Iranian Journal of Field Crops Research
Vol. 15, No. 1, Spring. 2017, p. 74-86

نشریه پژوهشهای زراعی ایران
جلد ۱۵، شماره ۱، بهار ۱۳۹۶، ص. ۸۶-۷۴

Symbiotic Effect of *Trichoderma atroviride* on Growth Characteristics and Yield of two Cultivars of Rapeseed (*Brassica napus* L.) in a Contaminated Soil Treated with Copper Nitrate

E. TashakoriFard[1]- F. Taghavi Ghasemkheyli[2]- H. Pirdashti[3*]- M. A. Tajick Ghanbary[4]- M. A. Bahmanyar[5]

Received: 24-09-2014
Accepted: 06-04-2016

Introduction

Accumulation of heavy metals in agricultural soils can be a threat to crop production due to plant toxicity. In the recent years, hyperaccumulator plants are cultivated to cleaning up the soils which contaminated with pollutants especially heavy metals. However, the biomass of these plants is low and metal specific. Many studies have shown that microorganisms can be used to significantly reduce the toxicity of heavy metals. Therefore, the present study aimed to determine the role of *Trichoderma atroviride* on the growth characteristics of tow cultivars of rapeseed in different levels on copper.

Materials and Methods

In this study, a pot experiment was conducted in factorial arrangement based completely randomized design with three replicates. Treatment were *T. atroviride* fungi at two levels of inoculated and non-inoculated plants, four levels of copper nitrate including 0, 50, 100 and 150 mg l^{-1} and two cultivars of rapeseed consist of Hayola 401 and Sarigol. *Trichoderma atroviride* was prepared from Mycology Lab of Sari Agricultural Science and Natural Resource University. PDA medium (potato extract, dextrose and agar) was kept for a week at 25˚C to propagation of fungal strain. The used medium was previously sterilized in autoclave for 30 minutes. So, this fungus propagated in Wheat's bran for five days. Healthy and uniform seeds of rapeseeds were separated from rogues and infertile ones. Seeds disinfected in hypochlorite sodium 0.5% for five minute and then washed with distilled water three times. After preparing fungus spore suspension of 10^8 CFU per ml water, 50 g wheat' bran mixed to the soil of each pot. Twenty sterilized seeds sown in 2 cm of soil depth in 25×30 cm pot with 10 kg capacity. Copper nitrate was used to pollute treated soil. During this experiment did not used any pesticides and herbicides and all weed controlled manually. Some growth and yield related parameters such as plant height, number of secondary branches, pod number and length of primary and secondary branches, were determined. All statistical analysis were performed using SAS software (version 9.1) and mean comparisons were made by the least significant difference (LSD) test (P<0.05).

Results and Discussion

Results showed that increasing copper content in growth medium markedly decreased pod number in main branches in Hayola 401 while in Sarigol the maximum pod number was recorded at the 50 mg l^{-1} of copper nitrate. The presence of the *Trichoderma*, however, increased pod number in branches. Sarigol resulted more pod numbers in branches than Hayola 401 (2.5 times vs. 64%). Also, the maximum pod numbers in branches (about 1.3 fold as compared to the uninoculated control) were observed in *Trichoderma* inoculated plants which received 100 mg/L of copper nitrate. The maximum plant height in Hayola 401 and Sarigol (0 and 100 mg l^{-1} of copper nitrate, respectively) recorded when those plants inoculated with *Trichoderma*. The presence of the *Trichoderma* in the growth medium significantly improved the pod length of in main branches in Hayola 401

1- Ph.D. Student of Agronomy, University of Guilan
2- Ph.D. Student of Agronomy, Sari Agricultural Sciences and Natural Resources University, Member of Young Researchers Club in Islamic Azad University, Sari Branch
3- Associate Professor, Department of Agronomy, Genetics and Agricultural Biotechnology Institute of Tabarestan, Sari Agricultural Sciences and Natural Resources University
4- Associate Professor, Sari Agricultural Sciences and Natural Resources University
5- Professor, Sari Agricultural Sciences and Natural Resources University
(*- Corresponding Author Email: h.pirdashti@sanru.ac.ir)

rather than Sarigol.

Conclusions

Many researches showed that rapeseed is a hyperaccumulatore plant for heavy metals such as copper, cadmium, nickel, zinc and lead. On the other hand, many researchers confirmed that soil beneficial microorganisms such as *Trichoderma* spp. could improve the growth and yield attributes of plant especially in polluted soil. In conclusion, inoculation of rapeseed plants with *Trichoderma* could enhance the growth characteristics of rapeseed particularly under high levels of copper in the soil. Sarigol, however, respond better than Hayola 401 in terms of yield and yield components. Since, important aspect of bioremediation is inhibition of pollutants passes through a food chain, thus, coexistence of beneficial microorganisms that capable to transform contaminants into nontoxic products are very important.

Keywords: Contamination, Grain yield, Heavy metals, *Trichoderma*