Germplasm Monitoring at National Gene Bank

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The Indian gene centre possesses rich plant biodiversity. National Bureau of Plant Genetic Resource (NBPGR) has been entrusted with the responsibility of conservation of genetic diversity in domesticated plant species and their wild relatives on long-term basis for posterity as base collections, as a part of a national network on conservation of plant genetic resource (PGR). To achieve this in case of orthodox seed producing species, seeds are processed and stored at –20 ^{0}C in long-term modules. The International Board on Plant Genetic Resources (IBPGR), Advisory Committee on Seed Storage recommends that seeds stored, as base collection should be monitored every 10 years, and as active collections every 5 years for their seed viability, seed quantity and seed health. These recommendations are of greater significance in case of tropical conditions of high temperature and relative humidity like India. Monitoring of germplasm is an essential component of safe conservation for sustainable use. The IBPGR recommendations on regeneration includes regeneration of an accession, if the seed viability falls below 85% of the original viability and/or the seed quantity falls below the number of the seeds required for a minimum of three regeneration cycles. The fall in seed viability is an indicator of setting of genetic deterioration.

In the Indian national gene bank a large number of accessions have been in-storage for more than 10 years. Therefore, the monitoring of all these accessions as per the IBPGR (now International Plant Genetic Resource Institute, IPGRI) recommendations became essential to follow international standards. The monitoring of germplasm at national genebank has been given priority in past few years to access the genetic potential of germplasm conserved and identify the accessions requiring regeneration. The accessions identified for regeneration using the above standard are being supplied to the concerned national active germplasm site(s) for regeneration.

The gene bank seed inventory records are checked at regular intervals and the list of accessions, which are to be monitored, is prepared.

While removing the seeds for monitoring it is ensured that sufficient seed material is available for subsequent regeneration of the accession.

The seed containers are conditioned to room temperature. The seed containers are immediately sealed after removing the seed material to prevent the entry of moisture from air.

Following two methods of seed testing are used during seed viability monitoring:

Fixed sample size germination test : This test is done using 100 seeds, each in two replications, following a suitable method of germination test (top of paper or between paper). The germination percentage is calculated on the basis of seed germinated. If the per cent germination is above 90, the test is accepted as valid. If it is below 90%, the test is repeated using another 200 seeds. The mean germination percentage is calculated, and if the germination percentage is below 85, the accessions are labelled for regeneration.

Sequential germination test: This method is used with accessions, with less quantity of seeds. In this method 40 seeds are used for germination test. The number of seed germinated are counted and the germination percentage is compared, with the number of seeds germinated (Table 1), to identify the accessions requiring regeneration.

The results of monitoring of germplasm in different crops have been summarised (Table 2) These results show that the germplasm accessions in most crops, except for oats, pigeon pea, chickpea, dolichos-bean, welvet-bean and cotton, have maintained the seed viability as per the international standards (without significant deterioration). Other crops like oats, pigeon pea and cotton etc. where the seed viability has gone down significantly, suggests their genetic deterioration and need for regeneration. Among these crops cotton registered the maximum deterioration in seed viability, which

Table 1. Sequential germination test

No. of Seeds	Regenerate if number of germinated seed is ≤	Repeat test if germination is between or equal to	Store if number of seeds germinated is >
40	29	30-40	–
80	64	65-75	76
120	100	101-110	111
160	135	136-145	146
200	170	171-180	181
240	205	206-215	216
280	240	241-250	251
320	275	276-285	286
360	310	311-320	321

Ellis *et al.*, 1980

Table 2. Results of monitoring of accessions of various crops stored for 10 or more years as base collections

Crop name	No. of acc. monitored	Initial viability range (%)	Present viability range (%)	Acc. with acceptable viability	% acc. for regeneration
Wheat	71	90-100	85-100	100**	Nil
Oat	84	86-100	59-100	94**	6
Barley	58	94-100	90-100	100**	Nil
Maize	65	80-100	80-100	100**	Nil
Amaranth	20	87-100	85-100	100**	Nil
Pigeon pea	447	>85%	–	98****	2
Chickpea	55	90-100	82-100	82*	10
Mung	71	90-100	84-100	97	3
Dolichos	136	80-85	75-65	64	36
Urd	55	85-90	82-90	98	2
Welwet bean	13	80-90	75-85	50	50
Pea	575	85-90	80-85	95	5
Rapeseed mustard	250	80-100	80-100	100***	Nil
Sesame	72	80-95	80-90	100***	Nil
Cotton	362	–	0-59	37**	63
Jute	107	90-100	85-100	100	Nil
Tobacco	75	95-100	92-96	100*	Nil
Ocimum	14	100	100	100*	Nil
Total	1573				

The above number has been calculated from: *10% of the randomly selected accessions **20% of the randomly selected accessions
***40% of the randomly selected accessions
****100%of the accessions stored

ranged from 0-59% where 63% of accessions requiring regeneration. These results are in the line the observation of some other gene banks, such as National Seed Storage Laboratory Fort Collins, USA.

Further, these results indicate that most cereals maintain their seed viability for longer duration, compared to other crops. Therefore, in such groups the monitoring interval can be extended from 10 to 15 years. Whereas, in crops like cotton or chickpea, which looses viability comparatively faster, more frequent monitoring is required to ensure the original genetic structure of an accession through regeneration.

References

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