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EFFECT OF VIGOUR LEVELS ON SEED QUALITY ATTRIBUTES OF GROUNDNUT VARIETIES

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ABSTRACT

A laboratory experiment entitled was conducted at Laboratory department of Seed Science and Technology, S.V. Agricultural College, Tirupati campus of Acharya N.G. Ranga Agricultural University, Andhra Pradesh, India during *rabi,* 2023-24. Vigour tests were conducted for ten different groundnut varieties and the results showed that significant differences were observed among different varieties with respect to vigour tests. Among all the varieties Kadiri-6 has shown highest performance in the laboratory studies and considered more vigorous whereas Kadiri Amaravathi have shown less vigour.

KEYWORDS: Vigour tests, Vigorous, Seed quality attributes.

INTRODUCTION

Groundnut (*Arachis hypogaea L.*) is an important oilseed crop, belonging to the family Leguminosae. chromosome number (2n=40). This crop is widely cultivated and consumed in various tropical and subtropical countries around the world. One of its unique characteristics is that it is geotropically positive, meaning its seeds develop underground. Groundnut is believed to be the native of Brazil. China is the world's leading producer of groundnut, followed by India, the United States, and Argentina.

Globally, groundnut is grown in an area of 30.5 million hectares with a production and productivity of 54.2 million tonnes and 1776 kg ha^{-1}, respectively. In India, groundnut is grown in an area of 5.7 million hectares with a production and productivity of 10.1 million tonnes and 1777 kg ha^{-1}, respectively (FAO, 2024).

Before seeds are sown, effective screening of high-quality seeds for planting is crucial to improve the quality of crop yield. Since perfect conditions are rare, we need alternative methods to estimate how seeds will fare under less favourable circumstances. If seeds encounter harsh environmental conditions, their ability to function properly (physiological potential) can be severely weakened.

In simpler terms, seed health is determined by two main factors: germination success (how many seeds will sprout) and seedling strength (how well the sprouted seeds grow). These factors affect how well seeds perform, even under challenging conditions. Among many factors affecting the yield and quality of peanut seed vigor plays a crucial role. Germination potential of seed is associated with seedling vigour (Maurya *et al*. 2006). Vigorous seeds lead to better germination, faster emergence, and stronger seedlings, ultimately establishing a healthy and uniform crop stand. Germination tests are a valuable tool for initial assessment of seed quality. When field conditions are favourable (optimal temperature, moisture, etc.), germination test results tend to closely correlate with field emergence. However, when conditions are unfavourable, the test might overestimate actual emergence.

The present study was initiated to predict the field performance of groundnut (*Arachis hypogaea* L.) varieties through various vigour tests.

MATERIAL AND METHODS

The present experiment was conducted at laboratory department of Seed Science and Technology, S.V. Agricultural College, Tirupati. Popular groundnut varieties viz., Narayani, Dharani, Dheeraj, TCGS-1694 and Nithya Haritha released from RARS, Tirupati, Kadiri-9, Kadiri Amaravathi, Kadiri-6 and Kadiri-1812 from ARS, Kadiri and TAG-24 from BARC, Trombay were collected and multiplied the seed. The harvested seed was used for conducting different vigour tests for prediction of field performance like germination test, speed of germination, seedling vigour index-I, seedling vigour index-II, accelerated ageing test, electrical

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conductivity of seed leachates by adopting completely randomized design with four replications. Observations were recorded under laboratory conditions including gerimination percentage which was conducted by employing between paper method as prescribed by ISTA in a germinator maintained at 25 ± 2°C and the number of normal seedlings obtained was recorded on final count *i.e.,* 10th day and expressed in percentage.

Number of normal seedlings emerged was counted every day till the end of the test period and was calculated using the formula suggested by Maguire (1962). The speed of emergence was calculated.

Speed of emergence = n1/d1+n2/d2+n3/d3+ ---

where, n is the number of emerged seedlings, d is the number of days.

Seed vigour index-I and seed vigour index-II were computed by adopting the following formula as suggested by Abdul-Baki and Anderson (1973) and was expressed in whole number.

Seed vigour index-I = Germination (%) x Mean seedling length (cm) Seed vigour index II = Germination (%) x Mean seedling dry weight (g)

Table 1. Effect of vigour levels on germination percentage, root length, shoot length, seedling length of groundnut varieties

Varieties	Germination percentage (%)	Root length (cm)	Shoot length (cm)	Seedling length (cm)
Narayani	72.10 (59.11)	15.37	11.38	26.74
Dharani	58.80 (51.07)	13.83	9.13	22.96
Dheeraj	69.85 (57.70)	15.16	10.50	25.66
Nithya Haritha	61.93 (52.90)	14.25	9.75	24.00
TCGS-1694	68.72 (57.00)	15.00	10.01	25.01
Kadiri-6	75.35 (61.23)	16.50	11.50	28.00
Kadiri-1812	71.14 (58.50)	15.25	10.63	25.88
Kadiri-9	53.20 (47.83)	13.50	8.80	22.30
Kadiri Amaravathi	44.27 (42.71)	12.25	8.00	20.25
Tag-24	66.92 (55.89)	14.74	9.87	24.61
Mean	64.23 (54.27)	14.59	9.96	24.54
S.Em. ±	3.57	0.65	0.27	0.66
C.D. (0.05)	10.33	1.90	0.79	1.92
C.V (%)	11.14	9.04	5.53	5.51

Figures in parenthesis indicates arcsine transformed values

The seeds were subjected to 42°C ±1°C temperature and 95 per cent relative humidity (RH) by keeping them in monolayer on a wire gauge / mesh for a period of four days (Delouche and Baskin, 1973). Accelerated aged seed samples were drawn after four days and subjected for germination test. Then germination percentage after accelerated ageing was recorded. Electrical conductivity test was conducted in four replications of five gram seeds which were weighed and the seeds were rinsed twice in distilled water and then soaked in 25ml of distilled water and incubated at 25 ± 1°C temperature for 24 hours (Presley, 1958). Electrical conductivity of seed leachate was measured in digital conductivity meter with a cell constant 1.0 and the mean values were expressed in µS cm^{-1}.

The following observations were recorded after performing vigour tests. Germination percentage, Root length, shoot length, seedling length, root dry weight, shoot dry weight, seedling dry weight, seedling vigour index-I, seedling vigour index-II, EC of seed leachates (µS cm^{-1}). At the time of germination count, ten normal seedlings were selected at random and used for measuring the root length, shoot length, seedling length of seedlings. The same seedlings were taken in the brown paper bags and kept in hot air oven at 70± 2^0C for 24 hr after cooling root and shoot were separated and root dry weight shoot dry and seedling dry weight was measured.

The mean data obtained from the experimentation was statistically analysed and subjected to the Analysis of variance by adopting appropriate statistical methods as outlined by Panse and Sukhatme (1985). The critical differences were calculated at five percent and one percent level of probability. The percentage data of germination and germination percentage after accelerated ageing were transformed into arc sine root transformation before analysis.

RESULTS AND DISCUSSION

In the present experiment, 10 different groundnut varieties were used to conduct laboratory based seed vigour tests. Based on the results obtained, significantly higher initial seed germination was recorded in Kadiri-6 (75.35%) followed by Narayani (72.10%) and the least value for germination was observed in Kadiri Amaravati (44.27%) followed by Kadiri-9 (53.20%) (Table 1). The results indicated that varieties showing higher germination on the first count day also showed higher final germination percentage. Similar observations were

Table 2. Effect of vigour levels on speed of germination, root dry weight, shoot dry weight, seedling dry weight of groundnut varieties

Varieties	Speed of germination	Root dry weight (g)	Shoot dry weight (g)	Seedling dry weight (g)
Narayani	9.50	0.063	0.254	0.317
Dharani	7.29	0.052	0.175	0.227
Dheeraj	8.94	0.062	0.248	0.310
Nithya Haritha	8.00	0.053	0.164	0.217
TCGS-1694	8.72	0.063	0.182	0.245
Kadiri-6	13.13	0.100	0.352	0.452
Kadiri-1812	9.20	0.058	0.245	0.303
Kadiri-9	6.30	0.053	0.142	0.195
Kadiri Amaravathi	3.56	0.052	0.142	0.194
Tag-24	8.44	0.054	0.181	0.235
Mean	8.31	0.061	0.209	0.270
S.Em. ±	0.63	0.003	0.01	0.011
C.D. (0.05)	1.82	0.009	0.029	0.031
C.V (%)	5.51	10.573	9.228	7.776

recorded in cotton (Shinde and Dadlani, 2012), pigeon pea (Kanakadurga *et al.,* 2012).

Maximum root length (cm) was recorded by Kadiri-6 (16.50 cm) followed by Narayani (15.37cm). Minimum root length was recorded by Kadiri Amaravathi (12.25cm) followed by Kadiri-9 (13.50cm) (Table 1.). Maximum shoot length (cm) was recorded by Kadiri-6 (11.50cm). followed by Narayani (11.38cm). Minimum shoot length was recorded by Kadiri Amaravthi (8.00cm) followed by Kadiri-9 (8.80cm) (Table 1**)**. The above results are in correlation with findings of Vanangamudi (1987). Seedling length was also highest for Kadiri-6 (28.00cm) and lowest seedling length was recorded in Kadiri Amaravathi (20.25cm) (Table 1.). Among different groundnut varieties Kadiri-6 showed the maximum root length, shoot length and seedling length.

Similarly, highest speed of germination was recorded by Kadiri-6 (13.13) followed by Narayani (9.50). Lowest speed of germination was recorded with Kadiri Amaravathi (3.56) followed by Kadiri-9 (6.30) (Table 2.). High speed of germination is noticed by varieties having higher germination percentage and vice-versa. Similar results were noticed by Rana and Biridarpatil (2019) that speed of emergence showed significant relationship with varied vigour levels of seed lots. Highest root dry weight was recorded in kadiri-6 (0.100g) and lowest in Kadiri Amaravathi and Dharani (0.052g) (Table 2.). Highest shoot dry weight was recorded by Kadiri-6 (0.352g) while, lowest shoot dry weight was recorded by Kadiri Amaravathi and Kadiri-9 (0.142g) (Table 2.), Seedling dry weight was recorded by Kadiri-6 (0.452g) followed by Narayani (0.317g). Lowest seedling dry weight was

Table 3. Effect of vigour levels on germination percentage after accelerated ageing, seedling vigour index-I, seedling vigour index-II, electrical conductivity of seed leachates of groundnut varieties

Varieties	Germination percentage after Accelerated ageing (%)	SVI-I	SVI-II	EC of seed leachates ($\mu S\ cm^{-1}$)
Narayani	60.17 (51.86)	1928	22.86	143.75
Dharani	53.25 (47.86)	1350	13.35	302.25
Dheeraj	59.10 (51.24)	1792	21.65	145.00
Nithya Haritha	54.46 (48.56)	1486	13.44	177.00
TCGS-1694	58.47 (50.87)	1719	16.84	225.00
Kadiri-6	61.37 (52.57)	2110	34.06	95.00
Kadiri-1812	59.55 (51.50)	1841	21.56	151.00
Kadiri-9	51.83 (47.04)	1186	10.37	337.50
Kadiri Amaravathi	40.85 (44.19)	896	8.59	345.00
Tag-24	56.34 (49.64)	1647	15.73	185.00
Mean	55.53 (49.52)	1595.50	17.85	210.65
S.Em. ±	2.01	95.41	1.25	7.92
C.D. (0.05)	5.81	275.57	3.62	22.99
C.V (%)	7.17	11.96	13.72	7.42

Figures in parenthesis indicates arcsine transformed values

recorded by Kadiri Amaravathi (0.194g) followed by Kadiri-9 (0.195g) (Table 2).

Kadiri-6 recorded highest seedling vigour index- I (2110) followed by Narayani (1928) Lowest seedling vigour index- I was recorded with Kadiri Amaravathi (896) and was least vigorous among the varieties followed by Kadiri-9 (1186) (Table 3.). The results of the study are in line with that of Manjunath (1993) who reported that high vigour seeds with higher initial germination had greater vigour index. Similar trend of response with respect to seedling vigour index-II was observed with highest value of Kadiri-6 (34.06) followed by Narayani (22.86). Lowest seedling vigour index- II was recorded with Kadiri Amaravathi (8.59) followed by Kadiri-9 (10.37) with 53.20 germination percent (Table.3.). Significantly higher germination percentage after accelerated ageing was recorded with Kadiri-6 (61.37%) with initial germination of 75.35% followed by Narayani (60.17%) which was having initial germination of 72.10%. Kadiri Amaravathi with initial germination of 44.27% followed by Kadiri-9 with initial germination of 53.20 % reduced to 40.85, 51.83 (%) respectively after accelerated ageing (Table 3.). Similar results were reported by Ravindar and vanga (1990), Narayanaswamy and Reddy (1996) where there is reduction in germination percent by accelerated ageing in all the cultivars. Electrical conductivity of different varieties ranged from 95.00(μS cm^{-1}) to 345.00(μS cm^{-1}).

Significantly higher electrical conductivity was recorded with Kadiri Amaravathi (345 μS cm^{1}) followed by Kadiri-9 (337.50μS cm^{-1}). Least value of electrical conductivity was observed for Kadiri-6 (95 μS cm^{-1}) followed by Narayani (143.75 μS cm^{-1}) were considered to be more vigorous (Table 3.).

In Conclusion, the present study revealed that seeds of groundnut varieties having high germination percentage, speed of germination, root length, shoot length, seedling length, root dry weight, shoot dry weight, seedling dry weight, seedling vigour index-I, seedling vigour index-II and low electrical conductivity were considered more vigorous. Kadiri-6 was found highly vigorous while Kadiri Amaravathi exhibited lower level of vigour.

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