

The Study of Seed Source on The S.C704 Corn Seedling Characteristics In Laboratory Conditions Using The Cold Test

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Abstract: In order to determine the best source of maize seed production (Hybrid Single Cross 704) and the most suitable seed size and also to determine the relationship between the seed size and foundation and their effect on the mean daily germination, the daily germination speed, Seedling Vigor Index, primary root length and seedling length were performed by three irrigations in 2008 crop year in the agricultural survey center of Safi Abad in Dezful in laboratory conditions using cold test. In this study, the factorial test was used in the form of completely randomized design using 100 seeds by 4 replication. The treatments under study included 2 factors of seed source in Khuzestan, Mooghan and Khorasan and the factor of seed size (6, 6.5, 7 mm) was determined using standard germination test. The results showed that in laboratory conditions, there is a significant difference among the characteristics regarding the sources and different seed sizes. The seedling vigor index became significant under the effect of the seed size and source, so that Khorasan seed source by 6.5 mm seed size and the mean (3267.2) had the maximum seedling vigor index and the source of Khuzestan seed by the size 6 mm and the mean (2151) had the minimum seedling vigor index. The primary root length was also affected by the seed size and source, so that Khorasan seed source by the size (7 mm) and the mean (10.8 mm) had the maximum primary root length and the source of Khuzestan seed by the size 5.5mm and the mean (7.33 mm) had the minimum primary root length. The seedling length had a significant difference by the effect of seed size and source, so that the source of Mooghan seed by the size (6 mm) and the mean (29mm) had the maximum seedling length and the source of Khuzestan seed, by the size 6mm and the mean (14.5) has had the minimum seedling length. Totally, the results show that the seed sources and also the size of the consumed seed affected the measured characteristics in the cold test and shows marked differences from themselves.

Key words: seed size, seed source, seedling vigor index, primary root length, seedling length.

INTRODUCTION

Seed is the most important agricultural resource. The effects on the other sources like fertilizers, irrigation water and herbicides in forming and fertilizing the agricultural plants are determined by this resource. By considering that the seed is the marginal product of the plant reform programs and it could be said that the success of a program specifies the time it's seed is in the hand of farmers and is used by them, every type of abnormality in germination and it's sprouting vigor affects the plant establishment and wastes away the difficulties that the reformers and producers confront. In relation to the seed production, there is a hypothesis that regarding different regional conditions, the source or place of hybrid seed production could have an effect on the quality of the produced seeds. Also, considering the inconsistency of seed germination in corn fields of the province which is observed very much in the field, it seems that the size of the cultivated seeds have a significant importance which must be investigated (Houshi, 1997).

Corn including a share equal to 65-70 percent in the poultry ration combination, the flint corn is considered as the most important energy supply source for the production. The existence of empty capacities in the poultry industry and the high conversion coefficient of the white meat have provided for the production increase. The seed size is one of the most prominent features of the seed and affects the seed growth vigor (Moujnzijah and Nakamoura, 1986). It's 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 a 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 percent of seedlings, the sprouting speed and the extent of seedling placement, the marginal amount of the bush leaves and their performance. The seed size has a central rule in the plant lifetime. The seed size determines the produced seed numbers (marginal

product) partially, which is affected by the complex environmental factors. These factors are effective on the seed size and the effects of seed size on different stages of the plant development have a major role on more biological activities of the plant and its ecological issues (Kaster, *et al.*, 2007).

Hunter, *et al.*, (1984), by an experiment on a cross single maize hybrid by (23 to 39g) variable thousand-kernel weight showed that the seed size has no effect on the product sprouting. Mazum, *et al.*, (1994) made an experiment on the effect of the seed size and shape on the sprouting of the maize seed. In this investigation, by increasing the seed size to 7.5-8.5mm, the seedling germination has been increased and the germination fluctuations have been decreased. So, in order to improve the seedling germination, it has been suggested that the seeds become graded. Hong, *et al.*, (1982) showed that the seed size in different maize hybrids has affected the germination and the plant height hasn't any difference by the large and middle size seed treatment. No significant difference had been observed between large, small and middle size seeds on the seed yield. Wanjura and Buxton(1972) showed that the large seeds has a better germination, but the cultivation of the large seed in the soil depth impedes the germination of these seeds, though the bigger seeds outweigh the small ones. The higher or lower temperature from the optimum during flowering or maturation decreases the seed size (Abd Allah, *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 especial regions is a convincing cause for the environmental factors to affect seed quality and its growth (Delouche, 1980). The centrality of some especial 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 the soybeans produced because 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 factors and the environmental factors after maturation and before harvesting, the drying and storage method of seed. In spite of the technological developments and the agricultural management of the seed, the optimal germination and placement of the produced seedlings have a key rule in agriculture, so that the success or failure in the 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. The environmental conditions of the seedbed usually will cause the seed to confront various tensions like dryness, low temperature, soil or water salinity and many live and dead stresses (Hall, *et al.*, 1990).

The cold test is one of the most common tests which determines the corn seedling vigor index under undesirable regional conditions (Tekrony; *et al.*, 1989a and McDonald, 1975). In the cold test, it is tried to simulate the spring cultivation especially in Europe which has had the humid and cool soil (Bouris and Navratil, 1979). Nigensten in 1985 stated that the cooling test is one of the major available methods in testing the corn seedling vigor and the soil type and humidity had an affect on the germination percentage in the field, but it had no effect on the germination rate. The wet and cold soils especially in medium weather regions in which the seed of agricultural plants is usually cultivated in spring results into the weak seedling establishment of almost all the agricultural plants in the field. The dominant conditions in this time, due to the high soil humidity rate, low soil temperature and the existence of the virulent fungus has was dangerous for the seedling establishment and results into the weak seedling establishment.

The cold test was invented to create conditions similar to the bad conditions of the field and this was done in laboratory in order to determine the seedling vigor which is resulted from the corn seeds in the bad conditions. This test is used in the Northern American Countries and Europe extensively in order to determine the corn seed vigor, soybean and sorghum (Tekrony, 1983; Fergosten 1990 and Hampton, 1992). Various studies in the field of different methods of cold test performance show that there is a close relationship between the results obtained from cooling test and the emergence of corn seedlings in the field. The performance of cooling test is obligatory in Austria in order to testify the corn seed and the performance standards of this test have been determined for the production of the grained and grass corn seed in Austria.

The cold test is one of the oldest tests of the seed vigor which is used in reproduction and corn seed production centers in order to test the vigor of all corn seed masses which annually are sold in northern America and Europe (Isli 1957). Although this test is used extensively, but its performance methods haven't been extended significantly and its related standards have been completed and suggested by (ISTA) and (AOSA) many years ago. In 1983, the guide of the performance of seed vigor test of the full time specialists of the council suggested the use of the especial vessels for cultivation and the cultivation method over the tubular

germination paper and also the seed cultivation over the trays of seed cultivation and the germination paper alternatively. Almost at the time by issuing the guidance of the seed vigor test of the international council of the seed vigor test (1981), the seed cultivation method in the tubular papers were proposed by making some corrections in its performance method. Also the different methods of the performance of cold test by different control laboratories are performed by minor differences regarding the standard method of cold test performance by the council of the full time seed specialists and the international seed testing council (Tao, 1987).

Bouris and Navratil (1979) compared the different methods of cooling performance test which were compared by 9 control and evidence seed laboratories for the corn seed vigor test in USA and have observed significant differences between the cooling test method for a seed mass in different laboratories. They have observed the minimum change coefficient regarding the seed cultivation test on the tray and the germination paper by a thin coverage of the soils on the seeds. Tekeroni (1987) observed many differences in the results obtained from the cold test in order to determine the seed vigor in different control laboratories and seed evidence which used the cultivation method in special boxes. However, more trusted and replicable results of this test were reported by means of the seed cultivation method in the tubular germination paper and the method of seed cultivation on germination paper over the tray.

The council of full time seed specialists in 1990 has made a consideration in the cold performance test and using the alternate cultivation method in the tubular germination paper and the seed cultivation was proposed over the tray or special boxes. In this guidance of the seed vigor performance test, also the method of the application of the two seed cultivation has been described in the tubular germination paper and the cultivation on similar trays by the council of full time specialists. The seed vigor for germination and the emergence of seedling from the cold and wet soil, is affected by the genotype and the seed quality (physical and physiological factors), the virulent factors and the chemical factors with which the seed has been treated. Considering the fact that this experiment shows that the seeds with high germination capacity in the optimal laboratory situation for germination, they haven't enough germination in the field and the number of existing and established seedlings in the field is less due to the emergence of possible undesirable germination conditions and the less primary seedling growth. So, the seed vigor test has a considerable importance in determining the seed quality and so different experiments have been designed to evaluate the seed vigor which totally are divided into two direct and indirect methods.

The direct tests are imitations of the regional field conditions and measure the seed vigor for sprouting under the stressful field conditions and the cooling test is one of the direct tests which is used extensively in order to measure the corn seed vigor. The indirect tests also measure the physiologic characteristics which are related to the seed vigor (Paul and Matius, 1992 and Hupton and Tekerony, 1995). The cold test is the effective index to evaluate the seed vigor and maintenance capability of it (Boursiet, *et al.*, 1969, Beerd and Doulch 1971). Walterz and Belansht (1983) were succeeded in prognosticating the corn seedling emergence amount in an optimal way using the cooling test. The cold test tried to measure the amount of different effects of all these factors. The cold test usually measures the maximum possible seedling emergence of a seed mass which were cultivated under optimal field conditions, while the standard germination test is the highest standard factor and seed mass which is expected and is produced under an extensive wet soil conditions. The cold test has been more accurate and useful in comparison with the standard germination test in order to evaluate the corn seed vigor (Luvato, *et al.*, 2005).

The cold test has been used extensively for several years in order to test the vigor of the corn seeds and sweet corn. The relationship of the cold test and the seedling emergence in a field has a scope of strong to variant relationships which is used by the method for the test performance and the stress exists in the field. Of course, when the seeds are cultivated in the field in very stressful conditions, the sprouting field percentage in these conditions has a very high consistency with the results of the cold test in comparison to the results of the standard germination test in usual conditions. The general principles of the cold tests are used to investigate the corn seed vigor and they could be used successfully in order to test the soybean seed and sorghum vigor and probably the seed of the other agricultural plants (Dehghan Shoar and *et al.*, 2005).

This idea which is the source and the place for hybrid seed production could have an effect on the next yield. In the recent years, it has been proposed in scientific forums that in spite of the need for more investigation, unfortunately there isn't enough sources in this case. This research seeks a proper response to determine the best source of the corn hybrid seed for the consumption in Khuzestan province and has also 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 study has been done in summer 2008 in Safi Abad research center which is located 18 kilometers away from the south of Dezful province in a one year period. This center has been located in the south-west of our country by 82 meters height from the sea level and 32° and 22' northern longitude and 32' in east in the southwest of the country. Generally, all the fields in the southern coasts of our country which their height is less

than 100 meters, have desert climate. Therefore, all the Khuzestan valley to the slope of Lorestan mountains have the characteristics of these climates. This area has really a very hot weather (the maximum absolute registered temperature is 53°C in this region and belongs to Ahwaz). The mean annual precipitation in this area has a very low and sporadic amount. Approximately, all the precipitation is fallen down during winter and there is no precipitation in 7 months of year (Kuchaki, *et al.*, 1995).

This survey was done in the seed control laboratory of Dezful, Safi Abad Research center. In this study, the factorial test was used in the form of fully random pattern by four 100 seeds iterations. According to various experiments which have been done, the best late maturation cultivar, regarding the seed yield is in Khuzestan region in summer cultivation (Hashemi Dezfuli, *et al.*, 1995). Also forage has shown its superiority for the production. This number even has proved the superiority of its yield in stress conditions in comparison to Twc600.Ck647 and Ck720 hybrids (Mannering, 1969). The maternal parent of this hybrid is B73 inbred line hybrid and its MO17 sire. The duration of the growth period of this cultivar is 125 days for seed production and is 95-100 days for grass production (Mori, 2004). In the present study, S.C 704 cultivar has been investigated by three different production seed regions (Khorasan, Moghan and Khuzestan). In order to classify the seeds according to the size, especial sieves which had vents by 6, 6.5 and 7 diameter were used.

In the laboratory, 4, 100 seed iterations were used in order to determine the standard germination test. The samples were placed in plastic boxes with the dimensions 38×9×26 cm in the cultivation room by 76-86 humidity percentages. After cultivation of the seeds on the cultivation trays, the trays were placed in wheeled rows which approximately are 7.5 centimeters away from each other. Then we transferred the trays to a dark room by 10° centigrade temperature and they were maintained there in 7 days. After 7 days, the trays are transferred to a room by 25°C temperature and the lightening alternation of 8-12 daily and are transferred in 4-8 days. Each day the iterations are observed and the seed amounts which have been germinated daily are determined. After 7 days, the number of normal seedlings, un normal and corrupted seeds are determined and 10 seedlings are determined randomly in order to do the measurements of the primary root length and seedling length on them. The obtained data have been used in order to determine the germination Vigor in this way:

The Seedling Vigor Index (SVI):

After determining the normal and abnormal seedlings, 10 seedlings were selected randomly from each mass and after measuring the seedling length, the primary leaves and roots were measured by a ruler (on the basis of centimeter) and the wet and dry weight of the seedling was determined by means of a torsion balance (on the basis of gram) and it was done after drying it in the oven by 75°C in 48 hours). Using these recent data, two seedling vigor indices were determined from this equation:

$SVI_1 = \text{The germination capacity} \times (\text{the mean primary root length} + \text{The mean peduncle length})$

$SVI_2 = \text{The germination capacity} \times \text{The dry weight of the seedling}$

RESULTS AND DISCUSSION

The Index of Seedling Vigor:

The results of variance analysis effect on the seedling vigor index have been indicated in table (1). From this table it is concluded that the different seed source levels regarding the seedling vigor index have a significant statistic difference in 1 percent probability level. The results obtained from the variance analysis of the seedling index in table (2) showed that the seed sizes had different significant statistic differences in 1 percent probability level. The results of variance analysis regarding the cooperative interaction of the seed sources and different treatments of seed sizes had a significant difference regarding the characteristic of the seedling vigor index (table 1) and had a significant statistic difference in 5 percent probability level. As it can be observed in table (2), the maximum seedling vigor index relating to the seed source by the seed size (6.5 mm) and the mean (3261.2) is related to Khorasan seed source by the seed size (6.5 mm) and the mean (3261.2) and the minimum seedling vigor has been related to Khuzestan seed source by 6 mm seed size and the mean (2151).

Table 1: Analysis of variance (mean squares) cold Test and seedling characters in laboratory conditions.

S. O. V	df	Cold Test		
		Seedling Vigor Index	Primary root length	Seedling length
Seed Source (A)	2	989026.02 **	6.34**	23.34**
Seed Size (B)	2	451001.71 **	1.11 ^{ns}	49.07**
Source × Size (A×B)	4	180455.58*	4.93**	54.56**
Error	12	61203.84	0.91	2.75
CV(%)		9.5	10.8	7.6

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

Table 2: Mean comparison interaction effect of cold Test and seedling characters in laboratory conditions.

S. O. V	Cold Test		
	Seedling Vigor Index	Primary root length (mm)	Seedling length (mm)
Khuzestan 7	2402.8 b	7.9 bc	23.4 b
Khuzestan 6.5	2190.5 b	7.33 c	22.1 b
Khuzestan 6	2150 b	8.7 bc	14.5 d
Mooghan 7	3027.4 a	8.3 bc	26.4 a
Mooghan 6.5	2521.8 b	10.6 a	18.8 c
Mooghan 6	2412.6 b	8.2 bc	29 a
Khorasan 7	2949.6 a	10.8 ab	20.7 bc
Khorasan 6.5	3261.2 a	9.5 ab	27.6 a
Khorasan 6	2504.3 b	8.5 bc	21 bc

Mean followed by the same letters in each column are not significantly different by using LSD multiple rang test at %5 probability level. are not significantly different by using LSD multiple rang test at %5 probability level.

The Primary Root Length:

The results of variance analysis of the seedling length have been offered in table (1). From this table, it is concluded that the treatments of the seed source regarding the primary root length had a significant statistic difference in 1 percent probability level. From the results of table (1) it is induced that the size of the seeds which were under investigation showed a significant difference in 1 percent probability level. From the results of table (2), it is deduced that the comparison of the mean treatments of the primary root length, the source of Khorasan seed by the size 7 mm and the mean 10.8mm had the maximum primary root length and Khuzestan seed source by the size 6.5 and the mean (7.333) had the minimum primary root length.

The Seedling Length:

The results of variance analysis of the seedling length have been offered in table (1). From the results of this table, it is deduced that the treatments of the seed source showed a significant difference in 1 percent probability level regarding the seedling length. Also regarding the effect of the seed sizes, the results showed that the effect of seed sizes has been significant on the seedling length. The results of the variance analysis regarding the cooperative interaction of the seeds and different treatments of the seed sizes regarding the length of the seedling characteristic have been mentioned in table (1) and showed that they have had a significant statistic difference in 1 percent probability level. As it could be deduced from table 2 which is related to the comparison of the mean cooperative interaction, the source of Mooghan seed by 6 mm seed size and the mean (29 mm) has had the maximum seedling length and Khuzestan seed source by the size 6 mm and the mean 14.5 had the minimum seedling length. The comparison of the means of different seed indices in Khuzestan and Mooghan follow a similar trend, while the trend changes in Khorasan in most of the characteristics is in contrast with them.

The primary root length in Khorasan increases by the increase in these two tests, but in Khuzestan and Mooghan, this trend is more slower. According to the different temperatures and the temperatures of the seed germination, we could conclude that in the hot regions, the hot stress is resulted. The coarse-textured seeds also have a weaker fetus while in the cold weather, this stress hasn't been more effective and the fetus characteristics are consistent with the seed size to a greater extent.

Conclusion:

Summarizing the results of the laboratory conditions also shows that the origin of the seeds and also the size of the consumed seeds could have an effect on the measured characteristics in the standard germination test and shows marked differences. In many cases, the results which were obtained in laboratory conditions could prognosticate the results of field conditions. In laboratory conditions, the seeds of Khorasan origin have shown their superiority over the two other origins regarding the index characteristic of the seedling vigor in the cold test and this could be due to the proximity of the laboratory temperature condition with the seed production region (Mooghan region).

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