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SOIL AMELIORATION AND ITS IMPACT ON GROWTH OF *RAPHANUS SATIVUS* CV. NEWAR IN CERTAIN AREA OF THE JAUNPUR CITY

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ABSTRACT

The radish (*Raphanus sativus*) is an edible root vegetable of the Brassicaceae family. Radishes are grown and consumed as salad, oil, medicines and as therapeutics. A particular variety of *Raphanus sativus* named newar or jaunpuri, grown in certain belt (Mandi Naseeb Khan) of the Jaunpur city, shows better growth in terms of length, girth and biomass. However, this was not conspicuous in nearby areas (5-6km away i.e. in Siddiquepur). It was found that chemical properties of the water such as pH, electrical conductance and hardness along with some chemical properties of soil such as organic carbon, nitrogen content and electrical conductance enhanced many fold growth of cv. newar at M.N. Khan site (experimental site). Therefore, to increase the fertility of nearby areas, soil from the highly supportive growth (M.N. Khan) was mixed with low growth supportive to find the correct degree of dilution of soil for increasing its fertility to the fullest.

INTRODUCTION

Radish produces a characteristic pungent flavour having volatile isothiocyanate (mustard oil). The typical radish odour is contributed by butyl crotonyl isothiocyanate sulfide as a chief constituent. It has been recently investigated that Trans - 4- methyl thiobutenyl iso thiocyanate is also found in the radish in the form of a glucoside and it gets released when hydrolysed by the action of an enzyme. The main enzymes found in radish are phosphatase, catalase, sucrase, amylase, etc. (Gopalkrishnan, 2007). Radish leaves are rich source of calcium, iron and ascorbic acid. They serve as a very good source of calcium when consumed with rice. Phytin found in rice helps in calcification. Radish roots are good in urinary complaints, piles and in gastrodynia. Trace elements in radish include aluminum, barium, lithium, manganese, silicon, titanium, fluorine and iodine (up to 18 µg/100g) (Gilani and Ghayur, 2004). The seeds of radish contain glycosidically bound mustard oils. Sulphoraphene is found to be very good for antibacterial activity against *streptococcus, Pyococcus, Pneumococcus* and *Escherichia coli* (Gutierrez and Perez, 2004). At Mandi Naseeb Khan, in the Jaunpur city of Uttar Pradesh, a variety known newar or jaunpuri is grown which attains enormous size with a length of up to 75-90 cm and a girth of 50-60 cm, and may weigh up to 5-15 kg, or even more. It grows well under irrigation with a kind of brackish water found in that area, and in rich friable sandy loam because heavy soils are likely to yield ill – shaped root. When these roots are cultivated elsewhere they do not attain this size. Therefore, in this research work it was planned to obtain the best dilution ratios of soil (mixture of both M.N.Khan and Siddiquepur soils) which can support the growth of radish in nearby areas.

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MATERIALS AND METHODS

Site selection and Experiment design

Mandi Naseeb Khan (M.N.Khan) site was selected in periurban part of the Jaunpur city. Seeds of the cultivar of *Raphanus sativus* such as newar/jaunpuri were procured from the research station of Krishi Vigyan Kendra of N.D. University, Faizabad. In experimental design, nine pits were prepared at M.N. Khan (experimental) site of 4'x3'x3' and were lined with polythene before putting the mixed soil in it. In the experiment, dilution of the soil of experimental site (M.N.Khan) was done with the soil of the control site (Siddiquepur). The ratios of soils are as below.

Table 1. The ratio of the combination of experimental site soil and control site soil

Combination no. (pit number)	Experimental site soil (M.N.Khan) (parts)	Control site soil (Siddiquepur) (parts)	Ratio
1.	1	0	1:0
2.	0	1	0:1
3.	1	1	1:1
4.	1	5	1:5
5.	1	25	1:25
6.	1	50	1:50
7.	1	100	1:100
8.	1	500	1:500
9.	1	1000	1:1000

In combination no. (1) One part of experimental (Mandi Naseeb Khan) site soil was added to zero part of control (Siddiquepur) site soil. Likewise, in other combinations, one part of soil of experimental site was mixed with 1, 5, 25, 50, 100, 500 and 1000 part of control sit soil. The seeds were sown of the cultivar (newar) of *Raphanus* sativus on alternate bunds in October. Seedlings were thinned manually to maintain the interplant distance of 25 cm. The experimental beds were subjected to manure by cowdung and irrigated after every 5 days throughout the experiment. After 90 days growth, the plants were harvested and relevant observations i.e. length, girth and biomass of radish root were monitored. Fortnightly, top soil (0-25 cm depth) and irrigation water were sampled to analyze physico-chemical characteristics following standard protocols.

Physico-chemical analysis

Physico-chemical analysis of water was carried out with respect to electrical conductance, pH, hardness, while soil was analyzed for pH, electrical conductance, soil organic carbon, phosphorus, potassium, and nitrogen estimation (Singh *et al*., 1999).

RESULTS

Soil and water samples from different pits were analyzed for various physic- chemical parameters. Changes in data of pH, hardness and EC are shown in Table 2.

observed maximum in combination no. 2(0:1) (8.56), followed by combination no.9 (1:1000) (8.43) and minimum was observed in combination no. 1(1:0) (7.82). The maximum availability of organic carbon in soil (Table 2) was found in combination no. 1(1:0) (0.75%), followed by combination no.3 (1:1) (0.57%) and least was observed in combination no. 9 (1:1000) (0.27%). However, the K content of the soil was maximally observed in combination no.2 (0:1) (200Kg/h), followed by combination no. 9(1:1000) (195Kg/h) and minimum was observed in combination no.1 (1:1) (137 Kg/h). Likewise, Phosphorus content in soil was maximally observed in combination no. 2 (0:1) (18.2Kg/h), followed by combination no. 9 (1:1000) (17.0 Kg/h) and minimum was observed in 1:1 combination (13.9Kg/h). While analyzing the percentage of nitrogen, it was revealed that Pit no.1 was maximally enriched with nitrogen (0.37%), followed by pit/ combination no. 3 (0.028%) and minimum was observed in combination no. 9 (0.018%). Likewise, electrical conductance of soil was observed maximum in plot no. 1(1982 mS/m) followed by plot/combination no.3 (1:1) (1109 mS/m) and minimum was observed in plot no. 2(0:1) (620 mS/m).

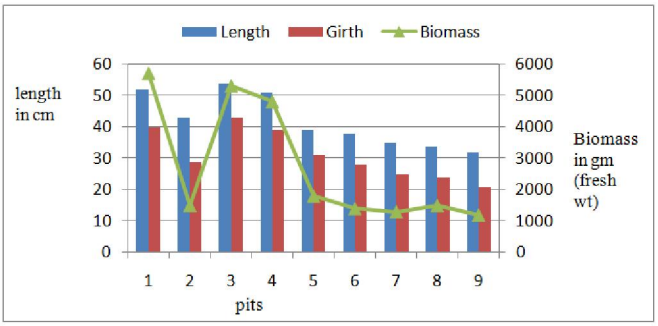

Figure 1. comparison of growth *Raphanus sativus* of nine pits with various combination of experimental with control site soil

When growth pattern of *Raphanus sativus* cv newar, in all the nine pits were studied. It was found that the length of the cv newar was maximum in pit no.3 (54 cm), followed by pit no.1 (52 cm) and minimum was observed in pit/combination no.9 (1:1000) (32 cm). Girth also followed the same trend as plot no. 3 showed maximum girth (43 cm) of newar root, followed by plot no. 1(40 cm) and minimum girth was reported by the

Table 2. Changes in physico- chemical parameters of soil and water of different combinations

		soil parameters				Water parameters			
Combination number/ Pit No.	Combinations of soil	N %	P (Kg/h)	K (Kg/h)	Organic carbon %	EC mS/m	EC µS/m	pH	Hardness (mg/l)
1	1:0	0.37	13.9	137	0.75	1982	79800	7.82	843
2	0:1	0.011	18.2	200	0.225	620	3421	8.56	548
3	1:1	0.028	15.0	171	0.57	1109	5674	7.97	654
4	1:5	0.025	16.5	179	0.45	1002	5298	8.02	643
5	1:25	0.024	17.0	183	0.42	986	5109	8.09	638
6	1:50	0.023	17.2	187	0.36	975	5087	8.14	620
7	1:100	0.023	17.5	189	0.32	943	5065	8.19	609
8	1:500	0.020	17.8	191	0.30	929	5054	8.23	587
9	1:1000	0.018	17.9	195	0.27	903	5033	8.43	567

The result revealed that the average electrical conductance of water was maximum in combination of soil no. 1 (1:0) (79800 µS/m), followed by combination no. 3 (1:1) (5674µS/m) and least was observed in combination no. 9 (1:1000) (5033µS/m). Likewise, average hardness of water was maximum in 1:0 combination (843mg/l), followed by combination 1:1 (654mg/l) and least was observed in combination 1:1000 (567mg/l). However, average pH of the irrigating water was

radish root cv newar in plot no.9 (21 cm). However, the pattern of biomass accumulation was different, as it was maximum in newar obtained from plot no.1 (5700gm), followed by plot no.3 (5300gm) and minimum biomass was observed in newar obtained from plot/combination no. 9 (1200gm).

Table 3. R^2 (Correlation co-efficient) values between soil and water properties with growth parameters

Soil/water properties	R^2											
	Pits/ combinations											
	1:0			0:1			1:1			1:5		
	L	G	B	L	G	B	L	G	B	L	G	B
pH(soil)	0.01	0.02	0.01	0.06	0.04	0.09	0.03	0.05	0.01	0.03	0.01	0.06
EC	0.58	0.66	0.72	0.04	0.03	0.05	0.06	0.80	0.03	0.02	0.03	0.07
N	0.41	0.59	0.81	0.55	0.43	0.48	0.52	0.92	0.66	0.35	0.76	0.52
P	0.85	0.56	0.75	0.31	0.56	0.42	0.82	0.75	0.91	0.51	0.32	0.49
K	0.52	0.81	0.76	0.51	0.49	0.32	0.87	0.67	0.72	0.01	0.09	0.04
Org. carbon	0.85	0.72	0.95	0.03	0.55	0.41	0.61	0.93	0.81	0.41	0.26	0.34
pH(water)	0.84	0.01	0.03	0.05	0.06	0.09	0.12	0.27	0.23	0.02	0.01	0.03
EC(water)	0.32	0.91	0.71	0.01	0.08	0.04	0.76	0.92	0.95	0.32	0.50	0.31
Hardness	0.78	0.91	0.56	0.03	0.07	0.05	0.52	0.89	0.92	0.01	0.07	0.03

L=Length. G=Girth, B=Biomass

DISCUSSION

The results depict that among the various chemical properties of water, EC of the irrigated water appears to be supportive for cv. newar at pits 3 with biomass (R^2 0.95) and at pit/combination no.1 with girth (R^2 0.91) (Table 3) as the growth was enhanced significantly. However, lesser EC of water was found at pit no. 9 where least growth was reported. It was observed (Naik *et al*., 2013) that influx concentration of nutrients absorbed by *Raphanus sativus* L. was increased with an increase in soil at EC from 1.0-2.0 mS/cm. Hardness of irrigated water at pit no. 1 and 3 was also correlated with the growth of cv. newar as reflected by positive correlation with girth (R^2 0.91) and with biomass (R^2 0.92) respectively. The soil highly enriched with organic carbon enhanced the growth of newar significantly at Pit no.3 showing positive correlation with cv. newar with respect to girth (R^2 0.93) and at pit no.1 with biomass (R^2 0.95). While at pit no.9 soil was not so enriched to support the growth to such extent. Impact of organic carbon on radish was evaluated (Asgar *et al*., 2006) and it was found that with the supply of organic carbon, growth parameters like leaf area, root growth and total biomass were increased significantly.

However, soil K content was found to be negatively correlated with cv. newar (R^2 0.87). It was observed that radish growth was more at pit no.3 and pit no.1 than that of pit no.2 where the K content was highest. In an experiment (Akber *et al*., 2013) K was used to observe impact on the growth of Safflower, it was revealed that with increasing soil K, the plant Ca content, leaf moisture content, seed number and their oil content was increased. Likewise the P content was also inversely correlated with plant growth particularly biomass of cv. newar (R^2 0.91) at pit no.3 and at pit no. 1 with length of cv. newar (R^2 0.85). In contrast to P and K, nitrogen content present at pit no.3 showed positive correlation with girth of cv. newar (R^2 0.92) and at pit no. 1 with biomass (R^2 0.81). In an experiment, (Ahmed *et al*., 2013) the impact of nitrogen on Guar plant was evaluated and it was found that with supply of nitrogen affects the growth parameters like plant wt, plant height, numbers of leaves, and seed yields significantly.

Conclusion

On the basis of above experimental results, it can be concluded that the soil of experimental site (M.N.Khan) was enriched significantly with high concentration of Organic carbon, nitrogen, potassium and phosphorus etc. (which are growth supportive factors). Their dilutions with least productive soil, in a specific proportion have produced such a mixed soil which regained its tendency to enhance the growth of even low growth supportive soil. The combination obtained, being more promising were - combination/ pit no.1 (1:0), combination/pit no. 3 (1:1) and combination/pit no.4 (1:5). Thus, this experimental research will prove to be milestone to the local people of that area (Siddiquepur) of Jaunpur city, where productivity of the plant and fertility of the soil is very low to grow vegetables and pulses.

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