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Morphological Traits of Dragon's Head (*Lallemantia iberica* Fish. etMey.) Affected by Intercropping with Dill

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ABSTRACT: In order to investigate the effect of intercropping with dill on morphological traits of Dragon's head (*Lallemantia iberica* Fish. etMey.), an experiment was arranged in RCB design with three replications. Intercropping patterns included; pure stand of Dragon's head, pure stand of dill variety Dukat, additive intercropping of optimal density of Dragon's head + 25%, 50% and 75% of optimum density of dill variety Dukat, pure stand of dill variety Super dukat, additive intercropping of optimal density of Dragon's head + 25%, 50% and 75% of optimum density of dill variety Super dukat. Plant height, number of lateral stems, leaf number and plant weight were recorded. Results showed that intercropping had significant effects on all of these characteristics. Superior effects of intercropping on these traits were achieved in additive intercropping of optimal density of Dragon's head + 25% treatments. In addition, regarding to the intercropping effects, highest amount of plant height, number of lateral stems, leaf number and plant weight were recorded at pure stand of Dragon's head treatments, According to the results obtained, pure stand of Dragon's head the best combination for Dragon's head morphological traits.

Keywords: Dragon's head, intercropping, morphological traits

INTRODUCTION

In recent years, a trend in agricultural production systems has changed towards achieving high productivity and promotes sustainability over time. Farmers are developing different crop production systems to increase productivity and sustainability since ancient times. This includes crop rotation, relay cropping and intercropping of major crops with other crops. Intercropping, the agricultural practice of cultivating two or more crops in the same space at the same time is an old and commonly used cropping practice which aims to match efficiently crop demands to the available growth resources and labor. The most common advantage of intercropping is the production of greater yield on given piece of land by making more efficient use of the available growth resources using a mixture of crops of different rooting ability, canopy structure, height, and nutrient requirements based on the complementary utilization of growth resources by the Dragon's head (*Lallemantia iberica* Fish. et Mey.) is an annual herb that belongs to Lamiaceae family and spreads in southwestern Asia and Europe (Ursu and Borcean, 2012). It grows well in arid zones and requires a light well-drained soil (Ion *et al.,* 2011). Dragon's head is a valuable species, i.e. all plant parts (leaves or seeds) can be economically used (Hedrick, 1972). However, it is mainly cultivated for its seeds that contain about 30% oil with iodic index between 163 and 203. These seeds are used traditionally as stimulant, diuretic and expectorant as well as in food (Naghibi, 1999). Due to the lack of relevant information, the present research was conducted to determine the effects of intercropping patterns of dill and Dragon's head on morphological traits of Dragon's head.

MATERIAL AND METHODS

The field experiment was conducted in 2015 at the Research Farm of the University of Tabriz, Iran (latitude 38°05_N, longitude 46°17_E, altitude 1360 m above sea level). The climate of research area is characterized by mean annual precipitation of 285 mm, mean annual temperature of 10°C and mean annual minimum temperature of 4.2°C maximum temperature of 16.6°C. The experiment was arranged in a randomized complete block design, with three replications and nine treatments. The treatments were represented by the following; different planting patterns: pure stand of Dragon's head, pure stand of dill variety Dukat, additive intercropping of optimal density of Dragon's head + 25%, 50% and 75% of optimum density of dill variety Dukat, pure stand of dill variety Super dukat, additive intercropping of optimal density of Dragon's head + 25%, 50% and 75% of optimum density of dill variety Super dukat. All plots were irrigated immediately after sowing.

The main and secondary crops were Dragon's head and dill, respectively. As dill seeds are sensitive to seed bed, though soft and smooth seed bed prepared and covered by thin layer of sand silt. Each plot consists of 16 rows, seeds planted 15 cm apart and 1-2 cm deep. Optimum density for dill and Dragon's head were 40 and 160 plant/m2, respectively. Weed controls were regularly performed by hands. Both plants were harvested after technical maturity and then laboratory measurements performed. Measurement of traits to specify Plant height, number of lateral stem, leaf number and weight per plant ten plants were selected from the middle of the plots and then, they were measured. Harvested plants were dried in 25°C and under shadow and air flow then grains were separated from their remains by threshing.

A. Statistical analysis

Statistical analysis of the data was performed with MSTAT-C software. Duncan multiple range test was applied to compare means of each trait at 5% probability.

RESULTS AND DISCUSSION

Analysis of variance for dill yield and yield components and essential oil yield (Table 1), showed that different intercropping patterns have a significant effect on all studied traits.

Table 1. Analysis of variance of selected parameters of Dragon's head affected by intercropping patterns.

		Mean square			
SOV	**df**	**Height of Plant**	**Lateral stem**	**Number of leaf**	**Weight per plant**
Block	2	16.12ns	1.476ns	4.905*	1.476ns
Intercropping	6	62.159*	2.429*	7.714**	2.429*
Error	12	14.944	0.643	1.571	0.65
(CV)%		10.10	14.52	5.31	22.75

Ns=Non significant; * and ** = Significant at 5% and 1% probability level, respectively

Statistical analysis of the data indicated that different intercropping patterns had significant effect on plant height of Dragon's head (Table 2). Maximum plant height (45.67 cm) was pure stand of Dragon's head treatment. Minimum plant height was recorded in the additive intercropping of optimal density of Dragon's head + 75% of optimum density of dill variety Dukat treatment (Table 2). The canopy characteristics of crops are not constant, but may change due to the presence of other crops species (Caldwell, 1987). This result is similar with finding of Silwana and Lucas (2002) who reported that plant height of maize intercropped with both beans and pumpkin were adversely affected by intercropping conditions. Maize plants were taller for sole crops compared to when intercropped with beans, both in the presence of weed infestation. In other results, (Thwala and Ossom, 2004) did not find any significant difference in plant height between mono cropping and intercropping of maize with sugar bean and ground nuts. According to Akobundu (1993).

Lateral stem of Dragon's head significantly affected by intercropping patterns (Table 2). Dragon's head plants in the sole cropping system treatment produced the highest mean number (7.1) of lateral stem and this was significantly different from the other cropping systems (Table 2). Additive intercropping of optimal density of additive intercropping of optimal density of Dragon's head + 75% of optimum density of dill variety Super dukat. Treatment produced the least lateral stem which was (Table 2).

Alizade *et al.,* (2009) reported that the lateral stem of *Ocimum* basilicum and *Phaseolus vulgaris* decreased in intercropping system under no weeds control treatments.

Number of leaf of Dragon's head significantly affected by intercropping patterns (Table 1). Dragon's head plants in the sole cropping system treatment produced the highest mean number (26.02) of number of leaf and this was significantly different from the other cropping systems (Table 2). Additive intercropping of optimal density of additive intercropping of optimal density of Dragon's head + 75% of optimum density of dill variety Super dukat and Dukat treatment produced the least number of leaf which was (Table 2).

Weight per plant of Dragon's head significantly affected by intercropping patterns (Table 1). Dragon's head plants in the sole cropping system treatment produced the highest mean number (5.12g) of weight per plant and this was significantly different from the other cropping systems (Table 2). Additive intercropping of optimal density of additive intercropping of optimal density of Dragon's head + 75% of optimum density of dill variety Super Dukat produced the least weight per plant which was (Table 2). The treatments were represented by the following; different planting patterns treatment: A1, A2, A3, A4, A5, A6 and A7: respectively, pure stand of Dragon's head, additive intercropping of optimal density of Dragon's head + 25%, 50% and 75% of optimum density of dill variety Dukat, additive intercropping of optimal density of Dragon's head + 25%, 50% and 75% of optimum density of dill variety Super dukat.

Table 2: Comparison of means of morphological traits of Dragon's head.

Treatment	Weight per plant	Number of leaf	Lateral stem	Height of Plant(cm)
A1	5.12a	26.02a	7.01a	45.67a
A2	3.66ab	24.01ab	5.67ab	40.33ab
A3	3.42ab	23.33bc	5.41ab	37.67bc
A4	3.01bc	21.67c	5.01bc	31.67c
A5	3.51ab	25.12ab	5.71ab	38.67b
A6	4.01ab	23.67bc	5.6ab	40.01ab
A7	2.01c	21.67c	4.02c	34.02bc

Different letters in each column indicate significant difference at p≤0.0

CONCLUSION

This research showed that Dragon's head could be an effective plant in intercropping system. Further long-term experiments will be necessary in order to demonstrate the application of such a technique to other medicinal and aromatic plant mixtures. Intercropping of Dill with Dragon's head caused significant reductions in morphological traits of Dragon's head due to competition.

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