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# Evaluation of enhanced growth for *Raphanus sativus* cv. newar on addition of growth supplements in certain area of the Jaunpur city

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**Abstract:** *Raphanus sativus* is native to western India. It is annual, sometimes biennial herb with a rosette of lyrate with short stem. A particular variety of *Raphanus sativus* named jaunpuri or newar in certain belt of Jaunpur city showed better growth in terms of length, girth and biomass at certain period of growth cycle. However, this was not conspicuous 5-6 km away from this site. To enhance the productivity of the soil in nearby areas, chemical properties of irrigating water such as electrical conductance, hardness and chloride content, along with some chemical properties of soil such as electrical conductance, nitrogen and organic carbon and some microelements such as Zn, Mn, S, Fe etc. were ameliorated. It was reported that the ameliorated soil supported the growth of *Raphanus sativus* cv. newar very significantly as the length increased 130%, girth 117% and biomass 140%.

**Key words:** *Raphanus sativus*, jaunpuri, hardness, organic carbon.

## I. INTRODUCTION

The word "radish" is a derivation of the Latin word "radix," or root [1]. The radish (*Raphanus sativus*) is an edible root vegetable of the Brassicaceae family that was domesticated in Europe in pre-Roman times. *Raphanus sativus* is native to Western India; it is annual herb, 20-100 cm long, with a rosette of lyrate, pinnatifid leaves arising from a short stem. The main enzymes found in radish are phosphates, catalase, sucrose, amylase, alcohol dehydrogenase and pyruvic carboxylase. Radish also contains a thermo stable antithiamine factor i.e. S- methyl -L- cystein sulfoxide designated as methin (M.P. 173 - 174°C). Steroidal saponinins have been also reported [2].

Radish contains glucose as the major sugar and smaller quantities of fructose and sucrose. Pectin (0.3% as calcium pectate) and pentosans are also reported while starch is absent [3]. An essential oil (0.002%) containing 2- hexen -1- al (leaf aldehyde) 3 - hexane -1- ol (leaf alcohol) and small quantities of n - and isobutylaldehyde and isovaleraldehyde are extracted from leaves. Some lavone compounds are also found in leaves [4]. The oilseed radish grows well in cool climates. Radishes are suggested as an alternative treatment for a variety of ailments including whooping cough, cancer, gastric discomfort, liver problems, constipation, dyspepsia, gallbladder problems, arthritis, gallstones, kidney stones and intestinal parasites. Radishes possess hydroxyl radical scavenging potency [5].

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 in certain belt. 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. In present study cv. newar of *Raphanus sativus* is grown under suitable combinations of micro and macro elements of the soil and some chemical properties of water to a place where least growth is reported.

## II. MATERIAL AND METHODS

### A. Site selection

The experimental bed (size 1.5m x 2.0m) was prepared in triplicate for sowing 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 such as 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.

### B. Physico-chemical analysis

Physico- chemical analysis of water was carried out with respect to electrical conductance, pH, alkalinity and hardness [6]. While soil was analyzed for electrical conductance, water holding capacity, bulk density, soil



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organic carbon [7], phosphorus [8], potassium [9], nitrogen. PH and electrical conductance were measured by digital pH meter and conductivity meter. Micronutrient such as S, Zn, Fe, Mn were analyzed by Atomic absorption spectrophotometer with using suitable lamps.

### III. RESULTS

Soil and water samples were analyzed for various physico- chemical parameters. Changes in data of EC, pH, hardness, alkalinity and chloride contents of water as well as soil parameters are shown in Table1. The result were highly supported by increasing salt concentration of water from 1296( $\mu\text{S}/\text{m}$ ) to 3460 ( $\mu\text{S}/\text{m}$ ). Similarly, water hardness which was earlier 330mg/l was enhanced to 910 mg/l, alkalinity was increased from 150 mg/l to 220 mg/l and chloride content was also upgraded from concentration 642.5 mg/l to 880.4 mg/l.

**Table 1: changes in concentration of various physico-chemical parameters of water and soil for *Raphanus sativus* cv. newar during growth period**

WATER	Parameters	Before amelioration	After amelioration
	EC( $\mu\text{S}/\text{m}$ )	1296	3460
	pH	8.20	7.93
	Hardness (mg/l)	330	910
	Alkalinity (mg/l)	150	220
	Chloride (mg/l)	642.5	880.4
SOIL	EC (dS/m)	130	722
	pH	8.75	7.92
	Water holding capacity %	65	75
	Bulk density ( $\text{g}/\text{cm}^3$ )	0.8	0.9
	Org. Carbon %	0.57	0.75
	Nitrogen %	0.028	0.038
	Phosphate (Kg/h)	18.0	13.5
	Potassium (Kg/h)	231	176
	S (mg/l)	9.60	9.00
	Zn (mg/l)	0.11	0.36
	Fe (mg/l)	4.47	4.15
	Mn (mg/l)	2.17	0.29

The electrical conductance of irrigating water found was 130(dS/m). Which was reported less growth supportive, hence the amended water was made more mineral rich to increase the electrical conductance of water to 722(dS/m) (Table 1). Similarly, organic carbon concentration was enhanced from 0.57% to 0.75%. Likewise, nitrogen concentration was also increased from 0.028% to 0.038% to support the growth utmost. However, the amount of phosphate before amendment was reported very high. Therefore, it was diluted to make concentration from 18 kg/h to 13.5 kg/h. Similarly, the potassium concentration was also diluted from 231 kg/h to 176kg/h to promote the growth of cv. newar.

Apart from this micronutrients were also amended. The previous soil sample was having higher concentration of S, Fe, Mn which were high enough to retard the growth of radish. Therefore, the soil was amended by diluting the concentrations of Fe, S, Mn to a level to support the growth. Sulphur was diluted from 9.60 g/l to 9.0 mg/l (Table 1). Similarly, Fe was also diluted from 4.47 mg/l to 4.15mg/l and Mn from 2.17 mg/l to 0.29 mg/. However, concentration of Zn was very low to support the growth. Therefore, the soil was made more concentrated in Zn content to make its concentration 0.36 mg/l, which was earlier 0.11 mg/l.

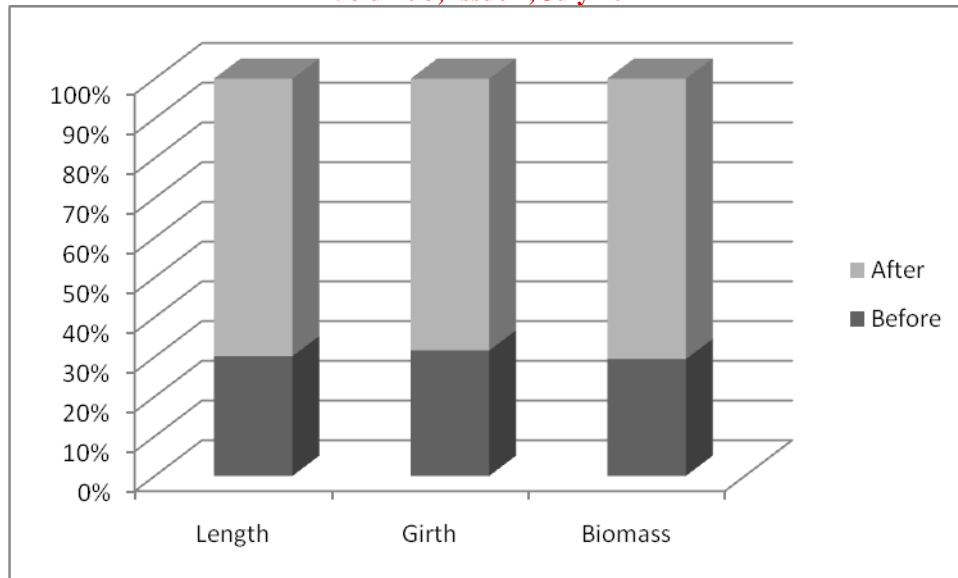
When growth pattern of cv. newar, before and after amendment was studied (Fig. 1), it was found that the length of cv. newar before amendment of soil was 22 cm at the time of harvesting. While, after amendment it was observed 51 cm (at the time of harvesting). Similarly, the girth after amelioration of soil, at the time of harvesting was reported 39 cm which was found 18cm before amelioration. Likewise, the biomass of cv. newar root in previous concentration of soil was observed 1500gm. However, after amendment of soil biomass of radish was reported 3600gm (at the time of harvesting).



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**Fig 1: Comparison of growth (length, girth and biomass) of *Raphanus sativus* cv. newar before and after amendments of soil and water**

The result depicts that the amendment of soil and water properties showed a positive increase in growth. Among all the properties of amended water the EC supported both the girth ( $R^2$  0.89) and biomass ( $R^2$  0.92) (Table 2). It was observed 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 [10]. Similarly, increasing carbonate and bicarbonate of irrigating water increased its hardness which showed positive co-relation with girth ( $R^2$  0.92) and length ( $R^2$  0.89) of cv. newar. Likewise, amended chloride content of irrigating water showed positive co-relation with length ( $R^2$  0.89) and girth ( $R^2$  0.93) of cv. newar. Soil ameliorated for organic carbon also showed positive co-relation with girth ( $R^2$  0.86) and biomass ( $R^2$  0.87) (Table 2). Likewise, amended K concentration enhanced the growth of cv. newar significantly with respect to biomass ( $R^2$  0.87) and girth ( $R^2$  0.81). In an experiment 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 [11]. Similar results of supporting growth with respect to girth and biomass were obtained from phosphorus and nitrogen. In an experiment, the impact of nitrogen on Guar plant was evaluated and it was found that with supply of nitrogen the growth parameters like plant wt, plant height, numbers of leaves, and seed yields were increased significantly [12]. However, amended soil with Zn, Fe, Mn and Cu could not show the promising results. Ameliorated soil with S content showed positive co-relation with respect to biomass ( $R^2$  0.85) of cv. newar.

**Table 2:  $R^2$  (correlation coefficient) values between soil or water properties (before and after amendment) and growth parameters of *Raphanus sativus* cv. newar**

Water/soil parameters	Before amendments			After amendments		
	Length	Girth	Biomass	Length	Girth	Biomass
EC (water)	0.53	0.53	0.37	0.89	0.92	0.66
pH	0.09	0.00	0.00	0.27	0.23	0.02
Alkalinity	0.00	0.16	0.10	0.02	0.01	0.07
Hardness	0.53	0.52	0.37	0.89	0.92	0.66
Chloride	0.54	0.53	0.38	0.89	0.93	0.67
EC (soil)	0.32	0.79	0.53	0.36	0.44	0.70
pH	0.01	0.06	0.04	0.09	0.06	0.01
Porosity	0.00	0.00	0.00	0.01	0.03	0.05
WHC	0.01	0.06	0.04	0.09	0.06	0.01
Org. carbon	0.55	0.82	0.57	0.78	0.86	0.87
K	0.53	0.85	0.58	0.72	0.81	0.87
P	0.56	0.77	0.54	0.84	0.91	0.85



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N	0.56	0.80	0.55	0.81	0.89	0.86
S	0.47	0.86	0.59	0.61	0.70	0.85
Zn	0.12	0.00	0.00	0.33	0.29	0.04
Fe	0.05	0.02	0.01	0.18	0.14	0.00
Mn	0.10	0.00	0.00	0.29	0.25	0.03
Cu	0.33	0.79	0.53	0.36	0.44	0.71
Bulk density	0.13	0.54	0.36	0.39	0.13	0.41

#### IV. CONCLUSION

On the basis of the above experimental results, it can be concluded that the soil of some part of Jaunpur city, deficient in certain concentration of the nutrients are supplemented with required concentrations, can enhance the growth many times more and could be beneficial to the local people.

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Preeti Tiwari (corresponding author) has qualified NET (Environmental Science) and passed M.Sc. (Environmental Science) in first division from B.B.A. (central) University, Lucknow. She has worked as Asstt. Prof in S.R Institute of Engineering and Technology, Lucknow, worked as Head of Department, Deptt. Of Environmental Science in Institute of Engg. and Technology, Sitapur, worked as a Lecturer (Environmental Science) in V. B. S. Purvanchal University, Jaunpur. Worked as assistant teacher for graduate students in **Swatantre Girls Degree College**, Lucknow. Regarding administrative experience she has worked as a **controller of examination** in institute of Engg. and Technology, Sitapur, appointed as a member of **Women helping cell** established by secretariat of **U.P. Government**, at V.B.S. Purvanchal, University, Jaunpur, appointed as **Internal examiner** in different Semester examinations at V.B.S. Purvanchal University, Jaunpur, **Editor** of the magazine Titled "Diary" published 3<sup>rd</sup> monthly in I.E.T. Sitapur. Visited **PHUKET, Thailand**, for paper presentation in "10<sup>th</sup> World Congress on clinical nutrition" (30 November- 3December, 2004), Titled "Phenolic acids in different preparations of pea plant (*Pisum sativum*). **Paper setter** for Environmental science in Teerthanker Mahaveer University, Moradabad. **Editor in Journal** - Global Journal of science and Technology, **ISSN - 2538-5969x**, 2013. Authored **Two** books for B.Tech students published by "New Age International publication," New Delhi, Titled "**Environment and Ecology**" and for MCA student published by "V-Max publication", Lucknow, Titled "**Environment and Ethics**". Delivered lecture at Jaunpur for Environment protection and awareness organized by **NABARD**, Jaunpur. Delivered lecture at meeting in Varanasi on **Women Empowerment**, organized by N.G.O., "National Association for Voluntary



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workers". Published 15 papers in different International journals. Convened, a national level seminar on **Therapeutic and Commercial Utilities of Medicinal Plants, preceded by Dr. P. K. Seth, (CEO Biotech Park)**, at Sitapur Shiksha Sanshan, Sitapur. Running an NGO (Non Government Organization) has been registered as a president (registration no. 248-2011-2012) in the year 2011, entitled "Eco-environment welfare society.



**Rajan Kumar Gupta (DOB-1963)**

Dr. Rajan Kumar Gupta obtained his M.Sc. and Ph.D. degree from Banaras Hindu University and worked on Ecophysiology of Antarctic Cyanobacteria for his Ph.D. degree with Late Prof. A.K. Kashyap of Centre of Advanced Study in Botany, Banaras Hindu University, Varanasi. For the past twenty years he has been working on various aspects of Antarctic micro flora. Dr. Gupta was deputed by Govt. of India for his participation as Biological Scientist in Antarctica twice. He has participated in XI and XIV Indian Scientific Expeditions to Antarctica during 1991-92 and 1994-95. He has visited several countries like Mauritius, Japan, Nepal, Thailand, South Africa and Belgium, Singapore, Srilanka etc. for presentation of his work on different aspects of algae. Dr. Gupta has worked on various aspects of cyan bacteria, i.e., morphology, ecology and nitrogen fixation, biotechnological applications and published more than 70 technical papers in various national and overseas journals and more than 40 chapters in various books. Dr. Gupta has published three Botany Practical Books and one book on Paryavaran Adhyan Environmental Studies) and 6 reference (research) books entitled "Glimpses of Cyanobacteria", "Advances in Applied Phycology", "Soil Micro flora", "Microbial Biotechnology & Ecology", Diversity: An Overview and Diversity of Lower Plants. Six students have been awarded the D.Phil degree and four are working under his supervision for their D.Phil degree of Various Universities of Uttarakhand. Dr. Gupta is a recipient of Research Award from University Grants Commission, New Delhi. Dr. Gupta is member of number of organizations in India and abroad. He is the Fellow of the Society for Environment & Ecoplanning and International Botanical Society and chaired various sessions in the conferences in India and abroad. He is in the editorial and advisory board of various journals. Presently, Dr. Gupta is teaching Microbiology and Biotechnology in Department of Botany, Govt. P.G. College, Rishikesh – 249201 (Dehradun), Uttarakhand.

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