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Effect of different nutrition on post harvest studies in soybean

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ABSTRACT

A field investigation entitled effect of different nutrition on post harvest studies in soybean was conducted at AICRP for Dryland Agriculture, M.A.U., Parbhnai. The experiment was laid out in Randomized Block Design (RBD) with three replications. There were eight treatments *viz.*, T_1 -75 % RDF without FYM), T_2 -75 % RDF with FYM @ 5 t/ha, T_3-100% RDF without FYM, T_4-100% RDF with FYM @ 5 t/ha, T_5-125% RDF without FYM, T_6-125% RDF with FYM @ 5 t/ha, T_7- FYM @ 10 t/ha and T_8- Absolute control. Growth attributes *viz.*, number of pod and nodule were significantly more in treatment T_4 (100% RDF + 5 t FYM/ha). The grain yield and straw yield were significantly more in treatments T_4 (100% RDF + 5 t FYM/ha). Based on the results it can be concluded that the treatment T_4 (100% RDF + 5 t FYM/ha) was found beneficial in improving growth, yield attributes, yield of soybean GMR and NMR as compared to other treatments. Treatment T_4 (100% RDF + 5 t FYM/ha) recorded double yield than absolute control.

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Key Words : Nutrition, Biological yield, Harvest index, Economic return

INTRODUCTION

Soybean is a legume crop they fixes atmospheric nitrogen. It sheds about 32 to 35 per cent of crop residue at the time of harvest, which help in increasing the soil fertility and soil physical condition. Hence, soybean crop also called as miracle crop. The pulses and the vegetable oil are the inseparable parts of Indian diet. The per capita availability of the pulses and oil in India 32 and 12 g day^{-1} as against recommended level of 85 and 45 g day^{-1}, respectively (Anonymous, 1968). This clearly indicated that there is a wide scope for expansion of area under oilseed crop.

Maharashtra ranks second in production of soybean after Madhya Pradesh in the country. Soybean has profitably replaced the main pulses of state like mung bean and black gram. Soybean was introduced in Maharashtra state during the year 1984-1985 and it was grown only on 5.6 lakh hectare till 1994 but today the area is increasing rapidly. Among the various division in Maharashtra, Nagpur division having larger area and highest production. But productivity was maximum in Kolhapur division.

At present FYM which is organic source helps in increasing the yield of crop. So the different nutrient combinations help in increasing yield as well as soil physical condition. Nutrient are second most important limiting factor of crop production after water. Most of the soil in the rainfed regions are not only thirsty but also hungry. The nutrient demand of crop should be met from application of recommended dose of fertilizer as well as FYM application with this view, the study was taken.

RESEARCH METHODOLOGY

The details of the material used and methods adopted during the course of investigation are presented in this paper.

Treatment details (Fertility level 8)
T_1 75% RDF without FYM
T_2 75% RDF with FYM @ 5 t/ha
T_3 100 % RDF without FYM
T_4 100% RDF with FYM @ 5 t/ha
T_5 125% RDF without FYM
T_6 125% RDF with FYM @ 5 t/ha
T_7 FYM @ 10 t/ha
T_8 Absolute control
RDF (100%) = 30 : 60 : 30 kg NPK/ha

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The present experiment was laid out in Randomized Block Design (RBD) with three replications. The treatment consisted of two sources of nutrients *i.e.* RDF and FYM. The allotment of treatments to various plot in replication was done by randomization.

Fertilizers and FYM were applied as a basal dose. Breeder seed of soybean (MAUS-71) was procured from AICRP on Dryland Agriculture. The variety is recommended for the Maharashtra State under rainfed condition. The germination percentage was more than 80 per cent for soybean.Soybean crop was sown on 9th July, 2009. The sowing was done by drilling at a distance of 45 cm x 5 cm at about 2.5 cm depth. The emergence of seed was started from 5 days after sowing and completed by 12 days. Spraying of endosulphan for the control of pest and murate of potash to save the crop from dry spell was carried out.

At maturity of soybean the plants in each net plot were cut to ground level with the help of sickles. The plot wise harvested plants were collected and sun dried for a week. Threshing and cleaning of seed was done. Biological, grain and stalk yield were recorded separately for each net plot.Data on important biometric observation were collected on fixed five randomly selected healthy plants in each treatment throughout the crop life.

Emergence count was done at 15 days after sowing and final plant stand from each net plot was recorded at harvest. The number of plants per net plot was recorded a day before harvesting. Number of pods arising from branches was counted after 60 days till harvesting. Number of nodules of plant was counted after 60 days till harvesting. The weight of grain per plant was taken after threshing of five samples plant.Pods of the five observational plants were threshed and average yield (g) per plant was recorded. Random sample of 100 seeds (grains) from total produce from each net plot was taken and its weight was recorded.The weight of whole dried produce harvested from net plot, before threshing was recorded as a biological yield and multiplied with hectare factor. After separation of grains from the biological yield, remaining material (stem +bhooosa) was considered as a straw yield and its final weight was recorded and multiplied with hectare factor. It is the per cent ratio of the economic yield to the total biological yield.

Harvest index reflects the proportion of assimilate distribution between economic and total biomass. It was computed by the following formula:

$$\text{Harvest index} = \frac{\text{Economic yield (kg)}}{\text{Biological yield (kg)}} \times 100$$

The cost of cultivation for raising the crops in each treatment was worked out. Similarly the gross returns were calculated as per prevailing market prices of economic produce of each treatment and there after the net returns were worked out. The data was subjected for 'F' test and inferences were drawn the commodity price for soybean Rs. 2500 q.

Statistical analysis:

Results obtained were statistically analyzed as per the methods given by Panse and Sukhatme (1967). The total variance and degree of freedom were partitioned into possible sources. The variance due to treatment was compared against variance due to error to find out 't' value and the significance at p=0.05. Whenever, the result was significant, standard error (SE) and critical difference (CD) at 5 per cent level of probability were worked out for comparing the mean of treatment. The data have been suitably illustrated at appropriate place.

RESEARCH FINDINGS AND ANALYSIS

The field experiment was conducted during 2009-10 at AICRP for Dry Land Agriculture, M.A.U., Parbhani. The summarized data as influenced by different treatments are presented in this paper under appropriate tables.

Growth studies in soybean:

Mean emergence count and final plant stand of soybean:

Mean number of plants emerged and final plant stand at harvest in each net plot were counted and converted into per cent. The per cent population was converted into arcsine values and data obtained given in Table 1.The data on mean emergence, count and final plant stand of soybean at harvest was not influenced significantly due to different treatments under study. This indicated that, variations obtained during the course of investigation were due to treatments and were real effects of treatment.

Mean number of pod per plant :

Data on mean number of pods per plant recorded at crop growth stages are presented in Table 2. Data revealed that mean number of pods per plant increased progressively up to the harvest of crop. At 60 DAS treatment T_4 (100% RDF + 5 t/ha FYM) recorded significantly more number of pod over the rest of treatments, but it was at par with treatment T_6. At 75 DAS the treatment T_4 (32.00) was at par with treatment T_6. From 90 DAS to harvest it was at par with treatment

Table 1 : Mean emergence count and final plant stand of soybean influenced by different treatment

Treatments	Emergence count (%)	Final plant stand (%)
T_1-75 % RDF without FYM	76.98 (97.35)	61.85 (88.15)
T_2-75% RDF with FYM @ 5 t/ha	75.11 (96.52)	61.18 (87.58)
T_3-100 % RDF without FYM	77.05 (97.36)	61.78 (88.03)
T_4-100% RDF with FYM @ 5 t/ha	77.13 (97.37)	62.17 (88.43)
T_5-125% RDF without FYM	75.32 (96.42)	60.30 (86.84)
T_6-125% RDF with FYM @ 5 t/ha	73.82 (95.84)	60.95 (87.39)
T_7-FYM @ 10 t/ha	76.12 (96.86)	59.65 (86.30)
T_8-Absolute control	73.17 (95.66)	59.11 (85.82)
S.E. ±	2.33	1.02
C.D. (P=0.05)	NS	NS
Mean	75.59 (96.67)	60.87 (87.32)

NS= Non-significant

Table 2 : Mean number of pod/plants of soybean as influenced by different treatments at various growth stages of crop

Treatments	Days after sowing			At harvest
	60	75	90	
T_1-75% RDF without FYM	17.37	24.63	28.47	33.00
T_2-75% RDF with FYM @ 5 t/ha	18.30	25.27	30.40	34.73
T_3-100 % RDF without FYM	16.97	24.97	28.47	32.80
T_4-100% RDF with FYM @ 5 t/ha	24.77	32.00	35.23	38.90
T_5-125% RDF without FYM	18.60	26.90	28.47	33.20
T_6-125% RDF with FYM @ 5 t/ha	19.37	27.63	31.27	34.93
T_7-FYM @ 10 t/ha	17.87	23.53	26.13	29.10
T_8-Absolute control	18.37	21.10	22.77	28.10
S.E. ±	1.08	1.49	1.67	1.84
C.D. (P=0.05)	3.27	4.54	5.03	4.69
Mean	18.57	25.75	28.95	33.09

T_2 and T_6 and recorded significantly more number of pods than rest of the treatments.

Number of nodule :

Number of nodule recorded at 75 DAS were higher than at 60 DAS and at harvest (Table 3). At 60 DAS, treatment T_4 (100% RDF + @ 5 t FYM ha^{-1}) showed more number of nodules than other treatment but it was at par with treatment T_6. At 75 DAS treatment T_4 showed more number of nodules than other treatments but it was at par with treatments T_3, T_5 and T_6. At 90 DAS treatment T_4 showed more number of nodules than other treatments but it was at par with treatments T_3 and T_5. At harvest treatment T_4 showed more number of nodules than other treatments but it was at par with treatments T_1, T_3, T_5 and T_7.

Post harvest studies:

Grain weight and test weight :

The data on mean grain weight and test weight (g) of plant influenced by different treatment are presented in Table 4.

Treatment T_4 (100 per cent RDF + FYM @ 5 t/ha) showed significantly greater grain weight and test weight than other treatment. In case of only grain weight treatment T_4 was at par with treatment T_6.

Grain yield, straw yield, biological yield and harvest index:

Data on grain, straw, biological yield and harvest index are presented in Table 5.

Grain yield :

Data presented in Table 5 showed that treatment T_4 (100 per cent RDF + 5 t/ha FYM) recorded significantly more grain yield than other treatment. But, it was at par with treatments T_1, T_2, T_3, T_6 and T_7.

Straw yield:

Straw yield also in the treatment T_4 (100 per cent RDF + 5 t/ha FYM) (2923.33 kg/plot) was significantly more over the control treatment. Treatment T_8 showed

Table 3 : Mean number of nodule of soybean as influenced by different treatments at various growth stages of crop

Treatments	Days after sowing			At harvest
	60	75	90	
T_1-75% RDF without FYM	11.00	17.00	10.00	7.00
T_2-75% RDF with FYM @ 5 t/ha	9.67	18.00	9.00	5.67
T_3-100 % RDF without FYM	13.00	20.00	11.00	7.00
T_4-100% RDF with FYM @ 5 t/ha	16.00	23.67	13.33	8.67
T_5-125% RDF without FYM	9.00	21.00	12.00	8.00
T_6-125% RDF with FYM @ 5 t/ha	14.00	20.33	7.33	6.00
T_7-FYM @ 10 t/ha	12.00	16.00	9.33	7.33
T_8-Absolute control	9.00	14.67	6.33	5.00
S.E. ±	0.70	1.15	0.97	0.57
C.D. (P=0.05)	2.14	3.94	2.49	1.74
Mean	11.70	18.83	9.79	6.83

Table 4 : Mean grain weight and test weight (g) of soybean as influenced by different treatments at various growth stages of crop

Treatments	Grain weight per plant (g)	Test weight (g)
T_1-75% RDF without FYM	11.40	119.00
T_2-75% RDF with FYM @ 5 t/ha	11.23	114.00
T_3-100 % RDF without FYM	12.47	117.33
T_4-100% RDF with FYM @ 5 t/ha	14.93	147.67
T_5-125% RDF without FYM	12.27	122.00
T_6-125% RDF with FYM @ 5 t/ha	13.47	120.00
T_7-FYM @ 10 t/ha	12.20	124.33
T_8-Absolute control	10.73	110.67
S.E. ±	0.61	5.37
C.D. (P=0.05)	1.87	16.31
Mean	12.40	121.95

less straw yield over the rest of treatments.

Biological yield:

Data presented in Table 5 shows that treatment T_4 (100 per cent RDF + 5 t/ha FYM) (4531.66 kg/ha) yielded more biological yield which was significantly superior over rest of treatments.

Harvest index of soybean:

The harvest index in treatment T_4 (35.48) was more than any other treatments.

Economic returns:

Data regarding gross monetary return, net monetary return and B:C ratio as influenced by different treatments are presented in Table 6.

Cost of cultivation:

Data in Table 6 revealed that the mean cost of cultivation of soybean was Rs. 15229 ha^{-1}

Gross monetary returns :

Table 6 indicated that gross monetary return per hectare was significantly affected by different treatments and the mean gross monetary return was 30975 kg ha^{-1}. The gross monetary return was significantly more in treatment T_4 (Rs. 36420 ha^{-1}) over the control. The lowest gross monetary return was recorded by treatment T_8 (Rs. 18030 ha^{-1}).

Net monetary return:

Data presented in Table 6 indicated that net monetary return was affected significantly by different treatments. The treatment T_1 *i.e.* 75 per cent RDF without FYM had highest NMR followed by T_3. (100 per cent RDF without FYM). The mean net monetary return was Rs. 15298 ha^{-1}.

The B : C ratio :

The benefit : cost ratio was affected by different treatments. The mean benefit : cost ratio was 2.08. The treatment T_1 has highest B:C ratio as compared to other

Table 5 : Mean grain yield, straw yield, biological yield (kg/ha) and harvest index of soybean as influenced by different treatments at various growth stages of crop

Treatments	Grain yield (kg/ha)	Straw yield (kg/ha)	Biological yield (kg/ha)	Harvest index (%)
T_1-75% RDF without FYM	1466.67	2233.33	3700.00	39.63
T_2-75% RDF with FYM @ 5 t/ha	1408.33	2353.33	3761.66	37.43
T_3-100 % RDF without FYM	1500.00	2343.33	3843.33	39.02
T_4-100% RDF with FYM @ 5 t/ha	1608.33	2923.33	4531.66	35.48
T_5-125% RDF without FYM	1233.33	2463.33	3696.66	33.36
T_6-125% RDF with FYM @ 5 t/ha	1358.33	2498.33	3856.66	35.22
T_7-FYM @ 10 t/ha	1275.00	2436.67	3711.67	34.35
T_8-Absolute control	766.67	2110.00	2876.67	26.65
S.E. $\pm$	117.87	115.24	178.96	
C.D. (P=0.05)	354.53	349.60	542.90	
Mean	1327	2420.00	3747.28	35.14

Table 6 : Cost of cultivation, gross and net monetary return and B : C ratio of soybean influenced by different treatments

Treatments	Cost of cultivation (Rs/ha)	Gross monetary return (Rs/ha)	Net monetary return (Rs/ha)	B : C ratio
T_1-75% RDF without FYM	13911	34120	20882	2.45
T_2-75% RDF with FYM @ 5 t/ha	16111	32770	16659	2.03
T_3-100 % RDF without FYM	15882	34900	19021	2.19
T_4-100% RDF with FYM @ 5 t/ha	18025	36420	10675	2.02
T_5-125% RDF without FYM	17852	32960	18574	1.84
T_6-125% RDF with FYM @ 5 t/ha	20052	28940	8891	1.44
T_7-FYM @ 10 t/ha	12200	29660	17466	2.43
T_8-Absolute control	7800	18030	10216	2.31
S.E. $\pm$	-	330	2276	-
C.D. (P=0.05)	-	988	6904	-
Mean	15229	30975	15298	2.08

treatments.

The number of pods increased rapidly during 60 DAS to 75 DAS. The treatment T_4 *i.e.* application of 100 per cent RDF + 5 t FYM/ha showed more number of pods than treatment T_8 *i.e.* (absolute control). This may be attributed to two dry spell. Similar finding was reported by Mandal *et al.* (1998) and Chaturvedi and Chandel (2003). Mujumdar and Beheva (1991) carried out experiment at Akola and reported higher number of pod, primary branches, seed weight and plant height of soybean when fertilized with nitrogen. Rani (1999) from Krishna-godavari zone (A.P.) opined that application of nitrogen levels affected pod and number of branches per plant, while phosphorus levels increased plant height and pod number of soybean crop.

The nodulation help in fixation of atmospheric nitrogen. The treatment T_4 *i.e.* (100 % RDF + 5 t FYM/ ha) showed more number of nodules than treatment T_8 (absolute control). Aggrawal and Narang (1975) conducted field experiment at Hissar and observed that nodulation of soybean was significantly affected by P application and highest number and weight of nodules recorded at 100 kg P_2O_5 ha^{-1}.

Yield attributes of soybean like seed weight per plant, test weight, grain yield, biological yield, straw yield were recorded and treatment T_4 (100% RDF + 5 t FYM ha^{-1}) was significantly superior over rest of the treatments.

It was found that treatment T_4 (100% RDF + 5 t FYM/ha) showed more grain weight. Similar finding were reported by Chaturvedi and Chandel (2003). Test weight recorded at after harvest. The treatment T_4 (100% RDF + 5 t FYM/ha) also recorded significantly more test weight over other treatments. This may be due to more availability of nutrients and soil moisture during the crop growth stages. Jaya Paul and Ganeshraja (1990) conducted field experiment at Coimbtor and reported that increase in P and N rates increased number of pod per plant, seed per plant and 100 seed weight in soybean. Vora and Patil (1994) conducted experiment at Allahabad and reported that an increase in plant height, pods, seed weight per

plant due to application of N @ 40 kg/ha and P_2O_5 @ 80 kg ha^{-1} in soybean crop. Jat *et al.* (1998) reported that 100% RDF (50 : 75 : 0 kg ha^{-1}) applied to soybean significantly improved the yield attributes such as number of pods/plant, grain weight/plant and 1000 grain weight.

Application of 100 per cent RDF + 5 t FYM/ha showed significantly more grain yield over the control. This treatment gave the higher grain yield because nutrient and FYM application enhanced root proliferation which helped more absorption of nutrients from deeper layer of soil resulting into significant increase in yield. Similar findings were reported by Wanjari *et al.* (1993), Singh *et al.* (1995), Kumar and Singh (1996), Jadhav *et al.* (1998), Mandal *et al.* (1998), Ravankar *et al.* (1998), Chaturvedi and Chandel (2003) and Bansode (2008).

It was found that treatment T_4 (100% RDF + 5 t FYM/ha) showed significantly more straw yield over the rest of treatments. Similar findings were recorded Singh *et al.* (1995) and Chaturvedi and Chandel (2003). Biological yield and harvest index were more in treatment T_4 (100% RDF + 5 t FYM/ha), which was significantly superior over rest of treatment. Patil and Pawar (1996) reported that number of pods per plant, test weight and straw yield were significantly increased with the increasing N and P level in soybean. Application of 45 kg N and 90 kg P_2O_5/ha gave significantly higher yield of straw as compared to lower doses and control. Kausadikar *et al.* (2003) studied the response of soybean to different doses of N, P, K fertilizer in vertisol. The results revealed among graded levels of nitrogen 90 kg N/ha significantly out yielded for pod per plant 1000 seed weight, crude protein, seed yield and straw yield. More *et al.* (2006) conducted field experiment at Nagpur and observed that plant height, number of branches, dry matter accumulation of soybean were maximum at 30:75:00 kg NPK ha^{-1}

Gross monetary returns and net monetary return were found more under treatment T_4 (100 % RDF + 5 t FYM) over the control treatment. Mean of B : C ratio was 2.08. This might be due to more supply of nutrients and moisture (Bansode, 2008).

Available nitrogen was increased slightly under FYM application. Available phosphorus was decreased under chemical fertilizer application and in the medium available quantity, available K was increased almost under all the treatments. The reason for increase or decrease towards positive value may be due to FYM application (Anonymoys, 2008).

Conclusion:

Based on present investigation following conclusions were drawn :

- The treatment $T_{4;}$ (100 % RDF + 5 t FYM/ha) was found beneficial in improving growth, yield attributes, yield of soybean GMR and NMR as compared to other treatments.
- Treatment T_4 (100 % RDF + 5 t FYM/ha) recorded double yield than absolute control.
- Treatment T_1 had highest NMR as well as B:C ratio as compared to other treatments but yield was highest in treatment T_4.
- Variety MAUS-71 is recommended under rainfed condition in Marathwada region. which is a early maturing as well as high yielding variety.

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