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Effect of Fertility Levels and Foliar Nutrition on Performance of Chickpea (*Cicer arietinum* L.) under South-eastern Rajasthan

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A B S T R A C T

A field experiment was conducted at Agricultural Research station, Ummedganj, Kota, during *rabi* season in 2021-22 to study the effect of fertility levels and foliar nutrition on growth, yield attributes and yields of chickpea, which was laid out in factorial randomized block design with three replications and comprised four fertility levels (control, 75% RDF, 100% RDF, and 125% RDF) and four foliar nutrition (control, NPK 19:19:19 @0.5%, NPK 17:44:00 @0.5% and NPK 00:52:34@ 0.5% at flower initiation and pod development stage). All the treatments were applied to the chickpea variety GNG-1958. The results reveals that among the various fertility levels, application of 125% RDF significantly increased the growth and yield parameters *viz*. plant height (cm), number of branches/plant, dry matter accumulation, number of root nodules, dry weight of root nodules, pods/plant, seed yield, straw yield and quality parameters *viz.* protein content and protein yield over 75% RDF and control but it was found statistically at par with 100% RDF. Similarly, among the foliar nutrition, NPK (19:19:19)@ 0.5% at flower initiation and pod development stage significantly increased the growth, yield and quality parameters *viz*. plant height (cm), number of branches/plant, dry matter accumulation, pods/plant, seed yield, straw yield, protein content and protein yield closely followed by NPK(17:44:00)over NPK(00:52:34) and control.

Introduction

Chickpea is a legume plant that grows in subtropical and temperate regions. It is cultivated mainly on lands under rainfed condition in *rabi* season (Shiyani *et al.*, 2001). India is the major chickpea growing country in the world which accounts for about 76 per cent of the total area and 67 per cent production of the world. During the year 2019-20, in India, the total area employed is about 9.68 million hectares with a total production of 11.08 million tons and average productivity of 1142 kg/ha whereas

in Rajasthan state, the total area is about 2.46 million hectares with the total production of 2.65 million tons and average productivity of 1079 kg/ha (Annual Report, 2020-21).

Chickpea is a good source of protein, carbohydrate, fat, minerals (calcium, phosphorus and iron) and vitamins. It is also useful as an animal feed and has a good forage value (Dinesh *et al.*, 2014).Chickpea seed contain essential amino acids like lysine, leucine, isoleucine, phenylamine and valine (Karim and Fattah, 2006). Like other pulses, supplementation of chickpea with cereal based diets is one of the possible options to mitigate the problems associated with protein energy malnutrition. It is also an important food for people in improving major food-related health problems (Jukanti *et al.*, 2012).

Although chickpea is very important pulse crop in our daily diet and also in agricultural production, its productivity is very low. The reasons behind low productivity of this crop are improper management practices like imbalance use of fertilizers, devoid of weed control, wide range of time of sowing and seed rate, ignorance of pest and disease management and not use of bio-fertilizers, etc. Out of all these mentioned reasons affecting the productivity of this crop, nutrient management is known to be the most important factor.

Foliar nutrition can improve the physiological efficiency including the photosynthetic ability of crops and play a significant role in improving the productivity potential of crop especially chickpea. Foliar application is credited with the advantage of quick and efficient utilization of nutrients, eliminated the losses through leaching and fixation and helps in regulating the uptake of nutrients by plants (Manonmani and Srimathi, 2009). Keeping in view the above mentioned facts, the present experiment was conducted with objective to study the effect of fertility levels and foliar nutrition on growth, yield attributes and yields of chickpea during *rab*i season 2021-2022 at Agricultural Research Station, Kota.

Materials and Methods

A field experiment was conducted at Agricultural Research Station of the Agriculture University, Kota (Rajasthan), during *rabi* seasons 2021-22. Experimental site was situated at 25.13^0 North latitude and 75.25^0 East longitude at an altitude of 271m above mean sea level. The experiment comprised of 4 fertility levels (Control, 75% RDF, 100% RDF and 125% RDF and 4 levels of foliar nutrition (Control, NPK (19:19:19) @ 0.5 %, NPK(17:44:00) @ 0.5% and NPK(00:52:34) @ 0.5%) in sub plots. The experiment was laid out in factorial randomized block design and replicated three times. The soil of the experimental site was clay loam in texture, slightly alkaline in reaction (pH 7.6), medium in available nitrogen (305.20 kg/ha) and phosphorus (22.11 kg/ha), while high in potassium (335.50 kg/ha). fertilizer was applied in soil before chickpea sowing in earmarked strips and subsequently foliar nutrition were sprayed flower initiation and pod development. The chickpea variety "GNG-1958" was used for experimental purpose and sown on 9th December, 2021 sown at 30 cm and 10 cm inter and intra row spacing, respectively by adopting the recommended seed rate of 80 kg/ha. Crop was kept weed free by pre-emergence application of pendimethalin 30 EC + imazethapyr 2 EC at 0.75 kg *a.i./*ha. The plant protection measures were taken up as and when required. In each plot five plants were randomly selected and tagged to record observations on growth and yield attributes. At maturity data on plant height, branches/plant, pods/plant, seeds/pod, seed index, biological yield and seed yield were recorded. All data were subjected to analysis of variance.

Growth

The application of different fertility level influenced growth significantly (Table 1). The minimum plant height, branches/plant, dry matter accumulation, nodules/plant and dry weight of nodules were recorded in plots where the crop was grown without fertilizer application. Significantly plant height,

branches/plant, dry matter accumulation, nodules/plant and dry weight of nodules increased with gradual increase in fertility levels, Hence, the maximum plant height, branches/plant, dry matter accumulation, nodules/plant and dry weight of nodules were recorded for 125% RDF which was statistically at par with the application of 100% RDF. The boosted root and shoot growth parameters due to increased supply of N and P may be because of the fact that application of N and P promotes plant growth by ensuring higher number of branches. The result further shows that phosphorus increased the number of nodules per plant. These results are similar to the findings of Singh (2005) and Choudhary and Yadav (2011).

Application of two times foliar nutrition were significantly improved growth parameters over control (No spray). Foliar nutrition of NPK (19:19:19) at flower initiation and pod development stage significant increase in plant height, branches/plant, dry matter accumulation closely followed by application of NPK(17:44:00) over to NPK(00:52:34). Foliar spray is a well established tool to complete and to enrich plant nutrition. Foliar feeding can provide the nutrients needed for normal developments of crops in cases where absorption of nutrients from the soil is disturbed. As uptake of nutrients through the foliage is considerably faster than through roots, foliar spray is also the method of choice when prompt correction of nutrient deficiencies is required. Maheswari and Khartik, (2017); Mamathashree *et al.,* (2017) and Takankhar *et al.,* (2017) have also reported the similar results.

Yield and yield attributes

Application of fertility levels significantly increased pods/plant, seed and straw yield over control (Table 2). The significantly higher seed and straw yield of chickpea was recorded with the application of 125% RDF closely followed by 100% RDF. Pods/plant, seed and straw yield gradually increased with increase in fertility level. This might be due to improved nutritional environment in the rhizosphere as well as in the plant system leading to enhanced translocation especially of N and P to reproductive structures *viz.* pods/plant. The results corroborate the findings of Kumar *et al.,* (2011). Foliar nutrition of NPK(19:19:19) recorded highest significant result of yield and yield attributes compare to other foliar nutrition. Foliar spray of nutrients is the fastest way to boost up crop growth and yield because nutrients are available to plants in critical stages and the nutrients will reach the site of food synthesis directly leading reduce the requirement of fertilizers. Foliar nutrition is economically superior to any other method of fertilization. These results confirm the findings of Das and Jana (2015) and Jadhav and Kulkarni (2016)

Quality parameters

The protein content and protein yield were significantly influenced by application of varying fertility level and maximum was recorded for 125% RDF witch statistically at par 100% RDF over to 75%RDF and control, further in case of foliar application significantly highest protein content was obtained in NPK(19:19:19). As foliar nutrition has synergistic effect on nitrogen uptake, facilitates protein synthesis and activates different enzymes therefore, protein content increased significantly with foliar nutrition. Similar results have also been reported by Waghmare *et al.,* (2019). Application of 100% RDF (20:40 kg NP/ha) was found significantly superior over 75% RDF and control but at par with 125% RDF with respect to growth parameter *viz.* plant height, DMA, CGR, RGR, number of nodules, nodules weight and branches.

Similar trend was also recorded with yield (kg/ha) and yield attributes. Significantly higher net return (₹/ha) and B:C ratio are obtained with 100% RDF application. Application of two times foliar nutrition were significantly improved growth, yield and economics over control (No spray). Highest significant results obtained with application of NPK (19:19:19) closely followed by NPK (17:44:00) and significant over NPK (00:52:34). Highest significant net return and B:C ratio were fetched with NPK (19:19:19) application.

Table.1 Effect of fertility level and foliar nutrition on growth parameters of chickpea

Treatment	Plant height		Dry matter accumulation		Nodules/plant	Dry weight of nodules	Branches/plant
	At 90 DAS	At harvest	At 90 DAS	At harvest	At 50 DAS	At 50 DAS	At harvest
Fertility level							
Control	50.23	52.93	15.54	19.28	24.25	112.08	3.23
75% RDF	53.48	58.41	17.55	22.36	27.22	123.93	3.73
100% RDF	56.90	62.29	18.91	26.31	29.35	131.50	4.22
125% RDF	58.70	64.53	19.90	28.32	30.58	134.83	4.43
SEm±	1.05	1.23	0.35	0.72	0.71	2.05	0.15
CD at 5%	3.04	3.56	1.01	2.07	2.04	5.93	0.43
Foliar nutrition							
Control	52.15	55.28	16.77	20.92	26.68	123.08	3.40
NPK (19:19:19)	57.33	63.10	18.87	27.29	28.35	123.18	4.33
NPK (17:44:00)	55.68	60.83	18.40	25.31	28.27	127.92	4.03
NPK (00:52:34)	54.15	58.94	17.85	22.74	28.10	128.17	3.85
SEm±	1.05	1.23	0.35	0.72	0.71	2.05	0.15
CD at 5%	3.04	3.56	1.01	2.07	NS	NS	0.43

Table.2 Effect of fertility level and foliar nutrition on yield attributes and yield of chickpea

Treatment	Pods (No./plant)	Seeds (No./Pod)	Seed index (g)	Seed yield	Straw yield
Fertility level					
Control	44.42	1.79	23.22	1548	2708
75% RDF	52.04	1.83	23.36	1882	3288
100%RDF	66.83	1.85	23.60	2202	3821
125% RDF	69.08	1.87	23.75	2324	4020
SEm±	1.92	0.03	0.19	43.68	64.12
CD at 5%	5.55	NS	NS	126.15	185.17
Foliar nutrition					
Control	46.08	1.80	23.36	1841	3220
N:P:K(19:19:19)	66.58	1.87	23.59	2107	3641
N:P:K(17:44:00)	61.25	1.85	23.50	2031	3524
N:P:K(00:52:34)	53.50	1.82	23.49	1986	3453
SEm±	1.92	0.03	0.19	43.68	64.12
CD at 5%	5.55	NS	NS	126.15	185.17

Table.3 Effect of fertility level and foliar nutrition on protein content and protein yield of chickpea

Treatment	Protein content (%)	Protein yield (kg/ha)
Fertility level		
Control	18.71	289
75% RDF	19.32	364
100% RDF	19.86	438
125% RDF	20.22	470
SEm±	0.15	8.59
CD at 5%	0.44	24.81
Foliar nutrition		
Control	18.84	349
NPK (19:19:19)	20.10	424
NPK (17:44:00)	19.72	402
NPK (00:52:34)	19.46	386
SEm±	0.15	8.59
CD at 5%	0.44	24.81

References

Choudhary, G. L. and Yadav, L. R. 2011. Effect of fertility levels and foliar nutrition on cowpea productivity. *Journal of Food Legumes*24(1): 67-68.

Das, S. K. and Jana, K. 2015. Effect of foliar spray of water soluble fertilizer at pre flowering stage on yield of pluses. *Agriculture Science Digest- A Research journal* 35(4): 275-279. https://doi.org/10.18805/asd.v35i4.6858

Dinesh Kumar, Arvadiya, L. K., Kumawat, A. K., Desai, K. L. and Patel, T. U. 2014. Yield, protein content, nutrition content and their uptake in chickpea (*Cicer arietinum* L.) as influence by graded level of fertilizers and biofertilizers. *Trends in Biosciences*7(24): 4229-33.

Jadhav, R. L. and Kulkarni, S. 2016. Effect of foliar spray of nutrients on productivity of greengram (*Vigna radiata*) in North Eastern transitional zone of Karnataka, India, *Legume Research - An International Journal* 39(5) : 817-819 https://doi.org/10.18805/lr.v0iOF.11335.

Jukanti, A. K., Gaur, P. M., Gowda, C. L. L. and Chibbar, R. N. 2012. Nutritional quality and health benefits of chickpea - *A Review. British Journal Nutrition* 108(S1):S11-S26. https://doi.org/10.1017/s0007114512000797

Karim, M. F. and Fattah, Q. A. 2006. Changes in bio components of chickpea *(Cicer arietinum* L.*)* sprayed with potassium napthenate and napthenicacetic acid. *Bangladesh Journal of Botany* 35(1): 39-43

Kumar, J. 2011. Effect of phosphorus and sulphur application on performance of vegetable pea (*Pisum sativum* L.) cv. Pant Matar-2. *Legume Research* 34(4): 292-295

Maheswari, U. M. and Karthik, A. 2017. Effect of foliar nutrition on growth, yield attributes and seed yield of pulse crops. *Advances in Crop Science Technology* 5:278 https://doi.org/10.4172/2329-8863.1000278

Mamathashree, C. M., Patil, M. B. and Shilpa, H. D., 2017. Effect of foliar spray of water soluble fertilizers on total dry matter production (g/plant) nutrient uptake and economics in pigeonpea. *Agric. Update 12 (TECHSEAR-3)*: 725-730. https://doi.org/10.15740/HAS/AU/12.TECHSEAR(3)2017/725-730.

Manonmani, V. and Srimathi, P. 2009. Influence of Mother Crop Nutrition on Seed and Quality

of black gram. *Journal of Madras Agriculture*96: 125-128.

Shiyani, R. L., Joshi, P. K. and Bantilan, M. C. S. 2001. Impacts of chickpea research in Gujarat. *In: International Impact series, No. 9*. ICRISAT, Hyderabad, India.

Singh, P. 2005. Studies on Efficacy of different herbicides for weed control in soybean [*Glycine max* (L.) Merrill] in conjunction with nutrient management and their residual effect on succeeding wheat (*Triticum aestivum* L.). Ph.D. (Ag.) Thesis, Maharana Pratap University of Agriculture and Technology, Udaipur.

Takankhar, V. G., Karanjikar, P. N. and Bhoye, S. R. 2017. Effect of foliar nutrition on growth, yield and quality of chickpea (*Cicer arietinum* L.). *Asian Journal of soil science* 12 (2): 296-299. https://doi.org/10.15740/HAS/AJSS/12.2/296-299

Waghmare, Y. V., Thaokar, A. C., Gawali, K. A., Nagmote, A. V. and Sarda, A. 2019. Impact of foliar application of water soluble NPK fertilizers on yield, nutrient uptake and quality of gram (*Cicer arietinum*. L). *Journal of Pharmacognosy and Phytochemistry* 8(5): 290-292.

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