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Investigating of Seedling Green Percent, Seedling Green Rate in the Field and Seedling Emergence Index of New Hybrid Seeds of Corn in Khuzestan Climate

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Abstract: A study, in two agricultural years (2010 and 2011), was conducted in the research field of Ramin University of Agricultur and Natural Resources located 35 km away from Northeastern Ahvaz in order to determine the most suitable seed vigor and new hybrid seedling corn in the field by studying and evaluating the capability of germination, growth rate and seedling emergence index. This experiment was conducted based on a complete randomized block design in a strip- plot arrangement of three replications. In this experiment seeds of hybrid figure at 10 levels, including $V_1$to V_{10} and SC704 as control figure (V_o), and tension at 3 levels, including stopping irrigation turn at eight- leaf stage (S_1), stopping irrigation turn at the stage of male flower emergence (S_2), and compete irrigation (S_3), were studied. Moreover, in this experiment, characteristics such seedling green percentage, seedling growth rate in the field and seedling emergence index were measured. 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 Duncan test. Statistical analysis of the data showed that there was statistically a meaningful difference between hybrids in terms of above- mentioned characteristics, and in different years there was statistically a very meaningful difference between the measured characteristics, and the results obtained in 2011 were better than those obtained in 2010. Between hybrids, as to seedling green percentage, hybrid PL711with an average of 86.71% and hybrid PL710 with an average of 55.65% had the most and the least seedling green percentage respectively. As to the characteristic growth rate in the field, hybrid PL711 with an average of 12.39 seedling per day and hybrid PL710 with an average of 7.96 seedlings per day had the most and the amount of seedlings respectively. Furthermore, like two other characteristics, for seedling emergence index, hybrid PL711 with an average of 87.14 had the most amount and hybrid PL710 with a mean of 59.34 had the least amount. Generally, hybrid PL711enjoyed a higher vigor of seed than other hybrids.

Key words: Corn, Seedling green percentage, seedling green rate, seedling emergence index.

INTRODUCTION

Nutritional and economical importance of corn requires us to evaluate any strategy to optimize the production system of this crop in the country. It seems that producing and introducing high- yield figures requiring low irrigation and also early-yielding figures among agricultural crops is one of the effective strategies that when integrated with other water- deficit management methods can minimize the effect of this phenomenon. In the past, success in the programs for plant breeding was limited because of the limitation of selection methods and information about how agricultural crops resist a tension. Because of significant losses resulting from environmental tensions (heat, cold, dryness, salinity, etc.) that have been inflicted on agricultural crops including cereals, the investigation of agricultural plants responses to environmental tensions has been considered very much in recent years. Accordingly, the seeds performance and its endurance in various regions where there are environmental tensions have always been used as crucial criteria in selecting and introducing figures.

Given the entrance of single cross figure 704 of the country dates back to 1967 and it is a late-yielding figure (a 125-day growth period), it is not suitable for being used in those parts of the country, especially Khuzestan, where corn is cultivated. In parts of the country such as Fars, Khuzestan and Kermanshah Provinces where have a high capacity for developing corn cultivation, this crop is regarded as the second cultivation and is cultivated in alternation with strategic planting of wheat. In case in these regions late- yielding corn figures such as single cross 704 is used, as the period of growth becomes longer, the cultivation of the crop that is planted after corn is delayed. By the way, cultivation earlier than the suggested date cant remove this problem because in earlier cultivation, plants generative stages face heat tension and corns fecundation and pollination will be

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disrupted. Therefore, identifying high- yield figures and middle-yielding figures that are inclined to early-yielding ones (more early- yielding than 704) can minimize the effect of such phenomenon.

In order to select genotype based on the seeds performance, different indices have been suggested. In recent years, the increase in the potential of the seeds performance of new figures has been obtained by increasing harvest index (Araus *et al*., 2001; Richards *et al*., 2001). Austin *et al* (1980) believes that by selecting through harvest index, the seeds performance can be increased up to 20 percent. He reported that harvest index of cereals may increase by about 60 percent. Despite the advance obtained in technology and agronomy management, seed, germination, and desirable establishment of resultant seedlings have still a key importance in agriculture such that success or failure in production depends on quick and complete germination of seeds and production of strong seedlings. The most establishment of seedling is achieved when seed is able to overcome undesirable conditions and exhibit a proper response. Undoubtedly, such a response is variable depending on the kind of genotype and environment. Environmental conditions of seeds bed usually cause seed to face various tensions such as dryness, temperature, water or soil salinity and many other animate or inanimate tensions (Hall *et al*., 1990) from the beginning of planting till the stage of emerging on the surface of the soil.

There is genetic variation in the figures of agricultural plants such as corn, and different genotypes show different responses to tensions (Caker, 2004). Bad effects resulting from water deficit on growth and performance of corn depend on the time of occurrence and intensity of tension, growth stage and genotype of the plant. The results from some studies show that water deficit in developmental growth period has less effect on final performance of corn compared with water deficit at blooming and grains getting filled stages (Denmead and shaw, 1960). Osborne *et al*.(2002) reported that water deficit tension at pre-blooming and post –blooming stages decreases corn performance 25% and 50% compared with control plants. Water deficit at blooming and pollination stages causes performance to decrease intensively through abnormal growth of embryo sac, sterilization of pollen grain and, finally, reduction in fertile grains (Denmead and Shaw, 1999). Moreover, researchers emphasize the importance of supplying enough water during the stage of developmental growth of corn. They believe that although water deficit at developmental growth stage has less effect on final performance compared with water deficit at blooming and grains getting filled stages, since it affects leaf expansion and stalk development and decreases substances accumulation in these organs intensively, it is important (Classen and Show, 1970) because in dryness tension condition, generative growth of plant is more dependent on the supplies of the leaves and stalk and the lack of proper formation of grain can be due to the inadequacy of available photosynthetic substances at the time of pollination and granis getting filled or/ and before that.

It seems that producing and introducing high- yield figures requiring low irrigation and also early – yielding figures among agricultural crops is one of the effective strategies that when integrated with other water- deficit management methods can minimize the effect of this phenomenon (AghaeeSarbarzeh *et al*., 2004; AghaeeSarbarzeh and Rostaee, 2008; Tritwan and Reynolds, 2007). In the past, success in the programs for plant breeding was limited because of the limitation of selection methods and information about how agricultural crops resist a tension. Because of significant losses resulting from environmental tensions (heat, cold, dryness, salinity, etc.) that have been inflicted on agricultural crops including cereals, the investigation of agricultural plants responses to environmental tensions has been considered very much in recent years (Christianson and Lewis, 1982; Blum, 1988; Passiora, 2007). Accordingly, the seeds performance and its endurance in various regions where there are environmental tensions have always been used as crucial criteria in selecting and introduction figures (Trethowan and Reynolds, 2007).

Edmeads *et al* (1999) reported that season dryness is one of the factors that limits the development and production of corn in the world such that it averagely reduces 17% of annual performance of flint corn in the world, and in some years, for some regions a performance reduction of 70 percent resulting from dryness has been reported. Water deficit at blooming and pollination stages leads to intensive decrease in performance through abnormal growth of ambryo sac, sterilization of pollen grain and, finally, reduction in the number of fertile grains (Denmed and Shaw, 1999). According to Nesmith and Ritchie (1992), the stage before pollination was the most sensitive stage to moisture deficit for flint corn. Finding genotypes that enjoy a good performance in both tension and non-tension environments seems complicated because of existing a meaningful interaction between genotype and environment (Biswas *et al*., 2001). After studying the effects of moisture tension on corn, Hugh and Davis (2003) stated that moderate and intensive tensions reduced the seeds performance 63% and 85% respectively in 2000 and 13% and 26% respectively in 2001.

Tekrony and Egli (1977) observed that final germination percentage of soybeen seeds has correlation with the degree of emergence of seedlings in the field only in desirable conditions of the field. Means wile Burris *et al*., (1969) reported the number of seeds germinated four days after standard germination experiment (initial counting) as a desirable laboratory index for evaluating seedling emergence in soybean field. Thus, increasing the performance of corn involves the identification of appropriate management methods including selecting the proper figure which is resistant to tensions and applying proper irrigation regimes. The present study tries to

seek a suitable solution to determine the best hybrid figure of corn to be cultivated in the fields of Khuzestan Province in order to be able to increase, based on obtained results, the performance of the fields of the province.

MATERIALS AND METHODS

This experiment was conducted in the research field of Ramin University of Agriculture and Natural Resources located 35km away from Northeastern Ahvaz for two years (summers 2010 and 2011). This place is located 20 m above the sea. The place of this experiment is situated in 31°36' north latitude and 48°50' east longitude. The average of maximum annual temperature is 44.2°C in July and the average of its minimum is 5.3°C in January. Also the average of annual rainfall is 264 mm. soil texture of the field of this university is mostly silty. Clam- loam that according to international classification belongs to acetic hyperthermic series with an average acidity of 7.6. It is worth noting that these factors are measured accurately and reported before starting the experiment. Generally all of south country coast lands that their height is less than 100 meter, including desert climate. So whole of khouzestan plain to lorestan's mountain slope have this climate figures. Heat in all of this area is severe (stable maximum temperature in this area is 53 and related to Ahvaz) rain mean annually in this area is of low amount and doesn't in order now. Almost all of raining is in winter and 7 months of year doesn't have raining (Kochakee *et al*, 2005).

Field experiment was conducted based on a complete randomized block design in a strip- plot arrangement of three replication on a land with dimension 81×90m. The land was allocated to cultivating wheat in the season before performing experiment. In this experiment seeds of hybrid figure were considered at 10 levels including V_1 to V_{10} and fugure SC 704 was regarded as control figure (V_0); furthermore, tension was studied at three levels including stopping irrigation turn at eight- leaf stage (S_1) stopping irrigation turn at the stage of male flower emergence (S_2) and complete irrigation (S_3). Each experimental plot was considered to consist of five-meter strips each of which was 75cm distant from the other.

Thus the dimension of each plot was 5×3 with an area of 15 M^2. The two middle strips were harvested for measuring final performance. Between plots three non-planting strips (2.25m) were considered and the distance between blocks was 3m, as shown in the figure. Regarding the 75cm distance between planting strips and the density of 76000 bushes per hectare, the distance of each bush from the other was considered to be 17.5cm. seeds were planted with hand based on the intended distance in the form of hill cultivation with two seeds on each hill. To determine physical and chemical soil characteristics, after choosing the place of test operation from testing soil before any land preparing operations by Oger sampling from 0-30 cm land depth from 10 point randomly, the sampling was performed. Obtained results of soil deposition in soil laboratory are expressed in table 1.

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

EC (m mho/cm)	pH	Total N (%)	P (mg/kg)	K (mg/kg)	OC (%)	Soil Tissue
2.1	7.6	0.06	9.3	182	0.82	Clay Loam

In order to determine the statues of field sprouting, the seeds were noted by of new hybrid seeds of corn in Khuzestan climate in the field regarding the date of the first irrigation as the cultivation time of the number of emerging seedlings within 7 days after the emergence of the first seedling in the field. In the beginning of seedling formation, in order to determine the germination percentage, the germination rate and evaluating the seed vigor and the way of seedling establishment. All the data were registered and maintained for statistical analysis. 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 Duncan test.

RESULTS AND DISCUSSION

Despite the advance obtained in technology and agronomy management, seed, germination, and desirable establishment of resultant seedlings have still a key importance in agriculture such that success or failure in production depends on quick and complete germination of seed and production of strong seedlings. The most establishment of seedling is achieved when seed is able to overcome undesirable conditions and exhibit a proper response. Undoubtedly, such a response is variable depending on the kind of genotype and environment. Environmental conditions of seeds bed usually cause seed to face various tensions such as dryness, temperature, water or soil salinity and many other or inanimate tensions (Hall *et al*., 1990).

The Seedling Green Percentage:

The results from variance analysis (table 2) show that green percentage of seedling is affected by the type of hybrid and year, and the interaction between hybrid and tension is meaningful at one-percent – possibility level;

however, the effect of tension on seedling green percentage characteristic is not meaningful. Table (3) indicates that out of hybrids, as to seedling green percentage, hybrid (PL711)with an average of 86.71% and hybrid (PL710) with an average of 55.65% have the most and the least seedling green percentage respectively. The results of this experiment are consistent with the results obtained by Grawn (1990), Galsis (1993), Kurdikri, et. al (1998) and Shirin, *et al* (2008), but are in contrast with the results obtained by Hunter and Kannenberg (1972).

Table 2: Analysis of variance (mean squares) green percent, seedling green rate and seedling emergence index.

S. O. V	df	Emreg Prcentage	Emreg Rate	Seedling Vigour Index
Year	1	386.8490 **	7.8840 **	944.6412 **
Error	4	5.3397	0.1092	6.3183
S	2	759.9984 ns	15.5085 ns	866.0107 ns
Year × S	8	17.1463 ns	0.3704 ns	22.0235 ns
Error $_b$	10	334.3900	6.8234	375.3863
Hybrid	10	1473.5066 **	30.0941 **	1378.6971 **
Year×Hybrid	40	11.8704 ns	2.2430 ns	14.8361 ns
Error$_c$	20	132.7219	2.7108	147.3728
Hybrid × S	20	388.1733**	7.9177 **	432.8778 **
Year×Hybrid×S	80	5.2411 ns	0.1068 ns	6.0428 ns
Error	198	132.2850	2.7012	147.4141
CV	-	16.76	16.77	16.76
ns: non significant, * , **: respectively significant ($p\leq0.05$) and highly significant ($p\leq0.01$)				

Table 3: Mean comparison of green percent, seedling green rate and seedling emergence index.

Treatment	Emreg Prcentage (%)	Emreg Rate (seedling per day)	Seedling Vigour Index
Year			
2010	67.22 b	9.60 b	70.28 b
2011	70.02 a	10.01 a	74.64 a
Water Stress			
1	66.53 a	9.50 a	70.30 a
2	66.80 a	9.54 a	70.43 a
3	72.54 a	10.36 a	76.64 a
Hybrid			
Mobin	67.95 bc	9.71 bc	74.28 bc
07-107	73.98 b	10.57 b	79.59 ab
PL706	68.95 bc	9.85 bc	71.46 bc
07-103	70.24 bc	10.03 bc	74.75 bc
PL710	55.75 d	7.96 d	59.34 d
Karon	63.38 bc	9.34 bc	68.48 c
AS71	73.60 d	10.52 b	75.54 bc
PL711	86.71 a	12.39 a	87.14 a
07-101	63.69 c	9.10 c	68.50 c
S.C 704	63.24 c	9.03 bc	65.87 c
PL774	74.20 b	10.60	80.24 ab
Means followed by the same letters in each column are not significantly different when Duncan multiple range test at 5% probability level is used.			

The Seedling Green Rate in the Field:

From the results obtained from variance analysis of seedling growth rate table (2) was provided, according to which it could be concluded that there wasn't a meaningful difference among dryness tension treatments in terms of growth rate. However the most growth rate with an average of 10.36 seedlings per day and the least growth rate with a mean of 9.50 seedlings per day were related to non- tension treatment and the tension at eight-leaf stage respectively. Statistically, hybrids studied in terms of growth rate were meaningfully different at 1% possibility level. As to growth rate trait in the field, hybrid (PL711) with a mean of 12.39 and hybrid (PL710) with an average of 7.96 had the most and the least rates respectively (table 3). Moreover, the interaction between under study hybrids and year was not meaningfully different; however, the interaction between hybrid and tension was meaningful at 1% possibility level (table 2). The results obtained by Tekerony and Egli (1991) and Hmidi *et al*. (2005) have verified the results of this research and are in contrast with the results obtained by Hunter and Kanberg (1972 and 1994).

The Index of Seedling Emergence:

There wasn't statistically a meaningful difference among dryness tension treatments in terms of the index of seedling emergence (table 2). Under study hybrids, in terms of the index of seedling emergence, exhibited a meaningful difference at 1% possibility level (table 2). Furthermore, as with two other traits, for the index of seedling emergence hybrid (PL711) with an average of 84.14 and hybrid (PL710) with an average of 59.34 had the most and the least amounts respectively (table 3). In general, under study hybrids were statistically at 1%

possibility level and in four different groups. According to table (2) of variance analysis the triplet interactions of year, hybrid and dryness tension didn't exhibit a meaningful different statistically. The results obtained by Kouchaki *et al*. (2005) also verify this experiment.

Conclusion:

The results obtained from the analysis of this experiments data showed that as the seed vigor increases, economical performance increases as well; Moreover, seeds with a higher vigor lead to the production of stronger seedlings, higher rate of establishment of seedling, and a better green cover in the field that finally result in the creation of stronger plants. Thus, seeds with a higher vigor cause the performance of seeds to increase through the above- mentioned mechanism. Also, the results from this experiment indicated that seedling green percentage, seedling growth rate, and the index of seedling emergence in hybrid (PL711) excelled other hybrids, meaning hybrid (PL711) took advantage of a stronger seed vigor than other hybrids.

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