

COMMERCIAL VIGOR TESTING

Alan Galbreth¹

This morning I'd like to direct my comments about commercial vigor testing to the realities of running a commercial vigor testing lab. Other speakers have addressed very well the specifics of performing particular vigor tests, but I would like to concentrate on the day-to-day operations of running a commercial lab and the task of interpreting the results we provide for seedsmen. I'll be discussing corn and soybeans but this could fit any crop. I hope my comments are as applicable to company labs as they are to service labs.

Indiana Crop Improvement Association (ICIA) began corn cold testing in 1957 on Foundation seed lots. We ran cold tests on soybeans for the first time in 1966. In the early 1970's we further expanded our vigor testing program. The program had three core tests: cold tests, accelerated aging, tetrazolium. Our program today is still centered on these three tests though some of the procedures have been modified over time. This past season we ran 15,000 cold tests, 2000 accelerated aging tests, and 1000 tetrazolium tests.

STAFFING

Early in our vigor testing program we made several mistakes. The most important was with technicians. We tried to use student help and worked two shifts during the busy season. Students would change from one semester to the next and the ones working evenings were not properly supervised. As you can imagine the consistency of evaluating tests and even of planting the tests was far from desirable.

It doesn't take too many inconsistent test results to quickly lose your client base. From an initial excellent response by seedsmen to vigor testing, ICIA's lab soon found itself with a reputation that it did not want with regard to lab testing. We made some management changes and several staffing changes and began the long, slow process of regaining customer confidence.

My point for discussing some of our rocky beginnings is that technicians are the key to any testing, be it germination, purity, or vigor. It's nice to be able to hire students because they're young and energetic and working in the lab is good experience for those who continue on in the seed business. But, it is also imperative that a seedsman be provided with test results he can depend on and are repeatable.

We now have a full time staff in charge of each testing area and our part-time lab technicians are people from the community who return season after season. We cross-train our permanent and part-time lab people. When the testing season begins we have the same individuals preparing and evaluating the same tests most of the time. This helps with consistency.

¹ Indiana Crop Improvement Association, Lafayette, IN 47905.

We believe it's very important that our lab staff continues to stay current with their analyst colleagues. Our lab people attend testing workshops, seed schools, participate in referee testing, and have access to all pertinent testing publications such as the Vigor Handbook, the recent Seedling Evaluation Handbook, and the Seed Analyst Training Manual.

QUALITY CONTROL IN THE LAB

To run a successful vigor testing program, a lab needs people who are experienced enough to have a feel for when a batch of tests doesn't look quite right. In spite of training and experience, mistakes are still made in any lab. Sometimes analysts come to work and just plain have a bad day. Because people have bad days and mistakes are made, we try to help alert our technicians to possible problems with a couple quality control measures.

One of our quality control measures involves getting a bag of corn and soybeans early in the fall. Every day we run cold tests, accelerated aging tests, or germinations, we lay a sample from that bag in that test. This procedure develops a track record for that lot. If readings for a particular day are unusual, it throws up a red flag that the lab equipment has malfunctioned or a technician has incorrectly evaluated or misreported a sample.

The second quality control measure involves splitting a sample in half and running the same vigor tests on each sample. The sister samples may or may not be planted on the same day but a computer program pairs the test results from the sister samples so we can be sure we are getting good repeatability. We run these tests on about every 50th sample of a particular crop. Running sister samples like this adds a fair amount of expense to the operation of the seed testing lab. The past season we ran warm germination and cold tests on 360 corn sister samples. The value of that quality control testing on corn alone was \$4140.00.

Participating in referees is also very important to our assessment of whether or not our vigor test results are in line with other labs running these vigor tests.

EXPLAINING THE RESULTS

Assuming you have good lab technicians and your quality control measures are in place and working, the next aspect of commercial vigor testing is explaining the results to the seedsmen. Many seedsmen need help interpreting what a vigor test result means. Oftentimes they want to know what caused a particular test result. Most seedsmen have an idea of what a cold test is, some are familiar with accelerated aging, and a few would know when to use a tetrazolium test. Much of my time related to the ICIA lab is spent answering questions, interpreting results, and helping seedsmen assess the true quality of particular lots of seed.

You may think seedsmen know more about vigor testing than I'm giving them credit for. Many do. Most of the commercial analysts in this room work for companies that have invested money in testing programs and have some idea of vigor testing. However, I suspect that most of you still explain to the production people or the marketing people or the owners what particular vigor results mean to the salability of the product.

We run vigor tests for well over 100 different companies. The knowledge level among these companies about vigor testing runs the full range. You need to realize our customers include many small and medium sized seed companies that have no testing programs or knowledge of testing protocols. We still have many seedsmen that throw some seeds on a towel, put the towel in a chamber with no temperature controls, and wait to see how many sprout. They don't evaluate normal or abnormal seedlings. They figure if the seeds sprout, they're good.

When I agreed to give this talk I decided I would keep track of some actual vigor test questions I received this past testing season. I would like to share these examples of the kinds of things involved from the consultation aspect of running a commercial vigor lab, because this is what I spend a lot of time doing.

EXAMPLE 1: Seedsman call on February 18, 1993. What does an 85% accelerated aging test on corn mean? Why are the small, round grade sizes bad this year?

As a commercial lab we don't have the benefit of knowing the pedigree of the corn hybrids we test unless the seed companies tell us. However, because of many previous phone calls and discussions with seedsmen, I could immediately ask this seedsman if his corn was comprised of one or two particular seed parent lines. It turned out the two products he was having trouble with were the same two that had weak results for many other companies.

It is important to be in a position of trust with these companies to be able to get pedigree information so reasons for bad results can be developed or presented. Being a crop improvement agency is obviously helpful because we work with that kind of confidential information for field inspection anyway.

**EXAMPLE 2: Seedsman call on March 12, 1993.
What happened to my seed?**

	Warm Germination	Cold Test	Tetrazolium Test
bin sample	96%	88%	96%
bag sample	85%	80%	82%

Seed had been treated, bagged, and delivered. Corn had to be picked up by the company. Total market value = \$20,000.

In this situation the corn sampled in the bin was fine. It had been moved once with air into the bin. When moved out again with air, the damage was too much. The remainder of the seed was moved out of the bin with a "beltveyor" and was suitable for sale. This lot had the same weak seed parent as in the previous example.

EXAMPLE 3: Seedsman visit of April 15, 1993. What do I do with this seed? Test dates February 1993

Iowa State		Indiana Crop	
Warm Germination	Cold Test	Warm Germination	Cold Test
91%	95%	90%	82%
96%	77%	86%	80%
95%	81%	89%	83%
90%	79%	86%	83%

300 bags of corn at \$55.00 per bag. Total market value = \$16,500

Many, many times the seedsman will want us to make the decision about whether a lot should be dumped or marketed based on vigor test results. Obviously we can't make those kinds of decisions for a company. Because of the significant sums of money involved in such decisions we do need to give them some guidance based on our experience in vigor testing of seed.

COMPARING LABS

Another area in which I spend a lot of time on the phone involves questions comparing our lab results to other labs. Sometimes there are legitimate concerns when our lab is consistently ten points different than another. Most are more like this example:

**Why are my results so different?
Cold Test dates November 1992**

	Iowa State	Indiana Crop
flats	83%	80%
rounds	82%	79%

To those of us who are analysts the above comparisons look pretty good and the differences are not significant at all. But to a seedsman whose contract calls for 92% germination and 82% cold test, the differences are several thousand dollars significant. Testing tolerances are not a factor when a contract has a guaranteed level specified.

When I receive a call like the one illustrated, I mostly just listen. When seedsmen start comparing laboratories, there are many times when no explanations can be given. When it's a borderline lot like the one just shown, I suggest a retest of the sample in the lab or ask them to submit a new sample. Obviously you don't want to see a client lose a contract based on only one test.

There are times, however, when a seedsman will continue to complain that our lab is lower or higher than the other lab he is using. In those situations it is best just to hear him out and counsel him to choose one lab

for testing and stick with that lab. I generally make the usual comments about the difficulty of getting repeatable vigor test results between labs. Consistency and repeatability are best obtained by using one lab and developing a feel for the relative scores received from that lab. After a period of time the seedsman will know what cold test scores or accelerated aging scores he needs from a particular lab to be assured of marketing high quality seed. For example, our cold test for corn at ICIA has been criticized by many for being too stringent. Our repeat customers are very satisfied with our cold test, because they know if they get an 85 or better on an ICIA cold test that corn will be able to do well under most stress conditions it will encounter during planting.

It is easy to make those kinds of comments, but in the real world of seed marketing and movement, one contract might require testing by Indiana Crop and another might require Iowa State or Illinois Crop or an ISTA lab in Europe for export material. That's why we need to continue to work toward better repeatability between labs, especially between service labs.

TESTS—MEANINGFUL AND COST EFFECTIVE

What about the tests themselves? The vigor tests a commercial lab offers must be meaningful to the seed company. All seedsmen can relate a cold test to actual field conditions under which the seed can be planted. Relating an accelerated aging test to field conditions is a bit more vague for seedsmen, but there is enough data now to show that accelerated aging can be used as a vigor test as well as a storability test, so that most labs feel comfortable running accelerated aging as one of their vigor tests. Few seedsmen that we work with would know when to use a tetrazolium test, but most understand it can be a good diagnostic tool for determining what happened to a lot of seed. We're finding, as part of our soybean work with Dennis Tekrony, that tetrazolium can also be a good vigor test.

Again there is some consultation required when seedsmen request vigor testing. We are always receiving requests to run cold tests on wheat for example. We explain wheat is subjected to a cold test condition initially in the lab just to do a warm germination. Then we can recommend an accelerated aging test as a more suitable vigor test for wheat.

Vigor tests have to be meaningful to the seed company, but they also have to be designed to run in a commercial seed lab. We need to be able to accurately test large numbers of samples in a short period of time. That is not possible with some tests that might otherwise be good vigor tests.

Two examples would be the seedling growth rate test and the conductivity test. Research indicates seedling growth rate has some usefulness as a vigor test, but in practice it is too difficult to run to be a salable test. It definitely does not meet the criteria of large numbers in a short period of time.

The conductivity test is another useful vigor test that is not offered by our lab. It is a difficult test to sell to a seedsman. Trying to convince a seedsman of how an electrical measurement of seed leakage relates to performance in the field is sometimes a difficult sell to make. I think the conductivity test will probably get more use in the future by commercial seed labs.

We all as lab managers, analysts and, quality assurance directors have a big effect on the tests being used and offered to seedsmen. We run the tests in which we have confidence and which fit our lab routine and equipment. When a lab adds a test or even changes the protocol of a test, it is usually expensive and takes time to gain a level of confidence in that test.

Seed companies buy what people in our positions sell them. It doesn't matter if you run a commercial lab or a company lab, our clients or bosses are relying on our expertise to determine which vigor tests to run on which crops.

SUMMARY

Indiana Crop Improvement Association prides itself on providing good service to the seed industry. Sometimes we can not provide some of the lab services requested. We will not run tests that we do not have some experience with, nor will we change protocol just because one client wants sand or Kimpak instead of soil or rolled towels.

Our goal is to offer reasonably priced tests to the seed industry that will generate enough revenue to pay for the tests and the people running them. We are a not-for-profit organization, but we are also self-supporting, so we won't run too many tests that are costing us money.

Neither will a seedsman spend a lot of money vigor testing a low value crop. A marginal lot of corn may get tested three or four times in two or three labs before the company decides what to do with that lot. One marginal vigor result or two on soybeans and they go to the elevator, because the crop is not worth spending more money on testing. The value of the crop very much determines what tests a seedsman will elect to run. We do our very best to provide accurate, reliable results to seedsmen, because they rely so much on that information. I've tried to talk about what it takes to run a commercial vigor testing lab. I've listed six points that are crucial to a successful lab operation. There are others but these are the ones I notice in our lab operation everyday:

1. Knowledgeable, experienced staff
2. Good quality control measures
3. Tests that are meaningful
4. Accuracy and timeliness
5. Patience
6. Trust