

Reckoning the implementation of paddle operated single roll farm yard manure applicator under protected cultivation

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ABSTRACT

In Uttarakhand, due to adverse climatic condition, protected cultivation is a very extensively used method for cultivation of horticultural crops viz. tomato, capsicum, strawberry etc. The present study was carried out in the crop research farm of Maya Group of Colleges, Dehradun in which a single roll farmyard manure applicator was designed and developed and its performance evaluation was done on two plots, one plot was an open field of size 2.5 *1.2 m² and other was under protected cultivation was 200 m² at different FYM delivery rates and application rates. The mean draft requisite of single roll paddle operated farmyard manure applicator at no load condition under open field and polyhouse was found to be 65N and 68 with a power requirement of 24.7 KW and 25.84 KW at forward speed of 0.38 m/s respectively. In case of full load condition under open field and polyhouse was found to be 134 N and 144 N with a power requirement of 178.22 KW and 191.52 KW at forward speed of 1.33 m/s respectively. The efficiency of machine was found to be highest at the speed of 4.48 km/h but leftover residue was found lowest at aperture opening of 8mm. Therefore, developed single roll paddle operated farmyard manure applicator was found working satisfactorily with prominent draftability of operator at different forward speed.

Key words: Farmyard manure applicator, Draft, Manure application rate, Efficiency, Leftover residue

Introduction

Conventionally, in India, Farmyard manure is distributed with the help of fork or broadcasted by hand which is a sluggish process and wearisome in nature. Posthumous embodiment of farmyard manure application can increase stink, menace the nutrient deficit in surfeit and mislaying of manure nitrogen by volatilization. The challenge for manure dispersal is not only in matter of its employment of

its rate of application but its uniformity of distribution. Eco-friendly bio-fertilizer called as farmyard manure is a boon for highly polluted epoch of contemporary fields.

The abundance of nutritive attributes of farmyard manure incumbent by the plant contrast by depending on plant attributes like crop, yield level, variety, planting rate whereas environment contingencies such as moisture and temperature and soil attributes viz. soil characteristics and soil fertility along with

management of crop and soil. Albeit of all interacting agents which impact the plant nutrient uptake and recapture of applicable nutrient, accumulation of nutrient during the growing season. In state like Uttarakhand, protected cultivation is blooming farming practice. In the districts like Dehradun, Udham Singh Nagar, Haridwar, it is practiced by all the cultivators to grow vegetable crops, flowers and fruits during off seasons and also in unfavorable circumstances.

Materials and Methods

In Uttarakhand, tomato is extensively cultivated in polyhouse in districts like Dehradun, Haldwani, and Haridwar. Therefore, the current study was carried out in crop research farm of Maya Group of Colleges, Dehradun in which a single roll farmyard manure applicator was designed and developed and its performance evaluation was done on two plots, one plot was an open field of size 2.5 *1.2 m² and other was under protected cultivation was 200 m² at different FYM delivery rates and application rates. During the course of research, the selection of parameters was divided into two parts although the study could be carried on different independent and dependent variables during seedbed preparation of tomato crop. The parameters were as follows:

a) Selection of parameters for performance evaluation of the paddle operated single roll farm yard manure applicator

Independent Variables

- Forward speed of operation
- Manure application rate

Dependent Variables:

- Efficiency in Mixing and pulverizing of FYM in Manure hopper
- Percentage Residues leftover the manure hopper

Performance evaluation of the paddle operated single roll farm yard manure applicator according to the selected parameters

The paddle operated single roll farm yard manure applicator was allowed to apply the farm yard manure on the field. The performance was evaluated in field conditions for determining the efficiency in mixing & pulverizing of FYM in manure hopper and percentage residues leftover the manure hopper. During application of farm yard manure the

above stated parameters were evaluated. The **independent parameters** were almost same for both the studies which are as follows:

Forward speed of operation: The farm yard manure applicator was allowed to at different forward speed at unloaded and loaded conditions. After observation, 1.36 kmph (0.38m/s), 2.41 kmph (0.67), 3.6 kmph (1m/s) and 4.78 kmph (1.33m/s) kmph were the forward speed of paddle operated single roll farm yard manure applicator.

Manure application rate: The concave of manure feed hopper was attached with a single roller and an agitator. The agitator has the basic purpose of mixing and pulverizing the bigger clods of farm yard manure. The manure was already sieved for any kind of unwanted particles like plastic or glass. The rate of application was controlled by a sliding sheet fitted on the roller at the walls of the manure feed hopper. The sliding sheet was hooked up to the walls at 2mm, 4mm, 6mm, and 8 mm respectively, above the roller to control the delivery rate of the manure dropped on the ground. The quantity of the manure dropped during unit time was calculated.

Dependent Variables: For the evaluation of the dependent variable of the paddle operated single roll farm yard manure applicator the following were calculated:

Efficiency in mixing and pulverizing of FYM in Manure hopper:

For determining the mixing capacity and pulverizing efficiency of farm yard manure, the manure hopper was filled with manure as per the capacity of the hopper and was allowed to run with load for 5, 10 and 15 minutes and efficiency was calculated as follows:

$$\text{Efficiency}_{\text{M\&P}} = \frac{\text{Load left in the manure hopper}}{\text{Total load in the manure hopper}} * 100$$

b) Percentage Residues leftover in Manure hopper:

After the application of manure in the field the manure hopper is checked with the residues if any. Then the residue leftover percentage is calculated:

$$R_L = \frac{\text{Leftover residue}}{\text{Total input in manure hopper}} * 100$$

Results and Discussion

The draft requirement was measured by dynamometer. Under no load, partial load and full load condition at different width of delivery slot is depicted in Table 1. The mean draft requisite of single roll paddle operated farmyard manure applicator at no

load condition under open field and polyhouse was found to be 65N and 68 with a power requirement of 24.7KW and 25.84 KW at forward speed of 0.38 m/s respectively whereas it increased after the speed was increased. Under partial load condition all the attributes showed a significant increase but in case of full load condition under open field and polyhouse was found to be 134 N and 144 N with a power requirement of 178.22 KW and 191.52 KW at

forward speed of 1.33 m/s respectively.

The power requisite of single roll paddle operated farmyard manure applicator amplified with the engagement of agitator and feeding drum, evidently, due to raise in power to run scattering and feeding units consequently improve the motion confrontation between side wheels. The draft exercised by single roll paddle operated farmyard manure applicator was well innards. The draft cubage of

Table 1. Draft and power requirement of single roll paddle operated farmyard manure applicator in open field condition in comparison to protected cultivation method.

Draft and power requirement of single roll paddle operated farmyard manure applicator in open field condition				Draft and power requirement of single roll paddle operated farmyard manure applicator in polyhouse			
Sr. No.	Draft (N)	Speed (m/s)	Power (KW)	Sr. No.	Draft (N)	Speed (m/s)	Power (KW)
Case-1. No Load condition							
1.	65	0.38	24.7	1.	68	0.38	25.84
2.	69	0.67	46.23	2.	73	0.67	48.91
3.	71	1	71	3.	77	1	77
4.	74	1.33	98.42	4.	81	1.33	107.73
Case-2. Partial Load condition							
1.	62	0.38	23.56	1.	65	0.38	24.7
2.	66	0.67	44.22	2.	70	0.67	46.9
3.	69	1	69	3.	78	1	78
4.	76	1.33	101.08	4.	83	1.33	110.39
Case-2. Full Load condition							
1.	112	0.38	42.56	1.	118	0.38	44.84
2.	119	0.67	79.73	2.	127	0.67	85.09
3.	126	1	126	3.	138	1	138
4.	134	1.33	178.22	4.	144	1.33	191.52

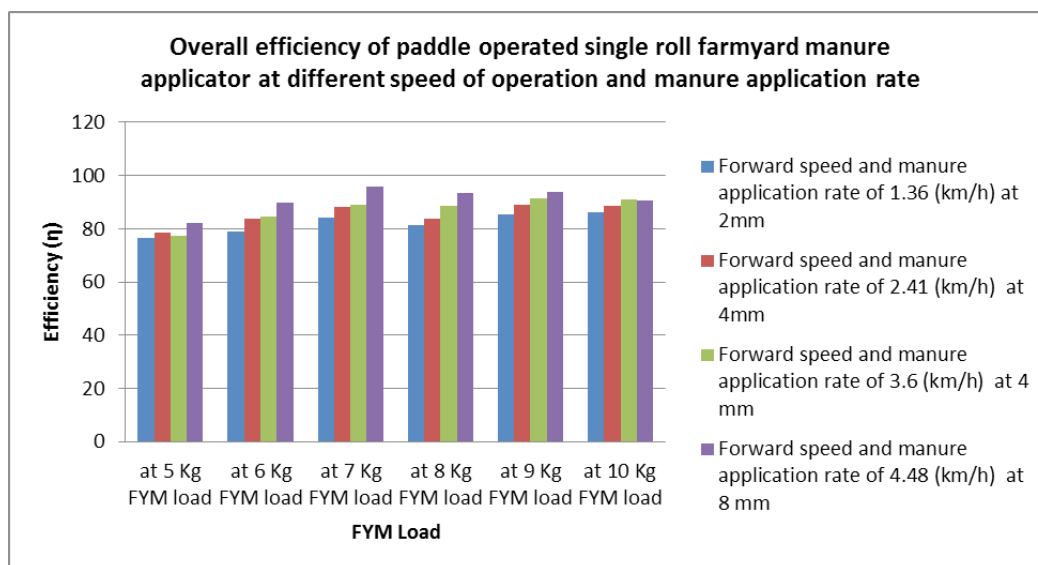


Fig. 1. Overall efficiency of paddle operated single roll farmyard manure applicator at different speed of operation and manure application rate

operation of paddle operator was 10% draft of body weight (Anonymous, 2003). Hence, the circumscribing agent of draft for human operated machine cannot be exceeded from ambient limit.

Variation in Efficiency(η) in Mixing and pulverizing of FYM in Manure hopper

The overall efficiency (η) at different forward speed and manure application rate of 4.48 km/h at 8mm was found to be highest that is 90.76% when the feeding unit was fully loaded to 10 Kg farmyard manure, whereas when manure application rate was opened aperture for the width of 2mm with forward speed of 1.36 km/h, when the average efficiency was found 76.67% at 5kg/h.

Hence, the variation of the efficiency depicted that when load gradually increased from 5kg to 10 kg. The efficiency also increased as the agitator and drum speed enhanced gradationally. The progressive acceleration was delineated; therefore the speed directly depends on the opening of feeding drum and influences the manure application rate.

Variation in Percentage Residues leftover (%) in Manure hopper

The feeding unit was filled with farmyard manure weighing to 5 kg to 10 kg. After partial load condi-

tion of 7kg, when the forward speed was increased from 1.36 km/h to 4.48 km/h, the leftover residue percentage was minimum, i.e. 4.28%. Accordingly, it was interpreted that at partial load condition of 7kg to 9 kg the residue leftover varied between 4.28% to 6.29%, respectively.

Henceforth, it was found the in partial load condition the leftover residue percentage was minimum which is due to the adjustment of agitator and feeding unit at 8 mm. So, at 8 mm opening was best suited for reducing the overall leftover residue and increasing efficiency.

Conclusion

The developed single roll paddle operated farmyard manure applicator was tested under protected cultivation unit (polyhouse) and open field condition. The draft requirement was found highest at the speed of 1.33 m/s in no load, partial load and full load condition with draft varying from 81N, 83N, and 144N, respectively in polyhouse on the contrary, it was slight low at same speed ranging from 74N, 76N and 134N, respectively. The power requirement also varied in the same manner from 107.73KW, 110.39 KW and 191.52 KW discretely at polyhouse but it was slight low in open field condi-

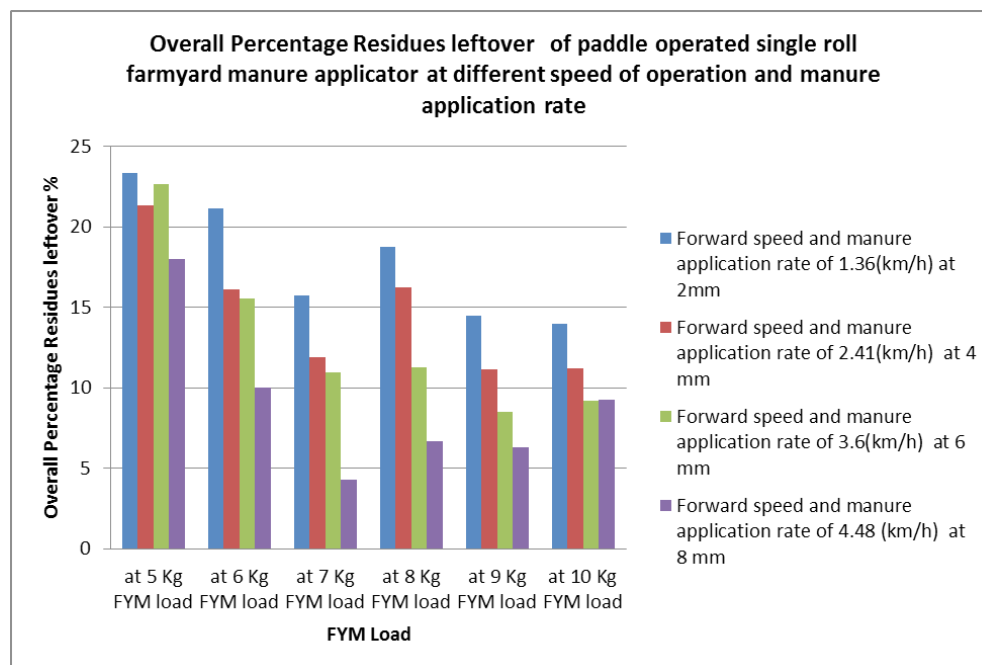


Fig. 2. Overall Percentage Residues leftover of paddle operated single roll farmyard manure applicator at different speed of operation and manure application rate

tion. The efficiency of machine was found to be highest at the speed of 4.48 km/h but leftover residue was found lowest at aperture opening of 8mm. Therefore, developed single roll paddle operated farmyard manure applicator was found working satisfactorily with prominent draftability of operator at different forward speed.

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