STORAGE OF SHEPODY SEED POTATOES TO ENHANCE COMMERCIAL PRODUCTION PERFORMANCE

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Seed storage temperature can be a useful tool in manipulating the performance of seed potatoes. It has the potential to positively alter stem numbers per plant, tuber yield and tuber size profile, along with seed vigor. As with most cultivars, especially ones we are less familiar with, there are often problems associated with the production of the crop. One cultivar in particular, which has significance in the Pacific Northwest region, is the cultivar Shepody. Shepody potatoes have been an important cultivar in the Northwest accounting for 11% of the total potato acreage in Washington, 26% in Oregon, and 10% in Idaho during the 1996 season. Although there is some limited out of storage uses the Shepody cultivar is primarily used for the early out of field processing niche. Even when harvested early, plants have large tubers with acceptable specific gravities in conjunction with good yields. These features make it a desirable cultivar to grow. Unfortunately there are problems associated with the production of Shepody potatoes including non-uniformity in stand establishment, low stem numbers per plant, and a wide range of tuber sizes. The plants typically produce very few stems per plant resulting in a tuber size that includes very large and undersized tubers. These problems may be made somewhat manageable by manipulating seed tuber storage temperatures.

Storage temperature influences the physiological age of seed tubers and therefore seed performance. Physiological age is a function of the environmental conditions and cultural practices tubers are exposed to during the growing season along with chronological age. Although the complex interactions of these factors are not understood it is known that storage temperature does influence the physiological age of the seed potatoes. Temperature conditions expressed as accumulation of heat units during the seed growing and storage season will impact the age of seed tubers and influence performance. Young seed potatoes will typically produce very few stems and tubers per plant and display other characteristics signifying that the seed has not reached its potential maximum performance level (Figure 1). Seed tubers that are physiologically old produce stems that emerge more rapidly, produce multiple, spindly stems per plant, and produce a greater number of smaller size tubers. In the field these plants will die-off earlier thus compromising yields. Seed potatoes of the 'ideal' age will result in the maximum field performance with high tuber yields and quality. Typically Russet Burbank seed tubers are stored at 38°F for 5-8 months resulting in seed tubers within the desired performance range (Figure 1). Since 38°F storage temperature appears to be acceptable for Russet Burbank seed tubers, it tends to be the storage temperature used for storage of tubers of other cultivars.

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Shepody seed potatoes, like those of many other cultivars, do not have the same characteristics as Russet Burbank and may need to be stored differently than Russet Burbank seed tubers. Storing Shepody seed tubers at 38°F may be maintaining the seed at too young of an age to produce the desired stem and tuber numbers, tuber yield and profile.

The objective of this study was to use seed storage temperature to slightly age Shepody seed to place it into that ideal seed performance range but not to age it so much that the detrimental characteristics of physiologically older seed would occur. Although the focus was on seed tubers of the Shepody cultivar in this study, it could be replaced with any cultivar where there is a lack of information on the appropriate seed storage management. This is especially applicable for many of the new cultivars being evaluated or in production.

Seed Storage Method

Certified Shepody seed tubers were obtained in the fall, cured for 30 days at 50°F, and placed into two storage temperatures (38°F and 44°F) for 160 days. The 38°F stored tubers accumulated fewer heat units compared to the 44°F stored tubers and therefore would be at a relatively younger age. The stored tubers were planted into a field trial and a growth chamber vigor test. Prior to planting, eyes of the tubers stored at 38°F were barely peeping compared to sprouts approaching 1/4" in length on the 44°F stored tubers.

Field Trial

Objective: *to assess stem numbers, tuber yield and size profile under field conditions*

Approximately 2 oz. seedpieces were planted in a field trial located in Othello, WA on April 25, 1996 and April 11, 1997. Plants were grown using standard cultural practices with 10 in row and 34" between row spacings. The trial was harvested 124 days after planting (DAP). Possible problematic characteristics of Shepody potatoes such as stem number per plant, yield and yield profile were evaluated.

In 1996, aboveground stem number per plant was significantly greater with the 44°F stored seed (average 1.86) compared to the 38°F stored seed (average 1.63). In comparison, in 1997, stem number per plant from the 38°F and 44°F stored seed was very similar, both producing approximately 2 stems per plant. This may be indicating that the seed used in the 1997 field trial was physiologically older than the seed used in 1996.

Total, U.S. #1 and U.S. #2 yields were comparable for the 38°F and 44°F stored seed in 1996 (Figure 2). In the 1997 season, total yield was greater from the 38°F stored seed compared to the 44°F stored seed. Seed tuber storage temperature altered tuber size profile both seasons (Figure 3). In 1996, there was a trend for a decrease in the yield of tubers greater than 12 oz. but with an elevation in the yield of tubers between 8 to 12 oz. with the 44°F stored seed. This would be considered a positive alteration in size profile for processors and growers under certain contracts.. As with total tuber yield (Figure 2), the difference in tuber size profile between the two years was quite dramatic with the 1997 season producing an almost equal distribution within the size categories above 4 oz. with the 44°F stored seed compared to 1996. Higher yields of the larger tubers were produced with the 38°F stored seed.

These results indicate that seed storage management is a viable tool to try to favorably impact tuber and stem numbers and size distribution.

There were substantial differences in how the seed performed between the 1996 and 1997 seasons. In 1996, the seed stored at 38°F appeared to be exhibiting characteristics of relatively younger seed (Figure 4). By aging the seed at 44°F the performance level shifted into that more ideal range producing a greater number of stems per plant and a more desirable tuber size profile. Whereas in 1997, the seed stored at 38°F appeared to be already in that ideal performance range (Figure 5). The 44°F stored seed may have been aged too much by the combination of growing season and storage conditions resulting in a reduction in yield and a considerably altered tuber size profile. Although the seed was obtained from the same seed source and stored the same way for both seasons, there was a shift in the performance level from 1996 to 1997. This between year difference may be partially accounted for by the difference in the age of the seed coming out of the field after the seed growing season. The seed used in the 1996 season was grown in 1995 which was generally a cooler growing season in the seed area where the tubers were grown than was the 1996 growing season in which the tubers for the 1997 trial were grown. As a result, the 1996 seed tubers were relatively younger and had accumulated fewer heat units in the field prior to being placed in storage. When the 1996 seed was stored at 44°F, the seed age obtained was in the ideal performance range. In comparison, the 1997 seed was relatively older coming out of the field, as a result of accumulating more heat units than the 1996 seed, and therefore when the seed was aged in the 44°F storage it became older than desired. It has been shown that the temperature and weather conditions experienced during the seed growing season in conjunction with cultural practices influences the age and performance of seed.

Growth Chamber Vigor Test

Objective: *to assess emergence, early growth and vigor under controlled temperatures*

Seed tuber vigor has been shown to influence stand establishment. Vigorous seed potatoes can be characterized as having early, uniform emergence, rapid sprout growth, rapid development of leaf area, and tolerance to stressful conditions. The latter can be especially critical if the seed is being planted into cold soil conditions often experienced with early plantings in the Northwest. To determine if seed tuber storage influences seed vigor and its' performance under different growing temperatures a controlled vigor test was conducted.

The same seed as planted in the field trial was used in this vigor test. Approximately 2 oz. bud-end seedpieces were planted into pots located in growth chambers each with a different temperature: 1) a cool 45°F, 2) a more optimum planting temperature of 55°F, and 3) a warmer temperature of 65°F. Plants were harvested 14, 30 and 50 days after planting to observe for early vigor growth characteristics such as emergence and leaf area development.

In 1996, at the cool emergence temperature of 45°F, the 44°F stored seed emerged 9 days earlier than the 38°F stored seed (Figure 6). The 44°F stored seed reached 100% emergence 3 days prior to the 38°F stored seed began to emerge. The 44°F stored seed showed vigorous early emergence at that cool growing temperature and may help explain the seed storage temperature difference shown in the field study.

These results indicate desirable characteristics of Shepody seed were impacted. In 1997, the 44°F stored seed emerged only 2 days prior to the 38°F stored seed. Overall, the 1997 season seed emerged 4 days earlier than the 1996 season seed further suggesting that the 1997 seed was older than the seed used in 1996.

In 1996, at the more ideal emergence temperature of 55°F, the 44°F and 38°F stored seed had fairly similar emergence (Figure 7). In 1997, the 44°F stored seed emerged a little more rapidly and uniformly than the 38°F stored seed. One of the characteristics of physiologically older seed is earlier emergence but lacking the strong performance in the field. In 1997, the 44°F stored seed is exhibiting characteristics of being aged too much due to the elevated storage temperature in combination with the in field conditions of the 1996 growing season. At the warmer emergence temperature (65°F), the 38°F and 44°F stored seed acted fairly similar in 1996 (Figure 8). In 1997, the 44°F stored seed emerged 3 days before the 38°F stored seed. This early emergence in conjunction with the field data from the 1997 season can be interpreted as indicating the 44°F stored seed was aged too much and thus the lowered performance.

Differences in emergence did equate to growth differences in 1996, with leaf area per plant at 50 DAP at the cool emergence temperature of 45°F being significantly greater with the 44°F stored seed compared to the 38°F stored seed (Figure 9). Leaf area per plant was similar in 1997 for both the 38°F and 44°F stored seed. Although the 44°F stored seed did emerge earlier in 1997 (Figure 6, 7), the 38°F stored seed was able to obtain the same plant growth as the 44°F stored seed by 50 DAP (Figure 9).

The 44°F stored seed appeared to be more vigorous than the 38°F stored seed by exhibiting uniform, early emergence at that cool 45°F growing temperature, strong sprout and plant growth in conjunction with a solid performance in the field trial. The 44°F stored seed may be showing enhanced emergence, lower yields, and significantly altered size profile in 1997 due to being physiologically older.

Overall Conclusions

* Seed tubers of different cultivars, for instance Shepody, respond differently to storage temperature than Russet Burbank seed tubers. If there is a lack of knowledge or experience with a cultivar, storing the seed tubers of these cultivars under the same conditions as Russet Burbank is stored may result in sub-optimal performance.

* Whether it is advantageous to store the seed of each cultivar at a slightly elevated or lower temperature than the typical seed storage temperature of 38°F needs to be evaluated. Knowing this will aid in having seed tubers at a physiological age that will optimize performance i.e. obtain the desired size distribution yet maintain high yields, and enhanced tolerance to cool temperatures.

* Differences in performance of seed tubers used in the 1996 and 1997 trials was evident. This confirms that seed tuber age encompasses both the temperatures and conditions the tubers are exposed to during the seed growing and storage season. It is the total age of the seed that must be considered when evaluating the influence of age on potential performance.

Seed storage is a tool that can be used to aid in maximizing the performance of seed tubers used in commercial production systems. There is a need to continue to evaluate how to best take advantage of this tool especially in identifying the age of seed tubers coming out of the field. This knowledge in conjunction with knowledge of how individual cultivars respond to aging in storage is needed.

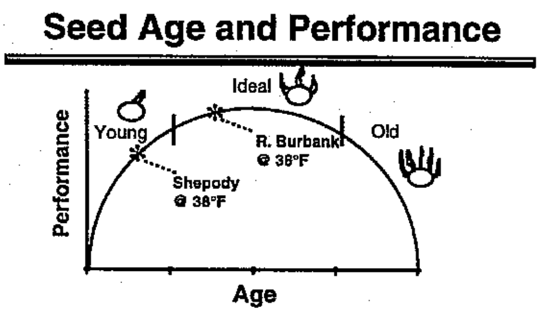


Figure 1

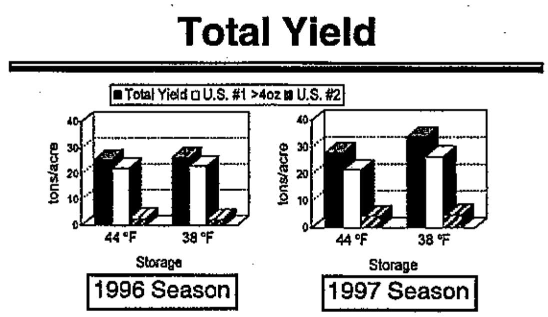
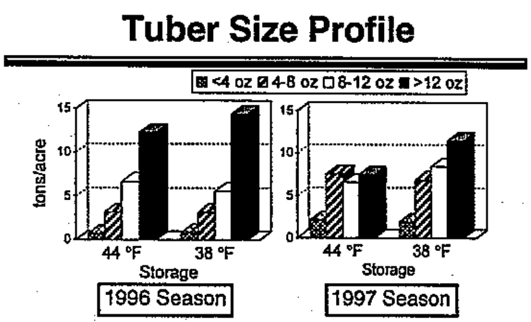


Figure 2



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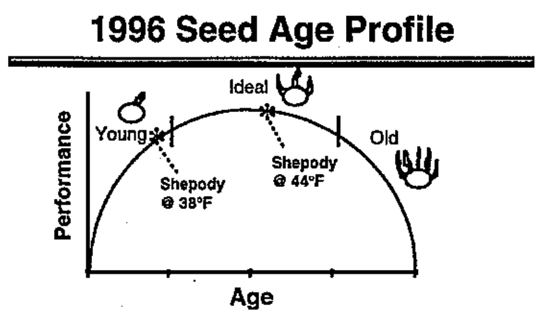

Figure 4

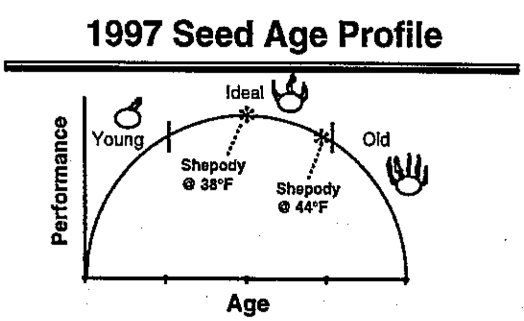

Figure 5

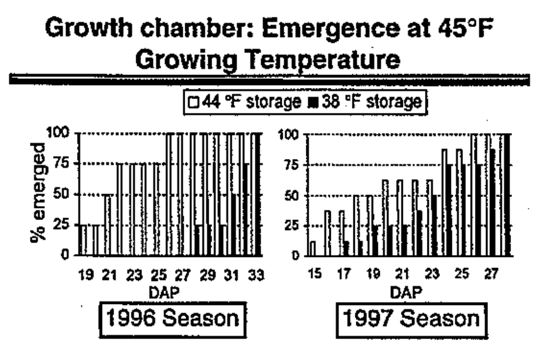

Figure 6

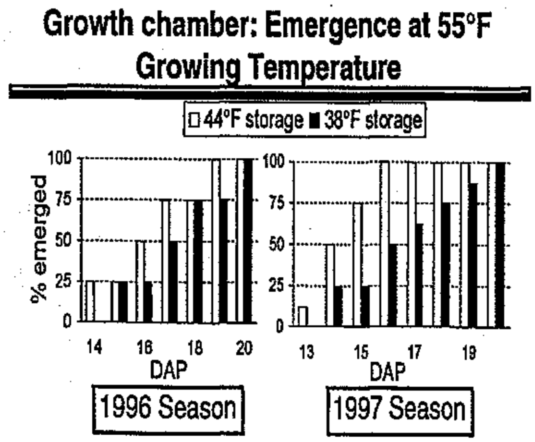

Figure 7

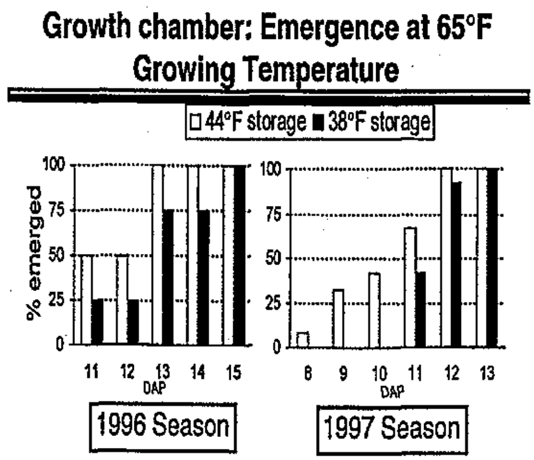

Figure 8

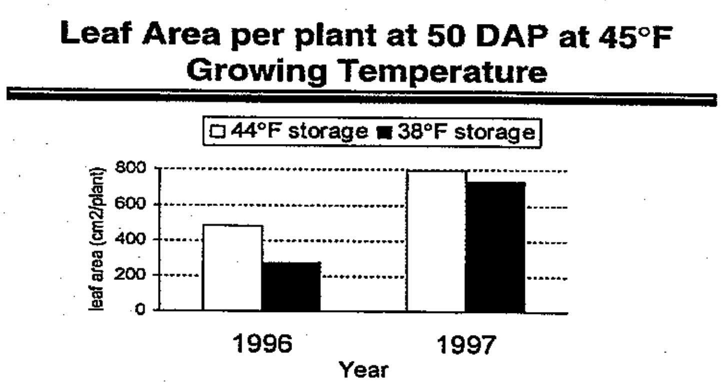

Figure 9