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Root area index of Lucerne affected by Rhizobia and Mycorrhiza under dry organic farming conditions

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ABSTRACT

This experiment has been done to investigate effect of dual inoculation of rhizoba and mycorrhiza on Root Area Index (RAI) changes in lucerne under water deficit condition. Three factors included Rhizobium inoculation*;* Mycorrhiza inoculation and Irrigation, each one at two levels (with and without application) have been studied in a factorial experiment in the form of complete randomized block design. The trial was located on the organically managed fields of the University of Natural Resources and Applied Life Sciences, Vienna (Rassdorf) in April 2007. This index is defined as a new index in root studies for crops. RAI is calculated with the following formula: RAI= Root Surface Area / Soil Surface Area. First, root surface is measured by WinRHIZO instrument. Results of mean comparisons by Duncan's multiple range test showed that root area index was higher when rhizobia and mycorrhiza used individually in compare without their application. Effect of double interaction of Rhizobium x Mycorrhiza on root area index ranged from 13.147(R0M0) to 14.697 (R1M1).Effect of double interaction of Rhizobium x Irrigation on this parameter varied from 11.040 to 14.509 and R0I0 was at the lowest group. In double interaction of Mycorrhiza x Irrigation all of treatments were at the same group. Effect of using irrigation was higher than the effect of using mycorrhiza. In triple interaction of Rhizobium x Mycorrhiza x Irrigation , root area index was higher than other treatments .Root area index had a positive and significant correlation with mycorrizal colonization (MC), water use efficiency (WUE), root dry weight (RDW) and shoot dry weight (SDW).

Key Words: root area index, mycorrhiza, rhizobia, lucerne.

Introduction:

Root system is now considered as a key issue for a successful exploitation of soil resources. It is hence of great interest to develop accurate indices to explore the best rooting configuration to optimize the competition for water and nutrients. Rhizosphere / mycorhizosphere system can therefore be tailored to help plants to survive in nutrient deficient, degraded habitats (Barea et al., 1987; Sanchez-Diaz et al., 1990) or during stress periods (Graham, 1992). Root area index could be a suitable parameter for root studies that has powerful correlation with most of plant's growth parameters.

Materials and Methods:

The trial was located on the organically managed fields of the University of Natural Resources and Applied Life Sciences, Vienna (Rassdorf) in April 2007. The factors were Rhizobium inoculation, Mycorrhiza inoculation and Irrigation, each one at two levels (with and without application). Root Area Index (RAI) is defined as a new index in root studies for crops calculates with the following formula: RAI= Root Surface Area / Soil Surface Area

Soil samples to investigate RAI were taken by using a root auger (10 cm diameter, 30 cm deep with 2 replicates per plot (one in row and one between rows).The roots subsequently separated from soil by a hydro pneumatic elutriation system (Gillison´s Variety Fabrication Inc., USA) through a sieve with a mesh of 760 µm. For evaluation Root Surface Area, we have used

WinRHIZO instrument.This method first presented at the American Society of Horticultural Science meeting held in Montreal (Qc.Canada) in 1995 (Arsenault et. al., 1995).

Results:

Results showed that main effect of irrigation, double interaction of Rhizobim x Irrigation and triple interaction of Rhizobium x Mycorrhiza x Irrigation had significant differences on this parameter at 5% probability level. Also, root area index had a positive and significant correlation with mycorrizal colonization (MC), water use efficiency (WUE), root dry weight (RDW) and shoot dry weight (SDW) (Fig 1- 4).

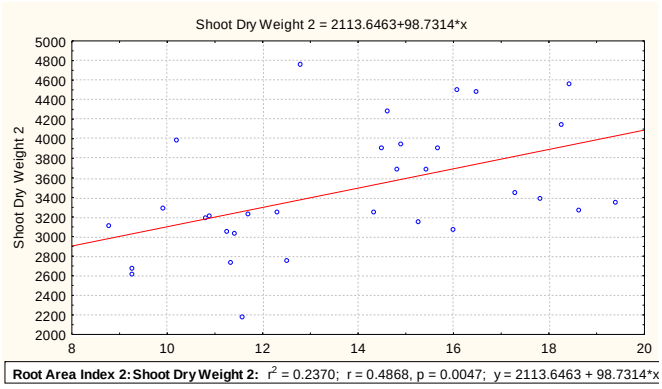

Fig 1: Correlation between SDW and RAI.

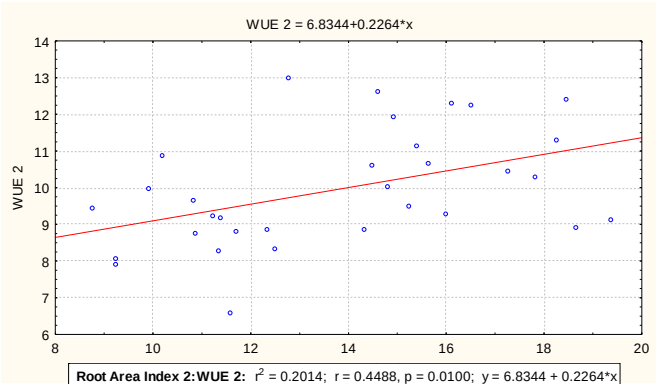

Fig 2: Correlation between WUE and RAI.

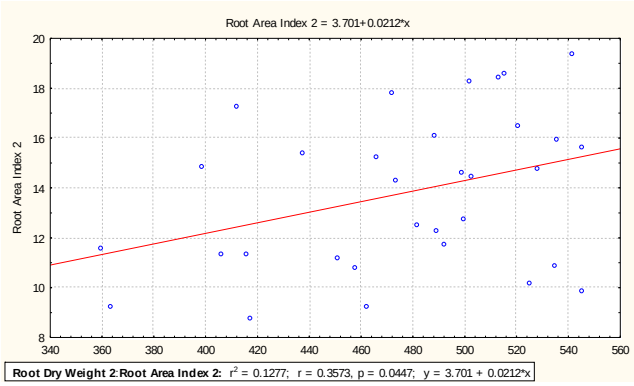

Fig 3: Correlation between RDW and RAI.

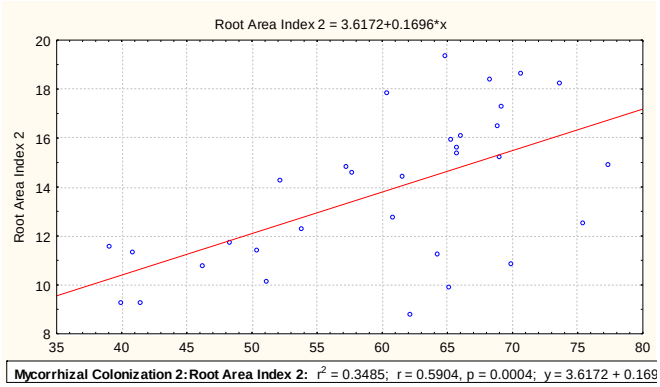

Fig 4: Correlation between MC and RAI.

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