Journal for Research in Applied Sciences and Biotechnology

www.jrasb.com

ISSN: 2583-4053

Volume-3 Issue-2 || March 2024 || PP. 9-12

https://doi.org/10.55544/jrasb.3.2.3

Effects of Nitrogen Application on Growth and Yield of Groundnut (*Arachis hypogaea* L.) in Northeast Agro-Ecology of Afghanistan

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www.jrasb.com || Vol. 3 No. 2 (2024): March Issue

Received: 08-03-2024	**Revised:** 12-03-2024	**Accepted:** 23-03-2024

ABSTRACT

A field experiment Conducted at the farm of Kunduz University during cropping season of 2023 to evaluate Effects of Nitrogen Application on Growth and Yield of Groundnut (*Arachis hypogaea* L.) in northeast of Afghanistan. The field experiment laid out in Randomized Complete Block Design with three replications, the treatments were Nitrogen fertilizer levels *viz*. Control, 15 kg N/ha, 30 kg N/ha and 45 kg N/ha respectively, result of the study revealed the highest Plant Height (32.61cm), Branches/plant (10.05), Leave area index (5.20), Kernel/pod (2.23), Pod weight (24.46), Pods/plant (32.30), 100- seed weight (76.38gr), Pod yield (2.89t/ha), haulm yield (5.53t/ha) and Biological yield (8.42t/ha) were in treatment with application 45 kg N/ha, the minimum growth and yield parameters were in Control plots, it can be concluded nitrogen fertilizer at the rate of 45 kg N/ha is optimum level for enhancing groundnut productivity and profitability in northeast of Afghanistan.

***Keywords*-** Groundnut, Growth, Kunduz, Nitrogen, Northeast, Yield.

I. INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is considered one of the most important leguminous crops cultured in diverse climatic conditions around the country. Among the Asuan countries, India holds the largest acreage (6.7 million ha) followed by China (4.7 million ha), Indonesia, Myanmar, Pakistan and Thailand. More than 25% of the groundnut area harvested in the world is in India followed by 20% in China. In India the important groundnut growing states are Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra, Madhya Pradesh, Uttar Pradesh, and Rajasthan. It provides a major source of edible oil and vegetable protein (Prasad *et al*., 2011). In Afghanistan the important growing provinces are Helmand, Nangarhar and Kunduz (*Hemmat et al., 2023*). Generally, the legumes in the rotation increase the available soil nitrogen because legumes are a large, diverse and agriculturally important family in plant kingdom (*Khaleeq et al., 2023a*). The benefits of the legumes in cereal cropping systems are well established. Legumes are reported to have favorable impact on the soil fertility and help in increasing the yield of succeeding crop (*Khaleeq et al., 2023c*). Legumes have

ISSN: 2583-4053

Volume-3 Issue-2 || March 2024 || PP. 9-12

https://doi.org/10.55544/jrasb.3.2.3

the ability to fix atmospheric nitrogen and convert it to a useable form for plant growth (*Khaleeq et al., 2024a*). Nutrient management in cropping sequence is an important step among the agronomic practices which is responsible for the sustainable production of these crops in long run. Nutrient requirement varies with different crops in the system and, if investigated systematically, may help to regulate the nutrient demands of the succeeding crops in terms of saving in fertilizer and changes in soil fertility. Use of nutrient for agricultural production is an essential factor to increase crop production but continuous use of chemical fertilizers has deleterious effects on soil which in turn cause decline in productivity, low nutrient recovery efficiency and increase in cost of production and environmental pollution (*Nazir et al., 2022; Farkhari et al., 2023; Khaleeq, 2024g).*

Reduction in the use of chemical fertilizer and increased used of organic manures is advisable as, the global environment pollution can be controlled considerably. Application of organic manures may also improve availability of native nutrients in soil as well as the efficiency of applied fertilizers (*Khaleeq et al., 2023b*), stimulate the proliferation of diverse group of soil microorganisms and play an important role in the maintenance of ecological balance of rhizosphere (*Sadiq et al., 2023; Samim et al., 202; Khaleeq et al., 2024h*). High N content helps to improve soil structure, soil microbial activity stabilize the production and productivity of the crops in a cropping system as well as these organic manures are low cost and easily available near this experimental area. Groundnut-wheat is one of the pre-dominant cropping sequences found suitable especially under northeast of Afghanistan conditions however the potential of groundnut-wheat cropping sequence has never been studied in the conditions (*Samim et al., 2023; Khaleeq et al., 2023d*; Ahmadi et al., 2024) Therefore, an attempt has been made to study the effect of different Nitrogen fertilizer levels on yield and yield attributes of groundnut.

II. MATERIALS AND METHODS

An experiment trial was laid out at the farm of Kunduz University located in northeast of Afghanistan during cropping season of 2023 to evaluate effects of Nitrogen fertilizer doses on growth and yield parameters of groundnut, The experiment site is at 367388884, N latitude and 68.869858 E longitudes, an elevation of 356 meter from the sea level. Temperatures during the cropping period was between 17.50oC to 47.3oC, the experiment was in randomized complete block design (RCBD) with three replications, The experiment consist of 4 treatments, viz. Absolute control, 15, 30 and 45 kg N/ha. Groundnut genotype (Spread) was obtained from Agronomy Department of Kunduz University. The net plot size was 3×4 (12 m^2), row and plant to plant spacing were 30 and 15 cm, respectively. The experiment site was ploughed two time with tractor drawn disc plough and harrowing was done by rotivator to achieve optimum soil. Seeds were drilled at the depth of 4 cm. Uniform all agronomic practices, irrigation, hoeing and weeding were carried out while needed, all phosphorus fertilizer applied basal at sowing time 60 kg p_2o_5/ha while nitrogen fertilizer applied according treatments at sowing time, 30 and 60 days after sowing respectively, experiment site was sandy loam, free from salinity, low in phosphorus and nitrogen and medium in potassium content. The organic matter content of the soil was low and textural class varying between sandy loams to loamy sand. The soils had lower Cation-exchange capacity due to coarse texture and low in organic carbon content, All Growth parameters were taken by taking the average of five tagged plants, yield attributes and yields were taken from net plot and recorded using standard procedure. One way ANOVA was used to define treatments effect. Standard errors of mean and LSD (P=0.05) level of significant worked out for each parameter.

III. RESULTS AND DISCUSSIONS

Application of Nitrogen fertilizer levels were significantly affected on groundnut growth parameters depicted on table (1) application of 45 kg N/ha was the performance for growth parameters, the highest plant height (32.61 cm), Branches/plant (10.05), Leave area index (5.20), Kernel/pod (2.23) and Pod weight (24.46 gr/plant) was in treatment with 45 kg N/ha followed by 30 kg N/ha, 15 kg N/ha and Control plots Respectively. Our result supported with the finding of (*Khaleeq et al., 2024c*) who reported nitrogen fertilizer significantly affected on growth parameters, application of 40- 50 kg N/ha was the maximum pant height, branches/plant and dry matter accumulations. (*Khaleeq et al., 2024b*) who reported applying nitrogen fertilizer at rate of 50 kg N/ha increase leave are, Leave area Index, dry matter accumulation and branches/plant of groundnut. Nitrogen Fertilizer was significantly affected on yield components and yield of groundnut on table (2), the maximum pods/plant (32.30), 100- seed weight (2.89 gr), Pod yield (2.89 t/ha), haulm yield (5.53 t/ha) and Biological yield (8.42t/ha) was in treatment with nitrogen application of 45 kg N/ha the yield parameters was in control plots. Our finding is similar with the finding of (*Khaleeq et al., 2023e*) who reported application of nitrogen at the rate of 45 kg N/ha increased pods/plant, seed yield and harvest index of common bean in northeast of Afghanistan (*Sadiq et al., 2023; Khaleeq et al., 2023b*) reported nitrogen fertilizer will significantly increase the yield of common bean in Kunduz province of Afghanistan. Our result is clos with the result of *(Nazir et al., 2022; Khaleeq et al., 2024d; Seerat et al., 2023*) nitrogen fertilizer significantly increased the pod yield/plant, seed yield and 100 seed weight of groundnut.

ISSN: 2583-4053

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https://doi.org/10.55544/jrasb.3.2.3

Table 1: Effect of Nitrogen fertilizer levels on Plant Height (cm), Branches/plant. Leave area index, Kernel/pod and Pod weight (gr/plant)

Treatments	Plant Height (cm)	Branches/plant	Leave area index	Kernel/pod	Pod weight (gr/plant)
Control	27.42b	7.38b	4.14b	1.52c	15.78c
15 kg N/ha	28.27b	8.22bc	4.35b	1.73bc	18.01c
30 kg N/ha	31.41a	8.83b	4.47b	1.84b	21.97b
45 kg N/ha	32.61a	10.05a	5.20a	2.23a	24.46a
SEm±	0.611	0.233	0.129	0.015	1.498
CD (P=0.05)	1.562	0.965	0.719	0.244	2.445

Table 2: Effects of Nitrogen fertilizer on Pods/plant, Shelling %, 100- seed weight (gr), Pod yield t/ha, haulm yield t/ha, and Biological yield t/ha

Treatments	Pods/plant	Shelling %	100- seed weight (gr)	Pod yield t/ha	haulm yield t/ha	Biological yield t/ha
Control	26.58b	64.96	65.40b	1.89d	4.190b	6.08c
15 kg N/ha	26.91b	65.19	65.83b	2.21c	4.370b	6.57c
30 kg N/ha	29.39ab	65.36	70.28b	2.56b	4.753b	7.31b
45 kg N/ha	32.30a	68.45	76.38a	2.89a	5.533a	8.42a
SEm±	4.027	2.715	6.511	0.009	0.149	0.103
CD (P=0.05)	4.010	NS	5.098	0.194	0.771	0.640

IV. CONCLUSION

From the results and discussions it will be concluded application of Nitrogen in groundnut will increase growth, yield components and yield of groundnut, application of 45 kg N/ha is the optimum level for enhancing groundnut productivity and profitability, further research is needed to optimization of nitrogen fertilizer for groundnut production in different part of Afghanistan.

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