Envisioning Tomorrow's Weed Control, And How To Get There

Source: *University of Nebraska*

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How will you control weeds in 10 to 20 years?

Look for sensor-driven, integrated weed management systems that identify weed species and immediately target the correct control measure for the plant growth stage and weed species. These systems could limit chemical applications to the micro dose needed, reducing herbicide amounts and practically eliminating drift and groundwater issues.

Robotic weed control could be an essential element of tomorrow's more targeted, integrated weed management systems. Reseachers at UNL's West Central Research and Extension Center are looking at what these systems would need and how they could integrate the latest technologies in weed identification, biology, engineering, and weed control. (Illustration conceived by Steve Young and drawn by Michael Heller)

At UNL's West Central Research and Extension Center, work is underway on targeted control systems for use with sensors and guidance systems that can identify and control weeds in real-time as a device moves through the field.

The combination of plant recognition and various application technologies into a single platform will require integrating research in the fields of biology, engineering, and computer science.

This single platform will incorporate sensors and decision support software so multiple application technologies can be accessed to provide directed weed management. Ideally, it would be a self-guided machine that could systematically comb the field to identify weeds and then apply the necessary control tool (e.g., spray, mow, cultivate) at the individual plant or patch scale.

From a biological approach, successfully integrating weed management requires an understanding of three key components:

- the effect of treatments on weed populations
- weed growth and development stages, and
- the critical period for applying control tools.

Control tools (e.g., mowing, spraying, cultivating) have different effects on weeds and without a complete understanding of the life history of the target weed(s) and crop, the development of effective and efficient robotic systems will be challenging, if not impossible.

In most crops, there is a period when weed control is critical to avoid yield loss. An autonomous robotic system that doesn't consider timing of weed removal will perform poorly in current cropping systems. For a robotic system to respond to critical periods of crop growth, it must be either manually sent into the field or programmed to perform weed control operations that are in sync with crop growth stage.

In a true integrated weed management system that uses the latest machine-based guidance systems with sensors and decision control systems, weed identification and control applications could occur simultaneously moving across a field.

Research Needs

An immediate research need in this area is to refine targeted application methods for quantifying micro-dose herbicide rates suitable for effective weed control. The research team at the West Central REC is conducting a series of related greenhouse studies and has proposed additional studies.

In the future, a single platform will need to have more than one tool for use in the field for controlling weeds. Greater collaboration among scientists in the fields of weed science and biological and computer science can help achieve two major goals:

1. combination of weed management tools into one operation to allow for a truly integrated system, and
2. advancement of more sustainable integrated weed management programs that result in reduced environmental contamination and human exposure to chemicals, as well as inputs needed to economically control weeds.