# GROWTH AND YIELD RESPONSE OF RADISH CV. PUSA HIMANI TO INTEGRATED NUTRIENT MANAGEMENT PRACTICES

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## ABSTRACT

The experiment was conducted at Horticultural Research Station, Anantharajupeta, Dr.Y.S.R Horticultural University, Andhra Pradesh during 2014-2015. The trail was carried out in radish cv. Pusa Himani, consisting of 15 treatment combinations, replicated thrice. The results revealed that, significantly taller plant (28.55 cm), higher leaf count per plant (19.02), leaf area (106.74 cm2), longer root (34.07 cm), root diameter (16.44 cm) and maximum yield (52.46 t/ha) were recorded with the application of Azospirillum (5 kg/ha) + PSB (7.5 kg/ha) + VAM (12.5 kg/ha) + 50% NPK (T14).

**Keywords:** Radish, *Azospirillum*, P.S.B, VAM, NPK, Growth, Yield

## INTRODUCTION

Among the root crops, radish (*Raphanus sativus* L.) belongs to the family Brassicaceae, genus *Raphanus* and species *sativus* having chromosome number (2n=18). Radish is grown for its young tender tuberous root, which is consumed either cooked or raw and potential source of non-drying fatty oil suitable for soap making. In homeopathy, it is used for neurological problems, headache, sleeplessness and chronic diarrhoea. The leafy top is very rich in minerals, particularly Ca and Fe (Aykroyd, 1966). Kamalakannan and Manivannan (2002) reported longest shoots, numbers of leaves per plant, root length, root weight and shoot weight occurred with the application of NPK in combination with *Azospirillum* in radish.

The concept of integrated nutrient management requires optimum use of organic, inorganic and bio-sources of plant nutrients. Integrated use of fertilizer, manure and bio-fertilizer improve soil fertility and crop growth. They are also reported to have an effective role in improving disease resistance in the crop by producing antibacterial and anti-fungal compounds and also produce growth regulators (Singh, 2000). IPNM is of paramount importance in achieving sustainable productivity of radish and improving soil health. Use of organic manures in integrated plant nutrient management correct multiple deficiencies of plant nutrients and improves physical, chemical and biological properties of soil. Being environment friendly and low cost input, greater emphasis has been given on application of bio-fertilizer with organic and inorganic fertilizers as part of an integrated nutrient management strategy, which play significant role in plant nutrition (Sharma *et al*., 2013).

Among various factors responsible for low production of radish, nutrition is of prime importance. The high cost of fertilizer also restricts their large scale use. Therefore, to reduce dependence on chemical fertilizers along with maintenance of sustainable production are vital issues in modern agriculture which is only possible through integrated plant nutrient management. In the absence of precise recommendations, the growers are following nutrient schedules of their own, which results in improper nutrition to the crop. This ends up with improper balance in plants and is considered to be a major factor contributing to low yields. Therefore, the present investigation was conceived and conducted with INM practices in radish to arrive at a feasible nutrient schedule under the prevailing ago-climatic conditions of the Rayalaseema region of Andhra Pradesh.

## MATERIALS AND METHODS

A field experiment entitled "Growth and yield response of radish cv. Pusa Himani to INM practices" was conducted during rabi season of 2014-15. The experiment was carried out at Horticultural Research Station, Anantharajupeta, Y.S.R Kadapa Dist. Andhra Pradesh. The experimental field was laid out in Randomized Block Design with 15 treatment combinations. These treatments randomized in three replications with total number of 45 plots. The details of experimental treatment plan employed in the present investigation was carried outas follows: $T_1$- R D of NPK (80:40:80 Kg NPK/ha), $T_2$- Azospirillum (5 kg/ha) + RD of NPK, $T_3$-Azospirillum (5 kg/ha) + 75% N + R D of P K, $T_4$-Azospirillum (5 kg/ha) + 50 % N + RD of P K, $T_5$-PSB (7.5 kg/ha) + R D of NPK, $T_6$-PSB (7.5 kg/ha) + 75% P + R D of N K , $T_7$- PSB (7.5 kg/ha) + 50 % P + R D of N K, $T_8$- VAM (12.5 kg/ha) + R D of NPK, $T_9$-VAM (12.5 kg/ha) + 75% P + R D of N K, $T_{10}$- VAM (12.5 kg/ha) + 50% P + R D of N K, $T_{11}$- Azospirillum (5 kg/ha) + PSB (7.50 kg/ha) + VAM (12.50 kg/ha), $T_{12}$- $T_{11}$ + 100% N P and K, $T_{13}$ - $T_{11}$ + 75% N P and K, $T_{14}$ - $T_{11}$ + 50% N P and K, $T_{15}$ - Control (no application of fertilizers).

After ploughing and digging, the land was brought to fine tilth. All weeds were completely removed from the field. All the stubbles of previous crop were removed from the field and burnt. The trial was conducted in red sandy loam soil with a spacing of 30 x 30 cm and seeds were sown on 2-11-2014. Necessary plant protection measures were followed to prevent pest incidence. Well decomposed farmyard manure was applied uniformly to all the experimental plots at 20 t $ha^{-1}$ and mixed well. Nitrogen (80 kg $ha^{-1}$), phosphorus (40 kg $ha^{-1}$) and potassium (80 kg $ha^{-1}$) were applied. The entire quantity of phosphorus and potash and 50 per cent of nitrogen was applied as basal dose and remaining 50 per cent nitrogen was applied as top dressing at three weeks of crop growth in the main field. At initial stages of growth, chlorpyriphos @ 2-3 ml $litre^{-1}$ of water was sprayed to control *Spodoptera litura*, while no disease incidence was noticed during the investigation period.For recording observations, five plants were selected per each plot at random and were labelled properly by indicating treatments. The data were analysed using the procedure outlined by Panse and Sukhatme (1985).

## RESULTS AND DISCUSSION

The perusal of the data furnished in Table 1 shows all biometric attributes varied significantly due to the influence of treatment combinations applied. Plant height (28.55 cm), leaf count (19.02) and leaf area (106.74 $cm^2$) recorded was maximum when the radish plants were treated with Azospirillum (5 kg/ha) + PSB (7.50 kg/ha) + VAM (12.50 kg/ha) + 50% NPK ($T_{14}$).

The maximum growth parameters were significantly affected with the treatment of $T_{14}$ because the integrated use of nutrients actually resulted in rapid cell division, multiplication and cell elongation in meristematic region of plant which promoted vegetative growth of the plant. This also might be due to the production of plant growth substances by *Azospirillum*, which stimulated the metabolicprocess of plants through the way of activation of desirable enzymes (Kachari and Korla, 2009; Yadav *et al*., 2007).This might also be due to more availability of nitrogen, released from organic and inorganic fertilizers. The nitrogen also synthesized into amino acids, which built complex proteins and helps in promoting the luxurious growth of crop.

The increase in maximum leaf area was due the availability of nitrogen through biological nitrogen fixation because of nitrogen nutrition play a vital role in development of plants and influenced physiological activities. It is a component of protoplasm and chlorophyll and also produced growth regulating substances. The results are in consonance with the findings of Sharma *et al*. (2013) in radish cv. Pusa Chetki and Kumar *et al.* (2013) in cauliflower cv. NHB-1012. It was observed that an increase in nitrogen levels positively affected the plant height character which might be due to role of nitrogen character for cell division, cell enlargement and protein synthesis characteristics. An improvement in plant height with improved nitrogen application levels has also been confirmed with the findings of Baloch *et al*. (2014) in carrot.

The information made available in Table 2 indicated that all the root and yield traits differ significantly by the application of applied inputs. Significantly longer root (34.07 cm), root diameter (16.44 cm) and maximum yield (52.46 t/ha) was recorded in treatment combination Azospirillum (5 kg/ha) + PSB (7.50 kg/ha) + VAM (12.50 kg/ha) + 50% NPK ($T_{14}$). However, none of the inputs had significant influence of fresh weight of one root (Table 2). Similar type of findings was also reported by Khalid*et al*. (2016) in radish.This might be due to possible role of Azospirillum through atmospheric nitrogen fixation, better root proliferation, uptake of nutrients and water and phyto-hormones are produced by the bio-fertilizers, which stimulated root growth and induced changes in root morphology. More photosynthesis enhanced food accumulation which might have resulted in better growth and subsequently higher yield. The present results are in conformity with the findings of Khalid *et al*. (2016) and Kumar *et al*. (2016) in radish.

The increase in yield might also be due to sustained availability of nitrogen throughout the growing phase and also due to enhanced carbohydrate synthesis and effective translocation of the photosynthates to sink. *i.e.* tuber. The proportion and activity of beneficial microbes would have been at the higher rate during fermentation and thus helping in synthesis of growth substances,

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which might have resulted in better yield. This finding is in accordance with the results obtained by Velmurugan *et al*. (2005).
From the results obtained it can be concludedthat radish is a short as well as fast growing vegetable. Growth and yield in radish cv. Pusa Himani was enhanced with the application of Azospirillum (5 kg/ha) + PSB (7.50 kg/ha) + VAM (12.50 kg/ha) + 50% NPK ($T_{14}$).

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**Table 1. Effect of integrated nutrient management on growth characters of radish cv. Pusa Himani.**

| Treatments | Plant height (cm) | Number of leaves per plant | Leaf area ($cm^2$) |
|---|---|---|---|
| $T_1$ | 24.26 | 13.95 | 98.11 |
| $T_2$ | 22.50 | 18.89 | 102.46 |
| $T_3$ | 23.49 | 16.23 | 101.99 |
| $T_4$ | 23.89 | 16.99 | 95.41 |
| $T_5$ | 21.78 | 18.74 | 98.85 |
| $T_6$ | 23.13 | 16.99 | 103.67 |

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|---|---|---|---|
| $T_7$ | 27.36 | 18.80 | 102.72 |
| $T_8$ | 24.51 | 17.16 | 101.03 |
| $T_9$ | 26.11 | 14.66 | 103.92 |
| $T_{10}$ | 21.09 | 12.37 | 93.33 |
| $T_{11}$ | 22.71 | 16.52 | 102.94 |
| $T_{12}$ | 25.33 | 18.78 | 86.71 |
| $T_{13}$ | 23.21 | 15.40 | 94.60 |
| $T_{14}$ | 28.55 | 19.02 | 106.74 |
| $T_{15}$ | 12.80 | 11.77 | 56.78 |
| CD ($P$=0.05) | 2.813 | 1.97 | 7.32 |
| S.Em.± | 0.966 | 0.67 | 2.51 |
| C.V% | 7.156 | 7.16 | 4.50 |

**Table 2. Effect of integrated nutrient management on yield attributes of radish cv. Pusa Himani.**

| Treatments | Root length (cm) | Root diameter (cm) | Fresh weight of one root (g) | Yield (t/ha) |
|---|---|---|---|---|
| $T_1$ | 24.63 | 13.28 | 249.88 | 44.75 |
| $T_2$ | 27.93 | 11.90 | 267.72 | 36.19 |
| $T_3$ | 27.64 | 12.68 | 221.11 | 31.46 |
| $T_4$ | 24.70 | 11.81 | 227.33 | 29.92 |
| $T_5$ | 23.16 | 10.55 | 218.77 | 49.24 |
| $T_6$ | 30.17 | 12.61 | 229.55 | 47.45 |

| | | | | |
|---|---|---|---|---|
| $T_7$ | 27.33 | 11.72 | 226.11 | 50.67 |
| $T_8$ | 30.94 | 11.22 | 319.22 | 43.91 |
| $T_9$ | 25.66 | 12.83 | 294.77 | 44.12 |
| $T_{10}$ | 26.96 | 15.21 | 338.33 | 47.18 |
| $T_{11}$ | 33.25 | 13.88 | 308.88 | 45.19 |
| $T_{12}$ | 29.72 | 13.55 | 316.66 | 37.31 |
| $T_{13}$ | 28.77 | 13.70 | 278.11 | 40.10 |
| $T_{14}$ | 34.07 | 16.44 | 387.22 | 52.46 |
| $T_{15}$ | 19.78 | 10.16 | 166.06 | 17.19 |
| CD (*P*=0.05) | 6.90 | 2.25 | N.S | 4.84 |
| S.Em.± | 2.37 | 0.77 | 48.22 | 1.66 |
| C.V% | 14.85 | 10.49 | 30.93 | 7.00 |