IPM ADOPTION FACTSHEETS

Arable crops sector

The aim of IPMWORKS is to encourage the implementation of IPM strategies across the European Union by utilizing a network of farmers. Through peer-to-peer learning and collaborative efforts, these farmers will advance in their use of IPM strategies and showcase the effectiveness of holistic IPM in achieving reduced pesticide reliance, improved pest control, cost savings, and increased profitability.

This factsheet outlines the IPM practices employed by the arable crops sector.

COUNTRIES

DENMARK, GERMANY, IRELAND, ITALY, POLAND, SLOVENIA, SPAIN, THE NETHERLANDS, UNITED KINGDOM

HUBS

There are **11** arable hubs, one per country, except Germany and Denmark which have two each. In total there are **115** farmers. There are **22** farmers involved in Denmark, **22** in Gernany, **6** in Ireland, **17** in Italy, **15** in Poland, **10** in Slovenia, **13** in Spain, **7** in the Netherlands and **10** in United Kingdom.

CROPS/CULTIVARS

Maize, cereals, potatoes, sugar beet, oilseed rape, soya bean, legume crops

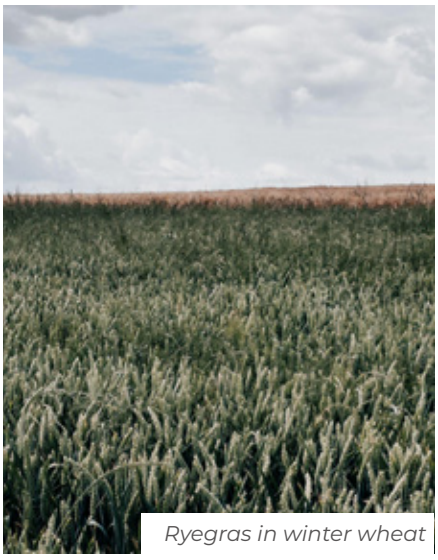
MAJOR PESTS AND DISEASES

Late blight, Barley Yellow Dwarf Virus, Ryegrass, Blackgrass, Lolium spec. european corn borer (*Ostrinia nubilalis*)

DENMARK

RESISTANCE IN GRASS WEEDS IS A MAJOR CONCERN AND THE PROBLEM IS SPREADING -MAINLY ITALIAN RYEGRASS AND BLACKGRASS.

There is no single solution to manage these grass weed populations whether it is resistant or non-resistant populations. Therefore, diverse strategies including management practices in the single season and changes in the crop rotation is necessary; delayed autumn sowing, soil bank management and increased spring crops in the rotation are some of the main elements.



Ryegras in winter wheat

DELAYED SOWING TO LIMIT GRASS WEEDS

The two grass weeds have life cycles similar to autumn sown cereals and will emerge during early autumn season. If sowing is delayed there are possibilities to make use of false/stale seed beds and control some of the grass weed population before establishing the crop. Following late sowing, some grass weeds will emerge, but the main flush have been surpassed.

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Delayed sowing, furthermore, prevents the grass weeds from growing vigorously, as temperatures decrease during autumn. Thus, keeping the weeds smaller and easier to control.

Discussing pros and cons of machinery

SOIL SEED BANK MANAGEMENT

Leaving the soil surface undisturbed for at least a month after harvest is a major part of soil seed bank management. It will increase the decay of grass weed seeds and limit the input to soil seed banks. Some of the seeds will also germinate and can be destroyed either chemically (glyphosate) or mechanical. The tillage strategy is also important in soil seed bank management to keep track of the position of the seeds in the soil. Deeply buried seeds will decay and only when the main part is expected to be non-viable should the soil be ploughed again. Tillage to 5-10 cm only will keep viable seeds being brought to the surface and germinate and new seeds to be buried in depths where they can germinate.

CHANGE CROP ROTATION

More spring sown crops should be included in the crop rotation. Italian ryegrass is able to germinate and produce viable seeds in spring sown crops, but to a lower extent than in autumn sown crops. Against blackgrass spring sown crops are more efficient and it is highly effective against another grass weed, *Vulpia myosuroides*, as Vulpia cannot produce viable seeds in spring in DK, because it needs vernalisation. In relation to the crop rotation, strategic use of herbicides in fields with no evident resistance is important. Use of ALS-herbicides should be avoided in spring cereals to make sure that ALS-herbicides are not used in every growth season.

Cross visit meeting, discussing strategies against Italian ryegrass in winter wheat

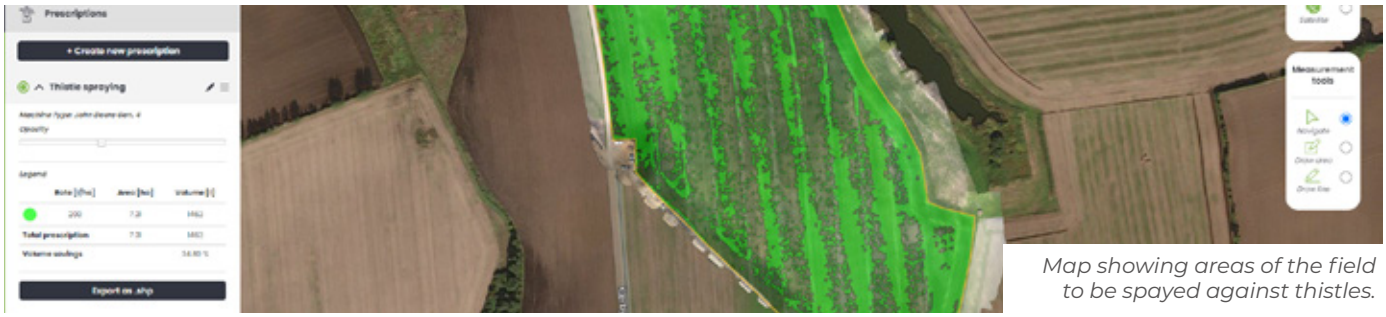
USE VARIETY MIXTURES TO LIMIT DISEASE PRESSURE

To make the crop more resilient to diseases a mixture of varieties with different tolerances to diseases is a powerful part of an IPM strategy. Even if one variety is harmed by a disease the other varieties can provide high yields. Furthermore, the disease pressure tend to be lower when “diluted” among varieties. Choose varieties that have similar maturity dates. Be aware of limitations to production of bread wheat or malting barley, not all accept variety mixtures.

Crop infested with Italian ryegrass

USING DRONE TO DETECT THISTLES

Many perennial dicotyledon weeds are patchy and spraying a whole field is unnecessary. A tool is developed to use drone recordings to generate spraying maps to do patch spraying as a part of an IPM strategy. Hub members are exchanging knowledge to get the sprayer working with the data from the drone. The image show a heavily infested field, where 2/3 of the field was sprayed (light green area).



Map showing areas of the field to be spayed against thistles.

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GERMANY

MECHANICAL WEED CONTROL IN SEVERAL ARABLE CROPS, USING CAMERA GUIDED HOES AND DIFFERENT TYPES OF HARROWS

Mechanical weed control is being successfully tested by several of our hub farmers. They use different types of hoes and harrows depending on the crop type and it's growth stage.

Effective mechanical weed control requires regular monitoring and detailed knowledge of the optimal machine settings depending on the growth stages of the crop and weeds and soil types. Success can be reduced in wet soils and climates, or on fields with many large stones.

Einböck rotary harrow

USE OF MECHANICAL WEED CONTROL AND SPOT SPRAYING IN SEVERAL ARABLE CROPS AND PERMANENT GRASSLAND BY USING CAMERA GUIDED HOES AND DIFFERENT TYPES OF FINGER WEEDERS AND DEVICES FOR SINGLE PLANT TREATMENT

While finger weeders are already being used by some of our demo farmers, especially on permanent grassland and in maize, hoes and devices for single plant treatment are not yet widespread, but are increasingly being offered by agricultural contractors in the region. As part of the demonstration events in our hub, we therefore want to show the effectiveness of mechanical weed control methods compared to conventional chemical methods and train the level of knowledge for combined methods that follow the approach of IPM among our farmers.

Since our demo-farmers are situated in a region with many protected areas of surface waters, there is a demand for weed management solutions suitable for such areas.

GST Biostar rotary hoe

Attendees at a demonstration event

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IRELAND

MONITORING APHIDS TO ASSESS BARLEY YELLOW DWARF VIRUS RISK IN WINTER AND SPRING BARLEY CROPS

Barley Yellow Dwarf Virus poses a threat, spread by various aphid vectors such as R. Padi, S. Avenae, Met. Dirhodium, among others. Yellow traps were strategically placed in crops to monitor the vector movement during susceptible growth stages—from emergence to to Growth Stage 31.

The count included tracking the numbers of each aphid species and identifying those carrying the virus. This data provides a valuable indication of the risk of virus transmission into the crops.

Upon detecting high numbers of aphids carrying the virus, the recommendation is to treat crops promptly with insecticide. Conversely, in cases of low risk, the advice is to adopt a wait-and-see approach, monitoring the populations for potential increases.

Yellow traps

EVALUATION OF THE TSUM MODEL FOR PREDICTING RISK

We assessed the effectiveness of the Temperature Summation Model (TSUM) in predicting the risk of aphid movement. The TSUM model determines risk based on the accumulation of degree days, recommending treatment once the 170-degree day threshold is reached. In the recent season, this limit was surpassed multiple times, suggesting the need for multiple treatments.

However, studies conducted in Ireland suggest a more conservative approach, advocating for only one application of insecticide. This recommendation takes into account the potential risk of developing resistance, emphasizing the importance of judicious pesticide use in pest management strategies.

Pollinator strip

Cover crop discussion

ITALY

INTERCROPPING FOR CEREALS WITH PULSES AND FORAGE COMPANION CROP

Lentils intercropped with durum wheat was tested. The technique has few agronomic limitations and can be successfully implemented. Post-harvest separation is a weak point. Tested both in flat fields and in hilly areas, where in the first environment the technique gives better results. Tested for two years in hilly environment in an organic farm with a relay sowing and a contemporary sowing, where lentils were not productive enough to justify the adoption of the technique.

Lentils intercropped with durum wheat

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Weed control is improved when lentil is grown with durum wheat with respect to the sole crop. Data still to be analysed. Using forage crops on common wheat in an organic farm gave good results for weed control and companion crop productivity with a contemporary sowing, with differences highlighted in the two species tested (Egyptian clover and sulla).

Intercrop sulla soft wheat

MINIPLOUGH FOR REDUCED TILLAGE AND COVER CROP TERMINATION TO ENHANCE RYEGRASS CONTROL

The technique is applied by a hub farmer with good results. A demo event and a video in the field were made to illustrate the technique.

NEW COMMON WHEAT VARIETIES FROM ORGANIC BREEDING PROGRAMMES AND TWO VARIETIES MIX FOR DISEASES CONTROL

After a demo event, a field trial was done to compare a new variety available labelled organic in a conventional hub farm. The variety proved to be more resistant to lodging and with a more competitive biomass against weeds. Yield data still to be processed and analysed. The mix between the new and a control variety gave good results in stem rust control. The farmer would like to test again one of these varieties but with durum wheat avoiding one herbicide treatment out of two.

Sulla intercropped with durum wheat

FLOWER STRIP IN ARABLE CROP MARGIN FOR ECOSCHEME 5

A flower strip was established in an organic farm with bee keeping activity close by. The species sown in late October showed different emergency rates. *Borrago officinalis* gave much better results with respect to Phacelia and gave flowers in early spring for pollinators. The high density of the crops sown controlled monocot weeds well with lower control on dicot weeds e.g. *Pychris eracioides*. The strip will be mown after 30 September to follow the Ecoscheme 5 rules.

Flower strip

Miniplough demo event

Soft wheat varieties comparison

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POLAND

MECHANICAL WEEDING WITH DIFFERENT TYPES OF HOES

The needed frequency of weeding is dependent upon various factors, including crop types, canopy closure time, and other variables. In general, precise and repetitive mechanical weeding proves to be an effective strategy against weeds, especially until the crop adequately covers the inter-row space.

On farm demo event on mechanical weeding

UTILIZING BIOLOGICAL CONTROL WITH TRICHOGRAMMA TO SUPPRESS EUROPEAN CORN BORER (OSTRINIA NUBILALIS)

There are two methods of application: attaching active eggs in cardboard pouches onto corn leaves by hand or dispersing biodegradable balls with Trichogramma eggs directly onto the field. The critical elements include timing and achieving an adequate density of Trichogramma, which means that application may need to be repeated 2-3 times during the growing season. The control agent has a short lifespan. As the success is dependent on density of the biological control agent, the farmer have to plan ahead with producers of Trochogramma eggs to ensure the availability.

Trichogramma dropping by drone

Trichogramma eggs cards and balls

SLOVENIA

IMPLEMENTING ANTI-RESISTANCE STRATEGY FOR DISEASE CONTROL IN BARLEY

In June 2023, the Integrated Pest Management method was adopted as a robust anti-resistance strategy to combat Ramularia Leaf Spot (Ramularia collo-cygni) fungal diseases in barley. This innovative approach incorporated the use of sulphur in conjunction with fungicides. Slovenian barley farmers typically rely on fungicides targeting a single site-specific target to combat major diseases in winter barley. Although these fungicides often consist of combinations of two or three active ingredients, they all act on different single-specific targets within the pathogen cell, posing a moderate to high risk of resistance development.

To address this, fungicides with multiple target sites were introduced, allowing only sulphur use in winter barley in Slovenia. In a practical demonstration, two farmers divided their fields into treated and non-treated sections. One farmer applied the conventional registered fungicide on one part and combined it with sulphur, while the other farmer sprayed three times throughout the growing season, applying sulphur only in the last round. The first farmer followed a preventive approach based on forecasts and weather conditions, while the second farmer timed the applications more according to phenological phases than weather conditions. Non-treatment areas were deliberately left on both fields.

"Day of Cereals" event

Attendees to the field exploration

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During a demo event, participants examined the non-treatment areas to identify existing diseases on the leaves. They then observed the treated areas with combinations of sulphur and the conventional fungicide. The Hub coach elucidated the importance of spraying based on disease pressure and weather conditions compared to timing applications according to phenological phases. This comprehensive strategy aims to curb resistance development and ensure effective disease control in barley cultivation.

At Farmer 1, a single fungicide treatment, complemented with sulphur, demonstrated an impressive 80% effectiveness in countering resistance. This approach resulted in a yield of 7.5t/ha, slightly exceeding the performance from the previous year in 2022.

On the other hand, Farmer 2 pursued a more intensive strategy, implementing a total of three fungicide sprayings in 2023. Sulphur was integrated into the final spray on the barley ears. Despite a 40% effectiveness in the anti-resistance method, the lower infection rate of Ramularia collo-cygni was attributed to the preceding two sprayings. Consequently, the farmer plans to reduce the frequency of fungicidal sprayings to twice a year, supplementing with sulphur.

Encouraged by the success of the IPM method, farmers express their commitment to sustaining the anti-resistance strategy in the future. The hub coach further propagated this effective IPM approach at the “Day of Cereals” event, presenting it to fellow farmers and agricultural advisors.

Participants in the demonstration event

THE NETHERLANDS

MECHANICAL WEED CONTROL: A KEY ELEMENT IN ARABLE CROP WEED MANAGEMENT

The effectiveness of mechanical weed control is greatly influenced by weather and soil conditions, with dry weather and soil playing pivotal roles. Various options are available for mechanical weed control:

- **Pre-crop Emergence:** Utilizing a harrow during the germination stage of weeds.
- **Post-crop Emergence:** Employing a harrow or hoe after crop emergence.
- **Precision Technology:** Increasingly, equipment integrates cameras or GPS steering for more accurate and targeted weed control.
- **Emerging Robotics:** Rapid advancements in robotics are being witnessed, with initial machines already operational, albeit at a substantial cost.

Cutting-edge agricultural machinery

LATE BLIGHT RESISTANT POTATO VARIETIES

Late blight stands out as a significant fungal threat, often requiring numerous fungicide applications for control. The introduction

Observers engaging with diverse potato varieties

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of resistant potato varieties presents a groundbreaking solution, potentially reducing fungicide use by up to 80%. While periodic fungicide applications during high infection risk periods remain crucial to preserving resistance, resistant potato varieties are gaining popularity, not only in the organic sector but also drawing interest from conventional farmers.

UNITED KINGDOM

COMPANION CROP INTEGRATION WITH BUCKWHEAT AND BERSEEM CLOVER IN WINTER OILSEED RAPE

This innovative approach has led to a notable reduction in pest pressure from cabbage stem flea beetles. The establishment of crops has shown improvement compared to the sole use of Oilseed Rape, accompanied by an increase in in-field biodiversity. By the end of autumn, the weed burden is comparable to conventional establishment methods. The companion crops do not survive the winter frost, eliminating competition with the crop in the following spring. This agroecological practice proves to be cost-effective, aiming to reduce the use of plant protection products and fertilizer inputs during establishment while maintaining output. Cutting-edge technology, including satellite images and drones, is employed to assess the effectiveness of this technique.

Companion crops transforming winter oilseed rape fields

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