



Effect of VA Mycorrhizae inoculation on vegetative growth in *Anethum graveolens* L (Dill, Shepu)

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ABSTRACT

Anethum graveolens L. called as dill or sowa is used as leaf vegetable and have any medicinal uses. it is widely used as carminative and appetizer. In Maharashtra it is called Shepu. *Anethum* is an important vegetable and medicinal plant for which it was selected in present research. Effect of VAM inoculation showed positive effect on vegetative growth parameters like plant height and no of leaves. Percentage of VAM colonization was higher in mycorrhizal plants with recommended phosphate in sterilized and non sterilized soil.

Keywords: *Anethum*, VAM, Vegetative growth.

INTRODUCTION

Anethum graveolens L. is species of the genus *Anethum*, It classified by some botanists as *Peucedanum graveolens* (L.) also called East Indian dill or sowa. It occurs in India and is cultivated for its foliage as a cold weather crop throughout the Indian sub-continent, Malaysia and Japan. In Maharashtra it is called Shepu. *Anethum* grows up to 90 cm tall, with slender stems and alternate leaves divided three or four times into pinnate sections slightly broader than leaves of fennel. The yellow flower develops into umbels. Cox, et al., (1975). The seeds are the halves of very small, dry fruits called schizocarps. Dill fruits are oval, compressed, winged about one-tenth inch wide, with three longitudinal ridges on the back. Taste of the fruits resembles caraway. The seeds are smaller, flatter and lighter than caraway and have a pleasant aromatic odor. (Nair and Chanda. 2007).

Medicinally *Anethum* is used in gripe water, given to relieve colic pain in babies and flatulence in young children. The carminative volatile oil is used as appetizer. Seed improves bad breath. *Anethum* stimulates milk flow in lactating mothers, and is often given to cattles for this reason. It also cures urinary complaints, piles and mental disorders. (Pulliah, 2002).

VAM means vesicular arbuscular mycorrhizal fungi. They form symbiotic association with majority of plants. They improve phosphate absorption capacity of plants to promote growth and development. VAM grows in close association with the roots and play an important role in transfer of soil nutrients to the plant. In exchange, the plant supplies the fungus with sugars. Mycorrhizal fungi have been suggested as having a role in uptake of water at during drought stress, and heavy metals contaminated soil (Courtecuisse, 1999). The hyphae of arbuscular mycorrhizal fungi penetrate roots and grow extensively between and within living cortical cells, forming a very large and dynamic interface between symbionts. The hyphae also extend from root surfaces into the surrounding soil, binding particles and increasing micro- and macro-aggregation (Auge, 2001). The VAM selected for the research was *Glomus fasciculatum*.

MATERIAL AND METHODS

Investigation was conducted at the Department of Botany, Arts, Commerce and Science College, Narayangaon, Pune to study the response of three commercially important plant *Anethum graveolens* to VA mycorrhizal inoculation.

Mature healthy seeds of *Anethum graveolens* were collected from local area, Narayangaon Tal. Junnar, Dist. Pune (Maharashtra) and used in all the experiments. Earthen pots with 30 cm diameter, and depth, with a hole at the base for drainage system were selected and were filled with 3 kg of sterilized soil mixture of sand: soil: FYM in 1: 2: 1 proportion. The pots were placed in full sunlight and were watered till field capacity a day before sowing and alternate days till the final harvest. Recommended phosphate fertilizer was procured from Suryakant agro service, Kalamb added at different levels as suggested in various treatments.

In *Anethum graveolens* there were five sets with five treatments in sterilized soil.

Set I – UP00- Control, uninoculated without phosphate.

Set II – IP00- VAM inoculated without phosphate.

Set IV – IP100% - VAM inoculated with 1gm phosphate per pot.

Set III – UP75% - Uninoculated with 0.75 gm phosphate per pot.

Set IV – IP50%- VAM inoculated with 0.5 gm phosphate per pot.

The similar sets were made for non sterilized soil also. Ten root segments of each species were collected and subjected for detection of mycorrhizal colonization. The root segments were fixed in F.A.A. for 24 hours and were autoclaved in 10% KOH. The autoclaved root segments were washed in 1 percent HCl- and stained with cotton blue in lactophenol. The stained roots were mounted on micro slide in lactophenol and were observed under microscope for the presence and kind of VAM fungi. Identification is attempted solely on manual for identification of VAM fungi by Schenck and Perez, (1987). Frequency was calculated using the formula,

$$\% \text{ frequency of mycorrhizal colonization} = \frac{\text{Number of mycorrhizal root segments}}{\text{Total number of root segments screened}} \times 100$$

Further observations were recorded at flowering period for vegetative parameters. Dry biomass on 60th day for which samples were oven dried at 60° C for 48 hours. S.E was calculated using excel programme

RESULTS AND DISCUSSION

The result of present investigation clearly indicates that *Anethum graveolens* responds well to the mycorrhizal inoculation under pot condition.

Maximum plant height was noted in plants inoculated with VAM at 100 percent recommended phosphate and least in control in both sterilized and non sterilized soil. Collectively VAM and phosphate showed two fold increase in growth as compared to uninoculated control plants. Similar results were recorded by Kanade and Bhosale (2014) in *Cassia tora* L., Kanade and Bhosale (2013) in *Dolichos lab-lab*, Linn. and Kanade and Bhosale (2013) in *Sida acuta*, Burm.

Many workers observed that VAM alone or with phosphate increased growth and yeild. Mosse, *et. al* (1969) observed that mycorrhizal onion seedlings grew better in both sterilized and non sterilized soil as compared to untreated plants. Arafat *et. al* (1995) showed increased growth in *Vicia faba* in hydroponic culture.

Maximum number of leaves was found in plants inoculated with VAM at 100 percent recommended phosphate and least in control in both sterilized and non sterilized soil. VAM or Phosphate alone did not

Table 1: Growth performance of *Anethum graveolens* in response to various levels of phosphate, and VAM in non sterilized and sterilized soil.

Soil type	Non sterilized					
Set	I	II	III	IV	V	VI
Treatments	UP00	IP00	UP100	IP100	IP75	IP50
Parameters	*	*	*	*	*	*
Plant height (cm)	32.00±0.1	30.00±0.01	37.00 ± 0.02	39.00 ± 0.01	38.00 ± 0.1	35.10±0.1
No. of Leaves	32.00 ± 01	33.00±01	38.66±0.1	34.00±0.1	32.00±0.01	33.00±0.01
% VAM Colonization	00	10	00	55	30	20
Spore count (Per 50 gm of soil)	00	10	00	30	25	30
Soil type	Sterilized					
Set	I	II	III	IV	V	VI
Treatments	UP00	IP00	UP100	IP100	IP75	IP50
Parameters	*	*	*	*	*	*
Plant height (cm)	30.00±0.1	28.00±0.01	35.00 ± 0.02	37.00 ± 0.01	36.00 ± 0.1	32.10±0.1
No. of Leaves	32.00 ± 01	32.00±01	37.66±0.1	33.00±0.1	31.00±0.01	32.00±0.01
% VAM Colonization	00	10	00	50	30	20
Spore count (Per 50 gm of soil)	00	10	00	30	20	30

UP00 (Control , un-inoculated, without phosphate & VAM). **IP00** (VAM Inoculated, without phosphate). **UP100** (VAM un-inoculated with 1gm phosphate per pot). **IP100** (VAM Inoculated with 1gm phosphate per pot). **IP75** (VAM Inoculated with 0.75gm phosphate per pot). **IP50** (VAM Inoculated with 0.50gm phosphate per pot). Standard *deviation (SD).

show marked effect as compared to combinations of VAM and phosphate. Similar trend was observed in Red Maple (*Acer rubrum*) reported by Daft and HacsKaylo (1977) in *Tamarindus indica* , L. , *Acacia nilotica* and *Calliandra calothyrsus* by Reena and Bagyaraj(1990).

Inoculation of plants with VAM without phosphate shows two fold increase in Total leaf area as compared to uninoculated plants without phosphate. VAM with 50 percent recommended phosphate shows tenfold increase as compared to uninoculated plants without phosphate. Generally the inoculation of VAM along with recommended phosphates shows increase in leaf area per plant. Similarly Biermann and linderman (1983) reported that total leaf area was increased in inoculated plants as compared to uninoculated plants in China aster.

Percentage of VAM colonization was higher in mycorrhizal plants with 50 percent recommended phosphate in sterilized and non sterilized soil. Similar observation was reported by Okon *et. al.* (1996) in *Gliricidia sepum* and *Senna siamea*. VAM with 50 percent recommended phosphate shows maximum

number of Mycorrhizal spores in non sterilized soil. Clamydospores were not observed in uninoculated plants. This suggests that the number of infective propagules in the soil is low and the infectivity of native fungi lower than that of inoculant fungus. Further there is decrease in VAM colonization level at 100 percent recommended phosphate and higher soil phosphate levels. There is increase in VAM colonization level in nonsterilized soil inoculated with VAM also observed by Bagyaraj and Manjunath (1980) in Cotton Cowpea, Menge, *et. al.* (1998) in Citrus. Present investigation clearly indicates that *Anethum graveolens* L. responds well to *Glomus fasciculatum*. VAM inoculation in combination with Phosphate at all levels increased height of shoot, Total leaf area and Dry biomass in both non sterilized and sterilized soil.

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