Field Analysis of Crop's for Sweeper Weeder Machine

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Abstract – Weed management is one of the tedious operations in vegetable production. Because of labor costs, time and tedium, manual weeding is unfavorable. The introduction of chemical weed control methods has alleviated these undesirable factors. However, the emergence of herbicide-resistant weeds, environmental impact and increasing demand for chemical free foods has led to investigations of alternative methods of weed control. Most implements employing mechanical cultivation cannot perform weed control close to the crops, and existing intra-row welders have limitations. A mechanical weeding actuation system was designed, and a prototype was constructed. This actuator was developed to mechanically control intra-row weed plants. The mechanical weeding actuator consisted of a belt drive system powered by an integrated servo motor and a rotating tine weeding mechanism powered by a brushless dc motor. One of the major challenges in this project was to properly design the actuator and its weeding mechanism for effective intra-row weed control. A prototype actuator was manufactured and a series of tests was conducted to determine actuator efficacy and the corresponding force and speed requirements of the actuator. The actuator would be combined with a machine vision system for detecting crop plant locations and guiding the weeding actuator to execute mechanical weeding operations without damaging crops. In the first field experiment, the performance of the first version of the intra-rowweeder was investigated across three factors: working depth, travel speed and tine mechanism rotational speed. There was evidence of differences in weed control efficacy across travel speeds.

Index Terms – Blade Harrow, Weeding, Weed's.

1. INTRODUCTION

Traditional farming practices have evolved over the years for various processes. Historically; agricultural development played a central role as a driver of rural poverty reduction. However, recent trends show in slowing down of agricultural productivity growth and the marginalization of poor farmers. In India Rs. 4,800 million worth of crop is being lost every year due to weeds. On average, the cost of weeding comes to Rs. 945 per ha, out of the total cost of cultivation of Rs. 3 000 per ha for agricultural crops. Weed control is becoming an expensive operation in crop production. Majority of Indian farmers use hand-hoe for weeding which requires 40-60 labourers for weeding one hectare of land. The effects of various shapes of blades of bullock-drawn blade harrow on depth of operation, weeding efficiency and crop yield was studied. Six different blade shapes viz., convex, concave, 1200 V shape, 1600 V shape, serrated edge and tyne cum blade were compared with straight blade. Maximum draft of 450 mm wide blade harrow was 286 N. Power requirement of the blade harrows was 0.20-0.27 kW. Human energy predominantly used one other for almost all operation in Indian agriculture. Even in specialized operation as rice transplanting, horticultural plantation of crops, hoeing and weeding, picking of cotton, human power is still only source of energy.

Mechanical weeding is preferred to chemical weeding because weedicide application is generally expensive, hazardous and selective. Besides, mechanical weeding keeps the soil surface loose by producing soil mulch which results in better aeration and moisture conservation. Keeping in view of the above facts, an engine operated weeder was designed, developed and tested in field.

In general equipment/machinery fabrication industries, CAD technology has been very widely applied to various fields. But Farm machinery still remains an the primary stage, which based on hand work such as objects, models and drawings and samples to complete the whole process of Farm machinery body design method without using the modern CAD design software tools. At present, foreign farm machinery companies have started to use CAD modern technology, while problems such as not precise enough, long design cycle still exist in domestic agricultural machinery companies.

2. MATERIALS AND METHODS

2.1: Base Frame

A base frame was made by welding two 40 x 6 mm size MS C-iron sections 825mm long so as to have H section. The tool bar was connected to a frame made of two 25 x 6 mrn size MS angles. The frame was fitted to the weeding attachment at the rear. In front of the base plate for mounting the front wheel frame was made on 6mm mrn thick MS plate of 825 x 170 mrn dimensions.

2.2: Driving Wheels

Two 300mm diameter driving wheels were made using fibre molded rim. Stiffening rods of 15 mrn diameter and 99.48 mm long 4 in numbers were used as spokes on the central hub. The

50 mm long hub was made to suit the 15 mrn size round MS rod which is the central axle of the ground wheels.

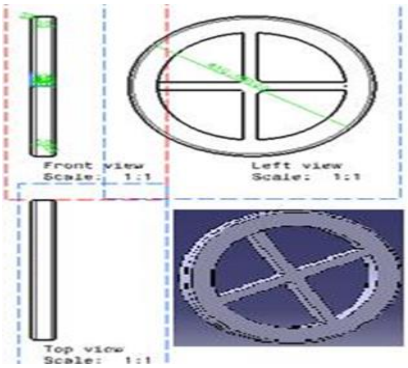

Fig. 2.2: Drafting of Wheel

2.3: Front Wheel

A 150mm diameter castor wheel was fitted at the front frame bracket of the machine to achieve economic weeding operation with reduced effort.

2.4: Weeder Blade

The weeder blade was assumed to be a simply supported beam subjected to a uniformly distributed load of 150 N/m. Based on it the thickness sweep of blade, was calculated to be 3mm The two different shapes weeder blades are designed according to need of different soil properties.

Fig. 2.4: Frame Weeder Blade

3. PROTOTYPE MODEL

Fig.3.1: Design of Weeder

4. WEED CONTROL METHOD

The removal and eradication of weeds from the fields, gardens or land with minimum damage to the desired plants is weed control.Various methods described below are used for removal of weeds from desired plants.

4.1: Manual Weeding

Manual control is the use of the hands or handheld tools to deal with weeds. Extensive amount of cheap manual labor is necessary for manual weeding. Manual weeding is commonly employed by smaller Indian framers for weed removal.

Many gardeners still remove weeds by manually pulling them out of the ground, making sure to include the roots that would otherwise allow them to resprout. Hoeing off weed leaves and stems as soon as they appear can eventually weaken and kill perennials, although this will require persistence in the case of plants such as bindweed. Nettle infestations can be tackled by cutting back at least three times a year, repeated over a three-year period. Bramble can be dealt with in a similar way.

4.2: Mechanical Weeding

Mechanical control is the use of powered tools and machinery to manage weeds. It is suitable for larger infestations because it reduces the weed bulk with less manual effort. Mechanical control consists of methods that kill or suppress weeds through physical disruption. Such methods include pulling, digging, disking, plowing and mowing.Mechanical or physical techniques either destroy weeds or make the environment less favorable for seed germination and weed survival. These techniques include hand-pulling, hoeing, mowing, plowing, disking, cultivating, and digging. Mulching (straw, wood chips, gravel, plastic, etc.) can also be considered a mechanical control means since it uses a physical barrier to block light and impede weed growth.

4.3: Chemical Weeding

Chemical control involves the use of herbicides. Herbicides control weed plants either by speeding up, stopping or changing the plant's normal growth patterns by drying out the leaves or stems; or by making it drop its leaves. Chemical Control with herbicide application can provide the most effective and time-efficient method of managing weeds. Numerous herbicides are available that provide effective weed control and are selective in that grasses are not injured. Weed removal is one of the major activities in agriculture. Chemical method of weed control is more prominent than manual and mechanical methods. However, its adverse effects on the environment are making farmers to consider and accept mechanical methods of weed control. Chemical weeding is the most extensively used method of weed removal. But these chemicals used for weeding are harmful to living organisms and toxic in nature.

4.4: Biological Weeding

Biological control involves the use of insects or pathogens that affect the health of the weed. It includes the use of living organisms for suppressing or controlling the weeds. Plant, animal or micro organisms may be used for destruction of weeds. The goal of biological control is not eradication, but the use of living agents to suppress vigor and spread of weeds. Such agents can be insects, bacteria, fungi, or grazing animals such as sheep, goats, cattle or horses. Grazing produces results similar to mowing, and bacteria and fungi are seldom available for noxious weed management. Biological control is most commonly thought of as 'insect bio control'.

5. COMPARISON OF CROP’S

The below table show the comparison between crop’s by the help of (Distance, Hour, Manual Worker, Blade Harrow)

1 Acer 0.00405 (km^2)

0.00405 Root is = 0.063639 km

0.063639/1000 = 63.63 m

Content	**In One Acer Row’s**	**Distance**	**Blade Harrow With Bull (For Weeding)**	**Manually Worker (For Weeding)**
Pigeon Pea	23 Row’s	9 Foot (1.5 Between Two Row’s)	3 to 3.5 hour	15 Without Blade Harrow30
Soyabean	117 Row’s	1.5 Foot	3 to 3.5 hour	15 Without Blade Harrow 30
Cotton	70 Row’s	3 Foot	2 to 2.5 hour	18 Without Blade Harrow 36

6. CONCLUSION

This research achieved the main goal of developing a mechanical intra-row weed actuation system focusing on weed control intentionally for vegetables crops production.

The prototype underwent several stages of development to achieve this goal. The final prototype used a pivot arm concept where an integrated servo motor was used to control the pivoting arm motion via a chain drive system. The chain drive system drives a rack and pinion mechanism to guide the swinging of the pivot arm. The weeding mechanism shaft was rotated using a chain drive system powered by a brushless dc motor.

The main objective was to study the weed control efficacy using different settings. A simulation was developed to investigate the effect of number of tines on the working zone at different travel speeds and different rotational speeds. This simulation was used as a basis to study the weed control efficacy. Using this simulation, minimum rotation speeds for specific travel speeds were obtained. The simulation also showed that with increasing travel speeds, the required rotational speed had to be increased to cover the same working zone. This result was also through two field experiments conducted using different versions of the prototype. In addition, the first experiment also showed that with increasing working depth, the weed canopy area reduction also increased.

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