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Research Article

Effective Manipulation of Potato Storage Timing Enable Seed Production as Summer and Winter Crop Consequently in Year

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Abstract

The study was planned to effectively manipulate seed storage timing so that seed can be used for growing summer and winter crop consequently in a year. Multiple harvested tubers with different grade were stored for different intervals in an ambient condition. Stored tubers were sown in polyhouse as winter crop in which early harvested tubers were stored for 4 months and control harvested tubers for 3 months. Further tubers were again sown during summer crop in which early harvested tubers were stored for 6 months and control harvested tubers for 5 months. It was observed that early harvested tubers performed better in winter crop season due to suitable storage time. In summer season by two harvests (H1+H2) more number of suitable seed grade was obtained and the pattern of grade-wise distribution of winter produce was similar to the summer produce, preferred crop growth season at hills was summer and observed that early harvest was good for early sowing preferably in winters in valley areas of hill or plains.

Keywords: Potato, early harvest, storage, summer, winter

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Introduction

Potato is grown under, subtropical, tropical and temperate conditions. It is essentially a cool weather crop, with temperature being the important limiting factor for production. Tuber growth is sharply inhibited at temperatures below 10°C and above 30°C while optimum yields are obtained where means daily temperatures are in the range of 18°C to 20°C. More than 90% of Indian potato production is done during cold weather season and quite a significant portion (45-50%) is stored and consumed over entire year. For that reason, potato is planted in early spring in temperate zones and late winter in warmer regions, and grown during coolest months of the year in hot tropical climates. In some sub-tropical highlands, mild temperatures and high solar radiation allow farmers to grow potatoes throughout the year, and harvest tubers within 90 days of sowing. In recent years rapid multiplication of disease-free clones using micro-propagation along with conventional multiplication methods has now become an integral part of seed production [1]. Besides the quality of seed there should be need of improvement in production at field level. Efficiency improvement of mini-tubers in field can be done by multiple harvesting instead of single harvesting [2]. The objective of study is to effectively manipulate seed storage timing so that seed can be used for growing summer and winter crops consequently in a year.

Material and Methods

Present investigation was conducted from 2010-2011 at Seed Science Research Block and Tissue Culture Section, College of Forestry and Hill Agriculture Hill Campus, Ranichauri, District Tehri Garhwal. The experimental site is located at an altitude of about 2100 meters above mean sea level under mid hill zone of Uttarakhand, India. Study was conducted by selecting a new hybrid variety of potato i.e. Kufri Himalini. This variety is a medium maturing (110-120 days) and has been recommended for cultivation in the northwestern and eastern hills during summer [3].

Potato plantlets of uniform length were taken from culture room for hardening in polyhouse under controlled environment. All the precautions for regular watering and weeding were under taken carefully till plantlets were ready for transplanting. Plantlets were transplanted into field in the month of April 2010 with proper shade by small leafy twigs provided for 10 days. Tubers were harvested twice at monthly intervals i.e. July and August. During1st harvest,

apical tubers whether small or big were plucked and during 2nd harvest all tubers were plucked. Grading of tubers was done on the basis of tuber weight after the harvest, and stored them at room temperature. 6 grades are specified as G1< 5.00, G2-5.00-14.99, G3-15.00-24.99, G4- 25.00-34.99, G5- 35.00-49.99 and G6 >50. During the month of November 2010 early and control harvested tubers obtained from in-vitro developed and hardened plantlets were sown in polyhouse as winter crop in 3 replications each. There were 4 ridges per replication and 6 plants per ridge. Early harvested tubers had been were stored for 4 months and control harvested tubers for 3 months at room temperature. Harvesting of tubers was done after 4 months of crop duration i.e. March 2011. Tubers were again sown during summer crop season in the month of February 2011 and harvested twice at monthly intervals i.e. May and Jun 2011. Early and control harvested tubers obtained from in-vitro developed and hardened plantlets were sown in 3 replications each. There were 4 ridges per replication and 6 plants per ridge. Early harvested tubers had been were stored for 6 months and control harvested tubers for 5 months at room temperature. Tubers were harvested twice at monthly intervals i.e. Jun and July.(remove this line) The experimental data were analyzed statistically in Randomized Block Design.

Results and Discussion

Seed Production after Storage of Early Harvested (P-H1) and Control (P-C) Tubers during Winter Crop Season

Seed tubers obtained from P-H1 and P-C after storage for 4 and 3 months, respectively, were sown in polyhouse for winter crop. Tubers were harvested after 4 months of crop duration to see the effect of storage of P-H1 and P-C on their yield. Total number of tubers recorded in P-H1(W) and P-C(W) was 123 and 88 respectively. It clearly indicated that tubers of different grades in P-C(W) were lesser in number than those in P-H1(W). The sum of tubers in 3 grades i.e. G2, G3, G4 of P-H1(W) was 75 which was higher than that 53 of P-C(W) and these grades were suitable as seed (**Figure 1**). The 15% contribution of G5 tubers in P-H1 (W) was also acceptable size for seed. The disadvantage of using large sized seed tubers was authenticated by [4] because the increase in seed size decreased the proportion of seed size tubers (>30–40 g) and increased the proportion of large size tubers (> 50–60 g). Healthy and diseased free small sized tubers with a seed rate of 10-20 q/ha can give yield comparable to that from large sized seed tubers [5]. Physiologically young and diseased free small tubers have high production potential. Such small tubers of Kufri chandramukhi, Kufri jyoti, Kufri Sunduri, Kufri Lalima weighing 8-12g can produced 30 tonnes/ha in 90 day crop duration.

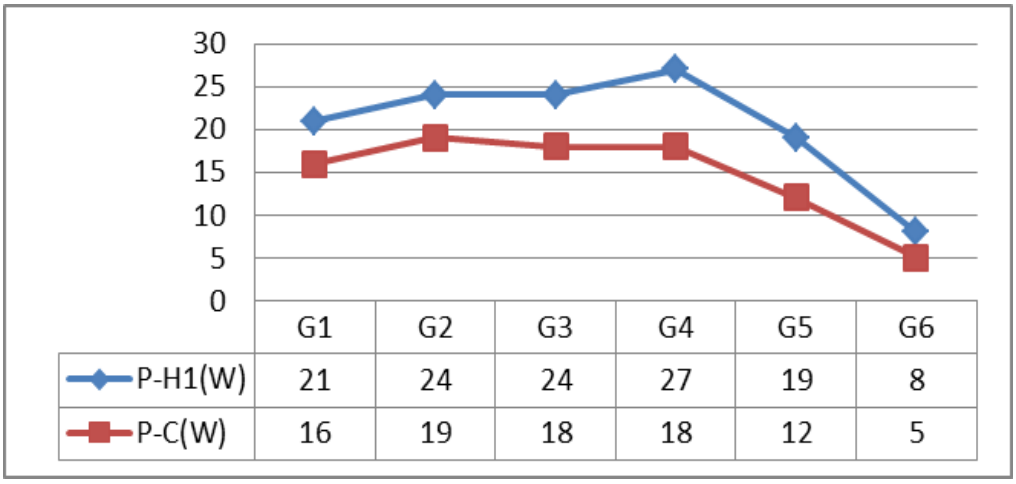
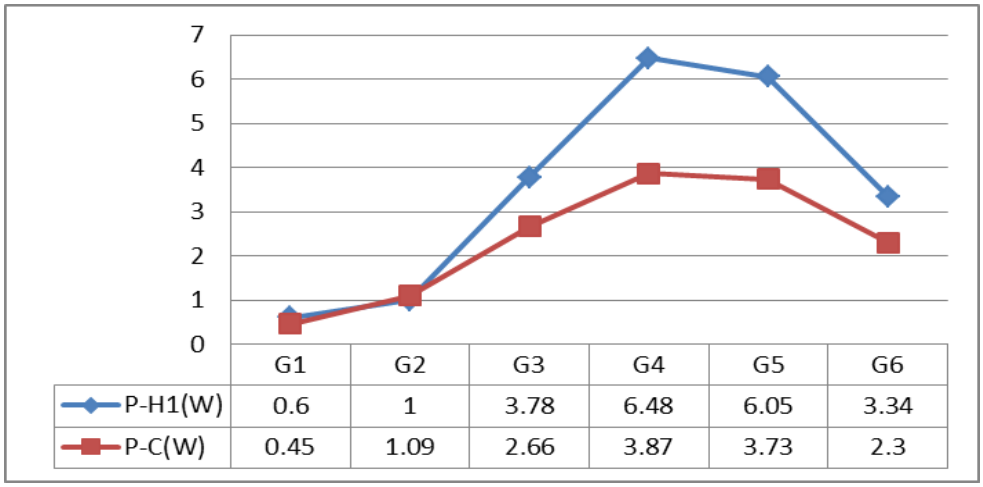


Figure 1 Number of tubers in P-H1(W) and P-C(W)

Total weight of tubers recorded in P-H1(W) and P-C(W) was 21.254kg and 14.10kg respectively and percentage distribution of each grade of P-H1(W) was also higher than P-C(W) **(Figure 2)**.The winter crop is largely grown in plains and sometime in valley areas of hills. Since the winter crop in present course of study was grown in polyhouse. P-H1(W) always performed better than P-C(W) despite the fact that the production was found to increase more than twice only in P-H1(W). The better performance of P-H1(W) tubers was due to their 4 months storage time whereas;

the P-C(W) tubers had been stored for 3 months. In this regard correlation between sprout tuber dormancy and earliness has been observed by [6] indicating that 4 months storage was better and lesser storage led to poor performance.

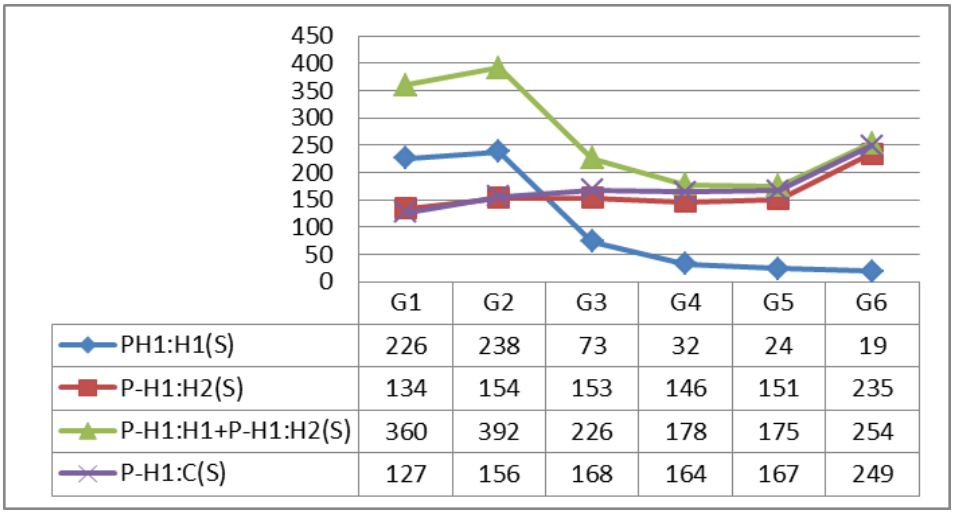


	G1	G2	G3	G4	G5	G6
P-H1(W)	0.6	1	3.78	6.48	6.05	3.34
P-C(W)	0.45	1.09	2.66	3.87	3.73	2.3

Figure 2 Weight of tubers in P-H1(W) and P-C(W)

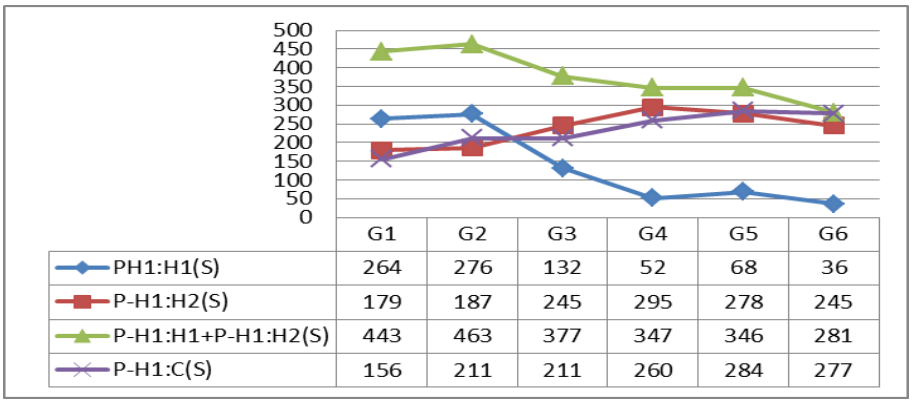
Seed Production after Storage of Early Harvested (P-H1) and Control (P-C) Tubers during Summer Crop Season

Seed tubers obtained from P-H1 and control P-C after storage for 6 and 5 months respectively, was sown in the field as summer crop to compare their performance. Tubers were harvested twice during the crop season. The number of tubers recorded in P-H1:H1+P-H1:H2(S) (1585) **(Figure 3)** and P-C:H1+P-C:H2(S) (2257) **(Figure 4)** was higher than their respective controls i.e. P-H1:C(S) (1031) and P-C:C(S) (1399)**.** Obviously, there was 153% increase in number of tubers in case of two harvests (H1+H2) of P-H1(S) and 161% in case of two harvests of P-C(S). Since two harvests were done in this experiment, the average number of tubers per plant (based on the data of 180 plants) was calculated to be 15 in case of P-H1:H1+P-H1:H2(S) and 21 in case of P-C:H1+P-C:H2(S) as compared to 10 and 13 in their respective controls where only single harvest at the end of crop season was done.



	G1	G2	G3	G4	G5	G6
PH1:H1(S)	226	238	73	32	24	19
P-H1:H2(S)	134	154	153	146	151	235
P-H1:H1+P-H1:H2(S)	360	392	226	178	175	254
P-H1:C(S)	127	156	168	164	167	249

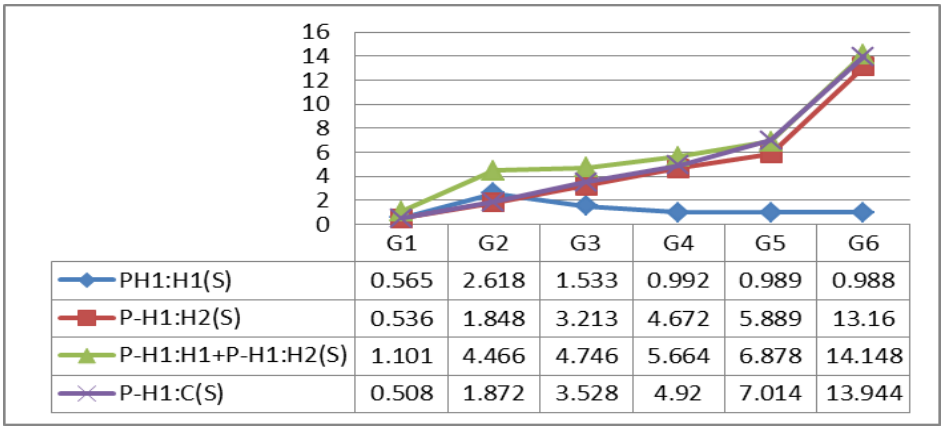
Figure 3 Grade wise distribution of number of tubers in different harvests of P-H1



	G1	G2	G3	G4	G5	G6
PH1:H1(S)	264	276	132	52	68	36
P-H1:H2(S)	179	187	245	295	278	245
P-H1:H1+P-H1:H2(S)	443	463	377	347	346	281
P-H1:C(S)	156	211	211	260	284	277

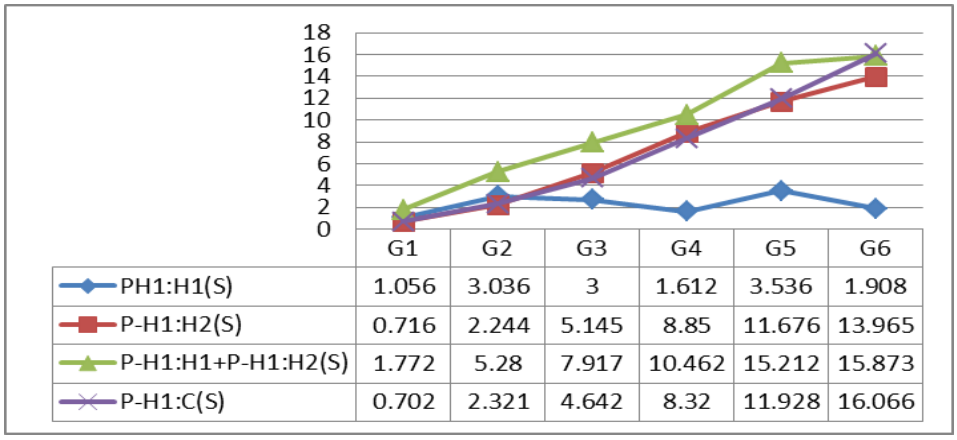
Figure 4 Grade wise distribution of number of tubers in different harvests of P-C

The weight of tubers recorded in P-H1:H1+P-H1:H2(S) (37.003kg)**(Figure5)** and P-C:H1+P-C:H2(S) (56.516kg) **(Figure 6)** was higher than their respective controls i.e. P-H1:C(S) (17.842kg) and P-C:C(S) (43.979).Comparison of weight of tubers during H1+H2 and control indicated that there was 207% increase in case of two harvests of P-H1 and 128% increase in case of two harvest of P-C. These observations clearly indicated that the P-C tubers had performed better than P-H1 tubers for both weight and number of tubers in there harvests due to the obvious fact that P-C tubers had been stored for 5 months and P-H1 tubers had been stored for 6 months. Tubers were over matured after the 6 months of storage in P-H1 whereas, months of storage in P-C was better for the summer crop season under study.



	G1	G2	G3	G4	G5	G6
PH1:H1(S)	0.565	2.618	1.533	0.992	0.989	0.988
P-H1:H2(S)	0.536	1.848	3.213	4.672	5.889	13.16
P-H1:H1+P-H1:H2(S)	1.101	4.466	4.746	5.664	6.878	14.148
P-H1:C(S)	0.508	1.872	3.528	4.92	7.014	13.944

Figure 5 Grade wise distribution of weight of tubers in different harvests of P-H1



	G1	G2	G3	G4	G5	G6
PH1:H1(S)	1.056	3.036	3	1.612	3.536	1.908
P-H1:H2(S)	0.716	2.244	5.145	8.85	11.676	13.965
P-H1:H1+P-H1:H2(S)	1.772	5.28	7.917	10.462	15.212	15.873
P-H1:C(S)	0.702	2.321	4.642	8.32	11.928	16.066

Figure 6 Grade wise distribution of weight of tubers in different harvests of P-C

Contrary to the winter crop season, the production was found to increase 11 times in P-H1 and 13 times in P-C during summer crop season, showed extraordinary better performance. Report for storage and dormancy was reported by [7] that when tubers are stored longer, their growth vigour will start to drop and tubers of this stage are not desirable for use as planting material in the field.

Conclusion

By two harvests (H1+H2) more number of suitable seed grade could be obtained and though the pattern of grade-wise distribution of winter produce was similar to the summer produce, preferred crop growth season at hills was summer. More detailed studies would be required to utilize early harvests of 1st summer season in forth coming winter season by conducting the experiment in plains/valley areas of the state. An early harvest was good for early sowing preferably in winters in valley areas of hill or plains

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