VINE KILL AND MATURITY

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INTRODUCTION

The 2002 production season was characterized by widespread difficulties on the part of many growers to get their vines killed and to get adequate skin set on the tubers. In a few cases, there were also reports of processing potatoes that were not frying the proper color. All three of these problems were probably due to immaturity in last season's crop. The immaturity, in turn, was the result of unusual growing conditions during several critical periods in 2002.

Before discussing the actual contributing factors that may have led to numerous cases of immaturity in last year's crop, I would like to give a brief description of the skin set and wound healing processes. I will discuss wound healing or "suberization" first, since the process of skin set is very similar and both are important. Most of us are familiar with wound healing as something that needs to occur when seed potatoes are cut to make seed pieces, but the same process becomes necessary anytime the potato tuber suffers a wound. The rigors of harvesting and handling, for instance, will lead to superficial wounds on many tubers. If harvest and handling are done carelessly, wounding can be significant.

WOUND HEALING AND SKIN SET

Wound healing begins within the layers of undamaged cells just underneath the freshly wounded surface of the tuber or seed piece. Changes begin to take place in the cell walls of the outermost 1.5 to 2 cell layers under the wound. Within a few hours, the walls of these cells begin to accumulate the chemical building blocks of a material called "suberin." Suberin is a very complex waxy substance whose structure has not yet been completely worked out. The material is easy to visualize, however, since common bottle cork is comprised of somewhere around 70% suberin. These suberin deposits in the walls of the outer cell layers help to seal the wounded area from moisture loss and are also an effective barrier which will prevent the soft rot bacterium from invading the fresh wound. A complete, uniform suberin layer is necessary before the wound healing process can continue. Formation of a complete suberin layer requires around 3-4 days at 55°F.

Once the suberin layer has properly formed, the next stage of wound healing, the formation of a layer of flattened, brick-shaped cells called the "phellum" can begin. Within the intact cells beneath the new suberin layer, a series of new cellular crosswalls begin to form. A region within a plant that is undergoing cell division is called a "meristem" and this particular meristem is called the "phellogen" layer. In this case, cell division does not lead to an increase in cell size – there is no bulging or swelling in the

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meristem area – just the creation of new crosswalls, parallel to the original wound, within the intact cells beneath the new suberin layer.

When the cell division phase of phellum formation is complete, the new flattened cells become suberized, the original layer of suberized cells on the very outside of the wound collapses and the entire wounded area takes on almost exactly the same appearance and structure as the native periderm or skin of the potato tuber.

"Skin set" or the maturation of the periderm on the tuber is a process very similar to wound healing. In the case of skin set, however, the meristem is already active near the outer surface at all stages of tuber growth. This meristem has to be active because new cells to make up the skin are constantly needed on the outside of tubers that are ever increasing their surface area, much like the rubber skin of an inflating balloon. Think of periderm formation as an ongoing, dynamic process until tuber enlargement ceases. During the cell division phases, whether we are referring to periderm or wound periderm formation, the barrier is extremely fragile. If you have ever experienced "skin slip" on a newly harvested tuber or healing seed piece, you will know what I am referring to. Generally, complete skin set or wound periderm maturity takes somewhere around 18 to 21 days.

VINE KILL

Many potato growers all over the U.S. must take measures to kill their potato vines prior to harvest. Vine killing stops any further increase in tuber size and initiates the skin set process. The ease of vine killing and the development of skin set is influenced by plant maturity – the more mature the plant before vine kill is attempted, the more easily the vines will go down and the more readily the skin will set.

FRY COLOR

Plant maturity also has an influence on the sugar/starch ratios in the tubers. Immature tubers have higher levels of reducing sugars and are more likely to produce darker colored fries or chips. The scenario goes something like this: in general, at tuber maturity, sucrose is a minimal level while starch levels are very high. High sucrose is the result of immaturity but can also be due to physiological stresses during the growing season or in storage. Finally, tubers with inherently high sucrose levels will accumulate more reducing sugars and will be more susceptible to rots and will produce darker fries or chips when processed.

CONCLUSIONS

It seems that one or another of the above problems were encountered by at a number of Idaho producers in the 2002 crop. These problems are very likely the direct result of the season experienced by Idaho growers last year. The season started out colder than usual so the crop got a late start. Very hot conditions during July and early August slowed crop progress as well. In about mid-August, the weather conditions turned into a more

favorable pattern for plant growth with cooler days and cooler nights so that producers were pleasantly surprised by the rapid increases in yield. When the time came to kill the vines, however, many growers found them to be more difficult to kill that usual. Many others found that the skin was poorly set as well. Still others found that the reducing sugar levels and thus the fry color were a little off as well. As we have seen, all of these problems are very likely a reflection of relative immaturity in the crop.