Horticultural Development Company

Grower summary

HNS 157

Optimising leaf defoliation in young trees

Annual 2008

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The results and conclusions in this report may be based on an investigation conducted over one year. Therefore, care must be taken with the interpretation of the results.

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Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

If you would like a copy of the full report, please email the HDC office (hdc@hdc.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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Headline

- Results indicate the continued use of 'Leaf Fall' to be the most effective way of defoliating young trees.

Background and expected deliverables

Nurserymen are concerned that natural leaf abscission on field-grown trees is occurring later each year, due to milder autumns. As such, the period in which field-grown trees can be lifted is becoming restricted. Some nurseries are being forced into lifting trees to meet orders whilst the foliage is still attached. Chemical defoliants are available to nurserymen, but these need to be applied with care to promote a strong enough abscission response, yet avoid damaging the crop.

This project aims to optimise the use of existing chemical products, and to explore cultural and alternative techniques that either enhance the effectiveness of these, or provide an alternative mechanism for defoliation. The first year's work comprised a rigorous field trial over three sites to examine the effectiveness of current defoliants in isolation, combination and varied application timings.

Summary of the project and main conclusions

Year 1 - Optimising the use of existing chemical products

Studies into defoliation regimes on a variety of species commenced in August 2007 at the University of Reading (UoR) and two commercial nurseries. Site A was a producer of hedging plants, grown from seed, lifted, cold-stored and distributed within one season. Site B produced grafted fruit and ornamental trees to be sold either bare root or potted. Combination treatments of ''Cuprokylt'' (copper oxychloride) +/- urea +/- 'Leaf Fall'

(copper in solution as a copper-EDTA complex), were made over three consecutive months (August – October). *Crataegus monogyna*, *Quercus robur*, *Pyrus communis* 'Conference', *Malus domestica* 'Bramley' and *Malus* x *moerlandsii* 'Profusion Improved' were selected for treatment.

The activity of the apical meristem was recorded at the time of chemical treatment in order to allow analysis of the relationship between plant vigour and the effectiveness of each treatment. Detailed observations of leaf abscission were made in order to ascertain how the position of each leaf on the stem may affect its sensitivity to defoliants. At UoR, this took the form of nodal maps, scoring each leaf on the leader for level of damage or abscission; levels of damage to the stem were also recorded in detail. Due to the density of planting and the size of the material at site A (*C. monogyna* and *Q. robur*) whole plant scores for percentage damage and defoliation were recorded. At site B, the percentage of leaves damaged and absent on the upper, middle and lower thirds of each plant were recorded.

Treatments that included 'Leaf Fall' were the most effective on all the species tested, but the total amount of leaf abscission varied greatly across species and at individual plant level (Table A). August applications of defoliant treatments were least effective as plants continued to produce new leaves at both the shoot apex and secondary growth points after spraying and initial treatment effects. At 50% of the recommended application rate (10 ml l^{-1}) 'Leaf Fall' gave rise to similar levels of defoliation to the full rate (20 ml l^{-1}) when applied to *C. monogyna* in September. Therefore, there may be an opportunity to reduce costs as long as plants have reached the required size by this time.

Table A. Summary of the most effective treatments across sites and species trialled in autumn 2007. Defoliation is expressed as a percentage of lost foliage at the time of lifting. NB some data sets have been omitted from the summary as it was not guaranteed that chemical penetration was effective in October, e.g. *Q. robur* at site A.

Site	Plant material	Most successful treatment	% Defoliation

Site	Plant material	Most successful treatment		% Defoliation
University of Reading	*Crataegus monogyna*	''Cuprokylt'' + Urea + 'Leaf Fall'	September	**59**
Site A	*Crataegus monogyna*	''Cuprokylt'' + 'Leaf Fall'	September	**64**
Site A	*Quercus robur*	''Cuprokylt'' + 'Leaf Fall'	August	**5**
Site B	*Pyrus* 'Conference'	''Cuprokylt' + Urea + 'Leaf Fall'	September	**44**
Site B	*Malus* 'Bramley'	''Cuprokylt'' + Urea + 'Leaf Fall'	September	**52**
Site B	*Malus* 'Profusion Improved'	'Leaf Fall 20ml l^{-1}'	September	**97**

Re-growth following chemical defoliation

A sample of *C. monogyna* plants recovered from site A was cold stored for several weeks at the University of Reading and then moved into a warm glasshouse during spring in order to examine the effects of defoliation on the shoot re-growth. Treatments selected for this exercise represented the highest levels of defoliation for both September and October regimes.

Untreated plants produced the lowest amount of new stem and foliage growth. Conversely, the plants that had highest levels of defoliation showed the most vigorous re-growth. This may have resulted from reduced moisture loss in the defoliated plants during storage, compared to controls. Alternatively, the non-treated controls may have entered dormancy later, and the subsequent artificial chilling was not sufficient to break dormancy fully. Analysis of the total nitrogen content of plants in the selected treatments did not reveal a

relationship between nitrogen content and the amount of new growth produced. Interestingly, plants treated with urea were no more abundant in nitrogen than those receiving no urea.

In Summary

- 'Leaf Fall' applied in late September, either with or without ''Cuprokylt'' (copper oxychloride) and urea was most effective at encouraging leaf abscission
- 'Leaf Fall' contains copper in solution (CuEDTA), which defoliates young trees more effectively than insoluble copper compounds found in most fungicides
- The most effective defoliation treatments also caused most plant damage
- August treatment with the same defoliants did not induce enough defoliation to facilitate early lifting

Supplementary experiments

Chelated Iron

Research conducted in the 1980s suggested that chelated iron, FeEDTA has similar abscission-promoting properties to 'Leaf Fall'. A small trial was imposed that examined the performance of 'Leaf Fall' alongside a 20g l^{-1} solution of 'Librel' hydroponic nutrient (13.2% FeEDTA) on *Salix* sp. The iron compound was a far less effective defoliant over a constrained time period, although levels of leaf tissue damage were similar. This suggests that higher concentrations of FeEDTA may give rise to more commercially significant results.

'Folicur'

Following meetings with other nurserymen, a trial was undertaken at the University of Reading to asses the effects of the triazole fungicide 'Folicur' (tebuconazole) when used in conjunction with 'Leaf Fall'. A small experiment conducted using *Alnus glutinosa* showed that three, weekly applications of this compound at a rate of 1 ml l^{-1} improved the subsequent effectiveness of 'Leaf Fall'. Additionally, omitting 'Leaf Fall' altogether and making four applications of 'Folicur' gave rise to similar defoliation rates. It was apparent, however, that one 'side-effect' of this fungicide is a reduction in plant vigour (triazoles also have growth regulator properties).

Areas for further Research

Following the initial trials conducted in 2007, it is hoped that further experiments in the following areas may yield data that contribute to a fuller comprehension of artificially induced abscission:

- Developing a greater understanding of the biochemical action of 'Leaf Fall' and using these data to evaluate possible alternatives. These may be less environmentally persistent or less costly.
- Evaluating the role of late season applications of growth retardants. Vigorous plant growth late into the year has been cited as a major constraint on defoliation regimes and as such, plant growth regulators may represent a way of mitigating the effects of warmer autumns.
- Investigate the potential of brushing treatments (thigmomorphogenesis) as a practical non-chemical approach to inducing earlier bud dormancy and encouraging leaf abscission.
- Investigations under controlled conditions into the effects of various climate variables on the relationships between, and possible delays in plant dormancy, leaf senescence and leaf abscission.

Financial benefits

- End-of-season application of ''Cuprokylt'' may not be required if applying 'Leaf Fall', saving at least £60/ha (assuming 2 applications of ''Cuprokylt'')
- Reduced rates of 'Leaf Fall' application on some species could potentially reduce costs by 50%.

Action points for growers

- Initial results indicate the continued use of 'Leaf Fall' to be the most effective way of defoliating young trees.
- 'Folicur' (tebuconazole) applied to HONS in higher concentrations or at reduced intervals under a SOLA may represent a less environmentally-persistent defoliant than copper.