

Full Length Research Paper

Effect of source and seed size on yield component of corn S.C704 in Khuzestan

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Seed source of corn production (hybrid SC704), desirable seed size and the relationship between seed vigor and seed size on the grain yield of field corn conducted at the Agricultural Research center, Safiabad Dezful in 2008 with 3 replicates was evaluated. In this study, seed source (Khoozestan, Moghan and Khorasan) was used as the main factor and seed size (6, 6.5 and 7 mm) as subplot. The design of the field experiment was split plot in log out of randomize complete block. Results indicated an increase in seed size, seed number in cob, row number in cob, seed number in row, and 1000 grain weight with different seed sources. In general, the results showed that grain yield increased with high seed size and vigor. High grain yield was obtained with the seed source of Khoozestan and 7 mm seed size (8717.7 Kg/ha) compared to the seed source of Moghan and Khorasan (8583.7 and 8344.3 Kg/ha) respectively.

Key word: Corn, seed size, seed source, yield, yield component.

INTRODUCTION

Seed size is one of the most prominent features of a seed and it affects the seed growth vigor (Moujnizjah and Nakamoura, 1986; Shirin et al., 2008). Considering the fact that the seed is the marginal product of the plant reform programs, it could be said that the success of a program specifies the time the seed was in the hand of the farmers and the time it was used by them. Every type of abnormality in germination and its sprouting vigor affects the plant establishment and eliminates the difficulties that confront the reformers and producers (Aryannia et al., 2011). The flint corn, including a share of 65 to 70% in the poultry ration combination, is considered as the most important energy supply source for its production. The existence of empty capacities in the poultry industry and the high conversion coefficient of the white meat have been provided for production increase. It is possible for the seed sizes of a genotype to increase in size due to the nutrition of the mother plant, the flowering

condition and seed maturation. The size of the seeds which are formed on maize is different based on the location of the constituting florets and also the filling length of each seed on the maize (Wych, 1988). Various studies have been done on the effect of the seed size on different characteristics of hybrid maize. Kurdikeri et al. (1998) observed a considerable difference between the green percentage of the field and different sizes of different maize hybrids. But Hunter and Kannenberg (1972) stated that the seed size has a marginal effect on the number of days till the emergence of 50% of seedlings, the sprouting speed and the extent of seedling placement, the marginal amount of the bush leaves and their performance.

The seed size plays a central role in the plant's lifetime and determines the produced seed numbers (marginal product) partially, which is affected by complex environmental factors. These factors are effective on the seed size and the effects of seed size on different stages of the plant development play a major role on more biological activities of the plant and its ecological issues (Castro et al., 2007). Hunter et al. (1984), through an

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Table 1. Physicochemical traits of the field soil used in the experiment.

Soil tissue	OC (%)	K(mg/kg)	P (mg/kg)	Total N (mg/kg)	pH	EC(m mho/cm)
Clay Loam	0.82	120	10.6	3.32	7.6	1.2

experiment on a cross single maize hybrid by variable thousand-kernel weight (23 to 39 g) showed that the seed size has no effect on the product's sprouting. Mazum et al. (1994) conducted an experiment on the effect of the seed's size and shape on the sprouting of the maize seed. In this investigation, by increasing the seed size from 7.5 to 8.5 mm, the seedling germination was increased and the germination fluctuations were decreased. So, in order to improve the seedling germination, it was suggested that the seeds should be graded. Hong et al. (1982) showed that the seed size in different maize hybrids affected the germination and the plant height has no difference by the large and middle size seed treatment. No significant difference was observed between large, small and middle size seeds on the seed yield. Wanjura and Buxton (1972) showed that the large seed had a better germination, but the cultivation of the large seed in the soil depth impeded the germination of these seeds, though the bigger seeds outweighed the small ones. The higher or lower temperature from the optimum temperature during flowering or maturation decreases the seed size (AbdAllah et al., 2001). The biological cooperative interaction which decreases the plant yield decreases the seed size (Karlsson and Orlander, 2002). The concentration of seed production of some agricultural plants in special regions is a convincing cause for the environmental factors to affect seed quality and its growth (Delouche, 1980).

The centrality of some special regions for the production of some products is a convincing reason for the effect of the environment on the growth and quality of the seed (Mati et al., 1989). Studying and investigating the effect of cultivation date on the quality of soybean seed, Green et al. (1966) found that soybeans formed as a result of the early cultivation, due to placement in a hot and dry weather, produced seeds with low growth vigor. Also, Perry and Harrison (1973) in their investigations found that exposing the mother plants to high temperatures during maturation and desiccation of premature seeds in high temperatures is the principal factor for physiological differences in the seeds. The emergence of this physiological disorder has been related to the delay in germination, decrease in the growth of seedling and plant, low green level, and low yield of the plant in field conditions. The effective factors on the seed quality could be issues like temperature, humidity, soil fertility, nutrition of mother plant, pathogenic and environmental factors after maturation and before harvesting, and the drying and storage method of the seed. In spite of the technological developments and the agricultural management of the seed, the optimal germination and placement

of the produced seedlings play a key role in agriculture, so that the success or failure of its production is dependent on the full and fast seed germination and the production of vigorous seedlings. The most seedling establishment is achieved when the seed could overcome the undesirable environmental conditions and shows a proper reaction from itself. Certainly, this reaction is variable according to the genotype and environment (Morid, 2004).

The environmental conditions of the seedbed will usually cause the seed to encounter various tensions like dryness, low temperature, soil or water salinity and many life and dead stresses (Hall and Wiesner, 1990). This idea which is the source and place for hybrid seed production could have an effect on the next yield. In recent years, it has been proposed in scientific forums that in spite of the need for more investigation, unfortunately there are not enough sources in this case. This research seeks a proper response to determine also the best source of the corn hybrid seed for consumption in Khuzestan province and has the most suitable size in order to increase the yield of the fields in the province according to the obtained results.

MATERIALS AND METHODS

This research was carried out in summer of 2008 in a farm research station of Safi-abad (Institute of Seed Control and Certification). This center is located 120 km north of Ahvaz with a height of 82 m from sea level and a geologic width of 32 m. It has a range of 24 north minutes and 24 east minutes with a length of 48 m. Generally, the height of the entire south country coast lands is less than 100 m including the desert climate. So, the entire Khuzestan plain to the Lorestan's mountain slope has this climate figures. Heat in the entire area is severe (stable maximum temperature in this area is 53 and related to Ahvaz), while the annual rain mean in this area is of low amount and does not follow orderly."

Almost all the rain that fell in this period was in winter, while the other 7 months of the year did not have rain (Kochakee et al., 2005). To determine the physical and chemical soil characteristics, after choosing the place of test operation from the testing soil before any preparation was made for land operations, the sampling was performed by oger sampling from 0 to 30 cm land depth at 10 points randomly. The obtained results of soil deposition in soil laboratory are expressed in Table 1.

Until now, according to different experiments, the maize hybrid of S.C704 is the best medium from the yield rate's point of view, and is cultivated in summer in Khuzestan province (Kochakee et al, 2005). The maternal parent of this hybrid is B73 inbred line and the paternal parent is mo17. This hybrid can be used in two ways and is used more in grainy regions. The grain yield of this hybrid is about 6 to 9 ton ha⁻¹, its whole plant is about 285 cm in height, the last role of ear from the soil surface is about 110 cm and the cylinder ear is about 20 to 23 cm in length. Seeds of this hybrid are horse dent and their color is light yellow. Every one thousand seed weight of this hybrid is 370 g. This hybrid takes 123 days to

Table 2. Analysis of variance (mean squares) yield component.

S. O. V	df	Row per ear	Grain per row	Grain per ear	Thousand-grain weight (g)
Block	2	0.148 ^{ns}	0.333 ^{ns}	9.592 ^{ns}	71.44 ^{ns}
Seed source (A)	2	0.148 ^{ns}	4.000 ^{ns}	2336.925*	928.11**
Main error (a)	4	0.092	1.333	155.148	42.22
Seed size (B)	2	0.703**	91.333**	21072.148**	5390.33**
Sourcex Seed size (AxB)	4	0.648**	6.666**	2318.370**	**517/94
Sub error (b)	12	0.111	0.666	164.907	20.13
CV (%)		2.6	2.5	3.06	1.4

ns: non significant, *** : respectively significant ($p \leq 0.05$) and highly significant ($p \leq 0.01$).

produce seeds and 95 to 100 days to produce forage (Kochakee et al., 2005). However, it has a relative dryness; as such, it is recommended to all areas in Iran except cold mountain areas.

In this study, S.C704 cultivar was investigated by three different seed production sources in Khorasan, Mooghan and Khuzestan. In order to classify the seeds regarding their sizes, a special sieve was used and the diameter of their pores was 6, 6.5 and 7. The experiment was done by testing the split-plots in the form of complete random blocks through three iterations in a field by (46.5×18 m) dimensions. Before the testing season, the field was used for wheat cultivation. In this experiment, the seed sizes were investigated in three levels including the produced seeds of Khorasan, Mooghan and Khuzestan as the main factor and the seed size as the minor factor in three levels which were alternatively 6, 6.5 and 7. In order to determine the status of field sprouting, the seeds were noted by different sizes and sources in the field regarding the date of the first irrigation as the cultivation time for the number of emerging seedlings within 7 days after the emergence of the first seedling in the field. The obtained data were entered into the tables of computer programs like Excel Spread Sheet after summarization and classification. The variance analysis of row data was made by SAS statistical programs and the mean analysis was done by LSD test.

RESULTS AND DISCUSSION

Yield component

According to the results of Table 2, the effect of the seed source and size and their cooperative interaction on yield components of corn were not the same in this research; as such, each yield component showed a different reaction to different seed sizes, sources and cooperative interactions.

Number of row per ear

The results of variance analysis in Table 2 showed that the number of row per ear has not been significant under the effect of the seed source but the effect of seed size and the cooperative effect of the seed source and size has become very significant regarding the attribute of the number of row per ear. Figure 1 reveals that the maximum number of row per ear is related to Khuzestan seed source by 7 mm seed size and Mooghan seed

source by 6.5 and 7 mm seed size, whereas the mean 13 and its minimum is related to the treatments of Khuzestan seed source by 6 mm seed size and Khorasan seed source by 7 mm. As can be observed in Khuzestan, the number of row per ear increased as the seed size increased too. The results obtained in this survey regarding the attribute of the number of row per ear shows that in spite of the fact that this attribute is more affected by the genetic factors, it is not affected by the environmental factors. Moadab and Mojtahedi (1990) observed that the seed size had an effect on the number of row per ear. The results of this experiment based on the genetic attribute which is under investigation are proportional to the results obtained by Salim et al. (1985).

Grain number per row

According to the results of variance analysis (Table 2), the attribute of seed number has not shown any significant statistical difference regarding the three seed sources. However, the maximum number of seeds in the row (33.8) was obtained from the source of Mooghan seed and its minimum number (31.1) was obtained from the source of Khorasan seed. A significant difference was observed between different levels of seed size regarding the seed number per row (Table 2). According to Table 2, the maximum seed number per row (35.1) is related to 6.5 and 7 seed sizes, and the minimum seed number per row (29.4) is related to 6 mm seed size. Salim et al. (1985) also stated that the seed number per row is affected by the seed size. In Figure 2, it is observed that in Kuzestan source, the seed number per row increased as a result of the increase in the seed number, but the 6.5 mm seed size has the maximum seed number per row in this trend and in these two sources.

Generally, the sizes of the seeds which were under investigation were in 1% probability level and two different groups. The cooperative interactions of the seed source and size regarding the attribute of the seed number per row show a considerable difference in 1% probability level (Table 2). From the results of Figure 2 regarding the cooperative interaction of the seed source on the seed size, it is deduced that Khorasan seed

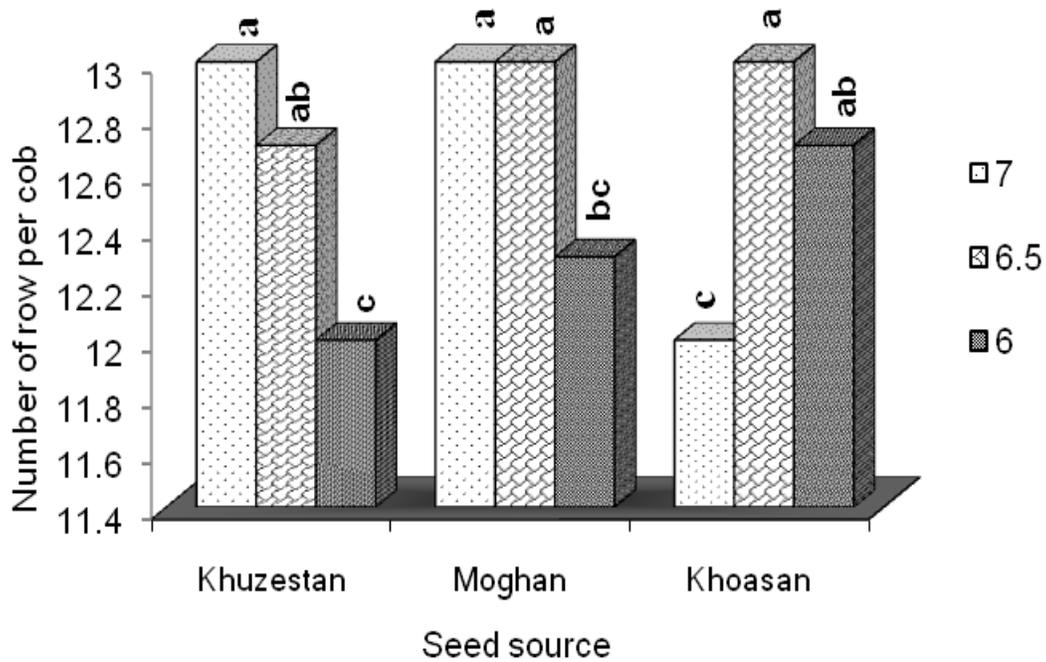


Figure 1. Interaction effects of source and seed size on number of row per cob.

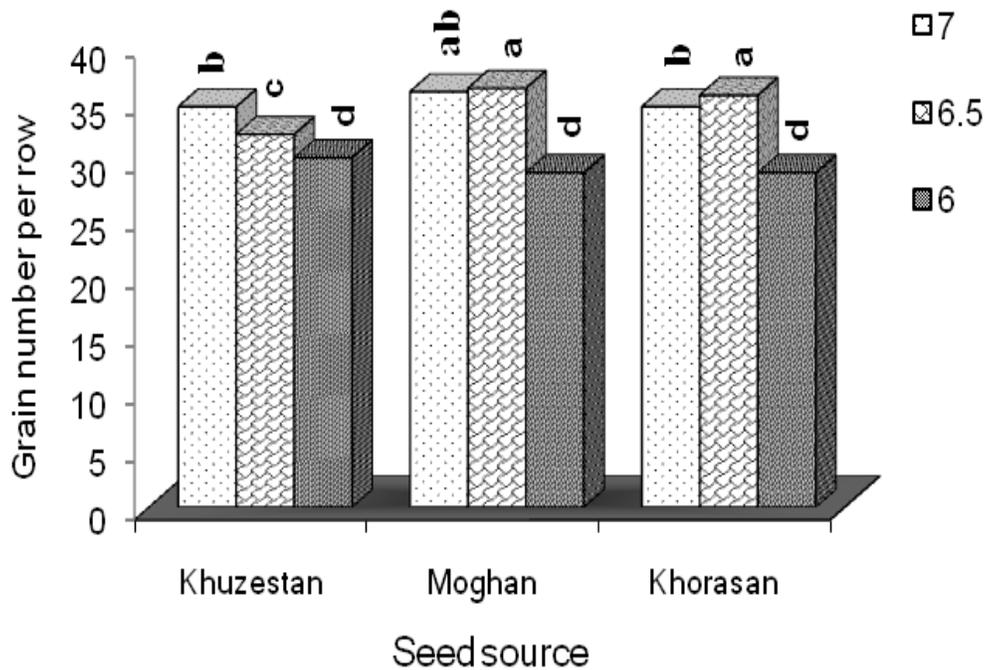


Figure 2. Interaction effects of source and seed size on number of grain per row.

source (6.5 mm in size) has the maximum seed number per row (36.3) and Khorasan seed source (6 mm in size) has the minimum number per row (29.0). From these results, it is deduced that the reason why the seed source factor is not significant regarding the seed number per

row is that the counter cooperative interactions of the regions with the seed size caused the seed size in Khuzestan to change into the proximity of the mean of this region with the mean of the two other regions. Nevertheless, the results obtained by Salim et al. (1985)

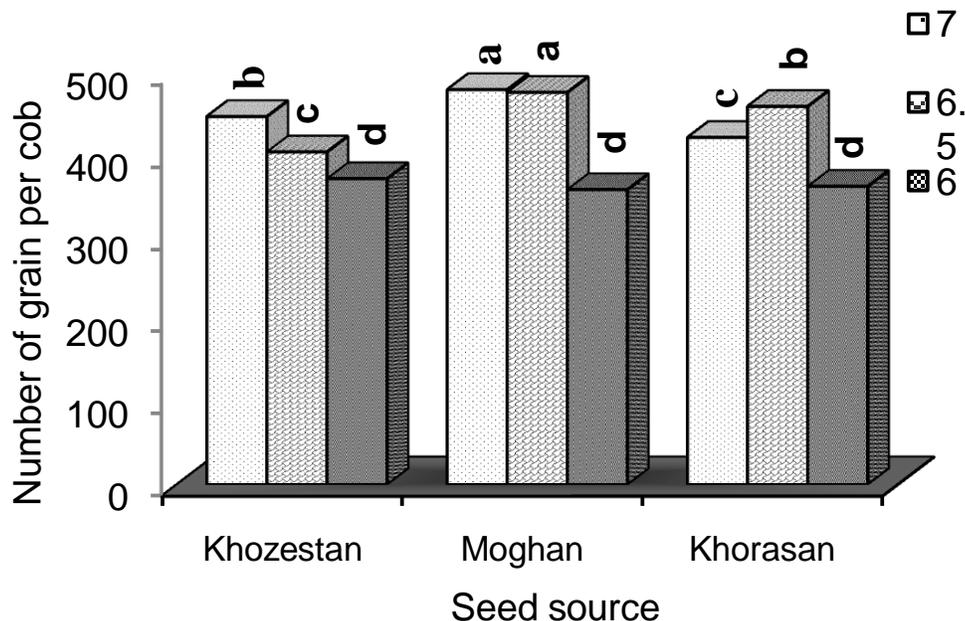


Figure 3. Interaction effects of source and seed size on number of grain per cob.

are similar to the results of this research.

Number of grain per ear

From the results of variance analysis of the number of seed per ear (Table 2), it is concluded that the treatments of the seed source regarding the number of seed per ear had a significant statistic difference in 5% probability level. The treatments of the seed source were located in two different groups and in 5% probability level. The source of Mooghan seed by the mean (437.8) number of seed per ear and the source of Khuzestan seed by the mean (363.8) number of seed per ear had the minimum number of seed per ear (Table 2). By observing Figure 3 which is related to the comparison of the treatment means regarding the number of seed per ear, it is deduced that the source of Mooghan seed (7 mm in seed size) and the mean (479.3) number of seed per ear, and the source of Mooghan seed (6 mm in seed size) and the mean (358) number of seed per ear had the minimum number of seed per ear. This figure indicates that in Khuzestan and Mooghan sources, the number of seed per ear increased by the seed size, but the source of Khorasan seed did not follow this trend.

Lafit and Admiz (1997) also reported that the corn hybrids, because of their affectability from the direct effect of temperature on the number of seed per ear have significant differences. The results of this survey verified the fact that the sources of the seeds which were under examination have many similarities regarding the maturation time of fruiting body and also the reaction to environmental conditions. However, the results obtained

by Salim et al. (1985) are similar to the results of this survey.

One thousand seed weight

The results of variance analysis of one thousand seed weight (Table 2) confirmed the fact that this factor under the effect of the different treatments under investigation showed a significant difference in 1% probability level. From this table, it is deduced that the source of Khorasan seed by one thousand seed weight (333.22 g) and the source of Mooghan seed by one thousand seed weight (313.44 g) had the minimum one thousand seed weight among the sources which were under investigation. In fact, it could be concluded that one of the factors responsible for the difference of seed size regarding the seed yield is the difference of their thousand seed weight. As such, it was observed that the seed with a seed size of 7 mm by one thousand seed weight had the maximum weight of 341.22, while the seed with a seed size of 6 mm by one thousand seed weight had the minimum weight of 296.56. The one thousand seed weight is one of the most important components of the seed weight; according to the results obtained from this experiment, it seems that the one thousand seed weight is affected by the seed size and source.

In each three seed source, the 6 mm seed size had the minimum weight of one thousand seed weight; while the smaller seeds had seed weight. The comparison of Figure 4 shows that the changes in the one thousand seed weight are almost in harmony with the changes in the seed numbers of one thousand seed, but these

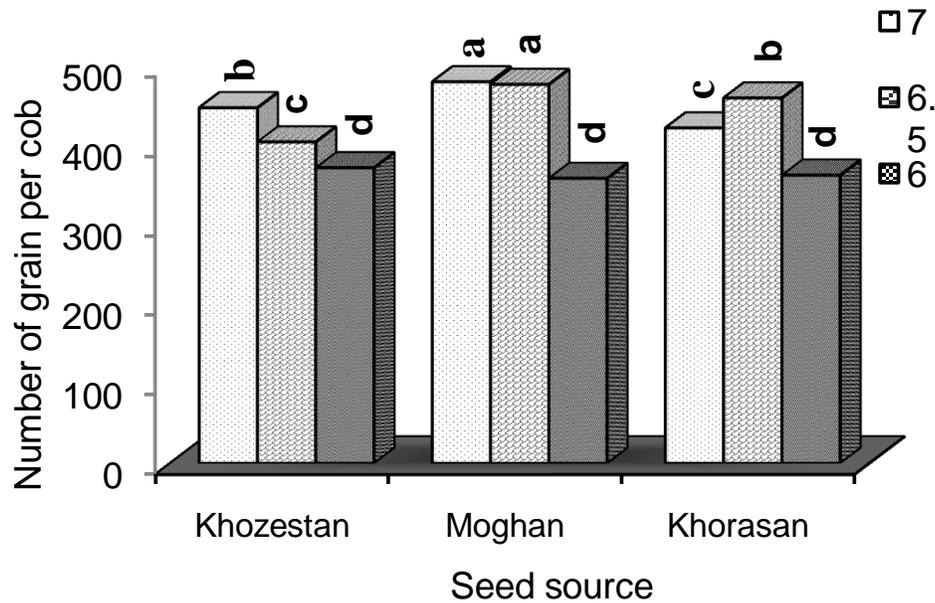


Figure 4. Interaction effects of source and seed size on number of one thousand grain weight.

consistent and significant changes had no significant effect on the yield. The results obtained by Salim et al. (1985) are similar to the results of this research. Figure 1 shows that the changes in the one thousand seed weight are almost in harmony with the changes in the seed numbers of one thousand seed, but these consistent and significant changes did not have any effect on the yield. Figure 1 also shows that in the coarse-textured seeds, no difference was observed for the source they originated from. The seed number per row is high in seeds with an average of 6.5 mm, though the seed number per row increases from Khuzestan seed to Mooghan and from Mooghan to Khorasan. This shows that more severe conditions in the production region of the seed will have more destructive effect on the environmental conditions of the small seeds.

Conclusion

The summarization of the data analysis of this experiment showed that by increasing the seed size, the economic yield increased and the seeds with higher vigor produced stronger seedlings, heightened the establishment speed of the seedling and created a better green covering in the field which finally produced more vigorous plants. So, the seeds with higher vigor increased the seed yield through the aforementioned mechanism. The results of this research showed that by increasing the seed size, the seed yield, the number of seed per ear, the seed number per row and one thousand seed weight increased in different sources, such that the seed yield of Khuzestan seed source (7 mm in seed size) showed a

superiority in its mean (8717.7 kg/ha) as compared to Mooghan and Khorasan source which were 8583.7 and 8344.3 kg/ha respectively. The reason for the superiority of the seeds of Khuzestan seed source could be due to the regional conditions in the growth period of the parent plant during the production of the hybrid seeds that formed the seedlings obtained from the cultivation of these seeds which have better compatibility with the regional condition of the area as a result of the increase in their establishment speed. Finally, due to the fact that they produced more vigorous seedlings, they had better yield in comparison to the two other sources.

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