

## Evaluation of Mycorrhizal Inoculations Associated with Rice var. *Mahasoori*

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Evaluation of indigenous VAM fungi was done in the pot experiment, under sterile soil conditions. Altogether, 15 different VAM inoculants were inoculated to the rice var. *Mahasoori* in the form of soil-inoculum, separately. Periodical analysis for the VAM root colonization was done and final data was taken at the 140 days age of the plants, which included growth parameters, 'P' content & yield. Our studies have shown that Rice var. *Mahasoori* responded very well towards mycorrhizal infection & colonization.; The effect of mycorrhization has also been very well demonstrated with respect to plant productivity as higher growth, and yield was recorded in the mycorrhizal plants as compared to control. On the basis of these, *Glomus* sp. 02, *Glomus* sp. 05 and *Glomus* sp. 10 are selected for rice var. *Mahasoori* for future use..

**Key words:** Mycorrhizal Inoculations, Rice. *Glomus* sp.

*Oryza sativa* L. (Rice) is very important agricultural crop for our country. Almost every crop plant viz; wheat, corn, pea etc. including rice has been reported as mycorrhizal. Several attempts were made to develop VAM inoculant for these crops, still responses of rice towards VAM fungi is very poorly understood. Enhanced growth and nutrient uptake like P and Zn through mycorrhizal inoculation was reported by many workers<sup>1-7</sup>. Now it has already been confirmed that wetland rice can respond very well to VAM inoculations as higher grain yields of the rice cultivar 'Prakash' were obtained through inoculations with *Glomus*

*intraradices* and *Glomus fasciculatus*<sup>8</sup>. The better performance of 'Kranti' was also reported after inoculating the indigenous VAM fungi i.e. *Glomus fasciculatus*<sup>9</sup>. Though not host specific, several studies have indicated host preference of mycorrhizal fungi and thus, suggesting the need for selecting indigenous strains of VAM fungi for a particular host<sup>10,11,2,6,7</sup>. Hence, in present study an attempt has been made to study on VAM fungi associated with rice variety *Mahasoori*.

### MATERIAL AND METHODS

To evaluate the efficiency of indigenous VAM fungi, an experiment was carried out in earthen pots (9 l capacity) filled with sterilized black cotton soil (autoclaved at 121.6°C, 15lb/3hr) having 7.31 initial pH and 1.17 ppm available Phosphorus. At the initial stage, Urea (1g/pot) and Ruakura Nutrient Solution (25ml/pot) was also

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added as basal dose. After the complete water saturation of the soil, pure cultures of 15 VAM fungi belonging to *Glomus sp.*, in the form of soil inoculum having 150-200 spore load was added in each pot. Uninoculated pots were treated as control. Then presterilized (0.01%  $HgCl_2$  for 5 min.) and presoaked seeds (lukewarm water for 1 hr.) were sown in each pot. Watering schedule was maintained as per the requirement. Supplementation of Nitrogenous fertilizer & Ruakura solution was also maintained with the periodicity of 30 days intervals. This experiment was set up for 10 replications. Periodical analysis of plant roots was done to assess the colonization pattern of indigenous VAM inoculant<sup>12</sup> and its percentage was calculated according to slide method<sup>13</sup>. At the stage of maturation plants were uprooted for the analysis of various growth parameters viz; plant height, number of tillers & panicles, dry biomass of plant, and grain yield. The 'P' content of shoot and root was estimated by the Vanadomolybdate Phosphoric Yellow Colour Method<sup>14</sup>. After harvesting the plants from pots, soils were analysed to determine its spore population according to Wet Sieving and Decantation Technique<sup>15</sup> and Population Count Method<sup>16</sup>.

Finally, all data were subjected to statistical analysis and the treatment means were separated by the Duncan's Multiple Range Test at  $p=0.01$ .

## RESULTS

The rice var. Mahasoori have shown varied response towards, various mycorrhizal inoculations. All fungi tested were found to be infective in roots of this rice variety. A wide range of % VAM colonization i.e. 36-84% was observed in their roots while maximum % colonization was recorded in roots of *Glomus sp.* 02 inoculations (Table-1). The total spore density was also recorded during the experiment and it was found to be maximum in *Glomus sp.* 02 inoculation i.e.  $1850.00 \pm 114.56$  spores/pot soil. A comparable decrease in soil pH was also observed as an effect of mycorrhizal inoculation (Table 1).

On the day of harvest, most of the VAM inoculations have shown better performance of host plants with respect to their height, inflorescence numbers and dry biomass. The highest shoot height, root length, and inflorescence number was recorded in *Glomus sp.* 02 inoculations (Table 2). Plants inoculated with

**Table 1.** Effect of Different VAM Inoculants on Soil pH, Root colonization and VAM spore population (Rice Var. *Mahassori*)

	pH		%Root Colonization 140 Days	Spore Count Initial	(g L/Pot Soil)
	Initial	Final			Final
Uninoculated	7.31 $\pm$ 0.01	7.03 $\pm$ 0.35	00	000-000	$\pm$ 000.00
<i>Glomus sp.</i> 01	7.31 $\pm$ 0.01	6.85 $\pm$ 0.02	64	184-190	1358.33 $\pm$ 118.14
<i>Glomus sp.</i> 02	7.31 $\pm$ 0.01	6.83 $\pm$ 0.09	88	155-162	1850.00 $\pm$ 114.56
<i>Glomus sp.</i> 03	7.31 $\pm$ 0.01	6.71 $\pm$ 0.00	80	150-200	1266.66 $\pm$ 166.45
<i>Glomus sp.</i> 04	7.31 $\pm$ 0.01	6.94 $\pm$ 0.03	44	150-188	0091.66 $\pm$ 52.04
<i>Glomus sp.</i> 05	7.31 $\pm$ 0.01	7.06 $\pm$ 0.04	52	156-170	0725.00 $\pm$ 132.28
<i>Glomus sp.</i> 06	7.31 $\pm$ 0.01	7.11 $\pm$ 0.01	56	142-150	1200.00 $\pm$ 275.00
<i>Glomus sp.</i> 07	7.31 $\pm$ 0.01	6.92 $\pm$ 0.005	44	180-198	0975.00 $\pm$ 294.74
<i>Glomus sp.</i> 08	7.31 $\pm$ 0.01	6.78 $\pm$ 0.01	36	180-190	0150.00 $\pm$ 32.28
<i>Glomus sp.</i> 09	7.31 $\pm$ 0.01	6.62 $\pm$ 0.02	60	132-150	1358.33 $\pm$ 177.36
<i>Glomus sp.</i> 10	7.31 $\pm$ 0.01	7.01 $\pm$ 0.005	50	158-160	0191.66 $\pm$ 101.03
<i>Glomus sp.</i> 11	7.31 $\pm$ 0.01	6.86 $\pm$ 0.005	64	182-185	0025.00 $\pm$ 43.30
<i>Glomus sp.</i> 12	7.31 $\pm$ 0.01	7.09 $\pm$ 0.01	52	145-150	1282.33 $\pm$ 340.34
<i>Glomus sp.</i> 13	7.31 $\pm$ 0.01	7.24 $\pm$ 0.005	36	144-150	0983.33 $\pm$ 80.3G
<i>Glomus sp.</i> 14	7.31 $\pm$ 0.01	6.81 $\pm$ 0.05	72	250-260	0133.33 $\pm$ 76.37
<i>Glomus sp.</i> 15	7.31 $\pm$ 0.01	6.84 $\pm$ 0.01	68	200-210	0233.33 $\pm$ 80.36

**Table 2.** Effect of Different VAM Inoculants on Root length, Shoot Height and dry. Biomass of Rice Var. *Mahasoori* (140 Days)

Treatments	Root Length (in cms.)	Shoot Height (in cms.)	Dry Biomass (in g)
Uninoculated	25.85±3.14 <sup>cde</sup>	125.66±2.08 <sup>def</sup>	3.918±0.14 <sup>cde</sup>
<i>Glomus sp.</i> 01	32.33±3.50 <sup>abcde</sup>	131.33±2.08 <sup>cde</sup>	5.306±0.35 <sup>cd</sup>
<i>Glomus sp.</i> 02	44.00±3.60 <sup>a</sup>	153.66±5.50 <sup>a</sup>	9.324±0.17 <sup>a</sup>
<i>Glomus sp.</i> 03	34.33±3.50 <sup>abcde</sup>	150.00±2.00 <sup>ab</sup>	8.257±0.63 <sup>ab</sup>
<i>Glomus sp.</i> 04	25.00±3.00 <sup>def</sup>	126.33±5.13 <sup>def</sup>	5.240±0.86 <sup>cde</sup>
<i>Glomus sp.</i> 05	36.00±2.64 <sup>abcd</sup>	133.00±4.58 <sup>cd</sup>	5.429±0.48 <sup>C</sup>
<i>Glomus sp.</i> 06	36.33±8.02 <sup>abcd</sup>	133.00±2.00 <sup>cd</sup>	4.778±1.73 <sup>dje</sup>
<i>Glomus sp.</i> 07	38.33±5.50 <sup>abc</sup>	163.00±2.00 <sup>cd</sup>	6.892±0.31 <sup>b</sup>
<i>Glomus sp.</i> 08	24.66±6.02 <sup>de</sup>	121.33±8.32 <sup>efg</sup>	4.904±0.26 <sup>cde</sup>
<i>Glomus sp.</i> 09	22.00±5.00 <sup>e</sup>	117.33±3.05 <sup>fgh</sup>	3.627±0.23 <sup>e</sup>
<i>Glomus sp.</i> 10	32.00±5.00 <sup>abcde</sup>	141.33±8.32 <sup>bc</sup>	4.957±4.49 <sup>cde</sup>
<i>Glomus sp.</i> 11	22.33±5.50 <sup>e</sup>	112.00±3.00 <sup>ghi</sup>	5.104±0.25 <sup>cde</sup>
<i>Glomus sp.</i> 12	34.00±9.54 <sup>abcde</sup>	134.66±3.05 <sup>cd</sup>	5.025±0.22 <sup>cde</sup>
<i>Glomus sp.</i> 13	42.00±3.00 <sup>ab</sup>	137.33±2.51 <sup>cd</sup>	4.265±0.61 <sup>cde</sup>
<i>Glomus sp.</i> 14	25.16±3.25 <sup>de</sup>	104.66±8.32 <sup>l</sup>	3.714±0.37 <sup>de</sup>
<i>Glomus sp.</i> 15	31.33±3.98 <sup>cde</sup>	109.33±2.51 <sup>hi</sup>	5.382±0.74 <sup>c</sup>

(Values without common letters differ significantly. Significance tested by Duncan's Multiple Range Test at P=0.01)

**Table 3.** Effect of VAM Inoculants On 'P' content (mg P/g tissue) of Root & Shoot Tissue of rice Var. *Mahasoori* (140 Days)

Treatments	'P' Content		
	In Roots	In Shoots	Total
Uninoculated	1.57±0.02 <sup>b</sup>	3.07±0.08 <sup>i</sup>	19.375±1.963 <sup>de</sup>
<i>Glomus sp.</i> 01	3.57±1.78 <sup>a</sup>	4.94±0.00 <sup>a</sup>	25.242±1.350 <sup>b</sup>
<i>Glomus sp.</i> 02	0.48±0.00 <sup>h</sup>	4.78±0.10 <sup>a</sup>	33.659±0.571 <sup>a</sup>
<i>Glomus sp.</i> 03	0.88±0.05 <sup>g</sup>	3.51±0.00 <sup>fg</sup>	23.622±0.191 <sup>bc</sup>
<i>Glomus sp.</i> 04	1.82±0.00 <sup>a</sup>	3.94±0.00 <sup>cde</sup>	19.318±3.631 <sup>cde</sup>
<i>Glomus sp.</i> 05	1.12±0.0 <sup>fe</sup>	4.07±0.01 <sup>bcd</sup>	19.937±1.799 <sup>cde</sup>
<i>Glomus sp.</i> 06	1.01±0.01 <sup>f</sup>	3.17±0.00 <sup>hi</sup>	12.327±5.090 <sup>fg</sup>
<i>Glomus sp.</i> 07	1.05±0.04 <sup>ef</sup>	3.58±0.10 <sup>fg</sup>	21.965±0.768 <sup>bcd</sup>
<i>Glomus sp.</i> 08	1.45±0.00 <sup>C</sup>	4.20±0.00 <sup>bc</sup>	18.875±0.577 <sup>cde</sup>
<i>Glomus sp.</i> 09	1.25±0.07 <sup>d</sup>	3.65±0.00 <sup>efg</sup>	11.167±0.668 <sup>fg</sup>
<i>Glomus sp.</i> 10	1.40±0.00 <sup>C</sup>	4.29±0.02 <sup>b</sup>	18.304±2.652 <sup>de</sup>
<i>Glomus sp.</i> 11	0.88±0.01 <sup>g</sup>	4.65±0.16 <sup>-a</sup>	18.507±0.757 <sup>de</sup>
<i>Glomus sp.</i> 12	0.83±0.01 <sup>g</sup>	3.78±0.03 <sup>def</sup>	15.445±1.070 <sup>ef</sup>
<i>Glomus sp.</i> 13	1.07±0.01 <sup>ef</sup>	2.91±0.04 <sup>j</sup>	10.463±1.761 <sup>g</sup>
<i>Glomus sp.</i> 14	0.79±0.03 <sup>g</sup>	3.42±0.36 <sup>gh</sup>	10.118±1.125 <sup>g</sup>
<i>Glomus sp.</i> 15	1.44±0.02 <sup>C</sup>	3.77±0.04 <sup>defg</sup>	17.987±1.987 <sup>de</sup>

(Value without common letter differ significantly. Significance tested by Duncan's Multiple Range Test at P=0.01)

**Table 4.** Effect of Different VAM Inoculation on total number of Tillers, Inflorescence, Grains & Grain wt. In Rice Var. *Mahasoori* (140 Days).

Treatments	Tiller No.	Inflorescence No.	Grain No.	Grain wt. (g/Plant)
Uninoculated	3±0.51	2±0.98	67 <sup>gh</sup>	1.26 <sup>ef</sup>
<i>Glomus sp.</i> 01	4±0.51	3±0.54	95 <sup>cde</sup>	2.04 <sup>bcd</sup>
<i>Glomus sp.</i> 02	5±0.81	4±0.98	151 <sup>a</sup>	3.15 <sup>a</sup>
<i>Glomus sp.</i> 03	3±0.51	3±0.40	90 <sup>def</sup>	1.81 <sup>cde</sup>
<i>Glomus sp.</i> 04	4±0.40	3±0.54	54 <sup>h</sup>	1.12 <sup>f</sup>
<i>Glomus sp.</i> 05	4±0.51	3±0.51	105 <sup>bcd</sup>	2.23 <sup>bc</sup>
<i>Glomus sp.</i> 06	4±0.81	3±0.40	98 <sup>bode</sup>	2.11 <sup>bc</sup>
<i>Glomus sp.</i> 07	3±0.40	3±0.00	104 <sup>bcd</sup>	2.07 <sup>bc</sup>
<i>Glomus sp.</i> 08	2±0.51	2±0.40	76 <sup>fg</sup>	1.44 <sup>def</sup>
<i>Glomus sp.</i> 09	2±0.51	2±0.40	82 <sup>efg</sup>	1.74 <sup>cde</sup>
<i>Glomus sp.</i> 10	3±0.40	3±0.40	116 <sup>b</sup>	2.52 <sup>b</sup>
<i>Glomus sp.</i> 11	3±0.40	2±0.40	81 <sup>efg</sup>	1.69 <sup>cdef</sup>
<i>Glomus sp.</i> 12	3±0.54	3±0.51	104 <sup>bcd</sup>	1.98 <sup>bcd</sup>
<i>Glomus sp.</i> 13	3±0.40	3±0.40	112 <sup>bc</sup>	2.19 <sup>bc</sup>
<i>Glomus sp.</i> 14	3±0.40	2±0.40	90 <sup>def</sup>	1.64 <sup>cdef</sup>
<i>Glomus sp.</i> 15	2±0.04	2±0.63	84 <sup>ef</sup>	1.72 <sup>cdef</sup>

(Values without common letters differ significantly. Significance tested by Duncan's Multiple Range Test at P=0.01)

*Glomus sp.* 02 showed the maximum increase in dry biomass, Grain weight was also highest i.e. 3.15g/plant in the same inoculations. Plants inoculated with other fungi showed significant increases in grain weight as compared to control.

Inoculation with VAM fungi significantly increased the 'P' content of Rice (Table 3). Again, shoot 'P' content was highest in plants treated with *Glomus sp.* 02 followed by *Glomus sp.* 01 and *Glomus sp.* 03. The maximum root 'P' content was estimated in *Glomus sp.* 01 and *Glomus sp.* 03 inoculations. Overall, the total 'P' content was highest in *Glomus sp.* 02 followed by *Glomus sp.* 01 and *Glomus sp.* 03 inoculations & statistically significant over uninoculated control (Table 4).

### DISCUSSION

The wetland rice var. Mahasoori have shown a good response towards mycorrhization. A very wide range with the highest 84% of VAM colonization indicated towards the generalized and high level of infectivity of these indigenous VAM fungi suggesting to select most suitable inoculants for each host<sup>6,7,10</sup>. Plants inoculated with different VAM fungi were generally having higher shoot length, dry biomass and 'P' content as compared

to control. Significant increase in plant growth may be due to higher percentage of root colonization after inoculation<sup>2</sup>, as the highest % root colonization by *Glomus sp.* 02 has given highest shoot length, dry biomass, 'P' content and finally grain yield. Our results suggest to select *Glomus sp.* 02 as the best VAM inoculant for the rice var. Mahasoori as one of the component of nursery package being developed for Rice in future.

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