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Organic sugar beet production and robotics use in



As harmful neonicotinoid insecticides are withdrawn from the market, some sugar beet farmers in France have started to transition to organic farming with the help of robots.

Context

Sugar beet cultivation is chemical-intensive. In 2017, the average number of pesticide treatments received by sugar beet crops in France was between five and six — which is more than most other crops (Agreste, 2019). Sugar beets need to be protected from weeds competing for resources and diseases transmitted by aphids; for example, the beet yellows virus. For this purpose, the sugar beet sector has had to rely extensively on neonicotinoid insecticides, which are often used in seed coating to prevent virus transmission. Since the approval of neonicotinoids such as thiamethoxam and imidacloprid for the EU market was withdrawn between 2018 and 2019, over 60% of the emergency authorisations EU Member States have granted for their use have concerned sugar beet crops. In France, all four emergency authorisations granted for neonicotinoids since 2019 were for this type of crop.

The definitive withdrawal of neonicotinoid insecticides in the EU — recently reinforced by the Court of Justice of the European Union, which effectively banned neonicotinoid-coated seeds from the market (CJEU, 2023) — means that sugar beet farmers must find alternative solutions for plant protection (Verheggen et al., 2022). Among these alternatives, avoiding the use of synthetic insecticides altogether and shifting to organic sugar beet production presents many obstacles — not only at the farm level but also on the aggregation and processing side. Thus, before 2018, no micro sugar

refineries were specialised in sugar production from organic sugar beets, at least in France.

Measures

In response to the need to eliminate neonicotinoid use in the sugar beet sector, some French farmers have started to switch to organic sugar beet farming. Growing organic beets, however, requires more manual labour for weeding and pest control. For example, it may involve the use of resistant varieties, high-diversity landscape features, crop rotation, intercropping and plant-defence elicitors, among other strategies (Verheggen et al., 2022).

One of the approaches used by farmers to reduce weeding costs in their transition to organic sugar beet farming is robotics use. The principle consists in assigning the robot an area of beets to sow and weed. The sowing pattern is recorded very precisely and each seed is geolocated. The robot can then return to the plot several times during the season to pass a mechanical weeding tool for weeds while preserving the beet roots. Several French or international robotics companies, such as Naïo, Farmdroid or Steketee, have proposed similar solutions. These are still expensive as they are produced in small series and are still prototypes. However, sugar beet farmers are currently trying to reduce the costs by sharing equipment.

Some companies have even developed robots that can reduce the need for human labour in diversified crop rotation management, a farming practice that facilitates pest control (Tibi et al., 2022). Crop rotation could also be complemented by adding beet companion plants with a repellent or attractive effect on aphids between rows, thus drastically reducing their presence on the beets in the plot. The robot can keep these companion plants in place until they are no longer needed, and it can then destroy them like weeds. In France, choosing the best companion plants is currently the subject of scientific experimentation.

Impact

The organic sugar beet sector is very recent in France. During the last campaign for which complete information is available (2021-2022), only 1,800 hectares of sugar beet were cultivated organically. This represents only 0.5% of the 400,000 hectares of beet cultivated in France (ITB, 2022). However, it is also a steep increase since 2019, when only 253 hectares were cultivated organically. The sector will probably continue to expand, continuing its momentum with ever-larger areas dedicated to organic sugar beet, as the organic sugar market is still far from being covered. For instance, the cosmetics sector has shown high interest in organic sugar beet production to meet its needs in perfumery and other body care products, as the sector uses ethanol from the organic sugar cane

industry. The food processing sector is also interested due to consumer demand for organic food products. Already now, the choice to produce organically can be very profitable: organic beetroot cost around €80/tonne compared to €30/tonne for conventional beetroot (Guyomard, 2023).

When it comes to the use of robotics, the economic model is also quite favourable because the savings made in terms of reducing staff offset the cost of the machine in a reasonable time. Pioneer organic farmers say that otherwise it takes between 20 to 200 hours of manual work to maintain one hectare of sugar beet, equating to around €4,000 of additional costs (Comité Technique Régional AB Hauts-de-France, 2022). Current yields in organic farming are around 50 tonnes per hectare, compared to 80-90 tonnes for conventional sugar beet production (Guitton-Boussion, 2023). However, as the sugar beet sector has been affected by overproduction since an EU-level system of quotas was lifted in 2017, organic farming may be a way to produce less but better.

Lessons learned

- The organic sugar beet sector has very recently emerged in France but is expected to continue its growth.
- Robotic solutions can reduce the need for synthetic herbicides and may also help manage crop diversification as an alternative to chemical pest control.
- While organic sugar beet farming has lower yields than conventional farming, part of this gap will be reduced with appropriate varieties and new agronomic practices mixing more than one species per field.
- The more farmers adopt organic production, the more the sector will be able to expand. Upstream and downstream parts of the sugar beet sector will increasingly see improvements in management (whether in terms of seed cultivators, agronomical practices or machinery).

Location	France
Timeframe	2018-2023 (ongoing)
Scale of measure	Farm level
Pesticide(s) targeted	The main pesticides used in the sugar beet sector are neonicotinoid insecticides and (to a lesser extent) herbicides.
Measure led by	Measures adopted at farm level.

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