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Response of inorganic fertilizers and FYM on yield attributes of yellow mustard (*Brassica campestris* L.) cv

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Abstract
A study was conducted in Soil Science Research Farm, Sam Higginbottom Institute of Agriculture Technology& Sciences Deemed-to-be-University. During Rabi season 2014-15 on the response of inorganic fertilizers and FYM on Yield attributes of Yellow Mustard. The result revealed that higher seed yield ha^{-1}(21.90 q ha^{-1}) was obtained in T_8 [N 80kg + P 60kg + K40kg & S40kg and FYM 10t ha^{-1}] and at par with and least was recorded in case of control T_0. Due to higher values of yield attributing characters viz. number of siliqua $plant^{-1}$ (127.00), number of seeds $siliqua^{-1}$ (40.33), 1000 seed weight(3.95g) there character was also recorded maximum at 100% N P K and S and 100% FYM and control were recorded very low number of siliqua $plant^{-1}$, number of seeds $siliqua^{-1}$,1000 seed weight. Therefore, it can be revealed that application of 100% N P K and S, and 100% FYM should be used for improvement of yield of yellow mustard during rabi season for better yield.

Keywords: Seed yield, FYM 100%, nitrogen, phosphorus, potassium, sulphur 100%, by different treatments

Introduction
Rapeseed (*Brassica campestris* L.) vegetable oils are preferred over the solid animal fats because of health benefits extraction of seed oil is high, with average oil content of 42% and a protein content of approximately 21% rapeseed has the lowest saturated fat content of any vegetative oil. (Declercq and Daun, 1999) [4]. The global production of rapeseed-mustard was 62.45mt and 33.64 mha with a total productivity of 18.556 q ha^{-1}(FAO STAT, 2011) [5].
The total area in India under rapeseed-mustard crop is 64.54 lakh hectares and total production is 72.82 lakh tonnes during 2013–14 (Anonymous, 2015) [1]. Rapeseed-mustard is mainly grown in North-West parts of India. Rajasthan and Uttar Pradesh are the major producing states in the country. The production from Rajasthan is highly monsoon dependent. In Uttar Pradesh, rapeseed-mustard crop occupies an area of 10.26 lakh hectares and production of 11.29 tonnes (Anonymous, 2015) [1]. Nearly 76% oilseeds area is rainfed which is often subjected to erratic monsoon. Nitrogen is the most important nutrient, which determines the growth of the mustard crop and increases the amount of protein and the yield. Phosphorus and potash are known to be efficiently utilized in the presence of nitrogen. It promotes flowering, setting of siliqua and in increase the size of siliqua and yield (Bharose *et al*., 2011) [3]. Phosphorus is generally deficient in majority of our Indian soils and need much attention for maintenance of soil fertility Phosphorus plays a vital role in photosynthesis, respiration, cell conclusion cell enlargement and several other processes in living plants.
Rapeseed is an important oil seed crop of arid and semi-arid region. Potassium is required for improving the yield and quality of different crops because of its effect on photosynthesis, water use efficiency and plant tolerance to diseases, drought and cold as well for making the balance between protein and carbohydrates (Singh *et al.,* 2012).Sulphur is also an important nutrient and plays an important role in physiological functions like synthesis of cystein, methionine, chlorophyll and oil content of oil seed crops. FYM is one of the oldest methods of manure used by the farmer for growing crops, because of its early availability and presence of almost all the nutrient required by plant. (Katyayan, 2010) [8].

Materials and Methods
Field experiment was conducted on the soil science research field of SHIATS-DU-Allahabad (U.P) during Rabi season of 2014-15. The treatment combinations are summarized in Table 1. Yellow mustard (*Brassica campestris* L.) Cv. Ulhas MYSL 203 was tested for three levels of N 80kg + P 60kg + K 40kg & S 40kg and FYM 10t ha^{-1}. The field was prepared by ploughing with a tractor-drawn disc plough two times followed by cross harrowing and planking.

Seeds were line sown at a depth of 2.5 to 3.0 cm with the spacing of 30 cm between the rows and 15 cm between the plants. One light irrigation was given 30DAS by flood method and 60DAS, fertilizers used NPK & S as Urea, SSP, MOP & gypsum. The fertilizers were applied N @80 kg ha^{-1}, P @ 60 kg ha^{-1} P_2O_5, 40 kg ha^{-1} K_2O and 40 kg S ha^{-1}. Half dose of Nitrogen and total doses of phosphorus, potash and sulphur were applied as basal dressing before sowing and mixed in soil. The rest of the nitrogen was applied as top dressing at @ 40 DAS. Intercultural operations like thinning of plants was done at 25 DAS, hand weeding was done manually, the crop was harvested plot wise at maturity stage when the siliqua turned yellow, 110 days after sowing. Harvesting was done manually with the sickles followed as per normal agronomic practices and post harvesting observation recorded, plat height taken in (cm) 30, 60 and 90DAS, for observation three plants were randomly selected from each plot and tagged. Total numbers of branches (plant^{-1}) of all the three tagged plants were recorded at 60 and 90 DAS and average numbers of branches were calculated. Total numbers of leaves (plant^{-1}) of all the three tagged plants were recorded at 30, 60 and 90DAS and average number of leaves was calculated. For calculating no of siliqua plant^{-1}, pods of tagged plants were picked separately and then counted. For calculating no of seeds siliqua^{-1}, some pods were randomly selected and then their seeds were counted. For seed yield (q ha^{-1}) the crop plants from each plot were harvested and were put for the sun drying. After the pods and plants are properly dried, threshing was done manually (by beating) and seed obtained were weighted on single pan physical balance. One thousand seeds were randomly collected from the seed of each plot and their weight was recorded in gram. Oil content (%) in seeds was estimated through 'Soxhlet' apparatus using diethyl eather as organic solvent (40-60 ^{0}C) as per the methodology of Perry and Green, 1984. The experiment was laid out in 2x2 m 3^2 factorial R.B.D with nine treatments and three replications. The seed yield was recorded at harvest for all the treatmentsand at harvest of crops for textural classes, pH, EC as per standard laboratory methods.

Soil sampling and analysis

Soil samples from each plot at 0-15cm depth were collected at different stages were air- dried, grind and passed through 2mm sieve and finally stored in polythene bags for analysis of different physico-chemical parameters and changes in available NPK and S content. The soil sample was analyzed for Bulk density (g cm^{-3}), Particle density (g cm^{-3}), % Pore space, pH (1:2) w/v, EC (dsm^{-1}), % Organic carbon, Available N P K and S.

Table 1: Response of inorganic fertilizers and FYM on yield attributes of yellow mustard (*Brassica campestris* L.) cv. Particulars of the treatments

Treatments	Levels of N P Kand S (kgha^{-1})	Symbol used
Levels of N P K & S	@ 0% N P K & S	L_0
	@ 50% N P K & S	L_1
	@100% N P K & S	L_2
Levels of FYM	@ 0% FYM	F_0
	@ 50% FYM	F_1
	@ 100% FYM	F_2

Table 2: Response of inorganic fertilizers and FYM on yield attributes of Yellow mustard (*Brassica campestris* L.) cv. Ulhas.

Treatment combination	No. of siliquaplant^{-1}	No. of seed siliqua^{-1}	1000seed weight(g)	Seed Yield (q ha^{-1})
T_0=L_0F_0	116.00	31.33	2.62	10.00
T_1=L_0F_1	119.33	31.67	2.89	12.50
T_2=L_0F_2	120.67	32.33	2.90	13.30
T_3=L_1F_0	121.00	32.67	3.10	13.90
T_4=L_1F_1	122.67	35.33	3.15	15.60
T_5=L_1 F_2	123.33	36.00	3.54	16.00
T_6=L_2 F_0	122.33	36.67	3.80	16.10
T_7=L_2F_1	126.00	38.00	3.92	17.90
T_8=L_2F_2	127.00	40.33	9.95	21.90
Mean	122.03	34.92	3.31	15.24
F- test	S	S	S	S
S. Em (±)	0.360	0.567	0.086	101
C. D. at 5%	0.763	1.201	0.182	0.305

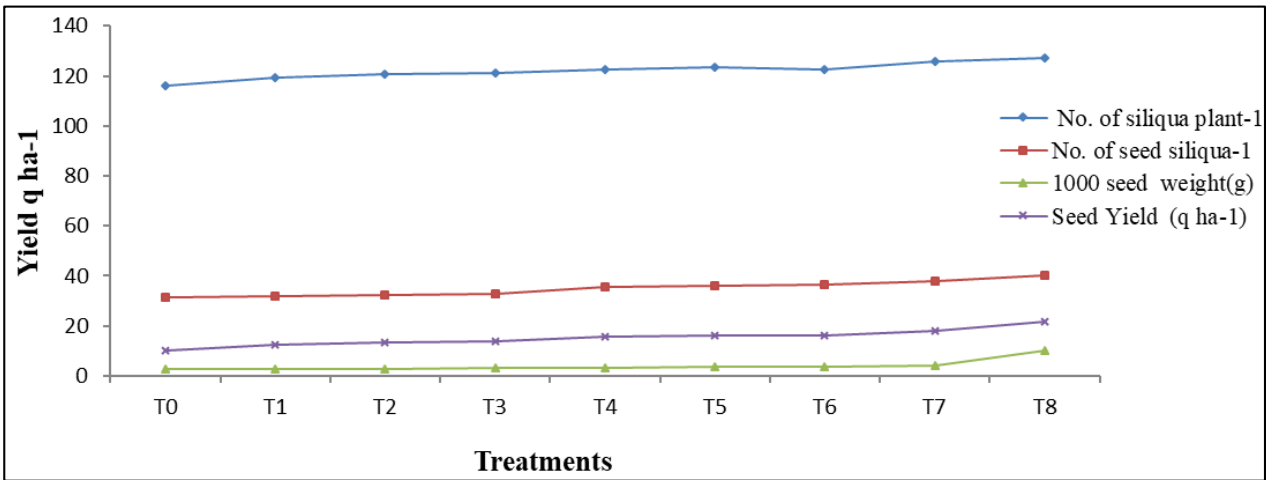

Fig 1: Response of inorganic fertilizers and FYM on yield attributes of yellow mustard (*Brassica campestris* L.) cv. Ulhas.

Results and Discussions

The yield attributing characters in above mentioned Table 2 and Fig 1shows highest number of siliqua plant^{-1} (127) in treatment $_2F_2T_8$-@100% NPK & S + 100% FYM on par with L_2F_1 treatmentT_7 -@100% NPK & S + 50% FYM (126) and control was recorded low (116). Other treatment viz, L_0F_1 treatment T_1 -@0% NPK & S + 50% FYM (119.33), L_0F_2 treatment T_2-@0% NPK & S + 100% FYM (120.67), L_1F_0 treatment T_3 -@50% NPK & S + 0% FYM (121), L_1F_0 treatment T_4 -@50% NPK & S + 50% FYM (122.67), L_1F_2 treatment T_5 -@50% NPK & S + 100% FYM (123.33), L_2F_0 treatment T_6 -@100% NPK & S + 0% FYM (122.33) were also found superior over control. Number of seedssiliqua^{-1}, test weight g1000 seeds^{-1} affected significantly due to different levels. @100% NPK & S + 100% FYM recorded higher number of siliqua plant^{-1}, similar results were also found Singh P *et al*. (2009) [10], Arunima *et al.* (2014) [2]. Numbers of seeds siliqua^{-1} similar result were also found Singh P *et al.* (2009) [13], Sinha *et al*. (2012) [12]. Test weight g1000 seeds^{-1}similar result were also found Kachroo and Kumar (1999) [10], Tripathi *et al.* (2011) [13]. However the control produced the lowest in all the cases. More seed weight plant^{-1} might be due to more number of siliqua plant^{-1}, Number of seedssiliqua^{-1} and higher in Test weight g1000seeds^{-1}. The higher value of yield attribute is the result of higher nutrient levels resulted in to better growth and more translocation of photosynthates from source to sink as reported in experiment. The values is due to the application of FYM and NPK & S together it helps in the boosting the crop and it also recorded highest yield in treatment T_8- L_2F_2 @100% NPK & S + 100% FYM and yield is (21.90 q ha^{-1}), similar result were also found, Khurana *et al*. (1995) [6] and Mishra (2000) [9].

Conclusion

It was concluded from trial that the various levels of integrated nutrients used from different sources in the experiment, the treatmentT_8-L_2 F_2.**[**@ 100%NPK&S+@100% FYM] was found to be the best in increasing the number of siliqua plant^{-1} (127.0). The number of seed siliqua^{-1} (40.33). Test weight of seeds g1000^{-1} (3.95), Seed yield (21.90 q ha^{-1}) were found to be at par than any other treatment combinations. Since the result is based on one-year experimental data. Further research may be initiated for the establishment of the above findings.

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