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GERMINATION ECOLOGY OF SOME NEW HYBRIDS OF CORN AND SUNFLOWER

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ABSTRACT

Germinations of two new hybrids of each of two crop species namely corn (*Zea mays* L.) and sunflower (*Helianthus annuus* L.) was studied. The test hybrid varieties of corn were Opener and 919, and that of sunflower were DK40404 and SF187. In both the test species there was a significant difference in percentage germination between the test varieties. Effect of temperature on germination was also significant for both the varieties of each of the two test crop species. In corn var. Opener germination ranged from 87–90.7% at alternating temperature of 10 and 25 ºC as compared to 91–96 % at constant temperature of 25 ºC while in var. 919 germination ranged from 88–93% at alternating temperature and 93–96 % at constant temperature of 25 ºC. Similarly in sunflower var. DK4040 germination ranged from 85–88% at alternating as compared to 87–92 % at constant temperature and in var. SF187 ranged from 87–90% at alternating and 89–95 % at constant temperature of 25 ºC.

Key words: New hybrids, corn, sunflower, germination, temperature.

INTRODUCTION

Sunflower (*Helianthus annuus* L.) is an important edible oil crop, ranking next to soybean. Its seeds contain high oil content ranging from 40-50% and are rich in protein (23%). The oil quality is also good due to higher percentage of linoleic acid and low percentage of linolenic acid, which is the most desirable character (Khan *et al*. 1999). It is a short duration and drought tolerant crop having a wide range of adaptability. It can be grown successfully twice a year as spring and autumn crop under our agro-climatic conditions, both in irrigated and rainfed areas. It is grown on 0.109833 m ha annually with production potential of 0.131657 million tones and average yield of 1199 kg ha^{-1} (Anonymous, 2004). (*Zea mays* L.) is an important multipurpose crop of Pakistan. It is grown on 0.9355 m ha annually with production potential of 1.7371 million tones and average yield of 1857 kg ha^{-1} (Anonymous, 2004).To meet the requirements of ever increasing population of the country it is imperative to regularly introduce new varieties of these crops with high quantitative and qualitative characteristics.

Seed viability refers to the percentage of seeds in the lot that are capable of germinating and developing into a normal seedling under optimal conditions. Germination has been defined in the physiological sense that when the embryo has protruded from the covering tissues, germination has ended and seedling growth has begun. For seed testing purposes, however, germination is not accomplished until the seedling has developed to the point that it can be judged to be normal according to specific criteria for each species (AOSA, 1992). This is because the intent of seed testing is to give some indication of how the seeds will perform as propagules in the field. On the other hand, in order to achieve consistency and uniformity, the conditions for seed testing are generally optimized to give the maximum potential germination, rather than trying to simulate field conditions, although the two are generally highly correlated. Seed viability tests are run under the conditions that are most conducive to germination of a particular species. Variables that can be altered include the substrate (paper towels, blotters, sand, etc.), the test temperature, constant versus alternating temperatures, light, nitrate, pre-chilling, and other procedures to break dormancy and reveal the potential viability of the lot. A standard test utilizes 400 seeds in four or more replicates, and each seedling is evaluated according to criteria specific for the species as to whether it has developed critical organs viz.root tip, shoot tip, cotyledons, intact hypocotyls, etc. (AOSA, 1992). If so, it is called a normal seedling. If it is deficient in some way and does not meet the criteria for a normal seedling, it is an abnormal seedling, or if no germination occurred at all, is dead. Common abnormalities include stunted roots, failure of meristems to grow, curling of hypocotyls, unusual geotropic growth, and necrotic lesions.

Corn is generally cultivated in January-February and in July-August in Punjab. Similarly sunflower is also cultivated twice in a year i.e. in January-February and in August-September. There is much difference in temperature between the two growing seasons. The present study was, therefore, designed to evaluate the viability of two new hybrid varieties of each of corn viz. Opener and 919, and sunflower viz. DK40404 and SF187 at constant temperature of 25 ºC and at alternating temperature of 10 & 25 ºC.

Table 1. ANOVA for effect of temperature on germination of two new corn hybrids.

Sources of variation	df	SS	MS	F values
Treatments	27	682	25	4.05**
Variety (V)	1	69	69	11.0**
Temperature (T)	1	403	403	65***
Sample (S)	6	152	25	4.07**
V × T	1	19	19	3.05ns
V × S	6	15.9	2.65	0.42ns
T × S	6	8.28	1.38	0.22ns
V × T× S	6	15	2.49	0.39ns
Error	56	349	6.23	
Total	84	712744		

, *, significant at P≤0.01 and P≤0.001, respectively; **ns:** non-significant

Table 2. ANOVA for effect of temperature on germination of two new sunflower hybrids.

Sources of variation	df	SS	MS	F values
Treatments	27	476	17.62	1.64*
Variety (V)	1	72	72.4	6.8**
Temperature (T)	1	254	254	24***
Sample (S)	6	47.6	7.937	0.74ns
V × T	1	0.048	0.047	0.004ns
V × S	6	93.9	15.6	1.46ns
T × S	6	3.2	0.54	0.05ns
V × T× S	6	4.9	0.82	0.077ns
Error	56	600	10.71	
Total	84	666796		

*, **, ***, significant at P≤0.05 P≤0.01 and P≤0.001, respectively; **ns:** non-significant

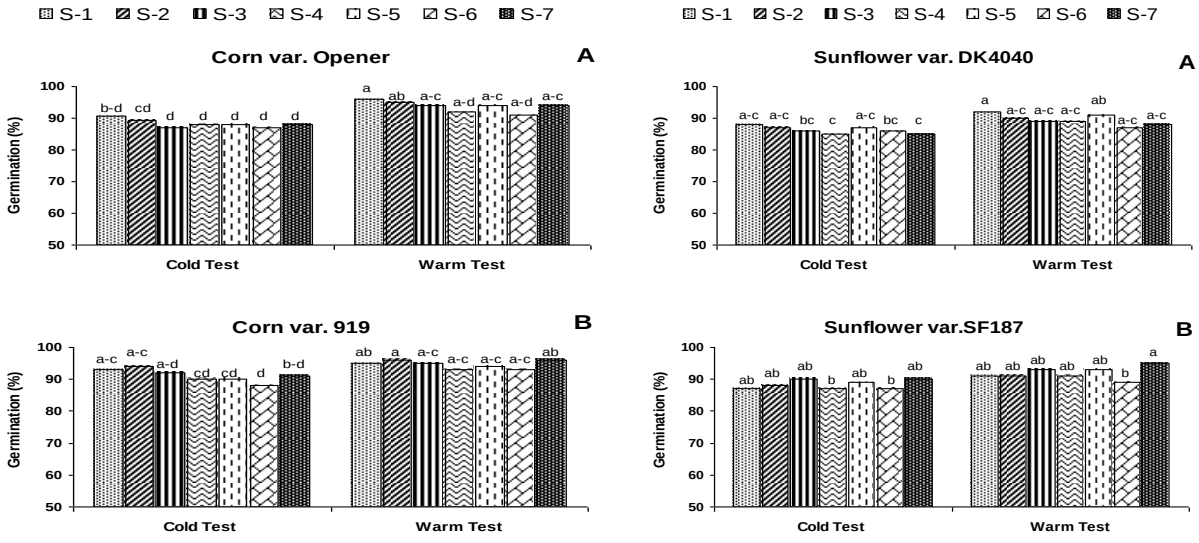

Fig. 1. Germination of different sample (S-1 to S-7) of two new corn hybrids in cold (10 ºC) and warm (25 ºC) tests. Values with different letters show significant difference as determined by Duncan's Multiple Range Test.
Fig. 2. Germination of different sample (S-1 to S-7) of two new sunflower hybrids in cold (10 ºC) and warm (25 ºC) tests. Values with different letters show significant difference as determined by Duncan's Multiple Range Test.

MATERIALS AND METHODS

Seeds of each of the two varieties of sunflower and corn were randomly selected and 50 seeds of each sample were placed on absorbent paper with 3 cm inter-seed distance. The seeds were covered with another sheet and folded in the edges to prevent the seeds from falling out. The papers were rolled loosely towards the end and were put in tray in upright position. The paper was kept moist with sterilized water in tray. The trays were incubated at 10 and 25 ºC in germination cabinets. Each treatment was replicated thrice. The seeds which were initially kept at 10 ºC, were transferred to 25 ºC after a cold stress of 7 days. Germination data were recorded after 12 days of incubation. All the data were analyzed by analysis of variance and means were separated by applying Duncan's Multiple Range Test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Germination of corn:

There was a significant difference in germination of the two test hybrids. The difference in germination percentage among the different samples of the two varieties was also significant. However, the interactive effect between and among the variables was insignificant (Table 1). The variety 919 exhibited comparatively better germination percentage as compared to variety Opener (Fig. 1A & B). Effect of temperature on germination was also significant. In both the test varieties germination was higher at 25 ºC as compared to at 10 ºC. In var. Opener germination ranged from 87–90.7% at 10 ºC as compared to 91–96 % at 25 ºC (Fig. 1A). In var. 919 germination ranged from 88–93% at 10 ºC and 93–96 % at 25 ºC (Fig. 1B). Effect of temperature on seed germination have been reported in many other plant species also. Recently Baes and Aréchiga (2007) have reported that seeds of *Trichocereus terscheckii* germinate within a range from 15 to 35 °C with maximum germination at 20-25 °C and no germination at 10 °C. Sánchez et al. (2006) found that the final germination and germination speed of *Juncus acutus* were affected by light, temperature and their interaction. Although this species was able to germinate at 10 °C (30%), high temperatures from 20 to 30 °C and alternating temperatures of 15:25 and 20:30 °C yielded germination percentages higher than 90%.

Germination of sunflower:

Data presented in Table 2 indicates that there was a significant difference in germination percentage between the sunflower varieties. However, in contrast to germination of corn, the difference among the samples was insignificant. Among the two test varieties, germination was comparatively better in SF187 than in DK4040 (Fig. 2A&B). The effect of temperature on germination was also significant (Table 2). . In var. DK4040 germination ranged from 85–88% at 10 ºC as compared to 87–92 % at 25 ºC (Fig. 2A). In var. SF187 germination ranged from 87–90% at 10 ºC and 89–95 % at 25 ºC (Fig. 2B).

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