



Federal Ministry
of Food
and Agriculture

Bilateral Research Cooperation with Japan Call for Research 2018

OptiUnder: Optimized undersowing for pest regulation in cabbage and onion

country/countries	Germany and Japan
funding agency	Federal Ministry of Food and Agriculture - BMEL
project management	Federal Office for Agriculture and Food – BLE
project coordinator	Dr. Elias Böckmann
project partner(s)	<p><u>Julius Kühn Institute (JKI) :</u></p> <p>Institute of Plant Protection and Horticulture and Urban Green (former Institute for Plant Protection in Horticulture and Forests)</p> <p>Institute for Biological Control</p> <p><u>National Agricultural and Food Research Organisation (NARO):</u></p> <p>Central Region Agricultural Research Center (NARO/CARC)</p> <p>Western Region Agricultural Research Center (NARO/WARC)</p> <p>Tohoku Agricultural Research Center (NARO/TARC)</p>

	Miyagi Prefectural Agricultural and Horticultural Research Center
project budget	277.706 Euro
project duration	15 th May 2019 – 14 th April 2022
key words	Undersowing, barley, wheat, vegetables, pest control, natural enemies, beneficial arthropods
background	<p>Undersowing has several positive functions in an agro-ecosystem. They can protect the ground from heat and erosion, fixate nitrogen, increase structural diversity and support carrying ability for vehicles. Another important factor is the influence on pest population densities due to reduced detection of the host crop, a physical barrier function against dispersal and the increase of natural enemies.</p> <p>The major drawback of undersowing is the potential negative impact on yield due to concurrence for water, light and nutrients with the main crop. Especially in the 80s and 90s, many studies of undersowing were carried out that showed positive effects in terms of pest reduction, but the yield decrease, and management effort impeded broad implementation into practice.</p> <p>Flowering plant can provide nectar or pollen sources for natural enemies such as hoverflies or parasitoids. A combination of an undersown crop with the integration of flowering plants might therefore be an even more effective method for sustainable pest control. Such combinations were not tested before the project and needed to be assessed for their efficacy on pest insects as well as potential drawbacks, e.g., decline in harvest yield.</p> <p>All participating working groups at NARO and JKI had already expertise and experience in regard to either undersowing implementation to vegetable crops or effects of flowering plants on natural enemies. Thus, ideas of all participating parties could be connected to form new sustainable pest control strategies for evaluation in field and laboratory trials.</p>
objective	<p>In a cooperation of NARO (Japan) and JKI (Germany), we wanted to test and improve measures as undersowing with wheat/barley or the introduction of insectary plants into vegetable agroecosystems (onion and cabbage) to increase their resilience and pest control capacity without creating negative impacts on crop yield.</p> <p>In both countries, <i>Thrips tabaci</i> was the major targeted pest of onion/leek and aphids were the major targeted pests of head cabbage. We also aimed to overcome those drawbacks on crop yield by careful selection of plant species</p>

	and to create suitable solutions for important vegetable crops in Germany and Japan.
results	<p>Our field studies showed that interspecific competition of winter wheat undersowing on seeded onion plants, the standard production type in Germany, was so strong that it led to heavy decreases in harvest weight. Therefore, an undersowing system in onion crops does not seem practicable in Germany and we focused on cabbage production with the most suitable cabbage variety “Socrates” in the coordinated field trials. The suitability of sweet alyssum and buckwheat as pollen resource for adult hoverflies was shown in laboratory trials at JKI-BI. Also, there was an influence of the sweet alyssum variety on fitness and oviposition of hoverflies. In this regard, the variety “Benthamii” seemed most suitable for the predatory hoverfly species <i>Sphaerophoria rueppelli</i>.</p> <p>Results of field trials in white cabbage showed regulating effects of wheat and barley undersowing on pest insects such as aphids and flea beetles. The influence on natural enemies was not consistent between trials. Flowering plants, sweet alyssum intercropping and flowering strips, had no significant effects on hoverfly numbers in white cabbage plots. This might be due to too close distance between plots of 2 m (2020) and 15 m (2021). Constructive cooperation and detailed joint planning of German and Japanese colleagues was carried out for conduction of the coordinated trials as well as analysis and discussion of joint results. The constructive collaboration of JKI and NARO continues in the project IPReg (Intercropping and Undersowing for Pest Regulation in Horticultural Crops).</p>
recommendations	<p>Undersowing systems in seed onion are not recommended because of the low competition of the crop. Wheat undersowing can be recommended for pest regulation in cabbage production systems, but the system still needs further improvement to ensure desirable effects in all years.</p> <p>Flowering plant sweet alyssum (<i>Lobularia maritima</i>) is a suitable pollen source for predatory hoverflies with a long flowering period of several month but is not unreservedly recommended for cabbage intercropping due to enhancing effects on herbivory flea beetles. Coriander did not provide a long flowering period. Buckwheat and phacelia attracted pollinators but no clear effects on aphid regulation was visible in the field trials.</p>
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