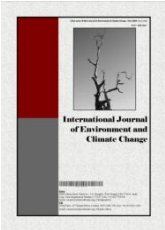

International Journal of Environment and Climate Change

12(8): 65-71, 2022; Article no.IJECC.85795
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Role of Nitrogen and Spacing on Growth and Yield of Summer Groundnut (*Arachis hypogaea* L.)

Nangunoori Ajay Kumar [a*], Rajesh Singh [a≡] and Ekta Singh [aφ]

[a] *Department of Agronomy, NAI, SHUATS, Prayagraj, Uttar Pradesh, India.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2022/v12i830723

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/85795

Original Research Article

Received 24 January 2022
Accepted 05 April 2022
Published 07 April 2022

ABSTRACT

The effect of nitrogen and spacing on summer groundnut traits like growth and yield was studied through an experiment performed in 2021 KVK Farm of SHUATS,Prayagraj (U.P) The experiment had 9 different treatments, replicated thrice in a Randomized control design. The treatments encompassed three different levels of nitrogen soil application and three different plant spacings. The outcome of the study revealed that in treatment (T_3) the grouping of 30 kg/ha nitrogen + 20 cm × 10 cm spacing resulted in maximum plant height (52.27cm) and in treatment (T_6) the usage of 30 kg/ha nitrogen + 25 cm × 10 cm layout resulted in a significant root nodules per plant (39.57) and dry weight (38.00 g). Treatment (T_2) showed a maximum crop growth rate (31.44 g/m^2/day) in the combination of 25 kg/ha nitrogen + 20 cm × 10 cm arrangement and 20-40 DAS interval. Furthermore, treatment (T_6) had a maximum pods per plant (30.80), seed capitulate (2355.6 kg/ha), and haulm yield (3402.3 kg/ha) with 30 kg/ha nitrogen + 25 cm × 10 cm while treatment (T_1) obtained maximum harvest index (42.32%) with the use of 20 kg/ha nitrogen + 20 cm × 10 cm.

Keywords: Groundnut; nitrogen; spacing; summer; yield; and yield attributes.

[#] *M.Sc. Scholar;*
[≡] *Assistant Professor;*
[φ] *Ph.D. Scholar;*
**Corresponding author: E-mail: ucc.ajaynangunoori@gmail.com;*

1. INTRODUCTION

Groundnut (*Arachis hypogea* L.) is an herbaceous crop of Leguminosae family. The plant has central stem upright with many branches which are different from prostate to almost erect based on the variety. Groundnut, also known as "The king of oilseeds". In India, it is produced mostly as oilseed crop, covers an area of 40-50% and gives a production of 60 to 70%. It is first major oil seed crop among all the other oil seed harvests. In India, it covers an area of 85 lakh hectares and produced 84 lakh tones from southern states (Andhra Pradesh, Tamil Nadu, Karnataka), from western and central parts (Gujarat, Maharashtra, Madhya Pradesh), from northern states (Uttar Pradesh, Rajasthan), north western part of the subcontinent i.e., Punjab and from eastern India (Orissa). However, the maximum yield and area of 84% is covered by southern and western regions.

Nitrogen is a significantly important element present in plants. It is included in chlorophyll, nucleotides, proteins, alkaloids, enzymes, hormones and vitamins [1]. It enhances rate of photosynthesis, helps with synthesis of metabolites and its transportation to the seeds. The effect of nitrogen fertiliser addition on soil natural matter status and soil significant characteristics is crucial for agricultural management and crop yield growth [2,3]. N fertiliser also affects dry matter production, as well as N collection and distribution to various parts of yield plants for development, advancement, and other purposes [4]. The deficiency of nitrogen causes restricted growth, and chlorotic leaves. The deficiency of N restricts protein and chlorophyll synthesis which results in pre-mature flowering and limiting the growth cycle. The standing pattern of a plant is responsible for many important factors required for the crop production like light, water, nutrients, and weeds. Apart from this, crop canopy is another factor that helps in intercepting quantity of radiation and gives better yield. The distance between the row is important, as wider distance makes radiation unconsumed and lesser distance makes the crop plants packed and shaded [3,5].

However, thin spacing lower the production of the crop plants because of the competitiveness of the crop plants for nutrients and moisture [6]. Likewise, the row alignment too influences photosynthetic competence and canopy temperature for a better light interception and greater photosynthetic efficiency, a sustained and uniform orientation as well as crop distribution is needed [7] Proper application of spacing along with suitable nutrients will help in attaining maximum productivity within India. All these points are the basis of the present study which was laid out in Zaid 2021.

Table 1.

S.No	Treatment	Treatment Grouping
1.	T1	20 kg/ha Nitrogen + 20 cm × 10 cm
2.	T2	25 kg/ha Nitrogen + 20 cm × 10 cm
3.	T3	30 kg/ha Nitrogen + 20 cm × 10 cm
4.	T4	20 kg/ha Nitrogen + 25 cm × 10 cm
5.	T5	25 kg/ha Nitrogen + 25 cm × 10 cm
6.	T6	30 kg/ha Nitrogen + 25 cm × 10 cm
7.	T7	20 kg/ha Nitrogen + 30 cm × 10 cm
8.	T8	25 kg/ha Nitrogen + 30 cm × 10 cm
9.	T9	30 kg/ha Nitrogen + 30 cm × 10 cm

2. MATERIALS AND METHODS

The present study was guided and carried out at the KVK farm, SHAUTS, Prayagraj (U.P.) during the Zaid 2021 which is situated at 25o 40'42" north latitude, 81o 85'56" east longitude, and 98 metres above mean sea level (MSL).The investigational field was composed of neutral and deep soil from central Gangetic alluvium. The soil texture was sandy loam and nearly nonaligned in soil effect with pH 7.3. It had little organic carbon (0.57%), accessible N (230kg/ha), obtainable P (32.10kg/ha) and available K (235kg/ha). The combination included three different level of N applications and spacings. The experiment was having 9 varied treatments imitated thrice and carried in randomized block design in Table 1. : T1 : N 20 kg/ha + 20 cm × 10 cm, T2 : N 25kg/ha + 20 cm× 10cm, T3 : N 30 kg/ha + 20 cm × 10cm, T4 : N 20kg/ha + 25cm × 10cm, T5 : N 25 kg/ha + 25 cm× 10 cm, T6 : N 30 kg/ha + 25 cm × 10 cm, T7 : N 20 kg/ha + 30 cm × 10 cm, T8 : N 25 kg/ha + 30 cm× 10cm, T9 : N 30 kg/ha + 30 cm × 10 cm. the fertilizers used for the experiment were carbamide, ssp,and mop. The crop planted was Kadiri-9 on 10th April 2021. and harvested on 22nd July 2021 (104 DAS).

3. RESULTS AND DISCUSSION

3.1 Growth Parameters

The results suggest, treatments significantly effects progress and groundnut harvest. Table 2. shows an increase in height of the groundnut. Increase in plant height with increase in nitrogen level might be due to proper nutrition availability and plant water status which resulted in increase in vegetative growth of the plants reported by Hasan et al. [8]. Application of 30 kg/ha nitrogen + 20 cm × 10 cm spacing in Treatment (T3) give maximum height (52.27cm) which is statistically at par to treatment (T2) height (51.83cm) with usage of 25 kg/ha nitrogen + 20 cm × 10 cm spacing. Similar outcomes were recorded by other researchers Meena *et al.* [7] and Parameshwara reddy et al. [9]. Significantly higher dry weight (38.00 g/plant) and root nodules/plant (39.57) were observed in treatment (T6) having 30 kg/ha nitrogen + 25 cm × 10 cm spacing which is accurately concurrent with the appliance of 25 kg/ha nitrogen + 25 cm × 10 cm (37.93 g/plant) and 20 kg/ha nitrogen + 25 cm ×10 cm (37.09 g/plant). Treatment (T6) reports higher root nodules with the usage of 30 kg/ha nitrogen + 25 cm × 10 cm layout which is accurately significantly with the application of 25 kg/ha nitrogen + 25 cm × 10 cm (38.73). Treatment (T2) have significantly higher crop growth rate (31.44 g/m2/day) from 20-40 DAS interval with the application of 25 kg/ha nitrogen + 25 cm × 10 cm, which is accurately at par with the application of (T1) 20 kg/ha nitrogen + 20 cm × 10 cm (29.79 g/m2/day), (T3) 30 kg/ha nitrogen + 20 cm × 10 cm (30.83 g/m^2/day), (T4) 20 kg/ha nitrogen + 25 cm × 10 cm (28.93 g/m2/day) and (T6) 30 kg/ha nitrogen + 25 cm × 10 cm (28.77 g/m2/day). This might be due to lesser competition amongst plants for space, light and nutrition as well and competition increased simultaneously at closer geometry as evident from data of nutrient concentration in planta. Comparable outcome were revealed by Sree et al. [10].

3.2 Yield Parameters

The data reported in Table 3. depicts maximum pods per plant (30.80) in treatment (T6) with the usage of 30 kg/ha nitrogen + 25 cm × 10 cm layout. These results were statistically in parallel with the 25 kg/ha nitrogen + 25 cm × 10 cm (30.53) in treatment (T_5) and 20 kg/ha nitrogen + 25 cm × 10 cm (30.56) treatment (T4). However, no significant difference was observed within the treatment for seed index (100 seed). Treatment (T_6) had a higher seed yield (2355.6 kg/ha) and haulm yield (3402.3 kg/ha) with the application of 30 kg/ha nitrogen + 25 cm × 10 cm spacing. Treatment (T5) 25 kg/ha nitrogen + 25 cm × 10 cm and (T4) 20 kg/ha nitrogen + 25 cm × 10 cm were recorded statistically comparable with treatment (T6) 30 kg/ha nitrogen + 25 cm × 10 cm in both seed yield and haulm yield. All these results report a positive effect of nitrogen on various parameters involved in growth of the crop plant. Parallel findings were described by Sree et al. [10]. The maximum harvest index (42.32%) was detected in treatment (T1) 20 kg/ha nitrogen + 20 cm × 10 cm, which is statistically comparable with application of 20 kg/ha nitrogen + 30 cm × 10 cm (41.89). This might be attributed to early expansion of seed produce in highly dense plant by enhancing growth factors, once the reproductive phase starts, the leads to harvestable crops while other climatic conditions are optimal. Comparable results are stated by Gawas et al. [11]. The optimum planting rate of Groundnut diminishes intra plant competition through juvenility, increases the produce of the plant, ground cover, and light seizure, and leads to maximum dry matter and yield [12]. This might be accredited to additional resources at the optimal plant density initiated more leaf the optimum plant density initiated more plant height, number of root nodules, rate of crop growth, quantity of pods per plant.

Table 2. Nitrogen and spacing influence on growth parameters of groundnut

Treatment	Plant height (cm) at harvest	Dry weight (g/plant) at harvest	Root nodulesat harvest	CGR (g/m^2/day) 20-40 DAS	RGR (g/g/day) 20-40 DAS
T1	50.80	34.09	33.20	29.79	0.099
T2	51.83	33.63	32.93	31.44	0.104
T3	52.27	34.75	34.60	30.83	0.098
T4	49.10	37.09	38.17	28.93	0.103
T5	49.20	37.97	38.73	28.33	0.106
T6	50.03	38.00	39.57	28.77	0.101

Treatment	Plant height (cm) at harvest	Dry weight (g/plant) at harvest	Root nodulesat harvest	CGR (g/m^2/day) 20-40 DAS	RGR (g/g/day) 20-40 DAS
T7	47.37	34.15	35.33	21.84	0.102
T8	47.03	34.35	35.57	22.62	0.110
T9	48.00	35.36	37.03	22.58	0.103
SEm (±)	0.32	0.45	0.35	0.97	0.001
CD (5%)	0.97	1.34	1.06	2.91	-

Table 3. Nitrogen and spacing effect on yield and yield parameters of groundnut.

Treatment	Numberof pods/plants	Seed index (g)	Seed yield (kg/ha)	Haulm yield (kg/ha)	Shelling percentage (%)	Harvest Index (%)
T1	24.33	36.66	2050.3	2748.2	67.10	42.32
T2	25.36	37.26	2131.0	3011.1	67.00	41.25
T3	25.56	37.10	2164.0	3095.2	67.36	41.14
T4	30.56	37.63	2328.1	3373.6	68.93	40.82
T5	30.53	37.03	2353.6	3380.3	68.73	41.04
T6	30.80	37.50	2355.6	3402.3	68.11	40.91
T7	28.33	37.26	2087.3	3172.3	67.93	41.89
T8	28.60	37.93	2118.0	3225.4	67.66	41.17
T9	28.76	37.43	2121.2	3351.6	68.78	40.60
SEm (±)	**0.23**	**0.58**	**20.03**	**13.81**	**0.48**	**0.23**
CD (5%)	**0.70**	**-**	**60.04**	**41.4**	**-**	**0.68**

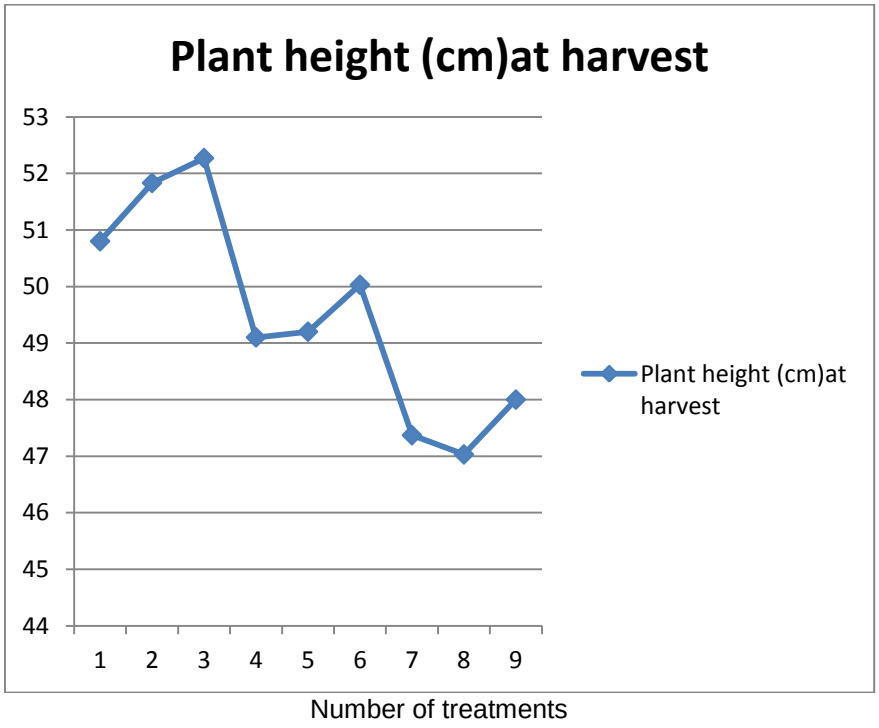

Fig. 1. Graph relates about plant height

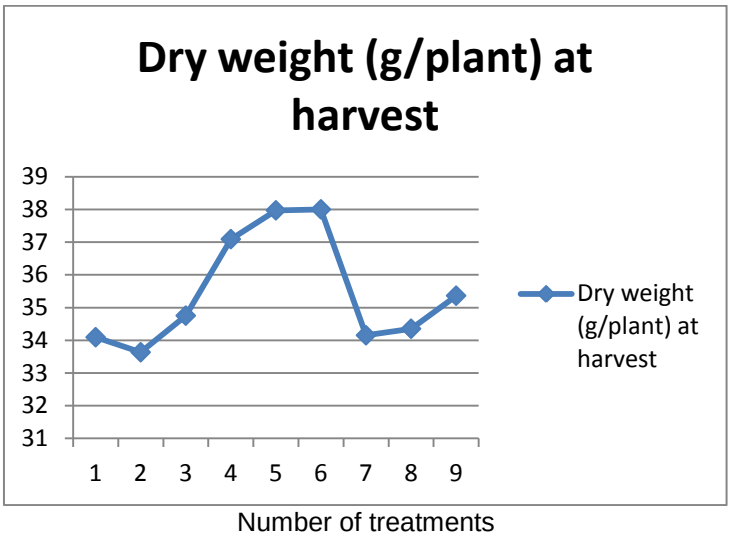

Fig. 2. Graph relates about plant dry weight

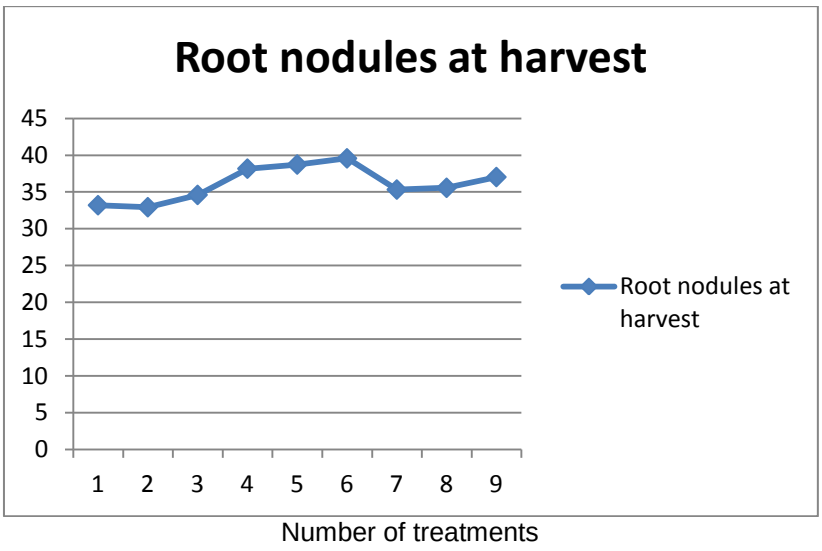

Fig. 3. Graph relates about number of root nodules

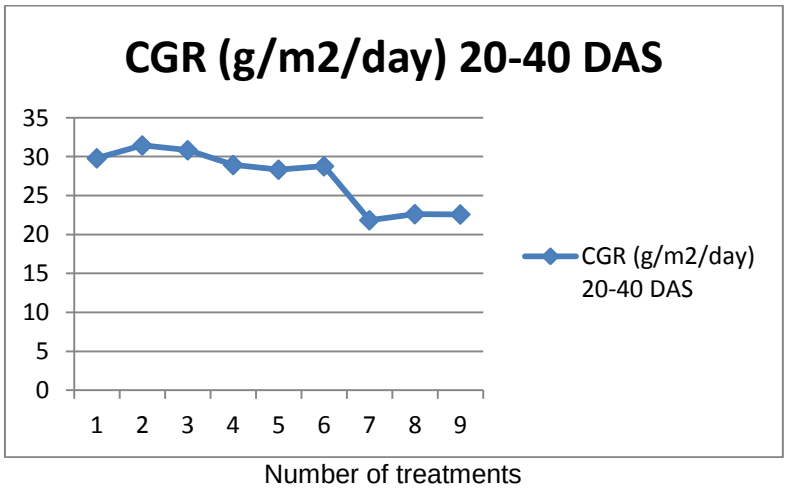

Fig. 4. Graph relates about CGR

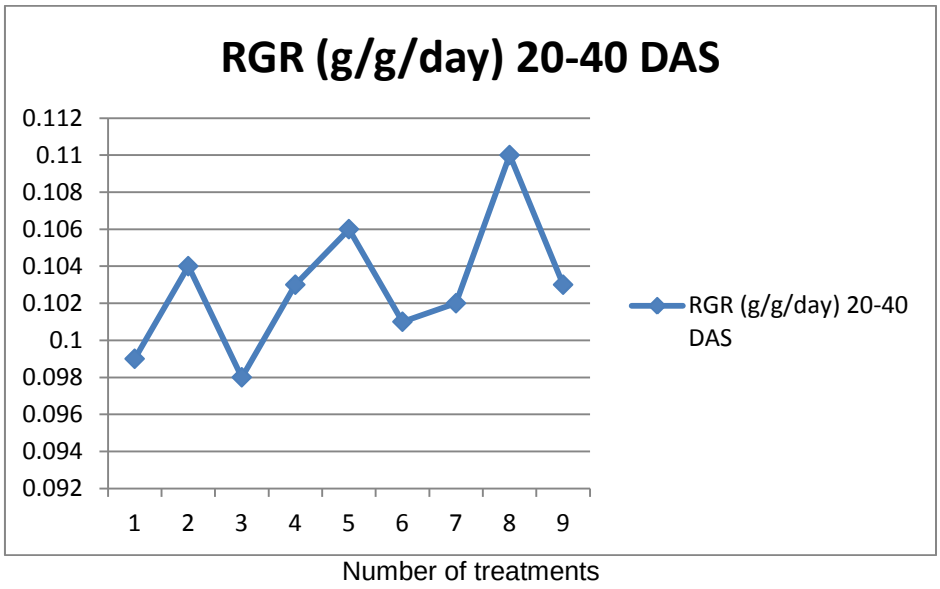

Fig. 5. Graph relates about RGR

4. CONCLUSION

According to the findings of the study, treatment (T6) produced the highest seed yield (2355.62 kg/ha) and haulm yield (3402.3 kg/ha) as a result of the application of 30 kg/ha nitrogen and 25 cm x 10 cm spacing. The results of the investigation are dependent on a single season; therefore, further investigation is required for confirmation.

ACKNOWLEDGEMENT

I acknowledge Dr. RAJESH SINGH, my advisor for helping me in preparing and improving this manuscript. Further, I am thankful to the faculty members of the Department of Agronomy, SHUATS, Prayagraj, Uttar Pradesh (U.P), India, for their support during this research

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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