

Original Research Article

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Effect of Seasons and Plant Spacings on Yield and Quality Parameters of Various Groundnut (*Arachis hypogaea* L.) Genotypes

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ABSTRACT

The study was conducted at the Education and Research Farm of the Department of Botany, College of Agriculture, Dapoli, Dist. Ratnagiri, Maharashtra state during the *kharif* and *rabi* 2017-18 and 2018-19 seasons, to study the "Effect of seasons and plant spacings on quality parameters of groundnut (*Arachis hypogaea* L.) genotypes". The experiment was laid out in split plot design replicated three times. The main plot treatment consists of two seasons (*kharif* and *rabi*); however, sub plot treatments consist of eleven groundnut genotypes. The sub- sub plot treatments consist of three plant spacings (D₁: 30 x 20 cm, D₂: 30 x 15 cm and D₃: 30 x 10 cm). Results showed that different treatments had significant influence on quality parameters and yield of groundnut (*Arachis hypogaea* L.) genotypes. The maximum pod yield was recorded in season S₂ (38.71 q/ha). Among the genotypes G₃ (45.41 q/ha) gave highest pod yield q/ha which was significantly more than the rest of genotypes. Closer spacing of 30 x 10 cm is the best spacing in terms of pod yield q/ha (38.09 q/ha) in groundnut genotypes. The quality parameters such as oil and protein content significantly highest was recorded in *kharif* seasons (48.61%) and (22.80%) during both years. Significantly maximum oil content was recorded in genotype G₁₀ (50.39%) and maximum protein content was recorded in G₆ (23.30%). The crop sown with 30 x 20 cm spacing recorded highest protein (22.84%) and oil content (48.77%).

Keywords

Arachis hypogaea,
Plant spacing,
Quality, Genotypes

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Introduction

Groundnut is one of the world's most popular crops cultivated in tropical and sub-tropical regions. Because of its high protein, oil, fatty acid, carbohydrates, vitamins and minerals contents, groundnut has high commercial and nutritional value. It contains 45-55% oil, 20-25% protein, 16-18% carbohydrate and 5% minerals (Gulluoglu, 2011; Gulluoglu, *et al.*,

2016a). Groundnut (*Arachis hypogaea* L.) the king of oilseed crops plays a vital role in the economy of national edible oil.

Groundnut is one of the most important oil and protein producing crops in the world. About two-thirds of total peanut production is crushed for oil and the remaining one-third is used in confectionery products in the world (Dwivedi *et al.*, 1993). Quality of groundnut

seed oil is influenced by temperature and moisture. Yield of any crop is a complex phenomenon, a function of genetic factor as influenced by climate and management. The crop must be given proper management so that better growth can take place. Amongst the management practices, spacing is the most important one for determining yield. It is important to accommodate the most appropriate number of plants per unit area of land to obtain better yield. Among the various factors that influence the yield of peanut, plantation with proper spacing is very important.

Planting density is one of the main factors that play an important role on growth, yield and quality of peanut too (Awal, and Aktar, 2015). Plant populations, cultivar, cultural practice and other environmental factors, interact with each other determine yield and quality. The purpose of this study was to determine, how quality parameters of groundnut are affected by seasons and plant spacings with different genotypes.

Materials and Methods

Experimental site

An experiment was conducted in the Education and Research Farm of the Department of Botany, College of Agriculture, Dapoli, during the *khari* and *rabi* 2017-18 and 2018-19 seasons. Geographically the site is situated in the sub-tropical region on the 17° 45' North latitude and 73° 12' East longitude having elevation of 250 meters above the mean sea level. The average annual precipitation is 3500-4000 mm, which is generally received from June to October. The metrological observations during the period of experimentation were recorded at the metrological observation at the College of Agriculture, Dapoli.

Land preparation and fertilization

The experimental field was first opened by a tractor drawn disc plough and two ploughings were done. After five days the land was further ploughed with a power tiller followed by laddering to get a good tilth. Weeds and stubbles were removed from the field prior to planting of seed. A uniform dose of 30 kg N, 40 kg P₂O₅ and 50 kg K₂O ha⁻¹ was applied through urea, single super phosphate and muriate of potash, respectively to all the plots. The experimental soil is lateritic type having acidic in reaction and medium in available macronutrients. The entire dose of phosphorous, potassium and 20 kg N ha⁻¹ were applied as basal at the time of sowing and remaining 10 kg N ha⁻¹ was applied as top dressing at 30 DAS. Gypsum was applied @ 500 kg ha⁻¹ at 40 days after sowing.

Experimental treatment, design and crop culture

The main plot treatment consists of two seasons viz., S1: *Khari* and S2: *Rabi*. However, sub plot treatments consist of eleven groundnut genotypes viz., G1: RTNG-14, G2: RTNG- 53, G3: RTNG- 27, G4: RHRG- 1308, G5: RHRG- 1435, G6: KDG-160, G7: KDG-187, G8: TKG- Bold, G9: JL-1232, G10: Konkan Bhuratna and G11: KonkanGaurav. The sub- sub plot treatments consist of three plant spacings viz., D1: 30 x 20 cm, D2: 30 x 15 cm and D3: 30 x 10 cm. The experiment was laid out in a split plot design. The seeds were sown in line manually by hand. Three seeds were sown in a place and after seedling emergence one healthy plantlet was kept for continuation of crop growth. Spraying of Monocrotophos @ 1.6 ml liter⁻¹ of water for the control of leafminer at 28 DAS and Chlorpyrifos @ 3.0 ml liter⁻¹ of water for the control of Spodoptera at 47 DAS was carried out. Weeding was done as and when necessary. Statistical analysis of the

data obtained during the course of investigation was carried out by using standard statistical analysis method of analysis of variance and correlation coefficient, as described by Panse and Sukhatme (1985).

Results and Discussion

Pod yield q/ha

The influence of different treatments on pod yield q/ha was statistically significant (Table 1 and Fig. 1). Effect of seasons on pod yield q/ha was found significant, the maximum pod yield was recorded in season S₂(38.71 q/ha). The yield of *Rabi* grown groundnut is significantly highest than *Kharif* grown mainly because of maximum temperature and bright sunshine hours during the flowering phase. Due to longer duration and more sunshine hours, the dry season crop produced more pod yield and total dry matter than the wet season crop (Singh and Joshi, 1993). Vijayakumar *et al.*, (2003) observed that groundnut varieties gives higher yield (q ha⁻¹) in rabi/summer grown groundnut compared to kharif grown.

The increased in the yield of G₃ (RTNG-27) was mainly attributed more number of pods, pod weight compared to remaining genotypes. Hatwar and Mahajan (1992), Chaniyara (2001) also observed improvement in yield attributes due to genotype having ability to produce the more number of pods, shelling percentage and dry yield. Similarly Bhosale and Andhale (1981), Jagtap and Deokar (1983), Attarde *et al.*, (2001) also observed differences in yield attributing character under different genotypes of groundnut. Among the genotypes G₃ (45.41 q/ha) gave highest pod yield q/ha which was significantly more than the rest of genotypes. However, G₁ (43.70 q/ha) at par with each other. The lowest pod yield was recorded in G₁₁ (23.44 q/ha) in

comparison to other genotypes. The differences in number of pods among the genotypes could be attributed to genotypic differences and their response to adverse environmental effects.

The effect of spacing on the pod yield q/ha was found significant (Table 1 and Fig. 1) where the crop grown with 30 x 10 cm (38.09 q/ha) spacing produced the highest yield and lowest yield was obtained from the 30 x 20 cm (28.78 q/ha) spacing. The interaction between Seasons and Genotypes (SXG), seasons and spacings (SXD) as well as genotypes and spacings (GXD) was found significant. This result is in agreement with the results of many researchers (Tavora *et al.*, 2002; Jordan *et al.*, 2005; Gopal *et al.*, 2007, Ramesh and Sambasiva Reddy (2007), and Howlader *et al.*, (2009) who reported that the pod yield of groundnut were significantly greater with closer spacing might be due to the reason that the increased plant population.

Interaction effects of Seasons and Genotypes

The interaction (Table 2) revealed that, treatments S2G3 (51.02 q/ha) shows highest pod yield which was at par with S2G1 (49.42 q/ha) over other treatments. Among the rest of treatments combinations, S2G1 (49.42 q/ha) recorded higher pod yield followed by S2G2 (47.16 q/ha which was statistically at par with each other. The lowest pod yield was recorded in S1G11 treatments combinations (19.84 q/ha).

Interaction effects of Seasons and Spacings

Result in (table 3) indicated that, treatments S2D3 (44.75 q/ha) recorded significantly highest pod yield over other treatments combinations. On the other hand, the lowest pod yield was found in S1D1 (25.64q/ha).

Interaction effects of Genotypes and Spacings

The interaction (Table 4) revealed that, treatments G3D3 (52.32 q/ha) recorded

significantly highest pod yield which was at par with G1D3 (50.26 q/ha) over other treatments. Whereas, the lowest pod yield was recorded in G11D1 (20.72q/ha).

Table.1 Influence of seasons and spacings on yield and quality parameters of different groundnut genotypes (pooled)

Treatments	Pod yield (q/ha ⁻¹)	Protein (%)	Oil (%)
Seasons			
S1 –Kharif	29.01	22.80	48.61
S2 –Rabi	38.71	22.58	48.34
S.E±	0.190	0.007	0.045
C.D at 5%	1.157	0.040	0.272
Genotypes			
G1 –RTNG 14	43.70	22.96	48.14
G2 –RTNG 53	41.40	22.14	50.23
G3 –RTNG 27	45.41	22.21	49.02
G4 –RHRG 1308	33.00	23.28	48.27
G5 –RHRG 1435	27.21	22.36	47.57
G6 –KDG 160	31.20	23.30	48.27
G7 –KDG 187	24.84	23.04	47.40
G8 –TKG Bold	34.70	22.12	48.65
G9 –JL 1232	29.65	22.90	46.35
G10 –KonkanBhuratna	37.90	23.17	50.39
G11 –KonkanGaurav	23.44	22.12	48.94
S.E±	0.645	0.083	0.089
C.D at 5%	1.843	0.239	0.253
Spacings			
D1 -30X20 cm	28.78	22.84	48.77
D2-30X15cm	34.70	22.71	48.46
D3 -30X10 cm	38.09	22.53	48.20
S.E±	0.278	0.036	0.033
C.D at 5%	0.780	0.102	0.093
Interaction effects			
S X G	SIG	NS	NS
S X D	SIG	NS	NS
G X D	SIG	NS	NS
S X G X D	NS	NS	NS
General Mean	33.86	22.69	48.48

Table.2 Interaction effect of seasons and genotypes on pod yield (q/ha⁻¹) at harvest

Seasons	Genotypes											
	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	
S1	37.97	35.65	39.80	28.42	22.37	26.20	20.98	29.73	25.09	33.01	19.84	
S2	49.42	47.16	51.02	37.58	32.05	36.20	28.71	39.66	34.22	42.78	27.03	
SEm±	0.912				C.D. at 5%				2.606			

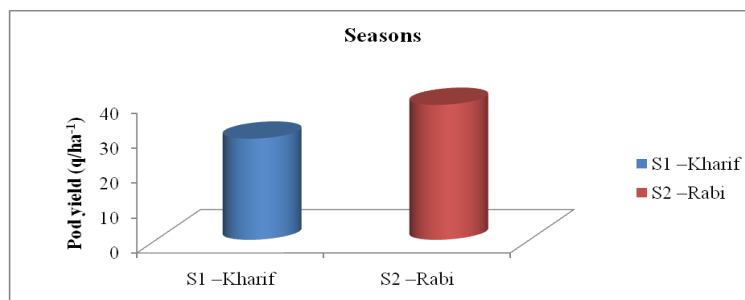
Table.3 Interaction effect of seasons and spacings on pod yield (q/ha-1) at harvest

Seasons	Spacings		
	At harvest		
	D1	D2	D3
S1	25.64	29.94	31.44
S2	31.92	39.47	44.75
SEm±	0.393	C.D. at 5%	1.104

Table.4 Interaction effect of genotypes and spacing on pod yield (q/ha-1) at harvest

Genotypes	Spacings		
	At harvest		
	D1	D2	D3
G1	36.43	44.40	50.26
G2	34.63	42.01	47.57
G3	37.92	45.99	52.32
G4	28.02	34.07	36.92
G5	23.99	28.18	29.45
G6	26.38	32.19	35.02
G7	21.78	25.57	27.19
G8	29.44	35.67	38.99
G9	25.73	30.69	32.54
G10	31.54	38.86	43.29
G11	20.72	24.11	25.47
S.E±	0.921		
C.D at 5%	2.588		

Fig.1 Influence of seasons and spacings on yield of different groundnut genotypes (pooled)



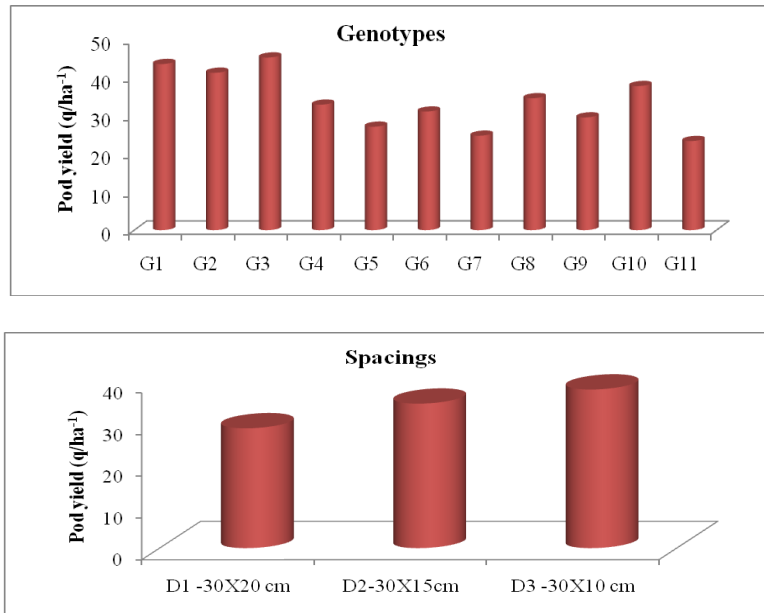
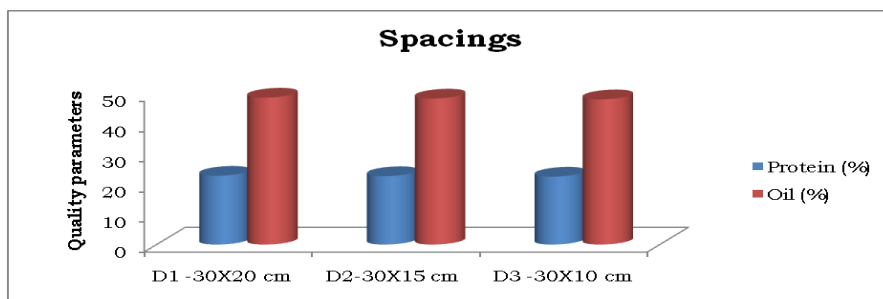
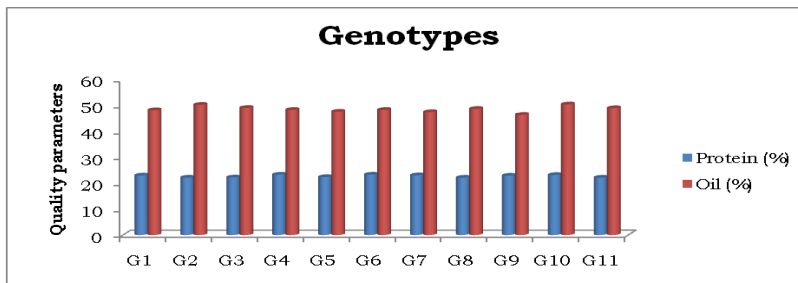
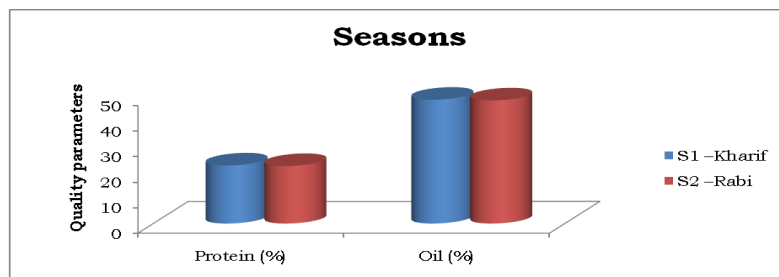


Fig.2 Influence of seasons and spacings on quality parameters of different groundnut genotypes (pooled)



Protein content (%)

Peanut are a good source of protein. The protein content ranges from 22-30% of its total calories, making peanuts are great source of plant-based protein. The most abundant proteins in peanut are arachin and conarachin. Effect of season on protein content was found significant, highest protein content(22.80%) was recorded in kharif seasons (S₁)(Table 1 Fig. 2). The highest protein content was recorded in seasons S₁ (kharif) than S₂ (rabi) season. Hence, for getting higher protein, the kharif groundnut is preferred may be due to effect of temperature. The temperature has been found to play an important in determining the protein contents and high temperature decrease the protein content. These results are in accordance with the findings of (Werner, 1995).The protein content in groundnut kernels varies depending on cultivar, location, season, seed maturity and agronomic practices. Average protein content is higher than that of eggs, dairy products, meat and fish and the digestibility of groundnut protein is very high (Singh and Singh, 1991).

Out of 11 genotypes tested, significantly maximum protein content was recorded in G₆ (23.30%) (KDG-160) which was at par with G₄ (23.28%) (RHRG-1308) and G₁₀ (23.17%) (Konkan Bhuratna) over other genotypes. Whereas, the lowest protein content was recorded in G₁₁ (22.12%) (Konkan-Gaurav) and G₈ (22.12%)(TKG- Bold) over rest of the genotypes. Genotypic difference for protein content was also reported by Borkar and Dharanguttikar (2014).

Crop grown with spacings D₁ (30 X 20 cm)(22.84%) exhibited significantly higher protein content over spacing D₃ (30 X 10 cm)(22.53%). Data indicated highest protein was obtained at wider spacing these results are in conformity with those of El-far and

Ramadan (2000) and Ramesh and Sabale (2001).

Oil content (%)

Groundnut seed contains approximately 50% oil. The nutritional and storage qualities of peanut are determined by its fatty acids composition. According to Andersen and Gorbet (2002) peanut oil contains both saturated and unsaturated fatty acids. The oil content was influenced significantly within seasons. Significantly highest oil content (48.61%)was recorded in kharif seasons (S₁) (Table 1 and Fig. 2). In the present investigation, significantly highest oil content was recorded in seasons S₁ (*kharif*) one might be due to abiotic factors such as rainfall, and other environmental parameters of a native season of seeds, which gave variation in seed quality parameters such as germination, seedling vigour index and seed weight. Similar difference in oil content due to seasons was revealed by Padma *et al.*, (1987), Bagewadi and Pundaleek (2000) and Limbani (2006).

Significant difference was observed among all genotypes for oil content, significantly maximum oil content was recorded in G₁₀ (Konkan Bhuratna) (50.39%) which was at par with G₂ (RTNG-53)(50.23%) over other genotypes. The lowest oil content was recorded in G₉ (JL-1232)(46.35%) in comparison to other genotypes was mainly governed by the genetic makeup of the genotype. Genotypic variation for oil content was also reported by Srinivas Kumar (1992), Appavu (2004), Howlander *et al.*, (2009), Soumya (2011) and Jeyaramraja and Fantahun (2014).

Groundnut sown at widely spaced plant spacings of (30 x 20 cm) had significantly highest growth and quality characters over rest of plant spacings. The maximum and

minimum oil content was obtained with the plant spacing of D₁ (30 X 20 cm) (48.77%) and D₃ (30 X 10 cm) (48.20 %) respectively. And results showed that the higher plant density gave lowest seed oil percentage. While over plant density gave the highest seed oil percentage. These results are in conformity with those of Patel and Patel (1995) and Subrahmaniyan *et al.*, (2010), Bhagavatha (2016) and Dheya and Ahmad (2019).

In conclusion the *rabi* groundnut gives higher yield than that of *kharif* season mainly because of higher photosynthetic rate, stomatal conductance, water use efficiency, net assimilation rate and leaf area index. Out of all the plant density studied, plant spacing 30 X 10 cm performed best with respect to seed yield (q/ha). Irrespective of genotypes and spacings the *kharif* groundnut gives higher protein and oil content than that of *rabi* season. The plant spacing 30 X 20 cm performed best with respect to both quality characters. Protein and oil content was decreased when the plant density was increased. The highest protein and oil content was obtained from 30 x 20 cm and the lowest from 30 x 10 cm planting density according to a two year average (pooled).

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