

GROWTH AND YIELD OF OKRA (*ABELMOSCHUS ESCULENTUS*) AS INFLUENCED BY SEED WEIGHT

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ABSTRACT

A field experiment was conducted during Kharif seasons in 2010, to evaluate the growth and yield response of okra at varying seed weight and determine the optimal seed weight that will maximise the marketing yield. Four varieties of okra have taken in consideration for this investigation viz. Sagum, Satsira, Arka Anamika, and Parbhani Kranti. The result indicated that in all the four varieties, the lowest seed weight was inferior to other seed weight grades. The light seeds showed significantly lower germination percentage (71.83) than the heavy seeds (80.50). Heavy seed weight recorded maximum root (8.19cm) and shoot length (13.19cm) and minimum of days required for opening of cotyledons leaf (5.08) and first true leaf (9.60). Other growth parameters like plant height and number of leaves at different stages varied significantly between the seed weight grades and varieties. Among the varieties, maximum yield of 10.5t/ha. was obtained from Arka Anamika with heavy seed weight.

INTRODUCTION

Okra (*Abelmoschus esculentus* L.) is an economically important vegetable crop grown in tropical and sub-tropical parts of the world (Arapitsas, 2008, Saifullah and Rabbani 2009). India ranks first in the world with 4.8 million tonnes (67% of the total world production) of okra produced from over 0.45 million ha land (FAOSTAT, 2009). Every parts of okra plant have equal importance and used as food, feed and fiber. Its green fruits are also good source of carbohydrate, protein, fats, vitamins and minerals (Owolarafe *et al.*, 2004; Ali *et al.*, 2005; Gopalan *et al.*, 2007; Arapitsas, 2008; Dilruba *et al.*, 2009; Fajinmiand and Fajinmi, 2010) and plays a vital role in human diet (Kahlon *et al.*, 2007; Saifullah *et al.*, 2009). Seeds of many horticultural crops have been distinguished by size, weight, density, and color (Smith *et al.*, 1973; Smith and Camper, 1975; Smittle *et al.*, 1976; Brandenburg, 1977; Smittle, 1982). Separation by seed weight and/or density, as well as seed size, offers a means of improving seedling vigor and/or yield for many crops (Hartwig and Edwards, 1970; Johnson and Ludders, 1974; Smittle, 1982). Seed weight is one of the most prominent features whose plays an important role in the establishment of the juvenile phase of the life cycle (Tripathi and Khan, 1990; Khan and Uma Shankar, 2001), principally under conditions where resources are scare (Grubb and Coomes, 1997; Grubb and Burslem, 1998; Meyer and Carlson, 2001). Seed yield in corn was influenced by different planting density and size of seed as reported by (Aryannia *et al.*, 2011).

There is very little published information on the influence of seed weight/ seed size on growth and performance of okra. Therefore, the present investigation was undertaken to find out the influence of seed weight on seed and seedling quality parameters as well as yield in order to determine the acceptable seed weight for realizing of higher vegetable yield.

MATERIALS AND METHODS

The experiment was carried out in Kharif season 2010 at Horticultural Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, West Bengal. The composite seed of each of four varieties were classified on the basis of individual seed weight on the basis of protocol use by Krishna Upadhaya *et al.* (2007) in temperate fruit crop and Phathizwe *et al.* (2011) in okra as shown below.

Seed Weight Grade	Symbol	Range (mg)
Light	W1	40-55
Medium	W2	56-70
Heavy	W3	71-85
Control	W0	Composite seed

The four varieties taken for the experiments were Shagun (V1), Satshira Bhindi (V2), Arka Anamika (V3) and Parvani Kranti (V4). The experiment was laid out in Factorial Randomised Block Design with two factors (seed weight and variety) and three replications. The total numbers of plots were 48 with 2.25m × 1.5m size of each plot. Seed were soaked 8 hours before sowing. FYM was applied @ 15 tonnes per hac along with NPK@ 50:25:25 kg/ha. A spacing of 45cm × 30cm was maintained between the rows and within the plant respectively.

The total number of irrigation was three in respective season. Germination percentage was recorded from 100 seeds sown in each plot with three replications. Speed of germination was calculated using formula n/t , where, n = number of seeds germinated, t = days from sowing *i.e.* average seed germinated / day after sowing. Root and shoot length of seedling were recorded after the fifteen DAS by uprooting five randomly selected seedlings per plot. Other seedling quality parameters like cotyledons emergence and expansion true leaf were recorded from five randomly selected seedlings per plot. Fruits were harvested after 5-6 days from flowering in almost every alternated day. Vegetable yield per hectare was computed by multiplying fruit yield per plant to total number of plants per hectare.

RESULTS AND DISCUSSION

Among the different seed weight grades heavy, medium and composite seeds (control) showed statically similar germination percentage and speed of germination. Light seeds exhibited significantly lower germination percentage (71.83) than the heavy seeds which recorded a maximum germination percentage of 80.50. This might be due to the reason that light seeds failed to emerge from the soil due to the low vigour. The similar results have been reported by Nakagawa *et al.* (1991); Noor-Mohammad *et al.* (2000); Cordazzo (2002); Khan (2003); Jorge *et al.* (2004); Akbari *et al.* (2004); Baalbaki *et al.* (2007); Kaydan *et al.* (2008); Nadya Wahid *et al.* (2012).

Speed of germination recorded from light seeds (6.49) was also significant lower than other seed weight grades. Harvey seeds recorded maximum speed of germination (7.57). The results are in agreement with the findings of Golamani *et al.* (2009). Among the varieties Arka Anamika recorded minimum germination percentage (84.58) and speed of germination (7.48). In case of treatment combinations heavy seeds of Shagun exhibited maximum germination percentage (87.67) and heavy seeds of Arka Anamika recorded maximum speed of germination. Maximum root length (8.19) was recorded from heavy seeds which was statistically at par with medium seeds but significantly higher than control and light seeds. The result is in conformity with the findings of Al-Karaki (1998). The Maximum shoot length (13.19) was obtained from heavy seeds which produced significantly taller seedlings than other three grades. Light seeds recorded minimum root length (6.85cm) and shoot length (11.27cm). The reason might be higher food reserve in heavier seeds.

Among the varieties Arka Anamika showed significantly higher root length (8.83cm) and shoot length (13.03cm) than the other varieties. Interaction effect was found to be significant and the heavy seeds of Arka Anamika exhibited maximum root length and shoot length (9.76cm and 14.45cm respectively). Similar findings were reported by Cookson *et al.* (2001); Nerson (2002); Seyed Saeid Hojjat (2011).

The effect of seed weight on number of days taken for opening of cotyledons leaf was found to be statistically significant (Table

Table 1: Growth characters as influenced by seed weight

Variety	Germination percentage	Speed of emergence	Root Length	Shoot Length	Days*	Days**	Plant Height	Number of leaves	Stem Diameter
Shagun	84.083	6.960	7.207	11.880	5.529	11.417	30.475	12.967	8.757
Sathsira bhindi	66.083	6.735	7.060	11.448	6.054	11.467	30.542	15.467	8.203
Arka Anamika	84.583	7.478	8.830	13.028	5.467	9.067	46.342	16.883	9.899
Parvani Kranti	76.416	7.087	7.098	12.213	5.717	11.317	50.292	19.600	10.117
S.Em(±)	1.937	0.168	0.232	0.237	0.118	0.368	0.496	0.266	0.154
CD at 5%	5.593	0.485	0.669	0.684	0.340	1.062	1.432	0.768	0.466
Seed Weight Grade									
W1	71.833	6.492	6.850	11.267	6.408	12.300	37.233	15.017	9.173
W2	79.583	7.100	7.642	12.085	5.654	10.867	40.042	16.517	9.293
W3	80.499	7.567	8.190	13.190	5.083	9.600	40.725	17.167	9.297
W0	79.249	7.099	7.513	12.028	5.621	10.500	39.650	16.217	9.212
S.Em(±)	1.937	0.168	0.232	0.237	0.118	0.368	0.496	0.266	0.154
CD at 5%	5.593	0.485	0.669	0.684	0.340	1.062	1.432	0.768	NS

Length, Height in cm and Diameter in mm; * = Days taken for opening of Cotyledons leaf; ** = Days taken for expansion of first true leaf

Table 2: Yield and yield attributing characters as influenced by seed weight

Variety	Days to first flower	Fruit Length (cm)	Fruit diameter (cm)	Fruit weight (g)	Number of fruits /plant	Fruit yield / plant (g)	Fruit yield / hectare (Tonnes)
Shagun	46.917	12.972	1.688	16.467	14.250	173.467	10.279
Sathsira bhindi	49.467	10.982	1.715	13.483	10.050	122.783	7.281
Arka Anamika	46.150	13.122	1.573	17.582	13.417	177.533	10.521
Parvani Kranti	47.950	14.717	1.571	16.448	11.967	148.033	8.772
S.Em(±)	0.457	0.123	0.038	0.087	0.254	2.272	0.134
CD at 5%	1.319	0.356	0.109	0.358	0.733	6.561	0.388
Seed Weight Grade							
W1	49.967	12.992	1.637	16.442	11.967	148.533	8.802
W2	47.633	12.953	1.625	16.448	12.533	157.217	9.316
W3	44.983	12.873	1.652	16.460	12.717	160.567	9.516
W0	47.900	12.973	1.635	16.630	12.467	105.00	9.218
S.Em(±)	0.457	0.123	0.038	0.087	0.254	2.272	0.134
CD at 5%	1.319	NS	NS	0.358	0.733	6.561	0.388

1). Minimum number of days (5.083) was noticed in the heavy seeds and with the decrease in seed weight; number of days was increased signifying at faster rate of growth in plants from heavier seeds. Light seed weight grade required more number of days for opening of cotyledons leaf *i.e.* 6.408.

The height of the plant was also significantly influenced by different seed weight grades. Heavy seed weight produced taller plants (40.73cm) than that of medium seeds (40.04cm) and control (37.23cm). The observation on plant height correlated with seed size was in agreement with the findings of Figueiredo *et al.* (1970); Anonymous (1998); M.S. Hossain *et al.* (2011). There was a significant difference among the different varieties in case of stem diameter (Table 1). Parvani Kranti exhibited maximum value of 10.117mm. Similarly there was significant variation in number of leaves among the varieties and seed weight. The maximum number of leaves 32.517 was obtained from heavy seed weight. The similar result was also observed by Pahathizwe *et al.* (2011). It revealed from the experiment that seed weight significantly influenced the number of days taken to produce first flower. Minimum days of (44.983) were recorded with heavy seed followed by medium, composite, and light seed weight grade. The length of fruit produced by different seed weight grades was statistically similar but there was significant variation in fruit length among the varieties. Maximum fruit length (14.717cm) was recorded in Parbhani Kranti. Variation in fruit diameter due to the influence of seed weight was not significant, but the maximum value (1.652cm) was obtained with heavy seeds. There was significant variation in fruit diameter among the varieties. Variety seven dhari showed maximum fruit diameter (1.715cm) which was at par with that of Shagun. The maximum fruit weight was obtained from heavy seed weight (Table 2). Among the varieties Arka Anamika produced maximum fruit weight. There was an increasing trend in number of fruits with the increase in seed weight. Dawande *et al.* (1993) also reported the similar results for number of maximum fruits in soybean with large seed weight. Maximum number of fruits was produced from variety Shagun followed by Arka Anamika. Heavy seeds showed the maximum fruit yield (9.52t/ha) followed by medium seeds (9.32t/ha). Medium and control seeds produced statistically similar yield to that of heavy seed. Light seeds recorded significantly lower yield (8.80t/ha) than the other seed weight grades. Similarly, higher vegetable yield from bolder seeds have been reported by Pearson and Miklas Heather and Sietka (1991) in broccoli, Singh *et al.* (1993) found maximum yield with heavy seed (tuber) weight of potato, Sokolowska *et al.* (1995) in carrot Kartapradja (1998) in tomato and. Roy *et al.* (1996) and Upadhy *et al.* (2001) suggested that seed size and their density strongly correlated with yield.

It is however, suggested to eliminate light seed weight seeds from the seed lot for improving seed quality as well as vegetable yield.

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