

## Implementation Programs

### Physico-Chemical Properties of Horticultural Mineral Oils, Orchex® 796—The Optimum Solution

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Increased efforts in low chemical input IPM programs for orchard pest control have renewed interest in summer applications of Horticultural Mineral Oils (HMOs). Historically growers have taken advantage of the substantial benefits of HMOs in dormant and delayed dormant pest control. Concerns about their potential phytotoxicity during the foliar season have, however, restricted their application for the control of summer pests.

Highly refined orchard spray oils (Orchex® 796, 692 and WS 2928, now available as Orchex 892) are currently being assessed in intensive research programs for summer applications on apples and pears in Washington and Oregon. These oils are specifically tailored to meet the requirements of high pest control efficacy and low phytotoxicity. Both efficacy and phytotoxicity are directly related to the molecular shape and size of the hydrocarbon molecules contained in the Horticultural Mineral Oils. Highest pest control is achieved with so-called paraffinics—molecules of strings of carbon atoms shaped like chains. Additionally, insecticidal efficacy is determined by the size, that is, the number of carbons in these chains. Molecules between 18 to 27 carbons have exhibited the greatest pest control effects while those below 18 carbons are known to contain relatively little.

Similarly, phytotoxicity is determined by shape and size of the hydrocarbon molecules. Thus, molecules that need to be eliminated are those with carbon numbers above 28 to assure low chronic phytotoxicity and those below 18 to limit acute phytotoxicity. The optimal carbon number for low phytotoxicity lies between 18 and 27. Because of their particular shape, certain aromatic compounds can pose a threat to tree health (as well as to humans and the general environment). Low concentrations of certain aromatics, known to be non-toxic to mammals, are however advantageous in that they act as antioxidants. Some of the currently available HMOs are refined to Unsulfonated Residues (USR) of greater than 97. In these materials aromatics and related compounds have been removed to such a degree that the potential for oxidation and thus formation of phytotoxic compound should be of concern. USR values of 92 to 97 have been shown to prevent the formation of these oxidation products that result in reactions with oxygen from the air and sunlight.

Manufacturing processes of HMOs target the most beneficial components of specific, highly paraffinic crude oils. As a result, molecules of the correct size range and shape are selected. The viscosity of these spray oils is a result of this size and shape selection. Viscosity itself has not been determined to increase efficacy or to lower phytotoxicity. Most oils of high viscosity contain high concentrations of very large, potentially harmful molecules and should therefore be avoided.

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The current, very promising research efforts aim to identify summer application rates and timing of Orchex® products to achieve maximum pest protection with lowest or no risk to the fruit or to tree health.