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First results on the effects of inoculum and organic matter fertilization on *Lupinus angustifolius* L. growth.

Antonio C. Barbera[1], Valeria Cavallaro[2], Giovanni Leonardi[1], Alessandra Pellegrino[2], Antonio Leonardi[3], Alfio Spina[3]

[1]Di3A - Dipartimento di Agricoltura, Alimentazione e Ambiente, Università di Catania, IT, antonio.barbera@unict.it

[2]CNR-Istituto per BioEconomia (IBE), Catania IT, valeria.cavallaro@cnr.it

[3]CREA-Centro di Ricerca Cerealicoltura e Colture Industriali, Acireale, IT, alfio.spina@crea.gov.it

Introduction

The Lupinus genus includes approximately 300 annual and perennial species. Recently, "sweet" lupin varieties, with a low concentration in alkaloids (bitter substances) and high protein content, were developed. The seed protein content ranges between 38% and 43%. Like all legumes, this genus is characterized by a high symbiotic nitrogen fixation rate. Introducing Fabaceae in crop systems improves soil physico-chemical characteristics and increases soil fertility. Soil microorganisms contribute greatly to net carbon primary production, approximately ~59 billion tonnes of carbon are emitted by heterotrophic soil microorganisms. Given the current knowledge, the aim of this work was to evaluate the effect of inoculum and organic matter fertilization on *Lupinus angustifolius* morphological characteristics and CO_2 emission from soil.

Materials and Methods

The study was conducted in pots located in an experimental field of Consiglio per la Ricerca in Agricoltura e l'Analisi dell'Economia Agraria (CREA) (37°37' 16''N - 15°09'45.50''E; 200 m a.s.l.) of Acireale (Sicily). The studied treatments were: control, inoculum with nitrogen fixing bacteria (I), fertilization with organic matter (OM), combined effect of inoculum and organic matter (I+OM). Four rows of *L. angustifolius* L. cv Polo were sown (27/11/2020) in 1 m^3 pots in a sandy-loam soil (SISS classification). A randomised block design, three times replicated, was used. The rhizobia used for the trial were two strains of *Bradyrhizobium japonicum* and one of *B. lupini*. For the OM treatment, in pre-sowing, 2,0 kg of organic matter was distributed. For the I treatment 0,05 kg pot^{-1} of biofertilizer was applied at sowing. CO_2 flux was measured with the static non-stationary chamber. Indirect chlorophyll measurements were performed using chlorophyll meter recording (SPAD-502, Minolta, Japan) four readings for each pot. Bio-morphological measurements, SPAD and CO_2 fluxes were carried out at the flowering stage.

Results

Plant height, dry biomass (tab.1) and SPAD data (fig.1) were significantly ($p<0.01$) influenced by the treatments. I+OM treatment determined an height increase of +11% as compared to I and +25% as compared to Control and OM. The treatments I and I+OM (on average 4,49 g) determined a +93% and +53% dry weight increase as compared to OM and control respectively. The lowest SPAD value was observed in the control (54.79). Soil CO_2 flux (fig.2) ($mg*h^{-1}*m^{-2}$) was significantly ($p<0.01$) enhanced by OM treatment. Pots fertilized with organic matter showed a CO_2 flux significantly higher than control (+45%).

Table.1 Morphological results. Different letters indicate significant differences at p < 0.01

Treatment	Dry weight (g)	Height (cm)
I+OM	4,55 (a)	51,70 (a)
I	4,44 (a)	46,96 (b)
Control	2,92 (b)	41,25 (c)
OM	2,35 (b)	41,45 (c)

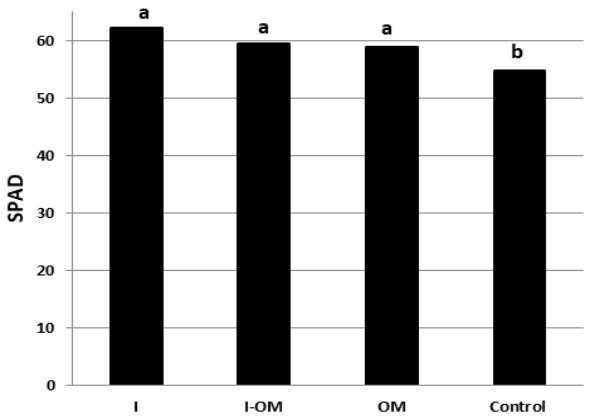

Fig 1 Studied treatments effects on SPAD. Different letters indicate significant differences at p < 0.01.

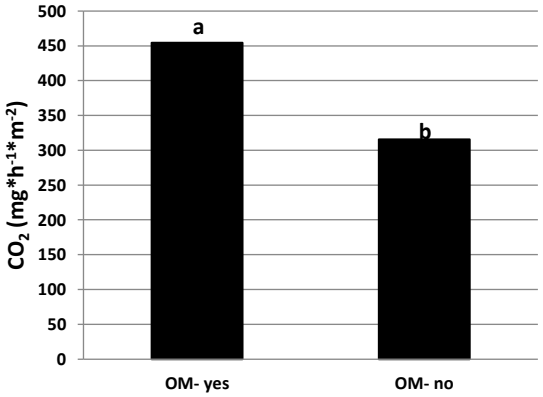

Fig 2 Studied treatments effects on CO_2 soil flux. Different letters indicate significant differences at p < 0.01.

Conclusions

Inoculum with selected rhizobium strains, alone or coupled with OM, was effective in determining significant improvement in plant growth. All the tested treatments determined an enhancement of SPAD values, that is the indirect photosynthetic efficiency compared to untreated plants. As expected OM fertilization promote higher soil CO_2 emission.

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