

Original Research Article

<https://doi.org/10.20546/ijcmas.2020.911.307>

Response of Different level of Nitrogen and Phosphorus on Soil health, Growth and Yield attributes of Radish (*Raphanus sativas* L.)

Choppari Shiva Kumar*, Narendra Swaroop, Arun Alfred David, Tarence Thomas, Dudekula Sarmas Vali and Odapally Vinay Kumar

Department of Soil Science and Agricultural Chemistry, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj -211 007, (U.P), India

*Corresponding author

ABSTRACT

Keywords

Nitrogen,
Phosphorus,
Growth, Yield,
Quality and radish

Article Info

Accepted:
20 October 2020
Available Online:
10 November 2020

The present investigation entitled Response of different level of Nitrogen and Phosphorus on Soil health, Growth and Yield attributes of Radish (*Raphanus sativus* L.) was carried out in Rabi season during 2019-20 in Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj district of Uttar Pradesh India. The experiment consisted of 9 treatment combinations and which were replicated thrice and laid out in a randomized block design. The results showed that progressive increase in the soil pH, EC and water holding capacity, available nitrogen and phosphorus respectively gave the best results in T₉-[Nitrogen@100% + Phosphorus @100%] in Radish (*Raphanus sativus* L.) were to be found the best treatment combinations.

Introduction

Radish (*Raphanus sativus* L.) is a member of the Brassicaceae family native to Europe or Asia. It is a popular root crop grown all over the world. In India, it is grown in one or the other part of the country throughout the year. It is grown for its young fleshy tuberous roots consumed mainly as salted vegetable, eaten as a grated salad. Radish is a cool season crop and divided broadly into two groups: European or temperate and Asiatic or tropical. Asiatic types produce roots and seeds under tropical climate, whereas, European types

produce roots under sub tropical and tropical climate. However, seed production of European types is possible only under temperate conditions in hills since these require chilling temperature for seed production. The Asiatic varieties although are higher yielders yet poor in quality attributes, whereas, European varieties are small in size, mild in pungency, early in maturity and rich in quality parameters (Tripathi *et al.*, 2017). Radish the most important root crop is grown widely all over the country. It is annual and biennial crop which botanical name is *Raphanus sativus*, originated in Europe and

Asia. It is mainly cool season crop which is popular in both tropical and temperate regions. The fleshy edible portion of the root develops from both primary root as well as the hypocotyl. Roots vary greatly in size, shape and other external characteristics as well as in the length of time they remain edible. Radish is a cool season vegetable but can tolerate high temperature. The best quality roots are produced at temperature between 10 to 15.5°C. Roots may acquire a repulsive flavour and become more fibrous and mature early at higher temperature. Radish contains glucose as the major sugar and smaller quantities of fructose and sucrose. It is also good source of vitamin- A and C and also rich source of minerals like calcium, potassium and phosphorus.

Nitrogen plays an important role in the building up of protoplasm and protein which induce cell division and initiate meristematic activities when applied in optimum quantity. Low nitrogen availability causes a decrease in cell size especially cell division (Akand *et al.*, 2015). Nitrogen improves the absorption & respiration process in plant and activates vegetation. Radish plants with more leaves can give more root yield as compared to the plants having less leaves. Nitrogen is the main component of protein & chlorophyll.

It plays vital role in transferring energy with in plant cells, cell division, and formation of meristem tissue; promote root growth, flowering and development of seed and fruit. Deficiency of phosphorus leads to reddish or purple leaves, stems and branches, stunted top growth that results in low yield and ultimately poor quality of crops (Zeb *et al.*, 2016). And also the Deficiency of Phosphorus limits the production of plant because the mobility of Phosphorus is low in soil and the root system. To explore its mobility in plant and its role in plant top development, 10 and 20 mg/l phosphorus in radish was applied. Fresh and

dry matter increased with phosphorus application (Kezia and David, 2013).

Materials and Methods

The soil of experimental area falls in order of Inceptisols and soil is a alluvial in nature. The samples randomly collected from five different sites in the experimental plot prior to tillage operations from a depth of 0-15 cm. the size of the entire soil sample was reduced by coning and quartering process the remaining soil was dried under shade and passed through a 2 mm sieve by way of preparing the sample for physical and chemical analysis. The experimental details are given below. The experiment considered of 9 treatments which were replicated thrice and laid out in a randomised block design. The treatment combinations are T₁- absolute control, T₂- Nitrogen @ 0% + Phosphorus @ 50 %, T₃- Nitrogen @0% + Phosphorus @100%, T₄-Nitrogen @50% + Phosphorus @ 0 %, T₅ - Nitrogen@50% + Phosphorus@50%, T₆-Nitrogen @50% + Phosphorus @100 %, T₇-Nitrogen@100% + Phosphorus @ 0%, T₈-Nitrogen@100% + Phosphorus @ 50 %, T₉-Nitrogen@100% + Phosphorus @100%.The experiment was conducted on the research farm of department of soil science and agricultural chemistry, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj city on the bank of Yamuna river, the experimental site was located in the sub-tropical region with 25.43⁰ N latitude, 81.84⁰ E longitude and 98 m above from the MSL.

Results and Discussion

Data presented in Table 1 showed that there was a significant effect on specific gravity and a non-significant effect on soil pH and soil EC by different treatment combinations. The maximum Organic carbon content , water holding capacity (0.77 %, 66.67%) was

recorded in the treatment combination T₉- [Nitrogen@100% + Phosphorus @100%] available nitrogen and available phosphorus (395.94 kg ha⁻¹ and 46.48 ha⁻¹) was recorded in the treatment combination T₉- [Nitrogen@100% + Phosphorus @100%] but the maximum available potassium in soil

(189.98 kg ha⁻¹) was recorded in the treatment combination T₇-[Nitrogen@100% + Phosphorus @ 0%] followed by T₈-[100% nitrogen + % 50 phosphorus] is noticed as second best treatment after T₈ compared with treatment combination T₁-[absolute control] (Table 1–4 and Fig. 1–4).

Table.1 Response of different level of nitrogen and phosphorus on Bulk density, Particle density and specific gravity of the soil

S. No.	Treatment combination	Bulk density (g cm ⁻³)	Particle density (g cm ⁻³)	specific gravity
1.	T ₁ - absolute control	1.24	2.36	2.14
2.	T ₂ - Nitrogen @ 0% + Phosphorus @ 50 %	1.23	2.41	2.26
3.	T ₃ - Nitrogen @0% + Phosphorus @100%	1.20	2.54	2.30
4.	T ₄ -Nitrogen @ 50% + Phosphorus @ 0 %	1.18	2.61	2.35
5.	T ₅ - Nitrogen@50% + Phosphorus @50%	1.16	2.68	2.40
6.	T ₆ -Nitrogen @50% + Phosphorus @100 %	1.15	2.65	2.34
7.	T ₇ -Nitrogen@100% + Phosphorus @ 0%	1.16	2.71	2.40
8.	T ₈ -Nitrogen@100% + Phosphorus @ 50 %	1.14	2.76	2.53
9.	T ₉ -Nitrogen@100% + Phosphorus @100%	1.12	2.84	2.58
	F-Test	NS	NS	S
	C.D at 0.5%	5.15	0.05	0.1
	S.Ed(±)	2.43	0.23	0.05

Table.2 Response of different levels of nitrogen and phosphorus on solid space, Water holding capacity and pore space of the soil

S. No.	Treatment combinations	Solid space (%)	W.H.C (%)	Pore space
1.	T ₁ - absolute control	36.75	61.27	51.13
2.	T ₂ - Nitrogen @ 0% + Phosphorus @ 50 %	37.39	62.39	51.44
3.	T ₃ - Nitrogen @0% + Phosphorus @100%	37.55	63.44	54.15
4.	T ₄ -Nitrogen @ 50% + Phosphorus @ 0 %	38.15	63.87	59.01
5.	T ₅ - Nitrogen@50% + Phosphorus @50%	38.37	64.70	62.34
6.	T ₆ -Nitrogen @50% + Phosphorus @100 %	38.51	65.78	62.07
7.	T ₇ -Nitrogen@100% + Phosphorus @ 0%	39.56	65.23	63.29
8.	T ₈ -Nitrogen@100% + Phosphorus @ 50 %	42.65	65.95	63.96
9.	T ₉ -Nitrogen@100% + Phosphorus @100%	44.49	66.11	64.41
	F-Test	NS	S	S
	C.D at 0.5%	0.65	0.76	1.77
	S.Ed(±)	0.30	0.36	0.55

Table.3 Response of different levels of nitrogen and phosphorus on soil pH, electrical conductivity and organic carbon of soil in radish

S. No.	Treatment combinations	soil pH	Electrical Conductivity (dSm ⁻¹)	Organic carbon (%)
1.	T ₁ - absolute control	7.60	0.03	0.56
2.	T ₂ - Nitrogen @ 0% + Phosphorus @ 50 %	7.62	0.03	0.61
3.	T ₃ - Nitrogen @0% + Phosphorus @100%	7.73	0.04	0.63
4.	T ₄ -Nitrogen @ 50% + Phosphorus @ 0 %	7.64	0.04	0.64
5.	T ₅ - Nitrogen@50% + Phosphorus @50%	7.68	0.03	0.66
6.	T ₆ -Nitrogen @50% + Phosphorus @100 %	7.71	0.03	0.65
7.	T ₇ -Nitrogen@100% + Phosphorus @ 0%	7.73	0.04	0.71
8.	T ₈ -Nitrogen@100% + Phosphorus @ 50 %	7.72	0.04	0.73
9.	T ₉ -Nitrogen@100% + Phosphorus @100%	7.75	0.04	0.73
	F-Test	NS	NS	NS
	C.D at 0.5%	0.06	0.01	0.06
	S.Ed(±)	0.02	0.04	0.03

Table.4 Response of different levels of nitrogen and phosphorus on available nitrogen, phosphorus and potassium of the soil

S. No.	Treatment combinations	Nitrogen (kg ha ⁻¹)	Phosphorus (kg ha ⁻¹)	Potassium (kg ha ⁻¹)
1.	T ₁ - absolute control	224.81	24.13	139.42
2.	T ₂ - Nitrogen @ 0% + Phosphorus @ 50 %	262.50	27.33	149.87
3.	T ₃ - Nitrogen @0% + phosphorus @ 100 %	272.09	29.48	149.87
4.	T ₄ -Nitrogen @ 50% + Phosphorus @ 0 %	287.58	35.50	176.90
5.	T ₅ - Nitrogen@50% + Phosphorus @50%	330.83	35.55	149.87
6.	T ₆ -Nitrogen @50% + Phosphorus @100 %	337.75	37.32	149.87
7.	T ₇ -Nitrogen@100% + Phosphorus @ 0%	341.75	41.26	187.25
8.	T ₈ -Nitrogen@100% + Phosphorus @ 50 %	350.61	44.49	176.94
9.	T ₉ -Nitrogen@100% + Phosphorus @100%	375.94	45.72	176.90
	F-Test	S	S	S
	C.D at 0.5%	14.3	2.00	4.27
	S.Ed(±)	6.2	0.94	2.01

Fig.1 Interaction effect of integrated nutrient management on bulk density, particle density and specific gravity of soil

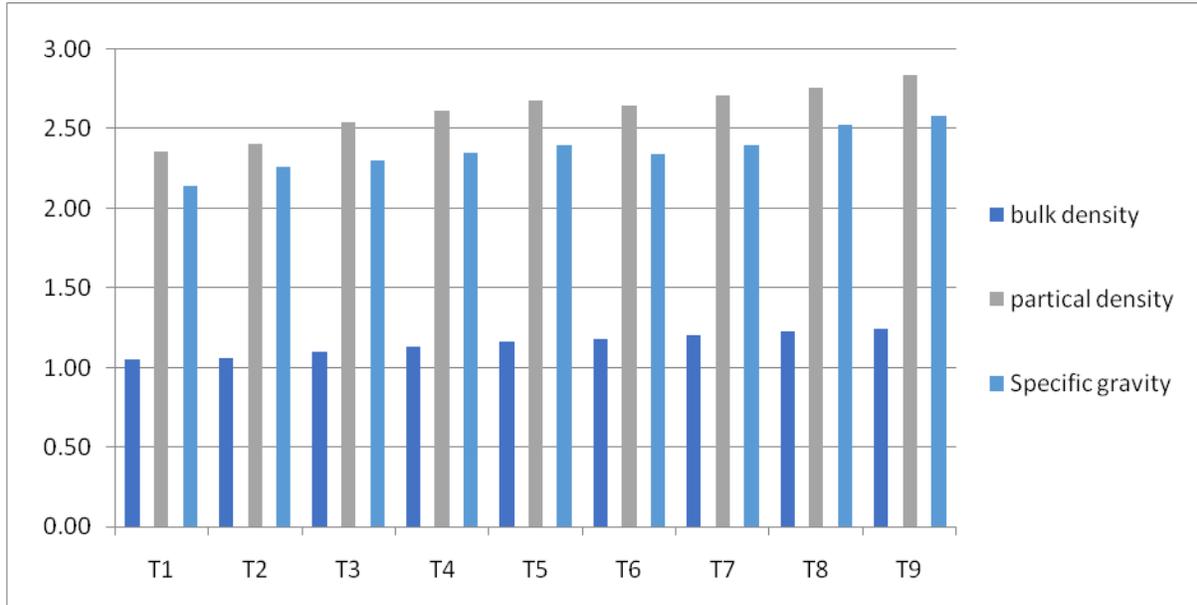


Fig.2 Interaction effect of different levels of nitrogen and phosphorus on solid space (%) water holding capacity and pore space of soil

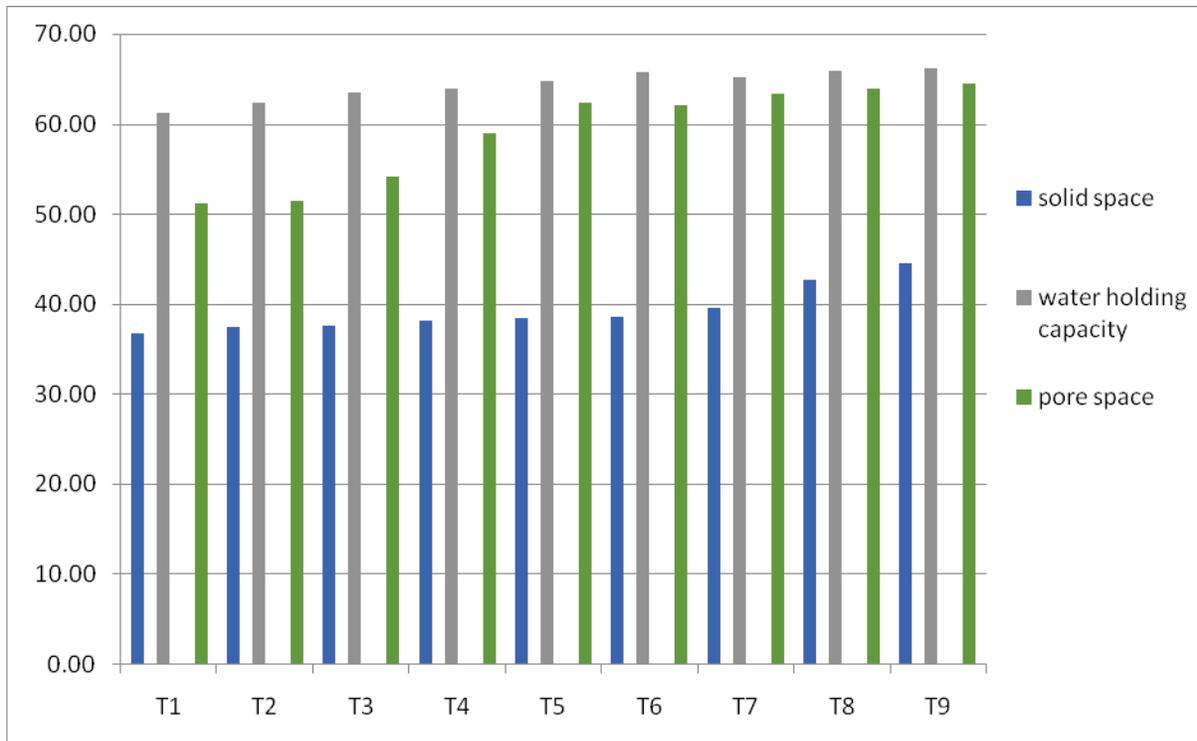


Fig.3 Interaction effect of different levels of nitrogen and phosphorus on soil pH, electrical conductivity and organic carbon of soil

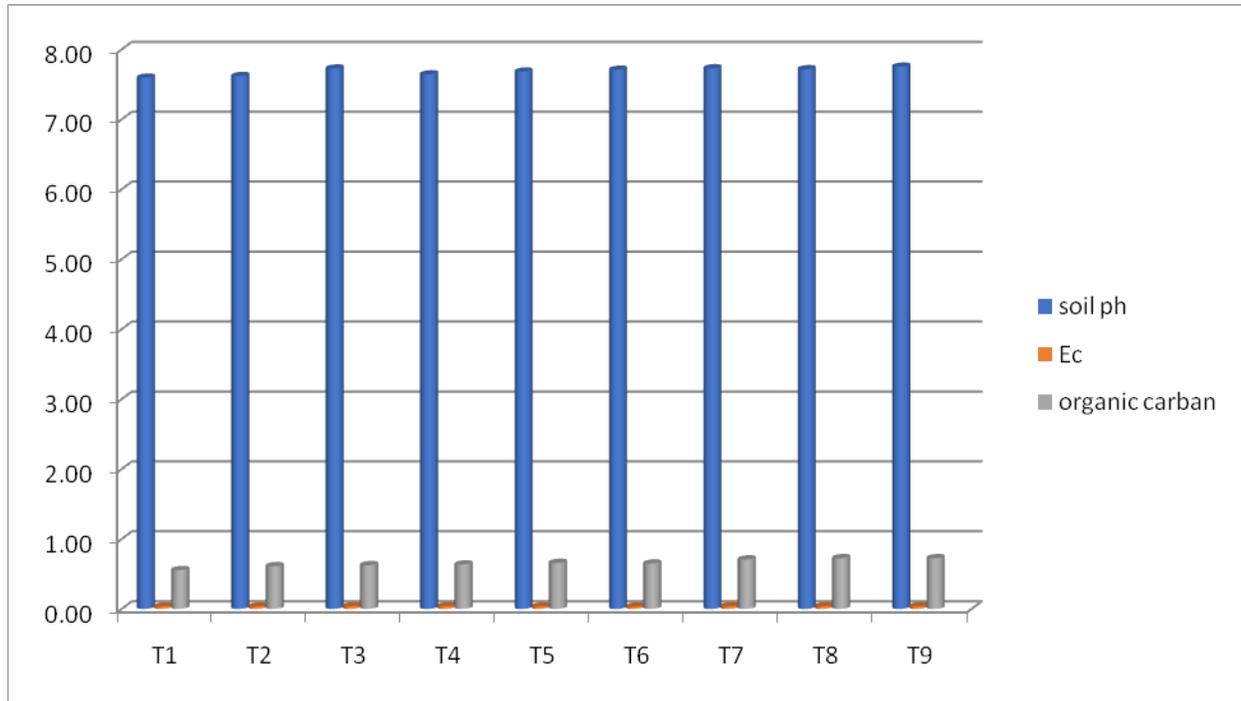
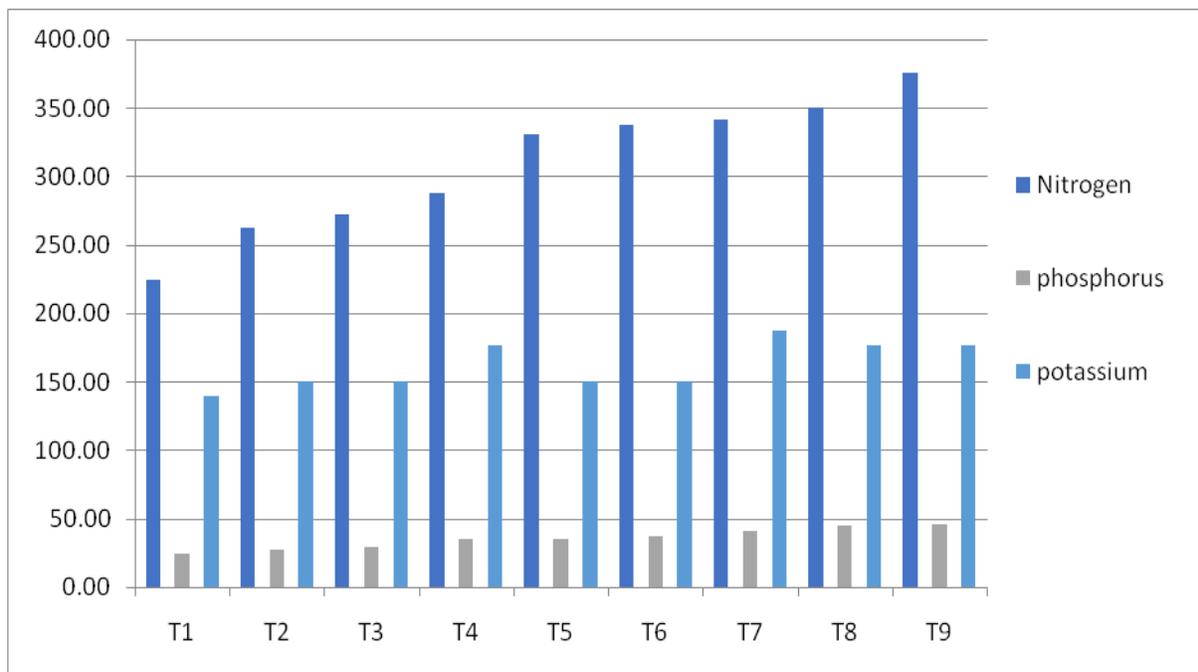


Fig.4 Interaction effect of different levels of nitrogen and phosphorus on available nitrogen, phosphorus and potassium in soil



The maximum Bulk density was observed in the treatment combination T₁-[absolute control] there was non-significant variation between various treatment combinations there was a non-significant effect on bulk density and solid space.

Similar findings had been reported by Kamalakannan and Manivannan (2003) stated that levels of nitrogen and phosphorus is the best approach to supply adequate and balanced nutrients and increase crop productivity in an efficient and environmentally benign manner, without sacrificing soil productivity of future generations. It is also found that by Jilani *et al.*, (2010). The maximum N and P uptake was noted when 100% RDF at the rate of one t ha⁻¹.

The experiment was conducted at the Research Farm of Soil Science and Agricultural Chemistry, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during *Rabi* season 2019-2020 study the “Response of different levels of nitrogen and phosphorus on soil health, Growth and yield attributes of Radish (*Raphanus sativas* L.)” in prayagraj soil.

The treatments were allocated in a randomized block design with three replications. The treatments consisted of combination of different levels of nitrogen and phosphorus.

The crop was sown 20th December 2019 with a seed rate of 10 kg ha⁻¹ and harvested on 19th January 2020. The observation taken on different plant characters during the crop growth period and at crop harvest.

The general results of the investigation are summarized below:

The plot treated with treatment combination T₉- [Nitrogen@100% + Phosphorus @100%]

there was significant increase in vegetative growth and yield attributes. At this level there was slight increase in pH and decrease in EC but increase in nutrient status of soil.

The plot treated with the treatment combination T₇-[Nitrogen@100% + Phosphorus @ 0%] there was significant increase in available potassium in soil. This treatment is showing nearly similar results with treatment combination T₈.

In conclusion, the treatment combination T₉- [Nitrogen@100% + Phosphorus @100%] given the significant result in the terms of soil quality parameters like soil pore space, specific gravity, available NPK. The pH, EC and solid space non-significant. From the economical point of view the same treatment combination gave the maximum profit of R.s 1,36,462.00 ha⁻¹ with B:C ratio of 1:5.52 and it was very closely followed by treatment combination T₈-[Nitrogen@100% + Phosphorus @50 %] as they compared with treatment combination T₁-[absolute control]. Nitrogen and phosphorus might have supplies continuous slow release and increased more available nutrients, which aided in better growth parameters.

Acknowledgement

The author is thankful to the honourable vice chancellor, HOD, advisor and non-teaching staff of Department of Soil Science and Agricultural chemistry, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj Uttar Pradesh for providing all necessary facilities and clarify studies.

References

Akand MDH, Mazed HEMK, Pulok MdAI, Moonmoon JF, Partho SG. Influence of different dose of nitrogen on the growth and yield of cabbage (*Brassica oleracea*

- var. capitata* L.) *Inter. J. Multidisciplinary Res. and Development*. 2015; 2(2): 11-14.
- Akoumianakis, K. A. and Karapanos, I. C. (2011). Nitrogen, season and cultivar affect radish growth, yield, sponginess and hollowness. *International Journal of Plant Prod.*, 5(2): 111-119.
- Bilekudari, M. K. Deshpande, V. K. Shekhargouda, M. (2005). Effect of spacing and fertilizer levels on growth, seed yield and quality of radish. *Karnataka Journal of Agricultural Sciences*. 18:2, 338-342.
- Bodkhe, V.A.Mahorkar, V.K. (2010). Effect of various organic manures on growth, yield and quality of radish. *International J. Agri. Sci.*, 6: (1) 72-73.
- Borisov, V. A. Tenkov, A. L. (2004). Yield and quality of radish, garden radish and daikon in Moscow province. [Russian] *Kartofel 'i Ovoshchi*. 2, 22-23.
- Dod, V. N. Java Giri Manisha Deshmukh More, G. B. (2010). Effect of plant spacings on seed yield and quality of radish. *Annals of plant physiology*.24: 1, 110-111.
- El-Desuki, M. Salman, S. R. El - Nembr, M. A.and Abdel - Mawgoud, A. M. R. (2005). Effect of plant density and nitrogen application on the growth, yield and quality of radish (*Raphanus sativus* L.). *Journal of Agronomy*. 4(3), 225-229.
- Ermokhin, Yu, I. Bobrenko, E. G. and Bobrenko, I.A. (2004) Varietal characteristics of radish productivity and quality with the use of fertilizers. *Russian Agricultural Sciences*. 10(5): 8-12.
- Gonge; V. S. Bhole, M. S. and Deshmukh, D. T. (2003). Effect of plant density and nitrogen levels on root yield and quality of radish (*Raphanus sativus* L.) var. Pusa Chetki. *Orissa J.Horti.*, 31(1): 82-84.
- Guvenc, I. (2002). Effect of nitrogen fertilization on growth, yield and nitrogen contents of radishes. *Gartenbauwissenschaft*; 67: (1) 23-27, 19.
- Jilani, M. S. Tariq Burki Kashif Waseem (2010) Effect of nitrogen on growth and yield of radish. *Journal of Agricultural Research (Lahore)*. 48(2): 219-225.
- Kamalakaran and Manivannan (2003) Response of radish for grades levels of nitrogen and phosphorus along with bio-fertilizers. *South Indian Horti.*, 51: (1/6), 199-203.
- Kezia EJ, David SJ. The effect of organic and Inorganic fertilizers on the growth of radish. *IOSR-JHSS*. 2013; 17(3): 51-55.
- Tripathi AK, Ram RB, Rout S, Kumar A, Patra SS, Effect of Nitrogen Levels and Spacing on Growth and Yield of Radish (*Raphanus sativus* L.) Cv. Kashi Sweta, *Int. J. Pure App. Biosci*. 2017; 5(4): 1951-1960.
- Zewide I, Mohammed A, Tulu S. Effect of different rates of nitrogen and phosphorus on yield and yield components of potato (*Solanum tuberosum* L.) at Masha District, South western Ethiopia. *International Journal of Soil Science*. 2012; 7: 146-156.

How to cite this article:

Choppari Shiva Kumar, Narendra Swaroop, Arun Alfred David, Tarence Thomas, Dudekula Sarmas Vali and Odapally Vinay Kumar. 2020. Response of Different level of Nitrogen and Phosphorus on Soil health, Growth and Yield attributes of Radish (*Raphanus sativas* L.). *Int.J.Curr.Microbiol.App.Sci*. 9(11): 2534-2541. doi: <https://doi.org/10.20546/ijemas.2020.911.307>