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Investigating the Reaction of Corn Hybrids against Moisture Stress

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ABSTRACT

For investigating the effect of dryness stress on performance of grain 20 of corn hybrid in condition of stress and without stress, a test has been performed in a research farm of modifying and preparing sapling and seed in Karaj in 2005 and this test includes four stages of normal irrigation, stress in the growth stage, stress in production stage and every other stress in the pattern of random blocks design with three times repetition. In each of four tests about attributes, number of days to budding, weight of 1000 grains, length of pollination, grain performance, number of grains in a row and number of grain row have been measured. Separation of variance and comparisons of averages showed that among hybrids, in each of four tests, there is a considerable variety in most of attributes. Also, among twenty hybrids under study, hybrids KLM76005/7-1-2-1-1-1 X K19/1 and KSC 704 in test of growth stress and hybrids ZP 677, ZP 684 and KLM 76005/7-1-2-1-1-1 X K19/1 in test of production stress and hybrids KLM 76005/7-1-2-1-1-1 X K19/1, KSC 720 and KSC 704 in test of general stress are considered as the best hybrids and the hybrid KLM 76005/7-1-2-1-1-1 X K19/1 is identified as the suffered hybrid in each of four tests such as growth stress, production stress, general stress and without stress.
KEYWORDS: corn hybrids, dryness stress

INTRODUCTION

Dryness stress is the most important restricting factor playing a role in reducing agricultural plants in a way that average performance reduction of corn because of dryness is 17% in the world and even in some years, it is up to 70 %(Zeidi et al., 2004).[10]

Geliz et al. (1995) [9] have investigated fourteen lines of corn in a test of plot split with two moisture cares for studying water stress. In dryness stress, reduction in plant biomass and performance has been observed. Performance reduction is mainly due to reduction in corn size. There is any change in number of corns. Reduction in corn weight due to reduction in number of grain is reported. Emam and Ranjbar (2001)[1] have performed a test in order to investigate the effect of bush density and dryness stress in growth stage on performance and elements of performance and efficiency of using water in grain corn and the results showed that dryness stress caused to decrease dry weight, cover of corn and diameter of corn significantly and it also reduces final performance of grain in an area unit. In stage of growth stress, with providing water on time for the plant or flowering stage, the lowest negative effect on performance has been observed in comparison with other stress steps. It means that when the plant is in the most sensitive stage of need (flowering stage, going to seed), the water was provided for plant. Jafari and Ahmadi (2005) [2] investigated the effect of dryness stress in three steps i.e. before flowering, during flowering and when corn grains are complete and they concluded that dryness stress in each of these steps caused to decrease corn performance significantly and from these, stress in flowering step

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has the highest loss on grain performance leading to 42% reduction in plant performance. Stress in the step of complete grains (full grains) caused to reduce 15.8% and in the step before flowering caused to reduce 12.5% in performance.

Another important factor in increasing corn performance is appropriate temperature of pollination and in growth stress test, faster and more complete inoculation has been achieved because of more appropriate temperature of pollination (Edmeads et al., 1990)[7].

Campose et.al (2004)[6] believed that corn is more sensitive to dryness during flowering, growth of cream and pollination. They reported that performance under stress conditions in flowering step strongly correlated with number of grain in each corn (r>0.68).

Ahmadi et al. (2001)[2] have performed a test under three irrigation systems in order to investigate resistance against dryness in commercial fall hybrids for grained corn and the results showed that there is a considerable variety among hybrids with respect to growth attributes, growth steps, performance and their elements and among some of attributes, these is a significant difference in a way that most of attributes under study have a negative reaction against stress conditions and the highest effect was on performance of grain and strong reduction in number of grains in a row, length of corn and weight of five hundreds grain. Farrel et al. (2006) [8] have performed a test for investigating competitive reaction of corn and sorghum with respect to lack of water in Mediterranean area. They reported that growth of suffered plants to dryness is because they can maintain water in areas which have limited irrigation source. In these tests, reproduction of corn under normal conditions is higher than sorghum. In addition, in the world, dryness stress, harvest index and water consumption efficiency is higher in sorghum than corn. As a result, in dry areas, sorghum can be a good substitution of corn.

Most of tests performed for modifying hybrid suffered from dryness are normally with and without stress. Most of physiological elements suffered from dryness are multi-genic. Increasing inherent power of plants which had an optimal performance under physiological stresses conditions due to lack of water are among the goals of plant modifying (Campose et al. 2004)[6]. According to importance of cultivation of corn in the country and growing trend of its plantation and programs of increasing grained corn, this paper makes it possible to access suffered lines of dryness in order to produce fruitful hybrids and suffered to dryness. So it will be possible to develop its growth.

Material and methods

This test has been performed in 2008 in a four-hundred-hectare farm of research association of modifying and preparing sapling and seed of Karaj. Twenty corn hybrids in three separate tests in normal irrigation condition, stress in growth stage, stress in production stage and every other stress have been investigated each of which is in the pattern of random blocks design with three times repetition. Land under study was fallow last year and in autumn, it has been under semi-deep plough. In the early of spring, a heavy disk has been done and then the land has been flattened by trowel. Phosphate ammonium fertilizers with amount of 300 kg per hectare and urea with amount of 200 kg per hectare have been consumed. Simultaneous with fertilizing, Aradikan toxin with amount of 6 liters per hectare has been used in order to prevent weeds. Then a light disk with depth of 5 to 10 cm has been done for mixing fertilizer and toxin with soil. Each line in each turn in a row containing twenty pans with a distance of 20 cm and each turn with three repetitions have been cultivated. In each pan, three seeds are implanted and after budding and ensuring that bushes are green, additional bushes including bushes with a weak appearance are eliminated and in each pan, a bush is maintained. 200 kg of urea per hectare has been consumed in the stage of being five-leaf bushes in the form of peep.

1- Date of plantation and the first irrigation 28/4/2006

2- Every other stress in a week - nest week stress after irrigation till finishing the harvest.

3- Production stress, cutting irrigation before appearing the tassel 19/8/2006 till finishing the harvest.

4- Growth stress after the plant is 20 cm in 10/6/2006 till appearing sexual organs of female and male - date: 10/80/2006.

Number of hybrid	Name of hybrid
1	KSC 704
2	KSC 700
3	KSC 720
4	20 NSX K 19
5	KLM 76002/4-2-1-2-1-1 X K 19/1
6	20 NS X K 19/1
7	K 47/2-2-1-2-1-1-1 X K 19/1
8	KLM 76005/7-1-2-1-1-1 X K 19/1
9	K 47/2-2-1-2-3-1-1 X K 19/1
10	K 74/1 X MO17
11	KLM 75010/4-4-1-2-1-1 X MO17
12	KLM 75010/4-4-1-2-1-1 X B73
13	BC 666
14	BC 678
15	ZP 677
16	ZP 684
17	G- 3393
18	NS 540
19	G- 3261
20	G-72019

After that, irrigation has been performed normally.

In test of optimal irrigation conditions, irrigation has been performed every 10 days based on appearance need of plant. In test of growth stress, the irrigation from the early of plant growth stage to the appearance of garland has been stopped and after that, irrigation will be continued optimally. In test of production stage stress, irrigation from time of appearing garland till ending pollination has been stopped and after that, irrigation was normally done and in every other irrigation, this was done related to witness group. During growth season and after harvesting from attributes such as number of days to budding, weight of one thousand grains, length of pollination, grain performance, number of grains in a row, number of grain row, diameter of corn, ASI and grain performance have been measured. Comparison of average for all hybrids with form of small grain has been performed in level of probability 5%. Software such as SPSS and Minitab are used for statistical calculations.

RESULTS

- The results of variance separation on all attributes under study in each of four normal irrigation conditions, stress in growth stage, and stress in production stage and every other irrigation are presented in table 1.

As seen here, in normal irrigation conditions, attributes such as number of days to budding, weight of one thousand grains, number of corn row grains, ASI and grain performance (Tone per hectare) are significantly different in level of 0.05 and 0.01.

In conditions of growth stress test, number of days to budding, weight of one thousand grains, number of corn row grains, diameter of corn, length of pollination, ASI and grain performance (Tone per hectare) are significantly different in level of 0.05 and 0.01 and in production stress test, number of days to budding, weight of one thousand grains, number of corn row grains, diameter of corn, length of pollination, ASI and grain performance (Tone per hectare) are significantly different in level of 0.05 and 0.01.

In every other irrigation test, number of days to budding, ASI and grain performance (Tone per hectare) are significantly different in level of 0.05 and 0.01 in 14% of moisture.

It should be noted that in this table, information about CV, the minimum averages and the maximum averages are presented.

Comparison of means among all hybrids with method of Dankan (small grain) has been performed in level of 5% of probability (Tables 2, 3, 4, 5). As observed, in normal test of attribute for number of days to budding for hybrid G-3261, weight of one thousand grains KSC 720, KLM 76005/7-1-2-1-1-1 X K 19/1, K 47/2-2-1-2-3-1-1 X K 19/1, ZP 684, number of corn grain row for hybrid ZP 677 are considered as highest average hybrids. The hybrids KLM 76005/7-1-2-1-1-1 X K 19/1 and ZP 684 have the highest average in attribute of performance (tone per hectare) and have the first rank and the hybrids KSC 704 and ZP 677 have the second rank and according to average performance (tone per hectare) and effective attributes in increasing performance such as weight of one thousand grains, number of grains in corn row and weight of one thousand grains, the hybrids KLM 76005/7-1-2-1-1-1 X K 19/1 and ZP 684 are the best ones and after these, the hybrids KSC 704 and ZP 677 are the best hybrids.

In growth stress test, the attribute number of days to budding for hybrid G-3261and number of corn grain row for hybrid KSC 704, weight of one thousand grains of hybrid KSC 720, diameter of corn for hybrid KLM 76005/7-1-2-1-1-1 X K 19/1 and ASI for hybrid K 74/1 X MO17 are the hybrids with highest average and hybrids KLM 76005/7-1-2-1-1-1 X K 19/1 and KSC 704 have the highest average in attribute of performance (tone per hectare) and have the first rank and the hybrids ZP 677, K 47/2-2-1-2-1-1-1 X K 19/1 and KSC 720have the second rank and according to average performance (tone per hectare) and effective attributes in increasing performance such as weight of one thousand grains, number of grains in corn row for hybrids KLM 76005/7-1-2-1-1-1 X K 19/1 and K 47/2-2-1-2-1-1-1 X K 19/1 and KSC 720 have the next ranks.

In production stress test, the attribute number of days to budding for hybrid G-3261and weight of one thousand grains of hybrid KSC 700, number of corn grain row for hybrid KLM 76005/7-1-2-1-1-1 X K 19/1, diameter of corn for hybrids ZP 684 and G-3393, length of pollination for hybrid 20 NSX K 19 and ASI for hybrid KSC are the hybrids with highest average.

In attribute of performance (tone per hectare), hybrid BC 666 has the first rank and the hybrids NS 540, ZP 677, 20 NS X K 19/1, KLM 76005/7-1-2-1-1-1 X K 19/1, K 74/1 X MO17 are in next ranks and according to average performance (tone per hectare) and effective attributes in increasing performance such as weight of one thousand grains, number of grains in corn row and number of inoculated grains for hybrids BC 666, ZP 677, ZP 684, KLM 76005/7-1-2-1-1-1 X, K 19/1 and K 74/1 X MO17 are considered as the best hybrids.

In every other stress test, the attribute number of days to budding for hybrid G-3261and in attribute of number of inoculated grain for hybrid KLM 76005/7-1-2-1-1-1 X K 19/1, weight of one thousand grains of hybrid KSC 720, diameter of corn for hybrid NS X K 19/1 20. , length of pollination for hybrids K 47/2-2-1-2-1-1-1 X K 19/1 , KLM 76005/7-1-2-1-1-1 X K 19/1, K 47/2-2-1-2-3-1-1 X K 19/1 and ASI for hybrids K 47/2-2-1-2-1-1-1 X K 19/1 and K 47/2-2-1-2-3-1-1 X K 19/1 are introduced as the hybrids with highest average.

In attribute of performance (tone per hectare), hybrid KLM 76005/7-1-2-1-1-1 X K 19/1 has the first rank and the hybrids KSC 720, KSC 704 and BC 666are in the second rank and according to average performance (tone per hectare) and effective attributes in increasing performance such as weight of one thousand grains, number of grains in corn row and number of inoculated grains for hybrid KLM 76005/7-1-2-1-1-1 X K 19/1 is considered as the best hybrid and then, the hybrids KSC 720, KSC 704 and BC 666 are considered as the best hybrids

Table1: analysis variance of the different attributes of corn hybrids in four normal conditions such as normal irrigation, growth stress, production stress and the general one.

		Mean square											
S.O.V	**df**	**number of days to budding**				**number of inoculated grains**				**weight of 1000 grain**			
		normal	growth	production	general	normal	growth	production	general	normal	growth	production	general
Treat	19	./85**	./5**	./969**	./74**	11733/35	25639/78**	18335/46**	8200/21*	2080/59**	3134/69*	2571/82*	2400/96*
Rep	2	./86	./65	./944	./15	25314/28	2292/37	119419/8	3193	218/75	60/87	291/66	1668
Error	38	./23	./18	./34	./13	13083/26	8440/97	6407/16	6017/9	613/48	1792/45	1662/28	1706/66
CV%		4/15	3/65	5/03	3	25/72	23/37	24//45	35/3	7/7	11/56	19/84	13/71
Mean		11/68	11/64	11/59	12/1	444/66	393/07	327/29	19/63	318/75	365/94	205/41	297/83
Min		11	11	10/66	11/33	301	167/5	157	122	266/67	295	150	233/33
Max		13/33	12/66	13/5	13/66	555	533	467	327	350	428/3	266/67	333/33

Table1: analysis variance of the different attributes of corn hybrids in four normal conditions such as normal irrigation, growth stress, production stress and the general one.

		Mean square															
S.O.V	**Df**	**number of grains n row**				**Diameter of corn**				**Length of pollination**				**Height Of bush**			
		normal	growth	production	general	normal	growth	production	general	normal	growth	production	general	normal	growth	production	general
Treat	19	7/46*	7/8**	13/16**	5/608	./133	./457**	./22	./0163*	2/62	2/32*	4/48*	2/66	302/6	660/17**	236/4**	139/44*
Rep	2	3/96	1/63	122/57	1/62	./71	./195	./066	./029	2/81	3/43	4/95	1/55	1756/55	1966/63	238/5	3180/2
Error	38	3/56	1/65	5/306	4/127	./128	./175	./21	./012	3/23	1/85	6/78	2/44	232/7	30/02	90/01	189/44
CV%		12/52	8/72	19/32	17/186	8/41	9/3	13/28	5/86	18/57	20/6	20	19/5	9/07	8/99	5/29	10/2
Mean		15/08	14/76	11/91	11/37	4/26	4/4	3/51	1/89	6/08	3/43	6/66	5/3	168/1	60/93	179/16	134/55
Min		10/58	10/56	7/56	8/13	3/58	3/82	3/09	1/68	7/66	2	3/66	3/66	153/67	46/5	159	111/33
Max		17/06	17/93	15/28	14/2	4/6	5//78	4/14	2/04	4/66	5/5	8/66	7/33	1933/33	71/66	196	157/67

Table1: analysis variance of the different attributes of corn hybrids in four normal conditions such as normal irrigation, growth stress, production stress and the general one.

		Mean square											
S.O.V	**df**	**number of grains in a row**				**A S I**				**Yield**			
		normal	growth	production	general	normal	growth	production	general	normal	growth	production	general
Treat	19	50/42	81/71*	58/35*	17/88	3/41*	1/105*	8/27	1/67*	14/13**	1/67**	2/53**	./701**
Rep	2	94/194	15/97	319/3	15/39	5	1/105	4/95	5/24	1/43	./039	0/38	0/009
Error	38	52/02	17/01	26/8	17/22	3/7	1/48	5/817	2/03	./99	19/15	0/25	./103
CV%		25/52	15/67	21/48	23	20	21	19/97	17/8	11/3	16/63	23	25/8
Mean		28/25	26/31	24/09	18/01	4/11	2/4	6/03	2/98	8/8	7/81	2/14	1/5
Min		18/15	13	14/53	12/4	2/33	1/33	3	1/66	4/7	1/92	0/691	./69
Max		36	34/26	31/46	22/3	6/33	3/66	8/66	4/66	12/76	11/39	4/56	2/90

*Difference in the level of0.05 **Difference in the level of0.01

Table 3: comparing various mean of attributes of corn hybrids in growth stress condition:

number of hybrid		number of days to budding		number of inoculated grains		weight of 1000 grains		number of grains in a row		number of grai n row		Diameter of corn		Length of pollination		Height Of bush		ASI		yield	
1	11/00	Ac	533	a	345	bac	34/26	a	14/33	ef	4/63	bcd	5	ab	132/67	bdac	2/66	bcd	11	a
2	12	Ab	426/33	bdac	361/6	bac	25	edc	17/06	ab	4/82	b	4	abc	113/67	ebdac	1/66	cde	8/5	cedb
3	11/33	Bc	492/6	bac	411/67	a	30/53	bdac	15/96	bdac	4/74	bc	3	abc	135/33	abc	2	cde	8/7	bcde
4	11	C	463/5	bdac	345	bac	28/31	ebdac	15/33	ebdc	4/6	bcd	3	abc	136/33	abc	3	abc	8	ced
5	11/66	Bc	491	bac	311/67	bc	30/6	bdac	16	bdac	4/38	bcd	2/33	bc	113/33	ebdac	3/66	a	7/61	edf
6	11/66	Bc	510/33	ab	311/67	bc	32/86	bac	16/2	bac	4/11	bcd	3/3	abc	138/33	ab	2/33	bcd	8/04	cdf
7	11/33	Ab	384	ebdac	395	ab	25/6	ebdc	13/6	edfc	4/44	bcd	4	abc	97	ed	2/5	bcd	9/59	abc
8	11/66	Ab	343/33	ebdc	395	ab	27/8	ebdac	15/06	ebdfc	5/78	a	3	abc	117	bdace	2/33	bcde	11/04	a
9	11/66	Ab	457/33	bdac	361/67	bac	25/53	ebdc	15/33	ebdc	4/52	bcd	2	c	119/67	bdace	2/66	bcd	8/28	cde
10	11/33	Ab	348/67	ebdac	378	bac	24/86	edc	13/86	edfc	4/36	bcd	2/66	abc	114/67	bdace	3/33	ab	6/5	feg
11	11/66	Ab	277	ed	361	bac	23/26	ed	13/3	ef	3/82	d	4/33	abc	102/67	ed	2	cde	6/9	edf
12	11/66	Ab	167/5	e	295	c	13	f	10/56	g	4/39	bcd	5/5	a	91/67	e	1/5	de	2/9	m
13	13/66	Ab	276	ed	378/33	abc	20/6	e	14/33	edfc	4/5	bcd	3/33	abc	106	edc	2/33	bcde	6/28	fg
14	12	Ab	399/67	bdac	366/67	bac	33/36	ab	14/86	ebdfc	4/7	bc	4/66	abc	143/33	a	2	cde	8/57	bcde
15	11/66	Ac	474/67	bac	411/67	a	30/53	bdac	17/03	a	4/57	bcd	3	abc	105/67	edc	3	abc	10/69	abc
16	12	Ab	446/33	bdac	378/33	bac	29/73	bdac	15	ebdfc	4/34	bcd	3	abc	129/67	bdac	2/66	bcd	7/5	edf
17	12	Ab	276	ed	385	ab	21/2	e	12	f	4/46	bcd	2/33	bc	105/67	edc	2	cde	5/52	fdeg
18	11	C	343/33	ebdc	378/33	bac	23/3	ed	14/7	ebdfc	3/95	cd	3	abc	108/67	ebdc	1/33	e	5/01	g
19	12/66	Ab	305/3	edc	345	bac	21/2	e	13/6	edf	4/2	bcd	4	abc	120/33	ebdac	1/66	cde	5/14	g
20	12	a	336/5	ebdc	345	bac	23/4	ed	14/5	edfc	3/5	cd	4	abc	95/5	e	3	abc	4/03	g

Table 3: comparing various mean of attributes of corn hybrids in general stress condition:

Number of hybrid		number of days to budding		number of inoculated grains		weight of 1000 grains		number of grains in a row		number of grai n row		Diameter of corn		Length of pollination		Height Of bush		ASI		yield	
1	12	Bd	281/3	abc	273/33	abc	21	ab	12/8	ab	3/68	ab	7	a	144/33	ab	6/33	abcd	2/63	bcd
2	12/33	C	192/5	abc	300	abc	12/4	b	9/95	abc	3/35	ab	5/66	a	135	bac	8	abc	1/39	fhg
3	11	Dc	245/33	abc	333/3	a	20/13	ab	12	abc	3/83	ab	5	a	126/67	bc	4/33	abcd	3/46	b
4	12	Dc	221/33	abc	300	abc	18/86	ab	11/66	abc	4/14	a	7	a	157/67	a	6/66	abcd	2/67	bc
5	12	Dc	99	abc	266/67	abc	17/6	ab	10/7	abc	3/09	b	6/66	a	132/67	bac	5/66	abcd	1/43	fhg
6	11/66	C	159/33	bc	316/67	ab	16/46	ab	10/8	abc	3/57	ab	3/66	a	134	bac	3/33	dc	./69	h
7	12/33	Dc	183/33	abc	283/33	abc	16/23	ab	11/3	abc	3/16	b	8/33	a	125/67	bc	8/66	a	2/67	bc
8	12	Dc	327	a	223/33	ab	19/4	ab	13/2	ab	3/41	ab	8/33	a	121	bc	6/66	abcd	4/56	a
9	12	Dc	258/67	abc	233/33	c	19/95	ab	12/3	abc	3/78	ab	8/33	a	131/67	bac	8/66	a	./96	gh
10	12/33	C	233/5	abc	306/67	abc	20/4	ab	13/1	ab	3/71	ab	7/33	a	126	bc	8/5	ab	2/73	bc
11	12	Dc	122/67	c	290	abc	14/33	ab	8/13	c	3/37	ab	7/33	a	129	bc	6/66	abcd	1/31	ghf
12	12	Dc	120/6	abc	266/67	abc	19/53	ab	10/77	abc	3/35	ab	6/66	a	111/33	c	4/66	abcd	1/69	gfed

13	11/66	Dc	180/5	bac	223/33	ab	16/3	ab	13/06	ab	3/36	ab	6	a	135/33	bac	3/66	bdc	2/81	bc
14	13	Dc	228/33	abc	323/33	ab	18/16	ab	11/62	abc	3/36	ab	7	a	140/33	ab	5/33	abcd	2/39	cde
15	12	Dc	299	ab	316/67	ab	22/3	a	14/2	a	3/57	ab	7/33	a	138/67	ab	6/66	abcd	2/23	cfed
16	12	B	147	bc	332	a	16/86	ab	8/93	bc	3/43	ab	6/33	a	128/67	bc	6	abcd	1/49	ghfe
17	12	Dc	301	ab	323/33	ab	21/76	a	11/8	abc	3/83	ab	7	a	140/33	bc	5/66	abcd	1/91	cfed
18	11/66	Dc	197/33	abc	223/33	ab	16/63	ab	9/76	bc	3/47	ab	4/66	a	145	ab	3	d	2/08	cfed
19	13/66	A	182	abc	250	bc	14/56	ab	10/4	abc	3/21	ab	7/66	a	147	ab	6/66	abcd	1/29	ghf
20	12	dc	200/4	abc	293/33	abc	16/8	ab	11	abc	3/1	b	5/66	a	140/33	ab	6/33	abcd	2/402	cde

	number of hybrid	number of days to budding		number of inoculated grains		weight of 1000 grains		number of grains in a row		number of grai n row		Diameter of corn		Length Of pollination		Height Of bush		ASI		yield	
1	11/33	Cd	443	ab	266/67	ad	21/93	ab	12/8	abc	4/15	ab	4/66	a	155	abc	3/66	ab	11/3	Cd
2	12/33	B	436/33	ab	316/67	abc	27/46	ab	15/4	ab	4/35	ab	5	a	175/33	ab	2/66	ab	8/7	Cd
3	11/66	Bcd	525/6	ab	350	a	32/4	ab	17/06	a	4/56	a	6/61	a	173/67	ab	3/66	ab	9/53	Abc
4	11/33	Cd	474/53	ab	325	abc	27/8	ab	16	ab	4/32	ab	5/33	a	75/33	ab	3	ab	8/1	Cde
5	11/32	Cd	463/63	ab	283/33	dc	32/4	ab	16/06	ab	3	c	7/33	a	161	b	3/5	ab	9/09	Abc
6	12	Cb	495/33	ab	300	bdc	29/6	ab	16/1	ab	4/2	ab	5	a	103/33	c	4/33	ab	8/11	A
7	11/66	Bcd	445/23	ab	266/67	d	29/46	ab	15/1	ab	4/36	ab	5	a	161/67	ab	4/33	ab	9/79	Cd
8	11/33	Cd	508/73	ab	350	a	32/23	ab	16/66	a	4/14	ab	7/53	a	159	b	6/33	a	11/87	Eg
9	11	C	490/33	ab	350	a	28/8	ab	16/6	a	4/59	a	6/33	a	169	ab	4/33	ab	8/43	Cde
10	12	Cd	428/33	ab	316	abc	28/46	ab	15/13	ab	4/32	ab	7/66	a	158	b	6	a	6/3	G
11	11/33	Cd	406	ab	300	bdc	29/46	ab	13/8	abc	4/13	ab	6	a	164	ab	3/33	ab	8/01	Deg
12	11/66	Bcd	335/9	ab	300	bdc	21/26	b	15/6	ab	4/21	ab	5	a	175/3	ab	3/66	ab	4/3	Bcd
13	11/33	D	301	b	325	bac	28/2	ab	14/8	ab	4/33	ab	6/66	a	160	b	4/66	ab	7/07	Ab
14	12/33	B	555/07	a	325	abc	28/86	ab	16/06	ab	4/55	a	5/66	a	159	b	3/66	ab	9/2	A
15	11/33	Cd	426	ab	325	abc	36	a	15/13	ab	4/43	ab	5/66	a	170/33	ab	5	ab	11/48	Eg
16	12	Cb	394/17	ab	350	a	28/32	ab	13/33	abc	4/6	a	6/33	a	176	ab	4/66	ab	12/06	Deg
17	11/66	Cbd	461/77	ab	233/33	ab	27/86	ab	16/46	ab	4/32	ab	5/66	a	172/33	ab	2/33	b	6/26	eg
18	11/33	Cd	367/5	ab	316/67	abc	18/15	b	10/5	c	3/58	b	7	a	168/33	ab	6/33	a	7/19	De
19	13/33	B	448/6	ab	350	a	25/86	ab	13/93	abc	3/97	ab	6	a	181/33	a	4	ab	7/96	Cd
20	11/33	cd	451/27	ab	333/33	ab	30/66	ab	14/66	ab	4/24	ab	7/33	a	153/67	b	5/33	ab	8/17	

Table 3: comparing various mean of attributes of corn hybrids in growth stress condition:

number of hybrid	number of days to budding		number of inoculated grains		weight of 1000 grains		number of grains in a row		number of grai n row		Diameter of corn		Length of pollination		Height Of bush		ASI		yield	
1	10/66	d	376/33	bdac	150	c	27/2	bdac	11/93	bdac	1/91	abc	4/66	ab	187/66	ab	3	ab	./84	fiemg
2	11/33	bcd	107	f	233/33	ab	5314	e	7/06	e	1/68	c	6	ab	159	e	4/66	a	./477	ihg

3	11	cd	450/5	ab	183	bc	21/59	ebdac	10/33	edc	1/9	abc	5	ab	196	a	3/33	ab	./45	im
4	11	cd	297/33	ebdacf	216/67	abc	26	bdac	12/23	bdac	1/94	abc	4	a	186	abcd	1/66	b	./65	fihg
5	11/66	bcd	411/67	bac	183/23	bc	28/56	bac	12/6	bdac	1/88	abc	5/33	ab	172	bdec	3/33	ab	1/07	fcedg
6	11/33	bcd	372	bdac	225	abc	20/4	ebdc	10/33	edc	1/83	abc	5	ab	177/66	abcd	2/33	ab	1/61	bc
7	11/32	bcd	263/33	edcf	250	ab	27/53	bdac	9/33	edc	1/85	abc	5/66	ab	167/66	ed	2/33	ab	./946	fiehdg
8	12	bc	467	a	266/67	a	31/46	a	15	ba	1/86	abc	4/66	ab	182/66	abcd	2/66	ab	1/33	cebd
9	11/66	bcd	307/67	ebdacf	200	abc	21/48	ebdac	14/46	bac	1/89	abc	4/66	ab	186	abcd	2/5	ab	1/03	cemdg
10	11/33	bcd	281	ebdacf	200	abc	22/46	ebdac	11/73	bdac	1/96	ab	6	ab	173	bdec	3/33	ab	1/55	cbd
11	11/66	bcd	298/33	ebdacf	216/67	abc	22/86	ebdac	13	bdac	1/97	a	7/33	a	168/33	cde	4/33	ab	1/41	cebd
12	12	bcd	434	abc	200	abc	18/53	edc	10/23	edc	1/72	bc	6/33	ab	169/33	bdec	2/66	ab	1/205	fcebd
13	11	cd	347/33	ebdacf	200	abc	26/46	bdac	13/13	bdac	1/906	abc	6/33	ab	187	abcd	3	ab	2/29	a
14	12/33	bcd	448	ab	183	bc	29/9	ab	15	ab	1/84	abc	5/33	ab	187/66	abcd	2/66	ab	1/13	fcebd
15	11/33	bcd	234	edf	216/67	abc	20/6	ebdc	10/73	edbdac	1/85	abc	6/33	ab	176/66	bdec	3/66	ab	1/64	bc
16	11/66	bcd	359	ebdac	200	abc	27/46	bdac	13/11	bdac	2/04	a	4/33	ab	181/66	abcd	2/66	ab	1/43	cebd
17	12	bcd	327/67	ebdacf	150	c	27/5	bdac	11/33	ebdac	2/04	a	4/66	ab	178/66	abcd	2/33	ab	./39	I
18	11/66	bcd	267	edcf	200	abc	25/13	bdac	10/6	ebdac	1/92	ab	5/66	ab	183	abcd	3/33	ab	1/58	bc
19	13/5	a	198	ef	2551	abc	17/8	edc	11/13	ebdac	1/89	abc	6/66	ab	178/66	abcd	3/66	ab	1/22	cebd
20	12	bcd	312/5	ebdacf	225/00	abc	24/5	ebdac	15/28	a	1/97	a	3/66	b	184/66	abcd	2/33	ab	1/66	bc

DISCUSSION

In growth stress of attributes, height of bush, weight of one thousand grains, number of grains in a row of corn, number of corn grain row have lower average in comparison with normal test but diameter of corn have higher average in comparison with normal test. As observed, in growth stress, physiologic attributes have more reduction related to attributes of performance elements. In test of production stress, stress in critical stages of pollination including falling pollinium was being full of grains which have the highest effect on performance. In addition, production stress in attributes of ASI, diameter of corn, number of grains in corn row and weight of one thousand grains have lower average in comparison with normal conditions. Other physiologic attributes occurred before plant production growths have nearly similar averages in both production stress and normal conditions. In every other stress test, stress has caused not to appear maximum potential in corns in a way that in all stages of plant growth, there is lower water in soil for plant leading to increase ASI in average of attributed and to decrease average number of inoculated grains and height of bush and in general, there was no water for plant in all stages including production and growth and this leads to performance reduction in this stage.

With respect to results of comparison among averages (Tables 2, 3, 4, 5), hybrid number KLM 76005/7-1-2-1-1-1 X K 19/1 have high performance average (Tone per hectare) in all tests. This hybrid has lower falling in all stages of stress and it has consistency in attribute the performance of grain (tone per hectare). After that, the hybrids ZP 684 and ZP 677are relatively high performance average in all tests and these hybrids had a good resistance against stress in all stages and caused lower loss in performance average and it means that stress in all stages has a similar effect on these hybrids and the hybrid KSC 704 in normal irrigation, growth and every other tests has a relatively high performance average in these tests but in normal irrigation test has not high performance average and it can be concluded that in production stress test, this hybrid has lower falling and had a good resistance. In addition, performance of grain (tone per hectare) in all tests (normal irrigation, growth stress, production stress and every other test) has a significant difference in hybrids under study.

The hybrids KSC 720 and KLM 75010/4-4-1-2-1-1 X B73 have the highest average in attribute diameter of corn and then, the hybrids KSC 700 and ZP 684 have the highest average for diameter of corn. Hybrids KSC 720 and KLM 75010/4-4-1-2-1-1 X B73 in stages of stress have lower falling in average in abovementioned attribute. Hybrid BC 666 is relatively consistent in all stress stages in diameter of corn except in growth stress in which it has a strong falling of

average because of stress and hybrid number KLM 76005/7-1-2-1-1-1 X K 19/1 in growth stress test has the lowest average reduction in attribute diameter of corn.

The highest average in ASI attribute is related to hybrids KLM 76005/7-1-2-1-1-1 X K 19/1 and K 47/2-2-1-2-3-1-1 X K 19/1 and is in every other stress test and normal irrigation test respectively. The hybrid K 47/2-2-1-2-3-1-1 X K 19/1, except in every other stress test which has higher average than normal irrigation test, has reduction in average in ASI attribute for other stages of stress.

In attribute the number of grains in a row, hybrids ZP 677, KLM 76005/7-1-2-1-1-1 X K 19/1 and KSC 704 have the highest average in normal irrigation, every other, growth and production tests. The hybrid ZP 677 in growth and production stress has lower average in comparison with normal test and it means that stress in flowering stage and complete grains (full of grains) has caused to reduce the number of grain in corn row in this hybrid. Hybrid KSC 704 has only falling in production stress test and average reduction is related to normal irrigation test. The hybrid KLM 76005/7-1-2-1-1-1 X K 19/1 has high average in number of grains in row of corn for all tests and it has consistency about this.

In attribute weight of one thousand grains for hybrids KLM 76005/7-1-2-1-1-1 X K 19/1, KSC 720 and ZP 684 in normal irrigation test have the highest average and hybrids KSC 720 and ZP 677 in growth stress test and hybrid KLM 76005/7-1-2-1-1-1 X K 19/1in production stress test and hybrids KLM 76005/7-1-2-1-1-1 X K 19/1 and ZP 684 in every other stress test are considered as hybrids with highest average in attribute of weight of one thousand grains and all of them have a high average in this attribute for all normal irrigation, growth stress, production stress and every other stress and the hybrids under study have a consistency in all stages of stress and their average has not changed strongly.

Hybrid G-3261 has a falling in average reduction in all stages of stress and this reduction is very strong in growth stress test.

Hybrid KSC 704 has a relatively high performance and the highest average in normal test for number of days to budding and in growth stress, this hybrid has a relatively high performance for number of grains in corn row and it has high number of inoculated grains and in every other stress test, number of grains in a row and high performance have been observed.

Also in all tests, the hybrid G-3261 for attribute number of days to budding has the highest average and the hybrid KLM 76005/7-1-2-1-1-1 X K 19/1 has the highest average in attribute the weight of one thousand grains.

Conclusion

In general, according to comparisons of averages (tables 2, 3, 4, and 5), we found that the increase in average of attributes such as number of inoculated grains, weight of one thousand grains, number of grains in corn row, number of corn grain row, diameter of corn and length of pollination will lead to increase in performance of grain (tone in hectare) in a way that hybrids with higher average of these attributes will have higher performance respecting to other hybrids and vice versa. Also decrease of average attributes of ASI and diameter of corn, performance will increase and hybrids with higher average of these attributes have lower performance and results of this test is consistent with results of TaherKhani (2006)[5]. Also, among twenty hybrids under study, hybrids KLM76005/7-1-2-1-1-1 X K19/1 and KSC 704 in test of growth stress and hybrids ZP 677, ZP 684 and KLM 76005/7-1-2-1-1-1 X K19/1 in test of production stress and hybrids KLM 76005/7-1-2-1-1-1 X K19/1, KSC 720 and KSC 704 in test of general stress are considered as the best hybrids and the hybrid KLM 76005/7-1-2-1-1-1 X K19/1 is identified as the suffered hybrid in each of four tests such as growth stress, production stress, general stress and without stress.

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