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Influence of INM Practices on Growth, Yield and Proximate Characters of Baby Corn in Baby Corn (*Zea mays* L.) – Hyacinth Bean (*Lablab purpureus* var. *typicus*) Cropping System

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Abstract

The field experiments were conducted in tropical rainy region of Northern Telangana Zone, India during *kharif* seasons (July-September) of 2015 and 2016 to study the effect of integrated nutrient management practices on growth and proximate characters of baby corn in Baby corn (*Zea mays* L.) – Hyacinth bean (*Lablab purpureus*var. *typicus*) cropping system. Experiment was laid in Randomized Block Design for baby corn during *kharif* 2015 with seven treatments comprised of 100% recommended dose of fertilizers (RDF 150:27:50 N, P and K kg ha^{-1}), 25% N supplemented through farm yard manure or vermicompost + 75% RDF with or without bio-fertilizers *Azospirillum* and *Bacillus megaterium* @ 5 kg ha^{-1} each in addition to control and replicated thrice. Each main treatment was divided into four subplots and the treatments of 100% RDF (20-22 N, P $kgha^{-1}$) and 75% RDF with or without *Bradyrhizobium* @ 500 g ha^{-1} (seed treatment) were imposed for hyacinth bean in *rabi* season and data of *kharif* 2016 was analyzed in split plot design. Application of 25% N through vermicompost in conjunction with 75% RDF and bio-fertilizers to baby corn during *kharif* resulted in significantly higher plant height, leaf area index, root volume, cob $plant^{-1}$, cob length, cob girth, cob width, cob weight, cob yield, stover yield, protein content and significantly lower fiber content over rest of treatments during 2015 and 2016. 100% RDF along with seed treatment with *Bradyrhizobium* to hyacinth bean during preceding *rabi* resulted in significantly higher growth, yield attributes, yield and proximate characters of baby corn in the succeeding *kharif* 2016 over rest of the treatments of 100% RDF, 75% RDF with or without *Bradyrhizobium* seed treatment.

Keywords: Baby corn, growth attributes, proximate characters, integrated nutrient management

1. Introduction

Baby corn is de-husked cob, harvested two or three days after silk emergence. Baby corn is a delicious and nutritive vegetable. It has nutritive value similar to that of non-legume vegetable such as cauliflower, tomato, cucumber and cabbage (Paroda and Sashi, 1994). Baby corn has high nutrient content, a good source of foliate, vitamin B6, riboflavin vitamin A, C rich in potassium, phosphorus and fiber content and low in fat content, free from saturated fat and cholesterol, very low in sodium. One hundred grams of baby corn contain 89% moisture, 1.9 g proteins, 0.2 g fat, 0.06 g ash, 8.2 mg carbohydrate, 28 mg calcium, 86 mg phosphorus and 11 mg ascorbic acid (Thavaprakash et al., 2005). Cultivation of baby corn to diversify cropping pattern and to increase productivity of the cropping systems has been considered important for improving the livelihood of resource poor farmers in South Asia (Kumar and De, 1998). Baby corn has been used by Chinese as vegetable for generations and this practice has spread to other Asian countries.Baby corn cultivation is now picking up in Meghalaya, Western Uttar Pradesh, Haryana, Maharashtra, Karnataka and Andhra Pradesh (Kheibari et al., 2012).

Baby corn is the high value crop and quality is the prime factor than quantity, integration of organics and bio fertilizers assumes significance. Judicious combination of organic manures (Suri et al., 1997), or bio fertilizers *viz., Azospirillum* (Rai and Gaur, 1982) and phospo bacteria (Dutta et al., 1992) along with in organic fertilizers not only reduce the quantity of chemical fertilizers but also improve the yield and quality of crop produce.

The judicious use of fertilizers from different sources to crop will maintain the environmental sustainability for generations without affecting the environmental health (Ranjan et al., 2013); Dadarwal et al. (2009); Kumar et al. (2014). The recent energy crisis and hike in prices of inorganic fertilizers necessitates, balance use of nutrients through organic sources like farm yard manure, poultry manure, vermicompost, green manuring, neem cake and bio fertilizers are prerequisites for producing maximal crop yields and higher quality with optimum input levels (Dahiphale et al., 2003).

Lablab bean or hyacinth bean is one of the most ancient crops among the cultivated legumes and is grown throughout the tropical regions of Asia, Africa and America. It has been cultivated in India since earliest times (Purseglore, 1997). The dwarf, bushy types of hyacinth bean plants are determinate and are photo insensitive and can be cultivated throughout the year. Dwarf varieties (determinate bush-type) have a potential for more extensive cultivation of the crop, because of the plants require no support system, the pods mature uniformly and the crop is amenable to mechanical harvesting which will reduce cost and labour.

In view of the above baby corn of 55-60 days duration is selected for testing during *kharif* and hyacinth bean a legume crop with duration of 130-140 days for *rabi,* is included in the study to evaluate the efficacy of farm yard manure and vermicompost in conjunction with microbial culture and inorganic fertilizers on growth and proximate characters of baby corn and the residual effect of integrated nutrient management practices to hyacinth bean on succeeding *kharif* baby corn.

2. Materials and Methods

2.1. Experimental site

The Field experiments were carried out during *kharif* seasons of 2015 and 2016 at Horticultural Research Station($19^0 08'$ $09''$ N latitude, $79^0 56'$ $03''$ E longitude and 264 m altitude), Adilabad, Telangana State, India which has a tropical rainy climate. The experimental soil was sandy clay loam in texture, neutral in reaction, medium in available nitrogen, phosphorous and potassium and belongs to the order Alfisol of shallow to medium depth. The experiment was laid out in randomized block design (RBD) replicated thrice during *kharif*, 2015 with seven treatments comprised of 100% recommended dose of fertilizer (RDF, 150:27:50 N, P, and K kg ha^{-1}), 25% N supplemented through farm yard manure (FYM) or vermicompost (VC)+75% RDF with or without soil application of *Azospirillum* and *Bacillus megaterium* @ 5 $kgha^{-1}$ each and unfertilized control with three 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, 22 kg P ha^{-1}) and 75% RDF with or without *Bradyrhizobium* @ 500 g ha^{-1} (seed treatment) were imposed in split plot design.

2.2. Method of data collection

The plant height at harvest was recorded from five randomly selected plants in the net plot area. The plant height was measured from the base to the tip of the longest leaf and mean value was expressed in cm. Five plant samples were collected in each treatment outside the net plot area leaving the extreme border row and leaf area was computed at harvest by using the formula as prescribed by Lenvill*et al.,* 1978. Leaf area index (LAI) was calculated by dividing leaf area with land area. Root portions from five plants used for estimating leaf area were separated, cleaned and root volume was estimated by the volume of water displaced when plant roots were submerged in a vessel of water (Novoselov, 1960).

Number of cobs $plant^{-1}$ were counted from tagged plants, averaged and expressed as number of cobs $plant^{-1}$. Cob length was measured from five randomly selected cobs from base to the tip of the cob after removing husk from tagged cobs and the average cob length was recorded for each treatment and expressed in cm. Cob girth was measured from five randomly selected cobs after removing the husk from the tagged cobs and the average cob girth was recorded for each treatment and expressed in cm. Weight of five cobs from the tagged plants without husk was recorded, averaged and expressed in weight cob^{-1} in grams. Baby corn yield of each net plot treatment including the observational plants during each picking was weighed and summed up to arrive at total yield. After harvesting the baby corn, ears were weighed and then de-husked. The de-husked ears were weighed and expressed in kg ha^{-1}. Baby corn plants from the net plot area were harvested separately by leaving 5 cm stubbles from ground surface, weighed and stover yield was expressed inkg ha^{-1}.

Total protein content of baby corn cob was estimated by combustion method by using Leco F-528 Nitrogen Analyzer as advocated in AOAC, 2005. Crude fibre content of baby corn cob was estimated by filter bag technique as advocated in AOAC, 2005. Moisture content of baby corn was estimated by drying a test portion at a temperature of 130°C±3 °C under conditions which enable a result to be obtained which is in agreement with that obtained by the basic reference method.Nitrogen content (%) in plant sample was estimated by the micro-kjeldhal method (AOAC, 1965). The data was analyzed statistically using *F*-test following Gomez and Gomez (1984). LSD values at $p<0.05$ were used to determine the significance of difference between treatment means.

3. Results and Discussion

3.1. Variation in growth

3.1.1. Variation in plant height (cm)

Significantly higher plant height of baby corn at harvest was noticed during both the years of study (2015 and 2016) with application of 75% RDF integrated with 25% RDN through VC in conjunction with biofertilizers (*Azospirillum* and *Bacillus megaterium*) over integration of 75% RDF with 25% N through VC, 75% RDF with 25% N through FYM with or without biofertilizers, 100% RDF with or without biofertilizers and un fertilized control (Table 1). There was no significant difference in plant height among 100% RDF with biofertilizers, 75% RDF+25% N through FYM and biofertilizers and 25% N through VC and 75% RDF during the both the years of study. Application of organic manures (VC and FYM) and biofertilizers to baby corn might have improved physical, chemical and biological properties of the soil, which helped

Table 1: Effect of integrated nutrient management practices on plant height (cm), leaf area index (LAI) and root volume (cm^3) of baby corn at harvest in baby corn-hyacinth bean cropping system

Treatments	Plant height (cm)		LAI		Root volume (cm^3)	
	2015	2016	2015	2016	2015	2016
Main treatments- (*Kharif*-Baby corn)						
T_1	205.7	199.2	5.02	5.09	53.63	43.26
T_2	222.2	214.2	5.54	5.42	66.37	53.07
T_3	223.8	217.4	5.62	5.44	67.72	53.40
T_4	239.7	228.5	6.18	5.71	75.33	60.72
T_5	203.7	202.5	4.96	5.09	53.62	48.68
T_6	222.4	214.2	5.74	5.37	62.83	52.38
T_7	155.1	147.3	2.70	2.85	28.50	26.67
SEm±	4.7	3.3	0.11	0.08	2.19	0.95
CD (p=0.05)	14.4	10.3	0.35	0.26	6.76	2.93
Sub-treatments– (*Rabi*- hyacinth bean)						
S_1-100% RDF		203.6		5.02		51.96
S_2-75% RDF		197.6		4.67		44.24
S_3-100% RDF+*Bradyrhizobium* @ 500 g ha^{-1} Seed treatment		209.8		5.38		51.85
S_4-75% RDF+*Bradyrhizobium* @ 500 g ha^{-1} Seed treatment		202.9		4.91		45.19
SEm±		1.8		0.08		0.68
CD (p=0.05)		5.1		0.22		1.94
Interaction between						
Bean treatment means at same level of baby corn INM treatments						
SEm±		4.7		0.20		1.80
CD (p=0.05)		NS		NS		NS
INM treatment means of baby corn at same or different level of bean treatments						
SEm±		5.3		0.19		1.83
CD (p=0.05)		NS		NS		NS

T_1: 25% N through FYM+75% RDF; T_2: 25% N through FYM+75% RDF+*Azospirillum* and *Bacillus megaterium* @ 5 kg ha^{-1} each; T_3: 25% N through VC+75% RDF; T4:25% N through VC + 75% RDF + *Azospirillum* and *Bacillus megaterium* @ 5 kg ha^{-1} each; T_5: 100% RDF; T_6: 100% RDF+*Azospirillum* and *Bacillus megaterium* @ 5 kg ha^{-1} each; T_7: Control (No fertilizer application) in improved root growth (Table 1) thereby enhancing plant growth in terms of plant height. Vermicompost has narrow C: N ratio (less than 20:1) than FYM, which might enhanced the release of nutrients and their availability to plant root than FYM. Hence the plant height was more with VC than FYM. Dadarwal*et al.* (2009) also reported maximum plant height of baby corn under 75% NPK+VC @ 2.25 t ha^{-1} along with bio fertilizer. Similar findings were reported by Aravinth et al. (2011) with application of RDF of NPK+VC @ 5 t ha^{-1}. These findings are also in close agreement with findings of Verma Arvind et al. (2006) on INM in maize, Khadtare*et al.* (2006) on VC in sweet corn, Zende (2006) and Sahoo and Mahapatra (2007)on INM in sweet corn.

Application of 100% RDF along with seed treatment with *Bradyrhizobium* to hyacinth bean crop during *rabi,* 2015-16 resulted in significantly higher plant height of baby corn in succeeding *kharif*, 2016 at harvest compared to 75% and 100% RDF alone and 75% RDF along with seed treatment. Similar results of increased plant height of baby corn were noticed by Sinha (2017) due to residual effect of application of 100% RDF with seed treatment to horse gram. Srinivasan et al. (2014) also found increased plant height of succeeding baby corn due to residual effect of 100% RDF with biofertilizer seed treatment to cabbage.

3.1.2. Variation in leaf area index (LAI)

Leaf area index of baby corn increased significantly with application of organic, inorganic sources of nutrition and biofertilizers over un-fertilized control (Table 1). Integration of 75% RDF with 25% N through VC in conjunction with the use of biofertilizer resulted in significantly higher LAI during both the years (*kharif*, 2015 and 2016) over un-fertilized control, 100% RDF with or without biofertilizer, 75% RDF integrated with 25% N through FYM with or without biofertilizer and integration of 75% RDF with 25% N through VC at harvest.Use of biofertilizers to baby corn in conjunction with 100% RDF or 75% RDF integrated with 25% N through FYM resulted in significantly higher LAI at harvest over un-fertilized control, 100% RDF and 75% RDF integrated with 25% N through FYM during both the years of study and was at par with 75% RDF integrated with 25% N through VC (Table 1). Biofertilizers either with organics in conjunction with 75% RDF or with 100% RDF improved the LAI than respective treatments without biofertilizers. Similarly, application of FYM or VC along with 75% RDF resulted in higher LAI than 100% RDF. VC was better in improving the LAI than FYM. Application of VC in conjunction with use of biofertilizer, apart from improving soil physical, chemical and biological properties might have also released adequate quantities of nitrogen and phosphorous to boost up the growth of the crop there by increasing the leaf area index. These results are also in line with findings of Dadarwal et al. (2009) in baby corn, Khadtare et al. (2006) and Oktem et al. (2010) in sweet corn. Residual effect of RDF alone or with biofertilizers applied to hyacinth bean during *rabi* significantly influenced the LAI at harvest of baby corn in the succeeding *kharif*.

3.1.3. Variation in root volume (cm ^{3})

Bio-fertilizers with organics or with 100% RDF improved the root volume over respective treatments. Application of VC resulted in higher root volume than FYM while 100% RDF was higher in root volume than FYM combined with 75% RDF at harvest (Table 1). Application of organic sources of nutrition (VC, FYM), inorganic sources of nutrition (100% RDF and 75% RDF with chemical fertilizers) and biofertilizers to baby corn significantly increased root volume at harvest over un-fertilized control during both the years of study. Integration of 75% RDF with 25% N through VC along with the biofertilizers resulted in significantly higher root volume at harvest during both the years of study over rest of the treatments. Barod et al. (2012) reported similar results of increased root volume with application of VC at knee high, tasseling and harvest stage over the use of chemical fertilizer.

Application of 100% RDF and 75% RDF integrated with 25% RDN through FYM resulted in at par root volume of baby corn and were significantly higher over un-fertilized control at harvest during 2015. Use of biofertilizers along with 100% RDF, combined application of 75% RDF with 25% N through FYM or integration of 75% RDF with 25% N through VC resulted in on par root volume at harvest in 2015 and 2016 and were significantly higher over un-fertilized control and 100% RDF during both the years of study. Substitution of 25% RDN through VC or FYM might have supplied major nutrients as well as micro nutrients ensuring balanced plant nutrition, besides improving soil physical, chemical and biological properties. The promising effect of biofertilizers may be attributed to production of biologically active substances like vitamins, nicotinic acid, Indole-acetic acid, gibberellins *etc*., which reflected in promoting better root growth.

Use of 100% RDF along with *Bradyrhizobium* seed treatment to hyacinth bean crop during *rabi,* 2015-16, resulted in significantly higher root volume of succeeding baby corn in *kharif,* 2016 at harvest over 75% RDF with or without seed treatment and at par with 100% RDF (Table 1).

3.2. Variation in yield attributes and yield

Organic and inorganic sources of nutrition with or without biofertilizers to baby corn showed significantly higher number of cobs plant^{-1}, cob length, cob girth, cob width and cob yield during both the years of study (2015 and 2016) over un-fertilized control (Table 2).

Integration of 75% RDF with 25% N through VC along with biofertilizers (*Azospirillum* and *Bacillus megaterium*) showed significantly higher number of cobs plant^{-1},cob length, cob girth, cob width and cob yield compared to rest of the treatments *viz.,* 75% RDF integrated with 25% N through FYM or VC, 75% RDF integrated with 25% N through FYM or through VC or 100% RDF and un-fertilized control.

Table 2: Effect of integrated nutrient management practices on yield attributes and yield of baby corn in baby corn-hyacinth bean cropping system

Treatments	Cobs plant^{-1}		Cob length (cm)		Cob girth (cm)		Cob width (cm)		Cob weight without husk (g)		Cob yield (kg ha^{-1})		Stover yield (kg ha^{-1})	
	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
Main treatments- (*Kharif*-Baby corn)														
T_1	1.8	1.8	10.69	9.31	5.25	5.13	1.68	1.63	9.26	9.03	1602	1495	19344	18919
T_2	2.0	2.0	10.83	9.64	5.6	5.54	1.72	1.68	10.00	9.08	1803	1596	20865	19708
T_3	2.0	2.0	10.95	9.65	5.58	5.46	1.76	1.71	10.00	9.26	1801	1601	21475	19762
T_4	2.2	2.2	12.5	12.24	5.74	5.65	1.86	1.83	13.46	12.06	2049	1890	24020	21165
T_5	1.8	1.8	10.66	9.89	5.24	5.12	1.71	1.61	9.20	9.01	1542	1471	19060	19364
T_6	2.0	2.0	10.96	9.90	5.55	5.44	1.80	1.74	10.38	9.36	1807	1553	20398	19631
T_7	1.0	1.5	7.5	7.11	3.98	3.73	1.27	1.27	3.58	5.13	823	749	13821	12168
SEm±	0.1	0.1	0.41	0.5	0.15	0.15	0.05	0.05	0.4	0.13	64	16	429	385
CD (p=0.05)	0.2	0.2	1.27	1.53	0.45	0.47	0.16	0.16	1.23	0.41	198	49	1321	1187
Sub-treatments– (*Rabi*- hyacinth bean)														
S_1		1.9		9.87		5.2		1.61		9.25		1546		19086
S_2		1.8		9.33		5.01		1.67		8.25		1369		17833
S_3		2.0		9.9		5.33		1.6		9.95		1590		19410
S_4		1.9		9.6		5.07		1.66		8.50		1411		18365
SEm±		0.03		0.24		0.17		0.05		0.19		16		280
CD (p=0.05)		0.1		NS		NS		NS		0.54		45		798
Interaction between														
Bean treatment means at same level of baby corn INM treatments														
SEm±		0.1		0.64		0.44		0.14		0.5		41		740
CD (p=0.05)		NS		NS		NS		NS		NS		NS		NS
INM treatment means of baby corn at same or different level of bean treatments														
SEm±		0.1		0.74		0.41		0.13		0.45		39		748
CD (p=0.05)		NS		NS		NS		NS		NS		NS		NS

T_1: 25% N through FYM+75% RDF; T_2: 25% N through FYM+75% RDF+*Azospirillum* and *Bacillus megaterium* @ 5 kg ha^{-1} each; T_3: 25% N through VC+75% RDF; T4:25% N through VC + 75% RDF+*Azospirillum* and *Bacillus megaterium* @ 5 kg ha^{-1} each; T_5: 100% RDF; T_6: 100% RDF+*Azospirillum* and *Bacillus megaterium* @ 5 kg ha^{-1} each; T_7: Control (No fertilizer application); S_1-100% RDF; S_2-75% RDF; S_3-100% RDF+*Bradyrhizobium* @ 500 g ha^{-1} Seed treatment; S_4-75% RDF+*Bradyrhizobium* @ 500 g ha^{-1} Seed treatment

Significantly lower cob number plant^{-1}, cob length, cob girth, cob width and cob yield was recorded with un-fertilized control than rest of the treatments during both the years of study (Table 2). Aravinth et al. (2011) reported higher number of cobs plant^{-1}, cob length and cob girth, Ashoka et al. (2009) higher cob weight, Ashish Shivran et al. (2015), Dadarwal et al. (2009), Ashoka et al. (2008) and Prasanna Kumar et al. (2007) higher cob yields Thavaprakash et al. (2005); Thavaprakash and Velayudham (2007) higher stover yields with the use of VC in addition to inorganic sources.

Integration of 75% RDF with 25% RDN through FYM to baby corn showed significantly higher number of cobs plant^{-1}, cob length, cob girth, cob weight, cob and stover yield over unfertilized control and was at par with 100% RDF during both the years of study, though these were significantly lower than other organic combination treatments. Increased yield attributes like cobs plant^{-1} (Lone et al., 2013), cob girth (Ravinchandran et al., 2016: Singh et al., 2014) were noticed with integration of organic manure (FYM) along with inorganic fertilizers.

3.3. Variation in proximate characters

3.3.1. Variation in moisture content (%)

Integration of 75% RDF with 25% N through organic manures (FYM or VC) in conjunction with biofertilizers (*Azospirillum and Bacillus megaterium*) showed significantly higher moisture content of baby corn over 100% RDF with or without microbes, 75% RDF with 25% RDN through FYM and un-fertilized control, and was at par with application of 75% RDF together with 25% N through VC during both the years of study (Table 3). Similar result of higher moisture was reported by Pain (1961) in mulberry leaves with application of compost and FYM.

The moisture content of baby corn with application of 100% RDF with or without the biofertilizers was non-significant with unfertilized control treatment during both the years. Application of 75% or 100% RDF along with or without seed treatment to hyacinth bean during *rabi*, 2015-16 didn't demonstrate any significant residual effect on the moisture content of succeeding *kharif* baby corn.

3.3.2. Variation in total protein content (%)

Combined application of 75% RDF with 25% N though VC in conjunction with the biofertilizers showed significantly higher total protein content of baby corn during both the years of

Table 3: Effect of integrated nutrient management practices on proximate characters (moisture, total protein and crude fibre content) of baby corn in baby corn-hyacinth bean cropping system

Treatments	Moisture content (%)		Crude fibre (%)		Total protein (%)		N Uptake (kg ha^{-1})	
	2015	2016	2015	2016	2015	2016	2015	2016
Main treatments- (*Kharif*-Baby corn)								
T_1	86.40	86.74	5.61	4.44	9.35	9.19	82.48	80.76
T_2	86.82	87.12	4.23	3.98	9.70	9.61	102.78	97.64
T_3	87.05	87.26	5.35	4.32	9.79	9.80	101.69	94.46
T_4	87.40	88.03	3.18	3.30	10.08	10.50	136.80	124.07
T_5	86.02	86.45	5.73	5.39	8.88	9.03	81.16	82.43
T_6	86.34	86.50	4.37	4.16	9.68	9.35	95.79	91.78
T_7	85.93	86.14	5.96	6.25	8.33	8.35	39.84	34.94
SEm±	0.15	0.20	0.04	0.04	0.03	0.05	3.09	2.08
CD (*p*=0.05)	0.46	0.62	0.11	0.11	0.10	0.14	9.53	6.40
Sub-treatments– (*Rabi*- hyacinth bean)								
S_1		87.06		4.52		9.40		91.14
S_2		86.87		4.48		9.38		84.71
S_3		86.87		4.60		9.45		88.12
S_4		86.77		4.59		9.39		82.36
SEm±		0.09		0.04		0.02		1.56
CD (*p*=0.05)		NS		NS		0.06		4.46
Interaction between								
Bean treatment means at same level of baby corn INM treatments								
SEm±		0.24		0.10		0.06		4.13
CD (*p*=0.05)		NS		NS		NS		NS
INM treatment means of baby corn at same or different level of bean treatments								
SEm±		0.29		0.09		0.07		4.14
CD (*p*=0.05)		NS		NS		NS		NS

T_1: 25% N through FYM+75% RDF; T_2: 25% N through FYM+75% RDF+*Azospirillum* and *Bacillus megaterium* @ 5 kg ha^{-1} each; T_3: 25% N through VC+75% RDF; T4:25% N through VC + 75% RDF + *Azospirillum* and *Bacillus megaterium* @ 5 kg ha^{-1} each; T_5: 100% RDF; T_6: 100% RDF+*Azospirillum* and *Bacillus megaterium* @ 5 kg ha^{-1} each; T_7: Control (No fertilizer application); S_1-100% RDF; S_2-75% RDF; S_3-100% RDF+*Bradyrhizobium* @ 500 g ha^{-1} Seed treatment; S_4-75% RDF+*Bradyrhizobium* @ 500 g ha^{-1} Seed treatment study than rest of the treatments (Table 3). Application of 25% N through FYM in conjunction with the biofertilizers and 75% RDF showed significantly higher total protein content of baby corn over 100% RDF, integration of 75% RDF with 25% N through FYM and unfertilized control and was at par with 100% RDF in conjunction with biofertilizer (*Azospirillum*+*Bacillus megaterium*) during *kharif*, 2015 and significantly superior during *kharif*, 2016. Significantly lower total protein content of baby corn was with control than rest of the treatments in both the years.

Incorporation of VC showed significantly higher content of total protein than with the use of FYM, inorganic sources of nutrition and un-fertilized control (Table 3). Suitable soil conditions, synchronized release of plant nutrients through-out crop growth period with the use of VC could be the probable reason for the higher protein content. Nitrogen, being the principle constituent of protein might have substantially increased the protein content of cob due to increased uptake of nitrogen under INM practices (Inorganic fertilizers integrated with VC and biofertilizer). Thus, better physiological and biochemical activity of baby corn under adequate and balanced nutrient supply might have enhanced the protein content of kernel as was also confirmed by Ramesh et al. (2008) in maize and Khadtare et al. (2006) in sweet corn.

3.3.3. Variation in crude fibre (%)

The crude fibre varied significantly among the treatments and it ranged from 3.18% to 5.96% in 2015 and 3.30% to 6.25% in 2016 in different treatments (Table 3). Unfertilized control recorded significantly higher crude fibre than rest of the treatments of 75 or 100% RDF in combination of FYM or VC and biofertilizers during both the years of study. Significantly lower crude fibre was reported with 75% RDF+ 25% N through VC and bio fertilizer treatment compared to application of VC or FYM and inorganic sources of nutrition and un-fertilized control in both the years (Table 2). Inorganic sources of nutrition (100% RDF and 75% RDF) and seed inoculation with *Bradyrhizobium* culture to hyacinth bean crop didn't show any significant residual effect on crude fibre content of succeeding baby corn crop in *kharif*, 2016.

3.4. Variation in nutrient uptake

Combined application of 75% RDF and 25% N through VC in-addition to biofertilizers incorporation showed significantly higher N uptake over integration of 75% RDF with 25% N through VC, integration of 75% RDF with 25% N through FYM with or without biofertilizer, 100% RDF with or without biofertilizer and un-fertilized control (Table 3). The higher uptake of N was due to higher availability of nitrogen due to application of VC, proportionate increase in growth parameters, and increase in total biological yield (cob+ stover yield) which ultimately increased the nutrient uptake of nutrients (Prasanna Kumar et al., 2007). Sharma and Pabitra Banik, (2014), Ashish Shivran et al. (2015), Dadarwal et al. (2009) also reported similar results of higher N uptake with integration of inorganic sources of nutrition with organic manures (VC).

4. Conclusion

Application of vermicompost (25% N) in combination with 75% recommended dose of fertilizer along with bio-fertilizers is recommended for baby corn during *kharif* and 100% recommended dose of fertilizer along with *Bradyrhizobium* seed treatment to hyacinth bean during *rabi* for better plant growth in terms of plant height, leaf area index, root volume, yield attributes, yield and superior proximate characters like higher protein and less crude fibreof baby corn in baby corn-hyacinth bean cropping system.

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