

Effects of Sowing Depth on Emergence of *Abelmoschus esculentus* by Modified Mechanical Equipment

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Abstract - The effects of sowing depth on emergence of two varieties of *Abelmoschus esculentus* (Okra) evaluated in pot and field trials. The pot experiments were done at five different sowing depths i.e., 1, 2, 3, 4 & 5 cm with two different varieties of Okra i.e., Parbhani Kranti and Pusa Sawani. The pots were arranged in randomized complete block design with four replications. The pot experiments were conducted on the roof top and the field experiments were done in Bihar Agricultural University, Sabour, Bhagalpur, Bihar in India. Data were taken after 4, 5 and 7 days after sowing okra seed. Result showed that Okra sown at 4 and 5 cm deep reduced seedling emergence percentage significantly. Seedling emergence at 1, 2 and 3 cm sowing depth was good but okra sown at 5 cm depth showed most damaging in this regard. The highest sowing depth for okra is 3 cm. The two varieties of okra i.e., Parbhani Kranti and Pusa Sawani have responded nearly same in the terms of emergence percentage in pot as well as in field experiments at different depth of sowing of okra.

Key Words: Okra, sowing depth, yield, *Abelmoschus esculentus*, emergence

1. INTRODUCTION

Okra (*Abelmoschous esculentus*) or lady's finger is an annual vegetable crop [2]. Okra belongs to *Malvaceae* family. Okra contains folic acid, calcium, vitamin B & vitamin C. It has a high dietary fiber content and low in calories. Farmers usually cultivate okra intercropped with

major food crops like yam, maize and cassava [4]. Occasionally it is grown as a sole crop. Generally, it is seen that for planting okra seeds, farmers usually open up the soil at variant depth and a couple of seeds are thrown and then soil is covered up. The potential of the resulting seedlings may not be fully realized since a shallow depth of sowing may lead to lodging of the plant during light rainstorm later in its life cycle and an excessively deep planting may result in non-emergence of the seedling. Depth of planting has been shown to have a varied effect on the performance of crops ([1],[5],[6] & [9]). Number of days required for emergence of okra, plant vigour and yield of crops depends on various factors such as soil type, depth of sowing etc.

Tayo [9] reported that deeply planted pigeon pea delayed emergence, adversely affected plant vigour and led to reduced yield. Fehr et al. [5] found that percentage of emergence of corn is influenced by planting depth of corn. They showed average emergence was 73% from 5 cm and only 44% emergence was from 10 cm. Alessi and Power [3] reported that for each 2.5 cm increase in depth of corn planting, one additional day was required. Abrecht [1] worked on maize crop and he found that deep planting slowed emergence but increased seedling growth in maize and soyabean.

The main aim here is to optimize sowing depth and the desirability to have lodging resistant plants vis-a-vis optimum planting depth which will also place the root at a

vantage position to tap soil nutrients and absorb water, it is imperative to investigate the optimum sowing depth for okra cultivation. Here, the main focus of this study is to determine the optimum sowing depth for Okra cultivation.

2. MATERIALS AND METHODS

2.1 Field Experiment

The field experiment was carried out in Bihar Agricultural University, Sabour, Bhagalpur. The plot selected for this experiment was 12m x 8m. This was divided into four blocks (replications) each measuring 8.5 m x 3 m. Each block was subdivided into 10 micro-plots each 1.5 m x 3 m. The experiment was a 2 x 5 factorial trial in randomized complete block design.

2.2 Pot Experiment

A pot trial was carried out on the open roof in campus of Bhagalpur Agricultural University, Sabour, Bhagalpur, Bihar. Forty cemented pots (20 cm rim diameter) were each filled with 5.0 kg soil. The seeds of okra varieties Parbhani Kranti (V₁) and Pusa Sawani (V₂) were obtained from Bhagalpur, Bihar. The seeds of these okra varieties were sown in forty cemented pots at varying depths (1, 2, 3, 4 and 5 cm). Fertilizer was applied at the rate of 80 kg NPK (15:15:15) so that 1.5 g of NPK fertilizer was incorporated into the soil in each pot. The experiment was a factorial combination of varieties and 5 sowing depths with four replications. Data were taken on seedling emergence % and vegetative characteristics.

2.3 Planting, Materials and Depths of sowing

The seeds of okra varieties Parbhani Kranti (V₁) and Pusa Sawani (V₂) obtained from Bhagalpur, Bihar, were planted on the field at depths of 1, 2, 3, 4 and 5 cm (D₁, D₂, D₃, D₄ and D₅, respectively) as done in the pot experiment. The spacing was 30 cm x 60 cm. The 10 treatments were randomized completely within each block separately using table of random numbers. The experiment was a 2 x 5 factorial trial in randomized complete block design with 4 replications. The soil was a non crusting one with properties shown in Table 1 and 2.

2.4 Equipment Description

A **dibber** or **dibble** or **dibbler** is a pointed wooden stick for making holes in the ground so that seeds, seedlings or small bulbs can be planted. Dibbers come in a variety of designs including the straight dibber, T-handled dibber, trowel dibber, and L-shaped dibber.

The dibber was first recorded in Roman times and has remained mostly unchanged since. By this mechanical Equipment, one person walk with a dibber making holes, and a second person plants seed in each hole and fill it in.

For experiment purposes, dibbler was modified in such a way that it restricted the hole depth as required for the experiment i.e., 1, 2, 3, 4 and 5 cm.

Table 1. Physical characteristics of the soil used for the experiments.

Particle	Size distribution(%)
Clay	28.70
Sand	64.17
Silt	7.13

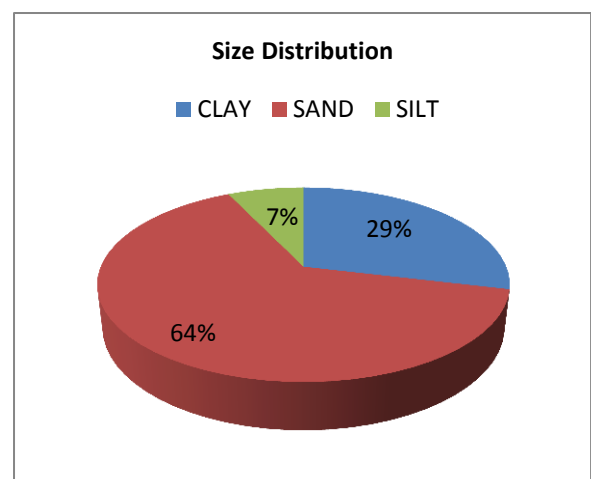


Chart 1: Pie chart for physical characteristics of the soil used for the experiments

Table 2. Chemical characteristics of the soil used for the experiments.

Chemical	Compositions
Acidity (me/100 g)	0.75
Exchangeable cations (me/100g)	0.21
Total N (%)	0.11
Organic C (%)	1.21
Available P (ppm)	1.38
K (me/100 g)	0.35
Ca (me/100 g)	1.84
Na (me/100 g)	0.34
Mg (me/100 g)	0.70
Mn (ppm)	21.01
Fe (ppm)	10.12
Cu (ppm)	1.38
Zn (ppm)	4.67
pH in H ₂ O	6.57

Sowing Depth	4 DAS	5 DAS	7 DAS
For Variety V ₁			
D ₁	82.65	90.36	90.38
D ₂	71.23	78.62	84.81
D ₃	68.56	78.77	80.13
D ₄	43.14	49.49	55.67
D ₅	38.45	46.52	54.55
For Variety V ₂			
D ₁	74.23	87.82	91.67
D ₂	68.38	79.98	88.96
D ₃	64.73	72.84	84.24
D ₄	43.13	47.91	52.60
D ₅	38.53	38.72	49.71
S.E.	5.27	6.10	5.60

D₁, D₂, D₃, D₄ and D₅ = 1, 2, 3, 4 and 5 cm sowing depths respectively, V₁ = Parbhani Kranti variety, V₂ = Pusa Sawani variety, S.E. = standard Error, DAS = Days after sowing

3. CONCLUSIONS

Effects of sowing depth on seedling emergence in pot experiment

Seedling emergence percentage was highest in seeds sown at 1 cm depth while seeds sown at 5 cm depth had the lowest percentage of seedling emergence. Seedling emergence at depths of 2, 3 and 4 cm were not significantly different. (Table 3).

Table 3: Effects of sowing depth on percentage of seedling emergence of two varieties of okra grown in pots.

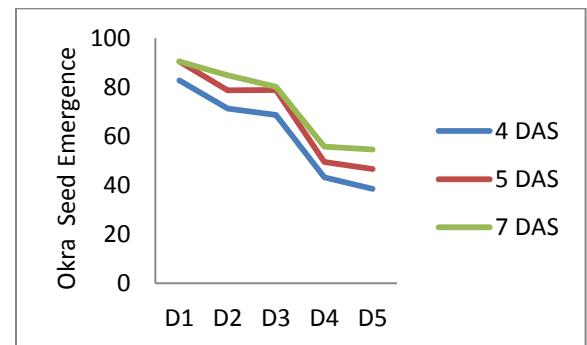


Chart 2: Seed emergence vs sowing depths of Parbhani Kranti variety of okra for pot experiment.

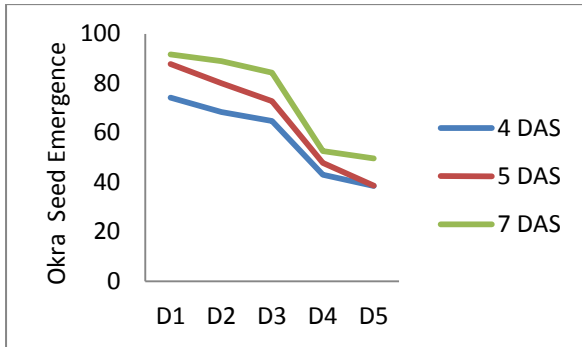


Chart 3: Seed emergence vs sowing depths of Pusa Sawani variety of okra for pot experiment.

Effect of sowing depth on seedling emergence in field experiment

The higher percentages of seedling emergence were recorded at sowing depths of 1 and 2 cm, while the lowest was recorded at the depth of 5 cm (Table 4). Even at seven days after sowing, seeds sown at 5 cm depth had only 52.59% emergence which was significantly lower than emergence at 1 and 2 cm. Overall best seedling emergence was recorded at the depth of 1 cm. The seedling emergences percentage of the two varieties were nearly similar (Table 4).

The highest emergence of Parbhani Kranti (V_1) was obtained when sown at the depth of 1cm ($V_1D_1= 84.96$ and 86.70 at 5 and 7 DAS, respectively) whereas in Pusa Sawani emergence was also best at the depth of 1cm $V_2D_1= 79.56$ and 81.92 at 5 and 7 DAS, respectively. The lowest emergence of both varieties was obtained at the depth of 5 cm (Table 4).

Table 4. Effects of sowing depth on percentage of seedling emergence of two varieties of okra in the field experiment.

Sowing Depth	4 DAS	5 DAS	7 DAS
For Variety V_1			
D ₁	80.02	84.96	86.70
D ₂	56.85	80.02	84.02
D ₃	59.70	76.70	80.12
D ₄	32.56	51.68	55.07
D ₅	30.04	49.28	50.94
For Variety V_2			
D ₁	71.92	79.56	81.92
D ₂	70.55	77.45	80.87
D ₃	74.18	76.65	80.88
D ₄	43.36	53.33	54.96
D ₅	40.89	50.15	54.24
S.E.	5.77	4.66	4.72

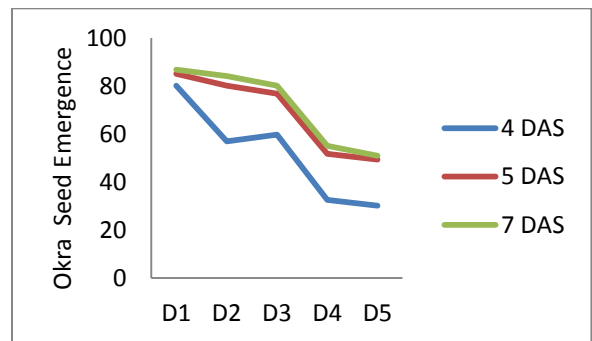


Chart 4: Seed emergence vs sowing depths of Parbhani Kranti variety of okra for field experiment.

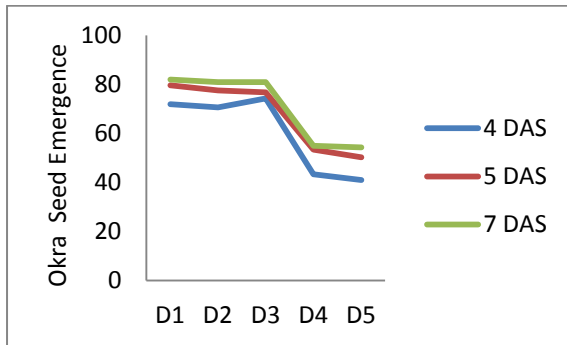


Figure 5: Seed emergence vs sowing depths of Pusa Sawani variety of okra for field experiment.

4. DISCUSSION

The results proved that emergence of okra is very much affected by sowing depth of okra seed. Deep sowing of okra i.e., 4 and 5 cm delayed emergence and reduced emergence percentage. Delayed emergence and reduced emergence percentage at 4 and 5 cm may be due to the inability of amount of food reserve in okra seed to support the growth of the hypocotyls above the soil. This must have resulted in the death of these seedlings before reaching the soil surface.

Other than this, two varieties that is Parbhani Kranti and Pusa Sawani did not show any significant difference in emergence percentage at various depths considered for our study. The experiment showed that in the two varieties, emergence generally decreased with increase in sowing depth. This trend has been reported by Tayo [9] in pigeon pea and by Fehr [5] and Abrecht [1] in corn. The results of experiment showed that 4 and 5 cm depths emergence was drastically and significantly reduced. Therefore, it is suggested that okra should not be planted more than 3 cm deep for good emergence percentage.

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