The Study on The Effect of Different Types of Blades / Tine on Energy Ratio Using Riding Type Power Tiller

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Abstract:
The study was carried out at the research farm of Faculty of Agricultural Engineering, IGKV, Raipur, Chhattisgarh, India during 2009-10 and 2010-2011. The soil of experimental site is represented as a silty clay soil mixed with sand. It is locally called 'Dorsa'. Two types of power tiller blades are used namely C and L and T tine/shovel is used. Total six types C, L, T, and their combinations C+T, L+T, Untilled were taken with single pass, double pass and triple passes. The Energy ratio of wheat grain (*Kanchan*) was observed and data are given in Table 1 and Table 2 for the years 2009-10 and 2010-11, respectively. In the year 2009-10, The ER was found maximum for the Rotary blade L followed by Rotary blade C. The difference of ER was found non-significant at the level of 5% of significance. The minimum ER was found with untilled Followed by Tine T (Shovel type). The difference of ER was found significant at the level of 5% of significance. For the combinations, The maximum ER was found with L+T followed by C+T. The difference of ER was found significant at the level of 5% of significance.

In the year 2010-11, The ER was found maximum for the Rotary blade L (3.58) followed by Rotary blade C (3.45). The difference of ER was found non-significant at the level of 5% of significance (CD= 0.35). The minimum ER was found with untilled (2.94) Followed by Tine T (Shovel type) (3.38). The difference of ER was found significant at the level of 5% of significance. For the combinations, the maximum ER was found with L+T (3.82) and C+T (3.82).

Key wards: Combinations of blades and tine, Energy input, Energy Ratio, Energy output, Power tiller

Introduction

Power tillers are specially designed and developed for use on small and medium farms and in farming situations where four wheel tractors are either difficult or uneconomical to use. Power tiller is more suitable than heavy tractors in rice zone and wet land farming Kumar (Shailendra and Singh Neelam Kumar, 2019). The Government is trying to boost the sale by providing huge subsidy on the power tillers. The tilth quality and tillage performance of the power tiller depends on types and shape of blade. Which type of blade and its combination with or without tractive tines performs better under local condition need to be studied to guide the farmers as well as power tiller suppliers (Kumar (Shailendra and Singh Neelam Kumar, 2022).

Sharma *et al.* (1984) compared the effect of no-tillage system with conventional tillage and stated that there was no significant difference between the average yields. Energy requirement and cost of cultivation was high in conventional system. No- tillage system required the least energy and cost of production while these requirements were about 1.5 times higher in conventional system.

They further reported that zero tillage system requires least energy (0.56 k W- h/q of grain) and reduced cost of production (Rs 2.89/q of grain). While the requirement were about 1.5 times higher in conventional

system (0.69 kWh/q of grain and Rs. 4.23/q of grain). Sharma *et al*. (1971) reported that variation in bulk density from 1.10 to 1.42 g cm^{-3} of the surface soil did not affect the plant height and number of tillers but above 1.42 g cm^{-3} bulk density, growth was inhibited. When subsurface bulk density increased from 1.34 to 1.55 g cm^{-3}, there was growth reduction. The natural bulk density of black soil in the order of 1.20 to 1.30 g cm^{-3} was well suited to wheat growth.

Methods and meterial

To see the effect of types of blades on power tiller shaft with and without their combinations, Energy output- input ratio, of wheat crop in Chhattisgarh plains and agro-climatic conditions. Further, design of power tiller mounted till drill machine and to operate with the existing roto-tiller proper arrangement were made. The machine was developed with the riding type SHRACHI power tiller. The machine was designed using CAD software and was fabricated in workshop of the Faculty of Agricultural Engineering, IGKV, Raipur. Basically, two types of rotary blades (C&L) for power tiller are available in the market. Their effect on tilth quality, crop yield, was needed to be observed. Therefore, suitable arrangement in the machine was made to operate the tillers with different type of blades and with and without tractive tines. The developed machine consisted a seed cum fertilizer box; four fluted feed rollers, four rigid tines mounted on toolbar with reversible shovels, ground wheel and adjusting devices. The field experiment was carried out during *Rabi* seasons in the years 2009-10 and 2010-11 at the research farm of Faculty of Agricultural Engineering, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh (CG) on conservation tillage equipments.

The grain yield data was obtained by harvesting the crop manually from one m^2 areas which were earmarked for data collection in the test field. The crop was threshed and cleaned manually, and the grain so obtained was weighed to determine the crop yield. Total five replications were taken from treatment to work out the average grain yield on per hectare basis. To determine the straw yield, the total dry biological yield was noted and the clean grain weight was subtracted. The straw yield was expressed in kg ha^{-1}.

Energy input and output in wheat was calculated from sowing to harvest of all treatments. It was calculated in Mega Joule (MJ) ha^{-1} with the reference value prescribed by Mittal *et al.* (1985). Standard values taken for energy estimation. Energy use efficiency and output- input ratio were calculated by using the formula:

$$\textbf{Energy output} - \textbf{input ratio (ER)} = \frac{\textbf{Energy output}(\textbf{ MJ ha}^{-1})}{\textbf{Energy input (MJ ha}^{-1})} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The operational energy requirement for cultivator-cum-seed drill was calculated on the basis of fuel, labour and time required for the sowing and other related operations (Shailendra. 2012)

Results

The Energy ratio of wheat grain (*Kanchan*) was observed and data are given in Table 1 and Table 2 for the years 2009-10 and 2010-11, respectively. In the year 2009-10, The ER was found maximum for the Rotary blade L followed by Rotary blade C. The difference of ER was found non-significant at the level of 5% of significance. The minimum ER was found with untilled Followed by Tine T (Shovel type). The difference of ER was found significant at the level of 5% of significance. For the combinations, The maximum ER was found with L+T followed by C+T. The difference of ER was found significant at the level of 5% of significance.

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was found significant at the level of 5% of significance. For the combinations, the maximum ER was found with L+T (3.82) and C+T (3.82).

Table 1 ER wheat grain (*Kanchan)* under different treatments and level of passes during 2009-10

Treatments	**Level of passes**				
Shape of blade/ tine	P_1	P_2	P_3	Total	Mean
1.Rotary "C"	2.88	3.05	3.18	9.10	3.03
2.Rotary "L"	2.95	3.52	3.37	9.85	3.28
3.Tra, "T" Tyne Shovel	2.90	2.66	3.24	8.80	2.93
4. "C+T"	3.47	3.56	3.52	10.55	3.52
5. "L+ T	3.49	3.91	3.89	11.29	3.76
6.Untilled	2.69	2.69	2.69	8.08	2.69
Total	18.40	19.39	19.89	57.67	3.20
Ave.	3.07	3.23	3.31		
CD	0.32				
CV	5.46				

Table 2 ER wheat grain (*Kanchan)* under different treatments and level of passes during 2010-11

Treatments	**Level of passes**				
Shape of blade/ tine	P_1	P_2	P_3	Total	Mean
1.Rotary "C"	3.04	3.57	3.75	10.36	3.45
2.Rotary "L"	3.06	3.78	3.89	10.73	3.58
3.Tra, "T" Tyne Shovel	2.91	3.49	3.74	10.14	3.38
4. "C+T"	3.36	3.97	4.14	11.46	3.82
5. "L+ T	3.21	4.13	4.13	11.47	3.82
6.Untilled	2.94	2.94	2.94	8.82	2.94
Total	18.52	21.88	22.58	62.98	3.50
Ave.	3.09	3.65	3.76		
CD	0.35				
CV	5.43				

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