COLORADO STATE UNIVERSITY EXTENSION

DAMAGE ANALYSIS OF THE POSTHARVEST PROCESS OF POTATO TUBERS CENTER CO IN RIO GRANDE COUNTY

Connor Henderson - Intern

Dr. Sastry – Associate Professor in Postharvest Biology
Dr. Bartolo – Manager/Research Scientist in Vegetable Crops

The Importance Of The Post Harvest Cycle Of Potato Tubers

Throughout the San Luis Valley area the potato tuber industry is a billion-dollar industry that provides tubers throughout supermarkets in the entire nation. With this many potatoes, there are reoccurring problems when the tubers must be shipped.

This shipping process, also known as post harvest processing, begins right after the tubers are pulled out of the ground during harvesting. During this process, there are two types of damage that the tuber can experience, black spot bruising and impact bruising. These kinds of bruising are the most common damage seen during the post harvest cycle. These damages affect $1/5^{th}$ of all tubers sent to supermarkets. This loss in produce causes major economical problems for the companies that supply the tubers.

INTERNSHIP GOALS

The main goal of the internship was to develop and conduct an experiment to gain insight into what could potentially be influencing the severity of the damage within the inside of the potato in the San Luis Valley region. The secondary part of the internship involved testing the various qualities of cantaloupes to gain a better understanding of the optimum harvesting period in the Rocky Ford area. Learning about the various agricultural communities, and the challenges they face, was also a key aspect of being involved in this internship.

Application to Bio-Engineering

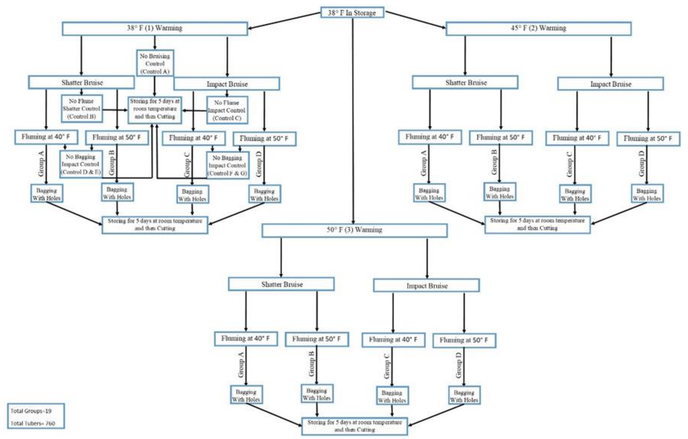
During this internship, knowledge was gained about how to develop, design and execute a research task. When beginning the development phase of a project, it is important to understand the bio-problem. To accomplish this, a lot of investigation must occur to properly understand that system before entering the design phase. When the design phase is in process, meticulously selecting the different variables and conditions can directly affect how meaningful the results are. Lastly, precise execution of the experiment is important otherwise the credibility of the results will not be an accurate representation of the problem in question. During each of these phases of the internship, I learned how to achieve a high-quality research experiment, which can be applied to any field of engineering.

Designing and Executing Tuber Damage Analysis

With the aim to reduce damage in tubers, an experiment was developed and conducted during the timeframe of the internship. Certain variables and conditions were studied to determine their impact on potato tuber damage. This resulted in different variable pathways to observe the affects that they could potentially have on the tubers.

There were four variables studied that are factors in the post-harvest cycle. The first variable that was tested involved the temperature at which the tubers are stored. The storage temperature of the tubers can vary from company to company. Some of the companies may take an additional step where the tubers are warmed up in storage before they are shipped. Due to this, higher storage temperatures also had to be considered. The next variable to be tested was damage to the tubers, including black-spot bruising and impact bruising. These two types of damage are the most prominent throughout the post-harvest process. Knowing the effects of these damages will help solve the majority of post-harvest damage. The third variable to be tested was the temperature of the fluming operations, this is known as fluming. With each post-harvest setup, there is the potential to have a system where water carries the tuber from harvest to storage and from storage to shipping. Not all systems have this, but it is a factor in large scale farms, so it is important to see what effects this has on the tuber damage. The last variable tested was the tubers being bagged versus no bag during shipping. Seven control groups were used to compare testing against baseline conditions. With each of the control groups, a temperature of 38° F was used. Additional controls included no bagging, no fluming, and no bruising to have a comparison to baseline conditions to determine if resulting data will be significantly different. Refer to figure 1 for a complete pathway of all groups used during the experiment.

Figure 1. The Complete Experimental Pathways for all Tuber Groups

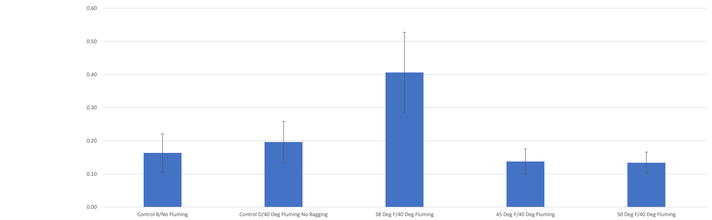


Results from the Experiment and Changes to be Made in the Postharvest Process

Given the results, there were a couple of trends that appeared after the data was processed. The first trend was that the nugget russet variety did not have any variation between the different pathways. This would indicate that for both the blackspot bruising and the impact bruising, the damage that the tuber experiences does not corollate with any temperature differences. In addition to that, there were no differences due to bagging. Unlike the nugget variety, the canella variety had one very distinct pattern that arose through the trials. When the storage temperature was different by five or more degrees from the fluming temperature, the damage size in the tuber was larger on average. This temperature difference was only seen when looking at the tubers that experienced shatter bruising. Other than that, there were no other significant differences in any of the tuber paths. Refer to figure two for the trend with the difference in temperatures.

Given these results, there are a couple of changes that can be made for future post-harvest operations of canella russet tubers. The first change would be to get the fluming water to be the same temperature as the tuber storage temperature while processing for shipping. If a farm chooses to heat the tubers before shipping, the fluming water would have to be warmed up as well. Although this situation is ideal, getting the water up to temperature may be cost prohibitive. A different recommendation for this issue is to try and keep the temperature changes minimal during the transportation process by not warming the tubers up before they are loaded on to shipping trucks. Instead, they could be warmed up after they are on the truck. This would allow the tubers to have no temperature changes when they have the greatest potential to be damaged. There is still more to understand about the relationship between the damages the tubers experience and the variables that affect that damage.

Figure 2. The Data Analysis of Damages Occurring During the Experiment



Next Steps

Tuber cell size, differences in variety, and differences in cultivars are avenues of study for the future. There are aspects of tuber cell size difference that could potentially correlate to how much damage the tuber can experience. During the experiments, the larger tubers seemed to have more damage within them when compared to the smaller tubers. In addition to this, the difference between the cultivars needs to be examined more to see if any correlation can be made with the temperature difference between the two cultivars. Lastly, other russet varieties need to be put through this path to see if any differences arise from those varieties. With the information currently gathered in this experiment, there is a clear path forward on how to continue research in lessening the damages in tuber varieties.