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Research Paper

Effect of Arbuscular Mycorrhizal Fungi, Pressmud and Growth Regulator on *Solanum Lycopersicum* L

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Abstract: *A pot culture experiment was conducted in green house, using three combinations; AMF, Pressmud and indol acetic acid. The plants grown in pots were investigated in a randomized block design with three replications to evaluate the effects of Solanum lycopersicum L., (Var Vaibhav). Growth regulators significantly influenced various physiological and biochemical parameters. Plant growth and biomass was significantly increased to all the treatments of AMF, Pressmud and indol acetic acid treatment compared to noninoculated (control) plants. This was found to be superior in augmenting the growth and yield of tomato plants.*

Keywords: Pressmud, Indol Acetic Acid, Replications, Significantly, Tomato.

1. Introduction

The advantage of AM fungus, pressmud and growth regulator in crop productivity raises concern their survival and preservation in soil. The conservation of soil covers many aspects of agricultural/ Horticultural crop production and managements programmes. Some of concerns include preventing reduction of infection through excessive use of fertilizers. A considerable progress is being paid to explore of the dry press mud can be exploited for generation of energy as it contains higher percentage of combustibles (Gupta *et al.*, 2011). Recently the major use of press mud in bio-composting when it is treated with the spent wash from the distillery (Padmanabhan *et al*, 1993). The arbuscular mycorrhizal fungus, *Rhizophagus fasciculatus* (Thaxter Senscu. Gerd.) Gerd. Trappe and Trichoderma spp, have been reported to reduce the infestation of nematodes in many crop plants (Windham *et al.*, 1989; Sankaranarayanan and Rajeswari Sundara Babu, 1994 and Tonathan *et al.*,

2000). The production of higher seed yield due to growth regulators may be attributed to the fact that plants treated with growth regulators remained physiologically more active to build up sufficient food reserves for developing flowers and seeds. Further, the beneficial effect on plant growth in presence of free living nitrogen fixing organisms was attributed to phyto-hormone production rather than or in addition to nitrogen fixation (Bagyaraj, 1990; Lakshman and Geeta patil, 2004; Lakshman *et al*., 2010). Hence, the present investigation was taken up studies to understand the compost with AM fungi and Indole acetic acid on biometric yield parameters of tomato plant.

2. Materials and Methods

2.1 Soil and Plant Material

The soil physical and chemical characteristic used for pot experiments were estimated as per Jackson (1973). The soil: sand (3:1 v/v) mixture was filled into 17.5 cm diameter pots containing 3 kg of soil. The seeds of Solanum *lycopersicum* L., (Var Vaibhav) were collected from Namdhari seed company Bangalore India. Seeds were surface sterilized by treating with 2% sodium hypochlorite for 2-3 min before sowing and after germination uniform seedlings were made one per pot.

2.3 Inoculum

The Am fungal spores *Rhizophagus fasciculatus* (Thax.) Walker & Schußler were maintained for 12 weeks in green house conditions using Jowar (*Sorghum vulgare* L) at host for mass multiplication in 30×15 cm diameter pots containing sterilized sand soil mix (1:1 v/v) and bio-compost were prepared by mixing Pressmud and water in the ratio of 1:2 were used for composting.

2.4 Pot Experimental Setup

The experimental pots amended with ten grams of the inoculum consisted of roots and soil contained 115-172 chlamydospores, as single inoculated and again were treated with 2% of IAA hormone the treatments given as follows:

1. Control
2. *Rhizophagus fasciculatus* (Thax.)Walker&Schußler
3. Pressmud
4. IAA
5. *Rf* + Pressmud+ IAA

The plants were uprooted periodically at 30, 60 and 90 days. The parameters like root length, fresh weight of root, dry weight of root, fresh weight of shoot, dry weight of shoot, percentage root colonization, spore number and number of leaves, were recorded. The AM fungal spores were counted after removing them from the soil by wet sieving and decanting (Gerdemann and Nicolson 1963). The percentage of mycorrhizal infection was evaluated microscopically followed by clearing of roots in 10% KOH, neutralized in 2% HCL and stained with 0.05% trypan blue in lactophenol according to method described by (Phillips and Hyman 1970). The following formula was used to calculate the root colonization (Giovanneti, Mosse 1980).

$$\text{Percent of root colonization (\%)} = \frac{\text{No of root bits colonization}}{\text{Total number of root bits}} \times 100$$

2.5 Statistical Analysis

Data were subjected to analysis of variance and mean values were compared using the Duncan's multiple range test (At the 0.05 level), as recommended (Snedecor, and Cochran, 1980).

3. Results and Discussion

The inoculation of arbuscular mycorrhizal fungi and pressmud with Indole acetic acid augmented plant growth (Figure 1), the growth parameters were recorded in the experimental variety. The results of *Solanum Lycopersicum* L., (Var. Vaibhav) are described below.

The table (1) reveals that after 30 days growth, inoculation with *Rhizophagus fasciculatus*, pressmud and IAA resulted significant increase on shoot length (8.10cm), fresh (36.00g) and dry weight of root (0.81g), number of leaves (20.33), root colonization (41.00%), spore number (51.00) in 50g of soil, the number of flowers and fruits were not recorded. After 60 days in the treatment amendment pressmud, IAA and inoculation with *Rhizophagus fasciculatus* there was significantly higher records of shoot length (30.11cm), fresh (52.14) and dry weight of shoot (7.74g), root length (8.51cm), fresh (10.90g) and dry weight of root (3.32g), number of leaves (77.00), number of flowers (9.00), number of fruits (3.00), root colonization (45.00%), spore number (51.00), stem diameter (2.12). The plant growth after days responded significantly with the amendment of pressmud, IAA and inoculation of *Rhizophagus fasciculatus* resulted higher in shoot length (45.08cm), fresh (89.19g) and dry weight of shoot (13.22g), root length (14.06cm), fresh (17.53g) and dry weight of root (5.41g), number of leaves (84.66), number of flowers (2.66), number of fruits (4.00), root colonization (85.66%), spore number (86.00) in 50g soil compared control (Table 1). The dry weight of shoot and rot colonization is shown in figure (2).

Majority of research work has been directed at expensive pure substrates to a much lesser quantity of solid waste (Hawkes *et al*., 2002). Pressmud from the sugar mills is a very useful source of fertilizer as well as some chemicals. These results are in line with the work carried out by other researchers (Nehra and Hooda, 2002; Naik and Rao, 2004), who reported increased plant height in lentil crop due to pressmud application. Mycorrhizae are considered essential for growth and survival of many plant species in disturbed and unproductive soils (Raman and Mahadevan, 1996; Bothe *et al.*, 2001). Mycorrhizal fungi provide direct link between soil and roots and ameliorate heavy metal toxicity (Leyvel *et al.*, 1997). The combined treatments of *Rhizophagus fasciculatus* along with pressmud were synergistic in reducing the nematode infestation and enhancing plant growth and yield. Earlier studies proved the efficacy of pressmud in containing the nematode infestation in banana (Uonathan *et al*., 1999). A similar result was reported (Rakkiyappan *et al.*, 2000). The results of the present studies clearly brought out the beneficial effect of inoculation with AM fungi, pressmud and indole acetic acid to Vaibhav variety.

Conclusion

The findings of the present study reinforce the inoculation of *Rhizophagus fasciculatus*, pressmud along with hormone were synergistic effect on *Solanum lycopersicum* L., (Var. Vaibhav) and enhancing plant growth and yield compared to non-inoculated control. Significant increase in root length, fresh weight of root, dry weight of root, fresh weight of shoot, dry weight of shoot, percentage root colonization, spore number and number of leaves.

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Table 1: Showing effect of *Rhizophagus fasciculatus* on growth characteristics of *Solanum lycopersicum* L. (Var. Vaibhav) for 30, 60 and 90 days. SL-shoot length, FWS-fresh weight of shoot, DWS-Dry weight of shoot, RL-Root length, FWR-Fresh weight of root, DWR-Dry weight of root, NL-Number of leaves, NF_{w}- Number of flowers, NF_{r}- Number of fruits, PC-percent of root colonization, SN-Spore number, SD-Stem diameter

Treatments	SL	FWS	DWS	RL	FWR	DWR	NL	NF_w	NF_r	PC	SN	SD
30 Days												
CN	0.053±0.02e	0.85±0.02d	0.08±0.01d	1.54±0.02e	0.15±0.01d	0.06±0.02c	9.00±0.57d	0.00±0.00e	0.00±0.00e	0.00±0.00c	0.00±0.00c	1.03±0.02d
Rf	6.50±0.01b	2.36±0.44b	0.45±0.01b	3.11±0.05b	0.95±0.01b	0.53±0.01b	17.00±0.57b	0.00±0.00b	0.00±0.00b	26.00±0.57b	43.33±0.81b	1.52±0.01ab
Pressmud	6.10±0.05c	1.32±0.11bc	0.35±0.03c	2.50±0.05c	0.32±0.08c	0.08±0.01c	12.33±0.33c	0.00±0.00c	0.00±0.00c	0.00±0.00c	0.00±0.00c	1.51±0.05c
IAA	5.55±0.04d	1.95±0.83c	0.35±0.08c	2.11±0.05d	0.33±0.01c	0.06±0.01c	11.33±0.33c	0.00±0.00d	0.00±0.00d	0.00±0.00c	0.00±0.00c	1.046±0.02c
Rf+Pressmud+IAA	8.10±0.05a	3.60±0.08a	0.81±0.05a	3.51±0.08a	1.41±0.08a	1.18±0.09a	20.33±0.33a	0.00±0.00a	0.00±0.00a	41.00±0.57a	51.00±0.57a	2.000±0.05a
60 Days												
CN	15.70±3.21d	16.04±0.01e	2.13±0.01e	4.08±0.04d	1.82±0.01e	0.63±0.27d	31.00±0.57e	2.000±0.574d	0.00±0.00c	0.00±0.00c	0.00±0.00c	1.06±0.03d
Gf	28.06±0.04ab	43.53±0.08b	6.10±0.05b	7.51±0.01b	7.81±0.08b	1.10±0.05b	62.00±0.57b	4.666±0.333b	1.66±0.33b	33.00±0.57b	42.00±1.52b	1.55±0.03b
Pressmud	25.06±0.03bc	29.19±0.04c	5.02±0.01c	5.35±0.16c	5.89±0.02c	0.63±0.27c	56.00±0.57c	3.333±0.666bc	1.33±0.33bc	0.00±0.00c	0.00±0.00c	1.51±0.05b
IAA	23.11±0.05c	28.16±0.08d	4.83±0.01d	5.14±0.01c	4.33±0.02d	1.74±0.02d	54.00±0.57d	4.000±0.577b	0.00±0.00c	0.00±0.00c	0.00±0.00c	1.03±0.02c
Rf+Pressmud+IAA	30.11±0.05a	52.14±0.001	7.74±0.02a	8.51±0.05a	10.90±0.02a	3.32±0.01a	77.00±0.57a	9.000±0.577a	3.00±0.57a	45.00±0.57a	51.00±0.57a	2.12±0.06a
90 Days												
CN	25.11±0.05e	32.60±0.21e	2.93±0.08e	6.11±0.05d	6.54±0.02d	2.51±0.08e	42.33±0.66de	1.33±0.33cd	2.33±0.33d	0.00±0.00c	0.00±0.00c	1.09±0.04d
Rf	41.51±0.01b	49.31±0.06b	11.44±0.01ab	10.07±0.03b	16.11±0.05b	4.72±0.05b	72.00±0.57b	1.66±0.33ab	4.66±0.66ab	84.00±0.57b	66.33±2.18b	2.11±0.06b
Pressmud	32.10±0.05b	38.30±0.06c	6.62±0.01bc	8.52±0.01c	11.35±0.01	2.89±0.02c	65.00±0.57c	1.66±0.33bc	3.66±0.33ab	0.00±0.00c	0.00±0.00c	1.50±0.06c
IAA	30.09±0.04c	35.62±0.01d	5.06±0.08c	8.06±0.03c	10.10±0.27c	2.46±0.05d	62.33±1.20d	1.33±0.33c	3.33±0.33c	0.00±0.00c	0.00±0.00c	1.50±0.01c
Rf+Pressmud+IAA	45.08±0.04a	89.19±0.08a	13.22±0.08a	14.06±0.03a	17.53±0.01a	5.41±0.08a	84.66±0.81a	2.66±0.33a	4.00±0.57a	85.66±2.02a	86.00±0.57a	2.51±008a

CN - Control, *Rf- Rhizophagus fasciculatus*, IAA- Indol acetic acid all the value represents. Data represents means ± SE of 3 replicates; each experiment was repeated thrice. Mean separation within column by Duncan's multiple range test at $P < 0.05$.

Figure 1: Showing symbiotic response of *Rhizophagus fasciculatus*, Pressmud and Indol acetic acid on plant growth of *Solanum lycopersicum* L., (Var. Vaibhav)

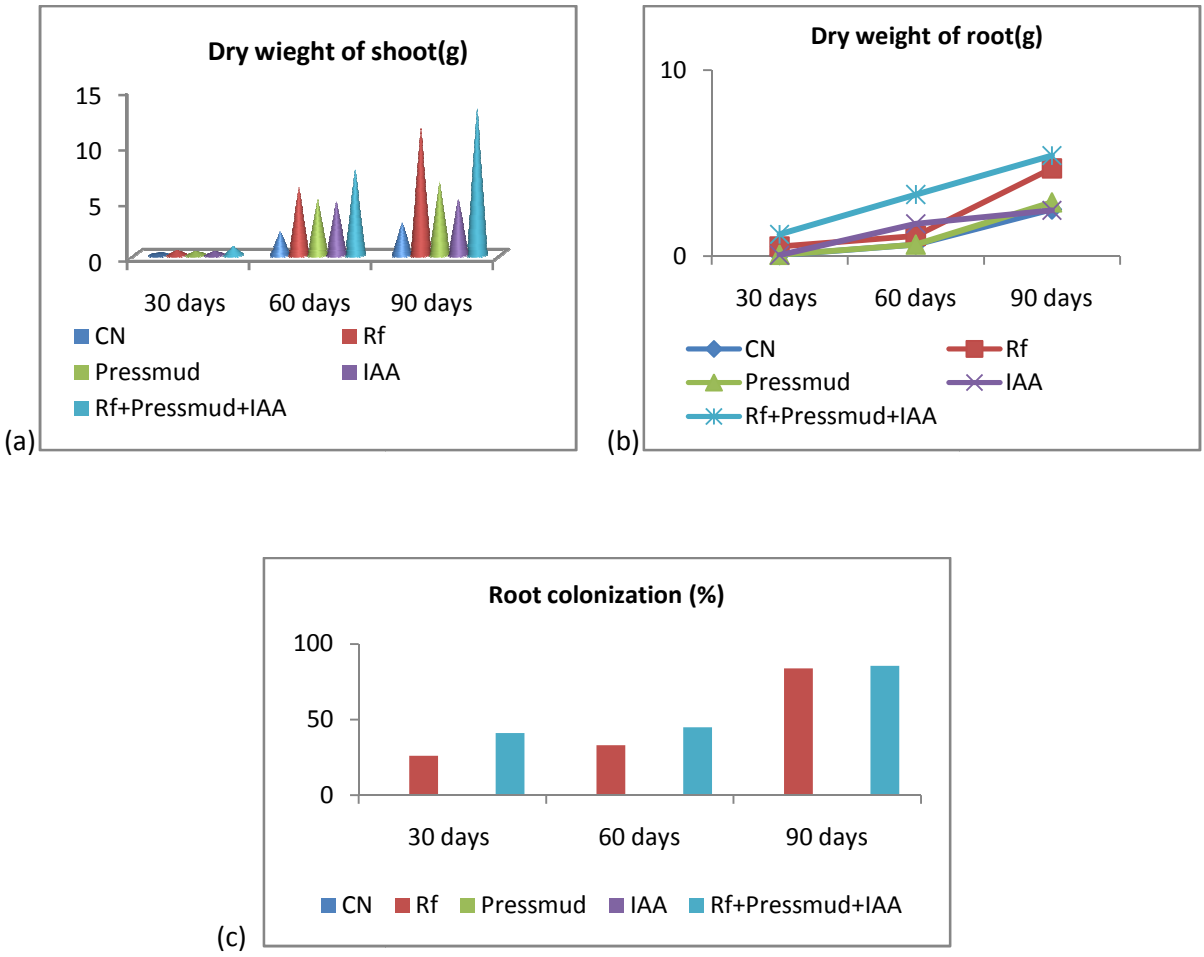

Figure 2: Showing effect of *Rhizophagus fasciculatus*, Pressmud and IAA on (a) Dry weight of shoot (b) Dry weight of root (c) Percent of root colonization in *Solanum lycopersicum* L., (var Vaibhav)

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