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# Nanofertilizers and Seed Storage Periods Role on Increasing the Germination Rate of Okra Crop.

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**Abstract:**

An experiment was implemented in the city of Al-Hamzah Al-Sharqi / Al-Qadisiyah Governorate for the year 2023, to determine the effect of a number of nanopotassium concentrations (0, 1 and 2 gm $L^{-1}$), and duration of storage of okra seeds (1, 2 and 3 years), on some growth traits of okra seedlings. The results can be summarized as follows, the seed revitalization treatment at a concentration of 1 gm $L^{-1}$ was significantly superior, by giving it the highest averages for the germination speed (45.6%), and germination rate (65.6%), compared to the comparison treatment, which gave the lowest averages for this trait, amounting to 37.8 and 57.8%, respectively, while the seed stimulation treatment (2 gm $L^{-1}$) excelled on the chlorophyll content and seedling stalk length, the two highest averages were recorded 35.24 spad and 6.143 cm, respectively. Seeds stored for two years outperformed significantly by giving the highest averages for the germination speed (46.7%) and germination rate (74.4%).

**Keywords:** Nanofertilizers, seed storage periods, germination rate, okra.

## Introduction:

Okra, whose scientific name is *Abelmoschus esculentus* L., belongs to the *Malvaceae* family and is one of the important summer vegetable crops in the world, it is grown in large areas in Asia and Africa, it is believed to be native to Ethiopia and Minya and has spread widely in the tropical, subtropical and temperate regions of the world. Okra is important in human nutrition because it contains carbohydrates, minerals and vitamins, every 100 grams of fresh green pods contain, on average, 81.8 grams of water, 36.11 calories, and 2.01 grams of protein. 0.21 gm fat and 9.21 gm carbohydrates, thiamine, riboflavin and niacin (Hussain *et al*., 2010). It is also rich in unsaturated fatty acids such as linoleic acid, which are essential for human nutrition. Okra has been used in many industries, including filtering sugarcane juice, as an adhesive for paper, and wrapping stored fruit as an anti-transpiration agent, these extracts reduce moisture loss because they contain pectin and wax-like substances (Sathish *et al*., 2013).

The world has recently begun to use nano-fertilizers and reduce the use of chemical fertilizers due to their negative effects, because it has many good properties due to its high solubility and high effectiveness. Nanofertilizers are an essential resource in agriculture in order to increase and enhance crop production, quality and productivity. Nanofertilizers provide more space for vegetative growth, thus, photosynthesis increases through exposure to more sunlight, thus increasing crop production. Nanotechnology has enormous potential to contribute significantly to sustainable agricultural production, especially in developing countries (Al-Juthery *et al*., 2021).

Seeds stored for several years suffer from weak and low germination rates and field emergence, so an increase the storage period of okra seeds leads to a significant decrease in

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the germination rate due to the decrease in enzymatic activity as the storage period increases. Soaking the seeds improved enzyme activity and increased germination characteristics (Azadi *et al*., 2013).

Due to the presence of real problems in the germination and emergence of okra seeds stored for several years, therefore, seed activation on the germination and emergence rate of okra, for seeds stored for several years, do stored seeds differ in germination rate, emergence and seedling strength, determine the best stimulation treatment in terms of the dose that gives the highest field germination rate.

**Materials and Methods:**

The experiment was carried out in normal atmospheres and conditions similar to open field conditions, during the year 2022, with the aim of improving the germination properties of okra seeds stored with different storage periods, accelerating their emergence rate in the field, by treating them with nano-fertilizers, determine the effect of this on some growth characteristics and yield of okra seeds, according to the completely randomized design (CRD) with factorial experiments arranged with three replicates.

**Experimental factors:**

**1. Seed activation treatments:** were soaking in dw, by several concentrations of nano-fertilizer (1 and 2 gm $L^{-1}$).

**2. Seed storage period:** 1, 3 and three years.

**Seed preparation for planting:**

The seeds were soaked in solutions and dw for 24 hours, the seeds were air dried for 6 hours, 120 seeds were taken from the treatments, the seeds were placed on paper towels, they were planted in plates with a good agricultural medium (peat moss) with good qualities and properties, and with three replicates, after seven days, the first count (germination speed) was measured, then the plates were left in the room until the end of the examination period of 14 days, then the qualities were measured. The seeds were sterilized with sodium hypochlorite at a concentration of 2% for two minutes, to eliminate fungi if present on the seeds, after that, they were washed with distilled water well more than once to ensure that no trace of the sterilizing substance remained, so as not to affect the vitality of the seeds.

**Traits studied:**

**1. Germination speed (%)** (ISTA, 2013):

$$Germination\ speed = \frac{\text{Number of natural seedlings}}{\text{Total number of seeds}} \times 100$$

**2. Germination percentage (%):** (ISTA, 2013):

$$Germination\ percentage = \frac{\text{Number of natural germinated seeds}}{\text{Total number of seeds}} \times 100$$

**3. Chlorophyll concentration in seedlings (SPAD):** (2013, Schepers and Blackmer).

**4. Seedling length (cm):** (AOSA, 1988).

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**Results and Discussions:**

**Germination speed (%):**

Table (1) shows the significant difference in seed storage periods in terms of germination speed, seeds stored for two years were significantly superior to the rest of the storage treatments by giving them the two highest average germination speeds (46.7%), while treating seeds stored for three years gave the lowest average (33.3%). 2 yr store give highest percentages, due to its high vitality and the lack of deterioration of some of its components, which led to its moral superiority over seeds stored for more than two years, agreed with Timotiwu *et al.* (2017) and Mokhtari and Hasan (2018), who indicated that the speed of germination decreases when the storage period increases.

Seed revitalization treatment with nanopotassium exceeds the concentration of 1 gm $L^{-1}$ numerically by giving them the highest average germination speed (45.6), may be attributed to the impact of nanopotassium on the effectiveness of the enzymes responsible for germination.

The results of the interaction indicate that the 1 mg/L (k) treatment was numerically superior in increasing germination speed for two years of seed storage and gave the highest rate (50.2%), while the interaction treatment between (no addition + three-year storage period) recorded the lowest value (26.7%), thus, seed stimulation with nanopotassium, improving the germination speed of stored seeds and the early emergence of seedlings.

**Table (1) The effect of seed activation and storage periods on average germination speed (%).**

| Year (X)<br>K concentrate | 1X | 2X | 3X | Mean (k) |
|---|---|---|---|---|
| **0 mg L** | 40.0 | 46.7 | 26.7 | 37.8 |
| **1 mg L** | 50.0 | 50.2 | 36.7 | 45.6 |
| **2 mg L** | 46.7 | 43.3 | 36.7 | 42.2 |
| **Mean (X)** | 45.6 | 46.7 | 33.3 | |
| **L.S.D** | **X** | **K** | **interaction** | |
| | 8.73 | N.S | N.S | |

**2. Germination rate (%):**

Seed storage periods differed significantly in germination rates, seeds stored for two years significantly outperformed the rest of the seed storage periods by giving them the highest rate (74.4%), while three yrs stored has low average germination percentage (54.4%), its high vitality and the lack of deterioration of some of its components, also due to its superiority in germination speed (Table 1). This resulted in it being significantly superior to seeds stored for more than two years, agreed with Azadi and Younesi (2013) and Stephen (2014), they

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indicated decreases significantly with increasing storage period and reduces the ability of seedlings to survive.

Table (2) shows the superiority of the two seed stimulation treatments, K1 and 2k, and recorded the same rate of (65.6%) for both of them, while the comparison treatment (dry seeds) gave the lowest average (57.8%).

As for the interaction between seed activation parameters and storage duration, we note from the same table, the interaction of K2 treatment with two yrs stored for resulted in the high average trait (86.7%). The lowest average germination percentage when the control treatment was overlapped with three yrs stored (46.7%).

**Table (2) The effect of seed activation and storage periods on the average germination percentage (%).**

| Year (X)<br>K concentrate | 1X | 2X | 3X | Mean (k) |
|---|---|---|---|---|
| **0 mg L** | 63.3 | 63.3 | 46.7 | 57.8 |
| **1 mg L** | 60.1 | 73.3 | 63.3 | 65.6 |
| **2 mg L** | 56.7 | 86.7 | 53.3 | 65.6 |
| **Mean (X)** | 60.3 | 74.4 | 54.4 | |
| **L.S.D** | **X** | **K** | **interaction** | |
| | 6.32 | 6.32 | 10.95 | |

**3. Chlorophyll percentage (SPAD):**

Table (3) shows that the K2 seed stimulation treatment was significantly superior to all treatments by giving it the highest average chlorophyll content (35.24 SPAD), while the comparison treatment (dry seeds) gave the lowest average chlorophyll content of (31.14 SPAD). The superiority of this treatment may be attributed to the effect of nanopotassium as an aid in increasing cell division, elongation and growth, reflected in vegetative growth, better growth of seedlings, and increased accumulation of nutrients, involved in the synthesis of all cell components, including chlorophyll. These results were consistent with the results of Iqbal and Ashraf (2010) and Takalidi and Barouchas (2011).

**Table (3) Effect of seed activation and storage periods on the chlorophyll content (SPAD) of seedlings.**

| Year (X)<br>K concentrate | 1X | 2X | 3X | Mean (k) |
|---|---|---|---|---|
| **0 mg L** | 32.88 | 30.19 | 30.35 | 31.14 |
| **1 mg L** | 33.38 | 33.57 | 33.95 | 33.63 |

| | | | | |
|---|---|---|---|---|
| **2 mg L** | 35.24 | 35.87 | 34.61 | 35.24 |
| **Mean (X)** | 33.83 | 33.21 | 32.97 | |
| **L.S.D** | **X** | **K** | **interaction** | |
| | N.S | 2.074 | N.S | |

**4. Seedling stalk length (cm):**

Table (4) shows that the K2 seed revitalization treatment was superior by giving it the highest average seedling stalk length (6.143) cm, while the comparison treatment (dry seeds) gave the lowest average for the stem length (5.434 cm), may be attributed to its superiority in emergence speed (Table 1), which led to giving active gestures that led to an increase in stem elongation. The reason may also be because potassium is an essential mineral nutrient for plants, which the plant cannot do without and which plays an important role in its growth and development processes (Tang *et al*., 2015). The factor that enabled the success of potassium is its use in nanoform, facilitated its entry process easily due to the small size of its nanoparticles (Monreal *et al*., 2016). These results are consistent with Ramadan and Shalaby (2016).

**Table (4) Effect of seed activation and storage periods on seedling stem length (cm).**

| **Year (X)<br>K concentrate** | **1X** | **2X** | **3X** | **Mean (k)** |
|---|---|---|---|---|
| **0 mg L** | 5.540 | 5.477 | 5.287 | 5.434 |
| **1 mg L** | 5.313 | 5.663 | 5.597 | 5.524 |
| **2 mg L** | 6.040 | 6.197 | 6.193 | 6.143 |
| **Mean (X)** | 5.631 | 5.779 | 5.692 | |
| **L.S.D** | **X** | **K** | **interaction** | |
| | N.S | 0.4142 | N.S | |

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