

A comparative study on the efficacy of herbals and biofertilizer as a nutrient source on the growth and yield of cluster bean (*Cyamopsis tetragonoloba* L. var. PNB)

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SUMMARY

The present report is an attempt to study the comparative effects of green leaf manures such as nochi, turmeric, vasambu, kuppaimeni, goose berry and biofertilizer on the germination, biometric, and yield parameters of cluster bean (*Cyamopsis tetragonoloba* L. var. PNB). The experiments were conducted at the Laboratory of Botany, Avinashilingam Deemed University, Coimbatore. The pots having 7 kg capacity were filled with soil and sand in the ratio 1:1. Fifteen seeds were sown in each pot containing red loamy soil and sand admixed with the above ameliorants. The dosage was as per the recommendations of Tamil Nadu Agricultural University, Coimbatore. Each treatment consisting of three replications were used for the experiment. The germination percentage was higher in biofertilizer soil treatment over control. From the investigation it was concluded that the treatment containing biofertilizer (*Rhizobium*), turmeric rhizome powder, vasambu rhizome powder and *Acalypha* leaf powder could be an ideal and suitable potting mixture for better seedling and crop production in cluster bean (*Cyamopsis tetragonoloba* L. var. PNB).

Key Words : Biofertilizer, Biometric, Cluster bean, Green manures, Yield parameters

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In India agriculture is the main occupation of majority of the population. The agricultural development depends on a number of factors like natural, economical and social and sub factors like climate, soil, use of advanced technology, labour factor and fertility status. Biofertilizers are eco-friendly organic agro-input and most cost effective than chemical fertilizers (Vessey, 2003). Instead of chemical fertilizers we can add green manure which provides all the nutrients required for plant growth.

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Green manures increase the percentage of organic matter in the soil, thereby improving water retention, aeration, and other soil characteristics. Hence, there is a great need for minimizing the dependence on chemical inputs by supplementing the plant nutrients with organic residues.

MATERIALS AND METHODS

An experiment was conducted to assess the manurial value of the following botanicals (Nochi, Turmeric, Vasambu, Goose berry, Kuppaimeni) and biofertilizer (*Rhizobium*). The impact of soil treatment on the growth attributes, quality parameters and yield components of cluster bean (*Cyamopsis tetragonoloba* L. var. PNB) was studied.

Collection of various materials:

The red sand loamy soil was collected from

Saravanampaty, Coimbatore. The seeds of cluster bean (*Cyamopsis tetragonoloba* L. var. PNB) were bought from department of pulses, Tamil Nadu Agricultural University, Coimbatore. A study was conducted with the seeds of cluster bean (*Cyamopsis tetragonoloba*) which was introduced to the soil treated with the following botanicals such as :

- Nochi (*Vitex negundo*) leaf powder
- Turmeric (*Curcuma longa* L.) rhizome powder
- Vasambu or sweet flag (*Acorus calamus*) rhizome powder
- Goose berry (*Phyllanthus emblica*) leaf powder
- Kuppaimeni (*Acalypha indica*) leaf powder
- Biofertilizer - Rhizobium

Treatments :

The soil was cleaned absolutely by removing stones and other unwanted materials and was homogenized properly by mixing red soil and sand at 1:1 ratio and filled in pots having 7 kg capacity. The dosage was as per the recommendations of Tamil Nadu Agricultural University, Coimbatore.

In each pot different green manure (Nochi, Turmeric, Vasambu, Goose berry, Kuppaimeni) and biofertilizer was mixed individually. In to these treated pots ten cluster bean seeds were sown at two inches apart and one inch deep. Each treatment consisting of three replications was used for the experiment. The experiment was set up in completely randomized design. Pots were watered regularly. There were six treatments as given below which were evaluated against the control.

Crop:

- Cluster bean (*Cyamopsis tetragonoloba* L. var. PNB)
- T₀ - Control – Red loamy soil (7 kg)
- T₁ - Red loamy soil + 35 g Nochi leaf powder / pot
- T₂ - Red loamy soil + 35 g Turmeric rhizome powder / pot
- T₃ - Red loamy soil + 35 g Vasambu rhizome powder / pot
- T₄ - Red loamy soil + 35 g Goose berry leaf powder / pot
- T₅ - Red loamy soil + 35 g Kuppaimeni leaf powder / pot
- T₆ - Red loamy soil + 10 g Biofertilizer Rhizobium /pot

Biometric observations :

- Germination percentage
- Root length (Shukla and Mishra, 1986)
- Shoot length (Shukla and Mishra, 1986)
- Fresh weight of the plant (Shukla and Mishra, 1986)
- Dry weight of the plant (Shukla and Mishra, 1986)
- Vigour index

On 7, 14, 21 and 28 days after sowing the number of seeds germinated was counted and the germination percentage was calculated using the following formula (ISTA, 1985).

$$\text{Germination percentage} = \frac{\text{Number of seeds germinated}}{\text{Number of seeds sown}} \times 100$$

The length of the root was measured with a scale from root collar point to main tap root tip which represents the length of the root and expressed in cm. The length of the shoot was recorded from the root collar point to shoot apex with a measuring scale and expressed in cm. The plant was then used for taking the fresh weight. The fresh weight was expressed in g.

The plant used for fresh weight was wrapped in butter paper and placed in a hot air oven at 70°C for 12 hours. The weight of the dried plant was taken and recorded in g. The vigour index was calculated adopting the procedure of Abdul Baki and Anderson (1973) and expressed in whole number.

$$\text{Vigor index} = \text{Germination percentage} \times (\text{Rootlength} + \text{Shootlength})$$

Yield parameters :

- Number of pod per plant
- Fruit length
- Number of seeds per pod

Number of pod per plant :

The number of pods were counted in each plant and expressed in whole number.

Fruit length :

The length of the above fruit was measured with scale and expressed in cm.

Number of seeds per pod

The number seeds per pod was counted and expressed in whole number.

RESULTS AND DISCUSSION

The results obtained from the present investigation are presented below:

Germination percentage :

Statistically significant difference was observed among the treatments. The higher germination per cent was obtained in T₆ (96.6 per cent) and T₁ (96.6 per cent) on 7 DAS (days after sowing) and 100 per cent germination was observed in T₆ on 14, 21 and 28 DAS (Table 1). The minimum germination per cent was shown by control on 7, 14, 21 and 28 DAS (83.3 per cent, 83.3 per cent, 85 per cent and 86.6 per cent, respectively).

The higher germination percentage due to biofertilizer inoculation might be attributed to higher foliar nutrition, uptake of N, P, K and growth of seedlings. The above results are in corroboration with the findings of Jain and Trivedi (2005) who

Table 1 : Influence of green leaf manures and biofertilizer on the germination percentage of cluster bean (*Cyamopsis tetragonoloba* L.).

Treatments	7 DAS (%)	14 DAS (%)	21 DAS (%)	28 DAS (%)
T ₀ – Control	83.3	83.3	85.0	86.6
T ₁ – Nochi	96.6	96.6	96.6	96.6
T ₂ – Turmeric	93.3	93.3	93.3	93.3
T ₃ – Vasambu	90.0	90.0	90.0	90.0
T ₄ – Kuppai meni	86.6	86.6	96.6	96.6
T ₅ – Goose berry	90.0	90.0	90.0	90.0
T ₆ – Rhizobium	96.6	100.0	100.0	100.0

DAS – Days after sowing, the values indicate average of three replications

recorded that application of 19.65 kg P ha⁻¹ with rhizobium and PSB registered higher seed yield, oil yield and protein content.

Root length :

Maximum root length was shown on 30th day by T₄ (*Acalypha*) 13.40 cm and on 45 DAS it was higher in T₁ (Nochi) 18.46 cm and on 60th day it was more in T₃ (Vasambu) 23.21 cm and on 75 DAS the maximum root length was shown by T₁ (Nochi) 26.53 cm. The minimum root length was shown by control on 30, 45, 60 and 75 DAS (6.84 cm, 11.27 cm, 13.46 cm and 13.57 cm, respectively) (Table 2).

The better emergence of the root length is due to the incorporation of green manure that increase root length and vigour index. The increase in available P is attributed to decomposition of organic matter and also the significant release of abundant quantities of CO₂ in soil (Gaffer *et al.*, 1992).

Shoot length :

Maximum shoot length was shown by T₃ (Vasambu) on 30 DAS (10.10 cm) and in T₄ (*Acalypha*) on 45 DAS (18.30 cm) and in T₂ (Turmeric) on 60 and 75 DAS (30.37 cm and 46.18 cm, respectively). On 30, 45, 60 and 75 DAS the lowest shoot

length was recorded by control plants as 6.07 cm, 13.11 cm, 15.87 cm and 22.55 cm, respectively (Table 2).

According to Govind *et al.* (1993) the treatment of high vigour wheat seeds with 5.6 g red chilli powder, 1 g turmeric powder and 2 g neem powder kg⁻¹ of seed significantly increased the shoot length and vigour index than that of the untreated soil.

Fresh weight :

The fresh weight was found to be maximum on Nochi soil treatment (T₁) on 30, 60 and 75 DAS as 1.56 g, 7.59 g and 13.37 g, respectively. On 45 DAS the higher fresh weight was obtained in T₂ (Turmeric) (2.36 g). The minimum fresh weight was shown by control on 30, 45, 60 and 75 DAS (0.63 g, 1.05 g, 3.87 g and 6.52 g, respectively) (Table 2). Subramanian *et al.* (2000) opined that the plant height, fresh weight and dry weight of black gram were significantly highest with application of green leaf manure.

Dry weight :

The maximum dry weight was shown in T₄ (*Acalypha*) on 30 DAS (0.28 g) and on 45, 60 and 75 DAS the maximum dry

Table 2 : Influence of green leaf manures and biofertilizer on the biometric parameters of cluster bean (*Cyamopsis tetragonoloba* L.).

Treatments	Root length (cm)				Shoot length (cm)				Fresh weight (g)				Dry weight (g)				Vigour index			
	30 DAS	45 DAS	60 DAS	75 DAS	30 DAS	45 DAS	60 DAS	75 DAS	30 DAS	45 DAS	60 DAS	75 DAS	30 DAS	45 DAS	60 DAS	75 DAS	30 DAS	45 DAS	60 DAS	75 DAS
T ₀ -Control	6.84	11.27	13.46	13.57	6.07	13.11	15.87	22.55	0.63	1.05	3.87	6.52	0.06	0.16	0.83	1.09	931	1138	1567	2161
T ₁ - Nochi	9.86	18.46	21.57	26.53	8.54	14.23	17.68	42.30	1.56	1.78	7.59	13.37	0.20	0.28	1.15	1.75	1585	2066	2395	2781
T ₂ - Turmeric	11.50	17.45	19.50	23.11	7.15	15.10	30.37	46.18	1.32	2.36	6.30	11.64	0.18	0.45	1.62	3.25	1432	1916	2470	2906
T ₃ - Vasambu	7.83	16.35	23.21	24.28	10.10	13.14	17.03	24.37	0.88	2.31	4.17	8.82	0.19	0.42	1.28	1.33	1538	2054	2201	2341
T ₄ -Kuppaimeni	13.40	17.07	22.75	23.14	9.23	18.30	26.63	31.20	1.45	1.92	6.56	11.44	0.28	0.38	1.11	2.12	1669	1860	2093	2125
T ₅ -Goose berry	8.90	12.37	16.07	16.86	7.08	13.07	15.73	27.53	0.95	1.22	4.86	8.42	0.12	0.16	0.52	2.01	1358	1638	2028	2672
T ₆ - Rhizobium	9.92	13.47	19.58	21.80	5.93	11.38	21.45	30.37	1.37	2.07	6.34	9.17	0.14	0.31	0.53	2.83	2106	2360	2853	2983
SEd	1.42678				1.30387				1.83000				0.42196				238.52			
CD (0.05)	2.85827				1.73871				3.66604				0.84530				477.837			
CD (0.01)	3.80522				3.47741				4.88061				1.12536				636.145			

SEd – Standard error deviation; CD – Critical difference; DAS – Days after sowing, the values indicate average of three replications

weight was obtained in T₂ (Turmeric) (0.45 g, 1.62 g and 3.25 g, respectively). The control plants (T₀) recorded lowest dry weight on 30, 45, 60 and 75 DAS (0.06 g, 0.16 g, 0.88 g and 1.09 g, respectively) (Table 2).

The dried and ground rhizome of sweet flag used at 50 g per kg of wheat recorded higher germination percentage, dry weight and vigour index, respectively (Gill *et al.*, 2002).

Vigour index :

Maximum vigour index was shown by T₆ (Biofertilizers). On 30 DAS (2106), 45 (2360), 60 (2853) and 75 (2983) DAS. The minimum vigour index was shown by control on 30, 45, 60 and 75 DAS (931, 1138, 1567 and 2161), respectively (Table 2).

According to Leithy *et al.* (2006) application of biofertilizers and mixed nutrients in the potting mixture in leguminous plants production systems results in high yields and plant height. Availability of nutrients contributes for higher seed vigour index in savory (*Satureja hortensis* L.).

Yield parameters :

Number of pods / plant :

The number of pods was found to be more in T₂ as (6.4) on 75 DAS. The control plants (T₀) had the least number of fruits per plant (3). Application of green leaf manure was correlated with higher yield of lentil per unit plant biomass, lower C and crude protein, higher NO₃ content in soft white spring wheat and greater NH₄⁺ concentration in soil (Boggs *et al.*, 2000).

Number of seed / pod :

The number of seeds was found to be more in T₂ (Turmeric) as (8.6) on 75 DAS. The control plants (T₀) had the least number of seeds per plant (6.6) (Table 3). Results of Rajavel (2002) revealed that rhizome powder (turmeric) increased number of pods per plant and number of seeds per pod in cowpea.

Table 3 : Influence of green leaf manures and biofertilizer on the yield parameters of cluster bean (*Cyamopsis tetragonoloba* L.)

Treatments	Number of pods / plant	Length of pod (cm)	Number of seeds / pods
T ₀ – Control	3.0	10.06	6.6
T ₁ – Nochi	4.6	10.7	6.6
T ₂ – Turmeric	6.4	10.8	8.6
T ₃ – Vasambu	6.3	9.5	6.6
T ₄ – Kuppai meni	3.6	7.9	7.0
T ₅ – Goose berry	6.0	10.06	8.0
T ₆ – Rhizobium	3.6	9.6	6.6

The values indicate average of three replications

Length of pod :

Length was obtained in T₂ (turmeric) as (10.8 cm) and the length of pods was minimum in T₀ (10.06 cm) control (Table 3). Boomiraj and Lourduraj (2005) obtained increased fruit weight and highest fruit yield of bendi due to three per cent spray of green manure.

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