

Multispectral remote sensing in participatory on-farm variety trials

Problem

In participatory on-farm variety trials, there is usually no possibility to set up a randomized, complete block design to collect eligible scientific results due to the lack of space, time and equipment of organic arable farmers.

Solution

We tested multicopters equipped with RGB and NIR cameras to assess field heterogeneity and crop health, to predict yield, and to identify N-efficient varieties within and between on-farm research sites. Our remote sensing tools were tested and successfully validated from 2014 to 2016 on conventional small plots of N-treatment trials. In order to compare results from remote sensing, standard sampling methods were applied.

Outcome

On the one hand, through the analysis of remote sensing images, it was possible to determine weed infestation, field heterogeneity and NDVI values/pixel (app. 1 cm per pixel). In some cases, we even discovered previously unknown underground field objects (e.g. a drainage system from the 1970s).

On the other hand, NDVI data did not correlate with traditional sampling results (SPAD values and yield estimations), probably because the multicopter covered 100 % of the large plot area, while sampling only provided data from specific points (50 SPAD points/plot and three yield sampling quadrats/plot). We can thus assume that for large plot variety trials, remote sensing can give substantially more precise results than traditional sampling methods. Further tests are needed to prove this assumption.

Applicability box

Theme

Soil quality and fertility, Nutrient management, Weed management

Geographical coverage

Global

Application time

Flowering/anthesis

Required time

1 day for field assessment, 1 day for data processing

Period of impact

Results have an impact on farmers' variety choice, the management of field heterogeneity and the methods of assessing on-farm large plot variety tests

Machinery

Multicopter, RGB+NIR camera, SPAD, MININ-FRA grain analyser

Best in

Arable cropping

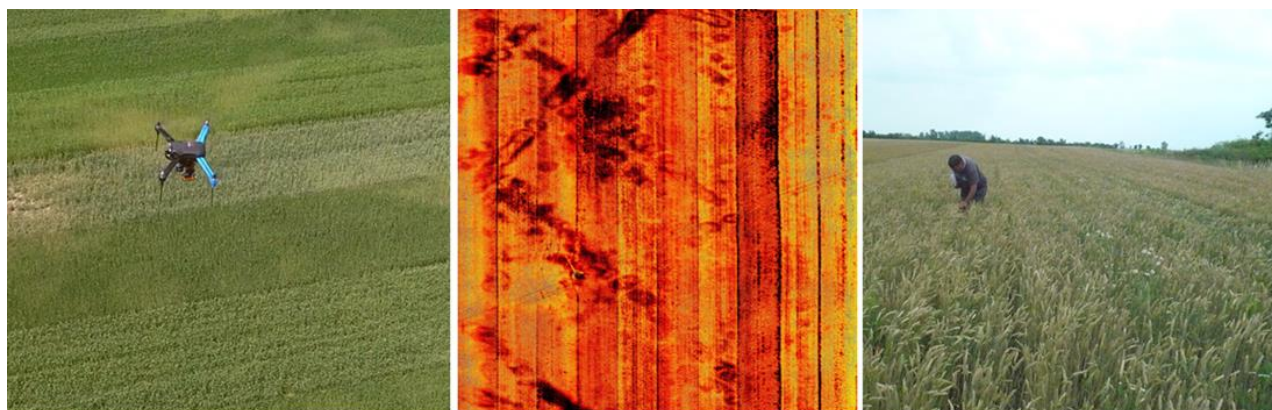


Figure 1: Multicopter (on the left), NDVI image (middle), ground data validation (on the right) (Kakasszék, Hungary 2017)

Practical recommendations

- A multicopter with a RGB and NIR camera was tested on four organic on-farm research sites in Hungary. Farm-scale plots (cc. 120 m² per variety) were set-up with 8 to 15 winter wheat varieties per farm.
- Data collection was performed at flowering/anthesis, on a sunny day, between 11 am and 1 pm (sun position, wind and clouds can highly affect image capturing).
- Ground data validation (chlorophyll readings (SPAD) from 50 randomly selected flag leaves/plot), phytopathology and weed bonitation were performed at the same time as image capturing (<1 cm resolution).
- 3 x 1 m² yield sampling squares per plot were collected at harvest for quantitative and qualitative yield estimation.
- Validation sample numbers (SPAD, squares) were most probably too small to assess field heterogeneity correctly and to validate remote sensing (NDVI-Normalized Difference Vegetation Index) results.

Practical testing and sharing of results

If this method seems to be suitable for your farm, we recommend that you test it under your own farm conditions.

Use the comment section on the [Farmknowledge platform](#) to share your experiences with other farmers, advisors and scientists! If you have any questions concerning the method, please contact the author of the practice abstract by e-mail.



Further information

Video

- [Demonstration video](#) of intelligent flying camera system on organic on-farm participatory variety tests.

Further readings

- Drexler D., Jung A., Bónis P., Somorjai G., Mones E., Vresak M., Vicsek T., Árendás T., Sárdi K., Vásárhelyi G. (2016). Mobile crop monitoring by intelligent flying cameras for breeding stations. In International Conference on Conservation Agriculture and Sustainable Land Use (CASLU) (p. 33). Budapest, Hungary.

Weblinks

- Check the [OK-Net Arable Tool Database](#) for more practical recommendations.
- Check ÖMKI's [arable field research findings](#) for more information
- [CollMot](#)

About this practice abstract and OK-Net Arable

Publishers:

Hungarian Research Institute of Organic Agriculture (ÖMKI)
Miklós tér 1, Budapest 1033, Hungary
Phone +3612448358, info@biokutatas.hu, www.biokutatas.hu
IFOAM EU, Rue du Commerce 124, BE-1000 Brussels
Phone +32 2 280 12 23, info@ifoam-eu.org, www.ifoam-eu.org

Author: Dóra Drexler, Tina Kovács, Korinna Varga

Contact: dora.drexler@biokutatas.hu

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among farmers, farm advisers and scientists with the aim to increase productivity and quality in organic arable cropping all over Europe.

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