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Seed Quality Status at Farmers' Level in Hilly Tribal Region of Himachal Pradesh

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ABSTRACT Majority of the tribal farmers in the hills of Himachal Pradesh still rely on their own saved seeds for raising next season crops. A study was carried out to assess the seed quality at farmers' level of crops grown in tribal region of Himachal Pradesh by collecting seed samples at the time of sowing for 4 years consecutively. Quality analysis of seeds showed high moisture content as compared to maximum prescribed limits laid out under Indian Minimum Seed Certification Standards (IMSCS). However, most of seed samples in majority of the crops including tartary and common buckwheat, dry beans, amaranthus etc. met minimum prescribed germination laid out under IMSCS and had good field emergence. Although a similar trend was observed for minor crops of the region including wheat, barley and maize for moisture content but germination was comparatively poor in these crops apparently due to the attack of stored grain pests. Data also showed considerable variation for seed quality parameters over different years. Study indicated considerable scope for interventions at seed production, processing, particularly at storage stage to enhance the quality of seeds at farmers' level so as to minimize yield reductions due to their use by farmers.

Key words: **Seed quality, Farmers' own saved seeds, Tribal region, Minimum prescribed germination**

Seed is a basis and vital input in crop production which provides foundation for sustainable agriculture. Potential of other agricultural inputs without good quality seed cannot be realized. Although seed industry was strengthened in India in 1963 with establishment of National Seeds Corporation Ltd (NSC), but majority of the farmers still heavily rely on their own seed production, saving, storage and distribution system to meet their seed requirements in most of the crops. The trend is further truly reflected by the low seed replacement rates recorded for various crops at national as well as regional levels due to the frequent use of own saved seeds. Therefore, under present scenario, low realized productivity of crops to an extent, is a reflection of the quality of such seeds used by farmers which in turn further depends upon the practices followed by them for their production, processing and storage, apart from agroclimatic conditions prevalent in the region.

In Himachal Pradesh, the seed replacement rate for most of the traditional and subsistence crops is low and farmers use their own seeds of previous year for raising the next season crops. The practice of seed storage is most interesting in tribal region of Himachal Pradesh, particularly in districts Kinnaur where seeds and grains are stored in separately constructed small wooden houses, better known locally as *'Kathars'*. These *"Kathars"* are thick wooden-walled and roofed structures located near their houses and have different chambers for storage of different types of grains and seeds (Fig. 1). The region/location being dry temperate zone remains snow-bound

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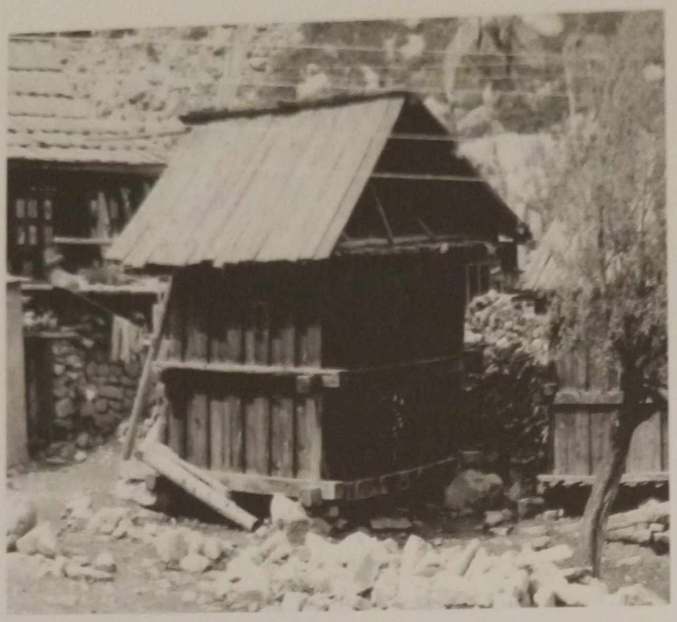

Fig. 1. Traditional seed storage structures (*kathars*) in tribal region of Kinnaur, Himachal Pradesh

from November to March, whereas cropping season lies between May and September after snow melt. The seed storages, is different from usual traditional storage systems of using bins and drums, are likely to influence quality of seeds under such a peculiar storage system.

Although various studies in past have been conducted to assess the quality of farmers' own saved seeds in crops like groundnut and rice. [1, 2] in India, Indonesia [3], Philippines [4] and Bangladesh [5], no such study have been conducted to assess the quality of farmers' own saved seeds of major crops under typical seed storage system, followed in the tribal areas of district of Kinnaur, Himachal Pradesh, where climatic conditions are dry temperate.

MATERIALS AND METHODS

Forty samples of farmers' own saved seeds of 7 mostly grown crops in the region were collected at the time of their sowing from farmers of different randomly selected villages in Kinnaur district during each year of study. For buckwheat, tartary buckwheat and rajmash, seeds were sampled consecutively for 4 years, starting from 2003 until 2006, whereas for remaining 4 minor crops, *viz.* amaranthus, maize, wheat and barley, the samples were collected during 2003 and 2004. All collected seed samples were analysed in the Seed Technology Lab for seed quality parameters including moisture content (%), germination (%), field emergence (%), seedling length, electrical conductivity and vigour index, following standard procedures given by ISTA [6]. The data recorded for all the samples were analysed to calculate mean and standard deviation for each parameter year-wise as well as pooled over years. The observed parameters were then compared with minimum standards prescribed under IMSCS [7] for interpreting the status of seed quality at farmers' level.

RESULTS AND DISCUSSION

Analysis of 160 samples of tartary buckwheat over 4 years showed higher initial moisture content in farmers' own saved seeds with a mean moisture content of 14.6% and none of the farmers' seed samples meet out the minimum standards kept tentatively at 11% due to non-availability of IMSCS for this crop (Table 1). Germination and field emergence were recorded 88.3% and 79.0%, respectively. Considering at least 80% germination standard to be minimum for tartary buckwheat, 77.5%, 90.2%, 93.0% and cent per cent of samples of seed met IMSCS during 2003, 2004, 2005 and 2006, respectively. Overall, 91.4% of the total sampled seed lots showed minimum prescribed germination. Similar to tartary buckwheat, farmers' own saved seeds of common buckwheat also showed high (14.8%) moisture content and none of samples could meet out IMSCS of 11% moisture content. In general, seed germination and field emergence were found to be low in common buckwheat as compared to tartary buckwheat. This might be due to differences in seed morphology and structure of common and tartary buckwheat as husk of the common buckwheat is more fragile and loose as compared to tartary buckwheat. A good proportion of farmers' seed samples to the tune of 64.2%, 81.5%, 83.7%, and 74.4% met out IMSCS for germination considering it at a minimum of 80%. Mean electrical conductivity, seedling length and vigour index were recorded as 0.27 m mho/g, 21.22 cm and 1760.9, respectively. Common

Table 1. Mean seed quality parameters of farmers' own saved seeds of 4 minor crops of tribal district Kinnaur of Himachal Pradesh over 2 years

Year	2003		2004		Mean over years		SD	IMSCS
Crop/parameter	Mean	% samples meeting IMSCS	Mean	% samples meeting IMSCS	Mean	% samples meeting IMSCS		
Grain amaranthus								
Moisture content (%)	12.8	0	10.2	0	11.5	0	1.83	8.0
Gemination (%)	74.4	64.7	84.1	87.5	79.25	75.7	6.85	70.0
Field emergence (%)	65.9	-	76.2	-	71.05	-	7.28	-
Electrical conductivity (m mho/g)	0.15	-	0.14	-	0.145	-	0.007	-
Seedling length (cm)	19.9	-	5.08	-	12.49	-	10.47	-
Vigour index	473.8	-	434.2	-	454.0	-	28.00	-
Maize								
Moisture content (%)	13.5	0	10.9	100	12.2	0	1.83	12.0
Gemination (%)	81.9	50.0	83.0	41.1	82.45	45.7	0.77	90
Field emergence (%)	71.6	-	75.9	-	73.75	-	3.04	-
Electrical conductivity (m mho/g)	0.08	-	0.13	-	0.10	-	0.03	-
Seedling length (cm)	31.9	-	16.8	-	24.35	-	10.67	-
Vigour index	2643.2	-	1402.5	-	2022.8	-	877.30	-
Wheat								
Moisture content (%)	14.5	0	11.3	100	12.9	0	2.26	12.0
Gemination (%)	63.9	0	74.8	28.5	69.35	10.0	7.70	85.0
Field emergence (%)	57.9	-	66.6	-	62.25	-	6.15	-
Electrical conductivity (m mho/g)	0.12	-	0.24	-	0.18	-	0.08	-
Seedling length (cm)	6.17	-	21.0	-	13.58	-	10.48	-
Vigour index	1319.4	-	1601.8	-	1460.6	-	199.6	-
Barley								
Moisture content (%)	12.3	65.0	14.4	0	13.35	30.2	1.48	12.0
Gemination (%)	89.9	95.0	79.4	43.4	84.65	67.4	7.42	85.0
Field emergence (%)	85.8	-	76.2	-	81.0	-	6.78	
Electrical conductivity (m mho/g)	0.30	-	0.62	-	0.46	-	0.22	
Seedling length (cm)	19.4	-	18.4	-	18.9	-	0.70	
Vigour index	1749.6	-	1462.8	-	1606.2	-	202.7	

buckwheat recorded higher seedling length and vigour index over years as compared to tartary buckwheat.

Farmers' own saved seeds of drybeans also showed higher mean moisture content (12% over four years) and none of 160 samples analyzed met out IMSCS for moisture content (9.0%). However, germination and field emergence were recorded high to the tune of 92.5 and 85.5%, respectively for drybeans. Germination (%) ranged from 88.4 in samples collected during 2003 to 95.5 in samples collected during 2004. Similarly, field emergence ranged from 79.1% in

samples during 2003 to 90.5% in samples during 2006. Most of samples (92.1%) during 2003, cent per cent during 2004, 88.8% during 2005 and cent per cent during 2006 met minimum germination for dry beans (75%) prescribed under IMSCS. Mean electrical conductivity, seedling length and vigour index were recorded 0.32 m mho/g, 20.0 cm and 1851.25, respectively. Since these crops are harvested during September and thereafter, weather remains cool and snow-bound, thus seeds do not dry to reach the level of IMSCS for moisture. The complete wooden structure of seed storage does not provide any chance for the loss of seed moisture during storage. Therefore, seed moisture remained high even up to the time of sowing in May. None of the fungal flora could infest the seed even with high moisture during storage because during this period the temperature conditions remain so cool that are not favourable for the growth of fungi to cause the seed infestation. The infestation by the stored grain pests was not observed and has also not so far been reported in common and tartary buckwheat. Present results confirmed the earlier reports of Ibanez [4] and Mollah *et al.* [8] who

Table 2. Mean seed quality parameters of farmers' own saved seeds of 3 major crops of tribal region

Year	2003		2004		2005		2006		Mean over years		SD	IMSCS
Crop/parameter	Mean	% samples meeting IMSCS	Mean	% samples meeting IMSCS	Mean	% samples meeting IMSCS	Mean	% samples meeting IMSCS	Mean	% samples meeting IMSCS		
Tartary buckwheat												
Moisture content (%)	14.3	0	13.5	0	15.6	0	15.3	0	14.67	0	0.96	11
Gemination (%)	81.5	77.5	87.3	90.2	91.5	93.0	93.1	100	88.35	91.4	5.18	80
Field emergence (%)	65.2	-	74.8	-	87.2	-	88.8	-	79.0	-	11.12	-
Electrical conductivity (m mho/g)	0.20	-	0.17	-	0.14	-	0.36	-	0.21	-	0.09	-
Seedling length (cm)	20.4	-	22.7	-	13.4	-	16.8	-	18.32	-	4.08	-
Vigour index	1692.6	-	1847.0	-	1226.1	-	1569.1	-	1583.7	-	264.12	-
Common buckwheat												
Moisture content (%)	15.4	0	13.6	0	13.8	0	16.5	0	14.82	0	1.37	11
Gemination (%)	79.2	64.2	80.0	81.5	88.5	83.7	86.6	74.4	83.57	75.6	4.66	80
Field emergence (%)	64.3	-	71.0	-	81.2	-	82.7	-	74.80	-	8.71	-
Electrical conductivity (m mho/g)	0.22	-	0.21	-	0.19	-	6.47	-	0.27	-	0.13	-
Seedling length (cm)	27.4	-	25.5	-	13.2	-	18.8	-	21.22	-	6.49	-
Vigour index	2197.3	-	2058.8	-	1177.2	-	1610.5	-	1760.9	-	462.78	-
Drybeans												
Moisture content(%)	11.9	0	9.8	0	12.6	0	13.9	0	12.05	0	1.71	9.0
Gemination(%)	88.4	92.1	95.5	100	89.9	88.8	94.8	100	92.15	95.8	3.52	75
Field rmergence(%)	79.1	-	85.2	-	85.8		90.5	-	85.15	-	4.67	
Electrical conductivity (m mho/g)	0.20	-	0.30	-	0.30		0.48	-	0.32	-	0.11	
Seedling length(cm)	19.9	-	17.7	-	19.4		23.0	-	20.0	-	2.21	
Vigour index	1779.3	-	1701.4	-	1749.6		2184.7	-	1851.25	-	218.00	

also reported higher initial moisture contents in farmers' own saved seeds of rice and jute in Philippines and Pakistan. Similarly our results also confirmed earlier findings of Lukose *et al.* [9] and Dhedhi *et al.* [1] who reported seed germination up to desired levels in groundnut seeds at farmers' level.

Analysis of 80 samples of seeds of minor crops, like grain amaranthus, maize, wheat and barley over 2 years also showed almost similar results. Mean moisture content (%) was recorded to be 11.5% in grain amaranthus, 12.2% in maize, 12.9% in wheat and 13.3% in barley (Table 2). None of the seed samples could meet prescribed IMSCS for moisture content in grain amaranthus, whereas in maize and wheat all samples collected during 2004 met minimum standards laid out for moisture content. However, none of the sample of these 2 crops met IMSCS for moisture content during 2003. In barley 65% of samples collected in 2003 met IMSCS for moisture content, whereas none of the samples during 2004 met IMSCS for moisture content.

Mean germination (%) over years was also recorded to be below IMSCS for maize, wheat and barley. However, grain amaranthus had higher mean germination (%) of 79.2 as compared to minimum of 70% prescribed under IMSCS and 75.7 % of the total samples met IMSCS during 2 years. Contrary to it, comparative situation was not good in wheat, maize and barley where only 16.0%, 45.7% and 67.4% of samples could meet IMSCS for germination. In these crops, this could be attributed partially to infestation of seeds with stored grain pests which in turn could be attributed to their high seed moisture content in these crops. Data of different years also showed considerable variation for these attributes.

The study showed generally high moisture content in farmers' own saved seeds. However, germination and field emergence were found up to desired levels mostly in all samples under present study, except cereals. Thus, the study indicated need of interventions in educating farmers about proper seed processing, particularly to reduce seed moisture contents to enhance seed quality of their own saved seeds.

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