AdvisoryNetPEST

Benefits and use cases of offline spot spraying

Farmer's name
LK Technik Mold

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Name of the farm
Mold 72 3580 Horn Austria

Country
Austria

Description of the farm context

Typical of this Novel Approach are larger farms with row crops. The soil is a regionally typical chernozem, the climate is arid.

The practices identified in this project are called 'Novel Approaches' and abbreviated as 'NA'

Partner Organization

Landwirtschaftskammer Niederösterreich

technik mold

Landwirtschaftskammer Österreich

AdvisoryNetPEST

The **AdvisoryNetPEST** project aims to create a **network** and **upgrade advisory services** across the EU to increase the sharing of knowledge and the **adoption of innovative solutions to reduce the use and risks of pesticides** (RURP) in all **EU Member States**, enabling the agricultural sector to achieve the targets proposed by the Farm to Fork Strategy.

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THE TECHNIQUE

Short Description:

This novel approach is a form of precision farming aimed at reducing pesticide use by utilizing high-resolution aerial images taken by drones to identify and map weed vegetation.

Crop Sector:

Arable crop sector

Targeted pest and diseases:

Weeds control

Objective of the NA:

There are significant problems with thistle weeds. On the other hand, the technical equipment is already available and there is a desire to use it. The field sprayer can operate in a site-specific manner; only the necessary data needs to be collected for this purpose.
Before adopting the new practice, the farmer faced several challenges, including high production costs per hectare and excessive expenses due to the overuse of chemicals. Manual spot spraying was nearly impossible to perform efficiently, resulting in unnecessary input use and reduced cost-effectiveness.

Level of practice adoption across the country:

1 2 3 4

Funded by the European Union

UK Research and Innovation

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Expectations regarding RURP

Another expectation is the exchange of knowledge between research, industry, and farmers to improve detection systems, application strategies, and retrofit solutions. In addition, RURP should help generate data on economic and environmental benefits to support wider adoption of the technology.

Key success factors

Key success factors include reliable weed detection under different field conditions, fast and precise nozzle control, and seamless integration of sensors, cameras, and GPS with the sprayer system. The technology must work consistently in varying light, crop stages, and weed densities. Another important factor is the ability to retrofit the system easily to existing sprayers, combined with proper calibration and simple operation for the farmer. Clear economic benefits, such as herbicide savings and effective weed control, are also essential for successful adoption.

Methods/strategy of application in the farm

Spot spraying retrofits allow existing sprayers to be upgraded with cameras, sensors, and electronic nozzle control to detect weeds and apply herbicide only where needed. These systems can be integrated with GPS guidance and individual nozzle or section control, enabling targeted application without replacing the entire sprayer.

Improvements of the NA

Further development should focus on easier retrofitting to existing sprayers, better integration with GPS and farm management systems, and simplified calibration procedures. In addition, optimizing nozzle response time and data processing speed can improve application precision and overall field performance.

Resources and skills needed to adopt the NA

Farmers and technicians need skills in system calibration, basic digital technologies, and data handling, including the interpretation of weed detection results and application data. In addition, technical support for installation, maintenance, and software updates is important to ensure reliable operation.

*RURP : Reduction of Use and Risks of Pesticides

ISOBUS terminal for spot spraying applications

Retrofit solution for spot spraying

Georeference points for referencing the spots

Advice from the Advisor

Advisors should support farmers in selecting suitable spot-spraying technologies and ensure that systems are properly installed and calibrated. They can also provide guidance on herbicide choice, application timing, and integration into existing weed management strategies.

Farmers Testimony

Farmers report that spot spraying can significantly reduce herbicide use while maintaining effective weed control. They highlight the benefit of treating only weed patches, which lowers input costs and reduces environmental impact.

Policies and Regulatory Support

Policies and regulatory support can facilitate the adoption of spot-spraying technologies by encouraging precision agriculture practices and reducing barriers to innovation. Supportive policies may include funding programs for equipment retrofitting, research and field trials, and incentives for technologies that reduce pesticide use.

Social and Cultural Acceptance

Social and cultural acceptance depends on the perceived benefits of spot spraying, particularly reduced pesticide use and lower environmental impact. Technologies that support sustainable farming practices are generally viewed positively by both farmers and the public.

To go further on NA replication:

To further develop the novel application, additional field testing under different crops, weed pressures, and environmental conditions is necessary to validate performance and reliability. Continuous improvement of detection algorithms, sensor systems, and nozzle control can increase accuracy and efficiency.
Further work should also focus on simplifying retrofitting to existing sprayers, improving user interfaces, and demonstrating clear economic and environmental benefits to support wider adoption.
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BENEFITS

Benefits of spot spraying include a significant reduction in herbicide use, lower input costs, and reduced environmental impact. By treating only weed-infested areas, chemical application becomes more targeted and efficient.
Additional benefits include improved resistance management, more precise crop protection, and the possibility to retrofit existing sprayers, making the technology accessible without replacing current equipment.

BOUNDARIES

Boundaries of spot spraying include limitations in weed detection accuracy under difficult conditions such as dense crops, small weeds, or poor lighting. High weed density can also reduce the effectiveness of targeted spraying compared to conventional broadcast applications.
Additional constraints are the cost and complexity of retrofitting equipment, the need for reliable sensors and calibration, and the requirement for technical knowledge to operate and maintain the system.

Systemic Feasibility Analysis: Expert insights from Literature and Field Data

CRITERIUM	INDICATOR	INDICATOR SCORE	EVALUATION
Pesticide use reduction level	Reduction of the applied volume of pesticides	**high reduction (>25%)** moderate reduction (10-25%) low reduction (<10%) no reduction	
Effectiveness of controlling the target pest/diseases/weed	Percentage reduction of the target pest/weed infestation or of the damage caused by the target disease	high reduction (>60%) moderate reduction (30-60%) low reduction (<30%) **no reduction**	
Biodiversity	Impact on aquatic organisms	-- / - / 0 / **+** / ++	
	Impact on earthworms	-- / - / 0 / **+** / ++	
	Impact on non-target soil micro-organisms	-- / - / 0 / **+** / ++	
Water quality	Impact on pesticide losses to surface water (runoff)	-- / - / 0 / **+** / ++	
Air quality	Impact on pesticide emissions	-- / - / 0 / **+** / ++	
	Impact on air pollutants emissions	-- / - / 0 / **+** / ++	
Working conditions	Knowledge requirements	high training level **moderate training level** low training level no training	
Costs	Required level of investment	> EUR 100.000 EUR 50.000 - 100.000 EUR 10.000 - 50.000 **< EUR 10.000**	
Outputs	Impact on crop quality	-- / - / 0 / **+** / ++	
Profitability	Impact on profit margin	**+ 5%**	
	Payback period	**8 years**	

Impact Highlights

The novel approach uses high-resolution aerial images, primarily from drones, to identify varying weed pressure in arable crops and generate application maps for targeted pesticide spraying. According to the systemic feasibility analysis, this spot spraying method efficiently reduces herbicide use without compromising yields and may even enhance crop quality.

Environmental indicators benefit from decreased chemical input, and with relatively low investment costs and an estimated eight-year payback period, profit margins improve slightly. The main limitation is the need for training, which may hinder broader adoption of the method.

Overall, this method offers a more precise and sustainable weed control strategy for field crop production.

Evaluation: