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# Evaluation of Power Weeders for Mechanized Weeding in Pulse Crop Cultivation

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**Now a days weeding necessitates the introduction of suitable power weeders for pulse cultivation. A study was conducted at TNAU fields with 3 models of commercially available power weeders (Model A, B and C). To suit the power weeder the crop geometry was modified with 60x10 cm and the performance of three power weeder models were compared with conventional method of hand weeding. The working width of the power weeders was 60 cm, 60 cm and 30 cm respectively for Model A, B and C. Manual weeding using hand hoe registred maximum weeding efficiency of 83.10 per cent (wet basis) and 82.5 per cent (dry basis). The weeding efficiency of Model A was 74.10 per cent (wet basis) and 73.45 per cent(dry basis), Model B recorded 63.49 per cent (wet basis) and 64.15 per cent (dry basis) and Model C recorded the lowest weeding efficiency of 43.43 per cent (wet basis) and 43.13 per cent (dry basis). The saving in cost of weeding was observed as 75.8, 72.5 and 54.8 per cent respectively for Models A, B and C when compared to manual weeding. The saving in time of weeding operation was 95.8, 94.6 and 89.8 per cent for Models A, B and C, respectively when compared to the manual weeding.**

**Key words**: power seeder, pulses, weeding efficiency, cost of weeding

Pulse crops are grown on large scale in almost all tropical and subtropical countries of the world. The major pulse producing counties are India, China, Canada, Brazil, Australia, Nigeria, France, Myanmar, USA, Turkey, and Mexico. Among these, India occupies first position in acreage and production. The area and production of pulses in India in 2009-10 was 23.28 million ha and 14.66 million tonnes, with a yield of 630 kgha$^{-1}$. India is the key player with 25 per cent share in the global pulses basket. The area under pulses, production of total pulses and productivity in Tamil Nadu in 2009-10 was 0.53 million ha. 0.204 million tonnes and 382 kgha$^{-1}$ respectively. Tamil Nadu accounts for about 2.3 per cent of the total area under pulses and 1.39 percent of total production in India.

Agricultural machines increase productivity of pulse crop and reduce problems due to non availability of labours by meeting timeliness of farm operations and increased work out-put per unit time. One third of the cost of cultivation is spent on weeding alone when carried out with manual labour. Weeding is the one of the labour intensive and tedious operation in pulse cultivation. This situation necessitates the introduction of suitable power weeders for pulse cultivation.

The efficiency of the work in terms of area covered was significantly better with the power weeder than with manual weeding. The energy demand in manual weeding is only about 27 per cent whereas for weeding with power weeders, the energy goes up to 56 per cent. The strain was relatively less in case of wheel hoe type weeder (Rajasekar, 2002). According to Pullen and Cowell (1997), cutting action of the blade hoe is used most efficiently when operated at shallow depth and increasing the working depth does little to improve weed kill but a higher forward speed increases soil covering of weeds and may reduce their survival. Padole (2007) reported that rotary power weeder works better in respect of working depth (5.67 cm) which is 16.67 per cent more than bullock drawn blade Goel *et al*. (2008) reported that the plant damage increased with decrease in moisture content below 11.63 per cent. Rangasamy *et al.* (1993) evaluated the performance of power weeder and the field capacity of the weeder was 0.04 ha hr$^{-1}$ with weeding efficiency of 93 per cent for removing shallow rooted weeds. The cost of operation with power weeder was Rs. 250 as against Rs. 490 by dryland weeders and Rs. 720 by manual weeding with hand hoe per hectare.

## Material and Methods

With this objective to select the suitable power weeder for pulse cultivation a study was conducted at TNAU fields with 3 models of commercially

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available power weeders (Model A, B and C). To suit the power weeder the crop geometry was modified with 60x10 cm in pulse cultivation. The three models were compared with conventional method of hand weeding. Specificaions of the three models of the power weeder are given in table.1. The operational view of power weeders are shown in Fig.1.

**Table 1. Specification of the power weeders**

| Particulars | Model A | Model B | Model C |
|---|---|---|---|
| Power, hp | 5.5 | 4 | 1.6 |
| Power source | Four stroke petrol engine | Four stroke diesel engine | Two stroke petrol engine |
| Width of operation, mm | 600 (Adjustable up to 800 mm) | 450 mm | 300 mm |

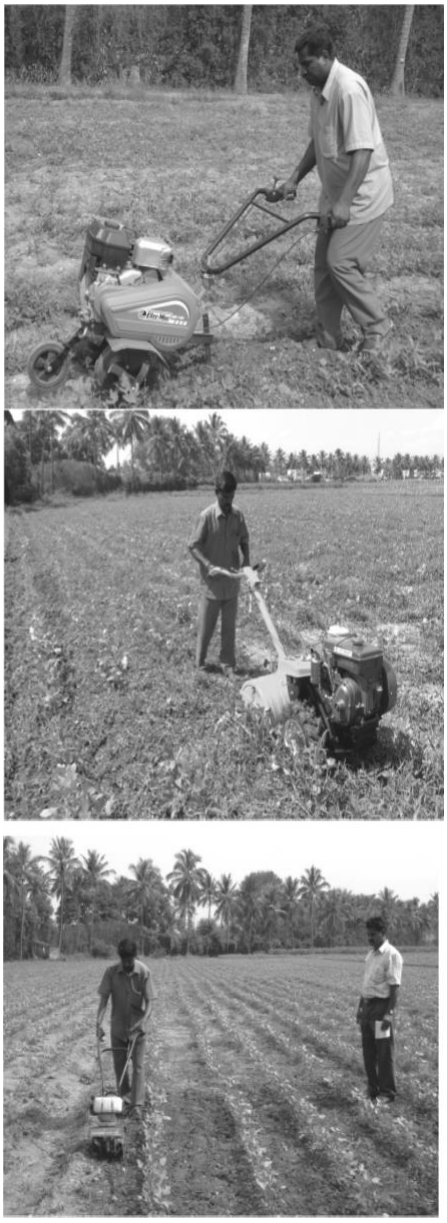

**Fig. 1.Operational view of the power weeders Model A, B and C**

In the conventional method, weeding is performed by women labourers using a hand hoe.

Treatments:

$T_1$ - Conventional (Manual weeding)

$T_2$ - Operation with self propelled power weeder - Model A

$T_3$ - Model B

$T_4$ - Model C

The weeders were evaluated for its performance in terms of weeding efficiency (wet and dry basis), depth of operation and percentage of plant damage. The moisture content of the soils during the evaluation was 15.28 per cent on dry basis.

**Table. 2. Results of the performance evaluation of the power weeders in pulse crop**

| Particulars | Manual | Model A | Model B | Model C |
|---|---|---|---|---|
| Wet weight of weeds collected, $gm^{-2}$ | 436.70 | 400.40 | 305.30 | 184.83 |
| Wet weight of weeds left out in the field, $gm^{-2}$ | 88.80 | 140.00 | 175.50 | 240.77 |
| Total wet weight of weeds, $gm^{-2}$ | 525.50 | 540.40 | 480.80 | 425.60 |
| Weeding efficiency(wet basis) | 85.1 | 74.1 | 63.49 | 45.43 |
| Dry weight of weeds collected, $gm^{-2}$ | 237.27 | 155.78 | 119.64 | 71.28 |
| Dry weight of weeds left out in the field, $gm^{-2}$ | 50.33 | 56.32 | 66.86 | 93.98 |
| Total dry weight of weeds, $gm^{-2}$ | 287.60 | 212.10 | 186.50 | 165.26 |
| Weeding efficiency(dry basis) | 82.5 | 73.45 | 64.15 | 43.13 |
| No. of plants for 30 m long | 109 | 104 | 98 | 118 |
| No. of damaged plants | 2 | 10 | 11 | 5 |
| Percentage of damage | 0.18 | 9.62 | 11.2 | 4.2 |
| Depth of operation, mm | 38 | 62 | 58 | 35 |

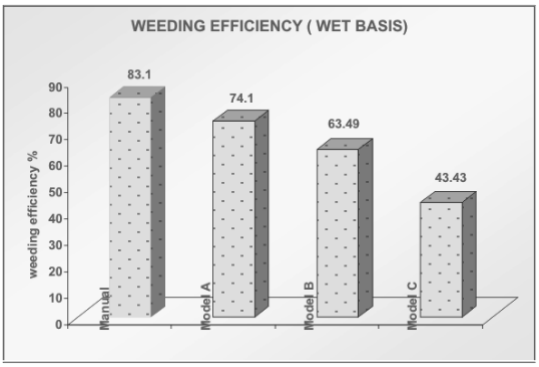


**Fig. 2. Weeding efficiency in wet basis**

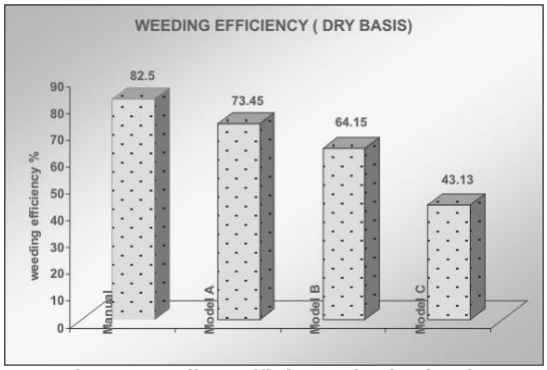


**Fig.3. Weeding efficiency in dry basis**

The cost of weeding using different models of power weeder was compared with the manual weeding method.

**Results and Discussion**

The performance evaluation results of the different models of the power weeder is shown in Table 2. The weeding efficiency of all the models is

shown in Fig.2 and Fig.3. It is observed that there was no significant variation between the weeding efficiency on wet basis and dry basis in all the treatments. Among the treatments, manual method

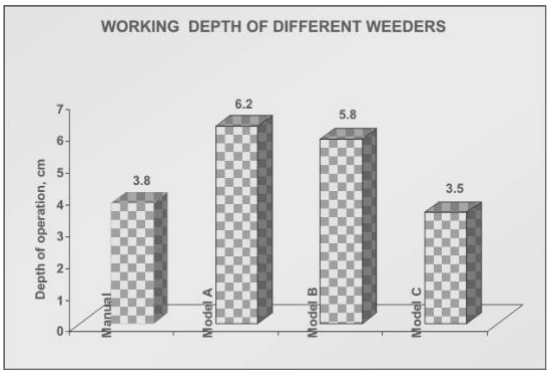


**Fig.4. Depth of operation of weeders**

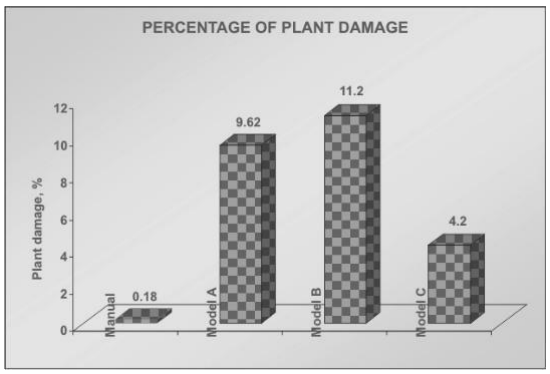


**Fig. 5. Percentage of plant damage**

registered the maximum efficiency of 83.1 per cent (wet basis) and 82.5 per cent (dry basis). The efficiency of model A and Model B are comparable. Model C had a lowest efficiency of 43.43 % (wet basis) and 43.13% (dry basis), this variation because of model c is the small weeder with 1.6 hp engine and 20 cm width.

**Table.3.Results of the evaluation of the power weeders in pulse crop**

| Particulars | Manual | Model A | Model B | Model C |
|---|---|---|---|---|
| Length of the field, m | - | 50 | 50 | 50 |
| Width of operation, m | - | 0.600 | 0.450 | 0.300 |
| Time taken to travel 50 m, sec | - | 125.4 | 135.5 | 160.4 |
| Forward speed, km/hr | - | 1.43 | 1.32 | 1.12 |
| Theoretical field capacity, ha/day | - | 0.686 | 0.475 | 0.268 |
| Size of the filed , $m^2$ | | | 50 x 15 = 750 | |
| Time taken to complete 750 $m^2$,min | 440 hrs/ha | 81.4 | 105.8 | 195.0 |
| Actual field capacity, ha/day | - | 0.44 | 0.34 | 0.18 |
| Field efficiency, % | - | 64.1 | 71.5 | 67.1 |
| Cost of operation, Rs/hr | - | 58.50 | 51.42 | 44.73 |
| Cost of weeding, Rs/ha | 4400 | 1064 | 1210 | 1988 |
| Saving in cost when compared to manual method, % | - | 75.8 | 72.5 | 54.8 |
| Saving in time when compared to manual method, % | - | 95.8 | 94.6 | 89.8 |

The depth of operation in weeding for all the treatments is shown in Fig.4. It was inferred that the depth of operation was highest in Model A operation (6.2cm) followed by Model B (5.8 cm). Owing to this maximum depth of operation the weeds were completely uprooted and the weight of the weeds collected per unit area was also maximum in Models A and B as seen from the observations recorded in Table 2.

The percentage of plant damage in the trail field during the operation of the weeders is shown in Fig.5. The percentage of plant damaged was greater in Model A and followed by Model B. This is due to the fact that wheels and the blade caused damage to the plants while passing between rows. With sufficient head land and training in operation of the weeders in between rows the percentage of plant damage can be minimized.

The results of the trail for weeding operation in pulse crop with the selected treatments are presented in Table 3. It is clearly reflected from the figure among all the treatments the saving in cost and time was maximum in Model A (75.8 % and 95.5%) followed by Model B (72.5 % and 94.8%). The Model C recorded the lowest cost of saving and time as 57.8 per cent and 88.8 per cent.

## Conclusion

Manual weeding using hand hoe registered maximum weeding efficiency of 83.10 per cent (wet basis) and 82.5 per cent (dry basis). The weeding efficiency of Model A was 74.10 per cent (wet basis) and 73.45 per cent (dry basis), Model B recorded 63.49 per cent (wet basis) and 64.15 per cent (dry basis) and Model C recorded the lowest weeding efficiency of 43.43 per cent (wet basis) and 43.13 per cent (dry basis). The saving in cost of weeding operation was 75.8, 72.5 and 54.8 per cent, respectively for Models A, B and C compared to manual weeding. The saving in time of weeding operation was 95.8, 94.6 and 89.8 per cent for Models A, B and C, respectively when compared to the manual weeding.

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