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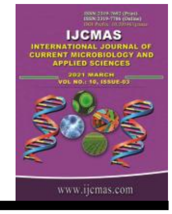

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Impact of Integrated Nutrient Management on Growth and Yield of Gobhi Sarson (*Brassica napus* L)

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A B S T R A C T

A field experiment entitled "Impact of integrated nutrient management on growth and yield of Gobhi sarson (*Brassica napus* L) was conducted during the *rabi* season 2019-2020 in the experimental field of Sant Baba Bhag Singh University, Khiala, Punjab. The experiment was conducted with seven treatments (T1: RDF, T2: FYM @4t/ha, T3: FYM @2t/ha + 50%RDF, T4: FYM@1t/ha +25% RDF, T5: VC @1.4t/ha, T6: VC @0.7t/ha+50%RDF, T7: VC @0.35t/ha + 25% RDF) in a randomized block design with three replication of each treatment. Observations on growth parameters (plant height, number of leaves per plant) were recorded before harvest at an interval of 25, 50, 75, 100 and 125 DAS (days after sowing). After harvesting, yield and yield attributes (number of siliqua per plant, length of siliqua (cm), number of grains per siliqua, 1000 seed weight (gm), grain yield (q/ha), stover yield (q/ha), and harvest index (%)) were recorded. The results showed that the application of vermicompost @0.7t/ha + 50% RDF (T6) followed by vermicompost @0.35t/ha + 25% RDF (T7) combinations was better in terms of yield and yield parameters.

Introduction

Oilseeds are one of the eminent crops cultivated all over the world. The nutrient composition of oilseed by-products has integrated the crop as an unavoidable human and animal diet. High contents of amino acids, proteins and the fat yields in oilseeds make it useful for the well being of the humans (Abiodun, 2017). The seeds and oil of the crop is used for making pickles, hair oil and medicines etc. The leaves and the young plants are used as green vegetables and the other portions of the crop such as stems and flowers can be used for fodder purpose. The oil cake is a good source of nutrients to the plants and animals. The area of rapeseed mustard cultivation in India is 49,000 ha with a production of 0.54 lakhs tones and the productivity of 1,102 kg/ha **(**Rai *et al.,* 2016). The excess utilization of inorganic source and production of the crop on minimal land holdings under rainy condition is one of the reasons for less productivity. The inadequate use of inorganic source not only makes the land less nutrient but results in poor yield of rapeseed crop in quality and quantity. To maintain the adequate provision of plant nutrients, it is obligatory to employ natural fertilizers. The use of organic manures supplies primary, secondary and micro nutrients to the soil and in addition it ameliorates the soil robustness (Arbad and Ismail, 2011). As a crop of high nutrition, proteins, fatty acids and amino acids, the crop must be cultivated for higher yield and this can be obtained by the integrated use of nutrients. Integrated implementation of nutrients focus at providing and maintaining the plant nutrient supply from all attainable fount in a consolidated manner, pertinent cropping pattern and farming locale to reach a specified magnitude of crop cultivation (Mahajan and Sharma, 2005; Rao and Reddy, 2010). Management of integrated nutrients can boost the monetary acquiesce of mustard-basedcrop sequences almost to 35 percent than that devoid of farmyard manure management (Gupta *et al.*, 2014). Acknowledging above realities, the present study was conducted to evaluate the effect of integrated nutrient management on productivity of Gobhi sarson (*Brassica naphus* L).

Materials and Methods

The present investigation was carried out at Research Farm, Department of Agriculture, Sant Baba Bhag Singh Uiversity during *Rabi* season 2019-2020.The experimental design was RBD (Randomized block design) with seven different treatments and three replications (7 X 3 =21 plots). The composite soil sample from 0 to 15 and 15 to 30 cm depth of the soil were taken from the experimental field before sowing to determine the native-fertility and texture of experimental field. The results reveal that soil texture was sandy loam having pH (8.1), EC (0.13 dsm^{-1}), OC (0.14%), available nitrogen (442.88 kg ha^{-1}), available phosphorus (9.3 kg ha^{-1}) and available potassium (221.60 kg ha^{-1}). Hayola PAC 401 was the variety used for the experiment. The crop was sown in second fortnight of October. The organic fertilizers were applied one week before the sowing of the crop so that the manures decomposed well in the soil. The application of inorganic fertilizers as basal dose were done at the time of sowing. The other intercultural operations such as bund preparation, thinning, weeding and fertilization were also carried out as per package and practice of PAU (Annonymous 2019). Observations on yield and yield parameters were recorded before or at harvest from five random selected plants from each replication of each treatment. Plant heights, number of leaves per plant were recorded at an interval of 25, 50, 75, 100 and 125 DAS. The yield and yield parameters measured in the form of number of siliqua per plant, length of siliqua (cm), number of grains per siliqua, 1000 seed weight (gm), grain yield (q/ha), stover yield (q/ha), and harvest index (%). Data were analyzed using SPSS (Version16.0 SPSS) statistical software.

Results and Discussion

Growth parameters

Plant growth was determined in the form of plant height (Table 1) and number of leaves per plants (Table 2). Plant height is one of the parameter which indicates the growth of the plant. The plant height measured after 25 DAS showed maximum plant height in the treatment with the application of recommended dose of fertilizers (12.13cm) followed by T7 (10.63cm) (VC @0.35 t/ha + 25% RDF). The measurement which was taken at 50 DAS showed the maximum plant height with the application of recommended dose of fertilizers followed by T7 (VC @0.35 t/ha + 25% RDF) (23.80 cm) and the lowest plant height was found in T6 (VC @ 0.7 t/ha + 50% RDF) (21.03). The plant height which was taken at 75 DAS indicates the maximum result in T2 (FYM @ 4 t/ha) (40.63) followed by T1 (RDF) (38.47). This may be because of the capacity of organic fertilizers to increase the yield. However, the plant height at 100 DAS was best in T7 (VC @0.35 t/ha + 25% RDF) (52.00) followed by T6 (VC @ 0.7 t/ha + 50% RDF) (46.67). This is because of the potential of vermicompost which was applied at different doses along with recommended fertilizers at different levels (Panwar 2008).The plant height measured at 125 DAS showed maximum result in T6 (76.80) followed by T7 (74.77). The combination of vermicompost and 50% RDF was best at the last measurement of plant growth. The lowest plant height was found with the application of recommended dose of fertilizers.

Table.1 Effect of integrated nutrient management on plant height (cm) in gobhi-sarson

Treatments	Plant height at 25 DAS	Plant height at 50 DAS	Plant height at 75 DAS	Plant height at 100 DAS	Plant height at 125 DAS
T1 (RDF)	$12.13^{a} \pm 1.02$	$24.33^{a} \pm 0.56$	$38.47^{b} \pm 1.37$	$40.63^{d} \pm 0.92$	$64.03^{f} \pm 1.52$
T2 (FYM @4t/ha)	$10.03^{bc} \pm 1.23$	$22.63^{ab} \pm 0.87$	$40.63^{a} \pm 1.38$	$43.93^{bc} \pm 0.96$	$68.87^{d} \pm 1.53$
T3 (FYM @2t/ha + 50%RDF)	$9.30^{c} \pm 0.98$	$21.67^{c} \pm 0.96$	$34.43^{bc} \pm 1.35$	$43.57^{bc} \pm 0.95$	$71.87^{c} \pm 1.54$
T4 (FYM@1t/ha +25% RDF)	$10.20^{bc} \pm 1.1$	$22.57^{ab} \pm 1.10$	$34.23^{bc} \pm 1.41$	$43.63^{bc} \pm 0.99$	$74.90^{b} \pm 1.55$
T5 (VC @1.4t/ha)	$8.87^{d} \pm 0.95$	$21.23^{ab} \pm 1.58$	$34.27^{bc} \pm 1.42$	$42.27^{c} \pm 0.91$	$66.70^{e} \pm 1.61$
T6 (VC @0.7t/ha+50%RDF)	$8.03^{d} \pm 1.2$	$21.03^{c} \pm 1.51$	$34.77^{bc} \pm 1.39$	$46.67^{b} \pm 0.98$	$76.80^{a} \pm 1.59$
T7 (VC @0.35t/ha + 25% RDF)	$10.63^{b} \pm 0.90$	$23.80^{b} \pm 1.59$	$32.93^{c} \pm 1.38$	$52.00^{a} \pm 0.93$	$74.77^{b} \pm 1.58$
Sem	0.40	0.59	0.44	0.86	0.78
CD (0.05)	1.18	1.74	1.32	2.56	2.30

Table.2 Effect of integrated nutrient management on number of leaves/plant in gobhi-sarson

Treatments	Number of leaves at 25 DAS	Number of leaves at 50 DAS	Number of leaves at 75 DAS	Number of leaves at 100 DAS	Number of leaves at 125 DAS
T1 (RDF)	$6.00^{a} \pm 0.52$	$10.00^{a} \pm 0.56$	$9.67^{e} \pm 0.37$	$16.67^{f} \pm 0.92$	$19.67^{f} \pm 0.52$
T2 (FYM @4t/ha)	$5.33^{bc} \pm 0.43$	$7.00^{cd} \pm 0.87$	$11.67^{c} \pm 0.38$	$21.00^{c} \pm 0.96$	$26.00^{b} \pm 0.53$
T3 (FYM @2t/ha + 50%RDF)	$4.33^{e} \pm 0.78$	$8.67^{ab} \pm 0.96$	$10.67^{cd} \pm 0.35$	$18.00^{e} \pm 0.95$	$25.33^{c} \pm 0.56$
T4 (FYM@1t/ha +25% RDF)	$5.00^{c} \pm 0.61$	$7.67^{c} \pm 1.10$	$9.67^{e} \pm 0.41$	$22.67^{b} \pm 0.99$	$22.67^{e} \pm 0.55$
T5 (VC @1.4t/ha)	$4.67^{d} \pm 0.75$	$6.67^{d} \pm 1.58$	$14.00^{a} \pm 0.42$	$16.67^{f} \pm 0.91$	$17.00^{g} \pm 0.61$
T6 (VC @0.7t/ha+50%RDF)	$5.67^{b} \pm 0.72$	$8.67^{ab} \pm 1.51$	$10.33^{cd} \pm 0.39$	$20.00^{d} \pm 0.98$	$27.33^{a} \pm 0.59$
T7 (VC @0.35t/ha + 25% RDF)	$5.33^{bc} \pm 0.78$	$8.00^{b} \pm 1.59$	$12.33^{b} \pm 0.38$	$23.67^{a} \pm 0.93$	$23.00^{d} \pm 0.58$
Sem	0.37	0.57	0.63	1.10	1.80
CD (0.05)	1.09	1.71	1.88	3.26	5.36

Table.3 Effect of integrated nutrient management on yield attributes of gobhi-sarson

Treatments	Number of branches / plant	Number of siliqua / plant	Length of siliqua (cm)	Number of grains / siliqua	1000 Seed weight (g)
T1 (RDF)	$4.00^{d} \pm 0.75$	$87.67^{e} \pm 0.56$	$5.93^{c} \pm 0.38$	$13.67^{d} \pm 0.92$	$4.03^{d} \pm 0.52$
T2 (FYM @4t/ha)	$6.00^{b} \pm 0.43$	$94.33^{cd} \pm 0.87$	$5.47^{c} \pm 0.38$	$18.00^{b} \pm 0.96$	$4.07^{d} \pm 0.53$
T3 (FYM @2t/ha + 50%RDF)	$5.00^{c} \pm 0.78$	$93.33^{d} \pm 0.96$	$5.70^{c} \pm 0.35$	$16.67^{c} \pm 0.95$	$4.30^{bc} \pm 0.62$
T4 (FYM@1t/ha +25% RDF)	$6.00^{b} \pm 0.52$	$110.33^{c} \pm 1.10$	$6.00^{b} \pm 0.39$	$19.00^{ab} \pm 0.93$	$4.33^{bc} \pm 0.72$
T5 (VC @1.4t/ha)	$5.00^{c} \pm 0.78$	$92.67^{de} \pm 1.58$	$6.00^{b} \pm 0.42$	$18.33^{b} \pm 0.91$	$4.23^{c} \pm 0.96$
T6 (VC @0.7t/ha+50%RDF)	$6.33^{a} \pm 0.61$	$114.00^{a} \pm 1.59$	$6.07^{a} \pm 0.37$	$20.33^{a} \pm 0.98$	$4.70^{a} \pm 1.02$
T7 (VC @0.35t/ha + 25% RDF)	$6.33^{a} \pm 0.72$	$111.33^{b} \pm 1.51$	$6.07^{a} \pm 0.41$	$19.67^{ab} \pm 0.99$	$4.40^{b} \pm 1.20$
Sem	0.41	1.87	0.27	0.66	0.09
CD (0.05)	1.20	5.56	0.79	1.95	0.26

Table.4 Effect of integrated nutrient management on yield of gobhi-sarson

Treatments	Grain Yield (q/ha)	Stover Yield (q/ha)	Harvest index (%)
T1 (RDF)	$14.00^{d} \pm 1.02$	$52.50^{g} \pm 0.85$	$21.02^{c} \pm 1.37$
T2 (FYM @4t/ha)	$16.63^{b} \pm 1.23$	$54.13^{f} \pm 0.89$	$21.18^{c} \pm 1.38$
T3 (FYM @2t/ha + 50%RDF)	$15.63^{c} \pm 0.98$	$57.20^{d} \pm 0.96$	$21.47^{c} \pm 1.35$
T4 (FYM@1t/ha +25% RDF)	$15.87^{c} \pm 1.10$	$55.77^{e} \pm 1.10$	$22.13^{b} \pm 1.41$
T5 (VC @1.4t/ha)	$15.53^{c} \pm 0.95$	$60.67^{c} \pm 1.58$	$20.38^{d} \pm 1.42$
T6 (VC @0.7t/ha+50%RDF)	$19.07^{a} \pm 1.20$	$67.27^{a} \pm 1.51$	$23.48^{a} \pm 1.38$
T7 (VC @0.35t/ha + 25% RDF)	$16.67^{b} \pm 0.99$	$62.03^{b} \pm 1.59$	$22.09^{b} \pm 1.39$
Sem	0.58	1.23	0.68
CD (0.05)	1.73	3.66	2.01

The number of leaves measured at 25 DAS were maximum in the plants which were supplied with the application of recommended dose of fertilizers (T1- 6.00) followed by T6 (VC @ 0.7 t/ha + 50% RDF) (5.67). The leaves counted at 50 DAS showed the same pattern in having highest number of leaves. At 75 DAS, the same treatment had the maximum number of leaves (14.00) at 75 DAS followed by T7 (VC @0.35 t/ha + 25% RDF) (12.33).When seeing the number of leaves at 100 days after sowing, the maximum number of leaves was found in T7 (23.67) followed by T4 (22.67). The number of leaves at 125 DAS the maximum was found in T6 (27.33) and the lowest was found in T5 (17.00). The maximum number of branches were found at par in T6 (VC @ 0.7 t/ha + 50 % RDF) and T7 (VC @ 0.35 t/ha + 25 % RDF) (6.33) followed by T4 (FYM @ 1 t/ha + 25% RDF) and T2 (FYM @4 t/ha) (6.00) which was also at par. This shows the ability of vermicompost to provide long term effect and to act on the growth of the plant when it is compared with 25% and 50% of recommended dose of fertilizers. This result is supported by (Singh and Totawat 2002). The lowest number of branches was found in T1 (Recommended dose of fertilizers) (4.00).

Yield attributes

Yield attributes which is directly related to the yield is found. The number of siliqua per plant counted before harvesting shows that the maximum number of siliqua was obtained from T6 (VC @ 0.7 t/ha + 50 % RDF) (114.00) followed by T7 (VC @ 0.35 t/ha + 25 % RDF) (111.33) which was then followed by T4 (FYM @ 1 t/ha + 25% RDF) (110.33). This may be because the FYM and VC may increase the microbial content and hence the treatment performed better. This result is supported by (Jaga and Tripathi 2011).The length of siliqua was measured before the harvesting. The maximum length was found at par in T6 (VC @ 0.7 t/ha + 50 % RDF) and T7 (VC @ 0.35 t/ha + 25 % RDF) (6.07) which was followed by T4 (FYM @ 1 t/ha + 25% RDF) and T5 (VC @ 1.4 t/ha) (6.00) at par. The lowest length of siliqua was found in T2 (FYM @ 4 t/ha) (5.47). The highest length of siliqua may be because of the application of vermicompost. The result was supported by (Kansotia *et al.,* 2013) (Table 3).

The number of grains per siliqua was counted after harvesting and found that the maximum number of grains was with the application of VC @ 0.7 t/ha + 50 % RDF (20.33) followed by the treatment with the application of VC @ 0.35 t/ha + 25% RDF (19.67) and then followed by T4 (FYM @ 1 t/ha + 25% RDF) (19.00). The treatment with the lowest number of grains was T1 (RDF) (13.67). (De and Sinha 2012) supports the result. The weight of 1000 seeds was taken after the harvest. The maximum weight was found with the application of VC @ 0.7 t/ha + 50 % RDF (4.70) followed by VC @ 0.35 t/ha + 25% RDF (4.40).

The minimum weight of seeds was found with the application of T1 (RDF) (4.03) but there was not much change in the 1000 gram weight of the seeds in between the treatments. This may be because of the organic fertilizers along with the inorganic source increased the 1000 seed weight significantly (Das *et al.,* 2010) support this result.

Yield

The grain yield obtained indicates that the maximum yield was found with the application of VC @ 0.7 t/ha + 50 % RDF (19.07) followed by the application of VC @ 0.35 t/ha + 25 % RDF (16.67) which was followed by T2 (FYM @ 4 t/ha) (16.63) and was not significantly affected each other. This result may be because of the integrated use of organic and inorganic source of nutrients (Kumpawat 2004). The grain yield was less in the treatment with applied with recommended dose of fertilizers (14.00). The stover yield is mainly calculated to find the biological yield. The stover yield found that the maximum stover yield was with the application of of VC @ 0.7 t/ha + 50 % RDF (67.27) followed by the application of VC @ 0.35 t/ha + 25 % RDF (62.03). The lowest stover yield was found with the application of recommended dose of fertilizers (52.50). (Das *et al.,* 2010) supports his result by proving the effect of both organic and inorganic source of nutrients on the yield and yield attributes of the crop. Harvest index was calculated after finding the biological yield and economical yield of the crop. Harvest index was high in T2 (FYM @ 4 t/ha) (23.48) followed by T7 (VC @ 0.35 t/ha + 25% RDF) (21.18). The lowest harvest index was found with the application of T1 (RDF) (21.02). Still, there was no larger change in harvest index in between the treatments (Shekhawat *et al.,* 2012) supports this result (Table 4).

In conclusion there were only small changes in the length of the siliqua of the different treatments applied. The maximum was found with the application of the combination of vermicompost and 50% RDF. Number of grains per siliqua was significantly affected by the combination of vermicompost and RDF in different doses. The same was seen in the case of 1000 seed weight too. The grain yield and the stover yield were also significantly influenced by the combination of vermicompost and RDF. There was a difference of 14 quintals in the grain yield of the treatments were recommended dose of fertilizers used when compared to VC @0.7 t/ha + 50% RDF used. If any combination can increase the yield in the same field when different combination of treatments used should be used for future. This is because the population is increasing day by day but not the land area. So, if the yield can be increased within the small area, which should be practiced.

From the above results, it may be concluded that the application of vermicompost and RDF combinations was better in terms of yield and yield parameters. This combination is also good when coming to the environmental pollution from the use of chemical fertilizers alone. For the better yield, and for controlling environmental pollution to an extent, this combination could be used.

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