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Organic farming research project report submitted to the Organic Farming Research Foundation:

Project Title:

Study of plant diversity adjacent to a monoculture system: Effects on beneficial arthropod populations and vineyard pest control

PROJECT REPORT

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From March 15 and throughout the 1997 growing season, intensive weekly sampling of herbivorous insects (mainly leafhoppers and thrips) and associated natural enemies (mainly *Anagrus* sp and *Orius* sp) have been conducted in two adjacent Chardonnay vineyard blocks of 5 acres each, North of Hopland. Both blocks are managed organically with half of the area of each block planted to summer cover crops (buckwheat and sunflower), and the other half maintained with bare ground.

Block A is located adjacent to a vegetational corridor composed of about 66 different species of flowering plants, while the neighboring block B has no adjacent corridor.

Methods

Main sampling methods include:

1. Yellow sticky traps: 5 yellow sticky traps have been weekly placed in rows: 1, 5, 15, 27, 47 (with row 1 closest to the corridor in block A) to monitor arthropod populations, mainly adult leafhoppers *Erythroneura elegantula* and its parasitoid *Anagrus* sp. Ten yellow sticky traps have been randomly placed each week within the corridor to estimate populations of beneficial insects.

2. Blue sticky traps: 5 blue sticky traps have been placed weekly as above in each sampled row of each block (rows 1,5,15,25,53, row 1 closest to the corridor in block A) for sampling of thrips and other insects. Ten blue sticky traps have also been randomly placed within the flower corridor.

3. Direct counting of leafhopper nymphs is conducted on 10 leaves per row in each block (rows 1,5,15,27,47). The same leaves are taken to the laboratory to determine number of parasitized leafhopper eggs by *Anagrus*.

4. Branch shaking: 10 vines are weekly chosen randomly and then shaken for 30 seconds over a cloth tray to determine number of arthropods on the vines in rows (1,7,15,27,47) in each block.

5. By randomly selecting three rows, cover crops are weekly sampled in each block using a sweep-net, (passing it 50 times over a 50 in transect) to estimate abundance of beneficial insects.

6. Malaise traps: three malaise traps have been placed in each block across "flight paths" between the vineyard and the adjacent edge. Each malaise trap contains a 1-*l* jar filled with alchohol which is replaced every 2 weeks. Samples are taken into the laboratory where arthropods are counted and sorted into families and trophic guilds.

Preliminary Results

1. Effects of corridor on population gradients: (data trends from March 15 -- June 15, 1997)

In block A, adult leafhoppers have shown a clear density gradient reaching lowest numbers in row I immediately adjacent to the corridor, increasing in rows 5 and 25, and declining again in vine rows close to the riparian habitat. Such a gradient has not been apparent in block B.

Predaceous insects (Orius, Coccinellidae, Chryspidae and Syrphidae) also exhibited a gradient in block A reaching highest numbers in row I and lowest in rows 5 and 25; these latter rows are towards the center of the field. Such a gradient was not noticeable in block B.

Populations *of Anagrus* peaked in rows 5 and 15 and reached lower density levels in rows 1, 25, and 47. This could be related to leafhopper densities. Similar trends were observed in block B where - *Anagrus* catches in yellow sticky traps were highest in rows 5, 15, 25 and lowest in rows 1 and 47. Number of eggs parasitized were lowest in row in row 1 in block A and block B.

Data derived from blue sticky traps has revealed a gradient of thrips with lowest densities in row 1 adjacent to the corridor and highest in rows 25 and 53. Such gradient has been as obvious in block B. In block A predators caught in blue sticky traps (mainly *Orius)* reached consistently high densities in rows 1 and 5 adjacent to the corridor and in row 53 close to the riparian habitat.

2. Effects of cover crops:

Yellow sticky traps and vine shaking have revealed a lower abundance of adult leafhoppers in the vineyard section with summer cover crops than in the section without cover crops.

Blue sticky trap data revealed that thrips catches were substantially lower on the vineyard sections with cover crops. *Anagrus* populations were higher in the no-cover section in block A. When cover crops were mowed this forced movement of natural enemies into the adjacent vine plants, and this greater number of *Anagrus* and predators on the vines over mowed cover crops resulted in lower numbers of leafhoppers than in vine plants over non-mowed cover crops.

Sweep net sampling of cover crops in both blocks revealed that the most abundant predator in the cover crop was *Orius,* followed by several species of lady beetles (Coccinellidae). Among the spiders the Thomisidae were the most common.

Preliminary Conclusions

Leafhopper and thrips populations seem to be influenced by the presence of the flower corridor; populations were generally lower as one moves away from the flower corridor. Predators *(Orius,* Coccinellidae, Syrphids, and Spiders) were also more abundant in vine rows closest to the corridor. However, *Anagrus* reached highest numbers in rows away from the corridor, where leafhopper densities were also highest.

Cover crops are an important source of *Orius,* Coccinellidae and spiders, which may explain why leafhoppers and thrips have exhibited lower abundance on vines in vineyard sections with cover crops. The corridor was also an important source of *Anagrus* and predators as fluctuation densities of natural enemies in the corridor seem to correlate well with fluctuations observed in the adjacent vine row.

Implications for the sustainable management of vineyards

Our data analysis suggests so far that the corridor serves as a source of natural enemy biodiversity affecting the abundance and distribution of predators in the adjacent vineyard, thus impacting densities of leafhoppers and thrips in vines close to the corridor.

This suggests that designing corridors that harbor natural enemies and that serve as a channel for their dispersal into adjacent crops is a strategy that can help restore functional biodiversity in agroecosystems. Cover crops complement the ecological effects of the corridor by serving as a source of *Orius,* Coccinellidae and spiders, which may explain why leafhoppers and thrips have exhibited lower abundance on vines in the vineyard sections with cover crops.

Agroecological research of this kind can provide the guidelines for the transition towards a more sustainable management of the vineyards.