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INVESTIGATION THE EFFECTS OF BIOFERTILIZERS ON VEGETATIVE GROWTH PARAMETERS OF MEDICINAL PLANT OF TARRAGON(*ARTEMISIA DRACUNCULUS)*

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Abstract

In order to investigate the effects of Plant growth promoting Rhizobacteria (PGPR) inoculation on the morfological traits of Tarragon(Artemisia dracunculus) an factorial pot experiment based on completely randomized design with four replication were conducted in Research field of Horticulture Department of Mohaghegh Ardabili University at 2010 - 2011. Experimental treatments include inoculation with three species of rhizobacteria namely Azotobacter, Azosperillium, Pseudomonas suspension in single and combination application and control (without inoculation with bactery), which applied as rhizome inoculation and foliar spraying. Result revealed that inoculation of tarragon plants with plant growth promoting Rhizobacteria had significant effect on growth parameters. The highest value for traits such as the number of stem branches and rhizome and leaf number were obtained by foliar application of Azosperillium – Pseudomonas combination and combined form of three mentioned Rhizobacteria. Rhizome inoculation of Azotobacter - Azosperillium combination caused increases in plant height and rhizome dry weight in comparison to control. In general results of this investigation indicated that inoculation with plant growth promoting Rhizobacteria leds to increases in growth indices of tarragon plants by enhancing root growth and development by supplying favorable condition for plant growth with respect to supplying better condition for water and nutritional elements absorption from soils.
Keywords: Biofertilizer, Plant growth promoting Rhizobacteria, Tarragon, medicinal plant

Introduction

Tarragon (Artemisia dracunculus L) is one of the medicinal plants belong to Asteraceae family. The origin of this species. is geographically associated with the steppes of Eastern Siberia and Mongolia( ). Tarragon is a perennial plant with a woody rhizome 0.5 – 1.5 cm thick, with a light covering of root hairs, some-times having well-developed underground shoots; the whole plant is bald, smooth, and green, and young plants have only occasional branching. The stalks are straight, single or few in number, 150 cm high, ribbed, more or less branched, the lower branches not bearing flowers. The leaves are unitary, linear or almost linear lanceolate, of size 1.5 – 8.0 cm in length and 1 – 10 (14) mm in width; the lowest sometimes have trifoliate tips. Flower heads are numerous, spherical, sessile, 2 – 4 mm in width, gathered into clusters at the apexes of the stalk and branches, forming paniculate inflo-rescences; the bract leaves are smooth, the external ones being elongated almost to the lanceolate, the inner ones being round to oval, wide at the edge and covering the spadix. The marginal florets are pistillate and there are usually seven of them, with tubular corollas widened towards the base; the laminae of the stigma are narrow, linear, and slightly pointed, and extend from the tube divergently. The florets of the disk are staminate and are usually 11 – 14 in number, with conical, quinquedentate corollas, linear anthers, blunt-angled but slightly pointed terminal appendages, the basal ones being shorter and blunt; the stigma of the rudimentary pistil is unitary and is funnel-shaped at the apex. The seeds are small, 0.6 mm long, flattish, egg-shaped, finely grooved, and brown. Seed weight is 0.3 – 0.5 g1000 seeds(Aglarova, 2008).

Plant Growth Promoting Rhizobacteria (PGPR) are a group of bacteria that actively colonize plant roots and increase plant growth and yield [1]. The mechanisms by which PGPRs promote plant growth are not fully understood but are thought to include: - the ability to produce phytohormons - asymbiotic N2 fixation against phytopathogenic microorganisms by production of siderophores, the synthesis of antibiotics, enzymes and/or fungicidal compounds and also - solubilisation of mineral phosphates and other nutrients(Bashan, 2004; Banchio, 2008; Mahfouz, and Sharaf- Eldin. 2007). The most important plant growth promoting Rhizobacteria which are used in agriculture are Nitrogen – fixing bacteria such as Azotobacter and Azosperillium and phosphate – solublizing bacteria belong to Pseudomonas.

The effect of plant growth promoting Rhizo bacteria in facilitation of rooting in mint (Mentha Piperata) cutting has been reported (Kamayk, et al 2008), and these increases in root formation is attributed to synthesis of plant growth regulations by PGRS. Fertilizing of fennel plants with different strains of Azotobacter chrochum and Azoserrilium lipoferem and Bacillus and Half deses of NPK eacrease production of plant shoots incomparison to single application of nitrogen. They founded that these increment of shoot production is related to nitrogen fixaction by Azotobacter and Azosperrilium (Mahfouz and sahar f ldin, 2007). Beaset Mia et al (2010) found that inoculation of in micropropagated seedling of banana with Azosperrilium leds to increases in Dry weisht, length of root and also the number of hairy root, Van loon (2007) reported that increase in lateral root formation in Turfgrass can be related to increases in the level of Auxin by inoculation by pseudoflourescence which may be related to elevation in Auxin synthesis by this Bactery.

Medicinal plants have an important value in the socio-cultural, spiritual and medicinal use in rural and tribal lives of the developing countries. The main objective of this research was to determine if PGPR strains on growth parameters and grain yield of Tarragon as important medicinal plants.

Material and methods

In order to investigate the effects of PGPRS on Tarragon Factorial pot experiment based on completely randomized design in four replication was conducted in 2010 – 2011 in Rresearch form of Mohaghegh Ardabili university. Experimental treatments include three plant growth promoting bacteria namely Azotobacter chrococcum strain 5- Azosperrillium lipoferum strain of – Pseudomonas putida, varion Cumlination of these PGPRS and Control cwithout inoculations.

For instance 95- 100 g of Rhizome were planted in beds containing 15 % v/v of vermicompost. PGPR fertilization corried out as rhizome inoculation and foliar spraying for Rhizoum inoculation 40 cc of Dilluted suspension from mentioned PGPRS were spread on rhizomes. foliar spraying were done with two month intervals two menth after lattur foliar sraying, plants were harvested and traits such as plant (stand) diameter number of aerial shoots plant fresh and dry weight leaf area, leaf number, Rhizome fresh and dry weights were recorded.

The collected data were analyzed statistically using the Statistical Analysis System (SAS, version 9.0, 2004).

Following the analysis of variance procedure (ANOVA), differences among treatment means were determined using Duncan’s New Multiple Range Test (DMRT) comparison method (whenever applicable) at 5% level of significance

Result

According to means of treatments in tables 1 and 2 inoculation with different plant growth promoting rhizobacteria, have significant effects on tarragon plants growth parameters as fallow as :

Plant diameter: As shown in Table 2 inoculation of Tarragon Rhizome with suspension derived from combination of each three PGPR, Azotobacter, Azosperillium and Pseudomonace produced plants with the highest Diameters (39.25 cm2) wich followed by Rhizeme inoculation with combination Azotobacter – pseudomonace and Azetobacter – Azosperillium with means of 33.75 and 31.75 cm respectively. The lowest value for plant diameter(29.25) cm was obtained in Feliar spraying of Azotobacter.

Stem number: The highest number of stems (76.75 and 68) were obtained by foliar sraying of combined suspension composed from Azesperillium- pseudomonace and Azotobactere-pseudomonace respectively which have significant Differce with control and other treatments(Table 2).

Rhizome fresh weight : Foliar spraying of azosperillium produceed the highest fresh weight of rhizome (477.25g) which has a significant diferrence with other treatments also Foliar spraying with combination of three plant growth promoting bacteria in this experiment caused poor rhizome growth(205g) (Table 2).

Rizome dry weight: inoculation of tarragon rhizomes with combination of azotobacter and azosperrilium leds to produce 247.5g of dry weight of rhizomes, which highrt than other treatments and combination of three plant growth promoting bacteria caused the lowest rhizome growth (70g) (Table 2).

Rhizome branch number: As shown in table 2 the highest value(31.75) for this trait were obtained by appliction of foliar spraying of azosperrillium- pseudomonas combined suspension which wasn’t significant difference with azotobacter and azosperrillium combination (30.5).

Leaf number: The results of comparision of means in table 1 revealed that combined of azosperrillium and pseudomonas pgprs produced the most leaf number in comparsion to other treatments.

Plant fresh weight: according to means in table 1 the highest fresh weight of plants were obtained by spraying method of plant growth promoting rhizobacteria and also application of azosperllium (39.15 g). leaf and total dry weight: inoculation with plant growth promoting rhizobacteria showe similar trend for both of these traits. The highest value for total dry weight (12.731g) and leaf dryweight(9.73g) were accived by application of azosperrillium genus of pgprs.

Results and discussion

Results of this experiment revealed that application of these three plant growth promoting rhizobacteria have significant effects on all of traits were studied. And foliar spraying were more efficient in enhancing growth parameters of tarragon plants. Increases in growth of rhizome and plant by these bacteria can be attributed to increases in lateral roots and enhancing in absorpation surface and increment of uptake of nutrients in roots. The findings of Abdul-Jaleel et al (2007) van loon (2007) confirms the results of this investigation Azospirillum represents the best characterized genus of plant growth-promoting rhizobacteria. Four aspects of the Azospirillum^plant root interaction are highlighted: natural habitat, plant root interaction, nitrogen fixation and biosynthesis of plant growth hormones. Each of these aspects is dealt with in a comparative way. Azospirilla are predominantly surface-colonizing bacteria, whereas A. diazotrophicus, H. seropedicae and Azoarcus sp. are endophytic diazotrophs. The attachment of Azospirillum cells to plant roots occurs in two steps. The polar flagellum, of which the flagellin was shown to be a glycoprotein, mediates the adsorption step (Steenhoudt,. and Vanderleyden, 2000)

Table 1. Mean comparision of Inoculation method and pgpr effects on tarragon plants growth

Variables		Leaf number	Total fresh weight	Total dry weight	Leaf dry weight
Control		913.5^{b}	37.406^{a}	7.775^{b}	6.208^{b}
Inoculation method	Rhizome inoculation	1124.69^{a}	39.038^{a}	10.048^{a}	7.852^{a}
	Foliar spraying	1080.63^{a}	35.261^{b}	9.033^{a}	7.177^{a}
Plant growth promoting rhizobacteria	Az	1030^{b}	23.388^{a}	8.195^{b}	6.6350^{b}
	As	1079.1^{b}	36.640^{a}	12.731^{a}	9.738^{a}
	Ps	1085^{b}	30.088^{a}	9.033^{b}	7.376^{b}
	Az- As	1013.5^{b}	28.648^{a}	9.758^{ab}	7.221^{b}
	Az- Ps	1169.1^{b}	29.171^{a}	9.239^{b}	7.340^{b}
	As- Ps	1454.4^{a}	32.107^{a}	10.330^{ab}	8.220^{ab}
	Az-As-Ps	1076.6^{b}	30.604^{a}	9.263^{b}	7.376^{b}

Similar letters in each column indicating non-significant difference at 0.05
Az=Azotobacter As= Azosperillium, Ps= Pseudomonas

Table 2. Interaction effects of Inoculation method and Plant growth promoting Rhizobacterias on tarragon plants growth

Variables		Plant (stand) diameter	Stem number	Rhizome fresh weight	Rhizome dry weight	Rhizome branches number
Control		30^{cd}	36^{d}	208.750^{f}	70^{d}	8.250^{f}
Rhizome inoculation	AZ	35.750^{ab}	51b^{cd}	240^{h}	93.75^{igh}	17.250^{de}
	AS	38.500^{a}	39.500^{cd}	333.75^{d}	140^{c}	20^{c}
	PS	37.500^{a}	42.750^{cd}	381.25^{c}	141.250^{c}	24.500^{b}
	AZ-AS	31.750^{cd}	45^{cd}	416.25^{b}	247.50^{a}	24.750^{b}
	AZ-PS	33.750^{bc}	43^{cd}	277.50^{e}	128.750^{cd}	25.250^{b}
	AS-PS	38^{a}	49.750^{cd}	252.50^{fgh}	112.50^{defg}	25.500^{b}
	AZ-AS-PS	39.250^{a}	40.250^{cd}	268.75^{efg}	116.250^{def}	27^{b}
Foliar spraying	AZ	29.250^{d}	43.250^{cd}	272.50^{efg}	102.50^{fg}	18.250^{cde}
	AS	32^{bcd}	44.500^{cd}	477.25^{a}	195^{b}	20.750^{c}
	PS	32.750^{bcd}	45.500^{cd}	238.75^{h}	99^{fgh}	24.750^{b}
	AZ-AS	30^{cd}	46^{cd}	248.75^{gh}	107.500^{efg}	19.750^{cd}
	AZ-PS	31.750^{cd}	68^{ab}	353.75^{d}	205^{b}	16^{e}
	AS-PS	30.500^{cd}	76.750^{a}	273.75^{ef}	126.250^{ced}	31.750^{a}
	AZ-AS-PS	30.500^{cd}	55.500^{bc}	205^{ij}	78.750^{i}	30.500^{a}

Similar letters in each column indicating non-significant difference at 0.05.
Az=Azotobacter As= Azosperillium, Ps= Pseudomonas

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