PPCNZ Plant Protection Chemistry NEW ZEALAND

Brief Report prepared for Zespri Ltd **09 May 2012**

Visualising spray coverage on expanding kiwifruit leaves

The effect of kiwifruit leaf expansion on protectant sprays has not been quantified to date. A project was undertaken to visualise how spray coverage changes on a leaf over a period of growth expansion, after application to newly emerged leaves. Because of the project timing (late autumn), rapidly expanding new foliage was not available on kiwifruit vines and so the rapidly-growing broadleaf, cotton (*Gossypium hirsutum*), was also investigated as a substitute leaf surface. Both kiwifruit and cotton leaves have similar moderately-easy-to-wet adaxial (upper) leaf surfaces.

A range of dyes were tested to monitor leaf coverage. Most dyes failed to provide sufficient contrast to be useful, or their intensity diminished too rapidly over time (Fig. 1). A fluorescent dye (Yellow Fluorescent Pigment SC, ex SARDI) was found to have the greatest intensity over time, but it has limited solubility in water. Applied to run-off in water, this dye failed to produce even spray coverage and was concentrated mainly in the leaf veins. Thus the dye was applied (at 2% v/v) in 50% aqueous ethanol solution with the addition of Du-Wett adjuvant (0.1%) to ensure the most even spray coverage possible.

Fig. 1: Decay of Blankophore P fluorescent dye solution over time, applied to broad bean foliage

Treatment application – day 0

Day 1 after treatment application

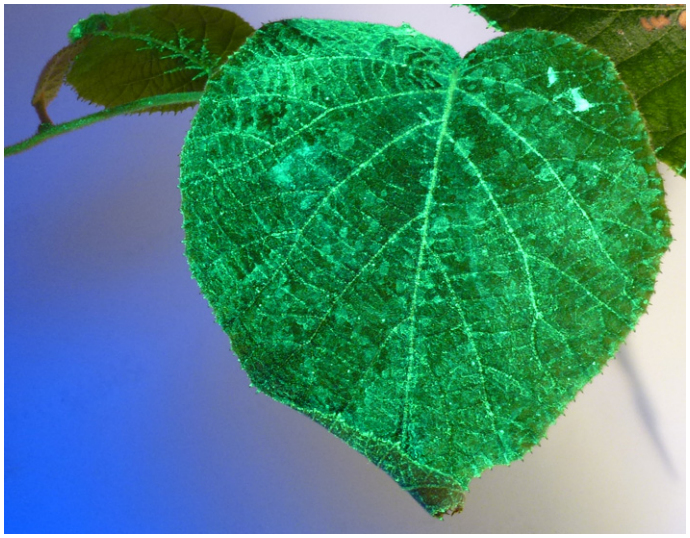
Dye application to leaves

The dye was applied in solution as described above to the adaxial surface of the youngest leaf on a healthy Hort 16A vine. It was photographed under UV illumination immediately after application and at four intervals up to 14 days after (Fig. 2). The kiwifruit potted vine was maintained well-watered in a controlled environment cabinet throughout at 23/20ºC day/night temp and 70% rh to promote new leaf expansion.

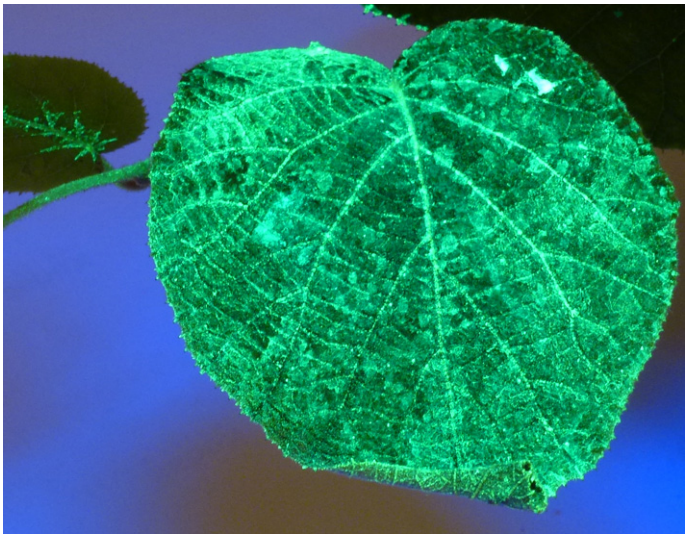
Fig. 2: Spray coverage on an expanding kiwifruit leaf over 14 days after application

Treatment application - Day 0

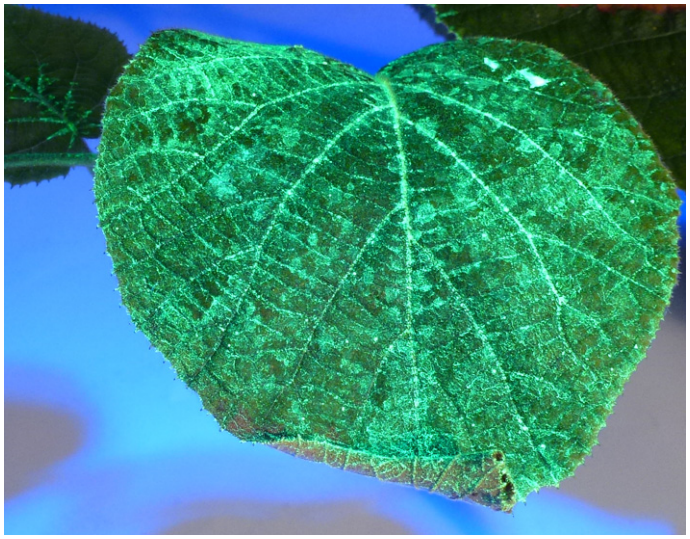
Day 1 after treatment application



Day 4 after treatment application



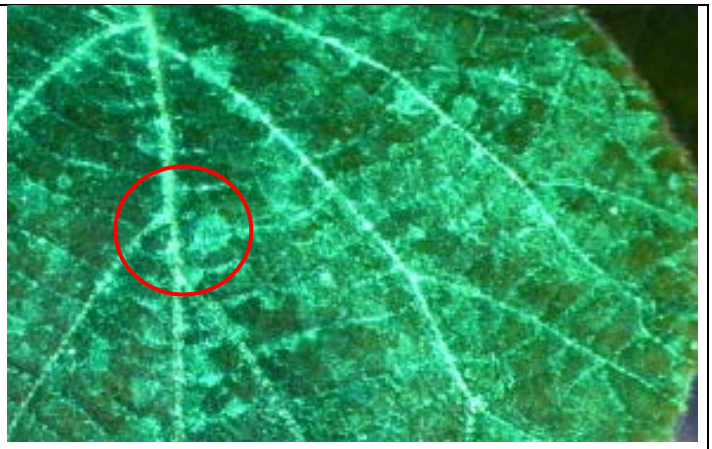
Day 5 after treatment application



Day 14 after treatment application

While growth expansion of the kiwifruit leaf was limited, it was obvious that coverage was reduced only by cell expansion (Fig. 2). Deposit boundaries were increased in size with the expanding leaf, and presumably the molecular density of deposits within these boundaries decreased accordingly (Fig. 2A). Correspondingly, the distance between deposits increased with leaf expansion (Fig. 2A).

Fig. 2A: Close-up of spray coverage on an expanding kiwifruit leaf at application and at 14 days after application

	
Leaf at time of treatment application	Leaf 14 days after treatment application

The dye application was also repeated on the youngest leaf of a four week old (from time of sowing) cotton seedling growing under the same conditions as the kiwifruit vine (Fig. 3). The same pattern of deposit coverage and growth dilution as on kiwifruit was visible on cotton, but was more obvious because of the faster and greater leaf expansion of the cotton seedling (Figs 3 & 3A).

Fig. 3: Spray coverage on an expanding cotton leaf over 14 days after application

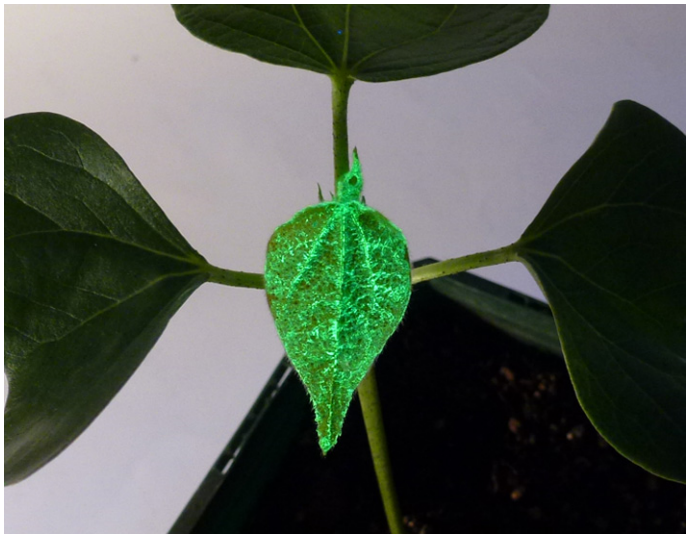
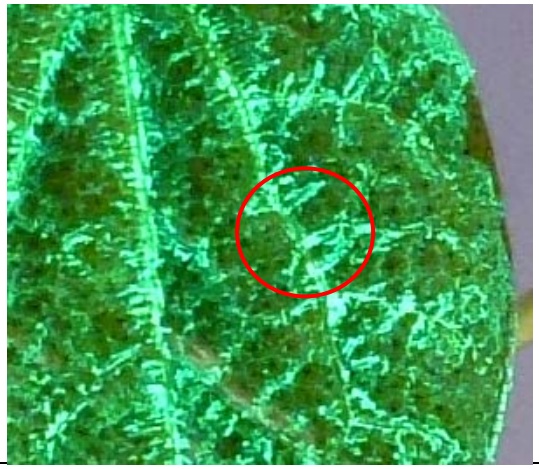
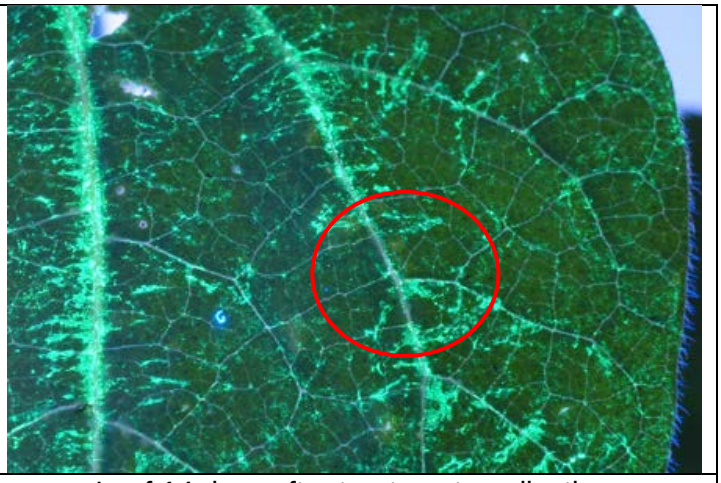
	
Treatment application - Day 0	Day 1 after treatment application
	
Day 4 after treatment application	Day 5 after treatment application
	
Day 14 after treatment application	

Fig. 3A: Close-up of spray coverage on an expanding cotton leaf at application and at 14 days after application

	
Leaf at time of treatment application	Leaf 14 days after treatment application

Conclusion

As expected, it appears that spray deposit coverage on new foliage of kiwifruit is reduced by leaf expansion/growth. Spray applied to newly emerged leaves will be distributed similarly across the entire leaf when it is fully expanded but there will be gaps in coverage due to the increase in leaf area. Whether this will reduce efficacy of a protectant spray depends on the mode of action of individual chemicals.

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