

What is precision agriculture?

2.1.1



Dear students, welcome to the first chapter! If the term “precision farming” is completely new to you, don’t worry. We will explain everything clearly and with concrete examples. I recommend that you read this section at a leisurely pace, feel free to return to some parts, and write down questions that come to mind as you read. The goal is to give you a clear idea of why farmers today need digital tools and what they bring to them.



Study text

Do you know how many decisions a farmer has to make in a single season? And how many of them are based on accurate data? Have you ever thought that even a small farm can now use technologies that only belonged to large companies a few years ago? Can you imagine that a phone in your pocket could be the key to more efficient and economical farming? Do you think that modern technologies are an unnecessary luxury in agriculture, or a path to a sustainable future? What do you think agriculture would look like if we used every drop of water and every gram of fertilizer only where it was really needed?

Precision agriculture, also known as **precision farming**, **smart farming** or sometimes referred to as **Agriculture 4.0**, is a contemporary way of farming that integrates digital technologies with the aim of improving the efficiency of agricultural production. Modern agriculture is undergoing a profound transformation. Like other sectors, it is also undergoing digitalization and the use of data to improve decision-making.

This approach is based on the collection and evaluation of data using technologies such as sensors, satellites, computing and various analytical tools. Based on this information, the farmer can make more precise decisions about when and how to intervene in the production process – that allow for more efficient management of land, water, labor, and other resources (FAO, 2022, ZD Sloupnice, n.d.).



The basic principles of this approach include the ability to **collect, evaluate and apply data from various sources** (e.g. from satellites, sensors or devices directly in the field) so that each decision is **as accurate as possible**. The goal is not only to increase revenues, but also to **reduce costs and minimize negative impacts** on the environment (World Economic Forum, 2023).

The successful implementation of precision farming principles is based on the integration of a wide range of digital technologies. These tools help farmers monitor and manage agricultural processes based on up-to-date and accurate data, which contributes to optimizing yields, reducing costs and conserving natural resources.

In practice, this means that, for example, in the field of crop production, it is possible to precisely determine the ideal moment for sowing, the type and dose of fertilizer, or the timing of irrigation. Precision agriculture makes it possible to respond to **specific conditions in different parts of the field** – i.e. to adapt interventions spatially and temporally. Similar principles are also applied in animal production, where it is possible to monitor the condition and needs of individual animals.

The main objectives of this approach are:

- increase in yields and production quality,
- cost reduction,
- waste reduction
- and reducing negative impacts on the natural environment (FAO, 2016).



Modern smartphones, combined with relatively inexpensive sensors, allow even smaller farmers to access the necessary data, which serves as the basis for informed production management decisions (Geopard, n.d.).



EXAMPLES OF HOW THE APPLICATION OF PRECISION AGRICULTURE PRINCIPLES CAN CONTRIBUTE TO MITIGATING THE IMPACTS OF CLIMATE CHANGE (FAO, 2016):

- Targeted use of chemicals can facilitate more efficient use of fertilizers, thereby reducing greenhouse gas emissions associated with their excessive use (while also reducing costs).
- Precise and variable plowing planning can prevent soil degradation and save energy.
- The right amount of water prevents over-irrigation and the formation of dry spots.
- The integration of scientific knowledge and data-driven decision-making leads to the avoidance of ad hoc and short-term solutions.
- Satellite images can help select the most suitable crop for a given field.
- Optimization of overall energy consumption (e.g., vehicle and machine trajectories).
- On-site cameras help decide whether a farmer needs to go out to the field or not.
- Forecasting extreme weather conditions.
- Assistance with pest prevention.



Summary

Precision farming is a modern way of farming that uses digital technology to manage agricultural production **more precisely, efficiently and sustainably**. Thanks to sensors, satellites and analytical tools, farmers can better decide when, where and how much input (e.g. water, fertiliser or feed) to use. This approach leads to increased yields, reduced costs and reduced environmental impacts.

Thanks to advances in mobile technologies, **precision agriculture is now becoming accessible to small and family farms**, which are gaining the opportunity to operate sustainably and competitively.

