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Integrated nutrient management studies in brown sarson (*Brassica rapa* L.) under temperate conditions of Kashmir valley

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Abstract
Brown sarson (*Brassica rapa* L.) is the most predominant species among the oilseeds cultivated in Kashmir valley as it fits well in rice based cropping system due to its early maturity. Field experiment was conducted during *rabi* 2013-14 and 2014-15 to evaluate the impact of integrating organic and inorganic nutrients on growth and seed yield of brown sarson at Mountain Research Centre For Field Crops, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Khudwani on silty clay loam soil neutral in reaction and with medium fertility. Eight treatments (T_1 Control, T_2 Recommended fertilizer dose (RFD), T_3 RFD + 20 kg S, T_4 RFD + 10 t FYM, T_5 RFD + 2 t Vermicompost, T_6 RFD + 4 t Vermicompost T_7 RFD + 20 kg S + 1.0 kg Boron and T_8 RFD + 20 kg S + 1.0 kg Boron + 2 t Vermicompost) were tested in a randomised block design with four replications. The results indicated that RFD + 20 kg S + 1.0 kg Boron + 2 t Vermicompost recorded highest seed yield (12.33 q ha^{-1}) followed by RFD + 20 kg S+ 1.0 kg boron and the yield superiority exhibited by integrating 2 tonnes vermicompost, one kg boron and 20 kg sulphur with RFD was 66.84 % and 27.11 % over control and RFD, respectively.

Keywords: INM, brown sarson, sulphur, boron, vermicompost, seed yield, siliquae

Introduction
Oilseeds play a vital role in the national economy, accounting for 5% gross national product and 10% of the total value of agricultural product. Rapeseed-mustard is the third important oilseed crop in the world after soybean and palm oil. Among the seven edible oilseed cultivated in India, rapeseed-mustard (*Brassica spp*.) contributes 28.6% in the total production of oilseeds. Brown sarson (*Brassica rapa* L.) is the most predominant species among the oilseeds cultivated in Kashmir valley as it fits well in rice based cropping system due to its early maturity. In Jammu and Kashmir oil seeds are cultivated on about 54.522 thousand hectares of land area with a production of 326 thousand quintals (Digest of statics J & K 2016) [4]. The productivity of this crop is very low due to which the requirement of edible oil is met by importing it from other states like Punjab and Haryana. Lower productivity of brown sarson is attributed to several factors which include poor management and nutritional imbalance. Further the continuous and indiscriminate use of chemical fertilizers deteriorates the soil health owing to deterioration of soil physical and biological qualities, besides creating the micro nutrient imbalance. On the other hand, continuous use of organics helps to build up soil humus and beneficial microbes besides improving the soil physical properties. In this context balanced nutrition is necessary which means application of all the deficient plant nutrients in sufficient amounts, in appropriate forms and ratios, is necessary to derive maximum benefit from applied nutrients (Roul *et al.*, 2006) [9] Therefore, a substitution and supplementation of major nutrients with a considerable proportion from organic manures for sustaining higher yield, is of urgent necessity (De *et al.*, 2009) [3]. Integrated nutrient management helps to maintain the soil fertility and improve plant nutrient supply at an optimum level for sustaining the desired productivity through optimization of benefits from all possible sources. Keeping the beneficial effects of integrated nutrient management in view present investigation was conducted to study the influence of various integrated nutrient management practices on growth and seed yield of brown sarson.

Materials and Methods
The field experiment was conducted at Mountain Research Centre For Field Crops, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Khudwani during *rabi* 2013-14 and 2014-15 to study the effect of integrating organic and inorganic nutrients on growth and seed yield of brown sarson.

The composite soil samples drawn at the depth of 0-15 cm before the start of experiment were subjected to mechanical and chemical analysis which revealed that soil was silty clay loam in texture, low in available nitrogen and medium in available phosphorus and available potassium with high organic carbon and neutral p^H (Table 1.) The experiment consisted of eight treatments T_1 Control, T_2 RFD, T_3 RFD + 20 kg S, T_4 RFD + 10 t FYM, T_5 RFD + 2 t Vermicompost, T_6 RFD + 4 t Vermicompost, T_7 RFD + 20 kg S+ 1.0 kg Boron and T_8, RFD + 20 kg S + 1.0 kg Boron + 2 t Vermicompost. Treatments were replicated four times in a randomised block design. Entire dose of phosphorous, potassium, sulphur and boron along with half of nitrogen as per treatments was applied as basal at the time of sowing. Remaining half of nitrogen was top dressed in two equal splits at flower and siliqua initiation stages. Brown sarson variety "Gulchin" was sown in the 1st week of October during both the years using a seed rate of 8 kg ha^{-1} with the row spacing of 30 cm. All other operations were carried out as per recommended package of practices. Observations *viz*; plant height (cm), primary and secondary branches were recorded from five randomly selected plants from each plot in penultimate row before harvest. yield attributes such as silquae $plant^{-1}$, seeds $siliqua^{-1}$ were recorded at harvest to assess the contribution towards yield. Total silquae of 5 randomly selected plants were counted and expressed as number of silquae $plant^{-1}$. The seeds per silquae were average of 10 random silquae from 5 plants. 1000 seeds were counted from the lot, weighed and expressed as 1000-seed weight. Seed and Stover yield were computed from the net plot and then converted to q ha^{-1}. The crop was harvested during 3rd week of May, during both the seasons of experimentation.

Table 1: Physico-chemical properties of soil of experiment field before start of experiment.

Parameter	Rating	Method employed
Mechanical characters		
Texture	Silty clay loam	International pipette method (Piper, 1966)
Chemical characters		
pH	7.1	1:2:5 Soil water suspension with Beckman's glass electrode pH meter (Jackson, 1967)
Electronic conductivity (dsm^{-1})		Solubridge conductivity meter (Piper, 1950)
Organic carbon (%)	0.89	Walkley and Black rapid titration Method (Jackson,1967)
Available nitrogen (kg ha^{-1})	203.7	Alkaline potassium permanganate method (Subbiah and Asija, 1956)
Available phosphorus (kg ha^{-1})	19.6	Extraction with 0.5 M NaHco3(Olsen *et al*., 1956)
Available potassium (kg ha^{-1})	235.6	Extraction with neutral normal ammonium acetate (Jackson,1967)

Results and Discussions

Growth attributes

Growth parameters were significantly influenced by the nutrient management practices**.** Highest plant height, primary and secondary branches per plant were recorded with plants receiving 2 t Vermicompost, 20 kg Sulphur, 1 kg Boron ha^{-1} in addition to RFD (Table 2). Maximum plant height of 105.80 cm was recorded with T_7 (RFD +20Kg S +1 Kg Boron +2 t V.C.) which was at par with- T_6 (RFD +20KgS +1 Kg Boron) and T_5 (RFD+ V.C. 4 t ha^{-1}) but was significantly superior to other treatments. Application of 4 tonnes vermicompost ha^{-1} in addition to RFD resulted in 9.07 and 53.25 % increase in total number of branches as compared to RFD and control, respectively. Higher plant height might be on account of readily available plant nutrients and growth enhancing substances from application of vermicompost. More number of primary and secondary branches in INM treatment can be attributed to favourable effect of INM in supplying the essential nutrients in balanced ratio and improving physico-chemical properties of soil thus helping in better nutrition and utilization by plant that resulted in achieving higher values of growth parameters. Further the higher availability of nutrients might have resulted in the increased meristematic activity leading to increased number of primary and secondary branches 5.68 and 5.24 respectively. Increase in number of branches with the use of organics has been reported by Singh and Sinsinwar, 2006 and Shekhawat *et al*. 2012 [11, 10].

Yield attributes and yield

Yield attributes and yield depicted significant improvement with integrated nutrient management treatments. The data pooled for the two seasons (2013-14 and 2014-15) revealed that plots which received organics FYM or Vermicompost (VC) along with sulphur and boron proved significantly superior to other treatments with respect to yield attributing characters (Table 2). Probably due to enhancement in vegetative growth considered as pre- requisite to optimum yield in terms of branches $plant^{-1}$ ultimately resulting in higher values of yield attributes. Highest number of siliquae $plant^{-1}$ (156) and seeds $siliqua^{-1}$ (11.6) were recorded with T_7 (RFD +20Kg S +1 Kg Boron + 2 t V.C.), thereby exhibiting a superiority of 39 and 26 per cent over control respectively. The higher values of yield attributes is the result of higher nutrient availability resulting in better growth and more translocation of photosynthates from source to sink (Tripathi *et al.*, 2010) [13]. Integrated nutrient management brought significant enhancement in seed yield over control and RFD. Higher seed yield of 12.33 q ha^{-1} was obtained with the integrated use of 2 t VC, 20 kg S, 1 kg B along with RFD which was significantly higher than control and RFD (Table 2). This may be ascribed to increased photosynthetic rate, stimulating better reproductive growth and overall improvement in crop growth owing to combined use of organics with balanced inorganic fertilizers resulting in yield advantage of 56.8 and 27.1 per cent in the treatment over control and RFD respectively. Bhat *et al* (2007) [2] have also reported beneficial effects of sulphur and boron along with NPK on yield and yield attributes of rapeseed. Application of 2 tonnes vermicompost ha^{-1} in combination with RFD increased the seed yield by 1.13 q (11.64%) over RFD, this might be on account of readily available plant nutrients, growth enhancing substances and number of beneficial organisms like phosphorus and cellulose decomposing organisms (Bark and Gulati, 2009) [1]. The Stover yield also exhibited a similar trend.

From the preceding discussion it is concluded that productivity of brown sarson under Kashmir valley conditions can be improved by integrating organic sources of nutrients like Vermicompost with inorganic NPK, Sulphur and Boron.

Table 2: Yield and yield attributes of brown sarson (*Brassica rapa* L.) as influenced integrated nutrient management practices (pooled 2013-14 and 2014-15).

Treatment	Plant height (cm)	Branches plant^{-1}		Siliquae plant^{-1}	Seeds siliqua^{-1}	1000-seed weight (g)	Seed yield (q ha^{-1})	Stover yield (q ha^{-1})
		Primary	Secondary					
Recommended Fertilizer Dose (RFD 60:30:20 N: P_2O_5: K_2O kg ha^{-1})	90.22	5.12	4.80	138	9.6	3.68	9.70	21.24
RFD + 20 kg Sulphur ha^{-1}	94.84	5.28	4.88	140	9.8	3.80	10.06	24.20
RFD +10 t FYM ha^{-1}	94.30	5.26	5.02	144	10.2	3.71	10.65	24.18
RFD + Vermicompost (VC) 2 t ha^{-1}	98.42	5.42	5.14	148	10.6	3.72	10.83	25.12
RFD + Vermicompost(VC) 4 t ha^{-1}	101.42	5.60	5.22	150	10.9	3.72	10.97	25.44
RFD + 20 kg Sulphur + 1.0 kg Boron	102.35	5.62	5.16	154	11.2	3.84	11.20	26.38
RFD + 20 kg Sulphur + 1.0 kg Boron +2 t V.C.	105.80	5.68	5.24	156	11.6	3.92	12.33	26.49
Control	85.52	3.28	3.78	112	9.2	3.62	7.39	15.64
C D (p=0.05)	5.76	0.26	0.32	7.0	0.6	0.17	2.20	2.31

References

1. Bark T, Gulati JML. Use of vermicompost in field crops and cropping systems. Agricultural reviews. 2009; 30:48-50.
2. Bhat A, Singh R, Kohli A. Effect of integrated use of farmyard manure and fertilizer nitrogen with and without sulphur on yield and quality of Indian mustard (*Brassica juncea* L.). Journal of Indian Society of Soil Science. 2007; 55:224-224.
3. De B, Sinha AC, Patra PS. Effect of organic and inorganic sources of nutrients on rapeseed (*Brasssica campestris* L.) under terai region. J Crop Weed. 2009; 5:281-84.
4. Digest of statistics. Department of Planning, Economics and Statistics, Government of Jammu and Kashmir, Srinagar. 2016; 41(17):148-54.
5. Jackson ML. Soil Chemical Analysis. Prentice Hall Inc., England, Cliffs, N. J, 1967.
6. Olsen SR, Cole CV, Watanabe FS, Dean LA. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. United States Department of Agricultural Circular. 1956; 939:19.
7. Piper GS. Soil and Plant Analysis. Hans Publishers, Bombay, 1966.
8. Piper GS. *Soil and Plant Analysis*. Academic Press, New York, 1950, 4(a).
9. Roul PK, Sarawgl SK, Shrivastava GS, Deepak K. Effect integrated nutrient mangement techniques on productivity, nitrogen productivity, N- use efficiency, economics and energetic of rice (*Oryza sativa*)- Indian Mustard (*Brassica juncea*) sequence. Indian Journal of Agronomy. 2006; 51:170-173.
10. Shekhawat K, Rathore SS, Premi OP, Kandpal BK, Chauhan JS. Advances in Agronomic Management of Indian Mustard (*Brassica juncea* L. Czernj. Cosson): An Overview. International Journal of Agronomy. 2012, 1-14.
11. Singh Raju, Sinsinwar BS. Effect of integrated nutrient management on growth, yield, oil content and nutrient uptake of Indian mustard (*Brassica juncea*) in eastern part of Rajasthan. Indian Journal of Agricultural Sciences. 2006; 76(5):322-24.
12. Subbiah BV, Asija CL. A rapid procedure for estimation of available nitrogen in soils. Current Science. 1956; 251:238-268.
13. Tripathi MK, Chaturvadi S, Shukla DK, Mahapata BS. Yield performance and quality in Indian mustard (*Brassica juncea*) as integrated nutrient management. Indian Journal of Agronomy. 2010; 55(2):138-42.