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Research Article

Effect of potassium and integrated nutrient management on quality and economics of soybean

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Abstract : The quality components *viz.,* oil, oil yield, protein and protein yields were found to be superior under potassiun and integrated nutrient management over rest of control and other treatments. The application of 50 kg N + 75 kg P_2O_5 + 50 kg K_2O + 5 t FYM ha^{-1} was found to be superior over other treatments. The highest gross income (Rs. 36420), net monetary returns (Rs.18210) and B : C ratio (2.00) was observed in the application of 50 kg N + 75 kg P_2O_5 + 50 kg K_2O + 5 t FYM ha^{-1}. Increasing the levels of fertilizer in combination of K_2O and FYM levels enhanced the quality as well as economic of soybean.

Key Words : Integrated nutrient management, Yield, Quality soybean and economic returns, FYM

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INTRODUCTION

Soybean [*Glycine max* (L.) Merrill] is one of the important pulse and oilseed crops of the world. It becomes miracle crop of twentieth century and designated as "Golden Bean". It has high nutritive value and it is extensively grown is verusol of India because of its wider adaptability to agro-climatic condition and high market value.

The crop soybean was introduced in sixties as supplementary oilseed crop to overcome the edible oil shortage in the country. Among all oilseed crops, soybean occupied third position in the edible oil scenario of India. It contains high quality of protein 43.2 per cent and oil 19.5 per cent. It also contains 26 per cent carbohydrates, 4 per cent minerals and 2 per cent phospholipids (Halvankar *et al.,* 1994). It is rich source of Vitamin A, B and D. Being best and cheapest source of high quality protein amongst vegetable and animal protein source. The protein from soybean is equivalent to that of milk product, eggs and meat in quality, hence it is called as "poor man's meat".

Imbalance nutrition is one of the important constraints of soybean productivity in North Indian Plains. Continuous use of high level of chemical fertilizers has led to problems of soil degradation, which is proving detrimental to soybean production. A crop producing 6,720 kg / ha biomass removed about 614 kg N: 148 kg P and 486 kg K/ha. Therefore, adequate and balanced fertilization is necessary to increase productivity and quality of soybean. The supplementary and complimentary use of organic manures and bio-fertilizer improve soil physical, chemical and biological properties, fertilizer use efficiency, mitigates short supply of micro nutrients, stimulates the proliferation of diverse group of micro-organisms and plays and important role in the maintenance of soil fertility and improves the ecological balance of rhizosphere. Hence an experiment was conducted to study the performance of soybean with different integrated nutrient management systems in terms quality and economics of soybean. Fertilizers play an important role in crop production. A substantial increase in production can be

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obtained by use of fertilizers.

Therefore adequate and balanced fertilization is necessary to increase productivity and quality of soybean.

EXPERIMENTAL METHODS

The field experiment was conducted at the M.P.K.V., Rahuri, Dist. Ahmednagar during rainy (*Kharif*) 2005 at Director of Farm, 'D' Block, Mahatma Phule Krishi Vidyapeeth, Rahuri (M.S.). The experimental soil was clayey in texture, contains 0.42 per cent organic carbon, 209.52 kg N, 21.73 kg /ha available P and 313.20 kg/ha available K. The experiment consisted of 8 treatments *viz.,* T_1 : Control, T_2 : 50 kg N + 75 kg P_2O_5, T_3 : 50 kg N + 75 kg P_2O_5 + 25 kg K_2O, T_4 : 50 kg N + 75 kg P_2O_5 + 50 kg k_2O, T_5 : 50 kg N + 75 kg P_2O_5 + 25 kg + 2.5 t FYM ha^{-1}, T_6 : 50 kg N + 75 kg P_2O_5 + 25 kg K_2O + 5 t FYM ha^{-1}, T_7 : 50 kg N+75 kg P_2O_5 + 50 kg K_2O+ 2.5 t FYM ha^{-1}, T_8 :50 kg N+75 kg P_2O_5 + 50 kg K_2O+5 t FYM ha^{-1} was laid out in Randomized Block Design with 3 replications. Soybean variety DS-228 (Phulw Kalyani) was grown during 5^{th} July 2005, sown at spacing of 30 x 10 cm.

The full dose of NPK and organic manure through urea, single superphosphate, muriate of potash and FYM, respectively were applied basally as per treatment at the time of sowing. The seeds were inoculated with *Rhizobium* and PSB culture to all treatments before sowing.

The grain and haulm were analyzed for nitrogen content by micro-Kjeldhal's method, potassium by flame photometer method and phosphorus was estimated by Vando-molybdate-yellow colour method as per A.O.A.C. (1992) and Jackson (1973), respectively. Protein content (%) was worked out by multiplying N content with 5.71 and protein yield per hectare was calculated by multiplying the protein content with per hectare grain yield of respective treatments.

The oil content (%) in grains of soybean was estimated with the help of soxhelt apparatus using ether as solvent for oil extraction. Oil yield per hectare was calculated by multiplying oil content with grain yield of respective treatments.

EXPERIMENTAL RESULTS AND ANALYSIS

The results obtained from the present study have been presented under following heads :

Nutrient content:

There was a significant effect of integrated nutrient management on N, P and K content of both grain and haulm (Table 1). The N, P and K content increased with increase the fertilizer and FYM levels. The application of 50 kg N + 75 kg P_2O_5 + 50 kg K_2O + 5 t FYM ha^{-1} registered the maximum nitrogen concentration in grain (7.07%) and haulm (0.62%), phosphorus concentration in grain (0.66%) and haulm (0.30%) and potassium concentration in grain (0.96%) and haulm (2.96). Lowest nitrogen, phosphorus and potassium concentration was recorded in control plot. Nitrogen, phosphorus and potassium content at flowering and harvesting stages were significantly enhanced due to increase levels of fertilizer. Similar, results were also reported by Patel and Chandravanshi (1996).

Quality parameter:

Protein and oil content were well with in the desirable limits in all the treatments and although there were no significant differences among integrated nutrient management treatments (Table 2), but improved with integrated nutrient management, the highest protein yield and oil yield of soybean was recorded under 50 kg N+75 kg P_2O_5 + 50 kg K_2O + 5 t FYM ha^{-1}. Protein and oil yield of soybean significantly increased by the combination of

Table 1 : Nutrient content (%) in grain and haulm of soybean as influenced by different integrated nutrient management treatments

Treatments	Content					
	Grain			Haulm		
	N	P	K	N	P	K
T_1 : Control	6.95	0.55	0.73	0.54	0.20	2.80
T_2 : 50 kg N+ 75 kg P_2O_5 ha^{-1}	6.98	0.57	0.80	0.55	0.22	2.82
T_3 : 50 kg N+ 75 kg P_2O_5 + 25 kg K_2O ha^{-1}	6.99	0.58	0.81	0.55	0.23	2.84
T_4 : 50 kg N+ 75 kg P_2O_5+50 kg K_2O ha^{-1}	7.01	0.59	0.88	0.57	0.24	2.85
T_5 : 50 kg N + 75 kg P_2O_5 + 25 kg K_2O + 2.5 t FYM ha^{-1}	7.03	0.59	0.91	0.59	0.26	2.57
T_6 : 50 kg N + 75 kg P_2O_5 + 25 kg K_2O + 5 t FYM ha^{-1}	7.04	0.60	0.93	0.59	0.27	2.89
T_7 : 50 kg N + 75 kg P_2O_5 + 50 kg K_2O + 2.5 t FYM ha^{-1}	7.06	0.65	0.95	0.60	0.29	2.93
T_8 : 50 kg N + 75 kg P_2O_5 + 50 kg K_2O + 5 t FYM ha^{-1}	7.07	0.66	0.96	0.62	0.30	2.96
S.E. $\pm$ Mean	0.02	0.01	0.02	0.01	0.01	0.01
C.D. (P=0.05)	0.07	0.03	0.07	0.04	0.04	0.03

Table 2 : Effect of integrated nutrient management on quality parameters of soybean

Treatments	Yield (q/ha)	Oil (%) in seed	Oil yield (kg/ha)	Protein content (%)	Protein yield (kg/ha)
T_1 : Control	17.61	18.35	3.23	39.68	6.99
T_2 : 50 kg N+ 75 kg P_2O_5 ha^{-1}	20.93	18.42	3.86	39.85	8.34
T_3 : 50 kg N+ 75 kg P_2O_5 + 25 kg K_2O ha^{-1}	22.03	18.54	4.08	39.91	8.79
T_4 : 50 kg N+ 75 kg P_2O_5+50 kg K_2O ha^{-1}	23.10	18.63	4.30	40.02	9.24
T_5 : 50 kg N + 75 kg P_2O_5 + 25 kg K_2O + 2.5 t FYM ha^{-1}	24.45	18.70	4.57	40.14	9.81
T_6 : 50 kg N + 75 kg P_2O_5 + 25 kg K_2O + 5 t FYM ha^{-1}	26.33	18.82	4.96	40.19	10.58
T_7 : 50 kg N + 75 kg P_2O_5 + 50 kg K_2O + 2.5 t FYM ha^{-1}	26.50	18.93	5.02	40.31	10.68
T_8 : 50 kg N + 75 kg P_2O_5 + 50 kg K_2O + 5 t FYM ha^{-1}	28.01	19.02	5.33	40.36	11.30
S.E. $\pm$	0.94	0.12	0.17	0.62	0.62
C.D. (P=0.05)	2.88	NS	0.60	NS	1.80

NS=Non-significant

Table 3 : Monetary economic as influenced by various integrated nutrient management treatments

Treatments	Cost of cultivation (Rs. ha^{-1})	Gross monetary returns (Rs. ha^{-1})	Net monetary returns (Rs. ha^{-1})	Benefit : cost ratio
T_1 : Control	14020	22893	11115	1.63
T_2 : 50 kg N+ 75 kg P_2O_5 ha^{-1}	16094	27639	12362	1.69
T_3 : 50 kg N+ 75 kg P_2O_5 + 25 kg K_2O ha^{-1}	16277	28639	13570	1.76
T_4 : 50 kg N+ 75 kg P_2O_5+50 kg K_2O ha^{-1}	16460	30030	14633	1.83
T_5 : 50 kg N + 75 kg P_2O_5 + 25 kg K_2O + 2.5 t FYM ha^{-1}	17152	31785	14633	1.85
T_6 : 50 kg N + 75 kg P_2O_5 + 25 kg K_2O + 5 t FYM ha^{-1}	18027	34229	16202	1.90
T_7 : 50 kg N + 75 kg P_2O_5 + 50 kg K_2O + 2.5 t FYM ha^{-1}	17335	34450	17115	1.99
T_8 : 50 kg N + 75 kg P_2O_5 + 50 kg K_2O + 5 t FYM ha^{-1}	18210	36420	18210	2.00
S.E. $\pm$Mean	-	766	494	0.03
C.D. (P=0.05)	-	2323	1499	0.09

inorganic fertilizer along with FYM. Similar results were also reported by Sharma and Dixit (1987).

Economics:

Use of no fertilizer was found to be uneconomical and recorded low values of gross returns, net returns and benefit : cost ratio. The gross returns, net returns and benefit : cost ratio increased progressively with increasing levels of FYM from 2.5 to 5 t/ha and K_2O levels 25 to 50 kg/ha (Table 3) Integrated application of inorganic fertilizer and FYM resulted in better economic returns and benefit : cost ratio. Maximum gross returns of Rs. ha^{-1} 36,420, net returns of Rs. ha^{-1} 18,210 and benefit : cost ratio of 2.00 were obtained with application of 50 kg N+75 kg P_2O_5 + 50 kg K_2O in conjuction of 5 t FYM/ ha might be due to balanced fertilization.

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