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Optical Sensor System for Fuel Saving during Thermal Weed Control

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Abstract

Agriculture is one of the most important sectors within the Colombian economy, in order to promote studies in this field and considering that until now, thermal weed control applications in agriculture are extremely simple. Regardless the amount of weed that covers the field in question, its surface distribution is usually irregular (*i.e.* nest forms) and consequently burning takes place across the entire surface.

In Colombia, weed removal techniques are limited to the use of herbicides or open burning. The result is a system with a high gas consumption that burns not only the intended weeds, but also nutrients and minerals which are important for the crop itself. With the help of a camera and digital image processing (machine vision), it is possible to know the exact position and amount of weeds on a field. With this information it is possible to regulate the gas pressure of each valve (and thus control the burner) with respect to the amount of weeds detected. As a consequence fuel can be saved drastically, and thus generate a system that is framed within the concept of precision agriculture.

There are variables that could decrease gas consumption; there is no need to carbonize weeds to guarantee their elimination; it is just necessary to damage the surface structure of the plant so that it can no longer perform its photosynthesis process. It has been reported that weeds die with temperatures ranging between 55 and 94°C. It has also been determined that the time of exposure to the flame should be between 0.065 and 0.13 sec. The system was designed with an angle 45° and a height of 12 cm approximately from the floor to the burner. This considerations where incorporated as design parameters since studies have shown that this may be the most appropriate way of burning weeds. The main advantage of using precision agriculture metodology is that the control of the vales results in significant fuel savings. Initial measurements indicate that gas consumption in a typical pre-emergence treatment in corn cultivation can be reduced form approximately 60 kg of fuel gas, to less than 15 kg.

Keywords: Machine vision, precision farming, weed detection

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