DESIGN AND FABRICATION OF AGRICULTURE POWER WEEDER

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ABSTRACT : *Weed control in crops is major problem in India. Generally Indian farmer use traditional way for doing fieldwork that is weeding is done by bulls or workers with the help of khurpi. This method is useful but it is very demanding of labour. To overcome this problem we introducing an alternative solution that is "power weeder". These power weeder will remove grass between two rows and also do the cultivation. We will use rotary adjustment for doing weeding as well as cultivation which is power operated. With the help of this machine we are trying to reduce human efforts with less maintenance cost. The weeder driven by man to move in forward direction and the blade is attached at front end is placed at the roots of weeds, once blades get rotated then they starts cutting the weed, like this the complete land of cultivation is made as weed free. Main benefit is reducing labour cost by reducing the number of labours with less time consumption.*
KEY WORDS: Engine, Rotor disc blades, Chasis wheels.

1. INTRODUCTION :

Weeding is one of the important and labour intensive agricultural operation which affects the yield of the crop. The weeds are undesirable, unwanted plants, which grows plentifully in the field and possess competition to the crop for nutrients, moisture, space and solar radiation. Delay and negligence in weeding operation affect the crop yield up to 40 to 60 per cent in cotton (Rao et al. 2014). In India, the weeding operation is carried out with indigenous hand tools like hand hoe and spade. Straight blade hoes and triangular blade hoes made by black smiths and village artisans are traditionally used and penetration of advanced method of weeding is still yet to be practiced. In spite of many tools available, the farmers are still practicing the manual uprooting of weeds, which is labour intensive and costly. The most common methods of weed control are mechanical, chemical, biological and cultural methods out of which mechanical weed control involves weeding the whole crop area, or it may be limited to selective inter-row or intra row weeding**.**

Therefore, the present work has been planned with the following specific objectives:

1. To develop an economical small-scale power operated weeder suitable for small farm holder in Egypt.

2. Study the performance of the weeder and its new designed vertically rotating blades as new concept for mechanical weed control.

Weeding is the removal of unwanted plants in the field crops. Mechanical weed control is very effective as it helps to reduce drudgery involved in manual weeding, it kills the weeds and also keeps the soil surface loose ensuring soil aeration and water intake capacity.

A weed is essentially any plant which grows where it is unwanted. A weed can be thought of as any plant growing in the wrong place at the wrong time and doing more harm than good (Parish, 1990). It is a plant that competes with crops for water, nutrients and light. This can reduce crop production. Some weeds have beneficial uses but not usually when they are growing among crops. Weeds decrease the value of land, particularly perennial weeds which tend to accumulate on long fallows; increase cost of cleaning and drying crops (where drying is necessary). Weeds waste excessive proportions of farmers' time, thereby acting as a brake on development

WHAT IS POWER WEEDER ?

Power weeder is a farm equipment utilized for secondary tillage. Another name refers to teeth called as shanks; this penetrates the soil as they are pulled through it directly. Another machine that uses rotary motion of disks to achieve a comparable outcome. Rotary tiller is the best example for this.

ADVANTAGES AND DISADVANTAGES :

ADVANTAGES :

1. Helps to reduce manpower.
2. Replace traditional method of weeding by using bulls.
3. Remove unwanted grass as well as provide rotary cultivation for crops like soybean, maize and gram etc.
4. Help to reduce process times.
5. Provide low cost and compact design.
6. Reduce use of harmful pesticide for weed control.

DISADVANTAGES:

1. Use of diesel engine require fuels which is non-renewable.
2. It can be only used for limited crops

2. LITERATURE SURVEY :

Hemeda and Ismail (1992) developed and evaluated a cultivator for inter-row cotton cultivation, the idea was to construct and develop a combined sweep type tool to be used extensively for grass and weed control. This type is considered highly efficient in smoothing the soil surface, but it caused the drifting of weeds without cutting. Two shares were added on both sides of the main sweep at different angles (15, 20 and 25°) to improve the weed cutting efficiency among rows.

Pitoyo et al. (2000) reported that the development of a power weeder for mechanical control of weeds in the rice field. The machine is driven by two strokes engine 2HP/6500 rpm. The machine performance was 15 hours/ha capacity at traveling speed 1.8 km/h. the mass of the machine was 24.5 kg. The pulverizing effect caused by turning of hexagonal rotavator could destroy weed effectively.

Pannu et al. (2002) evaluated a selfpropelled, engine operated power weeder, which has a diesel engine of 3.8 hp (2600 rpm), as a power source, this weeder was found to be suitable for weeding in wider row crops like maize, cotton, sugarcane etc. The moisture content of the soil at the time of evaluation was 17-18 %; the depth of operation ranged from 4-7 cm, the weeding efficiency of 88% was obtained.

To control weeds within the crop rows, mechanical intra-row weeder is developed and accomplishes their goal using two different approaches depending on the crop density. The first approach is to use selective machines or add-on tools that can perform weed control close to the crop, The second approach is to use machines that have weeding tools that move sideways to conduct weed control around the crop canopy. The - 4 - finger weeder is a simple mechanical intra-row weeder that uses two sets.

Bin Ahmad (2012) suggested that to design an effective intra-row power operated weeder; the weeder should be targeted for different scale crops production and to achieve intra-row weed control efficiency of 80% or more. Also, the weeder should be able to control weeds with minimal crop plant damage with low bulky overall dimensions of the weeder.

3. METHODOLOGY:

Rotating blades as soil working tool is gaining popular among farmers due to various reasons like simple structure, less weight and high efficiency. It gives better soil breakup and inversion, lower draft requirement and trash mixing (Mandal et al. 2013). When a rotating blade along its axis is used in the field, the edge of blade follows trochoidal path in the soil. For every forward movement, the blade cut the untilled soil, mix and pulverizes before throwing the soil away (Kinzel et al. 1981). The effect of blade shape, direction of rotation, number of blades on the periphery of rotary tillage tools on soil pulverization was studied by Lee et al. (2002).

The conceptual weeder blade was drafted in SOLIDWORKS and simulated with SOLIDWORKS simulation. The stress –strain as well as maximum displacement due to stress for three different thickness (blade thickness made of mild steel having 1.2, 1.5 and 2.5 mm thickness) was observed under soil penetration resistance on the blade edge. The whole part was disintegrated in to small

mesh of equal size having more than 15000 nodes and stress, strain and displacement of minimum and maximum value.

This part is including materials and methods adopted for the development and field performance of small-scale power weeder. This study was conducted in the Rice Mechanization Research Center (RMC), Meet ElDeeba, Kafrelsheikh Governorate, Egypt during agriculture season 2012 for maize crop variety of triple hybrid 314.

3.1.Development of power weeder:

The power operated weeder is developed to carry out the weeding operations in the field, where, the weeder moves due to the thrust provided by the soil engaged vertical blades. The major parts of the power weeder are engine, blades assembly and transmission system.

3.2.Weeder engine:

Engine is mounted on the back side of the machine while sets of vertical blades on the front side to provide stability and easy handling. The power source of cultivating unit was taken from the prime mover of Kubota AR120 rice and wheat reaper after separating the reaping unit. As the main goal of the proposed research is to use minimum power required to run the developed power weeder, the chosen engine was classified as small engine size. The continuous rated output of the engine is 3.5 hp.

3.3.Designs of rotating blades:

To develop and design the power weeder blade, functional requirement and consideration were:

a) Blade should be able to cut the soil properly without causing unnecessary damage to the sharpening edge.

b) The blades should be preferably designed, so that they do not enter the soil at the same time, but gradually (this helps in reducing the impact of the blades on the soil).

c) The speed of the blade and forward speed of machine should be adjusted to cut sufficient uniform part every time with considering that the bottom uniformity of the furrow is more or less. So, locally manufactured vertical type blades were used in the study and mounted on a circular rotating element on its horizontal side. The available types of blades in markets were mostly rotary blades that can be fixed around the main rotating shaft periphery in rotary weeders

3.4.CULTURAL WEED CONTROL:

Several cultural practices like tillage, planting, fertiliser application, irrigation etc., are employed for creating favourable condition for the crop. These practices if used properly, help in controlling weeds. Cultural methods, alone cannot control weeds, but help in reducing weed population. They should, therefore, be used in combination with other methods. In cultural methods, tillage, fertiliser application. and irrigation are important. In addition, aspects like selection of variety, time of sowing, cropping system, cleanliness of the farm etc., are also useful in controlling weeds.

1. Field preparation The field has to be kept weed free. Flowering of weeds should not be allowed. This helps in prevention of build up of weed seed population.

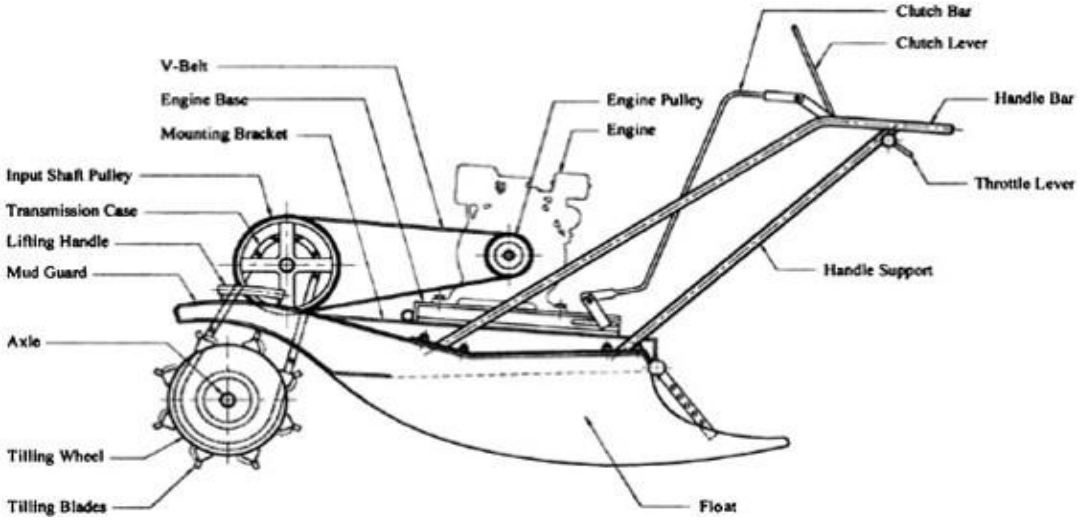
2. Summer tillage The practice of summer tillage or off-season tillage is one of the effective cultural methods to check the growth of perennial weed population in crop cultivation. Initial tillage before cropping should encourage clod formation. India is basically an agricultural country. FRP has much to offer in this field, plastic piping is already popular in irrigation. Many of the parts of a tractor body have been successfully replaced by FRP (Tube well casing pipes, wheel barrows).

3. Maintenance of optimum plant population Lack of adequate plant population is prone to heavy weed infestation, which becomes, difficult to control later. Therefore practices like selection of proper seed, right method of sowing, adequate seed rate protection of seed from soil borne pests and diseases etc. are very important to obtain proper and uniform crop stand capable of offering competition to the weeds.

4. Crop rotation The possibility of a certain weed species or group of species occurring is greater if the same crop is grown year after year. In many instances, crop rotation can eliminate

atleast reduce difficult weed problems. The obnoxious weeds like Cyperus rotundus can be controlled effectively by including low land rice in crop rotation.

3.5.CONSTRUCTION OF WEEDER MACHINE:



The rotary weeder consists of Troy–Bilt company four stroke 68 cc powered engine (approx. 3 hp) which have a maximum speed of 6800rpm. The power transmission system includes the centre shaft, bevel gears and final drive shaft (on which the blades are mounted). The power is transmitted to the shaft by a rectangular bush to increase the he rotary weeder consists of Troy–Bilt company four stroke 68 cc powered engine (approx. 3 hp) which have a maximum speed of 6800 rpm. The power transmission system includes the centre shaft, bevel gears and final drive shaft (on which the blades are mounted). The power is transmitted to the shaft by a rectangular bush to increase the speed.

The main parts of the machine is

1. Engine
2. Tilling wheel
3. Rotating disc blades
4. Transmission case
5. Clutch and throttle lever and axle

4.EXPERIMENTAL WORK:

An area of 1.1 feddan of clay soil was used and divided into three parts for weeder experiments; every part consists of (31×50 m2). Another part was left for traditional manually weed control method as a control. Each part of the field divided into 36 plots to cover the different variables with three replications. Each plot had width from 0.7 to 1 m (average 0.85 m) with fixed length for the field of 50 m. Both independent and dependent variables used in the study.

This study was carried out in the experimental paddy field of the Rice Research Institute of Iran (RRII), Rasht during the rice-growing season of 2009. Five weeding methods including, single row conical weeder (W1), two rows conical weeder (W2), rotary weeder (W3), power weeder (W4) and hand weeding (W5) were examined. Two transplanted paddy varieties, namely Hashemi and Hybrid that are local and high-yielding varieties, respectively were chosen in the experiment.

4.1.Experimental work:

Usage/Application: Inter Cultivation
Brand: Duxas
Power: 3 hp
Type: Walking
Size: 24 inches
Fuel: PETROL

Cutting Capacity: 200-400 kg/hr

Engine Displacement	**63 CC**
Power	3.0 HP / 2.2 Kw
Engine	3.0 HP Single Cylinder, Forced-Air Cooling Engine
Tilling Depth	8 Inch
Tilling Width	18 inch
Tank Capacity	1.20 Litres

4.2.3 HP WEEDER ENGINE:

The GreenMax Mini Power Tiller 63CC KB-63 combines a very high-performance engine at the bottom with Rated Output Power of 63CC 3.0 HP and 16 design-optimised metal blades to ensure even sun-hardened and clay-heavy soils can be tackled without problem. Quick-fold handlebars of the Mini Power Tiller mean it can be made even more compact ready for storage or transport; while Green Max's provision of a rust-resistant plastic housing works to reduce weight and makes the machine simple to keep clean. Thanks to two-handed safety-switching, the versatile Green Max Mini Power Tiller 63CC KB-63 cannot be accidentally started, so user-safety is guaranteed. Capable of handling fairly intensive tilling-jobs, this model has a maximum working-depth of 8 inches.

4.3.WORKING OF WEEDER:

1. Initially start the engine with the help of hand lever.
2. We used the 3 hp petrol engine and 63 cc.
3. The rotory blades are used for the forward movement of the machine.
4. Belt/chain drive is used to transmit power from engine to intermediate shaft.
5. The blades are mounted on the front side of the machine. When blades starts rotating forward motion occurs.
6. hence weeding is done with less effort and less cost.

   The performance evaluation of the constructed rotary power weeder was conducted on the experimental field of Department of Agricultural and Biosystems Engineering, University of Ilorin, ilorin Nigeria. The performance evaluations were conducted to investigate the effect of weed density on performance of four weeding tools. The experimental area was infested mostly with weeds like Trifolium repens (clover), cryperus eragrotis (umbrella sledge), cyperus rotumdus (Nut grass), cynodon dactrylon (couch grass), cynosures echinatus (Dog's Tail), phyllanthus amarus (Petty spurge), Lactuca taracifolia (Wild lettuce), Sida acuta (broom weed), Imperata cylindrical (logongrass), Amarantus spinosus (thorny pig weed) and Eleusine indicae (goose grass). Prior to each weeding schedule, weed density in each experimental unit was determined by laying-out a squared grid (0.3m× 0.3m) in the plot and weeds in the grid were counted. Three such determinations were made for each experimental unitRotating blades as soil working tool is gaining popular among farmers due to various reasons like simple structure, less weight and high efficiency. It gives better soil breakup and inversion, lower draft requirement and trash mixing (Mandal et al. 2013). When a rotating blade along its axis is used in the field, the edge of blade follows trochoidal path in the soil.

5.RESULTS AND DISCUSSIONS:

Results of the study undertaken regarding the influences of some operational parameters have been presented and discussed in this part.

Cutting Capacity: 200-400 kg/hr

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5.1.Fuel consumption:

At soil moisture content 7.73 % the fuel consumption increased by 19.4 and 10.6 % when the depth of operation increased from 0-20 to 20-40 mm for 2.1 and 2.4 km/h and by using two blades respectively. Moreover, the increasing percentages in fuel consumption were 14.6 and 3.7 % when the depth of operation increased from 0-20 to 20-40 mm for 2.1 and 2.4 km/h weeder forward speeds and by using four blades respectively.

5.2.Effective field capacity:

Figure 8 shows that as the depth of operation increased, the effective field capacity decreased. At 7.73% soil moisture content when the depth of operation increased from 0-20 to 20-40 mm, the effective field capacity decreased from 0.204 to 0.199 and from 0.200 to 0.198 fed/h with 1.8 km/h weeder forward speed and by using two and four blades, respectively. In addition, it was clear that the effective field capacity increased with increasing weeder forward speed.

5.3.Weeding index:

The ratio between the numbers of weeds removed by weeder to the number of weeds present before weeding in a unit area has been calculated under different variable levels as weeding index. Figure 9 shows the effect of this variation on weeding index at 7.73, 12.28 and 16.18 % soil moisture content. At 7.73 %, it was clear that, as the depth of operation increased, the weeding index increased.

5.4.Energy required per unit area:

Based on engine brake power and effective field capacity, the energy required per agricultural unit area was calculated. Figure 10 presents the effect of weeder forward speed, blades arrangements, soil moisture content and depth of operation on energy required per agricultural unit area.

5.5.Tool cost:

It represents total cost values obtained under different variables. When the depth of operation increased from 0-20 to 20-40 mm, the total cost increased from 76.84 to 79.58 and from 78.37 to 80.41 L.E/fed at 1.8 km/h weeder forward speed by using two and four blades respectively, and soil moisture content 7.73%. The percentages of total cost were increased from 3.75 and 2.76 % when the depth of operation increased from 0-20 to 20-40 mm for 2.1 and 2.4 km/h weeder forward speeds, respectively, by using four blades

5.6.Plant damage:

The tillers, which were either cut by the blades or crushed beyond the recovery, were considered as damaged. Total number of tillers for a length of 5 m was counted before operation. The numbers of tillers damaged were counted for the same stretch of five meter. The plant damage was given by Plant damage percentages and calculated directly after cultivation.

5.7.RESULT:-

1. Displacement of engine – 63 cc
2. Power of the engine-3 hp/2.2 kw
3. Cutting depth of the engine-8 inch
4. Cutting width of the engine-18 inch
5. Cutting capacity of the engine – 200-400 kg / hr

C0NCLUSION:

Using such developed small powered mechanical weeder under different variables and conditions can lead to finalize suitable operating parameters to fit farmers need. Using four blades with forward speed 2.4 km/h and depth of operation ranged from 20-40 lead to higher fuel consumption, higher value of plant damage and more power required from engine to operate the weeder. forward speed 1.8 km/h, soil moisture content 7.73% and under depth of operation ranged from 20-40 mm. reducing the number of blades to two is a good option while using the machine at higher moisture content with - 23 - 1.8 km/h forward speed with depth of operation up to 20 mm, in such condition the field efficiency was 89.88%. To minimize the total cost to be 55.09 L.E/fed using two blades with 2.4 km/h weeder forward speed at depth of operation ranged from 0-20 mm and soil moisture content 16.18 % is recommended.

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The main conclusion is as follows:

1. The machine requires one operator for operating the machine.
2. The machine can be used to a minimum 15 inch row spacing.
3. The average depth of operation was 25 mm. effective width of cutting tool is 8 inch.
4. Labour requirement in case of power weeder is least.
5. Overall working of power weeder was satisfactory, trouble free and smooth, there was no breakdown and accidental incident during operation.

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