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Seed viability of pigeon pea stored in two environments[1]

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Summary

Preliminary tests were carried out to obtain data on the viability of pigeon pea seeds in storage. Pigeon pea (*Cajanus cajan* (L.) Millsp.) cultivars ICP-1, -26, -2624, -6443, and -6997 were stored at 15-20 °C and 50-60 % relative humidity, and compared with ambient room conditions at ICRISAT Center. After 4 years in cool storage, viability of all cultivars except ICP-6997 remained above 92 %. At room temperature ICP-6997 lost viability completely, ICP-2624 maintained 53 % viability and ICP-26, -1, and -6443 germinated for 44, 24, and 4 % respectively. In respect of containers, plastic bottles kept viability best at ambient room temperature, and in cool storage no difference was detected with paper and cloth bags.

Introduction

Temperature, moisture and oxygen pressure are the major environmental factors during storage that influence seed viability and longevity. In genetic resources conservation, 'orthodox' seeds have to be stored at low temperatures and humidity, to prolong life and avoid genetic drift through frequent grow-outs and avoid errors in handling the seeds.

Germplasm seed samples at ICRISAT, where viability carry-over needs to be as long as possible, are stored under cool conditions. Cool rooms at 4 °C and ca. 30 % relative humidity (RH) for medium-term storage, were completed in 1980. Previous to that temporary conditions were created where commercial air-conditioners and dehumidifiers lowered the temperature to 15-20 °C and the relative humidity to 50-60 % for 24 h a day. A perusal of the literature reveals that

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not many data have been published on the viability of pigeon pea under regulated conditions of storage. The following summarizes important findings to date.

Pigeon pea viability was reduced after 60 days of storage at 70 and 90 % RH from an initial germination of 90 % or higher, to 83 % and 82 % at 27 °C (Yadav & Pant, 1979). On Guadeloupe, 45 % of the seeds of pigeon pea of 12.5 % initial moisture content germinated after 2 years' storage in a cold room at 6-12 °C and 75-85 % RH. In air-conditioned laboratory space (16-20 °C, 80 % RH), and in a cold room, viability was fairly constant up to 1 year, and declined thereafter, while seeds stored at ambient room temperature (24-29 °C, 75-95 % RH) dropped below 50 % after 5 months and to 0 % after 10 months (Suard & Degras, 1975). Previous work at ICRISAT on pigeon pea seeds of 1974-75 harvest showed marked decrease in viability if stored under ambient room temperatures (ICRISAT, 1978). In the present study on viability of pigeon pea seeds of 1975-76 harvest stored for up to 4 years under cool conditions were compared with storage in ambient conditions.

Materials and methods

The tests were initiated in February 1976 with fully air-dried seeds of five pigeon pea cultivars:

	Pedigree	*Origin*	*100-seed weight (g)*
1. ICP-1	Sharada Selection	Andhra Pradesh, India	9.8
2. ICP-26	T-21	Uttar Pradesh, India	7.7
3. ICP-2624	ST-1	Uttar Pradesh, India	8.2
4. ICP-6443	NP(WR)15	New Delhi, India	7.2
5. ICP-6997	Field Collection DSLR-17	Madhya Pradesh, India	12.8

Three types of containers were used: (1) cloth bags; (2) paper packets; (3) plastic bottles with screw caps and inner lids.

Storage took place under two conditions: (1) cool conditions of 15-20 °C and

Table 1. Analysis of variance for germination percentages of pigeon pea seeds stored at two temperatures (cool and ambient) for 4 years in three types of containers.

Source of variation	Degrees of freedom	Mean sum of squares	
		ambient room temp.	cool temp.
Containers	2	2394.1*	1.9
Cultivars	4	8779.0*	789.2*
Years	3	60872.5*	300.1*
Year × cultivar	12	1844.6*	183.6*

*F value significant at $P < 0.05$.

50-60 % RH; (2) ambient room temperatures of 22-35 °C and 50-95 % RH.

Initial moisture determinations were not taken, but usually pigeon peas are sun-dried to 9-11 % moisture. Twice a year seeds were germinated on filter paper moistured with distilled water in sterilized petri dishes. Prior to 1979, germination was carried out at ambient room temperatures (23-33 °C). Thereafter the seeds were incubated at 30 °C without illumination. Four replicates of 50 seeds each were tested and the first count of germination was taken after 5 days and the final one after 7 days. The data were analysed on a yearly basis (Table 1).

Results and discussion

All the cultivars showed a significant decline in viability after 4 years of storage at ambient room temperature. No appreciable differences in germination were recorded during the first 2 years of storage, except in cultivar ICP-6997 which lost 19.7 % of its viability. After 4 years all seeds of cultivar ICP-6997 were dead. Germination of cultivar ICP-6443 declined sharply after the 3rd year of storage from 71.8 % to 4.2 % after the 4th year, while the loss of viability was more or less gradual in other cultivars over the 4 years (Fig. 1).

Differences between containers were also appreciable at ambient room temperature. Plastic bottles kept seed viability better than cloth bags or paper packets, and the differences between the latter two were insignificant (Fig. 2). Containers such as plastic bottles, being non-pervious to moisture, retain the initial moisture content of the seeds, while the moisture content of seeds in moisture-pervious paper packets and cloth bags adjust to the changes in the relative

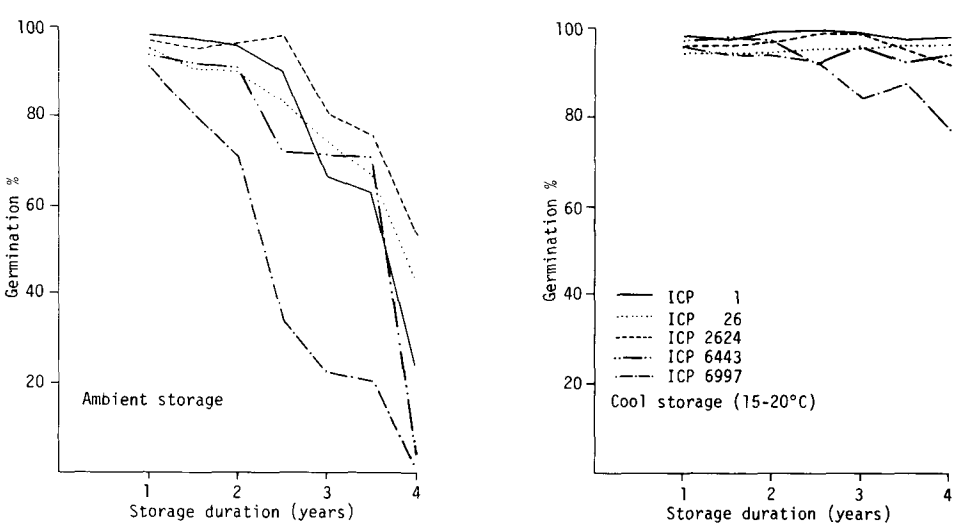

Fig. 1. Influence of temperature and genotype on seed viability of pigeon pea.

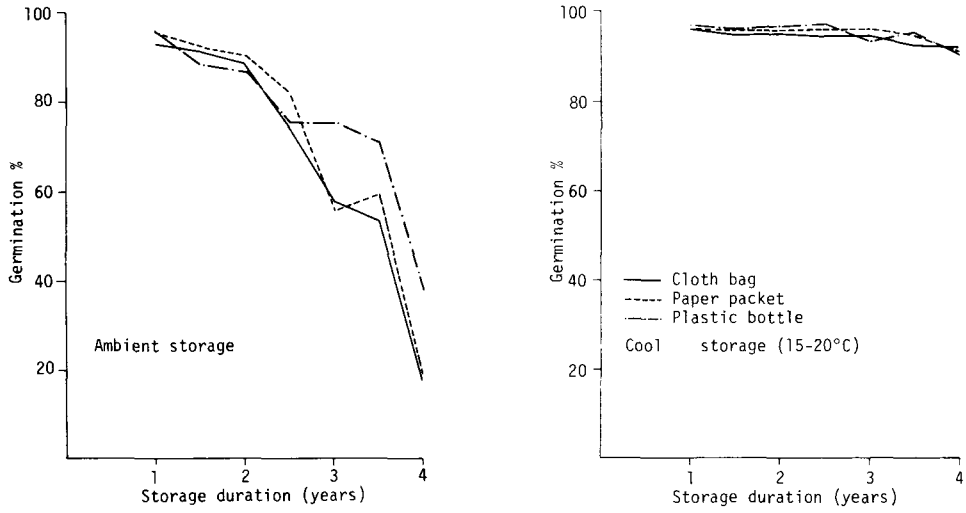

Fig.2. Influence of container type on seed vaibility of pigeon pea.

humidity of the surrounding environment (see Bass, 1973; Harrington, 1973). The presumed fluctuation in moisture content of the seeds stored in cloth bags and paper packets at ambient room temperatures could have contributed to the loss of viability in the present case.

Cultivar ICP-6997 differed from the other cultivars: on an average, over the years, seeds stored in paper packets maintained better germination (49.6 %) than those stored in plastic bottles (43.9 %), the difference being significant at $P < 0.05$. The actual cause has to be determined, though a higher initial moisture content of the seeds could have been one reason for it.

Seeds stored at cool temperatures retained their initial viability even after 4 years, regardless of the container in which they were stored. Cultivar ICP-6997, however, lost 19 % of its viability during 4 years of storage and the germination of seeds stored in paper packets was, again, a little better than those stored in plastic bottles (89.1 % and 87.1 % respectively).

The results demonstrate the influence of genotype, temperature, and seed moisture content on the viability of pigeon pea seeds. Seed viability is much higher after storage under moderately cool conditions (15-20 °C), in an isolated store room cooled with commercial air conditioners and dehumidified with commercial dehumidifiers – a relatively inexpensive way to prolong the life span of germplasm samples and breeder's seeds to at least 4 years.

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