The importance of insect pollination for field bean yield

Project report 2019 to SLU Ekoforsk

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Background

The field bean (*Vicia faba*) is an important break crop that fixates atmospheric nitrogen, thereby providing nitrogen to the crop rotation and improving the soil structure. Field beans have a high yield and protein content, and a protein composition that fits several livestock species. Yield in field beans is enhanced by insect pollination and can be severely reduced by insect pests. Knowledge about benefits, management, and underpinning ecology of ecosystem services such as pollination and biological control of insect pests is needed for sustainable, effective and economically viable field bean cultivation.

We set out to test if:

- Adding managed honey bees increases the yield of field beans.
- Cultivation of annual flower strips that provide pollen and nectar resources before and during field bean bloom, increases the presence of wild pollinators and natural enemies, thereby increasing the yield of field bean fields.
- High densities of pollinating insects reduce the occurrence of pests in field beans.

Project status

Originally, field work was planned for 2017, but due to parental leaves in the team, fieldwork was postponed until 2018. PhD-student Chloë Raderschall then joined the team for this experiment. Also, flower strips were planned to be sown in the autumn of 2017, but this was made impossible due to adverse weather. We instead established spring sown flower strips in 2018 in 9 locations across Skåne. To 4 of these we added a minimum of 10 honey bee hives per field. We also had 8 control fields without a flower strip, adding honey bee hives to 4 of these.

The crossed experimental design allowed us to examine how adding honey bees and/or flower strips affected: yield and yield components, pests attack of aphids (*Aphis fabae*) and bean beetles (*Bruchus rufinamus*), pest control and pollination, as well as population densities of wild pollinating and predatory and parasitic insects during flowering. Due to an extremely warm and dry spring in 2018, the establishment of the flower strips was somewhat uneven. For the same reason the field beans had a very early and brief flowering period. Despite this, we managed to sample most of the variables mentioned above. Due to a dry summer with high temperatures, yield levels were low. The yet many samples from the field season of 2018 have now been processed and digitized.

In addition to the measurements in the crop, we followed up these surveys in the spring of 2019

with an estimation of the number of bumble bee queens found at each site where we surveyed a field bean crop in 2018. This tells us whether the honey bee and flower strip treatments have had any effect on the wild bumble bee populations. This work was performed by Anna Douhan Sundahl which she used for her Bachelor thesis (Douhan Sundahl 2019).

We wished to test whether autumn sown flower strips affect yield, by providing early bloom to support ecosystem services and beneficial insects in field beans. We planned to, at the end of the summer 2019, establish flower strips in 8-9 sites, selecting yet another 8-9 sites as controls and survey these in the summer of 2020. This did not happen due to *e.g.* problems finding suitable field sites in 2019. Instead we are now focusing on analyzing and publishing the massive amount of data we have collected. Chloë Raderschall will analyse data from this project in 2020. Sandra Lindström is expected to spend up to 6 months to analyse and publish the data on which Douhan Sundahl thesis is based. Ola Lundin is expected to spend up to 4 months in the project. The project has been presented in agricultural media (Raderschall & Lundin 2019, Lundin et al 2018) and at an conference (Raderschall et al 2019).

Publications

Douhan Sundahl, A. 2020. Bumblebee resource dynamics: A review of foraging and nesting in the agricultural landscape. Independent project in Biology • 15 credits Swedish University of Agricultural Sciences. Link to publication. Publikationen finns på SLU:s biblioteks hemsida .

Raderschall, C. & O. Lundin. 2019. Bin och humlor lyfter skörden av åkerbönor. Lantmannen 7-8: 65.

Lundin, O., C. Raderschall, R. Bommarco & S. Lindström. 2018. Pollinering och växtskydd lyfter skörden i åkerbönor. Arvensis 1: 30-31.

Raderschall, C., O. Lundin, R. Bommarco, S. Lindström. 2019. Diversified farming systems at field- and landscape scales for pollination in faba beans. Oral presentation. 33rd ANNUAL MEETING OF THE SCANDINAVIAN ASSOCIATION OF POLLINATION ECOLOGY. Höör, 2019.