

# The effect of companion planting on the abundance of pest complex and its parasitism rate on white cabbage

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## Implications

The findings of this paper could help to develop and maintain a sustainable cabbage production by the enhancement of natural pest control with the help of companion planting. Our results indicate that *Lobularia maritima* (*Brassicaceae*) could be used to attract pests of cruciferous plants away from the crop.

*Centaurea cyanus* (*Asteraceae*) and *Fagopyrum esculentum* (*Polygonaceae*) could be used to suppress pests of cruciferous crops and to increase parasitism rate by fostering parasitoids.

## Background and objectives

The expansion of large monocultural fields and an increase of often prophylactically used chemicals have led to widespread decline of farmland biodiversity and ecosystem services, e.g. pollination and natural control of pests. Because of that the need for more sustainable and environmentally safe management systems has arisen.

To rebuild biodiversity and ecosystem services new approaches have been developed (Stoate et al., 2001; Tilman et al., 2002). Companion planting is a system of growing additional plants with the crop to attract beneficial insects, suppress pests, and mask the scent of crop plants or supply the soil with nutrients.

In the temperate climate, several important agricultural and vegetable crops from the family *Brassicaceae* are grown. In Europe the most grown are cole crops, nearly 69 million tonnes were produced in 2011, of that over 12 million tonnes in Europe (FAOSTAT, 2013). One of the most commonly grown cruciferous vegetable crops in the temperate climate is white cabbage (*Brassica oleracea* var. *capitata*). It is damaged by several insect pests of which the most damaging ones belong to the order *Lepidoptera*. Commonly occurring and the most widespread are the diamondback moth (*Plutella xylostella* L.: *Plutellidae*), the large white butterfly (*Pieris brassicae* L.: *Pieridae*), the small white butterfly (*Pieris rapa* L.: *Pieridae*) and the cabbage moth (*Mamestra brassicae* L.: *Noctuidae*) which, in the interest of plant protection, are usually treated as pest complex.

All these pests are attacked by natural enemies. Of these, hymenopteran parasitoids form a substantial and diverse portion; more than 50 different parasitoid species are known to parasitize each of these pests (Yu et al., 2012).

The aim of this study was to find out if and how will cabbage companion planting with *Agastache foeniculum* (Pursh) O.Kuntze (*Lamiaceae*), *Anethum graveolens* L. (*Apiaceae*), *Centaurea cyanus* L. (*Asteraceae*), *Fagopyrum esculentum* Moench (*Polygonaceae*), *Iberis amara* L. (*Brassicaceae*) and *Lobularia maritima* (L.) Desv. (*Brassicaceae*) affect the abundance of lepidopteran pests and their parasitoids.

## Key results and discussion

Plant species' significant influence on the abundance of pests of cruciferous plants was statistically proven (Kruskal-Wallis ANOVA  $H(6, N=640)=72.84, p<0.0001$ ; Fig. 1). The most attractive were cabbages planted with other cruciferous plants: *I. amara* and *L. maritima* but significantly less pests were found from cabbages planted with *C. cyanus* and *F. esculentum*.

Plant species had significant influence also on parasitoids of this pest complex, as parasitism rates were significantly influenced by the plant species (Kruskal-Wallis ANOVA  $H(6, N=609)=76.78, p<0.0001$ ).

These results suggest that taxonomically different plant species decrease the occurrence of specialised pests and due to extrafloral nectar on *C. cyanus* and low corollas on *F. esculentum* these species offer food for parasitoids without fostering lepidopteran pests. Parasitoids benefit more from easily accessible sugar-sources than insects with long proboscis as proven earlier by Winkler et al. (2009).

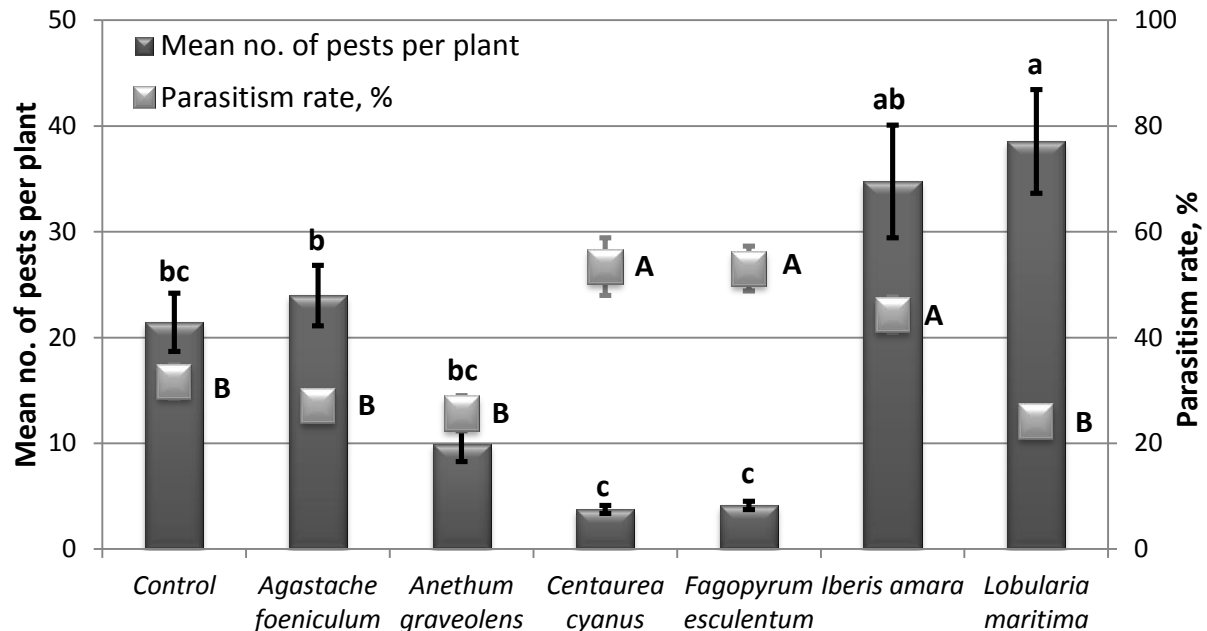


Figure 1. The mean ( $\pm$ SE) number of pests per cabbage plant and their mean ( $\pm$ SE) parasitism rate on cabbages planted with different companion plant species. Different letters indicate significant differences between plant species, lowercase letters – pests per plant, capital letters – parasitism rate ( $P < 0.05$ , unequal N HSD test).

### How work was carried out?

The study was carried out on the experimental field of the Estonian University of Life Sciences, 2009-2012. Six plant species from various families were used as companion plant for white cabbage: *A. foeniculum*, *A. graveolens*, *C. cyanus*, *F. esculentum*, *I. amara* and *L. maritima*. Cabbages were planted with different companion plants using Latin square design. Pests were collected from cabbage plants when they reached last larval instar and incubated in laboratory to rear parasitoids and to calculate the parasitism rate.

### References

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