

Progress report “Functional botanical diversity - a path to robust cropping systems”

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Performed experiments

1) Laboratory experiments to identify suitable mixtures of rye and wheat

In screening experiments we tested two winter wheat varieties, Stava and SW Magnefik, and three winter rye varieties (Caspian, Amilo and Brasetto). Wheat plants were exposed to volatiles from neighbouring rye plants in two - chamber cages. Different proportions of rye were used: 5% (1 plant), 15% (2 plants), 50 % (5 plants), and 100% (10 plants). Control wheat plants remained unexposed (0% rye). After five days of exposure, aphid acceptance of exposed and unexposed plants was quantified. Ten aphids were introduced on the second leaf of the test plant in a transparent plastic tube, sealed with foam plug. After two hours, the number of aphids that have accepted the plant (sitting and feeding on the leaf) was counted. The results were shown in our progress report 2015. No significant differences in aphid acceptance on rye-exposed wheat plants were found. The results were expected, because rye is known to be allelopathic active via root interactions and not via aerial interactions. Therefore, experiments are ongoing at the moment to test if root exudates from rye can induce changes in wheat plants that will lower their attractiveness for aphids. In our previous studies we found such an effect in barley plants that were exposed to root exudates from couch-grass.

2) Field experiment

The field experiment was sown on 30th of September 2015 at Ekhaga field station, Uppsala. A conventional randomised block design was used, with treatment plots (40m²) randomly placed in each of the six blocks. Five different treatments were used:

- a) 95% winter wheat (Stava) mixed with 5% rye (Herakles)
- b) 85% winter wheat (Stava) mixed with 15% rye (Herakles)
- c) 95% winter wheat (Stava) mixed with 5% rye (Palazza)
- d) 85% winter wheat (Stava) mixed with 15% rye (Palazza)
- e) 100% winter wheat (Stava)

The effect of mixing small amounts of rye in winter wheat on aphid occurrence, leaf spot fungi and the amount of weeds will be assessed during the growing season 2016.

a) Aphid population development

Population dynamics of naturally occurring aphids will be quantified once per week with previously established methods. The aphid development in winter wheat/rye mixtures will be compared with pure stands of winter wheat. The results will show whether the tested species mixtures reduce aphid populations in comparison to pure stands.

b) Natural enemies of aphids

The number of ladybirds will be counted by two observers performing a standardized visual search of each plot once per week. The number of natural enemies in plots with mixtures will be compared with those in plots with pure stands.

c) Weed occurrence

Weed occurrence will be estimated in each plot once per week. The occurrence of dominant weed species will be noted. At harvest the aboveground biomass of the crop/crops and weeds will be assessed in two randomly chosen areas (1m²) per plot, dried and weighed.

d) Disease attacks

Disease attack will be estimated in each plot twice during the growing season; for specific leaf spot, yellow rust and wheat dwarf disease.

e) Yield

Grain yield, nitrogen content, and other agronomic traits will be determined plot-wise for each treatment to quantify the economic performance of species mixtures, and to explain how the components affect each other.

Results to be reported next year

- We will have identified if rye can change wheat plants via root-exudates in order to affect aphid plant acceptance in laboratory experiments.
- We will have assessed the potential of co-cultivation of rye and wheat cereal species mixing in field experiments to manage aphid populations in wheat.