THE ROLE OF SOIL MOISTURE AND TEMPERATURE IN ESTABLISHING POTATO PLANT STANDS

by
Dr. David Curwen and Dr. Walter R. Stevenson
Departments of Horticulture and Plant Pathology
University of Wisconsin - Madison, Wisconsin

Obtaining the desired plant stand is a first step in achieving optimum potato production. An optimum planting environment, quality, certified seed, cut to the desired size, and well maintained and adjusted planters, properly operated, all contribute to establishing good stands. Growers carefully plan for and carry out the planting operations. And yet, no matter how carefully done, problems with stand establishment often occur. The Wisconsin experiences in 1985 and 1986 are illustrative of such problems.

The Wisconsin Experience

During the 1985 and 1986 growing seasons, some Wisconsin growers experienced significant reductions in plant stands as well as a loss in plant vigor. In parts of some fields, these stand reductions ran as high as 50%. Stand reductions of that magnitude certainly had significant impacts on yield.

While planter skips account for some loss in stand, these stand reductions appeared to be due to higher than normal level of seedpiece decay. In addition, slowly emerging plants and plants showing poor vigor were also associated with partial seedpiece decay. In assessing the problem, UW extension specialists found three factors that were common to these plant stand problems. The three factors were: 1) the handling of the seed prior to cutting; 2) the handling of the cut seed; 3) the soil moisture and temperature conditions at the time of planting and for two to three weeks after planting.

Seed Handling Prior to Cutting: Many table and process stock growers have adopted the practice of cutting and planting seed directly out of the seed grower's storage. Most of the problem fields (in both 1985 and 1986) had been planted with seed cut directly out of storage. This practice provides little or no warming of the seed, except that which may occur in transit. Since most seed growers store seed potatoes at 38° - 40°F, this practice often results in the transporting, cutting and planting of seed which is pulping at about 40°F. Handling cold seed also increases the risk of bruising.

Potato seed which is pulping at about 40°F has limited sprouting activity until it is warmed to 40° - 60°F. Such seed also has limited potential for suberization which is necessary for the healing of cut and bruised surfaces.

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Thus cold seed is susceptible to seedpiece decay by soft rot bacteria. This susceptibility is enhanced significantly when cold seed is planted on warm, humid days. Under these conditions, a film of condensation forms on the cold seedpiece. This film of water promotes growth of soft rot bacteria on cut surfaces and bruises.

Handling of Seed After Cutting: All fields which had stand problems utilized treated seed. The treatment of cut seed with dust formulations of fungicides is a traditional practice. Such a practice has proven to be beneficial in years with adverse weather conditions after planting. However, growers often place unwarranted faith in fungicide treatment of seedpieces. It must be remembered that such treatments only help to control soil and seed borne fungi. Such treatments do not control soft rot bacteria, do not promote wound healing, do not stimulate sprouting and are not substitutes for common sense at planting.

With some of the problem fields, planting had to be delayed because of weather. Under such circumstances the cut seed had to be stored temporarily. The temporary storage of cut and treated seedpieces can provide benefits in terms of wound healing and acclimatization of seedpieces to planting. However, such temporary storage can be risky unless adequate ventilation is provided and proper temperatures and relative humidities are maintained. In 1986, some of the stand problems were attributed to poor temporary storage of the cut seedpieces. Inadequate ventilation, condensation on the cut seed and a pasty film of fungicide that dried over the cut surfaces were the consequences of poor temporary storage. Such conditions provided a favorable environment for soft rot bacteria; and seedpiece decay, followed by stand loss, resulted.

Soil Moisture/Temperatures at Planting: An important factor in the plant stand problems of 1985 and 1986 was the soil moisture and temperature conditions at planting. Such conditions were not normal. In both years, soils were extremely dry and warm at the time of planting. This was especially true on the sandy soils where most of the stand problems occurred. Such conditions contributed to the seedpiece decay problem, particularly when cold seed was planted. Freshly cut, cold seed that was planted into dry soil failed to completely suberize on cut surfaces. Lack of suberization and subsequent wound healing permitted entrance of soft rot bacteria into cut or injured tissue. Since the soils were dry, many growers irrigated after planting if rain did not come within a week. With the addition of this moisture the ingredients were present for soft rot deterioration of the seedpiece. . . . .that is, an injured seedpiece which had not healed, an abundant supply of soft rotting bacteria and added moisture. Add to this the warm soil temperatures and it is easy to see why stand losses were higher than normal. It was interesting to note that growers who had warmed their seed and who irrigated before planting did not experience significant stand reductions.

Improving Plant Stands by Reducing Seedpiece Decay Potential

The experiences of 1985 and 1986 tended to reaffirm Wisconsin's recommendations for seed preparation and planting. Like many states, Wisconsin recommends warming potato seed to 50° - 55°F before planting. Warming the seed increases sprouting activity which leads to faster emergence. In addition, warming the seed enhances suberization and thus cut surfaces heal faster and become more resistant to soft rot activity.

It would be desirable if the seed could be warmed to 50° - 55°F before it is removed from seed storage. This would reduce bruising which increases tuber susceptibility to soft rot. Unfortunately, most seed growers do not have the capability to individually warm seed shipments. Thus the table or process stock grower needs to obtain his seed two to three weeks in advance of cutting and planting. This time period would be sufficient for warming the seed to 55°F. This would, of course, necessitate extra handling of the seed, a clean and disinfected storage and thus extra cost. However, the benefits of cutting and planting warmed seed would probably justify the added cost.

The potential for seedpiece decay can be further reduced by planting into soils which have warmed to at least 50°F at the depth of planting. If possible, the differential between soil and seed pulp temperature should be kept within 10 degrees. That is, at planting, the soil temperature should be within 10 degrees of the seed pulp temperature. Soil temperatures more than 10 degrees lower or higher than seed pulp temperature increase the potential for seedpiece decay problems.

Finally, soil moisture should be at adequate levels at planting. Adequate soil moisture will enhance wound healing, sprouting and faster emergence. If soil moisture is excessive at time of planting, then planting should be delayed if possible. Excessively dry soils should be irrigated prior to planting. It is recognized that soil moisture/temperatures are not always ideal for planting. When it is necessary to plant under adverse soil conditions, seedpiece treatments can be helpful.

Establishing the optimum plant stand is a key starting point to achieving the desired level of potato productivity. As the Wisconsin experience has indicated, many factors play a role in plant stand establishment. Understanding these factors and the ability to make needed changes are management skills needed to achieve optimum potato plant stands.