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INFLUENCE OF VARIETIES AND PLANT DENSITIES ON GROWTH AND YIELD OF GROUNDNUT (*Arachis hypogaea* L.) UNDER IRRIGATED CONDITIONS

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ABSTRACT

A field experiment was conducted at college farm, Agricultural College, Mahanandi, Acharya N.G. Ranga Agricultural University, Andhra Pradesh, India during *rabi* 2012-13 to evaluate the influence of varieties and different plant densities on the growth and yield of groundnut. The treatments consisted of three groundnut varieties *viz,* Kadiri 6, TAG 24 and TCGS 29 and four plant spacings *viz.*, 30 × 10, 22.5 × 10, 30 × 5 and 22.5 × 5 cm. The experiment was laid out in a randomized block design with factorial concept replicated thrice. The experiment revealed that TCGS-29 (Narayani) significantly produced tallest plants over Kadiri 6 and TAG 24. At 30 DAS higher leaf area index and dry matter production (g m^{-2}), was produced by TCGS 29 (Narayani) and it was comparable with Kadiri 6. At 60 DAS Kadiri 6 was produced higher leaf area index and dry matter (g m^{-2}) and at 90 DAS, TAG-24 had produced higher leaf area index and dry matter production (g m^{-2}) which was comparable with Kadiri-6 and TCGS-29 (Narayani) and at harvest higher leaf area index was produced by TCGS-29 (Narayani) and it was comparable with TAG-24. TAG-24 produced highest pod yield (2732 kg ha^{-1}) however which was comparable with Kadiri 6 (2630 kg ha^{-1}) and TCGS-29 (Narayani) (2688 kg ha^{-1}). TCGS-29 produced highest hulm yield (4833 kg ha^{-1}) which was significantly superior over TAG-24 (4441 kg ha^{-1}). Taller plants (48 cm) were produced with a spacing of 22.5 × 10 cm. The spacing of 22.5 × 5 cm was found significantly superior over rest of the treatments in increasing leaf area index (LAI) and dry matter production (g m^{-2}). Significantly highest pod yield was recorded at a spacing of 22.5 × 10 cm and at a spacing of 30 × 5 cm was found to be significantly superior in producing highest hulm yield.

KEYWORDS:

INTRODUCTION

Groundnut is an important food legume and an oil seed in the world and presently grown in about 90 countries over an area of 25 million hectares under different agro climatic regions. India is the second largest producer of groundnut accounting for 38 per cent of the total area (7.7 million ha) and 31per cent production (6.7 million t) of the world (Throat, 2004). The average productivity in India is 977 kg ha^{-1} (Alam, 2002). Groundnut is known for its rich source of vegetable fats, protein and also for its use as cattle feed, fodder and concentrated organic manure. Groundnut kernels contain 42 to 50 per cent oil, 26 per cent protein, 18 per cent carbohydrates and also rich source of riboflavin, thiamine, nicotinic acid and vitamin E. With regard to the consumption pattern, about 10 per cent is used for food purpose, 15 per cent for seed purpose and 75 per cent for oil extraction. Even though groundnut is primarily used for oil extraction; it is also consumed directly because of its high food value (Rajagopal *et al*., 2000). It is commonly called as poor man's nut. Groundnuts for edible purpose require considerable processing and sorting to ensure high quality.

Choice of the variety plays a significant role in groundnut production. Some of the groundnut varieties have shown that low source and sink relationship resulted in the formation of more unfilled pods and lesser seed yield. Plant density is highly associated with yield potential and optimum plant density per unit area is an important non monetary input to decide the maximum groundnut productivity. Yield is a function of inter and intra plant competition and there is a considerable scope for increasing the in yield by adjusting plant population to an optimum level (Hameed Ansari *et al*., 1993). The optimum plant density and planting pattern at one site may not apply at other locations because regional variations in weather and soil. Further, traits are needed for each site to validate general recommendations (Azam Ali *et al*., 1993). Considering all these facts, the present study was undertaken to find out the influence of plant spacing on the growth and yield of different groundnut varieties.

MATERIALS AND METHODS

A field experiment was conducted during *rabi*, 2012 at college farm, Agricultural College, Mahanandi. The soil

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of the experimental site was sandy loam and it was slightly alkaline in reaction with a pH of 7.98, EC of 0.06 dSm ^{1} and low in organic carbon (0.46%) and available nitrogen (266 kg ha^{-1}), medium in available phosphorous (96.6 kg ha^{-1}) and high in available potassium (674.3 kg ha^{-1}). The experiment was laid out in randomized block design with factorial concept and replicated thrice. The treatment consisted of three varieties *viz.,* V_1: Kadiri-6, V_2: TAG-24 and V_3: TCGS-29 and four plant densities *viz.,* D_1: 30 × 10 cm, D_2: 22.5 × 10 cm, D_3: 30 × 5 cm and D_4: 22.5 × 5 cm. Nitrogen, phosphorous and potassium were applied in the form of urea, single super phosphate and muriate of potash. Entire dose of nitrogen (20 kg ha^{-1}) phosphorous (40 kg ha^{-1}) and potassium (50 kg ha^{-1}) were applied as basal at the time of sowing. One inter cultivation followed by two hand weeding in rows was taken at 30 and 45 DAS. All the plots were irrigated uniformly as and when required based on soil moisture content and phenological stages of crop growth. Plant height (cm) was measured from the base of the plant to the tip of the top most leaf at 30, 60, 90 DAS and at harvest. Data on yield attributes, pod and hulm yield were recorded at harvest. Economics was calculated based on present market price of yield and inputs.

RESULTS AND DISCUSSION

Growth parameters

Plant height

Plant height was significantly influenced by the varieties. TCGS-29 (Narayani) significantly recorded tallest plants over Kadiri-6 and TAG-24. Taller plants (48 cm) were produced by a spacing of 22.5 × 10 cm, which was statistically at par with rest of the treatments tried.

Leaf area index and dry matter production

Varietal performance was inconsistent with leaf area index and dry matter production. At harvest higher leaf area index was produced by TCGS-2 and it was comparable with TAG-24. Total dry matter produced in Kadiri-6 was higher at all crop growth stages except at 90 DAS and this was on par with TCGS-29 and significantly higher over TAG- 24. At 90 DAS TAG-24 recorded significantly highest dry matter production over rest of the varieties and this was due to high LAI and more no. of branches compared to TCGS-29 and Kadiri 6.

The spacing of 22.5 × 5 cm was found significantly superior over rest of the treatments in increasing leaf area index (LAI). The increase in LAI with increase in plant population was due to more number of plants per unit area. At harvest, leaf area index was decreased due to decrease in number of green leaves per plant due to senescence. Plant spacing of 22.5 × 5 cm was found to be significantly superior in producing maximum dry matter (g m^{-2}) at all the stages of crop growth.

Number of pods per plant

Among the different varieties tested significantly highest number of pods per plant were obtained with TAG-24 (15.5) followed by Kadiri-6 (12.08) and TCGS-29 (9.33). Higher number of pods in TAG-24 was due to production of more branches per plant which in turn produced more number of flowers and pegs and finally resulted in more number of pods per plant.

The highest number of pods per plant was recorded with a plant density of 4.44 (13.88) lakhs ha^{-1} over the other plant densities 3.33 (13.33) and 6.66 (12.77) lakhs ha^{-1} which were at par with each other.

Number of kernels per pod

The effect of varieties, plant densities and interaction between varieties and plant densities on number of kernels per pod was found to be non significant and this indicates that number of seeds per pod was more of genetically controlled factor and is less influenced by varieties and plant densities. (Konlan *et al.,* 2013, Santo and Gyasi., 2011 and Akpalu *et al.*,2010).

Hundred kernel weight (g)

The effect of varieties, plant densities and interaction between varieties and plant densities on 100 kernel weight of groundnut was found to be non significant and this indicates that 100 kernel weight was more of genetically controlled factor and is less influenced by varieties and plant densities (Kaushik and Chaubey, 2000).

Shelling percentage (%)

Shelling percentage recorded with TAG 24 (73.67) was significantly higher compared to other varieties. Higher shelling percentage recorded by TAG 24 might be due to its varietal character with thin shell development, which might be due to channelization of more photosynthates from pod wall to kernel.

Table 1. Influence of varieties and plant densities on growth parameters of groundnut

Treatment	Plant height (cm)	Leaf area index	Dry matter production (g m^{-2})		
	At harvest	At harvest	30 DAS	60 DAS	90 DAS
Varieties (V)					
Kadiri-6	45	1.47	107	860	1440
TAG-24	36	1.85	86	623	1884
TCGS-29 (Narayani)	53	1.89	110	801	1422
SEm ±	4.0	0.33	11.9	121.1	268.4
C.D (P = 0.05)	6	0.51	18	178	394
Plant densities (D)					
30 cm × 10 cm	43	1.62	62	462	905
22.5 cm × 10 cm	48	1.30	77	679	1234
30 cm × 5 cm	44	1.94	124	726	1617
22.5 cm × 5 cm	42	2.10	140	1178	2571
SEm ±	4.7	0.39	13.8	139.0	309.9
C.D (P = 0.05)	7	0.59	20	205	455
V × D					
SEm ±	8.07	0.69	23.88	242.14	536.74
C.D (P = 0.05)	NS	NS	NS	NS	NS

Table 2. Influence of varieties and plant densities on pod yield and hulm yield (kg ha^{-1}) of groundnut

Treatment	Number of pods $plant^{-1}$	Number of kernels pod^{-1}	100 kernel weight (g)	Shelling percentage (%)	Pod yield (kg ha^{-1})	Haulm yield (kg ha^{-1})
Varieties(V)						
Kadiri-6	12.08	1.87	38.20	71.73	2630	4558
TAG-24	15.50	1.81	37.39	73.67	2732	4441
TCGS-29 (Narayani)	9.33	1.78	37.98	72.08	2688	4833
SEm ±	0.63	0.02	0.24	0.22	196.98	125.23
C.D (P = 0.05)	1.87	NS	NS	0.67	NS	NS
Plant densities(D)						
30 × 10 cm	13.33	1.79	38.00	72.13	2218	4533
22.5 × 10 cm	13.88	1.81	37.86	73.27	3043	4411
30 × 5 cm	12.77	1.85	37.61	72.27	2445	4988
22.5 × 5 cm	11.22	1.83	37.95	72.29	3027	4511
SEm ±	0.73	0.03	0.27	0.26	227.46	144.61
C.D (P = 0.05)	2.16	NS	NS	0.77	667	424
V × D						
SEm ±	1.27	0.06	0.48	0.45	557.07	250.47
C.D (P = 0.05)	NS	NS	NS	NS	NS	NS

Shelling percentage obtained with a plant density of 4.44 (73.27) lakhs ha^{-1} was significantly higher over the other plant densities 8.88 (72.29), 6.66 (72.27) and 3.33 (72.13) lakhs ha^{-1}, which were at par with each other. Similar findings were reported by Hirwe *et al*. (2005)

Pod yield and hulm yield

TAG-24 produced highest pod yield (2732 kg ha^{-1}), which was comparable with kadiri-6 (2630 kg ha^{-1}) and TCGS-29 (Narayani) (2688 kg ha^{-1}). TCGS-29 produced highest hulm yield (4833 kg ha^{-1}), which was significantly superior over TAG-24 (4441 kg ha^{-1}). The highest pod yield was recorded at a spacing of 22.5 × 10 cm, which was significantly superior over 30 × 10 cm and 30 × 5 cm and comparable with 22.5 × 5 cm. plant spacing of 30 × 5 cm was found to be significantly superior in producing highest hulm yield. These findings are in agreement with the results reported by Ramesh and Reddy (2007) and Chainyara *et al*. (2001).

CONCLUSION

The results from the above investigations lead to the conclusion that sowing of TAG-24 at a spacing of 22.5 × 10 cm in *rabi* was more beneficial to get higher yields.

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