DaNet NewsLetter

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Content

This newsletter describes a new innovation project dealing with technology for spraying of single weed plants. The idea is to detect weed plants by real time computer vision and to kill them by single droplets of glyphosate. This method can potentially reduce the use of glyphosate to a few percent of the amount used in conventional spraying.

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Technology for spraying of single weed plants

The usage of chemicals in agriculture may have undesired effects on the environment and human health. Herbicides represent a significant part of the pesticide use in agriculture and experiences from the last few years show that conventional spraying technology seems difficult to optimize further to reduce the usage of herbicides.

A large part of the foliar-active herbicides applied with conventional spraying technology has no activity because it ends up on the soil surface or the crop plants. The reason is that in most agricultural fields only a few percent of the soil surface is covered by weeds. Therefore, a technology that can apply single droplets of herbicides directly onto the weed plants could potentially lead to dramatic reductions in herbicide consumption.

Lee et al. (1999) demonstrated a so-called micro-spray system that could apply small amounts of herbicides on the weed plants at centimeter precision. Søgaard et al. (2006) developed a system that could apply even smaller amounts of herbicides at sub-centimeter precision. The system applied only a few micro-liters of spray liquid on each weed seedling.

Project goals and approach

The goal of a new project with the title “Operational spraying of single-plants” is to develop a prototype of a system that integrates computer vision technology and high precision droplet application technology for weed control at single plant level. The task of the computer vision system is to identify weeds that should be sprayed. The system should be able to apply glyphosate onto weed plants under realistic conditions. As the spray liquid is applied as single droplets rather than atomized spray, it will be necessary to change the physical properties (e.g. the viscosity) of the liquid to achieve optimum deposition on the plants. Therefore, one of the project aims is to develop liquid formulations that optimize the biological effect as well as the deposition on the weeds.

Work packages

The project is organized into work packages with specified sub-tasks to be solved. There are six work packages:

- Project coordination and dissemination of results obtained in the project.
- Development of a prototype that integrates computer vision and micro-spray technology. For the computer vision task a smart camera solution will be considered. A smart camera combines a CCD-camera and an image processor into an integrated unit that can process images at a very high rate. For the micro-spray task a new technology that can apply very small amounts of liquid extremely fast and precise will be considered.
- Study of the biological efficacy of different glyphosate formulations. A micro-spray unit will be used for application of different glyphosate formulations and dosages on selected weed species, and the biological efficacy will be evaluated.
- Characterization of the liquid transportation from the micro-spray unit to the target and measurement of the retention of liquid on the target (weed leaves). The properties of the spray liquid will be optimized in terms of maximum deposition on the weed leaves and minimum soil surface loss and spray drift.
- Validation of the integrated computer vision and micro-spray system. Tests under realistic outdoor conditions will be performed.
- Formulation of strategies for application of micro-spray technology. Potential application areas for micro-spray technology will be mapped out and the derived reductions in pesticide consumption will be analyzed.

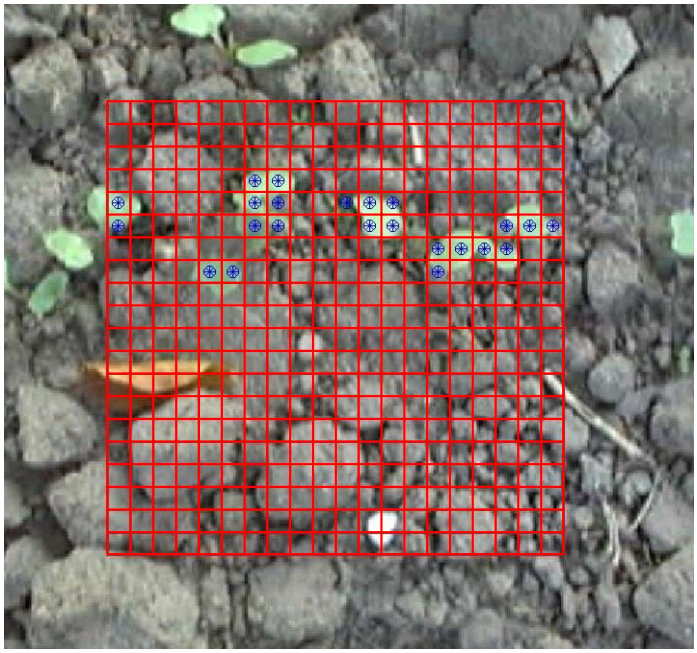

Figure 1. The computer vision system takes pictures from the field surface. In each picture the area of interest is divided into square cells (□) of e.g. 0.25 by 0.25 cm each. Cells containing at least 50% weed leaves are marked for spraying (⊛).

Participating organizations

Danish Institute of Agricultural Sciences, Research Centre Flakkebjerg
Danish Institute of Agricultural Sciences, Research Centre Bygholm
Hardi International A/S, Tåstrup

Financing

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References

Lee, W.S., D.C. Slaughter & D.K. Giles. 1999. Robotic weed control system for tomatoes. Precision Agriculture 1; 95-113.

Søgaard, H.T., I. Lund & E. Graglia. 2006. Real-time application of herbicides in seed lines by computer vision and micro-spray system. Presented at ASABE 2006 Annual International Meeting, Portland, OR, USA, 9-12 July, 2006 (Proceedings on CD-ROM).