Integrated pest management and farmer awareness – a Norwegian case study

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Background and objectives

- EU pesticide regulations and IPM-principles were adopted in Norwegian legislation in 2015.
- IPM-practices potentially conflict farming practices recommended based on priorities of the Water Framework Directive.

➢ A case-study in Norwegian cereal production was performed to demonstrate:

- the environmental impacts of current practice
- conflicting environmental and economic concerns in agricultural production systems
- the potential for improvements with selected IPM-tools and policy instruments

Methods

Case-study catchment

A small agriculture and cereal dominated catchment in South East Norway was selected as case study for the project. The catchment is part of the JOVA monitoring program*.

Plant diseases and weeds

Tools and practices for management of weeds and plant diseases were studied in the field, including field observations with or without aid of a forecasting/decision support system (DSS) and image processing for precision spraying (VIPS**).

Environmental impact and farm economics

Long term monitoring data (1995-2011/2013) for the Skuterud catchment (JOVA-program*) were used for model simulations of:

- Pesticide environmental effects (SYNOPS model)
- Soil and phosphorus loss (SWAT model)
- Economics of current cropping and pest management practices (regression models)

Farmer awareness studies

Current state of farmer awareness of IPM-principles (Directive 2009/128/EC), their actual IPM-practices and attitudes toward measures and instruments for increased adoption of IPM were assessed through:

- An online survey sent to 1000 cereal farmers (approx. 40% answers received)
- Focus group discussions with:
  - Farmers and advisors
  - Agricultural administration at local and regional level, the Norwegian Agriculture Agency, the Norwegian Food Safety Authority, the farmer union and the agricultural extension service

PROJECT FUNDING

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Adigo AS supported the project with DAT-sensor images and GPS-data.

Test of tools to improve IPM practice

✓ **VIPS** (forecasting and DSS) and expert recommendations** compared to farmer's choice showed:

- Reduced use of fungicides (leaf blotch disease)
- Reduced use of herbicides in spring
- Reduced use of glyphosate for stubble treatment

➢ No apparent effect on environmental risk from pesticide use (as modeled by SYNOPS GIS).

✓ **DAT-sensor*** for precision spraying of herbicides** compared to broadcast treatment showed:

- Up to 95% reduced area sprayed depending on weed infestation level

➢ Reduced environmental risk from pesticide use, due to reduced area sprayed.

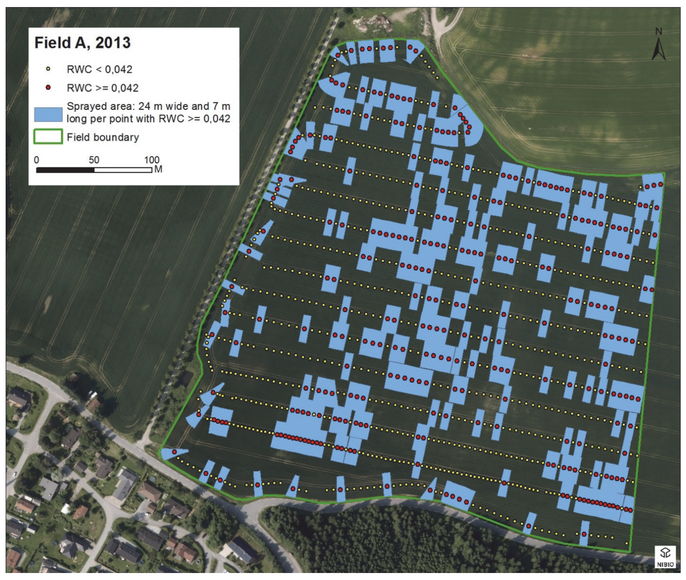


Fig. 2: Map for precision spraying based on DAT-sensor. RWC: relative weed coverage. Red dots: weed coverage above threshold, Yellow dots: weed coverage below threshold, Blue: sprayed area. Illustration: Roar Lågbu, NIBIO.

✓ **Site-specific environmental impact assessment** for current practice and the employed IPM-tools showed:

- low pesticide risk with current practice
- potential to reduce P-loss with reduced tillage or spring ploughing compared to autumn tillage

Table 1: Comparison of farmer's choice and VIPS/expert recommendation for pesticide use and tillage and corresponding pesticide risk level and risk of P-loss, for selected fields and crops in the case-study catchment. (A: autumn, S: spring, P: ploughing, H: harrowing)

Field	A	D	E	F	G	H	I	J
Crop	Spring barley	Winter wheat	Spring oats	Winter wheat	Spring wheat	Spring barley	Spring wheat	Spring barley
Farmer's choice								
Sum risk pesticides	Very low	Low	Low	Low	Very low	Low	Low	Very low
Tillage	AH	AP	AH	AP	AH	AP	AH	AP
P-loss (kg/ha) mean 20 yrs	0.15	1.04	1.23	1.42	1.37	2.47	0.29	4.19
VIPS'/expert recommendation								
Sum risk pesticides	Very low	Low	Low	Low	Very low	Low	Low	Very low
Tillage	SP	AH	SP	AH	SP	SP	AP/SP	SP
P-loss (kg/ha) mean 20 yrs	0.10	0.80	0.93	0.42	0.96	0.49	0.9/0.2	0.82

***JOVA**

The Norwegian Agricultural Environmental Monitoring Programme (JOVA) is a national programme for soil and water monitoring in agriculture dominated catchments in Norway, and is funded by the Norwegian Ministry of Agriculture and Food. Further details on www.nibio.no/jova

****VIPS**

VIPS is an automatic forecasting and decision support system for agricultural pests, diseases and weeds, developed by NIBIO and The Norwegian agricultural extension service (www.vips-landbruk.no).

*****DAT-sensor**

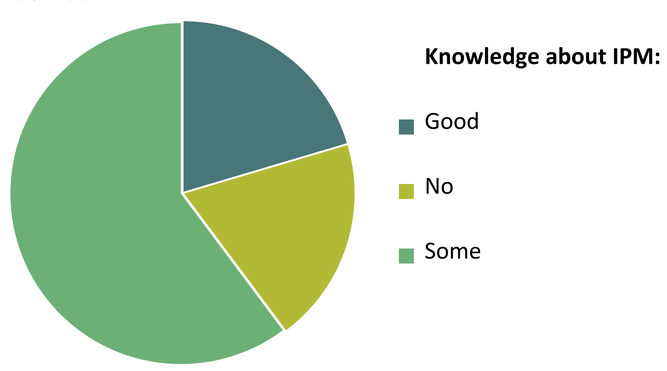
Sensor technology under development by DAT AS (Dimension Agri Technologies) for use in precision spraying.

Survey of farmer awareness of IPM

✓ **The top three priorities** of Norwegian cereal farmers' (internet survey) were:

- high crop quality
- high crop quantity
- low pesticide residue level

✓ **Survey showed low knowledge of IPM**, and reducing pesticide use was stated to not be a concern.



✓ **Current practice shows adoption of IPM,** as the farmers reported to often rely on:

- Crop rotation (mainly cereal species)
- Disease resistant varieties
- Visual pest assessment in the field before choice of pesticide and spraying
- Pesticide choice to avoid pesticide resistance
- (Professional) advice – incl. some use of decision support/forecasting system (VIPS**)

Nevertheless, almost half the farmers surveyed based their choices on previous years spraying practice.

✓ **The main suggestions to improve farming practices** were:

- better advisory service
- educational tools for farmers
- economic instruments targeting improved tools and technologies

✓ **Challenges for application of IPM** defined in focus group meetings included:

- Norwegian cold and moist climate conditions
- Need for good timing of plant protection measures
- Fewer full-time farmers and increasing acreage to farm
- Lack of information regarding economic benefits of IPM

Conclusions

➢ Current cereal cropping is sound, but precision treament will reduce environmental impact

➢ Under current practice risks for P-loss is larger than risks from use of pesticides, and this must be considered for non-chemical IPM-tools

➢ Measures are needed to improve farmer knowledge and awareness of IPM in Norway

➢ Economic instruments should target new precision farming technologies

FURTHER RESEARCH

The RCN-funded SMARTCROP-project (www.smartcrop.no; fb/smartcrop) assures continued focus on topics studied in the STRAPP-project, including:

- New tools for improved IPM practices to control weeds/plant disease/insect pests in cereal, strawberry and apple production
- Web application for site specific pesticide risk assessment (SYNOPS WEB)
- Farmer awareness and instruments for increased adoption of IPM

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PROJECT PARTNERS

The project has been a collaboration between NIBIO Divisions Biotechnology and Plant Health, Food Production and Society, Environment and Natural Resources, and Geography and Statistics (NO), the Julius Kühn Institute (DE), the Swedish University of Agriculture (SLU) Centre for chemical pesticides (SE), the University of Copenhagen Department of Food and Resource Economics (DK) and Thünen Institute for Regional Development (CH).