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Effect of spring and autumn sowing on some morphological traits of chickpea genotypes

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Key words: Autumn sowing, days to flowering, plant height, spring sowing.

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Abstract

Two field experiments were conducted at Islamic Azad University of Sanandaj in Kurdistan province of Iran, during 2012 growing season. The 25 chickpea varieties from diverse geographic origins were chosen and arranged randomized in augment experiment. Results showed that the sub branch number in autumn sowing was on average two times higher than that of spring sowing. The highest branch number was belonged to Torbat 5 and Esfahan 40 in spring sowing and Kaka in autumn sowing. The day numbers to flowering and podding was decreased in spring sowing. The minimum day to flowering and poddind was observed in Kermanshah 17 and Karaj 41 in spring and autumn sowing, respectively. The plant height was significantly affected by cultivars and sowing date, the chickpea cultivars have a higher plant height in autumn sowing, but the plant height of Flipo 40974, Esfahan 16, Torbat 21 and Jiroft 9 cultivars decreased in autumn sowing.

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Introduction

Chickpea (*Cicer arietinum* L.) is grown in tropical, sub-tropical and temperate regions. Kabuli type chickpeas generally have the larger seeds, and grow well under irrigated farms. Desi type have smaller seeds, and yield better in Indian subcontinent, Ethiopia and often elsewhere. Hybrids between Kabuli and Desi have produced strains with medium-size seeds and fair yields. Kabuli type is grown in temperate regions while the desi type chickpea is grown in the semi-arid tropics (Malhotra *et al*., 1987). Chickpea is valued for its nutritive seeds with high protein content, 25.3-28.9 %, after dehulling (Hulse, 1991). Chickpea genotypes is maintained at National centers including the Vavilov institute in Russia, the USDA-ARS Regional Plant Introduction Station at Pullman in the U.S. and two International centers (ICRISAT in India and ICARDA in Syria) and other gene banks. Tremendous variation for economically important traits has been documented and improved cultivars have been developed and released. Variation for morphological traits, flower and seed color and size, growth duration, grain yield, and biomass, disease resistance, quality traits are recorded. The bulk of chickpeas grown in developing countries are from unselected land races. Germplasm with resistance to major diseases has been identified and genes for important diseases have been named (Muehlbauer and Singh, 1987).

In Iran the chickpea cultivated in spring, but, because of high vegetative growth period, if the chickpea is sown in autumn, higher grain yield can be obtained in comparison with spring sowing. Findings of Ozdemir and Karadavut (2003) showed a 102% yield increase in autumn sowing over spring sowing in Turkey. Singh (1997) reported that winter-sown chickpea produced seed yield as 70% higher than spring-sown crop in Syria. Therefore, in this experiment the morphological traits of chickpea genotypes evaluated in spring and autumn sowing.

Materials and methods

Site specification

The 25 landraces chickpea (*Cicer arietinum* L.) accessions from different geographical location, investigated for the study of morphological traits. Therefore, two field experiments were conducted at Islamic Azad University of Sanandaj (35°11′ lat. N; 46°59′ long. E, 1400 m above sea level) in Kurdistan province of Iran, during 2012 growing season. This farm had been sown by wheat at last year. Annual rainfall (35-year long-term average) is mostly concentrated during the autumn and winter months (Fig. 1). Some of the soil physicochemical properties of farm in the surface layer (0–25 cm) were: clay-loam texture (29% sand, 41% clay and 30% silt), pH 7.31 (1:2.5 in water), 1.18% OM, 0.21% total N, 212 mg kg^{-1} extractable K^+ (NH_4Ac) and 7.1 mg kg^{-1} Olsen P.

Experimental design

The 25 chickpea varieties from diverse geographic origins were chosen and arranged randomized in augment experiment. Genotypes include: improved breeding lines were obtained from the International Center for Agricultural Research in the Dry Areas (ICARDA), Turkey and Cyprus cultivar, Iranian landrace chickpea (*Cicer arietinum* L.) accessions from different geographical location of Iran provided by Seed and Plant Improvement Institute, Karaj, Iran, and improved cultivars (ILC 263, Hashem, Kaka and Pirooz) that used in most of chickpea cultivation area of Iran (Table 1).

Preparation and performance

Mesorhizobium sp. cicer strain SW7 was added to all the chickpea seeds. Chickpea seeds were planted on March 1, 2012 and October 15, 2012 in spring and autumn sowing, respectively. Each genotype was sown 4 m in length, with 35 cm inter-row spacing. Weeds were removed manually in all plots. The chickpea cultivation was rainfed but, the field was irrigated two times with seven a day interval for the better germination of seeds.

Crop measurements

For each genotype the days to flowering and days to maturity, number of main and sub branch recorded. Flowering time were recorded when 50% of plants in

each plant flowered. In flowering stage the plant height was recorded.

Statistical analyses

The SAS procedures and programs were used for these calculations. The data collected in this study was subjected to analysis of variance (ANOVA) and the LS means was used to compare means of traits ($p< 0.05$). In addition, correlation coefficients among traits were also determined.

Results and discussion

Plant height, main and sub branch

The plant height was significantly affected by cultivars and sowing date, the chickpea cultivars have a higher plant height in autumn sowing, but the plant height of Flipo 40974, Esfahan 16, Torbat 21 and Jiroft 9 cultivars decreased in autumn sowing (Fig. 1). This decrease in vegetative growth can be related to origin of varieties. The origin of these cultivars was belongs to warm region. It seemed that these cultivars are sensitive to cold stress. For spring sowing, average plant heights were 34.2 cm and for autumn sowing were 41.4 cm. Plant metabolism will decrease at low temperatures and chemical reactions within the plant will take longer. Optimum plant growth often requires close temperature regulation; daytime temperatures between 25C and 30C are preferred. It seems that the more cultivars of this experiment were compatible to low temperature. Chickpea genotypes have higher main and sub branch in autumn sowing. The sub branch number in autumn sowing was on average two times higher than that of spring sowing (Table 2 and 3). The highest branch number was belonged to Torbat 5 and Esfahan 40 in spring sowing and Kaka in autumn sowing. The day numbers to flowering and podding was decreased in spring sowing. The minimum day to flowering and poddind observed in Kermanshah 17 and Karaj 41, in spring and autumn sowing, respectively (Table 2 and 3). This considerable variability provides a good opportunity for improving traits of interest in chickpea breeding programs. Morphological traits are complex traits that receive the interactive effects of many other plant traits, which are in turn influenced by their genetic structures and the environment where the plant is grown.

Table 1. List of chickpea accessions used in the study.

No.	Genotype	Source	No.	Genotype	Source
1	Flipo 40496	ICARDA	14	Kerman 40	Iran-Kerman
2	Flipo 40974	ICARDA	15	Esfahan 40	Iran-Esfahan
3	Flipo 41510	ICARDA	16	Flipo 02-58c	ICARDA
4	Flipo 40171	ICARDA	17	Flipo 2005-6c	ICARDA
5	Hashem	Iran	18	Flipo 05-183c	ICARDA
6	Kermanshah 17	Iran-Kermanshah	19	ILC 482	ICARDA
7	Esfahan 16	Iran- Esfahan	20	Pirooz	Iran
8	Torbat 39	Iran-Torbat	21	Kaka	Iran
9	Ardabil 50	Iran- Ardabil	22	C421	Landrace-Cyprus
10	Ardabil 71	Iran- Ardabil	23	Torbat 21	Iran-Esfahan
11	Kerman 19	Iran-Kerman	24	Jiroft 9	Iran-Jiroft
12	Torbat 5	Iran-Torbat	25	Karaj 41	Iran-Karaj
13	Turkey 602	Turkey			

Table 2. Morphological traits of chickpea genotypes in spring sowing.

Genotypes	Sub branch number	Main branch number	Day to podding	Day to flowering
Flipo 40496	11.5	2.5	90	78
Flipo 40974	12	2	93	83
Flipo 41510	12.5	1.5	90	79
Flipo 40171	9.5	3.5	91	80
Hashem	10.5	3.5	90	80
Kermanshah 17	13.5	2	88	78

Esfahan 16	11	2.5	91	82
Torbat 39	14	3.3	94	81
Ardabil 50	14	3	95	83
Ardabil 71	11	2	90	77
Kerman 19	12.5	2.5	90	79
Torbat 5	14.5	3.5	91	80
Turkey 602	11	3	92	80
Kerman 40	12.5	3	89	83
Esfahan 40	14	3	95	84
Flipo 02-58c	7	2	91	80
Flipo 2005-6c	11	3	93	83
Flipo 05-183 c	13	1.5	91	80
ILC 482	12	2	90	80
Pirooz	11.5	3	89	78
Kaka	12.5	3.5	94	82
Turkey C 421	13	3.5	93	81
Torbat 21	14	3.2	93	81
Jiroft 9	11	3.6	92	82
Karaj 41	12	3.5	94	85

Table 3. Morphological traits of chickpea genotypes in autumn sowing.

Genotypes	Sub branch number	Main branch number	Day to podding	Day to flowering
Flipo 40496	7.75	3	144	136
Flipo 40974	7.75	3	151	133
Flipo 41510	9	3.5	146	130
Flipo 40171	9.5	2.6	152	137
Hashem	8.33	2	143	127
Kermanshah 17	6	2.33	145	137
Esfahan 16	13	2.5	150	131
Torbat 39	12.25	3.75	141	133
Ardabil 50	14.6	3.25	144	133
Ardabil 71	10.2	4	143	130
Kerman 19	8.2	2.75	145	133
Torbat 5	13	4	140	130
Turkey 602	7	2	140	134
Kerman 40	10.5	3	145	129
Esfahan 40	12.5	3.5	144	133
Flipo 02-58c	14	4.5	150	132
Flipo 2005-6c	14.5	4	140	132
Flipo 05-183 c	11	3.5	144	133
ILC 482	11.5	1.5	147	133
Pirooz	11.5	3.5	147	133
Kaka	16.5	4.5	144	133
Turkey C 421	11	2	144	138
Torbat 21	11	3.5	148	131
Jiroft 9	6	3.75	140	134
Karaj 41	5.5	3	137	128

Morphological traits

The description of morphological traits and useful characteristics is an important prerequisite for effective and efficient utilization of germplasm collections in breeding programs. A small mini core collection of landrace, breeding line and improved chickpea cultivars has been assembled and we have shown that there is a high level of morphological diversity for most of the traits observed in autumn and spring sowing, which may be useful for future breeding endeavors. Finally, landrace chickpea collection has been assembled and we have shown

that there is a high level of morphological diversity for most of the traits observed, which may be useful for future breeding endeavors. The results of present study showed that even through the relationships (correlations) among some characters were significant. As in our research, Ciftci *et al.* (2004) and Talebi and Karami (2011) stated that positive and significant relationships were found between morphological traits.

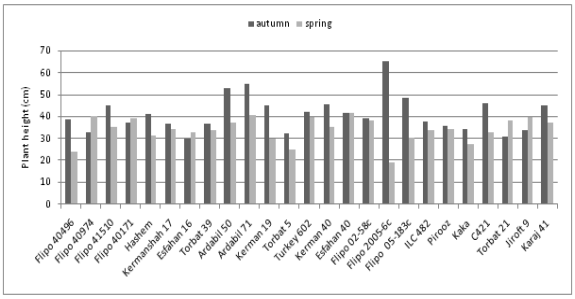

Fig. 1. Response of height of chickpea genotypes to spring and autumn sowing.

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