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Study of different cultivation methods and energy requirement of wheat

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Abstract

Comparative study was conducted for sowing of wheat with dibbling, drilling and BBF methods. Grain yield in dibbling method was high (26.34 q/ha) but it is not economical in terms of Labours cost for sowing. Grain weight of 10 plants (131.15gm), Weight of Straw and dry matter (78.35gm) and Whole weight of plants (209.50gm) was high in drilling methods. It was analyzed the input energy, energy output, net energy and energy use efficiency of three different sowing methods of wheat. The total energy input were 15663.57 MJ/ha, 13923.37MJ/ha and 13513.73 MJ/ha while total output energy were 52344.8MJ/ha, 44865.3 MJ/ha and 43799.8 MJ/ha for dibbling, drilling and BBF sowing methods of wheat respectively.

Keywords: Wheat, dibbling, BBF, input, output, net energy, energy use efficiency

Introduction

Wheat (*Triticum aestivum* L.) is the second most important cereal crop of India and plays a vital role in food and nutritional security of the country. Nearly 55 percent of the World population depends on wheat for about 20 percent of calories intake. It is one of major food grains of the country and a staple food of the people of North India. Where people have preference for chapatti. Wheat straw is a good source of feed for large population of cattle in India. The diverse environmental conditions and food habits of people in India supports the cultivation of three types of wheat (bread, durum and dicoccum). Among these, bread wheat is contributing approximately 95 percent to total production. In Maharashtra wheat was cultivated in Rabi season to 1126.2 m. ha., the production was 2071.4 thousand tones and productivity was 18.39 q/ha during 2020-21.

(Anonymus 2021) [1]. Methods of sowing plays a significant role in providing for the proper space required by the plant for efficient utilization of air, water, solar energy and nutrients; therefore, the crop yield and quality of the product may be improved to a great extent. (Raghuvanshi *et al.*, 2021) [7].

Dibbling is a type of sowing method most favorable under suitable soil conditions. This method involves inserting a seed in a shallow hole and covering it with nearby soil. The dibbling method is an efficient sowing method that is usually used where ploughing and harrowing are difficult. As dibbling is done manually, it is consider more time consuming compared to drilling and other conventional methods and is mostly used by small scale farmers (Luo *et al.*, 2016) [5]. Drilling is an advisable sowing method due to its uniform population per unit area. As seeds are placed at a uniform depth and covered with soil, high germination and uniform stands are expected (Tanveer *et al.*, 2003) [10]. A raised land configuration Broad Bed Furrow (BBF) system helps the soil to preserve the water level for a longer period. Holding moisture intact, the bed stimulates crops growth.

Energy use is one of the key indicators for developing more sustainable agricultural practice. The amount of energy used in agricultural production, processing and distribution is significantly higher. A sufficient supply of the right amount of energy and its effective and efficient use are necessary for an improved agricultural production. (Devi Sudesh *et al.* 2018) [2].

The study was conducted to make comparison between manual dibbling, drilling and BBF sowing methods and compare the energy requirements for production of wheat in different sowing methods.

Materials and Methods

A field experiment was conducted during Rabi season, which consisted of variety Sardar

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(AKAW-4210-6) tested and three replications for more accuracy and results. Sowing methods were namely manual dibbling, drilling and BBF with row to row spacing of 22.5 cm. Plant population, number of tillers per square meter area, grain weight, straw and dry matters and whole weight of 10 plants and grain yield per hectares were recorded for three sowing methods.

In dibbling, the seeds were placed in small holes in the prepared soil, in drilling, seeds were sown using tractor drawn seed drill and in BBF, seeds were placed by using tractor drawn BBF planter. The recommended basal fertilizer dose was given at the time of sowing and remaining dose of fertilizer was given at different stages of crop. 1m x 1m area was marked and plant population were counted. Same way number of tillers were measured. Ten plants were harvested randomly and grains were threshed manually and measured the weight of grains. The remaining straw and dry matters were measured. The grain yield was observed by actual field data.

Input and output energy of wheat crop were estimated using crop management (different cultivation operations carried out, machinery and inputs) and biomass production records. The amount of energy consumption per unit area of different inputs (human labours, machinery, implements, chemical fertilizers, fuel, irrigation water, herbicides and seeds) and

outputs (grain and straw yields was estimated by using energy equivalents (Devi Sudesh *et al.* 2018) ^[2], net energy and energy use efficiency were calculated as

$$\text{Net Energy} = \text{Output energy} - \text{input energy}$$

$$\text{Energy use efficiency} = \frac{\text{Output energy}}{\text{Input energy}}$$

Results and Discussion

Higher plant population per square meter area was recorded for dibbling method (128) than drilling and BBF method. Higher number of tillers per square meter area (68) was obtained in BBF sowing method than two methods. However, grain weight 131.15 gm, straw and dry matters weight 78.35 gm and whole weight of 10 plants 209.50 gm were observed in drilling method. Grain yield was higher in dibbling method (26.34 q/ha) than drilling and BBF methods. (Table.1). Grain yield in dibbling sowing method was 23.16% and 32.27% more than drilling and BBF method respectively. Biological weight of 10 plants was 35.82% and 26.85% more than dibbling and BBF method respectively. As per Figure 1 the weight of 1000 grains was nearby same, however the grain yield was more in dibbling method due to more plant populations.

Table 1: Effect of different sowing methods on various parameters of wheat

Sowing methods	Plant population (1x 1 m area)	No. of tillers/m ²	Grain weight of 10 plants (gm)	Weight of Straw and dry matter of 10 plants (gm)	Whole weight of 10 plants (gm)	Grain yield (q/ha)
Dibbling	128	62	95.10	39.35	134.45	26.34
Drilling	65	48	131.15	78.35	209.50	20.24
BBF	73	68	85.70	67.55	153.25	17.84

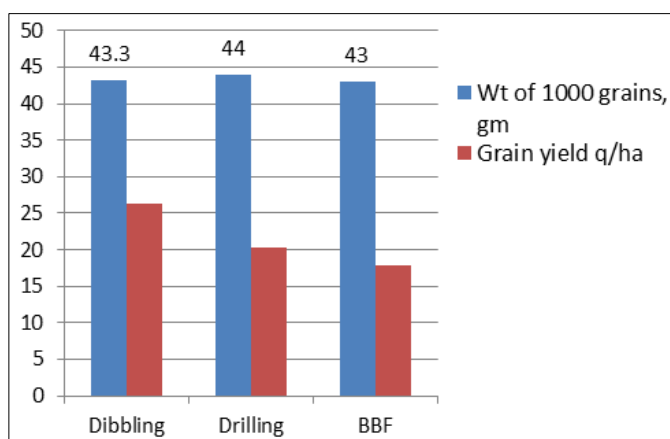


Fig 1: Effect of sowing methods on Weight of 1000 grains and Grain yield.

The total input energy use in various crop activities under dibbling method of sowing was 15663.57 MJ/ha which was high followed by drilling method (13923.37 MJ/ha) and BBF method (13513.73 MJ/ha). It was due to high labour requirement for sowing and harvesting operations. Maximum input energy was consumed for fertilizer (44.37%) out of total input energy. (Table 2.) The difference in total input energy between drilling method (13923.37 MJ/ha) and BBF method (13513.73 MJ/ha) was just one percent (409.64 MJ/ha). Dibbling method produced maximum total output energy 52344.8 MJ/ha followed by drilling method 44865.3 MJ/ha and 43799.8 MJ/ha. Maximum output energy was produced

by dibbling method due to high yield 26.34 q/ha than other methods. Dibbling method was recorded highest value of net energy (36681.23 MJ/ha) and energy use efficiency (3.34) (Table 3).

Table 2: Operation wise energy values (MJ/ha) of wheat crop for different sowing methods

Input	Dibbling method	Drilling method	BBF Method
Land preparation	1458	1458	1458
Seed	1837	1470	1470
Sowing	1210.47	861.25	1040.49
Fertilizer	6950	6950	6950
Irrigation	1588.8	1588.8	1194.54
Spraying/Weeding	768.08	768.08	768.08
Harvesting	470.88	329.6	329.6
Threshing	1380.34	1265.72	1071.1
Total input energy	15663.57	13923.37	13513.73
Output			
Grain yield	38719.8	29752.8	26224.8
Straw/Fodder yield	13625	15112.5	17575
Total output energy	52344.8	44865.3	43799.8

Table 3: Energy indices of different sowing methods

Energy	Dibbling method	Drilling method	BBF method
Input energy, MJ/ha	15663.57	13923.37	13513.73
Output energy, MJ/ha	52344.8	44865.3	43799.8
Net energy, MJ/ha	36681.23	30941.93	30286.07
Energy use efficiency	3.34	3.22	3.24

Conclusion

Wheat sown by dibbling sowing method was better than drilling and BBF methods in terms of grain yield. However, it is not economical due to higher cost incurred in labour. The reduction, elimination or combination of machinery operation will reduce energy input and also may reduce the uses of labour and time.

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