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Nutritional Composition of Iranian Desi and Kabuli Chickpea (*Cicer Arietinum* L.) Cultivars in Autumn Sowing

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***Abstract*—**The grain quality of chickpea in Iran is low and instable, which may be attributed to the evolution of cultivars with a narrow genetic base making them vulnerable to biotic stresses. Four chickpea varieties from diverse geographic origins were chosen and arranged in a randomized complete block design. *Mesorhizobium* sp. *cicer* strain SW7 was added to all the chickpea seeds. Chickpea seeds were planted on October 9, 2013. Each genotype was sown 5 m in length, with 35 cm inter-row spacing, in 3 rows. Weeds were removed manually in all plots. Results showed that Analysis of variance on the studied traits showed significant differences among genotypes for N, P, K and Fe contents of chickpea, but there is not a significant difference among Ca, Zn and Mg continents of chickpea. The experimental coefficient of variation (CV) varied from 7.3 to 15.8. In general, the CV value lower than 20% is considered to be good, indicating the accuracy of conducted experiments. The highest grain N was observed in Hashem and Jam cultivars. The highest grain P was observed in Jam cultivar. Phosphorus content (mg/100g) ranged from 142.3 to 302.3 with a mean value of 221.3. The negative correlation (-0.126) was observed between the N and P of chickpea cultivars. The highest K and Fe contents were observed in Jam cultivar.

***Keywords*—**Cultivar, genotype, nitrogen, nutrient, yield.

I. Introduction

THE chickpea (*Cicer arietinum* L.) is considered to be a healthy vegetarian food and it is one of the most important human and domestic animal foods in Iran. Chickpea's nutritional value and its ecological adaptability make it an important crop globally and in Iran as well as in other arid and semi arid countries [1], [2]. Having high protein content, it is so rich in zinc, dietary fiber, calcium, magnesium, phosphorus, potassium, iron and vitamins [3], [4]. There are three basic kinds of chickpea seed. Desi has small, darker seeds and a rough coat. It is grown mostly in India and other parts of the Indian subcontinent, as well as in Ethiopia, Mexico, and Iran. Desi means 'country' or 'local' in Hindustani; its other names include Bengal gram or kala chana ("black chickpea" in both Hindi and Urdu) or chhola boot. Desi is probably the earliest variety because it closely resembles seeds found both on archaeological sites and the wild plant ancestor *Cicer reticulatum* of domesticated chickpeas, which only grows in southeast Turkey, where it is believed to have originated. Desi chickpeas have markedly higher fiber content than other varieties, and hence a very low glycemic index, which may make them suitable for people with blood sugar problems. The desi type is used to make chana dal, which is a split chickpea with the skin removed. Bombay chickpeas (Bambai) are also dark but slightly larger than desi. They too are popular in the Indian subcontinent. Kabuli are lighter-coloured, larger and with a smoother coat, and are mainly grown in the Mediterranean, Southern Europe, Northern Africa, South America and Indian subcontinent. The name means "from Kabul" in Hindi and Urdu, and this variety was thought to come from Kabul, Afghanistan when it was introduced to India in the 18th century. It is called Kabuli chana in Marathi and safed chana in India. An uncommon black chickpea, ceci neri, is grown only in Apulia, in southeastern Italy. It is larger and darker than the desi variety.

It is a cheap source of high quality protein in the diets of millions of people in developing countries, who cannot afford animal protein for balanced nutrition. In addition to proteins, it is a good source of carbohydrates, minerals and trace elements. Also, chickpea plays a key role in organic cropping systems. In such agro-ecosystems, with limited availability of nitrogen, chickpea potentially constitutes both a cash crop and a source of N incorporation into system via biological nitrogen fixation. The growing chickpea in crop rotation increases crop productivity and sustainability under semi-arid climate. Maintenance and management of soil fertility is the core of development of sustainable food production systems.

In arid and semi arid environments, chickpea is traditionally sown in spring; therefore, the crop encounters heat and drought stress towards maturity; resulting in low and variable yields. However, with developing new cultivars, winter sowing of chickpea has recently been increased, since winter sowing provides higher and more stable productivity and better water-use efficiency [5], [6].

The aim of the present work was determining the suitable chickpea genotypes having the features of some qualitative traits and chemical characters, as well as interrelations between them in a collection of diverse geographic origins types.

II. Materials and Methods

A field experiment was conducted at Islamic Azad University of Sanandaj (11°45′ late. N; 30°47′ long. E, 1400 m above sea level) in Kurdistan province of Iran, in 2013 growing season. The annual temperature averages 12 °C and the annual rainfall averages 512 mm. Eight chickpea varieties

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from diverse geographic origins were chosen and arranged in a randomized complete block design. *Mesorhizobium* sp. *cicer* strain SW_7 was added to all the chickpea seeds. Chickpea seeds were planted on October 9, 2013. Each genotype was sown 5 m in length, with 35 cm inter-row spacing, in 3 rows. Weeds were removed manually in all plots.

Chickpea grains were taken from the middle row in each cultivar. The phosphorus and nitrogen content of matured seeds was determined by vanado molybdate phosphoric acid yellow colour method and microkjeldahl method, respectively. The microkjeldahl method consists of heating a substance with sulphuric acid, which decomposes the organic substance by oxidation to liberate the reduced nitrogen as ammonium sulphate. In this step potassium sulphate is added to increase the boiling point of the medium (from 337 C to 373 C). Chemical decomposition of the sample is complete when the initially very dark-coloured medium has become clear and colourless. The solution is then distilled with a small quantity of sodium hydroxide, which converts the ammonium salt to ammonia. The amount of ammonia present, and thus the amount of nitrogen present in the sample, is determined by back titration. The end of the condenser is dipped into a solution of boric acid. The ammonia reacts with the acid and the remainder of the acid is then titrated with a sodium carbonate solution by way of a methyl orange pH indicator.

Also, the potassium content was determined by flame photometer model-EEL [7]. The minerals, such as calcium, magnesium, zinc and iron, were determined with an atomic absorption spectrophotometer (Perkin–Elmer Model 5000) [7].

At harvest time harvest, grain yield and yield components were evaluated from an area of 2 × 2.5 m2 in each sub-sub plot. One hundred grams of harvested mature seeds of chickpea from different treatment were taken in beakers fitted with condensers to avoid evaporation losses during boiling.

The data collected in this study was subjected to analysis of variance (ANOVA). The UNIVARIATE procedure within SAS was used to examine the residuals for normality and to check for outliers in the data. Means were separated using Fisher's protected least significance difference (LSD) test at the 95% level of probability.

III. Results and Discussions

Analysis of variance on the studied traits showed significant differences among genotypes for N, P, K and Fe contents of chickpea, but there is not a significant different among Ca, Zn and Mg continents of chickpea (Table I). The experimental coefficient of variation (CV) varied from 7.3 to 15.8. In general, CV value lower than 20% is considered to be good, indicating the accuracy of conducted experiments.

The highest grain N was observed in Hashem and Jam cultivars (Fig. 1). The highest grain P was observed in Jam cultivar. Phosphorus content (mg/100g) ranged from 142.3 to 302.3 with a mean value of 221.3 (Fig. 1). The negative correlation (-0.126) was observed between the N and P of chickpea cultivars. The highest K and Fe contents were observed in Jam cultivar (Fig. 2).

All cultivars contained good amounts of calcium, zinc and copper (Table II). The results correspond to those already reported for chickpea in Pakistan and Iran [8], [9]. These results revealed that chickpea may provide a sufficient amount of minerals to meet the human mineral requirement. However, excess of one mineral may prevent others being absorbed and utilized properly. The mean Ca:P ratio in chickpea seed was 1.05. This ratio should not be less than 1.0 [8].

The description of qualitative important and useful characteristics is an important prerequisite for effective and efficient utilization of germplasm collections in breeding programs. A small mini core collection of 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, which may be useful for future breeding endeavors. The exploitation of crosses between genetically distant parents and those from diverse local sources may produce higher heterosis, better genetic recombination and segregation in their progenies and result in varieties with broad genetic base [10]. There is an opportunity to bring about improvement of the grain quality through direct and indirect selection as well as improving of these characters through hybridization using the germplasm collections in Iran [11]. Finally the Jam cultivar selected as the best cultivars of our experiment.

Thus, identifying these traits as selection criteria in further studies in the chickpea breeding program may be useful for breeders to introduce suitable chickpea cultivars [12]. Thus, there is an opportunity to bring about improvement of the crop yield through direct and indirect selection as well as improving of these characters through hybridization using the germplasm collections in Iran.

TABLE I
Analysis of Variance for Cultivar Effect on Mineral Constituents of Iranian Desi And Kabuli Chickpea Seeds

S.O.V	df	N	P	K	Ca	Mg	Fe	Zn
Cultivar	3	**	**	**	n.s	n.s	**	n.s
Block	3	**	*	n.s	n.s	**	*	**
CV	-	15.8	9.6	11.2	13.5	7.3	10.5	10.2

n.s., * and ** are Non- significant, significant at the 0.05 and 0.01 probability levels, respectively.

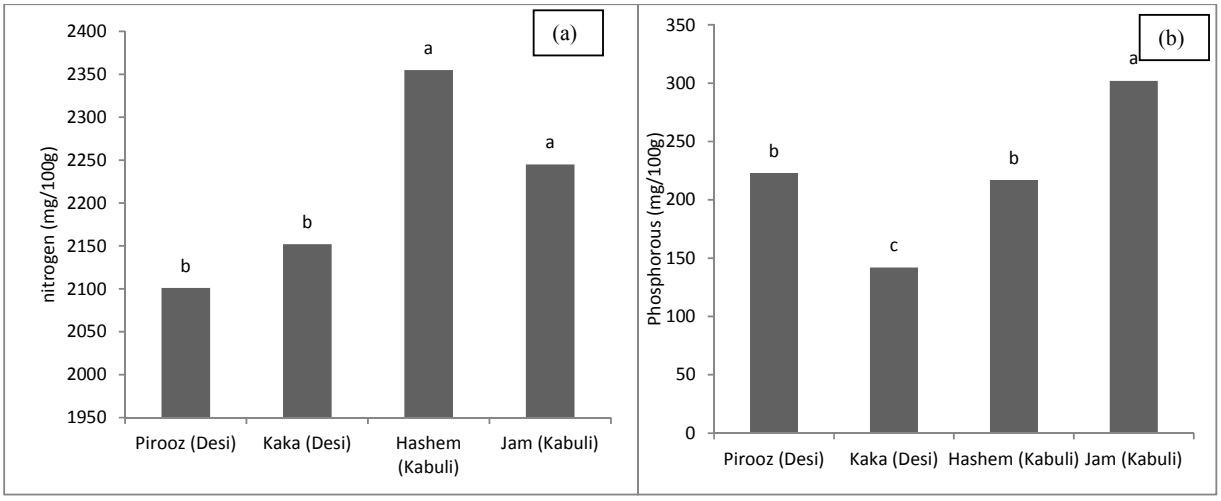
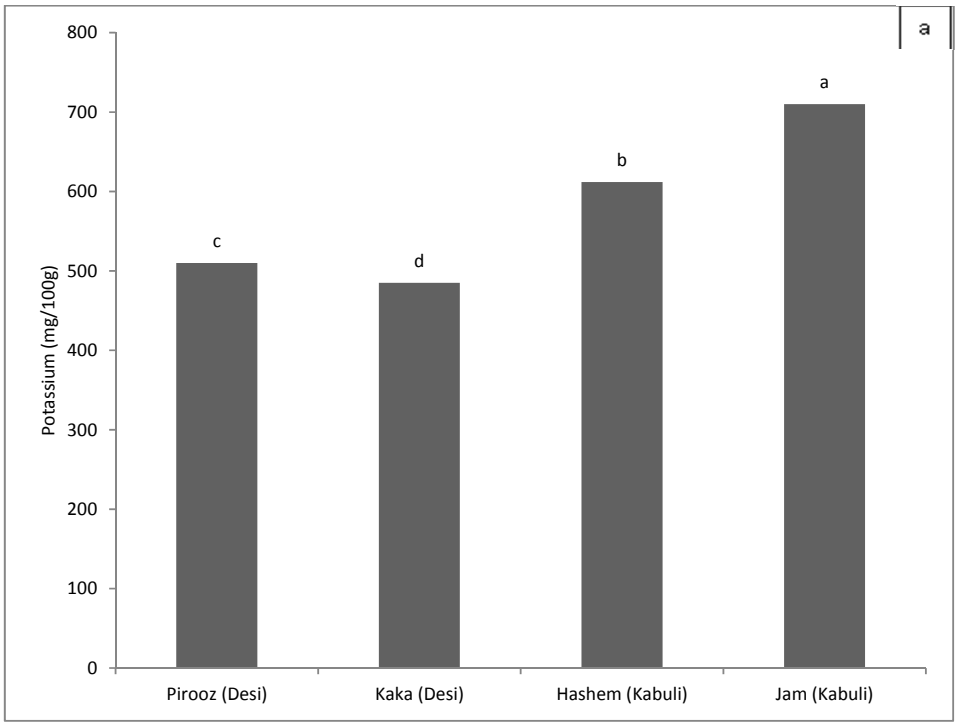


Fig. 1 Nitrogen and Phosphorous of Iranian Desi and Kabuli Chickpea Seeds

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, which may be useful for future breeding endeavors. Based on the three analyses using in this research among all traits, the number of seeds and 100-seed weight appeared to be the best criteria for selection. In general, based on correlation, path and factor analyses, the results of the present study suggested that a chickpea cultivar, for increased yield should have maximum number of seeds and higher seed size. Thus, identify these traits as selection criteria in further studies in chickpea breeding program may be useful for breeders to introduce suitable chickpea cultivars. Thus, there is an opportunity to bring about improvement of the crop yield through direct and indirect selection as well as improving of these characters through hybridization using the germplasm collections in Iran.



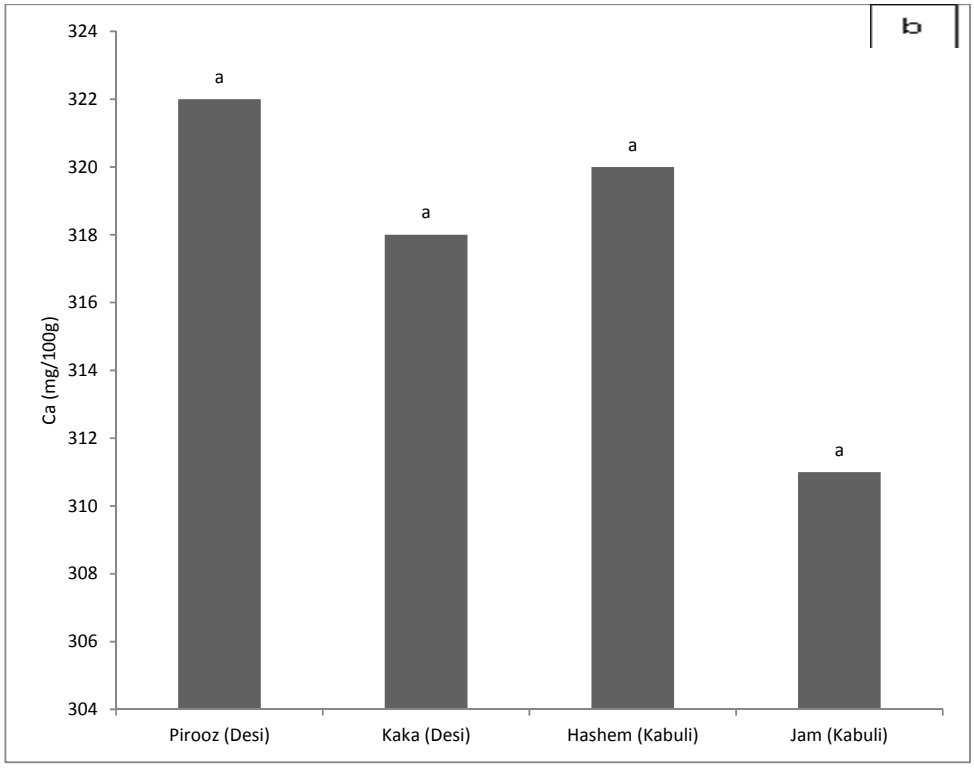


Fig. 2 Potassium (a) and Ca (b) of Iranian Desi and Kabuli Chickpea Seeds

TABLE II
MINERAL CONSTITUENTS OF IRANIAN DESI AND KABULI CHICKPEA SEEDS

Cultivars	Mg (mg/100g)	Fe (mg/100g)	Zn (mg/100g)
Pirooz (Desi)	4.2 a	6.2 b	4.2 a
Kaka (Desi)	4.6 a	5.5 b	4.3 a
Hashem (Kabuli)	4.3 a	8.9 a	4.3 a
Jam (Kabuli)	4.3 a	9.3 a	4.3 a

Mean values in each column with the same letter(s) are not significantly different using LSD tests at 5% of probability.

REFERENCES

[1] K. Shamsi."Effect of sowing date and row spacing on yield and yield components of chickpea under rain fed conditions in Iran". *Journal of Applied Biosciences*. 2009, pp. 941-947.
[2] A. Sadeghi, K. Cheghamirza, H.R. Dorri HR. "The study of morphoagronomic traits relationship in common bean *(Phaseolus vulgaris* L.)". Biharean Biologist. 2011, pp. 102-108.
[3] N. Kayan, M. Sait Adak. "Associations of some characters with grain yield in chickpea (*Cicer arietinum* L.)". Pakistan Journal of Botany. 2012. Pp. 267-272.
[4] R. Taleb, F. Fayaz, N.A. Jelodar NA. "Correlation and path coefficient analysis of yield and yield components of chickpea (*Cicer arietinum* L) under dry land condition in the west of Iran". Asian Journal of Plant Science. 2007, pp. 1151-1154.
[5] Y. Derya, A.E. "Anlarsal. Performance of some winter chickpea (*Cicer arietinum* L.) genotypes in mediterranean conditions". Notulae Botanicae Horti Agrobotanici Cluj-Napoca. 2008, pp. 35-41.
[6] J.E. Board, Q. Tan. "Assimilatory capacity effects on soybean yield components and pod number". Crop Science. 1995, pp- 846-851.
[7] AOAC. In K. Helrich (Ed.), Official methods of analysis (15th ed.). Arlington, VA/Washington, DC, USA: Association of Official Analytical Chemists. 1990.
[8] M. Zia-Ul-Haq, S. Iqbal, S. Ahmad, M. Imran, A. Niaz, M.I. Bhanger. "Nutritional and compositional study of Desi chickpea (*Cicer arietinum* L.) cultivars grown in Punjab, Pakistan". Food Chemistry. 2007, pp. 1357-1363.
[9] R. Talebi, A. Rokhzadi A. "Genetic diversity and interrelationships between agronomic traits in landrace chickpea accessions collected from 'Kurdistan' province, north-west of Iran". International Journal of Agronomy and Crop Science. 2013, pp. 2203-2209.
[10] R. Fatehi, R. Taleb, F. Fayyaz. "Characterization of Iranian Landrace Wheat Accessions by Inter Simple Sequence Repeat (ISSR) Markers". Journal of Applied Environment. 2011, pp. 423-436.
[11] H. Zali, E. Farshadfar, S. Sabaghpour. "Genetic variability and interrelationships among agronomic traits in chickpea (*Cicer arietinum* L.) genotypes". Crop Breeding Journal. 2011, pp. 127-132.
[12] H. Zali, E. Farshadfar, S. Sabaghpour. "Agronomic characteristics and genetic diversity in 17 chickpea genotypes". Agriculture Research. 2009, Pp. 169-181.