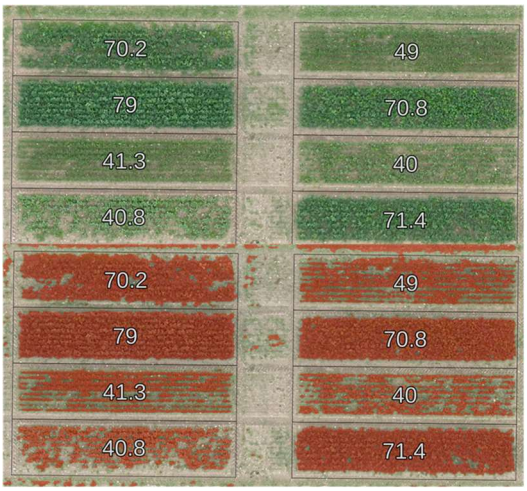
Practice abstract #3.2

A method to estimate crop cover and a case for its use



Upper: Normal RGB (red, green blue) orthophoto. The values show estimated plant coverage.

Lower: Overlay of red color indicates pixels classified as "plant".

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KEY WORDS
Crop cover, UAV, QGIS, intercropping, weeds

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CHALLENGE

Fast establishment and soil cover is a desired feature of crops, to improve the competitiveness against weeds. Evaluating the plant coverage and variation across a field can be challenging for both farmers and researchers, however, and the estimate is quite subjective.

SOLUTION

We tested a more objective and scalable method to determine plant coverage and variation by use of UAV (Unmanned Aerial Vehicle) images and GIS (Geographic Information System) analysis. As a test case, we evaluated the variation in an intercropping experiment, where oat and faba bean was established using different designs. In broad terms, the method comprised of these steps:

1. We collected real time kinetics tagged RGB (Red, Green and Blue) images with a UAV and created a stitched orthophoto using the software pix4d.

2. In QGIS, parts of the orthophoto were manually annotated as either "plant" or "soil". A raster calculator was used to create a crop-index layer ("excess green"). A classification model (plugin: dzetsaka) was trained on the annotated layer+Index raster and then applied to the entire layer. Within each plot, the number of pixels categorized as "plant" was counted and divided by the number of pixels in the entire plot to calculate the plant coverage percentage.

OUTCOME

The method contained several time-consuming steps, which took some trial and error, but it produced rather good results (see first page).

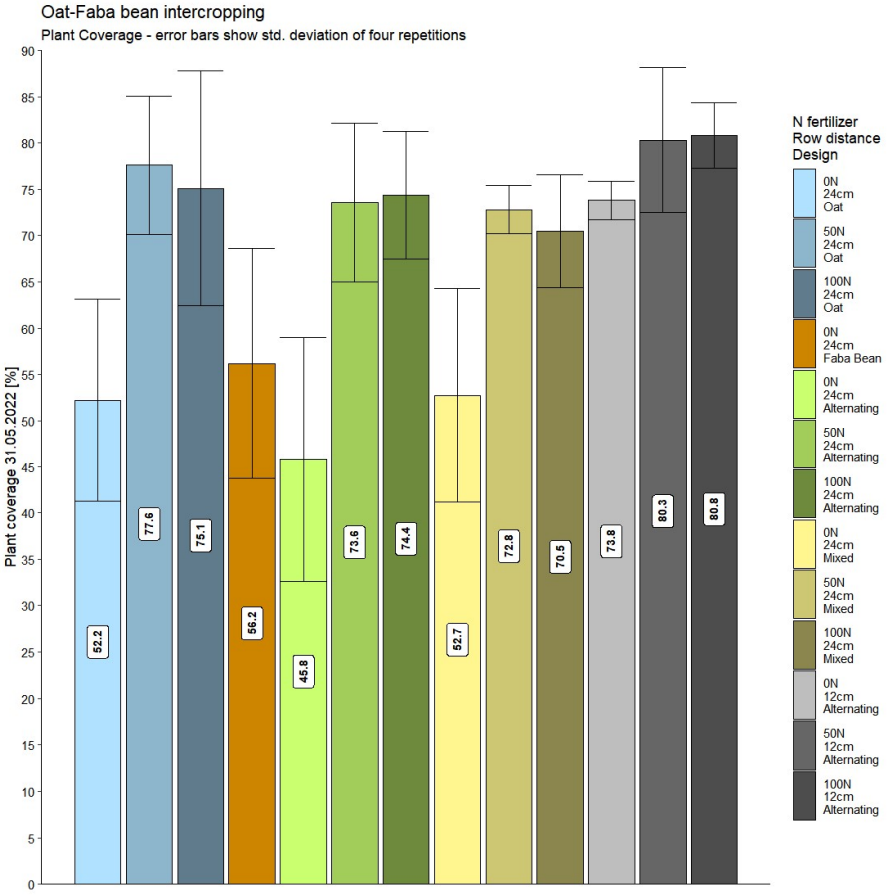
The case study utilized treatments with sole-cropping/intercropping in alternating rows, mixed rows and with row distances of either 12cm or 24cm.

The results indicate that it is a suitable approach to intercrop with a narrow row distance to obtain a quick crop establishment and soil cover - especially in unfertilized conditions.

PRACTICAL RECOMMENDATIONS

The described method produces more accurate results than visual scoring and the ability to describe variation is improved. However, it does not discriminate between crops and weeds, so manual estimation of weed pressure is still needed.

Unfertilized crops with a row distance of 24cm leaves a lot of space for weeds to develop. Reducing row space Improves competition against weeds.



Estimated crop cover on May 31st 2023 of oat, faba bean or intercropped oat-faba bean.

Under unfertilized conditions, narrowing the row distance to 12 cm is a good strategy to obtain a good crop cover compared to all other unfertilized scenarios.

There is no difference between alternating rows and mixing the crops in the rows at 24 cm in terms of crop cover.

In alternating rows and sole-cropping, the fertilizer was placed in the oat rows before sowing.

About CROPDIVA

CROPDIVA wants to put 6 underused arable crops back in the fields: oats, hull-less barley for human consumption, triticale, buckwheat, faba beans and lupins. 27 European partners are joining forces to enhance agrobiodiversity in Europe. They will achieve this by focusing on crop diversity and creating local value chains. The project is running from September 2021 to August 2025.

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En metode til at vurdere plantedække og et eksempel på dens anvendelse

UDFORDRING

Hurtig afgrødeetablering er en eftertragtet egenskab, da det øger konkurrenceevnen mod ukrudt. At vurdere plantedækket og dens variation henover en mark kan imidlertid være udfordrende, både for landmænd og forskere, og vurderingen er desuden subjektiv.

LØSNING

Vi har testet en mere objektiv og skalérbar metode til at bestemme plantedækket og dens variation vha. dronebilleder og GIS analyse. Til afprøvning af metoden, evaluerede vi variationen i et intercropping forsøg, hvor havre og hestebønne blev udlagt på forskellige måder. I korte træk bestod metoden af disse trin:

1. Vi indsamlede RTK-taggede rgb billeder med en drone og samlede dem til et orthofoto med programmet pix4d.

2. I QGIS annoterede vi orthofotoet som enten "plante" eller "jord". Et afgrødeindex ("excess green") blev udregnet vha. raster-beregneren, og en klassifikationsmodel (plugin: dzetsaka) blev trænet på det annoterede lag samt afgrødeindex-laget, hvorefter modellen blev anvendt på hele dette lag. Antallet af pixels kategoriseret som plante blev optalt per plot og divideret med det totale antal pixels per plot for at udregne plantedækket.

RESULTATER

Metoden bestod af en del tidskrævende trin, som det krævede nogle forsøg at få til at fungere, men den gav ganske gode resultater (se billederne på første side, hvor den røde markering på det nederste billede viser de pixels, der blev klassificeret som plante).

Casen bestod af behandlinger med monokultur/samdyrkning i skiftende rækker, blandede rækker og med rækkeafstande på enten 12 eller 24cm.

Resultaterne antyder at det er en god Idé at etablere havre-hestebønne samdyrknings systemet med en kortere rækkeafstand for at opnå en god etablering og et godt plantedække - det gælder især i ugødede systemer.

PRAKTISKE ANBEFALINGER

Den beskrevne metode giver mere præcise resultater en visuel bedømning og muligheden for at beskrive variation er bedre. Imidlertid skelner klassificeringsalgoritmen ikke mellem afgrøde og ukrudt, så manuel vurdering af ukrudtstrykket vil stadig være en god idé.

En ugødet afgrøde med en rækkeafstand på 24cm efter meget plads til ukrudt. Mindsk rækkeaftanden for at opnå bedre konkurrenceevne mod ukrudt.

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