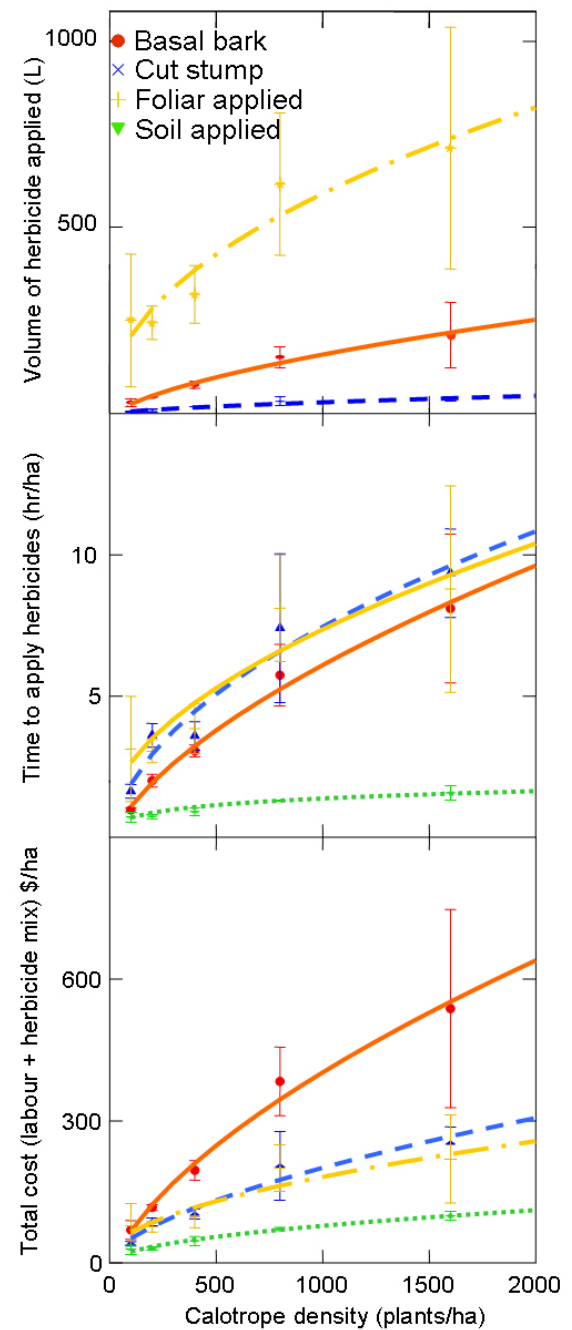
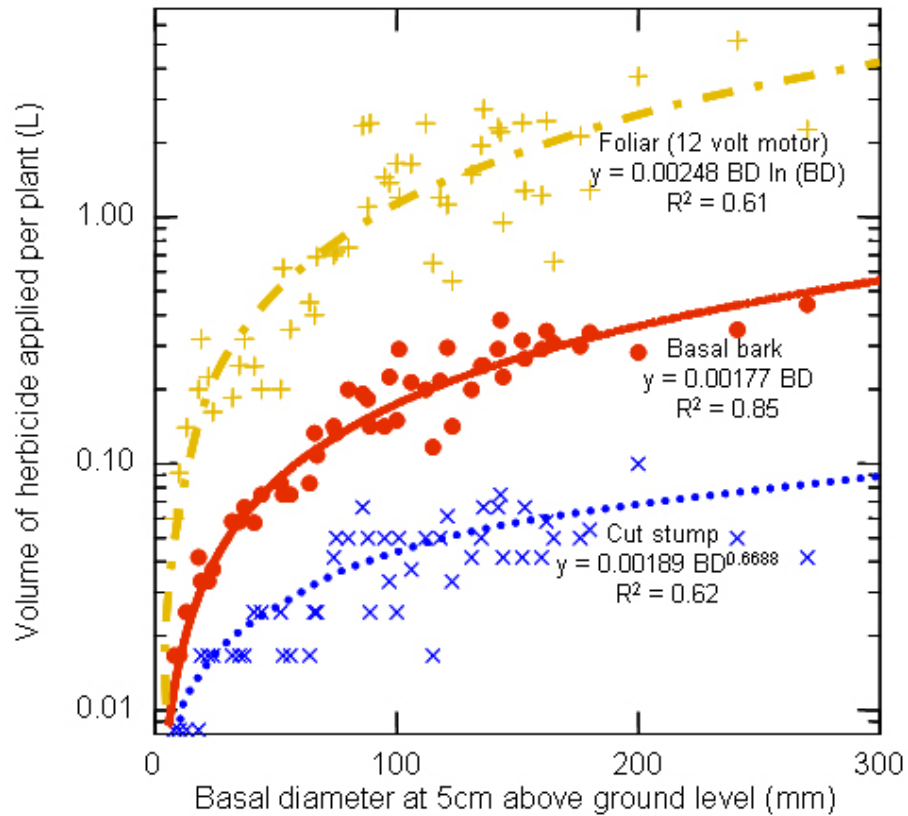


# Spray application methods

- Cut stump method – Stem scrape



# Calotropis procera

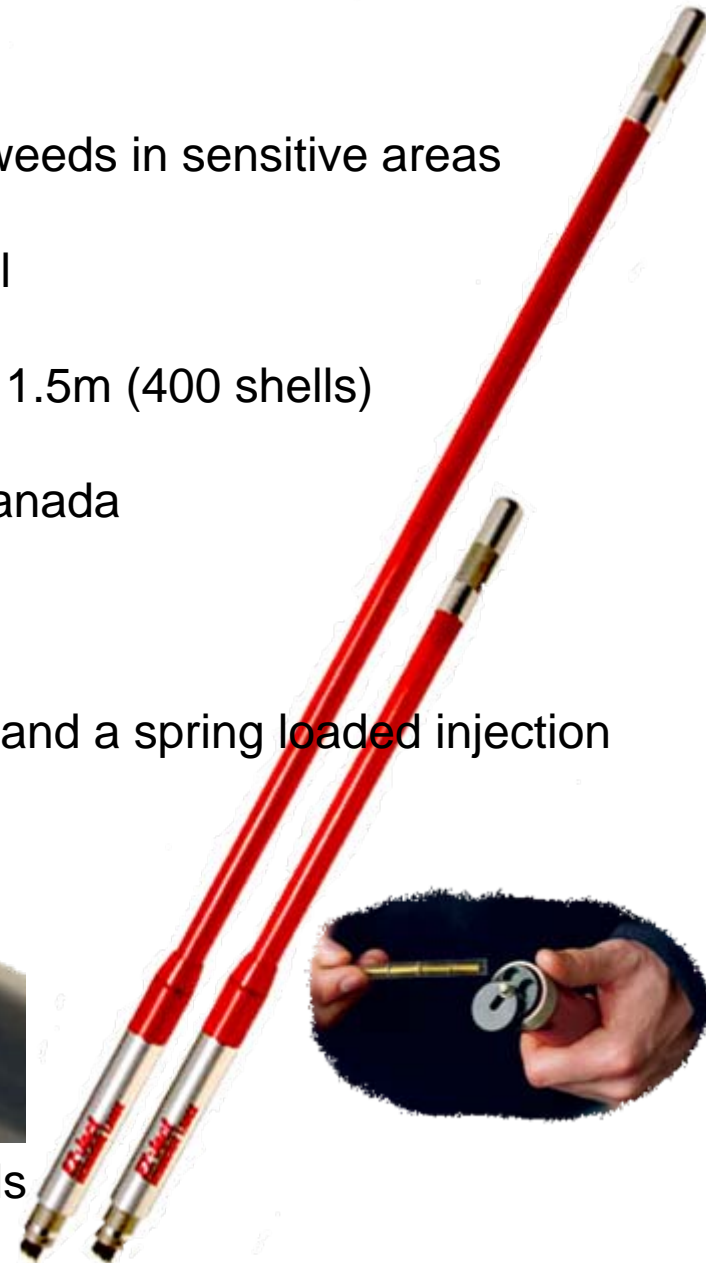




# Spray application methods

## - Ez-ject application

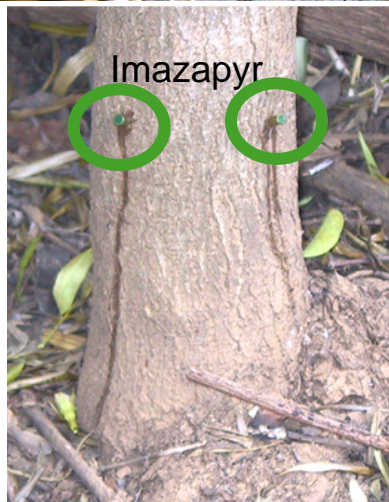
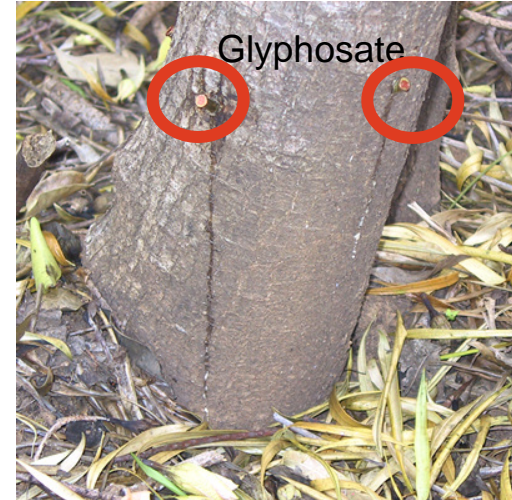
- Alternative technique for control of woody weeds in sensitive areas
- Stainless steel lance is a large injection tool
- Lances come in either 1.0m (228 shells) or 1.5m (400 shells)
- Two herbicides registered in the US and Canada
- Actives are glyphosate and imazapyr
- Bottom end of the lance has gripping teeth and a spring loaded injection assembly



- Herbicide encased in brass “22 bullet” shells

# Spray application methods

## - Ez-ject application





# Spray application methods

## - Ez-ject application



Imazapyr damage  
35 DAT



Glyphosate damage  
35 DAT

*Opuntia tomentosa*

# Spray application methods

## - Ez-ject application

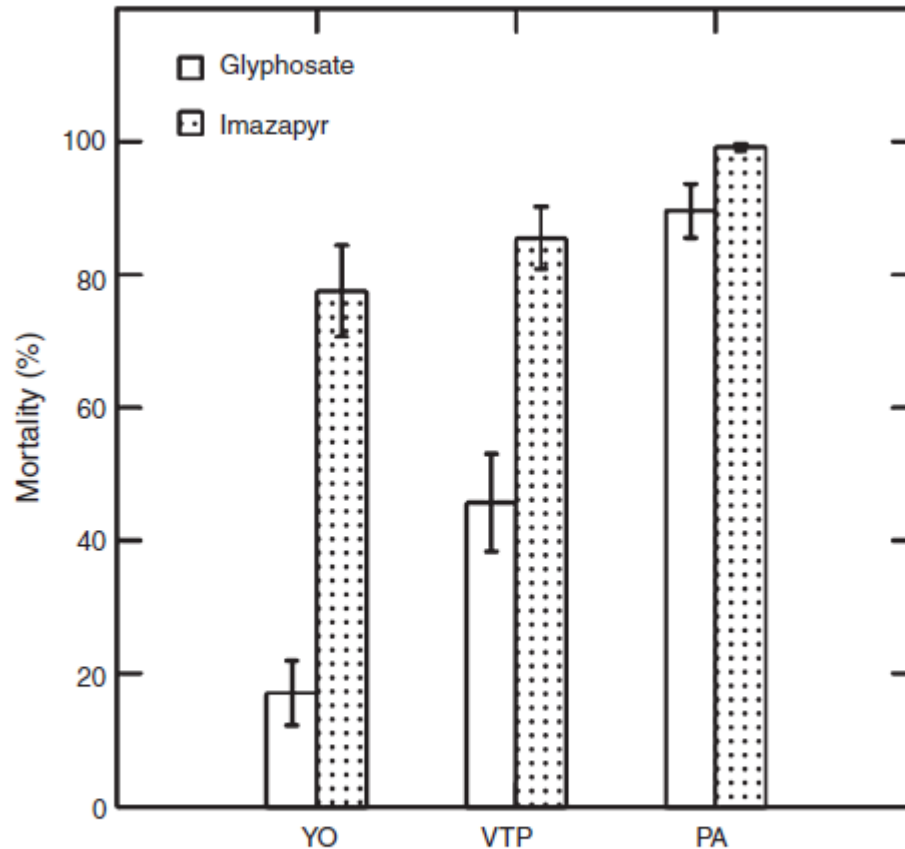
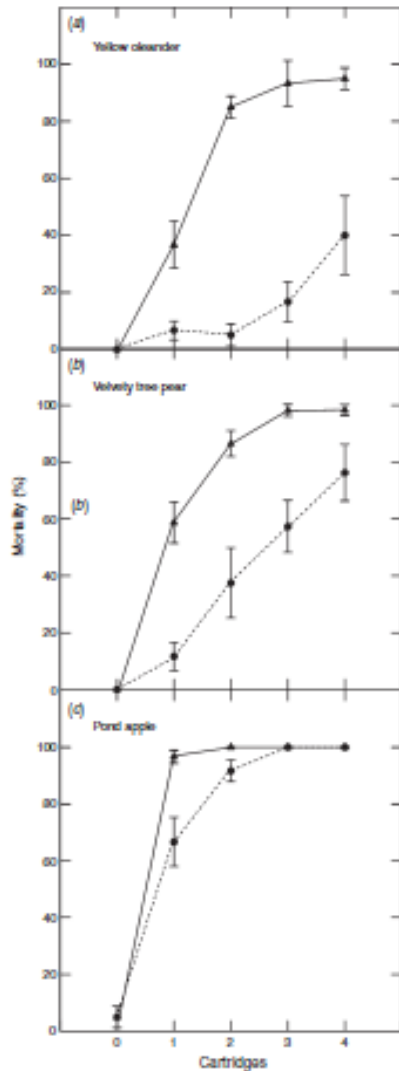


Fig. 2. Average plant mortality recorded for glyphosate (open bars) and imazapyr (shaded bars) treatments for yellow oleander (YO), velvety tree pear (VTP) and pond apple (PA), irrespective of number of cartridges injected.



# Spray application methods

## - Herbicide Ballistic Technology

- Designed to discretely administer encapsulated herbicide “balls” through a pneumatic device to individual weed plants with long-range accuracy
- Effective treatment range is 30 m in either horizontal or downward vertical trajectories
- High velocity impact of the projectile to the plant (ca. 50 m/s) creates a circular splatter pattern that is approximately 1 m<sup>2</sup>
- Majority of the fluid retained at the point of impact
- Effective on extreme topography or under tree canopy that would otherwise impede other traditional methods of herbicide application
- Nelson Paint Company has registered two pesticide



# Spray application methods

## - Herbicide Ballistic Technology



2

# Spray application methods

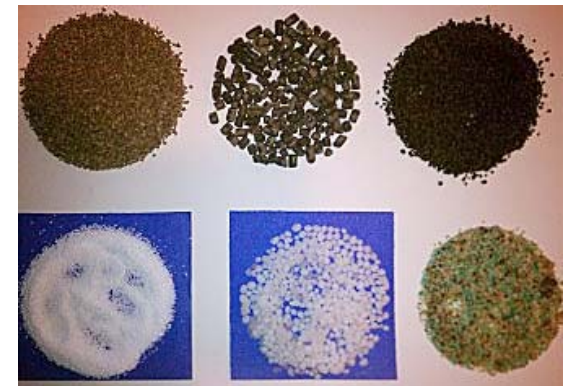
## - Granular application

### Advantages:

- ready to use
- easy to apply
- reduced foliage and off target damage
- ability to target weeds under canopies as granules fall through dense foliage
- minimises drift potential
- up to 60% cheaper application costs, as water not required for coverage
- reduced inhalation and dermal hazard
- simple application equipment

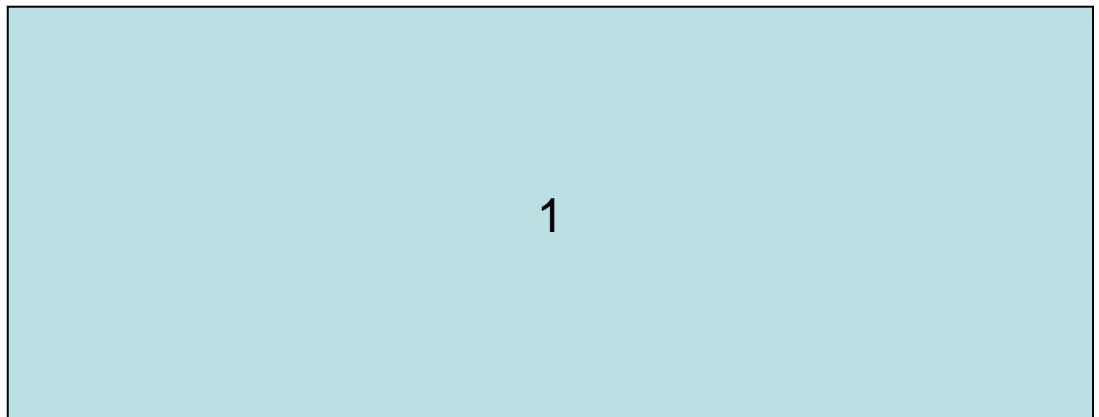
### Disadvantages:

- expensive per kilogram active ingredient
- needs moisture to activate herbicide action
- hazardous on steep slopes and around non-target plants
- can be attractive to non-target organisms such as birds
- difficult to spread uniformly around obstacles



# Spray application methods

## - Granular application



1



# Components of low pressure sprayers

Pressure regulators

◆ Bypass line

Sprayer tank

Pressure gauges

pumps

◆ Agitation Device

Spray boom

Control Area

Relief Valve

Agitation Line

Boom Valve

Control Valve

Roller Pump

Jet Agitators

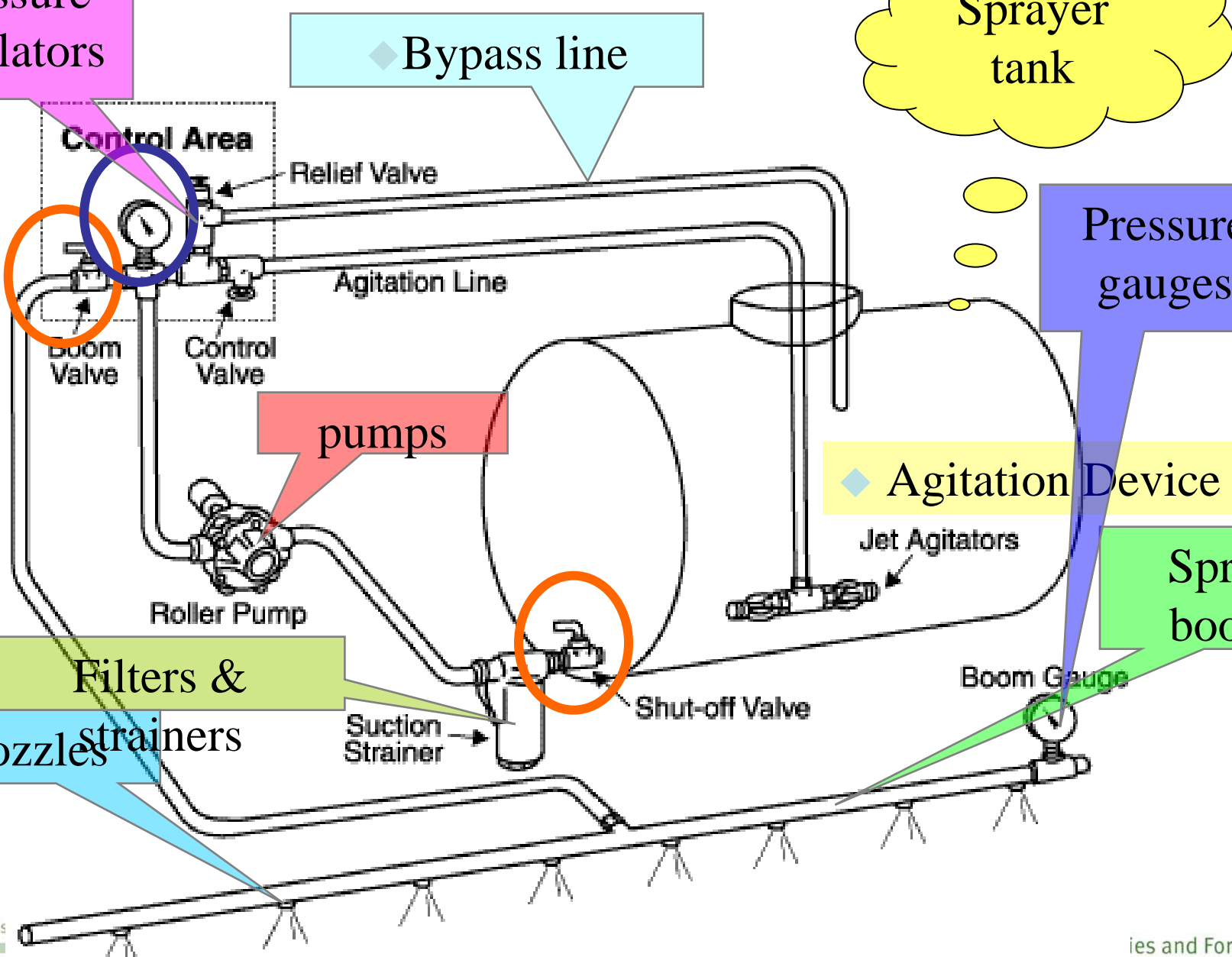
Filters & strainers

Shut-off Valve

Boom Gauge

nozzles

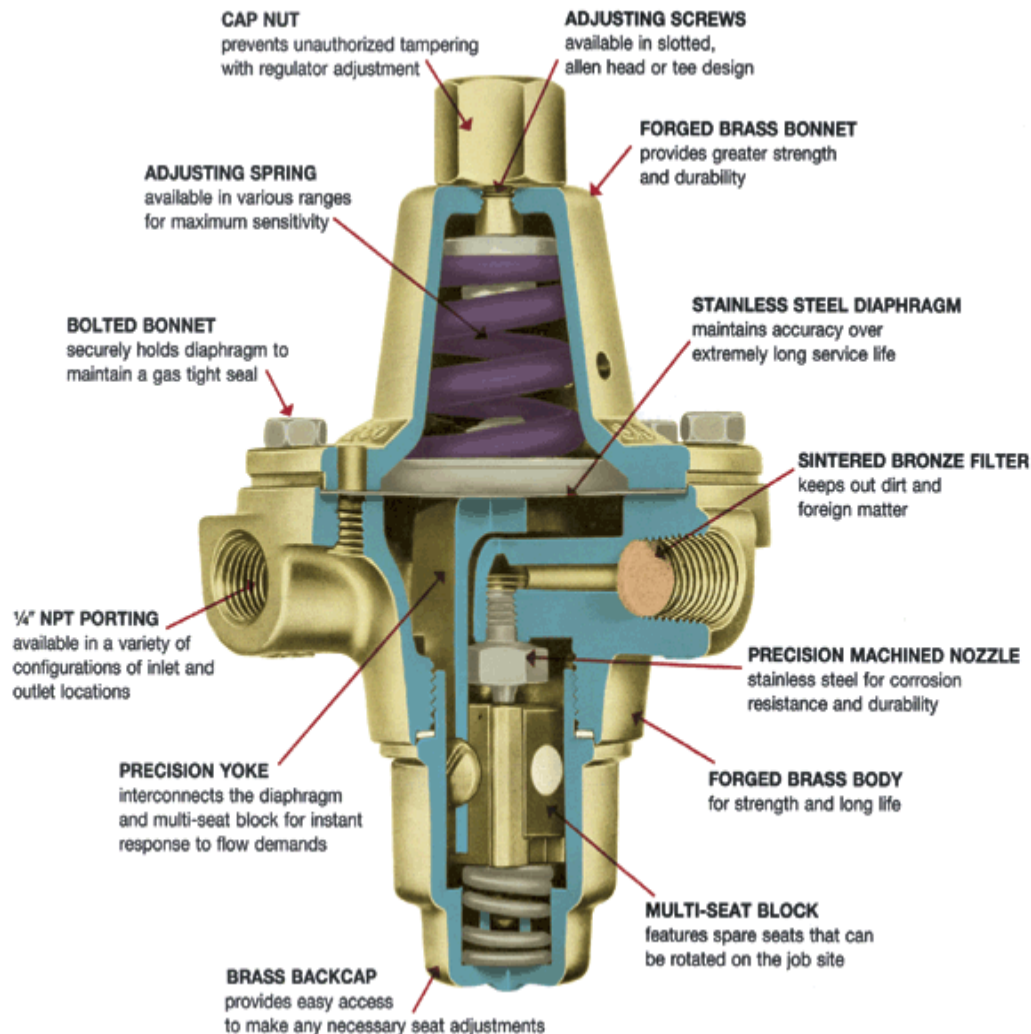
Suction Strainer



# Components of low pressure sprayers

## Pressure regulators

- maintain pressure in system and serve as relief valve
- should be spring loaded and adjustable



# Pressure gauges

accurate measurement of operating pressure is essential

range of gauge should be twice the maximum expected operating pressure



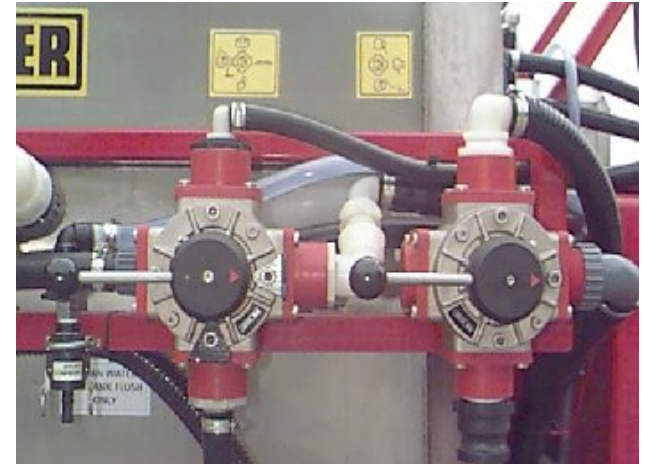
# Control valves

should be readily visible and easily assessable

should be quick acting & positive

two types

- 1. water faucet types
- 2. electric solenoid types



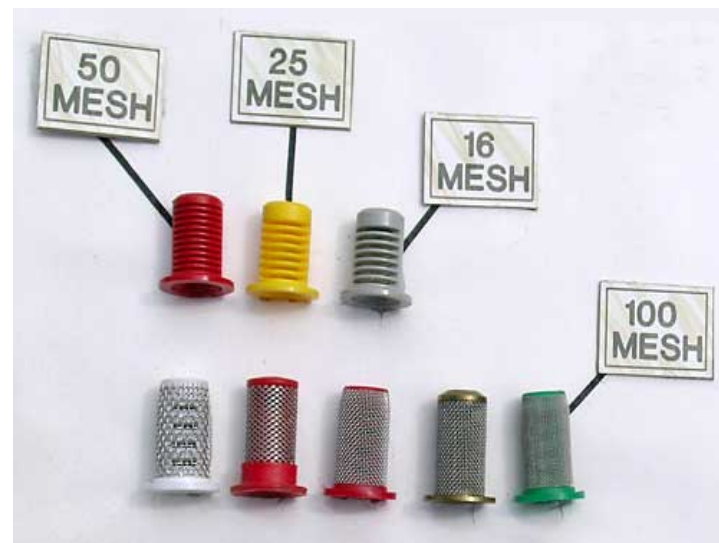


# Filters & strainers



should be located at three positions on spray system

- 1. Suction
- 2. Line
- 3. Nozzles
- WP-50 mesh
- EC-100 mesh



# Boom-by-pass-agitation fittings

## hoses

- should not collapse under suction
- must be able to withstand pressure (2X expected operating pressure)
- should be resistant to chemicals
- neoprene or some other oil resistant materials are best

## by-pass line

- prevent pressure buildup in system
- extremely important safety feature

# Pumps

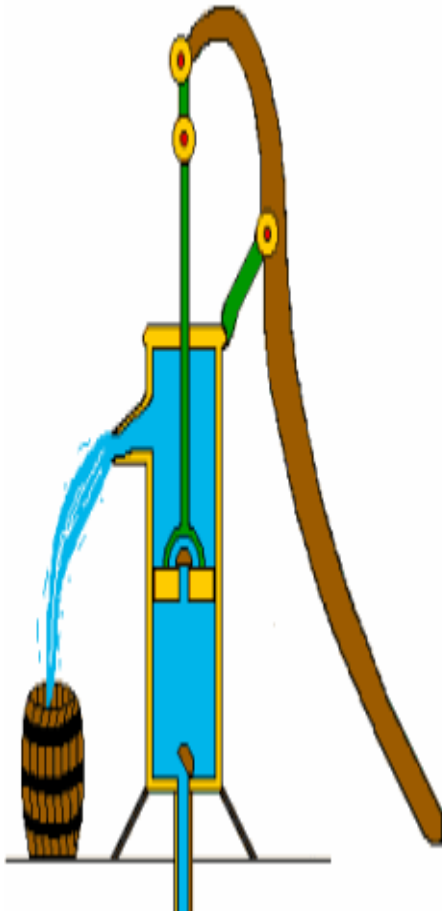
heart of sprayer

factors to consider when selecting pump

- capacity
- pressure
- resistance to wear
- cost
- Serviceability

Tank agitation (5 - 6 % of tank volume)

# Pump Types



Roller  
Piston  
Diaphragm  
Centrifugal  
Gear





# Positive Displacement

## Roller Pump

General Purpose

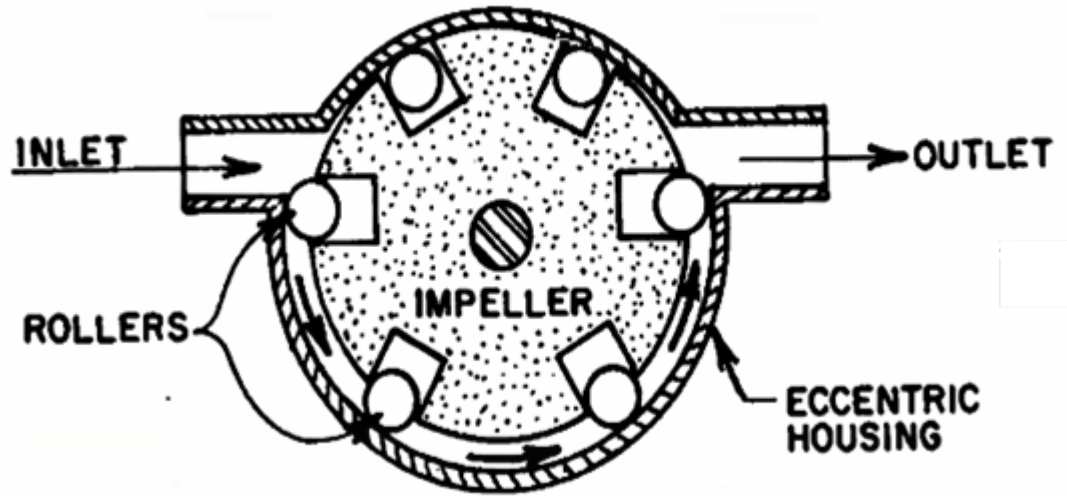
Wide range

Output

Pressures

Herbicides

Rollers can wear



# Piston pump

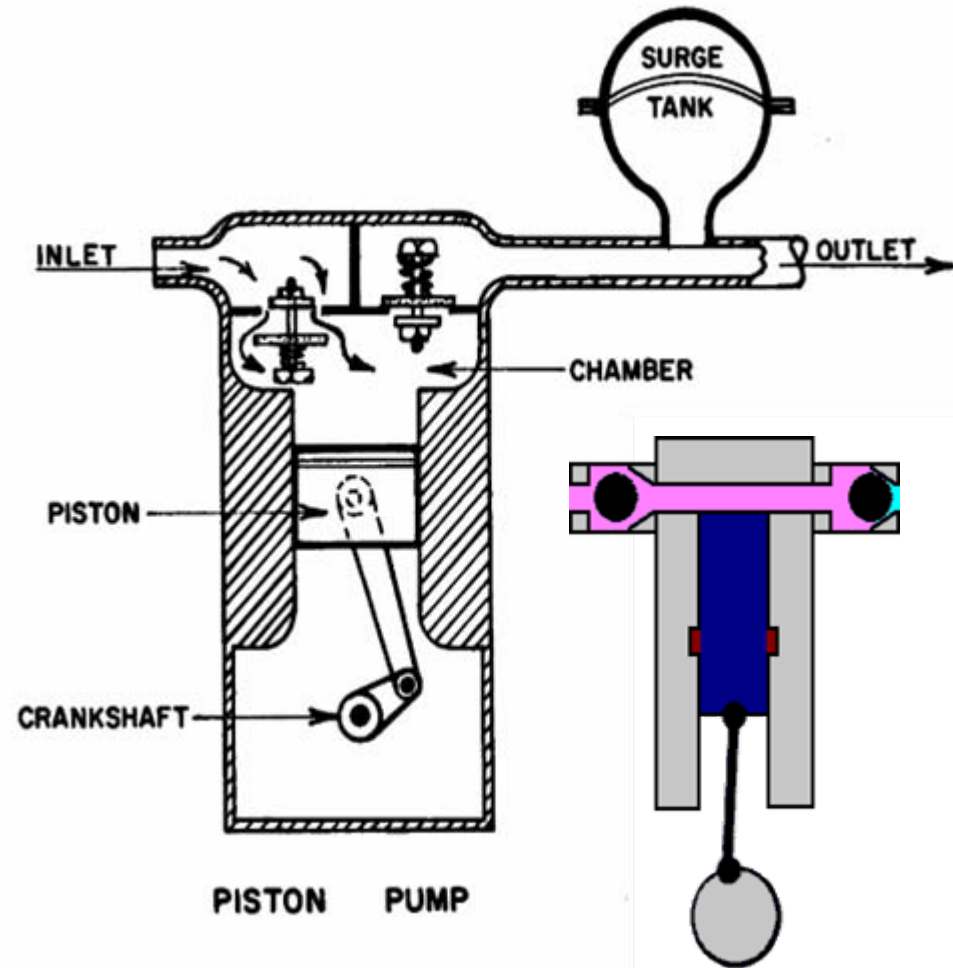
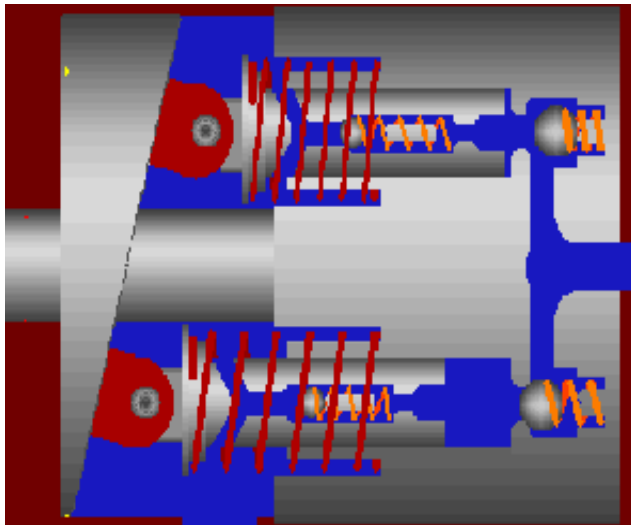
High Pressure

Volume depends on RPMs

Herbicides

Dry Formulations

Parts can wear



# Diaphragm pump

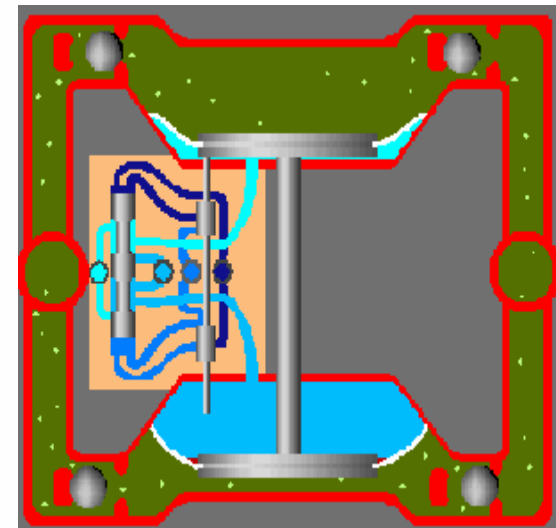
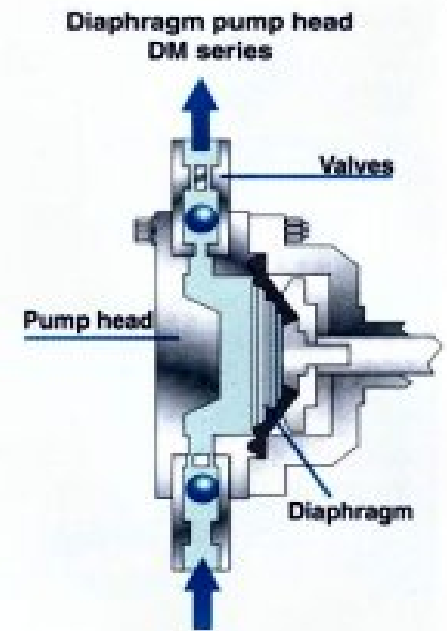
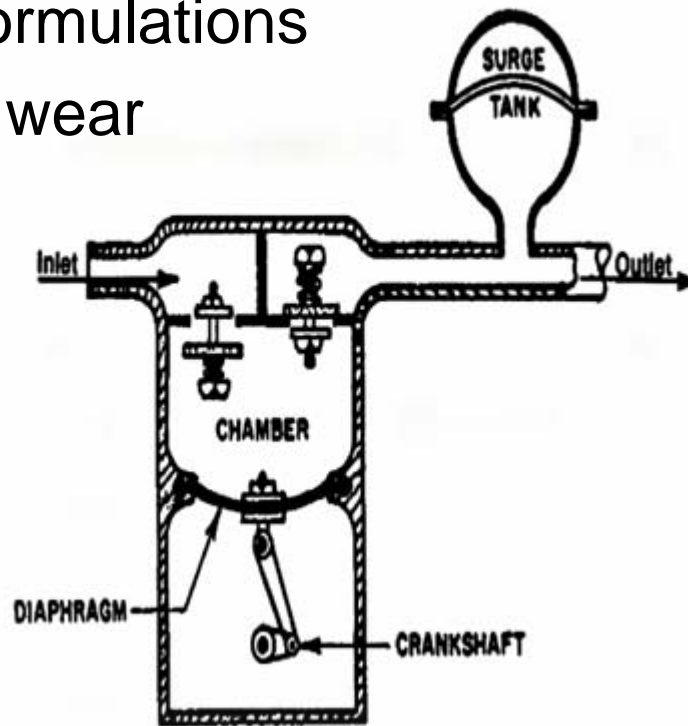
High Pressure

High Volume

Herbicide

Dry Formulations

Part can wear



# Centrifugal pump

Continuous Flow

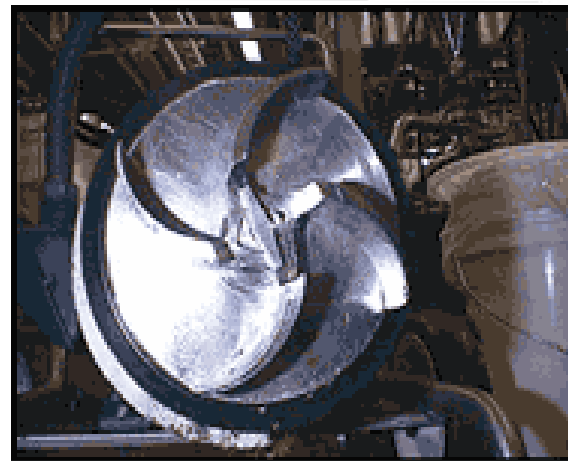
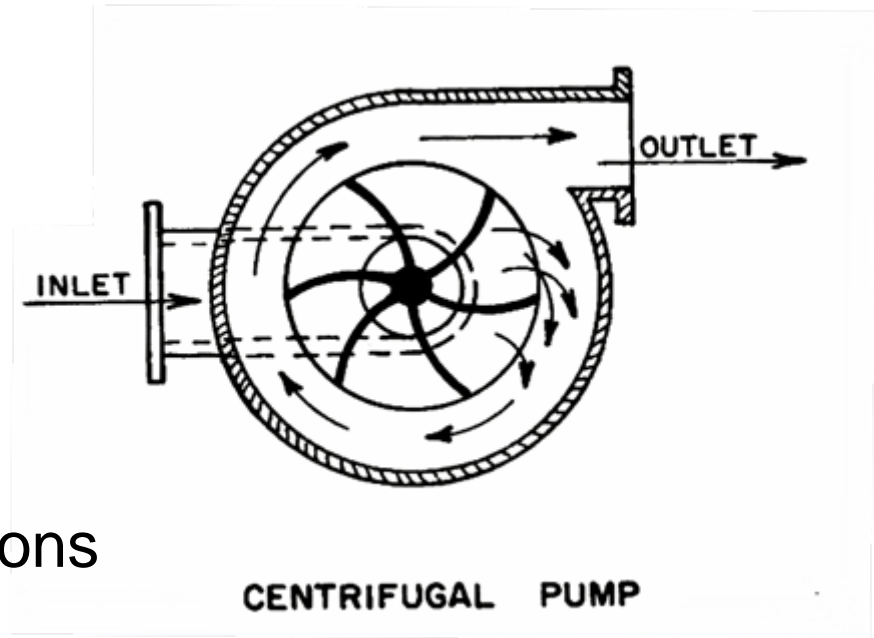
High RPM's

Low Pressures

Durable

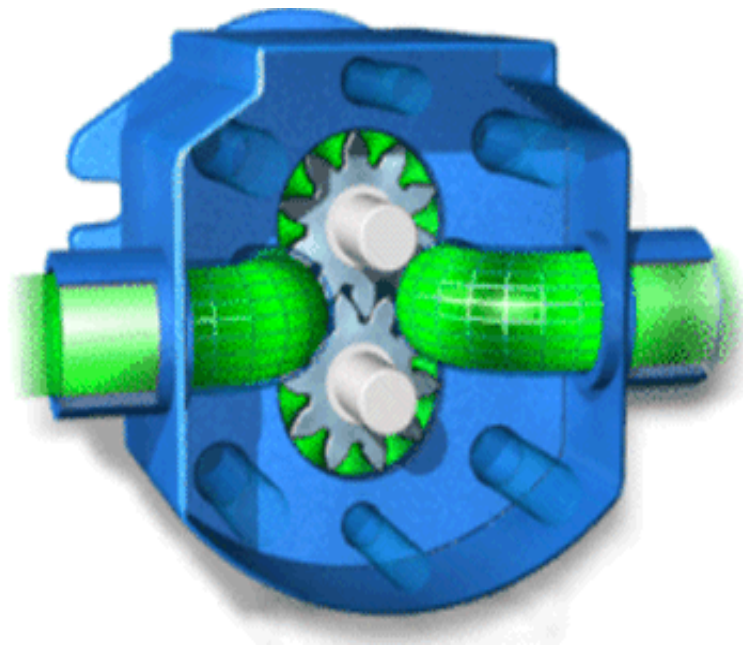
Easy to Maintain

Resistant to dry formulations

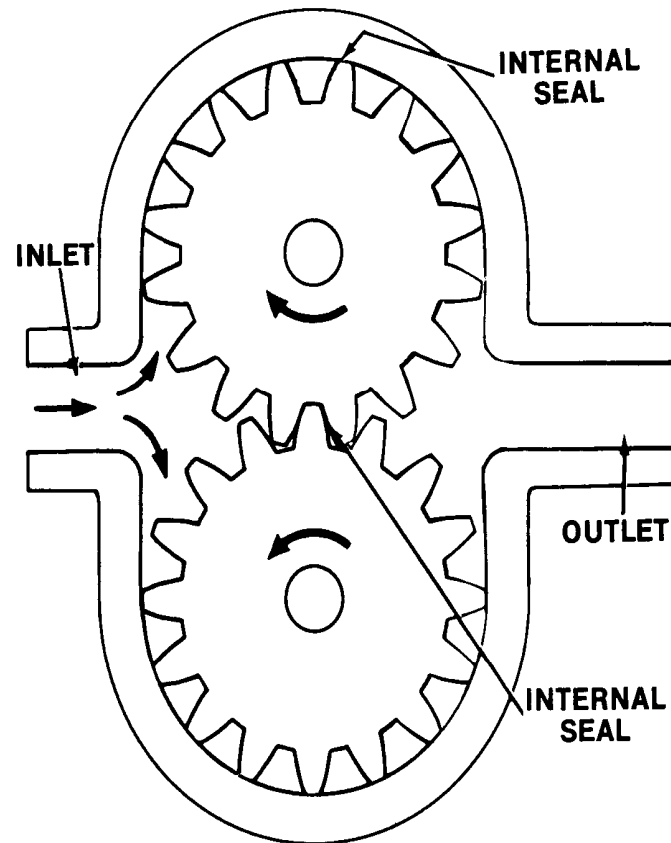




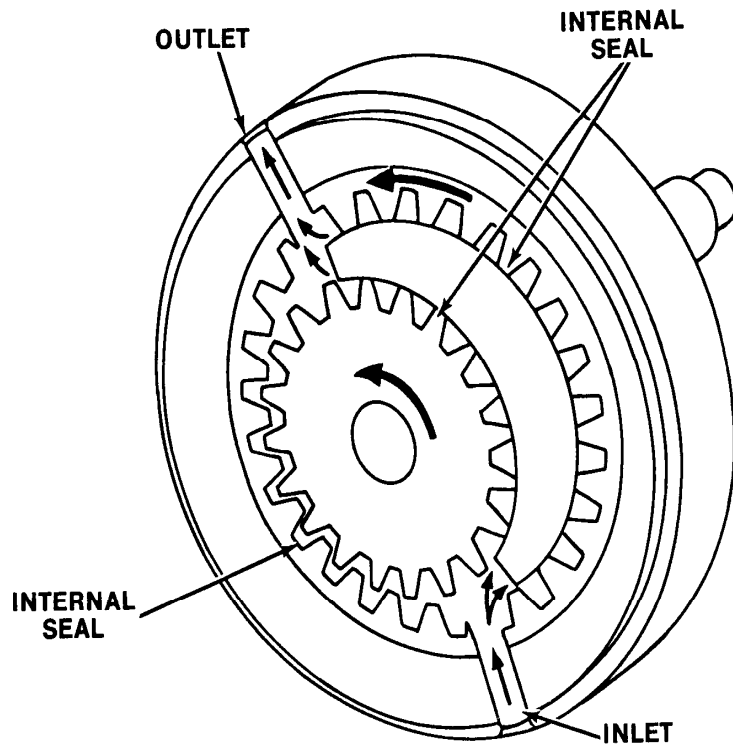
Parts wear rapidly



## EXTERNAL GEAR PUMP

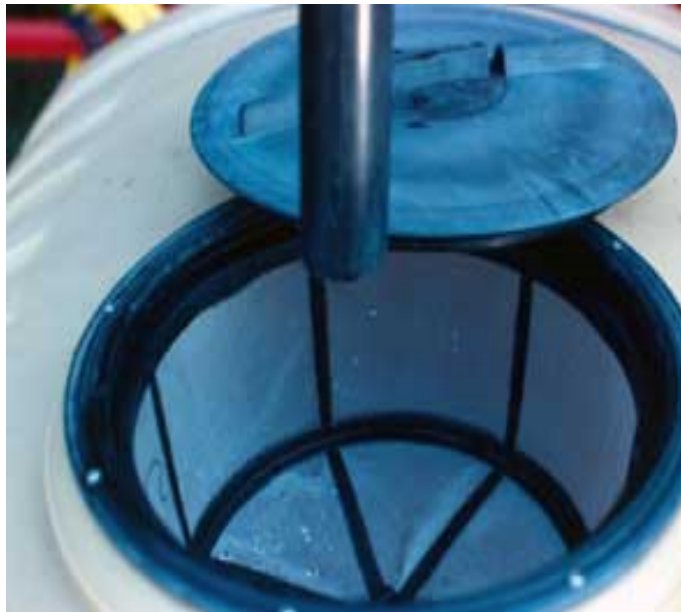


# INTERNAL GEAR PUMP



# Tanks

- requirements
  - large inlet with strainer
  - large drain
  - marker to show liquid level



# Tanks

Fiberglass

Stainless steel

Galvanized steel

Aluminium

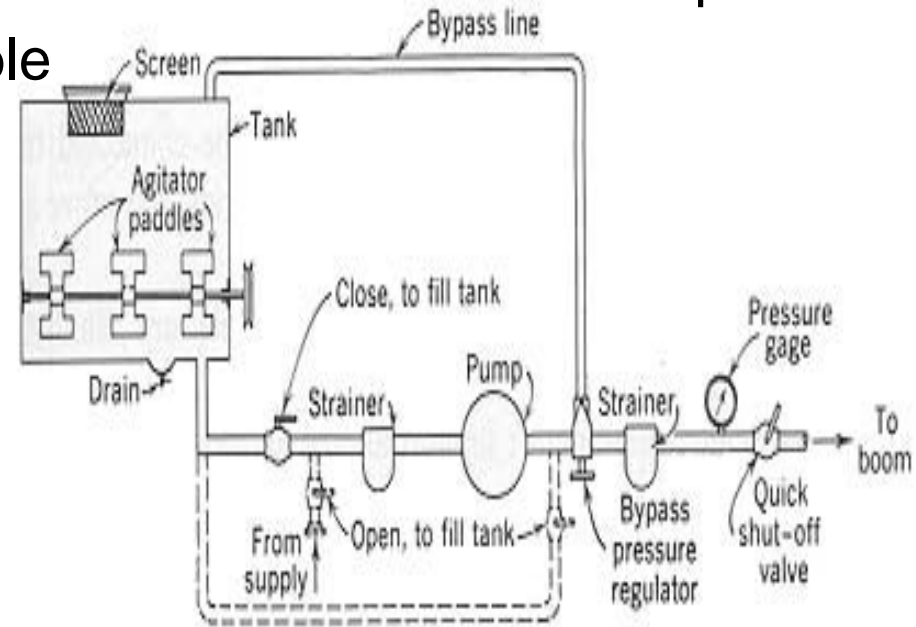
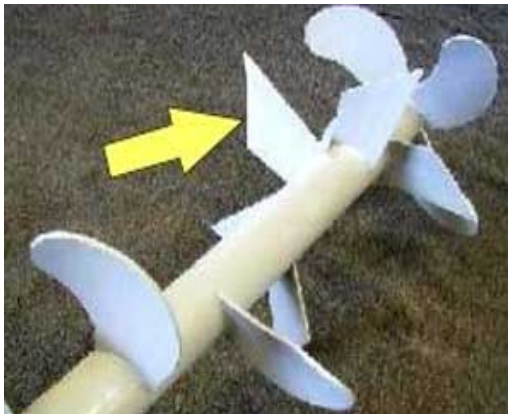
Polyethylene





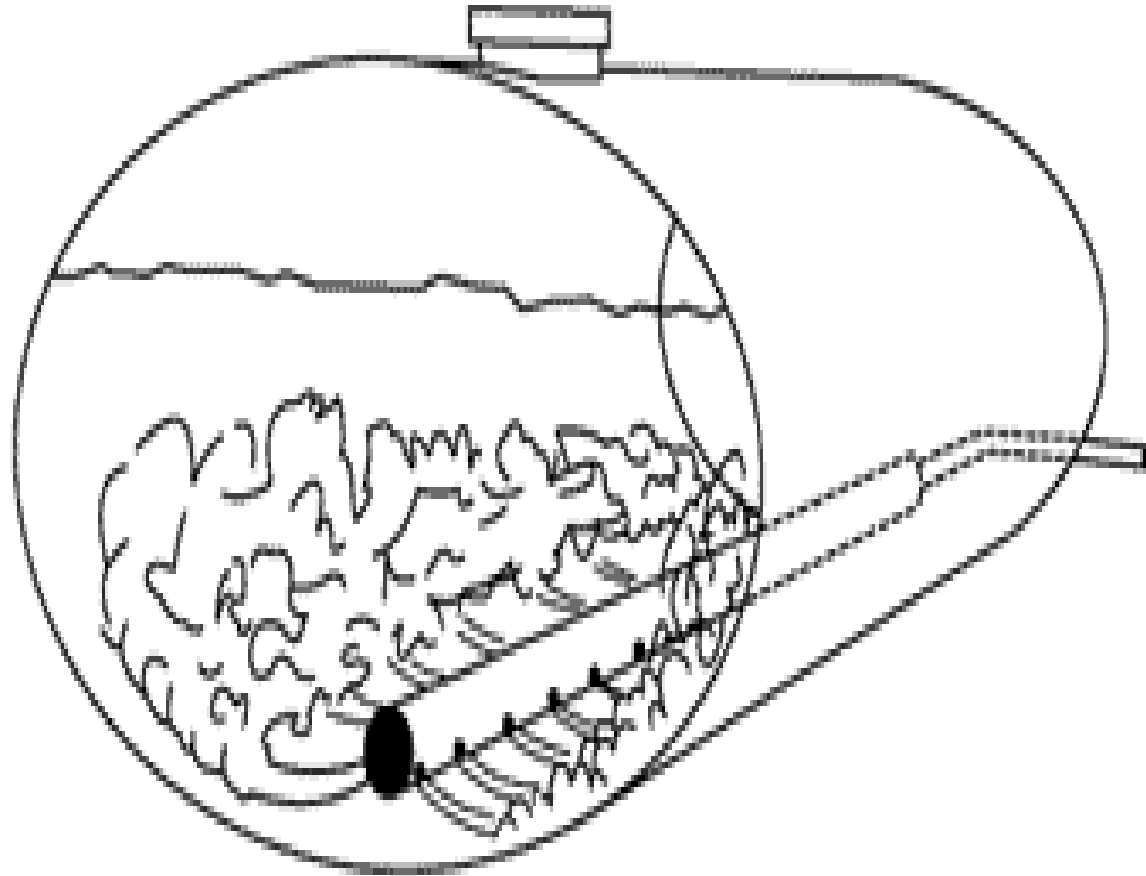
# Agitators

- extremely important if applying formulations that form suspension
- three types of agitators available
- mechanical
- jet (hydraulic action)
- return flow (bypass)



Mechanical Agitation

# Jet agitator



# Return flow (bypass)

