

RISKS ASSOCIATED WITH EARLY POTATO PLANTING

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It's no secret that a uniform stand of healthy, vigorous plants is one of the keys to producing high yields of good quality potatoes. Most potato growers spend a lot of time selecting seed and preparing to cut and plant in an effort to achieve those kinds of stands. Unfortunately, growers are sometimes disappointed with seed performance due to high levels of seed decay, erratic emergence or slow plant growth. The easiest thing to do in those situations is to blame the seed supplier, and ignore all the other things that determine seed performance. Seed quality is very important, but there are a number of other factors that also influence seed performance. Certainly germination and plant development are greatly affected by environmental factors such as temperature, rainfall and sunlight, which are not controlled by growers. One of the most important grower controlled factors is the decision on when to plant. This article will focus on the risks associated with early planting and what growers can do to manage those risks.

Every production region has an "optimum" planting window during which conditions are most favorable for producing the highest potential yield in a given season (Figure 1). Planting before this window tends to reduce yields by exposing the crop to stresses, such as unfavorable soil conditions and frost, which tend to reduce yield. Likewise, planting after this optimum window also reduces potential yield by reducing the days available for plant growth and tuber bulking.

So why do growers sometimes choose to start planting early, even when they know conditions are not ideal? Economics certainly play into this decision. As growing operations increase in size, they have to make decisions that impact the efficiency of equipment use. To plant more acres, they either have to buy more planters (which results in more equipment setting unused for 11 months of the year), or they can plant over a longer period of time. Growers also plant early to try and take advantage of seasons when conditions are warm early. If they can increase the length of the bulking period by even a few days, they can increase their potential yields. Due to the slim margins in the potato industry right now, high yields translate into lower per unit costs and more potential to make a profit. Finally, early planting can also help establish the crop during periods more favorable for attaining high tuber quality. Stress during early bulking has been strongly associated with defects such as sugar ends. One way to avoid stress is to establish the crop early and get the tubers past this critical stage prior to the time when daytime temperatures usually start to climb.

One of the problems with planting too early is that no two seasons are alike. A decision that has relatively little impact on the crop one year may turn out to be a disaster the

following year. The risks associated with making the wrong decision about planting date are many, and include increased incidence of disease problems such as Rhizoctonia stem canker and seed decay, slow or erratic emergence, frost damage, hollow heart, and slow canopy development. Let's take a look at each of these risks in more detail:

SEED DECAY AND RHIZOC

When potatoes are planted, a race begins between the disease organisms that are trying to infect the cut surface on the seed piece and the tuber tissue that is trying to heal those injuries and produce sprouts that will form a plant. The plant actually depends on the seed piece for energy and nutrients for quite a while after emergence. Research by Bill Bohl and Steve Love at Aberdeen has shown that the longer the seed piece remains intact, the more productive the plant will be. Ideally, the seed piece should remain sound until the plant has a chance to utilize all the nutrients and energy stored within it. Planting fresh cut seed into soil that is below 45°F restricts wound healing, and greatly increases the chances of seed decay.

Rhizoctonia stem canker causes damage by girdling sprouts, stolons and roots of potato plants. This disease is favored by the cool, wet conditions often associated with early planting. Under these conditions, emergence is delayed and developing plant tissues are exposed to potential damage from the Rhizoctonia pathogen for longer periods of time.

EMERGENCE

Cold soil conditions greatly delay the rate of emergence, and can also cause more variation in the date of emergence of individual plants. For example, Russet Burbank plants may emerge in 20 to 25 days at soil temperatures around 50°F, but can take more than 40 days at 45°F. Some cultivars, such as Shepody and Gem Russet, are even more sensitive to delayed emergence under unfavorable conditions. Sprout growth rate is directly tied to soil temperature through the range from 45 to 70°F (Figure 2). Dry soils, poor nutrient availability, and compaction can all aggravate the affect of cold soils, further delaying early plant development.

FROST

The danger of frost is a major factor in determining planting date in some production regions. In Idaho, it is not uncommon to get pockets of frost that will destroy some or all of the foliage after plant emergence. Frost damage can have several negative impacts on yield potential. First, the lost time between emergence and row closure directly reduces the time available for bulking. A severe frost that burns the plant down below the soil surface can also cause branching of the sprouts. This often results in an increase in tuber set and a resulting shift of tuber size profile towards smaller sizes.

HOLLOW HEART

Research has shown that soil temperatures below 55°F for 5 to 7 days during early tuber initiation can lead to development of brown center. Under the right conditions, brown center can develop into hollow heart as the tubers grow. However, brown center can also dissipate if tuber growth is moderate and uniform throughout the bulking period. Early planting increases the risk that soil temperature will fall below the 55°F threshold during

the period of early tuber development. Early planting also tends to reduce stem production of seed pieces by expressing the relatively young physiological age of the seed lot. Low stem production encourages lower tuber set and rapid bulking, which are exactly the conditions that lead to the development of hollow heart.

CANOPY DEVELOPMENT

A potato plant is most productive when it has developed enough leaves to capture all the available sunlight. Therefore, cold soils reduce potential yield by delaying emergence and the development of the canopy. However, the problem does not stop there. Cold soils also impact the development rate of individual leaves, resulting in smaller leaves and more compact plants. This is especially notable in determinant varieties such as Russet Norkotah that quit producing leaves shortly after tuber set. It certainly explains why some early planted fields struggle to close the rows.

MANAGING RISK

So how do potato growers reduce some of the risks associated with early planting? First, they need to understand the guidelines for soil temperatures at planting (Figure 3) and use this information when making decisions about when to plant. Seed decay and Rhizoctonia can be managed by using fungicide seed piece treatments that are effective against the pathogens that cause these problems. Growers should also be aware that they can aggravate cold soil conditions by planting too deep and not properly warming seed prior to cutting. In situations where frost is a risk, pay close attention to seed size to make sure that seed pieces are at least 2 oz in size. This will help ensure that if the plant is damaged by frost there will be enough energy remaining in the seed piece to help the plant recover. Growers can also age early-planted seed lots to promote stem production and reduce the risks of low tuber set that can encourage the development of hollow heart. Under those conditions, they should also closely monitor early season N applications to avoid over-fertilizing prior to early tuber bulking. Finally, they should consider changing the order they plant varieties. Late season varieties, such as Russet Burbank, are better able to overcome the effects of low soil temperature on leaf size and canopy development than some early varieties. This may seem counter intuitive, but sometimes it makes sense to hold off planting early varieties like Russet Norkotah and Shepody until soil conditions are more favorable.

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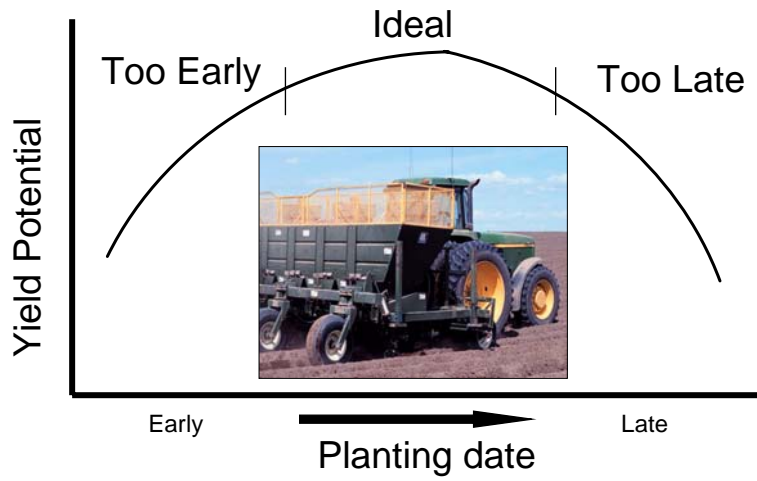


Figure 1. Effect of planting date and yield potential in potato.

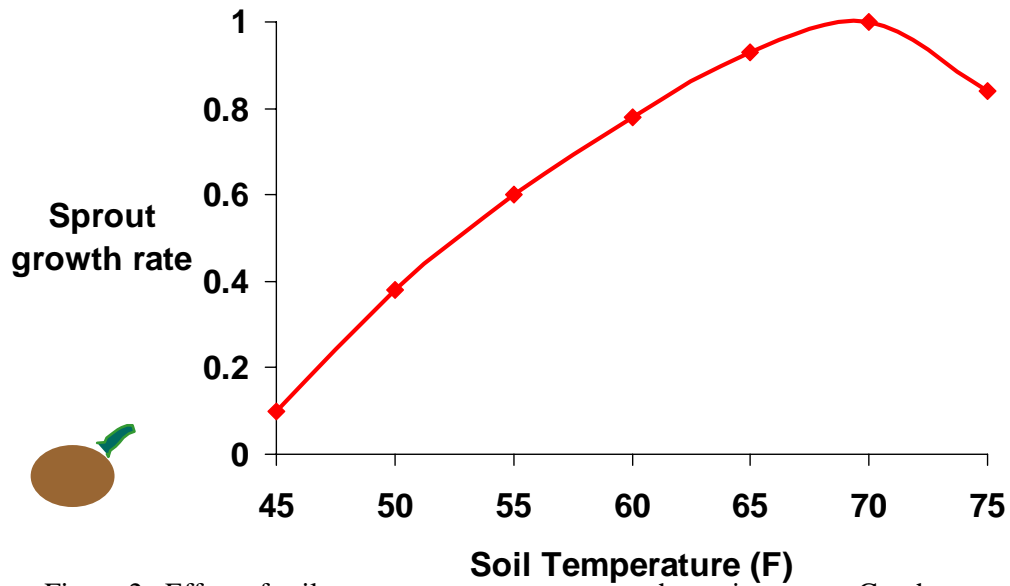


Figure 2. Effect of soil temperature on sprout growth rate in potato. Graph adapted from Kelmke and Moll, 1990.

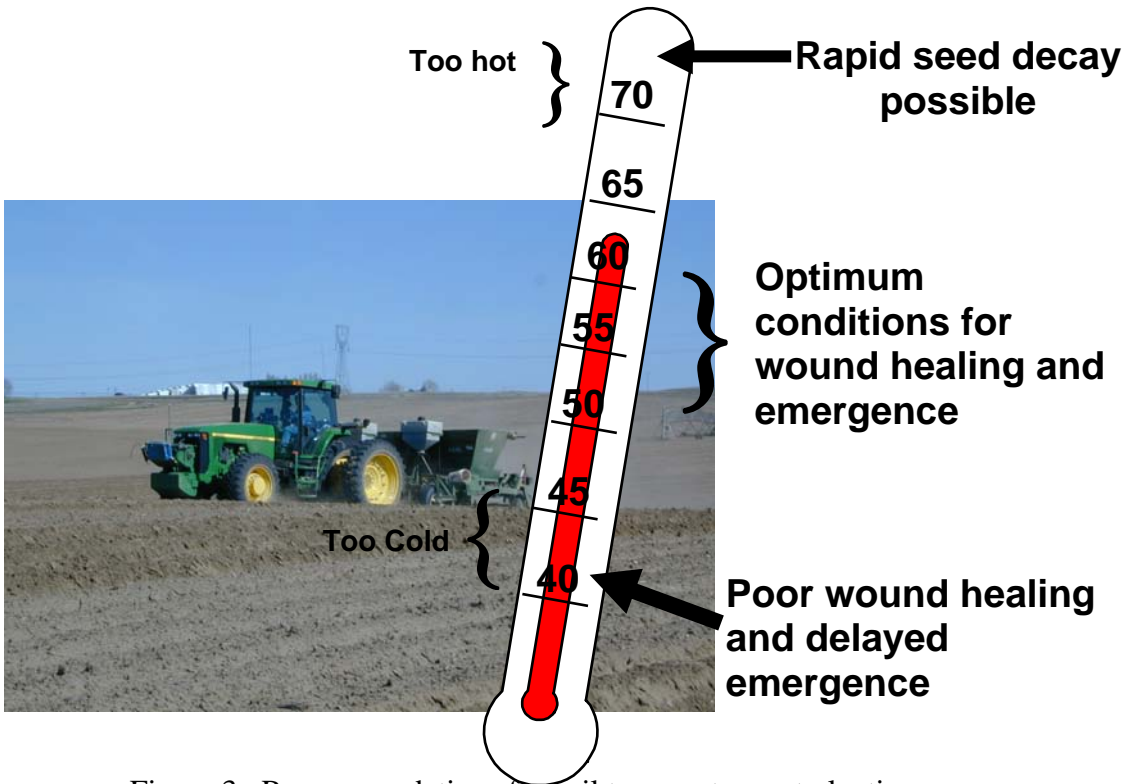


Figure 3. Recommendations for soil temperatures at planting.