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Seed quality and vigour in relation to nodal position and harvesting stage of okra under mid hills of North-western Himalayas

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ABSTRACT

The studies on quality of seed and its vigour were conducted during the *kharif* season of 2006 and 2007 with the okra cv. VL Bhindi 1 in three replicates. The fruits from the lower (1st to 3rd) and middle (4th to 8th) node positions at undried brown and dried brown stage produced the best quality seeds. Maximum germination and vigour was exhibited by the seeds obtained from fruits positioned at middle nodes, closely followed by seeds collected from the lower portion of the plant. However, seeds obtained from the upper fruits showed poor seed yield and quality. The number of seeds per fruit significantly varied with the fruit position (65.93 to 45.63 in 2006 and 66.05 to 47.2 in 2007). The harvesting stage and its interaction with fruit position were found non significant with respect to no. of seeds/ fruit. During both the years, an inverse relationship was observed with respect to dead and hard seeds percentage, seeds from farther fruits and mature fruits of turning stage produced more dead and hard seeds. Results revealed that reasonably good seedling length and vigour index were observed with seeds obtained from lower and middle fruits (P_1 & P_2) and undried brown to dry brown fruits (H_2 & H_3) and their interactions (P_2H_3, P_1H_3, P_2H_2 & P_1H_2).

Key words: Okra, seed quality, seedling vigour, fruit position, harvesting stage.

INTRODUCTION

Okra (*Abelmoschus esculentus* L. Moench) is one of the most important summer-rainy season crops grown in mid-hills of north western Himalayan regions. Good quality seed is a pre-requisite for achieving higher productivity in any crop and it plays very important role in successful production. In hills, insect-pests pose no serious threat, except fruit borer for its successful cultivation. Hence, there has been growing demand for production and distribution of quality vegetable seeds especially in hilly region. Ability of seeds to produce more number of normal and vigorous seedlings depends on proper seed filling and maturation because of the competition for assimilates between fruits and within fruit distresses seed set and development (Bertin, 3). Late maturing fruits contain immature lighter seeds, which result in more dead or hard seeds and less vigours seedlings ultimately reducing the overall germinability (Getzin, 4). The effect of position of the fruit on the plant and duration after anthesis has been reported by Yadav and Dhankhar (10) in okra. In okra, seed quality is found to be affected by fruit position, seed maturity and growing season (Prabhakar *et al.,* 6).

Since available literature on effect of fruit position and harvesting stage on germination behaviour and vigour of okra seeds produced in this region are not available. The present investigation was carried out for two years to identify proper position of fruits and also suitable stage of harvesting for obtaining good quality seed.

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MATERIALS AND METHODS

The field experiments were conducted during the *kharif* seasons of 2006 and 2007 with the okra cv VL Bhindi 1 in three replicates at VPKAS Experimental Farm, Hawalbagh, Almora situated at 79°39' E Latitude, 29°35' N Longitude and 1250 m altitude. Three fruit positions, i.e., 1-3 nodes (P_1), 4-8 nodes (P_2) and fruits above 8th node (P_3) and three harvesting stages of fruits, *viz.*, mature fruits of turning stage (H_1), brown undried stage (H_2) and brown dried (H_3), were tested for their effect on the seed quality and vigour in okra. Nine treatment combinations were replicated three times under randomized block design. All the production practices were adopted uniformly in all the treatments. Observations were recorded on number of seeds per fruit, 1000- seed weight (g), germination (%) , dead seed (%), hard seed (%), seedling length (cm), seedling vigour index and seed yield (kg/ha) by using standard procedures.

Four replications of 100-seeds each were placed on two layers of blotter paper moistened with water equivalent to 2.5 times the substratum weight and germinated on petri plates at 25 ^{0}C (ISTA, 5). Germination (%) counts were taken on the basis of number of normal seedlings after 4 and 21 days. The mean germination (%) and seedling length (cm) was calculated for each treatment.

Seedling vigour index (SVI) was performed simultaneously with standard germination. At the final count (21 days), all seedlings which had complete morphological parts without lesions or defects, were taken and average seedling length of 10 such seedlings was measured for calculating the SVI by following the modified formula of Abdul Baki and Anderson (1).

$$SVI = \frac{\text{Germination (\%) X Average seedling length (cm)}}{100}$$

RESULTS AND DISCUSSION

The results of this study depicted coherent effect of fruit position and harvesting stage on seed yield, germination and vigour of the seed. The number of seeds per fruit significantly varied with the fruit position (65.86 to 46.42). Fruits harvested from lower and middle nodes (P_1 & P_2) produced significantly higher No. of seeds per fruit and were found at par with each other, while the lowest No. of seeds per pod was recorded in fruits harvested from 9th node onward (P_3). Harvesting stage and its interaction with fruit position were also found significant with respect to No. of seeds/ pod (Table 1). Thousand- seed weight significantly varied with fruit position (66.34 to 47.66 g), harvesting stage (63.08 to 54.81g) and their interaction (69.90 to 43.78 g). Fruits from lower nodes (P_1), fruits harvested at dry brown stage (H_3) and their interaction (P_1H_3) gave the maximum 1000 seeds weight i.e. 66.34, 63.08 & 69.90 g, respectively (Table 1). These findings are in agreement with Rao *et al.* (7), who found that 1000 seed weight obtained from fruits positioned at bottom of the plant remained higher.

Seed germination significantly varied with fruit position, harvesting stage and their interaction. Seed germinability is decreased with seeds obtained from farther fruits and mature fruits at turning stage. Seed harvested from lower and middle fruits showed 66.55 to 67.48 per cent germination and seeds obtained from undried brown stage and dry brown stage gave 61.68

Table 1. Effect of fruit position and harvesting stage on seed yield and germination in okra.

Treatment	No. of seeds/ pod	1000 seed wt. (g)	Seed yield (kg/ha)	Germination (%)	Dead seeds (%)	Hard seeds (%)	Seedling length (cm)	Seedling vigour index
Fruit position								
P_1	65.86	66.34	212.08	66.55	18.11	14.37	14.82	12.77
P_2	65.57	64.98	712.20	67.48	17.79	13.35	14.77	13.29
P_3	46.42	47.66	26.54	39.81	40.11	24.73	10.90	4.62
CD (0.05)	1.45	1.12	17.02	10.88	9.81	9.52	0.50	0.77
Harvesting stage								
H_1	58.86	54.81	166.93	46.34	33.10	24.98	10.32	5.58
H_2	59.02	61.09	390.44	61.68	22.78	15.89	14.23	11.60
H_3	58.97	63.08	393.46	63.67	23.32	11.53	15.94	13.50
CD (0.05)	1.31	0.88	15.42	9.93	8.43	8.82	0.56	0.80
Interaction								
$P_1 \times H_1$	65.66	60.19	41.53	53.93	29.11	19.37	11.92	7.80
$P_1 \times H_2$	65.90	68.93	84.04	74.10	10.25	12.01	15.67	14.49
$P_1 \times H_3$	66.03	69.90	86.52	76.86	8.78	9.68	16.87	16.01
$P_2 \times H_1$	65.83	60.47	121.00	52.43	29.00	21.69	10.13	6.36
$P_2 \times H_2$	65.54	65.35	295.70	78.46	9.09	7.03	16.13	15.48
$P_2 \times H_3$	65.35	69.12	295.50	80.03	9.10	4.05	18.05	18.03
$P_3 \times H_1$	45.11	43.78	4.40	32.79	40.88	31.84	8.90	2.59
$P_3 \times H_2$	45.63	48.98	10.70	41.65	38.94	23.83	10.90	4.82
$P_3 \times H_3$	45.53	50.24	11.44	44.90	40.30	16.78	12.90	6.44
CD(0.05)	2.11	2.04	20.20	13.98	12.34	11.85	0.94	1.02

to 63.67 per cent germination. More than 70 per cent germination was obtained in P_1H_2, P_1H_3, P_2H_2 and P_2H_3 interactions, (Table 1). Thus, data elucidated that quality seeds with high germination were obtained from middle and lower fruits harvested at undried brown to dry brown stage. These findings are in line with those of Bhatt and Rao (2), Rao *et al* (7) and Verma *et al.* (9).

An inverse relationship was observed with respect to dead and hard seeds percentage, seeds from farther fruits and mature fruits of turning stage produced more dead and hard seeds. Though the number of dead and hard seeds varied with the fruit position and harvesting stage, the proportion of dead and hard seeds was significantly lower in fruits harvested from lower and middle nodes at undried brown to dry brown stage. However, minimum dead seed percentage was observed with P_1H_3 (8.78%) and P_2H_3 (9.10%), whereas, 4.05% hard seeds were recorded with P_2H_3 (Table 1). Singh *et al.* (8) also reported the significant interaction between fruit position and number of dead and hard seed. Such manifestations might be due to the competition for partitioning of assimilates between developing fruits and seeds at several nodes. Since, fruits at lower nodes get maximum share of assimilate and water during fruit formation, seed development and maturation. Incidentally, fruits at higher nodes lag behind in the competition for assimilate as the time available for assimilation of storage reserves is quite shorter.

Seedling length and vigour both were significantly affected by the fruit position, harvesting stage and their interaction. Seedling length and vigour index varied from 8.90 to 18.05, and 2.59 to 18.03, respectively (Table 1). Results revealed that reasonably good seedling length and vigour index were observed with seeds obtained from lower and middle fruits (P_1 & P_2) and undried brown to dry brown fruits (H_2 & H_3) and their interactions (P_2H_3, P_1H_3, P_2H_2 & P_1H_2). Which might be due to appropriate conversion, deposition and partitioning of assimilates in the fruits located at different nodes. Therefore, seeds from bottom fruits were bold and resulted in higher vigour. A significant interaction between harvesting stage and seedling vigour index was also reported by Singh *et al.* (8).

Share of the seeds yield from different fruit positions was 712.20, 212.08 & 26.54 , respectively. Proportion of the seeds yield from different harvesting stages was 393.46, 390.44 & 166.93, respectively. However, majority of quality seeds were produced from P_2H_2, P_2H_3, P_1H_2 and P_1H_3 interactions (Table 1).

On the basis of these findings, it could be inferred that seeds obtained from lower and middle fruits at undried brown and dry brown stages would possess maximum germination and vigour. Thus, the fruits from the top most nodes should be used for table purpose (fresh vegetable) and not for seed extraction.

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