Performance evaluation of hand weeders -A Review

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Absract

Weed control is one of the most difficult tasks in agriculture which accounts for a substantial share of the cost involved in agriculture production. Farmers generally expressed their worry for the effective weed control measures . More than 33 percent of the cost incurred in cultivation is diverted to weeding operations there by reducing the income share of farmers. Saving of labour requirement (man-h/day) is achieved with the use of enhanced long-handle mechanical weeders like wheel hoes, animal drawn weeders (two to three rows) and engine-operated power weeders.. It reduces human effort. It is a great saver of time and expenses on field operations. Thus it will have very effective uses on the farm field either for tiling in addition to for weeding. Weeder are helpful for improved labour productivity, cheap unit cost of operation, improved timeliness of operation and appropriate for custom hiring. It is preferably suited for mechanizing small farm holdings which account for 80 % of the farm holdings of the country.

Keywords: Weeder, Manual Weeder, Power Weeder, Push-pull weeder ,Weeding Efficiency, Field Efficiency

Introduction

Weed control is one of the most difficult tasks in agriculture that accounts for a substantial share of the cost involved in agriculture production. Farmers generally expressed their worry for the effective weed control. More than 33 percent of the cost incurred in cultivation is diverted to weeding operations there by reducing the income share of farmers. A weed is essentially any plant which grows where it is unwanted. According to Parish 1990 a weed can be thought of as any plant growing in the wrong place at the wrong time and doing more harm than good. It is a plant that competes with crops for water, nutrients and light. This can decrease crop production. Some weeds have advantageous uses but not usually when they are growing between crops. Weeds decline the value of land, particularly perennial weeds which tend to gather on long fallows; raise cost of cleaning and drying crops. Weeds waste excessive proportions of farmers' time, thereby acting as a brake on development (Lavabre, 1991). Saving of labour

requirement (man-h/day) is achieved with the use of improved long-handle mechanical weeders like wheel hoes, animal drawn weeders (two to three rows) and engine-operated power weeders. Typical work rate of hand tool (Khurpi), hand chopping hoe, push / pull type or push-pull weeder and animal drawn weeding implement varies between 300-500, 200-300, 100-125 and 6-20 man-h/ha respectively resulting in saving in cost of weeding approximately from Rs. 4000-5000 per ha (manual weeding) to Rs. 1500-2000 per ha in case of improved mechanical weeders (Singh et al., 1999-2000, Alam and Singh 2003). Besides, saving of labour requirement and cost of weeding operation, the drudgery of weeding operation is also reduced with the use of improved mechanical weeding implements and machines because their operation is usually in standing posture to that of manual weeding in squatting posture or sitting posture. There is need to devote more research efforts to develop improved weeding tools, implements and machineries especially suitable for black soil.

Performance evaluation of hand weeders

Kathirvel and Thambidurai evaluated ergonomically three power weeders viz.TNAU-Varun power weeder, Balram power weeder and Oleo power weeder with 12 male subjects for weeding in cotton on 30 and 60 DAS at 1.5, 1.8 and 2.1 km h-1 forward speed of operation. pulse, energy cost, oxygen consumption rate in terms of VO2 maximum and work pulse with the TNAU Varun power weeder was 123.32 beats min-1, 23.00 kJ/ min, 52.34 you look after VO2 maximum and 46.47 beats/ min, respectively. The corresponding values for the Oleo power weeder was 130.19 beats/ min, 23.96 kJ /min, 57.40 you look after VO2 maximum and 47.82 beats/ min, respectively. For the Balram power weeder, the values were 134.09 beats/min, 24.45 kJ /min, 58.59 you look after VO2 maximum and 44.42 beats /min , respectively. The energy cost of the weeding operation was graded as “Heavy” in the least levels of forward speed of the three power weeders. The energy cost of weeding was the utmost for the Balram power weeder and minimum for the TNAU Varun power weeder. The Oleo power weeder had the very best weeding efficiency of 73.4 %. The savings in cost with TNAU-Varun, Oleo and Balram power weeders was 21.5, 16.2 and 23.1 %, respectively, in comparison with manual weeding. The savings in time was 59.8, 58.6 and 59.8 %, respectively, in comparison with manual weeding.

An experiment to study the performance of power weeder for interculturing operation in maize crop (Zea mays L.) to match the value of operation of power weeder in maize vis-a-vis grubber, wheel hoe and 'Khurpi' as control treatment was conducted by Roy. Power weeder having the upper volume unit (0.067 ha/hr) was found most effective tool for weeding, particularly in sight of your time taken

operational followed by the wheel hoe (0.009 ha/hr), grubber (0.008 ha/hr) and 'Khurpi' (0.002 ha/hr). the very best field efficiency was attained just in case of 'Khurpi' (94.73%) followed by wheel hoe (90.54%), grubber (84.40%) and power weeder (76.39%). the very best weeding efficiency (99.44%) was recorded in treatment 'Khurpi' followed by grubber (96.8%), wheel hoe (94.64%) and power weeder (89.8%). The plant injury was highest under power weeder (1.94%) followed by wheel hoe (1.01%), grubber (0.76%) and 'Khurpi' (0.46%). the value of operation of 'Khurpi' was maximum (Rs. 4051/ha) followed by power weeder (Rs. 1350/ha), grubber (Rs. 1158/ha) and wheel hoe (Rs. 1152/ha). In spite of the marginal higher cost of operation of power weeder over other tools, power weeder ensures timeliness weeding operational than other weeding tools.

Potdar administered an ergonomic study to evaluate common postures to facilitate active combination of body muscles to get rotational motion in static mode. The study was conducted on five modes of posture, namely handle rotation, hand rocking, single pedal, dual pedal and foot rotation (cycling) for generating rotation. A postural dynamometer was developed for loading and recording power load in above-mentioned modes. The experiments were conducted with six subjects within the age bracket of 20 to 40 years at five levels of mechanical load. Physiological and postural parameters were recorded and data was statistically analyzed during the experiments. Foot cycling mode was found to be best for mechanical power load to 60W and dual pedal mode for 60 to 75 W. Study established the very fact that leg muscles are better suited to supply manual power on sustainable basis as in both modes (cycling and dual foot pedal), leg muscles were primarily used

Mohammad Reza Alizadeh evaluated the sector performance mechanical weeders within the paddy . The sector performance of 4 sorts of mechanical rice weeders including, single row conical weeder (W1), two rows conical weeder (W2), rotary weeder (W3) and power weeder (W4) was compared handy weeding (W5). Two transplanted local and improved rice varieties namely Hashemi and Hybrid, respectively were selected for this study. The results revealed that among the mechanical weeders, The highest weeding efficiency (84.33%) was obtained with W4 and Hybrid variety and the lowest value (72.80%) was measured with W3 and Hashemi variety. The average of damaged plants in mechanical weeders was obtained as 3.83% compared to 0.13% in hand weeding. The highest effective field capacities of 0.082 and 0.087 ha/h were measured with W4 and therefore the corresponding lowest values of 0.0084 and 0.0088 ha/h were obtained with W5 for Hashemi and Hybrid varieties, respectively. The weeding cost was reduced by 15.70, 38.51, 22.32 and 48.70% for W1, W2, W3 and W4, respectively

as compared to W5. The very best break-even point (1.24 ha/yr) was obtained with power weeder (W4). The typical break-even point in weedres of W1, W2 and W3 was found to be 0.077 ha/yr. Among the tested weeders, W4 showed a correct field performance

Ghanshyam Deshmukh conducted study in Sinduri village of Shahdol district in Madhya Pradesh to evaluate rotary weeder ergonomic effectiveness in terms of energy requirement, subjective judgment of labor Related Body Discomfort (WRBD) and work performance as compared with hand weeding. Ergonomic results showed that the energy requirements for farm women were 16.0 and 11.04 kJ/min for rotary weeder and hand weeding, respectively. The area covered by rotary weeder was 110 m2/hr as compare to 30m2/hr by hand weeding (nearly 4 times).The Overall Rated Perceived Exertion (ORPE) was used to express WRBD. It had been more in hand weeding thanks to continuous bending posture as against standing posture.

Aman Mor evaluated the performance of weeders in cotton. The crop and machine performance parameter were recorded at three stages of cotton crop i.e. pre-square, square and flowering. The soil resistance was recorded before, just after weeding (3rd stage) and at the time of harvest. The crop parameters like plant height, canopy of plant & machine parameter weeding efficiency were recorded at three stages i.e. pre-square, square and flowering. Yield data (g/plant) was collected under all the treatments taken in both varieties. The weeding efficiency with the utilization of tractor operated weeders was obtained up to the extent of 74 to 76 per cent whereas it had been 85.5 to 89.59 per cent with manual hand hoe. There was a big difference in plant height at square and flowering stage whereas the cover of plant was significant only at flowering stage. There was no significant effect on bolls per plant and lint yield per plant with the utilization of mechanical weeder. the sector capacity of tractor operated inter row rotary weeder was within the range of 0.54 to 0.59 ha/h whereas it had been 0.8 ha/h in tractor operated high clearance cultivator, 0.16 ha/h with engine operated power weeder and 0.05 ha/h with manual hand hoe. The per cent saving in cost of operation with mechanical weeder over manual hand hoe was within the range of 80 to 93. The B:C ratio of mechanical weeder selected for study was within the range of 1.57 to 4.4 and payback period was within the range of 0.44 to 1.7 years. Time saving over manual hand hoe in weeding operation with the utilization of tractor operated weeder was 90 to 93 per cent and for the engine operated weeder it had been 68.7 per cent over manual hand hoe. The per cent saving in labour requirement with the utilization of mechanical weeder was within the range of 96 to 99 per cent over manual hand hoe. the heart beat rate after weeding operation altogether the treatment were within the range of 104 to122 beats/min whereas

the vital sign was slightly higher with the utilization of engine operated power weeder (142/90) and manual hand hoe (135/88). supported study the tractor operated inter row rotary weeder (Make, M2) is suggested.

V K Tewari studied scope of adoption of rotary power weeder and evaluated performance and in Vegetable Crops .BCS make self propelled rotary power weeder was examined in wide row line sown vegetable crops tomato (Solanumly copersicum), yard long bean (Vignasesquipedalis) and okra (Hibiscus esculenta) at Research Farm of Agricultural and Food Engineering Department, Indian Institute of Technology Kharagpur, West Bengal. The effective field capacities at forward speed of two.3, 2.0 and 2.4 km/h were 0.092, 0.08, 0.096 ha/h in tomato, yard long bean and okra, respectively. The Average effective working width of 400 mm, the depth of weeding 53, 46, and 50 mm and weeding efficiency 97, 96 and 97 was observed with Plant damage percentage as 1.6, 2.8 and 1.9 in tomato, yard long bean and okra, respectively. The machine was found to be ideal and effective in completing the weeding operation in vegetable crops

Ergonomical study of the seeding and weeding operations, performed by the females in rice cultivation with selected equipment was administered by Bini Sam., Reduction of the energy expenditure of girls labourers, to the tune of 39 to 55 in comparison to manual operations was observed with use of rice farming machineries. indicating that the chosen operations, The machines couldn't be operated continuously for 8 hours, without frequent rest-pauses as oxygen uptake in terms of VO2 max, were above that of the AWL limits of 35. generally, it's also observed that the general discomfort rating, was lower for computer operation, than manual operation and part discomfort score, was maximum in sowing manually, where because it was minimum in weeding with rotary weeder. Modifications in paddy drum seeder and rotary weeder by adjusting the length of handle and handle grip, to suit the ladies were administered, and evaluated for effective use of girls labourers, in rice cultivation

B. Haribabu, et al (2015) administered ergonomical evaluation of manual and power operated weeders in land condition. the most focus of the study was to evaluate ergonomical and mechanical parameters of power weeder and wheel hoe. The estimation of oxygen consumption rate (OCR) by measuring the energy expenditure rate (EER) may be a fairly accurate and acceptable method. the guts rate of workers varied from 109.47 to 130.66 beats/min and 130.33 to 147.52 beats/min by using power weeder and wheel hoe respectively. The oxygen consumption rate of workers with power weeder and wheel hoewas in the rage of 0.873 to 1.302 l/min 1.389 to 1.738 l/min respectively. The particular volume unit of were observed for power weeder 114 man-h/ha and

wheel hoe 208 man-h/ha. The weeding efficiency of power weeder and wheel hoe were observed to be 80 and 75 per cent, respectively. the utmost value of weeding efficiency (80%) was observed just in case of power weeder

Summary and conclusions

Saving of labour requirement (man-h/day) is achieved with the use of improved long-handle mechanical weeders like wheel hoes, animal drawn weeders (two to three rows) and engine-operated power weeders. Typical work rate of hand tool (Khurpi), hand chopping hoe, push / pull type or push-pull weeder and animal drawn weeding implement varies between 300-500, 200-300, 100-125 and 6-20 manh/ha respectively resulting in saving in cost of weeding approximately 47 percent with the power weeder. Besides, saving of labour requirement and cost of weeding operation, the drudgery of weeding operation is also reduced with the use of improved mechanical weeding implements and machines because their operation is usually in standing posture to that of manual weeding in squatting posture or sitting posture. Weeding tool type had significant effect on the weeding efficiency and on field capacity .There is need to devote more research efforts to develop improved weeding tools, implements and machineries especially suitable for black soil.

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