

**EFFECT OF HEAT STRESS ON YIELD AND QUALITY OF
WHEAT**

A Thesis

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By

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SUMMARY

The present investigation was carried out in 2005/2006 and 2006/2007 seasons at AL-Bostan Experimental Farm, Faculty of Agriculture in Dammanhour, Alexandria University

:The main objectives of this study were to

Investigate the effects of heat stress on phenological development of bread wheat cultivars -١

Study the effects of heat stress on grain yield and its components of bread wheat cultivars -٢

Study the effect of heat stress on wheat quality traits -٣

The experiment layout was in a randomized complete block design, with four replicates

The experiment was repeated twice each season; planting dates were November 20 and January 23, in 2005/2006 season, and November 27 and January 28 in 2006/2007 season. The first planting date, in both seasons, was considered to be more suitable for spring wheat in this region, since the second date exposed the wheat plants to heat stress, especially during flowering and grain fill periods

:The studied traits were as follows

Number of days to		-1
	.anthesis	
Number of days to		-2
	.physiological maturity	
Grain fill duration		-3
	.(days	
.(Plant height (cm		-4
Number of		-5
	.spikes/m2	
Number of		-6
	.grains/spike	
.(Grain weight (mg		-7
.(Grain yield (ton/ha		-8
.(%) Crude protein		-9
Fermentation test		-10
	.(minutes	
.(%) Wet gluten		-11
.(%) Dry gluten		-12

:The obtained results could be summarized as follows

:Plant phenology and grain development traits-1

:Number of days to anthesis -1.1

In 2005/2006 season, average number of days to anthesis was decreased from 92.6 days, under normal environment, to 84.8 days under heat-stressful environment. Similar results were obtained in the second season (2006/2007), where number of days to anthesis was decreased from 93.8 to 82.3 days under normal and heat-stressful environments, respectively

In 2005/2006 Sakha 61 was the earliest genotype for number of days to anthesis, where it recorded 86.5 and 83.3 days under normal and heat-stressful environments, respectively. In 2006/2007 season, Gemmeza 10 and Sakha 61 were the earliest genotypes for number of days to anthesis, where they recorded 92.3 and 78.0 days, respectively, in normal and heat-stressful environments

:Number of days to physiological maturity - \.۲

Similar results were obtained in both seasons, where the average number of days to maturity declined with delaying sowing date. An average delay of about 16 and 25 days, in the first and second seasons, respectively, in maturity was observed between normal and heat-stressful environments

Under normal environment, the earliest genotype was Sakha 61 (122.8 and 126 days, in the first and the second seasons, respectively). However, under the heat-stressful environment the earliest genotypes were Giza 168, in the first season (102.7 days), and Sakha 61 in the second season (98.8 days)

:(Grain fill duration (GFD - \.۳

Similar results were obtained in both seasons, where average GFD declined with delaying sowing date. An average delay of about nine and fourteen days in the first and second seasons, respectively, in GFD .was observed between normal and heat-stressful environments

In 2005/2006 season, Sakha 61 had the longest GFD, where, it recorded 37.3 days under normal environment, while, Gemmeiza 10 had the longest GFD (27.5 days) under heat-stressful environment. In 2006/2007 season, Gemmeiza 10 had the longest GFD, where it recorded 39.5 days under normal environment, while, Sakha 94 had .the longest GFD (25.8 days) under heat-stressful environment

: (Plant height (cm) - ۲

In 2005/2006 season, average plant height was decreased from 88.9 cm under normal environment, to 70.9 cm, under heat-stressful environment. Similar results were obtained in the second season (2006/2007), where the plant height was decreased from 91.9 cm, under .normal, to 62.9 cm under heat-stressful environments

Under normal environment, the tallest genotype, in both seasons was Sakha 94, where, it recorded 96.8 and 97.5 cm in the first and the second seasons, respectively. Under heat-stressful environment, Gemmeiza 7 was the tallest genotype, where it recorded 76.3 and 73.3 .cm in the first and second seasons, respectively

: Grain yield and its components- ۳

: Number of spikes/m² - ۳. ۱

In 2005/2006 season, average number of spikes/m² was decreased from 231.9, under normal, to 126.1 spikes/m², under heat-stressful environments, while, in the second season (2006/2007), there were non-significant differences among the cultivars under both environments

The highest genotypes for number of spikes/m² were Sakha 61 and Sakha 94, where, they recorded 270.5 and 147.0 and 97.5 spikes/m² under normal and heat-stressful environments, respectively

:Number of grains/spike - ۳.۲

In 2005/2006 season, average number of grains/spike was decreased from 56.3 grains/spike, under normal environment, to 37.7 grains/spike under heat-stressful environment. Similar results were obtained in the second season (2006/2007), where, the number of grains/spike was decreased from 56.8, under normal environment, to 41.1 grains/spike under heat-stressful environment

The highest genotype for number of grains/spike, under normal environment, was Sakha 93, where, it recorded 71.0 and 71.5 grains/spike in the first and second seasons, respectively. Under heat-stressful environment, Gemmeiza 10, had the highest number of grains/spike, where, it recorded 41.5 and 45.8 grains/spike in the first and the second seasons, respectively

:(Grain weight (mg - ۳.۳

In 2005/2006 season, average grain weight was decreased from 53.56 mg, under normal, to 42.44 mg under heat-stressful environments.

Similar results were obtained in the second season (2006/2007), where, grain weight was decreased from 52.03 mg, under normal, to 36.53 mg .under heat-stressful environments

The highest genotype for grain weight was Gemmeiza 7 in both seasons, where, it recorded 60.25 and 48.00 mg under normal and heat-stressful environments, respectively, in the first season, while, in the second season, it recorded 55.00 mg and 40.25 mg under normal and .heat-stressful environments

:(Grain yield (tons/ha -۳. ۴

In 2005/2006 season, average grain yield was decreased from 3.875 tons/ha, under normal, to 1.493 tons/ha under heat-stressful environments. Similar results were obtained in the second season (2006/2007), where, grain yield was decreased from 3.977 tons/ha, .under normal to 1.534 tons/ha under heat-stressful environments

Under normal environment, Gemmeiza 9 was the highest genotype for grain yield in both seasons, where, it recorded 4.732 and 4.742 tons/ha, in the first and the second season, respectively, while, under heat-stressful environment Gemmeiza 7 was the highest genotype for grain yield in both seasons, where, it recorded 1.847 and 2.062 tons/ha in the .first and the second seasons, respectively

:Wheat quality traits- ۴

:_(%) Crude protein -۴. ۱

In 2005/2006 season, crude protein percentage was increased from 9.50 % under normal, to 11.35% under heat-stressful environments. Similar results were obtained in the second season (2006/2007), where crude protein percentage was increased from 9.94, under normal, to .11.30 under heat-stressful environments

The highest genotype for crude protein percentage was Gemmeiza 10 in both environments, where, it recorded 10.90 and 13.17 (%) under normal and heat-stressful environments, respectively, while, Gemmeiza 7 and Gemmeiza 10 were the highest genotypes in the second season, where, they recorded 10.98 and 13.12 % under normal .and heat-stressful environments, respectively

:Wheat-meal fermentation test - ٤.٢

In 2005/2006 season, average number of minutes elapsed between sample incubation to the sample bursting was decreased from 81.8 minutes, under normal to 59.3 minutes under heat-stressful environments. Similar results were obtained in the second season (2006/2007), where, the number of minutes elapsed between incubation to the sample bursting was decreased from 81.5 minutes, under .normal, to 57.0 minutes under heat-stressful environments

In 2005/2006 season, Sakha 61 had the strongest dough, where the number of minutes elapsed between incubation to the sample bursting was 111.8 and 92.3 minutes, under normal and heat-stressful environments, respectively. In 2006/2007 season, Sakha 61 was the highest genotype for number of minutes elapsed between incubation to the sample bursting, where, it recorded 109.5 and 92.0 minutes under normal and heat-stressful environments, respectively

:(%) Wet gluten - ٤.٣

In 2005/2006 season, average wet gluten (%) was increased from 37.83, under normal, to 39.83 under heat-stressful environments. Similar results were obtained in the second season (2006/2007), where, wet gluten percentage was increased from 36.67, under normal to 39.48, .under heat-stressful environments

The highest genotype for wet gluten percentage, under normal environment, was Gemmeiza 7, where, it recorded 41.75 and 41.00 in the first and the second seasons, respectively, while, the highest genotype for wet gluten percentage under heat-stressful environment was Gemmeiza 10 where it recorded 44.75 in the first and 45.5 in the .second seasons, respectively

:(%) Dry gluten - ٤.٤

In 2005/2006 season, average dry gluten (%) was increased from 21.00 under normal, to 23.75, under heat-stressful environments. Similar results were obtained in the second season (2006/2007), where, dry gluten % was increased from 23.9, under normal to 25.39 % under .heat-stressful environments

The highest genotype for dry gluten percentage, under normal environment was Gemmeiza 7, where, it recorded 25.25 and 27.00 % in the first and the second seasons, while, the highest genotype for dry gluten percentage, under heat-stressful environment, was Gemmeiza 10 where it, recorded 28.75 and 28.25 in the first and the second .seasons, respectively

