

Introduction

Within the framework of a three-year EIP-Agri-Project, the operational group of “Smart weed control” investigates alternatives to chemical weed control in conservation tillage or even no-till systems.

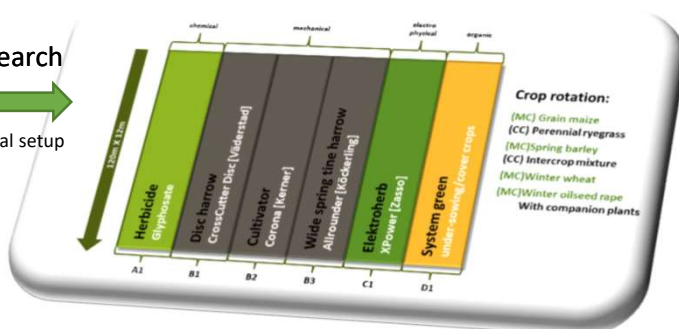
The reduction of plant protection products is a central demand of society and politics. Applications should be limited to a necessary level, which is why integrated pest management measures are increasingly being promoted. Due to the omission of previously used herbicides, weed control in conservation tillage systems as well as no-till farming systems will become a challenge in the future.

In the EIP project, alternative cultivation systems are being investigated in the absence of glyphosate, in order to be able to continue conservation tillage farming and no-till with all its advantages, also in the sense of integrated pest management.

Within a three-year crop rotation, various strategies are used to suppress weeds. The use of herbicides is compared with practice-driven new developments such as electrophysical weed control and alternative solutions using mechanical and biological methods (cover crops, under sowing, companion plants).

On Farm Research

Table 1. Experimental setup

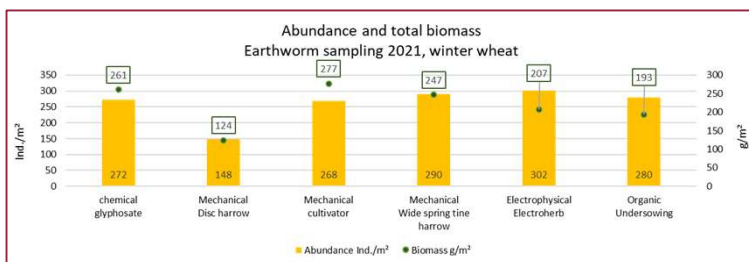


Methods

The trials were carried out under real farming conditions in two farms in Lower Saxony/Germany. This means that the variants were planted with common agricultural machinery. The experiment was designed as an on-farm trial; samples were taken georeferenced throughout the duration of the project. The *four-year crop rotation* consists of grain maize with perennial rye as the cultivated cover crop, spring barley, winter wheat and winter oilseed rape with companion plants (Table 1). Drone technology, multispectral cameras, soil scanners and satellite data are being used to monitor the trial. The following assessments are also carried out on the vegetation (Figure 1, Figure 2):

- Data on the plant population (field emergence, weed assessments)
- Studies on soil biology and soil microbiology (earthworm sampling; soil respiration tests (Solvita); Collembola; Fungal - bacteria ratio, Mycorrhiza)
- Nutrient studies and mineralization progress (N_{min} over the course of vegetation)

Picture 1 shows the sampling of earthworms as a method combination of expelling with a mustard oil solution and subsequent hand sorting. Figure 1 shows the results of earthworm abundance and biomass at the experimental sites in spring 2021.



Picture 1. Earthworm sampling

Figure 1. Earthworm sampling in Winter wheat 2021

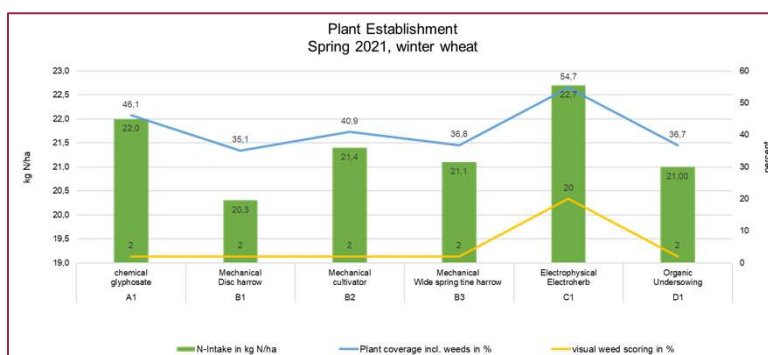


Figure 2. Plant establishment winter wheat, spring 2021

Preliminary results

The interest of stakeholders in the field days held so far on the trial plots in Lower Saxony, the workshops and the social media posts is high. As expected, the use of glyphosate has shown high efficacy in controlling weeds and volunteer cereals/oilseed rape before sowing in each main crop. Good results were also achieved with shallow mechanical tillage. With electrophysical control, the success depends strongly on the stage of development of the weeds and volunteer cereals. Here, resprouting can occur, especially in the case of weeds. In the case of the parameters investigated, such as earthworms or mycorrhiza, there is an advantage in the variants with little soil intervention, in which a lot of biomass remains on the arable land. In addition to the farmer's technical options for controlling weeds and volunteer cereals before sowing, the monetary input for the use of the technology will also be evaluated in the course of the project.