Introduction

Weeds are considered as one of the most challenging tasks in organic crop production (Bishopp et al., 2002). Chemicals are prohibited in organic crop production due to contamination of soil and underground water. In organically grown vegetables, labor for manual weeding can be intensive and time consuming (Melander and Rasmussen, 2000).

The contents of the hydraulic circuit were: pressure relief valve (2), pressure gauge (3), adjustable priority flow divider (4), unbalanced flow electromagnetic directional valve (6), hydraulic motor (5), and double-acting hydraulic actuators (7).

Weed rollers coated with horizontal grooved rubber

Intra-row weeder hydraulic circuit design

The weeder used the hydraulic power drawn from the tractor.

The weeder hydraulic circuit was custom built at the ABE workshop.

The contents of the hydraulic circuit were: pressure relief valve (2), pressure gauge (3), adjustable priority flow divider (4), unbalanced flow electromagnetic directional valve (6), hydraulic motor (5), and double-acting hydraulic actuators (7).

The hydraulic circuit was assembled at the ABE workshop.

Intra-row weeder operation

The weeder uprooted intra-row weeds by rotating the rollers of the weeding mechanism.

An ultrasonic proximity sensor was implemented to discriminate between weed and crop plants by their height differences.

The weeding mechanism tolerates crop plant by moving upward, when it passes crop plant, it will move downward to continue uprooting weeds.

Material and Methods

Intra-row weeder design concepts

- A mechanical intra-row weeder was designed and fabricated at the University of Florida Agricultural and Biological Engineering (ABE) workshop.
- The weeder was designed to control intra-row weeds when weeds were at early growth stages to minimize competition.
- The weeder operate in small vegetable farms.
- The weeder has only one weeding mechanism, thus it operate on single crop row.
- The weeder was mounted behind a tractor by the three point hitch.
- The weeder was powered by the hydraulic system from the tractor.
- A versatile vacuum mechanism was mounted on the weeder frame to collect uprooted weeds from the weeding roller mechanism for later measurements.

Weeder roller mechanism concept

Intra-row weeder hydraulic circuit diagram

- Each roller consisted of a steel core, coated with 1.27 cm horizontally grooved rubber.
- Roller dimensions was 30.48 cm long and 6.35 cm diameter.

Intra-row weeder operation concept

- The weeder roller mechanism tolerate crop plant by moving upward, when it passes crop plant, it will move downward to continue uprooting weeds.

Preliminary field test

- A field test for the weeder roller mechanism was conducted at Plant Science Research and Education Unit (PSREU), in Citra, FL in Fall 2013.
- The weeding mechanism was able to uproot weeds.
- The uprooted weed heights were ranged from 10.00 cm to 17.80 cm.
- The uprooted weeds were collected by a vacuum machine.
- Further field experiments are planned in the near future to examine the performance of the weeder roller mechanism and evaluate ultrasonic sensor detection.

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