

GROWERTALKS

Features

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Tank Mixes from Across the Pond

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Mixing one or more pesticides together is a useful method of reducing application time, compared to spraying separately, and of broadening your application's spectrum of activity against a wider range of pest organisms. It's possible to safely mix many fungicides with each other or with an insecticide or vice versa, thus tackling more than one problem at once. This article is a guide to known tank mixes, based on experience in the United Kingdom, and how to make and test your own.

First, the legal side. Many UK pesticide labels state that you should NOT mix this or that chemical with another. If this statement falls within the statutory box area of the label, then you must obey and not mix. However, if the warnings are anywhere else on the label and you decide to make a spray cocktail, it's done entirely at your own risk, there being no chance to claim from anyone for any issues that may arise. The product safety data sheets should also be checked for any relevant advisory information or cautions.

Method to the mixtures

Herbicides are the most frequent and well-understood category of pesticides to be mixed with each other. They are often mixed with a fertilizer to feed a non-target crop. The mixing of insecticides is less well understood, as most manufacturers don't test mixes with each other's products. The risk of phytotoxicity is greatest to greenhouse-grown crops which, being faster growing, are generally more tender. In the case of ornamentals, there could also be a wide range of different cultivars, including flowering plants, with differing sensitivities in the same nursery.

I have tested several insecticide tank mixes myself, including abamectin plus pymetrozine (see footnote—Helyer, 2002). Abamectin (UK formulation called Dynamec) is a potent acaricide when used at 25 ml. per 100 l. and has an "on label" approval to be used at double this rate to control leafminer (*Liriomyza* spp.) and thrips (including Western Flower Thrips). Abamectin can be harmful to most biocontrols, but it breaks down quickly in bright sunlight. Ideally, allow four to seven days between spraying and introducing biocontrols. Pymetrozine (UK formulation called Chess) has excellent activity against most sap-sucking insects such as aphids when used at 20 g. per 100 l. There is an extension of use (UK SOLA [specific off-label approval] system) for pymetrozine that allows it to be used at up to three times this rate for other sucking pests, including leaf and planthoppers, mealybug, scale insects and whitefly.

Pymetrozine shows good safety to almost all biocontrol agents (but not *Macrolophus caliginosus*, as they can

feed on sap when young and in the absence of suitable prey). Pymetrozine can be used through most of the year (with restrictions for some crops); it works best under warm conditions while pests are active but can be slow if too cold.

Both products have translaminar and apical systemic activity within plants and when combined they have a much broader range of activity. Several nurseries in the UK use this mix as a safe clean-up treatment before starting their seasonal biological control program and as part of a quarantine measure for newly introduced plants.

Abamectin can also be tank mixed with the neonicotinoid thiacloprid (UK formulation Calypso). It works well as an end-of-season clean-up spray for cold-grown crops when applied in late September. Thiacloprid, as with most other chloronicotinoids and neonicotinoids, is more harmful to biocontrols. Allow four weeks or more before introducing biocontrols.

Synthetic pyrethroids such as deltamethrin (UK formulation Decis) are broad-spectrum insecticides with good insect-deterrent activity that can persist for several weeks on treated plants. They aren't biocontrol-compatible, but they are useful as an out-of-season protectant against many pests. When mixed with abamectin, they provide additional control of spider mites, thrips and so on. Deltamethrin can also be mixed with thiacloprid to control insects hidden within the plant canopy and provide good protection lasting for several months, particularly if they are applied to cold-grown plants in October or early November.

Several soap and plant extract-based products are available. All have contact-only action, and the majority state that they shouldn't be mixed with another product. However, after careful screening it's possible to use some of these products as a co-formulant with conventional pesticides. The advantages are that physical-acting products are generally rapid in their activity and integrate well with biologicals. The downside is the requirement for thorough spray coverage to ensure contact with a pest. This can be difficult, particularly in dense leaf canopies. By mixing with a selective translaminar or systemic pesticide, you get the best of both worlds—rapid knockdown of those pests directly hit and penetrating control for those deeper within the plant. In the UK (and most European countries) we have a product called SB Plant Invigorator which is a mix of linear sulphanate with chelated iron and nitrogen.

This effectively acts as a tonic for the plants while killing various insect and mite pests by its physical mode of activity. It also controls powdery mildew. The insecticidal activity is by de-waxing the insect cuticle while long chain molecules of the surfactant smother the now-unprotected pest bodies.

Clofentazine (UK formulation called Apollo) is an acaricide with activity against spider mite eggs and young motile stages only; it is safe to most biocontrols, including *Phytoseiulus persimilis*. When mixed with SB Plant Invigorator it will control most stages of spider mite and have minimal effect on the predators. Apollo is a pink/magenta color and can leave a slight pink deposit.

Nemolt, the UK formulation of teflubenzuron, is a contact insect growth regulator with activity against the larval stages of caterpillar, thrips, whitefly and other pests, and is safe to most biocontrol agents. When mixed with SB Plant Invigorator, it will control whitefly larval stages and adults along with aphids, spider mites and other small insects.

The bioinsecticide *Beauveria bassiana* (UK formulation Naturalis-L, an entomopathogenic fungus that can infect and kill various insects and mites) are generally compatible with most insecticides. In fact, the addition of an insecticide can actually improve the efficacy of the fungal pathogen as, in most instances, they can infect live insects to kill them as well as grow as a saprophyte on recently killed organisms. This can effectively boost the number of infective spores to improve pest control. The majority of fungicides can obviously affect the fungus. As a rough guide, unless other reputable information indicates safety, you should allow four days between either fungicide and a bioinsecticide fungus applications.

Biofungicide *Bacillus subtilis* (UK formulation Serenade ASO, which is a bacterial based product, active against a wide range of plant diseases), is also compatible with most insecticides, and in this instance, with most fungicides. Frequently, some groups of fungicide show a synergistic improvement when mixed with the bacteria in *B. subtilis*.

Entomopathogenic nematodes are a group of eel or round worms that have symbiotic bacteria in their alimentary tract that are the killing agent in a nematode attack. These nematodes enter their host insect and release a minute pellet of bacteria. Under the right temperatures the bacteria reproduce and kill the host, usually within a few days. Generally, these nematodes are compatible with most insecticides and fungicides except those with nematicidal or antibacterial activity.

For the majority of bioinsecticides, biofungicides and entomopathogenic nematodes there's a wealth of compatibility information on each producer's website. As new products become available the information should be reviewed regularly and before any mixes are made.

Compatibility check

Compatibility is both physical and biological, and both should be considered before using any mixture. Testing a mix is relatively easy. A jar test should be done first to indicate visible physical compatibility. This is done by half filling a jar with a known volume of water and adding the component sprays at double their normal rate of use. Shake or stir the contents and leave for at least one hour. If, after this time, they have formed a precipitate or coagulated to form a cottony, wool-like mass, it indicates physical incompatibility and you go no further. However, if the products have separated slightly in layers or look no different, you should shake the mix and apply to your selected test plants.

As a guide, select plants that you consider to be the most susceptible to spray damage (soft growth, flowers and so on) and thoroughly spray. Leave for at least one week but monitor daily for any unusual damage. Chemical damage or phytotoxicity can show as small necrotic lesions, scarring, loss of color from flowers and in severe cases (most unusual) death of the plant. Always have a control batch that receives only a water spray. By doing the trial at double normal rate you build in a safety margin which should give you more confidence in using the mixes. **GT**

Note: This information is given in good faith and based on experience in the UK. Any feedback is gratefully appreciated. All mixes should be checked for their legality and all applications are at the risk of the user; therefore, check before use on a commercial crop. Always follow the label directions!

Footnote: Helyer, N.L., (2002). Abamectin plus pymetrozine; an extremely useful addition to the IPM armory.

Integrated control in protected crops. IOBC/wprs Bulletin Vol. 25(1).

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