Practice PF n° 8

CROPSAT - FREE SATELLITE IMAGERY FOR TAILORED NITROGEN FERTILIZATION IN WHEAT

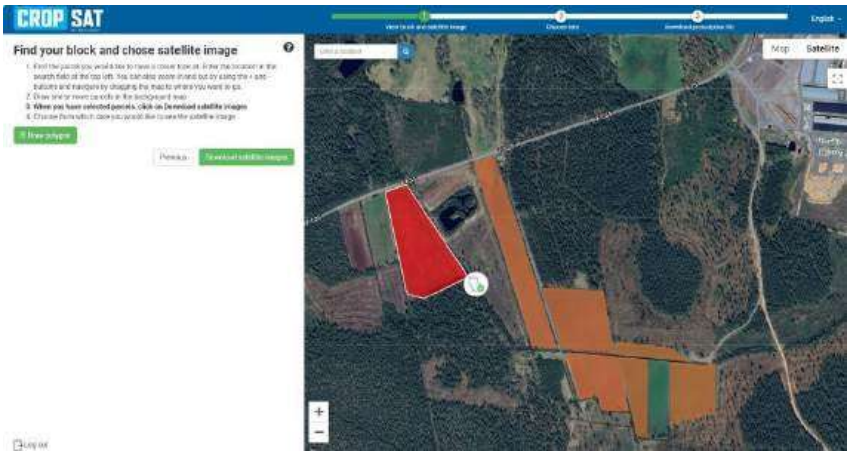
Introduction

Category: Good Practice (GP)

Practice identity card

#Optimize nitrogen fertilization, variable rate application (VRA)

#PF, Food, Feed, wheat, Fibre, GP, Sweden



Short description

- CropSat is a free precision farming tool developed in Sweden that leverages satellite imagery to optimize nitrogen fertilization, particularly for crops like wheat and other cereals. The tool uses Normalized Difference Vegetation Index (NDVI) data from satellite images captured every 2-5 days to monitor crop growth, biomass, and variability across fields. By providing tailored nitrogen application maps, CropSat ensures more efficient resource use, reducing both costs and environmental impact.
- The process begins with farmers accessing the user-friendly CropSat web platform, where they can view their fields on an interactive map. The platform highlights variations in vegetation caused by factors such as soil quality, water availability, or nutrient deficiencies. These insights help farmers identify underperforming zones that require targeted fertilizer applications.
- To create Variable Rate Application (VRA) maps, the user follows these steps:
  a) Satellite imagery identifies crop health and biomass variability, providing the basis for precise fertilization planning.
  b) Farmers can generate application maps by selecting the field, crop, and the target nitrogen rate for specific zones. The platform allows users to input parameters like product type (e.g., mineral fertilizers).

c) Once the VRA map is created, it can be downloaded in ISO-XML or Shapefile format, ensuring compatibility with modern tractor guidance systems and variable rate spreaders.

d) The task map is uploaded to the tractor's onboard terminal, allowing the equipment to automatically adjust nitrogen application rates in real time. This precision minimizes over-fertilization in healthy zones while providing additional nutrients where needed.

➔ CropSat has become an essential tool for farmers because it improves yields, promotes sustainability, and reduces fertilizer costs. Unlike traditional methods, where nitrogen is applied uniformly using generalized recommendations, CropSat enables farmers to account for field variability. The approach addresses previous inefficiencies where some zones were over-fertilized, leading to unnecessary expenses and increased nitrogen leaching, while others were under-fertilized, resulting in reduced yields. Compared to alternative technologies like N-sensors, CropSat provides a more affordable and accessible option, as it does not require costly equipment. Additionally, it requires minimal technical expertise, making it suitable for farmers with a basic understanding of digital tools. All that is needed is access to the internet, a compatible variable rate spreader, and a tractor capable of processing task maps.

➔ In terms of environmental impact, the precision offered by CropSat significantly reduces nitrogen leaching, contributing to improved water quality. This aligns with sustainability goals while enhancing the public image of agriculture. Moreover, the practice allows farmers to improve both crop quality and economic returns, fostering a sense of accomplishment in balancing profitability and environmental stewardship.

Implementation process

Which practice is considered as the standard in this region? If farmers do not use VRA for their nitrogen application, they use recommended nitrogen rate tables, which correlate with the crop and the expected yield. The same amount of nitrogen is then applied to the whole field without taking into account field variations.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Nitrogen fertiliser is a major expense for farmers and has a negative impact on the environment. A more resource-efficient approach to nitrogen application has both economic and environmental benefits. Previously, nitrogen fertilizer was applied evenly across fields, which led to inefficiencies: some areas received excessive amounts, while others received too little. Alternatively, farmers had to invest in expensive N-sensors. Compared to using satellite imagery, spreading nitrogen more evenly over the field reduces fertiliser costs, gives better and more consistent crop quality and reduces nitrogen emissions.

How long did it take to implement the practice and which are the measures needed to monitor: The system was developed in 2014-2015 in a collaboration of… There was an earlier version of Cropsat but it was not as user-friendly and accurate. After the development of 2014-2015 Cropsat is integrated and developed by DataVäxt. The use of Cropsat has been gradual since 2015, but by 2024 it is an established part of grain production for cereal farmers.

Logistics

- **Logistic aspects to consider:** To utilize the method, the farmer needs a fertilizer spreader that can spread VRA task maps
- **Other specific tools involved/included:** A tractor that may receive variation map and a spreader that can handle varied rates.
- **Additional requirements for application:** Access to internet

- **Skill/education level required:** rather high

Agronomical traits

- **Can the practice be applied to a multitude of cultivation techniques?** If the farmer uses mineral fertilisers, this practice is useful, but development is ongoing for other types of fertilisers like organic manure.
- **Targeted crop categories:** food, feed, fibre
- **Influence on soil quality:** No
- **Suitable soil types:** peaty, sandy, clay, loamy, chalky, silty
- **Expected effect on crop yield**: increase
- **Expected effect on crop yield variation**: decrease
- **Expected effect on crop quality:** increase
- **Expected effect on crop quality variation:** decrease
- **Which costs may increase due to the practice?** skilled labour, equipment, internet / data subscription costs
- **Which costs may decrease due to the practice?** fertilizers
- **Expected long-term/indirect economic benefits of the practice:** Improved water quality, Lower labour intensity, improvement of human skills.
- **Expected effect on the leaching of nutrients:** Decrease of nitrogen leaching.
- **Specific materials applicated through the practice:** digestate, animal manure, municipal sludge, compost

Administrative context

- **Does the practice qualify for subsidies?** No
- **Status of the legal framework that regulates the practice:** there is hardly any
- **Are there any policy barriers complicating the practice's application?** No
- **Does the practice involve the use of hazardous substances?** No
- **Is the practice supported by Eco-schemes?** No
- **Are there any gaseous emissions to be considered upon application of the practice?** Yes: Nitrous oxide
- Yes: Ammonia
- **Greenhouse gas (GHG) reduction potential of the practice:** substantial
- **Expected effects from the practice on the time occupation of the farmer?** moderate increase
- **May the practice contribute to a better public image of agriculture?** Yes. The environmental benefits from this practice should contribute to a better public image at the same time it contributes to better quality and quantity of the yield.
- **May the practice improve the farmer's self-image?** Yes. The environmental benefit from this practice gives the farmer a sense of accomplishment of doing something good at the same time they will improve their own economics. It´s a win-win situation.

Contact

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Eu member state: Sweden

Find out more

Source of information The CropSat platform is a collaboration between Swedish University of Agricultural Science (SLU), Hushållningssällskapet, DataVäxt AB and Agroväst Livsmedel AB. Financed by Stiftelsen Lantbruksforskning https://cropsat.com/