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Effect of integrated nutrient management on growth, yield, nutrient uptake and economic of lucerne (*Medicago sativa* L.)

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Abstract

The field experiment was carried out at the Department of Agronomy, N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat) during the *rabi*/summer seasons of 2014-15 to 2016-17. The treatment consists of two levels of organics *viz* FYM @10 t/ha and bio compost (Based on organic carbon content of FYM), two levels of bio fertilizers *viz* No bio fertilizer and *Rhizobium* + PSB each @ 10 ml each /kg seed as seed treatment and two levels of inorganic fertilizers *viz* 75% RDF and 100% RDF. The RDF was 20:50:50 N-P₂O₅-K₂O kg/ha. The experiment was laid out in a randomized block design with factorial concept with three replications. After three cuttings, the crop was left for seed production. The result of experiment revealed that plant height, green fodder yield, dry fodder yield, seed yield and green fodder equivalent yield found non significant due to different organic manures. However, numerically higher growth and yield were obtained with FYM. Same trend observed in case of NPK uptake. The maximum net returns and B:C ratio were also realized in application of bio compost. In case of bio fertilizers, plant height, green fodder, dry fodder and seed yield were not found significant but numerical higher yields were obtained with *Rhizobium* + PSB each @ 10 ml each /kg seed as seed treatment in pooled, while green fodder equivalent yield recorded significantly highest with *Rhizobium* + PSB each @ 10 ml/kg seed) in pooled. Similar results observed in case of NPK uptake. The net returns and B:C ratio were also realized higher with bio fertilizer application. In case of inorganic fertilizer, significantly the highest plant height, green fodder yield, dry fodder yield, seed yield and green fodder equivalent yield were recorded by 100% RDF during all the individual year as well as in pooled results over lower level 75% RDF. N, P₂O₅ and K₂O uptake also higher under 100% RDF. The net returns and B:C ratio were also secured higher with application of 100% RDF. Based on organic carbon content of FYM, the bio compost mean value were 7 t/ha.

From the three years experimentation, It can be concluded that for getting higher growth, green fodder yield, seed yield and green fodder equivalent yield, better economic return and higher nutrient uptake, the Lucerne crop should be fertilize with biocompost 7 t/ha, 100% RDF (20:50:50 N-P₂O₅-K₂O kg/ha) as basal and seed treatment of *Rhizobium* + PSB 10 ml each /kg seed.

Keywords: INM, lucerne, FYM, bio compost, *Rhizobium*, PSB

Introduction

India has 4.9 percent of the total cropped area under cultivated forages. At present, the country faces a net deficiency of 35.6 percent green fodder, 26.0 percent dry crop residues and 41 percent concentrate feed ingredients. Lucerne is an important leguminous fodder crop grown during *rabi* season. It is highly palatable and nutritious, rich in protein and minerals, hence called “Queen of cultivated fodder crop” or “Green Gold”. Its fodder contains about 15 to 20% crude protein with 72% digestibility (dry weight basis) and high amount of vitamins A, B, and D. The basic concept of integrated nutrient management is the maintenance or adjustment of soil fertility and to supply plant nutrient at an optimum level for sustaining the desired crop productivity through optimization of the benefits from all possible sources of plant nutrient in an integrated manner. The role of organic fertilizers are well recognized which supplies macro and micro nutrients necessary for plant growth. Bio fertilizers play an important role in fixing atmospheric nitrogen and thereby influencing growth, yield and quality of crops. Bio-fertilizers are formulations of useful microorganisms which can increase the availability of nutrients by their biological activity and help to accelerate certain microbial processes and improve the soil health. Nitrogen directly involved in the process of photosynthesis and also constituent of chlorophyll, which is important for the harvest of solar energy. Phosphorous is responsible for crop maturity at the right time. Phosphorus plays fundamental role in metabolism and energy producing relations in plants.

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Considering the above fact and views, the present experiment was planned and conducted to study the “Integrated nutrient management in lucerne (*Medicago sativa* L.) under south Gujarat condition”.

Materials and Methods

The present study was conducted during *rabi* seasons of 2014-15, 2015-16 and 2016-17 at instructional farm, Department of Agronomy, N. M. College of Agriculture, Navsari Agricultural University, Navsari. Soil of the experimental field was clayey in texture and showed low, medium and high rating for available nitrogen, phosphorus and potassium respectively. The soil was found slightly alkaline with normal electrical conductivity. The experiment was laid out in Randomized Block Design with factorial concept keeping eight treatment combination *viz* two levels of organic FYM 10 t/ha and bio compost (Based on organic carbon content of FYM), two levels of bio fertilizers *viz* No bio fertilizer and *Rhizobium* + PSB each @ 10 ml/kg seed (Seed treatment) and two levels of inorganic fertilizers 75% RDF and 100% RDF with three replications. The Lucerne variety ‘Anand 2’ was used and crop is left for seed production after three cut. Based on organic carbon content of FYM, the bio compost mean value were 7 t/ha.

Results and Discussion

Effect of organic manure

It is evident from Table- 1 that plant height not influenced significantly due to organic manure. Plant height, yields, green fodder yield, dry fodder yield, seed yield and green fodder equivalent yield were not affected significantly due to the application of different manures during pooled analysis. It may be due to the similar effect of both the organic manures. Maximum net returns and B:C ratio found under treatment bio compost over FYM because bio compost is cheaper source of organic manure than FYM. Data from Table-2 revealed that application of FYM and bio compost were not significantly differ to improve uptake of N, P₂O₅ and K₂O by Lucerne. It

may be due to similar effect of both manures. Similar results were reported by Patel *et al.* (2001) [3].

Effect of Biofertilizer

The result revealed that plant height, green fodder yield, dry fodder yield and seed yield were not significant but numerically higher plant height, green fodder yield, dry fodder yield and seed yield obtained with bio fertilizer however, while green fodder equivalent yield recorded significantly the highest yield with bio fertilizer inoculation (*Rhizobium* + PSB each @ 10 ml/kg seed) . This may be due to overall effect of growth and yield. Net returns and B:C ratio were maximum under application of bio fertilizer *Rhizobium* + PSB each @ 10 ml each/kg seed as seed treatment over no bio fertilizer. The bio fertilizer did not exert their significant effect on N, P₂O₅ and K₂O uptake by fodder and seed in Lucerne, but treatment *Rhizobium* + PSB each @ 10 ml/kg seed recorded significantly highest total N uptake. The results are in conformity with the findings of Tandon *et al.* (2009) [9].

Fertilizer effect

Data presented in Table-1 showed that significantly highest plant height, green fodder yield, dry fodder yield, seed yield and green fodder equivalent yield were recorded by 100% RDF over lower level of fertilizer 75% RDF. This might be due to the higher growth resulted in more yields. Maximum net returns and B:C ratio observed under the application of 100% RDF. Data presented in Table-2 showed that increasing the level of fertilizer, increase the total N, P₂O₅ and K₂O uptake. Significantly the highest total N, P₂O₅ and K₂O uptake were observed in 100% RDF over 75% RDF. This findings are in close agreement with the results obtained by Patel *et al.* (2007) [4].

All the interactions of organic manures, bio-fertilizer and inorganic fertilizer were found non-significant on growth, yield, economics and uptake of nutrients in lucerne.

Table 1: Effect of integrated nutrient management treatment on plant growth, green and dry fodder yields and economics of Lucerne (Pooled of three years)

Treatments	Plant height (cm)	Green fodder yield (q/ha)	Dry fodder yield (q/ha)	Seed yield (kg/ha)	Green fodder equivalent yield (q/ha)	Net monetary returns (Rs/ha)	Benefit Cost Ratio
(A) Organic							
FYM @ 10 t/ha	77.49	351.30	72.71	252.81	562	106177	2.70
Bio compost (Based on carbon content of FYM)	76.05	344.85	71.39	243.34	548	116273	3.42
S. Em. ±	1.16	6.26	1.30	4.50	8.0	-	-
CD (P=0.05)	NS	NS	NS	NS	NS	-	-
(B) Biofertilizer							
No bio fertilizer	75.83	399.93	70.29	244.51	544	107938	2.96
<i>Rhizobium</i> + PSB each @ 10 ml/kg seed (Seed treatment)	77.71	356.23	73.80	251.64	566	114512	3.08
S. Em. ±	1.16	6.26	1.30	4.50	8.0	-	-
CD (P=0.05)	NS	NS	NS	NS	22.21	-	-
(C) Fertilizer Levels							
75% RDF	72.80	326.04	67.21	227.46	516	99681	2.81
100% RDF	80.75	370.12	76.88	268.68	594	122769	3.21
S. Em.±	1.16	6.26	1.30	4.50	8.0	-	-
C.D. at 5%	3.288	18.01	3.71	23.19	22.77	-	-
Sig. interactions							
C.V. (%)	10.65	12.66	12.61	12.71	9.75		

Table 2: Effect of integrated nutrient management on N, P₂O₅ and K₂O uptake by Lucerne (pooled of 3 years)

Treatments	N uptake (kg/ha)			P ₂ O ₅ uptake (kg/ha)			K ₂ O uptake (kg/ha)		
	Fodder	seed	Total	Fodder	seed	Total	Fodder	seed	Total
(A) Organic									
FYM @ 10 t/ha	190.31	9.13	199.4	23.78	2.02	25.80	238.96	2.52	241.4
Bio compost (Based on carbon content of FYM)	184.86	8.71	193.5	23.13	1.94	25.08	232.00	2.43	234.4
S. Em. ±	3.84	0.19	3.91	0.521	0.046	0.53	5.17	0.051	5.19
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
(B) Biofertilizer									
No bio fertilizer	182.23	8.73	190.9	22.78	1.93	24.72	228.77	2.43	231.2
<i>Rhizobium</i> + PSB each @ 10 ml/kg seed (Seed treatment)	192.94	9.11	202.1	24.13	2.03	26.16	242.18	2.52	244.7
S. Em. ±	3.84	0.19	3.91	0.521	0.046	0.53	5.17	0.051	5.19
CD (P=0.05)	NS	NS	11.06	NS	NS	NS	NS	NS	NS
(C) Fertilizer Levels									
75% RDF	170.05	7.91	177.96	21.14	1.73	22.88	212.54	2.20	214.7
100% RDF	205.12	9.94	215.1	25.77	2.23	28.01	258.42	2.75	261.1
S. Em. ±	3.84	0.19	3.91	0.521	0.046	0.53	5.17	0.051	5.19
C.D. at 5%	11.058	NS	11.28	1.50	NS	1.55	14.90	NS	14.95
Sig. interactions	-	-	-	-	-	-	-	-	-
C.V. (%)	14.40	14.84	13.99	15.64	16.25	14.87	15.45	14.47	15.34

Conclusion

From the three years experimentation, It can be concluded that for getting higher growth, green fodder yield, seed yield and green fodder equivalent yield, better economic return and higher nutrient uptake, the lucerne crop should be fertilize with biocompost 7 t/ha, 100% RDF (20:50:50 N-P₂O₅-K₂O kg/ha) as basal with seed treatment of *Rhizobium* + PSB each @ 10 ml each /kg seed.

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