



Effects of Water Deficit on Grain Yield and Quality of Egyptian Bread Wheat Cultivars (*Triticum aestivum* L.)



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Introduction

- A main target of the agricultural policy in Egypt is to increase wheat production to satisfy ever growing population food demand. Deficit of irrigation water is a major obstacle limiting growing wheat in Egypt.
- Furthermore, the end-use quality of wheat is seriously affected by water deficit. Understanding the effects of such stress on yield and quality of wheat is an essential step in the development of new cultivars with high performance and acceptable quality.

Major Objectives

- To understand the effects of water deficit at different stages of wheat development on Yield and Quality traits (including technological, rheological, and sensory properties).
- To highlight the interrelationship among yield, yield components, quality traits under water deficit.

Materials and Methods

- **Plant Materials:** Widely grown eight Egyptian bread wheat cultivars.

Cultivar	Pedigree
Sids 1	HD 2172 / Pavon "S" // 1158.57 / Maya 74 "S"
Sakha 61	Inia / RL4220//7C / Y R"S"
Sakha 93	Sakha 92 / TR 810328
Sakha 94	Opata / Rayon // Kauz
Gemmeiza 7	CMH 74 A.630 /5X // Seri 82 / 3/ Agent
Gemmeiza 9	ALD"S" / Huac"S" // CMH 74A. 630/5X
Gemmeiza 10	Maya74"S"/On//1160-147/3/Bb/GLL/4/CHAT"S"/5/CROW"S".
Giza 168	Mil /Buc // Seri.

- **Field Study:** Three water regimes; optimum, moderately stressed, and severely stressed were applied in two seasons. The regimes were allocated in main blocks and the genotypes in the sub-plots of a split block design. **Grain Yield; Number of Spikes /m², Number of Grains / Spike, Grain Weight,** were recorded at harvest time.

- **Wheat Technological Traits:**

Grain Crude Protein was determined using micro Kjeldahl. **Wet Gluten (%)** was measured by hand washing as described by A.A.C.C. (1983). **Dry Gluten** was determined by oven drying.

- **Wheat Milling Traits:**

Flour (%), **Fine Bran (%)** and **Coarse Bran (%)** were determined from milled samples (15.5 % moisture), then sieving according to A.A.C.C. (1983).

- **Rheological Properties of Dough:**

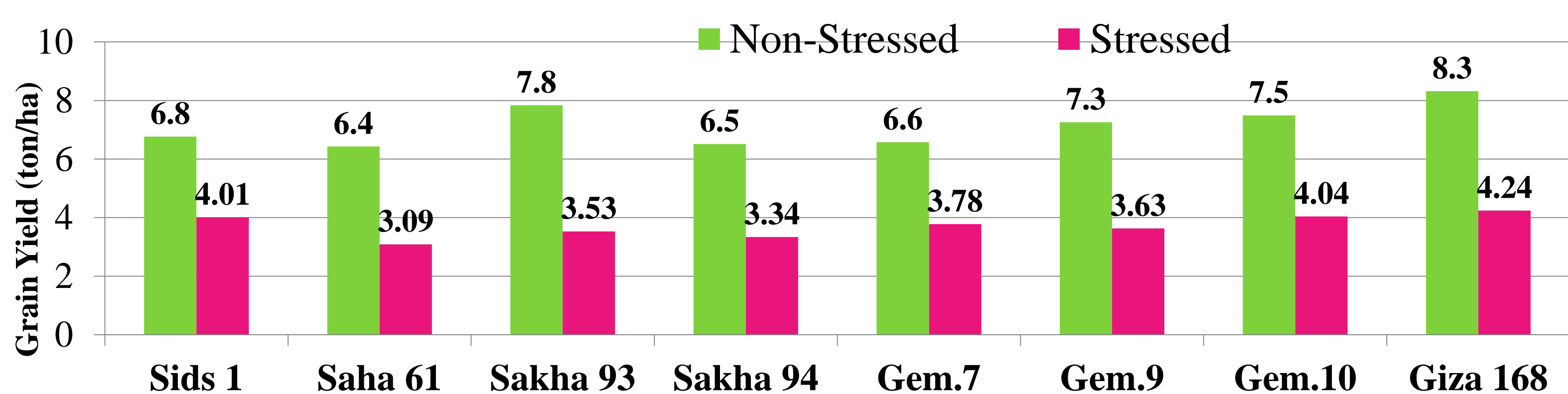
Water Absorption (%), **Arrival Time (min)**, **Dough Development Time (min)**, **Dough Stability Time (min)**, **Dough Weakness (BU)**, **Dough Resistance to Extension (BU)**, **Dough Extensibility**, **Proportional number**, and **Dough Energy** were carried out using both Barbender Farinograph and Extensograph apparatus.

- **Sensory Properties of *shamy* Bread:**

Shamy bread was prepared from both wheat flours (normal and stressed). Then, quality scores of 0-100 for **General Appearance**, 0 – 15 for each of **Crumb Distribution**, **Separation of Layers**, **Crust Color**; and a grade of 0 – 20 for **Taste** and 0-10 for **Odor**.

Results

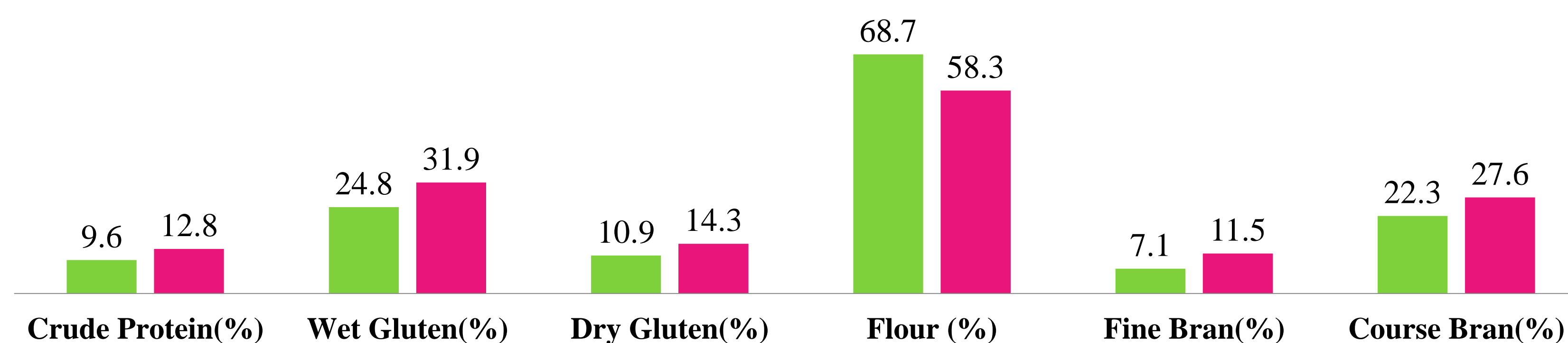
- **Grain Yield** and all of its components, **Number of Spikes / m²**, **Number of Grains/ Spike**, and **Grain Weight** were significantly decreased ($p < 0.01$) with water deficit in both seasons. Significant ($p < 0.01$) genotypic effects and genotypic by environmental interaction were observed for yield and its components.



- **Effects of water-deficit on Farinograph properties of dough (average of genotypes).**

- Significant increase in technological traits; **Crude Protein (%)**, **Wet Gluten (%)**, and **Dry gluten (%)** was observed with water deficit in both seasons. The increase of these traits was associated with shrunk grains and significantly less **Flour (%)** and more of both **Fine Bran (%)** and **Course Bran (%)** under stress.

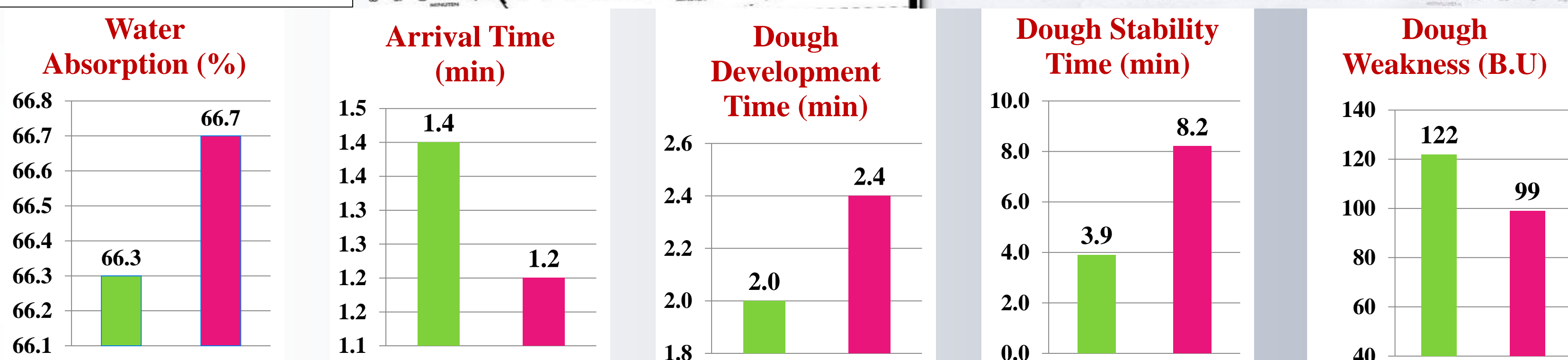
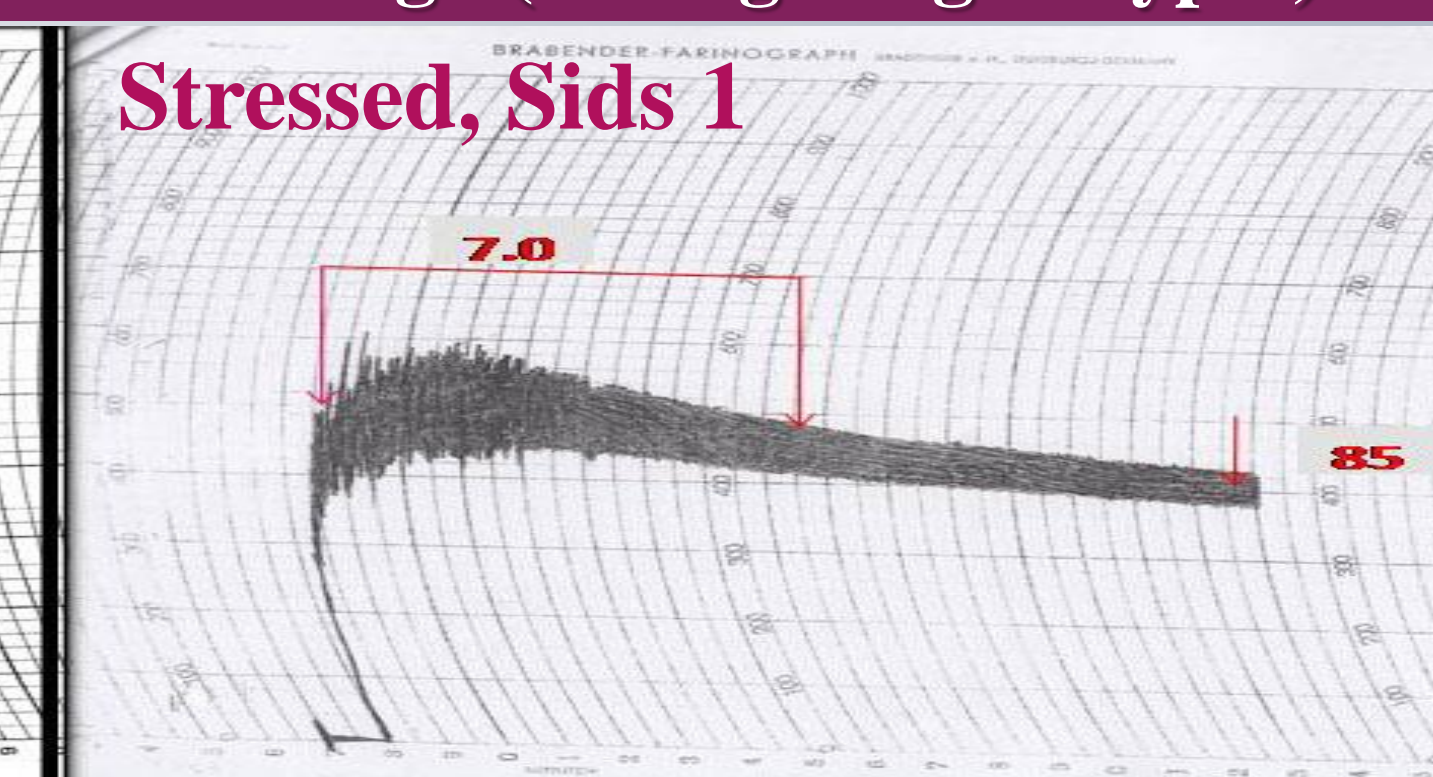
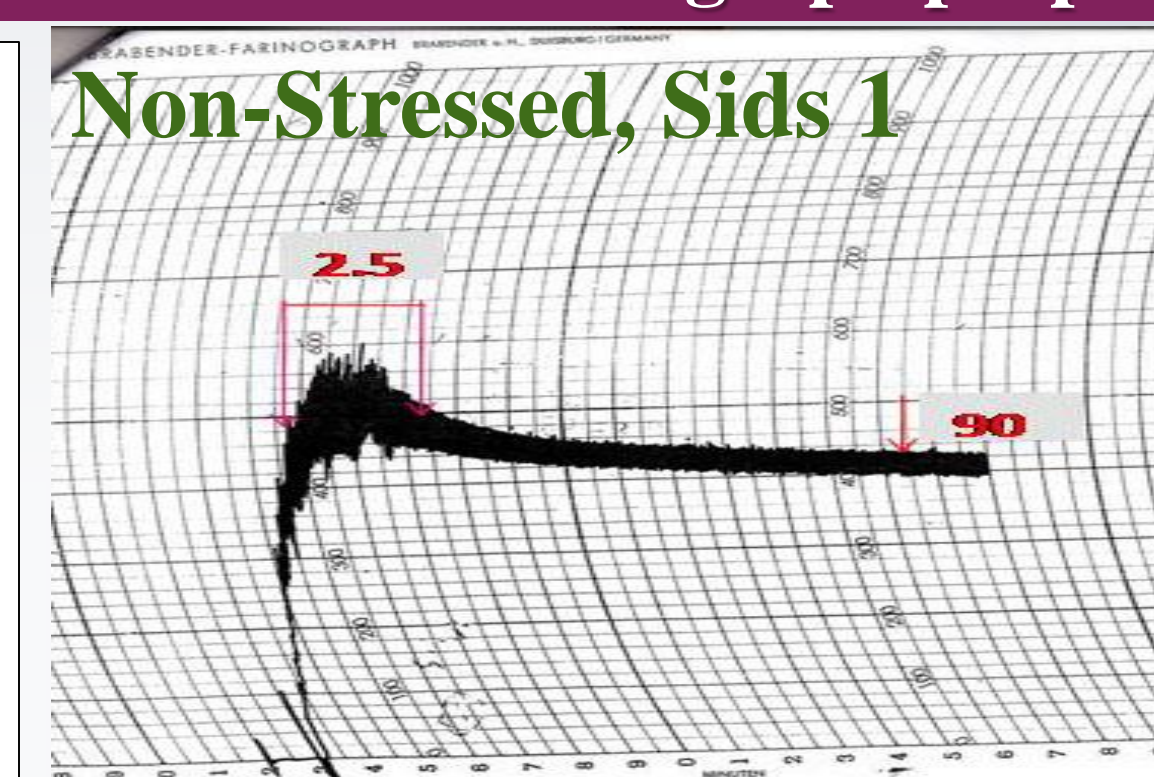
■ Non-Stressed ■ Stressed



- **Effects of water-deficit on Farinograph properties of dough (average of genotypes).**

- Water deficit increased each of:

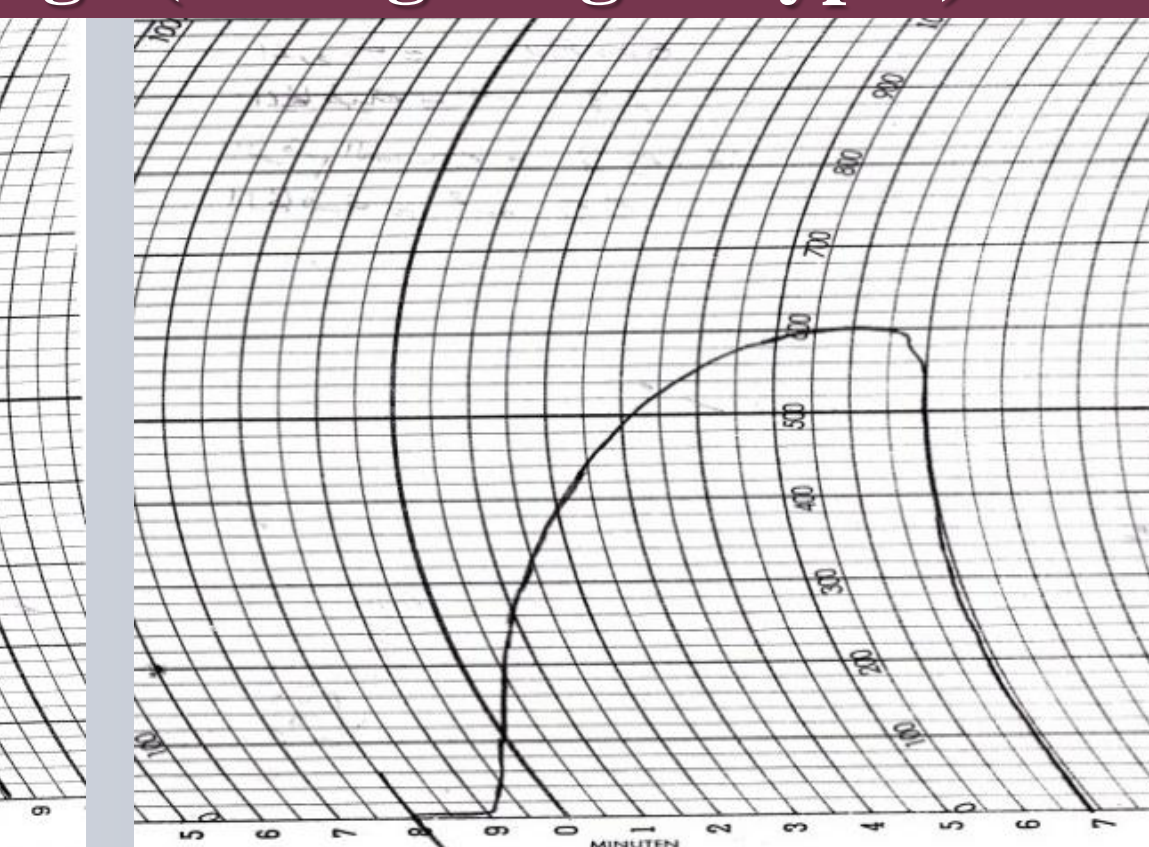
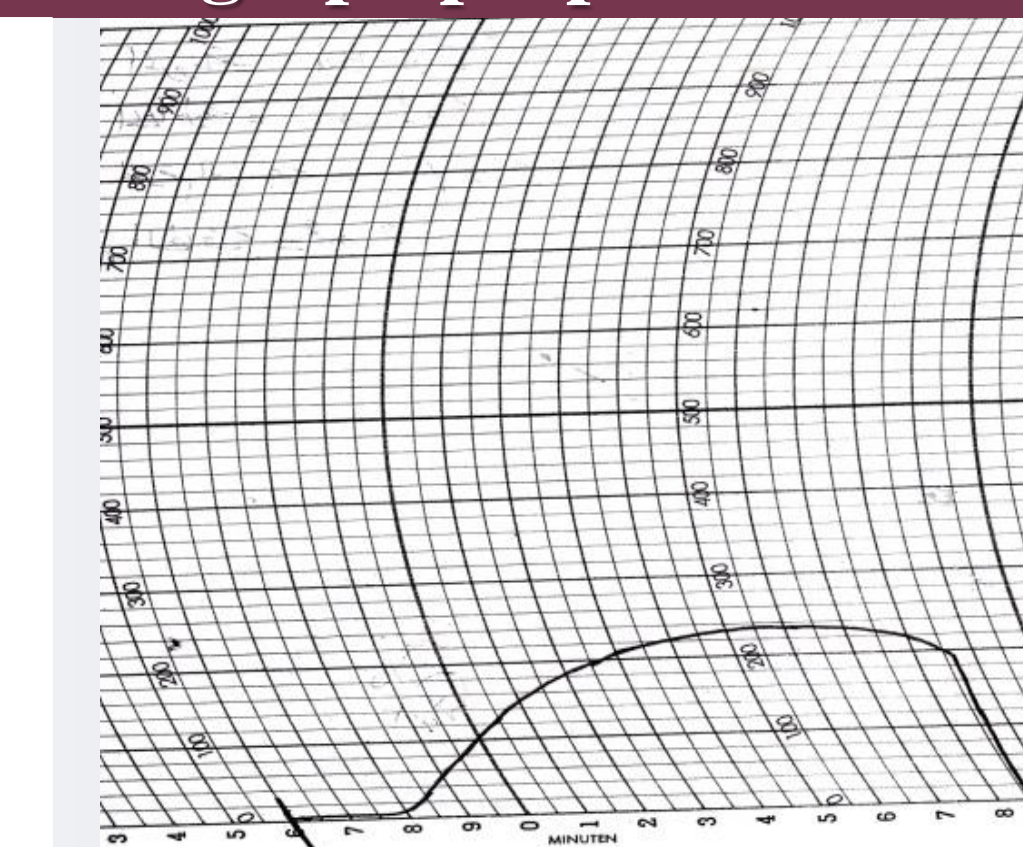
- Water Absorption,
- Arrival Time,
- Dough Dev. Time,
- Dough Stability Time,
- but decreased
- Dough Weakness



- **Effects of water-deficit on Extensograph properties of dough (average of genotypes).**

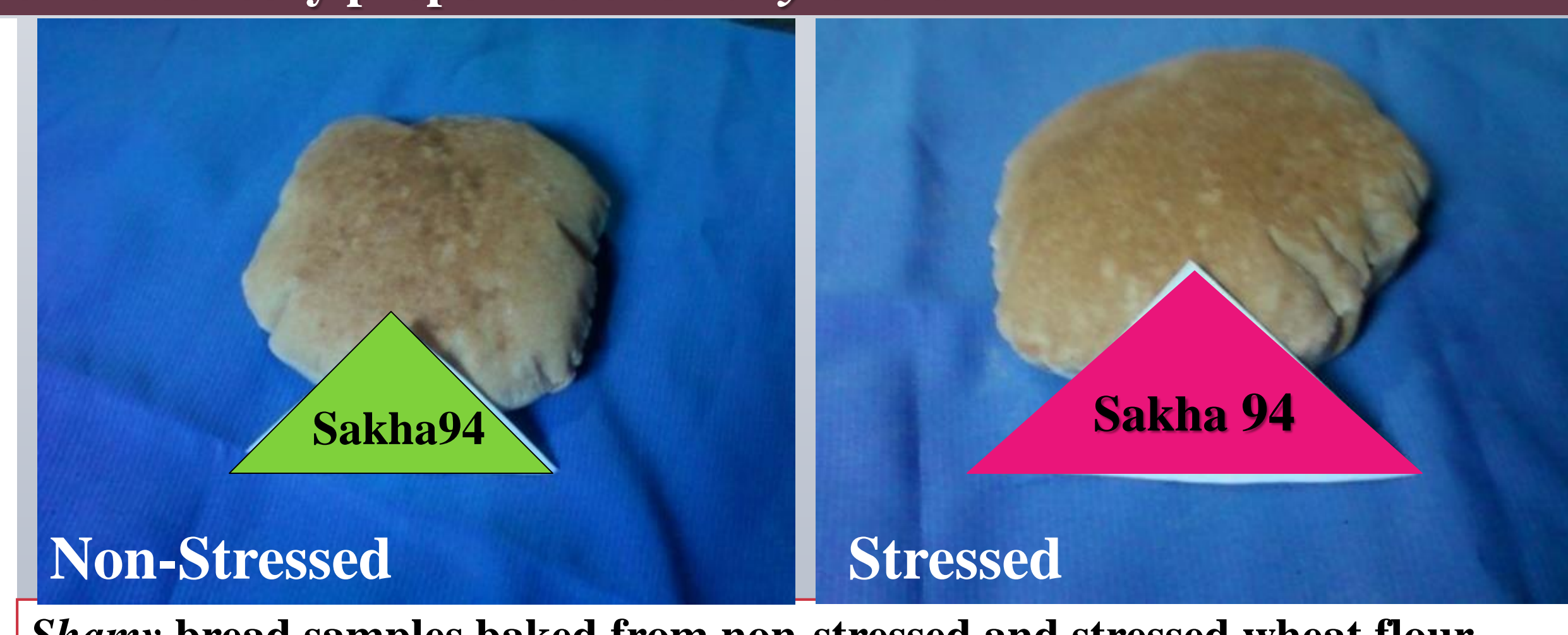
- Water deficit increased all of:

- Dough Resistance to Extension (R),
- Dough Extensibility (E),
- R/E Proportional Number, and
- Dough Energy.



- **Effects of water-deficit on Sensory properties of *Shamy* bread**

- In spite of the deleterious effects of water deficit on yield and its components, results showed some improvement in the sensory properties of *Shamy* bread under water-deficit stress.



Shamy bread samples baked from non-stressed and stressed wheat flour.

Key References

A.A.C.C. 1983. American Association of Cereal Chemists. Cereal Laboratory Methods. St. Paul., Minnesota, USA. Ping, L., J. Chen, and P. Wu. 2011. Agronomic characteristics and grain yield of 30 spring wheat genotypes under drought stress and non stress conditions. *Agronomy Journal* (103): 1619-1628.