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Research Article

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Effect of foliar nutrition on growth, yield and quality of chickpea (*Cicer arietinum* L.)

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Summary

The field experiment was on effect of foliar nutrition on growth and yield of chickpea (*Cicer arietinum* L.). It was conducted during *Rabi* season in the year 2015-16 at the Research farm of College of Agriculture, Latur. The experiment was laid out in Randomized Block Design with three replications and variety "Vijay" as test crop along with eight treatments *viz.*, T_1- RDF, T_2- RDF+ water spray, T_3- RDF + 19:19:19 @ 1.0 % at vegetative stage, T_4- RDF + 00:52: 34 @ 1.0 % at flowering stage, T_5- RDF + 13:00:45 @ 1.0 % at grain filling stage and T_6- T_3 + T_4, T_7- T_4 + T_5 and T_8-T_3 + T_4 + T_5. The results of the field study indicated that, the growth, yield and quality of chickpea was significantly influenced by foliar nutrition. The growth parameters *viz.*, plant height, number of branches, number of pod plant^{-1} and dry matter of chickpea were significantly improved due to treatment T_8 (RDF + 19:19:19 @ 1.0 % at vegetative stage, RDF + 00:52: 34 @ 1.0 % at flowering stage and RDF + 13:00:45 @ 1.0 % at grain filling stage) however, it was followed treatment T_7 (RDF+00:52:34 @ 1.0 % at flowering stage and RDF + 13:00:45 @ 1.0 % at grain filling stage). Yield contributing characters *viz.*, seed yield, straw yield and biological yield were also increased significantly with application of foliar nutrients as per T_8 (RDF + 19:19:19 @ 1.0 % at vegetative stage + RDF + 00:52: 34 @ 1.0 % at flowering stage + RDF + 13:00:45 @ 1.0 % at grain filling stage) over rest of the treatments followed by treatment T_7.

Key words : Chickpea, Foliar nutrition, Growth, Yield, Quality

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Introduction

Chickpea is a cool season legume crop and is grown in several countries worldwide as a food source. Seed is the main edible part of the plant and is rich source of protein, carbohydrate and minerals especially for the vegetarian population. Chickpea can fix atmospheric nitrogen through its symbiotic association with *Rhizobium* sp., thus, helping in enhancing the soil quality for the subsequence cereal crop cultivation. Chickpea is a hardy, deep rooted, dry land crop sown on marginal lands, which can grow to full maturity on conserved moisture that would be unsuitable for most crops (Singh and Reddy, 2010). The deep tap root system enhances its capacity to withstand drought condition. Chickpea is the third most important food legume crop and India is the largest producer contributing 65 per cent of world's chickpea production.

Very less quantity of fertilizer is required for foliar application and nutrients are directly supplied to the plant. Foliar feeding is a technique of feeding nutrients to plant by applying liquid fertilizer directly to crop canopy. If used widely, can more efficient, economical, environment friendly, target oriented when used to supplement soil fertilization. Now-a-days, foliar feeding is widely adopted strategy in modern crop management where to ensure higher or optimum crop performance by enhancing crop growth. Foliar application overcome soil fertilization limitations, soil unsuitable for fertilizer precipitation, antagonism between certain nutrients, heterogenic soil unsuitable for low dosages and fixation. Seasonal variability in available moisture is the major constraint to production under rained farming. The erratic and low rainfall along with high temperature in the rainfed farming induces periods of water stress during crop growth. Chickpea is grown during *Rabi* season under reducing soil moisture conditions without any irrigation. As a result there was water deficit for crop at critical stages which affects nutrient uptake ultimately causing yield reduction. To increase the yield during drought conditions, we have to take into consideration not only the normalization of plant water regime, but also the normalization of plant feeding and elimination of created deficiencies of some elements. Rainfall is erratic in nature and uneven in distribution. Thus, moisture stress usually occurs at various stages particularly during grain filling stage. In pulses, moisture stress had drastic effect on nitrogen fixation besides plant growth. The number of rhizobium in soil declines drastically as soil dries. A suitable way to feeding during and after drought is through foliar nutrition. Potassium nitrate may be considered as the best option as it provides potassium which influences the water economy and crop growth through its effect on water uptake, maintenance of turgor transpiration (Hsiao and Lauchli, 1986). Keeping this in view, an investigation was carried to know the response of chickpea to foliar nutrition under receding soil moisture conditions.

Resource and Research Methods

An experiment was carried out on during *Rabi* season in the year 2015-16 at Research farm of College of Agriculture, Latur under Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani. Total rainfall received during 2015-16 was 416.5 mm. The experimental soil was deep black in colour with good drainage, moderately calcareous in nature and moderately alkaline in reaction (8.1pH). The soil was low in available nitrogen (130.52 kg ha^{-1}), medium in available phosphorus (8.22 kg ha^{-1}) and very high in available potassium (596 kg ha^{-1}). The experiment was laid out in Randomized Block Design with three replications and variety "Vijay" as test crop along with eight treatments *viz.*, T_1- RDF, T_2- RDF+ water spray, T_3- RDF + 19:19:19 @ 1.0 % at vegetative stage, T_4- RDF + 00:52: 34 @ 1.0 % at flowering stage, T_5- RDF + 13:00:45 @ 1.0 % at grain filling stage and T_6- T_3 + T_4, T_7- T_4 + T_5 and T_8-T_3 + T_4 + T_5.

Research Findings and Discussion

The data on effect of foliar nutrition on growth, yield attributes, yield and quality of chickpea are presented in Table 1 and 2.

Growth attributes:

The plant height was significantly affected due to foliar nutrition at different stages of the crop and it was increased with advanced stage. The treatment T_8 (RDF + 19:19:19 @ 1.0 % at vegetative stage + RDF + 00:52: 34 @ 1.0 % at flowering stage + RDF + 13:00:45 @ 1.0

Table 1 : Effect of foliar nutrition on growth attributes off chickpea at harvest

Treatments	Height (cm plant^{-1})	No. of branches	Dry matter (g plant^{-1})
T_1- RDF	27.9	4.93	4.81
T_2- RDF+ water spray	28.5	4.98	4.82
T_3- RDF+19:19:19 @ 1.0 % at vegetative stage	29.0	5.26	5.10
T_4- RD + 00:52:34 @ 1.0 % at flowering stage	29.1	5.20	5.14
T_5- RDF+13:00:45 @ 1.0 % at grain filling stage	29.6	5.18	5.12
T_6- T_3 + T_4	30.1	5.46	5.20
T_7- T_4 + T_5	29.9	5.26	5.49
T_8- T_3 + T_4 + T_5	32.2	6.00	6.11
S.E.±	0.43	0.13	0.09
C.D. (P=0.05)	1.32	0.41	0.26

% at grain filling stage) recorded significantly higher plant height at maturity followed by T_6. The lowest plant height was observed with T_1. The increase in plant height might be due to foliar application of N, P and K which helped in acceleration of various metabolic processes in plants resulting greater apical growth. Above results are in line with that of Manivannan *et al.* (2002). Significantly, the highest number of branches plant^{-1} were observed with treatment T_8 at maturity stage while significantly minimum number of branches plant^{-1} were observed in treatment T_1. Among the other treatments, it was observed that treatment T_3, T_4, T_5, T_6 and T_7 were at par with each other in case of mean number of branches plant^{-1}. Increase in number of branches might be due to supply of N, P and K to chickpea through foliar nutrition which may have accelerated metabolic process and resulted in to maximum branches. Sarkar and Pal (2006) and Kumar *et al.* (2008) also reported similar results. Treatment T_8 recorded significantly higher dry matter at harvest than rest of the treatments and treatment T_1 produced significantly lower dry matter.

Yield attributes, yield and quality:

The number of pods plant^{-1} were significantly affected due to foliar application of nutrients. The treatment T_8 (RDF + 19:19:19 @ 1.0 % at vegetative stage + RDF + 00:52: 34 @ 1.0 % at flowering stage + RDF + 13:00:45 @ 1.0 % at grain filling stage) recorded significantly higher number of pods plant^{-1} at harvest than all other treatments. The treatments T_7 and T_6 which were at par with T_8. The minimum number of pods were observed with T_1 at maturity. Also treatment T_3, T_4 and T_5 were found to be at par with each other in case of number of pods plant^{-1} in chickpea. The reason for increasing the number of pods might be due to availability of nutrients through foliar application to chickpea crop which increased number of pods plant^{-1} (Dwivedi and Tiwari, 1991). Also, higher test weight (191.6 g) was observed with the treatment T_8. However, it was par with all the treatments except T_1 (182 g). The protein content was significantly affected by foliar nutrition treatments. Significantly higher protein content (24.73%) was recorded by treatment T_8 but it was at par with the treatments T_5 (23.61%), T_6 (23.87%) and T_7 (23.91%). Significantly, the lower protein content (20.50%) in seed was recorded with treatment T_1. It was observed from the results that treatment T_8 (RDF + 19:19:19 @ 1.0 % at vegetative stage + RDF + 00:52: 34 @ 1.0 % at flowering stage + RDF + 13:00:45 @ 1.0 % at grain filling stage) produced significantly higher grain yield (1465.75 kg ha^{-1}) than rest of the treatments and it was followed by treatment T_7 (1332.55 kg ha^{-1}) and T_6 (1328.02 kg ha^{-1}). The lowest grain yield was recorded by T_1 (1077.26 kg ha^{-1}). In case of straw yield also, T_8 recorded significantly higher straw yield (1399.42 kg ha^{-1}) than rest of the treatments and it was followed by T_7 (1237.33 kg ha^{-1}), T_4 (1225.75 kg ha^{-1}) and T_6 (1223.02 kg ha^{-1}). The per cent increase in straw yield over T_1 (RDF) was highest with foliar application treatment T_8 (33.17 %) and lowest in treatment T_2 (8.98 %). The biological yield of chickpea was significantly affected due to different foliar nutrition treatments. The treatment T_8 recorded significantly higher biological yield (2868.50 kg ha^{-1}), followed by treatment T_7 (2569.88 kg ha^{-1}) and treatment T_6 (2551.02 kg ha^{-1}) and lowest biological yield was noticed in treatment T_1 (2174.27 kg

Table 2 : Effect of foliar nutrition on yield attributes and yield of chickpea at harvest

Treatments	No. of Pods plant^{-1}	Test weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Protein content (%)	Protein yield (kg ha^{-1})
T_1- RDF	20.40	182.0	1077.26	1097.02	2174.27	20.5	220.9
T_2-RDF + water spray	21.53	190.1	1095.99	1178.94	2245.26	20.8	228.7
T_3- RDF + 19:19:19 @ 1.0 % at vegetative stage	23.53	189.3	1247.42	1210.75	2458.01	22.0	275.1
T_4- RDF + 00:52:34 @ 1.0 % at flowering stage	24.40	189.9	1153.52	1225.75	2379.07	22.8	263.0
T_5- RDF + 13:00:45 @1.0 % at grain filling stage	25.20	191.0	1246.41	1210.95	2457.36	23.6	294.8
T_6- T_3 + T_4	26.06	191.2	1328.02	1223.02	2551.02	23.8	316.9
T_7- T_4 + T_5	27.06	191.0	1332.55	1237.33	2569.88	23.9	318.6
T_8- T_3 + T_4 + T_5	28.60	191.6	1465.75	1399.42	2868.50	24.7	362.4
S.E.±	0.49	1.5	10.98	5.60	28.43	0.4	3.32
C.D. (P=0.05)	1.33	4.7	33.17	16.90	85.85	1.3	10.04

ha^{-1}). Treatment T_8 recorded significantly the higher protein yield than all other treatments. It was followed treatment T_6 and T_7. The increase in grain, straw, biological yield and protein yield might be due to increase in growth parameters *i.e.* plant height, number of branches and dry matter plant^{-1}. Similar results were observed by Yakadri and Ramesh (2002); Ramanathan *et al.* (2004) and Vekaria *et al.* (2013).

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