EFFECT OF SYMBIONTS IN THE CULTIVATION OF *LYCOPERSICUM ESCULENTUM*

SHAILAJA S.MENON, UNNATI PADALIA

Abstract: Twenty first century is noted for returning back to Nature, an era of usage of Natural resources as there is huge hue and cry of protecting the environment by all means. Arbuscular Mycorrhiza(AM) is a microbial source of Natural bio-fertilizers. The beauty of this fertilizer is, it is just natural, one only needs to exploit its potential in the desired fields. The expanse of Mumbai's coastal line has been enriched with the mycorrhizae, which are an assemblage of specific symbionts, a fungus and the roots of Angiosperms. Their presence is visible both in the rhizosphere soil and the roots. The study was carried out at 10 different sites of Mumbai and its suburbs by collecting the wild plants to ascertain their presence in their roots and rhizosphere soil. It revealed the presence of nine species of Arbuscular Mycorrhizal Fungi [AM]. The main genera involved were *Acaulospora, Gigaspora* and *Glomus*. Mycorrhizal inoculum was prepared and introduced into *Lycopersicum esculentum* (Tomato) to assess the reduced dormancy period, enhanced phenotype, early anthesis, fruit setting and the quality of the fruit. The growth patterns were encouraging retaining the basic nature of this valuable vegetable, rich in antioxidants and established as a preventive measure for the dreaded disease, cancer. The eco-friendly nature of this fertilizer and the economics involved in its cultivation and the productivity of the produce give a succor to the challenge in agricultural sector.

Key words: AM Fungi, Rhizosphere, Dormancy, Anthesis, Antioxidants, Natural Bio-fertilizer.

Introduction: Mumbai is known to have saline soil, with its marked vegetation as mangroves. The mesophytes may find it difficult to grow in the given geographical conditions. The survey of local plants had shown the presence of a novel fungi, the Mycorrhiza, a natural biofertilizer. Mycorrhiza is a symbiotic association of Fungus and the roots of higher plants [1]. The nature of this association is peculiar. As these microorganisms are not host specific, their introduction into cultivars is a novel idea. A survey to the local sites in the given geographical stretch had given a clear understanding of this association. This understanding prompted its introduction in the cultivated *Lycopersicum esculentum,* an important vegetable rich in nutrients antioxidants.

Materials and Methods: Roots along with the rhizosphere soil was collected from 10 locations of the Western Suburbs of Mumbai. Pretreatment of roots prior to staining was carried out [2]-[3]. Roots were cut into pieces of approximately 1cm.and microscopic examination was carried out to determine the symbiotic association of Arbuscular Mycorrhiza and percentage of Mycorrhizal association in the root was calculated by using Nicolson's formula [4]. Arbuscular Mycorrhizal spores were isolated, identified and quantified using the standard techniques [4]-[5]-[6]-[7]. Arbuscular Mycorrhizal inoculum was prepared and it was inoculated in the fruit bearing plant , *Lycopersicum esculentum* – (Tomato) and both the Vegetative and Reproductive growth was noted in the Experimental [E1,E2,E3] and

Control [C1,C2,C3] plants. Vegetative growth was evaluated by dormancy period, germination rate, shoot length in specific duration and the overall Phenotype of the plants. Reproductive growth was studied by the early maturity- anthesis, fruit setting and the quality of fruits.

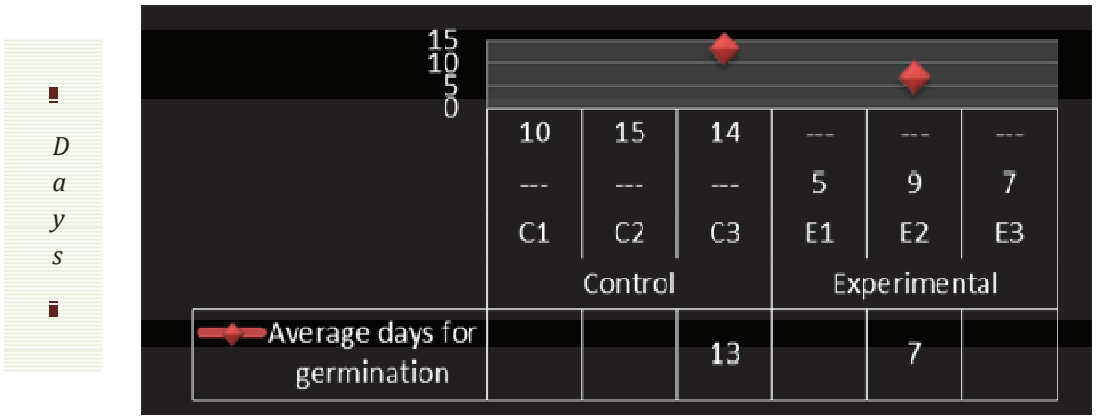
Result and Discussion :

Spores of *Glomus* were inoculated into the soil of experimental *Lycopersicum* plants and the following results were obtained.

Seeds sown in pots inoculated with Mycorrhiza,[Experimental plants] germinated in 7 days and the control plants germinated in 13 days . The data presented in **figure 1** indicated that the number of days for germination of *Lycopersicum esculentum* was influenced significantly due to the introduction of Mycorrhiza. Number of days taken for the germination is considerably reduced in treated soil compared to the control plants **[8].**

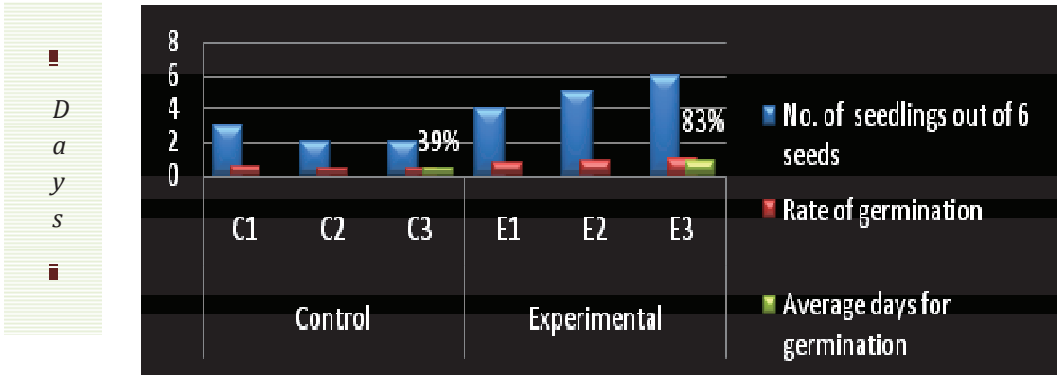
Data presented in **figure 2** showed that the mean germination in pots inoculated with Mycorrhiza (Experimental),were 15 out of 18 seeds sown, making a germination rate of 83% and in the control pots the mean germination was 7 out of 18 seeds sown making a 39% germination rate. A clear enhanced rate of germination is depicted in the experimental plants compared to the control plants. The germination rate was more than double in the experimental plants. This is in confirmation of the studies of Ajit Katdare [8].

Figure :1 Dormancy in Experimental and control plants



----------→ Use of inoculum

Figure :2 Rate of germination in xperimental and control plants



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The study on shoot length was spread in 15 days gap over a period of 90 days. The data reveals the mean shoot length as 31.5 inches in experimental plants and the control plants

showed a mean shoot length of 21.4 inches (**Fig.3**). There is a net difference (increase in shoot length) of 10.1 inch in experimental group when compared to control group, over a period of ninety days. Study on shoot length revealed enhanced phenotype in experimental plants compared to the non- mycorrhizal control plants. Similar observations were made by Chaturvedi et al.[9]-[10]. The increased shoot length in the experimental plants was mainly due to the increased nutrient uptake by way of this bio-fertilizer [11].

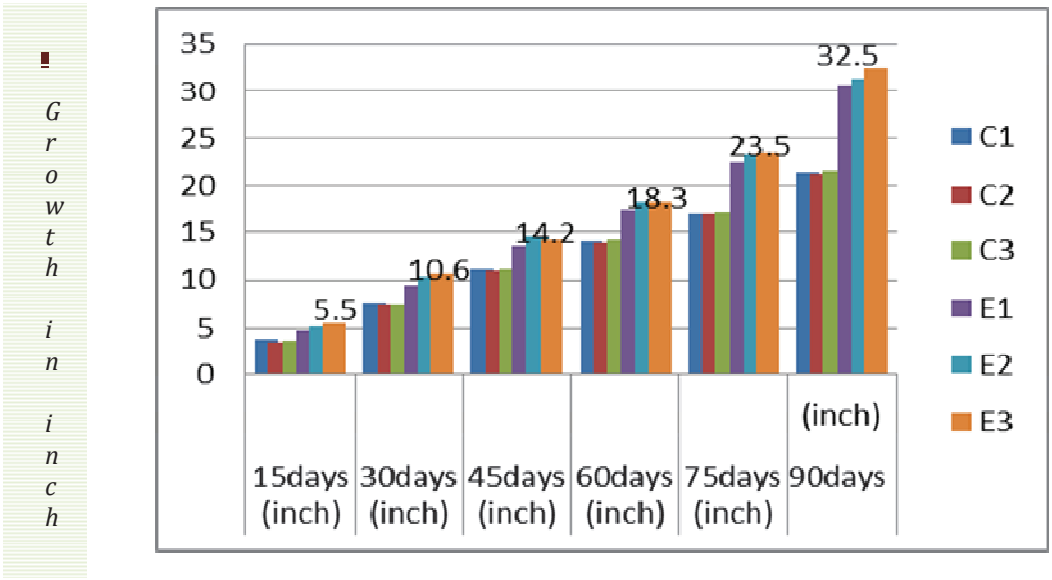
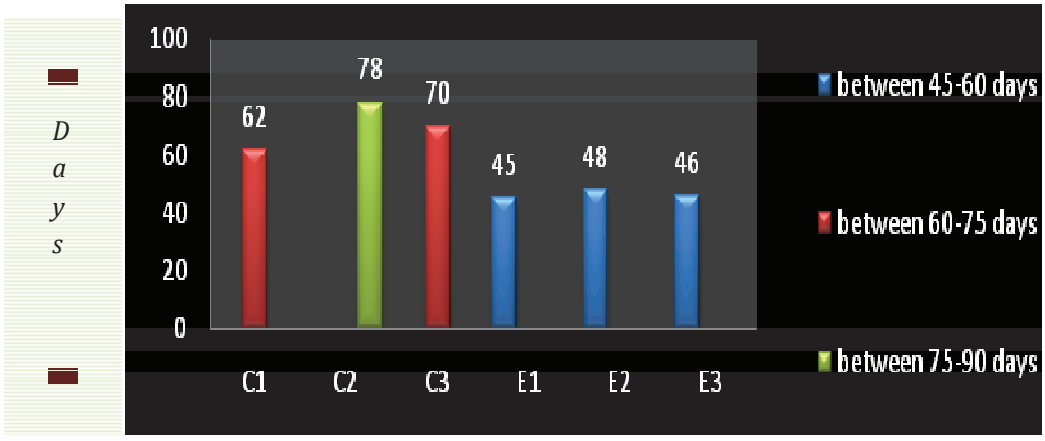


Figure :3 –Shoot length in *Lycopersicum esculentum*

Reproductive growth was studied by two parameters, anthesis and fruit setting. Data shows the experimental plants bloomed at a mean 46 days compared to the control plants which took a mean 70 days to flower as in **Figure no.4**

Figure :4 Anthesis in *Lycopersicum esculentum*



----------→ Use of inoculum

The mycorrhizal plants being healthy, showed early maturity. This result is in concurrence with the findings of Hildebrandt et al., who reported that a treatment of *Glomus* species accelerates early transition from vegetative to reproductive phase [**12**]-[13].

Experimental plants showed mean fruit setting

in 46 days and the control plants set its fruits in mean 71 days as seen in **Figure no. 5 .**Similar reports were made by Hildebrandt et al., and Alessandra et al., who reported the blooming and fruit setting of mycorrhizal tomato plants, much earlier than the control plants[12]-[13]

Figure :5 Fruit setting in *Lycopersicum esculentum*

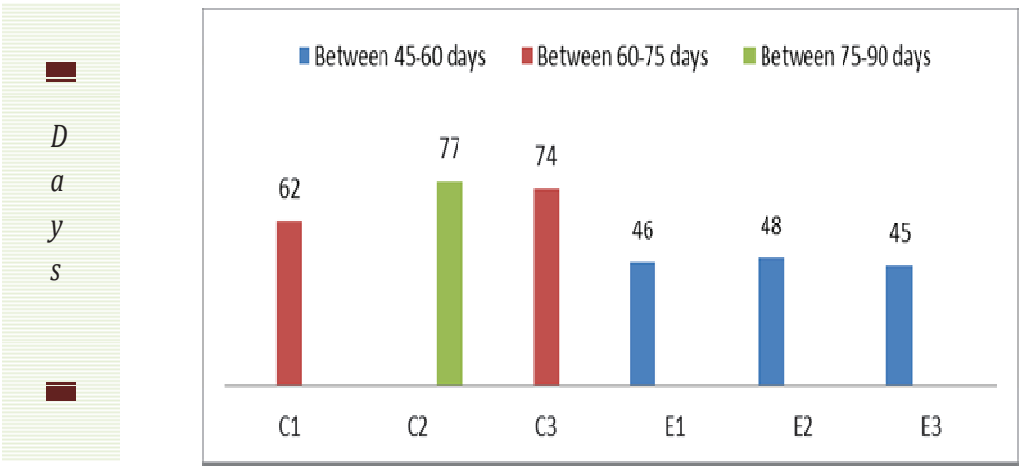
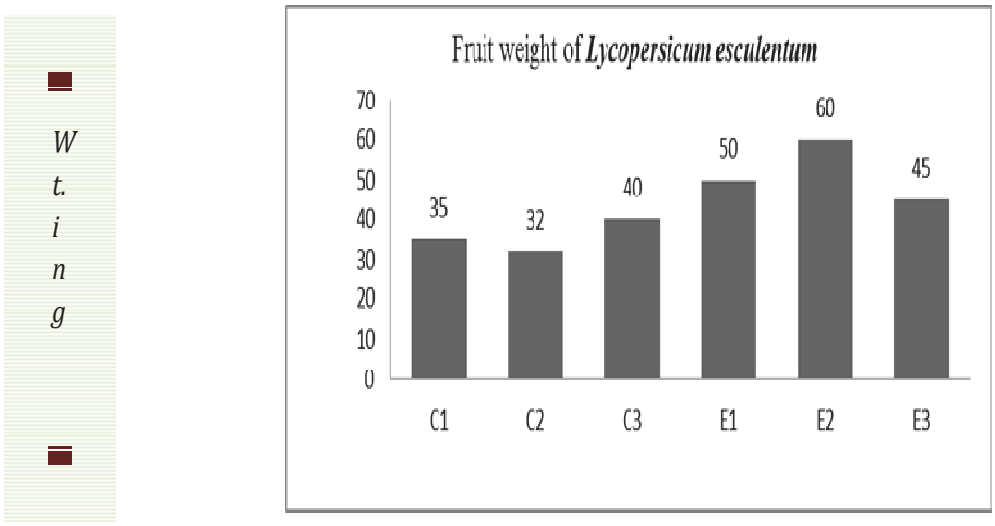


Figure :6 Fruit weight in *Lycopersicum esculentum*



Data (**Figure no.6**) depicts a mean fruit weight of 52gms.in experimental plants and a mean weight of 36gms in the control plants indicating a net increased weight of 16gms in experimental plants. The experimental plants showed enhanced phenotype of fruits. The increased nutritional status has been reported due to the extra matrical hyphae present in the biofertilizer which improved the nutrient uptake mechanism by increasing the effective absorptive surface area of the crop plant resulting in the quality of the produce[11]-[12].

Using Arbuscular Mycorrhizal Fungi as a natural fertilizer, will boost crop production and this fungus will reduce the cost incurred by farmers on fertilizers and pesticides. The response to inoculation varies with crop, soil and the associated fungi. Hence, it is necessary to

identify the right combination of Arbuscular Mycorrhizal Fungi to achieve utmost benefits. Mycorrhizal fungi usually proliferate both in the root and in the soil. In nutrient-poor or moisture-deficient soils nutrients taken up by the extramatrical hyphae can lead to improved plant growth. As a result, mycorrhizal plants are often more competitive and better able to tolerate environmental stresses than non mycorrhizal plants. Plants receive supports from Arbuscular Mycorrhizal Fungi, due to its symbiotic association in the uptake of inorganic nutrients, enhancement of organic constituents result in increased nutrient value of crop plants that improves emaciated health conditions of the end-user which is a boon to the ailing agricultural sector.

Conclusions: If we can exploit the constructive sides of biofertilizer, hectares of infertile land can be used for agriculture which is the economic mainstay of any nation. Proper management of this natural fertilizers and their administration to the crop plants, will increase the productivity thereby preserving the quality, originality and also improve the soil conditions keeping away from chemical fertilizers.

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Shailaja S.Menon/

Unnati Padalia/Department of Microbiology/

K.J.Somaiya College of Science & Commerce/Vidyavihar/ Mumbai-77/

shailajasmenon1961@gmail.com/

unnati.p@rediffmail.com