



Testing of Germination Ability to Four Tomato Hybrids (*Lycopersicon Esculentum* Mill) with Studying Some of Their Seedling Growth Indicators

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Abstract

The experiment was conducted in a private field in the city district, north of Basra, during the 2023-2024 agricultural season to study the germination ability of seeds of four tomato hybrids (Black de Parra, Gala Santa, Black Prince, and Tikerionic) and some of their seedling growth indicators. These hybrid seeds are planted in pots with a diameter of 5 cm in four replicates. Each replicate contained five pots for each variety, meaning the total number of pots was 80. The experiment was designed using the Completely Randomized Design (CRD). The results showed that the Black de Bara variety significantly excelled in germination percentage 95% and speed reaching 3.94, respectively. Additionally, the Black Prince variety outperformed in plant height, reaching 19.12 cm compared to the other Hybrids.

Keywords: seed viability, the germination rate, the best type.

1. Introduction

Tomato (*Lycopersicon esculentum* Mill) is one of the most important vegetable crops grown worldwide, including Iraq, due to the high nutritional value of its fruits and its various uses in food industries (fresh, cooked, or processed). Iraqi tables are rarely without

them. Every 100 grams of fresh tomato contains (5.93 grams) of protein, (22 calories), (7.4 grams) of total carbohydrates, (13 mg) of calcium, (27 mg) of phosphorus, (500 mg) of iron, (244 mg) of potassium, and (900 IU) of vitamin A. It is also considered a source of

dietary fiber, carotene, and lycopene (Ali *et al.*, 2014).

Statistics indicate high annual consumption rates because fruits contain large amounts of minerals, vitamins, and pigments that act as primary sources of antioxidants (Sgherri *et al.*, 2008). Tomato cultivation is widespread in Iraq by different agricultural methods. However, crop productivity in Iraq remains low compared to the world average. In 2010, the cultivated area in Iraq was (53,195 hectares), with a yield of about (5,190.46 kg/ha) compared to the world average cultivated area of 4,336,505 hectares, with a yield of about (53,358.7 kg/ha) (FAO, 2011).

Tomato crops are grown during different seasons to suit high consumer demand and its use in manufacturing, which leads to high prices. The hybrid's vigor has played an essential role in commercial variety production (increasing yield and improving production quality). Tomato hybrid varieties have shown positive ability for some traits related to vegetative growth, flowering, yield, and production quality, thus outperforming most cultivated varieties (Abdul Rahaman *et al.*, 2019).

The plant's vigor is defined as the percentage of seedlings germinating under suitable conditions without being restricted by a specific time frame. Germination percentage, conversely, is the percentage of seeds germinating under suitable conditions within a defined time frame as specified by seed testing standards. Woodstock (1965) described seed vigor as one of the important criteria for measuring seed viability and effectiveness, reflecting the strength and health of the resulting plant under favorable environmental conditions. It is well known that plant growth hormones significantly influence seed germination, as they regulate physiological processes during seed germination which is considered an important factor in increasing germination rate and percentage.

Havlin (2005) explained that there are several factors that affect seed vitality, including genetic, environmental, physiological, mechanical, storage conditions, and duration. The germination rate test is considered one of the most widely used tests to estimate the degree of vitality. A high germination rate means the production of larger seedlings characterized by rapid growth and high plant density (Khalaf and Al-Rajabo, 2006).

1.1.Objective of the Experiment

1. Testing seed viability.
2. Evaluating the varieties' germination percentage and suitability for the region's conditions.
3. Identifying the best-performing variety in the experiment.

2.Material and methods

The experiment was conducted in a private field in the Al Madina city district located north of Basra during the agricultural season (2023-2024). Four Russian tomato varieties imported from were planted. The experiment was designed using a Completed Randomized Block design (CRBD). Each four seeds of the hybrids was planted in a pot of diameter (5 cm), with four replicates, each replicate containing five pots for each variety, with a total of 80 pots in the experiment.

The data were analyzed using the least significant difference (LSD) test, and this test was at a significance probability level of (0.05) (Al-Rawi, 1980). The data were collected as follows:

2.1. Variety No. (V1)

- Variety name: Black de Barona or de Baro chornii
- Company name: Russkiy Agorod
- Description: High-yielding variety
- Time from germination to fruit formation: 120–130 days
- Growth type: Indeterminate, highly branched, with a plant height of approximately 2 meters
- Cultivation: Can be grown in protected or open fields
- Planting and harvest time: Planted in March and harvested in June
- Average production: 108 fruits per cluster or inflorescence
- Fruit characteristics: Oval-shaped, dark-colored, with an average weight of 60–80 grams
- Features: High transport and storage tolerance, high disease resistance, and cold resistance

2.2. Variety No. (V2)

- Spacing: 50 x 60 cm
- Variety name: Djalo Santa
- Company: Aelita
- Description: High-yielding crop, cold and drought-resistant
- Cultivation: Recommended for open-field cultivation
- Planting depth: 0.5 cm
- Time from germination to fruit formation: 110–117 days
- Growth type: Determinate, sparse foliage, plant height 60–70 cm

- Fruit characteristics: Round, smooth, crack-resistant, fruit weight 100–170 grams
- Features: Juicy and sweet-tasting fruits, total yield 6–8 kg/m²
- Precautions: Excessive irrigation leads to black legs
- Fertilization: Organic fertilizer is applied 7–10 days before planting; the best planting time is early June
- Lighting: Bright but diffuse light is essential

2.3. Variety No. (V3)

- Spacing: 70 x 40 cm
- Variety name: Black Prince or Chornii Prince
- Company name: Russkiy Agorod
- Description: Requires support, suitable for open or protected cultivation
- Growth type: Indeterminate, highly productive, with a plant height of up to 2.5 meters
- Leaf count per branch: Average of 9 leaves
- Fruit characteristics: Large, round, flat, average fruit weight 170 grams, possibly up to 300 grams
- Features: High solid content, resistant to several diseases
- Optimal temperature: 22–25°C
- First flower formation: After the development of 5 true leaves
- Irrigation: Necessary, especially before the appearance of the first fruit and during the early ripening stage

2.4. Variety No. (V4)

- Variety name: Tigronok (Tiger Cub)

- Company name: Aelita
- Growth type: Indeterminate, plant height ranges from 290–300 cm (1.2–1.6 meters)
- Fruit weight: 50–80 grams
- Growth rate: Fast-growing
- Time from seedlings to fruit formation: 102–104 days in protected cultivation
- Fruit-bearing period: Long; average yield of 10 kg/m² in spring-summer and 7 kg/m² in summer-autumn
- Fruit characteristics: Thick-skinned, crack-resistant
- First flower formation: At the stage of 4–5 true leaves
- Fruit production per inflorescence: 8–12 fruits
- Features: High storage tolerance and strong resistance to fungal diseases

The peat medium was prepared, sterilized, and placed in foam cups (20 cups) for each variety. Seeds were planted at a rate of one seed per cup for each variety.

2.5. Studied Traits:

1. Germination Percentage (%): This trait was calculated using the following equation (Khalaf and Al-Rajbou, 2006):

$$\text{Germination Percentage} = \frac{(\text{Number of germinated seeds})}{\text{Total number of seeds}} \times 100 \quad (1)$$

2.6 Germination Speed (seeds/day):

This was calculated using the following equation (Matloob, 1979):

$$\text{Germination Speed} = \frac{\sum (\text{Number of germinated seeds} \times \text{Days until germination})}{\text{Total number of seeds}} \quad (2)$$

The first seed count was conducted 5 days after planting, and the final count after 14 days of planting (Balliu and Hallidri, 2002).

2.7 Plant height

2.8 Number of branches

2.9 Number of leaves

3. Results and Discussion

3.1. Germination percentage and germination speed:

Based on result data in **Table (1)**, the highest seeds germination percentage, was obtained with

varieties 1, 2, and 4 outperformed variety 3. Varieties 1, 2, and 4 also outperformed variety 3 in terms of germination speed

Table 1. Germination percentage and germination speed of four tomato hybrids.

Variety	Germination Percentage	Germination Speed
V1	95%	3.94
V2	90%	3.66
V3	35%	5
V4	90%	3.77

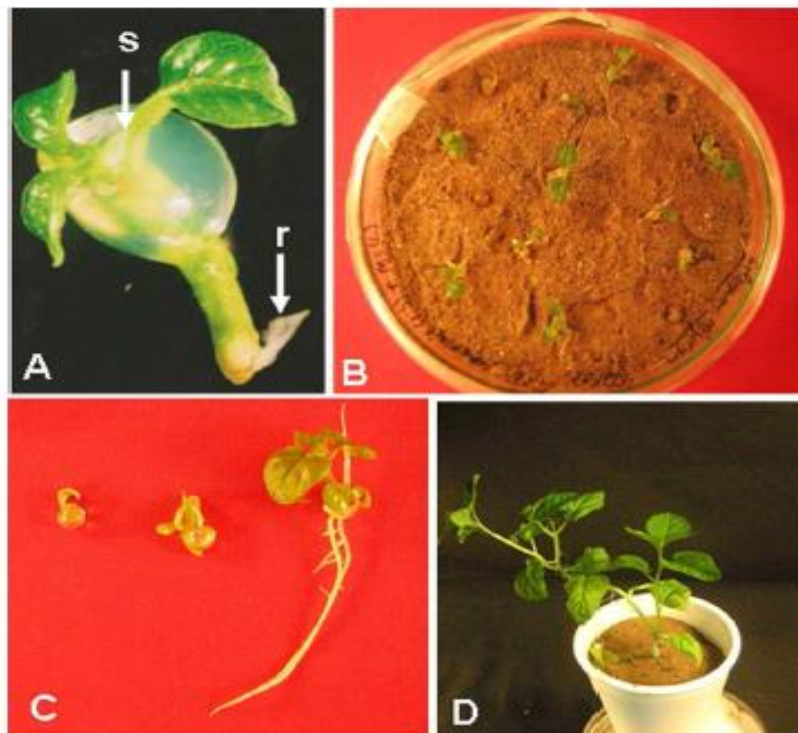


Fig. 1. Plantlet regeneration of *Solanum nigrum* L. from encapsulated shoot tips. (A) Shoot (s) and root (r) emergence from encapsulated shoot tip on 0.8% agar-solidified full-strength MS medium. (B) Development of plantlets on sterile soil moistened with MS medium devoid of sucrose. (C) Sprouting in the form of shoot and root development from encapsulated shoot tip. (D) A healthy and well hardened plantlet of *S. nigrum*.

3.2. Some vegetative growth:

Based on result data in **Table (2)** indicate that hybrid differences affect some seedlings' growth indicators. The results show that hybrid 3 had the highest plant height (19.12 cm), followed by hybrids 2 and 4, with non-significant differences. The lowest plant height was observed in seedlings of hybrid 1.

Table 2. Some vegetative growth indicators for seedlings of four tomato hybrids

Variety	Plant Height (cm)	Number of Branches per Plant	Number of Leaves per Plant
V1	11.75 b	6.00 a	28.85
V2	16.75 a	5.70 a	32.10
V3	19.12 a	4.25 b	32.00
V4	15.80 ab	5.30 a	31.40
LSD 0.05	4.19	0.76	4.63

Hybrid 1 (11.75 cm) did not significantly differ from Hybrid 4 in the mentioned trait. The results in the same table show that hybrids 1, 2, and 3 outperformed each other with non-significant differences in the number of branches per plant, with the lowest number observed in hybrid 3 plants. The results in the table also show no

significant difference among the four hybrids in the number of leaves per plant. The differences between the hybrids in growth indicators may be due to genetic variation or differences in their tolerance to the region's environmental conditions compared to their native conditions.

Conclusions

The experiments were conducted in the Al-Madina district, north of Basra, during the 2024 agricultural season and evaluated four tomato hybrids' germination and early growth. The Black de Bara variety excelled in germination percentage (95%) and speed (3.94), indicating its high potential for early cultivation. The Black Prince hybrid had the highest plant height (19.12 cm), suggesting robust growth compared to the others. Growth indicators showed differences among the hybrids.

Hybrids 1, 2, and 4 had similar branch numbers, while hybrid 3 had the lowest. No significant difference was found in the number of leaves per plant among the hybrids. These results suggest that while hybrid performance varies in traits like plant height and branching, genetic differences and environmental adaptation likely influence growth patterns. Overall, the differences observed emphasize the importance of selecting hybrids based on specific growth requirements and environmental conditions for optimal performance

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