Application in berries:

Optimising application for efficacy and sustainability

September 2025

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AGENDA

1. How important is nozzle size and spray coverage?
2. What do I do if a pesticide that is rain fast after four hours is washed off by an unexpected storm after 1 hour?
3. Time of day and temperature – how these can affect pesticides?
4. Who do I contact and what should I do if I experience plant damage after spraying a chemical?
5. Wind: How do I check wind speed?
6. How accurate is the local weather station?
7. Why preventing spray drift is important

Why application matters in berries

Image source: Croplands.com

Fungicides and insecticides are only as effective as their application

- Dense canopies, delicate fruit & high susceptibility

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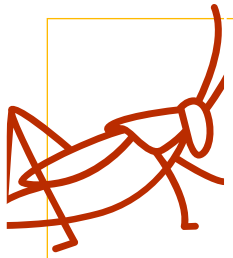
The high cost of inadequate application

Reduced efficacy

- Pests and diseases are not adequately controlled, leading to continued damage and yield loss



Resistance development

- Sub-lethal doses on target organisms accelerate the development of resistance to valuable chemistries

Wasted product & increased costs

- Money spent on ineffective applications

Environmental impact

- Increased risk of off-target movement (drift) and potential for higher overall pesticide use

Economic loss

- Direct impact on yield, quality, and profitability

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Defining “good coverage” in berry crops

Fungicides and insecticides are only as effective as their application

Want to achieve uniform distribution of droplets across *all* target surfaces

Challenges: dense foliage, multiple layers, waxy cuticles and the need for canopy penetration

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Identifying the target

Biological target

The pest or disease to be controlled

Application target

The place where the spray must be deposited for it to reach the biological target

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Nozzle size and droplet control

Nozzle selection dictates droplet size, which profoundly impacts coverage and drift

Smaller nozzles: Produce finer droplets

- Pros: Better coverage, increased surface area contact
- Cons: Higher drift potential, faster evaporation

Larger Nozzles: Produce coarser droplets

- Pros: Reduced drift, better penetration
- Cons: Potentially less uniform coverage, fewer droplets per unit area

Nozzle comparison

Strawberry application Grower nozzle LHS vs Syngenta Defy 04 nozzle RHS

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Droplet size increases with nozzle size

Increasing nozzle size

- As nozzle size increases, so to does the size of the spray quality (droplets) produced by the nozzle

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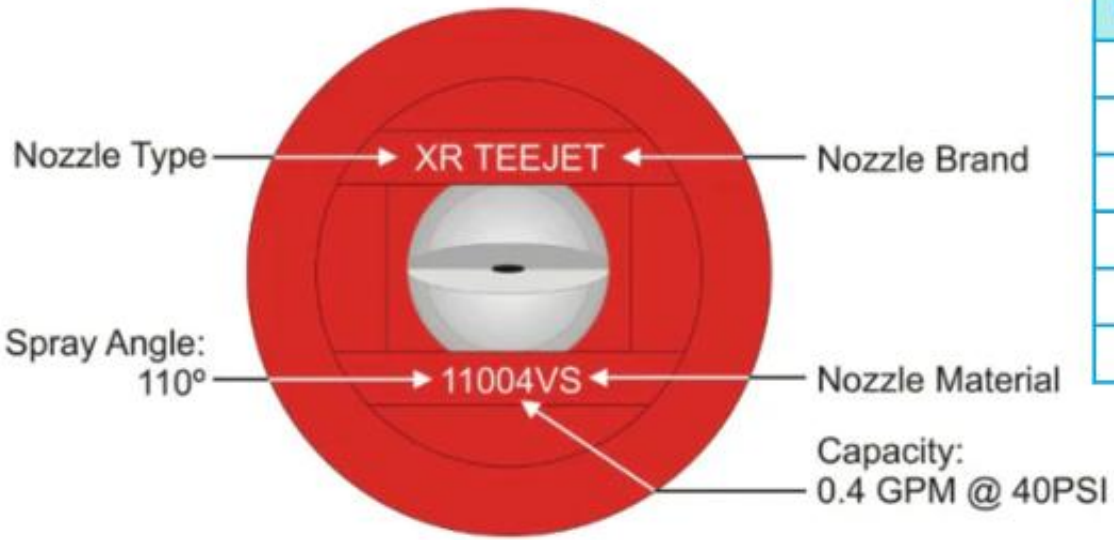
Nozzle identification

Flat Fan nozzles are rated in GPM

(e.g.: XR11004 = 0.4 GPM at 40 psi)

Low flowrate nozzles are rated in GPH

(e.g.: 04 = 4.0 GPH / 0.252361 L/min)



Nozzle Size	Colour
001	orange
015	dark green
002	yellow
025	lilac
003	dark blue
004	red

P=Plastic, S=Stainless Steel, HSS=Hardened Stainless Steel, K=Ceramic, V=VisiFlo, E=Evenspray

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Syngenta nozzle examples

Product	Specification	Spray Angle	Benefits
Syngenta Air Induction Nozzle 	110-02 (Yellow) 110-025 (Lilac) 110-03 (Blue) 110-035 (Maroon) 110-04 (Red)	10° backwards facing (110° fan)	• More droplets per litre for better coverage with a unique structure means drops stick when they land • 10° spray angle increases deposition on front and back of target • Reduce spray drift by up to 75% • Variable pressure (VP) nozzles. Hold spray pattern down to one bar
Syngenta Vegetable Nozzle 	65-04 (Silver) 65-06 (Silver) 65-08 (Gold)	Vertical (65° fan)	• Designed to apply high water volumes and force spray into the crop • 65° fan angle slows down the droplet speed to improve deposition into the crown of target crop (ie. carrots, brassiicas, lettuce)
Syngenta 3D Nozzle 	100-04 (Red)	38° alternating forwards and backwards (100° fan)	• 38° spray angle increases deposition on vertical targets (ie. small grass weeds, onions) • Alternating these nozzles forwards and backwards along the spray boom improves coverage on lower leaves in complex canopies (ie. potatoes) • Provides up to twice the spray deposition of vertical nozzles • Excellent performance at both 50 and 75 cm boom heights, allowing for the boom to be run at a comfortable level above the target without compromising coverage • 60-75% less drift (size dependent) compared to a conventional flat fan nozzle • Variable pressure (VP) nozzles • Hold spray pattern down to 0.7 bar

Droplet dynamics: Reaching every target

Fine droplets

Ideal for contact products on exposed surfaces (e.g., powdery mildew on leaf surface). Can struggle with canopy penetration

Medium droplets

Often a good compromise for general coverage and reduced drift

Coarse droplets

Best for penetrating dense canopies and reducing drift, but may lead to less uniform coverage on individual leaves

Droplet size directly influences how well the spray penetrates the canopy and adheres to surfaces

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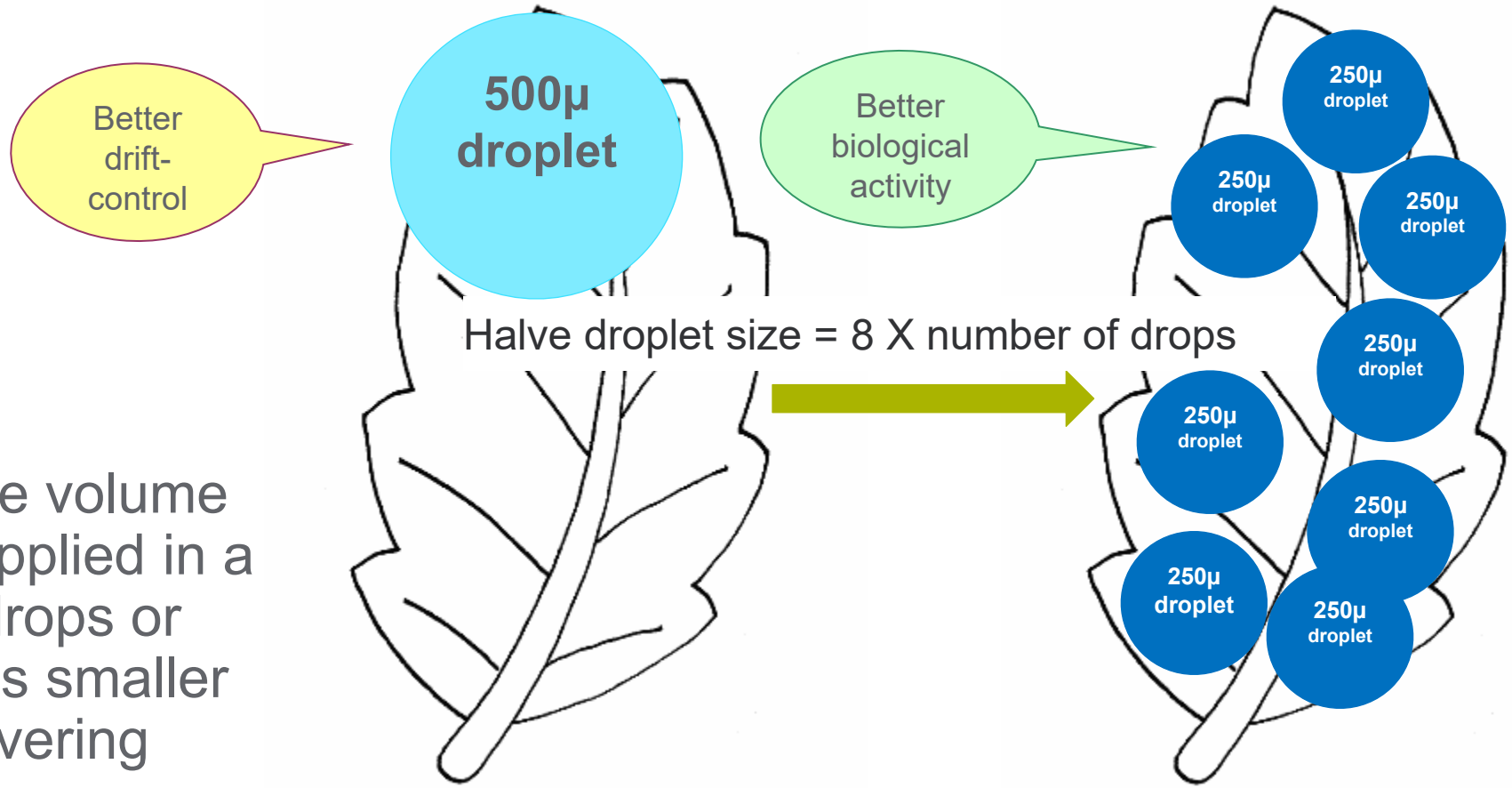
Reducing droplet size increases coverage



The same volume can be applied in a few big drops or numerous smaller drops covering more area

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Retention and adhesion

Retention

Fine droplets can bounce or run off waxy surfaces; very coarse droplets may also bounce. Optimal droplet size ensures good adhesion

Target contact

For systemic products, uniform coverage ensures sufficient uptake. For contact products, direct contact with the pest/pathogen is essential

Evaporation

Finer droplets evaporate faster, reducing the amount of active ingredient reaching the target, especially in hot, dry conditions

Droplet size affects how well the spray stays on the plant and its biological effectiveness

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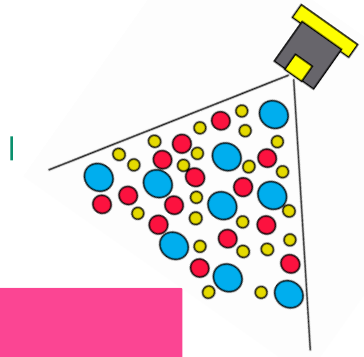
Droplet size and survival time



Droplet size (microns)	Category	Evaporation time*	Travel distance*	
< 50	Aerosol	3 seconds	12 cm	Lost before reaching target
50-100	Mist	13 seconds	1.9 m	Very prone to drift
100-200	Fine spray	3-4 minutes	30 m	Prone to drift
100-350	Fine-medium	Typical target range for foliar application		
>350	Medium-coarse	Risk of bounce & run-off without surfactants		

*Survival time and fall distance estimated at Delta T of 10°C

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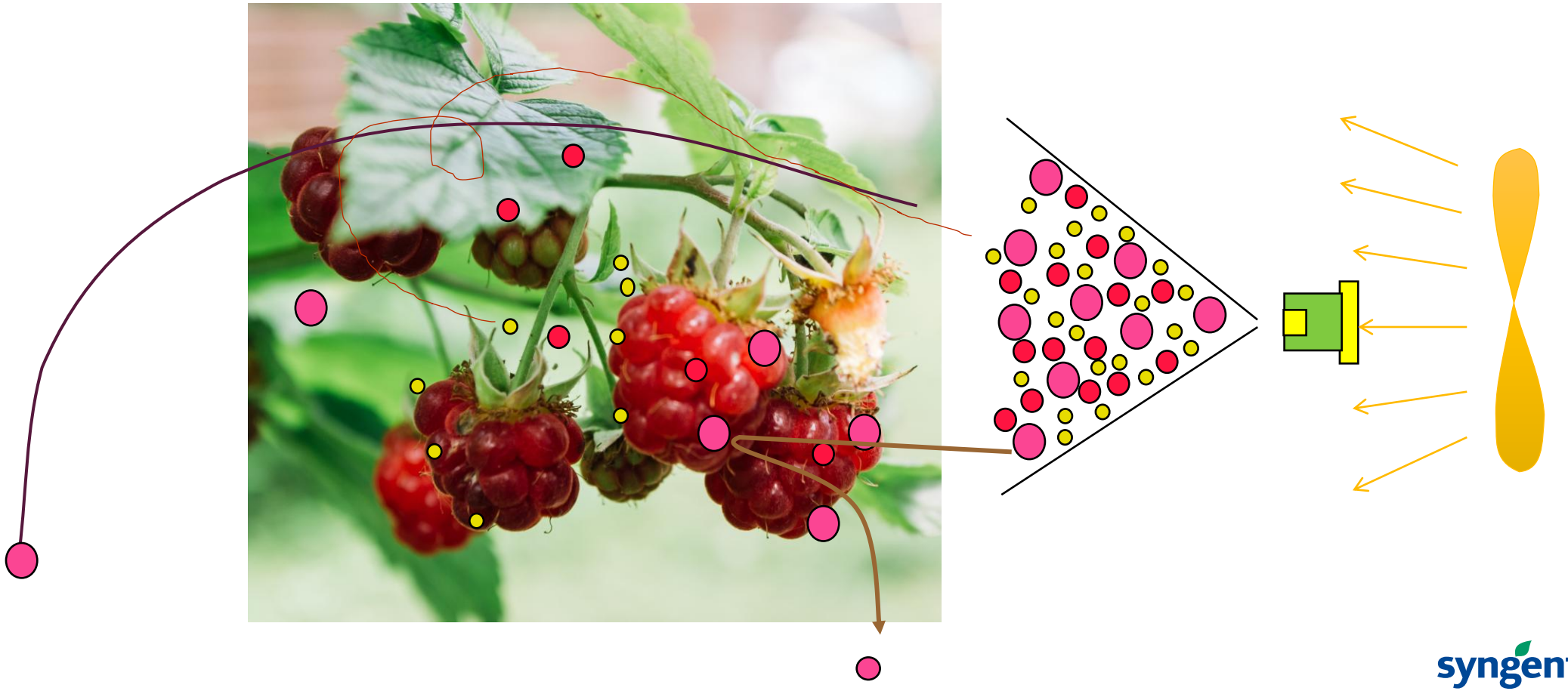
Large and small droplets behave differently

Large droplets move straight and down and can bounce off the target

Small droplets swirl with air turbulence and can deposit behind target



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Spray volume and its relationship to coverage

Low volume

Can be efficient but requires very fine droplets and precise application to ensure adequate coverage. Higher risk of uneven distribution

High volume

Provides more thorough wetting and penetration, often preferred for dense canopies or difficult-to-reach targets. Can lead to runoff if excessive

Calibration

Essential to match nozzle output, pressure, and ground speed to achieve the target spray volume per acre

Appropriate spray volume, in conjunction with nozzle choice, is crucial for achieving desired coverage

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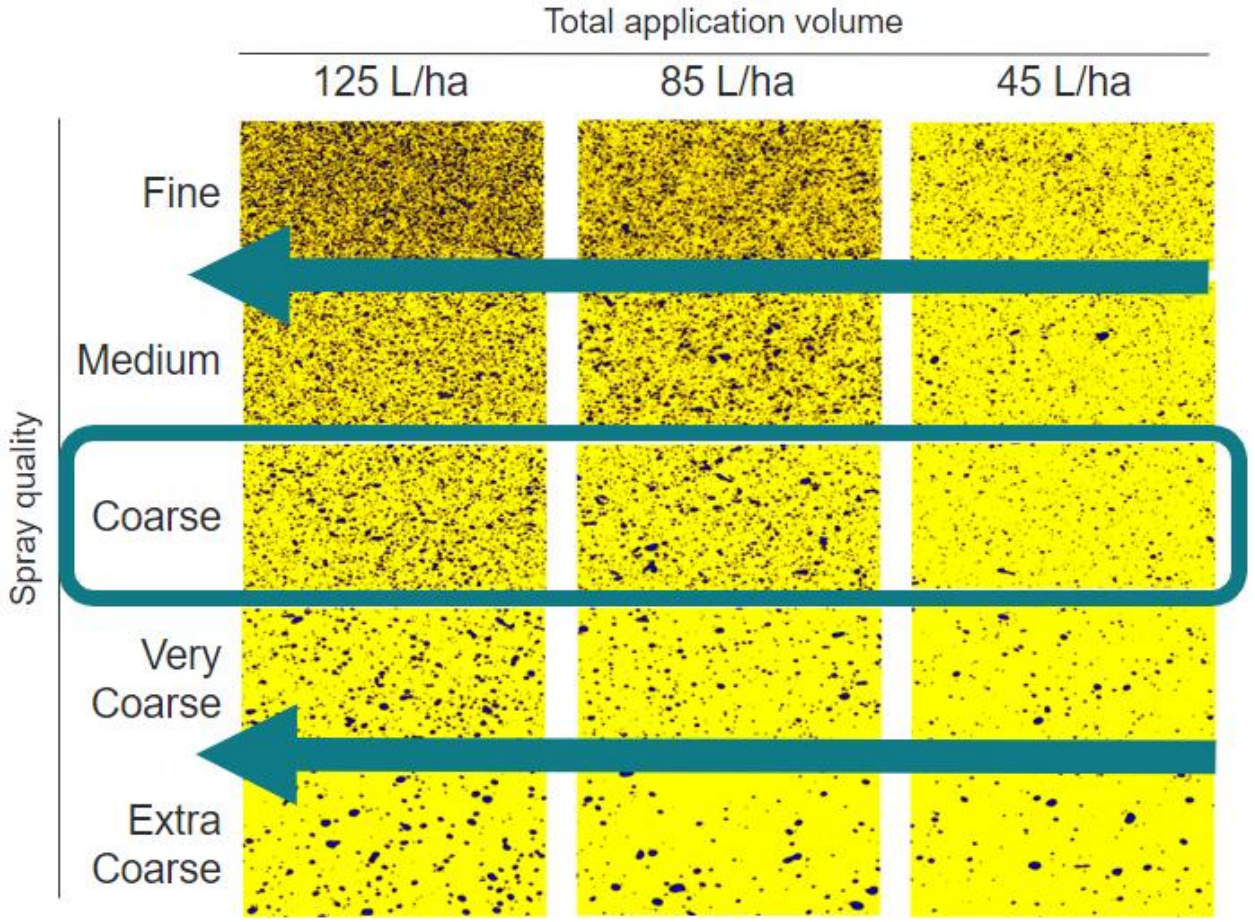
Spray quality and water rate effect on droplet density



Source: https://sprayers101.com/

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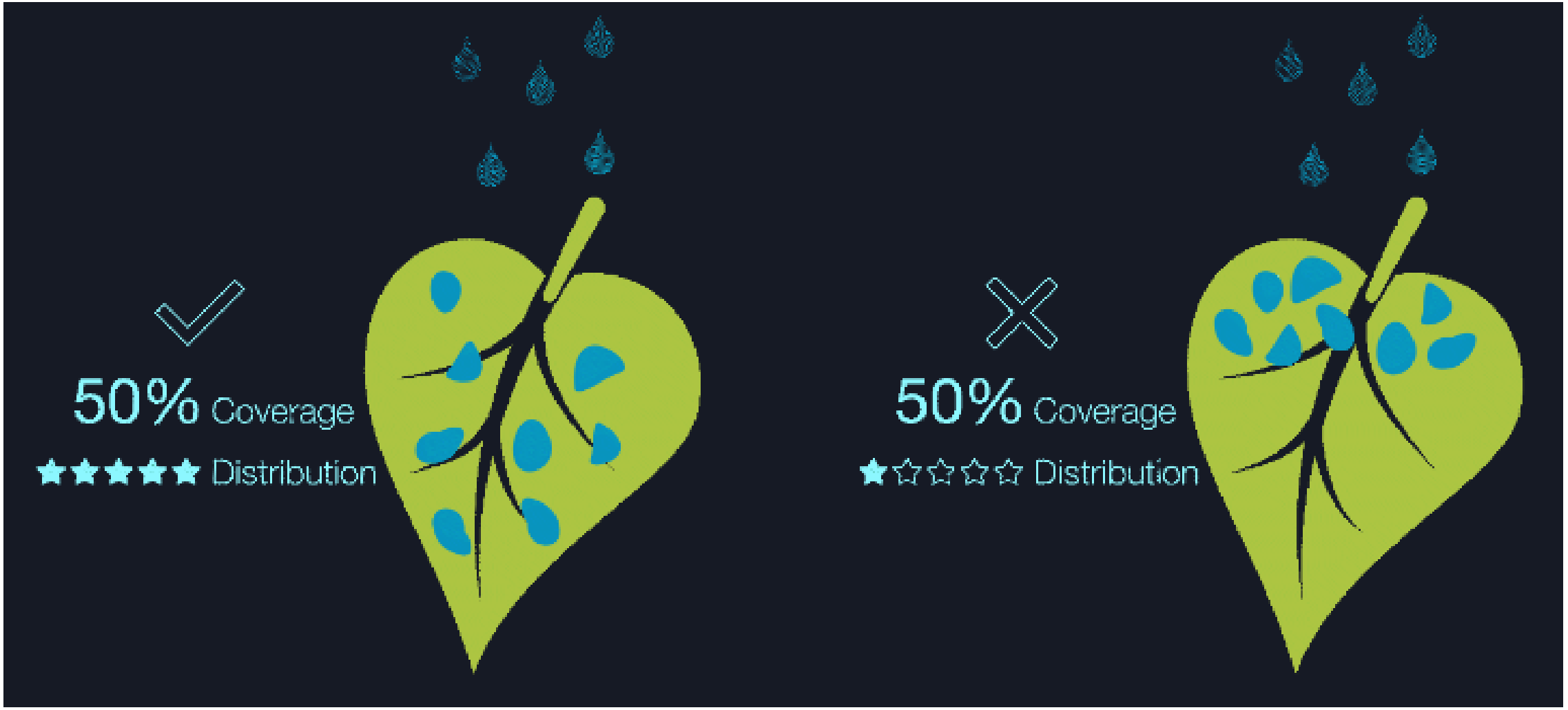
Goal is to achieve even coverage *AND* distribution to all target surfaces



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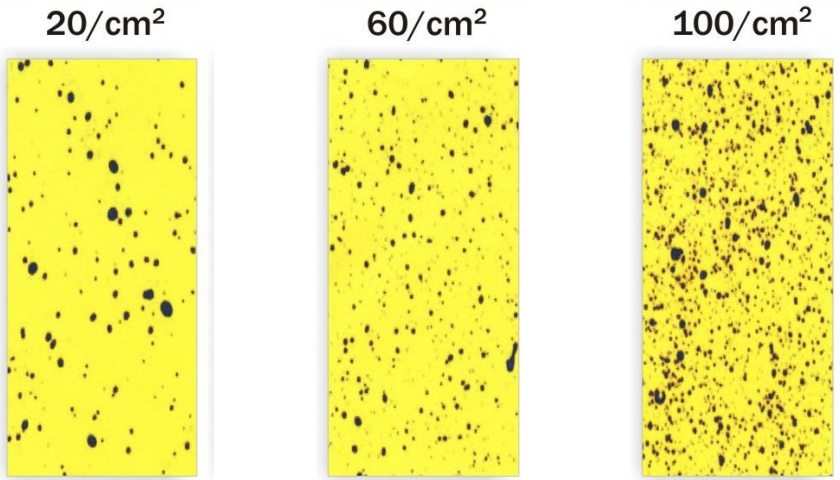
Optimal droplet density

Product	Type	Droplets/cm2
Insecticides	Mobile insects	60 – 100
	Systemic (Xylem Mobile)	20 – 30
	Contact / Translaminar	50 – 70
Herbicides	Pre-emergent	20 – 30
	Post-emergent	30 – 50
Fungicides	Systemic (Xylem Mobile)	20 – 30
	Contact / Translaminar	50 – 70
Foliar nutrients		20 – 30



Recommended minimum droplet density changes with product type

Source: https://sprayers101.com/

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Environmental considerations

TEMPERATURE

- Evaporation increases with temperature

HUMIDITY

- Evaporation increases as humidity decreases

- Droplets reduce in size or evaporate completely
- Smaller droplets evaporate faster
- Droplets that reach the plant may dry too quickly
- Plant uptake of actives is diminished

Counteract with higher water volumes or by adjusting spray quality to improve penetration

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Delta T – an atmospheric moisture parameter

- Wet bulb temperature minus dry bulb temperature
- A better indication of water evaporation rate & droplet survival time than relative humidity
- Higher Delta T means faster droplet evaporation
- 2-8 considered optimal range for spray application

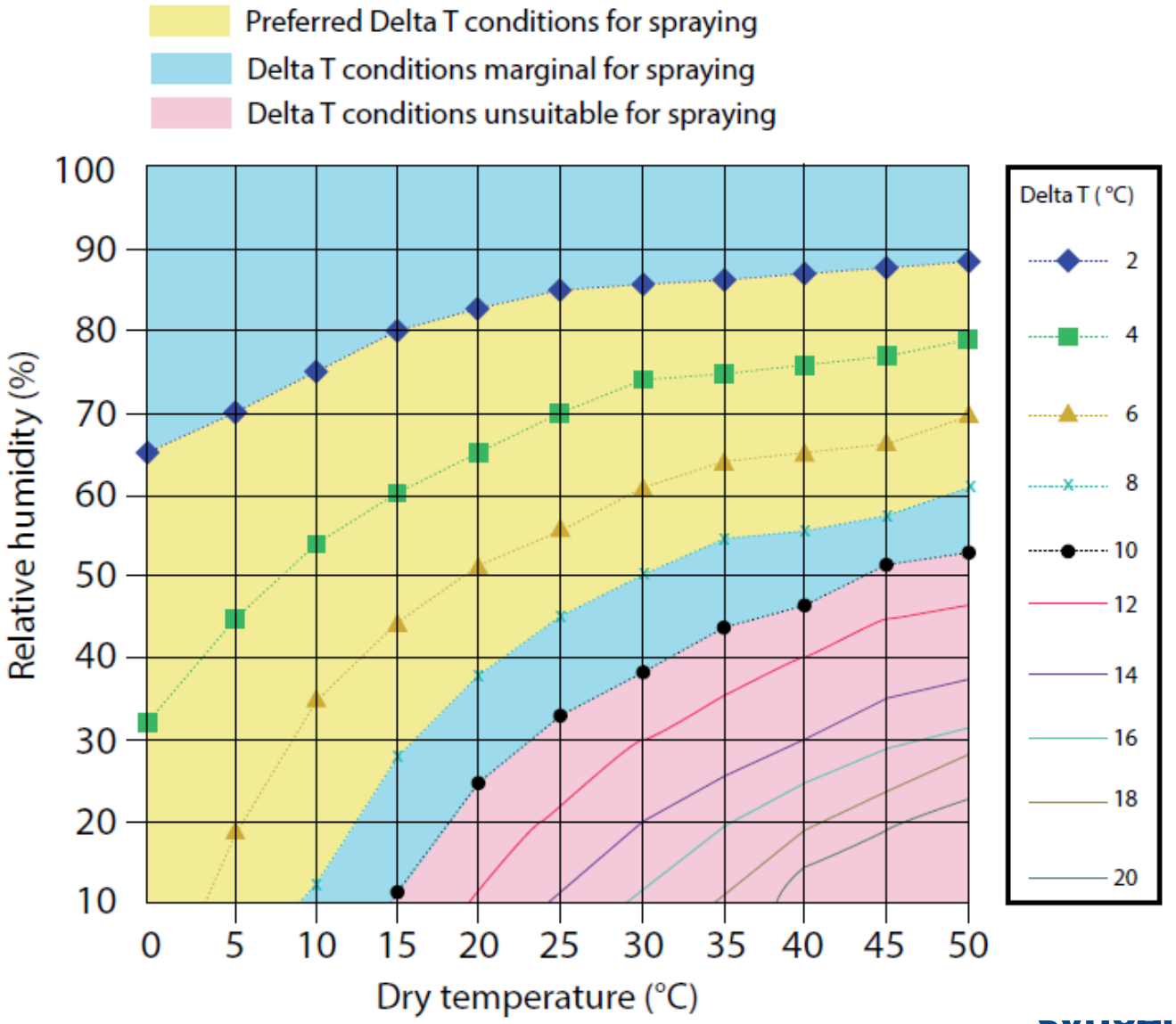

Image source: DPI NSW Berry Plant protection guide 2023-2024

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Beyond nozzles: other factors affecting coverage

Application pressure	Influences droplet size and spray pattern
Ground speed	Too fast, and coverage is reduced; too slow, and runoff may occur
Canopy density & architecture	Requires adjustments in boom type & angles, pressure, water volume & fan speed
Environmental conditions	Wind (drift), temperature & humidity (evaporation)
Adjuvants	Can improve spreading, sticking, and penetration of spray droplets

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Rainfastness

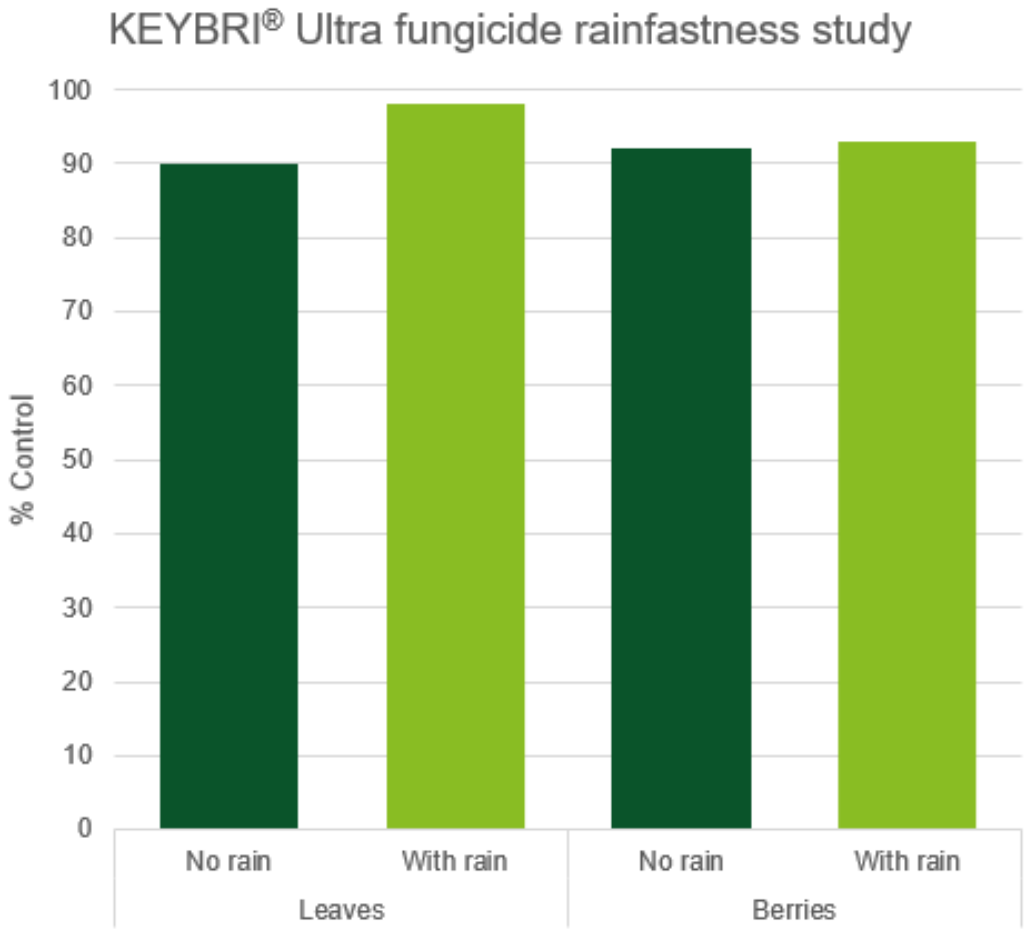
A function of chemical properties and formulation

- Product testing to determine length
- Not related to environmental restraints
- Affinity for wax (hydrophobicity) + solubility
- Leaf wetness prior to rain
- Amount of rainfall

Bravo® Weather Stik®

Ridomil® Gold MZ WG

Miravis™ Prime



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Suspected crop damage?

PREVENTION: Read product labels, test small areas, **seek advice first**

- Reporting – contact your retail agronomist
- Investigation – ensure accurate records available including spray records
- Document carefully – representative photographs, mapping and detailed notes
- Crop symptoms – injury type & location
- Extent of damage – localised or widespread

Image source: Cornell College of Agriculture and Life sciences

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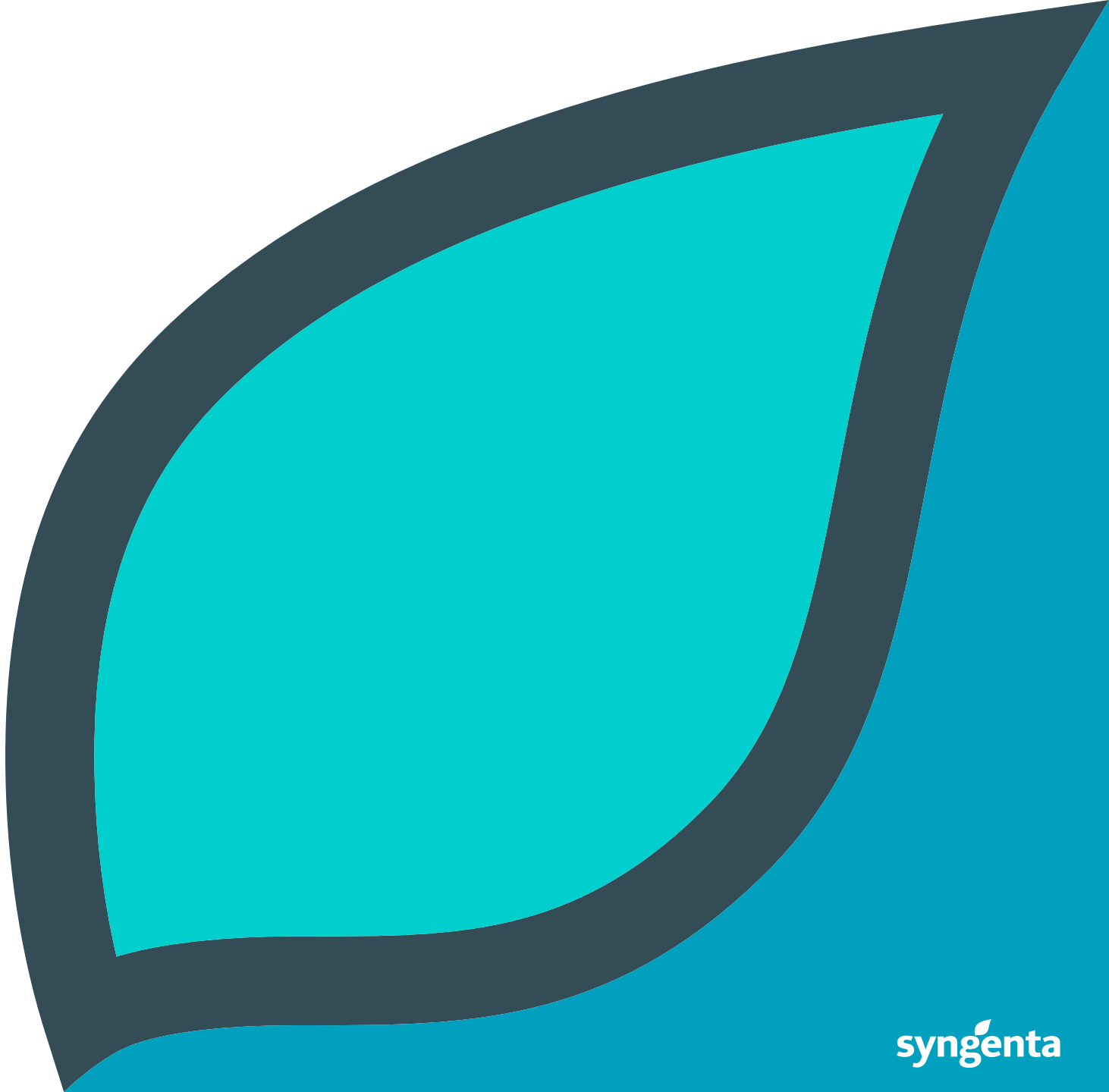
Minimising off-target movement: Effective strategies for spray drift reduction



What is spray drift and why is it a concern?

Definition: The physical movement of spray droplets or vapor away from the intended target area during or immediately after application

Impacts of drift

Reduced Efficacy	Crop Damage	Environmental Contamination	Regulatory & Legal Issues	Economic Loss
Less product reaches the target, leading to poor pest/disease control	Injury to sensitive non-target crops	Pollution of water bodies, non-target plants, and wildlife habitats	Fines, lawsuits, and loss of public trust	Wasted product, yield reduction, and potential legal costs

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Precision application: Optimising sprayer operation

Proper sprayer setup, calibration, and operational practices are essential for minimizing drift

Boom height

- Keep boom as low as possible while maintaining uniform coverage. Higher booms increase the distance droplets travel, increasing drift risk

Ground speed

- Maintain a consistent, appropriate ground speed. Excessive speed can increase turbulence and shear, leading to finer droplets and increased drift

Sprayer calibration

- Regularly calibrate your sprayer to ensure accurate application rates and uniform spray patterns. This prevents over-application and ensures optimal droplet size

Adjuvants

- Select appropriate drift reduction adjuvants (DRAs) to modify spray characteristics, reducing the number of fine droplets and improving deposition

Maintenance

- Ensure all sprayer components (nozzles, hoses, pumps) are in good working order to prevent leaks and inconsistent spray patterns

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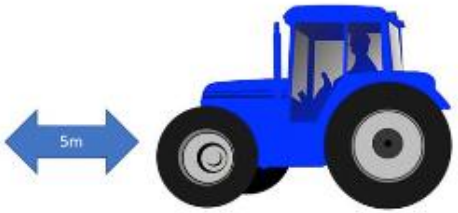
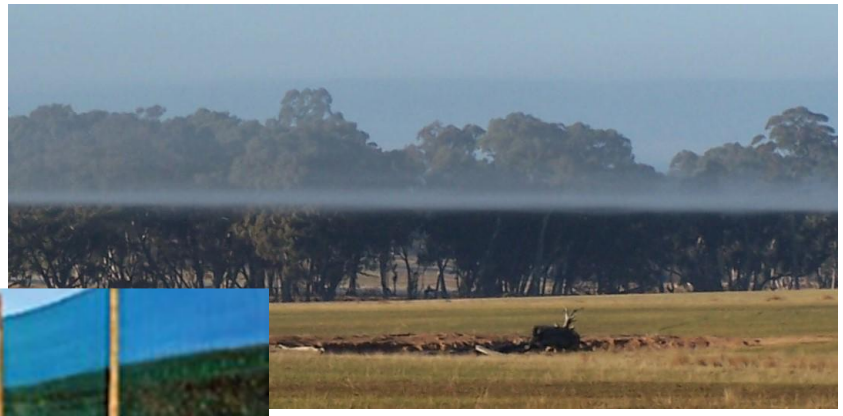
Environmental awareness & responsible application

- Wind speed & direction
- Inversions
- Temperature & humidity
- Buffer zones
- Record keeping
- Continuous learning





https://agriculture.vic.gov.au/farm-management/chemicals/spraying-agricultural-chemicals/managing-spray-drift

https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/566349/Berry-plant-protection-guide-2025-web.pdf

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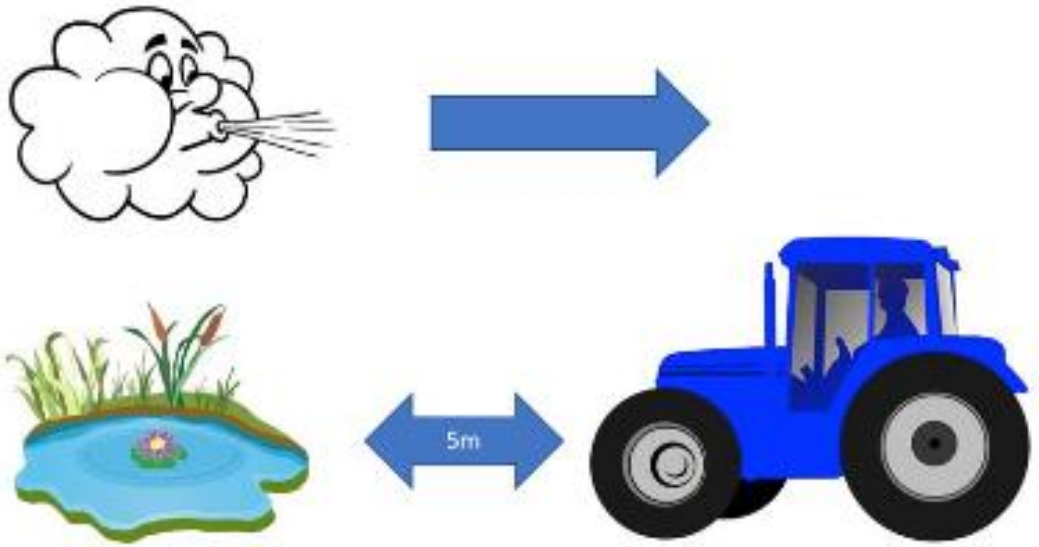
Downwind sensitive areas

Miravis™ Prime



DO NOT apply by a vertical sprayer unless the following requirements are met:

- **spray is not directed above the target canopy**
- **the outside of the sprayer is turned off when turning at the end of rows and when spraying the outer row on each side of the application site**
- **for dilute water rates up to the maximum listed for each type of canopy specified, minimum distances** between the application site and downwind sensitive areas (see 'Mandatory buffer zones' section of the following table titled 'Buffer zones for vertical sprayers') are observed.

Buffer zones for vertical sprayers					
Type of target canopy	Bystander areas	Natural aquatic areas	Pollinator areas	Vegetation areas	Livestock areas
All	0 metres	5 metres	0 metres	0 metres	0 metres

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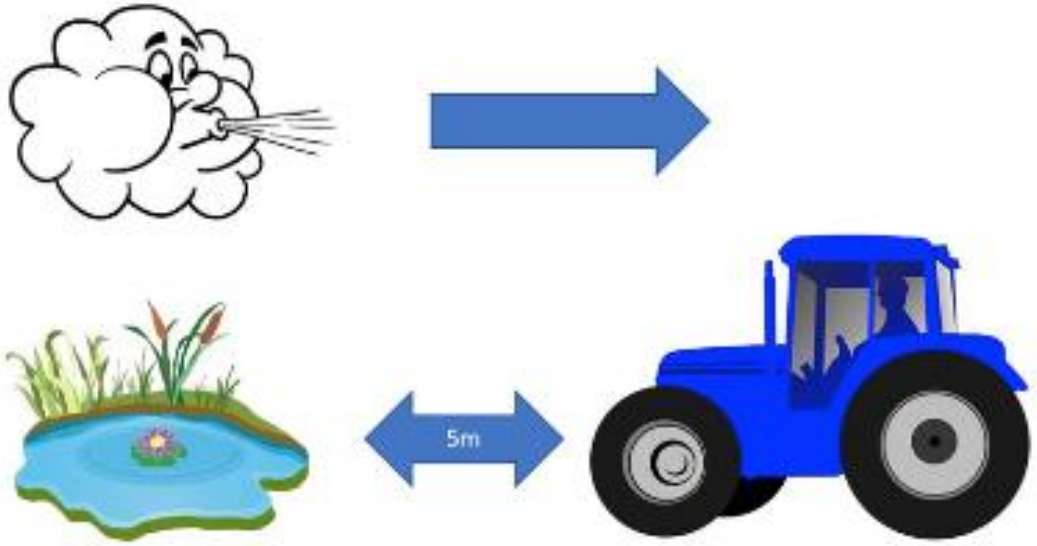
Downwind sensitive areas

A watercourse is a river, creek or other natural watercourse (whether modified or not) in which water is contained or flows.

Natural aquatic areas are where a ‘watercourse’ (as defined by the *Commonwealth Water Act 2007*) with the following exceptions:

- artificial ‘watercourses’ used exclusively for agricultural or ornamental purposes, such as irrigation channels, flood irrigation areas, farm dams, ornamental ponds, golf course dams and those used for agricultural production
- ‘watercourses’ that are dry at the time of pesticide application
- ‘watercourses’ that are commonly identified as ‘puddles’



Shelf life of chemicals

- All agricultural chemical products can undergo changes during the time that they are transported and stored, these can include chemical and physical changes.
  - These changes will occur at different rates and depends on the nature of the active constituent(s), the non-active components, the formulation type, the packaging and, most notably, the storage conditions (temperature, light and humidity).
  - The product will continue to be deemed fit for purpose if these changes have no adverse effects on the application, biological performance, or the safety of operators, consumers, or the environment.
- As a leading R&D crop protection company Syngenta spends many years of trial work and millions of dollars on formulation development, including testing the shelf life of our crop protection range.
  - This trial work is backed up by many years of real-time storage stability testing.
- As such, Syngenta products do not have an expiration date, apart from RIDOMIL® Gold MZ which is 3 years, in accordance with Australian Pesticides and Veterinary Medicines Authority (APVMA) legislation.
- **The shelf life of the Syngenta range of crop protection is at least three (3) years from the date of manufacture (DOM).**

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Chemclear

How the program works

- ChemClear provides a **safe and responsible way** for agricultural and veterinary chemical users to dispose of unwanted, outdated, or unknown chemicals. **Here's how the program works**.

1. Inventory your chemicals

Make a list of all your unwanted or outdated agricultural chemicals, noting details like product name, container size, and the condition of each item. This will help ensure everything is ready for registration.

2. Register your chemicals

Register your chemicals online or by calling our toll-free number (1800 008 182). You'll receive a reference number, and ChemClear will classify them as Group 1 (free collection) or Group 2 (disposal fee applies).

3. Store safely

Keep your chemicals in a secure area, away from people, animals, and potential hazards. ChemClear will send you storage stickers to help label and identify your chemicals until collection day.

4. Drop off your chemicals

Once a collection is scheduled in your area, you'll be notified of the date, location, and time. Transport your registered chemicals to the designated collection point safely, using a ute or truck.

5. Safe disposal

ChemClear's professional team will collect and safely dispose of your chemicals. 98% of chemicals are repurposed as an alternate fuel source for industries like cement manufacturing. The remaining 2% are treated using specialised technologies, such as Plasma Arc, or stabilised for secure landfilling. All disposal follows strict Environmental Protection Authority guidelines.

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Take home messages

Invest in proper application technology and training to protect your berry crops, optimize returns, and ensure sustainable practices

- Nozzle size, spray quality and spray coverage are paramount for successful berry pest and disease management
- Understand your target pest/disease and crop canopy:
  - Select the appropriate nozzle type and size for the desired droplet spectrum
  - Calibrate your sprayer regularly to ensure correct spray volume and pressure
  - Monitor environmental conditions and adjust application parameters accordingly
  - Utilize water-sensitive paper or other tools to verify coverage