



MAIN STREAM PRECISION FARMING - 7.000 VRA MAPS FOR WINTER RAPESEED

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Resume: SEGES is owned by the Danish farmers and is an agricultural advisory centre advising landowners with a total of 2.1 mill hectare. One of SEGES's goals is to make precision farming mainstream. One step in the process of making precision farming mainstream was in 2016 to give all farmers access to the free internet application CropSAT.dk. Here farmers can make variable rate application (VRA) maps based on satellite data from Sentinel-2. But this is not enough to make precision farming mainstream because a barrier for the farmer was to type in the amount of nitrogen in five levels, so a nitrogen model for winter rape was implemented in CropSAT. Still, only farmers interested in precision farming were reached and the goal was all farmers. Then the idea of pushing out all VRA maps for winter rape came up. To do this you have to have a site on the internet used by all farmers. SEGES has a platform like this where 2,000 unique users visit every day. Now, the farmer is showed all his winter rape fields with variable rate nitrogen. In 2017 SEGES pushed out 7,000 VRA winter rape maps. In 2018 SEGES has pushed out 12,000 VRA maps on winter rape and 70,000 on winter wheat fields.

SEGES is owned by the Danish farmers. Furthermore, there is a total of 25 local agricultural advisory centres spread throughout the country also owned by the Danish farmers. Overall, 85 per cent of the farmland is advised by SEGES and the local advisory centres - 2.1 million hectares. SEGES focuses on making precision farming main stream.

Since 2016, Danish farmers have had access to a free and very user friendly internet program CropSAT.dk. Here farmers can see the vegetation index map (NDVI) of his fields every time the satellite Sentinel-2 passes by. He can then make a VRA nitrogen map or crop protection map and export the map to a shape file that can be loaded into the tractor terminal which means that farmers can spread the fertilizer according to the VRA map.

How does CropSAT works?

CropSAT.dk is a very easy program to use and it only has four screenshots – see fig.1. In the first screenshot the farmer can type in his farm ID and all his fields will show up. He then picks one field and chooses a date where the satellite Sentinel-2 has passed by.

The green map shows the vegetation index NDVI in five levels, where yellow colour shows areas with low biomass and dark green areas show areas with high biomass. The farmer then type in the levels of nitrogen per hectare in each of the 5 levels and press next.

The blue map shows the VRA nitrogen map according to the input made by the farmer. If the farmer is satisfied, he can press a button and get a shape file or ISO-XML according to his machinery. If he is not satisfied with the blue map, he can change the amount of nitrogen by clicking pixels in the field and type in the right nitrogen level.

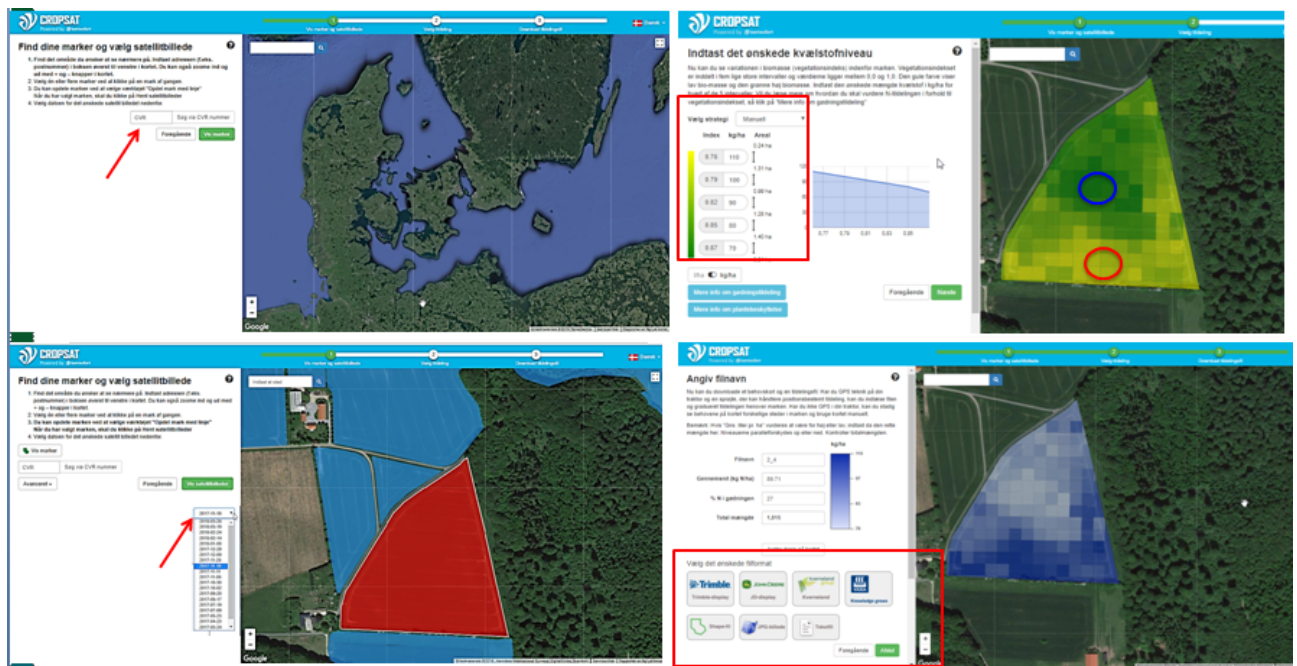


Fig. 1. CropSAT.dk is a very simple program, where farmers can make VRA maps based on vegetation maps made from Sentinel-2.

Even though CropSAT is an easy program to use, it is not so easy for the farmer to decide the nitrogen levels based on the NDVI map. To overcome this barrier SEGES decided to implement a nitrogen algorithm in CropSAT.

The winter rape nitrogen model

The calculation was based on NDVI vegetation maps from Sentinel-2 within the period from 1 October to 15 November 2016. So only winter rape fields that had a NDVI picture from that period was in the group.

First, the average NDVI for each of the 7.000 fields is calculated. Next, the fields are divided into 3 groups - one with low NDVI, normal NDVI and high NDVI. Fields in the three groups are applied in average 120 (low NDVI), 90 (normal NDVI) and 60 kg of nitrogen per hectare (high NDVI).

The algorithms then calculate all nitrogen levels within each 10 x10 meter pixels. If NDVI in the pixel is higher than the average NDVI for the field then a lower amount of nitrogen is applied and vice versa.

The model ensures that the nitrogen amount on average per field hits exactly the target.

Where does SEGES present the 7,000 VRA maps?

SEGES want precision farming to be main stream and for all farmers. To do that SEGES shows the VRA maps to all farmers whether he is interested in precision farming or not. If SEGES only put in nitrogen models in CropSAT, we only reach the farmers that already has an interest in precision farming. Therefore, SEGES push out the 7,000 VRA maps on the website Landmand.dk (Farmer.dk) that hosts all information of interest for the farmer and have 2,000 unique users per day.

SEGES also develops IT-programs for the farmer as field management systems. This means that when the farmer logon to Farmer.dk, the system will know if he has winter rape in his fields in 2017 or not. Only if he does have winter rape, he will see a small box informing him to press it and see the VRA maps - see picture 2.

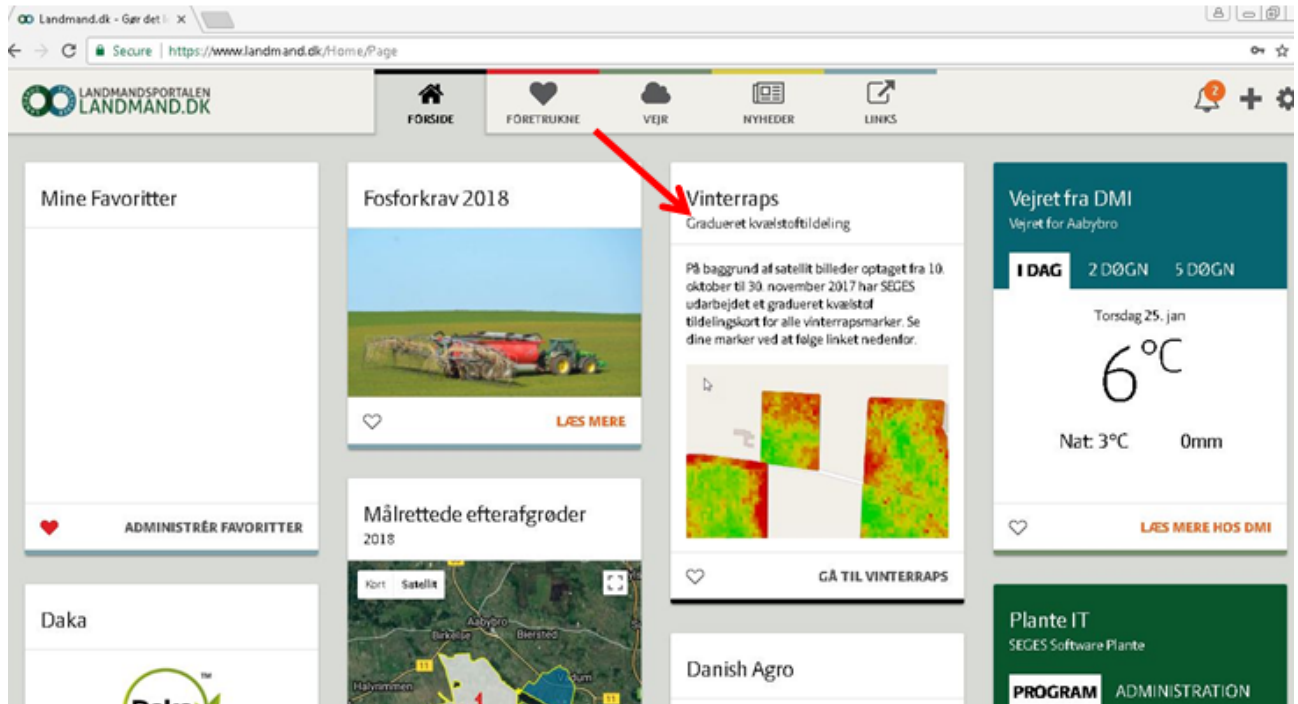
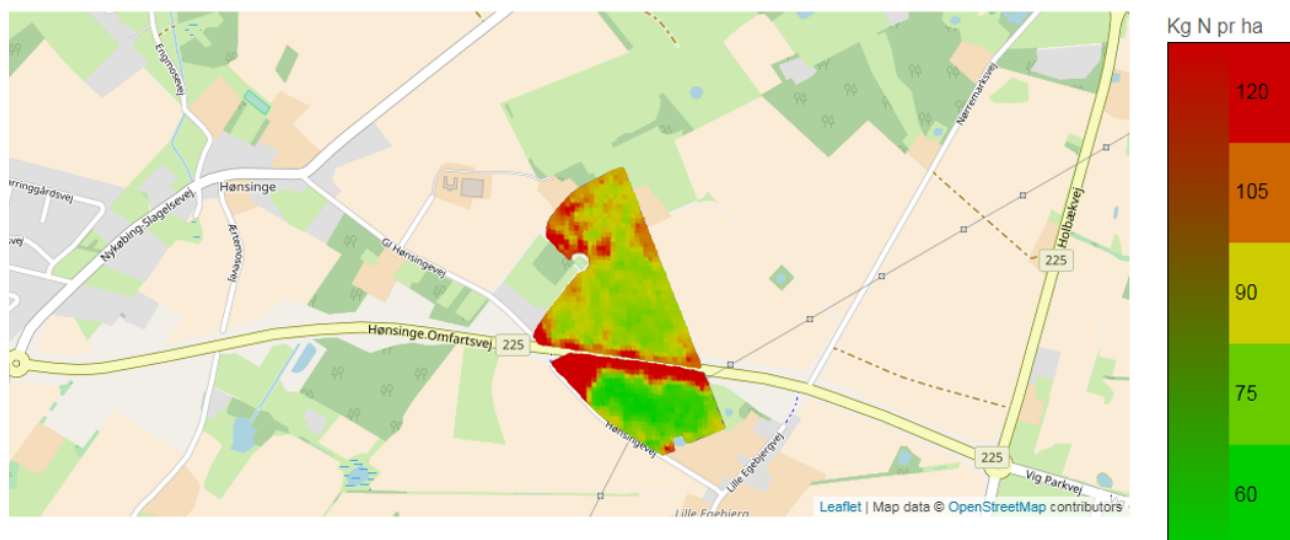


Fig. 2. Only farmers who grow winter rape in 2017 will see this VRA box. When the farmer pres the box he will see all his winter rape fields with VRA.

After pressing the small box the farmer can see all the VRA maps of his farm as well as a table. The table shows information about the individual field like field number, field area, average kilo of nitrogen per hectare, date of Sentinel-2 picture and whether the variation in NDVI is so high that it is recommended to graduate the nitrogen or not.

The farmer can then download the shape files or go to CropSAT and make the VRA files there.



Field no.	Hectare	NDVI	Avg. Kg N per hectare	Need for VRA ?	Date for Sentinel-2 measurement	Download
24-0	8,02	0,87	90	Yes	06-11-2016	24_0.zip
25-0	4,25	0,8	90	Yes	06-11-2016	25_0.zip

Fig. 3. On Farmer.dk all farmers growing winter rape seed can see the fields with VRA of nitrogen. They can also see if the variation within the field is so big that we recommend the fertilizer to be spread at variable rate instead of uniform.

In 2017, 200 farmers downloaded VRA maps from 300 winter rape seed fields.

In 2018 SEGES pushed out 70.000 VRA maps for winter wheat and 12,000 for winter rape

Here in 2018, SEGES made new VRA maps available on Farmer.dk and CropSAT. This time, not only nitrogen algorithm for winter rapeseed but also for winter wheat 1. and 3. application were made available. In all SEGES pushed out 70,000 VRA winter wheat 1. Application, 70,000 VRA winter wheat 3. Application and 12,000 VRA winter rapeseed.