PREDICTION OF FIELD PERFORMANCE OF GROUNDNUT VARIETIES THROUGH DIFFERENT VIGOUR TESTS

ABSTRACT

A field experiment was carried out to predict the field performance of groundnut varieties through different vigour tests during *Rabi*, 2023-24 at S.V. Agricultural College, Tirupati, Acharya N.G. Ranga Agricultural University, Andhra Pradesh. The experimental material consisted of 10 groundnut varieties collected from different sources. In the preliminary experiment seed multiplication was done and the multiplied seed was used for conducting six vigour tests namely Germination test, Speed of germination test, Seedling vigour index-I, Seedling vigour index-II, Accelerated ageing test, Electrical conductivity test and predicting field performance. Significant differences were found among the varieties based on vigour levels. Results with respect to field experiment showed that growth parameters *i.e.* field emergence percentage, days to 50 % flowering, days to maturity, number of branches per plant, number of pods per plant, pod yield per plant, kernel yield per plant, pod yield per plot, plant height, shelling percentage, 100 seed weight, harvest index varied significantly among different varieties based on different vigour levels. This study found that Significant correlation was observed among laboratory and field experiments. Vigorous varieties were able to perform better in terms of some of the field parameters and among all the vigour tests performed speed of germination test had high correlation with field emergence.

Key words : field performance, vigour levels, correlation

INTRODUCTION

Groundnut (*Arachis hypogaea L.*) is an important oilseed crop, belonging to the family Leguminosae. This self -pollinating plant species possesses a specific chromosome count of (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. Its introduction to India occurred in the first half of the sixteenth century. It is grown on approximately 42 million acres worldwide.

China is the world's leading producer of groundnut, followed by India, the United States, and Argentina. India is the largest exporter of groundnut globally. It is the third major oilseed of the world behind soybean and cotton.

Peanut (*Arachis hypogaea* L.), is an important crop economically and nutritionally in many tropical and subtropical areas of the world. It is mainly used for oil production, It's seeds contain 43-55 % (write in words like present) oil, 24-26 % protein, 45-48 % fat, 3 % fiber and 15- 18 % carbohydrates. Hence Groundnut serves as a vital source of food and energy. However, despite its importance, groundnut cultivation faces challenges due to the uncertainty of the pod development, where seeds are developed underground resulting in variations in plant productivity. Before seeds are sown, effective screening of high-quality seeds for planting is crucial to improve the quality of crop yield. Knowing how well seeds will germinate (sprout) and picking seed batches with the best germination rates is an important step towards getting a successful harvest. Field emergence percentage reflects the practical viability of the seeds and their ability to overcome various environmental challenges. It offers farmers crucial information about expected stand establishment and potential yield. Field emergence tests offer a more realistic picture of how seeds will perform in the actual growing environment.

MATERIALS AND METHODS (proper arrange)

The present experiment was conducted at Department of Seed Science and Technology, S.V. Agricultural College, Tirupati. Popular Groundnut varieties Narayani, Dharani, Dheeraj, TCGS-1694, Nithya Haritha released from RARS, Tirupati, Kadiri-9, Kadiri Amaravathi, Kadiri-6, Kadiri-1812 from ARS, Kadiri and Tag-24 from BARC, Trombay were collected and seed multiplication was taken up. The harvested seed was used for predicting field emergence and other yield parameters. Each variety was sown in 4 rows of 5m length at spacing of 22.5cm between the rows and 10cm between the plants in a row in randomized block design. The recommended dose of N, P and K were applied. Full dose of phosphorous and potassium and half dose of nitrogen were applied at the time of sowing while remaining is applied at 30 day safter sowing. Gypsum @ 500 Kg ha^{-1} was applied at initiation of flowering period. Intercultural operations and irrigation schedules were followed as and when necessary. Need based plant protection measures were adopted to raise a healthy crop. Crop was harvested at maturity and yield parameters were recorded.

Field emergence (%)**:** The total seedlings emerged upto 15 days after sowing is considered and emergence percentage was calculated as per the formula.

$$\text{Field Emergence (\%)} = \frac{\text{Number of seedlings emerged}}{\text{Total number of seed sown}} \text{x} 100$$

Plant height was recorded from the randomly selected five plants from base of plant up to the growing tip at the time of harvest and the average height of the plants was expressed in cm. The number of days taken by 50 percent of the population to produce flower was recorded as days to 50% flowering. The number of days taken from the date of sowing to complete physiological maturity in the plot was recorded as days to maturity. Numbers of branches from randomly tagged plants was recorded at harvest The average number of pods per plant were counted manually from randomly selected five plants and expressed as number of pods per plant. Groundnut pods were harvested, stripped, dried and weighed from randomly selected five plants and pod yield per plant is recorded. After shelling kernel yield per plant is weighed and expressed in grams. Pod yield was computed per hectare (kg ha^{-1}) based on area of each net plot. From each plot 100 g of clean pods were taken and shelling percentage is calculated using formula

$$\text{Shelling per cent} = \frac{\text{Kernel Weight (g)}}{\text{Pod Weight (g)}} \text{ X } 100$$

Hundred seeds were counted at random from the harvested produce of each replication, weighed with an electronic weighing balance and recorded as 100 seed weight in grams. Harvest index was calculated by using the formula given by Donald and Hamblin (1976).

$$\text{Harvest Index (HI)} = \frac{\text{Economic yield (kg)}}{\text{Biological yield (kg)}} \text{x} 100$$

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 (1978). Correlation analysis was conducted between laboratory and field emergence.

RESULTS AND DISCUSSION

Higher field emergence percentage (%) was recorded by Kadiri-6 (63.37 %). followed by Tag-24 (62.74 %) which was on par with Narayani (62.36 %) and were considered vigorous. The lowest field emergence (%) was recorded by Kadiri Amaravathi (35.60 %) followed by Kadiri-9 (47.53 %) which had low vigour potential. The results are in agreement with Perry, (1978).

Table 1. Effect of vigour levels on field emergence (%), days to 50% flowering, days to maturity, number of branches per plant of groundnut varieties

(Figures in parenthesis indicates arcsine transformed values)

Varieties	Field emergence (%)	Days to 50 % flowering	Days to maturity	Number of branches per plant
Narayani	62.36 (53.15)	27.67	95.33	5.47
Dharani	60.10 (44.58)	31.33	109.33	6.13
Dheeraj	57.77 (50.46)	32.67	108.67	5.87
Nithya Haritha	59.16 (51.27)	42.67	113.33	6.13
TCGS-1694	54.76 (48.72)	38.67	109.00	5.93
Kadiri-6	63.37 (51.82)	31.67	108.33	5.47
Kadiri-1812	48.01 (44.85)	60.67	128.33	9.73
Kadiri-9	47.53 (53.75)	41.67	118.33	5.53
Kadiri Amaravathi	35.60 (37.63)	63.33	126.67	7.87
Tag-24	62.74 (53.38)	29.33	100.00	6.60
Mean	**55.14 (48.95)**	**39.97**	**111.73**	**6.47**
S.Em. ±	**3.60**	**0.58**	**1.24**	**0.28**
C.D. (0.05)	**11.51**	**1.87**	**3.99**	**0.92**
C.V (%)	**11.31**	**2.54**	**1.93**	**7.72**

Table 2. Effect of vigour levels on number of pods per plant, pod yield per plant, kernel yield per plant, pod yield of groundnut varieties

Varieties	Number of pods per plant	Pod yield per plant (g)	Kernel yield per plant (g)	Pod yield (kg^{-ha})
Narayani	17.93	12.67	8.26	2299.70
Dharani	18.87	22.27	15.13	2729.97
Dheeraj	16.47	18.33	10.66	3367.95
Nithya Haritha	25.13	17.53	14.73	5187.93
TCGS-1694	18.33	24.73	16.80	3189.91
Kadiri-6	16.27	20.87	13.40	2706.23
Kadiri-1812	19.20	20.00	13.80	3991.10
Kadiri 9	20.00	15.53	12.66	4416.42
Kadiri Amaravathi	25.20	27.40	19.13	3406.53
Tag-24	21.93	18.27	11.93	3135.51
Mean	**19.93**	**19.76**	**13.65**	**3443.13**
S.Em. ±	**0.70**	**1.61**	**1.04**	**237.59**
C.D. (0.05)	**2.25**	**5.17**	**3.34**	**705.82**
C.V (%)	**6.11**	**14.18**	**13.27**	**11.95**

Table 3. Effect of vigour levels on plant height, shelling percentage, 100 seed weight, harvest index of groundnut varieties

Varieties	Plant height(cm)	Shelling percentage (%)	100 seed weight(g)	Harvest index (%)
Narayani	27.53	68.53	25.67	36.65
Dharani	25.73	57.84	34.33	42.87
Dheeraj	30.73	68.54	40.00	46.41
Nithya Haritha	19.20	66.38	43.00	67.65
TCGS-1694	24.53	64.91	35.33	48.80
Kadiri-6	24.73	68.89	39.33	41.50
Kadiri-1812	21.60	67.84	35.33	56.29
Kadiri-9	24.33	69.74	41.33	52.30
Kadiri Amaravathi	26.33	69.42	41.33	43.73
Tag-24	14.53	68.05	26.67	53.69
Mean	**23.92**	**67.01**	**36.23**	**48.99**
S.Em. ±	**1.10**	**0.76**	**1.03**	**2.26**
C.D. (0.05)	**3.53**	**2.46**	**3.32**	**7.23**
C.V (%)	**7.99**	**1.98**	**4.96**	**7.99**

Highest number of days to 50 % flowering was recorded by Kadiri Amaravathi (63.33) followed by Kadiri-1812 (60.67). Lowest days to 50% flowering was recorded by Narayani (27.67) followed by Tag-24 (29.33). Number of days to maturity for different varieties ranged from 95.33 to 126.67. Highest was recorded by Kadiri-1812 (128.33) followed by Kadiri Amaravathi (126.67). Lowest days to maturity was recorded by Narayani (95.33) followed by Tag-24 (100.00). the results are in line with Maurya *et al*., (2014). Highest number of branches per plant was recorded by Kadiri-1812 (9.73). Second highest number of branches per plant was recorded by Kadiri Amaravathi (7.87). Lowest number of branches per plant was recorded Narayani (5.47) which is on par with Kadiri-6 (5.47) followed by Kadiri-9 (5.53).

Number of pods per plant for different varieties ranged from 16.27 to 25.20. Highest number of pods per plant was recorded by Kadiri Amaravathi (25.20) followed by Nithya Haritha (25.13). Lowest number of pods per plant was recorded by Kadiri-6 (16.27) followed by Dheeraj (16.47). Findings of Bharathi (2010) support the current study.

Highest pod yield per plant was recorded by Kadiri Amaravathi (27.40g). Second highest pod yield per plant was recorded by TCGS-1694 (24.73g). Lowest pod yield was reported in Narayani (12.67g) followed by Kadiri-9 (15.53g). Highest kernel yield per plant was recorded by Kadiri Amaravathi (19.13g) followed by TCGS-1694 (16.80g). Lowest pod yield was observed in Narayani (8.26g) followed by Dheeraj (10.66g). Highest pod yield was recorded by Nithya Haritha (5187.93 kg ha^{-1}) followed by Kadiri-9 (4416.42 kg ha^{-1}). Lowest pod yield was reported in Narayani (2299.70 kg ha^{-1}) followed by Kadiri-6 (2706.23 kg ha^{-1}).

Highest plant height was recorded by Dheeraj (30.73cm) followed by Narayani (27.53cm). Lowest plant height was recorded by Tag-24 (14.53cm) followed by Nithya Haritha (19.20cm). Highest shelling percentage was recorded by Kadiri-9 (69.74%) and second highest shelling percentage was recorded by Kadiri Amaravathi (69.42%). Lowest shelling percentage was recorded by Dharani (57.84%) followed by TCGS-1694 (64.91%). The reports were in line with Maurya *et al.,* (2006). highest 100 seed weight was recorded by Nithya Haritha (43.00g) and second highest 100 seed weight was recorded by Kadiri-9 (41.33g) which was on par with Kadiri Amaravathi (41.33g). Lowest 100 seed weight was recorded by Narayani (25.67g) followed by Tag-24 (26.67g). highest harvest index was recorded by Nithya Haritha (67.65%) and second highest was recorded by Kadiri-1812 (56.29%). Lowest harvest index was recorded by Narayani (36.65%) followed by Kadiri-6 (41.50%).

	Germination (%)	Root length(cm)	Shoot length(cm)	Seedling length(cm)	Root dry weight (g)	Shoot dry weight(g)	Seedling dry weight (g)	Speed of germination	SVI I	SVI II	EC of seed leachates	Germination (%) after AA	Field emergence (%)

Germination (%)	1	0.979**	0.959**	0.979**	0.602NS	0.797**	0.776**	0.928**	0.992**	0.855**	-0.880**	0.993**	0.732*
Root length (cm)		1	0.964**	0.992**	0.741*	0.872**	0.863**	0.979**	0.991**	0.924**	-0.880**	0.979**	0.717*
Shoot length (cm)			1	0.990**	0.682*	0.879**	0.859**	0.927**	0.982**	0.915**	-0.907**	0.965**	0.686*
Seedling length (cm)				1	0.719*	0.884**	0.869**	0.963**	0.996**	0.928**	-0.901**	0.981**	0.708*
Root dry weight (g)					1	0.882**	0.919**	0.814**	0.684*	0.892**	-0.608NS	0.619NS	0.401NS
Shoot dry weight (g)						1	0.996**	0.889**	0.861**	0.991**	-0.787**	0.812**	0.495NS
Seedling dry weight (g)							1	0.891**	0.844**	0.990**	-0.768**	0.792**	0.487NS
Speed of germination								1	0.951**	0.937**	-0.832**	0.923**	0.745*
SVI I									1	0.910**	-0.900**	0.990**	0.706*
SVI II										1	-0.826**	0.867**	0.559NS
EC of seed leachates											1	-0.866**	-0.565NS
Germination (%) after AA												1	0.685*
Field emergence (%)													1

Table 4. Correlation between laboratory parameters and field emergence

**Correlation is significant at 0.01 level of probability * Correlation significant at 0.05 level of probability

From the correlation studies high level of correlation was found between the laboratory tests and field emergence. highest significant and positive correlation with field emergence was shown by speed of germination (r = 0.745). Germination test exhibited significant and positive correlation of r= 0.732 with field emergence. The results are in

agreement with Krishnappa *et al.* (1999), Sridhar and Nagraja (2004) and Pandita *et al.* (2014). Root length and shoot length exhibited significant positive correlation of 0.717 and 0.686 respectively with field emergence. The results are in line with Vanangamudi (1987). Whereas seedling length had exhibited significant positive correlation of r = 0.708 with field emergence which is in between that of root and shoot length. Among all the laboratory parameters electrical conductivity is nonsignificant and negatively correlated with field emergence of the varieties. similar results were reported by Bishnoi and Delouche (1980), Krishnappa *et al.* (1999), Sridhar and Nagraja (2004). Germination percentage after accelerated ageing significantly and positively correlated with field emergence. Similar findings were reported by Kulik and yaklich (1982) and Noli *et al.* (2008). Root dry weight, shoot dry weight, seedling dry weight and seedling vigour index- II which is the product of germination percent and mean seedling dry weight had shown a non-significant correlation with field emergence.

CONCLUSIONS

There was significant difference among the ten varieties for all the field parameters. Nithya Haritha exhibited best field performance with respect to pod yield per plot, harvest index, 100 seed weight and number of pods per plant followed by Kadiri-9. With reference to days to 50% flowering and maturity, Narayani is earliest followed by Tag-24. Among all the varieties, Dheeraj is tall and Tag-24 is short in stature. Number of branches per plant were highest in Kadiri-1812 and least in Narayani and Kadiri-6. Shelling percentage was highest in Kadiri-9 and least was observed in Dharani.

Correlation studies were conducted between the laboratory parameters and field emergence percentage. Based on the results obtained from the correlation studies, it was found that there was high level of correlation between the laboratory parameters and field emergence. Among all the parameters, speed of germination was highly positively correlated with field emergence percentage.

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