Support text for A1.L2.3. ID 9

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Arable Crops production cycle with SPA technologies

This text supports the presentation of the case study on the corn production cycle using SPA technologies.

We face nowadays great challenges in preserving the environment and the biodiversity when society needs to increase agriculture intensification considering future food demand.

How can we produce more with less?

How can we manage intensification *versus* biodiversity protection and systems sustainability?

Precision Agriculture can be seen as a cycle (Figure 1) that goes through several adaptation processes, fed by an intelligent framework that increasingly improves knowledge supporting decision making.

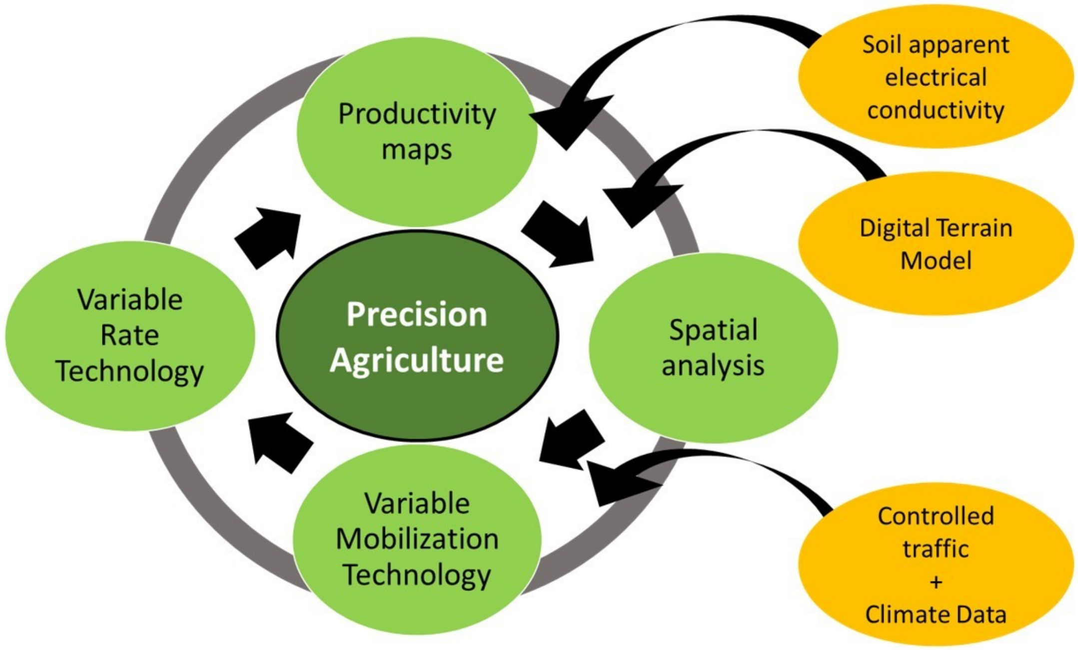


Figure 1 - Cycle of Precision Agriculture.

For each parcel one can collect information like physiography, soil apparent electrical conductivity, controlled traffic, yield and climate data. With this type of information, it is possible to manage inputs differentially and achieve the goals that farmers need in terms of systems sustainability. Knowledge intensive farming increases the ability to make better decisions.

Physiography collected by machinery when they are working the soil or others, allows us to study drainage or water supply restrictions. Considering the previous farmer can invest in a drainage plan in order to be prepared for climate change processes.

Soils can be extremely variable and the soil apparent electrical conductivity survey enables us to identify different type of soil textures. Different types of soils present different types of management strategies considering fertilization, irrigation, seed density and herbicides. The ideal approach is to use inputs variable rate maps according the plant needs.

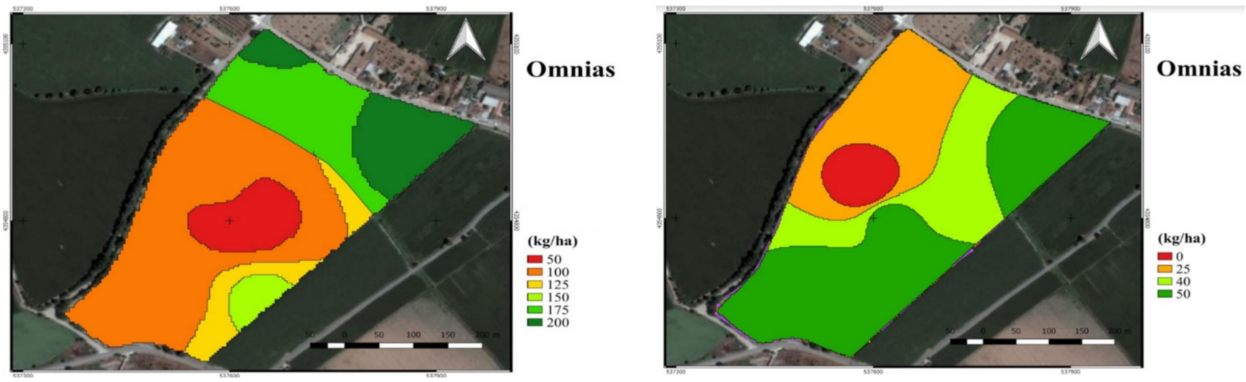
Georeferencing all the operations it's possible to evaluate the compaction caused by the machinery in the plot and act accordingly when performing a decompaction operation. This is important because some areas are more compacted than others and because of that need special attention.

Auto steering systems release the operator from the work of driving. The operator only has to turn the tractor at the end of the plot limit. The tractor works in parallel or circular lines, avoiding waste of time, human error due to fatigue and overlapping, saving energy and reducing costs. Knowing the equipment fuel consumption and the hours spent in a particular work is also important to support management. With auto-steering the loss of plants is reduced, work can be done faster, during day or night and the implements can have a bigger size.

Communication ability of the equipment is also very important. A great amount of data is collected in each operation and it must be stored to be processed, analysed and used to produce more information. The data must be compatible so that it can be compared and able to build a temporal dataset that can help to improve management.

Knowledge about the plot characteristics allows us to produce prescription maps to make variable rate applications of all the crop inputs, like phosphorous and potassium (Figure 2).

For herbicide application, a drone can collect photos to make a mosaic that shows a single image of the parcel. Weeds are identified and herbicide is applied only where it is needed, saving working hours, fuel and herbicide and avoiding unnecessary damages to the environment. Before, the farmer had to apply herbicide through the whole field or he didn’t, and he had productivity losses.



(i) (ii)

Figure 2 - Prescription maps for variable application of potassium (i) and phosphorous (ii).

Water and energy are the major costs in irrigated crops. Precision Agriculture can be very helpful in water management. We can determine the crop water needs with moisture sensors and data from a weather station, adapting irrigation automatically.

In crops like corn, we have to monitor the plants' development, the nutrient needs, the diseases and the water needs. Some satellites can help us to do it because the cost is low and they have a high temporal resolution. We can have images throughout the whole crop cycle and identify in advance many problems.

Gathering so many information about the parcels over the years allows the farmer to plan and manage the future of his parcels.

Productivity maps are one of the most important data that we can collect. This information is registered by the harvester and can also be used to manage variable rate applications for next campaign, adapting the supplied nutrients and the density of the seeds to the plot spatial variability.

A major concern is always how to process and analyse the huge amount of data that is being collected. The farmer must be able to manage this information, otherwise, it can become useless.