Journal of
Medicinal Plants and Herbs

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Research Article Open Access

Studying the Effect of Biological Fertilizers on Yield and Percent of Essential Oil in Hyssop (Hyssopus Officinalis L.) in Iran

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Received Date: September 05, 2024 **Accepted Date:** October 05, 2024 **Published Date:** October 08, 2024

Citation: Melika Baghdadi, Gholamreza Naderi (2024) Studying the Effect of Biological Fertilizers on Yield and Percent of Essential Oil in Hyssop (Hyssopus Officinalis L.) in Iran. J Med Plant Herbs 3: 1-6

Abstract

Medicinal plant (Hyssopus officinalis) is a perennial plant which belongs to Lamiaceae family. In this study the effects of biological fertilizers on yield and percent of essential oil in Hyssopus officinalis in Iran was investigated. Application of biofertilizers had considerable effect in most of the studied traits compare to control. Using the biological fertilizer (Nitroxen) by increasing dry yield of flowering branches (303 kg/ha), percent of essential oil (2.87%), yield of essential oil (8.8 kg/ha) than control and the other 2 levels of biological fertilizer had considerable increase.

Keywords: *Hyssopus Officinalis;* Essential Oil; Nitroxen; Phosphorus Biofertilizers

Introduction

Medicinal plants are called to a wide range of plants which have specific active ingredients and are used in curing diseases or preventing them. In deeper concept, we can say the term medicinal plants are not only called to the plants which are reduced pains but in subset of food (as flavor makers, drinks, sweeteners, natural colors and preservers) and also as raw materials in producing cosmetic and hygienic products have extensive application [1]. The medicinal plant Hyssop (with scientific name *Hyssopus officinalis*) is a plant of Lamiaceae family. This plant has thin and elongated green leaves. Flowers of Hyssop grow along shoots and are in 4 colors white, pink, blue and mixed. Form flowering branches of this plant oily essential oil is produced that its amount is between 0.3 to 1 percent [2]. In this research the effects of biological fertilizers on yield of flower and percent of essential oil in *Hyssopus officinalis* was studied. Common chemical fertilizers are nitrogen, phosphorus and potassium. Using these fertilizers will result in negative environmental effects in long term thus nowadays it is tried to use a proper alternative for them. Biological fertilizers have had many applications in organic agriculture during past 20 years [3]. Phosphorus is one of the key elements in plant that has important duties in it. This element has role in transferring energy in metabolic processes of plant, cell division, construction of cell wall, development of generative parts of plant and growth and development of roots [4]. Nitrogen is another required element for plant. It is of plant nutrients in soil and causes increase in fecundity and fertility of soil. Nitrogen in soil is absorbed by plant in forms of NO3 and NH4. Usually the major part of soil nitrogen is in form of NO3 and some plants prefer NO3 to NH4. Nitrogen makes the plant able to faster fixation and to produce more photosynthesis level [5]. Increase in nitrogen fertilizer results in increase in yield of flower and percent and amount of active ingredient. Biological fertilizers are organic fertilizers that can replace or supplement the chemical fertilizers so that wide research in different regions of the world has proved this issue. Using bacteria as biofertilizers or bio control the pests and diseases, has increased the yield of agricultural crops. Characteristics of phosphate dissolving bacteria has adapted well with various types of soils and aquatic environments [7]; and many breeds of phosphate dissolving bacteria have successfully caused increase in plants yield [8]. In a study which was carried out in soils of 4 areas of Quebec in Canada it was specified that phosphorus releaser bacteria have formed 26 to 46 percent of the soil total micro flora. Boifertilizer Nitroxin contains a set of the most effective nitrogen fixation bacteria of the genus *Azotobacter* and *Azospirillum* and phosphate dissolving of the genus *Pseudomonas*. Nitroxen can supply a major part of the nitrogen requirements of the plant. Also the bacteria inside it can solve the soluble phosphates in soil and by producing the plant growth stimulating natural hormones because root extension and result in more and better absorption of water and nutrients by plant [9].

Material and Methods

In this study the effects of phosphorus biofertilizers (Barvar2) and nitrogen biofertilizers (Nitroxen) on yield and percent of essential oil in medicinal plant Hyssopus officinalis was investigated. This research was carried out in Iran in Arak city in a land with the area of 1500 m2 during 2010 to 2011. This experiment was done in 3 replications. In this study the plots were considered in dimensions of 3 m width and 8 m length. The area of each plot was 24 m^2. The fertilizer treatments were including Psb (phosphorus biofertilizers), Nitroxin (nitrogen biofertilizers) and Psb+Nitroxin.

-control = without using any type of fertilizer

-Psb (phosphorus biofertilizers) = 100 gr/ ha in form of solution spray

-Nitroxin (nitrogen biofertilizers) = 1litre/ha in form of solution in irrigation water

-Psb+Nitroxin = nitrogen biofertilizers + phosphorus biofertilizers

Results and Discussion

Studying the 3 year mean average of different traits affected by biofertilizers showed that application of biofertilizers had considerable effect on traits such as plant height, length of flowering branches, number of lateral branches, number of leaves in main stem, number of flow-

ers on plant, 1000 seeds weight, fresh weight of flowering branches, dry weight of flowering branches, dry weight of leaves, dry weight of shoots, canopy cover, root length, root dry weight, root length to plant height ratio, root dry weight to shoot ratio, dry yield of shoots, percent of essential oil, yield of essential oil, biological dry yield and leaf area index (LAI). Using phosphorus biofertilizers (Psb) had considerable effect on mean height of plant (41.6 cm), length of flowering branches (10.3 cm), number of lateral branches (11.3), number of flowers on plant (130), 1000 seeds weight (0.64 gr), fresh weight of flowering branches (9.4 gr), dry weight of leaves (16.3 gr), dry weight of shoots (33.6 gr), canopy cover (423 cm2), root length (10.7 cm), root dry weight (6.2 gr), root dry weight to shoot ratio (0.193), percent of essential oil (1.55%), yield of essential oil (4.1 kg/ha) and biological dry yield (2098 kg/ha) than control. Using nitrogen biofertilizers (Nitroxen) had considerable increase on mean height of plant (42.1 cm), length of flowering branches (12.7 cm), number of lateral branches (13.6 cm), number of flowers on plant (196), 1000 seeds weight (0.71 gr), fresh weight of flowering branches (10.3 cm), dry weight of flowering branches (4.04 gr), leaves dry weight (17.0 gr), shoot dry weight (40.5 gr), canopy cover (440 cm2), root length (11.6 cm), root dry weight (6.5 gr), root length to plant height ratio (0.274) , root dry weight to shoot ratio (0.18), dry yield of flowering branches (253 kg/ha), percent of essential oil (1.58%), yield of essential oil (4.1 kg/ha) and biological dry yield (2530 kg/ha) than control. Also this treatment obtained the most plant height, number of flowers on plant, length of flowering branches, 1000 seeds weight, leaves dry weight, dry weight of shoot, canopy cover, dry yield of flowering branches, percent of essential oil, yield of essential oil and biological dry yield than three other treatments.

Table 1: Effect of biofertilizers on mean of characteristics in Hyssop

Treatments	Plant Height (cm)(cm)	Length of flowering branch (cm)	Number of lateral branches	Number of leaves on stem	Number of flowers
Control	38.81	9.38	11.22	156.89	98.89
Psb	41.63	10.33	11.88	149	130
Nitroxin	42.07	12.66	13.55	124.44	196.2
Psb+Nitroxin	40.46	10.14	12	124.44	137.3
Treatments	1000 seeds weight (g)	Fresh weight of flower branch (g)	Dry Weight of flower branch(g)	Dry weight leaves(g)	Shoot dry weight (g)
Control	0.48	9.32	3.57	15.73	33.4
Psb	0.64	9.35	3.39	16.29	33.57
Nitroxin	0.71	10.3	4.04	17.02	40.47
Psb+Nitroxin	0.64	8.71	3.6	16.83	33.77
Treatments	Canopy cover (cm2)	Root Length (cm)	Root dry weight (g)	Root length to shoot Ratio	Root to shoot weight Ratio
Control	423.02	9.889	4.86	0.259	0.154
Psb	440.46	10.66	6.17	0.256	0.193
Nitroxin	476.4	11.55	6.46	0.274	0.18
Psb+Nitroxin	423.02	12.44	6.81	0.303	0.217

Treatments	Yield flower branches (kg ha-1)	Percent of essence (%)	Yield of essence (kg ha-1)	Yield of shoot (kg ha-1)	Leaf Area Index
Control	223.33	1.5	3.325	2087.6	6.33
Psb	212.08	1.55	3.317	2098.4	5.56
Nitroxin	252.92	1.58	4.097	2529.8	5.49
Psb+Nitroxin	225	1.75	4.013	2111.2	5.18

Application of nitrogen biofertilizers plus phosphorus biofertilizers (Psb + Nitroxen) had considerable increase on mean height of plant (40.5 cm), length of flowering branches (10.1 cm), number of lateral branches (12.0), number of leaves on main stem (124 leaves), number of flowers on plant (137), 1000 seeds weight (0.64 gr), fresh weight of flowering branches (8.7 gr), dry weight of flowering branches (3.6 gr), leaves dry weight (16.8 gr), dry weight of shoot (33.8 gr), canopy cover (476 cm2), root length (12.4 cm), root dry weight (6.8 gr), root length to plant height ratio (0.217), dry yield of flowering branches (225 kg/ha), percent of essential oil (1.75%), yield of essential oil (4.01 kg/ha) and biological dry yield (2111 kg/ha) than control.

Also this treatment obtained the most root length, root dry weight, root length to plant height ratio, root dry weight to shoot ratio, percent of essential oil yield of essential oil than three other treatments. Therefore using biofertilizers especially nitrogen biofertilizers and or combination of two fertilizers in order to increase dry yield of flowering branches, percent of essential oil and yield of essential oil of Hyssopus officinalis in the region is recommended.

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