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Response of foliar fertilization on growth and yield of Gram (*Cicer arietinum* L.) under irrigated conditions

AASTHA MEHTA AND KAMALESH KUMAR
Department of Agriculture, G.S.S.D.G.S Khalsa College Patiala-147001

Abstract

A field experiment was conducted at Campus for Research and Advanced Studies, Dhablan, P.G. Department of Agriculture, G.S.S.D.G.S. Khalsa College, Patiala during Rabi season of 2020. The experiment was carried out in Randomized Block Design and replicated three times consisting of 13 treatments. The soil of the field was of clayey texture having slightly alkaline pH (7.9), medium in organic carbon (0.59%), medium in available nitrogen (262 kg ha^{-1}), medium in available phosphorus (21.4 kg ha^{-1}) and medium in available potassium (137 kg ha^{-1}). The growth and yield attributes of gram were significantly influenced by foliar fertilization. Among all the treatments foliar spray of 3 % urea fb *2 % DAP* fb *5% punchgavya was found to be more suitable for maximum per unit production, resulted in higher growth and yield attributes. It was observed to be more suitable in terms of economic returns as compared to others. Treatment T_9 statistically remained at par with treatment T_{10}.*

Key words: Gram, foliar fertilization, nitrogen, phosphorus, potassium

Introduction

Chickpea (*Cicer arietinum* L.) commonly referred to as 'gram' or Bengal gram is that the most vital pulse crop in India. it's also referred to as the king of pulses. Chickpea may be a cool season crop with chromosome number 2n=14 and may be a member of *Leguminosae* and sub *Papilionaceae*. Chickpea is one among the important rabi pulse crop which has high digestible dietary protein.

India is that the leading producer and consumer of pulses. India ranks first in production of chickpea in world contributing 25-28 % world's total crop production. Chick pea contains 21.1 per cent protein, 61.5 per cent carbohydrates, 4.5 per cent fat. it's rich in calcium, iron and niacin. Being rich source of protein, chickpea meets 80% of its nitrogen requirement from symbiotic organic process from air. It leaves substantial amount of residual nitrogen for subsequent crops and adds many organic interests maintain and improve soil fertility. The Indian gram is classified into two broader groups, desi or brown gram (*Cicer arietinum* L.) and Kabuli or white gram (*Cicer kabulium* L.). It is used for human consumption also as for feeding to animals. It's eaten both whole fried or boiled and salted or more generally within the sort of split pulse which is cooked and eaten. Both husks and bits of the 'Dal' are valuable cattle feed. Fresh green leaves are used as vegetable (sag).

Foliar feeding may be a technique of feeding plants by applying liquid fertilizer on to the leaves. it's also referred to as non-root feeding. Plants are ready to absorb essential elements through their leaves. The absorption takes place through their stomata and also through their epidermis. Foliar feeding may be a widely adopted strategy in modern crop management where it's wont to ensure higher or optimal crop performance by enhancing crop growth at certain growth stage, correcting the nutrient deficiency in crop and enhancing crop tolerance to adverse conditions for crop growth.

The essential nutrients when applied to the foliage they're referred to as foliar sprays. These solutions could also be prepared in low concentration to use anybody of the plant nutrient or a mixture of nutrients. Nutrients to be employed by plant must be placed in such a fashion that they will be dissolved by the moisture within the soil. The rates and distance

[1]Professor and Director, Shobhit Institute of Engineering & Technology (Deemed to-be-University), Meerut.

that fertilizer element can move within the soil depend upon the chemical nature of the fabric that furnishes the nutrients and character of soil. This method is more fruitful (convenient, economic and quick responsive) when, Small quantity of micronutrient is required to use. it's been well established that the fertilizer elements which are absorbed through roots also can be absorbed with equal efficiency through foliage (*Ganapathy et al.*.,2008)

Materials and methods

The experimental field was located at Campus for research and Advanced studies, Dhablan of P.G. Department of Agriculture, G.S.S.D.G.S Khalsa College, Patiala situated at about 30p 192 North latitude and 76p 242 East longitude at an altitude of about 250 metre above the mean sea level. It is located in south eastern direction in Punjab state and North West India. The experimental site falls in Indo-Gangetic plains. The experimental plot was homogeneous in fertility having assured irrigation and other required facilities.

After the field preparation, replication borders, plots, bunds, irrigation channels and path were made manually. The experiment was laid out in randomized block design with thirteen treatments vis: T_0: Control, T_1: 2% Urea solution, T_2: 3% Urea solution T_3: 1% DAP solution, T_4: 2% DAP solution, T_5: 2% Punchgavya solution, T_6: 5% Punchgavya solution, T_7: 2% Urea solution *fb* 1% DAP solution, T_8: 3% Urea solution *fb* 2% DAP solution, T_9: 2% Urea solution *fb* 1 % DAP solution *fb* 2 % Punchgavya solution, T_{10}: 3% Urea solution *fb* 2 % DAP solution *fb* 5 % Punchgavya solution, T_{11}: 50 ppm NAA solution, T_{12}: 50 ppm GA_3 solution. All treatment combinations were applied randomly in each replication. Foliar application of fertilizer was given according to the treatments. Fertilizers were applied 20, 40, 60 days after sowing. The required application of fertilizer as per treatments were applied in the form of urea (46 % N) for nitrogen, DAP (46% $P_2O_5$and 18% N) for phosphorus and Panchgavya solution for (0.02% N), (0.02% P_2O_5), (0.02% K_2O) respectively. Five plants were randomly selected from each plot and tagged prior to recording of first observation. Plant height was measured at 30, 60, 90 and 120 DAS and at harvest. Height of each plant was recorded from the base to the tip of the plant. At maturity, plant height was measured from base to the tip of the main shoot. Plants of one meter row length were selected and cut from each plot for fresh weight was used. Fresh weight of plants was recorded separately for each plot and converted into kg ha^{-1}.

Results and Discussion

The effect of foliar fertilization on plant height was more prominent with the advancement of crop growth stage indicating better effect of fertilization plant height of chickpea due to steady availability of nutrients (Table 1). The plant height of Chickpea crop at 30, 60, 90,120 DAS and at harvest increased deliberately and significantly as influenced by different treatments. A close perception of the data revealed that plant height was maximum in treatment T_{10} at 30, 60, 90, 120 DAS and at harvest (8.27, 20.20, 37.27,

Table 1: Response of foliar fertilization on plant height (cm) of Gram under irrigated conditions

Treatments	Plant height (cm)				
	30 DAS	60 DAS	90 DAS	120 DAS	At harvest
T_0	5.56	17.3	34.00	52.61	62.80
T_1	6.60	18.60	35.03	53.70	63.90
T_2	6.83	18.80	35.50	54.15	64.47
T_3	6.50	18.52	34.80	52.62	63.20
T_4	6.73	18.70	35.40	53.17	63.43
T_5	7.02	19.02	35.69	54.32	65.30
T_6	7.13	19.10	35.80	54.45	64.47
T_7	7.53	19.50	36.20	54.87	65.97
T_8	7.60	19.60	36.60	55.22	66.12
T_9	7.85	19.80	36.85	55.78	67.98
T_{10}	8.27	20.20	37.27	56.65	68.72
T_{11}	7.09	19.09	36.09	54.71	65.80
T_{12}	7.10	19.10	36.13	54.82	65.73
SEm (±)	0.24	0.22	0.46	0.98	0.95
CD (P=0.05)	0.54	0.53	0.64	0.91	0.87

Table 2: Response of foliar fertilization on number of leaves plant^{-1} of gram under irrigated conditions

Treatments	Number of leaves plant^{-1}				
	30 DAS	60 DAS	90 DAS	120 DAS	At harvest
T_0	25.10	58.63	92.03	132.03	123.23
T_1	26.70	60.30	93.06	133.03	122.05
T_2	26.80	61.77	95.10	135.10	128.56
T_3	27.06	63.17	96.50	136.50	128.45
T_4	27.40	63.77	97.40	137.70	130.07
T_5	27.60	65.27	98.80	140.80	132.05
T_6	28.02	66.53	100.50	141.82	133.05
T_7	28.41	67.43	102.03	144.13	131.57
T_8	28.69	67.54	103.40	147.45	140.58
T_9	29.70	68.89	105.80	150.27	143.98
T_{10}	30.00	69.80	106.70	151.70	146.65
T_{11}	28.90	67.51	103.50	149.22	140.56
T_{12}	29.40	68.43	104.40	149.32	140.56
SEm (±)	0.15	1.12	1.56	1.32	1.15
CD (P=0.05)	0.35	1.02	1.06	1.51	2.97

56.65, 68.72 respectively), remains at par with treatment T_9 (7.85, 19.8, 36.8, 55.78, 67.98). Plant height enhanced due to the combination of three different fertilizers successively. Nitrogen present in fertilizers significantly affected the growth i.e. plant height. Being a major component of chlorophyll, nitrogen intensified the photosynthetic rate which eventually enhance the food material for the plant and hence increased the plant height.

The number of leaves plant^{-1} was influenced by foliar spray of fertilizers (Table 2). Number of leaves plant^{-1} was recorded at 30, 60, 90, 120, and at harvest, it was observed maximum in Treatment T_{10} i.e. foliar spray of 3 % urea solution fb 2 % DAP solution fb 5 % punchgavya solution, (30, 69.80, 106.70, 151.7 and 146.65 respectively) and it remains at par with treatment T_9 i.e. foliar spray of 2 % urea solution fb 1 % DAP solution and 2 % punchgavya solution (29.70, 68.89, 105.8, 150.27, 143.93 respectively). The increase in number of leaves was due to additional supply of nutrients through foliar fertilization which might have increased nutrient uptake and better translocation of nutrients. The higher uptake of nutrients were mainly due to its easy availability and absorption of nutrients under foliar spray without spending much energy for their transport and without any loss in transit (Srivastav, 1994).

Grain yield is the most important character and the superiority of the treatment is judged by its capacity to produce more grain yield. The data on grain yield of Gram as influenced by different foliar treatments are depicted in Table 3. The seed yield of gram were significantly affected by the use of foliar fertilizers used successively. A close monitoring of the data revealed that the highest grain yield was observed in treatment T_{10} (22.67 qha^{-1}) i.e. foliar spray of 3%urea solution fb 2% DAP solution and5 % punchgavya solution, it remains at par with treatment T_9 (21.25 q ha^{-1}) i.e. foliar spray of 2 % urea solution fb 1 % DAP solution fb 2% punchgavya solution.

Biological yield was recorded maximum in treatment T_{10} (70.8 q ha^{-1}) i.e .foliar spray of 3%urea solution fb 2% DAP solution and5 % punchgavya solution, and it remains at par with treatment T_9 (68.5). This was due to the fact that adequate supply of N, P, and K through foliar application would have increased its uptake and increased the dry matter. Also, biological yield directly depends on the combination of grain yield and straw yield and grain yield was also maximum in treatment T_{10}. The economic and biological yield are inter related, which is governed by plant parameters i.e. plant height, number of leaves plant^{-1} and fresh

Table 3: Response of foliar fertilization on yield of Chickpea under irrigated conditions

Treatments	Yield attributes		
	Seed yield (q ha^{-1})	Biological yield (q ha^{-1})	Harvest index (%)
T_0	10.71	61.8	17.45
T_1	12.08	65.6	18.41
T_2	12.76	66.3	19.25
T_3	13.86	66.7	20.78
T_4	15.35	67.1	22.88
T_5	16.91	67.4	25.07
T_6	17.22	67.7	25.42
T_7	17.27	67.9	25.56
T_8	17.20	68.2	25.23
T_9	21.25	68.5	30.72
T_{10}	22.67	70.8	32.04
T_{11}	18.09	68.5	26.42
T_{12}	21.04	68.3	30.02
SEm (±)	0.21	1.66	0.44
CD (P=0.05)	1.52	2.36	2.01

weight $plant^{-1}$ all these factors resulted in higher biomass production.

Harvest index was shown by treatment T_{10} i.e. foliar spray of 3%urea solution fb 2% DAP solution and5 % punchgavya solution (32.04) and this remains at par with treatment T_9 (30.72) The increase in harvest index of chickpea crop with foliar fertilization might be due to higher fertility levels which could increase the yield of crop by which harvest index is increased directly. Significantly lower harvest index was recorded in T_0 i.e. control.

References

Aliloo A.A., Khorsandy, H. and Mustafavi, S.H. (2012). Response of chickpea (*Cicer arietinum* L.) Cultivars to nitrogen applications at vegetative and reproductive stages. *Cercetãri Agronomice în Moldova*. Vol. XLV, No. 4(152).

Amany A. Bahr (2007). Effect of plant density and urea foliar application on yield and yield components of chickpea (*Cicer arietinum* L.). *Research Journal of Agriculture and Biological Sciences*. 3(4): 220-223.

Ganapathy, M., Baradhan, G. and Ramesh, N. (2008). Effect of foliar nutrition on reproductive efficiency and grain yield of rice fallow pulses. *Legume Research*. 31(2): 142-144.

Kachave, T.R., Kausadikar, H.K. and Deshmukh, M.G. (2018). Effect of specialty fertilizer on growth, yield and quality of chickpea. *International JCS*. 6(3):1660-1662.

Khokar, R.K., and Warsi, A.S. (1987). Fertilizer response studies in gram. *Indian Journal of Agronomy*. 32: 326—364.

Maheswari, M. (2014). Department of Agronomy, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India. Effect of Foliar Nutrition on Growth, Yield Attributes and Seed Yield of Pulse Crops. *Indian Journal of Agricultural Sciences*. 81(9).

Olsen, S.R., Cole, C.V., Watanable, F.S. and Dean, L.A. (1954). Estimation of available phosphorus in soils extraction with sodium carbonate. United states Department of Agriculture Circular. 939: 1-9.

Piper, C. S. (1957). Soil and plant analysis.The university of Adelaide, Australia. pp 286.

Piper, C. (1966). Soil and Plant analysis, Hans publisher Bombay.

Srivastava, G.P. and Srivastava, V.C. (1994). Effect of irrigation and foliar spray of nutrients on growth and seed yield of gram (*Cicer arietinum* L.). *Indian Journal of Agricultural Sciences*. 64(4): 219-222.

Walkley, A.J. and Black, C.A. (1934). Estimation of soil organic carbon by the chromic acid digestion method. *Soil Science*.31: 259-60.