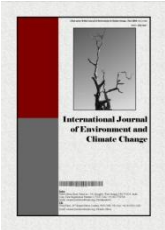

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Impact of Nitrogen and Iron on Growth and Yield Attributes of Chickpea (*Cicer arietinum* L.)

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Authors' contributions

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

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ABSTRACT

Background: Chickpea is leguminous crop, which offers a good nutrition to people across the world. Chickpea ranks second after soybean as the common leguminous crop that people grow and consume across the world. Therefore, its study is significant because chickpea has nutritional and economic importance in the world.
Objectives: Effect of Nitrogen and Iron on growth and yield of Chickpea.
Methods: With the goal of studying the effect of Nitrogen and Iron on growth and yield of chickpea (*Cicer arietinum L*.) var RVG-202 under a Randomized block design with 9 treatments which are replicated thrice. The experimental results revealed that of 25 kg/ha Nitrogen +7.5kg /ha Iron recorded maximum plant height (48.8 cm), number of nodules per plant (23.0), plant dry weight (55.7g/plant), number of pods per plant (61.2), number of seeds per pod (3.5), Seed yield (1919.1 kg/ha), Haulm Yield (3186.6 kg/ha).
Conclusion: 25 kg/ha Nitrogen and 7.5kg /ha Iron determined to be the most beneficial to farmers, resulting in plant height (48.8 cm), dry weight (55.7g/plant), nodules per plant (23.0), number of pods per plant (61.2), number of seeds per pod (3.5), seed yield (1919.1kg/ha) and Haulm yield (3186.6 kg/ha).

Keywords: Chickpea; growth; iron; nitrogen and yield.

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1. INTRODUCTION

Chickpea plays an important role not only in pulses production worldwide but also in sustaining soil productivity by improving its physical, chemical and biological properties and trapping atmospheric nitrogen in their root nodules [1]. India ranks first in area and production of chickpea followed by Australia (5.10%), Pakistan (4.1%) and Turkey (4.1%) [2]. As per 4th advance estimates, it accounts an acreage of 10.17 million hectares contributing 11.35 million tonnes of production with an average productivity of 1,116 kg/ha during 2019-20 in India. Among states, Rajasthan, Madhya Pradesh, Maharashtra, Karnataka, Bihar, Andhra Pradesh, Tamil Nadu and Gujarat are primarily growing states of chickpea. Moreover, it has occupied on 2.46 million hectares with a production of 2.66 million tonnes and productivity of 1,080 kg/ha in Rajasthan [3]. Nitrogen application is more important than the other major important fertilizers/nutrients for successful crop production [4]. This crop is tolerant to drought, can be grown successfully on well drained loamy to sandy loam soils under residual moisture [5].

Nitrogen is required for both vegetative and reproductive growth of a crop. It is primarily applied to agricultural crops through the soil. Foliar nitrogen administration, on the other hand, effectively boosts both vegetative and reproductive growth. Photosynthates are used for root nodule formation and function during early development of grain legumes, but as flowering begins, the developing seeds require higher nitrogen levels.

Iron (Fe) plays an important role in chlorophyll synthesis and act as structural component of hematin and leghaemoglobin involved in the nitrogen fixation in pulses catalysed by an enzyme called “nitrogenase” [6]. Iron plays an important role in respiration, photosynthesis and the production of healthy green leaves. It serves as component of many vital enzymes such as cytochromes of the electron transport chain, and it is thus required for wide range of biological functions [7]. Moreover, iron is the most essential micronutrient for plant growth especially for chickpea grown on saline and alkaline soils [8].

2. MATERIALS AND METHODS

The experiment carried out during *rabi* season of 2021 at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (U.P.). which is located at 25^0 30’ 42’’N latitude, 81^0 60’ 56” E longitude, and a height of 98 metres above sea level. According to Jackson [9], the soil texture of experimental plot was sandy loam, with a practically neutral soil reaction (PH 7.1), having low organic carbon (0.44 percent), low in N (171.48 kg/ha), medium in P (27.0 kg/ha), and high in K (291.2 kg/ha). The crop was sown on 28 November 2021 using variety RVG -202. The experiment was set up in a Randomized Block Design with three replications and nine treatments in total *Viz.,* T_1: 15kg/ha Nitrogen +2.5kg/ha Iron, T_2: 15kg/ha Nitrogen + 5kg/ha Iron, T_3: 15kg/ha Nitrogen +7.5kg/ha Iron, T_4: 20kg/ha Nitrogen +2.5kg /ha Iron, T_5:20kg/ha Nitrogen + 5kg /ha Iron, T_6: 20kg/ha Nitrogen + 7.5kg /ha Iron, T_7: 25kg/ha Nitrogen +2.5kg /ha Iron, T_8: 25kg/ha Nitrogen + 5kg /ha Iron and T_9: 25kg/ha Nitrogen +7.5kg /ha Iron. Recommended dose of fertilizers (P: K) was supplied in the form of single super phosphate (SSP), and muriate of potash (MOP) as a basal dose in all plots, and the treatments (Nitrogen and Iron) were applied in the form of Urea and Ferrous sulphate according to the treatment levels in as basal doses. The growth Parameters were measured at 20, 40, 60,80 days after sowing, as well as at harvest stage, from randomly selected five plants in each treatment. The yield attributes were recorded at harvest from randomly selected plants in each plot. A statistical analysis was performed, and the mean was compared at a 5% probability level of significance [10].

3. RESULTS AND DISSCUSSION

3.1 Plant Height

The maximum plant height was recorded at treatment (9) with application of 25kg/ha Nitrogen + 7.5kg/ha Iron. Whereas no other treatment is statically at per with treatment 9. Higher doses of nitrogen and iron might have reduced the nutrient deficiencies at advanced growth stages and led to the increased cell division, cell elongation, chlorophyll production, photosynthetic rate which may be helpful to increase in plant height [11,12].

3.2 Number of Nodules per Plant

Maximum no of nodules was recorded maximum in treatment 9 with application of 25 kg/ha nitrogen +7.5kg/ha iron. Where as treatment 8 with application of 25 kg/ha nitrogen +5kg/ha iron at par with the

Table 1. Effect of Nitrogen and Iron on growth parameters at harvest in chickpea

S. No.	Treatments	Plant Height (cm)	Number of Nodules per plant	Plant Dry weight (g/plant)
1	15kg/ha Nitrogen +2.5kg/ha Iron	43.0	13.8	48.7
2	15kg/ha Nitrogen +5kg/ha Iron	46.2	17.4	51.2
3	15kg/ha Nitrogen +7.5kg/ha Iron	46.0	17.9	52.9
4	20kg/ha Nitrogen +2.5kg /ha Iron	44.2	15.3	49.3
5	20kg/ha Nitrogen +5kg /ha Iron	47.2	18.6	53.7
6	20kg/ha Nitrogen +7.5kg /ha Iron	47.9	19.7	54.1
7	25 kg/ha Nitrogen +2.5kg /ha Iron	45.1	16.4	50.4
8	25 kg/ha Nitrogen +5kg /ha Iron	48.5	21.7	55.4
9	25 kg/ha Nitrogen +7.5kg /ha Iron	48.8	23.0	55.7
	F test	S	S	S
	SEm (±)	0.41	0.34	0.51
	CD (P=0.05)	1.23	1.03	1.51

Table 2. Effect of Nitrogen and Iron on yield attributes of chickpea

S. No.	Treatments	No. of Pods/plant	No. of Seeds/pod	Seed Index (g)	Seed yield (kg/ha)	Haulm yield (kg/ha)	Harvest index (%)
1	15kg/ha Nitrogen +2.5kg/ha Iron	54.8	2.9	24.2	1312.3	2617.9	33.4
2	15kg/ha Nitrogen +5kg/ha Iron	56.4	3.1	25.0	1465.0	2836.1	34.1
3	15kg/ha Nitrogen +7.5kg/ha Iron	56.7	3.1	25.1	1474.1	2903.2	33.7
4	20kg/ha Nitrogen +2.5kg /ha Iron	55.5	2.9	24.7	1382.9	2684.3	34.0
5	20kg/ha Nitrogen +5kg /ha Iron	57.9	3.2	25.2	1573.7	3022.1	34.2
6	20kg/ha Nitrogen +7.5kg /ha Iron	59.0	3.4	25.4	1815.3	3070.4	37.2
7	25 kg/ha Nitrogen +2.5kg /ha Iron	55.7	3.0	24.8	1402.0	2755.7	33.7
8	25 kg/ha Nitrogen +5kg /ha Iron	60.6	3.4	25.6	1869.0	3148.7	37.2
9	25 kg/ha Nitrogen +7.5kg /ha Iron	61.2	3.5	26.0	1919.1	3186.6	37.6
	F test	S	S	S	S	S	S
	SEm (±)	0.40	0.06	0.20	17.52	34.69	0.33
	CD (P=0.05)	1.20	0.19	0.61	52.52	103.29	1.00

treatment 9 (25 kg/ha nitrogen +7.5kg/ha iron). Increase in nodulation due to application of nitrogen and iron might be attributed to the translocation of enzymes, metabolites and higher nutrient uptake efficiency [13,14].

3.3 Plant Dry Weight

Maximum was with applicaton of 25 kg/ha Nitrogen + 7.5 kg/ha Iron recorded significantly superior plant dry weight (55.7g/plant) over all other treatments, however T8 (25 kg/ha Nitrogen + 5 kg/ha Iron) statistically at par with the treatment no 9 Higher dry matter accumulation may be due to higher photosynthetic rate, translocation of nutrients, formation of regulating enzymes and better availability of nutrients, to crop from early growth stages to advanced reproductive stage [15].

3.4 No of Pods/Plant

Most no of pods/plant per plant was recorded maximum in treatment 9 with application of 25 kg/ha Nitrogen + 7.5 kg/ha Iron. Where as treatment no 8 (25 kg/ha Nitrogen + 5 kg/ha Iron) statistically at par with treatment no 9. This could be attributable to the crop's accelerated nitrogen metabolism and extended moisture retention, especially during the moisture stress stage, which may have aided in bearing a higher number of pods per plant at harvest. [16].

3.5 No of Seeds/Pod

Most no of seeds/pod per plant was recorded maximum in treatment 9 with application of (25 kg/ha Nitrogen + 7.5 kg/ha Iron). Where as treatment no 8 (25 kg/ha Nitrogen + 5 kg/ha Iron) statistically at par with treatment no 9. Application of nitrogen which helps in yield and food supply for plant and increases seeds per pod [17].

3.6 Seed Yield

Seed yield was recorded maximum in treatment 9 with application of (25 kg/ha Nitrogen + 7.5 kg/ha Iron). Where as treatment no 8 (25 kg/ha Nitrogen + 5 kg/ha Iron) statistically at par with treatment no 9. Application of nitrogen improves the growth and development of seed yield through increasing nutrient status in plant and their translocation towards sink. Significant improvement due to nitrogen as observed under present investigation are in close conformity with findings of Bonthala Vineeth (2022) [16].

3.7 Haulm Yield

Haulm yield was recorded highest in treatment 9 with application of (25 kg/ha Nitrogen + 7.5 kg/ha Iron). Whereas treatment no 8 (25 kg/ha Nitrogen + 5 kg/ha Iron) statistically at par with treatment no 9. Increasing the dosage of nitrogen increases chloroplast content so that the food supply for the plant through the green leaves increases so the haulm yield of the crop will increases automatically.so increasing dosage of the nitrogen increases the haulm yield [18].

4. CONCLUSION

The combination of 25 kg/ha nitrogen and 7.5 kg/ha iron proved to be the most advantageous to farmers, resulting in plant height (48.8 cm) no of nodules/plant (23.0), plant dry weight (55.7 gm), no of pods/plant (61.2), no of seeds/pod (3.5), seed yield (1919.1kg/ha), haulm yield (3186.6 kg/ha) respectively.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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