International Journal of Environment and Climate Change

Volume 13, Issue 10, Page 4046-4050, 2023; Article no.IJECC.106929
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Effect of Foliar Nutrition on Yield, Quality, Nutrient Content and Uptake of Kharif Cowpea

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Authors' contributions

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

Article Information

DOI: 10.9734/IJECC/2023/v13i103081

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/106929

Original Research Article

Received: 17/07/2023
Accepted: 21/09/2023
Published: 25/09/2023

ABSTRACT

A field experiment was conducted at the Agronomy Instructional Farm, C. P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar to investigate the "effect of foliar nutrition on yield, quality, nutrient content and uptake of *kharif* cowpea" during *kharif* season of 2020. In Randomize Block Design, eight treatment combinations were tested in four replications. Cowpea variety Gujarat cowpea 5 was planted at a distance of 45 cm × 10 cm. Application of 75%

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of RDF + 2% spray of each urea and urea phosphate at 15 and 30 DAS gave significantly higher yield (1422 kg/ha), protein content (22.93 %), nutrient content of nitrogen and phosphorus in seed (3.67 % and 0.446 %) and in stover (0.73% and 0.273% respectively) and nutrients uptake of nitrogen (71 kg/ha), phosphorus (13 kg/ha) and potassium (56 kg/ha) by cowpea crop it was at par with application of 75% of RDF + 2% spray of NPK 19:19:19 at 15 and 30 DAS

Keywords: Yield; quality; nutrient content; nutrient uptake and cowpea.

1. INTRODUCTION

According to Sebetha et al. [1] a 100g edible green cowpea pod contains 84.6 g of moisture, 4.3 g of protein, 0.2 g of fat, 0.9 g of minerals, 2.0 g of fiber, and 8.0 g of carbohydrates. and its seed serves as a nutritional supplement to human diets as well as animal feed. In India, pulses are grown nearly in 29.99 million ha with an annual production of 23.15 million tons and average productivity of 841 kg/ha [2]. The per capita per day availability of pulses in 2017 was 52.9 g per day. The total area under *kharif* and summer pulses in Gujarat is 9.08 lakh ha and production of 9.43 MT with average productivity of 1037 kg/ha in 2018-19. Gujarat has 5.2 Lakh hectares area under cowpea cultivation and generates 3.5 lakh tons with the productivity of 665 kg per hectare [3].

On comparison to other common grain legumes, this crop is more resistant to of low fertility because of its significant of nitrogen fixation, efficient symbiosis with *mycorrhizae*, and capacity to grow on soils with a wider range of pH. Higher or lower yields, elevated or reduced development of the crop, and changes in the crop's physiology are all caused by variations in the availability of nutrients to the crop. Quality and seed yield decline when nitrogen level decreases.

The application of phosphorus increased the number of pods per plant, the number of seeds per pod, and the mean seed weight, all of which boosted cowpea yield [4]. Legume benefits from potassium application in terms of growth, nodulation, nitrogen fixation, and yield [5].

Cowpea productivity in our country is quite poor, so it is necessary to establish appropriate agronomic strategies to increase cowpea output. The most crucial of these activities is the foliar application of nutrients, which fully utilizes the crop's genetic potential. Foliar application is thought to have the advantages of quick and effective nutrient consumption, elimination of leaching losses, fixing, and regulation of nutrient uptake by the plant.

2. MATERIALS AND METHODS

A field experiment was carried out at Agronomy Instructional Farm, Department of Agronomy, C. P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, S. K. nagar. Located in the North Gujarat Agro-climatic region at 24^0 $19^{'}$ North latitude and 72^0 $19^{'}$ East longitude with an elevation of 154.52 meter above the mean sea level. This area's climate is sub-tropical monsoon type and falls under semi-arid region. The soil of research field was loamy sand in texture low levels in organic carbon (0.27%) available nitrogen is 158 kg per hectare, available phosphorus is 38.9 kg per hectare, and available potash is 295.2 kg per hectare, having Electrical Conductivity 0.14 (dSm^{-1}), pH value of 7.58.

Total eight treatment combinations were laid out in (RBD) randomized block design with four replications. Treatments details are T_1: Control, T_2:RDF (Recommended dose of fertilizer), T_3:75% of RDF + 1% spray of each urea and urea phosphate at 15 and 30 DAS, T_4:75% of RDF + 1% spray of NPK 19:19:19 at 15 and 30 DAS, T_5:75% of RDF + 2% spray of each urea and urea phosphate at 30 DAS, T_6:75% of RDF + 2% spray of NPK 19:19:19 at 30 DAS, T_7:75% of RDF + 2% spray of each urea and urea phosphate at 15 and 30 DAS, T_8:75% of RDF + 2% spray of NPK 19:19:19 at 15 and 30 DAS. Cowpea variety (GC 5) was sown at a spacing of 45 cm × 10 cm spacing on 7^{th} July and the RDF was 20:40 kg N: P_2O_5/ha. The crop was harvested at physiological maturity on 1^{st} Oct, 2020.

Representative samples were taken from the output of each net plot in order to estimate the amounts of nitrogen, phosphorous, and potassium in the seed and stover. The materials were mechanically ground into powder and oven dried at 60°C for 24 hours before the nutrients were calculated using Micro Kjeldhal's method,

Vanadomolybdo phosphoric yellow color method and Flame photometric method respectively [6].

3. RESULTS AND DISCUSSION

3.1 Effect on Yield

The increase in seed yield (kg/ha) under T_7 and T_8 over T_2 (RDF) was 19.92 and 13.70 per cent and over T_1 (control) was 61.59 and 53.29 per cent, respectively. stover yield due to T_7 over T_1 (control) and T_2 (Recommended dose of fertilizer) was to the extent of 64.39 and 31.79 per cent and T_8 over T_1 and T_2 was to the accordance of 29.10 and 16.66 per cent, respectively. Bute et al [7] Whereas Treatment T_1 (control) produced significantly lowest seed yield and stover yield.

The improvement in the overall seed production was mostly brought about by the enhanced nitrogen supply and decreased nutrient losses. Spraying of either 2 per cent urea and urea phosphate or 2 per cent NPK (19:19:19) aided with fast nitrogen and phosphorus absorption when the need for nutrients is at its highest due to foliar spray at 15 DAS and 30 DAS of the crop. As a result, it decreased flower drop, improved pod setting and increased seed production. The outcomes support the conclusions made by Choudhary and Yadav [8] in cowpea who indicated that foliar spray of 2% DAP recorded significantly higher growth, yield parameters and yield at branching and flowering stages over other treatments [9] observed similarly result in cowpea crop.

3.2 Effect on Quality Parameter

The set of data concerning to the protein content in seeds of cowpea which are provided in Table 1. illustrated that the various treatments succeed to produced their significant effect on protein content. At 15 and 30 DAS, 75% RDF+2% spray of each urea and urea phosphate treatment (T_7) resulted in significantly greater protein content (22.93%), However, it was statistically equivalent to all other treatments examined except T_6 (75% of RDF + 2% spray of NPK 19:19:19 at 30 DAS) and T_1(Control). Increased protein content in seed could be attributed to the fact that higher nitrogen content in seed is directly related to increased nitrogen availability to plants. Because nitrogen is a vital component of amino acids, which constitute the basis of protein content, higher nitrogen levels in seeds were directly responsible for higher protein levels. Gupta et al [10] found similar results.

3.3 Effect on Nutrients Content

Summarized in Table 1. it appeared that different treatments excreted their significant influence on nitrogen content (%) in seed and stover. Treatment T_7 is recorded significantly higher N content but Except for T_6 and T_1, all other treatments remained on par in terms of nitrogen content (%) in seed. In case of nitrogen content in stover treatment T_7 observed significantly higher N content which was at par with T_8 and T_3.

Table 1. Effect of inorganic fertilizers and foliar spray on yield, quality and content of *kharif* cowpea

Treatments	Yield (kg/ha)		Protein content (%)	Nitrogen Content (%)		Phosphorus content (%)		Potassium content (%)	
	Seed	Stover		Seed	Stover	Seed	Stover	Seed	Stover
T_1	880	1553	20.30	3.25	0.62	0.399	0.189	1.30	1.33
T_2	1186	1937	21.98	3.52	0.69	0.434	0.259	1.35	1.38
T_3	1214	2083	22.05	3.53	0.71	0.431	0.258	1.37	1.39
T_4	1194	2002	22.03	3.53	0.69	0.420	0.236	1.41	1.39
T_5	1098	1892	21.94	3.51	0.66	0.420	0.222	1.35	1.36
T_6	1079	1937	20.93	3.33	0.64	0.409	0.227	1.39	1.35
T_7	1422	2553	22.93	3.67	0.73	0.446	0.273	1.35	1.44
T_8	1349	2260	22.75	3.64	0.71	0.439	0.255	1.45	1.40
S.Em. ±	59	106	0.52	0.08	0.01	0.010	0.008	0.03	0.04
C.D. at 5 %	173	313	1.52	0.24	0.03	0.029	0.025	NS	NS
C.V. %	10.01	10.50	4.74	4.74	3.16	4.69	6.95	4.27	6.01

Table 2. Effect of inorganic fertilizers and foliar spray on total nutrient uptake and available nutrients after harvest in soil

Treatments	Nitrogen uptake (kg/ha)	Phosphorus uptake (kg/ha)	Potassium uptake (kg/ha)	Available Nutrient (kg/ha)		
				N	P_2O_5	K_2O
T_1	38	7	32	156	46	258
T_2	55	10	42	165	49	263
T_3	58	11	46	172	48	270
T_4	56	10	44	160	50	269
T_5	51	9	40	176	51	263
T_6	48	9	41	176	48	268
T_7	71	13	56	171	52	262
T_8	65	12	51	169	51	274
S.Em. ±	3.0	0.5	2.0	4.8	1.3	6.3
C.D. at 5 %	9.0	1.5	6.7	NS	NS	NS
C.V. %	11.1	10.38	10.38	5.77	5.08	4.72

A close exanimation of data indicated that significantly higher phosphorus content in seed (0.446%) and stover (0.273%) were recorded with treatment T_7, but it was at par with Treatments T_8, T_2, T_3, T_4 and T_5 in case of phosphorus content in seed and with treatments T_8, T_2 and T_3 in case of phosphorus content in stover**.** Treatment T_1 (control) recorded lower content of phosphorus in seed (0.399%) and stover (0.189%).

Potassium content in cowpea seed and stover was not found significant with respect to various treatments of fertilizer and foliar spray sources.

This increase in nutritional content in seed and stover might be due to favorable and synergistic effect on availability of nutrients at different rate of fertilizer at basal and foliar sprays. Similar observation was reported by Vikrant et al [11-14].

3.4 Effect on Nutrients Uptake

A close exanimation of data (Table 2.) revealed that various treatment manifests their significant impacts on the N, P and K uptake by cowpea

plant. Among all treatments, T_7 (75% of RDF + 2% spray of each urea and urea phosphate at 15 and 30 DAS) observed significantly higher nitrogen (N) uptake (71 kg/ha), Phosphorus (P) uptake (12 kg/ha) and Potassium (K) uptake (56 kg/ha) by the crop which was statistically equivalent to the application of Treatment T_8 (75% of RDF + 2% spray of NPK 19:19:19 at 15 and 30 DAS). Though, treatment T_1 (control) noted significantly lower nitrogen uptake (38kg/ha), Phosphorus uptake (7 kg/ha) and Potassium uptake (32 kg/ha) by the cowpea crop Respectively.

The enhanced nutrient intake may be attributed to increased nutrient availability to the plant and higher biomass production and retarded loss of chlorophyll and leaf nitrogen with boost photosynthesis and increased N, P, and K provide during flowering and pod filling stages, results collaborated with the findings of Choudhary and Yadav [8,13,14].

Data substantiated that different treatments did not significantly improve the soil fertility in terms of available N, P_2O_5 and K_2O (kg/ha) in soil after harvest of cowpea [15-18].

4. CONCLUSION

In light of results obtained from present investigation, as a result, it is recommended that the kharif cowpea crop be fertilized with 75% of RDF (15:30 kg N: P/ha) and 2% of either urea and urea phosphate or NPK 19:19:19 at 15 and 30 DAS to achieve good quality and greater nutrient content and uptake in loamy sand.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/106929