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Effect of Integrated Nutrient Management on growth and yield of yardlong bean (*Vigna unguiculata* (L.) walp. ssp. *sesquipedalis* verdc.)

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ABSTRACT
The present investigation was carried out during Rabi season of 2018-19 to evaluate the effect of various sources of nutrients including organic, inorganic and biofertilizers on growth and yield of yardlong bean (Vigna unguiculata ssp. sesquipedalis) cv. Arka Mangala. As regards the gowth parameters the maximum vine length (2.61m), number of primary branches (7.60), terminal leaf length (16.57 cm), number of nodes per plant (19.37), were reported by application of 75% RDN through inorganic + biofertilizers (Rhizobium + PSB). In respect of yield per hectare and over all yield contributing factors, such as number of cluster per plant (48.30), pods per cluster (3.93), pod length (62.08 cm), pod girth (24.87 cm), pod yield (14.26 t/ha) and seeds per pod (15.06) recorded significantly higher in the treatment of 75% RDN through inorganic+25% RDN through vermicompost + biofertilizers (Rhizobium + PSB). Thus growth and yield may be improved by integrated use of organic and inorganic sources of nutrients.

KEY WORDS: *Yardlong bean, RDN, Rhizobium, Phosphate solubalizing bacteria, Vermicompost*

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I. INTRODUCTION

Yardlong bean (*Vigna unguiculata* ssp. *sesquipedalis* (L.) verdc.) is a distinct form of cowpea and it belongs to the family leguminoceae, chromosome number 2n=22 and originated from Central Africa. It is cultivated mainly for its crisp and tender green pods which are consumed both fresh as well as in cooked form. Yard long bean belongs to sub family – Papilionaceae it is viny, indeterminate in growth habit, leaves are trifoliate and green in color. Flowers are of papilionaceous type with violet color. Pods are long, slender and pendent with sparely arranged bold seeds. Considering the nutritive value, 100 g of green pods of yard long bean contain energy (34.00 Kcal), protein (4.20 mg), calcium (110.00 mg), iron (4.70 mg), vitamin A‟‟ (2.40 mg), vitamin „C‟‟ (35.00 mg) and is also good source of lysine (Anon; 2006).

Yardlong bean highly responsive to fertilizer application. The dose of fertilizer depends on the initial soil fertility status and moisture conditions. Although yardlong bean being a legume is capable of fixing atmospheric nitrogen, it responds to small quantity of nitrogenous fertilizers applied as starter dose. Application of 20-30 kg N/ha has been found optimum to get better response. In terms of significance, phosphorus is most indispensable mineral nutrient for better root growth and development and thereby making them more efficient in biological nitrogen fixation (BNF). Use of biofertilizers can have a greater importance in increasing fertilizer use efficiency. Indian soils are

characterized poor to medium status with respect to nitrogen and available phosphorus. The use of organic manures (vermiconpost FYM, neemcake) will help in improving the efficiency of inorganic fertilizers. The present investigation was undertaken with a view to study the effect of integrated nutrient management on growth and yield of yardlong bean.

II. MATERIALS AND METHODS

The experiment entitled studies on integrated nutrient management in yardlong bean was carried out at College of Horticulture, Venkataramannagudem, Andhra Pradesh during 2018-19. Geographically it is situated between 16.83° N latitude and 81.5° E longitude at an altitude of 34 m above the mean sea level. The climate of venkataramanna gudem is characterized by three distinct season hot and dry summer from March to May, warm humid and rainy monsoon from June to October and mid cold winter from November to February. The soil was loamy sand in texture with good water hoiding capacity. The soil pH (6.98), EC was (0.26 dsm^{-1}), organic carbon (0.34%), available nitrogen (140.0 kg/ ha), available phosphorus (41.0 kg P2O5/ ha) and potassium (175.0 kg K2O/ha) content. The experiment was arranged in a randomized complete block design and replicated three times. Treatments included T_1-75% RDN through inorganic+25% RDN through vermicompost+

biofertilizers; T_2-75% RDN through inorganic+25% RDN through FYM + biofertilizers; T_3-75% RDN through inorganic+25% RDN through neemcake+ biofertilizers; T_4-50% RDN through inorganic+50% RDN through vermicompost + biofertilizers; T_5-50% RDN through inorganic+50% RDN through FYM +biofertilizers; T_6-50% RDN through inorganic +50% RDN through neemcake+biofertilizers; T_7-25% RDN through inorganic+75% RDN through vermicompost+biofertilizers ; T_8- 25% RDN through inorganic+75% RDN through FYM +biofertilizers; T_9- 25% RDN through inorganic+75% RDN through neemcake + biofertilizers; T_{10}- 100% RDN through inorganic+ vermicompost; T_{11}- 100% RDN through inorganic+ FYM; T_{12}-100% RDN through imorganic+neemcake; T_{13}-100% RDN through inorganic+biofertilizers; T_{14}-100% RDN (50:75:60 kg/ha); T_{15}-control (no fertilizer). Seeds ofyardlong bean, var. Arka Mangala, were sown on 3 October 2018 on ridges measuring 8.5m × 1.50 m at the spacing of 1 m × 75 cm and irrigated timely according to the need of crop. To keep the crop free from insect pest four spraying were given. Observations on growth parameters were recorded at the time of harvest. The analysis of variance was carried out using the randomized complete block design (Panse and Sukhatme 1967).

III. RESULTS AND DISCUSSION

Growth parameters

From the data presented in (Table 1), significantly maximum vine length was recorded by the plant fertilized with treatment T_1 (2.61m) followed by T_2 (2.50 m), T_3 (2.30 m) and T_{10} (2.23m) which was statistically at par with each other. Whereas, the minimum vine length was recorded under control (1.03 m). The results of the present investigation showed an increase in plant height, might be due to the application of nitrogenous fertilizers applied through inorganic fertilizers might have supplied nutrients in the early stages, whereas in later stages, the mineralized N from organic manures and atmospheric N fixation by *Rhizobium* contributed to N availability to crop. Another reason for increase in vine length is result of PSB biofertilization. Additionally it may also be due to the fact that the efficiency of nitrogen might have increased in the presence of phosphorus. Hence, there was continuous supply of nutrients throughout the crop growth period. These findings are in conformity with Ashwinkumar and Pandita (2016) in cowpea, Jubinchauhan *et al*. (2016) in cowpea, Barcchiya and Kushwah (2017) in French bean. Data presented in (Table 1), revealed that the number of primary branches per plant were significantly maximum with T_1(7.60) followed by T_2 (7.13) which was found to be at par with T3 (7.10). While, minimum number of branches per plant was recorded under control (4.92). It might be due to the application of phosphorus through inorganic fertilizer and inoculation with PSB, which increased the availability of phosphorus in root zone, which in turn resulted in better growth and development of roots and shoots and also helped in better nodulation. Similar results were reported by Sajitha *et al.* (2016) in dolichus bean. A reference to data in (Table 1) shows that the significantly maximum terminal leaf length was recorded with treatment T_1 (16.57 cm) and it is at par with T_2 (16.08 cm) followed by T_3 (15.81 cm). Whereas, minimum leaf length was recorded under control (13.13 cm). Increase in leaf length, might be due to the inoculation with Rhizobium and PSB, which accelerate root development hence improved uptake of nutrients. Similar results were reported by Ujjainiya and Choudhary (2015) in Indian bean. The results (Table1) revealed that the maximum number of nodes per plant under treatment T_1 (19.37) which was found to be at par with T_2 (19.13), significantly superior to all other treatments. Whereas, minimum number of nodes per plant was recorded under control (12.11). The results of the present investigation showed an increase in number of nodes per plant, might be due to the inoculation with treatment of Rhizobium and PSB, which accelerate root development and ultimately uptake of nutrients. It is evident from the data in Table 1 that significantly minimum number of days to first flowering was recorded in treatment T_1 (41.13 days) and it was at par with T_2 (41.49 days), while the maximum number of days to first flowering was recorded in control (45.93 days). Application of organic and inorganic fertilizers as well as by Rhizobium and PSB treatment increased availability of nitrogen and phosphorus might have resulted in minimum number of days for first flowering. Similar results were observed by Jubin chauhan *et al*. (2016) in cowpea. The data shows that minimum number of days to 50% flowering was recorded in T1 (44.23 days) and it is at par with T2 (44.46 days), while the maximum number of days was recorded in control (49.04 days) These trend is due to the application of organic and inorganic fertilizers as well as by *Rhizobium* and PSB seed treatment increased availability of nitrogen and phosphorus might have resulted in minimum number of days for 50% flowering. These findings are in accordance with work done by Sahu (2014) in French bean, Jubinchauhan *et al*. (2016) in cowpea.

Yield attributes

The data presenting in (Table 2) revealed that maximum number of clusters per plant was recorded in treatment T_1 (48.30) which was at par with T_2 (46.20), T_3 (44.80) and T_{10} (43.60). However, the minimum number of cluster per plant was recorded under control (26.25). Similarly data on number of pods/cluster in (Table 2), showed that maximum number of pods per cluster was recorded in treatment T_1 (3.93) which was at par with T_2 (3.73). Whereas, minimum number of pods per cluster was recorded under control (2.00). The results of the present investigation showed an increase in cluster per plant and pods per cluster, might be due to the application of organic and inorganic fertilizers as well as by Rhizobium and PSB treatment. The treatment was responsible for more vegetative and reproductively growth of such plant due to release of more nutrient and organic acids, from the soil and thereby utilizing more nutrient and moisture from the soil. Similar results were observed by Mishra

Table 1 Effect of Integrated Nutrient Management practices on growth parameters of yardlong bean var. Arka Mangala

Treatments	Growth parameters					
	Vine length (cm)	Branches per plant	Terminal leaf length (cm)	No. of nodes per plant	Days to 1st flowering	Days to 50% flowering
T1:75% RDN through in organic+25% RDN through vermicompost+biofertilizers	2.61	7.60	16.57	19.37	41.13	44.23
T2:75% RDN through in Organic+25% RDN through FYM +biofertilizers	2.50	7.13	16.09	19.13	41.49	44.46
T3:75% RDN through in Organic+25% RDN through Neemcake+biofertilizers	2.30	7.10	15.81	18.26	42.34	44.53
T4:50 % RDN through in Organic+50% RDN through Vermicompost+biofertilizers	2.02	6.60	15.59	16.00	43.86	46.71
T5:50% RDN through in Organic+50% RDN through FYM+ biofertilizers	1.95	6.20	15.34	14.93	43.86	46.71
T6:50% RDN through in Organic+50% RDN through Neemcake+biofertilizers	1.82	6.15	15.01	14.13	44.10	47.41
T7:25% RDN through in Organic+75% RDN through Vermicompost+biofertilizers	1.46	6.13	13.85	13.20	44.82	47.71
T8:25% RDN through in Organic+75% RDN through FYM +biofertilizers	1.45	6.00	13.82	12.66	45.40	48.50
T9:25% RDN through in Organic+75% RDN through Neemcake+biofertilizers	1.37	5.26	13.40	12.40	45.67	48.62

T10:100% RDN through in Organic+vermicompost	2.23	7.02	15.52	16.71	41.53	44.70
T11:100% RDN through in Organic+FYM	2.21	7.00	15.33	16.60	41.58	45.00
T12:100% RDN through in Organic+neemcake	2.09	6.80	15.10	16.00	41.60	45.30
T13:100% RDN through in Organic+biofertilizers	2.06	6.73	15.09	15.46	41.63	45.80
T14:100% RDN (50:75:60kg/ha)	2.04	6.13	15.04	15.13	41.80	45.90
T15:control	1.03	4.92	13.13	15.13	41.80	49.04
S.E (m)	0.128	0.114	0.091	0.167	0.131	0.157
C.D (5%)	0.374	0.333	0.266	0.485	0.382	0.457

(2003). It is evident from the data in (Table 2), that the length of pod was maximum in the plant getting treatment T_1 (62.08 cm) which was at par with T_2 (60.54 cm), T_3 (59.84 cm), T_{10} (58.73 cm) while the minimum length of pod was observed in control (47.80 cm). Data presented in (Table 2), revealed that the treatment T_1 exhibited maximum girth of pod (24.87 mm) which was at par with T_2 (24.46 mm). Whereas, the minimum pod girth was observed under control (21.91mm). The results of present investigation shows increased supply of N and P and their higher uptake by plants might have stimulated the rate of various physiological processes in plant and resulted in increased pod length. The results are in concurrence with the findings of Saikia *et al.* (2018) in French bean. From the reference to data in (Table 2), showed that maximum pod yield per plant was observed in treatment T_1 (263.70 g). Whereas, the minimum yield per plant was observed by the plant with control (170.50 g).The maximum pod yield per hectare was observed in T_1 (14.26 t) it was followed by treatment T_2 (13.52 t) and T_3 (13.20 t), while minimum pod yield per hectare was observed in control (9.79 t). This increase is due to the supply of N and P through organic manures and inorganic fertilizers along with *Rhizobium* and PSB and their higher uptake by plants might have stimulated the rate of various physiological processes in plant and led to increased pod yield. These findings are in accordance with Arulananth and Rameshkumar (2018) in dolichus bean.

Table 2 Effect of Integrated Nutrient Management practices on yield parameters of yardlong bean

Treatments	Yield parameters					
	No. of clusters /plant	No.of pods /cluster	Pod length (cm)	Pod girth (mm)	Pod yield/ plant (kg)	Total yield (t/ha)
T1	48.30	3.93	62.08	24.87	263.70	14.26
T2	46.30	3.73	60.54	24.46	234.60	13.52
T3	44.80	3.60	59.84	24.41	228.00	13.20
T4	36.00	2.91	54.29	23.76	203.30	11.81
T5	31.80	2.80	53.17	23.72	201.00	11.63
T6	30.50	2.66	52.63	23.71	199.60	11.55

T7	29.60	2.60	50.99	23.69	193.60	11.21
T8	28.40	2.53	50.80	23.54	185.20	10.52
T9	27.10	2.33	48.42	23.28	176.10	10.14
T10	43.60	3.46	58.73	24.34	218.80	12.56
T11	41.70	3.26	57.74	24.20	212.30	12.29
T12	40.40	3.24	56.40	24.07	212.10	12.25
T13	39.90	3.00	55.94	23.98	207.60	12.00
T14	37.60	2.93	55.53	23.97	207.30	11.90
T15	26.25	2.00	47.80	21.91	170.50	9.79
S.E(m)	0.302	0.105	0.912	0.125	4.593	0.296
C.D(5%)	0.879	0.306	2.655	0.364	13.373	0.861

IV. CONCLUSION:

It can be concluded that application of 75% RDN through inorganic+25% RDN through vermicompost + biofertilizers (Rhizobium+PSB) had favourable influence on growth and yield of yardlong bean.

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