

The overall objective of EcoStack is to develop and support ecologically, economically and socially sustainable crop production via enhancement of ecosystem services provision and protection of functional biodiversity.



Practice principles

The agroecological practice of cultivar mixtures, an intraspecific diversification of the cropping system, increases the genetic diversity of the crop and can provide functional diversity that limits the spread of fungal diseases and pests. The mix of cultivars includes varieties with different abilities in terms of disease and pest resistance, weed competition, and can provide an interesting alternative to stabilize yields. It is important to understand the mechanisms behind the effects of cultivar mixtures, as herbivore response to each mixture component must be considered.



Research context

EcoStack researchers investigated the impact of cultivar mixtures on natural enemies of cereal aphids and analysed whether cultivar mixtures can contribute to crop resilience against/resistance to aphids. Two-way combinations of different cereal cultivars were tested in laboratory experiments. The variety pairs with lower rate of aphid setting on the host plant were then tested in field experiments between 2019 and 2021 in different countries belonging to different pedoclimatic regions (Finland, Sweden, UK, Spain, Serbia, Bulgaria and Bosnia and Herzegovina) to investigate the impact on crop infestation by aphid.



Main results

- Plant volatile organic compounds (VOCs) play an important role in plant-plant interactions. A reduction in aphid infestations was observed in field trials, but the effects on aphid abundance were specific to the cultivar mixture.
- The effects of cultivar mixture are highly dependent on climatic factors, as abiotic conditions can weaken plants, impact their physiology and therefore influence the effect of cultivar mixtures on pest infestation.
- It became apparent that aphid suppressive mixtures are highly cultivar specific and it is necessary to find suitable combinations for different countries, climatic conditions and newly bred cultivars.

Information on crop production protocol

To be successful, we propose some guidance on desirable associations of cultivars and on optimized diversification strategies.



Machinery and cultivars example

No specific machinery is needed to implement this practice as it is a mixture of two or more cultivars of the same crop, the same seed drill can be used to sow the crop in fields.

Nevertheless, work organization for sowing is different, it would need to take some time before sowing to mix cultivars seeds together. For large quantities of seeds, space is needed to mix the seeds and store them for a few weeks until sowing.

Different cereal cultivars were used in the EcoStack experiments, Table 1 provides an overview for the respective countries.

Table 1 : EcoStack fields experiments specifications, from EcoStack 2023

Country	Crop	Cultivar 1	Cultivar 2	Cultivar 3
Sweden	Barley	Salome	Fairytale	Anakin
Sweden	Barley	Salome	Fairytale	Anakin
Sweden	Barley	Salome	Fairytale	Anakin
Finland	Barley	Alvari	Toria	Vertti
Finland	Barley	Alvari	Toria	Vertti
UK	Wheat	Claire	Hereward	Xi19
UK	Wheat	Claire	Hereward	Xi19
Spain	Wheat	Florence Aurora	Montcada	Forment
Spain	Wheat	Florence Aurora	Montcada	Forment
Serbia	Wheat	Simonida	NS40S	NS Rani otkos
Serbia	Wheat	Simonida	NS40S	NC Rani otkos
Bulgaria	Wheat	Enola	Apolon	Lazarka
Bulgaria	Wheat	Enola	Apolon	Lazarka
Bosnia and Herzeg.	Barley	Matej	Jaran	Scarlet
Bosnia and Herzeg.	Wheat	Simonida	NS40S	NC Rani otkos
Bosnia and Herzeg.	Barley	Matej	Jaran	Scarlet





Crop management

Cereal sowing

Harvest



Picture 1 : Cultivar mixtures in barley field in France. (Photo ISARA 2021)

Mixing seeds of cultivars



Points to pay attention to

Different cultivars can have different growing season length, resulting in late or early harvesting.

At harvest, all cultivars must be mature to avoid yield loss or quality deterioration.






Mixing different cultivars must match the required outlet/sales quality. For example, cultivar mixtures for malting barley must exclude feed barley cultivars to ensure sales in the malting barley market.





Overview of the practice

Researchers at the Julius Kuehn Institute (Germany) gathered information to systematically identify the socioeconomic impacts and potential costs and benefits of EcoStack strategies. The description of expected impacts is based on a literature and data review, as well as interviews with EcoStack researchers about their field trials and expected outcomes. Here are results for the measure “cultivar mixtures”:

-  At the field scale, cultivar mixtures are expected to have strong positive effects on crop production, especially on weed and diseases control. At farm scale, better pest control can reduce pesticide use.
-  Cultivar mixtures can have slightly positive effects on other crop performance parameters such as yield stability under biotic and abiotic stresses and insect pest control. Reducing pesticide use through better pest management can have a positive impact, on farmer health and overall pesticide costs at the farm level and provide better water protection at the ecosystem scale.
-  The organization of work is modified by the use of cultivar mixtures. Time is needed for mixing the cultivars before sowing, but this might be compensated by reducing the time for weed or disease control. In addition, no specific investment in machinery is needed to implement this practice on farms.
-  Some aspect can be slightly negatively affected by using cultivar mixtures. The seed costs may become more expensive due to the use of multiple varieties and the marketing of mixtures might be limited.
-  No strong negative effects are expected from this practice.

When taking into account the field, farm and regional scale to evaluate cultivar mixtures practices, the overall ranking is mostly positive due to the expected positive impact on pests control, no need for investment in machinery and fewer changes in work organization.

Reference : EcoStack Deliverable WP4.1 “Guidance on crop cultivar mixture to enhance insect biocontrol”, 2023

Questions? Please contact us info@ecostack-h2020.eu

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