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Influence of Different Fertility Management Practices on Productivity and Economics of Forage Soybean

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ABSTRACT

Background: Quality and higher fodder production is one of the important aspects to get higher productivity from live stock. India suffer a net deficiency of 35.6% green fodder, 10.95% dry crop residues and Jammu and Kashmir faces a net deficit of 19% in fodder. The choice to grow cultivated fodder crops during *kharif* season in Kashmir is limited and are grown generally under rainfed conditions. The major *kharif* season fodder cereal crops are maize and sorghum and the legume fodder crops are cowpea and soybean. To improve the quality and yield of fodder crops, it is important to standardise production technology for legume fodder crops.

Methods: A field experiment was undertaken at Agronomy Farm, Faculty of Agriculture, Wadura of Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir during *kharif* 2019 and 2020 to study the impact of different fertility management practices on productivity and economics of forage soybean. The experiment comprising of seven treatments laid out in a randomized complete block design with three replications.

Result: Application of N, P_2O_5, K_2O (30, 90, 45 kg/ha) along with 0.1 tons/ha vermicompost recoded higher green fodder productivity and growth characters of soybean. However application of N, P_2O_5, K_2O (20, 60, 30 kg/ha) was found economically viable option.

Key words: Fodder, Quality, Soybean, Soil fertility.

INTRODUCTION

India suffer a net deficiency of 35.6% green fodder, 10.95% dry crop residues and 44% concentrate feed ingredients (IGFRI Vision, 2050). In Jammu and Kashmir, 0.6 lakh ha is under cultivated fodder crops and faces a net deficit of 19% in fodder (Raja, 2013). The choice to grow cultivated fodder crops during *kharif* season in Kashmir is limited and are grown generally under *rainfed* conditions. The major *kharif* season fodder cereal crops are maize and sorghum and the legume fodder crops are cowpea and soybean. Among the legume fodder crops the soybean produced higher fodder yield as reported by Ummaisa, (2020). Therefore, to increase further the productivity of fodder soybean under rainfed conditions one of the option is to supply the nutrients in optimum level. The vermicompost was proven an important organic manure in supplying nutrients to agricultural crops and has attracted the researchers throughout the globe in past few decades. Proper rate of vermicompost along with chemical fertilizer is imperative to supply the nutrients to soybean fodder crop to get higher quality and production. Keeping these aspects in view the present investigation was undertaken to study influence of different rates of vermicompoast and chemical fertilizers on growth, fodder yield and quality of fodder soybean.

MATERIALS AND METHODS

Field experiments were conducted during *kharif* 2019 and 2020 under rainfed condtions at Faculty of Agriculture Wadura, Sher-e-Kashmir University of Agricultural Science and technology Kashmir to find out the rate of vermicompost and N, P_2O_5, K_2O on fodder soybean. The study area falls in temperate climatic zone of Kashmir Valley. The soil of experimental field was clay loam in texture, high in organic carbon (2.3%), medium in available phosphorus (13.2 kg ha^{-1}), available potassium (327 kg ha^{-1}) and low in available nitrogen (128 kg ha^{-1}). The fertility levels were N, P_2O_5, K_2O kg/ha T_1 (0,0,0), T_2 (10, 30, 15), T_3 (20, 60, 30), T_4 (30, 90, 45) and T_5 (T_2+0.1 ton/ha V.C), T_6 (T_3+ 0.1 ton/ha V.C), T_7 (T_4+0.1 tons/ha V.C) were assigned to RBD with three replication. 'Shalimar soybean-1' variety of soybean was sown at 30cm row to row spacing during both years of investigation. The experiment was conducted under *rainfed* conditions. The vermicompost as per the treatments was

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applied in the rows at the time of sowing. The nitrogen through urea, phosphorus through diammonium phosphate and potassium through muriate of potash as per treatments was applied as basal. For dry matter accumulation the samples were taken at the time of harvest and dried in shade, then oven dried at 60°C for 72 hours. Samples were weighed to a constant weight and dry matter was expressed as tonnes/ha. For economic analysis (benefit cost ratio) cost of inputs and price of outputs were calculated at prevailing market price.

RESULTS AND DISCUSSION

Plant height and dry matter accumulation

The fertility management practices induced significant difference in plant height and dry matter accumulation of soybean (Table 2). In general the growth characters (plant height and dry matter accumulation) of soybean were higher in 2019 compared to 2020. This is due to higher rainfall during the crop growth period in year 2019 compared to 2020 (Table 1). Taller plants were recorded with integrated approach (Chemical fertilizer + vermicompost) than to their corresponding chemical fertilizers alone. The data of two years showed that T_7 recorded significantly taller plants than T_5, T_4, T_3, T_2 and T_1, however was statistically at par to T_6. Further T6 recorded significantly higher plant high than T_3, T_2 and T_1. The mean dry matter accumulation was also observed higher in treatment T_7 (9.1 t/ha) followed by T_6 (8.8 t/ha) T_4 (8.3 t/ha), T_5 (8.2 t/ha), T_3 (8.1), T_2 (7.5 t/ha) and lowest in T_1 (6.4 t/ha). This is attributed to increased availability of nutrients with application vermicompost with chemical fertilizers. Also the increased rate of vermicompost and chemical fertilizer will have increased the availability of nutrients which have resulted in higher plant height and dry matter accumulation. Similar findings were reported by Chaudhani *et al.,* (2019), Jagdeesh *et al.,* (2018), Verma *et al.,* (2017) and Maeshbabu *et al.,* (2008).

Table 1: Weather parameters during the crop growth period (2019 and 2020).

	Crop growth duration (days)	Mean temperature (°C)		Rainfall (mm)
Year		Max	Min	
2019	83	30.7	14.3	133.0
2020	82	30.8	14.0	126.5

Green fodder yield and economics

The green fodder yield of soybean was higher during 2019 compared to 2020. Moreover nearly similar trend was

Table 2: Effect of fertility management practices on plant height, dry matter of soybean.

Treatment	Plant height (cm)		Drymatter accumulation (t/ha)	
	2019	2020	2019	2020
T_1: Control	55.0	45.4	7.6	5.2
T_2: N, P_2O_5, K_2O (10, 30, 15 kg/ha)	58.0	51.6	8.7	6.3
T_3: N, P_2O_5, K_2O (20, 60, 30 kg/ha)	63.2	54.0	9.4	6.8
T_4: N, P_2O_5, K_2O (30, 90, 45 kg/ha)	64.3	54.7	9.6	7.0
T_5: N, P_2O_5, K_2O (10, 30, 15 kg/ha) + 0.1 tons/ha V.C	60.1	52.7	9.7	6.7
T_6: N, P_2O_5, K_2O (20, 60, 30 kg/ha) + 0.1 tons/ha V.C	67.7	59.6	10.5	7.2
T_7: N, P_2O_5, K_2O (30, 90, 45 kg/ha) + 0.1 tons/ha V.C	70.0	60.5	10.9	7.4
S,Em±	1.30	1.27	0.37	0.24
C.D	4.06	4.04	1.01	0.73

Table 3: Effect of fertility management practices on green fodder yield and benefit cost of soybean.

Treatment	Green fodder yield (t/ha)		B:C	
	2019	2020	2019	2020
T_1: Control	26.0	21.5	3.02	2.50
T_2: N, P_2O_5, K_2O (10, 30, 15 kg/ha)	30.6	26.3	3.25	2.79
T_3: N, P_2O_5, K_2O (20, 60, 30 kg/ha)	34.3	28.5	3.39	2.81
T_4: N, P_2O_5, K_2O (30, 90, 45 kg/ha)	37.8	29.3	3.36	2.69
T_5: N, P_2O_5, K_2O (10, 30, 15 kg/ha) + 0.1 tons/ha V.C	36.1	28.2	2.86	2.24
T_6: N, P_2O_5, K_2O (20, 60, 30 kg/ha) + 0.1 tons/ha V.C	39.8	30.3	2.99	2.27
T_7: N, P_2O_5, K_2O (30, 90, 45 kg/ha) + 0.1 tons/ha V.C	42.3	31.0	3.00	2.20
S,Em±	1.62	0.97	_	_
C.D	5.05	3.03	_	_

Note: Green fodder - Rs.2.5/kg; Vermicompost: Rs 12/kg; N Rs. 11.95/kg; P_2O_5 Rs. 50/kg; K_2O Rs. 28.3/kg.

registered during both years (2019 and2020) in all treatments (Table 3). Data presented in Table 2 revealed that the treatment T_7 recorded higher green fodder yield than T_5, T_3, T_2 and T_1 during both years (2019 and 2020). However T_7 registered marginally higher green fodder yield than T_6 and T_4. The higher growth characters (plant height and dry matter accumulation) in treatment T_7 were the reason for higher green fodder yield than rest of the treatments. Verma *et al.,* (2017) also recorded higher biological yield of soybean in integrated fertility management. Furthermore, higher straw yield of soybean was reported by Jagdeesh *et al.,* (2018) in treatments receiving integrated nutrient sources.

The treatment T_3 (N, P_2O_5, K_2O (20, 60, 30 kg/ha) recorded higher benefit cost ratio of 3.39 in 2019 and 2.81 in 2020 compared to other treatments. The reason for higher B:C in treatment T_3 is due to lower cost of cultivation compared to T_7, T_6, T_5, T_4 and higher green fodder yield compared to T_2 and T_1.

CONCLUSION

The present investigation revealed that application of N, P_2O_5, K_2O (30, 90, 45 kg/ha) along with 0.1 tons/ha vermicompost recoded higher green fodder productivity of soybean. However, the higher benefit cost ration was observed with application of N, P_2O_5, K_2O (20, 60, 30 kg/ha. Thus it may be concluded that for higher fodder production of soybean N, P_2O_5, K_2O (30, 90, 45 kg/ha) along with 1.0 tons/ha vermicompost should be applied. But, for higher economic returns only chemical fertilizers N, P_2O_5, K_2O (20, 60, 30 kg/ha should be applied.

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