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Effect of integrated nutrient management on growth, yield attributes and yield of dolichos bean (*Lablab purpureus (L)* Sweet)

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ABSTRACT

*A field experiment was conducted in randomised block design during summer season of 2015 at farmer's field near Annamalai University, Tamilnadu to study the effect of organic and inorganic sources of nutrients in combination with consortium of biofertilizers on growth, yield and quality of dolichos bean [**Lablab purpureus (L)** **Sweet**]. The various treatments were evaluated in randomized block design with three replications. All the growth and yield characters were significantly influenced by the application of different combinations of chemical fertilizers, organic manures and biofertilizers. Among the treatments, T_9—(NP 30:50 kg ha^{-1}+ 5 t vc ha^{-1} + BF 2.5 each kg ha^{-1}) recorded significantly highest number leaves plant^{-1}, number of branches plant^{-1}, number of raceme plant^{-1}, pods plant^{-1}, pod yield plant^{-1}, and pod yield (9.88 t ha^{-1}). Application of 30 kg N + 60 kg P_2O_5 + 50 kg bioash + 2.5 kg BF ha^{-1} proved the next best treatment in respect of growth, yield attributes and yield of dolichos bean followed by 30 kg N + 50 kg P_2O_5 + 25t FYM + 2.5 kg BF ha^{-1} (T_5) treatment values of these parameters were recorded under 35 kg N + 50 kg P_2O_5 + 25 kg K_2O ha^{-1}(T_1) treatments.*

Key words: Biofertilizer, Chemical fertilizer, Dolichous bean, Yield

INTRODUCTION

Dolichos bean (***Lablab purpureus (L) Sweet)*** has become popular not only for its consumption as a vegetable but also for its use in the treatment of cholera. The juice from the pods is used to treat inflamed ears and throat. The seeds are anthelmintic, antispasmodic, aphrodisiac, astringent, digestive, febrifuge and stomachic (Ali Esmail, 2017). In the southern region of Tamilnadu, this crop attained a status of commercial value due to its high productivity and low input requirement. For its better production and quality, the supply of nutrients in adequate amount is essential due to responsive behaviour of the crop (Singh 2018, Gandhi and Sivakumar, 2010). Application of organic input like vermicompost showed an increased growth in terms of height and yield of the plant and it could be a better alternative to inorganic fertilizers (Sarma *et al.* 2014). Farmyard manure (FYM) is valuable organic manure that can improve soil health due to its high humus, macro and micro nutrient contents. Besides helping in improvement of soil structure, aeration and water holding capacity of soil, it can stimulate the microbial activity that enhances number of biological processes improving nutrient uptake (Hellal *et al.* 2014). Bio ash as an amendment for agricultural soils can improve the physical and chemical properties of deficient soil, thereby improving soil fertility and crop yield the results are in agreement with finding (Przygocka-Cyna 2018). integrated nutrient management system has become an accepted strategy to study the effect of different organic, inorganic sources of nutrients alone and in combination with bio fertilizers on growth, yield and yield attributing characters in Dolichos bean. To find out suitable combination of organic manures and biofertilizers with reduced sources of inorganic nutrients for higher yield of Dolichos bean as well as to sustain the soil fertility and also to protect the environment, the present study was taken up.

MATERIALS AND METHODS

A field experiment was conducted during 2015 in RBD with 13 treatments replicated thrice. The treatments comprised of organic manure *viz.*, FYM, Vermicompost and Bio Ash, reduced levels of inorganic fertilizers, (25 kg N, 60 kg P_2O_5 and 25 kg K_2O ha^{-1}) and biofertilizers (*Rhizobium* and *Phosphobacteria*). The treatment details *viz.,* T_1- RDF (25:50:25 kg ha^{-1}), T_2 - NP (30: 60 kg ha^{-1}) + 25 t FYM ha^{-1}, T_3- NP (30: 50 kg ha^{-1}) + 25 t FYM ha^{-1}, T_4- NP (30: 60 kg ha^{-1}) + 25 t FYM + BF 2.5 each kg ha^{-1}, T_5- NP (30: 50 kg ha^{-1}) + 25 t FYM + BF 2.5 each kg

ha^{-1}, T_6- NP (30: 60 kg ha^{-1}) + 5 t VC, T_7- NP (30: 50 kg ha^{-1}) +5 t VC ha^{-1}, T_8- NP (30: 60 kg ha^{-1}) + 5 t VC + BF 2.5 each kg ha^{-1}, T_9- NP (30: 50 kg ha^{-1}) + 5 t VC + BF 2.5 each kg ha^{-1}, T_{10}- NP (30: 60 kg ha^{-1}) + 50 kg BA, T_{11}- NP (30: 50 kg ha^{-1}) + 50 kg BA, T_{12} - NP (30: 60 kg ha^{-1}) + 50 kg BA + BF 2.5 each kg ha^{-1} and T_{13}- NP (30: 50 kg ha^{-1}) + 50 kg BA ha^{-1} +BF 2.5 each kg ha^{-1}. Nitrogen was applied as per treatment schedule in the form of urea in two equal splits *viz*., first dose at the time of sowing (as basal dose) and second dose as top dressing at 30 days after sowing (DAS). Well decomposed FYM, Vermicompost and Bio Ash were applied to different treatment plots before 15 days of sowing. Phosphorus and potassium were applied as basal through single superphosphate and muriate of potash, respectively. The soil of the experimental field was medium sandy loamy in texture, alkaline in reaction (pH 7.3), low in available nitrogen (53.0 kg ha^{-1}), higher in available phosphorus (31.0 kg P_2O_5 ha^{-1}) and higher in potassium (145.0 kg K_2O ha^{-1}) content. Dolichos bean variety of Co (Gb)14 seeds was sown on first week of march. A plant spacing of 30 x 60 cm was adapted in a plot of 1.5 x 1.3 m dimension. The growth parameters like plant height, number leaves $plant^{-1}$, number of branches $plant^{-1}$, leaf area (cm^2), leaf area index, chlorophyll in leaf fresh tissue and yield parameter like number of nodes $plant^{-1}$, inter nodal length (cm), days to first flowering (DAS), number of raceme $plant^{-1}$, raceme length (cm), pods inflorescence^{-1}, pods $plant^{-1}$, pod length, pod width, pod weight, days to first pod harvest (DAS), days to last pod harvest (DAS), pod yield $plant^{-1}$ and pod yield were recorded and the data were statistically analyzed by adopting the standard procedure of Panse and Sukhatme (1985) and using AGRISTAT software. Wherever, the results were found significant, critical differences (CD) were computed at 5 per cent level of probability to draw statistical conclusions.

RESULTS AND DISCUSSION

The data (Table 1) revealed that all the growth characters were significantly influenced due to application of various combinations of chemical fertilizers, organic manures and biofertilizers. Significantly maximum plant height (96.2 cm), number leaves $plant^{-1}$ (75.5), number of branches $plant^{-1}$ (12.4), leaf area (18.0 cm^2), leaf area index (7.5), chlorophyll in leaf fresh tissue (1.8 mg g^{-1}), number of nodes $plant^{-1}$ (8.4) and inter nodal length (6.0 cm) were recorded in the treatment T_9 (NP 30:50 kg ha^{-1} + 5 t VC ha^{-1} + BF 2.5 each kg ha^{-1}) which was at par with T_8 (NP 30: 60 kg ha^{-1} + 5 t VC ha^{-1} + BF 2.5 each kg ha^{-1}). These two treatments were significantly superior over other treatments. Whereas, the minimum values of growth characters were observed in the control (T_1).

Table 1: Effect of Integrated nutrient management on growth characters of bush bean

Treatments	Plant height (cm)	No. of leaves $Plant^{-1}$	No. of branches	Leaf area (cm^2)	Leaf area index	Total chlorophyll in (mg g^{-1}) of fresh leaf
T_1-RDF (25:50:25 kg ha^{-1})	54.8	45.1	5.0	16.3	4.1	1.2
T_2 -NP (30: 60 kg ha^{-1}) + 25 t FYM ha^{-1}	69.9	48.3	5.9	16.5	4.4	1.5
T_3- NP (30: 50 kg ha^{-1}) + 25 t FYM ha^{-1}	74.1	51.5	6.6	16.7	4.7	1.6
T_4-NP (30: 60 kg ha^{-1}) + 25 t FYM + BF 2. kg ha^{-1}	79.2	58.5	9.4	17.2	5.6	1.7
T_5-NP (30: 50 kg ha^{-1}) + 25 t FYM+BF 2.5 kg ha^{-1}	84.6	62.8	10.1	17.4	6.0	1.7
T_6-NP (30: 60 kg ha^{-1}) + 5 t VC ha^{-1}	74.0	55.1	7.9	17.0	5.2	1.7
T_7-NP (30: 50 kg ha^{-1}) +5 t VC ha^{-1}	81.3	59.6	9.4	17.2	5.7	1.7
T_8-NP (30: 60 kg ha^{-1}) +5 t VC + BF 2.5 kg ha^{-1}	93.0	72.3	11.7	17.8	7.1	1.8
T_9-NP (30: 50 kg ha^{-1}) +5 t VC + BF 2.5 kg ha^{-1}	96.2	75.5	12.4	18.0	7.5	1.8
T_{10}-NP (30: 60 kg ha^{-1}) + 50 kg BA ha^{-1}	74.2	51.9	7.2	16.8	4.8	1.6
T_{11}- NP (30: 50 kg ha^{-1}) +50 kg BA ha^{-1}	76.0	55.7	8.7	17.0	5.2	1.7
T_{12} -NP(30: 60 kg ha^{-1}) +50 kg BA + 2.5 BF kg ha^{-1}	86.6	66.0	10.3	17.4	6.4	1.7
T_{13}-NP (30: 50 kg ha^{-1})+50 kg BA +BF 2.5 kg ha^{-1}	89.8	69.2	11.0	17.6	6.7	1.7
SED	1.2	1.1	0.27	0.07	0.13	0.31
CD 5%	2.5	2.4	0.54	0.14	0.38	0.64

RDF – Recommended dose of fertilizer, NP – Nitrogen and Phosphors, VC– Vermicompost, BA – Bio Ash, FYM– Farmyard manure, BF – Biofertilizer (Rhizobium, Phosphobacteria)

(2017) in soyabean. Pronounced influence of organic manures and biofertilizers might have exerted their strong influence like improving soil biological activity, fixing atmospheric nitrogen by *Rhizobium* besides production of phytohormones and converting insoluble phosphates into soluble forms by PSB in the rhizosphere and supplied the required nutrients to plant at optimum level constantly from the soil solution at all stages of crop growth (Sharma *et al.* 2011).

Significantly highest flowering characters *viz.,* days to first flowering (27.9 DAS), number of raceme per plant (8.6), raceme length (62.9 cm) and number of pods per inflorescence (8.2) were recorded with NP (30:50 kg ha^{-1}) + 5 t VC + BF 2.5 each kg ha^{-1} (T_9) followed by treatment T_8 (NP 30: 60 kg ha^{-1} + 5 t VC + BF 2.5 each kg ha^{-1}). Whereas, the minimum values of yield characters were recorded in control (T_1). Application of vermicompost attributed to better growth of plant and yield by slow release of nutrients for absorption with making available additional nutrients like gibberellins, cytokinins and auxins. It also promotes humification, increased microbial activity and enzyme production, which in turn, brought about the aggregate stability of soil particles resulting in better aeration and a property of binding mineral elements like Ca, Mg and Potash in the form of stable aggregates of soil particles for desired porosity to sustain the plant growth. Soil microbial biomass and enzyme activity improved as a result of vermicompost addition, which favoured the total increase in plant produce as reported by Mishra *et al.* (2018).

Table 2: Effect of Integrated nutrient management on yield characters of bush bean

Treatments	N.o of nodes Plant^{-1}	Inter nodal length (cm)	Days to first flowering (Days)	No. of raceme plant^{-1}	Raceme length (cm)
T_1-RDF (25:50:25 kg ha^{-1})	3.7	1.8	40.2	4.3	31.1
T_2 -NP (30: 60 kg ha^{-1}) + 25 t FYM ha^{-1}	3.9	2.2	39.1	6.2	35.9
T_3- NP (30: 50 kg ha^{-1}) + 25 t FYM ha^{-1}	4.2	2.5	38.0	6.5	40.7
T_4-NP (30: 60 kg ha^{-1}) + 25 t FYM + BF 2.5 kg ha^{-1}	5.6	3.8	33.8	7.2	50.1
T_5-NP (30: 50 kg ha^{-1}) + 25 t FYM +BF 2.5 kg ha^{-1}	6.8	4.8	32.1	8.6	53.7
T_6-NP (30: 60 kg ha^{-1}) + 5 t VC ha^{-1}	4.6	2.9	36.8	6.9	46.4
T_7-NP (30: 50 kg ha^{-1}) +5 t VC ha^{-1}	6.5	4.4	33.2	7.2	50.9
T_8-NP (30: 60 kg ha^{-1}) +5 t VC + BF 2.5 kg ha^{-1}	8.2	5.7	29.0	8.3	60.2
T_9-NP (30: 50 kg ha^{-1}) +5 t VC + BF 2.5 kg ha^{-1}	8.4	6.0	27.9	8.6	62.9
T_{10}-NP (30: 60 kg ha^{-1}) + 50 kg BA ha^{-1}	4.3	2.5	37.9	6.5	40.6
T_{11}- NP (30: 50 kg ha^{-1}) +50 kg BA ha^{-1}	5.4	3.5	34.8	6.9	47.3
T_{12} -NP (30: 60 kg ha^{-1}) +50 kg BA + BF 2.5 kg ha^{-1}	7.6	5.1	31.2	7.6	54.6
T_{13}-NP (30: 50 kg ha^{-1})+50 kg BA +BF 2.5 kg ha^{-1}	7.9	5.4	30.1	7.9	57.4
SED	0.10	0.13	0.42	0.12	1.0
CD 5%	0.21	0.26	0.85	0.26	2.1

Plants supplied with NP 30:50 kg ha^{-1} + 5 t VC + BF 2.5 each kg ha^{-1} (T_9) recorded maximum yield in terms of number of pods per plant (27.2), pod length (13.0 cm), pod width (2.8 cm), pod weight (6.5 g), days to first pod harvest (34.0 DAS), days to last pod harvest (113.3 DAS), pod yield per plant (177.7 g), pod yield (9.8 t ha^{-1}). The treatment T_9 was found to be at par with the treatment T_8 (NP 30:60 kg ha^{-1} + 5 t VC + BF 2.5 kg ha^{-1}). However, the least values of these yield characters were recorded in treatment control (T_1). Enhanced yield recorded in T_9 might be due to better assimilation of photosynthetic elements and better partitioning into developing green pod development, might have taken place and improved yield attributing characters like pod length, pod width and pod weight. The present results are in line with the results of Baljinder Singh and Rakesh Kumar (2016) who reported in cluster bean. Nitrogen application enhanced vegetative growth and increased considerable degree of the uptake of phosphorus and potassium, which are important for yield production. Similar observations of enhancement in pod length of bush bean due to vermicompost treatment were reported by Jamliya *et al.* (2018). Organic fertilizers are not only the source of organic matter and nutrient, but also boost microbial population, physical, biological and chemical properties of the soil.

Among organic fertilizers, compost and vermicompost are well known sources of plant nutrients Gangwar and Dubey (2012), Ramanna *et al.* (2010) and Jakhar *et al.* (2018) also reported similar results due to application of combined inoculation of Rhizobium and PSB that increased the number of pods per plant, seed yield, straw yield, net monetary returns and pod length in cluster bean.

Table 3: Effect of Integrated nutrient management on yield attributes and yield of bush bean

Treatments	Pods inflorescence^{-1}	Pods plant^{-1}	Pod length (cm)	Pod width (cm)	Pod weight (g)	Days to first pod harvest (Days)	Days to last pod harvest (Days)	Pod yield plant^{-1} (g)	Pod yield (t ha^{-1})
T_1	5.2	6.9	6.8	1.6	4.9	36.8	97.2	34.6	1.9
T_2	6.7	8.6	7.3	1.7	5.1	36.4	98.6	44.8	2.4
T_3	7.5	10.3	8.9	1.8	5.3	36.1	100.0	55.7	3.1
T_4	7.7	16.8	10.8	2.1	5.7	35.2	105.9	96.9	5.3
T_5	7.9	19.9	11.3	2.3	5.9	34.9	108.3	119.7	6.6
T_6	7.6	13.5	10.3	2.0	5.5	35.5	103.7	75.1	4.1
T_7	7.8	18.2	10.8	2.1	5.8	35.2	106.9	105.8	5.8
T_8	8.1	25.3	12.4	2.7	6.3	34.3	112.0	160.3	8.9
T_9	8.2	27.2	13.0	2.8	6.5	34.0	113.3	177.7	9.8
T_{10}	7.5	11.8	9.8	1.8	5.3	35.8	101.3	63.7	3.5
T_{11}	7.6	15.0	10.3	2.0	5.5	35.5	104.6	84.2	4.6
T_{12}	7.9	21.4	11.4	2.3	5.9	34.9	109.3	128.7	7.1
T_{13}	8.0	23.3	11.9	2.5	6.1	34.6	110.6	144.0	8.0
SED	0.03	0.77	0.21	0.04	0.07	0.61	0.52	6.9	0.38
CD 5%	0.07	1.58	0.42	NS	0.14	1.24	1.07	13.9	0.76

RDF–Recommended dose of fertilizer, NP–Nitrogen and Phosphors, VC–Vermicompost, BA–BioAsh, FYM –Farm Yard Manure, BF– Biofertilizer (*Rhizobium, Phosphobacteria*)

From the above results it may be concluded that application of T_9-NP (30: 50 kg ha^{-1}) +5 t VC ha^{-1} + BF 2.5 each kg ha^{-1} may influenced enhanced growth and yield of dolichos bean.

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