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Effect of integrated nutrient management on yield and yield attributes 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 yield and yield attributing characters of yardlong bean (*Vigna unguiculata* ssp. *sesquipedalis*) cv. Arka Mangala. As regards the 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 per plant (263.70 g), total 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).

Keywords: Yardlong bean, RDN, *Rhizobium*, Phosphate solubalizing bacteria, Vermicompost

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) [1].

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.

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) [4].

Results and Discussion

Yield and Yield attributes

The data presenting in (Table1) 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 (Table1), 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 (2003) [3]. It is evident from the data in (Table 1), 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 1), 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) [5] 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) [2] in dolichus bean.

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

Yield parameters						
Treatments	**No. of clusters /plant**	**No. of pods /cluster**	**Pod length (cm)**	**Pod girth (mm)**	**Pod yield/ plant (g)**	**Total yield (t/ha)**
T1:75% RDN through in organic+25% RDN through vermicompost+biofertilizers	48.30	3.93	62.08	24.87	263.70	14.26
T2:75% RDN through in Organic+25% RDN through FYM +biofertilizers	46.20	3.73	60.54	24.46	234.60	13.52
T3:75% RDN through in Organic+25% RDN through Neemcake+biofertilizers	44.80	3.60	59.84	24.41	228.00	13.20
T4:50 % RDN through in Organic+50% RDN through Vermicompost+biofertilizers	36.00	2.91	54.29	23.76	203.30	11.81
T5:50% RDN through in Organic+50% RDN through FYM+ biofertilizers	31.80	2.80	53.17	23.72	201.00	11.63
T6:50% RDN through in Organic+50% RDN through Neemcake+biofertilizers	30.50	2.66	52.63	23.71	199.60	11.55
T7:25% RDN through in Organic+75% RDN through Vermicompost+biofertilizers	29.60	2.60	50.99	23.69	193.60	11.21
T8:25% RDN through in Organic+75% RDN through FYM +biofertilizers	28.40	2.53	50.80	23.54	185.20	10.52
T9:25% RDN through in Organic+75% RDN through Neemcake+biofertilizers	27.10	2.33	48.42	23.28	176.10	10.14
T10:100% RDN through in\Organic+vermicompost	43.60	3.46	58.73	24.34	218.80	12.56
T11:100% RDN through in Organic+FYM	41.70	3.26	57.74	24.20	212.30	12.29
T12:100% RDN through in Organic+neemcake	40.40	3.24	56.40	24.07	212.10	12.25
T13:100% RDN through in Organic+biofertilizers	39.90	3.00	55.94	23.98	207.60	12.00
T14:100% RDN (50:75:60kg/ha)	37.60	2.93	55.53	23.97	207.30	11.90
T15:control	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

Conclusion

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

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