EFFECT OF INTEGRATED NUTRIENT MANAGEMENT PRACTICES IN SOYBEAN (*GLYCINE MAX* L. MERRILL) ON GROWTH BEHAVIOR, NUTRIENT UPTAKE AND YIELD IN CENTRAL INDIA

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Abstract: A field experiment was carried out at Instructional cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur during *kharif* season of 2006 study the "Effect of integrated nutrient management practices in soybean (*Glycine max* L. Merrill) on Growth behavior, Nutrient Uptake and yield in central India ". The experiment was laid out in randomized block design with three replications. The treatment consist 10 integrated nutrient management *viz.* T_1- Control (no fertilizers), T_2-100% RDF (25:80:60 kg NPK ha^{-1}), T_3-FYM 10 t ha^{-1}, T_4 50% RDF (12.5:40:30 kg NPK ha^{-1}) + FYM 10 t ha^{-1}, T_5- 50% RDF (12.5:40:30 kg NPK ha^{-1}.) + FYM 5 t ha^{-1} +*Rhizobium* + PSB, T_6- T_2 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1}, T_7- T_3 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1}, T_8- T_4 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1}, T_9- T_5 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1}, T_{10}- 100% RDF (25:80:60 kg NPK ha^{-1}) + FYM 10 t ha^{-1} + Zinc 5 kg + Mg 10 kg ha^{-1} + *Rhizobium* + PSB ha^{-1}. The result revealed that growth parameter viz.- plant height, number of leaves, number of branches, dry matter accumulation, chlorophyll content & leaf area were recorded highest result with the application of 25:80:60 kg NPK ha^{-1} + 10 t FYM ha^{-1} + Zn 5 kg ha^{-1} + Mg 10 kg ha^{-1} + *Rhizobium* + PSB. Among the all integrated nutrient management practices, application of 25: 80:60 kg NPK ha^{-1} + 10 t FYM ha^{-1} + Zn 5 kg ha^{-1} + Mg 10 kg ha^{-1} + *Rhizobium* + PSB (T_{10}) recorded the highest NPK content (272.66, 22.56, 323.23 NPK kg ha^{-1} , respectively) in the soil & NPK uptake (198.96:15.73:160.3 kg NPK ha^{-1}, respectively) by crop, whereas the lowest NPK content (225.6, 11.40, 282.60 NPK kg ha^{-1} , respectively) in the soil & NPK uptake (97.63, 8.71, 61.86 NPK kg ha^{-1} , respectively) by crop recorded under control (T_1). In respect of the highest seed & Stover yield recorded 21.41 q ha^{-1} & 26.50 q ha^{-1} , respectively under application of 25: 80:60 kg NPK ha^{-1} + 10 t FYM ha^{-1} + Zn 5 kg ha^{-1} + Mg 10 kg ha^{-1} + *Rhizobium* + PSB (T_{10}) compared to other treatment but, it was statistically at par with treatment (T_6).. However, the lowest seed & Stover 12.97 q ha^{-1} & 16.39 q ha^{-1}, respectively recorded with no fertilizers application (control -T_1).

Keywords: Integrated Nutrient Management, Nutrient Uptake and yield of soybean

INTRODUCTION

Soybean (*Glycine max* L. Merrill) is the only crop which has been included both in the categories of oilseeds and pulses. From nutritional point of view it is called as miracle bean (*Anonymous,* 2001). It is a cheapest source of vegetable oil and protein. It contains about 40% protein, well balanced in essential amino acids, 20% oil rich with poly unsaturated fatty acids specially Omega 6 and Omega 3 fatty acids, 6-7% total mineral, 5-6% crude fibre and 17-19% carbohydrates (Chauhan *et al.,* 2005). The protein quality of soybean is equivalent to that of meat, milk products and eggs. It is generally grown as a rainy season crop under rainfed situation predominantly in *Vertisols* and associated soils. Integrated nutrient management envisages exploitation and combine use of all available sources of nutrients which are organic and inorganic nature. Fertilizer is an important input for successful crop production. It is essential to provide adequate and balanced dose of fertilizer to soybean crop for increasing productivity and fertilizer use efficiency under irrigated condition. Effective judicious use of fertilizer depends upon the application of right amount of fertilizer at time to crop and it is feasible only under irrigated conditions. The supplementary and complementary use of organic manure and bio-fertilizers improve soil physico-chemical and a biological property, fertilizer use efficiency, mitigate short supply of micronutrients, stimulate the proliferation of diverse group of soil micro-organism and plays an important role in the maintenance of soil fertility and improve the ecological balance of rhizosphere (Chaturvedi and Chandel, 2005). To attain well crop stand, maintain soil fertility & higher production, it is necessary to apply optimum and integrated use of the nutrients with proper combination of organic, inorganic and micronutrients as well as inoculation with bio-fertilizer to soybean.

MATERIAL AND METHOD

A field experiment was carried out at Instructional cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Geographical situated in the south eastern part of C.G. at $21^0 4'$ North latitude $81^0 21'$ East longitude at the height of 289.60 metre above the mean sea level) during *kharif* season of 2006. The soil of the experimental field was clayey in texture (*Vertisols*) locally known as "*Bharri*" with pH 7.12 . Fertility status of soil was categories as low nitrogen (228.60 kg ha^{-1}) and medium phosphorus (13.50 kg ha^{-1}) and high in potassium (372.30 kg ha^{-1}) , organic carbon (0.62%) & EC 0.14 (dsm^{-1} at $25^{o}C$). Climate of this region is sub- humid with an average annual rainfall of about 1200-1400 mm and the crop received 1009.9 mm of rainfall during its crop growth. The maximum temperature during its period varied between $28^{0}C$ in the third week of July to $33.7^{0}C$ in the second week of October, whereas, minimum temperature varies between $18.8^{0}C$ in the third week of October to $26.0^{0}C$ in the second week of July. Relative humidity throughout the season varied between 82 to 94 per cent at morning and 43 to 84 per cent in evening hour. The wind velocity ranged between 2 to 13.3 km hour $^{-1}$. The open pan evaporation average values ranged from 2.4 to 5.8 mm day^{-1}, whereas the bright sunshine varied from 0.3 to 9.3 hours day^{-1}. The experiment was laid out in randomized block design with three replications. The treatment consisted of 10 integrated nutrient management: T_1- Control (no fertilizers), T_2-100% RDF (25:80:60 kg NPK ha^{-1}), T_3- FYM 10 t ha^{-1}, T_4 50% RDF (12.5:40:30 kg NPK ha^{-1}) + FYM 10 t ha^{-1}, T_5- 50% RDF (12.5:40:30 kg NPK ha^{-1}.) + FYM 5 t ha^{-1} +*Rhizobium* + PSB,T_6- T_2 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1}, T_7- T_3 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1}, T_8- T_4 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1}, T_9- T_5 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1}, T_{10}- 100% RDF (25:80:60 kg NPK ha^{-1}) + FYM 10 t ha^{-1} + Zinc 5 kg + Mg 10 kg ha^{-1} + *Rhizobium* + PSB. Soybean variety *JS*- 335 was sown in rows with spacing of 30 cm and plant to plant spacing of 10 cm on July 11, 2006 using a seed rate 75 kg ha^{-1} and was harvested on October 27, 2006. Observations like- plant height, number of leaves $plant^{-1}$, number of branches $plant^{-1}$, dry matter accumulation $plant^{-1}$, chlorophyll content and leaf area $plant^{-1}$, seed yield (q ha^{-1}) and stover yield (q ha^{-1}) were recorded and stastically analyzed. The computation and stastical analysis were done for LAI, RGR, CGR , NAR, NPK content in plants and soils after harvest of the crop as well as organic carbon content in soil, were also worked out.

RESULT AND DISCUSSION

Plant height (cm) & Number of leaves plant^{-1}

It is obvious from the data that significant difference in plant height was noted at 30, 60, 90 DAS and at harvest & number of leaves at 30, 60, 90 DAS due to different treatments. The plant height & number of leaves increased rapidly upto 60 DAS, thereafter rate of increase declined slightly at 90 DAS and at harvest. Throughout the growing period higher plant height & number of leaves were recorded from the crop provided with 25:80:60 kg NPK ha^{-1} + 10 t FYM ha^{-1} + Zn 5 kg ha^{-1} + Mg 10 kg ha^{-1} + *Rhizobium* + PSB (T_{10}) which were significantly superior over control, whereas minimum plant height & number of leaves were recorded under control. The increased in plant height & number of leaves may be due to the regular availability of different organic and inorganic sources and bio-fertilizer which helped in acceleration of various metabolic process (Jain *et al.* 1995 and Kumar *et al*. 2005).

Number of branches plant^{-1} & Dry matter accumulation plant^{-1}

Number of branches $plant^{-1}$ & Dry matter accumulation $plant^{-1}$ has been presented in Table-1 & 2. Since the emergence of branch took place quite late, the number of branches $plant^{-1}$ & Dry matter accumulation $plant^{-1}$ were recorded at 30, 60, 90 DAS and at harvest. The data reveal that the mean number of branches plant $plant^{-1}$ & Dry matter accumulation $plant^{-1}$ were affected significantly at 60 DAS, 90 DAS and at harvest, however branches plant $plant^{-1}$ & Dry matter accumulation $plant^{-1}$ were recorded at 30 DAS remained unaffected due to different treatments. It is clear from data that the appearance of new branches & Dry matter accumulation $plant^{-1}$ were continued increases upto 90 DAS. Among the different nutrient management treatments, application of 25:80:60 kg NPK ha^{-1} + 10 t FYM ha^{-1} + Zn 5 kg ha^{-1} + Mg 10 kg ha^{-1} + *Rhizobium* + PSB (T_{10}) resulted in higher branches $plant^{-1}$ & Dry matter accumulation $plant^{-1}$ as compared to rest of the treatments only at 60 DAS, 90 DAS and at harvest followed by application of 25:80:60 kg NPK ha^{-1} + 10 t FYM ha^{-1} + Zn 5 kg ha^{-1} + Mg 10 kg ha^{-1} (T_6). Lowest branches $plant^{-1}$ & Dry matter accumulation $plant^{-1}$ observed under control. The increased in branches plant $plant^{-1}$ & Dry matter accumulation $plant^{-1}$ may be due to the regular supply of organic and inorganic sources and bio-fertilizer which helped in acceleration of various metabolic process (Jain *et al.* (1995), Kumar *et al*. (2005), Singh *et al*. (2001) and Shirpurkar *et al*. (2005).

Chlorophyll content & Leaf area cm^{-2} plant^{-1}

Data on relative chlorophyll content & Leaf area cm^{-2} $plant^{-1}$ in plant are presented in Table-1 & 2 . It is clear from the result that the mean relative chlorophyll content & leaf area of $plant^{-1}$ were affected significantly from different nutrient management treatments. The maximum relative chlorophyll content & leaf area of $plant^{-1}$ were recorded with the application of 25:80:60 kg NPK ha^{-1} + 10 t FYM ha^{-1} + Zn 5 kg ha^{-1} + Mg 10 kg ha^{-1} + *Rhizobium* + PSB (T_{10}) as compared to rest of the treatments. The results corroborate with the finding recorded by Singh and Rai (2004) and Paradkar and Deshmukh (2004).

Leaf area index & Leaf area duration

Data on leaf area index computed for 30, 60 and 90 DAS are presented in Table-2. The data reveal that the leaf area index increased upto the 60 DAS and thereafter a slight decrease was noticed at 90 DAS under all the treatments. Maximum leaf area index &

Leaf area duration were obtained between 60 DAS were as 30 DAS recorded the minimum. The Maximum leaf area index & Leaf area duration were recorded under T_{10} which is 25:80:60 kg NPK ha^{-1} + 10 t FYM ha^{-1} + Zn 5 kg ha^{-1} + Mg 10 kg ha^{-1} + *Rhizobium* + PSB followed by T_6 which is 25:80:60 kg NPK ha^{-1} + 10 t FYM ha^{-1} + Zn 5 kg ha^{-1} + Mg 10 kg ha^{-1} as compared to other treatments at all stages of plant growth, whereas minimum leaf area index & Leaf area duration were recorded under control. The results was also corroborate with the finding recorded by Singh and Rai (2004) and Paradkar and Deshmukh (2004).

Crop growth rate (g day^{-1} $plant^{-1}$), Relative growth rate (g g^{-1} day^{-1} $plant^{-1}$) & Net assimilation rate

Crop growth rate & Relative growth rate (g g^{-1} day^{-1} $plant^{-1}$) Were computed between 0-30 DAS, 30-60 DAS, 60-90DAS and 90 DAS- at harvest and data are presented in Fig 1 & 2. The data show that the crop growth rate & Relative growth rate (g g^{-1} day^{-1} $plant^{-1}$) Were more in between the 60-90 DAS and less in 0-30 DAS irrespective of different treatments in general. Application of 25: 80:60 kg NPK ha^{-1} + 10 t FYM ha^{-1} + Zn 5 kg ha^{-1} + Mg 10 kg ha^{-1} + *Rhizobium* + PSB produced significantly higher crop growth rate & Relative growth rate (g g^{-1} day^{-1} $plant^{-1}$) Were at 60-90 DAS and 90 DAS-at harvest as compared to other treatments. At 0-30 DAS and 30-60 DAS there was no significant difference between crop growth rates & Relative growth rate (g g^{-1} day^{-1} $plant^{-1}$) due to different . Net assimilation rate was computed 0-30 DAS and 30-60 DAS presented in Figure-3. The results showed that there was no significant variation in net assimilation rate due to different treatments.

NPK content in soil (kg ha^{-1})

The data pertaining to NPK content in soil have been presented in Table-3. It revealed that the mean content of NPK in soil was significantly affected due to different treatments. Among the all integrated nutrient management practices, application of 25: 80:60 kg NPK ha^{-1} + 10 t FYM ha^{-1} + Zn 5 kg ha^{-1} + Mg 10 kg ha^{-1} + *Rhizobium* + PSB (T_{10}) recorded the highest NPK content (272.66, 22.56, 323.23 NPK kg ha^{-1} , respectively) in the soil, whereas the lowest NPK content was recorded under control (225.6, 11.40, 282.60 NPK kg ha^{-1} , respectively) in the soil. Similar results were found by Chaturvedi and Chandel (2005) and Dubey (2003).

Organic carbon in soil

The maximum organic carbon content (0.75 %) in soil was found with the application of 25:80:60 kg NPK ha^{-1} + 10 t FYM ha^{-1} + Zn 5 kg ha^{-1} + Mg 10 kg ha^{-1} + *Rhizobium* + PSB (T_{10}) followed by T_4 (0.71 %). However, the minimum organic carbon content (0.54 %) was recorded under control. The soil organic carbon content (%) showed in increasing trend with the integration of inorganic fertilizer with organic fertilizer. All the fertilizer treatments had a slight positive impact on the organic carbon content of the soil over the initial value, but the control treatments where no fertilizer and manure was applied in lower organic carbon content than the initial value. Application of FYM to soybean improved the organic carbon and N content of soil over their initial status (Bobde *et al.*, 1998 and Jain *et al*., 2005).

NPK uptake by plant (kg ha^{-1})

The maximum NPK uptake by plant was recorded with the application of 25:80:60 kg NPK ha^{-1} + 10 t FYM ha^{-1} + Zn 5 kg ha^{-1} + Mg 10 kg ha^{-1} + *Rhizobium* + PSB (T_{10}), whereas, minimum NPK uptake by plant was recorded under control (T_1). The plants were analyzed for NPK uptake and soils were analyzed for the NPK and organic carbon. It was noticed that the NPK uptake by soybean crop was found to be highest (198.96:15.73:160.3 kg NPK ha^{-1}, respectively) due to combined application of 25:80:60 kg NPK ha^{-1} + 10 t FYM ha^{-1} + Zn 5 kg ha^{-1} + Mg 10 kg ha^{-1} + *Rhizobium* + PSB. However, the lowest NPK uptake (97.63, 8.71, 61.86 NPK kg ha^{-1} , respectively) by crop recorded under control (T_1). Similar results were found by Singh and Rai (2004) and Wandhekar *et al.* (2005). Higher uptake of N and P due to the co-inoculation of bio-fertilizers which enhance the nitrogenase and nitrate- reductase enzyme activity in the soil (Sarawagi *et al*., 1998), Increase of nutrient uptake due to the better nodulation caused upon phosphorus and *Rhizobium* integration application as well as increased utilization of atmospheric .

Seed and straw Yield: In respect of the highest seed & Stover yield recorded 21.41 q ha^{-1} & 26.50 q ha^{-1} ,
respectively under application of 25: 80:60 kg NPK ha^{-1} + 10 t FYM ha^{-1} + Zn 5 kg ha^{-1} + Mg 10 kg ha^{-1} + *Rhizobium* + PSB (T_{10}) compared to other treatment but, it was statistically at par with treatment (T_6). However, the lowest seed & Stover yield 12.97 q ha^{-1} & 16.39 q ha^{-1} , respectively recorded under control (T_1). The higher yield response might be due to synergistic effect of phosphorus and biofertilizer and involved transformation of energy in higher value of growth and yield attributes (Bhaskar *et al*., 2000 and Thanki *et al*., 2005). Higher yield attributes may be due to the favourable effect of PSB on root growth and there by increase root activity (Dubey *et al*., 1997.

Table: 1. Effect of integrated nutrient management on plant height, number of leaves, number of branches & chlorophyll content of soybean

Treatments	**Plant height (cm)**				**Number of leaves plant^{-1}**			**Number of branches plant^{-1}**				**chlorophyll content**
	30 DAS	**60 DAS**	**90 DAS**	**At harvest**	**30 DAS**	**60 DAS**	**90 DAS**	**30 DAS**	**60 DAS**	**90 DAS**	**At harvest**	
T_1 (Control -no fertilizers)	9.62	29.54	33.40	36.97	39.63	60.38	40.50	1.26	3.40	4.06	4.06	40.41
T_2 (100% RDF, 25:80:60 kg NPK ha^{-1})	12.15	38.16	40.60	44.96	47.23	70.73	46.93	1.60	4.33	4.53	4.53	44.16
T_3 (FYM 10 t ha^{-1})	10.06	29.94	35.74	39.70	40.84	64.43	42.86	1.40	3.60	4.13	4.13	40.87
T_4 (50% RDF + FYM 10 t ha^{-1})	11.36	35.70	38.76	40.06	47.40	69.03	43.90	1.46	4.13	4.40	4.40	42.66
T_5 (50% RDF + FYM 5 t ha^{-1} + *Rhizobium* + PSB)	11.08	34.88	38.50	42.96	45.00	64.93	44.33	1.46	3.86	4.33	4.33	41.44
T_6 (T_2 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1})	12.57	39.21	40.81	46.06	49.46	74.16	49.52	1.73	4.40	4.60	4.60	45.65
T_7 (T_3 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1})	10.84	34.13	37.98	40.46	45.73	65.33	44.80	1.40	3.66	4.26	4.26	41.47
T_8 (T_4 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1})	11.86	35.99	39.50	43.56	45.10	66.60	45.53	1.53	4.26	4.53	4.53	43.21
T_9 (T_5 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1})	11.55	36.93	39.20	42.87	47.10	67.00	44.93	1.46	4.20	4.46	4.46	43.09
T_{10} (T_2 + T_3+ Zinc 5 kg + Mg 10 kg ha^{-1} + *Rhizobium* + PSB)	12.66	40.93	43.40	47.26	52.60	76.46	53.07	1.80	4.46	5.20	5.20	49.88
SEm±	0.25	1.27	1.32	1.05	**0.93**	**2.87 3.21**	**2.12**	**0.141**	**0.21**	**0.18**	**0.18**	1.61
CD (5%)	0.74	3.79	3.93	3.12	**2.77**	**8.52**	**6.32**	**NS**	**0.63**	**0.55**	**0.55**	4.80

Table: 2. Effect of integrated nutrient management on Dry matter accumulation, Leaf area cm^{-2} plant^{-1} , LAI , Leaf area duration, yield & HI of soybean

Treatments	**Dry matter accumulation**				**Leaf area cm^{-2} plant^{-1}**			**LAI**			**Leaf area duration**			**yield (q ha^{-1})**		**HI**
	30 DAS	**60 DAS**	**90 DAS**	**At harvest**	**30 DAS**	**60 DAS**	**90 DAS**	**30 DAS**	**60 DAS**	**90 DAS**	**0-30 DAS**	**30-60 DAS**	**60-90 DAS**	**Seed**	**Stover**	**HI (%)**
T_1 (Control -no fertilizers)	0.84	3.93	9.36	12.25	372.72	902.20	548.33	1.23	2.61	1.96	5590.8	19457.23	21758.05	12.97	16.39	43.90
T_2 (100% RDF, 25:80:60 kg NPK ha^{-1})	0.99	5.50	14.84	17.47	604.37	1422.89	820.07	2.01	4.32	2.73	9065.65	30409.1	33644.56	18.60	21.17	46.70
T_3 (FYM 10 t ha^{-1})	0.86	4.22	11.45	13.89	425.49	1010.21	615.27	1.41	3.21	2.17	6382.4	21537.3	24384.05	15.43	19.94	44.01
T_4 (50% RDF + FYM 10 t ha^{-1})	0.96	4.98	14.22	15.57	528.86	1259.01	666.99	1.75	4.19	2.21	7932.9	26818.15	28890.2	17.62	21.93	44.35
T_5 (50% RDF + FYM 5 t ha^{-1} + *Rhizobium* + PSB)	0.92	4.38	13.11	14.07	500.96	1134.19	691.29	1.66	3.77	2.33	7514.51	24527.35	27382.07	17.03	20.21	45.66
T_6 (T_2 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1})	1.03	5.97	15.26	17.97	618.55	1593.22	835.18	2.05	4.83	2.61	9278.75	33180.15	36426.2	19.64	22.91	47.80

T_7 (T_3 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1})	0.92	4.40	12.42	14.32	476.31	1022.83	675.09	1.58	3.40	2.37	7144.75	22487.3	25468.91	16.80	19.94	43.80
T_8 (T_4 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1})	0.98	5.20	13.90	16.44	539.09	1291.59	781.35	1.79	4.30	2.60	8086.45	26791.23	31094.25	18.50	21.19	49.70
T_9 (T_5 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1})	0.91	5.13	13.65	15.10	543.47	1256.64	747.95	1.71	4.11	2.41	8152.05	27001.75	29568.95	18.37	18.77	45.50
T_{10} (T_2 + T_3+ Zinc 5 kg + Mg 10 kg ha^{-1} + *Rhizobium* + PSB)	1.10	6.34	16.23	18.31	699.95	1775.76	969.50	2.33	4.98	3.19	10499.2	36469.03	41176.24	21.41	26.50	44.00
SEm±	**0.09**	**0.49**	**1.25**	**1.23**	**16.58**	**54.11**	**40.85**	**0.05**	**0.420.42**	**0.21**	**248.36**	**940.40**	**1140.65**	**1.34**	**1.47**	**2.13**
CD (5%)	**NS**	**1.46**	**3.71**	**3.65**	**49.17**	**160.71**	**121.33**	**0.16**	**1.26**	**0.30**	**736.60**	**2792.86**	**3387.56**	**3.98**	**4.37**	**NS**

Table 3: Effect of integrated nutrient management on nutrient status of post harvest soil & total uptake of nutrients in soybean

Treatments	**Concentration of nutrients in soil**				Total uptake of nutrients (kg ha^{-1})		
	Nitrogen (kg ha^{-1})	Phosphorus (kg ha^{-1})	Potassium (kg ha^{-1})	OC (%)	Nitrogen	Phosphorus	Potassium
T_1 (Control -no fertilizers)	225.6	11.40	282.60	0.54	97.63	8.71	61.86
T_2 (100% RDF, 25:80:60 kg NPK ha^{-1})	260.3	18.10	306.36	0.64	185.30	13.99	145.80
T_3 (FYM 10 t ha^{-1})	242.66	16.03	287.16	0.66	155.60	10.96	110.40
T_4 (50% RDF + FYM 10 t ha^{-1})	252.33	16.76	291.80	0.71	158.26	11.36	121.96
T_5 (50% RDF + FYM 5 t ha^{-1} + *Rhizobium* + PSB)	267.00	19.66	316.70	0.67	168.03	14.83	148.73
T_6 (T_2 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1})	264.66	19.40	312.80	0.66	187.23	14.43	144.40
T_7 (T_3 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1})	248.33	17.93	308.46	0.65	160.73	11.73	105.3
T_8 (T_4 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1})	259.16	19.56	306.33	0.70	165.23	11.56	138.43
T_9 (T_5 + Zinc 5 kg ha^{-1} + Mg 10 kg ha^{-1})	266.66	19.80	318.40	0.67	183.96	13.26	145.61
T_{10} (T_2 + T_3+ Zinc 5 kg + Mg 10 kg ha^{-1} + *Rhizobium* + PSB)	272.66	22.56	323.23	0.75	198.96	15.73	160.30
SEm±	0.06	0.095	0.025	**3.81**	**2.81**	**0.84**	**3.33**
CD (5%)	0.20		0.075	**11.33**	**7.47**	**2.51**	**9.90**

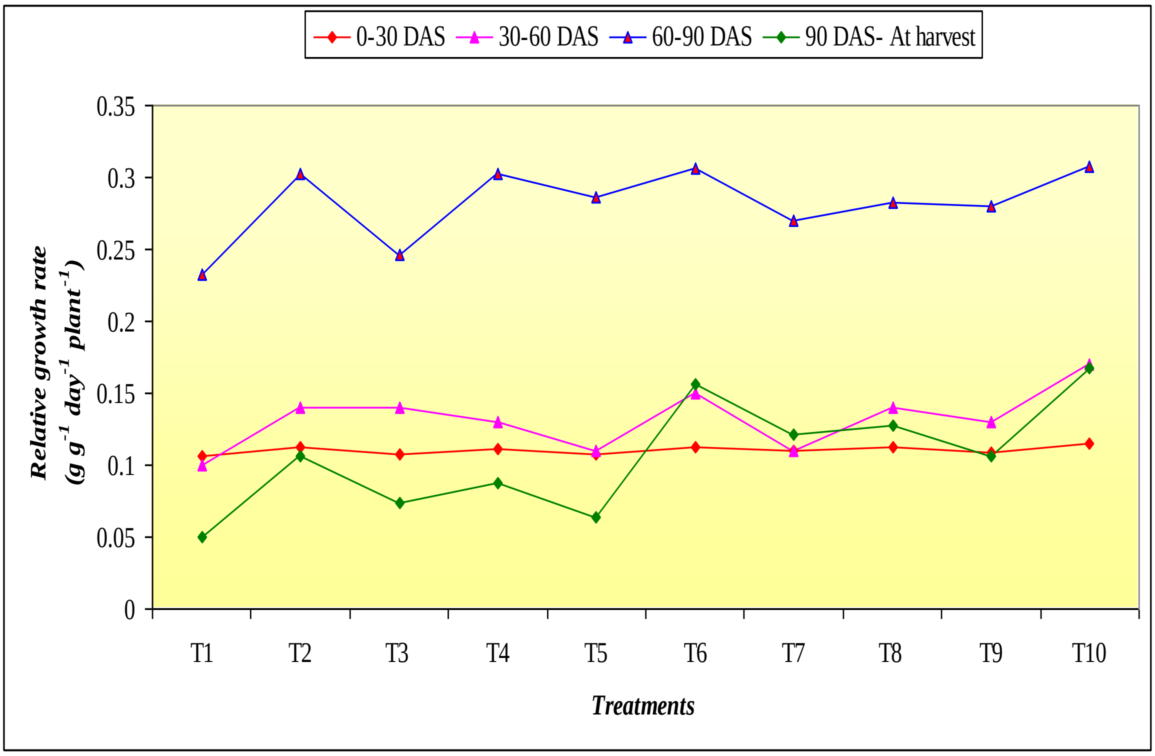

Figure 1: Effect of integrated nutrient management on relative growth rate of soybean

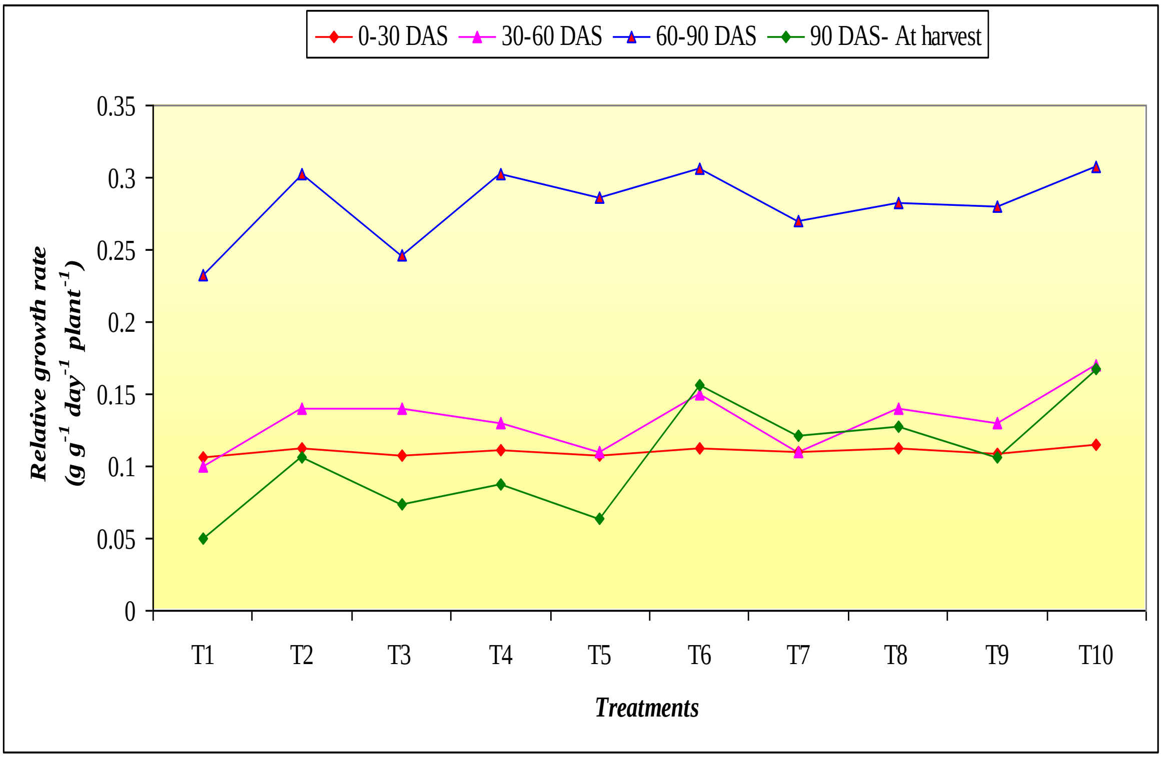

Figure 2: Effect of integrated nutrient management on crop growth rate of soybean

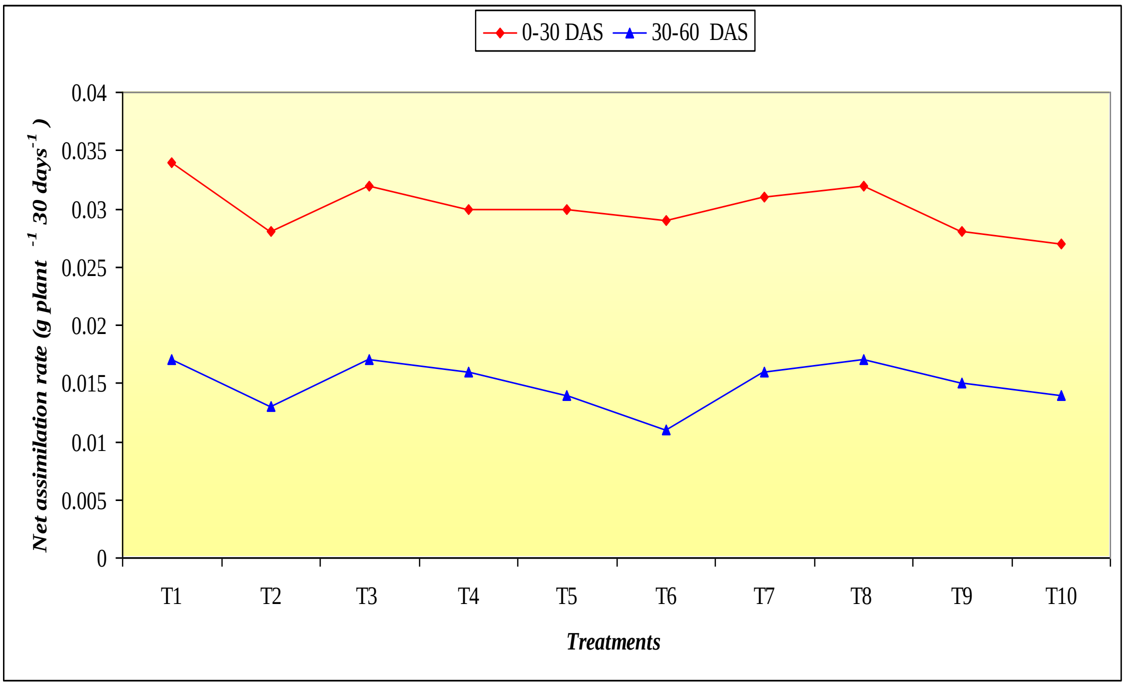

Figure 3: Effect of integrated nutrient management on Net assimilation rate of soybean

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