Factors affecting spray deposits and their biological effects on New Zealand apple canopies

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by

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Abstract

A series of apple tree spraying experiments was conducted to identify factors affecting agrichemical deposits from airblast sprayers and to relate deposit observations to biological responses in selected pest, disease and physiological systems. Factors addressed included tree canopy form, application volume, travel speed and sprayer type.

Several tracers were evaluated and deposits quantified by wash-off removal from bulked leaf or fruit samples drawn from 10-15 spatially consistent 1.5 m^3 zones per tree. Deposit data were expressed on a tissue area basis and/or as a proportion of the spray emitted (retention).

Spray deposits were compared across 11 canopy forms to identify interactions with tree size, leaf area and canopy density and volume. A two-fold difference in deposits between canopies occurred when sprays were applied at a constant chemical rate per hectare. This variability was approximately halved when chemical rates per hectare were adjusted on the basis of the canopy Tree-Row-Volume (TRV). The best TRV measurement system identified used across-row canopy spread measurements at half metre height intervals, rather than just a single measurement of canopy spread. Deposits were better correlated with TRV data than with any of the other canopy descriptors used. Canopy density was identified as an important covariate, but light penetration proved an unsuitable indicator of canopy density as it was strongly correlated with TRV. Deposit variations between zones within trees were consistent between all but the smallest canopy sprayed. Increasing the distance from the sprayer and/or increasing canopy penetration requirements reduced spray deposits.

Spray retention across these canopies in full leaf ranged from 25-90%, but tended to increase with decreased application volume. There was a ca. 10-15% increase in deposits when spray volumes were reduced 4-5 times below those used in typical dilute spray volumes (ca. 2,000 l ha^{-1}). At high volumes with significant run-off, retention could ca. 50% of that at lower volumes. Run-off losses could be related to TRV, with significant run-off occurring once application volumes exceeded one litre per 7.5-11 m^3 of TRV.

Surprisingly, average deposits on 5m tall slender pyramid trees increased with increased travel speed over the range 1.9-8.8 km h^{-1}. Within-tree spray deposit distributions were not markedly affected by the travel speeds tested with air assistance volumes of ca. 30,000 or 44,000 m^3 h^{-1}.

High, but relatively consistent within-tree deposit variability was a feature of deposits from axial fan, airblast sprayers, especially when used in intensive 4-6 m

tall, single leader tree plantings. Within-tree deposit variability decreased with increased application volumes. Tower sprayers provided a more even vertical distribution of spray emission points and achieved different, but not necessarily more even, within-tree deposit distributions than airblast machines.

Experiments on chemical thinning, mealybug (*Pseudococcus viburni*) and black spot (*Venturia inaequalis*) control, showed the biological responses could not have been predicted from the spray deposit measurements. However, combined assessment of spray deposits and biological effects greatly facilitated interpretation of both sets of data.

KEYWORDS: spray application, deposit, retention, spray volume, tracer, spray distribution, tree-row-volume, canopy, light penetration, apple, *Malus domestica, Venturia inaequalis*, *Pseudococcus virbuni.*, chemical thinning, sprayer.

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Well maybe slightly differently next time.....

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