Effect of organic and inorganic sources of nutrients on rapeseed (*Brassica campestris L.*) under terai region.

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Rapeseed is one o f the most important edible oilseed crops of the Indo-Gangetic plains, however, the production of rapeseed is poor due to erratic management practices and climatic condition. Nutrient management is the key component technology towards the production of rapeseed. A substitution and/or supplementation of major nutrients with a considerable proportion from organic manures or in combination for sustaining of high level of production, is of urgent necessity.

The experiment was conducted at the research farm of Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal during the *rabi* season of 2007-08. The farm is situated at $26^0$19´86´´ N latitude and $89^0$23´53´´ E longitude at an elevation of 43 meters above mean sea level. The area as a whole is humid and warm except having a short winter spell during December to February. The soil is sandy loam, acidic with a pH of 5.42, low in available nitrogen (118 kg ha^{-1}), medium in available phosphorus (24 kg ha^{-1}) and available potash (76 kg ha^{-1}). Twelve treatments *viz*, T_1:100% RDF (60:30:30 kg $ha^{-1}$of N: P: K), T_2:100% RDF + Borax @ 10.0 kg ha^{-1}, T_3:FYM @ 10.0 $t.ha^{-1}$, T_4:Vermicompost @ 5.0 $t.ha^{-1}$, T_5:Neemcake @ 5.0 $t.ha^{-1}$, T_6:Poultry manure @ 5.0 $t.ha^{-1}$, T_7:T_1+ FYM @ 5.0 $t.ha^{-1}$, T_8:T_1+ Vermicompost @ 2.5 $t.ha^{-1}$, T_9:T_1+ Neemcake @ 2.5 $t.ha^{-1}$, T_{10}:T_1+ Poultry manure @ 2.5 $t.ha^{-1}$, T_{11}:50% RDF+ FYM @ 2.5 $t.ha^{-1}$+ VC @1.25 $t.ha^{-1}$+ NC @ 1.25 $t.ha^{-1}$+ PM @ 1.25 $t.ha^{-1}$ and T_{12}:control were laid out in RBD with three replications. Rapeseed cultivar "B-9" was sown with the spacing of 30 x 10 cm. Data were recorded on plant height, leaf area index, crop growth rate , net assimilation rate, number of siliqua $plant^{-1}$, length of siliqua, number of seeds $siliqua^{-1}$, test weight and seed yield. The data were analysed statistically for comparing the treatment means.

Plant height

Treatment receiving 50% RDF+ FYM @ 2.5 $t.ha^{-1}$ + vermicompost @1.25 $t.ha^{-1}$ + neemcake @ 1.25 $t.ha^{-1}$ + poultry manure @ 1.25 $t.ha^{-1}$ recorded the tallest plant (147.18 cm) at harvest which was statistically *at par* with T_9 and T_8, might be due to greater availability of soil nutrients through out the growth period. Sharma *et al*. (2007) and Kumar and Yadav (2007) also investigated similar trend of result by combination of organics and inorganics sources of nutrients.

Leaf area index (LAI)

Treatment receiving 50% RDF+ FYM @ 2.5 $t.ha^{-1}$ + vermicompost @1.25 $t.ha^{-1}$ + neemcake @ 1.25 $t.ha^{-1}$ + poultry manure @ 1.25 $t.ha^{-1}$ recorded highest value of LAI (1.88) at 50 days after sowing which was statistically *at par* with T_9, T_8 and T_{10}, might be due to synchronous supply of plant nutrients throughout the growth period.

Crop growth rate (g m^{-2} d^{-1})

Treatment receiving 50% recommended dose+ farmyard manure @ 2.5 $t.ha^{-1}$ + vermicompost @1.25 $t.ha^{-1}$ + neemcake @ 1.25 $t.ha^{-1}$ + poultry manure @ 1.25 $t.ha^{-1}$ recorded highest value (4.32 g m^{-2} d^{-1}) followed T_8, T_{10} and T_9.

Net assimilation rate (NAR)

At 30-40 days after sowing, T_7 (1.018 g m^{-2} d^{-1}) recorded the highest value of net assimilation rate which was followed by T_2 (1.02 g m^{-2} d^{-1}) and T_8 (0.93 g m^{-2} d^{-1}). At 40-50 days after sowing T_{11} gave the highest value (1.14 g m^{-2} d^{-1}) of NAR which was followed by T_9 (1.13 g m^{-2} d^{-1}) and T_8 (1.11 g m^{-2} d^{-1}).

Number of siliqua $plant^{-1}$

Treatments receiving 50% RDF+ FYM @ 2.5 $t.ha^{-1}$ + vermicompost @1.25 $t.ha^{-1}$ + neemcake @ 1.25 $t.ha^{-1}$ + poultry manure @ 1.25 $t.ha^{-1}$ recorded highest number of siliqua $plant^{-1}$ (209.66) followed by T_9 (186.66). Sole application of chemical fertilizer recorded lower number of siliqua than the other treatments except T_2 (Table 1). Singh and Singh (2006) opined alike.

Length of siliqua

The length of siliqua was found to be highest (7.20 cm) with T_{11} (50% recommended dose+ farmyard manure @ 2.5 $t.ha^{-1}$ + vermicompost @1.25 $t.ha^{-1}$ + neemcake @ 1.25 $t.ha^{-1}$ + poultry manure @

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Table 1: Effect of organic and inorganic sources of nutrients on growth attributes of rapeseed.

Treatments	Plant height (cm)			Leaf area index			Crop growth rate (g m^{-2} d^{-1})				Net assimilation rate (g m^{-2} d^{-1})			
	80 DAS	90 DAS	At harvest	30 DAS	40 DAS	50 DAS	30-40 DAS	40-50 DAS	50-60 DAS	60-70 DAS	30-40 DAS	40-50 DAS	50-60 DAS	60-70 DAS
T_1	128.08	129.02	131.24	0.50	1.06	1.62	1.54	2.22	1.90	0.67	0.90	0.73	0.30	0.07
T_2	128.91	129.92	131.61	0.51	1.07	1.63	1.77	2.30	2.69	0.45	1.01	0.75	0.43	0.04
T_3	117.50	120.48	125.27	0.45	0.86	1.27	0.93	1.07	0.18	0.44	0.63	0.44	0.03	0.05
T_4	127.00	128.65	130.95	0.50	1.01	1.53	1.40	2.35	1.04	0.62	0.84	0.81	0.17	0.06
T_5	123.50	126.32	130.16	0.47	1.00	1.53	1.18	1.52	0.21	1.33	0.72	0.52	0.03	0.15
T_6	119.50	122.51	128.33	0.46	0.98	1.51	1.01	1.32	0.27	1.55	0.63	0.46	0.04	0.17
T_7	129.33	130.03	133.33	0.53	1.08	1.63	1.82	2.24	3.06	0.47	1.01	0.72	0.46	0.04
T_8	130.00	137.33	140.12	0.56	1.20	1.84	1.81	3.84	4.10	0.54	0.93	1.11	0.58	0.05
T_9	130.33	139.00	143.39	0.56	1.21	1.86	1.75	3.97	4.05	0.32	0.89	1.13	0.57	0.03
T_{10}	129.58	131.53	135.55	0.56	1.19	1.82	1.50	3.11	4.09	0.14	0.78	0.90	0.58	0.01
T_{11}	134.74	141.13	147.18	0.58	1.23	1.88	1.63	4.02	4.32	1.82	0.81	1.14	0.60	0.16
T_{12}	107.58	116.50	119.51	0.16	0.36	0.56	0.41	0.49	1.13	0.24	0.72	0.48	0.51	0.07
SEm (±)	**4.99**	**3.29**	**7.20**	**0.007**	**0.014**	**0.03**	**0.072**	**0.165**	**0.307**	**0.047**	**0.045**	**0.60**	**0.04**	**0.005**
LSD (p=0.05)	**10.35**	**6.84**	**14.94**	**0.013**	**0.029**	**0.05**	**0.14**	**0.34**	**0.63**	**0.099**	**0.094**	**0.12**	**0.09**	**0.01**

T_1:100% RDF (60:30:30 Kg/ha^{-1} of N: P: K), T_2:100% RDF + Borax @ 10.0 Kg/ha^{-1}, T_3:FYM @ 10.0 $t.ha^{-1}$,
T_4:Vermicompost @ 5.0 $t.ha^{-1}$, T_5:Neemcake @ 5.0 $t.ha^{-1}$, T_6:Poultry manure @ 5.0 $t.ha^{-1}$,
T_7:T_1+ FYM @ 5.0 $t.ha^{-1}$, T_8:T_1+ Vermicompost @ 2.5 $t.ha^{-1}$, T_9:T_1+ Neemcake @ 2.5 $t.ha^{-1}$,
T_{10}:T_1+ Poultry manure @ 2.5 $t.ha^{-1}$, T_{11}:50% RDF+ FYM @ 2.5 $t.ha^{-1}$ + VC @1.25 $t.ha^{-1}$ + NC @ 1.25 $t.ha^{-1}$ + PM @ 1.25 $t.ha^{-1}$,
T_{12}:Control.

Table 2: Effect of organic and inorganic sources of nutrients on yield attributes of rapeseed.

Treatments	Seed yield (q ha^{-1})	Siliqua. $plant^{-1}$	Length of siliqua (cm)	Number of $seeds.\ siliqua^{-1}$	Test weight (g)
T_1	4.02	143.33	5.83	17.00	2.55
T_2	4.98	163.33	6.06	17.66	2.56
T_3	2.46	115.66	5.26	14.66	2.37
T_4	3.99	125.66	5.36	16.00	2.53
T_5	3.97	119.66	4.86	14.00	2.52
T_6	3.83	116.66	4.86	13.66	2.51
T_7	5.48	166.33	6.10	18.66	2.60
T_8	6.03	168.66	6.73	22.00	2.90
T_9	6.51	186.66	6.80	22.66	2.96
T_{10}	5.57	167.00	6.76	21.00	2.76
T_{11}	7.36	209.66	7.20	23.33	3.07
T_{12}	1.92	90.00	3.46	13.33	2.03
SEm (±)	**0.18**	**7.41**	**0.33**	**2.66**	**0.22**
LSD (p=0.05)	**0.38**	**15.37**	**0.69**	**5.52**	**0.46**

T_1:100% RDF (60:30:30 Kg/ha^{-1} of N: P: K), T_2:100% RDF + Borax @ 10.0 Kg/ha^{-1}, T_3:FYM @ 10.0 $t.ha^{-1}$,
T_4:Vermicompost @ 5.0 $t.ha^{-1}$, T_5:Neemcake @ 5.0 $t.ha^{-1}$, T_6:Poultry manure @ 5.0 $t.ha^{-1}$,
T_7:T_1+ FYM @ 5.0 $t.ha^{-1}$, T_8:T_1+ Vermicompost @ 2.5 $t.ha^{-1}$, T_9:T_1+ Neemcake @ 2.5 $t.ha^{-1}$,
T_{10}:T_1+ Poultry manure @ 2.5 $t.ha^{-1}$, T_{11}:50% RDF+ FYM @ 2.5 $t.ha^{-1}$ + VC @1.25 $t.ha^{-1}$ + NC @ 1.25 $t.ha^{-1}$ + PM @ 1.25 $t.ha^{-1}$,
T_{12}:Control.

1.25 t.ha^{-1}) which was statistically at par with T_9 (T_1+ Neemcake @ 2.5 t.ha^{-1}) followed by T_{10} (T_1+ Poultry manure @ 2.5 t.ha^{-1}) & T_8 (T_1+ vermicompost @ 2.5 t.ha^{-1}) and lowest in T_{12} (table 1).

Number of seeds siliqua^{-1}

The Highest number of seeds per siliqua (23.33) was recorded with T_{11} which was statistically at par with T_9 followed by T_8 and the lowest with T_{12} (Table 1). Sole application of chemical fertilizer recorded lower number of seeds siliqua^{-1} These results are in conformity with Singh and Singh (2006).

Test weight

Treatments receiving 50% RDF+ FYM @ 2.5 t.ha^{-1} + vermicompost @1.25 t.ha^{-1} + neemcake @ 1.25 t.ha^{-1} + poultry manure @ 1.25 t.ha^{-1} recorded the highest test weight value (3.07 gm) followed by T_{10} and T_8 and the lowest was in T_{12} (Table 1).

Seed yield

Seed yield was recorded to be highest (7.36 q ha^{-1}) under T_{11} (50% RDF + FYM @ 2.5 t.ha^{-1} + vermicompost @1.25 t.ha^{-1} + neemcake @ 1.25 t.ha^{-1} + poultry manure @ 1.25 t.ha^{-1}) which was statistically *at par* with T_9 (6.51 q ha^{-1}) followed by T_8 (6.03 q ha^{-1}) and T_{10} (5.57 q ha^{-1}) and lowest was recoded in T_{12} (1.92 q ha^{-1}). This might be due to higher number of seeds siliqua^{-1} and higher test weight (Table 2). These results confirm the findings of Abrol *et al*. (2007).

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