Greenresilient Factsheet

Flower strips: a tool for pest control in greenhouses

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Establishing flower strips in greenhouses can promote natural enemies. They can improve biological pest control in vegetable crops, which complement preventative measures and organic pesticides. Choosing suitable plant species and establishing them at the right time and place ensures food and shelter for a diverse community of natural enemies.

Choice of plant species in flower strips

Flowering plants can support natural enemies in different ways. Some natural enemies (such as parasitoid wasps, lacewings and predatory hoverflies) feed on insects only during their larval stage and need floral resources (nectar and pollen) in the adult stage. Without floral resources, populations of these natural enemies would not persist. For other natural enemies (such as ladybirds and predatory bugs) pollen and nectar are not essential but provide additional food sources, which are especially important to survive when prey is scarce. In addition, plants can be useful because they provide alternative prey, shelter or tissue to deposit eggs for natural enemies.

The selection of suitable plants species depends on the crops grown, their main pests and the natural enemies available to combat these pests. For most natural enemies, flowers are more suitable when their nectar is accessible for insects with short tongues. In this respect, species from the parsley family (Apiaceae) and cruciferous species (Brassicaceae) are beneficial, but also, e.g. buckwheat and some composite (Asteraceae) flowers (see table 1 for more examples). At the same time, the plants should not be a host plant for pests or diseases, which would affect the crops grown. For example, cruciferous flowers should be avoided when growing broccoli or other cabbage crops.

Table 1. Families and examples of easy-to-grow species that can effectively provide resources for various groups of natural enemies (references below).

Plant family	Example species (A = annual, P = perennial)	Natural enemies supported	Main pests regulated
Apiaceae	Coriander (*Coriandrum sativum*, A), Dill (*Anethum graveolens*, A), Bishop's weed (*Ammi majus*, A), Fennel (*Foeniculum vulgare*, P)	Hoverflies, lacewings, parasitoid wasps	Aphids, moths
Brassicaceae	Sweet alyssum (*Lobularia maritima*, A)	Hoverflies, parasitoid wasps	Aphids
Polygonaceae	Buckwheat (*Fagopyrum esculentum*, A)	Hoverflies, parasitoid wasps	Aphids
Asteraceae (shallow florets)	Yarrow (*Achillea millefolium*, P), Oxeye daisy (*Leucanthemum vulgare*, P), Golden marguerite (*Anthemis tinctoria*, P), Corn marigold (*Glebionis segetum*, A), Cornflower (*Centaurea cyanus*, A)	Hoverflies, lacewings, ladybirds, parasitoid wasps	Aphids, moths
Asteraceae (deeper florets)	Marigold (*Calendula officinalis*, A/P), Brown knapweed (*Centaurea jacea*, P)	Predatory bugs (Macrolophus, Orius), ladybirds	Whitefly, moths, incl. *Tuta absoluta*
Fabaceae	Birdsfoot trefoil (Lotus corniculatus, P) Common vetch (Vicia sativa, P)	Ladybirds (Scymnus), parasitoid wasps	Aphids
other	Annual baby's breath (*Gypsophila elegans*, A)	Hoverflies, lacewings	Aphids

Other characteristics important for plants in flower strips are:

- ease of growing flowers from seed (preferentially perennial),
- a size which avoids competition with crops, and
- flowers in the period when natural pest control is most needed.

The trials of the French Research Group in Organic Agriculture (GRAB) over several years have identified some very interesting species which combat specific pests (see also table 1):

- For Aphids: Sweet alyssum (*Lobularia maritima*), oxeye daisy (*Leucanthemum vulgare*), yarrow (*Achillea millefolium*), brown knapweed (*Centaurea jacea*), birdsfoot trefoil (*Lotus corniculatus*).
  The latter two species are good food plants for ladybirds; the others also for hoverflies, lacewings, and parasitic wasps.
- For spider mites, *Tuta* and whiteflies: marigold (*Calendula officinalis*), as seen in photo 1. This plant is attractive for *Macrolophus pygmaeus*, a predatory bug, both for feeding and for leaving her eggs.

Growing three to four different plant species within one flower strip extends the period of flower availability, reducing the risk of failure and providing diverse food and shelter for a range of natural enemies. Since some plants may be lost due to, e.g. drought, frost or accidental weeding, it may be necessary to regularly re-sow and re-plant the flower strips.

The best locations for flower strips

The outer edges of greenhouses are not used for growing crops, and therefore a good location for establishing flower strips. Another possible location to establish a flower strip is within the production rows. Annual species, such as sweet alyssum (photo 2) and buckwheat, flower very quickly. They can be transplanted directly from the nursery, near the drip irrigation, close to the cultivated plants. These plants are very attractive to predatory hoverflies and will be pulled up at the end of the cropping season.

For most species, it is not always necessary to plant flower strips on both sides of the greenhouse or along its entire length. Planting a few flowers patches near the poles already benefits greenhouse functional biodiversity, e.g. between 5 and 10 marigold plants/100 m² can

host enough of the predatory bug *Macrolophus* to protect tomato crops from the pest *Tuta*. Trials show that it is also favourable to plant some species along the entire length of the greenhouse edge, allowing flowers to act as a 'living mulch'. For example, yarrow, planted every 20 cm, is competitive enough to prevent weed development (photo 3).

When and how to seed?

Flower seedlings for the establishment of flowers strips can be propagated using lettuce or cabbage seedling trays. Two or three seeds should be sown per cell, and seedlings should be transplanted 1 to 1.5 months before planting the main crop.

The best periods for planting flower strips are autumn and spring. The planting date should be planned to ensure the plants are sufficiently developed; this allows the plants to accumulate ample natural enemies before winter. If timed correctly, the flower strips positive effects are carried over into the following year. These measures should therefore be part of a long-term pest control and greenhouse management plan until the ecological balance of beneficial and pest organisms is established.

Photo 1. Marigold is a good host plant for Macrolophus, as it provides pollen and nectar as well as tissue to deposit eggs for this species. Source: Lambion (GRAB)

Optimise agroecological services

The effectiveness of flower strips to control pests further improves with active transfer between the flower strips and crops. This active transfer involves cutting off parts of the plant, which carry plentiful natural enemies (*Macrolophus*, mummies, ladybirds, etc.), transporting them in closed boxes, and placing them in a crop which needs protection. This practice, which requires common materials and takes no longer than a classical release, makes it possible to increase the population of favourable natural enemies and homogenise their populations. This transfer can be carried out within a greenhouse as well as between greenhouses. This approach can be used to redistribute *Macrolophus*, present on marigold, as well as mummies (parasitised aphids) and ladybirds, present on plants like yarrow and knapweed. The presence of natural enemies should be checked visually or by shaking the plant before considering the transfer.

Note that for some pests no effective biological control agents have yet been identified, such as flea beetles and Colorado potato beetles. For these pests other management measures should be considered.

Photo 2. Sweet alyssum planted along the greenhouse edge, at the pole. Source: Lambion (GRAB)

Photo 3. Yarrow as a living mulch. Source: Lambion (GRAB)

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Cover picture: Mixed species flower strip on the greenhouse edge. Source: Lambion (GRAB)

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