



RECENT ADVANCEMENTS IN PRECISION WEED CONTROL

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INTRODUCTION

An increase in agricultural output of 25 to 75% over current levels is necessary to meet the increased demand for food. The living conditions of people who live in agricultural communities are eventually raised by improvements in yields and resource efficiency brought about by advancements in agricultural technology and practices. Furthermore, it expands export opportunities, allowing countries to earn foreign currency and improve trade balances. To achieve food security, local food production and productivity must be increased, food imports must be increased on a regular and consistent basis, and farming systems that use climate-smart techniques and produce a more diverse mix of foods must be promoted. By improving food security, promoting 'nutrition-sensitive agriculture,' and improving food safety, the World Bank Group works with partners to build food systems that can feed everyone, everywhere, every day. The United States Agency for International Development (USAID) promotes global food security by supporting in-country capacity building, basic and applied research, and improved market information. USDA also contributes to global food security by increasing productivity, building local capacity, and improving markets and trade. In summary, increasing agricultural production is critical for ensuring global food security, and advances in agricultural technology and practices drive increased yields and resource

efficiency. To achieve food security, it is necessary to increase local food production and productivity, promote climate-smart farming systems, and improve food safety and nutrition.

PRECISION WEED MANAGEMENT

TECHNIQUES

Precision weed control is emerging as a game changer in the agricultural sector, leveraging cutting-edge technologies such as robotics, drones, and laser systems. These technologies allow farmers to identify and treat only weed-infested areas with high precision, optimizing the use of resources such as herbicides and labor, resulting in less waste and cost savings. Precision weed control, as opposed to traditional blanket herbicide application, reduces chemical usage, lowering agriculture's ecological footprint and the risk of soil and water pollution. Weeds are effectively managed without harming crops with precision weed control, resulting in increased crop yields and significant cost savings for farmers. The precision farming community is becoming more interested in site-specific weed control methods, which identify changes within a field and manage weeds at the subfield level. Depending on the level of weed infestation, decision models help with treatment selection and adjustment. This can be done mechanically or with herbicides. Additionally, the development of site-specific weed management has been greatly

influenced by sensor technologies for identifying individual and patchy weeds.

PRECISION WEED CONTROL METHODS

Precision Hoeing: This method of weed removal on farms makes use of sophisticated agricultural equipment that is GPS-guided. High-resolution cameras on some cutting-edge precision hoes are used to distinguish between target crops and weeds.

Site-Specific Weed Control: Subfield-level weed management and field-level change detection are key components of site-specific weed control strategies. To do this, it is necessary to measure the fluctuating weed density in a field and use decision models to choose and modify treatments based on the level of weed infestation. Weed control can be achieved mechanically or with herbicides.

Application of Precision Herbicides: Targeting weeds at an extremely early stage of development with extremely low concentrations of herbicides is known as precision herbicide treatment. Herbicides applied precisely can be very effective at keeping weeds under control without lowering crop yields.

Smart Spraying Technologies: Using smart sprayers to effectively cut down on herbicide overuse can help precision weed management by lowering the environmental impact of herbicide use.

These methods show the variety of approaches to precision weed control, they include sophisticated technologies like smart spraying systems and precision herbicide application, as well as mechanical methods like precision hoeing. By providing distinct advantages in terms of effectiveness, resource optimization, and environmental impact, each technique advances agricultural weed control

techniques. The use of computer vision and AI enables the precise identification of weed clusters and the subsequent use of targeted interventions, such as chemical, mechanical, or electrical methods, for their eradication. Commercial spraying systems, such as H-Sensor and See and Spray, use AI to distinguish between weeds and different crop species. Finally, precision weed control, made possible by advanced technologies and techniques such as site-specific weed management, sensor-based variable rate applications, computer vision, and AI, holds great promise for revolutionizing agriculture by increasing efficiency, reducing environmental impact, and increasing crop yields. These developments are critical for meeting rising food demand while reducing agriculture's environmental footprint.

CONCLUSION

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