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Seed longevity of cereal seed samples during hermetic vs. 'open' storage at 35°C and the effect of headspace gasses in hermetically stored samples.

Seed banks are the main *ex situ* method for the conservation of plant genetic diversity. According to the IPGRI recommendations for orthodox seed, dried samples are stored in hermetic containers at approximately –25°C. However, aging processes are not stopped completely. An important role in the aging of dry seed is played by the oxidative reactions of lipids due to free radical activity or auto-oxidative processes. Low-molecular volatiles, the end-products of these reaction, could be accumulated In hermetic storage containers. Due to their chemical activity, they may react with proteins and/or nucleic acids, negatively affecting seed viability. This experiment analyzed the changes in germinability of cereal samples stored in mild, artificial ageing conditions and the head space gas contents of cereal seed samples sealed in aluminum foil.

Materials and methods. Cereal seed samples of rye (Dańkowskie Złote and Warko), triticale (Magnat and Pronto), and wheat (Santa and Zorza) with different moisture contents (MC, 7, 10, and 13% (fwb)) were stored sealed in laminated, aluminum foil bags (hermetic storage) and/or over salt solutions in a periodically ventilated, glass desiccator ('open' storage) at 35°C. During storage, seed viability and moisture content were checked periodically. After 155 weeks, the head-space gas content of hermetically stored seed was assessed by GC/MS.

Viability results. The slowest decrease in viability was observed for wheat at 7% MC. The highest rate of aging was represented by triticale cultivars despite the MC. At 13% MC, all samples lost their viability after a few weeks.

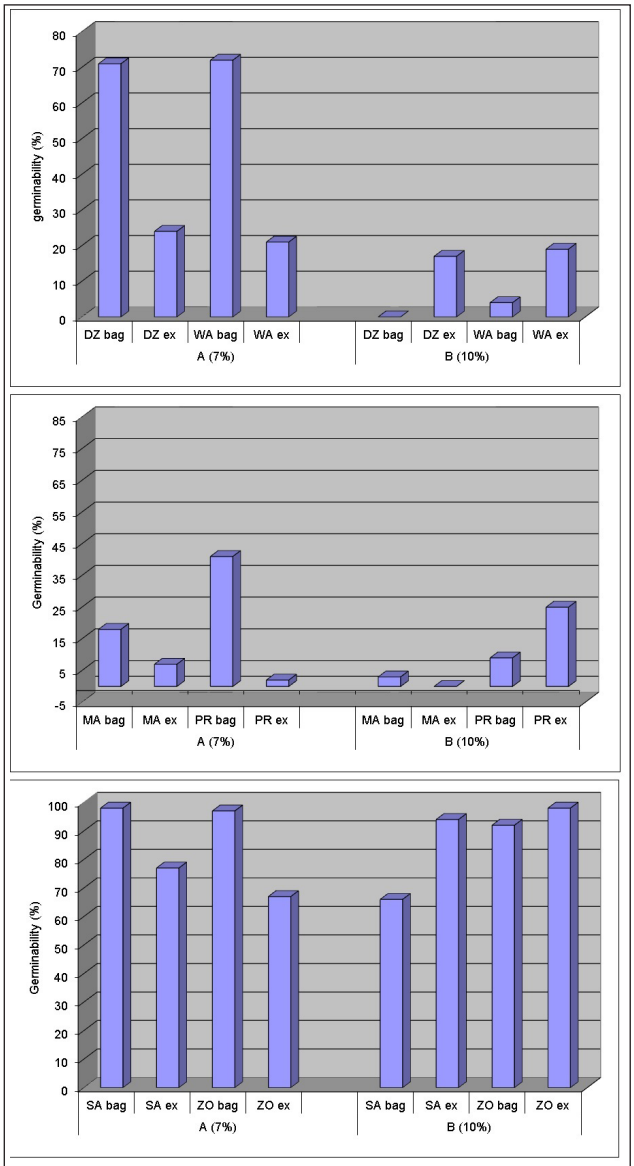

Fig. 1. Viability of cereal samples at 7% (A) and 10% (B) moisture content of after 155 weeks of storage at 35°X in hermetically sealed bags or 'open' storage (ex). Dańkowskie Złote (DZ) and Warko (WA) rye (top), Magnat (MA) and Pronto (PR) triticale (middle), and Santa (SA) and Zorza (ZO) wheat (bottom).

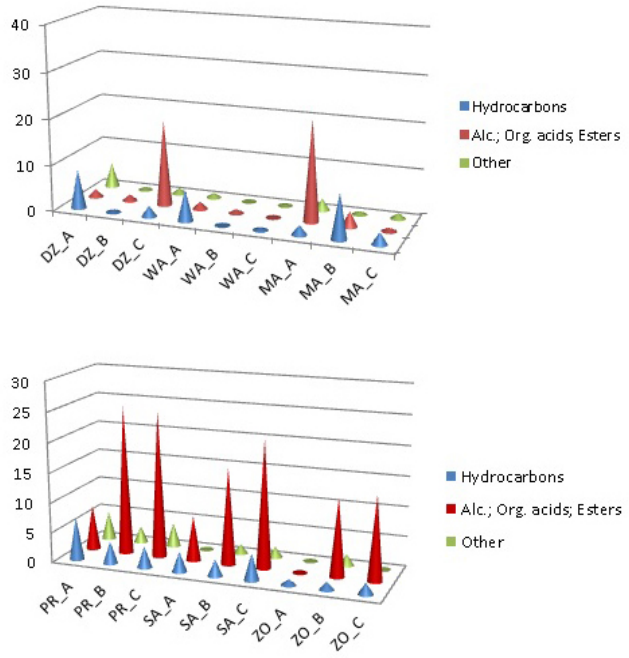

Fig. 2. The main groups of volatiles (a.u.) of head-space atmosphere of cereal seed samples hermetically stored for 155 weeks at 35°C at a moisture content of 0.07 (A), 0.10 (B), or 0.13 (C) gH_2O/gfw for Dańkowskie Złote (DZ) and Warko (WA) rye, Magnat (MA) and Pronto (PR) triticale, and Santa (SA) and Zorza (ZO) wheat.

Table 1. Seed moisture content at 0 time and after 155 weeks of hermetic (bag) or 'open' (desiccator) storage.

Crop	Cultivar	Time		
			155 days	
		0	Hermetic	Open
Rye	D Złote	7	7	4
	Warko	11	10	9
Triticale	Magnat	7	7	4
	Pronto	10	10	9
Wheat	Santa	7	7	3
	Zorza	10	10	9

Table 2. Total amount of accumulated volatiles (a.u.) after 155 weeks of hermetic seed storage at 35°C in relation to seed moisture content (*probably the result of microbial (fermentation) activity).

Crop	Cultivar	Seed moisture content		
		7%	10%	13%
Rye	D Złote	15.53	2.36	22.25*
	Warko	10.47	1.33	1.14
Triticale	Magnat	27.72	14.32	5.68
	Pronto	20.41	31.46	33.09
Wheat	Santa	10.80	19.30	27.78
	Zorza	1.40	16.30	17.80

Seed with 7% MC were stored better when sealed in an hermetic container, but seed with a higher MC (10%) maintained their viability longer in 'open' storage (Fig 1, p. 44). The putative effect of varied metabolic activity due to different seed MCs did not result in head-space content (Fig 2). The lower viability of seed at 7% MC and stored in an 'open' regime might be an effect of over-drying during storage to 3–4% (Table 1).

Head-space gas results. The most abundant of more than 63 gasses identified were alcohols, organic acids, esters, and hydrocarbons. Volatile aldehydes and/or ketones, putative products of lipid peroxidation, were hardly present (Fig 2). No volatiles specific to process of cereal seed aging were found. The total amount of volatile content increase was observed at higher seed MCs for longer lasting wheat and one triticale cultivar. In the case of rye and the second triticale cultivar, a low viable sample showed that less volatile products were accumulated (Table 2).

Conclusions. The results support recommendations for the optimal seed MC for hermetic long-term seed storage in the seed bank. A negative influence on seed longevity from over-dryingwas observed in the evaluated cereals. Hermetic storage did not result in deleterious volatile accumulation during seed storage.