J. Farm Sci., 30(1): (129-131) 2017

RESEARCH NOTE

Effect of mode of fertilization on growth, yield and economics of cowpea genotypes

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(Received: August, 2014 ; Accepted: March, 2017)

A field experiment was conducted during *kharif* season of 2013 at Main Agricultural Research Station, College of Agriculture, UAS, Dharwad to study the effect of mode of fertilization on growth and yield of cowpea genotypes. Results indicated that genotype DC-15 recorded significantly higher plant height (83.76 cm), number of branches plant^{-1} (10.89), LAI (4.59). Dry matter production plant^{-1} (28.37 g) number of pods per plant (13.87), number of seeds per pod (11.51), test weight (12.37 g), seed yield (1548 kg ha^{-1}), gross returns (₹ 49,329 ha^{-1}) and net returns ₹ 31,735 ha^{-1}). Results further indicated that application of 75% RDF through soil along with three sprays of 2% DAP foliar spray at 30, 45 and 60 days after sowing recorded significantly higher number of pods per plant (15.39), number of seeds per pod (12.09), test weight (12.82 g), seed yield (1630 kg ha^{-1}), gross returns (₹ 51,843 ha^{-1}) and net returns (₹ 32,745 ha^{-1}) over water sprayed control.

Key words: Cowpea, Foliar spray, Fertilizers

Cowpea [*Vigna unguiculata* (L.) Walp] commonly known as lobia is one of the important *kharif* pulse crop grown for grain, forage and green manuring. The crop gives such a heavy vegetative growth and covers the ground so well that it checks the soil erosion in problematic areas and can later be ploughed down for green manure. It has considerable promise as an alternative pulse crop in dry land farming. Cowpea is highly responsive to fertilizer application. The dose of fertilizer depends on the initial soil fertility status and moisture availability conditions. Now days foliar application of fertilizer is gaining importance in plant nutrition. The foliar applied nutrients are more effective as compared to soil applied nutrients. Because of higher uptake efficiency, nutrients applied through foliage can increase photosynthetic efficiency by delaying the onset of leaf senescence. Crop nutrition through foliar feeding at particular stage may solve the slow growth, nodule senescence and low seed yield of pulse without involving root absorption at critical stage (Latha and Nadanassababady, 2003). Recent interest in foliar nutrition is also due to the greater awareness of soil water pollution resulting from indiscriminate or excessive soil fertilization and adverse soil conditions which favors soil fixation of nutrients. Therefore, the present study was carried out to investigate the effect of mode of fertilization on growth and yield of cowpea genotypes.

A field experiment was carried out during *kharif* season of 2013 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad (Karnataka) in plot number 127 of 'E' block situated at 15°26' N latitude, 75°01' E longitude and at an altitude of 678 m above mean sea level. Which comes under Northern Transition Zone (Zone-8) of Karnataka. The soil type of experimental site was medium black clay soil. Which was low in nitrogen (213. 4 kg ha^{-1}), medium in phosphorous (21.50 kg ha^{-1}) and high in potash (325.84 kg ha^{-1}). There were 14 treatment combinations consisting of two cowpea genotypes (G_1- DC-15 and G_2- DCS-47-1) and seven modes of fertilization F_1- 50 % RDF through soil + two sprays of 2% DAP at 45 and 60 DAS, F_2- 50% RDF through soil + three sprays of 2 % DAP at 30, 45 and 60 DAS, F_3- 75 % RDF through soil + two sprays of 2 % DAP at 45 and 60 DAS, F_4- 75 % RDF through soil + three sprays of 2 % DAP at 30, 45 and 60 DAS, F_5- 100 % recommended dose of fertilizer through soil, F_6- five sprays of 2 % DAP at 15, 30, 45, 60 and 75 DAS and F_7- Control (no fertilizer and water spray). All the treatments were replicated thrice and laid out in a factorial randomized complete block design. Fertilizers were applied as per treatment (50 %, 75 % and 100 % of RDF) through Diammonium Phosphate (DAP) and urea at the time of sowing as basal dose. Two, three and five foliar sprays of 2 per cent DAP was given as per treatment. For foliar application, 20 g DAP was mixed with one litre of water and sprayed two times (at 45 and 60 DAS), three times (at 30, 45 and 60 DAS) and five times (15, 30, 45, 60 and 75 DAS) as per treatment. The cowpea genotypes DC-15 and DCS-47-1 were sown on 9th July, 2013 using seed rate of 20 kg ha^{-1} with a row spacing of 45 cm.

Among the two genotypes evaluated, DC-15 recorded significantly higher seed yield (1548 kg ha^{-1}), which was 10.72 per cent higher over DCS-47-1(1382 kg ha^{-1}). Seed yield is governed by number of factors which have direct or indirect impacts. Among the yield components significantly higher number of pods per plant (13.87), number of seeds per pod (11.51), and test weight (12.37 g) were recorded in DC-15 than in DCS-47-1. This improvement was mainly due to significantly higher number of branches (10.89), plant height (83.76 cm), total dry matter production per plant (28.37 g) in DC-15 at all growth stages of crop coupled with higher photosynthetic efficiency, due to its higher LAI (0.65, 4.59 and 1.63 at 30, 60 DAS and at harvest, respectively), which might have led to formation of larger sink (pods) and increased the grain yield. Which led to significantly higher gross returns (₹ 49329), net returns (₹ 31735) and benefit cost ratio (2.80) compared to DCS-47-1.

The seed yield of cowpea was significantly influenced by mode of fertilizer application. Among the treatment combinations, 75 per cent RDF through soil along with 3 sprays of 2 per cent DAP at 30, 45 and 60 DAS recorded significantly higher seed yield (1630 kg ha^{-1}) and it was on par with 75 per cent RDF through soil along with 2 sprays of 2 per cent DAP at 45 and 60 DAS (1566 kg ha^{-1}), 50 per cent RDF through soil along with 3 sprays of 2 per cent DAP at 30, 45 and 60 DAS (1562 kg ha^{-1}) and 50 per cent RDF through soil along with 2 sprays of 2 per cent DAP at 45 and 60 DAS (1554 kg ha^{-1}). The lowest seed yield was recorded with Control where no fertilizer

Table 1. Effect of mode of fertilization on yield attributes, yield and economics of cowpea genotypes

Treatment	Seed yield (kg ha^{-1})	No. of pods plant^{-1}	No. of seeds pod^{-1}	Test weight (g)	Gross returns(₹ ha^{-1})	Net returns (₹ ha^{-1})	B:C
Mode of fertilization							
F_1	1554	14.84	11.52	12.54	49470	31733	2.79
F_2	1562	14.97	11.65	12.57	49720	31308	2.70
F_3	1566	15.18	11.86	12.70	49901	31478	2.71
F_4	1630	15.39	12.09	12.82	51843	32745	2.71
F_5	1425	12.39	10.80	12.28	45632	27873	2.57
F_6	1363	11.18	9.53	11.57	43695	26145	2.49
F_7	1157	10.13	7.38	11.30	37358	23183	2.64
S. Em.±	28	0.18	0.39	0.09	818	818	0.05
C.D. (P=0.05)	80	0.53	1.12	0.25	2377	2377	0.14
Genotypes							
G_1	1548	13.87	11.51	12.37	49329	31735	2.80
G_2	1382	13.01	9.87	12.13	44276	26683	2.52
S. Em.±	15	0.10	0.21	0.05	437	437	0.03
C.D. (P=0.05)	43	0.28	0.60	0.13	1270	1270	0.07

F_1-50 % RDF through soil+2 sprays of 2 % DAP at 45 and 60 DAS
F_2-50 % RDF through soil+3 sprays of 2 % DAP at 30, 45 and 60 DAS
F_3-75 % RDF through soil+2 sprays of 2 % DAP at 45 and 60 DAS
F_4-75 % RDF through soil+3 sprays of 2 % DAP at 30, 45 and 60 DAS
F_5-100% RDF through soil
F_6-Five sprays of 2 % DAP at 15, 30, 45, 60 and 75DAS
F_7-Control (no fertilizer and water spray)
G_1- DC- 15
G_2- DCS-47-1

Table 2. Effect of mode of fertilization on growth parameters of cowpea genotypes

Treatment	Plant height (cm) at harvest	No. of branches plant^{-1} at 60 DAS	LAI at 60 DAS	Dry matter production (g plant^{-1}) at 60 DAS
Mode of fertilization				
F_1	80.39	9.33	4.11	29.55
F_2	83.54	9.92	4.39	29.67
F_3	85.27	10.89	5.00	29.88
F_4	89.87	11.86	5.27	30.65
F_5	84.67	10.69	4.67	26.81
F_6	75.94	9.14	4.02	23.37
F_7	74.23	8.75	3.80	21.75
S.Em.±	1.2	0.24	0.08	0.42
C.D. (P=0.05)	3.4	0.69	0.23	1.22
Genotypes				
G_1	83.76	10.89	4.59	28.37
G_2	80.21	9.28	4.34	26.40
S.Em.±	0.6	0.13	0.04	0.23
C.D. (P=0.05)	1.8	0.37	0.12	0.65

F_1- 50 % RDF through soil+2 sprays of 2 % DAP at 45 and 60 DAS
F_2- 50 % RDF through soil+3 sprays of 2 % DAP at 30, 45 and 60 DAS
F_3- 75 % RDF through soil+2 sprays of 2 % DAP at 45 and 60 DAS
F_4- 75 % RDF through soil+3 sprays of 2 % DAP at 30, 45 and 60 DAS
F_5- 100% RDF through soil
F_6- Five sprays of 2 % DAP at 15, 30, 45, 60 and 75DAS
F_7- Control (no fertilizer and water spray)
G_1- DC- 15
G_2- DCS-47-1

was applied and sprayed with water spray) (1157 kg ha^{-1}). Further, yield per hectare is determined by growth and yield components. Application of 75 per cent RDF through soil along with 3 sprays of 2 per cent DAP at 30, 45 and 60 DAS significantly increased the plant height (89.87 cm), No. of branches per plant (11.86), LAI (5.27), dry matter production per plant (30.65 g), number of pods plant^{-1} (15.39), number of seeds pod^{-1} (12.09) and test weight (12.82 g), compared to control. Increase in number of pods plant^{-1} played a major role in increasing the total seed yield and this improvement was mainly due to the increased nutrient supply and reduced nutrient losses. Spraying of 2 per cent DAP at 30, 45 and 60 DAS perhaps helped in quick absorption of nitrogen and phosphorous, at the time of reproductive stage where the nutrient demand is at the peak due to indeterminate growth habit of the crop. Hence it reduced the flower drop and ultimately enhanced the pod setting and resulted in higher seed yield. The results are corroborating with the findings of Choudhary and Yadav (2011) in cowpea who revealed that foliar spray of 2 % DAP at branching and flowering stages recorded significantly higher growth and yield parameters and yield over other treatments. Shashikumar *et al.* (2013) also reported that application of RDF as basal dose and foliar spray of 40 ppm NAA + 0.5 % chelated micronutrient + 2 % DAP at 35 DAS recorded significantly higher growth components and grain yield over rest of the treatments in blackgram. Similar findings were observed by Dixit and Elamathi (2007) in green gram.

Among mode of fertilizer application the treatment received 75 per cent RDF through soil along with 3 sprays of 2 per cent

DAP at 30, 45 and 60 DAS and 50 per cent RDF through soil along with 2 sprays of 2 per cent DAP at 45 and 60 DAS recorded significantly higher gross returns (₹ 51,843 and 49,470 respectively), net returns (₹ 32,745 and 31,733 respectively) compared to control. This was mainly due to higher seed and stover yield compared to other mode of fertilizer application. Genetype DC-15 recorded significantly higher net returns than DCS-47-1.

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