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Effect of intercropping chickpea and dragon's head (*Lallemantia iberica* Fish. et Mey) on weeds control and morphological traits in chickpea

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Key words: Chickpea, Dragon's head, harvest index, intercropping, monocroping.

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Abstract

In order to investigate the effects of intercropping on weeds dry matter, morphological traits and yield components of Chickpea, an experiment was carried out as Factorial based on randomized complete block design with three replications at the research station of Tabriz University in 2012. different planting patterns treatments (a_1, a_2, a_3, a_4, a_5 and a_6: Respectively, pure stand of Chickpea, pure stand of Dragon's head , additive intercropping of optimal density of Chickpea + 25%, 50%, 75% and 100% of optimum density of Dragon's head) were assigned to main plots and four times of weeds control levels (b_1, b_2, b_3 and b_4: complete control, no weeds control, control after 2-4 weeks after emergence, control after 5-7 weeks after emergence) were allocated to the sub plots. Results showed that intercropping and time of weeds control treatments had significant effects on all of the characteristics. Means compression showed that number of pod in main stem, number nod of main stem, numbers of lateral stem, grain yield and harvest index were maximum in pure stand with complete control of weeds and in intercropping with no control of weeds were minimum. As addition of density in plant different patterns and increase of duration of weeds control make decrease this characteristics exception plant height. Plant height of Chickpea in intercropping treatments with no weeds control significantly was higher than pure stand and weeds control treatments.

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Introduction

For increasing land use efficiency and weed suppression, intercropping plays a pivotal role (Banik *et al.,* 2006). A practice often associated with sustainable agriculture and organic farming, intercropping is one form of polyculture, using companion planting principles (Altieri, 1991). Intercropping is a common feature in traditional farming of small land holders. It provides farmers with a variety of returns from land and labour, often increases the efficiency with which scarce resources are used and reduces the failure risk of a single crop that may be susceptible to environmental and economic fluctuations. The objective of enhanced cropping intensity can also be achieved through intercropping. Besides, intercropping of compatible crops use resources very efficiently and provides yield advantage over sole crops. When a legume is grown in association with another crop (intercropping, the nitrogen nutrition of the associated crop may be improved by direct nitrogen transfer from the legume to other plants (Giller and Wilson, 1991). Intercropping as one of the most applicable farming system in many developing countries for crop diversification and enhancing the land unit area benefit, is preferable for growing these two crops. Intercropping is one option for reducing weed problems through nonchemical methods (Vandermeer, 1989). Weed growth suppression is an explanation of intercropping yield advantage, which can be applied to diminish herbicide use in agriculture (Poggio, 2005).

Chickpea is the second and most important crop which plays main role in the economy is essential world agriculture. Chickpea is one of the three important legumes in West Asia and North Africa. this plant is cultivated in almost all around the world especially in the middle dry widely (Majnoon Hoseini, 2008) and has a special role in intercropping because reserve nitrogen in the soil (Banic *et al.*, 2006).

Dragon's head (*Lallemantia iberica*) is a mucilaginous endemic plant which is grown in different regions of Middle East countries especially Turkey, Iran and India (Zargari, 1980). Dragon's head seeds are used in a wide range of traditional or industrial products such as a beverage (namely Tokhme Sharbati) and bread in Iran and Turkey (Razavi *et al.,* 2008). The seed contains up to 30% of a drying oil. It is used for lighting, as a varnish, in paints and as a lubricant (Sacilik *et al.,* 2003). The present investigation may be one of the preliminary studies concerned with intercropping chickpea and lallemantia, as an attempt to find a chance for incorporation them in the local cultivation in order to increase the yield for our increasing demand. Therefore, some intercropping patterns of chickpea and Lallemantia coupled with some times of weeds control treatments were investigated.

Methods and materials

Site description and experimental design

The field experiment was conducted in 2012 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 experiment was arranged as factorial design with three replications. different planted patterns treatments (a_1, a_2, a_3, a_4, a_5 and a_6: respectively, pure stand of Chickpea, pure stand of Dragon's head, additive intercropping of optimal density of Chickpea + 25%, 50%, 75% and 100%of optimum density of Dragon's head) were assigned to main plots and four time of weeds control levels (b_1, b_2, b_3 and b_4: Complete Control, no weeds control, control after 2-4 weeks after emergence, control after 5-7 weeks after emergence) were allocated to the sub plots.

Measurement of traits

To specify height plant, number of pod in main stem, number nod of main stem, numbers of lateral stem, grain yield and harvest index were selected from the middle of the plots and then, they were measured. Also to determine of grain yield an area equal to $1m^2$ was harvested from middle part of each plot considering marginal effect. Harvested plants were dried in 25^{oC} and under shadow and air flow then grains were separated from their remains by threshing.

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.

Discussion and conclusion

In this study, based on local ecological conditions tested, *(Convolvulus arvensis* L.) and *(Amaranthus retroflexus* L.) and *(Chenopodium album* L.) and *(Setaria viridis* L.) and *(Polygonum persicaria* L.) Weeds were dominant. Many researchers also in their studies this weeds have been reported in different environment that include insisting and dangerous species weed (Poggio *et al.,* 2005). Denhollander *et al.,* 2007). Based on data analysis, effect of cropping pattern of intercropping and time of weed control and interaction factors was significant on the dry weight of weeds (table1).

Table 1. Analysis of variance of weeds dry matter affected by different cropping patterns and weeds control treatments.

Mean Square		
SOV	Df	Weeds dry matter
Replication	2	2.121
Plants different pattern	5	805.141**
Time of weeds control	2	3144.191**
interaction	10	81.104**
error	34	0.469

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

Mean comparison of weeds dry matter showed that by increasing duration of weed control and decreasing density of plants, weeds dry matter were increased. as maximum of weeds dry matter (56.01 g/m2) in response to the factores interaction was in monocropping with weeds complete control tereatment (a1b1) and minimum of weeds dry matter (1.5 g/m2) in response to the factors related was in 100% of optimum density of Dragons head with no weeds control treatment (a6b2) treatment (Fig1).

Table 2. Analysis of variance of morphological traits of Chickpea affected by different cropping patterns and weeds control.

Main square							
SOV	Df	Plant height	numberpod main stem	of Number node Main stem	of numbers lateral stem	of seedyield	Harvest index
Replication	2	1.244	0.675	19.519	4.705	338.33	1.555
Plants different pattern	4	98.029**	44.749**	370.808**	2.32**	5830.64**	79.732**
Time of weeds control	3	203.193**	82.625**	672.634**	45.663**	10618.879**	160.849**
Interaction	12	6.372**	21.161**	31.638**	3.75**	519.985**	4.217**
Error	38	1.881	0.457	8.193	0.564	131.373	0.651

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

Effect of intercropping Chickpea and Dragon's head (Dragon's head iberica) on morphological characters in Chickpea

The data presented in table 2 show that, height of the main stem, numbers of lateral stem, number pod of main stem and lateral stem, number nod of plant height, numbers of lateral stem, grain yield and harvest index were significantly affected by intercropping patterns, weeds control treatments and their interaction.

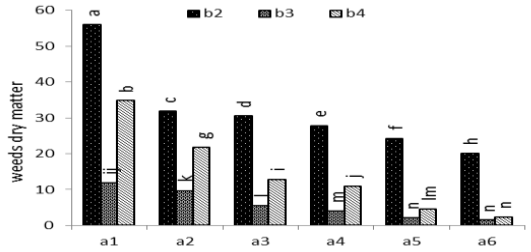

Fig. 1. Effect of interaction effect of different pattern of intercropping with times of weed control on weeds dry matter (Duncan, P< 0.05). a_1: pure stand of Chickpea, a_2: pure stand of Dragon's head, a_3: a_4, a_5 and a_6, additive Intercropping of optimal density of Chickpea + 25%, 50%, 75% and 100% of optimum density of Dragon's head. b_2: no weeds control, b_3: control after 2-4 weeks after emergence and b_4: control after 5-7 weeks after emergence.

Plant height of Chickpea increased by intercropping compared to pure stand and also in treatment of no weeds controlled compared to weeds control treatments, as maximum of height of main stem (54.81cm) was in 50% of optimum density of Dragons head with no weeds control (a4b2) treatment that had no significant difference with 100% of optimum density of Dragons head with no weeds control treatment (a6b2) and 25% of optimum density of Dragons head with no weeds control treatment (a3b4) and minimum plant height was in pure stand with complete control treatment (fig 2). This is due to increased competition for light (Sadegi *et al.*, 1381). Other researcher also reported these results (Sachan and Yotan, 1992; Mahfooz and Miger, 2004; Kumar *et al.*, 2009).

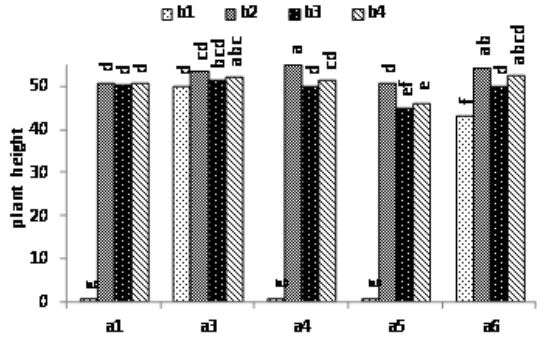

Fig. 2. Effect of interaction of different pattern of intercropping and time of weed control on plant height (Duncan, P< 0.05). a_1: pure stand of Chickpea, a_2: pure stand of Dragon's head, a_3: a_4, a_5 and a_6, planting additive Intercropping of optimal density of chickpea + 25%, 50%, 75% and 100% of optimum density of Dragon's head. b_1: Complete Control, b_2: no weeds control, b_3: control after 2-4 weeks after emergence and b_4: control after 5-7 weeks after emergence.

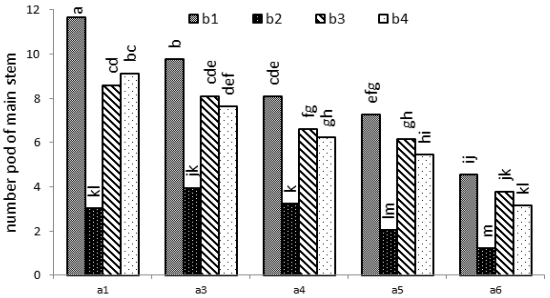

Fig. 3. Effect of interaction of different patterns of intercropping and time of weeds control on number pod of main stem (Duncan, P< 0.05). a_1: pure stand of chickpea, a_2: pure stand of Dragon's head, a_3: a_4, a_5 and a_6, plant additive Intercropping of optimal density of Chickpea + 25%, 50%, 75% and 100% of optimum density of Dragon's head. b_1: Complete Control, b_2: no weeds control, b_3: control after 2-4 weeks after emergence and b_4: control after 5-7 weeks after emergence.

Pod number of main stem in pure stand with weeds control treatment was more than intercropping and not weeds control, and with increasing of density, it reduced. as maximum and minimum of pod of main stem regularity was in monocropping with weeds complete control treatment with average 11.67 pod in per stem and 100% of optimum density of Dragons head with no weeds control treatment (a6b2) with average 1.233 pod in per stem that no significant different with a5b2 treatment (fig3). In more density, increment of competition for light and uptake natural resources, cause decrease prolific flower and pod in plant (Banik *et al.*, 1983).

Number of node of main stem in monocropping with weeds complete control treatment with average 37.1 node/main stem was maximum and the minimum number of node/main stem with average 5.133 node in main stem was in 100% of optimum density of Dragons head with no weeds control treatment (a6b2) treatment that no significant differences with 100% of

optimum density of Dragons head with control after 5-7 week after emergence (a6b4) treatment (fig4). This decrease was due to low competitive ability of Chickpea with weeds for light and other resources (Liu *et al.*, 2003). Increase number of nodes per plant at low densities due to reduce competition between plants (Shahein *et al.*, 1995. and Sing *et al.*, 1992). Whereas nodes are site of constitution pod on the stem, so if numbers of node in plant are increase, length of internode decrease, and yield will increase (Shahin *et al.*, 1995).

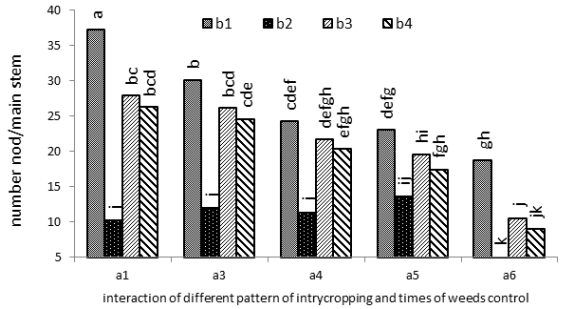

Fig. 4. Effect of interaction of different pattern of intercropping and time of weeds control on number node of main stem (Duncan test 0.5%). a_1: pure stand of Chickpea, a_2: pure stand of Dragon's head , a_3: a_4, a_5 and a_6, additive intercropping of optimal density of Chickpea + 25%, 50%, 75% and 100% of optimum density of Dragon's head. b1: complete control, b_2: no weeds control, b_3: control after 2-4 weeks after emergence and b_4: control after 5-7 weeks after emergence.

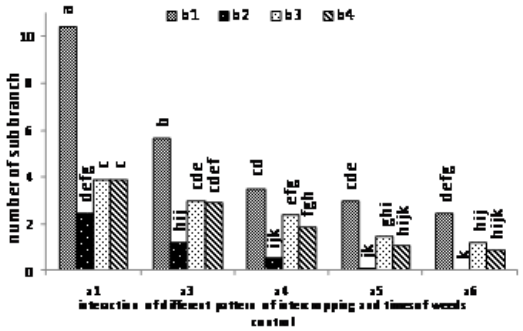

Fig. 5. Effect of interaction of different pattern of intercropping and time of weeds control on numbers of lateral stem (Duncan test 0.5%). a_1: pure stand of Chickpea, a_2: pure stand of Dragon's head, a_3: a_4, a_5 and a_6, plant additive Intercropping of optimal density of Chickpea + 25%, 50%, 75% and 100% of optimum density of Dragon's head. b_1: Complete Control, b_2: no weeds control, b_3: control after 2-4 weeks after emergence and b_4: control after 5-7 weeks after emergence.

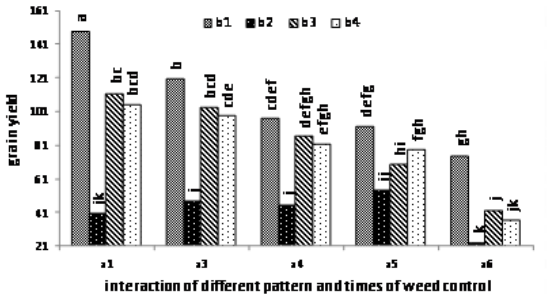

Fig. 6. Effect of interaction of different pattern of intercropping and time of weeds control on grain yield (Duncan test 0.5%). a_1: pure stand of Chickpea, a_2: pure stand of Dragon's head, a_3: a_4, a_5 and a_6, plant additive Intercropping of optimal density of Chickpea + 25%, 50%, 75% and 100% of optimum density of Dragon's head. b_1: Complete Control, b_2: no weeds control, b_3: control after 2-4 weeks after emergence and b_4: control after 5-7 weeks after emergence.

Numbers of lateral stem decreased in intercropping and no weeds control treatment than monocroping and weeds control. That reason for this, reduce of environmental resources available to plants. So that maximum numbers of lateral stem with average 5.683 stem/plant was in monocropping with weeds complete control and minimum numbers of lateral stem (0.13 stem/plant) was in 100% of optimum density of Dragons head with no weeds control (a6b2) treatment (fig 5). Alizade *et al.*, (2009) represented that the sub stem of Ocimum basilicum and Phaseolus vulgaris decrease in intercropping and no weeds control treatments.

Maximum and minimum grain yield regularity was in monocropping with weeds complete control treatment (a1b1) with 148.4g/m2 and 100% of optimum density of Dragons head with no weeds control treatment (a6b2) with 22.53g/m2 (fig6). In intercropping with increase of density, due to decreasing of available environmental resources, the decrease of yield in plants was occurring.

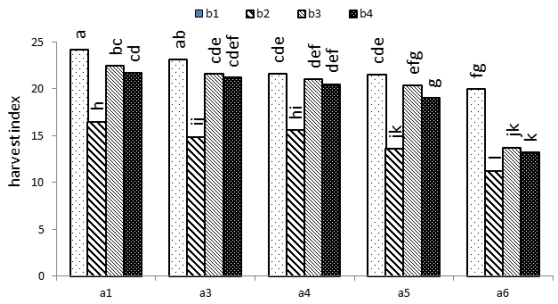

Fig. 7. Effect of interaction different pattern of intercropping and time of weed control on harvest index (Duncan test 0.5%). a_1: pure stand of Chickpea, a_2: pure stand of Dragon's head , a_3: a_4, a_5 and a_6, plant additive intercropping of optimal density of Chickpea + 25%, 50%, 75% and 100% of optimum density of Dragon's head. b_1: complete control, b_2: no weeds control, b_3: control after 2-4 weeks after emergence and b_4: control after 5-7 weeks after emergence.

Maximum harvest index (24.21%) was in monocropping with weeds complete control treatment (a1b1) and minimum for it (11.19%) was in 100% of optimum density of Dragons head with no weeds control (a6b2) treatment (Fig7). increase of plant density and duration of weeds control cause decrease in harvest index. It seems this because of reduction in competitive ability of Chickpea against weeds and other plants in intercropping.

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