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Studies of different plant geometry on yield and quality of groundnut genotypes drought prone area of Marathwada region

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Abstract
The experiment was conducted during *Kharif* season in the Block B-12 at college farm, Department of Agronomy Vasantrao Naik Marathawada Agricultura University, Parbhani, to study the "Assessment of Groundnut (*Arachis hypogaea* L) Genotypes for plant Geometry during *Kharif* season. The experiment was laid out in factorial RBD with the replications. Total nine treatment combinations consisted of three genotypes (TAG-24, TAG-26, TAG-19) and three plant geometry (30cmx10cm, 30cm x 15cm and 22.5cm x 10cm). All three varieties are released from Trombay. So the name is given Trombay Groundnut (TG) with the help of radiation at Bhabha Atomic Research Centre. The genotypes were tolerant to bud necrosis and jassids. Among more promising to produce higher biomass and pod yield compare to TAG-24 and TG-26 for the cultivation during *kharif* season exposed to various biotic and abiotic stress. The spacing of 30cm x 10 cm was found optimum to produce higher pod yield compared to wider spacing 30cmx 15cmas well as closer spacing 22.5cm x10cm. The oil content was higher in TG-26 i.e. (45.61) over TAG-24 and TG-19. Similarly TAG-24 (44.50) was significantly superior over TG-19(43.39) in producing oil.

Keywords: geometry, yield, quality, groundnut, genotypes, oil content

Introduction
Ground (*Arachis hypogaea* L.) is also known as peanut; it is an important oilseed crop of the tropical and subtropical countries. Oilseed crops have been the backbone of agriculture economy of India from the time immemorial. Among all the oilseed crops, groundnut accounts for more than 40% acreage and 60% production in the country and ranks first place among the oilseed crops in India.

In Marathwada region groundnut is cultivated in *kharif* and summer season. The oil content of kernels varies from 44-50% depending on the varieties and agro-climatic conditions as it is grown in a diverse agro climatic environment characterized by variation in rainfall; temperature, radiation photoperiod and soils of varying moisture retention capacity. The oil content of Kernels varies from 44-51 % depending on the varieties and agro-climatic conditions as it is grown in a diverse agro climatic environment characterized by variation in rainfall, temperature, radiation photoperiod and soils of variation moisture retention capacity. The low production of groundnut is due to the fact that most of the area in India is under rain fed cultivation and exposed to the erratic distribution of rainfall during crop growth. Unavailability of suitable variety for rain fed condition is also another reason coupled with infestation of disease like rust, tikka and bud necrosis.

Choice of proper variety, spacing and optimum dose of fertilizer are some of the important practices for increasing the yield of groundnut. The yield of groundnut is very complicated, quantitative character mainly contributed by two critical factors viz; variety and number of plants per unit area (Kumar and Venatachari, 1971). The newly developed varieties through radiation at Bhaba Atomic Research Center (Trombay) in relation with SAU performed well and produce targeted yield during *rabi* and summer season. These varieties are being popular on cultivars field due to high yield potential, moderate tolerance to pest and diseases and having adjusting nature to climatic variation. These genotypes are Spanish bunch having variation in phonology. In rabi and summer season of Marathwada region these genotypes are performing well and produced potential yield. However, these genotypes potential during kharif season is necessary to evaluate.

Materials and Methods

The experiment was conducted during *kharif* season of 2003 in the block B-12 at college farm, department of Agronomy, Marathwada Agricultural University, Parbhani. Soil samples were taken before sowing from 30cm depth at four random places in the field of experimental area to study the physical chemical properties of soil. The data of soil analysis revealed that the soil was clayey in texture, low in total nitrogen and available phosphorus and fairly rich in available potassium and slightly alkaline (pH 8.3) in reaction. Climate and weather Parbhani is situated at 409 m altitude 190 16'N latitude and 760 47'east longitude in Marathwada division of Maharashtra state and has a semi- arid climate.

Parbhani is grouped under assured monsoon rainfall zone with an average annual precipitation of 905 mm. The total rainfall during the period of investigation in *kharif* season was 648 mm (July to November) and no long dry spell occurred except at 43rd MW. The mean maximum temperature ranged between 29^0C to 33.9^0C. While, mean minimum temperature fluctuated from 16.1 ^{0} C to 23^0 C.

The experiment was laid out in factorial RBD with three replications. Total nine treatment combinations consisted of three genotypes (TAG-24, TG-26, TG-19) and three plant geometry (30 cm X 10 cm, 30cm X 15cm and 22.5cm X 10cm). All three varieties are released from Trombay so the name is given Trombay groundnut (TG) with the help of radiation at Bhabha Atomic Research Centre. The genotypes were tolerant to bud necrosis and jassids. The layout consisted of 27 experimental plots in three replications. Each replication was divided in to 9 experimental units. Each experiment unit was 4.5 m X 4.5m in size. The treatments were randomly allotted to different plots. The field was ploughed 30cm deep in summer and fine tilth was obtained by subsequent harrowing. Layout marking and fertilizer application. The fertilizer dose of 25kg nitrogen/ha was given in the form of urea and 50kg/ha of phosphorous through single super phosphate. The fertilizer was applied along the marked lines 5cm below the soil surface before sowing.

Seed and sowing

The pods of groundnut genotypes under study was shelled at the time of sowing. The kernels were treated with Bavistin @ 2.5 g/kg of seed. Sowing was done by dibbling 30cm X10cm, 30cm X 15cm and 22.5cm X 10cm by keeping seed rate 100 kg per ha. Sowing was done when adequate rainfall occurred. Gap filling was undertaken 10 DAS to maintain optimum plant population or plant stand.

Irrigation

Only two irrigations were given to the crop when dry spell occurred.

Harvesting and drying of pods

After maturity, the crop was harvested by uprooting the plants. The fresh pods from each net plots were weighed and kept in gunny bags and labelled properly and thereafter they were sundried separately for about a week until nearly constant weight were obtained. Plot wise pod yield and haulm yield weighed separately.

Sampling technique

To monitor periodical growth and developmental characters at different stages, five plants were selected randomly from each plot. The same plants were harvested separately for recording individual plant yield at maturity. For dry matter studies one plant at each observation was taken from the gross plot area.

Results

The important findings in the form of summarized data on growth, yield and their attributes analyzed and the critically interpreted results.

Table 1: Number of pegs and pod per plant, shelling percent and hundred kernel weight (g) as influenced by genotypes and plant geometry at harvest.

Varieties	No of pegs /plant	Pod weight /plant (g)	No of /plant	Shelling (%)	100 kernel weight (g)
Genotypes					
V1 : TAG-24	3.96	9.02	18.14	18.14	28.03
V2 : TG-26	3.25	8.07	16.96	16.96	27.09
V3 : TG-19	5.69	11.04	19.89	19.89	32.33
SE+/-	0.29	0.51	0.45	0.45	0.40
CD at 5 %	0.88	1.53	1.35	1.35	1.20
Spacing (cm)					
S1 : 30x10	4.42	9.75	18.39	18.39	29.59
S2 : 30x15	5.05	11.13	19.72	19.72	30.32
S3 : 22.5x10	3.42	7.25	16.88	16.88	27.53
SE+_	0.29	0.51	0.45	0.45	0.40
CD at 5 %	0.88	1.53	1.35	1.35	1.20
Interaction (V x S)					
SE+_	0.51	0.90	0.80	0.80	0.71
CD at 5 %	NS	NS	NS	NS	NS

Number of pegs per plant: Genotypes TG-19 produced significantly more number of pegs than TAG-26. However, genotypes, TAG-24 and TG-26 were at par with each other in respect of pegs per plant. The mean number of pegs per plant was significantly more at 30 cm x 15 cm spacing than 22.5 cm x 10 cm spacing but at par with 30 cm x 10 cm. The interaction effects were not evident.

Number of pods per plant: There was significant difference among the genotypes in bearing total pods per plant. The genotype TG-19 produced significantly more number of total pods than TAG-24 and TG-26 whereas, TAG-24 and TG-26 both genotypes were at par with each other. The plant spacing 30 cm x 15 cm were at par and produced significantly higher number of pods per plant than 22.5 cm x 10 cm spacing. The interaction effect were not observed.

Weight of pods per plant: Among the genotypes TG- 19 gave highest dry pod weight per plant which was significantly more than the genotype TAG-24 and TG-26. However, TAG-

24 and TG-26 at par with each other. The plant spacing 30 cm x 15 cm produced significantly higher dry pod weight per plant than spacing 22.5 cm x 10 cm and at par with the 30 cm x 10 cm spacing. The interaction effect between genotypes and plant geometry did not reach to the level of significance.

Shelling Percentage: The genotype TG-19 gave significantly higher shelling percentage (72.06%) than TAG-24 and TG-26 whereas, TAG-24 (68.24) and TG-26 (67.63) are at par with each other. The wider spacing 30 cm x 15 cm gave significantly higher shelling percentage over the narrow spacing 22.5 cm x 10 cm and at par with 30 cm x 10 cm spacing. The interaction effect between genotypes and spacing was found to be non significant.

100 kernel weights: The genotype TG-19 gave significant highest 100 kernal weight over TAG-24 and TG-26. However, TAG-24 and TG-26 both genotypes were at par with each. The mean hundred kernel was influenced significantly by spacing. The maximum kernel weight was observed at 30 cm x 15 cm which was significantly more than 22.5 cm x 10 cm spacing at par with the 30 cm x 10 cm spacing. Interaction effect for 100 kernel weight was found to be non significant.

Dry pod yield: The dry pod yield was influenced significantly by genotypes. The genotypes TG-19 produced significantly highest dry pod yield (22.36 q/ha) over TAG-24 and TG-26 respectively. However, TAG-24 (18.57 q/ha) and TG-26 (17.29 q / ha were at par with each other. The plant spacing 30cm x 10 cm produced significantly higher dry pod yield (21.20 q/ha) over 30 cm x 15 cm spacing (16.16 q / ha) and at par with the 22.5 cm x 10 cm spacing (20.86 q /ha) which indicate that 30 cm x 10 cm spacing was optimum from the point of view of yield. The interaction effect of genotype and plant geometry under study on dry pod yield was non evident.

Dry Haulm yield: The data on haulm yield revealed that the haulm yield wasinfluenced significantly by genotypes. the genotypes TG-19 produced (31.85 q/ha) significantly higher dry haulm yield over TAG-24 (27.44q/ha) and TG-26 (25.19q/ha). However, TAG-24 and TG-26 at par with each other with respect of haulm yield. The effect of various spacing on haulm yield was found to be significant. The spacing 22.5 cm x 10 cm gave significantly higher haulm yield (30.82 q/ha) over 30 cm x15 cm and 30 cm x 15 cm. However, 30 cm x 10 cm spacing (27.42 q /ha) and 30 cm x 15 cm spacing (26.26 q / ha) were at par with each other. The effect of interaction between genotypes and plant geometry were not observed.

Table 2: Dry pod yield, haulm yield and biological yield (q/ha)and harvest index (%) as influenced by genotypes and plant geometry at harvest.

Treatments	Pod yield (q/ha)	Haulm yield (q/ha)	Biological yield (q/ha)	Harvest index (%)	Oil (%)
Genotypes					
V1 : TAG-24	18.57	27.46	46.03	40.34	44.50
V2 : TG-26	17.29	25.19	42.48	40.70	45.61
V3 : TG-19	22.36	31.85	54.21	41.24	43.39
SE+_	0.78	0.82	1.51	1.56	0.32
CD at 5 %	2.34	2.47	4.54	NS	0.97
Plant Geometry (cm)					
S1 : 30x10	21.20	27.42	48.62	43.60	44.63
S2 : 30x15	16.16	26.26	42.42	38.09	44.32
S3 : 22.5x10	20.86	30.82	51.68	40.36	44.54
SE+_	0.78	0.82	1.51	1.56	0.32
CD at 5 %	2.34	2.47	4.54	NS	NS
Interaction (VxS)					
SE+_	1.39	1.45	2.70	2.75	0.56
CD at 5 %	NS	NS	NS	NS	NS

Biological yield (q/ha): The biological yield was significantly influenced by genotypes. The genotype TG-19 produced significantly higher biological yield (54.21) comp aired with TAG-24 and TG-26.The spacing 22.5 cm x 10 cm produced higher biological yield (51.68q/ha) over 30 cm x 10 cm (48.62q/ha)whereas 30 cm x 10 cm and 30 cm x 15 cm were at par with each other. The interaction effect between genotypes and plant geometry found to be non significant.

Harvest index: The data indicated that harvest index was not significantly influenced by genotypes, plant geometry and their interaction effect.

Oil content: Genotype TG- 26 gave significantly highest oil percentage (45.61%) over TAG -24 and TG-19. Similarly TAG-24 (44.50) was significantly superior over TG-19 (43.39%) in producing oil. The spacing and interaction effects were found to be non-significant.

Discussion

Groundnut genotypes: The yield attributes viz. number of pods, pod weight per plant shelling percentage was higher in TG-19. It may be due to higher number of pegs produced in TAG-19 which bears the more number of pods per plant. The TG-19 more branches, more height, number of leaves which in turn reflected in increased total dry matter. Thus genotype TG-19 has more potential to produced more photosynthetic by harvesting more solar radiation. The LAI was maximum in TG-19. These are responsible to produced more photosynthate, which was in turn translocated towards economic parts of TG-19. With regards to pod yield, haulm yield which was maximum genotype TG-19. The increased in the yield TG-19was 16.95 % higher than TAG-24 and 22.68 % than TG-26. The increased in the yield of TG-19 was mainly attributed more number of pods, pod weight compaired to TAG-24 and TG-26. Thangavelu *et al*. (1982), Hatwar and Mahajan (1992) [9] Lodh (1994 also observed improvement in yield attributes due to genotype having ability to produced the more number of pods, shelling percentage and dry yield. Similarly Bhosale and Andhale (1981) [4], Jagtap and Deokar (1983) [10], Attarde *et al*. (2001) also observed differences in yield attributing character under different genotypes of groundnut. Differences in shelling percentage was evident by genotypes. The genotype TG-19 produced

significantly higher shelling percentage (72.06%). Such varietal difference in shelling percentage were also reported by Tripathi *et al*. (1972) [14]. However, TAG-24 and TG-26 in respect of shelling percentage marginally differed with each other. Groundnut genotype TG-19 produced maximum haulm yield (31.87a/ha, which was higher by 13.91 % and 20.97 % than TAG-24 and Tg-26, respectively. The genotype TG-19 also produced higher biological yield. (54.24q/ha). Which was higher by 18.14%and 21.74% than TAG-24and TG-26, respectively. The higher haulm and biological yield of TG-19compaired to TAG-24 and TG-26 may be attributed to accumulation of more dry matter and higher biomass production. Such type of findings in case of groundnut genotypes was reported by Attarde *et al*. (2001).

Oil percentage was also influenced by genotypes. Groundnut genotype TG-26 produced higher oil percentage (45.61%) than TAG-24 and TG-19due to their genetical potential. Similarly, TAG-24 produced higher oil percentage (44.50%) than TG-19 (43.39%). Chandra *et al*. (1993) [5], Parmeshwari *et al*. (2001) [12] also observed different value of oil percentage in different varieties.

Plant geometry: The wider spacing of 30 cm x 15 cm proved superior in increasing number of pods per plant and pod weight per plant than closer spacing of 22.5 cm x 10 cm. similar types of results reported by the Mozingo *et al*. (1989) that the number of pods per plant decreased with closer spacing. The higher yield of groundnut under spacing 30 cm x 10 cm was associated due to higher and greater formation of total pods at harvest. Higher yield obtained at 30 cm x 10 cm because for plant growth and yield plant occupied optimum and uniform space at 30 cm x10 cm than 30 cm x 15 cm spacing. These results are in line with Ragjavaith *et al* (1995) who reported that 30 cm x 10 cm spacing resulted in significant pod yield over 30 cm x 15 cm Shelling percentage was also influenced by spacing. The wider spacing 30 cm x 15 cm produced the higher shelling percentage than closer spacing 22.5 cm x 15 cm but marginal difference with 30 cm x 10 cm spacing. Similar results were reported by chavan and Karla (1983) [7]. The closer spaing 22.5 cm x 10 cm produced the higher haulm yield (38.82 q/ha) and biological yield (54.21 q/ha) than wider spacing of 30 cm x 15 cm and 30 cm x 10 cm. Increased biological yield in closer spacing may be attributed to higher plant population per unit area. Higher biological yield due to closer spacing was also reported by Chainyara *et al* (2001) [6]. There was no effect of spacing on oil yield in the present investigation, it was also reported by earlier worker Kaushik and Chaubey (2000) [11].

Interaction: The interaction effect between genotype and spacing was absenting most of characters.

Summary and Conclusion

A field investigation entitled "Assessment of groundnut genotype for plant geometry during Kharif season" was carried out at Agricultural college farm. Marathawada Agricultural University Parbhani (MS) during kharif season with an object to find out the suitability of newly released groundnut genotype during kharif season and to find out sutiable plat geometry for these genotypes.

Groundnut genotypes: Result regarding important yield attributes like number of pods /plant pod weight /plant, hundred kernel weight indiceted that groundnut variety TG-19 produced maximum yield attributes than TAG-24 and TG-26.However, there was marginal differences in TAG-24 and TG-26 genotypes. The significantly higher pod yield observed with TG-19, which was 16.95 and 22.68 % higher than TAG-24 and TG-24, respectively. The oil content (%) was higher in TG-26 than TAG-24 and TG-19. However, YG-19 genotype produced lower oil content.

Plant geometry: The yield attributing characters, number of pods per plant, pod weight per plant and shelling percentage were highest at 30 cm x 15 cm spacing compared to closer spacing of 30 cm x10 cm and 22.5 cm x 10 cm. These character were comparable between 30 cm x 10 cm and 22.5 cm x 10 cm spacing. The growth and yield attributes was significantly higher at 30 cm x 15 cm but on accounting of unit area of 1.0 ha. Producing the total population count for yield and due to this the result revealed that the sowing at 30 cm x 10 cm spacing was optimum. The pod yield was significantly higher with 30 cm x 10 cm spacing compared to other spacing. The improvement in yield at 30 cm x 10 cm was 23.78 and 1.61 % higher than 30 cm 15 cm and 22.5 cm x 10 cm, respectively. Increase in the haulm yield at 22.5 cm x 10 cm was 11.04 and 14.8 % more than 30cmx 15 cm and 22.5 cm x 10 cm, respectively. There was no marked difference on oil content among the different spacing.

Interaction: The interaction effect between genotype and spacing was above in most of the character.

Conclusion

1. Among the different groundnut genotype TG-19 was found more promising to produce higher biomass and pod yield compare to TAG-24 and TG- 26 for the cultivation during kharif season exposed to various biotic and abiotic stresses.
2. The spacing of 30 cm x 10 cm was found optimum to produce higher pod yield compared to wider spacing 30 cm x 15 cm as well as closer spacing 22.5cm x 10 cm.
3. The oil content was higher in TG-26 compared to TAG-24 and TG-19.

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