



SMART ORCHARD BEST PRACTICE

Inspired innovations driven by growers, shared by BAPL



SUPPORTING POLLINATORS AND BENEFICIAL INSECTS IN MODERN ORCHARDS

THE CHALLENGE

Apple and pear growers face increasing pressure to maintain productivity while reducing reliance on crop protection products. At the same time, the availability of some plant protection options continues to decline, increasing the importance of Integrated Pest Management (IPM).

Perennial wildflowers are attracting growing interest as a practical way to support pollinators, encourage natural enemies of pests and enhance biodiversity within commercial orchards. Once established, flowering habitats can provide long-term benefits with relatively low ongoing management.

THE OPPORTUNITY

Using perennial wildflowers to strengthen orchard ecosystems

Research from the UK and across Europe suggests that carefully selected wildflower habitats can:

- Support pollinators before, during and after blossom.
- Provide food and habitat for beneficial insects that help control pests (although effective pest control depends on the pest, vegetation and orchard conditions and requires further research).
- Increase biodiversity within orchards.
- Improve soil structure and biological activity.
- Contribute to wider sustainability and environmental objectives.

Wildflowers are not a replacement for conventional crop protection, but they can form an important part of an integrated orchard management strategy.

WHY IT MATTERS

Perennial wildflowers have the potential to:

- Increase pollinator numbers and diversity
- Encourage beneficial insects that contribute to natural pest control
- Support healthier, more resilient orchard ecosystems
- Reduce reliance on synthetic inputs over time
- Deliver environmental benefits alongside commercial production

The strongest evidence to date shows that established perennial flower margins can reduce rosy apple aphid damage in apple orchards, with estimated economic benefits of up to £3,000 per hectare in severe rosy apple aphid years; this is not a guaranteed annual return.



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WHAT DOES THE EVIDENCE SHOW?

Pollination benefits

Research consistently shows that wildflower habitats increase both the abundance and diversity of pollinating insects.

The European BEESPOKE project found that apples benefit from a diverse pollinator community, including solitary bees, bumblebees and honeybees. Wildflowers help maintain these populations throughout the season by providing forage before and after the relatively short orchard blossom period.

Natural control of rosy apple aphid

UK research provides evidence that established perennial flower margins can reduce damage from rosy apple aphid (*Dysaphis plantaginea*) in apple orchards. Further research is needed into the control of orchard pests generally.

University of Reading-led studies of rosy apple aphid and its natural enemies found that flower margins:

- Reduced the spread of rosy apple aphid colonies.
- Lowered fruit damage caused by rosy apple aphid at harvest.
- Supported natural enemies studied in relation to rosy apple aphid.
- Offered estimated economic benefits of up to £3,000 per hectare in severe rosy apple aphid years; this is not a guaranteed annual return.

Reductions in rosy apple aphid damage were detected up to 50 metres into orchard blocks. These findings do not demonstrate benefits across multiple pest species, or equivalent outcomes in pear orchards.

Evidence for other apple pests

Woolly apple aphid (*Eriosoma lanigerum*): two Washington State field experiments found lower aphid densities near sweet alyssum, beginning after one week and lasting several weeks. Predators moved between flowers and apple trees. This demonstrates suppression under the tested conditions.

Spirea aphid (*Aphis spiraeicola*): an orchard experiment in China found fewer aphids and more predators with *Cnidium monnieri*. Marking confirmed predator movement into apple trees. Transfer to UK conditions and locally suitable mixes requires testing.

Codling moth (*Cydia pomonella*): perennial alleyway strips in organic apple orchards across seven European countries produced a greater decline in immature moth numbers and a smaller increase in fruit damage from 2016 to 2017 than controls. The result was a difference in change between years, rather than an overall direct treatment effect on fruit damage.

Results are not uniformly positive: a study of 18 Mediterranean apple orchards found more hoverflies and parasitoids with spontaneous flowering vegetation, but only small or marginal effects on pest regulation and damage. More natural enemies do not necessarily mean commercially adequate control.





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Soil health

Although less well researched in orchards, perennial wildflowers may also help:

- Improve soil structure.
- Increase soil organic matter.
- Enhance water infiltration.
- Support earthworms and soil biology.

Deep-rooting species can help improve soil structure, while legumes may contribute nitrogen and stimulate biological activity.

BEST-BET SPECIES FOR ORCHARD WILDFLOWER MIXES

Current evidence suggests the following species offer the greatest **potential** benefits:

For pollinators

- Bird's-foot trefoil (*Lotus corniculatus*) — perennial
- Field scabious (*Knautia arvensis*) — perennial
- Sainfoin (*Onobrychis viciifolia*) — perennial
- Selfheal (*Prunella vulgaris*) — perennial

For natural pest control

- Yarrow (*Achillea millefolium*) — perennial: included in tested orchard mixtures; mixture-level results do not establish its individual pest-control effect.
- Wild carrot (*Daucus carota*) — biennial or short-lived perennial: established in the European orchard flower-strip trials; evidence of establishment and resource provision is not proof of control by this species alone.
- Sweet alyssum (*Lobularia maritima*) — usually grown as an annual in the UK: direct field evidence of woolly apple aphid suppression in Washington State. Consider for targeted trials; its establishment and management differ from a persistent perennial mix.
- Monnier's snowparsley (*Cnidium monnieri*) — annual or biennial: direct evidence of spirea aphid suppression in China. A research example, not an established recommendation for UK orchards; local suitability and risks require assessment.

For season-long flowering and habitat

- Oxeye daisy (*Leucanthemum vulgare*) — perennial
- Lady's bedstraw (*Galium verum*) — perennial
- Musk mallow (*Malva moschata*) — perennial
- Red campion (*Silene dioica*) — perennial, sometimes biennial

These species should provide nectar, pollen and habitat for pollinators and beneficial insects throughout the growing season. However, relatively little orchard-specific research has been undertaken in this area and many of the claimed benefits are extrapolated from wider agroecological studies.



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PRACTICAL TAKEAWAYS FOR GROWERS

Start with margins

Current evidence is strongest for flower margins around orchard boundaries. These are often the simplest and lowest-risk areas in which to establish perennial habitats.

Focus on establishment

Poor establishment is one of the most common causes of failure. Careful site preparation and early weed control are critical to achieving long-term success.

Think long term

Perennial wildflowers typically take time to establish fully but can provide benefits for many years once established.

Integrate with IPM

Wildflowers should be viewed as one component of a wider IPM strategy, alongside monitoring, biological controls and targeted crop protection measures.

WHAT STILL NEEDS ANSWERING?

Evidence does not yet provide dependable species mixes for apple and pear pests. Replicated, multi-season commercial-orchard trials should build on existing studies, identify locally suitable plants and test whether suppression translates into less crop damage and worthwhile returns. Priorities include:

- Pest-specific natural enemies: establish which predators and parasitoids contribute most to suppression of priority apple and pear pests under local conditions, building on known associations; identify their resource needs and timing.
- Plant selection and risks: test plant traits, species and mixes that support those enemies, including accessible nectar, pollen and shelter. Assess whether vegetation also hosts or feeds target pests and whether the net effect reduces crop damage.
- Planting location and management: compare margins, alleyways and combinations across orchard sizes; measure effects into the crop. Test establishment, weed control, cutting regimes and persistence alongside machinery access and crop protection practices.
- Seasonal continuity: identify mixes and management that maintain food and refuge through relevant natural-enemy life stages, including early-season and overwintering needs, without creating gaps when pest suppression is required.

Trials should compare treatments with standard orchard management and measure natural enemies, pest populations, fruit damage, marketable yield and crop protection use.

Economic assessment should include establishment, maintenance, land and labour costs, and returns over several years. This would establish where vegetation delivers commercially useful control, where it carries risks, and which recommendations are justified for growers.

