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Physiological parameters of cowpea [*Vigna unguiculata* (L.) Walp] as influenced under integrated nutrient management

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Abstract
A field trial was conducted at agronomy farm, S.K.N. Agriculture University, Jobner during *kharif* season of 2019 to study the response of cowpea [*Vigna unguiculata* (L.) Walp] to integrated nutrient management. The experiment comprised of 12 treatments involving control, RDF (20:40), FYM, Poultry Manure and their respective combinations including biofertilizers which was laid out in randomized block design with four replications. Results revealed that the magnitude of most of physiological parameters was increased under combined application of T_{12}- 50% RDF + PM @ 2 t/ha + *Rhizobium* + PSB followed by T_{11}- 50% RDF + FYM @ 4 t/ha + *Rhizobium* + PSB, T_{10}- 50% RDF + PM @ 2 t/ha + PSB, T_9- 50% RDF + FYM @ 4 t/ha + PSB, T_8- 50% RDF + PM @ 2 t/ha + *Rhizobium*, T_7-50% RDF + FYM @ 4 t/ha + *Rhizobium*, T_6- 50% RDF + PM @ 2 t/ha, T_5- 50% RDF + FYM @ 4 t/ha, T_4-PM @ 4 t/ha, T_3- FYM @ 8 t/ha and T_2- 100% RDF (20:40) and significantly superior to rest of the treatments. T_{12} treatment recorded higher CGR, RGR, Leaf area index and Chlorophyll content remained at par on treatment T_6, T_7, T_8, T_9, T_{10} and T_{11}.

Keywords: Physiological parameters, CGR, RGR, LAI

Introduction
Among the different pulses, cowpea [*Vigna unguiculata* (L.) Walp] is the important crop grown in arid and semi-arid regions of the state. Cowpea belongs to the family *Leguminosae*, (chromosome no. 2n = 22 or 24) and commonly referred to as lobia. Cowpea is *kharif* pulse crop grown for vegetable, grain, forage and green manuring. It has good promise as an alternative pulse crop in dry land farming. It also works as smother crop keeping weed infestation low. Being rich in protein and containing many other nutrients, it is also known as vegetable meat. It has long, green or purplish pods to be cooked as vegetable or for dry seeds used as pulse. Its foliage is also used as fodder or green manure.

Cowpea is highly responsive to fertilizer and manures. Among nutrients, nitrogen is one of the important nutrients. Cowpea is a legume crop able to fixing atmospheric nitrogen, and still it responds to small amount of nitrogenous fertilizers apply as starter dose (Meena and Chand, 2014) [7]. In addition, N and P have a stimulating effect on root activity and rooting pattern of the leguminous crop. Plants fed with organic nitrogen during vegetative periods are much larger till the onset of flowering than those dependent on symbiotic N-fixation.

Application of 20 kg Nitrogen/ha has been found ideal to get better response from the pulses. Application of higher dosage of nitrogen may reduce growth and number of nodules and thus badly affect the nitrogen fixation capacity (Singh and Nair, 1995) [11]. Phosphorus is most important mineral nutrient for pulses as it aids in proper root growth and development and hence, making them more effective in biological nitrogen fixation (BNF). It is an essential constituent of nucleic acid such as ribonucleic acid (RNA) and deoxyribonucleic acid (DNA), adenosine diphosphate (ADP) and adenosine triphosphate (ATP), nucleoprotein, amino acids, proteins, phosphotides, phytin, several coenzymes *viz*. thiamine, pyrophosphate and phyrodoxy phosphite. Balanced nutrition is essential for the proper growth and productivity of crops.

Low cost nutrient supplementation through biofertilizers as integrated nutrient supply system may be a better option to fulfill nutrient requirement of the crop. FYM is rich in plant nutrients and helps to buffer soils against rapid chemical changes.

FYM also acts as a source of energy for the growth of soil microbes and improvement in organic carbon, available nitrogen, phosphorus, potassium etc.

Poultry manure is a by-product of poultry and is rich in nutrients, which can provide a major source of nitrogen, phosphorus and trace elements for crop production. Poultry manure can also improve physical and biological fertility of soil, making it ideal for land application as a fertilizer. India produces about 8.0 million tonnes of poultry manure, enough to fertilize about 3.6 million hectares of land annually, if appropriately utilized it can help to save billions of foreign exchanges, by replacing vast imports of chemical fertilizers (Meena, 2012) [8].

Biofertilizers are small microbes containing living cells of nitrogen fixing and phosphate solubilizing microorganism for treatment of seed or soil. Biofertilizers help in increasing the soil fertility naturally and has no harmful effect on soil like chemical fertilizers. Hence, to increase the productivity of the soil, the use of biofertilizer is must (Schutz *et al.*, 2018) [10]. Biofertilizer also increases fertilizer use efficiency in crops. They can play a significant role in fixing atmospheric nitrogen and enrich soil fertility. Among these biofertilizers, *Rhizobium* inoculants are specific for different leguminous crops.

Materials and Methods

An attempt was made to study response of cowpea [*Vigna unguiculata* (L.) Walp] to integrated nutrient management. Field experiment was conducted during *kharif* season of 2019 at agronomy Farm, SKN Agriculture University, Jobner (Rajasthan). The soil was loamy sand with pH 8.2, available N 121.7 kg/ha (Subbiah and Asija, 1956) [12], P 16.12 kg/ha (Olsen et al., 1954), K 153.24 kg/ha (Jackson, 1967) [4] and 0.21% organic carbon (Jackson, 1973) [5]. The twelve treatments comprised of control, RDF (20:40), FYM, Poultry Manure and their respective combinations including biofertilizers were laid out in Randomized Block Design with four replications. The treatments were derived on keeping the base of nitrogen in FYM and poultry manure. Recommended dose of fertilizer was applied @ 20 and 40 kg N and P_2O_5 /ha, respectively, as per treatment through DAP. *Rhizobium* and PSB inoculation was done with 30 g of jaggery was boiled in one half litre water and then cooled, 50 g of culture was mixed in jaggery solution. The required quantity of seed was thoroughly mixed with the paste of culture to inoculate them with *Rhizobium*/ PSB and then the seeds were allowed to dry in shade. The treated seeds were sown as per treatments. Well decomposed farm yard manure and poultry manure were applied as per treatment at the time of sowing and thoroughly incorporated in soil with the help of spade. Seeds were inoculated with *Rhizobium* and PSB culture as per treatments. The seeds were sown by 'kera' method with row spacing of 30 cm by hand plough at a depth of 5 cm using a seed rate of 20 kg/ha. The variety RC-19 of cowpea was used as the test crop and the sowing was done on 20 July 2019.

CGR is calculated on the basis of following formula

CGR= (1/P) x (W2-W1) / (t2-t1)

LAI is calculated on the basis of following formula

LAI = leaf area / ground area

RGR is calculated on the basis of following formula

RGR= (1/W) (dW/dt)

The experimental data recorded for CGR, RGR, LAI and chlorophyll content were subjected to statistical analysis in accordance with the "Analysis of Variance" technique suggested by (Fisher, 1950). Appropriate standard error for each of the factor was worked out. Significance of differences among treatment effects was tested by "F" test. Critical difference (CD) was worked out, wherever the difference was found significant at 5.0 or 1.0 per cent level of significance.

Results and Discussion

Crop growth rate (CGR)

It is apparent from data in table 1 that the different treatments of integrated nutrient management significantly increased the CGR of cowpea. Application of 50% RDF + PM @ 2 t/ha + *Rhizobium* + PSB recorded significantly higher CGR indicating an increase of 21.2, 20.9 and 13.5 per cent, at 25 - 50 DAS, respectively, over T_1, T_2 and T_3 treatments. However, it remained at par with T_4, T_5, T_6, T_7, T_8, T_9, T_{10} and T_{11}.

Relative growth rate (RGR)

Results shown in data (Table 1) further revealed the relative growth rate of cowpea varied significantly with the different treatments of integrated nutrient management. The treatment T_6 (50% RDF + PM @ 2 t/ha) recorded maximum RGR per plant which was at par with T_7, T_{10} and T_{11} at harvest but superior to remaining treatments.

Leaf area index (LAI)

A perusal of data in (Table 2) revealed that different treatments of integrated nutrient management significantly increased the leaf area index of cowpea over control wherein the treatment 50% RDF + PM @ 2 t/ha + *Rhizobium* + PSB recorded maximum LAI per plant which was at par with T_{11}, T_8, T_7 and T_6 treatments at 25 DAS, whereas at 50 DAS, the treatment T_{12}; 50% RDF + PM @ 2 t/ha + *Rhizobium* + PSB recorded maximum leaf area index which was at par with T_{11}, T_{10}, T_9, T_8, T_7, T_6 and T_3 and represented an increase of 23.92, 19.24, 16.46 and 14.70 per cent, over T_1, T_2, T_4 and T_5 treatments.

Chlorophyll content

An examination of data (Table 2) further indicated that application of treatment of integrated nutrient management significantly increased the chlorophyll content of cowpea at 40 DAS over control. Treatment T_{12} i.e. 50% RDF + PM @ 2 t/ha + *Rhizobium* + PSB represented a significant increase of 41 per cent over control. However, treatment T_{12} remained at par with T_2, T_3, T_4, T_5, T_6, T_7, T_8, T_9, T_{10} and T_{11} in chlorophyll content of cowpea.

This increase in growth parameters may be due to added advantages of organic manure in conjunction with chemical fertilizers along with biofertilizers besides supplying all the essential nutrients. It is well established fact that organic manures such as poultry manure and FYM improve the physical and biological properties of soil as well as supply of approximately all the plant nutrients which are important for growth and development of plants. Thus, balanced nutrition

under crucial environment might have helped in production of new tissues and in turn development of new shoots of cowpea which have increased the CGR, LAI, RGR and chlorophyll content of cowpea. These results are in close agreement with those of Yadav and Yadav (2011) [13] and Meena *et al.* (2015) [6] who observed higher value of physiological parameters of cowpea due to application of fertilizers and manures in combination. The role of free living nitrogen fixing microorganisms (*Rhizobium* and PSB) for enhancing plant growth through their ability in nitrogen fixation as well as the effect of their metabolites secretion on the crop may also be attributed for the increased growth of cowpea. The availability of phosphorus increased due to use of PSB because it produces plant growth promoting antifungal and antibacterial substances which influence plant growth favorably. The findings of present investigation corroborated with those of Deshumkh *et al*. (2010) [2] and Chattopadhyay and Dutta (2003) [1] in cowpea.

Table 1: Effect of integrated nutrient management on crop growth rate and relative growth rate of cowpea

Treatments	Crop growth rate (g/m2/day)		Relative growth rate (mg/g/day)	
	25 - 50 DAS	50 DAS – At harvest	25 - 50 DAS	50 DAS - At harvest
T_1 -Control	9.04	2.31	76.4	6.4
T_2 -100% RDF (20:40)	9.06	3.32	70.1	8.7
T_3 -FYM @ 8 t/ha	9.66	3.51	71.9	8.7
T_4 -PM @ 4 t/ha	9.87	3.65	72.2	8.8
T_5 -50% RDF + FYM @ 4 t/ha	10.36	3.28	73.6	7.7
T_6 -50% RDF + PM @ 2 t/ha	10.62	4.95	73.3	10.9
T_7 -50% RDF + FYM @ 4 t/ha + *Rhizobium*	10.48	4.83	73.5	10.8
T_8 -50% RDF + PM @ 2 t/ha + *Rhizobium*	10.64	3.86	73.1	8.7
T_9 -50% RDF + FYM @ 4 t/ha + PSB	10.59	3.66	74.1	8.4
T_{10} -50% RDF + PM @ 2 t/ha + PSB	10.82	4.70	73.4	10.2
T_{11} -50% RDF + FYM @ 4 t/ha + *Rhizobium* + PSB	10.78	4.71	71.2	10.2
T_{12} -50% RDF + PM @ 2 t/ha + *Rhizobium* + PSB	10.96	4.43	70.8	9.5
S.Em+	0.41	0.16	2.8	0.4
CD (P=0.05)	1.22	0.49	NS	1.1
CV (%)	7.93	8.33	7.7	8.1

NS = Non Significant

Table 2: Effect of integrated nutrient management on leaf area index (LAI) and total chlorophyll content at 40 DAS of cowpea

Treatments	LAI		Total chlorophyll content (mg)
	25 DAS	50 DAS	
T_1 -Control	2.18	5.10	1.87
T_2 -100% RDF (20:40)	2.62	5.30	2.05
T_3 -FYM @ 8 t/ha	2.64	5.67	2.10
T_4 -PM @ 4 t/ha	2.75	5.57	2.14
T_5 -50% RDF + FYM @ 4 t/ha	2.69	5.51	2.17
T_6 -50% RDF + PM @ 2 t/ha	3.43	5.83	2.20
T_7 -50% RDF + FYM @ 4 t/ha + *Rhizobium*	3.45	5.96	2.24
T_8 -50% RDF + PM @ 2 t/ha + *Rhizobium*	3.53	6.02	2.23
T_9 -50% RDF + FYM @ 4 t/ha + PSB	2.90	5.73	2.27
T_{10} -50% RDF + PM @ 2 t/ha + PSB	3.10	5.92	2.26
T_{11} -50% RDF + FYM @ 4 t/ha + *Rhizobium* + PSB	3.40	6.04	2.25
T_{12} -50% RDF + PM @ 2 t/ha + *Rhizobium* + PSB	3.60	6.32	2.28
S.Em+	0.12	0.23	0.08
CD (P=0.05)	0.37	0.69	0.23
CV (%)	8.25	7.96	7.08

Conclusion

On the basis of one year experimentation, it may be concluded that application of 50% RDF + PM @ 2 t/ha + *Rhizobium* + PSB was found the most superior treatment combination for obtaining higher values of CGR, RGR, Leaf area index and chlorophyll content in cowpea.

References

1. Chattopadhyay A, Dutta D. Response of vegetable cowpea to phosphorus and biofetilizers in old alluvial zone of West Bengal. Legume Research. 2003;26:196-199.
2. Deshmukh SS, Shaikh AA, Desai MM. Influence of integrated nutrient management on growth and yield contributing characters of summer sesame. Maharashtra Journal of Agriculture University. 2010;35(1):3-6.
3. Fisher RA. Statistical Methods for Research Workers. Oliver and Boyd Edinburg, London, 1950, pp. 57-63.
4. Jackson MC. Soil chemical analysis. Printice Hall Enc., N.J., USA, 1967.
5. Jackson ML. Soil chemical analysis. Printice Hall Enc., N.J., U.S.A, 1973.
6. Meena JS, Verma HP, Pancholi P. Effect of fertility levels and biofertilizers on growth and yield of cowpea on sandy loam soil of Rajasthan. Asian Journal of Soil Sciences. 2015;10:55-58.
7. Meena LR, Chand R. Response of fodder cowpea to varying levels of nitrogen and phosphorus under rainfed conditions of Rajasthan. Indian Journal of Small Ruminents. 2014;20:121-123.

8. Meena RS. Effect of organic and inorganic sources of nutrients on growth, yield and quality of mungbean [*Vigna radiata* (L.) Wilczek]. *M.Sc. Thesis*, Rajasthan Agricultural University, Bikaner, 2012.
9. Olsen SR, Cole CW, Watanable FS, Dean LA. Estimation of available phosphorus in soils by extraction with NaHCO3. Circular, United States Department of Agriculture, 1954, pp. 939.
10. Schutz L, Gattinge RA, Meier M, Muller A, Boller T, Mader P, *et al*. Improving crop yield and nutrient use efficiency via bio-fertilization-A global meta-analysis. Frontiers in Plant Science. 2018;12(8):204-208.
11. Singh B, Nair TVR. Effect of nitrogen fertilization on nodulation and nitrogen assimilation in cowpea. Crop Improvement. 1995;22:133-138.
12. Subbiah BV, Asija GL. A rapid procedure for the determination of available nitrogen in soils. Current Science. 1956;25:259-260.
13. Yadav SL, Yadav LR. Effect of phosphorus and biofertilizers on productivity of garden pea under semi-arid condition. Journal of Food Legumes. 2011;24(3):248-249.