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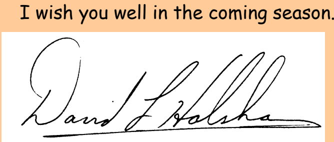
Virginia Soybean Update

Volume 12, No 1 **May 2007**

Dear Reader,

Welcome to the 12th year of the Virginia Soybean Update (time does fly). You did not miss the first issue, which is usually published in March or April. I just did not get a chance to write one. That issue usually relates to variety selection and that information was distributed at our county meetings, through our county agents, and is available at the web site listed below my phone numbers (Note that the web address has changed). So, hopefully, little was lost. I will attempt to continue to publish this newsletter monthly through September. Let me know your major issues and concerns; I try to address them the best I can.

I wish you well in the coming season.



Extension Soybean Specialist

In This Issue

May Checklist for More Profitable Soybeans

Reduce tillage and trips over the field. Although fuel prices have come down, conservation tillage systems will build our soils and yield potential, and better utilize nutrients. Fewer trips over the field will reduce compaction as well as save fuel.

1. Match varieties to fields. You've selected your varieties. Now make sure that you're planting the right variety in the right place. Does a particular field have a nematode infestation? Then make sure the variety has resistance for that species or race. Does the field have weed problems or is there a herbicide-resistant weed nearby? Then make sure that variety has the STS trait so you can safely combine sulfonylurea herbicides with glyphosate if needed. Are you planting soybeans in that field again (no rotation)? Then make sure the variety has frogeye leaf spot, stem canker, or other necessary resistance.
2. Split your planter or drill with two varieties of the same relative maturity. Observe and check yields. Farming is site-specific, so don't just rely on official variety tests or company data. Conduct your own on-farm research. If your results differ from variety tests, find out why.
3. Lower full-season seeding rates and plant at the correct depth. A final plant stand of 80,000 plants per acre are adequate for maximum full-season yields (5 years of Virginia research). Allowing for 70-75% emergence, 100,000 to 110,000 seeds per acre (35 to 40 lbs/A) are adequate. For drills, bump the rate up to 120,000 to 140,000 seed per acre due to non-uniform seed drop. Plant the seed ¾ to 1¼ inches deep; never deeper than 1½ inches. Adjust down pressure for each field. Calibrate the planter, even if you have a seed monitor. Never base your seeding rate on pounds per acre. Count the seed by either turning the drive wheel and catching the seed for a given distance or by planting without any down pressure on a field border, then counting the seed. Calibrate drills for each variety (seed size can vary greatly).
4. Use a residual herbicide in Roundup-Ready weed control programs. Weed resistance is upon us. We no longer have the luxury of using just glyphosate. Residual herbicides can be applied with the burndown (always start with a clean field) or tank-mixed with glyphosate. Apply glyphosate within 3 weeks of emergence to avoid yield-robbing competition with the weeds.
5. Use seed treatments when and where you need them. Only use treated seed if you know you have disease or insect problems or if certain environmental conditions favor the pests. You only need armor if you're going into battle. Although not that expensive, unjustified use of fungicides or insecticides can gobble up lots of cash if used on every acre. Our research shows little benefit of fungicide seed treatments if high quality seed is planted into warm soils in rotated fields. Nor is there a consistent benefit to insecticide seed treatments unless there is a field history of certain insects.
6. Walk your fields weekly. Or hire someone to do this for you. Most problems can be solved if recognized early enough. If they cannot be solved this season, they can be solved next year. In addition, you'll discover new ways to build your yields.
7. Invest in tractor guidance systems. Not only will this relieve you of some stress, it'll save you 2-10% in fertilizer and chemical costs. It'll also allow you to better control your traffic, which will reduce compaction in conservation tillage systems. This doesn't have to be auto-steering systems; simple light bars will do.

Soybean Inoculation for Adequate N Fixation

Soybean seed contain 35 to 45% protein. Depending on the protein content, nitrogen (N) requirements can approach 5 pounds per bushel. Therefore, a 40 bushel crop may use over 200 pounds of N. This N comes from two sources: oxidation of soil organic matter and that produced by a symbiotic relationship between soybean and N-fixing soil bacteria.

In low organic matter soils, most of the N supplied to the soybean crop is provided via a symbiotic relationship with the bacteria strain, *Bradyrhizobium japonicum*. The N-fixing process is initiated by the soybean when it releases chemical signals into the soil soon after emergence. These signals are picked up by rhizobia in the soil or in inoculants applied with the seed. The bacteria then infect the roots and the roots form a specialized structure around the bacteria called a nodule. As the bacteria increase in numbers and size, an enzyme in the nodules fix N^2 from the air, which is unusable by the plant, into ammonia (NH_3), which can be used by the plant. The nitrogen-fixing process usually begins at the 2- to 3-leaf stage. When the process is working, nodules will have a pink or red interior. Nodules reach their full size in about 4 weeks and continue to fix N for another 2 to 3 weeks. Peak N fixation occurs during seed fill (R5-R6).

The process is called symbiotic because the soybean provides the bacteria with photosynthesis products that the bacteria use as food and a protective growing environment. The rhizobia, in turn, provide the nutrient needed in the largest amount (N) to the soybean. This relationship needs to work well in order to meet the high N requirements of a high-yielding soybean crop.

Bradyrhizobia bacteria must be present in relatively high numbers at planting. If soybean has never been grown in a field, then seed must be inoculated with the bacteria. Stresses on the bacteria such as drought, cold temperatures, flooding, and low soil pH will reduce their numbers and interfere with the fixation process. Planting inoculated seed into dry soils will cause drying of the bacteria and death. Other stresses such as certain seed treatment chemicals and starter fertilizer can kill the bacteria and inhibit nodulation. Finally, soil N concentrations in excess of 30 to 50 pounds per acre can delay the N-fixing process.

<u>When should inoculants be used?</u> The process of introducing an organism into another is called inoculation. Rhizobia can be added directly to the soil (in-furrow with the seed) or as a seed coating. The later is most often used due to cost or lack of in-furrow injection equipment. In general, if soybean has been grown in the past 3 years, a field will normally have sufficient soil bacteria for adequate nodulation and N fixation. However, if soybean has not been grown in over 3 years, I recommend an inoculant. Still, I've seen sufficient nodulation in soils that haven't had soybean grown in them for over 5 years. But, that's a risk that should not be taken. The big question today is whether or not rotated soybean fields will benefit from inoculants. Before we answer that question, I should mention changes in inoculant technology.

<u>New products.</u> Inoculants have changed over the last 10-15 years. Instead of just peat-based products with relatively low numbers of bacteria, we now have sterile peat- and liquid-based products with much higher numbers and more strains of bacteria. Sterile inoculants contain no contaminants that can reduce the number of rhizobia. The number of viable bacteria cells has risen from less than 500 million to over 2 billion cells per gram of inoculant. Some inoculants contain new and multiple strains of bacteria. Combining strains that are productive in different environments result in inoculants that are vigorous over a wide range of environments. But, keep in mind that it is very difficult to replace the indigenous rhizobia population with an introduced strain. Some inoculants contain plant growth hormones and biological disease control organisms. Some include biological signals that supposedly speed up the inoculation process. Inoculants are now easier to apply. They stick to the seed better, insuring better coverage of every seed. One of the biggest improvements is the addition of extenders that allows the bacteria to be applied to the seed up to 30 days or more before the seed is planted. Inoculants without extenders should usually be applied within 24 hours or less of planting. The extenders also extend the life of bacteria cells when applied to seed treated with fungicides.

These improvements have resulted in more concentrated products with longer shelf life and ease of use. The outcome of these improvements is more effective inoculation. Now, instead of establishing less than ½ million rhizobia cells per seed, we're putting on ¾ million to 1.5 billion cells per seed if used at recommended rates. For new soybean land, this should result in a better establishment of this critical organism. But, do these improvements necessarily results in yield improvements on rotated land?

<u>University tests results.</u> Many trials have been conducted in the Midwest since the introduction of the new sterile inoculants with new strains. Although many studies did not result in a significant yield increase, the results show a long-term economic benefit from applying inoculant to rotated soybean land when results are averaged over time and locations. Keep in mind that the cost of inoculants was only $2 to $4 per acre, depending on the product.

A two-year Michigan study found a 45% and 23% soybean yield increase when inoculants were used in fields where soybean have never been grown. In another 3-year study, fields with a history of soybean cropping, significant yield increases were found in 6 of 14 sites with an average yield increase of 1.3 bushels per acre.

In Ohio, the average yield increase from 64 field trials conducted over 11 years was 1.9 bushels per acre. In North Dakota, the average yield increase from 155 product evaluations was 2.7 bushels per acre. Michigan State trials (11 test sites) averaged 1.1 bushels per acre and Purdue tests (19 locations) averages 1.0 bushels per acre. A 3-year study in New York showed a 2 bushel per acre benefit of inoculants in fields with a history of soybean and a 3 bushel per acre benefit in fields with no soybean history.

In Virginia, our results have not been as promising. In 13 trials (11 in 2004; 1 in 1998; 1 in 1997), inoculants increased yield by an average of 0.4 bushels per acre. Furthermore, in only 2 of the 13 trials was the response to inoculant significant. Nine of the 13 trials were planted in double-crop systems; the two significant responses were from double-crop plantings. Results from dozens of North Carolina trials are similar.

Why the difference between results in the Midwest and here? I'm not sure. It could be soil differences or higher yield potentials in the Midwest. Or, it could be the lower soil temperatures. Regardless, the likelihood of getting a consistent response, regardless of location, is small. If I average all of the studies in our region, we generally get less than a 0.5 bushel advantage in fields with a history of soybean. That will pay for the product, but that's about it. Still, we occasionally get the 3 to 5 bushel increase in some fields.

In summary, inoculants applied to fields with no history of soybean are necessary. The cost of the inoculant will pay for itself many times over. In fields where soybean has been grown in the last 3 years, the use of inoculant is an insurance treatment. This insurance will probably pay for itself, but not necessarily give a large return on investment.

Rules for Good Inoculation

Proper storage and mixing of inoculants with the seed are key to making sure you're getting the most bang for your buck. Improper storage or leaving the inoculant on the seed too long before planting will kill the bacteria. Not properly mixing the bacteria will result in a field where some plants have nodules and others don't. The photos to the right show a Virginia field with no soybean history and the inoculant was not properly mixed with the seed. The plants on the right contained nodules; the plants on the left did not.

Listed below are some tips for good soybean inoculation.

- Adjust your soil pH to 5.8 to 6.2 by regular liming. Acid soils will kill rhizobia.
- Choose a sterile inoculant product. These products have much higher numbers of living bacteria cells.
- Buy fresh inoculant every year. Never use inoculants past their expiration date.
- Store in a cool place and out of direct sunlight. Rhizobia survive best at temperatures between 40 to 80 degrees F. The shelf life of products vary from a few months to two years; so check the label and expiration data. When transporting, keep out of the sun. Sunlight is a problem of heat, not radiation.
- After opening, use the entire contents of the product within the time period listed on the product label.
- Use the recommended rate of inoculant and mix thoroughly with the seed. All seed need to contain at least ½ to ¾ million cells to be effective.
- If combining an inoculant with a fungicide or insecticide seed treatment, use an inoculant that contains a protector. Even with the protector, check for compatibility of other chemical seed treatments. Products containing captan or PCNB are detrimental. Others can be safely mixed, but one should check the inoculant label to determine the maximum amount of time the products can be mixed before planting. The inoculant should be applied after (sequentially) the seed treatment. Intervals between application to treated seed and planting can range from a few hours to days or event weeks, depending on the product. If the inoculant and seed treatment is mixed together in a slurry, the seed will usually need to be planted within a few hours.
- If dilution of the product is necessary, never use chlorinated water
- If loading a planter or drill with an auger or other bulk loading equipment, the inoculant can be metered as the seed enters the auger. Be sure to calibrate the flow rate of the seed and the inoculant. Manufacturers usually provide specific instructions for this.
- If applying as a seed box treatment, place about 3 to 4 inches of seed in the bottom of the planter or drill box,


apply the proper amount of inoculant, and mix thoroughly. Repeat this process until the box has been filled.

- Plant inoculated soybean seed as soon as possible. Soybean seed should be planted within 4 hours of inoculation for non-sterile low-count products without extenders.
- Plant into soils with good moisture. Dry soils will dry out and kill the bacteria.

Insuring Good Emergence

Soybean germination and emergence will be slowed with soil temperatures less than 65°F. The longer a swelled or germinated seed remains in the soil un-emerged, the more likely it will suffer from seed and seedling disease. Fungicide seed treatments can be of value if soybeans are planted in to cool soils; but the following agronomic practices should be the first line of defense.

1. Know the germination and vigor for the seed. The germination rate written on the bag is the number of seed that should germinate under optimal soil conditions. Seed having germination less than 75% should be exchanged for better seed. Plant your best seed (85% or higher) in early plantings that may be subjected to soil temperatures below 65°F, and follow with lower germ seed in plantings that are made in later plantings when soils temperatures are warmer (75F or above). Seed vigor is the ability of the seed to emerge over a wide range of conditions, including cold soils. Seed is considered highly vigorous if greater than 70% emerge from a more rigorous testing procedure. These test results are not on the seed tag, but can usually be obtained from your dealer. Plant the most vigorous seed first as they will best survive cold soils and disease.
2. Plant soybeans 0.75 to 1 in. and into sufficient moisture. Sometimes 0.5 inches is deep enough for no-till soils, which generally have better at-planting soil moisture. Planting deeper is risky, especially if heavy rainfall follows and creates a hard crust that hampers seedling emergence. Quick emergence is a key to avoiding seedling disease.
3. Plant into warm soils. Plant when soils warm to 65°F and the forecast calls for stable or warmer temperatures over the next 7 days. Medium range forecasts can be obtained at various web sites: www.weather.gov, www.accuweather.com, www.wunderground.com, www.weather.com, etc. Enter your location to obtain the regional forecast for your area. Three-day forecasts are reasonably accurate and temperature forecasts are more accurate than rainfall forecasts.
4. Consider fungicide seed treatments. Use a fungicide seed treatment if germination level is less than 80%, if soybeans are planted in poorly-drained soils ("wet" soils), or if a soil temperature is less than 65°F. Read and follow label directions on seed treatments before planting.

Fungicide Seed Treatments for Soybean

Pat Phipps & David Holshouser

Fungicide seed treatment are not usually needed when high-quality seed are planted into warm (>65° F) soils at the correct depth. Warm, moist soils promote rapid germination and emergence, therefore the disease does not become well established during the vulnerable preemergence stage. Warm conditions are present after small grain harvest, so there is little need for seed treatments for soybeans being double cropped. On the other hand, planting soybean into cool soils in April or May does entail some risk. In addition, no-till fields generally have cooler soils. Under these circumstances, seed treatments should be considered.

Keep in mind that fungicides will not improve on inherently poor seed quality (not due to infestation with fungi). They will however improve emergence if seed quality is low due to fungal infection or when seeds must be planted into cool soils. If lower-than-recommended seeding rates are used (limited seed supply, expensive seed, etc.) a seed treatment will be of more value.

Seed treatments are available as dusts, flowable suspensions, liquids, and wettable powders. Some products are available for commercial use in slurry- or mist-type applicators. Others are labeled for on-farm use and are usually referred to as hopper-box or planter-box treatments. Regardless of type of application, good coverage is essential for consistent control of disease. Commercial seed treatment equipment provides the best coverage. Some varieties may come pre-treated. However, if seed are pretreated, they must be planted; they cannot enter into the food, feed, and oil markets. For good coverage with on-farm application, add ½ of the seed to the hopper add ½ of the fungicide and mix thoroughly, then the other ½ of the seed, and finally mix in the other ½ of the fungicide. Always read and follow label directions, and wear personal protection equipment when making this or any chemical application.

Fungicide seed treatments can be divided into contacts or systemics. Contact fungicides protect only the seed surface, while systemics are absorbed by the emerging seedling and inhibit or kill the fungus inside the soybean plant. Systemics usually have a longer residual than contacts. Examples of contact fungicides are: captan, fludioxonil, PCNB, and thiram. Systemic examples include: azoxystrobin, carboxin, mefenoxam, metalaxyl, and thiabendazole.

Products can also be divided into fungicides that are effective against water mold fungi, *Pythium* and *Phytophthora* or those effective against fungi other than water molds, such as *Rhizoctonia*, *Fusarium*, *Cercospora*, and other soil- or seed-borne fungi. This is important since the only fungicides effective against *Pythium* and *Phytophthora* (damping off only; not root and stem rot) are those containing metalaxyl or mefenoxam. They do not, however, control the other soil- and seed-borne fungi.

From the standpoint of *Phomopsis*, there is less information regarding the effectiveness of specific compounds. However, products containing thiram (various products) or PCNB and thiabendazole (Rival) provide the best control. This is not to say that other active ingredients are not effective; they are. There is probably not enough difference between the active ingredients to justify choosing the more expensive product.

In general, the most important seedling diseases in Virginia will be *Phomopsis*, *Rhizoctonia*, and possibly *Fusarium*. Therefore, products that are effective on these fungi will be most useful. It is not clear whether or not products that also control Pythium are needed (except in the cases field with a history of "Essex syndrome").

A quick word about nitrogen-fixing bacteria (*Bradyrhizobia*) is warranted. Some fungicides will injure and kill these bacteria. Captan and PCNB, in particular, will reduce bacteria populations. If inoculating seed with nitrogen-fixing bacteria, better choices are thiram, carboxin, or azoxystrobin. Metalaxyl or mefenoxam are also compatible with the bacteria. Regardless of fungicide, always apply inoculants last and right before seeding.

Once again, anything that reduces days till emergence (rain, low temperatures, soil compaction, crusting, planting dept, herbicide injury) increases the risk of seedling disease. Growers need to carefully monitor seeding depth (0.75 to 1.25") and be mindful of changes in different soil types. Building crop residue via no- or reduced-tillage will reduce crusting. Fungicide seed treatments are not a cure for poor agronomic practices.

Table 12.1.1 lists common fungicide seed treatments. The list may not be complete from the trade name standpoint, but is basically complete from the active ingredient standpoint. Table 12.2.1 is a summary of the fungicide seed treatment research conducted in Virginia since 2000.

Insecticide Seed Treatments are of Limited Value To Virginia Soybeans

Ames Herbert & David Holshouser

Insecticide seed treatments are on almost every bag of seed corn and provide protection against several common insect pests. However, until recently, insecticide seed treatments on soybean were rare. Successful Farmer magazine reported in their March issue that seed treatments (fungicide and/or insecticide) for soybean are on the rise, increasing from 28% of the seed treated in 2005 to 52% in 2008 to an estimated 70% in 2010). This "front-loading" of insect protection is likely a response to the ever-increasing cost of soybean seed and possibly unsupported expectations of yield increases.

Insecticide seed treatments can protect soybean from (according to company websites) wireworm, chinch bug, seedcorn maggot (only a problem if soybean are planted into fields where a green, living cover crop is incorporated into the soil), bean leaf beetle, Mexican bean beetle, soybean aphid, white grub, leafhoppers, thrips, and several other insect pests. Seed treatments can reduce feeding by some species of insects early on the season, for the first 3 to 4 weeks after plant germination. However, we do not typically treat for insects early, nor is there data to support the value or need.

Early season insects affecting Virginia soybeans include thrips (various species) and bean leaf beetle. Thrips feed by rupturing the cell walls of leaves and sucking out the cellular contents. Under drought conditions, high numbers of thrips can severely damage young leaves. Although thrips numbers can be reduced with insecticide seed treatments, they can be controlled by foliar insecticides when thresholds are exceeded. Therefore, a preventative seed treatment (money spent without evidence of a problem) should not be favored over a curative foliar insecticide (money spent only when there is a problem). Several years of research conducted across the state revealed that there was little to no yield advantage to controlling thrips.

Bean leaf beetle is a defoliating insect that sometimes feeds on seedling soybean plants. Seed treatments are effective again low populations of the overwintering and first-generation beetles, but a yield reduction from this early feeding is rare. This is because soybean can tolerate a large amount of defoliation (~50%) without appreciable yield reduction. The bean leaf beetle is also a vector of bean pod mottle virus, a virus that there is no known soybean variety resistance. Some will tout this as a good reason to utilize the seed treatments as they might reduce virus incidence and transmission. In most of Virginia, bean pod mottle virus is generally not a problem; however, the disease has been noticed on soybean plants and seed in fields and research plots on the Eastern Shore. Drs. Steve Rideout and Sue Tolin are currently evaluating this perceived threat at the Eastern Shore AREC. Still, like thrips, bean leaf beetle can be controlled with foliar insecticides and thresholds are established. Therefore, a judicious approach to this insect pest is to scout after emergence and only treat with an insecticide if needed.

In the Midwest, growers use seed treatments to reduce first generation soybean aphid. In Virginia, aphids don't appear until late July or August, long after seed treatment effectiveness has diminished. Seed treatments don't last through mid-season.

Insecticide seed treatments do protect soybeans against wireworms and may have some utility for grubs.

Until some change in insect activity is noted or until data shows that insecticide seed treatments can be justified, it is not recommended to automatically apply these treatment to soybean seed. Virginia Cooperative Extension Specialists and Agents have conducted numerous field trials over the period from 2001-2008 to determine the value of insecticide seed treatments (Table 12.1.3). There was only one case where there was a significant advantage

Cut the Residue
Penetrate to the Proper Depth
Insure Soil-to-Seed Contact

Bobby Grisso & David Holshouser

One of the most enjoyable experiences of serving as an Extension Specialists in Nebraska was interacting with Mr. Paul Jasa, agricultural engineer and one of the world's foremost authorities on setting planters and drills in reduced- and no-tillage conditions. It seems he could take any planter or drill, modify it slightly, and then set it to plant through nearly any amount of residue. While in Nebraska and with Paul's help, we planted through 10+ tons/acre of switchgrass residue that has accumulated from 10 years of CRP and through nearly the same amount of residue left from 220 bushel corn. Simple adjustments allowed the same planter or drill to plant in any soil, regardless of clay content or hardness/compaction. Paul stressed three principles (or steps) for no-till planting: 1) cut the residue; 2) penetrate the soil to the proper seeding depth, and 3) insure good soil-to-seed contact. When you think about it, these principles are intuitive. But, performing each of them (in order) is sometimes a challenge. To some, the steps are easier said than done. But, by keeping these principles constantly on our mind, we've found them to greatly assist us when modifying or adjusting a planter/drill for difficult no-till conditions.

With continued dry weather, planting soybean into high-yielding barley or wheat may present a challenge. There could potentially be a lot of residue and the soil might be hard. But, following the three principles above and understanding how to achieve them will result in good soybean stands.

Step 1: Cut the Residue

Condition of the Field and Residue. Management of the small grain residue and weed control are key factors for successful no-till equipment operation. If residue and weed issues are not managed, then the ability of the planter or drill to perform its functions is greatly limited.

The residue has to be uniformly spread behind the combine. The planter/drill will not perform correctly if the combine has left a narrow swath of thick residue and chaff. The first step of cutting the residue cannot be accomplished under these conditions. Therefore, spread the residue! Better yet is to use a stripper combine header. Less residue on the surface means there is less to cut. Even with a stripper header, the chaff must be spread. We don't really cut through the piles of chaff. Instead we till it into the seed slot; thereby fouling up the third step of insuring good soil (not chaff)-to-seed contact. Chaff in the seed zone will only pull moisture away from the seed.

Another key is weed control. If standing weeds exist, the planter/drill must cut and move extra living plant material through the system. Weeds that have a head start on the crop will compete for light, water, and nutrients more than weeds emerging with the planted crop. Therefore, weeds need to be controlled before crop emergence or soon afterwards to prevent yield loss.

Allow the residue to dry and become crisp before planting. Planting too early in the morning is one of the biggest mistakes that we make. Regardless if the planter is set right or not, cutting wet or tough residue is a challenge that might not be overcome. Remember, 75% of the yield is established when you put the seed into the ground. Don't get in a big hurry; allow the residue to dry.

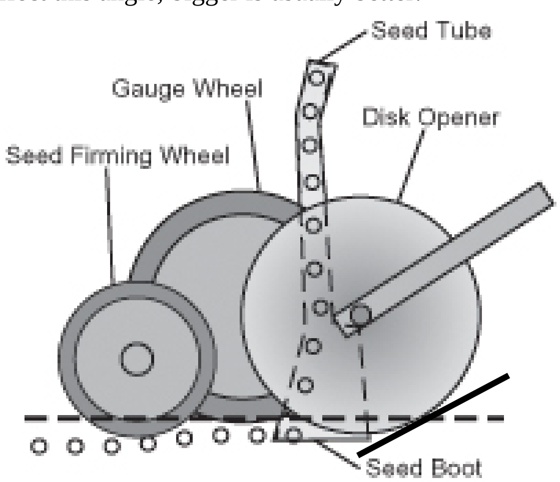
A final comment about residue management, that shouldn't have to be spoken, is warranted– **Don't burn the straw!** The straw is a valuable resource. Burning will remove any nitrogen and carbon and send it up in the air. This adds to pollution and throws away probably our two most important resources in producing a good crop and improving soil quality. If you don't have the planter to perform the steps to be listed, then consider bailing the straw. And, please don't underestimate your or your planter/drill's ability to get the seed into the ground.

Adjust the disk openers. For double-disk openers, maintain approximately 1 to 1½ inch of contact between the two disks. Adjustment washers are found in the double-disk opener assembly, which allow some adjustment to compensate for wear. Machine bushings located on the spindle between shank and disc blade can be added or removed as required to maintain contact. As the blade diameter decreases because of wear, it will be necessary to remove the machine bushings. If 1 to 1½ inch of blade-to-blade contact cannot be maintained after removing machine bushings, if blade diameter is worn below the manufacturer's recommendations, or if the blade edge is bent, chipped, or jagged, the blade should be replaced.

Operators of no-till planters/drills with offset double-disk openers need to watch the leading edge of the double-disks for significant wear. Single-disk openers are also subject to similar wear. Essentially, the leading edge of the disk takes the abrasion and wear of cutting straw or stalks and penetration into the soil. The leading and trailing disks typically are two different parts and cannot be interchanged. As the double-disk openers wear, check the gap between them. If a gap opens between the double-disks, they will push residue into the furrow and have less ability to cut the residue. For offset double-disk openers, a business card-width gap should be maintained to prevent the trailing disk from cutting into the leading disk blade.

Check end play of the disk opener by shaking it from side-to-side. With the single-row ball bearings, some end play will be normal. The disc is stabilized by the contact between the double-disk openers. However, if end play is excessive and the bearing sounds dry when turned, replace bearing/hub assembly or complete disc assembly. Also, check to see that the bearing hubcap is in place. Replace the hubcap if it is lost or damaged.

<u>Adequate down pressure is most important.</u> You may think that we're skipping to Step 2 before we finish our discussion on cutting the residue. You're partly right, we are – sort of. Keep in mind that you much approach these steps in order; but, practices and adjustments within each step may overlap. To adequately cut the residue, we must penetrate the soil to the proper depth (Step 2). Why? This is because we want the coulters and/or disk openers acting like a pair of scissors. The below illustration may help. The dashed line represents the soil surface and the solid line represents the angle between the coulter and soil. Note that the coulter is running at the proper depth and the contact angle is about 45^{O}. At this angle, the cutting is scissor-like and residue will be cut. Think about the way a pair of scissors cuts. When open too wide, it doesn't work. Nor would the scissor work well if you disassembled the tool and tried to press the two cutting edges together at the wrong angle. Keep in mind that the size of the coulter will affect this angle; bigger is usually better.



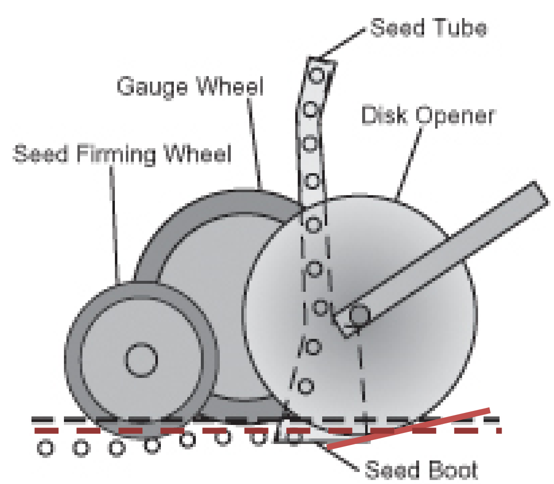
Step 2: Penetrate the Soil to the Proper Seeding Depth

The primary differences between conventional planter/drill systems and those designed for conservation tillage systems are down pressure and weight. Since openers and soil engaging devices must deliver more down pressure to penetrate firmer no-till soils and cut the residue, conservation planter/drill systems include heavy-duty down-pressure devices, are built heavier, and have the ability to carry much more weight than conventional tillage systems.

Individual planting units should be equipped with heavy down-pressure springs. In some conditions, the amount of down-pressure required to penetrate the soil will require 500 pounds per planting unit. Usually down-pressure springs are adjustable and multiple springs can be added if insufficient pressure is achieved. Only after adequate down-pressure is achieved are we ready to add weight to the planter/drill. **Adding weight by itself will not ensure penetration to the proper seeding depth.** Add sufficient weight to the planter to ensure penetration of the coulters and seed furrow openers into untilled soil, and to keep the seed-metering drive wheels on the ground.

Let's do some weight calculations. We have a 15-row 15-inch planter. We've achieved at least 400 pounds of down-pressure per row unit with two heavy duty down-pressure springs not quite set for maximum down-pressure. So, 15 units x 400 lbs/unit = 6,000 pounds. Does the planter weigh enough, or do we need to add weight? Now, consider a 15-foot drill with 24 7.5-inch spaced units. With this number of units, we need at least 9,600 pounds (24 x 400) to make the drill work correctly.

Here are a couple of common scenarios. Let's assume that we don't have adequate down pressure. The scenario would look something like this (the dashed red line is the soil surface):

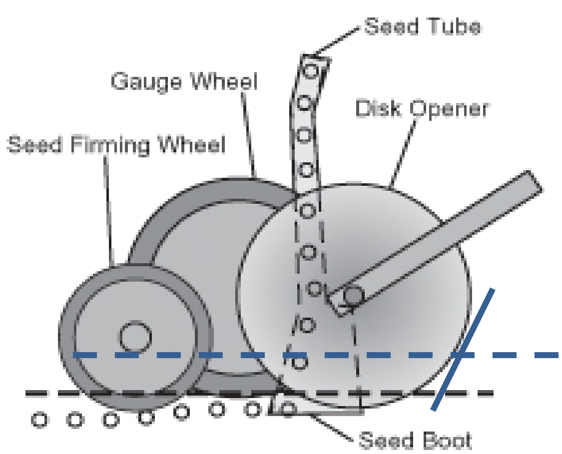


First, we would not cut the residue because the angle of cut is wrong. We would however be pushing the residue into the seed furrow. Residue in the seed furrow prevents good soil-to-seed contact (Step 3). In addition to the seed drying out due to the residue in the seed furrow, we have a shallow planted seed.

Soybean seed depth should be between ¾ to 1¼ inches.

If topsoil moisture is lacking, use the deeper placement, but never plant deeper than 1½ inches. If topsoil is adequate shallower seed placement may speed up emergence, but probably won't make much difference under warm soil conditions. Just make sure that the seed is in contact with moist soil. Placement depth is controlled by the gauge wheels (but only if we can penetrate the soil with adequate down-pressure and weight). Ideally, these should be adjacent to the disk opener. If controlled by the seed firming/closing wheel, then uniformity of seed depth could be erratic.

Now, let's consider too deep of a placement from improper adjustment (figure with blue lines). Not only will this delay and possibly prevent emergence, we will not likely cut the residue. Instead, we will be pushing it. Notice the angle created by running the planter too deep (and I've seen planters/drills run deeper than what is illustrated). There is no scissors action. Pushing the residue causes planters, and especially drills to drag up piles of residue.



Another thing to keep in mind is different soil types within a field. If the planter/drill moves out of heavier soil into a lighter soil or if the planter moves from compacted land to that which is not compacted, the planter will tend to sink and begin dragging up residue. The same principle applies; we begin cutting too deep and pushing the residue. Never set the planter on the field edges where the soil is more likely to be compacted or in an unrepresentative soil. Wide gauge wheels usually helps with this. Wide gauge wheels, drill units that do not run side-by-side and high clearance will go a long ways towards reducing residue dragging when in a field with highly-variable soil types.

Although not necessary, coulters can be added in front of the planter openers to ensure residue cutting. Like double-disk openers, the cutting angle must be correct. For adequate coulter penetration, weight may have to be added to the carrier. Some planter/drills use a weight transfer linkage to transfer some of the tractor weight to the coulters to ensure penetration. Because coulters are usually mounted several feet in front of the seed opening/placement device (in the case of coulter caddies even further), many use wide-fluted coulters. A pivoting hitch or a steering mechanism will keep the seed openers tracking in the coulter slots.

Step 3: Insure Good Soil-to-Seed Contact

Good soil-to-seed contact cannot be achieved unless the first two steps are performed correctly. If the first two steps were carried out correctly, the last step will be much easier.

<u>Press Wheels and Depth Control.</u> There are two methods for seed-depth control on most no-till planter/drill systems: 1) setting the depth from a gauge wheel adjacent to the seed furrow device or 2) adjusting press wheel pressure behind the seed furrow openers. The disadvantage of any system using the press wheel for depth control is its distance from the seed opener. As the distance increases there is a greater possibility that irregular terrain will influence both depth control and the press wheel's ability to provide good soil-to- seed contact. Therefore, depth control from an adjacent gage wheel is preferred. In either case, keep adequate pressure on the gauge or press wheel to force the openers into the soil to the proper depth. A harrow behind a drill ensures seed coverage and redistributes residue for effective conservation measures.

Regardless of the depth control, wide-flat press wheels are unacceptable for no-till since they will ride on the firm soil adjacent to the seed furrow and will not firm the seed into soil. On the other hand, a wide press wheel equipped with a rib that runs on each side of the seed furrow or a rib that runs directly over the furrow to press the seed works well. Another option is to use a pair of angled press wheels behind the opener to close the seed furrow at the same time. When using angled press wheels, make sure that pressure is not placed on the seed furrow to the point that a ribbon of soil moves the seed up. If available, adjust the angle such that the angle of the press wheels meets at the seed depth. Most planters are set for 1¾ inches for proper soil-to-corn seed contact. Therefore, they will have to be adjusted for soybean, cotton, or other more shallow planted crops. Press the seed, not the soil below the seed.

Sufficient weight must remain on the press wheels to ensure firming of the seed into the soil. Wet soil is easily compacted and care must be taken not to over pack the soil, making it difficult for seedling roots to penetrate the soil. In dry soil conditions, extra closing force may be needed. The key is to evaluate seed-to-soil contact, not the top of the seed-vee. As long as the contact is maintained, something as simple as a harrow that acts to close the top of the vee and pull light residue cover back over the vee may be all that is needed. This is a common practice on drills that use a narrow press wheel.

Cut the Residue, Penetrate the Soil, and Insure Soil-to-Seed Contact

These three principles will make you successful at no-tilling soybeans, or any crop for that matter. More detailed information can be found in the Virginia Cooperative Extension publication 442-457, "Planter/Drill Considerations for Conservation Tillage Systems." Contact your local county extension office to obtain a copy. Or you can view and obtain a copy on the web at http://www.ext.vt.edu/pubs/bse/442-457/442-457.html.

Soybean Rust Update

Soybean rust scouting continues in the Southern U.S. and Mexico. Soybean sentinel plots continue to be established in the Gulf Coast states and kudzu is breaking dormancy throughout the region. In 2009, soybean rust has been found in five states and 17 counties in United States, and in two states and five municipalities in Mexico.

In 2008, soybean rust was found in 16 states representing 392 counties in the United States. Rust was also reported in 14 municipalities (counties) across four states in Mexico.

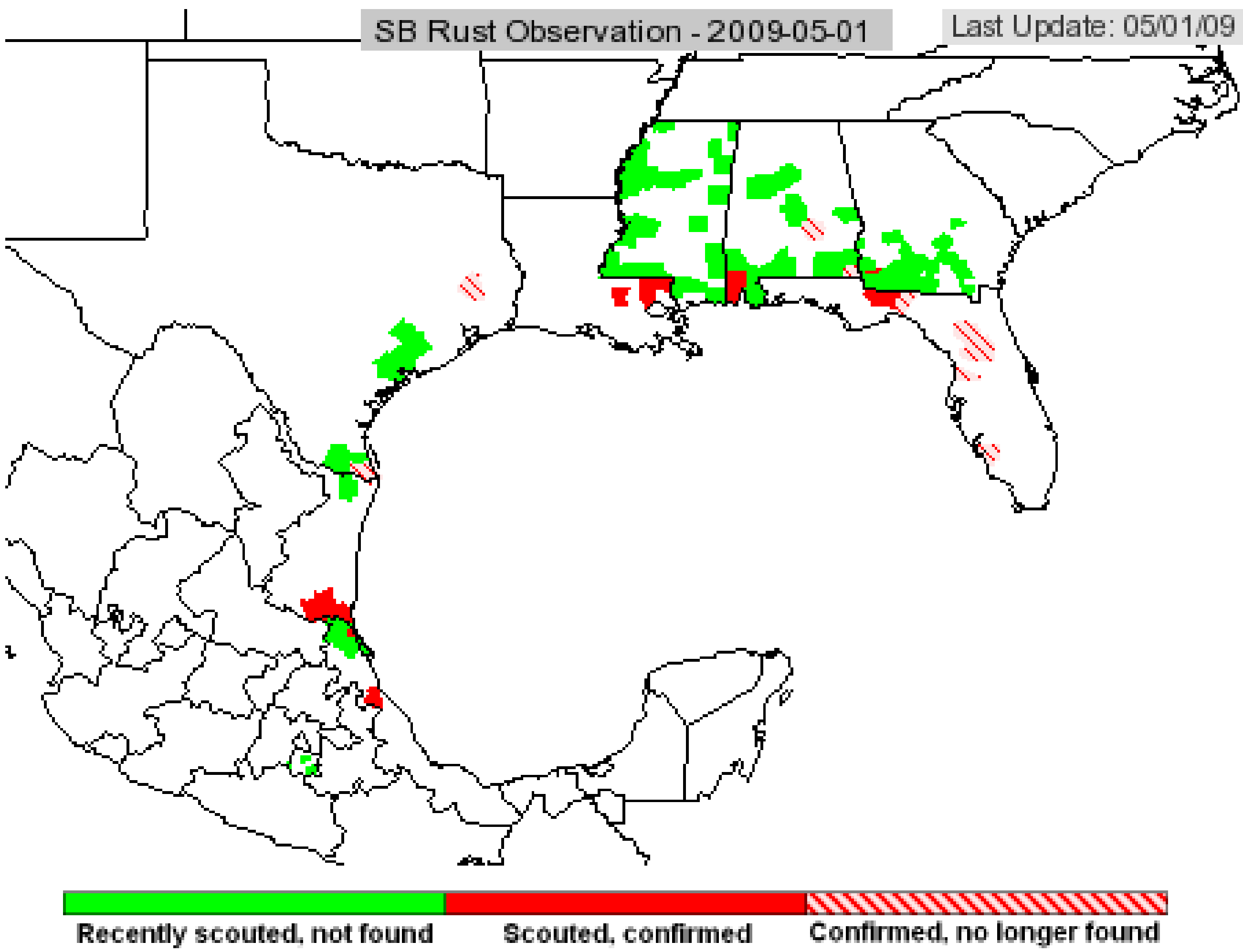


Table 12.1.1. Fungicide seed treatments labeled for soybean.

			Application Method		Disease Listed on Label				
Trade Name	Manufacturer	Active Ingredient	Commercial Treated	On-farm	Pythium	Phytophthora	Rhizoctonia	Phomopsis	Fusarium
Allegiance LS	Bayer CropScience	metalaxyl	+	+	+	+	-	-	-
Allegiance Dry	Trace Chemicals	metalaxyl	-	+	+	+	-	-	-
Allegiance-FL	Bayer CropScience	metalaxyl	-	+	+	+	-	-	-
Apron Maxx RFC	Syngenta	mefenoxam fludioxonil	+	+	+	+	+	+	+
Apron Maxx RTA	Syngenta	mefenoxam fludioxonil	-	+	+	+	+	+	+
Bean Guard/Allegiance	Trace Chemicals	captan carboxin metalaxyl molybdenum	-	+	+	+	+	+	+
Captan 400	Bayer CropScience	captan	+	+	-	-	+	-	+
Cruiser Maxx (Apron Maxx + Cruiser)	Syngenta	mefenoxam fludioxonil thiamethoxam	+	-	+	+	+	+	+
Dynasty	Syngenta	azoxystrobin	+	+	+	-	+	-	-
Enhance	Trace Chemicals	captan carboxin	-	+	-	-	+	+	+
Enhance AW	Trace Chemicals	captan carboxin imidacloprid	-	+	-	-	+	+	+
Hi Moly / Captan	Trace Chemicals	captan molybdenum	-	+	-	-	+	+	+
Kernel Guard Supreme	Trace Chemicals	carboxin permethrin	-	+	-	-	+	-	-
Latitude	Trace Chemicals	carboxin metalaxyl imidacloprid	-	+	+	-	+	-	-
Maxim XL	Syngenta	fludioxonil mefenoxam	+	+	+	+	+	-	+
Prevail	Trace Chemicals	carboxin PCNB metalaxyl	-	+	+	-	+	+	+

			Application Method		Disease Listed on Label				
Trade Name	Manufacturer	Active Ingredient	Commercial Treated	On-farm	Pythium	Phytophthora	Rhizoctonia	Phomopsis	Fusarium
Protector-D	Trace Chemicals	thiram molybdenum	-	+	-	-	+	+	+
Protector-L Allegiance	Trace Chemicals	thiram metalaxyl	-	+	+	+	+	+	+
Rival Flowable	Gustafson	captan PCNB thiabendazole	+	-	-	-	+	+	+
RTU-Vitavax-Thiram	Bayer CropScience	carboxin thiram	+	+	-	-	+	+	+
Stiletto	Trace Chemicals	carboxin thiram metalaxyl	-	+	+	-	+	+	+
Thiram 50	Bayer CropScience	thiram	+	+	-	-	+	-	+
Trilex	Bayer Crop Science	trifloxystrobin	+	+	-	-	+	-	+
Trilex AL Trilex 2000	Bayer CropScience	Trifloxystrobin metalaxyl	+	+	+	-	+	-	+
Trilex 6000 (Trilex + Allegiance + Yield Shield + Celgard + Gaucho)	Bayer CropScience	trifloxystrobin metalaxyl bio-fungicide imidacloprid seed coating red colorant	+	-	+	+	+	+	+
Vitavax CT	Helena Chemical	carboxin thiram	-	+	-	-	+	+	+
Vitavax M	Helena Chemical	carboxin thiram	-	+	-	-	+	+	+
Vitavax M DC	Helena Chemical	carboxin thiram molybdenum	-	+	-	-	+	+	+
Vitaflow 280	Trace Chemicals	carboxin thiram	+	-	-	-	+	+	+
Vitavax- PCNB	Bayer CropScience	carboxin PCNB	+	+	-	-	+	+	+
Vitavax-34	Bayer CropScience	carboxin	+	+	-	-	+	-	-

Table 12.1.2. Replicated Soybean Fungicide Seed Treatment Tests in Virginia (2000-2008)

Year	Location	Conducting Test	Seed Treatment	Yield[1]
2000	Charles City	Paul Davis	Check	60.2 a
		David Holshouser	Bean Guard	56.3 a
			Bean Guard-Allegiance	55.0 a
			Protector L	58.7 a
			Stiletto	60.4 a
2000	Suffolk[2]	Pat Phipps	Check	30.9 b
			Stiletto	36.3 ab
			Protector L	40.6 a
			Bean Guard	41.9 a
			Bean Guard-Allegiance	41.3 a
2001	Essex Co.	Keith Balderson	Check	58.6 a
			Stiletto	59.5 a
2001	Middlesex Co.	David Moore	Check	54.0 a
			Stiletto	58.2 a
2001	Prince George	Glenn Chappell	Check	53.4 a
		David Holshouser	Stiletto	51.3 a
			Protector L	49.3 a
			Bean Guard	54.7 a
			Bean Guard–Allegiance	54.9 a
			Apron Max RTA	53.1 a
			Vitavax CT	51.1 a
2001	Suffolk[2]	Pat Phipps	Check	40.1 a
			Stiletto	37.6 a
			Protector L	43.2 a
			Bean Guard	43.5 a
			Bean Guard-Allegiance	41.1 a
2002	Essex Co.	Keith Balderson	Check	24.5 a
			Stiletto	24.0 a
2002	Essex Co.	Keith Balderson	Check	21.8
			Apron Max	21.5
2002	Northumberland Co.	Bob Pitman	Check	40.0 a
			Apron	36.4 b
2002	Northumberland Co,	Bob Pitman	Check	29.3 b
			Stiletto	34.1 a
2002	Caroline	Mac Saphir		(plants/foot)
	(yield not taken)	David Holshouser	Check	1.9 a
			Stiletto	2.2 a
			Protector L	2.6 a
			Bean Guard	2.3 a
			Bean Guard-Allegiance	2.6 a
2002	Suffolk[2]	Pat Phipps	Check	16.2 a 23.7 a
	(high and low germ seed used)		Stiletto	19.0 a 21.4 a
			Protector L	18.5 a 18.0 a
			Bean Guard	21.6 a 21.7 a
			Bean Guard-Allegiance	15.3 a 16.7 a
2003	Essex Co.	Keith Balderson	Check	54.4 a
			Vitavax-Thiram	56.5 a
			Stiletto	55.4 a
			Apron Maxx	57.4 a

Year	Location	Conducting Test	Seed Treatment	Yield[1]
2003	Middlesex Co.	David Moore	Check	43.5 a
			Bean Guard	41.1 a
			Stiletto	38.0 a
2003	Middlesex Co.	David Moore	Check	46.2 b
			Apron Maxx	48.3 ab
			Stiletto	48.8 a
2003	Prince George Co.	Glenn Chappell	Check	35.1 a
			Bean Guard	37.1 a
			Stiletto	35.6 a
2003	Prince George	Glenn Chappell	Check	41.6 b
			Apron Maxx	47.2 ab
			Stiletto	52.9 a
2003	Richmond Co.	David Holshouser	Check	47.8 b
		Bob Pitman	RTU-Vitavax-Thiram	66.4 a
			Stiletto	62.6 a
2003	Suffolk	David Holshouser	Check	43.6 b
			Bean Guard	44.7 b
			RTU-Vitavax-Thiram	43.8 b
			Stiletto	49.4 a
2007	Suffolk	Pat Phipps	Check	24.1 a
			Trilex AL	25.6 a
			Trilex 6000	25.0 a
2008	Suffolk[2]	Pat Phipps		(plants/foot)
	(yield not taken)		Check	1.5 a
			Trilex 2000	1.7 a
			Apron Maxx RFC	1.7 a
			Hi Moly Captan	1.6 a

[1]Means followed by the same letter are not significantly different.
[2]Poor quality seed was sometimes used and all Suffolk experiments were planted on non-rotated land. Germination tests of seed planted in Suffolk: 2000 – 73%; 2001 - 64%; 2002 - 90% and 71%; 2007 – 85%; 2008 – 64%.

Table 12.1.3. Replicated Soybean Early-Season Insecticide Seed Treatment Test Results (2001-2008).

Year	Location	Agent Conducting Test	Seed Treatment	Yield[1]
2000	Middlesex Co.	David Moore	Check	43.2 a
		Ames Herbert	Adage	41.1
2000	Prince George Co.	Glenn Chappell	Check	42.1 a
			Gaucho	42.6 a
			Warrior (foliar)	43.8 a
2001	Essex Co.	Keith Balderson	Check	59.7 b
		Sam Johnson	Gaucho	63.5 a
2001	Middlesex Co.	David Moore	Check	28.3 a
			Gaucho	28.5 a
2002	Essex Co.	Sam Johnson	Check	29.2 a
		Matt Lewis	Gaucho	30.2 a
		Keith Balderson		
2002	Prince George Co.	Glenn Chappell	Check	36.3 a
		Mike Parrish	Gaucho	41.6 a

Year	Location	Agent Conducting Test	Seed Treatment	Yield[1]
2003	Lancaster	Ginny Pitman	Check	38.6 a
			Gaucho	39.8 a
2003	Essex Co.	Keith Balderson	Check	29.2 a
			Gaucho	30.2 a
2005	Westmoreland Co	Sam Johnson	Check	40.0 a
		Keith Balderson	Cruiser	41.0 a
2005	Middlesex	Ames Herbert	Apron Maxx	36.7 a
		David Moore	Cruiser Maxx	35.9 a
2006	Westmoreland Co.	Sam Johnson	Check	49.9 a
		Keith Balderson	Cruiser Maxx	50.7 a
2006	Charles City Co.	Paul Davis	Check	32.0 a
			Cruiser Maxx	34.3 a
2007	Suffolk	Ames Herbert	Check	44.3 a
			Cruiser	42.2 a
			Cruiser Maxx	44.1 a
			Gaucho	44.8 a
2008	Chesapeake	Ames Herbert	Check	54.2 a
			Cruiser	47.4 a
			Gaucho 600	50.9 a
			Regent	56.5 a
2008	Chesapeake	David Holshouser	Apron Maxx	33.0 a
	(MG 4)	Watson Lawrence	Cruiser Maxx	30.5 a
2008	Chesapeake	David Holshouser	Apron Maxx	42.8 a
		Watson Lawrence	Cruiser Maxx	44.5 a
2008	Essex	David Holshouser	Apron Maxx	44.6 a
	(MG 4)	Keith Balderson	Cruiser Maxx	46.6 a
2008	Essex	David Holshouser	Apron Maxx	24.7 b
	(MG 5)	Keith Balderson	Cruiser Maxx	29.2 a
2008	Suffolk	Ames Herbert	Check	62.6 a
			Cruiser	63.0 a
			Gaucho 600	62.9 a
			Regent	63.0 a
2008	Surry Co.	David Holshouser	Apron Maxx	30.8 b
		Glenn Slade	Cruiser Maxx	40.4 a
2008	Surry Co.	Ames Herbert	Check	48.1 a
			Cruiser	47.3 a
			Gaucho 600	47.2 a

[1]Means followed by the same letter are not significantly different.