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EFFECT OF ORGANIC AND IN ORGANIC SOURCES OF NITROGEN ON GROWTH AND YIELD OF SOYBEAN UNDER ARID ZONE OF RAJASTHAN.

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Abstract: A field experiment entitled ' Effect of organic and inorganic sources of nitrogen on growth and yield of soybean under arid zone of Rajasthan' was conducted on sandy loamy soil having the medium in the nitrogen (181.21), low phosophorus (16.00) and medium potassium (257.37) with pH 7.5 at the institutional farm, Bhagwant University, Ajmer during the kharif season of 2015-2016 with the objectives to select 10 treatment T_1 (control), T_2 (FYM 20t/ha), T_3 Poultry manures, T_4 (RDF 20kgN : 80kgP : 20kg K), T_5 (RDF 50% +FYM), T_6 (50%RDF+Poultry manure 50kg/ha), T_7 (75%RDF+biofertilizer), T_8 (50%RDF + biofertilizer), T_9 (100% RDF+ lime/ha), T_{10} (75%RDF + lime 50%. The result showed that significant the organic sources of nitrogen application influence the plant height at all stages of observation. The maximum plant height was recorded with T_8 treatment with RDF 50% + biofertilizer the organic manure is more conductive then in organic fertilizer to better growth and development and yield of soybean and grater uptake to nitrogen due to availability of major and minor nutrients in the organic manures.

Keywords: RDF, FYM, RBD, DAS

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INTRODUCTION

Soybean (*Glycine max* L. Merril) belongs to the leguminoseae family. Soybean is considered highly nutritive crop. It's an important oil seed crops besides being an important source of food, feed nutrition and fodder. It contains 40% high biological value protein and 20% oil and considered as a wonder crops of the 21st century. Its oil is used as cooking medium and also for making vanaspathi ghee. The industrial uses include soyamilk, soya flour, soya cake, biscuits, varnish and paints. Soyalecithine- a byproduct of oil industry is used as emulsifier in cosmetics and pharmaceuticals. Soybeans plant is used as fodder and cake as an excellent concentrates for livestock. Approximately 85% of soybeans produced is used for oil extraction, 10% for seed and 5% for food (Rathore, 2000). It also enriches soil by fixing atmospheric nitrogen. Soybean is known as the Golden Bean of the 20th century. Though soybean is a legume crop, yet it is widely used as oilseed. Due to very poor cook ability on account of inherent presence of trypsin inhibitor, it cannot be utilized as a pulse. It is now the second largest oilseed in India after groundnut. It grows in varied agro-climatic conditions. It has emerged as one of the important commercial crop in many countries. Due to its worldwide popularity, the international trade of soybean is spread globally. Several countries such as Japan, China, Indonesia, Philippines and European countries are importing soybean to supplement their domestic requirement for human consumption and cattle feed. Soybean has great potential as an exceptionally nutritive and very rich protein food. It can supply the much needed protein to human diets, because it contains above 40% protein of superior quality and all the essential amino acids particularly glycine, tryptophan and lysine, similar to cow's milk and animal proteins. Soybean also contains about 20% oil with an important fatty acid lecithin and Vit-A and Vit-D. The 4% mineral salts of soybeans are fairly rich in phosphorous and calcium. Soybean is an important crop of the world. It is cultivated on 67.62mha with production of 142.62 million tons (1996-97). The important soybean producing countries are USA, Brazil, China Argentina and India. In respect of total production India rank 5th in the world and area 4.2 m. ha. The important states producing Soybean are Madhya Pradesh, Utter Pradesh, Rajasthan and Maharashtra. (Rathore 2000). Soybean does not require heavy doses of nutrient supply through fertilizers FYM @ 15-20 tones/ha along with 20kg/ha N as a starter does enhance yield of soybean. Rhizobium inoculation can fix up to 150kg N/ha in soybean. A crop fertilized with N has more protein % as compare to unfertilized crop. Soybean needs large quantity of phosphorus and potassium. The basic concept of integrated nutrient management is the maintain of fertility and plant nutrient supply to an optimum level for sustaining the desired crop productivity through optimization of the benefits from all possible sources of plant nutrients in an integrated manner. Like other nitrogenous crops requirement of nitrogen is substantially fulfilled from symbiotic nitrogen fixation through Rhizobium not only enhance yield but enriches the soil, integrated nutrient management involving use of organic manures. Crops residues and in organic fertilizer is beneficial while the use od mineral fertilizer is the quickest and surest way of boosting crop production their costs and other constrains frequently deters farers from using them in recommended quantities and in balanced propitiations. As a consequences of this and

other constrains there seems to be no other options but to fully exploits other alternatives sources of plant nutrients (organic /biological) along with mineral fertilizers is of general is of great importance for the maintained of soil productivity i.e. soil structure, soil bioactivity, soil exchange capacity and water holding capacity of the soil. Like other legumes crops, requirement of nitrogen is substantially fulfilled from symbiotic nitrogen fixation through Rhizobium. Seed treatment nutrient management involving use of organic manure, crop residues and inorganic fertilizer (Rathore 2000). Sharma et al. (1987) reported that application of N in general caused significant increased in growth and yield of soybean but the highest seed yield and uptake of NPK Ca and Mg protein and oil yield were by the combined use of fertilizer and FYM improved soil fertility and yield was obtained due to integration of organic manure and fertilizer then fertilizer alone (Mihas and Stood 1994). Soybean at low yield level is usually tolerant to soil acidity but respond markedly to lime application of lime @2 tonnes to leached sandy alluvial soil pH 5.4 increased seed and dry matter yield, nodulations and Ca content of plant (Chatterjee *at al.* 1972). The current experiment involved the use of different plant nutrient in an integrating manner. The plant nutrient used was nitrogen, phosphorus and potassium, FYM, poultry manure, Rhizobium and lime. These plant nutrients were integrated and applied to the crop in different combinations and varying level of doses. Considering the low productivity of soybean in the country and also to meet the oilseed production there is a need to adopt the concept of integrated nutrient management. No single sources of nutrient is capable of maintaining soil productivity and supplying plant nutrient in balanced proportion for optimum growth, yield and quality of the crop in a specific agro ecological situation, it is needed to practice integrated nutrient management through combined use of organic, biological and chemical sources of plant nutrient. Hence a pertinent need arises to study the effect of different organic and inorganic sources of nitrogen on the growth and yield of soybean and to sort out the most economically viable combination of these sources for increased yield and sustainable soybean production. Under agro climatic condition of Rajasthan therefore considering the above facts the present experiment, entitled "Effect of Organic & In Organic Sources of Nitrogen on Growth and Yield of Soybean Under arid Zone of Rajasthan" was undertaken with the following objectives:- (i) To study the effect of different sources of nutrients on growth of soybean.(ii) To study the effect of different sources of nutrients on yield of soybean. (iii) To find out the uptake of nitrogen.

Effect of organic manure on growth and yield:-In a field experience conducted by Dev and Tilk (1976) on soybean cv Bragg with various organic amendments. The soil was amended with manure (FYM and Poultry manures) and caked separately @2.5, 5 and 7.5t/ha. Soil amended with manure recorded better nodulation, consequently better nitrogen fixation than the unamended soil and the cake amended soil. The manorial treatments brought about a significant increased in soybean yield when compared with the cake amended soil but the number of pods per plant was significantly, more than the caked amended soil. Aziz *et al* (2011) a field experiment

was conducted at KVK Srinagar during two consecutive kharif seasons of 2008-09 and 2009-10 to study the "Effect of Integrated Nutrient Management for soybean (*Glycine max* L.) under temperate conditions." The experiment was laid out under 18 treatment combination viz. three level of recommended inorganic fertilizer (50,75,and 100% RD) three levels of organic manures (control, FYM 10 t ha-1 and Dalweed 10 t ha^{-1}) and two level of biofertilizers (control and dual inoculation with Rhizobium + PSB) in randomized complete block design with three replication. Among organic FYM (10 t ha^{-1}) yielded significantly superior results for seed quality than Dalweed (10 t ha^{-1}).

Effect of inorganic sources of nutrients on growth and yield:- Jat *et al.* (2000) conducted a field experiment to study the response of mustard to 5 t FYM + N levels and 4 levels of P. The result revealed that plant height, dry matter accumulation, number of primary and secondary branches number of silique per plant, number of seeds/silique, seed yield test weight and harvesting index increased significantly up to individual application of 10t FYM +30 kg N and 20 kg P_2O_5/ha. Singh *et al* (2001) conducted an experiment during rainy season (kharif) to study the effect of graded dose of NPK, FYM and lime their combination on the yield and yield attributing characters of soybean. Application of lime @ 1t/ha + full dose of NPK gave significantly higher seed and straw yields over control. Aziz *et al* (2011**)** a field experiment was conducted at KVK Srinagar during two consecutive kharif seasons of 2008-09 and 2009-10 to study the "Effect of Integrated Nutrient Management for soybean (*Glycine max* L.) Under temperate conditions." The experiment was laid out under 18 treatment combination viz. three level of recommended inorganic fertilizer (50,75,and 100% RD) three levels of organic manures (control, FYM 10 t ha-1 and Dalweed 10 t ha^{-1}) and two level of biofertilizers (control and dual inoculation with Rhizobium + PSB) in randomized complete block design with three replication. Lycine content was found superior with application of 75% recommended inorganic fertilizers over other levels, Linoleic acid content increased with increasing levels of recommended inorganic fertilizers.

Effect of lime on growth and yield:-Mishra *et al* (1999) conducted a field experiment to evaluate the effect of lime and sulphur on rape seed (*Brassica compestris*) spp. Oleiferan var toria soybean cropping sequence. The levels of lime (0 and 1.25 t/ha) and sulphur (0, 10, 20, 30 and 40 kg/ha) were tried and observed that application of lime (1.25t/ha) and sulphur (30kg/ha) to rape seed significantly increased the seed yield as well as NPK uptake. The residual effects of lime on soybean were superior to no lime and no S application in increasing the seed yield and nutrient uptake. In another experiment to study the direct effect to lime, organic and inorganic nutrient on wheat and its carry over effect on soybean they observed that lime (1.25 t/ha), FYM (4t/ha) in combination with 60 kg N + 30kg P_2O_5 + 20 kg K_2O /ha resulted in higher yield of wheat (29.3 q/ha) and significant residual effect was also observed for soybean (23.4q/ha) with application

of 30 kg N + 60kg P_2O_5 + 30kg K_2O/ha and significant increase in the uptake of N,P and K were also observed by both the crops.

Materials and methods

The experiment entitled "Effect of Organic & In Organic Sources of Nitrogen on Growth and Yield of Soybean Under arid Zone of Rajasthan" was carried out in the experiment Research Farm of Department of Agriculture sciences, Bhagwant University, Ajmer campus during the period of June October 2015.

Location:-The experiment farm is located in the Ajmer Rajasthan at an altitude of 426.7 meter above mean sea level with the geographical location at 11 latitude and 60 longitudes.

Climate:-The climate of the experiment farm lies in humid sub tropical zone with high humidity, moderate temperature and medium to high rainfall. The mean temperature ranges from 420 to 460 C during summer and rarely goes below 300 C in winter due to high atmospheric humidity. The average rainfall varies from 500-600 mm from April to September and from October to March it remains comparatively dry.

Soil condition:-The soil of the experimental field was found to be well drained and sandy loam in texture. The texture and fertility of the soil were ascertained by taking soil sample from a depth of 0-15 cm from different locations of the experimental plots with the help of soil auger which were processed and analyses by methods of mechanicals and chemicals analysis.

Experimental details:-

Crop- Soybean	**Experimental design- Randomized Block Design (RBD)**	**Treatment Number-10 (Ten)**
Variety- JS335		Plot size-4.5m X 2.7 m
Plot length-4.5m	Total number of experiment units 30	Net area-485 m^2
Plot width-2.7 m		Spacing-45cm X 10cm

Treatments Details
T_1 (control),
T_2 (FYM 20t/ha),
T_3 Poultry manures,
T_4 (RDF 20kgN: 80kgP: 20kg K),
T_5 (RDF 50% +FYM),
T_6 (50%RDF+Poultry manure 50kg/ha),

T_7 (75%RDF+biofertilizer),
T_8 (50%RDF + biofertilizer),
T_9 (100% RDF+ lime/ha),
T_{10} (75%RDF + lime 50%.

Details of cultivation:-Selection of variety: -JS-335 it is a medium tall variety which matures in 95-100 days. The flowers are violet, pods are glabrous and seed are yellow color. It has yield potential of 25-32q/ha.

Selection and preparation of field:-A three tier terrace having uniform fertility status was selected. The experimental plot was ploughed one month ahead of sowing by using tractor drawn disc plough. The clods were the broken by using disc harrow and leveled properly. The stubbles and weed were then removed manually. Then the layout of the field was done according to the plan and design of the experiment.

Manures and fertilizers application:- The manures were applied through sources like well decomposed FYM, Poultry manure two week before sowing. Application of lime was done one week before sowing and recommended dose of fertilizer @ 20kg N, 60kg P_2O_5 and 20kg K_2O/ha in the form of urea, SSP and MOP

Seed treatment:-Before sowing the seeds were treated with *Rhizobium* culture. The seeds were soaked in slurry made from *Rhizobium* culture and then dried under shade just before been sown in the field.

Seed rate and sowing:- The seeds were sown in furrows at a depth of 3 to 4cm with 45cm row to row and 10cm plant to plant spacing. The crop was shown on 23rd June 2015.

After care:-To maintain he uniform plant population, thinning and gap filling were done after 15 days of sowing. To control the weeds in the plots two hand weeding were done first after 20 days and second after 40 days of sowing. It was observed that the crop was infested by the blister beetle during the flowering stage and was controlled by the application of Imidicloropid.

Harvesting and threshing:-Harvesting was done 2nd October 2015 after the crop has attained proper maturity. The crop was harvested at ground level by cutting with hand sickle and the harvested plant of each plot was labeled, bundled and sun dried separately, threshed and cleaned manually.

Determination of some nutrient status of soil:-To determine the nutrients status of the soil sample of the experimental field were analyzed for pH, Organic carbon, and available NPK content.

Organic carbon:- Organic carbon was determined by Walkely and Black Method as outline by Jackson (1967).

Available Nitrogen:-Q the procedure involves distillation of soil with alkaline postassium permanganate solution and determining the ammonia liberate. This serves as an index of the available N status of the soil by Subbiah and Asijia (1956).

Observations recorded:-Growth parameter:- For recording the vegetative character, five randomly selected plants are tagged in each plot and their growth observation was recorded at 30,60 and 90 days after sowing.

Plant height (cm):-The height of the plant was measured by the linear scale from the ground level up the tips of the plant at 30, 60 and 90 days after sowing. The average plant height was calculated for each treatment.

Shoot fresh weight (g/plant):- The shoot fresh weight was taken at 30, 60 and 90 DAS. The fresh weight of plant were taken the data obtained were expressed as shoot fresh weight.

Shoot dry weight:-The shoot dry weight was taken at 30, 60 and 90 days after sowing. The plant was sundried and finally over dried at 45 C for 48 hours and weights of the plant samples were taken. The data were obtained expressed as shoot dry weight in g/plant.

Number of nodulation per plant:-The numbers of nodules were counted from the tagged plant and averaged values were obtained.

Yield attributes:-After proper maturity of crops, five plants were randomly selected and averaged data was worked out.

Number of pods per plant:-The pods of 5 plants were counted and their average was estimated.

Number of branches per plants:-The number of branches from the tagged plant was counted and average was estimated.

Number of seed per pod:-From the selected sample the number of seeds per pod were counted and average were obtained.

1000 grain weight or test weight (g):-From the individual plot the threshed grain samples were taken randomly for test weight 1000 seed were counted and weight to get the test weight of grains.

Seed yield (q/ha):-The harvested plants from net area of each plot were threshed separately. The weight of the Stover per plot recorded separately and the basis of grain and Stover yield per hectare were calculated and expressed in quintal per hectare.

Chemical analysis of plant materials:- The soybean grains and straw sample were washed with deionised water and dried in sun followed by oven dry at 70^0 and powdered packed in polythene bags with proper labeling for chemical analysis.

Nitrogen:- Nitrogen in plant and grain sample was analyzed by Kjeldhal method.

Nitrogen uptake estimation:- The uptake of Nitrogen by plant was work out by multiplying content values with corresponding yield data

$$\text{Nitrogen uptake (kg/ha)} = \frac{\text{Yield kg/ha X Nitrogen content (\%)}}{100}$$

Statistical analysis:-The data on growth yield and quality components were subjected to Fisher's method of analysis of variance (ANOVA), where the 'F' tests was significant for comparison of the treatment means, CD values were worked out at 5% probability level.

Analysis of Variance (ANOVA):-Analysis of treatment for all treatments in Randomized Block Design was carried out. For testing the hypothesis the following ANOVA table was used.

Table 3.9 Skeleton of ANOVA

Source of variation	d.f.	S.S.	M.S.S.	F.cal.	F(table) at Result5%
Due to replication	(r-1)	R.S.S.	$\frac{\text{R.S.S.}}{\text{r-1}}$	$\frac{\text{M.R.S.S.}}{\text{M.E.S.S.}}$	
Due to treatment	(t-1)	T.S.S.	$\frac{\text{T.S.S}}{\text{t-1}}$	$\frac{\text{M.T.S.S.}}{\text{M.E.S.S.}}$	(r-1) (t-1)
Due to error	(r-1) (t-1)	E.S.S.	$\frac{\text{E.S.S.}}{\text{(r-1) (t-1)}}$	M.E.S.S.	F(t-1) (r-1)(t-1)
Total	(rt-1)	TSS	-	-	-

Where:-d.f.= Degree of freedom, r = replication, S.S. = Sum of squares, t = treatment, M.S.S = Mean sum of squares, R.S.S. = Replication sum of squares, T.S.S. = Total sum of squares, E.S.S. = Error sum of squares,

M.R.S.S. = Mean replication sum of squares, M.T.S.S. = Mean treatment sum of squares, M.E.S.S. = S.E. (d) x't' error d.f. at 5% level of significance

$$\text{S.E. (d)} = \sqrt{\frac{2 \times \text{M.E.S.S.}}{r}}$$

The significance and non-significance of the treatment effect was judged with the help of 'F' variance ratio test. Calculated 'F' value was compared with the table value of 'F' at 5% level significant. If the calculated value exceeds the table value, the effect was considered to be significant. The significant differences between the mean were tested against the critical differences at 5% level of significance. For testing the hypothesis, the ANOVA table was used.

Results

The experimental findings based on the observations recorded during the course of investigation at various stages has been critically examined and statistically analysed which are illustrated in this chapter. The influence of treatments on growth, yield and yield attributes, nutrient content and uptake are well illustrated with the help of suitable tables and finger cited at appropriate places. Primary data were recorded at 30, 60 and 90 DAS. All these were statistically analysed and significant variations have been discussed.

Growth attributes:-Plant height (cm):-The observations on plant height as influenced by organic and inorganic sources of nitrogen were recorded at an interval of 30, 60 and 90 DAS as indicated in Tables 4.1 and Fig. 4.1. A perusal of the result showed there were significant differences in the treatments at 30, and 60 DAS. At 90 DAS treatment did not show any significant differences in plant height over control. At 30 DAS the maximum plant height was recorded with RDF (100%) + Lime (4t/ha) *i.e.* 26.27 cm, and at 60 DAS the maximum plant height was recorded with RDF (50%) + Poultry manure (2t/ha) *i.e.* 44.90 cm.

Fresh weight per plant:-Data recorded on fresh weight on soybean are presented in table 4.2 and Fig. 4.2. The effect of organic and inorganic sources of nitrogen on fresh weight of plant was recorded at intervals of 30, 60 and 90 DAS. From the data it was evident that organic and inorganic caused significant increased in fresh weight of the plant at all observation *i.e.* at 30, 60 and 90DAS over control. The maximum fresh weight was recorded with RDF (100%) + lime (100%) at 30 and 60 DAS. At 90 DAS maximum fresh weight (143.30 gm) was recorded with 52% RDF + Bio fertilizer.

Table 4.1 Effect of organic and in organic sources of nitrogen on plant height at different days after sowing.

Treatment	Plant height (cm)		
	30 DAS	60 DAS	90 DAS
T_1	18.82	39.87	54.67
T_2	17.67	37.97	51.67
T_3	19.40	40.23	61.53
T_4	18.00	43.37	60.73
T_5	19.13	41.07	58.53
T_6	20.73	44.90	62.53
T_7	18.20	36.33	57.23
T_8	22.80	43.37	62.73
T_9	26.27	44.47	62.73
T_{10}	24.73	45.50	63.47
S.Ed ±	**1.59**	**2.63**	**7.22**
$CD_{0.05}$	**3.33**	**5.53**	**NS**
CV(%)	**9.49**	**7.71**	**14.84**

Fig. 4.1 Effect of organic and in organic sources of nitrogen on plant height at different days after sowing.

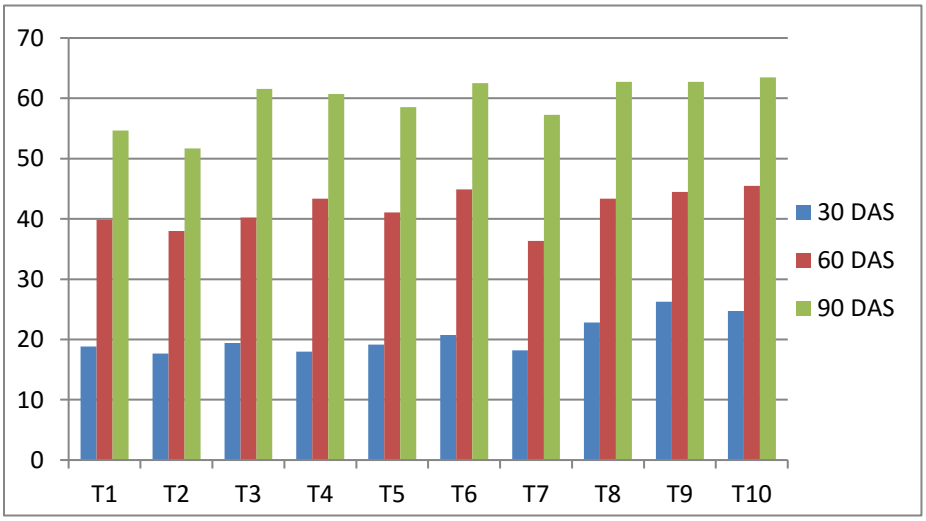


Table 4.2 Effect of organic and in organic sources of nitrogen on fresh weight at different days after sowing.

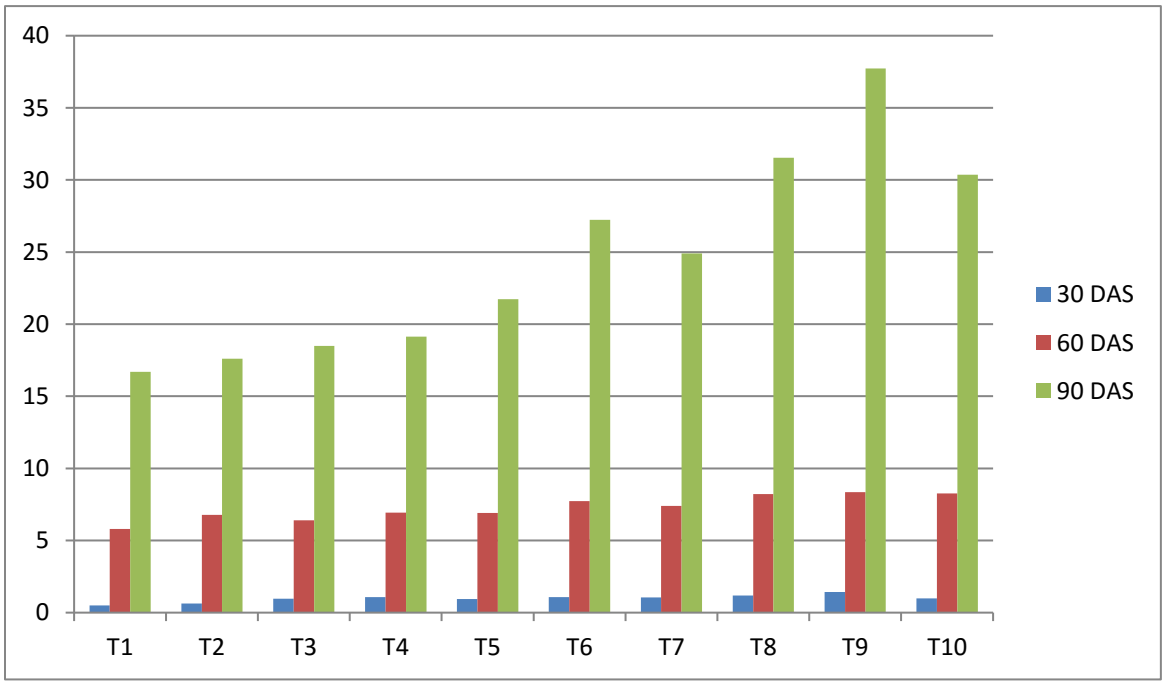
Treatment	Fresh weight per plant (gm)		
	30 DAS	60 DAS	90 DAS
T_1	1.57	10.68	65.43
T_2	2.21	13.60	81.90
T_3	3.20	20.37	119.30
T_4	3.77	20.17	110.23
T_5	3.10	19.47	121.60
T_6	3.50	22.03	116.80
T_7	3.48	21.20	135.83
T_8	3.93	24.10	143.30
T_9	4.37	27.33	139.17
T_{10}	3.87	26.83	131.41
S.Ed ±	**0.31**	**1.12**	**2.68**
$CD_{0.05}$	**0.66**	**2.34**	**5.64**
CV(%)	**11.67**	**7.64**	**3.19**

Fig. 4.2 Effect of organic and in organic sources of nitrogen on fresh weight at different days after sowing.

Table 4.3 Effect of organic and inorganic sources of nitrogen on dry weight at different days after sowing.

Treatment	Dry weight per plant (gm)		
	30 DAS	60 DAS	90 DAS
T_1	0.49	5.80	16.70
T_2	0.64	6.77	17.60
T_3	0.97	6.40	18.50
T_4	1.07	6.93	19.13
T_5	0.94	6.92	21.73
T_6	1.08	7.73	27.23
T_7	1.05	7.40	24.90
T_8	1.18	8.23	31.53
T_9	1.42	8.35	37.73
T_{10}	0.99	8.27	30.37
S.Ed ±	**0.15**	**0.44**	**2.36**
$CD_{0.05}$	**0.32**	**0.92**	**4.96**
CV (%)	**18.79**	**7.41**	**11.83**

Fig 4.3 Effect of organic and inorganic sources of nitrogen on dry weight at different days after sowing.



Dry weight per plant:- The data pertaining to the organic manure inorganic nitrogen on dry weight are shown in table 4.3 and Fig 4.3. From the table and figure it was evident that various treatment showed significant increased at 30, 60 and 90 DAS. The maximum dry weight was observed with RDF (100%) + lime (100%) at all the growth stages *i.e.* 1.42 gm at 30 DAS, 8.35 gm at 60 DAS and 37.73 gm at 90 DAS.

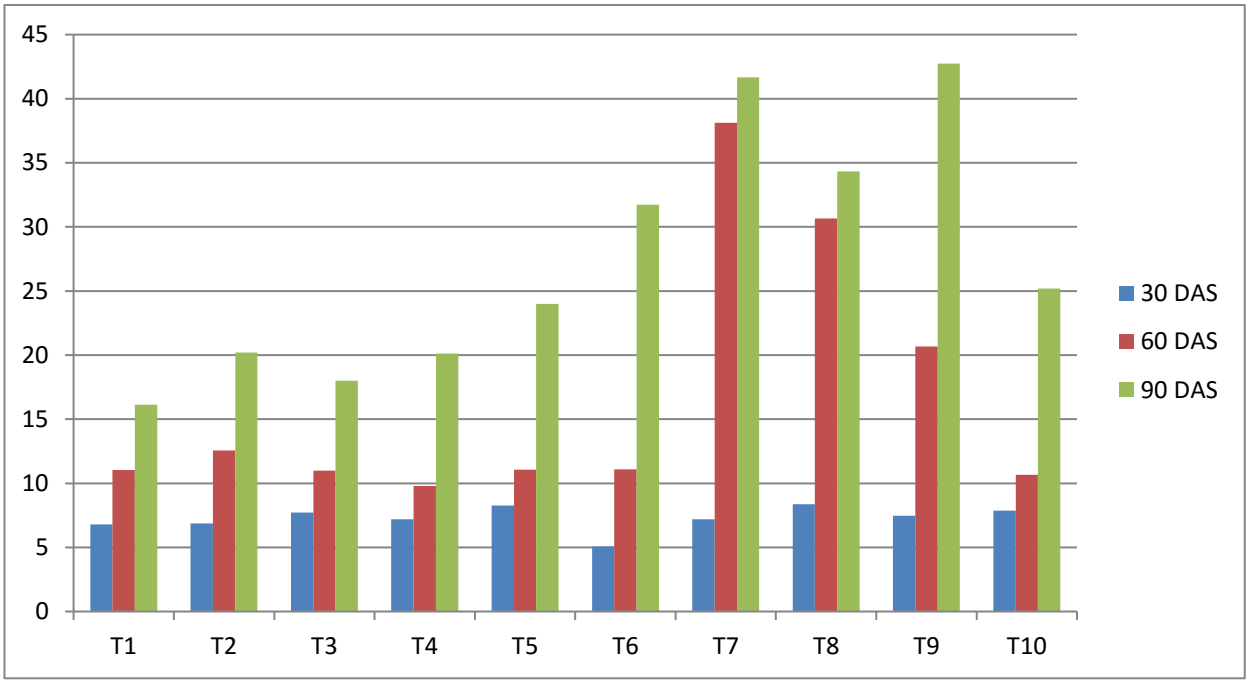
Number of Nodules per plant:-The effect of organic and inorganic sources of nitrogen application on number of nodules is presented in Table 4.4 and Fig. 4.2. It was evident that all these sources of nutrient application had significant effect on the number of nodules at all the growth stages. At 30 DAS the maximum number of nodules was observed at RDF(50%)+ Biofertilizer with 8.37 nodules at 60DAS the maximum number of nodules was observed at RDF(75%) + bio-fertilizer with 38.13 nodules and at 90 DAS the maximum number of nodules (42.73) was recorded at RDF(100%) + lime(4t/ha).

Yield and yield attributes:-Number of branches per plant:- Data recorded on number of branches per plant presented in Table 4.5 and Fig. 4.5 shows no significant variations by application of different of organic and inorganic sources of nitrogen over control. However the maximum number of branches per plant was recorded at RDF (50%) + bio-fertilizer with 8.65 branches per plant.

Table 4.4 Effect of organic and inorganic sources of nitrogen on number of nodules per plant at different days after sowing.

Treatment	Number of nodules per plant		
	30 DAS	60 DAS	90 DAS
T_1	6.80	11.05	16.13
T_2	6.87	12.57	20.20
T_3	7.73	11.00	18.00
T_4	7.20	9.80	20.13
T_5	8.27	11.07	24.00
T_6	5.07	11.10	31.73
T_7	7.20	38.13	41.67
T_8	8.37	30.67	34.33
T_9	7.47	20.67	42.73
T_{10}	7.87	10.67	25.20
S.Ed ±	**0.93**	**4.97**	**6.17**
$CD_{0.05}$	**NS**	**10.45**	**12.97**
CV (%)	**15.61**	**33.70**	**27.69**

Fig. 4.4 Effect of organic and inorganic sources of nitrogen on number of nodules per plant at different days after sowing.



Number of pods per plant:-The effect of organic and inorganic sources of nitrogen sources of nitrogen application on number of nodules is depicted in table 4.5 and Fig. 4.5. Data recorded on effect of organic and inorganic sources of nitrogen on the number of pods per plant shows no significant influence by these sources over the control. The maximum number of pods per plant (64.47) was recorded with RDF (50%) + bio-fertilizer.

Number of seeds per pod:-Data recorded on number of seeds per pod have been presented in Table 4.5 and Fig. 4.5. A perusal of data revealed significant variation in number of seeds per pod due to application of organic and inorganic sources of nitrogen. The maximum number of seeds per pod was found in RDF (100%) +lime (4t/ha) with 2.15 followed by 2.12 with RDF (50%) + Poultry manure (2t/ha).

Number of seeds per plant:-The result recorded in Table 4.5 and Fig. 4.5 indicates that various treatments showed significant differences in number of seeds per plant over control. The maximum number of seeds per plant (160.34) was recorded at RDF (50%) + bio-fertilizer with followed by RDF (100%) + lime (4t/ha) with 154.08.

Test weight (g):-Data recorded on 1000 grain weight are being presented in table 4.6 the result showed significant variation in 1000 grain weight due to various sources of organic and inorganic

sources of nitrogen. Application of RDF (50%) + bio-fertilizer recorded the maximum test weight of 150.19 gm and it was followed by RDF (50%) + poultry manure (2t/ha) with 147.60 gm.

Table 4.5 Effect of organic and inorganic sources of nitrogen on number of branches/plant, number of pods/plant, number of seeds/pods, and number of seeds /plant.

Treatment	Number of branches/plant	Number of pod/plant	Number of seeds/plant	Number of seeds/plant
T_1	7.00	53.00	1.99	105.47
T_2	7.07	51.60	1.80	91.80
T_3	6.33	53.53	1.81	114.03
T_4	6.00	55.80	2.00	134.92
T_5	6.67	51.60	1.66	116.03
T_6	7.13	55.17	2.12	140.80
T_7	8.00	57.47	2.01	121.80
T_8	8.65	64.47	2.04	160.34
T_9	5.93	56.27	2.15	154.08
T_{10}	8.13	47.67	1.83	107.60
S.Ed ±	**1.14**	**5.41**	**0.07**	**1.02**
$CD_{0.05}$	**NS**	**NS**	**0.15**	**2.13**
CV(%)	**19.76**	**12.14**	**4.53**	**1.00**

Fig. 4.5 Effect of organic and inorganic sources of nitrogen on number of branches/plant, number of pods/plant, number of seeds/pods, and number of seeds /plant.

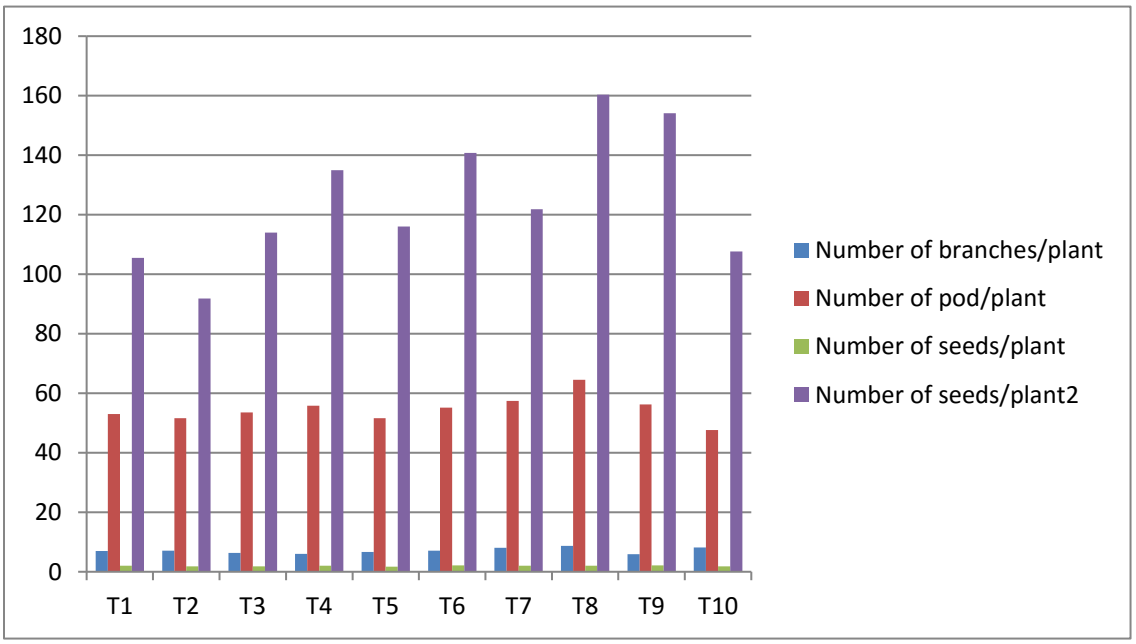


Table 4.6 Effect of organic and inorganic sources of nitrogen on test weight, grain and straw.

Treatment	Test weight (g)	Grain yield (q/ha)	% increased over control	Straw yield (q/ha)	% increased over control
T_1	138.10	18.50	0	20.19	0
T_2	139.30	24.74	33.73	28.52	41.26
T_3	146.33	21.83	18.00	29.32	45.22
T_4	146.07	23.71	28.16	30.56	51.46
T_5	142.50	20.27	9.57	21.99	8.92
T_6	147.60	20.43	10.43	27.49	36.16
T_7	136.17	19.58	5.84	22.16	9.76
T_8	150.19	26.56	43.03	21.82	8.07
T_9	146.77	21.47	16.05	26.97	33.58
T_{10}	139.10	25.15	36.16	32.61	56.56
S.Ed ±	**1.47**	**1.74**		**3.54**	
$CD_{0.05}$	**3.09**	**3.65**		**7.43**	
CV (%)	**1.26**	**19.50**		**8.16**	

Fig. 4.6 Effect of organic and inorganic sources of nitrogen on test weight, grain and straw.

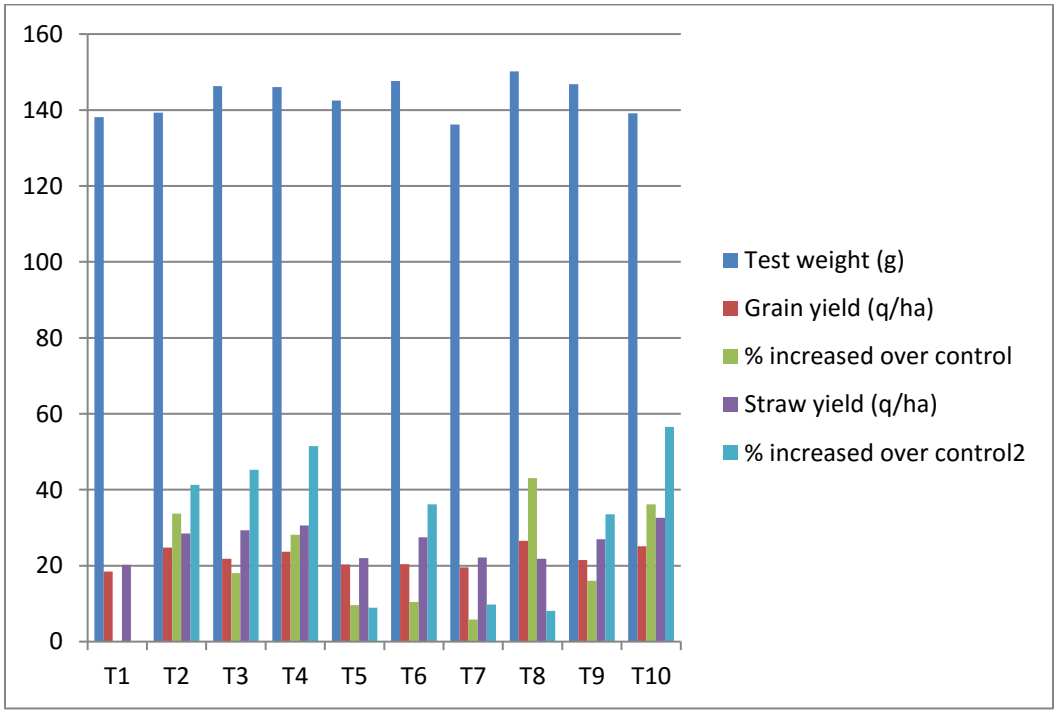
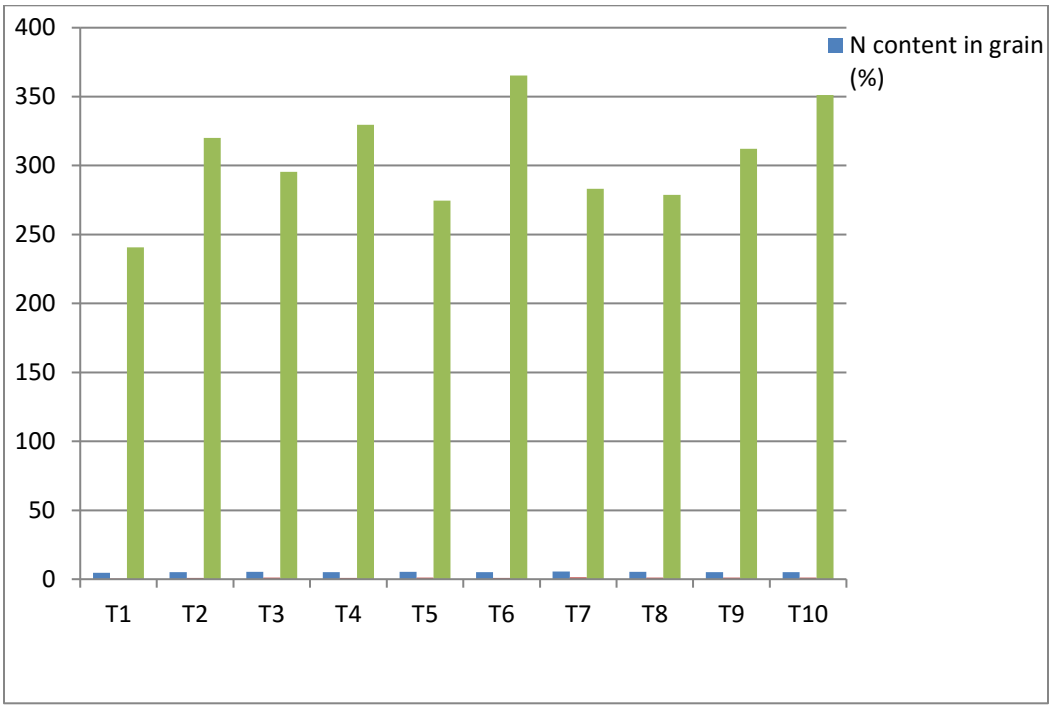


Table 4.7 Effect of organic and inorganic sources of nitrogen on nitrogen content in grain and straw and total nitrogen uptake.

Treatment	N content in grain (%)	N content in straw (%)	Total N uptake (Kg/ha)
T_1	4.73	0.43	240.68
T_2	5.17	0.83	320.12
T_3	5.27	1.24	295.49
T_4	5.11	0.97	329.49
T_5	5.43	1.07	274.47
T_6	5.13	1.03	365.36
T_7	5.60	1.30	283.15
T_8	5.32	1.07	278.68
T_9	5.18	1.27	312.28
T_{10}	5.13	1.07	351.20
S.Ed ±	**0.18**	**0.04**	**39.44**
$CD_{0.05}$	**NS**	**0.09**	**82.85**
CV (%)	**4.33**	**4.85**	**15.83**

Fig. 4.7 Effect of organic and inorganic sources of nitrogen on nitrogen content in grain and straw and total nitrogen uptake.



Grain yield (g/ha):- The result presented in Table 4.6 and Fig. 4.6 indicated the application of different sources of organic and inorganic significantly increased the grain yield over control. The maximum yield (26.56q/ha) was recorded at 50% RDF + bio-fertilizer which was at par 25.15q/ha with RDF (75%) + lime (50%).

Straw yield:-Table 4.6 and Fig 4.6 represent the data recorded on straw yield (q/ha). A critical observation of the data clearly revealed that straw yield significantly increased with various sources of organic and inorganic nitrogen over control. The maximum straw yield (32.61q/ha) was recorded at RDF (75%) + lime (50%) followed by RDF (100%) with 30.56 q/ha.

Nitrogen content (%) and nitrogen uptake (kg/ha) of soybean:-Nitrogen content (%) in grain:-A critical examination of the data pertaining to the effect of organic and inorganic sources of nitrogen content in grain in presented in Table 4.7 and Fig. 4.7. It showed that various treatment have no significant influence on nitrogen content in grain. The minimum nitrogen content (4.73%) was recorded with in control and maximum value (5.60%) was observed by RDF (75%) + bio-fertilizer.

Nitrogen content (%) in straw:-The data presented in Table 4.7 and Fig 4.7 indicated that application of organic and inorganic nitrogen significantly increased the N content in straw. The maximum N content (1.30%) was recorded with RDF (75%) + bio-fertilizer.

Nitrogen uptake:-The result pertaining the effect of organic and inorganic sources of nitrogen on N uptake by soybean is presented in Table 4.7 and Fig. 4.7. It was observed the N uptake did not significantly increase with several of nutrient over control. The maximum uptake (365.36kg/ha) was recorded with RDF (50%) + poultry manure (2t/ha).

CONCLUSION

The present research project entitled “Effect of Organic & in Organic Sources of Nitrogen on Growth and Yield of Soybean Under arid Zone of Rajasthan.” Was carried out during June to October 2015 Kharif season at the experimental research farm of Department of Agriculture Sciences Bhagwant University Ajemr Rajasthan. The response obtained from different sources of organic and inorganic nitrogen application during the whole investigation has been described in preceding chapters. To explain and discuss possible reasons of variations exhibited by statistically proven significant effect of organic and inorganic sources of nitrogen application at different days after sowing and maturity stage an attempt was made. The relative findings with appropriate citation are discussed as follows.

Growth and growth attributes:-The plant height was not significantly increased with different sources of organic and inorganic nitrogen at all the growth but in general the plant height increased with the advancement in age in all the treatment because growth processes are

irreversible in nature (Anonymous 1969). The plant height was (65cm) with application of RDF (100%) + lime (100%), which might be due to the presence of nitrogen with other nutrient received by the from the organic and inorganic sources (Appavu and Saravanan 1999).The fresh weight of the plant in all the stages were increased by the application of organic and inorganic sources of nitrogen. The treatment of RDF (100%) +lime (100%) recorded the maximum plant fresh weight per plant this may be due to direct involvement of nitrogen in major plant process as it is a constitute of proteins enzymes chlorophyll and also promotes leaf and other vegetative part. The number of seeds per pod and seeds per plants were slightly influenced by the application of organic and inorganic sources of nitrogen. The results confirm the findings of Saxena *et.al.* (2001) who reported that various treatment did not influence the seeds per pod of soybean plant significantly. The test weight and grain yield were slightly increased due to the application of organic and inorganic sources of nitrogen. This result may be due to the increased in the number of pods per plant (Appavu and Sarvanan 1999). Application of various sources of organic and inorganic nitrogen signifivantly increased the grain and straw yield of soybean over control. Nitrogen help in increasing the vegetative growth, plant dry matter increased nodule formation, grain yield per plant and ultimately the grain yield per hectare (Ramasamy *et al.*2001).

Uptake of total nitrogen (kg/ha):-Application of organic and inorganic, Nitrogen content and uptake by grain and straw of soybean showed superiority over control. Among the various treatment RDF+ FYM application showed significant higher content and uptake. The increased in N content might be due to enhanced symbiosis fixation of N by different part of plant (Sharma *et al.* 1978) The field experiment was conducted during June to October 2015 at Experimental research farm of Bhagwant University Ajmer campus on “Effect of organic and inorganic sources of Nitrogen on Growth and Yield of Soybean under Arid Zone of Rajasthan”. The experiment was conducted in Randomize Block Design with tree replication. All together 10 treatments were selected for the study. The response of soybean to various treatments was selected. The responses of soybean crop to various treatments were measured with growth attributes, yield parameters and nutrient uptake. To get the best response from different treatment Economics of soybean cultivation was calculated. Finding derived from the various observations are summarized under:-

- The organic and inorganic sources of nitrogen application influenced the plant height at all the stages of observation. The maximum plant height was recorded with RDF (100%) + lime (100%).

- The organic and inorganic sources of nitrogen application influenced the fresh weight per plant significantly at all growth stages. Maximum fresh weight was observed with RDF (100%) + Lime (100%).

- Application of organic and inorganic sources of nitrogen application influenced the dry weight with increasing rate at all the growth stages. Maximum dry weight was observed with RDF (100%) + Lime (100%).
- It was found that the number of nodule per plant was affected significantly by the application of different treatment at both 60 and 90 DAS. The Maximum number of nodule was observed with RDF (100%) + Lime (100%).
- The number of pods per plant significantly increased with various treatments over control. The maximum number of pod was recorded with RDF (100%) + Biofertilizer.
- Various organic and inorganic sources failed to show marked variation in number of seed per plant there is no marked variation was found in number of seeds per plant by the application of organic and inorganic sources of nitrogen.
- The weight was slightly significance due to application of organic and inorganic sources of nitrogen. The maximum weight was recorded with RDF (50%) + Biofertlizer.
- Grain yield of soybean increased significantly influenced by the application of various organic and inorganic sources of nitrogen. The maximum weight was recorded with RDF (50%) + Bioferitlizer.
- Straw yield of soybean increased significantly by the application of various organic and inorganic sources of nitrogen. . The maximum weight was recorded with RDF (50%) + Bioferitlizer.
- Nitrogen content in grain and straw was increased significantly influenced by the application of various organic and inorganic sources of nitrogen. The maximum weight was recorded with RDF (50%) + Bioferitlizer.
- By the application of various organic and inorganic sources of nitrogen significantly increases the nitrogen uptake by plant. The maximum uptake was recorded with RDF (50%) + Poultry manures.

Based upon the experimental findings the following conclusions way is drawn.

- The organic manure is more conducive then inorganic fertilizer to better growth, development and yield of soybean and grater uptake of nitrogen due to availability of major and minor nutrient in the organic manure.

- Incorporation of organic and inorganic sources of Nitrogen had advantages on overall growth and development and uptake of nitrogen and yield on soybean crop under arid zone of Rajasthan.

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