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Effect of enrich on the production of rapeseed in *inceptisols* of West Bengal

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ABSTRACT

A field experiment was conducted during winter season of 2003-04 to study the effect of enrich, an organic source of plant nutrients on the production of rapeseed in the *inceptisols* of West Bengal. Highest seed yield of 1528 kg/ ha was obtained when full doses of NPK (80:40:40 kg ha^{-1} $N:P_2O_5:K_2O$ respectively) were applied along with the Enrich 1500 kg/ha followed by full NPK + Enrich 1250 kg/ha (1367 kg/ha) and both showed significantly higher rapeseed yield as compared with the full doses of only NPK (1033 kg/ha). Plant height, branches / plant and siliqua / plant showed similar trend of variations as recorded in case of seed yield. The chemical analysis of available nitrogen, total phosphorus and total potash in the soil taken at initial stage and after harvesting clearly indicates the benefits of using Enrich with NPK over sole application of NPK. Population on non-symbiotic nitrogen fixing bacteria and Phosphorus solubilizing bacteria in the rhizosphere soil of rapeseed also increased due to the application of Enrich.

Key words: Enrich, production, rapeseed

Rapeseed and mustard are important edible oilseed crops in the Indo-Gangetic plains. To meet the challenge in post WTO regime there is need to adopt multi-pronged strategy which involves enhancement of oilseed production and improvement of quality with the help of better improved technology. However, maximization of yield is not possible with application of inorganic fertilizer only. Organic manure is required, both in terms of soil health maintenance and proper utilization of inorganic fertilizer. Combination of organic with inorganic source is also necessary for sustainable crop production, besides its beneficial effects on the quality of the produce. Organic manure provides food for microbial population, which set in a chain reaction for further availability of plant nutrients in soil. Keeping the above view, a field experiment was conducted in Kalyani 'C' block farm, B.C.K.V., West Bengal, to find out the effect of enrich, an organic source of plant nutrients on the production of rapeseed in the *inceptisols* of West Bengal.

MATERIALS AND METHODS

A field experiment was conducted during winter season of 2002-2003 at the 'C' Block Farm, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal. The soil was sandy loam in texture with a pH value of 6.8, organic carbon of 0.61

%, total nitrogen of 0.058%, available P_2O_5 and K_2O of 19.3 and I18.7 kg ha^{-1}, respectively. The composition of enrich was carbon 16%, nitrogen 1.5%, P_2O_5- 2.5%, and the microbial population per gram of enrich were – total bacteria 1000 million, actinomycetes 10 million, nodule bacteria 1 million, nitrobactor 1 million, beneficial fungi 100 million, phosphorus solublilizing bacteria 10 million. The experiment was laid out in randomized block design with seven treatments replicated thrice. The treatments comprised of sole NPK (80:40:40 N:P_2O_5:K_20 kg ha^{-1}) and NPK (full and 75%) in combination with different doses of Enrich (@1000, 1250 and 1500 kg ha^{-1}). The crop variety, B-9 was sown on first week of November 2003. Full P_2 O_5 and K_2O were applied basal in the form of single super phosphate and muriate of potash respectively along with half nitrogen applied as urea. Rest half nitrogen was applied at 30 DAS. The Enrich as per treatments was also applied as basal. Ten plant samples were collected from each plot to record plant height, number of branches per plant, number of siliqua per plant. The soil was analyzed at initial and at harvest with the help of Bray and Kurtz (1945) method and by flame photometer method for respective available N, P_20_5 and K_2O. Table 2).The analysis of the beneficial micro flora have been done from the soil sample collected from the rapeseed experimental field at initial and at harvest to find out the different treatment effects. The soil micro flora particularly the population of beneficial soil microorganisms, the non-symbiotic nitrogen fixing and phosphate-solubilizing bacteria were analyzed. The enumeration of the microbial population was done on Agar plates containing appropriate media following serial dilution technique and pour plate method. For counting non-symbiotic nitrogen fixing bacteria and phosphate solubilizing microorganisms, the Thornton's agar medium and Pikovskaia's agar medium were used respectively.

RESULTS AND DISCUSSION

Effect on yield and yield attributes

The seed yield of rapeseed revealed that the highest yield of 1528 kg/ ha was obtained when full doses of NPK were applied along with Enrich 1500 kg/ha followed by the treatments, full NPK + Enrich 1250 kg/ha, full NPK + Enrich 1000 kg/ha, 75% NPK + Enrich 1500 kg/ha and 75% NPK + Enrich 1250 kg/ha. Except the treatment, 75%NPK + Enrich 1000 kg/ha (1067 kg/ha) all other treatments showed significantly higher yield as that recorded from the full doses of NPK without Enrich which recorded the lowest yield, 1033 kg/ha). The data related to the plant height, number branches / plant and the number of siliqua / plant showed the similar trends of variations as found in case of seed yield. This might be due to the better *rhizosphere* environment in Enrich treated plots, which caused higher nutrient availability to crop plants that was ultimately reflected on the yield attributes and yield. Ghosh *et al.* (1995) have noticed similar type of observation.

Table 1 Effect of fertilizer and enrich on growth, yield attributes and yield of rapeseed

Treatment	Plant height(cm)	Branches /plant	Silliqua / plant	Yield (kg/ha)
T_1-Full NPK alone (80:40:40 N:P_2O_5:K_20 kg ha^{-1})	33.4	4.2	53.8	1033
T_2-Full NPK + Enrich @ 1000 kg/ ha	34.4	4.5	64.9	1256
T_3- Full NPK + Enrich @ 1250 kg/ ha	35.1	4.7	65.8	1367
T_4 - Full NPK + Enrich @ 1500 kg/ ha	37.1	5.0	71.6	1528
T_5- 75 % NPK+ Enrich @1000 kg/ ha	33.5	4.4	58.2	1067
T_6-75 %NPK+ Enrich @1250 kg/ ha	34.2	4.5	64.1	1111
T_7-75 % NPK+ Enrich @1500 kg/ ha	34.6	4.5	64.3	1167
CD (p=0.05)	2.19	0.48	10.9	62

Effect on nutrient status in soil

The chemical analysis of the soil for available nitrogen, total phosphorus and total potash at the initial soil sample and after harvesting of the crop, presented in Table 2, gave a clear indication about the benefits of using the Enrich with NPK over only NPK treatment. Similar type of findings have been reported by Rana *et al.*(1198) in pigeon pea.

Table 2 Effect of Enrich on the available Nitrogen, total Phosphorus and Potash in the experimental soil

Treatments	Available N (kg/ ha)		Total P_2O_5 (kg/ ha)		Total K_2O (kg/ ha)	
	Initial	Harvest	Initial	Harvest	Initial	Harvest
T_1- NPK (80:40:40) kg / ha	228.5	223.2	19.3	18.7	117.6	108.2
T_2- T_1-+ Enrich @ 1000 kg / ha	228.1	236.0	19.0	28.4	117.8	139.6
T_3- T_1- + Enrich @ 1250 kg / ha	227.2	241.2	20.1	30.7	117.9	141.9
T_4- T_1- + Enrich @ 1500 kg / ha	226.1	242.3	20.0	33.5	118.0	147.9
T_5-75% T_1 + Enrich @ 1000 kg/ha	228.3	232.1	19.9	23.6	117.4	127.1
T_6-75% T_1 + Enrich @ 1250 kg/ha	227.9	232.6	19.3	29.8	117.9	130.3
T_7-75% T_1+ Enrich @ 1500 kg/ha	227.6	240.4	19.3	30.9	118.1	132.9

The number of beneficial microorganisms in the *rhizosphere* soil of the experimental field at initial and after harvesting of the crop is presented in Table 3.The data revealed that the soil micro flora population particularly non- symbiotic N- fixing bacteria and Phosphorus solubilizing bacteria were also showed a distinguished better performance in NPK with Enrich treated plots as compared to only chemical source of NPK treatments.

Table 3 Population of beneficial microorganisms in the *rhizosphere* soil of the experimental soil

Treatments	Beneficial micro-organisms (CFU x 104 g^{-1} of dry soil)			
	N- fixing bacteria		P- solubilizing bacteria	
	S -I	S-II	S -I	S-II
T_1- NPK (80:40:40) kg / ha	78.4	118.6	19.5	48.4
T_2- T_1+ Enrich @ 1000 kg / ha	77.9	147.3	18.9	62.5
T_3- T_1 + Enrich @ 1250 kg / ha	78.3	158.9	19.1	76.0
T_4- T_1- + Enrich @ 1500 kg / ha	79.4	164.1	18.5	84.3
T_5-75% T_1 + Enrich @ 1000 kg/ha	78.6	139.9	19.3	57.8
T_6-75% T_1 + Enrich @ 1250 kg/ha	79.1	142.4	17.8	72.3
T_7-75% T_1 + Enrich @ 1500 kg/ha	78.5	158.1	19.0	79.8

S-I = Initial S-II = At harvest of the crop

From the results it can be concluded that the bio- fertilizer Enrich, applied @ 1250 or 1500 kg/ ha either with full NPK or reducing the NPK doses by 25% can give good results in terms of both growth and yield attributes and yield of rapeseed and nutrient content of the soil in comparison to only NPK treated plots. The population of the beneficial microorganisms also showed that the plots receiving Enrich in addition to NPK recorded higher non- symbiotic N-fixing bacteria and P- solubilizing bacteria than the plots that received only chemical source of NPK fertilizer. The application of the bio-fertilizer Enrich in addition to chemical fertilizer NPK can substantially enhanced the production of Rapeseed as well as improves the soil health in comparison to the only chemical source of NPK.

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