

**EFFECT OF VAM-RHIZOBIUM INTERACTION ON NODULATION AND TOTAL BIOMASS OF CANAVALIA GLADIATA (JACQ.) DC. (SWORDBEAN)**

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**Introduction**

Vesicular-arbuscular mycorrhizae (VAM) are the most prevalent of the root-fungus symbiosis (Smith, 1980). These fungi commonly colonize the roots of crop plants including legumes (Manjunath et al., 1984). Addition of VAM fungi to soils low in or lacking indigenous VAM has been shown to affect plant growth, primarily by increasing the uptake of Phosphorus (P) (Jensen, 1983). Interaction studies between VAM fungi and Rhizobium have shown that dual inoculation improves nodulation, nitrogen fixation and plant growth (Subba Rao et al., 1986; Krishna & Bagyraj, 1984; Rodrigues & Torne, 1990).

Canavalia gladiata (Jacq.) DC. is a robust legume, which produces nutritious pods in marginal areas, where other pulses fail. It also provides a plentiful green manure and forage. The present study was undertaken to investigate the interaction of VAM and Rhizobium on nodulation and plant growth in C. gladiata.

**Materials and Methods**

Clayey loam soil (pH 6.1) of low phosphate status was used. The soil was sterilized for 1 hr. at 15 lbs. to eliminate naturally occurring endophytes and other contaminants. Pots (26cm diameter) were filled with 8 Kg of sterilized soil. The inoculum was placed 5 cm below the soil surface to produce mycorrhizal plants. At planting, to ensure nodulation, seedlings were inoculated with 2 ml ( $9.3 \times 10^8$  cells/ml) of effective strain.

Seeds of C. gladiata were surface sterilized, soaked overnight in distilled water, allowed to germinate on moist filter papers in petri dishes for 2 days at 30°C, selected for uniformity and planted in pots (one seed/pot). The experiment consisted of six treatments.

viz.,

1. Uninoculated control.
2. Inoculated with rhizobium.
3. Inoculated with Glomus albidum.
4. Inoculated with Glomus albidum and Rhizobium.
5. Inoculated with Glomus fasciculatum, and
6. Inoculated with Glomus fasciculatum and Rhizobium.

Table 1. Effect of VAM-Rhizobium interaction on colonization, nodulation and biomass of *C. gladiata* plant.

Treatment	VAM fungi colonization (%)	No. of nodules/plant(g)	Dry wt. of nodules/plant(g)	Total dry wt./plant(g)
Uninoculated control	0	0	0	7.05 ± 0.17
<u>Rhizobium</u> spp.	0	56.0 ± 4.98	1.12 ± 0.10	9.34 ± 0.80
<u>Glomus albidum</u>	69.8	0	0	10.32 ± 0.58
<u>Glomus albidum + Rhizobium</u>	73.9	71.5 ± 8.41	1.37 ± 0.10	14.71 ± 0.79
<u>Glomus fasciculatum</u>	74.8	0	0	12.64 ± 0.94
<u>Glomus fasciculatum + Rhizobium</u>	86.2	89.33 ± 12.16	1.96 ± 0.28	16.52 ± 0.72

± Indicates Standard deviation.

Table 2. Effect of VAM-Rhizobium interaction on nodule morphology of *C. gladiata* plant.

Treatment	Degree of nodulation	Position on root system	Shape	Colour		Surface
				outside	inside	
Uninoculated control	-	-	-	-	-	-
<u>Rhizobium</u> spp.	+++	Lateral	Globose	Brown	Pink	Rough
<u>Glomus albidum</u>	-	-	-	-	-	-
<u>Glomus albidum + Rhizobium</u>	+++	Lateral	Globose	Brown	Pink	Rough
<u>Glomus fasciculatum</u>	-	-	-	-	-	-
<u>Glomus fasciculatum + Rhizobium</u>	+++	Lateral	Globose	Brown	Pink	Rough

Legend:

- + = Sparse nodulation = <25 nodules/plant.
- ++ = Moderate nodulation = 25-50 nodules/plant.
- +++ = Abundant nodulation = 50-75 nodules/plant.
- ++++ = Very abundant nodulation = >100 nodules/plant.

At weekly intervals, the plants received a nutrient solution from which nitrogen and phosphorus had been excluded. All plants were watered daily to field capacity with distilled water.

Mycorrhizal colonization in the roots was estimated on the 45th day after clearing the roots with 10% KOH and staining with Trypan blue (Phillips and Hayman, 1970), using the formula.

$$\frac{\text{Number of VAM positive segments} \times 100}{\text{Total number of segments scored}} = \text{Colonization.}$$

Six plants of each treatment were selected at random and harvested on the 60th day of growth. The degree of nodulation was estimated by counting the nodules under a low power stereomicroscope. Plant dry weight was recorded after drying to constant weight.

### Results and Discussion

The results obtained from the present study indicates that the dual inoculated plants showed a greater number of nodules as well as marked increase in the nodule and plant dry weight as compared to plants inoculated with either VAM, *Rhizobium* or uninoculated control (Table 1). These results clearly confirm the earlier findings (Crush, 1974; Daft & El Giahmi, 1976).

There was no change in nodule morphology in the plants inoculated with various treatments (Table 2). However, no nodulation was observed in plants inoculated with VAM fungus and uninoculated control.

### References

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