



Analyze the specific technological aspects of soft wheat seeds treated with purified wastewater

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Introduction

Cereal cultivation is a significant factor in Algerian agriculture [1]. Among these cereals, common wheat is widely used in the diet of Algerian populations. However, its output remains extremely low and does not exceed 1.02 MT [2].

Many countries today, and possibly in the future, face the most difficult issue, which is the lack of water. According to the World Bank, drinking water shortages will affect over five countries and over 3 billion people by 2025. The WHO estimates indicate that around 20% of the world's population is unable to obtain quality drinking water [3].

By using treated wastewater in agriculture, the consumption of traditional water resources that are no longer suitable for intensive agriculture can be reduced, and the water deficit can be mitigated [4].

In arid and semi-arid climates, treated wastewater serves as an important source of water and nutrients for many farmers. It is sometimes the only source of water available for agriculture. Proper management of wastewater use can help recycle nutrients and water, reduce land amendment costs, or simply make these resources accessible to farmers [5].

In addition, the reuse of treated wastewater in agriculture can also bring additional benefits due to the nature of wastewater, which is rich in fertilizing elements as well as trace elements that are beneficial for crops by increasing their yields [6], especially for the cultivation of soft wheat, which is one of the main sectors of agricultural production in Algeria and is widely used in food [7].

This work focuses on examining some technological parameters of soft wheat seeds that have been treated with purified wastewater.

Results

The key parameters measured include soil texture, pH, pH (Kcl), salinity, and electrical conductivity, as summarized in Table 1.

Table 1. Soil Physical Parameters

Parameter	Value
Texture	Sandy loam
pH (H ₂ O)	7.3
pH (KI)	7.38
Salinity	1.13
Electrical Conductivity (mS/cm)	0.58

The physiological and biochemical parameters of different plant varieties (ARZ1, HD1, ARZ2, and HD2) were analyzed to understand their response to different treatments, including irrigation with treated wastewater and accelerated aging (VA) tests. The mean values of the studied parameters are presented in Table 2.

Table 2. Physiological and biochemical mean parameters analyzed (Mean ± SE)

Parameters Studied	Purified waste water		Rainwater	
	ARZ1 (Mean ± SE)	HD1 (Mean ± SE)	ARZ2 (Mean ± SE)	HD2 (Mean ± SE)
Germination rate (%)	93.33 ± 2.10 a	83.33 ± 1.85 b	0 ± 0 c	0 ± 0 c
Root length (cm)	21.66 ± 0.95 a	12.83 ± 0.75 b	0 ± 0 c	0 ± 0 c
Chlorophyll a (µg/g)	15.89 ± 1.12 b	10.46 ± 0.98 c	25.80 ± 1.34 a	10.08 ± 0.89 c
Chlorophyll b (µg/g)	20.10 ± 1.05 b	10.49 ± 0.92 c	28.88 ± 1.45 a	32.87 ± 1.50 a
Chlorophyll (a + b) (µg/g)	35.98 ± 1.56 b	20.95 ± 1.20 c	54.66 ± 2.08 a	42.93 ± 1.75 a
Total protein (µg/g)	71.15 ± 3.00 a	15.13 ± 0.88 b	15.64 ± 0.95 b	7.88 ± 0.50 c

* Different letters indicate significant differences according to the Duncan test (P ≤ 0.05).

Table 3: Comparative Analysis of Quality Characteristics in Different Grain Samples.

Metric	ARZ1	HD1	ARZ2	HD2
Humidity (%)	9.57 ± 0.15 a	9.21 ± 0.10 a	10.71 ± 0.12 b	12.63 ± 0.14 b
Weight (thousand grams) (g)	41.86 ± 0.25 a	33.15 ± 0.20 b	28.17 ± 0.30 c	34.71 ± 0.15 b
Specific Weight	79.62 ± 0.18 a	81.76 ± 0.22 a	83.30 ± 0.15 b	76.16 ± 0.20 b
Whole Grains (%)	85.89 ± 0.20 a	91.72 ± 0.10 a	85.61 ± 0.15 a	88.59 ± 0.12 a
Broken Grains (%)	5.84 ± 0.30 a	1.77 ± 0.20 b	1.93 ± 0.25 b	5.72 ± 0.15 a
Scalded Grains (%)	3.84 ± 0.15 a	1.93 ± 0.10 b	5.55 ± 0.12 a	1.75 ± 0.08 b
Small Grains (%)	2.28 ± 0.05 a	4.58 ± 0.08 a	6.91 ± 0.10 b	-
Moldy Grains (%)	-	-	-	-
Various Plants (%)	0.36 ± 0.02 a	-	-	-
Presence of Other Cereals (%)	0.04 ± 0.01 a	-	-	0.96 ± 0.05 b
S - Speckled Grains (%)	1.70 ± 0.03 a	-	-	2.98 ± 0.04 b

* Different letters indicate significant differences according to the Duncan test (P ≤ 0.05)

Table 4: Ash Content Percentage and Standard Error of Different Varieties

Variety	Ash Content %
1 ARZ1	0.97 ± 0.05 a
2 ARZ2	0.55 ± 0.02 b
3 HD1	0.70 ± 0.04 ab
4 HD2	0.83 ± 0.03 ab

Table 5: Gluten Content Analysis of flours in different varieties.

Variety	Wet Gluten(%)	Dry Gluten (%)
ARZ1	27.18±0.05a	10.42±0.02a
ARZ2	30.86 ±0.05b	10.90±0.03a
HD1	28.72±0.05ab	10.60±0.02a
HD2	29.09±0.05ab	9.60±0.03b

* Different letters indicate significant differences according to the Duncan test (P ≤ 0.05)

Material and Methods

Plant material.: This work involves the irrigation of two soft wheats (*Triticum aestivum* L.) varieties, El-Hiddab (HD1220) and Beni Sélimane (ARZ) from the 2021 harvest of Sedrata (Souk ahras) pilot farmTidjani.

Technological Parameters: This study was conducted at the mill laboratory level of « LES GRANDS MOULINS BELGHITH » in M'daourouch, Souk Ahras, Algeria, one of the largest milling complexes in Algeria.

Biological Material Used : Purified rainwater was used to irrigate two varieties of common wheat, El-Hiddab (HD1220) and Béni Sélimane (ARZ), both of which are known as *Triticum aestivum* L.

Moisture Determination * Determining the Ash Content * Impurity Rate (Aggregation) * Extraction Rate * Determination of the Water Content of Flours (Finished Products)

Discussion

The neutral pH of 7.3 is classified as ideal for most crops (Joshi, 2021). Since the pH (KCl) is only slightly higher than the pH (H₂O) by 0.08 units, it remains within the acceptable range suggested by Angelova and coworkers [8].

A difference exceeding 0.5 to 1 unit could lead to mineral nutrition problems for plants, but in this case, the stability of pH suggests no risk of nutrient deficiencies or toxicities.

The measured EC value of 0.58 mS/cm is below the 0.6 mS/m threshold, classifying the soil as non-saline according to the [9]. Non-saline soils like this one do not pose a risk of salt stress, which is favorable for crop growth.

Given the neutral pH and non-saline conditions, the soil does not pose any significant risks to crops, as noted by some researchers; [10]). The sandy loam texture also suggests good water drainage and aeration, which are beneficial for root health and plant growth.

The sustained germination rates in ARZ1 and HD1 after 72 hours suggest that these varieties possess robust physiological mechanisms that allow them to maintain seed vigor even under adverse conditions. The slight reduction in germination rates may be due to the inevitable effects of aging stress, such as the accumulation of reactive oxygen species (ROS) and other damaging factors that can impair seed metabolism (Li et al., 2022).

However, their ability to continue germinating at high rates indicates that they have efficient antioxidant defense systems and repair mechanisms, which protect the seeds from excessive oxidative damage (Adetunji et al., 2021). On the other hand, the complete lack of germination in ARZ2 and HD2 at both time points highlights the vulnerability of these varieties to aging stress.

Conclusion

- The study highlights the suitability of various wheat varieties for crop production based on their soil conditions and physiological responses.
- The neutral pH and non-saline properties of the soil ensure a favorable environment for plant growth, with sandy loam texture promoting good drainage and aeration. Among the varieties tested, ARZ1 and HD1 demonstrated superior seed vigor and resilience to aging stress, maintaining high germination rates and root growth compared to ARZ2 and HD2, which were more susceptible to stress.
- Overall, the findings underscore the importance of selecting appropriate varieties and irrigation methods to optimize agricultural practices and ensure sustainable crop production.
- Future research should focus on nutrient profiling and further assessment of these varieties in varying environmental conditions.

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