Original Research Article

INFLUENCE OF VARYING PLANTING GEOMETRY ON THE GROWTH AND YIELD OF SUMMER GROUNDNUT VARIETIES

ABSTRACT

The field experiment was conducted during Zaid 2023 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P.) to study . The treatments comprised of three types of Groundnut varieties Kadiri-6, TAG-24, Kadiri Amaravathi and three different planting geometry *viz*. 30 cm x 15 cm, 35cm x 15 cm, 45cm x 10 cm, forming total 9 treatment combination each was replicated three times and laid out in randomized block design. The results showed that the significantly higher plant height (37.78cm), higher number of nodules/plant (125.77), higher plant dry weight (22.37 g),maximum number of pods/plant (30.20), maximum number of kernels/pod (1.50), higher seed index (32.20 g), higher seed yield (2.19 t/ha), higher haulm yield (5.20 t/ha), and higher harvest index (35.86%), Shelling percentage (55.97%)was recorded in [Kadiri Amravati+ Spacing (30 cm x 15 cm)]. Similarly, maximum gross return (141650.00 INR/ha), net return (97386.00 INR/ha) and benefit cost ratio (2.20) was also recorded in [Kadiri Amaravathi + Spacing (30 cm x 15 cm)] as compared to other treatments. It is concluded that in Groundnut variety Kadiri Amaravathi along with the spacing (30cmx15cm) (Treatment 7) was observed highest seed yield and B: C ratio.

Key words: *Economics, Growth, Groundnut, Spacing, Varieties, Yield.*

INTRODUCTION

"Groundnut (*Arachis hypogea* L.) is a legume crop commonly known as peanut/earthnut a self-pollinated, annual, and herbaceous crop. Recast Groundnut contains 45% of oil and 26% protein in kernels. Groundnut, King of Vegetable Oil Seeds in India, occupies pre-eminent position in national edible oil economy. Groundnut is originated from Brazil. In India groundnut cultivation is from 6.64 m.

ha area produces 7.00 m.t productivity 1045 kg/ha respectively" (FAO Production Yearbook, (2004). In Uttar Pradesh, it is cultivated in an area of 8.51 mha and its production and productivity are 6.94 mt and 816(kg/ha) respectively. (Fertilizer Association of India, 2006). Groundnut is a major oil seed crop that contains around 45% to 51% high-quality hydrogenated edible oil, dietary proteins (26%) as well as soluble carbohydrates (24.2%) and minerals. It isused not only as edible oil, but also used in manufacturing of hydrogenated vegetable oil, soaps, toilet requisites and for culinary purpose at well. The groundnut also high in vitamins such as A, B_1, B_2, and E and the cake is rich in protein (46%) content, hence make it a good for poultry andanimal feed. (Patil *et al.,* 2007).

"Variety is the most important factor in groundnut production. Use of high yielding varieties has been increased remarkably in recent years and the country has reached almost a level of sufficiency in groundnut. Optimum plant population with unit area per hectare for a given variety at specific situation not only reduce the cost of cultivation but also augment to the full yield potential of the cultivar" (Dileep *et al*., 2021). kadiri-6 varieties' crop duration is 100-105 DAS in (kharif) 110-115 DAS in (rabi). Its average yield in is 20-25 q/ha in (kharif) and 40-45 q/ha in (rabi). The Oil percentage is 48% and shelling is 74%. The kadiri-6 is a early maturing variety, high yielding, spanish bunch, attractive kernel and synchronous maturity. (salma *et al.*, 2023) TAG-24 is the high yielding, Spanish bunchy type variety of ground nut. This variety is of 100-105days duration which gives pod yield of 1311 kg/ha, oil percentage of 45.5%This variety is tolerant to bud necrosis and jassids. Kadiri Amaravathi, crop duration is 115-120 DAS in (kharif) while 120-125 DAS in (rabi). Its average yield in is 20-25 q/ha (kharif) and 40-45 q/ha in (rabi). The oil percentage is 50% and shelling is 70%. Kadiri Amaravathi is high yielding, medium duration, Spanish bunch with attractive pods like kadiri-6. Resistant to sucking pests like thrips, hoppers, mite and life eating insects, Spodoptera and helicoverpa**.** (P.P.Reddy 2023).

"The cost-effective technologies for utilization of natural resources such as optimum row spacing, precise nutrient and irrigation management, timely weed management etc, are the important agronomic techniques for enhancing and stabilizing the yield of any crop. Considering the above facts, plant density is one of the important factors which play a vital role in enhancing the production and productivity of groundnut.

Plant density (plant spacing) is an efficient management tool for maximizing grain yield by increasing capture of solar radiation within the canopy thereby increasing land use efficiency" (Gadade *et al.,* 2018**)**. "If early weeding is done well and recommendation crop spacing is followed, then the weeds that come up later are smothered due to thevigorous growth of the crop". [23] "Plant density (Plant spacing) is an efficient management tool for maximizing grain yield thought enhancement in in the of solar radiation capture by the canopy, thereby increasing land use efficiency. The plant population is often determined by the various attributes which are largely under grower control and one of the major aspects of crop ecology, production and management which often limit crop production, improper crop density is maintain" (Yeswanth and Debarma 2022). In order to increase the yield and to gain more profits we need to adopt cultivation certain developed varieties. We adopt some plant geometry for growing crops so that plant can grow freely without any competition and will give more yield by utilizing the resources provided. So to know which varieties exhibits better growth parameters and higher yield at different plant geometry in Prayagraj conditions my field trail on 'Response of summer Groundnut varieties as influenced by plant geometry on growth and yield of ground nut (Arachis hypogea. L)

MATERIAL AND METHOD

The experiment was carried out at the Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology, and Sciences Prayagraj, (U.P) during *Zaid* season of 2023. The soil of the experimental field constituting a part of central Gangetic alluvial is neutral (PH 7.2) and deep. The soil was sandy loam in texture with, high in organic carbon (0.941%) and low in available nitrogen (225kg/ha), high in phosphorous(43.5kg/ha) and medium in potassium(253.4kg/ha). The treatments consist of three different varieties viz, kadiri-6, TAG-24, kadiri Amaravati with the combination of different row spacing of 30cmx15cm, 35cmx15cm, 45cmx10cm, the experiment was laid out in Randomized Block Design (RBD) with total 27 plots and size of each plot 9 m^2 with 9 treatments each replicated thrice. The treatment combinations are T_1 [(Kadiri -6 + Spacing (30 cm x 15cm)] ,T_2 [(Kadiri-6 + Spacing (35 cm × 15 cm)] ,T_3 [(Kadiri -6 +

Spacing(45cm×10cm)],T_4[(TAG-24+spacing(30cmx15cm)],T_5[(TAG-24+spacin(35cmx15cm)] T_6 [TAG-24+spacing (45cmx10cm)], T_7 [(Kadiri Amaravati + Spacing (30 cm x 15cm)], T_8 [(Kadiri Amaravati + Spacing (35 cm x 15cm)],T_9 [(Kadiri Amaravati + Spacing (45 cm x 10cm)].Urea, SSP, and MOP were chosen as the source for N, P, and K respectively. The growth parameters such as, plant height(cm), dry weight(g), no/nodules (No), Crop growth rate(g/m/day), Relative growth rate (g/g/day), and yield attributes no.of pods /plant,no.of kernels/pod,sed Index (g),kernal yield (t/ha),halum yield (t/ha)harvest Index (%),shelling (%). The parameters were calculated and analysed using the statistical tool of ANOVA Analysis of variance for randomized block desingn (Gomez and Gomez 1984).

RESULT AND DISCUSSION

A. GROWTH PARAMETERS

1.plant height(cm)

The significantly and higher plant height(37.78cm) was observed in the Kadiri Amaravathi variety with the spacing 30cm x 15 cm, However, treatment 8[(Kadiri Amaravathi + Spacing (35 cm x 15 cm)] (35.66) and treatment 1[(Kadiri - 6 +Spacing 30cm x 15 cm] (35.80) which was found statistically at par with treatment 7 [(Kadiri Amaravathi + Spacing (30 cm x 15 cm)]. which might be due to wider space between plants in a row gave the opportunity for all the resources to be available readily to the individual plants such as nutrients, light, space, moisture and thus resulting in higher growth rate of the plant. Similarly, results were also reported by Ngala *et al*. (2013) while Kadiri Amaravathi has fast growing and bushy habit. Further, the differential behavior among the varieties depends on their genetic makeup and prevailing weather conditions (Kathirvelan and Kalaiselvan 2006).

2. Number of nodules/plants

The significant and higher number of nodules/plants (125.77) was observed in the Kadiri Amaravathi variety with the spacing (30 cm x 15 cm)

However, treatment 8 [(Kadiri Amaravathi + Spacing (35 cm x 15 cm)] (49.89) were found statistically at par with treatment 7 [(Kadiri Amaravathi + Spacing (30 cm x 15cm)].

3. Plant dry weight (g/plant)

A significant and higher plant dry weight (22.37) was observed with the spacing (30cm x 15 cm) However, treatment 6 [(TAG -24+ Spacing (45 cm x 10 cm)] (20.35) and treatment 1 [(Kadiri -6 + Spacing 30 cm × 15cm] (20.78g) which was found statistically at par with treatment 7[(Kadiri Amaravathi + Spacing (30 cm x 15 cm)]. might be due to the production increased steadily with advancing growth stages and reached the maximum at harvest results in higher dry weight of the plant. Similar results were also reported by Varshitha (2022). Highest dry weight was observed in Kadiri Amaravathi, this might be due to production of a greater number of branches plant and increased assimilation of nutrients which increased the leaf biomass compared to other varieties (Vaseem Akram *et.al.,* 2021)

B. YIELD ATTRIBUTES

1.Number of Pods/plants

The significantly highest number of pods/plant (30.20) was recorded in the treatment 7 [Kadiri Amaravathi + Spacing (30 cm x 15 cm)]. However, treatment 2[Kadiri-6 + Spacing 35 cm × 15 cm)] (27.73), treatment 1[Kadiri - 6 +Spacing 30cm x 15 cm)] (28.06) and treatment 8[Kadiri Amaravathi +Spacing 30cm x 15 cm)] (28.26) were found to be statistically at par with treatment 7 [Kadiri Amaravathi + Spacing (30 cm x 15cm)].These results due to the sufficient space between rows which encouraged moreplants and also less in inter competition for space, light, nutrient and moisture. Similarly,results were also reported by Chandrasekaran (2007). .....Highest pods/plant was observed in the variety kadiri amaravathi due to the variation in the number of pods per plant observed was highly attributed to the genetic character of the groundnut varieties. Similar results were reported by, Gabisa *et al*. 2017

2. Number of kernels/pods

The Significantly and higher number of kernels/pod (1.50) was recorded in the treatment 7 [Kadiri Amaravathi + Spacing (30 cm x 15 cm)]. However, the treatment 8 [Kadiri Amaravathi + Spacing (30cm x 15 cm)] (1.38), and treatment 1[Kadiri - 6 +Spacing 30cm x 15 cm)] (1.42) were statistically at par with treatment 7 [Kadiri Amaravathi+ Spacing (30 cm x 15 cm)]. This might be due to wider spacing plants have more space to grow vigorously and produced lengthy pods, which contained more seeds. Similar results were also agreed by Shaukat *et al.* (2012) and Idris *et al.* (2008).

3.Seed Index (g):

The significantly highest seed index (33.20 g) was recorded in the treatment 7 [Kadiri Amaravathi + Spacing (30 cm x 15 cm)]. However, the treatment 2[Kadiri-6 + Spacing 35 cm × 15 cm)],(30.46).and treatment 9 [Kadiri Amaravathi + Spacing 45 cm x 10 cm)],(30.46). were found to be statistically at par with the treatment7 [Kadiri Amaravathi + Spacing (30 cm x 15 cm)]. “The maximum seed index was observed with the 30 cm x 15 cm spacing. Might be due to wider spacings provides more soil space for growth and development due to less plant competition both in above and below the ground biomass resulted better proliferation and higher canopy development which finally results in higher nutrients up take, seed filings and more seed weight”. [23] Similar results were also reported by Singh *et al.* (2021).

4.**Kernal yield (t/ha)**

The significantly highest seed yield (2.91 t/ha) was recorded in the treatment 7 [Kadiri Amaravathi + Spacing (30 cm x 15 cm)]. However, treatment 1 [Kadiri Amaravathi + Spacing 45 cm x 10 cm)] (2.50), was found to be statistically at par with treatment 7 [Kadiri Amaravathi+ Spacing (30 cm x 15 cm)]. This might be due to the better availability of growth resources like water, nutrients. air, better cultural practices and effective weed control in wider plant geometry were aided the plants to exhibit their maximum yield full potential and produced higher yield. Similar findings were also agreed by Meena *et al.* (2011).

5.Haulm yield (t/ha)

Higher haulm yield (5.20 t/ha) was recorded in the treatment 7 [Kadiri Amaravathi+ Spacing (30 cm x 15 cm)]. However, treatment 8[Kadiri Amaravathi

+ Spacing 35 cm x 15 cm)], (4.93) was statistically at par with treatment 7 [Kadiri Amaravathi+ Spacing (30 cm x 15 cm)]. This might be due to optimum how is it optimum row spacing have effectively utilized the growth resources, particularly solar radiation. Similar results were also agreed by Bhairappavar *et al.* (2005) and Murade *et al.* (2014)**.** The highest haulm yield was obtained with Kadiri Amaravathi, which was significantly higher than rest of the varieties tried, due to increased vegetative growth in terms of plant height, leaf area index and dry matter production resulting in increased haulm yield. Bhagavata Priya *et al.* (2019) Among the varieties Kadiri Amaravathi resulted in significantly highest haulm yield.

6.Harvest Index (%)

The significantly harvest index (35.86%) was recorded in treatment 7 [Kadiri Amaravathi +Spacing (30 cm × 15 cm)]. However, treatment 4 [TAG-24 + Spacing 30 cm x 15 cm)],(33.59)was found to be statistically at par with treatment 7 [Kadiri Amaravathi +Spacing (30 cm × 15 cm)].

7. **Shelling Percentage (%)**

Significantly highest Shelling Percentage (%) (55.97%) was recorded in treatment 7 [Kadiri Amaravathi +Spacing (30cm×15cm. However, treatment 4 [TAG-24 + Spacing 30 cm 15 cm)], (50.59) was found to be statistically at par with treatment 7 [Kadiri Amaravathi +Spacing (30 cm×15 cm)]. Significantly the highest shelling percentage (55.97%) was recorded with Kadiri Amaravathi variety. The reason is that the difference between the varieties for the shelling percent originated from their genetic background. Similar results were reported by Rakesh ***et al***. (2010).

C. ECONOMICS.

The maximum gross return (141650.00 INR/ha), net return (97386.00 INR/ha) and highest benefit cost ratio (2.20) was recorded in treatment-7 [Kadiri Amaravathi +Spacing (30 cm × 15 cm)].

CONCLUSION

Based on the findings of this study, It is concluded that in Groundnut variety Kadiri Amaravathi along with the spacing (30cmx15cm) was observed highest

seed yield and B: C ratio.

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Table 1 Response of summer Groundnut varieties as influenced by plant geometry.

S.No.	Treatments combinations	At 80 DAS		At 60 DAS	At 40-60 DAS	
		Plant Height (cm)	PlantDry weight (g)	No. of Nodules/plant	CGR ($g/m^2/day$)	RGR (g/g/day)
1	Kadiri - 6 +Spacing 30cm x 15 cm	35.80	20.78	114.66	6.47	0.023
2.	Kadiri-6 + Spacing 35 cm × 15 cm	34.28	18.26	111.00	4.33	0.022
3.	Kadiri -6 + Spacing 45 cm × 10cm	36.10	18.41	112.88	5.92	0.023
4.	TAG-24 + Spacing 30 cm x 15 cm	34.67	21.43	112.33	4.27	0.016
5.	TAG-24 + Spacing 35 cm x 15 cm	34.08	19.46	115.00	6.06	0.026
6.	TAG-24 + Spacing 45 cm x 10 cm	33.48	20.35	108.55	7.02	0.027
7.	Kadiri Amaravathi+ Spacing 30 cm x 15cm	37.78	22.37	125.77	7.06	0.024
8.	Kadiri Amaravathi + Spacing 35 cm x 15cm	35.66	19.5	120.44	4.97	0.022
9.	Kadiri Amaravahti + Spacing 45 cm x 10 cm	34.44	21.46	115.44	7.27	0.026
	SEm(±)	0.78	0.72	3.01	0.65	0.0025
	CD (P=0.05)	2.36	2.18	9.05	1.95	_

Table 2 Response of summer Groundnut varieties as influenced by plant geometry.

Treatment combinations	Pods/ plant	Kernels/pods	Seed Index (g)	Seed yield (t/ha)	Halum yield (t/ha)	Harvest index (%)	Shelling (%)
1. Kadiri - 6 +Spacing 30 cmx 15 cm	28.06	1.42	29.10	2.50	5.16	32.40	48.18
2. Kadiri-6 + Spacing 35 cm × 15 cm	27.73	1.25	30.46	2.05	4.43	31.76	46.77
3. Kadiri -6 + Spacing 45 cm × 10cm	26.80	1.20	28.70	2.10	4.30	32.84	48.93
4. TAG-24 + Spacing 30 cm x 15 cm	27.00	1.30	31.07	2.21	4.36	33.59	50.59
5. TAG-24 + Spacing 35 cm x 15 cm	26.46	1.25	30.36	2.03	4.43	31.44	45.93
6. TAG-24 + Spacing 45 cm x 10 cm	24.33	1.26	30.43	2.17	4.53	32.38	47.90
7. Kadiri Amaravathi+ Spacing 30 cm x 15 cm	30.20	1.50	32.20	2.91	5.20	35.86	55.97
8. Kadiri Amaravathi + Spacing 35 cm x 15 cm	28.26	1.38	30.27	2.36	4.93	32.44	48.05
9. Kadiri Amaravathi + Spacing 45 cm x 10 cm	26.80	1.32	30.46	2.46	4.43	35.75	55.66
SEm±	0.97	0.050	0.622	0.141	0.186	0.99	2.15
CD (p = 0.05)	2.91	0.150	1.865	0.422	0.560	2.97	6.46

Table 3 Response of summer Groundnut varieties as influenced by plant geometry.

S.No	Treatment combinations	Cost of cultivation (INR/ha)	Gross return (INR/ha)	Net return (INR/ha)	B:C
1.	Kadiri - 6 +Spacing 30cm x 15 cm	44264.00	122833.33	78569.33	1.78
2.	Kadiri-6 + Spacing 35 cm × 15 cm	43164.00	101116.67	57952.67	1.34
3.	Kadiri -6 + Spacing 45 cm × 10cm	44264.00	103100.00	58836.00	1.33
4.	TAG-24 + Spacing 30 cm x 15 cm	44264.00	108183.33	63919.33	1.44
5.	TAG-24 + Spacing 35 cm x 15 cm	43164.00	100366.67	57202.67	1.33
6.	TAG-24 + Spacing 45 cm x 10 cm	44264.00	106866.67	62602.67	1.41
7.	Kadiri Amaravathi+ Spacing 30 cm x 15cm	44264.00	141650.00	97386.00	2.20
8.	Kadiri Amaravathi + Spacing 35 cm x 15cm	43164.00	116366.67	73202.67	1.70
9.	Kadiri Amaravathi + Spacing 45 cm x 10 cm	44264.00	119866.67	75602.67	1.71