



Effect of Rhizodyne on growth patterns of local cultivars of Paddy (*Oryza sativa* L.) using paper towel and pot culture assay methods

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Abstract

In the current Study pot assay has been employed to investigate the effect of commercial biofertilizer (Rhizodyne - complex bio fertilizer) application on 4 rice local cultivars (*Oryza sativa* L.) growth both shoots and roots in local lake soil. Rhizodyne is a product of Varsha Biosciences and Technology (VBTIPL), Hyderabad (India) that contains species of Phosphate solubilising bacteria (PSB), Azospirillum species, K mobilizing bacteria and Zn solubilising bacteria (5×10^7 CFU minimum per gram of rhizodyne). In paper towel experiment of studied parameters in 4 cultivars of Indica rice Cotton dora sannalu response was maximum in shoot length, root length and weight of root and in weight of shoot Erramallelu showed maximum weight. In seeds treated with rhizodyne of studied parameters in 4 cultivars of Indica rice Cotton dora sannalu response was maximum in shoot length, root length and weight of root and in weight of shoot Erramallelu showed maximum weight, No of tillers were more in Pothana. In soil treated with rhizodyne of studied parameters in 4 cultivars of Indica rice Erramallelu was maximum in shoot length, root length and weight of shoot and in weight of root Cotton dora sannalu showed maximum weight, No of tillers were more in Pothana

2007). This process can contribute as much as 75 kg N ha^{-1} per crop cycle with means of 8 to 30 kg N ha^{-1} (Irissarri and Reinhold-Hurek, 2001). These N-fixing bacteria may be free-living or naturally associated to rice plants. Recent studies have shown that several bacteria may be isolated from sterilized surface roots of flooded rice plants, suggesting endophytic colonization (Raimam *et al.*, 2007). The most likely candidates for biological N fixation in rice are species of *Alcaligenes*, *Azospirillum*, *Bacillus*, *Enterobacter*, *Herbaspirillum*, *Klebsiella*, *Pseudomonas*, and *Rhizobium* (Malik *et al.*, 1997; James *et al.*, 1999; Yanni *et al.*, 1997). After laboratory testing and studying field performance, efficient bacterial strains for biofertilizer production were finally selected. A suitable carrier material was selected after trying a number of local materials to ensure maximum survival of the inoculated bacteria during storage and transportation. They named this biofertilizer as Rhizodyne, which improves crop growth and yield by increasing photosynthesis, producing bioactive substances, such as hormones and enzymes, controlling soil diseases, and accelerating decomposition of lignin materials in the soil (Higa, 2000; Hussain *et al.*, 2002).

Key Words: Investigated, Commercial Biofertilizer, Shoot length, Root length, Control

Introduction

Rice (*Oryza sativa* L.) is probably the most important cereal in the world and serves as food for about 50% of the world's population (Ladha *et al.*, 1997). This crop requires about 10 million tons of N fertilizers every year worldwide (IRRI, 1996). Rice is usually grown in N-deficient soils, and this element must be supplied to the field by commercially available N fertilizers. However, a substantial amount of urea-N or $\text{NO}_3\text{-N}$ applied as fertilizers is lost through different mechanisms, thus causing environmental pollution problems. Use of biological N_2 -fixation technology can decrease N fertilizer application and reduce environmental risks (Raimam *et al.*,

Materials and Methods:

Collection of Plant material

Plant material was provided by Agricultural Research Station, Warangal, Telanagana and SFCl, Surathgarh, Rajasthan and they were kept in lab away from contamination.

Soil characteristics

Loamy textured soil was taken containing the organic matter 0.82%, pH 7.6, 0.041 % N, 12 mg kg^{-1} available P, and 220 mg kg^{-1} available K were employed. Micronutrients Fe, Cu and Zn were 9.32, 1.6 and 4.03 mg kg^{-1} of soil respectively (Raimam *et al.*, 2007). The experiment was carried out in local garden at Dilshuknagar, Hyderabad, India.

Soil amendments

Earthen pots of 24-cm diameter and 36-cm depth were taken and filled with 5 kg of soil in each pot. Soil was amended with vermi compost mixture 10 g/1 kg soil. A basal dose of 35 mg kg⁻¹ N as urea. All the pots were irrigated with tap water and left for 10 days for organic decomposition

Table 1: Shows the Characteristics of the Soil

TABLE I CHARACTERISTICS OF SOIL		
Soil properties	Unit	Value
Carbon Organic	%	0.84
Salinity	ds/m	3.2
P	ppm	280
pH	-	7.73
N	%	0.08
P	ppm	7

Treatments and Experimental Design

There were three treatments with 2 replicates each, for each of the study. These were;

- i) Control
- ii) Seeds treated with rhizodyne + soil no treatment
- iii) Seeds no treatment + soil treated with rhizodyne
- iv) Seeds not treated with rhizodne+water on blotting paper
- v) seeds treated with rhizodyne+water on blotting paper

Rhizodyne application

Commercial rhizodyne was obtained from Varsha Bioscience and Technology (VBTIPL), Hyderabad (India). Rhizodyne contained Phosphate solubilising bacteria (PSB) , Azospirillum species, K mobilizing bacteria and Zn solubulising bacteria (5 * 10⁷ CFU minimum per gram of rhizodyne) and was applied 10g/1 kg of seed and 10g/1 kg of soil respectively.

Harvesting

Plants were harvested 5, 10, 20, 30 and 40 days after sowing. Shoot length and root length were measured using scale and number of tillers was counted for each plant on day 20 and 40 days.

Statistical Analysis

There were two replicates for each study and mean data was calculated for various studied parameters. Data of various shoot, root and tillers per plant were noted and ANOVA was done.

Results and Discussion

Effect of Biofertilizer and Soil amendments on Plant Growth

There were three different types of treatments given

- 1) Seeds treated with rhizodyne in soil (pot culture assay)
- 2) Soil treated with rhizodyne (pot culture assay)
- 3) Seeds treated with rhizodyne on blotting paper (paper towel assay)

In these two treatments, seeds treated with rhizodyne showed more shoot length then control and less root length then control, where as in soil treated with rhizodyne showed more shoot length as well as root length when compared with control.

Paper Root Weight:

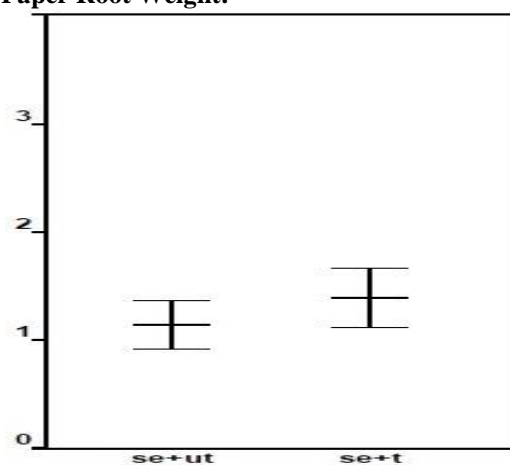


Fig 1(A): Root weights in grams in Paper Towel assay

*se+ut = seeds untreated; se+t = seeds treated

Paper Towel Assay Root Length:

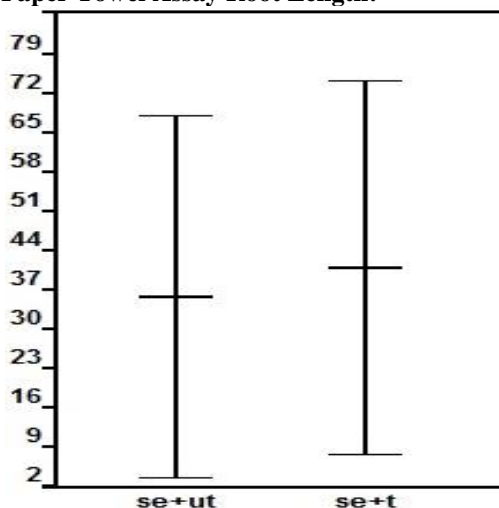


Fig 1(B): Root length in centimetres in Paper Towel assay

*se+ut = seeds untreated; se+t = seeds treated

Paper Towel Assay: Weight at 3rd Hour

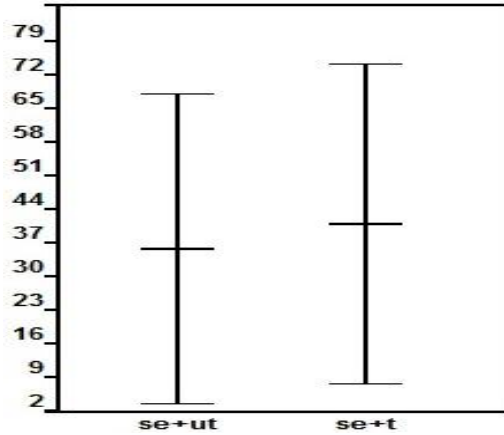


Fig 1(C): Shoot weight in grams at 3rd hour in Paper Towel assay at 65^oc

*se+ut = seeds untreated; se+t = seeds treated

Paper Towel Assay: Weight at 0th Hour

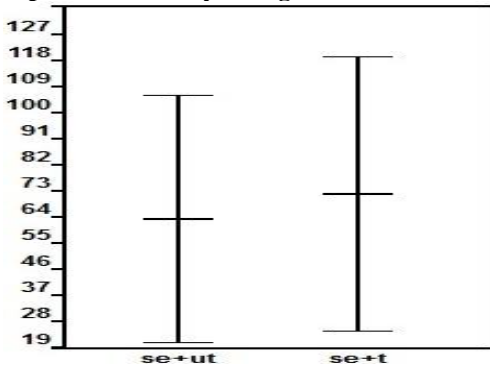


Fig 1(D): Shoot weight in grams at zero hour in Paper Towel assay

*se+ut = seeds untreated; se+t = seeds treated

Paper towel shoot length:

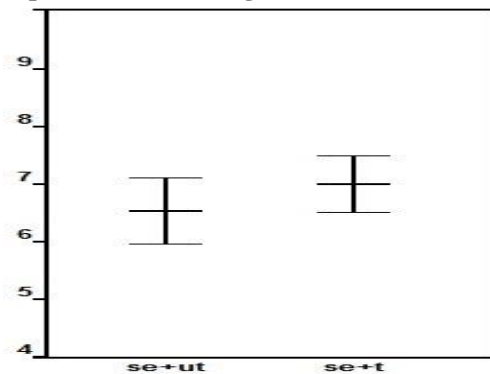


Fig 1(E): Shoot length in centimetres in Paper Towel assay

*se+ut = seeds untreated; se+t = seeds treated

Root Length

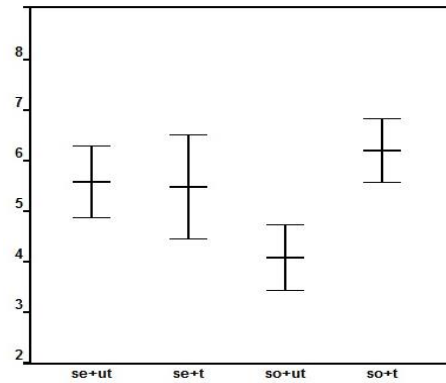


Fig 2(A): Root length in centimeters in Pot culture assay

* se+ut = seeds untreated; se+t = seeds treated; so+ut = soil untreated; so+t = soil treated

Shoot Length

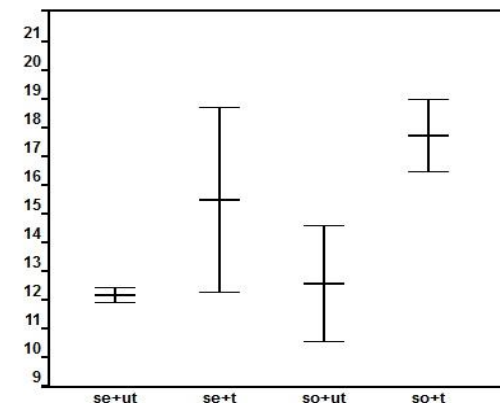


Fig 2(B): Shoot length in centimeters in Pot culture assay

* se+ut = seeds untreated; se+t = seeds treated; so+ut = soil untreated; so+t = soil treated

Soil Root Weight:

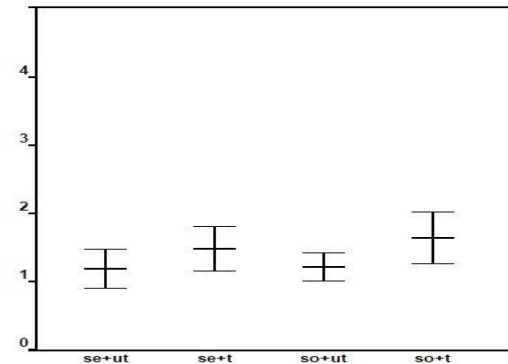


Fig 2(C): Root Weight in grams in Pot culture assay

* se+ut = seeds untreated; se+t = seeds treated; so+ut = soil untreated; so+t = soil treated

Weight at Zero Hour:

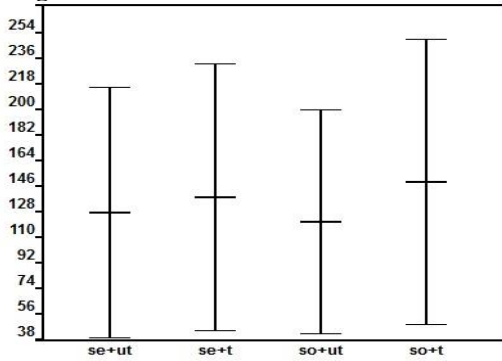


Fig 2(D): Shoot Weight in grams in Pot culture assay at zero hour

* se+ut = seeds untreated; se+t = seeds treated;
so+ut = soil untreated; so+t = soil treated

Weight at 3rd Hour

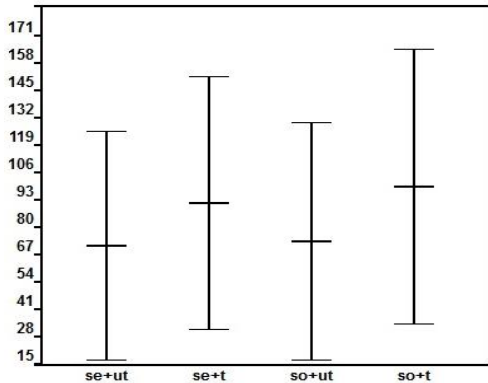


Fig 2(E): Shoot Weight in grams in Pot culture assay at 3rd hour at 65^oc

* se+ut = seeds untreated; se+t = seeds treated;
so+ut = soil untreated; so+t = soil treated

Number of Tillers:

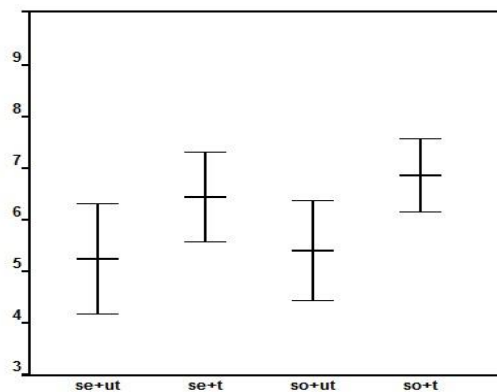


Fig 2(F): Number of Tillers in Pot culture assay

* se+ut = seeds untreated; se+t = seeds treated;
so+ut = soil untreated; so+t = soil treated

Results and Discussion

Paper Towel Assay (18 day study)

The biofertilizer (10g/1Kg) markedly enhanced the plant shoot length, root length, no of tillers and weight of roots and plant weight in local lake soil when compared with control in paper towel assay.

Best

Shoot length- 7.5cms in Cotton dora sannalu, (Fig 1(E))
Root length- 4.9 cms in Cotton dora sannalu, (Fig 1(B))
Shoot weight- 143.33 grams Erramallelu, (Fig 1(D))
Root weight- 1.8 grams Cotton dora sannalu, (Fig 1(A))

Seeds Treated With Rhizodyne (60 day study)

The biofertilizer (10g/1Kg) on average markedly enhanced the plant shoot length, root length, no of tillers and weight of roots and plant weight in local lake soil when compared with control

Best

Shoot length- 18.3 cms in Cotton dora sannalu, (Fig 7)
Root length- 6.4 cms in Cotton dora sannalu, (Fig 7)
Shoot weight- 280.42 grams Erramallelu, (Fig 6)
Root weight- 2.0 grams Cotton dora sannalu
No of tillers- 7.3 tillers/plant- Pothana

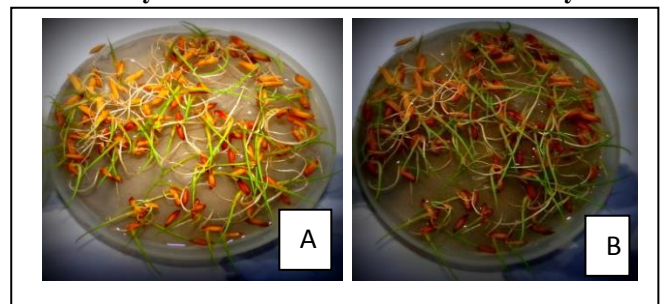
Soil Treated with Rhizodyne (60 day study)

The biofertilizer (10g/1Kg) on average markedly enhanced the plant shoot length, root length, no of tillers and weight of roots and plant weight in local lake soil when compared with control

Best

Shoot length- 18.9 cms in Erramallelu and Cotton dora sannalu, (Fig 2(B))
Root length- 7.2 cms in Erramallelu, (Fig 2(A))
Shoot weight- 300.13 grams Erramallelu, (Fig 2(D))
Root weight- 2.2 grams Cotton dora sannalu, (Fig 2(C))
No of tillers- 7.6 tillers/plant – Pothana, (Fig 2(F))

Pot Assays Untreated and Treated After 05days



A) Untreated with Rhizodyne; B) Treated with Rhizodyne

Pot Assays Untreated and Treated After 30days

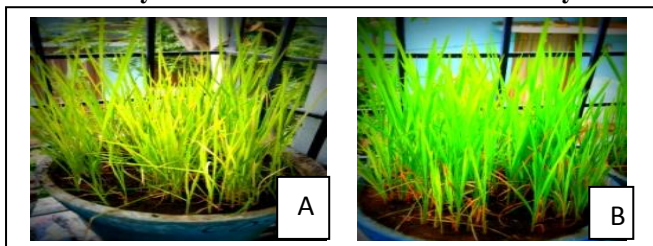


Fig 4: Pot culture assay of Sambha mahsuri at day 30, A) Untreated with Rhizodyne; B) Treated with Rhizodyne

SM + Water + Rhizodyne and SM + Water

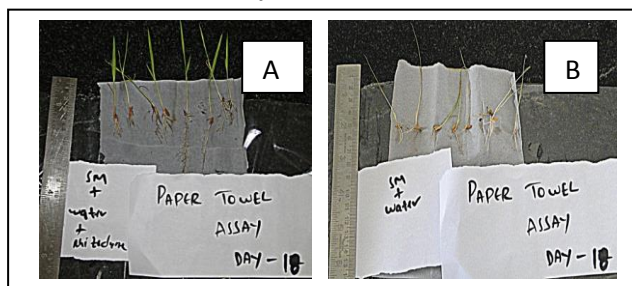


Fig 5: Paper Towel assay of Sambha mahsuri at day 18 A) Treated with Rhizodyne; B) Untreated with Rhizodyne

Weight of Erramallelu



Fig 6: Weight of Erramallelu, Seeds treated with Rhizodyne

Shoot and Root length Of Cotton dora sannalu

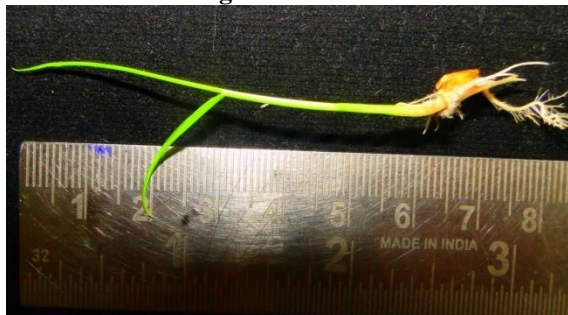


Fig 7: Shoot and root lengths in centimetres, Seeds treated with Rhizodyne

Calculations:

1) Shoot length

$$\text{Length of shoot} = (X1 + \dots + X20) = Q$$

$$\text{Total no of plants taken} = A$$

$$\text{Shoot length} = Q \div A$$

2) Root length

$$\text{Length of longest root} = (Y1 + \dots + Y20) = V$$

$$\text{Total no of plants taken} = B$$

$$\text{Root length} = V \div B$$

3) No of tillers

$$\text{No of tillers per plant} = (Z1 + \dots + Z20) = W$$

$$\text{Total no of plants} = C$$

$$\text{No of tillers} = W \div C$$

4) Weight of plant

$$\text{Weight of beaker} = P$$

$$\text{Weight of beaker + plants} = R$$

$$\text{Weight of plants} = R - P$$

5) Weight of Root

$$\text{Weight of petriplate} = J$$

$$\text{Weight of roots + petriplate} = K$$

$$\text{Weight of root} = K - J$$

Conclusion:

Rhizodyne has a positive effect on shoot length root length, no of tillers and weights of shoots and roots of studied rice cultivars in paper towel assay, seeds treated with rhizodyne and soil treated with rhizodyne when compared with control.

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