

Response of Micronutrient Spray on Seed yield and Quality of Cowpea

MAHAMMAD ISAK AND ASHOK S SAJJAN*

Department of Seed Science and Technology, College of Agriculture
University of Agriculture Science, Dharwad, Karnataka - 586101, India
*sajjanas@uasd.in

(Received : March 2018; Revised : May 2018; Accepted : May 2018)

Cowpea [*Vigna unguiculata* (L.) Walp.] being termed as black-eye pea, china pea, southern bean, is also considered as a miracle crop of the world. It is an important multipurpose arid legume crop, extensively cultivated in arid and semi arid regions of Africa and Asia, which can be utilized as a pulse or green pod vegetable or forage crop [1]. It plays an important role in maintaining soil fertility, yield potential of cowpea. It can be exploited by the application of adequate amount of micronutrients required by the legumes. Generally, balanced fertilizer is inevitable to boost crop productivity. Deficiency of boron, copper, manganese, molybdenum and zinc have been widely reported in pulses and it is either due to low level of nutrients in soil or reduced availability. Correction of micronutrients deficiency is warranted to improve the yield potential in pulses. Cowpea is widely cultivated pulse crop under rain fed condition on marginal and sub marginal land and due to plant nutritional problem which is main cause of reduction yield. In India, soil are deficient in micronutrients like Zn and Fe but in many crop the foliar application of micronutrients shows a positive result and such studies in cowpea are meager. Keeping in this view, present studies was carried out to analyses the impact of foliar spray of micronutrient in cowpea genotypes.

The field experiment was conducted during *kharif*-2010 at main Agriculture Research Station, UAS, Dharwad on black fertile soil, the experimental site having a nitrogen of 204.0 kg/ha (kjeldahl method) [2], phosphorus 50 kg/ha (OLSEN's method) [3], potassium 321 kg / ha (flame photometry method) [4], soil having a pH of 7.70. The treatment consisted T₁: control, T₂: ZnSo₄ @ 0.5 % foliar spray, T₃: FeSo₄ @ 0.5 % foliar spray and T₄: MgSo₄ @ 0.5 % foliar spray at 25 days after sowing (DAS) and 45 DAS. The cowpea genotype were used in

experiment are C-152, DC-47-1 and DC-15. The experiment was sown at row spacing 45 cm and plant to plant 15 cm. The recommended plant protection measures were taken out as and when required and other agronomic practices were carried out for production of healthy crop. The experimental observation on 100 seed weight, seed yield per plot, seed yield per hectare, germination, shoot length, root length, seedling vigour index, Electrical conductivity and seedling dry weight were recorded.

Seed yield and quality is more important than total biological yield which results from combination of many physiological processes based on the environment under which the crop is grown. Seed yield and quality depends on photosynthesis and the distribution of its products among various plant parts. The synthesis, accumulation and translocation of photosynthates depend upon efficient photosynthetic structure as well as source to sink relation and also on plant growth development during early stage of crop growth. Since, production as well as translocation of photosynthates is directly or indirectly dependent on seed production practices. The data on seed yield and seed quality attributes in cowpea genotypes presented in table 1. The results of experiment revealed that the effect of foliar application of ZnSo₄ @ 0.5 % at 25 DAS and 45 DAS was significantly influenced the seed yield and seed quality attributes of cowpea genotypes. Foliar application of ZnSo₄ @ 0.5 % at 25 DAS and 45 DAS recorded significantly higher seed yield per hectare (1353 kg) followed by MgSo₄ @ 0.5 % and FeSo₄ @ 0.5 %. The increased seed yield may be attributed to higher 100 seed weight (13.14g) and seed yield per plot (1217g). In cowpea, the seed yield depends on accumulation of photoassimilates and partitioning in different parts of the plant. The yield is strongly influenced

by application of micronutrients indicating the role of these micronutrients in increasing the yield through their effect on various morpho-physiological traits. Micronutrients like zinc sulphate, boron are brings about profound changes in various metabolic processes within the plant system and thereby, influence the seed yield potential [5, 6] in soybean. The micronutrients are capable of redistributing dry matter in the plant system thereby bring about an improvement in the yield and its attributes as it was also reported by [7] in cotton. Similarly, Mali *et al.* [8] reported that zinc takes part in metabolisms of plant as on activator of several enzymes which is directly or indirectly affected on carbohydrates and protein synthesis. Increased seed yield due to zinc application could possibly be due to the enhanced synthesis of carbohydrate and protein and their transport

to the site of seed formation. Good seed is the basis for successful crop production. The quality seeds ensured with uniform germination, rapid root and shoot development and resulted in increase in the yield per unit area. However realization of seed yield always depends on production of superior quality seeds without which targeting profits cannot be achieved. Foliar application of $ZnSO_4$ @ 0.5 % at 25 DAS and 45 DAS has recorded higher seed germination (96.44%); shoot length (22.29 cm), root length (14.94 cm), seedling vigour index (3596), lower electrical conductivity (0.380), and seedling dry weight (0.230 g) as compared to other treatments. This beneficial effect of foliar application of micronutrient were exhibited only when it was applied in conjunction which could be due to synergistic role of micronutrient in increasing the nutrient availability and

Table 1. Effect of foliar spray of micronutrients on seed yield and quality parameters in cowpea (*Vigna unguiculata* L.) genotypes

Varieties	100 seed weight(g)	Seed yield per plot (g)	Seed yield per hectare(kg)	Germination (%)	Shoot length(cm)	Root length(cm)	SVI	EC (dS m ⁻¹)	Seedling dry wt(g)
V ₁	11.83	1149	1265	94.93	21.07	13.87	3317	0.396	0.213
V ₂	13.92	1170	1328	96.72	22.89	15.89	3751	0.393	0.230
V ₃	11.65	1037	1153	94.20	20.83	13.69	3251	0.398	0.231
SEm(±)	0.37	36.92	21.62	0.27	1.665	0.163	167.65	0.003	0.008
CD (p=0.05)	1.518	75.26	102.71	0.398	0.301	0.264	243.1	0.015	NS
Treatments									
T ₁	12.10	1014	1123	93.92	21.23	14.19	3327	0.408	0.223
T ₂	13.14	1217	1353	96.44	22.29	14.98	3596	0.380	0.230
T ₃	12.35	1094	1241	95.56	21.45	14.40	3427	0.396	0.230
T ₄	12.28	1150	1277	95.22	21.41	14.36	3407	0.400	0.216
SEm(±)	0.18	36.97	43.66	0.948	0.695	0.43	82.28	0.003	0.006
CD (p=0.05)	0.551	127.94	151.08	0.271	0.186	0.178	103.8	0.013	NS
Interaction									
V ₁ T ₁	11.13	1033	1103	93.93	20.33	13.33	3162	0.404	0.209
V ₁ T ₂	12.93	1250	1388	96.13	22.20	14.60	3540	0.376	0.207
V ₁ T ₃	11.47	1103	1225	95.1	20.67	13.60	3255	0.396	0.219
V ₁ T ₄	11.80	1210	1344	94.67	21.07	13.93	3312	0.409	0.217
V ₂ T ₁	13.50	1060	1210	95.15	22.50	15.50	3615	0.409	0.228
V ₂ T ₂	14.80	1266	1407	97.87	23.47	16.47	3907	0.377	0.243
V ₂ T ₃	13.80	1150	1352	97.53	22.87	15.87	3777	0.395	0.233
V ₂ T ₄	13.60	1206	1340	96.33	22.73	15.73	3705	0.392	0.216
V ₃ T ₁	11.65	950	1055	92.67	20.87	13.73	3206	0.411	0.231
V ₃ T ₂	11.70	1136	1263	95.33	21.20	13.87	3343	0.386	0.239
V ₃ T ₃	11.80	1030	1144	94.13	20.80	13.73	3251	0.396	0.239
V ₃ T ₄	11.45	1033	1148	94.67	20.43	13.43	3205	0.398	0.215
SEm(±)	0.32	64.04	75.62	1.642	1.203	0.751	142.51	0.006	0.01
CD (p=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

Note: V₁: C-152 V₂: DC-47-1 V₃: DC-15
 T₁- control; T₂: $ZnSO_4$ @ 0.5 % foliar spray at 25 DAS and 45 DAS; T₃- $FeSO_4$ @ 0.5 % foliar spray at 25 DAS and 45 DAS; T₄: $MgSO_4$ @ 0.5 % foliar spray at 25 DAS and 45 DAS.

sustaining it over a period of time as compared to their individual application in pea and soybean [9]. Kasturikrishna *et al.* [10] also recorded that zinc application increased seed yield of pea probably owing to its influence of auxin synthesis, nodulation and development. There by favorably influencing seed yield which results in higher grain yield in mung bean due to zinc application has been reported [11].

Seed yield is governed by number of factors which have direct or indirect impacts. Among the genotypes, DC-47-1 was recorded significantly higher in seed yield per hectare (1,328 kg ha⁻¹) followed by C-152 (1,265 kg ha⁻¹) and lowest in DC-15 (1,153 kg ha⁻¹) (Table 1). Genotypes play an important role in determining the yield of a crop. The potential yield of genotypes within the genetic limit is set by the environment provided. Genotypes differed in their yield potential depending on many physiological processes, which are controlled by both genetic makeup of the plant and the environment. During summer availability of photoperiod is more that is reflected yield of genotype. Earlier studies by several workers also revealed varietal differences in the seed yield of cowpea [12-14]. The seed quality is also significantly influenced by genotypes (Table 1). The genotype DC-47-1 was recorded significantly higher seed germination (96.72 %), shoot length (22.89 cm), root length (15.89 cm) seedling vigour index (3751), lower seed leachate (0.393 dS m⁻¹) except seedling dry weight followed by C-152 and lowest in DC-15. Differences in seed quality parameters among varieties may be related seed maturity in ground nut [15]. Dry matter accumulation is genotype specific attribute and has relation with embryo development in soybean [16]. The interaction due to foliar spray of micronutrients cowpea genotypes did not differed significantly. However, the genotypes DC-47-1 has recorded higher seed yield and better seed quality parameters.

The foliar application of micronutrients like zinc, iron and magnesium has significantly influenced seed yield and seed quality attributes in cowpea genotypes. However, spraying of ZnSo₄ @ 0.5% at 25 and 45 DAS proved to be most effective treatment followed by MgSo₄ @ 0.5% and FeSO₄ @ 0.5% foliar spray at 25 and 45 DAS. Hence, it is concluded that foliar spray of micronutrients ZnSo₄ @ 0.5% at 25 and 45 DAS foliar spray and the genotypes DC-47-1 was found to be superior and economical for cowpea.

REFERENCES

1. ANONYMOUS (2014). Agriculture statistics at a glance. Retrieved from <http://agricoop.nic.in>.
2. KIRK PL (1950). Kjeldahl Method for Total Nitrogen. *Analytical Chemistry*, **22**(2): 354-358.
3. OLSEN SR, CV COLE, FS WATANABE AND LA DEAN (1954). Estimation of Available Phosphorus in Soils by Extraction with Sodium Bicarbonate. U. S. Department of Agriculture Circular No. 939. Banderis, A. D., D. H. Barter and K. Anderson. Agricultural and Advisor.
4. JANKOWSKI SJ AND H FREISER (1961). Flame Photometric Methods of Determining the Potassium Tetraphenylborate. *Analytical Chemistry*, **33**(6): 773-775.
5. PRAMOD KUMAR, SD DUBE AND VS CHAUHAN (1999). Effect of salicylic acid on growth, development and sum biochemical aspects of soybean (*Glycine max* L. Merrill.). *Indian Journal of Plant Physiology*, **4**: 327-330.
6. TRIPATHY SK, AK PATRA, AND SL SAMUI (1999). Effect of micronutrients on nodulation, growth yield and nutrient uptake by groundnut (*Arachis hypogaea* L.). *Indian Journal of Plant Physiology*, **4**(3): 207-209.
7. WANKHADE ST, LD MESHARAM, AND HK KENE (1994). Impact of foliar feeding of nutrients on hybrid seed production. *Punjabrao Krishi Vidya Peeth Research Journal*, **18**: 127-128.
8. MALI GC, NN SHARMA, HK ACHARYA, SK GUPTA AND PK GUPTA (2003). Response of mung bean to zinc and iron on vertisols in south eastern plain of Rajasthan. *Advances in Arid Legume Research*: 267-271.
9. HUGARAB AND MB KURDIKERI (2000). Effect of application methods and levels of zinc and molybdenum on field performance and seed yield in soybean. *Karnataka Journal of Agricultural Science*, **13**: 439-441.
10. KASTURIKRISHNA S AND IPS AHLAWAT (2000). Effect of moisture stress and phosphorus, sulphur and zinc fertilizers on growth and development of pea (*Pisum sativum*). *Indian Journal of Agronomy*, **45**: 353-356.
11. GUPTA PK, NN SHARMA, HK ACHARYA, SK GUPTA AND GC MALI (2003). Response of mung bean to zinc and iron on vertisols in south eastern plain of Rajasthan. *Advances in Arid Legume Research*: 259-356.
12. JADHAV AG, SHINDE SH AND PS POL (1995). Growth and yield of cowpea varieties as influenced by seedling dates. *Journal of Maharashtra Agriculture University*, **20**: 295-296.
13. NIRMAL, RAJKUMAR, G KALLOO, AND R KUMAR (2001). Diet versatility in cowpea (*Vigna unguiculata*) genotypes. *Indian Journal of Agricultural Sciences*, **71**: 598-601.
14. PURUSHOTHAM S, GV NARAYANSWAMY, R SIDDARAJU AND GK GIREJESH (2001). Production potential of fodder cowpea genotypes under rainfed conditions. *Karnataka Journal of Agricultural Science*, **14**(2): 446-448.
15. TIMMANAVAR M, PN UMAPATHY, M SHEKARGOUDA, MB KURDIKERI AND AS CHANNAVEERSWAMY (2003). Influence of harvesting stage on seed yield and quality in confectionary groundnut varieties. *Seed Research*, **31**(1):13-17.
16. GORE SV, RB PATIL AND GR WANKADE (1997). Effect of maturity period and harvesting time on seed quality in Soybean (*Glycine max*) cultivars. *Seed Research*, **25**(1): 45-49.