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Influence of Seed Vigour on Seed Quality and Yield in Okra (*Abelmoschus esculentus* L.)

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ABSTRACT An experiment was conducted to determine the influence of seed vigour on initial seed quality and yield of okra hybrid during *Rabi* 2002-03. The Sun 008 hybrid with four vigour levels after accelerated ageing constituted the treatments. The germination, seedling vigour, seedling dry weight and field emergence decreased with increased period of accelerated aging. Thus ultimately affected the plant height, dry matter production per plant, leaf area per plant, number of fruits per plant, number of seeds per fruit and seed yield with the declining trend of germination levels from 94% (control) to 54% germination.

Keywords: Okra, seed vigour, seed quality, yield

High quality seed is an essential factor to ensure good crop establishment and obtain higher yields. Seed must be viable and possess good physiological traits to allow rapid germination, seedling establishment and uniformity in crop growth, crop performance and ultimately increase in yield per unit area. Seed germination and vigour are the main physiological attributes. The germinability and vigour of a seed lot is directly related to the yield performance. Slow or erratic emergence and poor stand establishment are symptoms of low seed vigour [1]. Genetic makeup, mother plant nutrition, field weathering, time and method of harvesting, drying, processing, treating and storage are some of the factors affecting seed vigour in all vegetables crops including okra.

Availability of quality seed is a limiting factor for cultivation of vegetable crops in India. These crops require specific temperatures and other congenial climatic conditions for flowering and fruit setting to produce quality seed. Hence, some vegetables are grown in one part of the country and their seed production is restricted to another part. Therefore, systematic research efforts are also required to achieve sufficiency in production of high quality seeds. Though okra is one of the important vegetable crops, the literature pertaining to seed vigour in field performance, seed quality and yield is scanty. Keeping in view the research gap an experiment was conducted to study the influence of seed vigour on field performance, seed quality and yield in okra.

MATERIALS AND METHODS

Freshly harvested seeds (94% of germination) of okra cv. Sun 008 hybrid were subjected to accelerated ageing at 40±1°C and 85±5% relative humidity for 4, 8, 12 and 16 .days for inducing different vigour levels in terms of germination. The resultant seed lots represented seeds of four vigour levels with 84, 76, 65 and 55 per cent of germination, respectively and these seeds were used to study the effect on initial seedling quality in laboratory and seed vigour on field performance and yield. After subjecting the seeds for accelerated ageing, to determine initial seed quality of vigour levels, observations on the germination percentage, seedling length, drymatter content of seedlings were recorded as per the standard procedure [2]. The vigour index I and II were determined as per Abdul Baki and Anderson [3]. The field performance and yield were assessed

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from the resultant seeds of four vigour levels of Sun 008 seeds were sown in the field in a Randomized Block Design with three replications by adopting the recommended package of practices during *Rabi*, 2002-03 at Department of Seed Science and Technology, Rajendranagar, Hyderabad.

The observations on field emergence (10^{th} DAS), days to 50 per cent flowering, plant height, dry weight of plant, leaf area per plant, number of green fruits per plant, green fruit yield per plant, number of seeds per fruit and seed yield per plant were recorded. The leaf area was measured from leaves of five randomly selected plants using leaf area meter and expressed in cm^2. Days to 50 per cent flowering were recorded on plot basis, while observations for yield and other parameters were recorded in ten randomly selected plants in a plot for each treatment. The results of laboratory and field studies were statistically analysed as per the standard procedures.

RESULTS AND DISCUSSION

Laboratory studies

In the present study, the vigour of the seed was high in fresh seed lots in terms of germinability, seedling length and dry matter and seed vigour index (Table 1). The differences among treatments of different vigour levels were significant. The germination per cent decreased from 94 to 55 with increase in days of accelerated ageing from 4 to 16 days. The decline in germination (66% and 55%) after 12 and 16 days of accelerated ageing was more pronounced and drastic reduction in germination may be attributed to deterioration as a result of loss in initial seed vigour in Sun 008 hybrid. Reduction in germination due to accelerated ageing was reported in other crops like soybean [4] and mungbean [5].

The effect of lower vigour levels in decreased seedling length (22.57 to 14.25 cm), reduced dry weight of seedling (2.14 to 1.40 g) and low seedling vigour index (2138 to 770) is discernible in affecting the initial seed quality.

Reduction in seedling length and drymatter accumulation was directly proportional to reduction in germination levels. The decline in seedling length, drymatter and vigour index was more in seed lots having 66 and 55 per cent germination as compared to the lots having 94, 84 and 75 per cent in the hybrid. The reduction in seedling length, drymatter and vigour index may be due to loss of membrane integrity of cellular membranes, leaching of solutes and intercellular disorganization and also impairing the growth of seedling by slowing down the metabolic activity.

Table 1. Effect of seed vigour levels on germination, seedling length, seedling dry weight and seedling vigour index of Sun 008 okra hybrid

	Treatment	Seed germination (%)	Seedling length (cm)	Dry wt. of seedlings (g)	SVI-I (seedling length basis)	SVI-II (dry weight basis)
T_1	Without accelerated ageing (control)	94	22.57	2.14	2138	201.71
T_2	Accelerated ageing for 4 days at 40±1°C and 85±5% RH	84	20.32	1.93	1711	163.27
T_3	Accelerated ageing for 8 days at 40±l°C and 85±5% RH	75	17.60	1.76	1320	132.27
T_4	Accelerated ageing for 12 days at 40±1°C and 85±5% RH	66	15.97	1.56	1054	103.02
T_5	Accelerated ageing for 16 days at 40±1°C and 85±5% RH	55	14.25	1.40	770	77.00
	Mean	74.8	18.14	1.758	1398.75	135.45
	SEm±	0.59	0.37	0.018	26.75	2.17
	CD (0.05)	1.67	1.16	0.056	82.4	6.69

Similar findings of reduction were reported in sorghum [6] and maize [7]. The laboratory studies clearly indicated that the vigour levels in okra influenced the seed quality parameters.

Field studies

When the seeds of different vigour levels were sown in the field, the crop growth and yield parameters differed significantly (Table 2). There was a significant reduction in field emergence index with the decrease in vigour levels ranging from 80.49 to 44.02 units. A significant positive association between germination and field emergence index was observed in Sun 008 hybrid. Similar findings were also reported by Kharb and Dahiya [8] in pigeonpea and Gray and Steckel [9] in carrot. This variation in field emergence of different treatments was mainly due to different vigour levels. It is not uncommon that low germination seed vigour may emerge in the field well. But, the seedlings emerging from such seed may not be due to low vigour, insufficient to overcome the compactness of soil especially under sub optimal conditions [10].

The time taken for flower initiation and 50 per cent flowering increased with the decrease in seed vigour. The delay in flowering was pronounced in plants developed from seed lots with low germination, decreased seedling length and field emergence than those plants from high germination, increased seedling length and high field emergence. The findings of Camargo and Vaughan [11] in sorghum support the present observation.

Plant growth in terms of plant height (83.29 to 53.27 cm) and leaf area (346.52 to 241.99 cm^2) was affected by different vigour levels in terms of germination. The plants having high vigour showed increased height and leaf area, which may be due to early emergence, rapid seedling growth and uniform crop growth. Similar findings were reported by Paramesh *et al.* [12]. The growth characters *viz.*, plant height and leaf area showed a concommittant effect on drymatter production. The total drymatter production drastically decreased in low vigour seed lots (30.85 g) compared to high vigour seed lots (50.41 g) at 90 DAS. Hence, it is evident that from the present findings any improvement in seed vigour ultimately influences the crop yield.

Table 2. Effect of seed vigour levels in terms of germination on field performance and seed yield units in Sun 008 okra hybrid at different periods of crop growth

	Treatment	Field emergence	Plant heght (cm)	Leaf area (cm^2)	Dry matter production/ plant (g)	No. of green fruits/ plant	Green fruit yield/ plant(g)	No. of seeds/ fruit	Seed yield/ plant (g)
T_1	Without accelerated ageing (control)	80.49	85.29	367.74	50.41	30.75	315.72	45.50	33.66
T_2	Accelerated ageing for 4 days at 40±1°C and 85±5% RH	75.38	77.11	341.84	44.41	28.00	277.27	43.25	29.37
T_3	Accelerated ageing for 8 days at 40±1°C and 85±5% RH	60.06	68.40	318.15	39.65	25.75	249.11	38.50	25.22
T_4	Accelerated ageing for 12 days at 40±1°C and 85±5% RH	55.36	60.62	289.07	35.43	23.00	224.63	36.50	20.30
T_5	Accelerated ageing for 16 days at 40±1°C and 85±5% RH	44.02	53.27	258.65	30.85	20.25	190.53	32.50	15.70
	Mean	61.46	68.93	315.09	40.09	25.55	251.45	39.25	24.85
	SEm±	0.36	0.38	3.34	0.40	0.49	3.48	0.54	0.92
	CD (0.05)	1.12	1.19	10.31	1.25	1.52	10.74	1.66	2.85

Yield in crop plants is an ultimate expression and depends upon the expressibility of yield components. The present study revealed that there was a significant variation in the yield and yield components *viz.*, number of green fruits per plant (31.0 to 22.0), number of seeds per fruit (46 to 33) and seed yield per plant (33.61 to 15.70 g) due to different seed vigour levels. Seed lots with low seed vigour and poor germination exhibited reduced plant size, less number of fruits per plant, seeds per fruit and low fruit weight as compared to those of high seed vigour. This might be due to timing and emergence at subsequent growth periods cumulatively influenced by seed vigour and seed quality. Similar observations were recorded in maize [7], rice [13] and sunflower [14].

The laboratory studies to know the seed quality after harvest revealed that there was no significant variation among the treatments for germination, seedling length and vigour index in okra hybrid Sun 008 (Table 3) indicating that seed quality was not influenced by the resultant seeds of different vigour levels after harvest.

From the results obtained in the present investigation, it can be inferred that seed having high vigour levels and germinability more than 75 per cent should be preferred to obtain higher crop yield though the minimum seed certification standards (MSCS) of germination for okra is 65 per cent. Hence, relatively high vigorous seeds (more than 75 % germination) should be used to have early emergence, uniform growth thereby improving yield potential even in sub-optimal conditions.

Table 3. Effect of seed vigour on seed quality of harvested seed in Sun 008 hybrid

Treatments	Germination (%)	Seedling length	Seedling vigour index (SVI)
T_1 Without accelerated ageing (control)	86	23.57	2037
T_2 Accelerated ageing for 4 days at 40±1°C and 85±5% RH	88	23.72	2087
T_3 Accelerated ageing for 8 days at 40±1°C and 85±5% RH	87	22.22	1931
T_4 Accelerated ageing for 12 days at 40±1°C and 85±5% RH	86	22.82	1911
T_5 Accelerated ageing for 16 days at 40±1°C and 85±5% RH	86	21.77	1963
SEm±	3.13	0.50	71.01
CD (0.05)	NS	NS	NS

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