

Seed Viability under Different Storage Conditions

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Introduction

The aim of this study was to compare the effects of various types of storage conditions on the viability of seeds, with a specific objective of determining the effect of long-term storage under carbon dioxide (CO₂) on germination.

Materials and Methods

Storage Conditions

The following storage conditions applied:

- normal warehouse storage;
- storage in an air-conditioned chamber (T = 9°C, relative humidity 65 ± 10%); and
- chamber storage under constant (35 ± 5%) carbon dioxide.

Seeds

The following types of seeds were tested:

- maize (*Zea mays* L.) — BC388
- winter wheat (*Triticum* sp.) — Sivka: untreated seeds; Baranjka: treated seeds
- spring wheat (*Triticum* sp.) — Anka: untreated seeds
- soybean (*Glycine max* (L.))
- green pea (*Pisum sativum*) — Provansalac mali
- onion (*Allium cepa* L.) — Srebrenac skopski majski
- paprika (*Capsicum annuum* L.) — Rotund zuta
- kale (*Brassica oleracea* var. *sabauda* L.) — Zeljezna glava
- parsley (*Petroselinum hortense* Hoffm) — Berlinski
- lettuce (*Lactuca sativa* L.) — Majska kraljica
- grass seed (*Festuca rubra* L.) — Chewings fescue
- rapeseed (*Brassica napus* var. *oleifera* L.) — Jet neuf

Method of Packing

Seeds were stored in small lots in jute and laminated plastic bags, as well as in their original paper packages. The laminated plastic bags used for seed storage were purged with CO₂ then sealed.

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Storage Period and Seed Testing

The total storage period was 12 months. Viability was tested by the standard (JUS) method on samples of 200 seeds at the beginning of the experiment and after 6 and 12 months.

Results and Discussion

Determinations of seed viability at the beginning of the experiment and after 6 and 12 months are given in Table 1.

Table 1. Viability of seeds (%) after 6 and 12 months in a warehouse, an air-conditioned chamber, or in a carbon dioxide atmosphere

Seeds	Time of testing (months)	Warehouse storage			Air-conditioned chamber			CO ₂ chamber		
		Paper bag	Jute bag	Plastic bag	Paper bag	Jute bag	Plastic bag	Paper bag	Jute bag	Plastic bag
Wheat (Baranjka)	Initial	98								
	6	91	93	83	92	85	93	55	73	81
	12	87	85	89	86	90	92	25	69	79
Wheat (Sivka)	Initial	93								
	6	92	91	79	91	91	89	47	25	83
	12	85	86	89	96	86	86	24	65	71
Wheat (Anka)	Initial	73								
	6	83	81	78	76	83	80	–	–	83
	12	77	72	76	76	79	85	–	–	73
Rapeseed	Initial	90								
	6	75	68	66	43	60	69	32	37	53
	12	83	79	86	63	85	84	44	21	78
Maize	Initial	97								
	6	94	92	95	94	94	92	95	93	95
	12	96	96	95	96	97	96	94	96	96
Soybean	Initial	76								
	6	67	76	70	82	75	75	56	54	60
	12	80	77	70	78	85	80	25	40	66
Green pea	Initial	93								
	6	93	91	92	94	95	92	90	89	91
	12	86	94	93	87	92	92	90	87	86
Parsley	Initial	79								
	6	66	68	51	69	71	63	34	34	62
	12	27	44	41	25	14	17	6	15	5
Paprika	Initial	85								
	6	33	46	51	68	78	71	1	6	16
	12	2	2	–	18	18	66	0	0	0
Lettuce	Initial	78								
	6	76	50	38	75	70	79	20	86	37
	12	76	73	65	75	78	79	0	89	53
Kale	Initial	90								
	6	88	97	97	95	96	94	95	95	94
	12	64	57	48	73	70	71	58	90	54
Onion	Initial	91								
	6	89	77	95	88	91	89	69	85	95
	12	91	93	82	99	83	91	67	66	98
Grass seed	Initial	82								
	6	89	77	95	88	91	89	35	64	54
	12	52	32	15	27	56	59	38	–	–

It can be seen from the results that the viability of maize, green pea, and, to a lesser extent, onion seeds remained constant for all package types and storage conditions. For the most part, however, all other seed displayed lower germination after storage under CO_2 .

Warehouse Storage

For 6 of the 13 types of seed tested, the samples held in laminated plastic bags filled with CO_2 displayed lowered germination following 6 months storage than did seeds held in paper or jute bags. The greatest reductions in germination occurred with parsley, paprika, kale, and grass seed following 12 months storage.

Air-conditioned Chamber

After 6 and 12 months, almost all seeds stored in laminated plastic bags had viabilities equal to or better than those stored in the other types of packages. The exceptions were grass and parsley (6 months) and grass, parsley, and paprika (12 months).

CO_2 Chamber

Wheat and rapeseed stored in laminated plastic bags displayed higher germination than the seeds of those two species held in the other types of packages. In general, the laminated plastic bags appeared to afford the greatest protection, though paprika, parsley, and lettuce seeds were clearly sensitive to the CO_2 used to purge the bags.

Note that any insects present in laminated plastic bags will be killed following purging with CO_2 and the seeds will be protected during storage as long as the bag remains intact. Also, all insect stages will be controlled by the constant CO_2 atmosphere of the chamber.

Conclusion

This study suggested that, with the exception of maize and green peas, CO_2 atmospheres can reduce the viability of stored seeds. Care must therefore be taken in using CA strategies based on CO_2 for long-term protection of seed from insect infestation.

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