Effect of integrated nutrient management practices on growth, yield attributes and yield of hyacinth bean in baby corn (Zea mays. L) – hyacinth bean (Lablab purpureus var typicus) cropping system

R. Preetham*, K. Avil Kumar¹, A. Srinivas¹, A. Manohar Rao¹ and T. Ram Prakash¹
Horticultural Research Station, Adilabad-504 001, Telangana, India.
Received: 14-01-2019 Accepted: 30-05-2019 DOI: 10.18805/IJARe.A-5205

ABSTRACT
A field experiment was conducted at Horticultural Research Station, Adilabad, Telangana State, India during kharif and rabi seasons of 2015-16 and 2016-17 to study the effect of INM practices on hyacinth bean in baby corn-hyacinth bean cropping system. The experiment was laid out in a randomized block design for baby corn during kharif season of 2015 season with seven treatments comprised of 100% recommended dose of fertilizer (RDF, 150:60:60 N, P₂O₅ and K₂O kg ha⁻¹), 25% N supplemented through Farm Yard Manure or vermicompost + 75% RDF with or without soil application of Azospirillum and Bacillus megaterium @ 5 kg ha⁻¹ each and unfertilized control with 3 replications. Each main treatment was divided into four subplots during rabi season of 2015-16 and 2016-17 for hyacinth bean and the treatments of 100% RDF (20 kg N, 50 Kg P₂O₅ ha⁻¹) and 75% RDF with or without Bradyrhizobium @ 500 g ha⁻¹ (seed treatment) were imposed in split plot design. Mean data of two rabi seasons revealed that seed treatment with Bradyrhizobium in conjunction with 100% RDF recorded significantly higher plant height, leaf area index, nodule number, dry matter production at harvest, higher number of pods plant⁻¹, maximum pod length, pod weight and higher pod yield, respectively over 100% RDF alone, 75% RDF with or without seed treatment.

Key words: Cropping system, Hyacinth bean, INM, Pod length, Pods plant⁻¹, Pod weight, Pod yield.

INTRODUCTION
Lablab bean (Lablab purpureus L.), an annual herbaceous vegetable is commonly called as dolichos bean, hyacinth bean, sem, butter bean, egyptian kidney bean and lubia bean. It is one of the most ancient among the cultivated legumes and is grown throughout the tropical regions of Asia, Africa and America. The crop is indigenous to India and it is mainly grown in Madhya Pradesh, Uttar Pradesh, Gujarat, Maharashatra, Telangana, Andhra Pradesh, Tamil Nadu and Karnataka. It is generally grown for pods as edible vegetable and dry seeds as pulse for the preparation of sambar and spicy foods. Its foliage is also used as hay, silage and green manure. The green pods and dry seeds of hyacinth bean are highly nutritive in nature, which contain carbohydrates (6.7 g), protein (3.8 g), fat (0.7 g), minerals (0.9 g), magnesium (34 g), calcium (210 mg), phosphorus (68 mg), sodium (55.4 mg), iron (1.7 mg), potassium (74 mg), sulphur (40 mg), vitamin A (312 I.U), riboflavin (0.06 mg) and vitamin C (9 mg) nicotinic acid (0.7 mg) and fibre (1.8 g) per 100 g of edible portion (Aykroyd, 1963 and Thamburaj and Singh 2003).

The dwarf, bushy types of hyacinth bean are determinate and photo insensitive, which can be cultivated throughout the year. Dwarf varieties have the potential for more extensive cultivation because the plants require no support system, the pods mature uniformly and the crop is amenable to mechanical harvesting reducing the labour cost. Erratic behavior of rainfall pattern, especially the late onset of monsoon or early cessation of rainfall and long duration cultivars are failing to yield good returns in Telangana region. Besides the application of heavy doses of chemical fertilizers without organic manures, is causing deterioration of physical and chemical properties of soil, declining soil microbial activities, reduction in soil humus and increased pollution of soil. Hence, a study was conducted on the integrated nutrient management (INM) practices in baby corn – hyacinth bean cropping system to study the effect of inorganic fertilizers and microbial cultures on hyacinth bean during rabi season.

MATERIALS AND METHODS
The experiment was conducted for rabi hyacinth bean during 2015-16 and 2016-17 following kharif/baby corn in baby corn – hyacinth bean sequence (19°08'09" N latitude, 79°56'03" E longitude and 264 m altitude) at Horticultural Research Station Farm, Adilabad. The experimental soil was sandy clay loam in texture, neutral in reaction, medium in
available nitrogen, phosphorous and potassium, belongs to the order Alfisol of shallow to medium depth. An experiment was conducted in a randomized block design for baby corn during kharif, 2015 and 2016 with seven treatments comprising of 25% N supplemented through farm yard manure (FYM) or vermicompost (VC) + 75% Recommended dose of fertilizer, (RDF; 150:60:60 N, P₂O₅ and K₂O kg ha⁻¹) with or without soil application of *Azospirillum* and *Bacillus megaterium* @ 5 kg ha⁻¹ each, and unfertilized control, replicated thrice. Each of baby corn treatment was divided into four subplots including treatments of 100% RDF (20:50 N and P₂O₅ kg ha⁻¹) and 75% RDF, with or without seed treatment of *Bradyrhizobium* @ 500 g ha⁻¹ during rabi season for hyacinth bean in split plot design. Nitrogen was applied in the form of urea in two splits at basal and 20 days after sowing (DAS), and entire P₂O₅ was applied as basal through single super phosphate to hyacinth bean during both the years. *Bradyrhizobium* (nitrogen fixing bacterial formulation) collected from Agricultural Research Station, Amaravathi, Andhra Pradesh was utilized for seed dressing of hyacinth bean @ 500 g ha⁻¹ as per the treatments. Arka Jaya variety released by ICAR-Indian Institute of Horticultural Research, Bangalore was sown on 6th and 10th October of 2015 and 2016, respectively. Two seeds were dibbled hill¹ at a depth of 3-4 cm with a spacing of 45 cm x 20 cm, and gap filling was done on 7 DAS and thinning was done on 14 DAS. Pendimethalin @ 1.0 kg a.i ha⁻¹ applied at 2 DAS and hand weeding at 15 and 30 DAS to maintain the fields under weed free condition. Need based plant protection measures were taken up.

The observations on growth parameters (plant height, leaf area index and dry matter production), yield components (total pods plant⁻¹, mean pod length and mean pod weight) were recorded on five plants selected at random in the net plot area of each treatment, at each picking and yield from net plot (5.4 m X 2.0 m) after removing border rows. The data was analyzed statistically by applying the technique of analysis of variance as suggested by Gomez and Gomez (1984).

**RESULTS AND DISCUSSION**

**Growth parameters:** Significant variations were noticed among the treatment means of growth parameters (plant height, LAI, nodule number and DMP) of hyacinth bean due to direct and residual effect of treatments imposed to preceding kharif baby corn during kharif 2015 and 2016 and rabi 2015-16 and 2016-17 hyacinth bean. Plant height, leaf area index (LAI), nodule number and DMP increased significantly with applications of inorganic sources of nutrition and bio-fertilizers.

Application of 100% RDF with *Bradyrhizobium* seed treatment to hyacinth bean resulted in significantly higher plant height, leaf area index, nodule number and DMP at harvest over application of 75% RDF with or without seed treatment during rabi 2015-16 and 2016-17 and pooled mean of two years (Table 1).

Significant increase of plant height, LAI, nodule number and DMP with inorganic fertilizer might be attributed to the fact that nitrogen being an essential constituent of plant tissue favoured rapid cell division and enlargement which together with adequate quantity of phosphorous helped in rapid cell division and development of cell size. Application of bio-fertilizer for seed treatment might have improved physical, chemical and biological properties of soil, which helped in improved nodulation there by enlarging plant growth in terms of plant height, LAI, nodule number and DMP.

Significantly higher plant height, LAI, Nodule number and DMP was noticed in the succeeding rabi 2015-16 and 2016-17 due to residual effect of 75% RDF integrated with 25% N through FYM in conjunction with bio-fertilizers (*Azospirillum* and *Bacillus megaterium*) applied to preceding baby corn crop in kharif 2015 and 2016 over 100% RDF with or without bio-fertilizer and un-fertilizer control and was at par with other organic treatments (Table 1). The residual effect of FYM to preceding kharif baby corn along with 100% RDF to succeeding hyacinth bean in conjunction with the use of *Bradyrhizobium* seed inoculation might have helped in improving the physical, chemical and biological environment in soil there by making conducive to better plant growth of hyacinth bean (Suma, 2007 and Katyal, 1986).

**Yield attributes:** Application of organic and inorganic sources of nutrition with or without biofertilizers to preceding baby corn crop during kharif, 2015 and 2016 showed significantly higher number of pods plant⁻¹, pod length and pod weight of succeeding hyacinth bean crop during rabi season of 2015-16 and 2016-17 over un-fertilized control.

Least number of pods plant⁻¹, minimum pod length and pod weight was observed with application of 75% RDF alone to hyacinth bean during rabi. The number of pods plant⁻¹, pod length and pod weight were 35 & 33, 8.39 & 8.26 cm, 3.82 & 3.88 g with 75% RDF alone and 41.2 & 41.0, 8.87 & 8.96 cm and 4.26 & 4.25 g with integration of 100% RDF along with seed treatment with *Bradyrhizobium* to hyacinth bean during rabi, 2015-16 and 2016-17, respectively (Table 2). Significantly higher number of pods plant⁻¹, pod length and pod weight was recorded with 100% RDF in conjunction with *Bradyrhizobium* seed treatment over 100% RDF, 75% RDF alone and 75% RDF in conjunction with seed treatment. This may be attributed to increased photosynthetic activity, higher LAI, translocation and accumulation of photosynthates from source to the developing sinks, higher nutrient uptake (Noor et al., 1992). These results are in agreement with those of Dwivedi et al. (2002) in *Dolichos* bean and Tagore et al. (2013) in chick pea. Application of 100% RDF alone showed significantly
Table 1: Effect of integrated nutrient management practices on growth parameters of hyacinth bean in sequence with *kharif* baby corn.

| Treatments | Plant height (cm) | LAI | No. of root nodules Plant⁻¹ | DMP (kg ha⁻¹) |
|------------|-----------------|-----|----------------------------|---------------|
|            | 2015-16  | 2016-17 | Pooled Mean | 2015-16 | 2016-17 | Pooled Mean | 2015-16 | 2016-17 | Pooled Mean |
| **Kharif-Baby corn** |     |         |            |          |         |            |          |         |            |
| T₁ - 25% N through FYM + 75% RDF | 78.9  | 80.1 | 78.9  | 0.72 | 0.72 | 0.72 | 26.2 | 28.6 | 27.4 | 2760 | 2685 | 2723 |
| T₂ - 25% N through FYM + 75% RDF + Azospirillum and Bacillus megaterium @ 5 kg ha⁻¹ each | 81.3  | 82.8 | 81.3  | 0.75 | 0.75 | 0.75 | 26.9 | 29.6 | 28.3 | 2887 | 2811 | 2849 |
| T₃ - 25% N through VC + 75% RDF + Azospirillum and Bacillus megaterium @ 5 kg ha⁻¹ each | 79.5  | 82.1 | 79.5  | 0.73 | 0.73 | 0.73 | 26.3 | 29.3 | 27.8 | 2774 | 2688 | 2731 |
| T₄ - 25% N through VC + 75% RDF + Azospirillum and Bacillus megaterium @ 5 kg ha⁻¹ each | 79.2  | 81.4 | 79.2  | 0.71 | 0.70 | 0.71 | 26.0 | 28.3 | 27.2 | 2722 | 2684 | 2703 |
| T₅ - 100% RDF | 71.7  | 71.8 | 71.7  | 0.64 | 0.62 | 0.63 | 21.3 | 24.5 | 22.9 | 2348 | 2272 | 2348 |
| T₆ - 100% RDF + Azospirillum and Bacillus megaterium @ 5 kg ha⁻¹ each | 73.0  | 72.9 | 73.0  | 0.65 | 0.64 | 0.65 | 22.2 | 25.6 | 23.9 | 2424 | 2272 | 2348 |
| T₇ - Control (No fertilizer application) | 67.4  | 65.7 | 67.4  | 0.58 | 0.56 | 0.57 | 16.1 | 19.5 | 17.8 | 1961 | 1919 | 1940 |
| S.Em + | 1.3  | 1.7 | 1.3  | 0.02 | 0.02 | 0.02 | 0.7 | 0.4 | 0.6 | 47 | 55 | 51 |
| C.D. (P=0.05) | 3.8  | 5.4 | 3.8  | 0.05 | 0.05 | 0.05 | 2.1 | 1.4 | 1.8 | 144 | 171 | 158 |
| **Rabi- hyacinth bean** |     |         |            |          |         |            |          |         |            |
| S₁ -100% RDF | 75.0  | 74.8 | 75.0  | 0.69 | 0.67 | 0.68 | 22.4 | 25.5 | 24.0 | 2612 | 2521 | 2567 |
| S₂ -75% RDF | 73.0  | 73.8 | 73.0  | 0.65 | 0.62 | 0.64 | 21.6 | 24.5 | 23.1 | 2361 | 2238 | 2300 |
| S₃ - 100% RDF + Bradyrhizobium @ 500 g ha⁻¹ Seed treatment | 79.5  | 80.5 | 79.5  | 0.72 | 0.75 | 0.74 | 25.8 | 29.8 | 27.8 | 2787 | 2712 | 2750 |
| S₄ - 75% RDF + Bradyrhizobium @ 500 g ha⁻¹ Seed treatment | 75.9  | 77.6 | 75.9  | 0.67 | 0.66 | 0.67 | 24.4 | 26.2 | 25.3 | 2455 | 2386 | 2421 |
| S.Em + | 0.8  | 1.5 | 0.8  | 0.01 | 0.01 | 0.01 | 0.4 | 0.3 | 0.4 | 35 | 36 | 36 |
| C.D. (P=0.05) | 2.3  | 4.2 | 2.3  | 0.04 | 0.03 | 0.04 | 1.1 | 1.0 | 1.0 | 99 | 102 | 101 |

**Interaction between Bean treatment means at same level of baby corn INM treatments**

|            | Plant height (cm) | LAI | No. of root nodules Plant⁻¹ | DMP (kg ha⁻¹) |
|------------|-----------------|-----|----------------------------|---------------|
|            | 2015-16  | 2016-17 | Pooled Mean | 2015-16 | 2016-17 | Pooled Mean | 2015-16 | 2016-17 | Pooled Mean |
| **S.Em +** | 2.2  | 3.9 | 2.2  | 0.03 | 0.02 | 0.03 | 1.0 | 0.8 | 0.9 | 92 | 95 | 94 |
| C.D. (P=0.05) | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

**INM treatment means of baby corn at same or different level of bean treatments**

|            | Plant height (cm) | LAI | No. of root nodules Plant⁻¹ | DMP (kg ha⁻¹) |
|------------|-----------------|-----|----------------------------|---------------|
|            | 2015-16  | 2016-17 | Pooled Mean | 2015-16 | 2016-17 | Pooled Mean | 2015-16 | 2016-17 | Pooled Mean |
| **S.Em +** | 2.2  | 3.8 | 2.2  | 0.03 | 0.03 | 0.03 | 1.1 | 0.8 | 0.9 | 28 | 99 | 64 |
| C.D. (P=0.05) | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

FYM: Farm yard manure; VC: Vermicompost; RDF: Recommended dose of fertilizers; NS: Non significant.
Table 2: Effect of integrated nutrient management practices on yield attributes and yield of hyacinth bean in sequence with kharif baby corn.

| Treatments | Pods Plant\(^{-1}\) | Pod length (cm) | Pod weight (g) | Pod yield (kg ha\(^{-1}\)) |
|------------|----------------------|-----------------|----------------|-----------------------------|
|            | 2015-16 | 2016-17 | Pooled | 2015-16 | 2016-17 | Pooled | 2015-16 | 2016-17 | Pooled | 2015-16 | 2016-17 | Pooled |
| **Kharif-Baby corn** |         |           |        |        |        |        |        |        |        |        |        |        |        |
| T\(_1\)-25% N through FYM + 75% RDF | 42.3     | 41.0     | 41.6   | 9.28   | 9.15   | 9.22   | 4.19   | 4.25   | 4.22   | 7859   | 7772   | 7815   |
| T\(_2\)-25% N through FYM + 75% RDF + Azospirillum and Bacillus megaterium @ 5 kg ha\(^{-1}\) each | 43.5     | 42.6     | 43.0   | 9.37   | 9.22   | 9.29   | 4.27   | 4.30   | 4.29   | 8082   | 7889   | 7985   |
| T\(_3\)-25% N through VC + 75% RDF + Azospirillum and Bacillus megaterium @ 5 kg ha\(^{-1}\) each | 41.6     | 40.4     | 41.0   | 9.19   | 9.00   | 9.09   | 4.16   | 4.21   | 4.18   | 7732   | 7632   | 7682   |
| T\(_4\)-25% N through VC + 75% RDF + Azospirillum and Bacillus megaterium @ 5 kg ha\(^{-1}\) each | 42.2     | 40.8     | 41.5   | 9.26   | 9.06   | 9.16   | 4.18   | 4.28   | 4.23   | 7838   | 7747   | 7792   |
| T\(_5\)-100% RDF | 33.9     | 33.5     | 33.7   | 7.89   | 8.07   | 7.98   | 3.83   | 3.94   | 3.88   | 6685   | 6346   | 6516   |
| T\(_6\)-100% RDF + Azospirillum and Bacillus megaterium @ 5 kg ha\(^{-1}\) each | 35.8     | 35.4     | 35.6   | 8.45   | 8.36   | 8.40   | 3.93   | 4.01   | 3.97   | 6960   | 6619   | 6790   |
| T\(_7\)-Control (No fertilizer application) | 26.0     | 24.7     | 25.4   | 6.92   | 7.21   | 7.07   | 3.57   | 3.60   | 3.59   | 5995   | 5893   | 5944   |
| S.Em\(_1\) (P=0.05) | 0.6      | 0.9      | 0.6    | 0.08   | 0.11   | 0.07   | 0.04   | 0.04   | 0.02   | 115    | 96     | 95     |
| C.D. (P=0.05) | 2.0      | 2.8      | 1.8    | 0.25   | 0.33   | 0.22   | 0.13   | 0.12   | 0.08   | 355    | 296    | 291    |
| **Rabi- hyacinth bean** |         |           |        |        |        |        |        |        |        |        |        |        |        |
| S\(_1\)-100% RDF | 38.2     | 37.5     | 37.8   | 8.66   | 8.67   | 8.67   | 4.05   | 4.14   | 4.10   | 7445   | 7282   | 7364   |
| S\(_2\)-75% RDF | 35.0     | 33.0     | 34.0   | 8.39   | 8.26   | 8.33   | 3.82   | 3.88   | 3.85   | 6822   | 6629   | 6726   |
| S\(_3\)-100% RDF + Bradyrhizobium @ 500 g ha\(^{-1}\) Seed treatment | 41.2     | 41.1     | 41.1   | 8.87   | 8.96   | 8.91   | 4.25   | 4.26   | 4.25   | 7718   | 7576   | 7647   |
| S\(_4\)-75% RDF + Bradyrhizobium @ 500 g ha\(^{-1}\) Seed treatment | 37.2     | 36.2     | 36.7   | 8.57   | 8.43   | 8.50   | 3.96   | 4.06   | 4.01   | 7244   | 7026   | 7135   |
| S.Em\(_2\) | 0.7      | 0.6      | 0.5    | 0.06   | 0.06   | 0.06   | 0.03   | 0.04   | 0.03   | 74     | 97     | 74     |
| C.D. (P=0.05) | 2.0      | 1.6      | 1.3    | 0.17   | 0.26   | 0.18   | 0.09   | 0.11   | 0.07   | 210    | 277    | 211    |
| **Interaction between** |         |           |        |        |        |        |        |        |        |        |        |        |        |
| Bean treatment means at same level of baby corn INM treatments | 1.9      | 1.5      | 1.2    | 0.16   | 0.24   | 0.16   | 0.08   | 0.10   | 0.07   | 195    | 257    | 195    |
| C.D. (P=0.05) | NS       | NS       | NS     | NS     | NS     | NS     | NS     | NS     | NS     | NS     | NS     | NS     |
| **INM treatment means of baby corn at same or different level of bean treatments** | 1.8      | 1.6      | 1.2    | 0.16   | 0.23   | 0.16   | 0.08   | 0.09   | 0.06   | 204    | 242    | 194    |
| C.D. (P=0.05) | NS       | NS       | NS     | NS     | NS     | NS     | NS     | NS     | NS     | NS     | NS     | NS     |

FYM: Farm yard manure; VC: Vermicompost; RDF: Recommended dose of fertilizers; NS: Non significant.
higher number of pods plant\(^{-1}\) and pod length over 75% RDF alone and was at par with 75% RDF along with \textit{Bradyrhizobium} seed treatment to hyacinth bean. This may be due to imbalance with availability of nutrients in soil with 75% RDF which couldn’t meet its uptake required for optimum growth.

Among the different treatments imposed to \textit{kharif} baby corn, application of 75% RDF integrated with 25% N through FYM and bio-fertilizers recorded maximum pods plant\(^{-1}\) (43.5 and 42.6), pod length (9.37 and 9.22 cm) and pod weight (4.27 and 4.30 g) in succeeding hyacinth bean crop during \textit{rabi} and was at par with other organic treatments of integration of 75% RDF with 25% vermicompost with or without biofertilizers and integration of 75% RDF with 25% N through FYM (Table 2). The increase in pod number, pod length and pod weight might be due to symbiotic relationship between \textit{Bradyrhizobium} bacteria and root nodules of legumes which fix atmospheric nitrogen into a usable form required for the plant growth.

### Pod yield (kg ha\(^{-1}\)):

Application of 100% RDF to hyacinth bean along with seed treatment with \textit{Bradyrhizobium} resulted in significantly higher pod yield (7718, 7576 & 7647 kg ha\(^{-1}\)) during \textit{rabi} 2015-16, 2016-17 and pooled mean, respectively over 100% RDF alone, 75% RDF with or without seed treatment. The yield increase with 100% RDF with seed treatment was 3.67%, 4.03% & 3.84% over 100% RDF during \textit{rabi}, 2015-16, 2016-17 and pooled mean, respectively (Table 2).

Application of 75% RDF in addition seed treatment to hyacinth bean resulted in significantly higher pod yields over 75% RDF alone and was at par with 100% RDF alone. Significantly lower pod yields of hyacinth bean were recorded with the application of 75% RDF alone than rest of the treatments. Significantly higher yields in \textit{Bradyrhizobium} inoculated treatment may be due to increased availability of nitrogen, phosphorus and potassium in soil which gave scope for higher plant uptake of nutrients, which in turn might have resulted in higher plant growth (Table 1) and improved in yield attributes (Table 2) and ultimately resulted in higher yield. The promising effect of biofertilizers may be attributed to production of biologically active substances like vitamins, nicotinic acid, indole-acetic acid, gibberellins etc., in better germination, root and shoot growth and fixation of atmospheric nitrogen (Datta and Banik, 1997). Similar results of higher yields with RDF in conjunction with biofertilizer seed treatment were reported by Rughheim and Abdelgani (2009) in faba bean, Rudresh \textit{et al.} (2005) and Bhuiyan \textit{et al.} (2008) in chick pea.

Imposition of various treatments to preceding \textit{kharif} baby corn resulted in significant variations on the yields of succeeding hyacinth bean during \textit{rabi}, 2015-16 and 2016-17 due to residual effect. Integration of 75% RDF with 25% N through FYM or vermicompost with or without biofertilizers during \textit{kharif} resulted in significantly higher pod yields of succeeding \textit{rabi} hyacinth bean over 100% RDF with or without bio-fertilizers and un-fertilized control. Residual effect due to application of 100% RDF with or without bio-fertilizers during \textit{kharif}, 2015 and 2016 to baby corn showed significantly higher pod yields of hyacinth bean in the succeeding \textit{rabi} over un-fertilized control though these were significantly lower than the treatments having organic manures. Reducing 25% of inorganic fertilizers resulted in significant reduction in yield of hyacinth bean; however seed treatment with \textit{Bradyrhizobium} compensated the loss of yield and was at par with 100% RDF. Residual effect of FYM applied to baby corn was higher compared to vermicompost on the succeeding hyacinth bean. Presence of persistent material, \textit{i.e.}, cellulose in FYM which required longer time for complete decomposition, thus nutrients released from FYM for longer periods might had notable benefits on succeeding hyacinth bean. Soil application of microbes in combination with organics during \textit{kharif} has shown residual effect on \textit{rabi} hyacinth bean compared to RDF alone. Organic manures (FYM and vermicompost), apart from serving as source of nutrients (Macro and micro) to a certain extent, their decomposition produces ligands capable of complexing nutrient elements. Such complexes remain more available to plant roots as complex shields than against immobilization in soil. In addition several indirect effects of organic matter on improvement of soil fertility have been well documented like increased availability of phosphorus (Stevenson, 1982), acceleration in the availability of several micro nutrients like iron, manganese etc., (Katyal, 1986) and improvement in soil microorganisms (Chitesh, 2005 and Nandani, 2006). All these factors might have helped in better growth and yield of hyacinth bean.

### CONCLUSION

Conjunctive use of 100% RDF along with microbial (\textit{Bradyrhizobium @ 500 g ha\(^{-1}\)} seed treatment to hyacinth bean during \textit{rabi} and application of 25% N recommended through FYM or vermicompost in conjunction with 75% RDF through chemical fertilizers and soil application of biofertilizers (\textit{Azospirillum} and \textit{Bacillus megaterium}) to preceding \textit{kharif} baby corn can be recommended for significant improvement in growth, yield attributes and yield of succeeding hyacinth bean.

### REFERENCES

Aykroyd, W. R. (1963). Indian Council of Medical Research Spl. Rep. Series.No. 42.

Bhuiyan, M.A.H., Khanam, D., Hossain, M.F. and Ahmed, M.S. (2008). Effect of \textit{rhizobium} inoculation on nodulation and yield of chick pea in calcareous soil. \textit{Bangladesh Journal of Agricultural Research}, \textbf{33}: 549-554.
Chithesh, C. (2005). Studies on use of organics in tomato (Lycopersicon esculentum Mill.) production. M.Sc (Hort.) Thesis, University of Agricultural Sciences, Dharwad.

Datta, M. and Banik, S. (1997). Comparative efficacy of different phosphatic fertilizers and phospho bacterium (Bacillus firmus) on rice (Oryza sativa) in acid soil. Indian Journal of Agricultural Sciences. 67:545-547.

Dwivedi, Y.C., Kushwah, S.S. and Sengupta, S.K. (2002). Studies on nitrogen, phosphorus and potash requirement of Dolichos bean. Jawaharlal Nehru Krishi Vishwa Vidyalaya Research Journal. 36: 47-50.

Gomez, K. A. and Gomez, A. A. (1984). Statistical Procedures for Agricultural Research. John-Wiley and Sons Inc., New York. 258-259.

Katyal, L.C. (1986). Research achievements of All India Co-ordinated Scheme of micronutrients in soil and plants. Fertilizer News. 30:67-70.

Nandani, T. (2006). Effect of organic treatments on growth, yield and quality of tomato (Lycopersicon esculentum Mill). M.Sc. (Hort.) Thesis, University of Agricultural Sciences, Dharwad.

Noor, S., Huq, M.S., Yasmin and Islam. (1992). Effect of fertilizer and organic manure on the yield of hyacinth bean (Dolichos lablab L.). Legume Journal of Asian Horticulture. 7:95-98.

Rudresh, D.L., Shivaparakash, M.K. and Prasad, R.D. (2005). Effect of combined application of Rhizobium, phosphate solubilizing bacterium and Trichoderma spp. on growth, nutrient uptake and yield of chickpea (Cicer aritenium L.). Applied Soil Ecology. 28: 139-146.

Rughheim, A.M.E. and Abdelgani, M.E. (2009). Effects of Rhizobium, Bacillus megatherium var phosphaticum strains and chemical fertilizers on symbiotic properties and yield of faba bean (Vicia faba L.). Advances in Environmental Biology. 3: 337-346.

Stevenson, F.J. (1982). Variations in the relative distribution of amino sugar with depth in some soil profiles. Soil Science Society of American Proceedings. 32: 590-598.

Suma, D.S. (2007). Studies on response of hyacinth bean (Dolichos lablab L.) to organics M.Sc. (Hort.) Thesis, University of Agricultural Sciences, Dharwad.

Tagore, G.S., Namedeo, S.L., Sharma, S.K. and Narendra Kumar. (2013). Effect of Rhizobium and phosphate solubilizing bacterial inoculants on symbiotic traits, nodule leghemoglobin and yield of chickpea genotypes. International Journal of Agronomy. 1-8.

Thamburaj, S. and Narendra Singh. (2003). Vegetables tubers and spices, Directorate of Information and Publication of Agriculture, ICAR, pp. 214-216.