Policy Brief No6

Precision Agriculture as energy consumption reduction strategy

What is the challenge?

Agricultural activities imply Greenhouse Gas emissions increase in both direct and indirect ways. Direct implications derive from fossil fuel consumption for agricultural machinery operations, while indirectly due to inputs application such as for fertilization and plant protection purposes.

The farming community can save a lot of cost and prevent further GHG emissions by applying Precision Agriculture (PA) techniques (i.e., guidance, recording, decision-making and reacting) that suggest **optimal routes** for less fuel consumption by agricultural vehicles (path planning) and **reduction of agricultural inputs** through site-specific application (target inputs to spatial and temporal needs of the field).

Applying PA strategy requires farm managers to use certain high-tech equipment most times, both in terms of hardware and software. In a PA concept, a lot of challenging agricultural operations are solved and optimally performed nowadays, but PA remains an active research topic yet, where solutions to problems such as early disease detection are still under development. Adopting current PA technologies can have a **positive impact on farm productivity and economics**, providing higher or equal yields with lower production cost than conventional practices.

PA can be applied to almost every category of open-field crop production (i.e., arable, orchards, vineyards, vegetables), but also to cultivations grown in controlled environments such as greenhouses. The necessary equipment used for PA purposes can be quite expensive in some cases. Exclusive ownership by single farmers may not be the most financially "attractive" idea for an investment sometimes, especially given the existing support framework for such technologies.

Policy Recommendations

EU Level:

The new Common Agricultural Policy (CAP) of the European Union (EU) has put PA on the list of eco-schemes practices eligible for funding and a total of 270 billion euros will be spent on EU farms introducing this practice until 2027[26]. However, certain policies that could be applied to promote PA implementation are:

- **Subsidies and incentives** should be given to farmers to acquire technologies that allow for precision input application. From remote sensing technologies to modern agricultural machinery (e.g., field robots or drones), the supporting technologies necessary to apply such agricultural practices should be affordable for farmers to accelerate their widespread adoption. Fortunately, the new CAP that started in 2023 is aligned with the concept of PA. One of the reforms is to provide financial incentives and, at the same time, support schemes for farmers to invest in PA technologies (e.g., precision fertilizer spreaders)[27]
- In case of very expensive equipment, the **concept of joint ownership or purchase by a group of farmers or agricultural associations** should be promoted and simplified.
- **Raise agricultural communities' awareness** regarding the aspects of PA is also a matter of the existing policies, as in most cases there is a need to support farmers on gaining knowledge on how to implement certain methods and what are the outcomes that they should expect. **Training programmes** are necessary to be organized by each member-state following a common standard that will be developed at EU-level.
- Farmers should be urged to record their inputs (annually) and join a program developed by the state to provide their data for monitoring/assessment purposes. If they also provide information about the respective yield, then a ratio could be formatted. Based on this ratio, farmers' footprint can easily be identified. Such a framework could be integrated into the **energy audits system** proposed (See Policy Brief "Farm Energy

[26] https://www.arc2020.eu/cap-beyond-the-eu-precision-agriculture/
[27] https://www.euractiv.com/section/science-policymaking/news/europe-entering-the-era-of-precision-agriculture/

Audits"). Consequently, the member-state could either provide multiple rewards (for the successful cases) or recommendations from advisory services for further improvement.

- Farmers providing their **production data and energy audit information** showcasing their capacity for improvement of the direct and indirect energy consumption through PA application could be prioritized for respective incentives provision to **replace/upgrade the existing conventional agricultural equipment**.
- **Extension services should be trained adequately** to provide recommendations and technical support to farmers applying PA practices.

Member States Level:

- In Poland, the success of PA implementation requires an **operationally functional decision support system (DSS) dedicated directly to farmers**, which will power the on-board computers of agricultural machines controlling applications of variable doses of means of production or navigating agricultural machines. A coherent DSS should be responsible for supporting PA (at the national level), which will provide data using e-services and API services on spatial differentiation of production properties of fields, weather and its forecast, agrotechnical recommendations adapted to the current situation and crop phenology.
- In Italy, according to ENEA (National agency for new technologies, energy and sustainable economic development), the widespread application of good practices would be capable of generating energy savings of 25% in irrigation, 70% in the ventilation of industrial environments and 20% in agri-food production and processing. Confagricoltura will build a new model of sustainable agriculture 5.0, which looks to digital, the production of renewable energy, and more generally to green technologies, but capable of guaranteeing production levels and competitiveness.
- In Greece, Measure 4 of the Rural Development Programme (RDP) 2014–2020, which was co-funded by the European Agricultural Fund for Rural Development (EAFRD) and the Greek government, offered the opportunity to farmers to get 50% of their investment in smart farming technologies from an official list and shift their production to the new era, if selected for the upgrading of their farm.
- In the Netherlands, there is a policy that offers tax incentives for farmers that invest in climate smart applications (e.g., electricity driven drip irrigation systems). Farmers have the choice to: (i) deduct 75% of investment costs from their income on a self-chosen moment (a year with a high income) or (ii) deduct 27-45% of the investment as extra costs to lower their income in the year of investment.
- Mission booster is a special program in autumn 2022 with a focus on supporting the contribution of small and medium-sized enterprises (SMEs) to future solutions to the green challenges. The mission booster program specifically aims to support the creation of companies' innovative knowledge base for future solutions within Climate- and environment-friendly agriculture and food production.

Expected Impacts

- PA application will allow farmers to apply plant protection products (PPP), fertilizers, and water more precisely, reducing directly or indirectly cost and related negative environmental impact.
- Fuel consumption of agricultural machinery could decrease when agricultural machinery follows certain optimal routes to carry out agricultural activities.
- The enhancement of the ability of soils to operate as carbon stock reserve by reducing tillage and soil compaction from reduced traffic could positively contribute to GHG emission reduction.
- Remote sensing allows detailed field mapping to isolate areas of need.
- Sensor technology in conjunction with field mapping can replace blanket fertilizers' and pesticides' application with targeted variable application.
- Regarding spraying, modern nozzle technologies combined with Pulse-width modulation systems (PWM) can further reduce PPP use and waste.
- Variable rate nutrient application (VRNA) technologies can reduce the fertilizer quantities applied.
- Positive effect on farm productivity by optimizing agricultural inputs producing higher yields with lower cost

than conventional practices.

- Assist food security and safety for human food consumption by reducing significantly the amount of inputs.
- End-users (farmers) will receive quantified information of the farm profit augmentation and the positive sustainability impact.

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