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To study the effect of organic manures on nutrient uptake & economics of mustard crop

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Abstract

A field experiment was conducted at Agronomy Research Farm of Narenda Deva University of Agriculture and Technology, Ayodhya (Uttar Pradesh) during the *Rabi* season of 2012-13 "To Study the Effect of Organic Manures on Nutrient Uptake (Nitrogen, Phosphorus & Potassium) & Economics Of Mustard Crop. The experiment comprised of six treatments *viz.* one 100% fertilizer, one integrated (FYM+Fertilizer) and four 100% organic consisting various combinations of organic sources (FYM, Vermicompost, Neemcake, PSB, Azotobacter), tested in Randomized Block Design and replications three times. The basic information on the physico-chemical properties of the soil indicated that the soil of the experimental field was classified as silty loam which was low in organic carbon, nitrogen and phosphorus and medium in potassium. The crop recorded normal recommended cultural practices and plant protection measures. Results revealed that all the growth, nutrient uptake of nitrogen, phosphorus & potassium, yield attributes and quality increased significantly under the integrated treatment (FYM+FERETILIZER). The growth characters *viz.*, plant height, leaf area index, dry matter accumulation and number of branches per plant and yield attributes like number of siliqua per plant, number of seed per siliqua, length of siliqua (cm), 1000 seed weight(g), biological yield, seed yield, stover yield($q\ ha^{-1}$), harvest index(%) and NPK uptake of mustard crop. On the basis of economics of different treatment, the maximum gross returns (Rs. 78598.00 per ha), net returns (Rs 59067.00 per ha) and Benefit:Cost ratio (3.02) was recorded under integrated treatment (FYM + fertilizer) for mustard crop.

Keywords: Mustard crop, growth and yield

Introduction

Indian mustard (*Brassica juncea* (L.) Czern & Coss) belongs to family Cruciferae. It is the most important winter (*Rabi*) oil seed crop. India is one of the largest mustard growing countries in the world, occupying the first position in area and third position in production after China and Canada. Among the seven edible oil seed cultivated in India, rapeseed-mustard (*Brassica* spp.) contributes 28.6% in the total production of oil seed crops. In India, cultivation of mustard is done over an area 5.96 million hectare with production and productivity of 8.32 million tonnes and $1397\ kg\ ha^{-1}$, respectively (2017-2018). In India, Rajasthan ranks first both in area and production. In U.P., Mustard is grown on 0.68 million hectare with production of 0.95 million tonnes and productivity of $1392\ Kg\ ha^{-1}$.

The oilseed crops have a key role to human and animal nutrition for maintaining normal health. Indian mustard is a fairly high remunerative crop and a major source of high quality edible oil. Besides oil, the leaves of young plants are used as green fodder. The per capita per day oil availability is 19g as recommended oil 33g per day per capita by medical scientists.

The use of organic manures for improving and maintaining the soil health has been in practice since long time but its use is limited due to poor availability and higher cost of nutrients supplied through organic sources. Therefore, combined use of organic manure and inorganic fertilizers have shown better performance in cereals by sustaining higher yield maintaining soil health (Anonymous, 2004) [1].

In this context a keen awareness has to be created on the adoption of organic farming as a remedy to maneuver the ill effect from chemical farming. In organic farming, we feed soil with micro and macro organisms, which deliver a smorgasbord of minerals vitamins and other nutrients to be crop at a metered pace. It entails the use of compost, FYM, vermicompost, green manures, green leaf manuring in crop rotation and biofertilizers to enrich soil organic

carbon, supply all required plant nutrients and improve soil properties. Organic manures in agriculture add much needed organic and mineral matter to the soil. The organic matter added is an indispensable component of soil and plays an important role in maintenance and improvement of soil fertility and productivity. The proper management of these make it possible to increase the efficiency of native and added nutrients.

Since, soil microbial and enzyme systems are associated with organic manure management, incorporation of organic manures into soil not only plays an important role in soil chemical and biological activity, but also affect the rate at which nutrients become available to crops. Nutrient management through organics plays a major role in maintaining soil health due to build up of soil organic matter, beneficial microbes, enzymes, besides improving soil physical and chemical properties. Addition of organic materials to soil results in increased organic matter, crop productivity and soil biological activity. Production of mustard using organic manures and biofertilizers is found to favourably alter the availability of several plant nutrients through their impact on chemical and biological properties of soil. Keeping all above facts the present study entitled is "Effect of organic manures on nutrient uptake of nitrogen, phosphorus & potassium & economics Of mustard Crop (*Brassica juncea* L. Czern & Coss)".

Materials and Methods

A field experiment was conducted at Agronomy Research Farm of Narendra Dev University of Agriculture and Technology, Ayodhya (Uttar Pradesh) during the *Rabi* season of 2012-13. The experiment site falls under sub tropical zone in Indo-Gangetic plains and lies between 26.47° N latitude, 82.12° E longitude and about 113 metres above the mean sea level. The experiment was laid out in Randomized Block Design (RBD) with 3 replications with Mustard variety NDRI 8501. With 6 different treatment combinations (T₁, T₂, T₃, T₄, T₅, T₆) table 1, sowing was done on 10 November 2012 using 6 Kg seed ha⁻¹ in 45 cm apart. The required quantity of various organic manures *viz.*, FYM, vermicompost and neemcake were applied in moist soil as per treatment about one week before sowing of seeds. In 100% and 50% chemical fertilizer treatments the recommended doses of N,P,K,S and Zn (120, 60, 60, 40 and 5 kg ha⁻¹ respectively) were applied through urea, diammonium phosphate, murate of potash, elemental sulphur and zinc oxide respectively. In chemical fertilizers treatment, the half dose of nitrogen and full dose of phosphorus, potassium, sulphur and zinc were broadcasted uniformly and mixed in soil. The application of PSB and azotobacter at the time of sowing was done at the rate of 5 kg ha⁻¹.

Result and Discussion

Nitrogen Uptake (kg ha⁻¹)

The data regarding nitrogen uptake as influenced by various nutrient sources have been presented in table 2 and the study reveals that application of 50% recommended NPK through fertilizers and 50% recommended N through FYM and 5 kg zinc (T₁) resulted in highest nitrogen uptake (113.03 kg ha⁻¹) which was statistically at par to treatment which received 100% NPK + recommended dose of sulphur through elemental sulphur + 5 kg zinc (T₆) and T₃ received 100% nutrients through organic manures (recommended N each equivalent to 1/3rd of total N requirement of crop as FYM, vermicompost and neemcake) but significantly to rest of the

treatments at all growth stages. The lowest nitrogen uptake (75.51 kg ha⁻¹) was recorded in the treatment T₄ received 50% FYM with inoculation of PSB and Azotobacter. This might be due to proper establishment of roots, higher absorption of mineral nutrients from soil, transport of more nutrients to seed, vigorous plant growth and higher seed and straw yields under proper availability of nutrients. The overall increase in uptake of nitrogen was the cumulative effect of rise in their concentration in plant tissues and in yield levels. The results are in conformity with Mandal *et al.* (2002)^[3] and Singh *et al.* (2009)^[5].

Phosphorus Uptake (kg ha⁻¹)

The data regarding phosphorus uptake as influenced by various nutrient sources have been presented in table 2 and the study reveals that application of 50% recommended NPK through fertilizers and 50% recommended N through FYM and 5 kg zinc (T₁) resulted in highest phosphorus uptake (44.68 kg ha⁻¹) which was statistically at par to treatment which received 100% NPK + recommended dose of sulphur through elemental sulphur + 5 kg zinc (T₆) and T₃. The lowest nitrogen uptake (75.51 kg ha⁻¹) was recorded in the treatment T₄ received 50% FYM with inoculation of PSB and Azotobacter significantly superior over chemical and other organic manured treatments. The lowest phosphorus uptake (25.35 kg ha⁻¹) was recorded in the treatment T₄ received 50% FYM with inoculation of PSB and Azotobacter. This might be due to proper establishment of roots, higher absorption of mineral nutrients from soil, transport of more nutrients to seed, vigorous plant growth and higher seed and straw yields under proper availability of nutrients. The overall increase in uptake of nitrogen was the cumulative effect of rise in their concentration in plant tissues and in yield levels. The results are in conformity with Mandal *et al.* (2002)^[3] and Singh *et al.* (2009)^[5].

Potassium Uptake (kg ha⁻¹)

The data regarding potassium uptake as influenced by various nutrient sources have been presented in table 2 and the study reveals that application of 50% recommended NPK through fertilizers and 50% recommended N through FYM and 5 kg zinc (T₁) resulted in highest potassium uptake (110.64 kg ha⁻¹) which was statistically at par to treatment which received 100% NPK + recommended dose of sulphur through elemental sulphur + 5 kg zinc (T₆) and T₃ received 100% nutrients through organic manures (recommended N each equivalent to 1/3rd of total N requirement of crop as FYM, vermicompost and neemcake) but significantly to rest of the treatments at all growth stages. The lowest nitrogen uptake (71.64 kg ha⁻¹) was recorded in the treatment T₄ received 50% FYM with inoculation of PSB and Azotobacter. This might be due to proper establishment of roots, higher absorption of mineral nutrients from soil, transport of more nutrients to seed, vigorous plant growth and higher seed and straw yields under proper availability of nutrients. The overall increase in uptake of nitrogen was the cumulative effect of rise in their concentration in plant tissues and in yield levels. The results are in conformity with Mandal *et al.* (2002)^[3], Singh *et al.* (2009)^[5] and Rundala *et al.* (2012).

Economics

The cost of cultivation was calculated for all the treatment. The maximum total cost of cultivation (Rs. 29717.00 ha⁻¹) was recorded under the treatment T₃ received 100% nutrients through organic manures (recommended N each equivalent to

1/3rd of total N requirement of crop as FYM, vermicompost and neemcake) along with weeding and pest control through agronomic practices and the minimum total cost of cultivation (Rs. 16132 ha⁻¹) was recorded in the treatment T₄ received 100% nutrients through organic manures (50% N as FYM + Azotobacter + PSB) in mustard crop. Higher cost of cultivation in this treatment might be due to the huge amount of organic manures used in this treatment in comparison to chemical and integrated treatments.

The maximum gross income (Rs. 78598.00 ha⁻¹), net return (Rs. 59067.00 ha⁻¹) and benefit- cost ratio was recorded from integrated treatment T₁ which received 50% recommended NPK through fertilizers and 50% recommended N through FYM and 5 kg zinc. The minimum gross income (Rs. 57224 ha⁻¹) was recorded in the treatment T₄, minimum net return (Rs. 34844 ha⁻¹) was recorded in the treatment T₂ and minimum the minimum benefit- cost ratio (1.275) was recorded in the treatment T₂ (table 3). The results are in conformity with Tripathi *et al.* (2012)^[7], Singh *et al.* (2014)^[6] and Singh *et al.* (2005)^[4].

Table 1: Details of Treatment

Treatment	
T ₁	50% recommended NPK+50% N as FYM+ 5kg zinc
T ₂	Recommended N each equivalent to 1/3 rd Of total N requirement of crop as FYM, vermicompost and neemcake
T ₃	Recommended N each equivalent to 1/3 rd Of total N requirement of crop as FYM, vermicompost and neemcake + agronomic practices for weed and pest control
T ₄	50% N as FYM + azotobacter and PSB
T ₅	Recommended N each equivalent to 1/3 rd Of total N requirement of crop as FYM, vermicompost and neemcake + azotobacter and PSB
T ₆	100% NPK + recommended dose of sulphur through elemental sulphur + 5 kg zinc

Table 2: Effect of different treatments on NPK uptake (kg ha⁻¹) of mustard crop

Treatments	NPK uptake (Kg ha ⁻¹)								
	N uptake (Kg ha ⁻¹)			P uptake (Kg ha ⁻¹)			K uptake (Kg ha ⁻¹)		
	Seed	Stover	Total	Seed	Stover	Total	Seed	Stover	Total
T ₁	58.92	54.11	113.03	12.06	32.62	44.68	14.70	95.94	110.64
T ₂	45.86	41.43	87.29	8.05	22.02	30.07	10.71	73.24	83.95
T ₃	51.50	46.35	97.85	9.88	26.84	36.72	12.27	81.64	93.91
T ₄	39.88	35.63	75.51	7.15	18.23	25.35	8.93	62.71	71.64
T ₅	47.43	43.69	91.12	9.10	24.06	33.16	11.37	77.01	88.38
T ₆	53.33	48.30	101.63	10.50	28.85	39.35	12.91	85.41	98.32
SEm±	1.19	1.08	2.27	0.23	0.63	0.86	0.29	1.91	2.20
CD(P=0.05)	3.75	3.41	7.16	0.73	1.97	2.70	0.90	6.02	6.93

Table 3: Economics analysis of various treatment combinations

Treatment	Cost of cultivation (Rs ha ⁻¹)	Gross Return (Rs ha ⁻¹)	Net Return (Rs ha ⁻¹)	Benefit-Cost Ratio
T ₁	19531	78598	59067	3.024
T ₂	27717	65561	34844	1.257
T ₃	29717	70996	41279	1.389
T ₄	16132	57224	41092	2.547
T ₅	28117	67674	39557	1.406
T ₆	22393	71765	49372	2.204

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