

Original Research Article

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## Compatibility between Groundnut *Rhizobium* and Seed Dressing Fungicide

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### ABSTRACT

#### Keywords

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A pot culture experiment was conducted to examine the compatibility of *Rhizobium* (Rhs-1) with four fungicide and there combination used for seed treatment. The combination effects of inoculation with fungicide growth and number of nodules, dry weight of nodules, dry matter parameters were studied, present investigation on two Spanish bunch varieties (JL-24 and SB- XI)

### Introduction

The survival and inoculation efficiency of root nodules bacteria are highly influenced by several soil and plant factors such as, soil constitution, soil physical properties and the chemical seed treatments. Agricultural practices that discourage the frequency of the beneficial microorganism and subsequently their intensity of nodulation need to be carefully evaluated. Seed treatment with chemicals may impair microbial activity subsequently and attention towards this point has often been drawn in the rhizobia literature.

Contradictory evidences have been given on the compatibility between the rhizobia and seed dressing chemicals. The toxicity of chemicals containing mercury, copper or zinc to *Rhizobium* has been reported in the forties

by Allington (1945) and Kernkamp (1948). However, Wankhede and Bhide (1972) did not find toxic effect on phenyl mercury acetate to *Rhizobium japonicum*. Mukewar and Bhide (1969) studied the effect of seed treatment with fungicides and antibiotic aureofungin, on nodulation in groundnut by *Rhizobium* sp. They observed that captan and aureofungin seed treatments did not have adverse effect on nodulation and dry weight of plant.

Balaraman and Prasad (1973) and Sardeshpande *et al.*, (1973) reported that captan, ceresin and Brassical had no harmful effect on nodulation, dry matter weight and nitrogen content of groundnut when *Rhizobium* inoculation was done after fungicidal seed treatment. Kulkarni *et al.*,

(1975) treated the groundnut seeds with four fumigants viz., ethylene dibromide, ethylene dichloride, carbon tetrachloride, chloropicrin and phosphomine and one insecticides malathion. The pretreated seeds were used for inoculation and observed for nitrogen fixing traits. It revealed that all the fumigants expected an adverse effect on nodulation, nodule weight, leghamoglobin content, yield, dry matter weight and nitrogen content. However, malathion did not show any harmful effects.

### **Materials and Methods**

To study effect of commonly used seed dressing fungicides on *Rhizobium* in groundnut, a pot culture experiment was conducted. The seeds of the groundnut variety SB-XI were treated with different fungicides, and then inoculated with rhizobial suspension, seeds dried in shade and sown.

Eight seeds per pot were sown and five plants per pot were maintained. The plants were terminated 60 days, after sowing and observation were recorded on nodule number, nodule dry weight and dry matter content of plant. The various fungicides used in the experiment for seed treatment are given in table 1. The complete treatment schedule with and without fungicide is given in table 2.

### **Results and Discussion**

A pot culture experiment was conducted to examine the compatibility of *Rhizobium* (Rhs-1) with four fungicide and their combination used for seed treatment. The combination effects of inoculation with fungicide growth and number of nodules, dry weight of nodules, dry matter parameters were studied

#### **Emergence**

The data on emergence count are given in table 3. None of the fungicide applied either

alone or in combination was detrimental to *Rhizobium* during treatment on the country the fungicide improved the emergence and plant stand significantly over no fungicidal treatment. The emergence was lowest in treatment when *Rhizobium* alone used. It was highest in *Rhizobium* + ceresn treatment and as per with *Rhizobium* + vitavax + Thiram and *Rhizobium* + vitavax treatment. During summer season however, significance reduction in emergence count was noted only in *Rhizobium* + Bevistin SD, while treatments with Vitavax was included, improved the emergence markedly. Similarly Bavistin WP + Thiram seed treatment also appeared to be compatible with *Rhizobium* as emergence count in this treatment, was statistically superior to the treatment where *Rhizobium* alone was applied.

#### **Nodule number and nodule dry weight**

The result of effect of *Rhizobium* inoculation along with fungicides on nodules number and dry weight are tabulated in table 4. The data indicated that *Rhizobium* was compatible with all the fungicides tested when the evaluations were done in terms of nodule number. The nodule number per plant did not vary greatly in any of the treatments in both the season. However when dry weight of nodules were considered, it became clear that seed treatment of groundnut with a ceresn was detrimental, as it reduced the dry weight of nodules significantly over the *Rhizobium* alone. The effects between *Rhizobium* and fungicides were observed only in case of Vitavax treatments. The dry weight of nodules increased substantially in *Rhizobium* + Vitavax treatment, significant increase being over *Rhizobium* alone.

#### **Nitrogen content of nodules**

In the compatibility studied yet another parameters viz, the nitrogen content of nodules was also considered if that would be

influenced by fungicides when applied along with *Rhizobium* and the data are given in table 5. It is evident from the data that, the percent nitrogen content at nodule and total N content of nodules per plant did not show significant difference amongst the treatments. The fungicide adversely affected the total nitrogen content of nodules per plant. Vitavax was found to be beneficial as it increased the total N content of nodules per plant *Rhizobium* alone.

**Dry weight and nitrogen content of shoot** combined application of fungicides and *Rhizobium* did not affect the dry weight of shoot data are given in table 6.

The nitrogen content of shoot was highly influenced by the combined application of *Rhizobium* and fungicides, *Rhizobium* when applied with thiram reduced the percent Nitrogen and total Nitrogen content of shoot

per plant, over *Rhizobium* alone, indicated an adverse effect of Thiram. *Rhizobium* applied with Vitavax improved the percent N content of shoot significantly over *Rhizobium* alone. Similarly the treatment with Bavistin SD also improved the percent N content of shoot.

Dry weight and nitrogen content of root- The effect of combined application of *Rhizobium* and fungicides on the dry weight and nitrogen content of root are tabulated in table 7. From data, it was evident that none of the fungicides had detrimental effect on *Rhizobium* inoculation in terms of dry weight of roots. It contract Vitavax applied along with *Rhizobium* has improved the dry weight of root significantly over *Rhizobium* alone. However, this was not reflected in present estimation. The fungicidal treatments such as ceresin, vitavax reduced the percent N and total N content of roots per plant.

**Table.1** List of the fungicides used in the experiment on compatibility

Common Name	Chemical Name	Trade product used
Thiram	Tetra methyl thiram sulphate	Hexathir sowp
Phenyl mercury acetate	Phenyl mercury acetate	Ceresin dry
Carbendazim (wp)	Methyl-2-benzimidazole carbonate	Bavistin 50 WP
Carbendazim (SP)	Methyl-2-benzimidazole carbonate	Bavistin 25 SPp
Carboxin	5,6-dihydro-2-methyl-1,4-oxathin-3-carboxanilide	Vitavax 50 WP

**Table.2** List treatment schedule for compatibility pot culture experiment

Treatment code	Treatment details	Concentration of fungicide
T1	<i>Rhizobium</i> inoculation only	--
T2	Thiram seed treatment followed by <i>Rhizobium</i> inoculation	4 g/kg
T3	Cerasan dry seed treatment followed by <i>Rhizobium</i> inoculation	3 g/kg
T4	Carbendazim SD seed treatment followed by <i>Rhizobium</i> inoculation	4 g/kg
T5	Carbandazim WP + Thiram seed treatment followed by <i>Rhizobium</i> inoculation	2 g + 2 g/kg
T6	Carboxin + thiram seed treatment followed by <i>Rhizobium</i> inoculation	2 g + 2 g/kg
T7	Carboxin seed treatment followed by <i>Rhizobium</i> inoculation	4 g/kg

**Table.3** Effect of combined seed application *Rhizobium* and fungicides on emergence of groundnut

Treatment	Number of nodules per Plant
<i>Rhizobium</i> alone	178.33
<i>Rhizobium</i> + Thiram	184.55
<i>Rhizobium</i> + Ceresan	194.33
<i>Rhizobium</i> + Bavistin SD	187.22
<i>Rhizobium</i> + Bavistin + Thiram	186.00
<i>Rhizobium</i> + Vitavax + Thiram	188.35
<i>Rhizobium</i> + Vitavax	189.00
SE +-	0.26
CD at 5 %	0.78

**Table.4** Effect of combined seed application *Rhizobium* culture and fungicides on nodule number and dry weight of nodule of groundnut

Treatment	Number of nodules per Plant	Dry weight of nodule per plant (g)
<i>Rhizobium</i> alone	280.00	0.25
<i>Rhizobium</i> + Thiram	240.00	0.21
<i>Rhizobium</i> + Ceresan	180.00	0.17
<i>Rhizobium</i> + Bavistin SP	250.20	0.27
<i>Rhizobium</i> + Bavistin + Thiram	280.15	0.29
<i>Rhizobium</i> + Vitavax + Thiram	220.12	0.27
<i>Rhizobium</i> + Vitavax	30.00	0.35
SE +-	4.71	0.031
CD at 5 %	NS	0.093

**Table.5** Effect of combined seed application *Rhizobium* culture and fungicides on nitrogen content of nodule of groundnut

Treatment	Number of nodules per Plant	Dry weight of nodule per plant ( g)
<i>Rhizobium</i> alone	3.85	9.37
<i>Rhizobium</i> + Thiram	3.67	9.00
<i>Rhizobium</i> + Ceresan	3.76	6.05
<i>Rhizobium</i> + Bavistin SP	4.85	10.80
<i>Rhizobium</i> + Bavistin + Thiram	4.33	11.50
<i>Rhizobium</i> + Vitavax + Thiram	3.66	9.55
<i>Rhizobium</i> + Vitavax	3.86	12.86
SE +-	0.02	0.11
CD at 5 %	0.06	0.33

**Table.6** Effect of combined seed application *Rhizobium* culture and fungicides on shoot dry weight and nitrogen content of groundnut

Treatment	Dry weight of shoot per plant (g)	Percent N content in Shoot per plant	Total N content in shoot per plant (mg)
<i>Rhizobium</i> alone	5.88	2.24	113.50
<i>Rhizobium</i> + Thiram	5.82	1.88	98.35
<i>Rhizobium</i> + Ceresan	5.78	1.94	96.50
<i>Rhizobium</i> + Bavistin SP	5.83	2.36	118.80
<i>Rhizobium</i> + Bavistin + Thiram	5.68	2.13	103.40
<i>Rhizobium</i> + Vitavax + Thiram	5.72	2.00	96.60
<i>Rhizobium</i> + Vitavax	5.96	2.34	119.90
SE +- CD at 5 %	0.05 NS	0.01 0.03	0.6 1.8

**Table.7** Effect of combined seed application *Rhizobium* culture and fungicides on dry weight and nitrogen content of root of groundnut

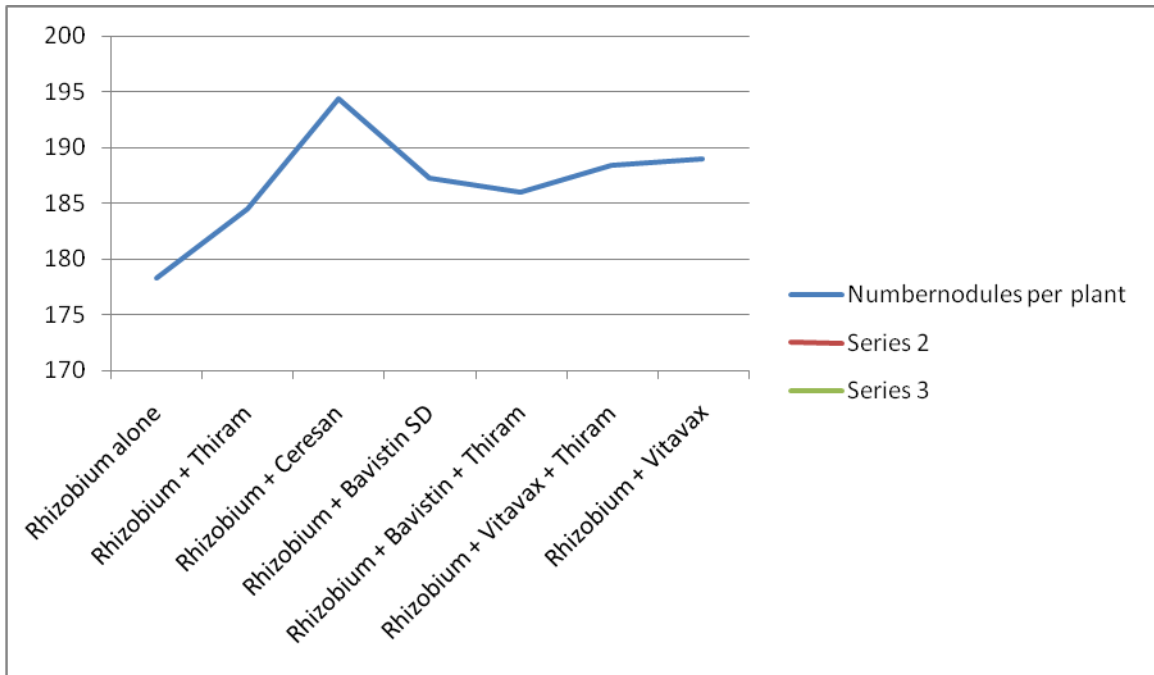
Treatment	Dry weight of root per plant (g)	Percent N content in root per plant	Total N content in root per plant mg)
<i>Rhizobium</i> alone	0.35	1.48	4.86
<i>Rhizobium</i> + Thiram	0.41	1.52	5.88
<i>Rhizobium</i> + Ceresan	0.32	0.84	2.43
<i>Rhizobium</i> + Bavistin SP	0.35	1.40	4.59
<i>Rhizobium</i> + Bavistin + Thiram	0.37	1.48	5.09
<i>Rhizobium</i> + Vitavax + Thiram	0.39	1.41	5.35
<i>Rhizobium</i> + Vitavax	0.42	1.15	4.58
SE +- CD at 5 %	0.01 0.03	0.01 0.03	0.05 0.15

**Table.8** Effect of combined seed application *Rhizobium* culture and fungicides on plant dry weight and nitrogen content of groundnut

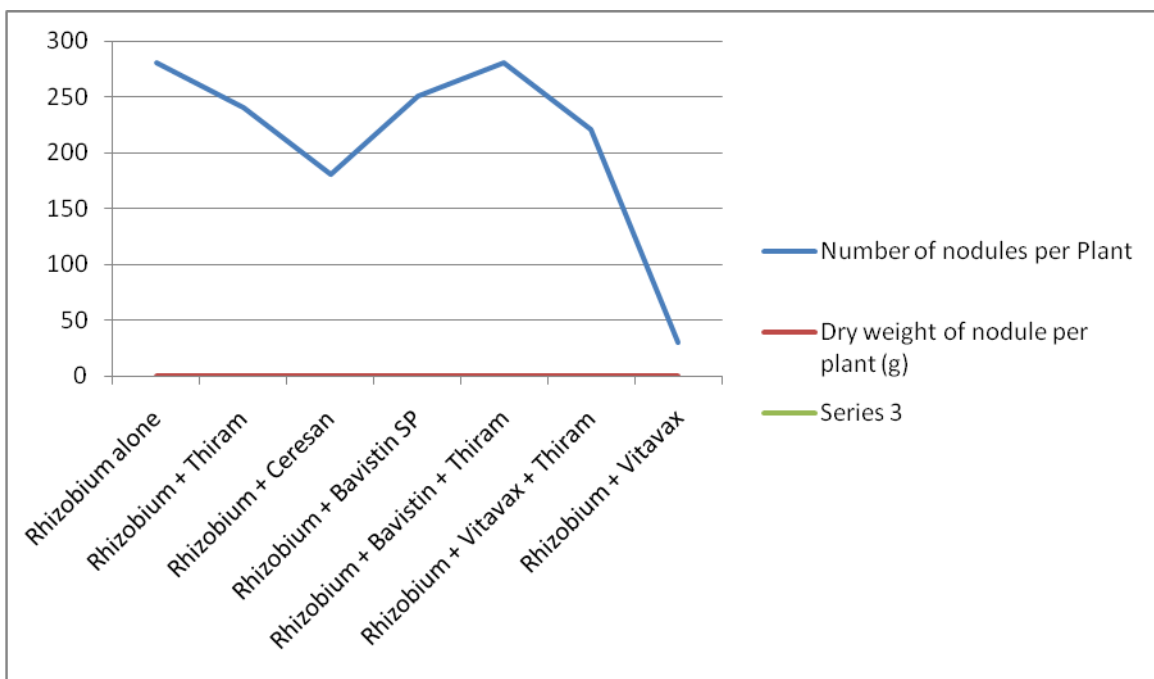
Treatment	Dry weight per Plant	Total N content per plant
<i>Rhizobium</i> alone	6.46	118.18
<i>Rhizobium</i> + Thiram	6.45	111.35
<i>Rhizobium</i> + Ceresan	6.34	106.42
<i>Rhizobium</i> + Bavistin SP	6.48	128.84
<i>Rhizobium</i> + Bavistin + Thiram	6.32	118.87
<i>Rhizobium</i> + Vitavax + Thiram	6.23	110.37
<i>Rhizobium</i> + Vitavax	6.70	140.43
SE +- CD at 5 %	0.08 0.25	0.64 1.92

Figures in percentage are transformed values and statistics applied to them

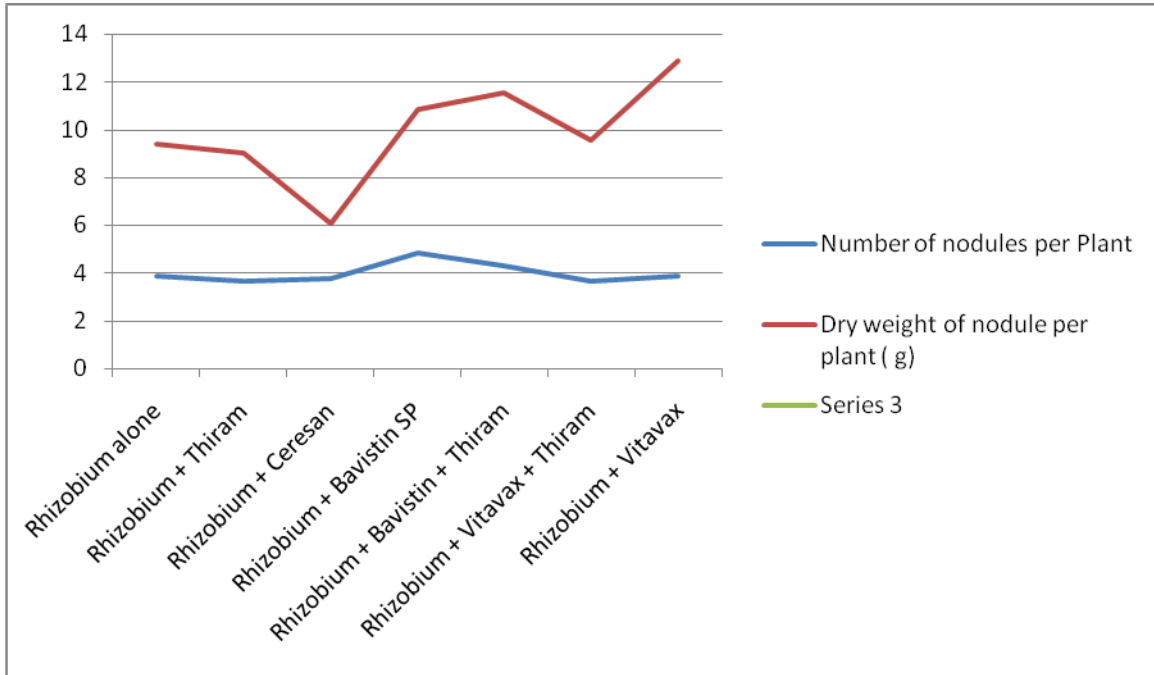
**Fig.1** Graphical representation of effect of combined seed application *Rhizobium* and fungicides on emergence of groundnut



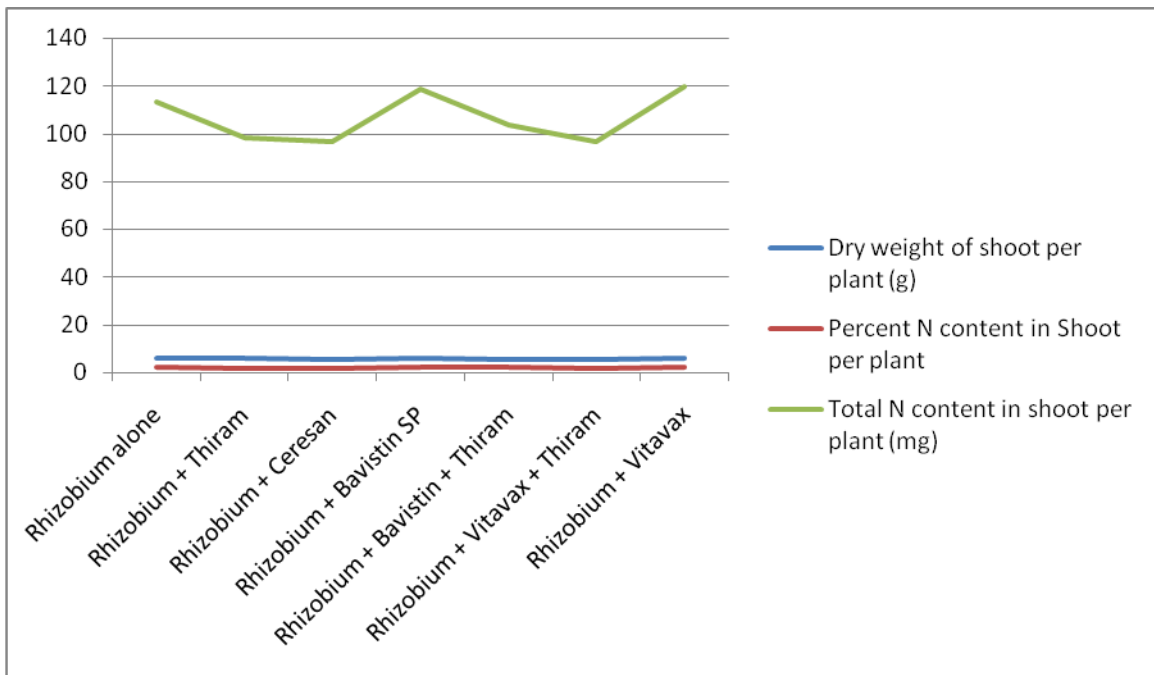
**Fig 2** Graphical representation of effect of combined seed application *Rhizobium* culture and fungicides on nodule number and dry weight of nodule of groundnut



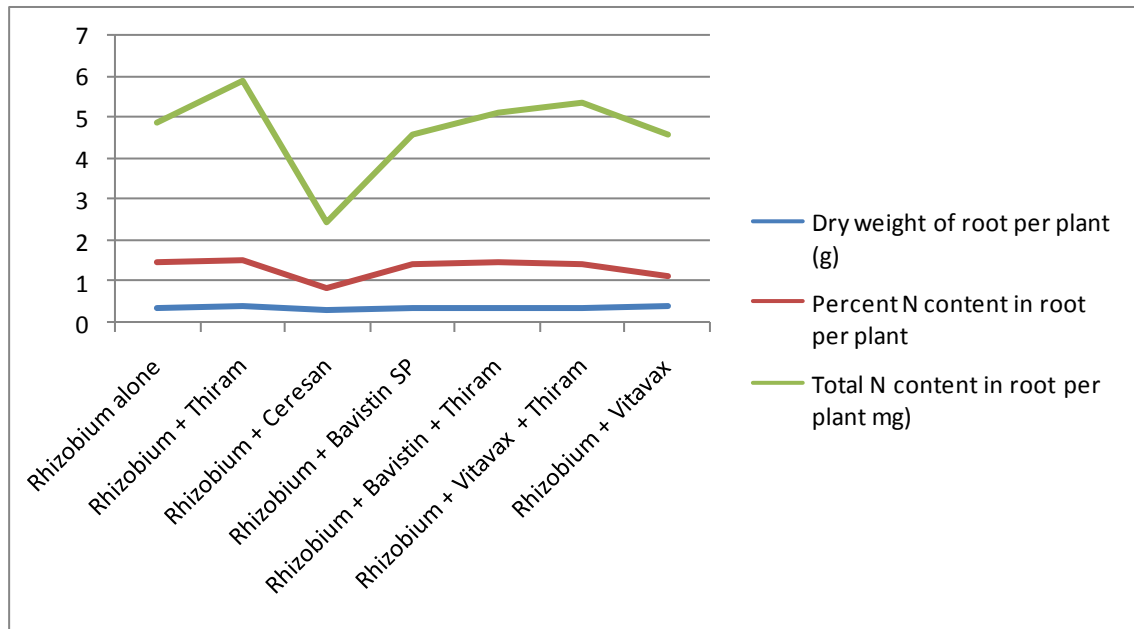
**Fig.3** Graphical representation of effect of combined seed application *Rhizobium* culture and fungicides on nitrogen content of nodule of groundnut



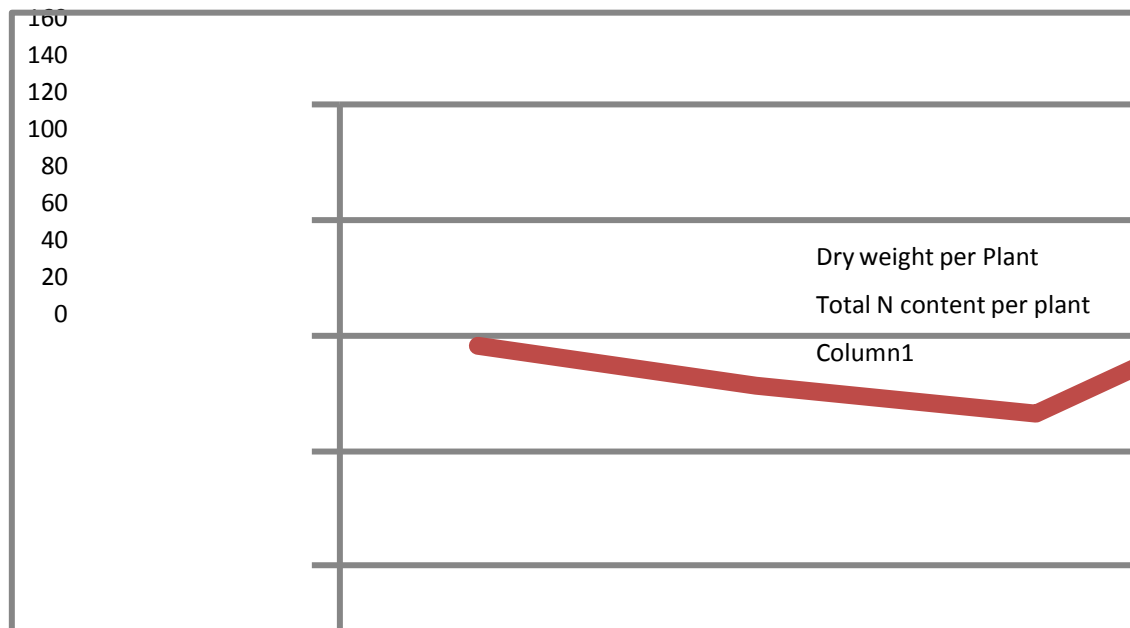
**Fig.4** Graphical representation of effect of combined seed application *Rhizobium* culture and fungicides on shoot dry weight and nitrogen content of groundnut



**Fig.5** Graphical representation of effect of combined seed application *Rhizobium* culture and fungicides on dry weight and nitrogen content of root of groundnut



**Fig.6** Graphical representation of effect of combined seed application *Rhizobium* culture and fungicides on plant dry weight and nitrogen content of groundnut



**Dry weight and total nitrogen content of plant**

The overall effect of fungicides application along with *Rhizobium* on the dry weight and

total nitrogen content of groundnut plant are presented in table 8. It is clear from the data that, none of the fungicidal seed treatments influenced an adverse effect on the dry weight and total nitrogen content per plant. Vitavax



was found highly compatible with *Rhizobium*. When dry weight and total N content were considered as the parameters, Thiram and cerasin reduced the dry weight and nitrogen content, but the reduction did not achieve the level of significance and it was as per with the *Rhizobium* alone treatment. Seasonal variations were observed as treatments such as Bavistin + Thiram, which produced significant increase in the dry weight and total N content per plant was as per with *Rhizobium* alone.

Five Fungicides viz., Thiram, Cerasan, Bavistin SD, Bavistin WP, and Vitavax, and there combinations were tested as seed dressers along with *Rhizobium* in a pot culture experiment. The results of the experiment are summarized below:

- 1) Cerasan was detrimental to *Rhizobium* as it reduced the nitrogen fixing ability and yield.
- 2) Vitavax was highly compatible with *Rhizobium* as none of the N- fixing traits were adversely affected by the treatment. Instead, Vitavax improved the N- fixing ability of *Rhizobium* and enhanced yields.
- 3) Bavistin WP, Bavistin SD, Thiram and the combination of Bavistin WP + Thiram and Vitavax + Thiram was compatible with *Rhizobium* inoculation and none of them brought about significant detrimental alternations in the N- fixing ability of rhizobia.
- 4) Seasonal variations were apparent on the effect of Bavistin and Thiram but not in

Vitavax and cerasan, some of these chemicals were more compatible.

A field experiment was conducted using randomized block design where *Rhizobium* alone with six fungicidal treatments were examined for their influence on N- Fixation and pod yield. Cerasin produced adverse effect on the introduced *Rhizobium* as the nitrogen fixing parameters and pod yield were substantially declined in this treatment. On the contrary vitavax was found highly compatible as it improved the N- Fixing parameters and pod yield. Rest of the fungicides and their combinations were compatible as none of them adversely affected the nitrogen fixation by *Rhizobium*.

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