



E-ISSN: 2278-4136

P-ISSN: 2349-8234

JPP 2019; 8(5): 2034-2037

Received: 10-07-2019

Accepted: 12-08-2019

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Growth & yield of cowpea influenced by foliar application of nutrient

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Abstract

A field experiment was conducted on clay loam soil texture with pH of 6.9 and EC is 0.51 dSm⁻¹ on cowpea with ten treatments in a randomized block design during the year of rabbi 2019 at Experimental Farm, Department of Agronomy, School of Agricultural Sciences, G. H. Rasoni University, Saikheda, Chhindwara, (M.P) to evaluate the impact of foliar application of nutrients on growth and yield of cowpea. Application of neem coated urea 2%, TANU pulse wonder, Salicylic acid 75 ppm, Boron 0.25 ppm, Thiourea 500ppm, Urea phosphate @1%, NPK (19:19:19) 2% and mixture of neem coated urea 2% + Salicylic acid 75 ppm significantly influenced on growth and yield parameters of cowpea compared with control.

Keywords: Cowpea, foliar application of nutrients, neem coated urea, TANU pulse wonder, salicylic acid, boron, thiourea, urea phosphate, NPK

Introduction

Cowpea [*Vigna unguiculata* (L.) Walp] is an annual legume of tropical and subtropical area, commonly known as *lobia*. It is one of the most important multipurpose grain legume extensively cultivated in arid and semi-arid tropics of India. It is drought tolerant and warm weather crop, which is well adapted to the drier regions of the tropics. Cowpea is a poor men's source of protein. Cowpea is probably a native of central Africa. On dry weight basis, cowpea grain contains 23.4% protein, 1.8% fat and 60.3% carbohydrate and a rich source of calcium and iron. It is mainly grown in Africa covering about 90 per cent of the total world acreage. In India, cowpea is grown in an area of 3.9 million hectares particularly in western, central and peninsular regions. The cultivated area of cowpea in M.P. is about 5391 hectares with the low productivity.

It is usually grown as *kharif* crop, however can be grown as a *rabi*, spring or summer crop in different parts of the country. The crop is known for initial fast growth with dropping leaves which suppress weed growth initially. Initially fast growth helps in extensive root development and early establishment of crop in wake of drought like situation. It also has the useful ability to fix atmospheric nitrogen through its root nodules and it grow well in poor soils with more than 85% sand and with less than 0.2% organic matter and low levels of phosphorus. It also has the excellent ability against soil erosion from rain water and being denoted as prominent cover crop.

In addition, it is shade tolerant and therefore, compatible as an intercrop with maize, millets, sorghum, sugarcane and cotton. Cowpea an important component of traditional intercropping system, especially in the complex and elegant subsistence farming systems of dry regions. Cowpea is not being cultivated by the farmers as a sole crop on large acreage in M.P. It is mainly grown as inter crop, legume crop, fodder crop and vegetable crop also.

Material and Methods

The present investigation, "Growth and Yield of Cowpea [*Vigna unguiculata* (L.) Walp] as influenced by Foliar Application of Nutrients" was conducted at Department of Agronomy, School of Agricultural Sciences, G. H. Rasoni University, Saikheda, Chhindwara, (M.P). The experiment was laid out in randomized block design with twelve treatments comprising of T1-Control (water spray), T2-Neem coated urea 2% spray at flower initiation, T3-TNAU pulse wonder @ 5 kg/ha at flower initiation, T4-Salicylic acid 75 ppm spray at flower initiation and 7 days after 1st spray, T5-NPK (19:19:19) 2% spray at flower initiation, T6-Neem coated urea 2% + salicylic acid 75 ppm spray at flower initiation, T7-Boron 0.25 ppm spray at flower initiation, T8-Nitrobenzene 500 ppm spray at flower initiation, T9-Thiourea 500 ppm

spray at vegetative and flowering stage., T10-Urea phosphate @ 1% spray at flower initiation. The field experiment was completed with three replications and crop was fertilized and irrigated as per treatment schedule. Variety VBN 1 was sown at a spacing of 30 X 15 cm. Periodical observations were taken up with different growth stages. The experimental data on observations were statistically analyzed by adopting the procedure of Panse and Sukhatme⁷. The critical difference was calculated at five per cent probability level to draw statistical calculations.

Result and Discussion

Effect on growth parameters

Foliar application of nutrients caused a marked variation in growth parameters of cowpea at all of the crop growth stages except at 20 DAS. The growth parameters *viz.*, plant height, number of branches per plant, number of leaves per plant, dry weight per plant, CGR, RGR and LAI had a direct relationship with foliar application of nutrients. All foliar nutrient treatments significantly increased all growth parameters over control treatment (T₁). The maximum values of all these growth parameters were recorded with the application of Neem coated urea 2% spray at flower initiation (T₂) followed by NPK (19:19:19) 2% spray at flower initiation (T₅) and Neem coated urea 2% + salicylic acid 75 ppm spray at flower initiation (T₆) and these treatments were found significantly superior over other treatments. The order of significance were followed by application of TNAU pulse wonder @ 5 kg/ha at flower initiation (T₃) and Salicylic acid 75 ppm spray at flower initiation and 7 days after 1st spray (T₄).

Neem coated urea 2% spray at flower initiation (T₂), NPK (19:19:19) 2% spray at flower initiation (T₅) and Neem coated urea 2% + salicylic acid 75 ppm spray at flower initiation (T₆) also gave significantly higher plant height, number of branches per plant, number of leaves per plant, dry weight per plant, CGR, RGR and LAI compared to control treatment (T₁).

Similar results had also been reported by Mona and Azab (2016)^[7] reported that the effects of foliar application of NPK compound with Fe, Zn and Mn at different doses on cowpea plants. In addition, soluble fertilizers NPK (19:19:19) and 500 ppm Fe, 300 ppm Zn and 300 ppm Mn were applied. Four treatments of fertilization were tested: control (no fertilization), (50%), (100%), and (125%). The NPK fertilizers were sprayed every 15 days. The results are as follows: Foliar fertilization NPK with Fe, Zn and Mn reflect increase in vegetative growth, yield and its components and nutrient concentration of cowpea plant compared with control. The results obtained are also in close conformity with the findings of Haq and Mallarino (2000)^[4], Reddy *et al.* (2005)^[9], Deshmukh *et al.* (2008)^[11].

Effect on yield attributing characters

The factors which are directly responsible for ultimate seed production *viz.*, number of pods/plant, length of pod, seeds/pod and 100-seed weight were augmented almost significantly due to all treatments over control treatment (T₁). The yield attributing characters like number of pods/plant, pod length, number of seeds/pod, and 100 seed weight were increased significantly with Neem coated urea 2% spray at flower initiation (T₂) followed by NPK (19:19:19) 2% spray at flower initiation (T₅) and Neem coated urea 2% + salicylic acid 75 ppm spray at flower initiation (T₆) and these

treatments were found significantly higher over rest of the treatments.

These results are in close agreement with Gupta and Saxena (2014)^[3]. They studied the effect of resource management in cowpea for yield maximization under rainfed conditions. Results of three years pooled data revealed that foliar application of urea either @ 1% or @ 2% and mulching @ 3 t/ha at 25-30 DAS of crop significantly increased yield attributes (pods/plant, seeds/pod and seed index) and seed yield of cowpea. Foliar application of 2% urea recorded maximum values of yield attributes, seed yield, net returns and B:C ratio. The significant increase in pods/plant, seeds/pod and seed index due to foliar application of 2% urea were 7.64 and 16.34, 4.38 and 9.30 and 5.23 and 6.23 per cent respectively over normal planting and control. Further, the maximum value of pooled grain yield (9.26 q/ha), net returns (₹21892/ha) and B:C ratio (1.77) were recorded under foliar application of 2% urea while the least were observed under control (5.47 q/ha, Rs 9299/ha and 0.85).

Effect on productivity parameters

Each plant passes through the vegetative as well as reproductive phases of growth to complete its life cycle. Yield can be considered to be the final expression of the physiological and metabolic activities of plants and is governed by various factors. These yield-attributing factors have direct bearing on plant productivity and for increasing the yield that means the number of pods/plant, pod length, number of seeds/pod and 100 seed weight and seed yield as well as stover yield/plant, etc play an important role.

The application of Neem coated urea 2% spray at flower initiation (T₂) followed by NPK (19:19:19) 2% spray at flower initiation (T₅) and Neem coated urea 2% + salicylic acid 75 ppm spray at flower initiation (T₆) brought significantly higher but statistically equal seed and stover yields (1459, 1364, 1329 and 3823, 3675, 3509 kg/ha, respectively) and proved to be significantly superior to the remaining treatments. The next best treatment was TNAU pulse wonder @ 5 kg/ha at flower initiation (T₃), which also gave significantly higher seed yield compared to other treatments. The trend of increases in seed and straw yields obtained due to these treatments was exactly in accordance with the similar increases in the yield-attributing characters *viz.*, pods/plant, pod length, seeds/pod, 100 seed weight and grain yield/plant as well as increased vegetative growth. The increase in yield-attributing characters and consequently the seed yield of cowpea and other pulses as a result of foliar application of nutrients have also been reported by many research workers *i.e.* Velayutham *et al.* (2003)^[12], Dixit and Elamathi (2007)^[2], Mondal and Mondal (2012)^[8].

Since yield is the resultant of additive and complementary effect of plant growth and yield attributing parameters and these yield attributing characters had better expression at higher availability of nutrients due to adequate quantity and balanced proportion of plant nutrient supplied during the crop growth period which ultimately led towards an increase in seed and straw yields.

Effect on quality parameter

Maximum protein content (%) in seed was recorded under Neem coated urea 2% spray at flower initiation (T₂) followed by Neem coated urea 2% + salicylic acid 75 ppm spray at flower initiation (T₆), NPK (19:19:19) 2% spray at flower initiation (T₅), TNAU pulse wonder @ 5 kg/ha at flower initiation (T₃), Salicylic acid 75 ppm spray at flower initiation

and 7 days after 1st spray (T₄) and Thiourea 500 ppm spray at vegetative and flowering stage (T₉). Maximum protein yield (kg/ha) was also recorded under Neem coated urea 2% spray at flower initiation (T₂) followed by NPK (19:19:19) 2% spray at flower initiation (T₅), TNAU pulse wonder @ 5 kg/ha

at flower initiation (T₃), Neem coated urea 2% + salicylic acid 75 ppm spray at flower initiation (T₆). Similar results were also found by Singh (2007)^[11], Hemn Othman Salih (2013)^[5] and Senthikumar (2015).

Table 1: Influence of foliar application of nutrients on growth attributes of cowpea.

Treatments	Plant population/m row length		Plant height (cm)	Number of branches per plant	Number of leaves per plant	Plant dry weight (g)	crop growth rate (g/m ² /day)	RGR (mg/g/day)	Leaf Area Index	Seed yield (g/plant)	Stover yield (g/plant)	Protein % in seed	Protein yield (kg/ha)
	Initial	Final											
T1	11.08	10.13	47.47	8.24	16.24	25.44	4.33	10.85	1.16	14.90	18.44	19.47	206.92
T2	11.02	10.30	55.67	11.04	26.97	37.97	6.20	14.97	1.64	25.30	34.24	23.67	340.75
T3	11.14	10.50	52.97	10.14	23.50	34.30	5.41	13.26	1.57	21.17	27.30	22.87	300.22
T4	10.81	9.90	52.70	10.07	23.04	34.24	5.26	12.42	1.56	19.50	27.10	21.80	264.06
T5	11.21	10.53	54.04	10.80	24.50	35.74	5.97	13.88	1.62	24.34	32.64	22.97	310.62
T6	11.01	9.96	53.44	10.44	23.70	34.90	5.82	13.79	1.61	23.62	30.87	23.54	288.90
T7	10.94	10.28	52.64	9.74	20.84	32.77	4.80	11.78	1.50	17.90	21.24	20.50	237.27
T8	10.85	9.61	51.00	9.07	20.30	30.97	5.21	11.34	1.38	15.37	20.97	20.10	221.63
T9	11.04	9.93	51.40	9.40	21.34	32.10	5.09	11.90	1.57	18.57	25.10	21.70	255.83
T10	10.90	10.26	52.24	9.54	22.10	33.17	5.65	11.74	1.50	19.40	30.17	20.70	243.11
S.E.(m)±	0.0183	0.01826	0.02509	0.04564	0.25092	0.25092	0.03991	0.01948	0.03651	0.25092	0.25092	0.25092	0.31032
C.D. (at 5%)	NS	NS	0.07456	0.13562	0.74556	0.74556	0.11858	0.05789	0.1085	0.74556	0.74556	0.74556	0.92203

Table 2: Influence of foliar application of nutrients on yield attributes of cowpea.

Treatments	Yield attributing characters				Seed yield (kg/ha)	Stover yield (kg/ha)	Biological yield (kg/ha)	Harvest index (%)
	Number of pods/plant	Pod length (cm)	Number of seeds/pod	100 seeds weight (g)				
T1: Control (water spray).	16.57	10.24	9.17	10.26	1083	2881	3961	27.64
T2: Neem coated urea 2% spray at flower initiation.	25.70	13.20	11.17	11.29	1459	3823	5279	28.00
T3: TNAU pulse wonder @ 5 kg/ha at flower initiation.	21.57	12.07	10.64	11.12	1236	3420	4653	26.88
T4: Salicylic acid 75 ppm spray at flower initiation and 7 days after 1st spray.	21.37	11.87	10.57	11.08	1225	3407	4629	26.83
T5: NPK (19:19:19) 2% spray at flower initiation.	24.10	12.84	10.77	11.24	1364	3675	5036	27.43
T6: Neem coated urea 2% + salicylic acid 75 ppm spray at flower initiation.	23.08	12.80	10.70	11.23	1329	3509	4835	27.94
T7: Boron 0.25 ppm spray at flower initiation.	18.77	11.69	9.64	10.91	1177	3172	4346	27.41
T8: Nitrobenzene 500 ppm spray at flower initiation.	17.57	10.77	9.24	10.79	1123	2965	4085	27.88
T9: Thiourea 500 ppm spray at vegetative and flowering stage.	19.50	11.37	9.57	10.99	1188	3219	4404	27.32
T10: Urea phosphate @ 1% spray at flower initiation.	20.57	11.67	10.17	11.00	1196	3343	4536	26.66
S.E.(m)±	0.18257	0.15857	0.18257	0.19013	0.18257	0.10541	0.36515	0.03651
C.D. (at 5%)	0.54248	0.47114	0.54248	0.56492	0.54248	0.3132	1.08495	0.1085

Conclusion

From this study it is concluded that different treatments has positive effect on growth and yield of cowpea. Application of Neem coated urea 2% spray at flower initiation (T₂) gave significantly higher seed yield (1456 kg/ha), net monetary return (₹ 74396/ha) and B:C ratio (4.30), which was at par with treatment (T₅) NPK (19:19:19) 2% spray at flower initiation (1361 kg/ha) and Neem coated urea 2% + salicylic acid 75 ppm spray at flower initiation (1326 kg/ha).

Hence, it is concluded that application of Neem coated urea 2% spray at flower initiation (T₂) was most effective in enhancing seed yield, net monetary return, B:C ratio as well as economic returns than other treatments in cowpea.

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