

## SURFACTANTS - AIDS TO HERBICIDE EFFECTIVENESS

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*Abstract.* An effective foliar herbicide must first of all be able to penetrate the plant, and to achieve this many post-emergence herbicides depend upon the addition of a surfactant to the spray solution. Surfactants can enhance herbicidal activity by several mechanisms, the most common being reduction of solution surface tension, thus allowing increased surface coverage of, and spray retention on, the plant. However, despite their widespread use and proven effectiveness in commercial practice, the behaviour, or mode of action, of surfactants with herbicides is largely unknown.

An integrated research effort was undertaken to examine the physical properties of surfactant solutions, to characterise their behaviour on plant leaves, and their effect on uptake and translocation of herbicides. Methods were developed to quantify wetting, spreading, drying rate, retention and phytotoxicity of solutions on plants. Radiolabelled herbicides were used to evaluate the effect of surfactants on uptake and translocation. Although most studies were with products and plants of most relevance to forestry, the principles and results are applicable to a much wider range of situations.

Some results obtained to date using the various screening methods to select and optimise spray formulations are:

- \* *In vivo* and *in vitro* studies of surfactant phytotoxicities on a range of species.
- \* Correlation of foliar ion leakage with surfactant concentration and uptake.
- \* Selection of new or alternative surfactants and optimisation of additive concentrations.
- \* Influence of foliar development on uptake and translocation in pampas grass.
- \* Up to ten-fold increase in glyphosate uptake and seven-fold increase in hexazinone uptake by mature gorse foliage.
- \* Triclopyr and clopyralid uptake into old gorse foliage improved to same level as uptake into young foliage (a two-fold increase).
- \* Enhanced, but selective, uptake of triazines into pine foliage.
- \* A three-fold increase in asulam uptake and four-fold increase in glyphosate uptake into mature bracken.
- \* Translocation increased ten-fold and seven-fold respectively for these two herbicides in bracken.

The methods and results obtained with various plant species will be presented, together with observations on the effect of surfactant solution properties on herbicide behaviour in field situations.