7thNational Congress on Medicinal Plants
12-14th May 2018
Shiraz, Iran

952 & 953 & 954

Effect of Plant Density, Planting Date and Method on Yield and Yield Components and Some Phytochemical Characteristics of *Echium amoenum*

Mohammad Behzad Amiri,[1*] Parviz Rezvani Moghaddam,[2] Mohsen Jahan[2]

[1]*Agriculture Department, Gonabad University, Gonabad, Iran.*
[2]*Agriculture Department, Ferdowsi University, Mashhad, Iran.*

In order to evaluate of plant density, planting date and method and comparison of organic and chemical fertilizers and biofertilizers on yield and yield components and some phytochemical characteristics of Iranian Ox-Tongue (*Echium amoenum*), 3 experiments was conducted in 2011-2014 growing seasons, in Ferdowsi University of Mashhad, Iran. In first experiment, the main and sub plots included 3 plant densities (10, 5 and 3 plants per m^2) and 3 types of organic fertilizers and one type of chemical fertilizer (compost, vermicompost, cow manure, nitrogen chemical fertilizer and control), respectively. In second experiment, Two different planting dates (10 March 2011 and 4 Aprill 2011), three different types of biofertilizers and chemical fertilizers (mycorrhiza (*Glomus mosseae*), Biosulfur, chemical fertilizer and control), two different types of planting methods (direct seeding and transplanting) and two agronomic year assigned to main plots, sub plots, sub-sub plots, sub-sub-sub plots, respectively. In third experiment, Treatments included seven different types of soil amendments and biofertilizers concluded: 1- humic acid, 2- fulvic acid, 3- Nitroxin (containing *Azotobacter* spp. and *Azospirillum* spp.), 4- Biophosphorous (containing *Bacillus* sp. and *Pseudomonas* sp.), 5- Biosulfur (containing *Thiobacillus* spp.), 6- Mycorrhiza (*Glomus mosseae*), 7- Mycorrhiza (*Glomus intraradices*), and 8- no fertilizer as control. In first experiment, The results showed that the highest antioxidant activity obtained in 10 plants per m^2 (79 mg/ml) and the highest total phenolic observed in 5 plants per m^2 (51 mg GAE/g flower DW). Compost, vermicompost, cow manure and chemical fertilizer increased total phenolic 51, 35, 40 and 63% compared to control, respectively. Application of vermicompost and cow manure in density of 3 plants per m^2 increased total flavonoid 39 and 38% compared to control, respectively. The highest total anthocyanin obtained in density of 5 plants per m^2. Vermicompost and cow manure increased seed oil 10 and 13%, respectively, and seed protein 34 and 13%, respectively compared to control. In second experiment, The results showed that the highest dry flower yield obtained in March planting date and seeding method and in conditions of mycorrhiza application. Application of biofertilizers and chemical fertilizers in both of planting dates and both of planting methods increased seed yield, so that application of mycorrhiza, biosulfur and chemical fertilizer in transplanting planting method and Aprill planting date increased seed yield 45, 42 and 35% compared to control, respectively. In third experiment, The results showed that humic acid, fulvic acid, biosulfur and *Glomus mosseae* increased flower yield 36, 27, 26 and 30% respectively and improved seed yield 32, 22, 21 and 16% compared to control, respectively. The highest total phenol obtained in biosulfur treatment. Total anthocyanin in humic and fulvic acids was 38 and 33% more than control, respectively. Biophosphorous and biosulfur biofertilizers increased the antioxidant activity 8 and 7% compared to control, respectively. *Glomus mosseae* and *Glomus intraradices* increased seed oil 20 and 15% and seed protein 30 and 18% compared to control, respectively. In general, based on the results of this research, it seems by using eco-friendly inputs and determine of optimum plant density and direct seeding of Iranian Ox-Tongue in March can be improve quality and health of product and decrease the damages of chemical inputs.

Keywords: Antioxidant Activity, Biosulfur, Humic Acid, Mycorrhiza