

IMPROVING POTATO STANDS - SEED CERTIFICATION ISSUES

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The seed potato certification process effects plant stands primarily through its impact on overall seed quality. Some of these effects are directly related to low levels of disease in certified seed, while others are a by-product of the economic realities that must be faced to be a successful certified seed potato grower. A brief discussion follows on examples of both types of influences on the quality of certified seed and its subsequent performance in that critical period of time between planting and emergence.

Certification and incidence of diseased plants

Certified seed has been carefully scrutinized by certification program crop inspectors at several key points in its production and storage. Certification is granted only after these inspectors have judged, to the best of their ability, that it does not contain harmful levels of major tuber-borne plant pathogens; specifically certain viruses and bacteria. In most states, including Wisconsin, there are strict limits in certification regulations on the amount of mosaic-causing viruses, like potato virus Y (PVY) and potato virus X (PVX), that can be present in seed lots. The amount of potato leafroll virus in seed also is tightly regulated. Seed pieces cut from tubers with high levels of mosaic and leafroll viruses often give rise to plants that are stunted and unproductive. The impact on plant emergence and development varies with the amount of virus in the seed tuber and the variety, but the net effect of having a poor plant stand and having a field dotted with skips and virus-crippled plants often is pretty much the same - reduced yields and poor tuber uniformity in the harvested crop.

It is important to note what certification does and does not mean in terms of the likelihood of disease incidence in a seedlot. Certified seed is not guaranteed to be free from disease, but based on inspectors' observations (and corroborating lab testing where warranted), it is reasonable to expect disease levels of major potato pathogens in certified seed to be low and of minimal consequence for crop productivity. Some pathogens of significance in determining plant stands, however, are not particularly focused on in the seed certification process, because a direct link between their presence on seed and crop productivity is not well established. Soft rot bacteria (*Erwinia caratovora* subsp. *atroseptica* and *Erwinia carotovora* susp. *carotovora*) are examples of such pathogens. Crop inspectors routinely note levels of blackleg (usually due to *E. c. atroseptica*) in a seed

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crop during summer inspections, but the presence or absence of blackleg does not affect certification status unless it becomes extreme. There is no established tolerance for blackleg in Wisconsin regulations, nor in regulations of most other states for that matter, because scientific studies have failed to show a significant relationship between the presence of blackleg in a seed crop and soft rot problems in the crop produced with that seed. Most seed lots, in fact, are contaminated to some degree with soft rot bacteria, but the bacteria are usually dormant and do not cause disease until environmental conditions are favorable for development. High soil temperatures and bruising of seed tubers favor seed piece decay and preemergence blackleg. Cool, wet soils at planting followed by high temperatures after emergence favor postemergence blackleg. Poor handling of seed can predispose it to develop problems under conditions where they otherwise would not have occurred. Blackleg problems, therefore, tend to be of more significance in some geographical areas than in others due to prevailing climatic conditions and traditional seed handling practices. In general, most states do not find the level of soft rot bacteria present on seed to be a particular problem, so certification tolerances for those organisms have not been developed. This is not to say that these tuber-borne bacteria can't cause problems with certified seed given the right conditions, especially when it has been handled improperly.

Certification and high quality potato storages

Wisconsin seed potato farms are required by the Wisconsin Department of Agriculture, Trade and Consumer Protection to comply with demanding regulations governing the production and sale of certified seed. The purpose of these regulations is to foster the highest possible quality in the Wisconsin seed potato industry. These rules cover everything from disease tolerances, as mentioned above, to cultural practices deemed essential to minimizing the potential of disease occurrence and spread. Similar rules regulate certified seed production in most other areas of the country. Because of all of the fuss and bother and vagaries of stringent disease control associated with certified seed production, it tends to be demanding and risky. Consequently, it is common to find that growers of certified seed have invested in modern, technologically sophisticated storages to ensure their crops make it all the way to the market. A commendably high percentage of Wisconsin certified seed is stored overwinter in these well-equipped, quality-maintaining storages. The benefit to table and process growers in terms of improved plant stands is this: certified seed typically has been handled properly and stored under exceptionally good conditions, keeping it physiologically young. Physiologically young seed is more vigorous, leading to faster emergence. The less time it takes for a plant to develop from a seed piece and emerge from the soil, the less its vulnerability to pathogenic soil organisms, like soft rot, that can sap its strength and stifle emergence.

Limited generations and speed of crop emergence

Most modern seed potato certification programs in the country have switched over in the last 10 years or so to what are referred to as "limited generation" systems of seed production. Potato seed in a

limited generation system must originate from disease-indexed tissue culture stocks. Disease-indexed does not mean that every plant pathogen known to man has been tested for and eliminated, but it does mean that potato pathogens of significance (and the list of these is long) have been tested for, and the tissue found to be free of their presence to the limits of detection. The number of times that plants derived from these tested tissue-culture stocks can be propagated in the field is limited to 5 to 8 cycles, depending on the state regulating seed certification. Wisconsin certified seed growers are restricted in our limited generation program to at most 7 field generations. In reality, most of the seed sold off our seed growers' farms to table and process growers is only 3 to 5 years away from tissue culture.

Data we began collecting this summer indicate there may be a relationship between the speed of plant emergence and the number of times seed has been propagated in the field after being derived from tissue culture. Our study was conducted during the summer of 1993 at the University of Wisconsin's Lelah Starks Elite Foundation Seed Potato Farm in Rhinelander. During the summer of 1992, seed of 3 potato varieties (*Atlantic*, *Superior*, and *Red Norland*) was produced with separate lots that ranged from 1 to 5 years away from tissue culture. In 1992 these seed lots were planted in close proximity for propagation purposes. There were no visually detectable disease levels in any of the propagation seed plots at any time during the 1992 season. Seed harvested from the plots was stored together overwinter at the farm and planted during May of 1993 in 3 randomized complete block experiments (one per variety), each with 4 replications. There were 17 total generations represented in these experiments (*Atlantic* generations 1-6, *Superior* generations 1-6, and *Red Norland* generations 1-5). Differences in speed of emergence were noted between generations of the same variety within 2 weeks after planting. At 4 weeks after planting, the earliest generation material had reached nearly 100% stand. There was a significant negative relationship between emergence and generation of planted material at this time. Within 2 weeks, however, all plots achieved full stands. Thus while, final stand itself was not affected in our trial, there were detectable differences in the speed of emergence. These data must be considered preliminary only, being the product of only one year's investigations. If these data are corroborated in further studies, a relationship between seed generation and final stand via the impact on speed of emergence might be postulated, since faster emerging seed may be less susceptible to pathogens, like soft rot bacteria, that can prevent emergence of slower-emerging seed. There are important "might"s and "may be"s here that need further study, and we intend to pursue these issues in the years ahead.