PRACTICE ABSTRACT

Diagchamp: a methodology for on-farm diagnostic assessment

Problem

Many agronomic experiments, such as those carried out in the SolACE Project, are designed to vary a single factor, with all other conditions being equal. This can be limiting in what can be measured in one experiment, at one time. Oppossingly, an agroecological approach is based on using and measuring several factors in the same field, adapted to various pedoclimatic conditions and objectives. This is also a limitation, as pedoclimates can often vary across short distances on-farm, at different times during the year.

Solution

The "Diagchamp method" is a diagnostic, holistic approach to identify and hierarchize the limiting factors of final crop yield directly in the farmer's fields by comparing crop growth to a climatic potential. The user of this method can compare results from agronomic experiments against agronomic diagnoses. Retrieving an agronomic diagnosis is done by choosing a sample field (Figure 1) and assessing multiple agronomic factors (Figure 2). This creates a baseline that suggests what the potential output of the field could be, based on the field data taken previously, which can then be compared with the actual production yields.

Applicability box

Theme
Arable crops; crop efficiency

Agronomic conditions
650mm annual rainfall; 12°C mean annual temperature; limestone clay soil textures

Application time
Throughout the growing season

Required time
5 working days per plot (for the technician in charge of application)

Period of impact
Current crop and improvement for the man-agreement of future crops.

Measurements
Dry biomass, grain yield, humidity, thousand kernel weight, soil nitrogen residues, climate

Best in
durum wheat; bread wheat

Benefits

The acquired agronomic diagnosis is adapted to site-specific contexts (soil, climate, management practices, etc.) of different farmers who use the method. Applying this method can help to identify technical improvements and by comparing performances of plots in the same system (conservation agriculture, organic agriculture). The method can be used by one farmer or groups of farmers from the same region. The method can enable farmers to make economic comparisons between varying factors when comparing the agronomic diagnosis and field results or production yields. The Diagchamp method is participatory and Arvalis can assist with implementing the method.

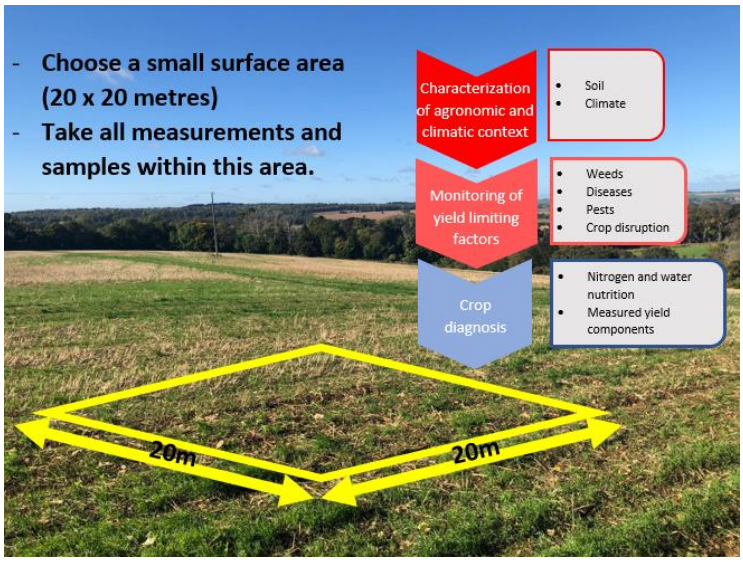

Figure 1 (left). Sample field plot with agronomic factors to report for the Diagchamp method. Figure 2 (below): Factors to consider and measure for agronomic diagnosis in the Diagchamp method. An agronomic diagnosis consists in understanding and measuring the limiting factors of the yield (nitrogen nutrition, diseases- or pest, weeds, climatic constraints, etc.) to propose some improvements to technical itineraries.

Field measurements: - Biomass sampling - Nitrogen residues (biomass and soil)	Records of biotic stresses: - Diseases - Pests
Management practices: - Irrigation - Nitrogen application (timing and rate) - Pesticide application	Timings of phenological stages: - Emergence - Heading - Flowering - Harvest

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Practical recommendation

Identify plots of interest to run the Diagchamp method and the technical questions to be studied with farmers.

- Select an experimental unit (homogenous and representative of the full field). This is where all measuring, sampling, and counting will take place (Figure 1). Collect soil and climate data from the field and record management practices throughout the growing season (fertilizer type, rate, and timing; irrigation rate and timing; etc.)
- Record the following measurements to understand limiting factors throughout the growing season:
  - Field measurements at flowering: biomass sampling and nitrogen residues. These tests can be easily done by taking biomass samples collected along a 1-m stick in the field (Figure 3).
  - The dates of phenological stages in crops: emergence, first node, booting, flowering and harvest.
  - Soil mineral nitrogen content at key stages (tillering and flowering).
  - Yield components at maturity (grain yields, thousand kernel weight, grains/m^2, spike/m^2, harvest index, grain protein).

Compare field measurements to the maximum potential yield simulated with "CHN Model" (which simulates the growth of the crop in the pedoclimatic conditions defined and quantifies nitrogen and water stress). Figure 4 illustrates how the agronomic potential can be compared against the real yield, enabling an agronomic diagnosis to be concluded. Hierarchization of the limiting factors thanks to the model and the agronomic expertise.

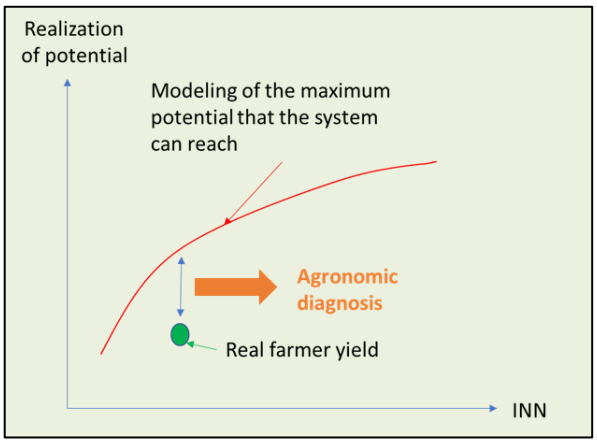

Figure 3 (right). 1-m stick placed in field to select sampling area. All plant biomass along the stick is collected. Figure 4 (left) shows the potential of nitrogen against INN (Nitrogen Nutrition Index) in real yields and the agronomic diagnosis.

Further information

Video

Diagchamp method in English videos: https://www.youtube.com/channel/UC3twVsFUmyuR_HdlsIpuI2Q/playlists

Further readings

Methodology for the diagnostic assessment of farmers' fields as part of the "Diagchamp" protocol (Arvalis)

Soenen et al. (2016). CHN Model - a crop model to jointly manage water and nitrogen on winter wheat (Arvalis)

About this practice abstract and SolACE

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SolACE: The project is running from May 2017 to April 2022**.** The goal of SolACE (Solutions for improving Agroecosystem and Crop Efficiency for water and nutrient use) is to help European agriculture face major challenges, notably increased rainfall variability and reduced use of N and P fertilizers

Project website: www.solace-eu.net

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