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Response of inorganic fertilizers and FYM on physico chemical properties of soil of yellow mustard (*Brassica campestris* L.) cv. Ulhas

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Abstract
A study was conducted on the "Response of inorganic fertilizers and FYM on physico-chemical properties of soil of yellow mustard (*Brassica campestris* L.) cv. Ulhas", at soil science research farm, Sam Higginbottom University of Agriculture, Technology and Sciences Allahabad. During rabi season of 2014-15. Soil pH (1:2.5), EC (dS m^{-1}) and bulk density (g cm^{-3}) decreased with increase in fertilizer levels. The lowest values related to all parameters were obtained in control treatment. Soil chemical properties, growth parameters, yield and oil content decreased in absolute control. Results revealed that all significant findings in treatment T_8 - [*i.e.* N @ 80 kg ha^{-1} + P @ 60 kg ha^{-1} + K @ 40 kg ha^{-1} & S @ 40 kg ha^{-1} and FYM 10 t ha^{-1}]

Keywords: N, P, K, S, FYM, soil properties, yellow mustard.

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) [10]. The global production of rapeseed-mustard was 62.45mt an 33.64 mha with a total productivity of 18.556 q ha^{-1}(FAO STAT, 2011) [11].
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) [2]. 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) [2]. 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) [6]. 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) [20]. 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) [13].

Materials and methods
Field experiment was conducted on the Soil Science research field of SHUATS, 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 10 t ha^{-1}. Irrigation scheduling, fertilizers application and intercultural operation are followed as per normal agronomic practices. The experiment was laid out in 2x2 m 3^2 factorial R.B.D with a nine treatments and three replications. Seed yield was recorded at harvest for all the treatments and 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 N,P,K and S content. The soil sample was analysed for Bulk density (g cm^{-3}), Particle density (g cm^{-3}), % Pore space, pH (1:2), 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. Ulhas particulars of the treatments

Treatments	Levels of N P K and S (kg ha^{-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 post harvest properties of soil.

Treatment combination	BD (gcm^{-3})	PD (gcm^{-3})	Pore space (%)	pH (1:2)	EC (dSm^{-1})	Organic carbon (%)	N (Kg ha^{-1})	P (Kgha^{-1})	K (Kg ha^{-1})	S (Kgha^{1})
T_0=L_0F_0	1.27	2.65	39.76	6.92	0.17	0.70	224.33	16.47	224.50	10.38
T_1=L_0F_1	1.25	2.76	42.70	6.57	0.18	0.47	255.53	17.60	232.00	10.72
T_2=L_0F_2	1.20	2.65	40.83	6.69	0.18	0.62	266.17	17.80	238.53	10.42
T_3=L_1F_0	1.17	2.55	39.36	6.90	0.18	0.74	269.17	18.27	228.90	11.87
T_4=L_1F_1	1.30	2.45	42.80	6.85	0.18	0.76	270.20	19.67	241.77	11.57
T_5=L_1F_2	1.19	2.55	41.20	6.80	0.19	0.73	272.93	19.73	255.13	12.27
T_6=L_2F_0	1.22	2.62	42.20	6.95	0.20	0.70	273.93	20.40	264.13	13.23
T_7=L_2F_1	1.30	2.63	40.20	6.87	0.18	0.79	276.17	21.67	269.97	13.97
T_8=L_2F_2	1.22	2.75	39.70	6.81	0.20	0.67	277.63	22.27	270.50	14.31
Mean	1.23	2.62	40.97	6.81	0.18	0.68	265.11	19.32	247.27	12.08
F- test	S	**S**	**S**	NS	NS	NS	S	NS	S	NS
S. Em (±)	0.011	0.018	0.360	0.305	0.014	0.168	6.395	0.984	1.003	0.284
C. D. at 5%	0.023	0.038	0.763	0.647	0.031	0.357	13.558	2.087	2.126	0.603

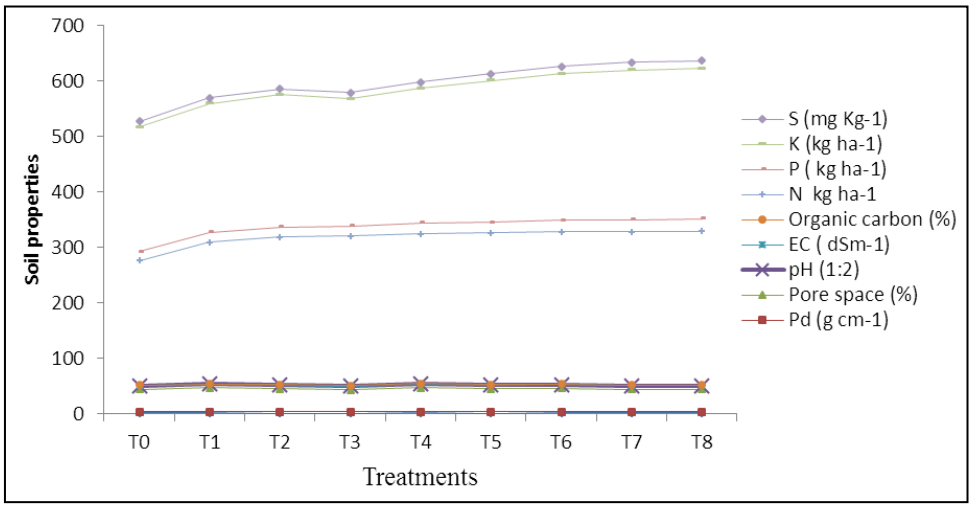

Fig 2: Response of inorganic fertilizers and FYM on post harvest properties of soil.

Results and discussion

In table 2 Soil bulk density after crop harvest was significant. The minimum bulk density of post harvest soil was 1.17gcm^{-3} in treatment T_3. @50% NPK & S + @ 0% FYM. Maximum bulk density of post harvest soil was 1.30 gcm^{-3} in treatment T_7 -@ 100% NPK & S + @ 50 % FYM. was greater than all other treatment combinations. Similar findings were recorded by Bhattachrya *et al.* (2004) and Nikam *et al*. (2006) [17]. Soil particle density after crop harvest was significant. The maximum particle density of post harvest soil was found in treatment 2.76 gcm^{-3} in treatment T_1. @ 0 % NPK & S + @ 50% FYM. The minimum particle density of post harvest soil was 2.45 gcm^{-3} in treatment T_4 @ 50% NPK & S + @ 50% FYM. was greater than all other treatment combinations. Similar findings were recorded by (**Bhattachrya *et al.* 2004).** Soil pore space (%) after crop harvest was significant. The minimum % pore space of post harvest soil was 39.36 in treatment T_3. @50% NPK & S + @ 0% FYM. The maximum % pore space of post harvest soil was 42.80 in treatment T_4 @ 50% NPK & S + @ 50% FYM. which was greater than all other treatment combinations. Similar findings were recorded by Nikam *et al*. (2006) [17]. The minimum pH of post harvest soil was 6.57 found in treatment T_1. @ 0 % NPK & S + @ 50% FYM. The maximum pH of post harvest soil was 6.95 found in the T_6 @ 100 NPK & S + @ 0 % FYM which was greater than all other treatment combinations. The interaction between N P K, & S and FYM the soil pH after crop harvest was significant. Similar findings were recorded by Bhattachrya *et al.* (2004) and Khanday *et al.* (2012) [14] The minimum EC of post harvest soil was 0.17 in T_0. *i e*.control. The maximum EC of post harvest soil was 0.20 in T_8 @100% NPK & S+ @100% FYM which was greater than all other treatment combinations. Similar findings were recorded by Bhattachrya *et al*. (2004) and Verma *et al.*(2012) The minimum organic carbon (%)of post harvest soil was 0.47 in T_1. @ 0 % NPK & S + @ 50% FYM. The maximum organic

carbon (%) of post harvest soil was 0.79 in T_7 -@ 100% NPK & S + @ 50 % FYM. which was greater than all other treatment combinations. Similar findings were recorded by Agarkar *et al.* (2012) [1] The maximum available nitrogen 277.63 kg ha^{-1}, available phosphorus 22.27 kg ha^{-1}, available potassium 270.50 kg ha^{-1}, available sulphur 14.31 mg kg^{-1} was found in treatment L_2F_2 T_8-@100% NPK & S + 100% FYM showed significant and non significant difference and was greater than all other treatment combinations. Similar findings were recorded by Banerjee *et al.* 2011 [4], Mishra (2000) [16], Das *et al.* (2010), Bharose *et al. (*2011) [6], Bansal *et al.* (2000) [5] and Parmar *et al.* (2011) [18].

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 the physical and chemical properties of soil such as bulk density (1.22 gcm^{-3}), particle density (2.75 gcm^{-3}), pore space (42.80 %), pH (6.81), EC (0.20 dsm^{-1}) ,organic carbon (0.67%), nitrogen (277.63 Kg ha^{-1}), phosphorous (22.27 Kg ha^{-1}), potassium (270.50 Kg ha^{-1}), and Sulphur (14.33 mg kg^{-1}), were found to be at on par than any other treatment combinations

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