VEGPRO INTERNATIONAL

CASE STUDY

A robot to say goodbye to weeds?

In the current context, Vegpro faces two pressures: on one hand, a **historic labour shortage in agriculture**, and on the other, growing expectations from consumers and customers regarding **environmentally friendly and healthy practices**. In addition, weeds are becoming increasingly resistant to chemical herbicides, which is something we want to avoid. Faced with these challenges, Vegpro sought an innovative, environmentally friendly weeding solution.

Challenges of traditional weeding

1 Limited labour

Weeding by hand is costly and requires a lot of manpower. The next generation of farmers is slow to arrive, and recruitment remains difficult. Vegpro therefore had to find a solution to automate this demanding task.

2 Increasingly tough weeds

Weeds, whether tiny or already developed, compete with crops for water and nutrients. Controlling them requires labour and costly herbicides.

3 Limitations of conventional methods

Mechanical weeding requires fuel, compacts the soil, and cannot be done too early to avoid damaging young plants. Manual weeding is tedious and laborious. Vegpro was therefore looking for a chemical-free approach that was both effective and more respectful of the soil and workers.

In 2025:

4,453 ACRES

weeded with the robot

340+ MILLION

weeds destroyed

Choice of technology

After careful consideration, Vegpro opted for a thermal weeding robot. The robot can identify harmful plants among crops using its recognition cameras and integrated analysis system. Once weeds are detected, the robot eliminates them by injecting targeted heat, a method that destroys plant tissue without disturbing the soil or damaging young plants.

This choice is based on several advantages: unlike mechanical weeding, the thermal method does not compact the soil; and unlike electrical systems, it does not require frequent recharging. Laser weeding offers extreme precision on very young shoots but becomes less effective when weeds are more developed. Thermal technology, on the other hand, remains effective regardless of the size of the unwanted plants.

Finally, although it is not autonomous—the robot must be attached to a tractor and driven by an operator—it can operate 24 hours a day, 7 days a week. Its design, adapted to our soil types and row widths, makes it a mature, robust solution that is compatible with our agricultural realities.

Implementation

Trials of the weeding robot began in the fall of 2024 in Vegpro's fields in Sherrington, Quebec. The team first worked on adapting the machine to the varieties of lettuce grown on the site, before continuing trials in Florida during the winter to validate its effectiveness on other crops and in different climatic conditions.

Carbon Robotics' engineers provided close technical support throughout the project, particularly for equipment inspection, software updates, and sensor adjustments based on observed needs. This collaboration optimized the robot's performance and adapted the weeding strategy to the realities of Vegpro's fields.

The data collected during this trial phase, particularly that transmitted in real time by the sensors, was used to refine the settings and gain a better understanding of the potential for integrating this technology into large-scale agricultural operations.

Results and benefits

The adoption of the thermal weeding robot has generated several measurable benefits for Vegpro, both economically and environmentally and socially:

1 Economic gains

The time spent on manual and mechanical weeding has been significantly reduced. Harvesting is faster, crops are cleaner, and replanting can be done earlier, without the need for re-weeding. These efficiency gains make it possible to increase the area cultivated in a single season and directly improve the profitability of operations.

2 Reduced environmental footprint

Powered by electricity but pulled by a diesel tractor, the robot emits less CO_2 than a conventional thermal machine and exerts less pressure on the ground. These characteristics contribute to reducing the overall carbon footprint and preserving soil biodiversity.

3 Improved crop quality and yield

Frequent and precise weed control promotes uniform plant growth. Freed from competition for water and light, lettuce and other crops grow more vigorously. Unlike mechanical tools, the robot does not damage leaves or throw soil onto vegetables. The result: better visual and sanitary quality of crops, as well as optimized overall yield—with the potential to eventually grow an additional crop per year.

4 Versatility and adaptability

Thanks to its digital configuration, the robot can be adjusted for different crops (lettuce, onions, carrots, etc.) and for various densities or row widths. It can also perform other delicate tasks, such as thinning densely sown romaine lettuce. This technological flexibility makes it a scalable tool, capable of adapting to crop rotations and Vegpro's future needs.

5 Health, safety, and quality of life at work

Reducing manual weeding frees operators from the most repetitive and physically demanding tasks. They can now focus on activities with higher added value. This automation helps reduce fatigue and the risk of musculoskeletal disorders, while improving job satisfaction.

Limitations and challenges of robots

The adventure was not without obstacles:

Initial investment

A weeding robot represents a significant purchase cost. It is a truly specialized piece of equipment. Furthermore, as the system is complex, Vegpro depends on the manufacturer for maintenance and updates. Not all farmers are prepared to make such a commitment in terms of capital and training.

Risks associated with flames

Thermal weeding works by injecting heat. In extremely dry conditions, the thermal shock can cause dried-out plants to catch fire. Vegpro has therefore implemented strict precautions (do not work in high winds or extreme heat, maintain safety strips, etc.).

Terrain conditions

When being towed, the robot is heavy. On very muddy or uneven ground, it may have difficulty moving forward and risks getting stuck. Vegpro encountered this problem once in Quebec (very wet soil) and now adjusts the schedule to avoid this type of terrain. On the other hand, the robot can work in wet soil (when it is just soggy) better than a mechanical shredder, thanks to its wide tracks that distribute its load.

Variable performance

The robot is very effective on emerging or small weeds, but less effective on weeds that are already well developed. Certain types of very dense crops can also slow down the camera. Finally, effectiveness may vary from one crop to another. These nuances mean that Vegpro must adjust the settings and still monitor certain rows by hand.

Despite these challenges, most obstacles have been overcome. Feedback indicates that the robot is on track to fulfill its missions: it weeds without chemicals, frees up staff, and fits into the farm without damaging crops.

Lessons learned and outlook

In conclusion, the thermal robot trial has validated Vegpro's expectations. The initial objectives of reducing manual labour and herbicide use are well on track to be achieved. Teams are already seeing a significant reduction in physical effort and chemical use. Overall, the economic and environmental benefits are encouraging compared to the costs incurred.

The key lessons learned are that this type of technology, although recent, offers a new advantage for modern farmers. Vegpro has gained autonomy and flexibility in its weeding operations, while improving the well-being of its teams. The experience confirms the need for innovation in the face of labour constraints and environmental requirements.

Looking ahead, Vegpro plans to expand the robot's use to other crops and test advanced scenarios. The system's digital design (tablet control, continuous learning) suggests other potential uses, such as real-time agronomic data collection and precise weed mapping. The possibilities are therefore vast.

In fact, this initial case study shows that Vegpro's agriculture can evolve toward greater sustainability. The results obtained exceed initial expectations in some respects, promising more efficient, healthier, and more comfortable vegetable farming for farmers.

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