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Field Response of Quinoa (*Chenopodium quinoa* Willd.) to combined inoculation of VA Mycorrhizal fungus *Glomus fasiculatum* and *Glomus mosseae*

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Abstract

Seedlings of Quinoa inoculated in nursery beds with VA mycorhhizal fungus *Glomus fasciculatum* and *Glomus mosseae* singly and in combination and subsequently transplanted to plots in the field responded favorably to the treatment as compared to uninoculated controls. *G. fasciculataum* and *G. mosseae* treatment increased synergistically the plant dry weight, leaf nitrogen and yield by 11, 32 and 45% respectively over untreated controls. A three way interaction between VAM fungus with Quinoa and naturally occurring nitrogen fixing bacteria within the root system is discussed.

Keywords: Quinoa$_1$, VA mycorrhiza$_2$, *Glomus fasciculatum*$_3$, *Glomus mosseae*$_4$, Nitrogen fixation $_5$.

Introduction

Beneficial effects of Vesicular Arbuscular Mycorrhizal (VAM) fungi on crop growth are well established. It is also found that simultaneous inoculation of *Glomus mosseae* and *Glomus faciculatum* fungi causes synergistic beneficial effects. Quinoa is the common name for *Chenopodium quinoa* Willd [1] of the flowering plant under Chenopodiaceae family and considered as a pseudo cereal. It is commonly called as Goosefoot family; it has 102 genera and 1400 species. In India these members abundantly grew in dry, xerophytic, alkaline soil. The other members of Chenopodiaceae family are City Goosefoot (*Chenopodium urbicum*) is a moderate allergen, Fremont's Goosefoot (*Chenopodium fremontii)* Lamb's-Quarters (*Chenopodium album*).

Quinoa is the only food crop that contains all the essential amino acids, trace elements and vitamins, and it is also gluten-free. VAM fungi are eco-friendly bio-fertilizers which enrich the soils and increase the efficiency of plants in phosphate utilization by formation of dense root clusters [2-3]. Mycorrhizae show a symbiotic association with all terrestrial plants [4] and shows synergistic increase in dry weight and nitrogen and nitrogen in Crops.

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Mycorrhizae, the symbiotic association of fungi and plants are proven microbes that help in the establishment, nourishment and disease resistance of the crop plants. As arbuscular mycorrhizae are promising bio-fertilizers, it is proposed to study the arbuscular mycorrhizal association in Quinoa and to screen establish the indigenous VAM fungi for growing this new crop at Nizamabad, Telangana State. VAM fungi are eco-friendly bio-fertilizers which enrich the soils and increase the efficiency of plants in phosphate utilization by formation of dense root clusters [2-3]. Further, it was evidenced that VAM inoculation proved beneficial to Quinoa plants in improving plant growth, nitrogen and yield, Introduction of mycorrhizal fungi in barren land is a key tool to improve the quality of soil and plant growth [5]. In the present study also, such a response was noticed with *Glomus mosseae* and *Glomus fasiculatum* independently. This response must be due to the favorable interaction between *Glomus mosseae and Glomus fasiculatum* and the naturally occurring VAM in Quinoa plants. According Dr. Arshad Javaid [6], demonstrated the role of VAM in nutrient uptake and seed production and quality in sorghum cultivars.

And in present work, there must have occurred a synergism between two organisms *Glomus mosseae* and *Glomus fasiculatum* and both known to be produce growth producing substances and VAM fungus known to improve Phosphate and water uptake [7-8]. This way Quinoa plants might have got benefitted by all the two organisms. Further studies on the mode synergism between two organisms in 30 days plants found to 40% mycorrhizal infection were transplanted to 3.5 to 4m experimental plots maintain an interplant distance of 70X50cm. As a result, each plot contained 56 plants. All the treatments were replicated 5 times in a randomized block design. A month after transplanting the seedlings was sampled at the rate of 5 per plot and their leaf area meter. Shoot dry weight was determined by drying the samples in an oven at 80^0C for 48 hours. Nitrogen was estimated in the oven dried leaves by the Microkjeldhal method* the seeds were harvested when mature and total yield was calculated per plot. Two such trials were conducted in the field between July to December 2018 and February to May 2019. The maximum and minimum temperature and rainfall range during July to December 2018 were respectively 25 – 34^0C, 13 to 22^0C, 12-24^0C and 0-150mm.

Results of the trails were analyzed statistically using F test. Values of the 2nd trails were presented here as the trend in response was similar among the trails.

Table1: Effect of combined inoculation of VAM fungus *Glomus fasiculatum* and *Glomus mosseae* on the growth of Quinoa (*Chenopodium quinoa* Willd.)

Treatment	Leaf area (sq cm)	Shoot dry weight plant^{-1} (g)	Nitrogen in plant^{-1} (g)	Yield plot^{-1} (g)
control	560.6	7.5	2.8	10740
Glomus mosseae	866.13	10,3	3.6	11538
Glomus fasiculatum	1105.2	10.5	3.8	12250
GM + GF	1177.3	9.0	3.9	13220
S. D	154.9	2.08	0.27	38.6
C.D	488.25	NS	0.88	101.0

GM = *Glomus mosseae*, GF = *Glomus fasiculatum*, C.D.,= Critical Difference, S.D = Standard Deviation.

Results and Discussions

Results revealed that Quinoa plants raised from nurseries inoculated with VAM fungi *G.fasiculatum* and *Glomus mosseae* proved superior to those raised from un inoculated nurseries (Table 1) VAM treatment independently brought about an improvement of 14, 27 and 75% in leaf area, shot dry weight, nitrogen and yield per plot. VAM inoculation brought about an improvement respectively of 97, 13 35 and 14% in the similar parameters studied. Combined inoculations doubled the leaf area and improved nitrogen and yield in Quinoa due to combined inoculatation with VAM fungus. The effect when treated singly and in combination shows synergistic beneficial effects of the two organisms on crop growth.

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References

1. Valencia-Chamorro SA. Quinoa In: Caballero B. Encyclopedia of Food Science and Nutrition, vol. 8. Academic Press, Masterdam. 2003, pp.4895-4902.nces:
2. Cheng L et al. White lupin cluster root acclimation to phosphorus deficiency and root hair development involve unique glycerophosphodiester phosphodiesterases. *Plant Physiol*., 2011, 156(3):1131-48.
3. Lambers H, Finnegan PM, Laliberté E, Pearse SJ, Ryan M H, Shane MW, Veneklaas EJ. Phosphorus nutrition of Proteaceae in severely phosphorus-impoverished soils: are there lessons to be learned for future crops? *Plant Physiol.,* 2011, 156*:* 1058–1066.
4. Parniske M. Arbuscular mycorrhiza: the mother of plant root endosymbioses. *Nature Rev. Microbiol*. 2008, 6, 763-775. Nature Reviews Microbiology 6(10):763-75.
5. Ajay pal and Sonali Pandey. Role of Arbuscular Mycorrhizal fungi on Plant Growth and Reclamation of Barren Soil with Wheat (*Triticum aestivum* L.) crop. International journal of Soil science, 2019, 12: 25 – 31.
6. Arshad Javaid. Role of Mycorrhizae in Plant Nutrition September 2009. In book: Microbes in Sustainable Agriculture (pp.145-166) Chapter: Role of Mycorrhizae in Plant Nutrition Publisher: Nova Science Publishers, Inc. New York Editors: M. S. Khan, A. Zaidi, J. Mussarrat.
7. Gonzalez O and Osorio W. Determination of mycorrhizal dependency of lulo [Determinación de la dependencia micorrizal del lulo]. *Acta Biol. Colomb.*, 2015, 13, 163–174.
8. Casierra-Posada F, Peña-Olmos J, Peñaloza J and Roveda, G. Influence of shading and mycorrhizae on growth of lulo plants (*Solanum quitoense* Lam.). *Rev. UDCA Actual. Divulg. Cien.* 2013, 16, 61–70.