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Suma AM
M.Sc (Hort.), College of Horticulture, GKVK post Bengaluru, Karnataka, India

Mallikarjuna Gowda AP
Senior Scientist and Head, ICAR KVK Bengaluru Rural, Doddaballapura, Karnataka, India

Thimmegowda MN
Associate Professor, Department of Dry land Agriculture, University of Agricultural Sciences, GKVK, Bengaluru, Karnataka India

Maruthi Prasad BN
Assistant Professor, Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture, GKVK post Bengaluru, Karnataka, India

Pragath UB
M.Sc (Hort.), College of Horticulture, GKVK post Bengaluru, Karnataka, India

Praneeth YS
Ph.D (Hort.), College of Horticulture, GKVK post Bengaluru, Karnataka, India

Correspondence
Mallikarjuna Gowda AP
Senior Scientist and Head, ICAR KVK Bengaluru Rural, Doddaballapura, Karnataka, India

Effect of seed treatment and nutrient levels on growth, yield and quality of Shankapushpi (*Clitoria ternatea* L.)

Suma AM, Mallikarjuna Gowda AP, Thimmegowda MN, Maruthi Prasad BN, Pragath UB and Praneeth YS

Abstract
The experiment was laid out in Randomized Complete Block Design with nine treatments and three replication. The seed treatment with *Rhizobium* and application of 125 per cent RDF has recorded maximum germination percentage (92.67 %), plant height (102.57 cm), number of branches (22.91) and number of nodes (33.81). Early flowering (43.33), number of pods per plant (111.34), weight of pods per plant (109.41 g), number of seeds per pod (9.14), weight of seeds per pod (0.42 g), fresh and dry weight of herb and root (103.61 g, 27.90 g, 25.20 g and 6.30 g) and seed yield (24.56 q ha^{-1}) was observed maximum with seed treatment of *Rhizobium* and application of 125 per cent RDF. The maximum net returns of Rs. 1,75,107 and B: C ratio of 1: 2.48 was recorded with seed treatment of *Rhizobium* and application of 125 per cent RDF.

Keywords: Shankapushpi, Seed treatment, *Rhizobium*, RDF

Introduction
Plants have been one of the important source of medicines ever since the dawn of civilization. Shankapushpi (*Clitoria ternatea* L.) belongs to the family Fabaceae, known as Butterfly pea, cordofan pea is one of the most important forage legumes in tropical Asia, South and Central America. [1] The genus C*litoria* comprises of sixty species distributed mostly within the tropical belt with a few species found in temperate regions. The plant is mainly used as a forage as it is highly palatable for livestock apart from its medicinal usage [2].
Clitoria ternatea has twining fine stems. The leaves are pinnate, with 5 - 7 elliptic to lanceolate leaflets, long and shortly pubescent underneath. Flowers are solitary. Pods are flat, linear beaked contains up to 10 seeds. Seeds are olive, brown or black in colour. The root system consists of a fairly stout taproot with few branches and many slender lateral roots. The plant is adaptable to a wide range of temperature, rainfall and altitude, but susceptible to frost and does not grow well during cold spells in winter. The rainfall requirements ranges from 400 to 1500 mm per annum, sensitive to water logging and flooding and it is claimed to have some tolerance to salinity. The Shankapushpi is considered as a medya rasayana, in *Ayurveda* and used as a rejuvenating recipe for treatment of neurological disorder, CNS (Central Nervous System). It is used for boosting memory and also as laxative [3]. The leaves of Shankapushpi contain glycosides *viz*., kaempferol-3-glucoside, kaempferol-3-rutinoide, kaempferol-3-neohesperidoside and Clitorin. The major phyto-constituents found in seeds of *Clitoria ternatea* are taraxerol and taraxerone. (Zingare *et al*., 2013). The root contains alkaloids, flavonoids, saponins, tannins, carbohydrates, proteins, resins, starch. The flower is also being used traditionally as diuretic, anthelmintic, purgative, demulcent and remedy for rheumatism, bronchitis, urinogenital disorder and cancer [4].
India is a meadow of medicinal plants where most of the plant species are exploited for traditional system of medicine. Shankapushpi is one such upcoming medicinal plant with plenty of medicinal properties. However, its cultivation is only confined to tropical Asia and parts of South and Central America. Hence, there is a need to expand the area under this valuable medicinal crop with good horticultural practices. Shankapushpi can grow well on a wide range of ecological conditions. But, no attempt has so far been made for the extensive cultivation of this crop. Hence, it is warranted to standardize seed treatment and suitable fertilizer levels to realize maximum growth and yield.

Material and Methods

The field experiment was conducted at College of Horticulture, University of Horticultural Sciences Campus, Gandhi Krishi Vignana Kendra (Post), Bengaluru during November to April 2017-18. Shankapushpi seeds (CoHB SpW-1) of last season crop were collected from Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture, Bengaluru and used for sowing at the rate of 5 kg per hectare.

The *Rhizobium* strain of *Bradyrhizobium japonicum* isolated and identified from the last season experiment and used for seed treatment of shankapushpi. The different levels of recommended doses of nutrient according to the treatments *viz.,* 40:80:40 kg N: P_2O_5: K_2O ha^{-1} + 10 t FYM ha^{-1} (100 per cent), 50:100:50 kg N: P_2O_5: K_2O ha^{-1} + 12.5 t FYM ha^{-1} (125 per cent), 30:60:30 kg N: P_2O_5: K_2O ha^{-1}+ 7.5 t FYM ha^{-1} (75 per cent)] and molybdenum @ 1-2 kg ha^{-1} were applied and mixed thoroughly into the soil as a basal dose in the form of urea, single super phosphate, muriate of potash and ammonium molybdate with three replication by using RCBD design and nine treatments *viz*., T_1 – 100 % Recommended dose of fertilizers, T_2 - 100 % Recommended dose of fertilizers + *Rhizobium,* T_3 - 100 % Recommended dose of fertilizers + Molybdenum, T_4 - 125 % Recommended dose of fertilizers, T_5 - 125 % Recommended dose of fertilizers + *Rhizobium,* T_6 - 125 % Recommended dose of fertilizers + Molybdenum, T_7 -75% Recommended dose of fertilizers, T_8 - 75 % Recommended dose of fertilizers + *Rhizobium*, T_9 – 75 % Recommended dose of fertilizers + Molybdenum. Seed treatment with Rhizobium was done before sowing. Weeds are controlled by manual weeding as per need of the crop. Five plants were selected randomly from each plot. Observations on plant height, number of branches, number of nodes, yield attributing characters viz., flowering, number of pods per plant, length and width of pod, seeds per pod and yield were recorded. The statistical analysis was done as per procedure outlined by Sundararaj *et al.* (1972) [5].

Results and Discussion

Growth Parameters: There is a significant difference in germination percentage among the different treatments. The treatment combination of seed treatment with *Rhizobium* and application of 125 per cent RDF took minimum number of days (4.67) for first germination, number of days for 50 per cent germination (8.33) and maximum germination percentage (92.67 %). Seed treatment process with water, jaggery and Rhizobium helped seed to retain higher moisture and might stimulated better germination. The *Rhizobium* seed treatment might have attributed for creating favourable conditions through secretions of vitamins and growth promoting substances which, helped in maximum germination of seeds. The results are in line with those obtained by Abdolshakoor *et al*. (2012) [6] in Isabgol (Table 1).

The maximum plant height of 17.4, 66.47, 93.19 and 102.57 cm was recorded with seed treatment with *Rhizobium* + application of 125 per cent RDF at 30, 60, 90 and 120 days after sowing, respectively. However, it was found to be *on par* with soil application of molybdenum + of 125 Per cent RDF at all the growth stages except at 90 and 120 days after sowing (Table 2). The data showed that plant height continued to increase with the advancement of crop age and this increase was maximum during early crop growth period. However, a slow rate of improvement in plant height was observed after 90 days. Increment in plant height might be due to stimulation of biological activities in the presence of balanced supply of nutrients. Further, *Rhizobium* has ability to fix atmospheric nitrogen in the roots of leguminous crops. These results are in accordance with those obtained by Singh *et al.* (2016) [7] in Lentil.

The seed treatment with *Rhizobium* + application of 125 per cent RDF has recorded significantly maximum number of branches per plant (6.33, 13.33, 20.61 and 22.91 at 30, 60, 90 and 120 days after sowing, respectively) (Table 3). It is evident that when there is higher availability of nutrients, crop puts up better vegetative growth. The significant improvement is noticed under higher fertilizer level might be attributed to greater uptake of nutrients by the plants favoring better cell division, elongation, amino acids and protein synthesis and it might have produced more number of branches. These results are in accordance with Kumar *et al.* (2015) [8] in fenugreek. Further, increment in branches might be due to vital role of bacteria present in the roots applied with bio-fertilizer contributing some hormonal substances. These findings are also in conformity with Priya and Elakkiya (2012) [9] in *Eclipta alba*.

The treatment combination of seed treatment with *Rhizobium* + application of 125 per cent RDF has recorded significantly maximum number of nodes *viz.,*9.24, 21.57, 27.36 and 33.71 at 30, 60, 90 and 120 days after sowing, respectively and was *on par* with treatment combination of 125 per cent RDF + soil application of molybdenum at all the growth stages (Figure 1). Increased growth of plants might be due to macro and micro nutrients available in sufficient quantity in FYM and when applied with major nutrients might have helped in better growth of crop. Further, application of nutrients might have resulted in more branches and internodes due to cumulative effect of nutrients especially phosphorous on the process of cell division. These results are in line with Nadukeri *et al.* (2014) [10] in coleus and Singh *et al.* (2016) in Lentil and Priya and Elakkiya, (2012) in *Eclipta alba*. The presence of readily available form of nitrogen which was further accompanied by the presence of other nutrients and bio-fertilizers that might have resulted in increased vegetative growth of plants mainly by elongation of cells and partly by cell division. These results are in line with those finding of Kayina and Reddy, (2012) [11] in Senna.

Yield Parameters

The treatment combination of seed treatment with *Rhizobium* + application of 125 per cent RDF resulted in early flowering (43.33 days) and took minimum number of days for 50 per cent flowering (54.67 days). The early initiation of flowering with higher doses of nutrients might be the result of early and balanced vegetative growth due to higher availability of nutrients. The possible reason for increased number of flowers may be more availability of major nutrients which were translocated towards growing point resulting in more flower bud formation. These results are in accordance with those obtained by Phatak *et al.* (2016) [12] in Glory lily. Adequate amount of available nutrients throughout the plant growth period without any nutrient stress brought about proper growth and development of plant (Kalita *et al.,* 2010 in Bhringaraj) [13] (Table 4).

Significantly maximum number of pods per plant (111.34) was recorded in treatment combination of seed treatment with *Rhizobium* + application of 125 per cent RDF. The maximum number of pods may be attributed to the role of *Rhizobium* which has helped in increased vegetative growth in terms of maximum plant height and number of branches. The increased vegetative growth resulted in synthesis of greater amount of food materials, which in turn supported profused flowering and pod setting and resulted in maximum number of pods. The results are in conformity with the works carried out by Yadav and Kumawat (2003) [14], Jat (2004) [15] and Purbey and Sen (2005) [16] and Kumar *et al*. (2015) in fenugreek. Pod length being a genetic factor might have not influenced by the management. Width of pod didn't show any significant difference with respect to different treatment combination. Pod width is basically regulated by the genotype. Nutrition and seed treatment might have least influence which might be insufficient to bring significant different. The treatment combination of seed treatment with *Rhizobium* + application of 125 per cent RDF has recorded maximum weight of pods per plant (109.41 g). Nitrogen is the building blocks in the synthesis of protein. Higher doses of nitrogen and its continuous supply throughout the life cycle contributed for the increased protein synthesis besides other photosynthates and translocation in to the developing pods. The increase in weight of pods might be due to availability of higher doses of nutrients throughout the growing period. These results are in line with Thapa and Maity, (2004) [17] and Ruveyde *et al.* (2011) [18] in fenugreek (Table 5). The seed treatment with *Rhizobium* + application of 125 per cent RDF has recorded maximum number of seeds per pod (9.14) because of availability of nutrients during maturation wherein most of nutrients get accumulated and especially phosphorous helps for filling of seeds. Similar, findings were reported by Yadav and Kumawat (2003) in fenugreek. The maximum seed weight per pod (0.42 g) was observed with the seed treatment of *Rhizobium* + application of 125 per cent RDF. The significant increase in seed weight may be due to availability of NPK during the development and maturation of seed, wherein most of the nutrients gets accumulated in the seed thereby, size and weight of seeds were improved. These results are in line with those obtained by Phatak *et al.* (2016) in Glory lily. Further, optimum dose of nutrients and role of *Rhizobium* which inturn responsible for vigourous growth and production of greater amount of photosynthates, which helped in production of longer pods in fenugreek reported by Yadav and Kumawat (2003). The nutrient doses did not influence the test weight of seeds significantly. This might be due to the fact that seed weight is an inherent characteristic of the species and it cannot be altered by management practices but yield may be altered. Although, there is improve in seed weight, but the difference is insufficient to show statistical variation (Table 5). The seeds treated with *Rhizobium* + application of 125 per cent RDF has recorded maximum fresh herb yield per plant (103.61 g), dry yield per plant (27.90 g). It may be due to increased availability of nutrients and other growth promoting substances supplied by inorganic fertilizers and bio-fertilizers. Further, nitrogen is the chief constituent of protein, essential for the formation of protoplasm, which leads to cell division and cell enlargement and thereby responsible for higher yield of leaves. Increment in plant fresh and dry weight may be attributed to increased plant height and branches. These results are in confirmity with those of Priya and Elakkiya (2010) in Bhringaraj. The maximum fresh weight of root per plant (25.20 g), dry weight of root per plant (6.30 g) and dry root yield (3.74 q ha^{-1}) was recorded with application of 125 per cent RDF + seed treatment with *Rhizobium.* The increase in fresh and dry root yield might be due to N and P were found to be essential minerals for the support of intensive leaf and root growth. Nitrogen application facilitated more metabolite transport for growth and enhanced the yield. The increased P nutrition enhanced the synthesize of biological molecules, which in turn played a vital role in carbohydrate and protein metabolism. P is also involved in energy transfer system in the plant tissues. Hence, it is obvious that a good supply of P would generally improve the yield of crops. Increased level of K supplied through fertilizer might have increased the efficiency of plant in translocating higher photosynthates. These may also due to bio-fertilizers which, might have helped plant growth by phytohormone production, N2 fixation, stimulation of nutrient uptake and bio-control of pathogenic microorganisms. These results are in conformity with lines of Vembu *et al*. (2010) [19] in periwinkle and Kayina and Reddy (2012) in senna (Table 6). The combination of seed treatment with *Rhizobium* + application of 125 per cent RDF has recorded maximum seed yield (24.56 q ha^{-1}) (Table 7). The seed yield is an output of sequential metamorphosis from source to sink. Hence, higher growth parameters, in-turn resulted in increased seed yield. Partitioning of photosynthates into vegetative and reproductive parts has gone simultaneously in the later growth phases, which resulted in higher seed yield. A positive correlation was observed between nutrient level and seed yield indicating that, seed yield increases with increase in nutrient dose. These results are in accordance with the findings of Parakhia *et al.* (2000) [20], Jat (2004), Purbey and Sen (2005) in fenugreek. The maximum biological yield (43.72 q ha^{-1}) was obtained in seeds treated with *Rhizobium* + application of 125 per cent RDF (Table 7). This may be attributed to maximum fixation of atmospheric nitrogen, increased uptake of phosphorous and potassium due to seed inoculation of *Rhizobium* and timely availability of nutrient at optimum level to the plants. Kayina and Reddy (2012) in Senna and Abdolshakoor *et al*. (2012) in periwinkle have reported similar results. The maximum economical yield (40.05 q ha^{-1}) was recorded with the application of 125 per cent RDF + seed treatment with *Rhizobium* .The increased herb and seed yield contributed for enhancement of economical yield in plants, where seeds were treated with *Rhizobium* and with the application of higher dose of RDF. The findings of the present investigation are in agreement with those of the Meena *et al*. (2016) [21] in fenugrrek (Table 7). The treatments recorded significant difference for total biomass yield. The maximum total biomass yield (132.34 q ha^{-1}) was observed with seed treatment of *Rhizobium* + application of 125 per cent RDF (Table 7). The increased in total biomass may be attributed to higher availability of nutrients accompanied by seed treatment with *Rhizobium,* which might have lead to higher growth and yield parameters intern produced higher biomass. These findings are in accordance with those obtained by Meena *et al.* (2016) in fenugreek.

Quality Parameter

There is no significant difference among the treatments with respect to total nitrogen, phosphorus and potassium content in leaves of Shankapusphi. This might be due to the fact that per cent crude protein content of particular species is constant and it cannot be manipulated by management practices. The per cent crude protein content of seeds did not differ significantly due to varied levels of nutrients and seed treatment with *Rhizobium.* This might be due to the fact that per cent crude protein content of particular species is constant and it cannot be manipulated by management practices and protein concentration is a function of nitrogen, since nitrogen content is found to be non-significant, protein content doesn't altered with the nutrition (Figure 2)

Economic Analysis

The maximum gross returns of Rs. 2,45,600 per hectare was realized from the treatment combination of seed treatment with *Rhizobium* + application of 125 per cent RDF. While, the lowest gross returns of Rs. 1,23,700 recorded with application of only 75 per cent RDF. The maximum net profit of Rs. 1,75,107 was realized with application of 125 per cent RDF + seed treatment with *Rhizobium*. While, the least profit of Rs. 65,951 was realized with application of 75 per cent RDF alone. Maximum benefit per rupee invested was obtained with application of 125 per cent RDF + seed treatment with *Rhizobium* which is followed by the application of 125 per cent RDF + molybdenum (2.48) as compared to 75 per cent RDF alone (1.14), which has lower economic benefit. The higher gross returns, net returns and B: C ratio was obtained with seed treatment of *Rhizobium* + application of 125 per cent RDF. The higher net returns with combination of *Rhizobium* + application of 125 per cent RDF is due to higher seed yield per plant and higher yield per hectare. These results are in line with those obtained by Meena *et al.*, (2016) in fenugreek (Table 8).

Conclusion

The seed treatment with *Rhizobium* and application of 125 per cent RDF has resulted in better growth, maximum yield and good quality of Shankapushpi. Therefore, this treatment combination may be recommended for commercial cultivation of Shankapushpi under Eastern Dry Zone of Karnataka.

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Table 1: Effect of seed treatment and nutrient levels on germination of *Clitoria ternatea* L.

Treatments	Days to first germination	Days to 50 % germination	Germination %
T_1 : 100 % RDF	6.67	11.67	81.67
T_2 : 100 % RDF + *Rhizobium*	6.00	10.33	85.25
T_3 : 100 % RDF + Molybdenum	6.33	10.67	84.58
T_4 : 125 % RDF	5.67	9.67	89.28
T_5 : 125 % RDF + *Rhizobium*	4.67	8.33	92.67
T_6 : 125 % RDF + Molybdenum	5.67	8.67	90.50
T_7 : 75 % RDF	7.67	12.67	73.33
T_8 : 75 % RDF + *Rhizobium*	7.00	11.67	77.72
T_9 : 75 % RDF + Molybdenum	7.33	11.33	75.95
F test	*	*	*
S.Em±	0.39	0.81	1.05
CD at 5 %	1.17	2.41	3.16

Table 2: Influence of seed treatment and nutrient levels on plant height of *Clitoria ternatea* L.

Treatments	Plant height (cm)			
	30 DAS	60 DAS	90 DAS	120 DAS
T_1 : 100 % RDF	11.39	36.03	60.93	67.23
T_2 : 100 % RDF + *Rhizobium*	13.97	47.43	65.25	73.30
T_3 : 100 % RDF + Molybdenum	13.03	46.07	65.13	71.57
T_4 : 125 % RDF	15.50	54.73	84.07	90.47
T_5 : 125 % RDF + *Rhizobium*	17.47	66.47	93.19	102.57
T_6 : 125 % RDF + Molybdenum	16.38	65.03	86.98	93.29
T_7 : 75 % RDF	8.52	22.00	44.23	53.33
T_8 : 75 % RDF + *Rhizobium*	10.75	29.63	54.26	61.13
T_9 : 75 % RDF + Molybdenum	10.25	27.95	51.58	57.68
F test	*	*	*	*
S.Em±	0.43	0.82	0.76	1.12
CD at 5 %	1.28	2.45	2.38	3.35

DAS: Days after Sowing

Table 3: Number of branches as influenced by seed treatment and nutrient levels in *Clitoria ternatea* L.

Treatments	Number of branches			
	30 DAS	60 DAS	90 DAS	120 DAS
T_1 : 100 % RDF	4.13	10.72	16.72	18.77
T_2 : 100 % RDF + *Rhizobium*	5.06	11.24	17.13	19.72
T_3 : 100 % RDF + Molybdenum	4.72	11.06	17.06	19.27
T_4 : 125 % RDF	5.62	11.62	17.62	20.62
T_5 : 125 % RDF + *Rhizobium*	6.33	13.33	20.61	22.91
T_6 : 125 % RDF + Molybdenum	5.94	12.94	19.44	21.97
T_7 : 75 % RDF	3.09	9.59	15.59	18.59
T_8 : 75 % RDF + *Rhizobium*	3.89	10.39	16.39	19.63
T_9 : 75 % RDF + Molybdenum	3.71	10.21	16.21	18.97
F test	*	*	*	*
S.Em±	0.15	0.15	0.18	0.34
CD at 5 %	0.46	0.45	0.54	1.02

DAS: Days after Sowing

Table 4: Influence of seed treatment and nutrient levels on flowering of *Clitoria ternatea* L.

Treatments	Days to first flowering	Days to 50 % flowering
T_1 : 100 % RDF	47.67	61.67
T_2 : 100 % RDF + *Rhizobium*	45.33	58.33
T_3 : 100 % RDF + Molybdenum	46.67	60.33
T_4 : 125 % RDF	45.67	57.67
T_5 : 125 % RDF + *Rhizobium*	43.33	54.67
T_6 : 125 % RDF + Molybdenum	44.67	56.67
T_7 : 75 % RDF	50.33	63.33
T_8 : 75 % RDF + *Rhizobium*	48.33	62.00
T_9 : 75 % RDF + Molybdenum	49.67	62.67
F test	*	*
S.Em±	1.15	1.43
CD at 5 %	3.45	4.30

Table 5: Pod and Seed characteristics as influence by seed treatment and nutrient levels in *Clitoria ternatea* L.

Treatments	Pod characteristics				Seed characteristics		
	No. pods/plant	Pod length (cm)	Pod width (cm)	Pod weight per plant (g)	Number of seeds/pod	Seed weight /pod (g)	Test weight (g/100 seeds)
T_1 : 100 % RDF	75.36	8.75	0.84	69.84	7.89	0.35	4.76
T_2 : 100 % RDF + *Rhizobium*	88.87	8.81	0.87	80.67	8.25	0.38	4.98
T_3 : 100 % RDF + Molybdenum	87.08	8.78	0.84	74.95	8.03	0.36	4.83
T_4 : 125 % RDF	96.84	9.13	0.89	85.33	8.65	0.40	4.92
T_5 : 125 % RDF + *Rhizobium*	111.34	9.44	0.93	109.41	9.14	0.42	5.20
T_6 : 125 % RDF + Molybdenum	106.06	9.28	0.91	93.74	8.80	0.41	5.07
T_7 : 75 % RDF	50.38	8.03	0.80	47.30	7.45	0.30	4.53
T_8 : 75 % RDF + *Rhizobium*	61.90	8.38	0.82	55.94	7.80	0.34	4.75
T_9 : 75 % RDF + Molybdenum	57.59	8.31	0.81	55.13	7.52	0.32	4.48
F test	*	-	-	*	*	*	-
S.Em±	3.81	0.32	0.03	1.21	0.35	0.02	0.17
CD at 5 %	11.43	NS	NS	3.61	1.05	0.07	NS

Table 6: Influence of seed treatment and nutrient levels on fresh and dry yield of *Clitoria ternatea* L.

Treatments	Fresh and dry yield (g)			
	Fresh weight of herb	Dry weight of herb	Fresh weight of root	Dry weight of root
T_1 : 100 % RDF	74.96	20.74	21.17	5.29
T_2 : 100 % RDF + *Rhizobium*	83.37	22.89	23.70	5.24
T_3 : 100 % RDF + Molybdenum	79.76	21.94	22.15	5.12
T_4 : 125 % RDF	88.67	24.16	23.90	5.97
T_5 : 125 % RDF + *Rhizobium*	103.61	27.90	25.20	6.30
T_6 : 125 % RDF + Molybdenum	95.35	25.83	24.50	6.12
T_7 : 75 % RDF	62.28	17.57	20.27	5.06
T_8 : 75 % RDF + *Rhizobium*	70.25	19.56	20.94	5.23
T_9 : 75 % RDF + Molybdenum	65.94	18.48	20.77	5.19
F test	*	*	*	*
S.Em±	1.54	1.23	0.95	0.28
CD at 5 %	4.60	3.68	2.85	0.83

Table 7: Seed, biological, economic and total biomass yield as influenced by seed treatment and nutrient levels in *Clitoria ternatea* L.

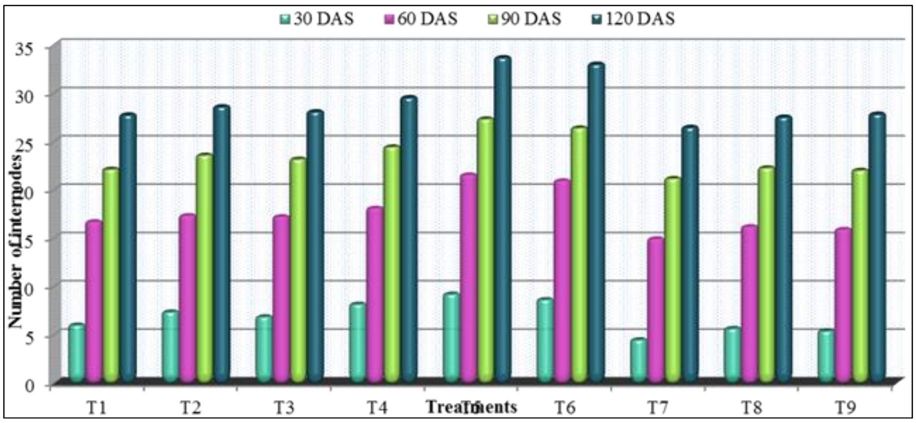
Treatments	Dry herb yield (q ha^{-1})	Dry root yield (q ha^{-1})	Seed yield (q ha^{-1})	Biological yield (q ha^{-1})	Economic yield (q ha^{-1})	Total biomass (q ha^{-1})
T_1 : 100 % RDF	11.52	2.93	17.16	31.60	28.68	92.20
T_2 : 100 % RDF + *Rhizobium*	12.71	3.10	19.34	35.15	31.52	99.03
T_3 : 100 % RDF + Molybdenum	12.18	2.15	18.53	32.86	31.24	104.30
T_4 : 125 % RDF	13.42	3.31	22.58	39.32	36.12	109.94
T_5 : 125 % RDF + *Rhizobium*	15.49	3.74	24.56	43.72	40.05	132.34
T_6 : 125 % RDF + Molybdenum	14.34	3.39	23.15	40.73	37.49	118.66
T_7 : 75 % RDF	9.76	2.81	12.37	24.53	22.13	72.14
T_8 : 75 % RDF + *Rhizobium*	10.26	2.90	14.32	27.93	24.58	79.34
T_9 : 75 % RDF + Molybdenum	10.86	2.88	13.61	27.22	24.47	81.19
F test	*	*	*	*	*	*
S.Em±	0.66	0.21	1.13	1.09	0.94	1.39
CD at 5 %	1.97	0.63	3.38	3.27	2.82	4.18

Table 8: Influence of seed treatment and nutrient levels on cost of cultivation, gross, net returns and B: C ratio in *Clitoria ternatea* L.

Treatments	Cost of cultivation (Rs. ha^{-1})	Yield (q ha^{-1})	Gross return (Rs. ha^{-1})	Net return (Rs. ha^{-1})	B: C ratio
T_1 : 100 % RDF	64071	17.16	171600	107529	1.68
T_2 : 100 % RDF + *Rhizobium*	64171	19.34	193400	129229	2.01
T_3 : 100 % RDF + Molybdenum	65471	18.53	185300	119829	1.83
T_4 : 125 % RDF	70393	22.58	225800	155407	2.21
T_5 : 125 % RDF + *Rhizobium*	70493	24.56	245600	175107	2.48
T_6 : 125 % RDF + Molybdenum	71793	23.15	231500	159707	2.22
T_7 : 75 % RDF	57749	12.37	123700	65951	1.14
T_8 : 75 % RDF + *Rhizobium*	57849	14.32	143200	85351	1.48
T_9 : 75 % RDF + Molybdenum	59149	13.61	136100	76951	1.30

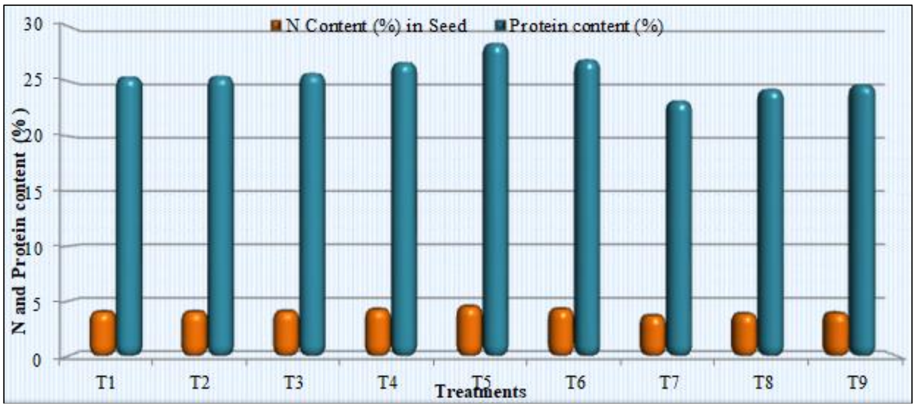
Note: Seeds were sold at 100 Rs. Per kg

The cost of installation of drip irrigation unit was Rs. 80,000 per hectare. The depreciation cost of drip system has been worked out and it has been spreaded over to six cropping period. Hence Rs. 13,333 is considered as drip cost per year for this crop.



DAS: Days after Sowing

Fig 1: Number of nodes as influenced by seed treatment and nutrient levels in *Clitoria ternatea* L.



Legends

T_1 - 100 % RDF | T_4 - 125 % RDF T_7 - 75 % RDF

T_2 - 100 % RDF + *Rhizobium* | T_5 - 125 % RDF + *Rhizobium* | T_8 - 75 % RDF + *Rhizobium*

T_3 - 100 % RDF + Molybdenum | T_6 - 125 % RDF + Molybdenum | T_9 - 75 % RDF + Molybdenum

Fig 2: Influence of seed treatment and nutrient levels on nitrogen and per cent crude protein content of seeds in *Clitoria ternatea* L.

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