

Research Article

Use of Early Harvested Potato Tubers as Seed

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The present study was planned to describe the use of early harvested potato tubers as seed. It is observed during storage that weight loss in all grades H1 and H2 (H1 at 3 months and H2 for 4 months) harvests was significantly lesser than that of control for both the cases of 10-P and 30-P. the weight loss was gradual with duration of storage. Tubers were stored for 115 days to study the sprouting characteristics. Sprout length of tubers of all grades was consistently higher in H1 than those of P-C. The large sized tubers in H1 sprouted earlier than the P-C. Initiation of sprouting occurred from 7 to 10 weeks in P-H and 11 to 13 weeks of sprouting in P-C. Sprouting index of P-C tubers was higher in comparison to P-H1. During storage by studied these characteristics in early harvested potato tubers, they can be validated as seed.

Keywords: Potato, weight loss, dormancy, sprouting

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Introduction

Potato tuber dormancy depended on both the genotype and environmental conditions during growth and storage. In many potato cultivars, natural dormancy progression occurred over a period of many months. Tuber formation under cool and wet conditions extended the dormant period, whereas, hot and dry conditions typically shortened dormancy period. Larger micro-tubers sprouted significantly earlier while the small tubers sprouted very late [1]. The sprout length was significant in large tubers, while medium tubers were at par with small tubers. The dormancy was long and was greatly elongated by low storage temperature. Like conventional seed tubers, micro tubers showed differences in optimum physiological age associated with cultivar earliness. Larger micro tubers had better storability in terms of maintenance of fresh weight during long term storage [2]. It was also observed that the sprouting rate of larger micro tubers sprouted significantly earlier while the small tubers sprouted very late. Keeping these points in view, the present study has been undertaken with the objective to study the changes on weight loss and sprouting during storage, so that early harvested tuber can be validated as seed.

Material and Methods

The experimental site Hill campus, Ranichauri, Tehri Garhwal is located 10 kms away from Chamba (at Rishikesh-Gangotri Road) of about 2100 meters above mean sea level, lying between 30°15' N latitude and 78°30' E longitude under mid hill zone of Uttarakhand, India. The present investigation was carried out with 10 day (10-P) and 30 day (30-P) old hardened plantlets which were harvested twice at monthly interval i.e. July, August. Harvested tubers were stored grade wise at room temperature for observations on weight loss and sprouting characteristics. Experiment related to sprouting characteristics was conducted on tubers stored for 115 days using three replications. Sprouting was recorded throughout the storage period. A tuber was considered sprouted when at least 3 mm in sprout length appeared. After storage sprout measurements were terminated and total sprout weight recorded after 16 weeks. Sprouting indices, i.e. rate index was developed to provide a numerical summary of sprouting characteristics in all tuber grades.

$$\text{Sprouting rate index} = L \times 100 / (D_2 - D_1)$$

Where, L was maximum total sprout length (mm); average sprout length per tuber times number of sprouted eye per tuber and D1 and D2 were the number of days at which sprout length measurements started (D1) and terminated (D2). This index expressed sprouting rate in mm/100 days [3].

Result and Discussion

Weight loss during storage

Weight loss in all grades during H1 and H2 harvests was significantly lesser than that of C for both the cases of 10-P and 30-P. The weight loss was gradual with duration of storage and it ranged from 12.13 to 20.63% in H1, 24.54 to 38.77% in H2 and 33.72 to 51.09% in control of 30-P tubers and similarly the weight loss ranged in 10-P tubers from 19.02 to 22.54% in H1, 27 to 40.50% in H2 and 37.36 to 62.02% in control. Tubers obtained from P-H1 and P-H2 both in case of 10-P and 30-P appeared to resist loss of moisture content than their respective controls. Storage temperature interact with storage time to increase weight loss during storage and weight loss of stored potato tubers were mainly through evaporation and sprouting 90% and respiration 10% [4]. An increase in weight loss of tubers with increasing storage period was due to loss of moisture from the tubers through transpiration and utilization of reserved food material in respiration process. These results confirm the findings of [5, 6, 7]. The external factors affecting the intensity of transpiration are air, temperature, humidity and air circulation in the storehouse. The weight loss of potato tubers was significantly influenced due to the size of potato tubers. In present investigation, the small sized potato tubers showed a considerably low value for weight loss when compared with large and medium sized tubers. This is also in confirmation with the earlier reports of [8]. Long dormancy and reduced sprout growth might be the reasons for lower physiological loss in small tubers during storage. Sprout weight is known to be positively associated with physiological loss in weight [9] since the epidermis of sprouts is about 100 times more permeable to water as compared to the tuber skin [10]. Though reports are not available on storability of H1 and H2 harvests of in-vitro plantlets of different age it appeared in present study that tubers obtained from 30-P showed lesser variation in weight loss as compared to 10-P. Such an observation was in accordance to the fact that the size of tubers in P-H1+P-H2 was grossly smaller than that of control. The 30-P tubers were also found better in performance than 10-P tubers in terms of number and weight of tubers. Therefore, tubers of 30 day hardened plantlets were used for sprouting studies to assess their quality as seed.

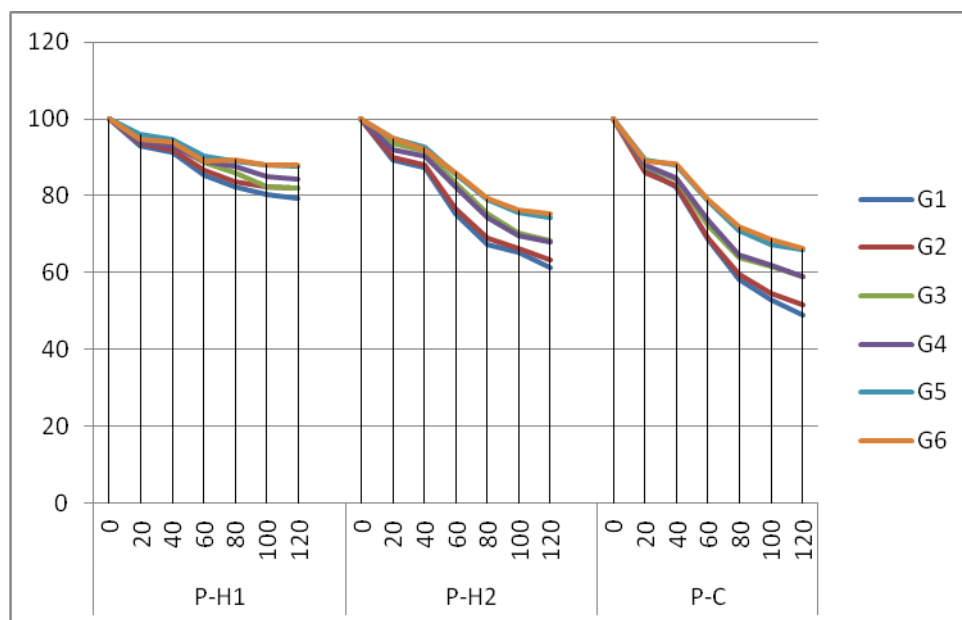


Figure 1 Weight loss during storage in 30-P harvested tubers

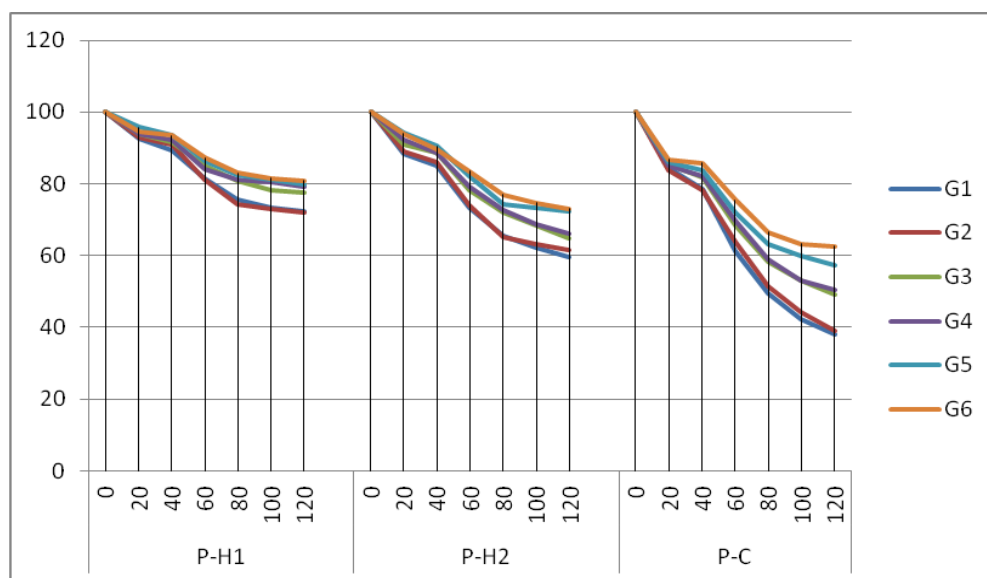


Figure 2 Weight loss during storage in 10-P harvested tubers

*P-H1=Plantlets of 1st harvest, P-H2=Plantlets of 2nd harvest, P-H1+P-H2= Plantlets of 1st & 2nd harvest, P-C=Control

Sprouting length

Tubers from the harvest of 30-P were stored for 115 days. Tubers were considered sprouted when at least 3 mm length appeared. Sprouting length of P-H1 tubers significantly differed from that of P-C tubers. Sprout length of tubers of all grades was consistently higher in P-H1 ranging from 15 to 30.93 mm than those of P-C that ranged between 9.93 to 27.82 mm. The early harvested tubers sprouted early than the control. Initiation of sprouting occurred from 7 to 10 weeks in P-H1 and from 11 to 13 weeks of storage in P-C. Such observations clearly indicated that maturity of early harvested tubers was attained earlier and also that the bigger grades had mature earlier. Tubers harvested when immature usually sprouts earlier than a mature tubers [11]. The highest sprouting length was observed in P-H1-G₆ which was significantly higher than other grades. The obvious reason was more reserve food stored in larger tuber.

Table 1 Sprouting length of P-H1 tubers

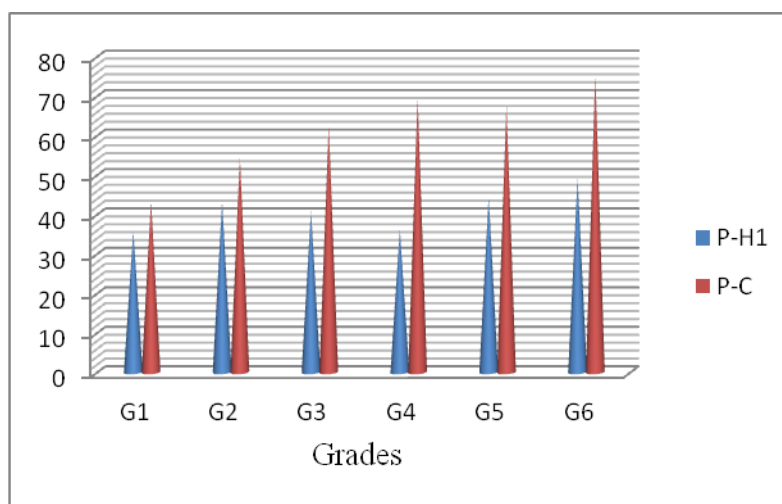
Weeks	Grades						Mean
	1	2	3	4	5	6	
7 th	0	0	0	0	3.00	3.20	1.03
8 th	0	0	0	3.00	5.33	5.66	2.33
9 th	0	0	2.80	4.06	7.46	8.13	3.74
10 th	3.00	2.86	5.00	6.93	11.06	11.26	6.68
11 th	4.20	5.00	7.80	8.93	13.93	15.60	9.24
12 th	5.86	8.00	10.00	12.00	18.26	20.20	12.33
13 th	9.93	11.00	13.00	13.86	20.80	23.40	15.33
14 th	11.06	14.00	15.13	16.86	23.20	26.13	17.73
15 th	13.00	15.80	17.13	19.00	25.66	28.66	19.87
16 th	15.00	18.13	20.00	20.20	28.40	30.93	22.11
Mean	6.20	7.48	9.08	10.48	15.71	17.32	11.04
CD (5%)	CD (1%)		SEM				
Grades - .151	Grades - .200		Grades - .540				
Weeks - .195	Weeks - .258		Weeks - .697				
Grade X Weeks - .478	Grade X Weeks - .632		Grade X Weeks - .170				
CV - 2.678							

Table 2 Sprouting length of P-C tubers

Weeks	Grades						Mean
	1	2	3	4	5	6	
11 th	0	0	0	0	3.00	2.80	1.16
12 th	0	0	2.80	2.80	5.13	6.93	3.53
13 th	3	3	6.80	9.73	10.80	12.00	8.42
14 th	4.06	7.2	11.00	13.93	14.86	16.86	12.14
15 th	7.00	9.5	16.60	14.46	20.00	22.00	16.01
16 th	9.93	14	18.73	20.86	24.93	27.86	20.46
Mean	3.96	8.425	9.32	10.30	13.12	14.74	10.29
CD (5%)	CD (1%)		SEM				
Grades - .718	Grades - .956		Grades - .253				
Weeks - .787	Weeks - 1.047		Weeks - .278				
Grades X weeks - 1.760	Grades X Weeks - 2.342		Grades X Weeks - .621				
CV - 10.466							

Sprouting rate index

There was significant difference in sprouting rate index of P-H1 and P-C tubers. Since the initiation of sprouting was early in P-H1 tubers and the time period under observation (D2-D1) was larger in early harvested tubers the sprouting rate index values were lesser than their respective controls. Calculation of sprouting rate index was devised as a simple method by [8] to estimate sprouting characteristics and the authors observed that this method enabled accurate monitoring of sprout growth throughout the storage period.

**Figure 3** Sprouting rate index of P-H1 and P-C

Conclusion

Early harvested tubers obtained from 30-P and 10-P found minimum weight loss as compared to control which determines the longevity of tuber's storability and hence their keeping quality. Among two harvest tubers of 30-P found better than 10-P due to their lesser variation in weight loss during storage, likewise during storage early harvested tubers sprouted earlier than the control indicates their early maturity. So these characteristics showed that early harvested potato tubers can be used as seed.

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