

SLIDE 1:

This is Steve Johnson, University of Maine Cooperative Extension, bringing you information on Potato Seed Treatments. It is possible to receive a Maine Board of Pesticides Control recertification credit for this presentation. As this presentation is approximately a half hour, another presentation would also have to be viewed. Additionally, a test must be passed with a minimum of 80 percent correct answers on each presentation. While there is no charge for viewing this information, there is charge for taking each test, whether the tests are passed or not.

SLIDE 2:

Physiological age is important consideration in potato seed and producing a healthy crop as well. The potato goes through some distinct stages: dormant, young, middle age, old, and no top stages. While these are not mathematically precise, they are fairly distinct; although, there is a gray area.

SLIDE 3:

A dormant potato does not sprout. This is easily viewed shortly after harvest.

SLIDE 4:

Young seed exhibits very strong applicable dominance as seen here. Often only one sprout—the one farthest from the stem or stem end which would be on the left side of the screen sprouts. Often these plants will produce a single stem and a very large tuber.

SLIDE 5:

Middle age seed have most of the applicable dominance broken. All of the eyes tend to sprout at the same time as seen here. This produces multiple stems and is frequently desirable for most production.

SLIDE 6:

Old age seed can produce very unthrifty sprouts. All of the pieces will sprout from it. It tends to have a little shorter length of growing in season. It produces more numerous smaller potatoes not really desirable for most any situation. Again, the sprouts are not really robust; they tend to be thin and skinny.

SLIDE 7:

Potato No Top is the term given to the physiological disorder of extremely aged seed. Functionally, the seed do not produce any sprouts that come above ground. They start to sprout and then produce a tuber right at the end of the sprout. These are clearly non-productive and will not produce a crop. Physiological age can result from temperature stress or drought stress or simple time stress—how long they have been stored.

SLIDE 8:

Growing season stress advances the physiological age of seed. However, drought trumps all especially late season drought. The later the drought occurs during the growing season, the more physiologically advanced the seed will be.

SLIDE 9:

This is a list of a number of years of work from Greg Porter at University of Maine where he looks in days to pip or sprout breaking of potato tubers. These are Russet Burbanks. You can see that on an average you are looking at days that are about 165 days at 38 degrees or about 71 days under the years highlighted in red. 1994, 1995, 1996 and 1997 were extraordinarily dry years. The drought really occurred late in the season and specifically during the last half of August and September. The dramatic effect on the seed physiological age can be seen by cutting the days to sprouting by less than half.

SLIDE 10:

Dealing with seed. Things that you are not really looking for are a varietal mixture.

SLIDE 11:

Rhizoctonia is a huge seed-borne issue. Seed that is heavily contaminated with Rhizoctonia scurf, as can be seen here, is not the best candidate for planting. The seed-borne Rhizoctonia, undoubtedly, will lead to tuber Rhizoctonia or stem and stolon lesions and reduced stand. This is not the pathogen that takes down whole plants. It tends to be more of a nibbler instead of a gobbler, but it will consistently affect yield.

SLIDE 12:

Stolen lesions and stem lesions (The stem lesions are shown here.) will affect plant productivity. It will produce a plant that can be less thrifty and less efficient and less productive in the field.

SLIDE 13:

I'd like to return to *Rhizoctonia solani*. I really feel this is one of the yield losses that we need to get under control. Certain tubers, like are seen in the picture, are not marketable, are not acceptable under any conditions, certainly not for seed.

SLIDE 14:

Over a number of years, I have treated varieties. I'm going to present information on Shepody and then Russet Burbank. This is some seed treatment trials over 1989 – 2000 where I have selected some materials that have been consistently looked at during that period of time. You can see that the emergence is up, down, erratic. If you notice the emergence is over 100 percent, the reason it is over 100 percent that in all cases in all years the Check or the untreated was moved to 100 percent and everything else was proportionally raised so that at that point everything is in comparison against the Check.

SLIDE 15:

Focusing on the mean from 1989 to 2000 period of Shepody, you can see that for the most part the emergence is a little better with materials no matter what they are. The Terrachlor is no longer recommended. It does tend to hurt the vigor quite dramatically. But realistically, any seed-piece treatment is going to help the emergence of Shepody in this situation as can be seen here. Again, this is data from 1989 to 2000.

SLIDE 16:

Vigor – visual rating on how healthy the plants are, how big they are, and what they are doing. Again, you can see Terrachlor with the black bar; it doesn't look that good. In all cases, the Check is at 100 percent so anything greater than 100 percent, the plots treated with the material look better than the Check. Certainly, in respect of what used, the material looks better. So, the vigor is improved by using a seed treatment.

SLIDE 17:

Part of the vigor and part of the whole process is getting a healthy plant trying to get a stem rating which is a visual observation of the stems, how big the Rhizoctonia lesions are, how many there are, were they coalescing where the stem is dead. Certainly, you can see the movement all across the board that in the most case, the Check which is the green bar here is higher. Again, the Check was moved to 100 percent and everything else was correspondingly moved so that the Check is what was being compared here.

SLIDE 18:

Focusing on the mean, outside of the Terrachlor, which isn't really for the stem lesions no matter what was used. It cut the stem rating by about a half. This was correspondingly observed in the Vigor where no matter what the material was, the Vigor was increased. Certainly, the stem rating is going to pay benefits or dividends by using one of the seed treatments.

SLIDE 19:

Again, the bottom line is overall yield, how did the materials do, how did they compare against the Check treatment. Again year by year, the bars tend to be higher than 100 percent on the seed treatment. So looking at the mean for the period 1989 to 2000, on Shepody variety.

SLIDE 20:

The yield is better with the exception of Terrachlor which again is out of our recommendation. Certainly, no matter what was used, that our trial shown here, the yield was better than the Check. The 100 percent of the Check certainly was 7-12 percent better than the untreated material. Again, all other conditions were held constant on this. Basically, on the Shepody, the seed treatments controlled the Rhizoctonia on the stem lesions, the increased the vigor, they helped the emergence, and the overall yield is increased as a result of the applied treatments

SLIDE 21:

Here is some emergence data from Shepody from 1998 to 2002 where some different materials--Tops MZ, Moncoat MZ, as well as Maxim--are used. Certainly, the data also appear, the emergence is improved with application of a seed treatment.

SLIDE 22:

Looking at the mean over this period, there, irrespective of which treatment was used, there was better emergence. In other words, there was some not emerged. It may well have been from Rhizoctonia nipping all of the stolons off so it basically never emerged.

SLIDE 23:

Again, vigor during the 98-2002 period with some different materials—Maxim MZ, Tops MZ, Moncoat MZ, the Vigor, as before during the other period, looks improved. Again, looking at the mean during this period of 1998-2002.

SLIDE 24:

Irrespective of which materials were put on, they are improved.

SLIDE 25:

Again on Shepody, the Rhizoctonia stem rating shown here 98-2002 with Moncoat MZ, Tops MZ, Maxim MZ, and a Check, you can see that, in some cases, the stem rating was worse with the applied material. In the most part, the Maxim and the Moncoat did a good job reducing the stem lesions on the Shepody during the period 98-2002.

SLIDE 26:

The total yield in 2002-98, that period again, the green bar is not the Check. The Check bar is on right hand side and it is gray. No matter what was used, Moncoat, Maxim, Tops, they all improved yield over the Check as much as 10-15 percent.

SLIDE 27:

Dealing with Russet Burbank during the 2002-2005 period where Check, Quadris, Maxim FS + Quadris, Tops MZ, Moncut, Moncoat MZ and Maxim FS were used, this is the incorporation liquid materials in there as well. Certainly, you can see the Check with the green bar on the left of each year is less than this any of the applied seed treatments.

SLIDE 28:

If I look at the Vigor on the same period of time 2002-2005, with the exception of Quadris on Russet Burbank, the Vigor is improved with each of the material. In other words, the materials with the seed

treatments applied look better, emergence better for Russet Burbank than the untreated Check.

SLIDE 31:

Again, stem ratings are one thing that will decrease Vigor as well as increase the soil-borne population, and, possibly, lead to tuber contamination as well. Certainly, the green bar which is the Check, is the highest. Again, the high number is not what you are looking for so, irrespective of which treatment, the stem rating was reduced. In this treatments of Quadris, Maxim and Quadris, both liquids, Tops MZ, Moncut, which is a liquid, Moncoat MZ and Maxim which is a straight liquid.

SLIDE 32:

Again the total yield, the Moncoat MZ and Quadris out yielded the Check over the 2002-2005 period; the other treatments did not with the exception of Maxim FS out yield the Check treatment. Certainly, the Quadris has performed well on the Russet Burbank variety.

SLIDE 33:

On the harvested tubers, this is 2004 and 2002, not every year is there a good colonization, but you can see that the incidence in severity on the top of the Check, the incidence is 68.75 which means that just over 2/3 of the potatoes that were harvested out of the Check plot had *Rhizoctonia sclerotia* on them and the severity was as high as 10 percent. The Maxim FS + Amistar worked very well. The combination actually better than Maxim + Quadris which is a different formulation. In a different year with the Check, the Moncoat MZ did significantly reduce the amount of infection incidence as well as severity.

SLIDE 34:

Again, *Rhizoctonia*, you are not looking for the top row of the potatoes, you really would like the bottom row.

SLIDE 35:

Other pathogens that can affect the seed crop are Pink rot. Not that often a seed-borne issue, because it breaks down so quickly, but certainly any Pink rot like as seen here will spread very quickly to the other seed pieces, cut or uncut.

SLIDE 36:

Pythium or soft rot is a concern in seed issues. Certainly, in the field and during cutting, if there is soft rot or Pythium Leak in the storage, there certainly can be expectations that there will be problems in the field as well. Soft rot in the field after the cut seed or whole seed is planted can be a result of a number of different causes.

SLIDE 37:

Soft rot does not make good seed. Planting seed with soft rot as shown right here will not yield good stand.

SLIDE 38:

Freshly cut seed that is warmer than the soil it is planted into generally leads to poor stands. Planting seed that is planted into cold wet soils generally leads into poor stand.

SLIDE 39:

Planting seed into poor conditions into cool wet soils will lead to disastrous stands.

SLIDE 40:

Fusarium dry rot is a problem in storage specifically on the drier years that we have in Maine. It can affect seed performance; and certainly on years when the potatoes are planted in too dry conditions, they may not even suberize. The Fusarium can be quite an issue at that point. Any lot of seed with 5 percent of Fusarium should not be planted; even culling out or stripping out the infected seed pieces will not necessarily get enough out to not cause some problems.

SLIDE 41:

Late blight is the biggy on seed. You can a seed-borne Late Blight in the picture right here. The plant basically comes out of the ground and dies very quickly. This is very hard to pinpoint unless you are right there when it is happening looking just like this.

SLIDE 42:

Late blight on seed is not controllable in the field which is why a Mancozeb based seed treatment is recommended to try to reduce this.

SLIDE 43:

Black leg in seed is a bacterial infection. It is not necessarily common in the drier seasons in Maine. We tend to see this more with windblown rain under wet seasons or flooded conditions; but certainly this is a problem for subsequent seed lots. Seed lots with a high level of black leg or even a modest level of black leg should not be planted. The black leg will continue to build up in subsequent seed generation or multiplications. Most people don't realize this is one of the key elements that the test tube culture was developed on potatoes to get rid of black leg because of build up as does viruses in subsequent multiplications of the potato tubers.

SLIDE 44:

There are some things that there are not seed treatments for. This is what certification and quality seed are about. Viruses are one of these. What is seen here is Calico—Alfalfa mosaic virus.

SLIDE 45:

Other viral problems can be mosaic or Rugose mosaic with a PVY and a PVX shown right here. Clearly, this is not a productive. In fact, it is wasting and taking up space. It would be better to have a missing plant right there; and certainly, it is going to spread to the other plants. You can see the grower is not very happy right here.

SLIDE 46:

The plant not so severe is PVY will lead to smaller plants, shorter internodes, much smaller plants, as can be seen here.

SLIDE 47:

The combination will actually lead to Rugose mosaic which can produce very tiny plants that are clearly physiologically disrupted in their normal processes.

SLIDE 48:

PVY or mosaic symptoms include shortened internodes as can be seen here which makes a dwarfed, bunched plant.

SLIDE 49:

Leaves tend to be rough as seen.

SLIDE 50:

Under severe cases, stem twinning and malformation can occur. Again, these are PVY symptoms.

SLIDE 51:

Severe PVY can leave vein marking on the underside as can be seen here.

SLIDE 52:

As well as stem staining on some of the main stems.

SLIDE 53:

Potato Leaf Roll virus is different than PVY. This is a circulative virus. The insect actually houses the virus in its gut; and every time it feeds once it goes through its cycle, it will inject a leaf roll virus into the subsequent plants. These plants tend to be thicker leaves, brittle, and rattle like parchment; but certainly, the leaves cup and roll as seen.

SLIDE 54:

Planting seed in poor condition into cool, wet soils will lead to disastrous stands.

SLIDE 55:

Seed cutting is an important step in potato planting. Size, shape, and distribution of the cut seed are three critical factors.

SLIDE 56:

Warming seed before cutting is important. The speed at which the seed is warmed is not critical within reason. It is critical to avoid condensation. Warm humid air on cold tubers can lead to condensation. The larger the difference between the air and the tuber temperature, the lower the relative humidity should be. Rough values, if your air is under 95 percent relative humidity, you can have 1 degree difference between the air and the tuber. If your relative humidity is 90 percent, you can have 2.5 degrees difference. If your 85 degrees and below, you can have 5 degrees between the air and the tuber temperatures.

SLIDE 57:

On the basics, slabs are too big; undersized are too small. I think we all know what they are. The slivers should be removed by the sliver remover. A good seed piece is shown in the corner. A blind seed piece has no eyes. A ripped seed piece or torn is indicative of the cutter blades need sharpening or repaired.

Seed cutting disease spread

No dip treatments

SLIDE 58:

Some people may see a decent seed cutting operation right here. I do not. I see an undersized seed piece; I see a ripped seed piece face; I see a sliver, and I see a slab--all in the same. Besides, the seed treatment here is very poorly distributed as you can see from the dye.

SLIDE 59:

Growers should look for 70 percent between 1 and a half and 3 oz. of the seed piece. It is not really a function of what your average seed piece size is. It is really a function of what your distribution is. You want a tight distribution.

SLIDE 60:

A poor cutting distribution is seen here which is an actual seed cutter. The average size is about what they are looking for, but they really don't have that many of them. The range is too long and there is too many of sizes where you are really not even looking for them.

SLIDE 61:

A good seed cutting distribution has a classic bell curve around the midpoint. In this case, looking for a 2 oz. seed piece size, not too many 3 oz not too many $\frac{3}{4}$ oz seed pieces. Most of the seed pieces are right where you are looking for.

SLIDE 62:

Here is a seed load that I would consider acceptable. Nothing to get really excited about, but I would accept this.

SLIDE 63:

Here is a seed lot that is not acceptable. I think if you go through this load, you would see too many slabs, rough torn pieces, chips, two cut, three cut and whole seed. The size of variability that is so wide that it is not going to feed well through the planter.

SLIDE 64:

This is what I look for as a good seed cutting distribution. That's a pretty picture!

SLIDE 65:

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Potato seed treatments are an important part of potato disease control and quality potato production.

Rhizoc intro soil borne stuff

Soil-borne pathogens infect the soil