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Growth, Yield and Economics of Groundnut (*Arachis hypogaea* L.) Cultivars as Affected by Levels of Nitrogen

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ABSTRACT

A field experiment was carried out during *rabi*, 2020-2021 on sandy loam soil at Agricultural College Farm, Bapatla, Guntur, Andhra Pradesh to study the growth, yield and economics of groundnut (*Arachis hypogaea* L.) cultivars as affected by levels of nitrogen. The experiment was laidout in Randomized Block Design with factorial concept in three replications. The treatments consisted of three varieties *viz* V_1: Dharani, V_2: Kadiri lepakshi and V_3: TAG-24 and four nitrogen levels *viz*, 0 kg, 25 kg, 50 kg, and 75 kg N ha^{-1}. The results of the investigation revealed that Kadiri lepakshi (V_2) recorded the highest drymatter accumulation (kg ha^{-1}), more number of branches $plant^{-1}$, higher pod yield, kernel yield and haulm yield while dharani (V_1) recorded the highest plant height. Gross returns, Net returns and B:C ratio were recorded maximum with the cultivar kadiri lepakshi (V_2). Among the levels of nitrogen application, application of 75 kg N ha^{-1} (N_4) recorded the highest growth parameters, yield parameters and economic parameters.

Keywords: *Drymatter accumulation, Economics, Groundnut cultivars, Haulm yield, Nitrogen levels, Plant height and Pod yield,*

Groundnut (*Arachis hypogaea* L.) being one of the most important cash crops of the world and referred to as poor man's almond as well as "king of oilseeds" is also a major oilseed crop of India. Groundnut is not only an oilseed crop but also a member of leguminacea family (Venkata Lakshmi *et al.*, 2019) India is the second largest producer of groundnut after China since it accounts for 34.5% of the world's groundnut area with 27.3 % production with a total area of 4.9 Mha producing 9.25 Mt. India has an average productivity of 1893 kg ha^{-1} (Ministry of Agriculture and Farmers welfare www.ap.gov.in 2017-2018). Among the different states of India, Gujarat with 41.35% of total production is the lead producer followed by Rajasthan (13.76%), Andhra Pradesh (12.28%) Tamil Nadu (10.55 %) and Karnataka (5.14%). Andhra Pradesh occupies an area of 0.73 M ha producing 1.04 Mt with a productivity of 1426 kg ha^{-1} (www.indiastat.com 2017- 2018).

Oilseeds being energy rich crops demand increased quantity of nutrients for the manifestation of their production potentiality. With the evolution of new generation groundnut varieties of varied maturity exhibiting response to additionally added nitrogen, its judicious management besides determining the favourable requirement has become necessary. Further when nitrogen applied in ammonical form to the soil induces acidification in the rhizosphere with reduced pH resulting in higher root proliferation (Mandakranta Chakraborthy 2019). Hence, optimisation of mineral nutrition is the key component to stabilize groundnut production and recommendation of a nutrient response cultivar with

adequate fertilizer application to help and standardize the nutrient requirement for ostentation of yield feasibility has been a long felt need in the sandy loam soils of the region. To find out the optimum dose of nitrogen for different cultivars the investigation was carried out to study the effect of cultivars and levels of nitrogen on performance of groundnut.

MATERIAL AND METHODS

A field experiment was conducted on Groundnut cv. Kadiri-Lepakshi, Dharani and TAG-24 at Agricultural College Farm, Bapatla, ANGRAU, Guntur (Andhra Pradesh), India during *rabi* season, 2020.The soil of the experimental site was sandy loam in texture, slightly acidic in pH, (6.7) non-saline in nature, (0.27 dSm^{-1}) low in available nitrogen (180 kg ha^{-1}), medium in organic carbon (0.35) and K_2O (146 kg ha^{-1}) and medium in available P_2O_5 (26.2 kg ha^{-1}). The experiment was laidout in factorial randomized block design with three replications. The treatments comprised combination of three varieties V_1- Dharani, V_2-Kadiri Lepakshi, V_3- TAG-24 and four nitrogen levels N_1- 0 kg N ha^{-1}, N_2- 25 kg N ha^{-1}, N_3- 50 kg N ha^{-1} and N_4- 75 kg N ha^{-1}. Entire phosphorus 40 kg P_2O_5 ha^{-1} and potassium 50 kg K_2O ha^{-1} were uniformly applied as basal dose to all the plots and nitrogen (N_3, N_4: 1/3rd Basal+ 1/3rd @ 20DAS+ 1/3rd @ 40DAS) was applied in split doses. The data on growth parameters, yield parameters and economics was recorded according to standard procedures and subjected to statistical analysis.

RESULTS AND DISCUSSION

Effect on growth parameters

Among the varieties, Dharani (V_1- 14.9 cm) recorded highest plant height at all the stages of plant growth and was found superior to kadiri lepakshi (V_2) and TAG-24 (V_3). At all the stages of observation the plant height increased significantly with the application of nitrogen upto 75 kg N ha^{-1}. Similar results have been reported by Chaudhary *et al.* (2015), Ali and Seyyed (2010). The higher levels of nitrogen assimilation might have accelerated the synthesis of higher chlorophyll and amino acids thus stimulating the cellular activity, responsible for cell division and meristematic growth

The highest number of branches $plant^{-1}$ was recorded with kadiri lepakshi (V_2-6.4) which was statistically at par with TAG -24 (V_3- 5.7). This might be due to inherent characteristic of kadiri lepakshi to produce more number of branches $plant^{-1}$ compared to other varieties. Identical behaviour in respect of number of branches was also reported by Raagavalli *et al*. (2019).

Drymatter accumulation (kg ha^{-1}) was recorded the highest with kadiri lepakshi at all the stages of observation which however displayed statistically comparable behaviour with Dharani (V_1) while the lowest drymatter accrual was registered with TAG-24 (V_3). This might be due to production of more number of branches $plant^{-1}$ and increased assimilation of nutrients which increased the leaf biomass compared to other varieties. Higher drymatter accumulation was associated with the treatment receiving 75kg N ha^{-1} (N_4- 2019.3 kg ha^{-1}) at harvest, which was however on par with the treatment receiving 50 kg N ha^{-1}(N_3). This might be due to addition of more amount of nitrogen fertilizer to the plant increased the vegetative growth thereby increasing drymatter production. The data on growth parameters is presented in (Table 1). Similar result have been reported by Sengupta *et al*. (2016) as well.

Effect on yield parameters

The data on yield of groundnut cultivars as influenced by nitrogen levels is presented in (Table 1). The highest Pod yield was recorded with kadiri lepakshi (V_2-2979.6 kg ha^{-1}), which was however

Table1.Growth and yield parameters of groundnut as affected by varieties and nitrogen levels.

Treatments	Plant height (cm)	Number of branches plant^{-1}	Drymatter accumulation (kg ha^{-1})	Pod yield (kg ha^{-1})	Haulm yield	Kernel yield (kg ha^{-1})	Harvest index
	At harvest	At harvest	At harvest	At harvest	At harvest	At harvest	At harvest
Varieties (V)							
V_1: Dharani	32.9	5.8	7156.2	2413.0	4502.8	1875.4	35.9
V_2: Kadiri Lepakshi	25.9	7.6	7895.9	2979.6	4921.7	2218.0	37.5
V_3: TAG- 24	26.5	6.0	6328.5	2187.8	4152.9	1541.1	32.7
SEm±	1.3	0.2	646.6	196.5	199.0	203.4	2.2
CD (P=0.05)	3.7	0.6	1896.2	576.2	583.8	596.5	NS
Nitrogen levels (N)							
N_1: 0 kg N ha^{-1}	24.7	5.9	5638.8	1992.4	4095.6	1414.7	32.8
N_2: 25 kg N ha^{-1}	26.7	6.3	6862.8	2492.9	4400.3	1859.0	35.8
N_3: 50 kg N ha^{-1}	30.6	6.6	8154.6	2546.3	4536.8	1911.4	35.5
N_4: 75 kg N ha^{-1}	31.7	7.2	9857.6	3075.6	5070.6	2327.7	37.4
SEm±	1.5	0.3	746.6	226.9	229.8	234.8	2.6
CD (P=0.05)	4.3	0.7	2189.5	665.4	674.1	688.8	NS
Interaction (V x N)							
SEm±	2.51	0.43	1293.20	392.90	398.10	406.80	4.42
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS
CV (%)	5.11	5.20	9.53	8.98	9.86	12.50	7.22

Table 2. Cost of cultivation (Rs ha^{-1}), Gross returns (Rs. ha^{-1}), Net returns (Rs. ha^{-1}) and B:C ratio of groundnut as influenced by varieties and nitrogen levels.

Treatments	Cost of Cultivation (Rs. ha^{-1})	Gross Returns (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B:C ratio
Varieties (V)				
V_1- Dharani	44, 266	1,25,476	81,210	1.8
V_2- Kadiri Lepakshi	46, 666	1,54,938	1,08,272	2.3
V_3- TAG- 24	39, 450	1,13,767	74316	1.9
SEm±	-	10217.84	10219.89	0.23
CD (P=0.05)	-	29965.2	NS	NS
Nitrogen levels (N)				
N_1- 0 kg N ha^{-1}	42,930	1,03,607	60,677	1.4
N_2- 25 kg N ha^{-1}	43,600	1,29,630	86,029	2
N_3- 50 kg N ha^{-1}	43,511	1,32,409	88,897	2
N_4- 75 kg N ha^{-1}	43,802	1,59,928	1,16,126	2.6
SEm±	-	11,798.55	11,800.91	0.27
CD (P=0.05)	-	34600.8	34607.7	0.8
Interaction (Vx N)				
SEm±	-	20435.6	20439.7	0.47
CD (P=0.05)	-	NS	NS	NS
CV (%)	-	8.9	13.6	13.4

statistically comparable with dharani (V_1-2413.0 kg ha^{-1}). This might be due to its higher yield potential up to 4200 kg ha^{-1} compared to other varieties. Among the nitrogen levels the highest pod yield was associated with the treatment supplying 75 kg N ha^{-1} (N_4 - 3075.6 kg ha^{-1}), which was however comparable with the treatment receiving 25 kg N ha^{-1} (N_2) as well as 50 kg N ha^{-1} (N_3) respectively. Similar results were reported by Raagavalli *et al*. (2019), Haricharan reddy. *et al*. (2014) and Kamara *et al*. (2011). Further adequate nitrogen fertilization might have stimulated the rate of photosynthesis towards formation of photosynthetic matter, thereby increasing the yield components and finally the pod yield.

Among the groundnut varieties tested kadiri lepakshi registered the highest haulm yield (V_2- 4921.7 kg ha^{-1}), which was distinctly superior to other varieties but was comparable with the cultivar Dharani (V_1 - 4502.8 kg ha^{-1}) (Ramesh and Sambasiva Reddy, 2007) might be due to more drymatter accumulation compared to other varieties. With regard to the nitrogen levels, application of 75 kg N ha^{-1}(N_4) registered the highest haulm yield, which was significantly superior to other treatments, but was statistically similar to the treatment supplied with 50 kg N ha^{-1} and 25 kg N ha^{-1} respectively.

The highest kernel yield was recorded with kadiri lepakshi (V_2 -2218.0 kg ha^{-1}), which was on par with dharani (V_1- 1875.4 kg ha^{-1}). The lowest kernel yield was obtained with TAG-24 (V_3). Among nitrogen levels highest kernel yield was registered with 75 kg N ha^{-1} (N_4-2327.7 kg ha^{-1}) which was on par with the treatment receiving 25 kg N ha^{-1} and 50 kg N ha^{-1} respectively. Harvest index did not differ significantly with either varieties or nitrogen levels.

Economics

The data on cost of cultivation (Rs ha^{-1}), gross returns (Rs ha^{-1}), Net returns (Rs ha^{-1}) and benefit: cost (B: C) ratio influenced by varieties and nitrogen levels is presented in (Table 2).

The highest gross returns realised with kadiri lepakshi (Rs 1,54,938.3/-) was found at par with dharani (1,25,476.0/-). The lowest gross returns was found to associate with cultivar TAG-24 (V_3). With regard to nutrient levels, application of 75 kg N ha^{-1} resulted in highest gross returns of Rs 1,59,928.9/- was comparable with 50 kg N ha^{-1}(Rs 1,32,409.3/-) and 25 kg N ha^{-1} (Rs 1,29,630.2/-) The lowest gross returns was associated with control plot (0 kg N ha^{-1}).

The highest net returns obtained with nitrogen fertilization of 75 kg N ha^{-1} (Rs. 1,16,126.9/-) was found on par with 25 kg N ha^{-1} (86,029.7/-) and 50 kg N ha^{-1} (Rs 88,897.6 /-). The highest net returns found with kadiri lepakshi (V_2) due to maximum productivity besides higher pod yield.

The highest net returns obtained with nitrogen fertilization of 75 kg N ha^{-1} (Rs. 1,16,126.9/-) was found on par with 25 kg N ha^{-1} (86,029.7/-) and 50 kg N ha^{-1} (Rs 88,897.6 /-). The higher net return might be due to higher pod and haulm yields registered under higher nitrogen levels.

Maximum B:C ratio was also recorded with 75 kg N ha^{-1} (2.6) which was on a par with the treatment 25 kg N ha^{-1} and 50 kg N ha^{-1} (2.0). This could be due to manifestation of higher pod and haulm yields fetching higher net returns at increased level of nitrogen. Similar results are found with Chitdeshwari *et al*. (2007).

CONCLUSION

Thus it can be concluded that new generation groundnut cultivars responded positively to higher doses of fertilizer. Kadiri lepakshi exhibited superior performance over Dharani and TAG-24 in terms of growth and yield characteristics. Application of Nitrogen @ 75 kg ha^{-1} displayed distinctly superior

performance of groundnut, but was however found comparable with the treatment receiving 50 kg N ha^{-1} and distinctly superior to 25 kg N ha^{-1} and the treatment receiving no nitrogen application.

Higher gross returns, was exhibited with the cultivar kadiri lepakshi due to higher pod yield compared to other varieties. Despite higher gross returns, net returns and B:C ratio found to be higher with application of 75 kg N ha^{-1}, but was found to be comparable with supply of 50 kg N ha^{-1}.

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