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EFFECT OF ARBUSCULAR MYCORRHIZAL FUNGI ON PRODUCTIVITY OF *ARTEMISIA PALLENS* AT FIELD LEVAL CONDITION

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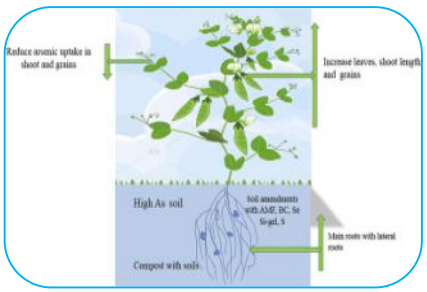
ABSTRACT



Arbuscular mycorrhizal fungi play an important role in mobilization of nutrients and enhancing plant growth. It maintain the intimate link between the plant roots and soil the present investigation deals with Effect of Arbuscular Mycorrhizal Fungi on Productivity of Artemisia pallens at Field leval condition with five replicates and six treatment. Growth parameters of Artemisia pallens was increased with inoculation of Arbuscular Mycorrhiza as compared to non-mycorrhizal treatment. Plant height, root length, fresh and dry biomass of root, stem, and leaves. Number of branches, number of seeds per plants and spore density and root colonization was increased with mix culture of arbuscular mycorrhizal fungi with addition rock phosphate and ash as compared to non-inoculated plant.

KEYWORDS: *Arbuscular Mycorrhiza, Artemisia pallens, Productivity.*

INTRODUCTION

The term Mycorrhiza was coined by A.B. Frank in 1885. Mycorrhiza is the Mutualistic symbiotic association between soil born fungi and roots of higher plants in which both are benefited. (Sieverding *et.al*., 1991; Kasliwal and shriniwasmurthy., 2016).

Arbuscular mycorrhizal fungi is the mother of plant root endosymbiosis that establish symbiotic relationship with plants and play an essential role in plant growth, disease protection and soil fertility.(Thapa *et.,al*.2015). Arbuscular Mycorrhiza fungi absorb immobilized mineral nutrition such as phosphorus, zinc and copper from the soil. (Bagyaraj,2014).

Arbuscular mycorrhizal fungi also absorb nutrient i.e zinc, copper, nitrogen, sulphur, potassium, phosphorous, calcium, magnesium and iron from soil and it supply to the plant. (Alizadeh,2012). It maintains carbon and nitrogen cycle. It regulates growth hormone. It increases photosynthetic rate. It maintains plant community and ecosystem. It helps in seedling establishment in forest. (Aggarwal *et. al*.,2011).

Artemisia pallens Wall commonly called as Davana. It is included in Asteraceae family. It has been widely used in Indian folk medicine for the treatment of diabetes mellitus. This plants with accredited with antihelmentic, antipyretic, antibacterial and tonic properties also considered as good fodder. (Suresh *et.al*., 2011).

Leaves are small, whitish green coloured and devided. Flower is small yellow coloured. (Anonymous, 1985). *Artemisia pallens* Wall is erect, number of branches, leaves bipinnatisect, lower and

upper leaves are orbicular. Heads globose in lax compound recemose panicles and Florets bisexual.(Yadav and sardesai;2002).

MATERIALS AND METHODS:

Isolation of spores by using wet-sieving method. (Gerdman and Nicolson; 1963).

Spore extraction is involve in three sub steps such as wet-sieving, sedimentation, flotation. Mix 5 gm of soil in 250 ml of luck warm water in a beaker until all aggregates disperse to a uniform suspension. Allow the heavier particles to settle down. Filter the suspension through 710 µm sieve to remove large organic matter and roots. Then solution was sieved through series of sieves i.e710 µm, 210 µm 150 µm, 75 µm, 45 µm and 25 µm respectively. Content of each sieves i.e 210 µm 150 µm, 75 µm, 45 µm and 25 µm was taken separately on blotting paper in petriplate and This petriplate was observed under stereo zoom binocular microscope.

Percentage of root colonization. (Phillips and Hayman ,1970).

Young root segments were taken in test tube adding 10% KOH and it autoclaved at 15 lbs for 1 hr. After 10 minute 10% KOH was removed from test tube then root segments were washed under tap water with 2 to 3 times . Then 10 ml 1N HCL was added and were kept for 5 minute for neutralization of root tissue. Then HCL was removed and washed the root segments 2 to 3 times with tap water. After 30 minute root segments stained with cotton blue and kept for 24 hrs. After 24 hrs root segments mounted on slide with Acetic acid –glycerol (1:1v/v). Seal the corners of the cover slip with DPX, root colonization was observed under compound microscope. Then **%** of Arbuscular Myccorhizal fungal colonization calculated by using this formula;

$$\textbf{Percent of mycorrhizal colonization} = \frac{\textbf{Number of root segments colonized}}{\textbf{Total number of root segments examined}} \times \textbf{100}$$

3.8) Field cultivation experiments. (Five replications): (Anonymous, 1985).

Effect of pure culture, mix culture with addition rock phosphate and ash on *Artemisia pallens* Wall:

i) Cultivation:

Cultivation of davana was done in winter season crop from November to March and ratoon crop increases up to April/may. Whitish, black or red soil was used for the cultivation

One year old seeds were used for cultivation but not more than one year because seed lose their viability after one year. Seven soil beds each of 30cm height and of dimension 1m × 1m was prepared. Firstly prepared the beds and it irrigated at 10 days before sowing the seeds. Then rock phosphate (500gm) and layer of ash was added in different beds then layer of soil was added on beds. Added 750 gm of AM fungi culture (mix and pure culture of AM fungi) was sprayed uniformly on separate beds before sowing the seeds of *Artemisia pallens* and it covers with soil. Seeds were sown in the soil and covered with soil.

The experiment was done on field in five fold replicate of each treatment.

Set-F1-Control(Without AMF and rock phosphate and ash)
Set-F2-Pure culture of AM fungi (*Glomus mosseae.*) with ash
Set-F3-Pure culture of AM fungi(*Glomus mosseae.*)
Set-F4-Pure culture of AM fungi(*Glomus mosseae*), rock phosphate and Ash
Set-F5-Mix culture of AM fungi and Ash
Set-F6-Mix culture of AM fungi
Set-F7-Mix culture of AM fungi, rock phosphate and Ash.

First week of sowing the beds watered regularly. . After 60 days AM inoculated seedlings of *Artemisia pallens* were transferred into field. it is reaches height 5 to 7 cm. The plots were irrigated near

about transplanting. Seedlings were instantly watering after transplanting. Regularly the plots were irrigated at first ten days and later once in two days and finally 10-15 days before harvest the water supply to the plants was totally stopped. Davana grows extending upto 50-65cm in height.

ii) Harvesting:

The plants were harvested at the age of 30, 60, 90, 120 and 150 days after sowing.

iii) Estimation of fresh and dry biomass-

The root and shoot portions of the plants was separated out. Root portion was washed gently under running tap water to remove all the adhering particals. Both portions were pressed in filter paper to remove excess moisture. The fresh weight was determined and samples were wrapped in paper and it kept in a hot air oven at 72 ^{0}C for 48 hrs. Samples was removed, cooled and reweighed to record dry weight.

iv) Evalution of agronomical characters-(Morphological parameters)

Various parameters was analysed like the height of the plant (cm), root length, fresh and dry weight (gm). Number of leaves/plant, number of branches, number of seed and number of flower/ plant and productivity.

RESULT AND DISSCUSION:

In present study mycorrhizal parameters like root colonization, spore density, height of plant, root length, number of leaves, number of branches, number of flower, number of seeds and dry biomass was increased with dual inoculation of arbuscular mycorrhizal fungi i.e *Glomus mosseae* and *Acaulospora laevis* with addition rock phosphate and ash as compared to non inoculated plant and it can be considered as efficient AM fungus for *Artemisia pallens*.

5.5) Field experiment:

In present investigation *Artemisia pallens* were selected for analysing the effect of pure culture of arbuscular mycorrhizal fungi and mix culture of arbuscular mycorrhizal fungi with addition phosphate and ash which were mass multiplied on *Eleusina coracana* as host.

Pure and mix culture of arbuscular mycorrhizal fungi were prepared by using *Eleusina coracana* as host and again multiplied on *Eleusina coracana* were sufficient culture raised. *Artemisia pallens* seeds were sow in tray and it transfer after 60 days into field. The prepared cultures were used following treatments. Mix culture of Arbuscular mycorrhizal fungi inoculated with *Glomus fasciculatum,Glomus microcarpum Glomus reticulatum, Glomus mosseae,Glomus fragilistatum., Glomus pachyculais,Glomus citricolla. Glomus macrocarpum. Glomus globiforum. Acaulospora laevis, Acaulospora sp.Gigaspora rosea., Scutellospora pellicida.*

Following treatments were maintained for field trials such as

Set-F1-Control(Without AMF, rock phosphate and ash)
Set-F2-Pure culture of AM fungi (*Glomus mosseae*) with ash
Set-F3-Pure culture of AM fungi (*Glomus mosseae.*)
Set-F4-Pure culture of AM fungi (*Glomus mosseae*), rock phosphate and Ash
Set-F5-Mix culture of AM fungi and Ash
Set-F6-Mix culture of AM fungi
Set-F7-Mix culture of AM fungi, rock phosphate and Ash.

In field cultivation experiment 95±1 (SD)% root colonization of *Artemisia pallens* was observed in Set-F7-Mix culture of AM fungi, rock phosphate and Ash, *as* followed by 90±1.41 observed in Set-F6-Mix culture of AMF and 88±1.58% root colonization was observed in Set-F-5-Mix culture of AMF+ ash, 85±1% was observed in Set- F4 containing *Glomus mosseae + rock phosphate +ash,* 82±1.22% was observed in Set-F2 containing *Glomus mosseae. + ash.* In set-F3 root colonization 81±1% inoculated

with *Glomus mosseae.* Highest spore i.e 650 ±1.14 density was found in Set-F7- inoculated with Mix culture of AMF+ rock phosphate+ ash as compared all treatments. Manimeghalai *et., al*. (2011) observed 98% root colonization in *Solanum Viarum* plant with inoculated *Glomus fasciculatum.*

The height and root length of *Artemisia pallens* was increased in set-F7 were the mix culture of mycorrhizal fungi supplemented with rock phosphate and ash as followed by Set-F4 were mycorrhizal fungi containing *Glomus mosseae* supplemented with rock phosphate and ash as compared to set-F1 were in which plants were not supplemented by either fungi or phosphate an ash. Similar observations were made by Height of maize and finger millet was increased with inoculated mycorrhizal inoculum reported by Shreshta *et.,al* (2009). Saif and Khan, (1977) reported height was increased with inoculated mycorrhizal fungi in barley. Tufenkci *et.al*.(2010) observed height and root length of *Cucumis sativus* plant was increased with inoculated Mycorrhiza. Kanwal *et, al*. (2015) observed height and root length of wheat plant was increased with inoculated arbuscular mycorrhizal fungi.

Number of leaves, Number of branches, number of flower and number of branches was increased in set-F7 were the mix culture of mycorrhizal fungi supplemented with rock phosphate and ash followed by Set-F4 were mycorrhizal fungi containing *Glomus mosseae* supplemented with rock phosphate and ash as compared to set-F1 were in which plants were not supplemented by either fungi or phosphate an ash. Similar observation were made by Santos *et.al*., (2010) in *Zingiber officinale*. Secilia and Bagyraj(1992), in wetland rice for grain yield enhancement. Ammani and Rao,(1996) in upland rice for enhancement of grain yield. Khan(1975) in wheat for three fold enhancement of grain.

Fresh and dry biomass was observed in set-F7 were the mix culture of mycorrhizal fungi supplemented with rock phosphate and ash as compared to set-F1 were in which plants were not supplemented by either fungi or phosphate an ash. Similar observation were made by Jangandi, *et. al.*, (2016) observed dry weight of *Terminalia paniculata* was significantly increased with arbuscular mycorrhizal culture with rock phosphate. Castillo *et., al*. (2013) observed dry weight of shoot and root of *Capsicum annum* was significantly increased with inoculated arbuscular mycorrhizal fungi. Bona *et., al* (2016) reported on dry biomass of tomato fruit was increased with arbuscular mycorrhizal fungi. Yield of potatoes was increased inoculate with arbuscular mycorrhizal inoculum reported by Douds *et.al.,*(2015).

Earlier flowering was observed in month February month in set-F7 were mix culture of mycorrhizal fungi supplemented with rock phosphate and ash followed by Set-F4 in which plants were provided with *Glomus mosseae* with supplemented rock phosphate and ash and late flowering was observed in March month in set-F1 were in which plants were not supplemented by either fungi or phosphate an ash. Similar observation were made by Bryla and Koide, (1990) in *Lycopersicon esculentum* Mill. Reported early flowering and therefore significantly increase in seed production. Daft *et. al*., (1973) reported early flowering initiation in *Pteunias*.

TABLE NO- 1 Effect of various treatments of AM fungi with addition rock phosphates and ash on height of *Artemisia pallens* at 30 to 150 days intervals in Field leval condition.

	Parameters	Height of plant(cm)				
	Treatment / Days	30	60	90	120	150
1	F1	3.1±0.654	5.2±1.79	12.6±2.41	23.8±2.58	32±2.1
2	F2	5.6±0.258	11.2±1.14	23.2±1.92	35.8±1.92	47.5±1.72
3	F3	5±0.374	9.2±1.18	19.2±1.78	32.2±1.31	43.4±2.30
4	F4	6.7±0.277	13.6±1.28	27±1.22	41±1.58	50.6±1.76
5	F5	6±0.313	12±1.58	24.2±1.92	38±1.58	49±1.58
6	F6	5.3±0.311	10±1	21±1.58	35±1.87	44±1.58
7	F7	8.2±0.27	15±1.14	29±1.87	46.4±1.34	64±1.87

TABLE NO- 2 Effect of various treatments of AM fungi with addition rock phosphates and ash on root length of *Artemisia pallens* at 30 to 150 days intervals in Field leval condition.

	Parameters	Root length (cm)				
	Treatment / Days	30	60	90	120	150
1	F1	1.64±0.24	2.82±0.19	3.8±0.22	4.56±0.27	6.52±0.24
2	F2	3.48±0.13	5.76±0.16	7.72±0.14	9.7±0.15	11.64±0.11
3	F3	2.78±0.13	4.58±0.13	6.8±0.15	8.4±0.15	10.38±0.19
4	F4	4.26±0.15	6.86±0.16	9.28±0.14	11.3±0.23	13.76±0.16
5	F5	3.76±0.16	6.46±0.15	8.58±0.13	10.5±0.15	12.5±0.15
6	F6	3.24±0.11	5.36±0.16	7.3±0.18	9.24±0.16	11.24±0.11
7	F7	4.46±0.16	7.2±0.15	9.52±0.14	11.72±0.14	14.72±0.16

TABLE NO- 3 Effect of various treatments of AM fungi with addition rock phosphates and ash on number of leaves of *Artemisia pallens* at 30 to 150 days intervals in Field leval condition.

	Parameters	Number of leaves (cm)				
	Treatment / Days	30	60	90	120	150
1	F1	6±2.34	12±2.44	25±2.64	66±2.91	76±2.73
2	F2	10±1.58	21±1.22	72±2.23	112±2.12	128±2.12
3	F3	8±1	19±2.23	60±2.12	92±1.58	103±1.41
4	F4	14±1.41	25±1.22	87±1.58	129±2.34	143±1
5	F5	12±1.22	23±2	78±1.41	122±2	134±2.34
6	F6	9±1.22	20±1.58	68±2	105±2.5	120±1.58
7	F7	15±1.14	27±1	95±1.87	135±1.58	154±1.22

TABLE NO- 4 Effect of various treatments of AM fungi with addition rock phosphates and ash on dry biomass of *Artemisia pallens* at 30 days intervals in pot condition.

Sr.no.	Parameters	Dry biomass of plant(gm)30			
	Treatment	Root(gm)	Stem(gm)	Leaves((gm)	Total Dry biomass in (gm)
1	F1	0.072±0.037	0.15±0.042	0.12±0.044	0.342
2	F2	0.14±0.021	0.28±0.021	0.24±0.014	0.66
3	F3	0.11±0.022	0.232±0.016	0.194±0.011	0.536
4	F4	0.18±0.025	0.344±0.016	0.31±0.015	0.834
5	F5	0.16±0.023	0.302±0.014	0.27±0.017	0.732
6	F6	0.13±0.024	0.26±0.018	0.224±0.013	0.614
7	F7	0.21±0.022	0.406±0.013	0.35±0.014	0.966

TABLE NO-5 Effect of various treatments of AM fungi with addition rock phosphates and ash on dry biomass of *Artemisia pallens* at 60 days intervals in pot condition.

Sr.no	Parameters / Treatment	Dry biomass of plant(gm)60			
		Root (gm)	Stem(gm)	Leaves(gm)	Total Dry biomass in (gm)
1	F1	0.11±0.069	0.264±0.099	0.21±0.094	0.584
2	F2	0.22±0.022	01.47±0.038	1.02±0.048	2.74
3	F3	0.18±0.027	1.1±0.033	0.71±0.043	1.99
4	F4	0.344±0.027	1.85±0.038	1.408±0.044	3.602
5	F5	0.29±0.0291	1.66±0.022	1.25±0.035	3.2
6	F6	0.202±0.026	1.3±0.025	0.85±0.033	2.352
7	F7	0.39±0.0258	2.3±0.027	1.87±0.031	4.56

Mean ± SD,(Standard deviation with 5 replicates)

TABLE NO- 6 Effect of various treatments of AM fungi with addition rock phosphates and ash on dry biomass of *Artemisia pallens* at 90 days intervals in pot condition

Sr. No	Parameters / Treatment	Dry biomass of plant(gm) 90			
		Root (gm)	Stem(gm)	Leaves(gm)	Total Dry biomass in (gm)
1	F1	0.204±0.054	2.584±0.45	1.28±0.46	3.826
2	F2	0.334±0.029	4.408±0.11	3.56±0.015	8.308
3	F3	0.28±0.028	3.578±0.18	3.14±0.058	6.982
4	F4	0.406±0.027	4.808±0.17	3.95±0.015	9.162
5	F5	0.376±0.032	4.64±0.17	3.75±0.036	8.766
6	F6	0.296±0.023	4.384±0.18	3.354±0.011	8.044
7	F7	0.618±0.019	5.66±0.15	4.88±0.025	11.148

TABLE NO- 7 Effect of various treatments of AM fungi with addition rock phosphates and ash on dry biomass of *Artemisia pallens* at 120 days intervals in pot condition

Sr.no	Parameters / Treatment	Dry biomass of plant(gm)120			
		Root (gm)	Stem(gm)	Leaves (gm)	Total Dry biomass in (gm)
1	F1	0.522±0.23	3.116±0.33	2.464±0.45	6.102
2	F2	0.54±0.14	6.524±0.17	5.32±0.18	12.384
3	F3	0.45±0.11	5.778±0.18	4.638±0.14	10.866
4	F4	0.75±0.057	6.61±0.15	5.8±0.18	13.16
5	F5	0.586±0.033	6.6±0.13	5.736±0.24	12.922
6	F6	0.402±0.028	6.3±0.18	4.914±0.25	11.616
7	F7	0.936±0.0178	8.958±0.041	8.866±0.16	18.76

TABLE NO- 8 Effect of various treatments of AM fungi with addition rock phosphates and ash on dry biomass of *Artemisia pallens* at 150 days intervals in pot condition

Sr. No	Parameters / Treatment	Dry biomass of plant(gm)150 days			
		Root (gm)	Stem((gm)	Leaves(gm)	Total Dry biomass in (gm)
1	F1	0.56±0.21	4.08±0.64	3.40±0.44	8.044
2	F2	0.75±0.045	7.71±0.18	6.71±0.21	15.172
3	F3	0.63±0.022	6.77±0.21	6.34±0.26	13.742
4	F4	1.35±0.061	8.36±0.31	7.56±0.15	17.27
5	F5	0.98±0.013	7.8±0.21	7.27±0.16	16.052
6	F6	0.678±0.013	7.35±0.038	6.53±0.15	14.564
7	F7	2.95±0.015	11.8±0.18	10.87±0.16	25.706

Mean ± SD,(Standard deviation with 5 replicates

TABLE NO- 9 Effect of various treatments of AM fungi with addition rock phosphates and ash on Number of branches, number of flower and number of seeds of *Artemisia pallens* at 150 days intervals in pot condition.

Sr.no	Parameters / Treatment	Number of branches	Number of flower	Number of seed per plant
1	**F1**	13±2.64	24±2.91	46±2.7
2	**F2**	25±2.12	47±1.87	286±1.8
3	**F3**	22±1.58	38±1.58	196±1.5
4	**F4**	29±2.12	64±2.12	387±1.7
5	**F5**	27±1.58	58±1.87	322±2.4
6	**F6**	23±1.87	42±2.12	267±1.5
7	**F7**	34±1.58	72±1.58	442±1.5

TABLE NO- 10 Effect of various treatments of AM fungi with addition rock phosphates and ash on Arbuscular mycorrhizal root colonization of *Artemisia pallens* in pot condition

Sr.no	Treatment	M	V	A	Percentage of root colonization	Arbuscular mycorrhizal spore per 100gm of soil.	Inoculated arbuscular mycorrhizal spores.
1	F1	-	-	-	00	00	Without AMF, ash and rock phosphate
2	F2	+	+	+	82±1.22	600±1.58	*Glomus mosseae +ash*
3	F3	+	+	-	81±1	625±1.58	*Glomus mosseae*
4	F4	+	+	+	85±1	632 ±1.14	*Glomus mosseae +rock phosphate +ash*
5	F5	+	+	+	88±1.58	640±1.30	*Mix culture of AMF+ ash*
6	F6	+	+	-	90±1.41	635±1.51	*Mix culture of AMF*
7	F7	+	+	+	95±1	650±1.14	*Mix culture of AMF+ rock phosphate+ ash*

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