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STORAGE LIFE OF ONION SEEDS IN RELATION TO THE METHODS OF THRESHING AND CLEANING, AND DRYING PERIOD

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ABSTRACT

A combination of threshing method (hand and stick), cleaning method (water dipping and winnowing) and drying period (8, 12 and 16 hours) were imposed on onion seed prior to storage in polythene bag (300 gauge) at Lumle Centre (1670m asl) under ambient conditions. The seeds were analysed in an interval of 2 months for germination from June 1995 to April 1998. Germination standard for onion seeds was maintained up to 36 months of storage. A combination of hand threshing, water dipping and 8 hours drying was the best having higher germination percentage over the study period, but there was no clear distinction between rest of the treatments.

Additional Key Words: *Allium cepa*, germination, post-harvest operations, seed storage, seed viability

INTRODUCTION

Onion (*Allium cepa*) is an important winter vegetable and spice in Nepal and is regarded as a new crop in the hills. Because the area under onion production is expanding every year the demand for its seed is increasing as well. In order to fulfil the demand for seed, a few pocket areas have been identified for seed production. There is an ample prospect for production of onion seeds in Nepal, but at present majority of the demand is fulfilled by importation from India. Since onion seed stores poorly and loses its viability quickly (Ellis *et al.*, 1996), it is important to maintain the seed viability over years for better utilisation of any carry-over stock from surplus production or for redistribution within the country.

Post-harvest operations include threshing, cleaning (processing), drying, seed treatment, seed storage and other operations till the final use of seeds. Literatures indicate that post-harvest operations have effects on seed viability. Initial seed moisture contents are important factor determining storage life of onion seed. Similarly, threshing method also affect onion seed viability. The effect of both these practices when combined together may be different. Rudolph (1988) observed that cold air-drying had slowest decline in germination rate and rack drying the steepest; this indicates that drying periods and drying methods affect germination of onion seeds.

Seed quality of *Vigna radiata* was not affected by low drying temperatures, but seeds dried under high temperatures showed greater loss of viability (Sangakkara and Wanisekara, 1990). They also reported that machine threshing was detrimental to seed quality compared with hand threshing and both low temperature and low humidity maintained high seed quality throughout the experiment. It means we could achieve better onion seed viability by identifying an optimum combination of drying period and threshing method. There are several other factors affecting onion seed viability in storage (Singh and Singh, 1990), e.g. threshing methods (Sangakkara and Wanisekera, 1990), microbial activity, initial seed moisture content, relative humidity of the store, storage temperature (Rudolph, 1988) and storage structures. Effects of threshing and cleaning methods, and drying period were investigated to determine most suitable combination for maintaining onion seed viability in this present experiment.

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MATERIALS AND METHODS

Required numbers of umbels were produced on farmers' field at Mallajh (1000 m), Parbat district of West Nepal and harvested at full maturity stage and threshed by two different methods i.e. by hand and stick. Seed cleaning was done by two methods i.e. winnowing the seedsand then dipping them in water. The individual lots of seeds were sun dried for 8, 12 or 16 sunshine hours. This procedure was followed in three replications. Since umbels from one farmer's field were not enough for all the replications, each replication was from one farmer for all treatments. Seeds after drying were collected at Lumle Centre and moisture content was determined by gravimetric method before storing it in polythene bags (300 gauge). The polythene bag was stapled after folding it for three to four times so that there is less chance of moisture absorption by seeds. The seed bags were sealed and then kept at Seed Laboratory of Lumle Agricultural Centre (1670 m). Germination test was carried out at an interval of 2 months by taking a sample of 400+ seeds from the bag as described by International Seed Testing Association (ISTA, 1985). Careful attention was given while opening the bag to take sample so that there is less damage and it was re-sealed as above. Four hundred seeds (100 seeds per replication) were planted on moist germination paper and rolled it. Such rolls were prechilled at 5-7°C for 3 days and then transferred to 20°C constant temperature. These rolls were watered as and when necessary until germination counts were taken on 7^{th} and the 14^{th} days after planting. It should be noted that only normal seedlings were considered for total germination percentage. This study was started from June 1995 to April 1998. Data were analysed by using GENSTAT software.

RESULTS

There was a significant ($P<0.01$) effect of threshing methods on maintaining onion seed viability. Hand threshing (73.65%) was better for maintaining seed viability than stick threshing (71.01%). There was no interaction ($P > 0.05$) between threshing methods and storage period indicating that hand threshing was consistently better than the stick threshing. There was no effect ($P > 0.05$) of cleaning methods as well as drying periods on maintaining onion seed viability (Table 1). However, there was a significant ($P < 0.01$) interaction between threshing, cleaning and drying period (Table 2) indicating that a certain combination was better than others.

The best combination was hand threshing, water dipping and 8 hours drying. Interestingly, there was no interaction between different combinations and storage period indicating that all treatments were behaving on a particular time of storage in a certain pattern. However, none of the treatments showed a regular pattern over storage period. The viability percentage was somewhat poor during winter and it was relatively better during summer (Table 1).

Table 1. Effect of threshing and cleaning methods, and drying period on maintaining the onion seed viability (%) in storage.

Month	Threshing		Cleaning		Drying (hours)		
	Hand	Stick	Winnowing	Water dippin	8	12	16
0	75.18	72.46	73.74	73.90	76.52	74.96	69.98
2	70.82	67.12	69.74	68.21	69.04	70.42	67.46
4	79.65	79.44	78.89	80.21	80.17	79.37	79.10
6	78.28	81.35	81.15	78.47	83.21	75.79	80.44
8	64.40	64.75	66.22	62.93	66.06	59.06	68.60
10	73.82	72.89	74.31	72.42	76.73	67.60	75.75
12	80.49	77.60	78.57	79.51	78.73	80.19	78.21
14	81.18	79.44	80.07	80.56	82.23	80.62	78.08
16	79.14	77.36	79.14	77.36	79.00	78.08	77.67
18	76.08	70.75	73.97	72.86	74.92	72.00	73.33
20	76.14	70.00	75.69	70.44	72.52	74.96	71.67
22	79.92	78.56	78.03	80.44	80.33	79.62	77.75
24	79.75	77.97	77.50	80.22	77.87	81.50	77.21
26	75.14	73.53	75.42	73.25	74.29	74.67	74.04
28	55.50	53.11	53.86	54.75	53.50	52.50	56.92
30	57.01	50.11	52.88	54.25	52.23	53.56	54.90
32	72.19	67.44	68.22	71.42	71.42	64.08	73.96
34	70.34	64.33	63.75	71.53	67.46	67.33	68.13
Mean	73.65	71.01	72.29	72.37	73.13	71.46	72.40

C.V. (%) = 15.3
SEd (T) = 0.87^{**}
SEd (M) = 2.60^{***}
SEd (T x M) = 3.68^{ns}
SEd (T x C x D) = 2.13^{***}

SEd (C) = 0.87^{ns}
SEd (M) = 2.60^{***}
SEd (C x M) = 3.68^{ns}

SEd (D) = 1.06^{ns}
SEd (M) = 2.60^{***}
SEd (D x M) = 4.51^{ns}

Note: C = Cleaning, D = Drying, M = Month and T = Threshing; *, ** and *** denotes $P < 0.05$, $P < 0.01$ and $P < 0.001$, respectively.

Table 2: Interaction effect of cleaning and threshing method, and drying period on onion seed viability (Mean value of the study period).

Drying period	Cleaning method		Threshing method	
	Water dippi	Winnowing	Hand	Stick
8 hours	73.21	73.05	77.24	69.01
12 hours	69.17	73.75	72.35	70.58
16 hours	74.47	70.32	71.35	73.45

C.V. (%) = 15.3
SEd (D x C) = 1.50***
SEd (D x T) = 1.50***
SEd (D x C x T) = 2.13***

DISCUSSION

Viability percentage was maintained up to about three years. In the first cycle of the experiment, which is not reported here, seed viability was maintained up to 16 months (Panthee, 1995) whereas it is 20 months more in the second cycle. This might be attributed to an initial moisture content of the seed. Although drying period was same in both the cycles as specified in the treatment, seed moisture was not determined before storing onion seeds in the first cycle. Furthermore, seeds were collected in August and the drying days were cloudy. Therefore, it is more likely to have higher seed moisture content causing relatively poor storage period. Contrary to this, in the present experiment, seeds were collected in June and days were sunny to dry seeds because of which 8 or less than 8% of moisture was achieved by drying for 8 hours. It should be noted that moisture content of seeds under most of the treatments was 6 (data not shown). Inverse relationship of storage life with initial seed moisture has already been established in several crops including onion seeds (Ellis *et al*, 1996, Stumpf *et al*, 1996). They could store onion seeds for five years in hermetic storage container but in our case, it was polythene (300 gauge). Our findings are in agreement with Singh and Singh (1990), they also stored onion seeds for more than three years by bringing down seed moisture content to 6.3%. Therefore, onion seeds can be stored for up to three years, if they are dried to bring the moisture lower than 8% and stored in polythene bag (300 gauge) in an altitude of around 1600 m asl.

Hand threshing was better than stick threshing for maintaining the onion seed viability. This is expected for the threshing method because onion seed embryo is embedded just inside the testa covered with a very thin layer of seed coat. Because of such position, there is likely to have an environmental effect on seed embryo, slight external force may damage embryo resulting into loss of viability. When using stick for threshing, it exerts more stress on embryo than hand threshing and hence this is likely to damage the embryo more easily which eventually reduces storage life of seeds.

No effect of cleaning method could be observed in present experiment. Normally, winnowing method of cleaning is expected to be better than water dipping. Because, seeds may absorb more water in water dipping method of cleaning and because of high seed moisture content, seed storage life is shortened. However, the present experiment proved that if we dry the seeds properly before storage, irrespective of cleaning methods, water dipping does not have negative effect on maintaining onion seed viability. Therefore, farmers may use any one of these methods as per their convenience.

There was no effect of drying period on prolonging onion seed viability. Normally, longer the drying period, lesser the seed moisture content, longer would be the storage life of seed. However, no such relationship could be detected from present experiment. It should be because of the fact that at the time of onion seed harvesting (in May), drying for 8 hours is enough to get the safe moisture content (8%) in onion seeds. Although there is no harm when drying exceeds 8 hours, there is no improvement in storage life.

A combination of hand threshing, water dipping and drying for 8 hours was best for maintaining onion seed viability. The reason could be the same as explained for individual factors above, but no specific reason can be given to explain the results of this particular combination. Contrary to this, no significant difference was found between all the factors and in their combination for maintaining storage life of onion seed in previous experiment (Panthee, 1995). Interestingly, onion seeds could be stored for up to 34 months, which is the fourth planting season. This findings has helped to establish the fact that onion seeds can also be stored safely for more than one season in the hills of Nepal having similar to Lumle climate where average summer temperature is around 25°C, if we handle the seeds carefully.

One of the peculiarity of this present experiment is that none of the treatments produced a normal seed viability curve. Normally, seed viability curve is `S'-shaped in which high level of viability is maintained for sometime in the beginning and it falls down rapidly followed by reduced rate of decrease and eventually reaching to zero. Every orthodox seeds are expected to follow this pattern (Ellis *et a.l*, 1996). Reasons for not getting such a pattern in the present experiment could be due to very small lot and sample size as well as fluctuating temperature during test time. Because only about a kilogram of seed was started with each treatment, which reduced later on as samples were taken for viability test. It is well established fact that smaller the sample size is less reliable the test results. Second reason could be due to error in seed testing itself because of fluctuating temperatures. Examination of Table 1 indicates that the viability percentage during winter is relatively poor (the trial was started from June '95 and seed testing was done in an interval of two months). This might be due to electric power failure or irregular supply of power at night leading to reduce temperatures having adverse effect on seed germination. Since the testing temperature for onion seed is 20°C, this might have been maintained during summer but it must have dropped during winter nights causing reduced germination of onion seeds.

CONCLUSION

Onion seed could be stored for about three years under ambient storage condition at an altitude of 1600 m asl in polythene bags, but moisture content should be brought down to less than 8% before storing. Onion seed viability can be improved significantly by threshing method, hand threshing is better than stick. However, there is no main effect of cleaning methods and drying period on onion seed viability provided 8% moisture is achieved prior to storage. A combination of hand threshing, water dipping for cleaning and 8 hours drying is effective for maintaining onion seed viability in storage.

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