

VIABILITY AND YIELD OF TREATED SEEDS WITH AN OXYGENATED AQUEOUS MEDIUM AFTER STORAGE

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ABSTRACT

This study has been carried out using the sweet pepper (*Capsicum annum* L., cultivar "Podarok Moldovy") and Dill (*Anethum graveolens* L., cultivar "Armiansky") seeds. All the samples were taken from the same lot (Vegetable Crop Research Station, Moscow Agriculture Academy). The main emphasis was to determine the possibility of preserving the viability of treated seeds with oxygen in an aerated water medium during storage. Pepper seeds were treated for 36 hours, and Dill seeds for 18 hours. The treated seeds for different time intervals were dried out until the seed moisture content declined to 9% on dry weight basis (initial moisture content before treatment), and kept in paper sacks within room temperature. Sowing was carried out after immediately treatment, within 7 days, 1 month, and 3 months after storage. The results of study made under field (i.e. Dill seeds) and laboratory (i.e. sweet pepper seeds) conditions had shown that the treated seeds preserved their viability during storage. The germination percentage of treated seeds and yield of grown plants (from the treated seeds) did not differ so much before and after storage, provided that the seeds will not be dried under the sun rays and that temperature of drying air will not exceed 35°C otherwise, the high temperature will kill the embryo, and the seeds will lose their viability.

Key words: Seed viability, Seed storage, Germination, Aerated hydration with oxygen, Sweet pepper, Dill

INTRODUCTION

Such treatment to invigorate seeds can be broadly divided into two groups, namely: limited hydration in soak water followed by dehydration (Haight and Grabe, 1972) and priming in which seeds are allowed to imbibe from osmotica such as polyethylene glycol (Heydecker *et al* 1973).

A recently developed method in which seeds were hydrated with an aerated water (Gepting, 1975; Tarakanov *et al* 1985; Thornton and Powell, 1995). However, the effect of priming treatments on the storage life of seeds remains unclear.

In some studies, priming treatments did not adversely affect the storage life of seeds. Primed carrot and leek seeds

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retain their enhanced vigor after storage for 450 days (Dearman *et al* 1987). The improved germination performance of primed spinach seeds was retained after 30 days of storage at 5°C (Atherton and Farooque, 1983). A short hydration treatment applied to wheat seeds had little effect on germinability during storage, while longer hydration treatments increased the susceptibility to deterioration. Nath *et al* (1991) and Dearman *et al* (1986), reported that primed and dried onion seeds stored at 10°C, and 9% moisture content (MC) maintained a faster rate of germination after 18 months in storage.

Other studies have shown that primed seeds have decreased storage life. Tomato (Alvarado and Bradford, 1988; Owen and Pill, 1994); Muskmelon (Melkidezek and Wilbaum, 1996); Carrot, Leek and Onion (Drew *et al* 1997) seeds exhibited reduced storage life following priming.

Prehydration treatments in water for <1 h had little effect on the rate of germination or storage life of lettuce seeds, but increasing the duration of either priming or prehydration reduced the mean time to germination or seed longevity by as much as 84% compared to non-primed seeds (Tarquis and Bradford, 1992).

However, currently there are no proofs about the moistened seeds being preserving the effects of aerated water in a clean form in the condition of aeration, especially the condition that does not allow sowing of the cultivated seeds to often by happens. This serviced the basis for studying the possibility of preserve the viability to seed treatment in an aerated hydration with oxygen during storage.

MATERIAL AND METHODS

This study has been carried out using the sweet pepper (*Capsicum annum* L. cultivar "Podarok Moldovy") and Dill (*Anethum graveolens* L., cultivar "Arminansky") seeds. All the samples came from the same lot (Vegetalbe Crop Research Station, Moscow Agricultural Academy, Russia).

Seed material was aerated at 20±2°C in the system of 3-5 glass columns (Fig. 1), water: seed ratio (w/w) was equal to 4:1. The flasks were continuously bubbled with oxygen for 18 h (Dill), 36 h (sweet pepper) using an oxygen tanks at the rate providing uniform seed stirring in water without splash (Tarakanov *et al* 1985 and Boras, 1998). After treatment for the designed time, seeds were allowed to dry back to the initial moisture content of 9% on dry weight basis, and were preserved in the packet within room temperature.

Sowing was carried out immediately after treatment, within 7 days, 1 month, and 3 months after storage.

Laboratory germination tests were set up with 100 seeds in four replications for each treatment (ISTA, 1985). Sweet pepper seeds were placed in petri dishes (9 cm diameter) over two filter papers, previously moistened with 3 ml distilled water, and kept in boxes on moist soil (80% Soil moisture content). Distilled water was replaced regularly.

The petri dishes and boxes placed in the dark at 20°C and 25°C for Dill and pepper respectively.

The field experiment was carried out on Dill with 6 replicates. The area of each replicate was 2.1 m². All data were also subjected to an analysis of variance and when a significant ($P < 0.05$) ratio

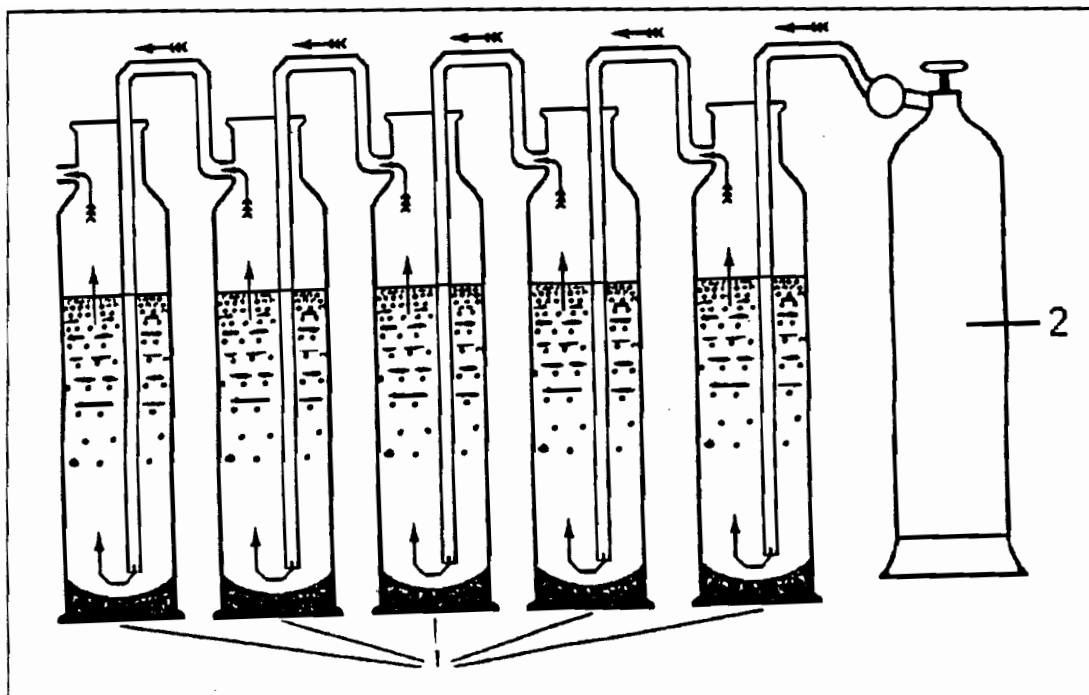


Fig. 1 A system for seed treatment using aerated hydration
1- columns, 2- oxygen tanks

occurred for treatment, a least significant difference (LSD) was calculated.

RESULTS AND DISCUSSION

The effect of treatment in an aerated hydration with oxygen was positive in the

improvement of germination of pepper seeds, whether those which were germinated on the filter paper or cultivated in the soil, (Table 1). The germination percentage of treated seeds with oxygen for 36 hours in lab., and soil was 97% and 90% respectively, against 86% and 76% for the untreated seeds.

Table 1. Effect of pre-sowing seed treatment on germination rate in sweet pepper (After storage)

Methods of seed treatment	Period between treatment and sowing							
	Sowing immediately after treatment		Sowing after 7 days of storage		Sowing after 1 month of storage		Sowing after 3 months of storage	
	Germination rate (%)							
	Filter paper	Soil box	Filter paper	Soil box	Filter paper	Soil box	Filter paper	Soil box
Untreated seeds	86	76	86	75	86	72	84	70
Soaking 36 hours	90	79	88	79	87	75	85	72
Aerated hydration 36 hours (pure oxygen)	97	90	96	89	96	85	94	82
L.S.D (P<0.05)	4.92	5.47	4.81	5.13	6.61	6.04	7.20	6.30

The same effect was noticed with respect to activity of oxygen during storage of seeds, where the results (Table 1) have shown that treated seeds in an aerated hydration with oxygen had preserved its viability during storage for three months, as the germination percentage was 94% and 82% against 84% and 70% for untreated seeds.

As for the study of capability of treated seeds in an aerated hydration with oxygen to preserve their viability after storage during cultivation under field

conditions, the results of study carried out on the Dill seeds have shown that field emergence of treated seeds in an aerated hydration with oxygen for 18 hours is higher than that of untreated seeds, and that of soaked seeds, whether the cultivation was carried out immediately after treatment or after storage up to three months (Table 2).

The productivity has increased upon the cultivation of treated seeds in an aerated hydration with oxygen, whether such cultivation has been carried out

Table 2. Effect of pre-sowing seed treatment on field emergence and yield in Dill seeds (after 3 months of storage)

Methods of seed treatment	Field emergence % (10 days after sowing)		Yield Kg/m ²	
	Sowing immediately after treatment	Sowing after 3 months of storage	Sowing immediately after treatment	Sowing after 3 months of storage
Untreated seeds	41	32	1.3	1.22
Soaking 18 hours	50	39	1.85	1.75
Aerated hydration (18 h) Pure oxygen	62	58	2.23	2.14
L.S.D (p<0.05)	7.21	6.73	0.25	0.23

immediately after treatment (2, 23 against 1.30 and 1.85 kg/m² for untreated seeds and soaked seeds) or after storage for three months (2.14 against 1.22 and 1.75 kg/m²).

Oxygen aerated hydration increased germination percentage due to enhanced seed imbibition, early activation of enzymes, and seed respiration rate, thus promoting its metabolic activity (Tarakanov *et al* 1985; Smith and Coble, 1991).

The effect of the treatment on capability of seeds to preserve their viability during storage is perhaps due to the removal of the materials which prevent the germination (inhibitors), and the continuation of enzyme activity inside treated seeds during storage period, and the conversion of the food reserves due to metabolism and their positioning under the disposal of the main growing areas of the embryo.

Seeds germinate best immediately after treatment. If term storage is neces-

sary before planting, seeds should be primed as close to the planting date as possible.

The results of both term storage experiments and controlled deterioration tests showed that seed treatment in Dill and pepper in an aerated hydration, exhibited decreased storage life compared to untreated seeds.

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حيوية البذور المعاملة بوسط مائي مؤكسج وإنتاجيتها بعد التخزين

[٦]

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حرارة الغرفة. تمت الزراعة بعد يوم من المعاملة، وبعد أسبوع، وبعد شهر وثلاثة أشهر من التخزين. أوضحت نتائج الدراسة التي أجريت على بذور الفليفلة في ظروف مخبرية وعلى بذور الشمرة في ظروف حقليّة أن البذور المعاملة في وسط مائي مؤكسج نقي احتفظت بحيويتها خلال التخزين. وأن نسبة إنبات البذور المعاملة وإنتاجية النباتات النامية منها (من البذور المعاملة) لا تختلف كثيراً قبل التخزين وبعده ، على ألا تجف البذور تحت أشعة الشمس، أو لا تزيد درجة حرارة هواء التجفيف على ٣٥ مئوية حتى لا تفقد البذور حيويتها.

أجريت الدراسة على بذور الفليفلة الحلوة *Capsicum annum L.* وبذور الشمرة *Anethum graveolens L.* في محطة أبحاث الخضر بأكاديمية موسكو للعلوم الزراعية، لتحديد إمكانية احتفاظ البذور المعاملة في وسط مائي مؤكسج (مهوى بالأوكسجين) بحيويتها خلال التخزين. عوملت بذور الشمرة مدة ١٨ ساعة وبذور الفليفلة مدة ٣٦ ساعة. جففت البذور بعد انتهاء المعاملة بتعريضها إلى تيار هوائي تراوحت حرارته بين ٣٠-٣٥ درجة مئوية حتى انخفضت رطوبتها إلى نسبتها الأولية (٩% من وزنها الجاف). حفظت بعدها البذور في أكياس ورقية على درجة

الكلمات الدالة: حيوية البذور - الإنبات - تخزين البذور - وسط مائي مؤكسج (مهوى بالأوكسجين) - الفليفلة الحلوة - الشمرة

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