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QUALITY ASSURANCE OR QUALITY CONTROL

Charles C. Baskin[1]

The term quality control has been used in the seed industry for many years whereas the term quality assurance is relatively new. What might be the differences in the two concepts? Everyone has a quality control program. These will range from very detailed, very sophisticated to barely meeting the minimum requirements of market seed. The concept of quality assurance implies that the efforts of a seed company are directed toward supplying the buyer with a higher quality, uniform product that will perform well in the field under a variety of conditions.

What, then, is involved in a quality assurance program? High quality must be the goal and must be ever present in the minds of everyone involved in the seed program.

Let's begin with field selection. Seed should be a more valuable commodity than grain, therefore, our most productive fields should be selected for seed production. Consideration must be given to weed problems, especially noxious weeds. Difficult weed problems should be avoided if at all possible. It is much simpler to avoid these than to try to deal with them in the crop or trying to remove them from the harvested seed.

Follow the best production practices that are available to you. Plant good quality seed. Have a good weed control program. Weeds are not only a problem in the seed, they reduce yields and may even contribute to disease and insect problems. An insect control program will also be necessary on certain crops to optimize yields and maintain quality.

Application of fungicides may be necessary in some crops such as soybeans and wheat. Defoliation in crops such as cotton, desiccation in other crops. There are several sources of information available to you for the latest in crop production recommendations. State extension services and experiment stations provide a wealth of information on all phases of crop production, variety responses, harvesting, storing and other areas. Private consultants and various companies can help formulate good pest control program. Field inspections are a a must throughout the growing season. Timing depends on the crop. You must know what you have in the field particularly from a genetic purity stand

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point and from a weed standpoint. Do your fields meet the standards necessary to produce the quality seed you want?

If you need to establish standards, the respective Seed or Crop Improvement associations have standards as does the Association of Official Seed Certifying Agencies. These can provide some basis for establishing field standards or in most instances may be adequate field standards if you are not participating in your state's certification program. Certainly consideration should be given to participation in a certification program in most states.

Timely harvesting is most critical. Seed of most crops will reach physiological maturity when seed moisture content is between 25 and 35%. For most crops this is too high for harvest. There are some exceptions such as corn that is harvested in the ear at 30 plus percent seed moisture, dried on the cob, then shelled. Generally, we wait until seed have reached 16 to 18 percent moisture or less before harvesting. Once seed have reached physiological maturity, they peak in germination and quality (vigor). From this point, loss in quality (deterioration) begins. Seed are essentially stored in the field from physiological maturity until harvest. The amount of deterioration (quality loss) depends on field conditions. It will be quite rapid if conditions are warm and humid to quite slow if conditions are cool and dry. Whatever the field conditions, this is not a desirable place for seed storage.

An example of deterioration related to field conditions is presented in Table 1. This test was conducted in Mississippi but the relativity of the results are applicable anywhere.

Harvesting is a very critical time in the life of a seed. Mechanical damage is one of the primary reasons for loss in quality in combining and handling. Damage of soybeans, for example, is negligible at seed moisture contents of 14 to 16 percent, is minimal at 12 percent but at 10 percent or less can be quite severe. The reduction of germination in germination in soybean seed as related to handling and moisture content is presented in Table 2. Harvesting corn seed with a combine as opposed to harvesting the ear, drying and then shelling can make a tremendous difference in the amount of mechanical damage. Field conditions can change rapidly from morning to noon to afternoon. It may be necessary to change combine settings during the day to minimize damage. The grain tank should be monitored regularly with a fragile crop like beans to be sure excess damage is not occurring, less with a crop like wheat although damage can occur to any seed.

Some seed must be dried. Corn, rice, and sometimes many other seeds require drying to adjust seed moisture content to a safe storage level. Drying temperatures are critical. Underdrying results in seed too high in moisture to store safely. Over-drying can cause quality losses in mechanical damage, even death and monetary losses in weight. If seed are held in storage for a period of time before conditioning and

Table 1. Effect of weathering on moisture content (M.C.) and germination of seed of the Hill and Bragg soybean varieties.

Date of Harvest[a]	Hill		Bragg	
	M.C.	Germination %	M.C.	Germination %
9/15	26	96		
9/22	13	97		
9/29[b]	17	90		
10/6[b]	20	78		
10/13	11	76	26	98
10/20[b]	19	71	18	98
10/27	12	53	13	93
11/3[b]	14	37	14	92
11/10			12	92
11/17[b]			20	89
11/24[b]			13	86
12/1			15	87
12/8			11	84
12/15[b]			14	84

[a]Seed hand harvested and threshed, then cleaned with hand screens and aspirator before germination test.

[b]One or more rains during preceding week.

Table 2. Relation of seed moisture content and force of impact (height of drop) to loss of germinability of soybean seed dropped onto a hard surface.

Seed Moisture Content (%)	Height of Drop (ft.)				
	0	5	10	10(2X)[a]	20
	----------% Germination----------				
8	98	88	78	65	70
10	98	90	82	73	73
12	98	97	94	88	87
14	98	97	97	96	97

[a]Seed dropped twice from height of 10 ft.

bagging, aeration is necessary to maintain quality. Stored grain insects can also be a problem. Regular monitoring is necessary to guard against insect losses.

Conveying equipment must be in good repair and properly adjusted to prevent mechanical damage. This is an area where improper adjustment can cause severe mechanical damage.

Adjustment of conditioning equipment is important to remove the materials you want to remove from the seed lot. (I am assuming that plant supervisors and equipment operators are knowledgeable enough of the various kinds of machines to know what can and can't be done.) I have been in conditioning plants where the cleaning equipment wasn't much more than a conveyor.

Once seed are conditioned and bagged, good storage conditions are necessary until seed are shipped.

The assurance of quality requires a well organized testing program. The organization and logistics of your operation will determine the organization of this phase of your program.

If you are dealing with contract growers that store seed on their premises, you can determine seed quality before bringing it to the plant. If you are accepting seed from the field, you don't have this option, but samples of seed from each grower should be identified so that when tests are conducted, you can evaluate the respective growers. If you are producing your own, seed samples from each load should be saved for spot checks and/or future reference if additional quality information is needed.

A systematic monitoring of seed as it passes through the conditioning plant is necessary. Samples collected periodically from different points in the conditioning line can often be used to identify where problems are occurring. The volume of samples need not be large. If problems arise, then sample frequency can be increased if necessary. Any profiles that you can develop on growers, production areas, or methods of handling, etc. can be useful to you in evaluating your program. Records can be extremely important to you in solving problems and evaluating your business.

A sound testing program is basic in a quality assurance program. Evaluation for mechanical damage is quite often a vital part of a program. Visual inspection of a sample may be all that is necessary. Seeds such as cotton may be evaluated as to the severity of the damage. The indoxyl acetate test for soybean, the fast green test for corn or other starchy grains are tests that will aid in evaluating mechanical damage.

The standard germination test is basic. There are certain minimum levels of germination that you will accept for marketable seed. If these standards aren't met, there is no need to proceed any further.

There are several other tests that may be useful to you in assuring the quality level you want. The tetrazolium test is fairly quick. Germination can be estimated as well as quality. It is particularly useful in problem solving. Such things as "hidden" mechanical damage, heat damage, acid burn in the case of cottonseed, insect damage, and possibly other things can be determined from a tetrazolium test.

The soil cold test is almost universally used by the better corn seed companies and may have application to other species.

Accelerated aging has several applications. It was developed to predict relative storability of seed lots. If you know that you will have to carry over some seed lots, you can select those that have the best potential of maintaining germination during the carryover period. With some detailed work, you probably can estimate absolute storability, i.e., about when a seed lot will begin to break in germination. In the case of soybeans stored here at Mississippi State University, we predicted which lots would sustain an acceptable level of germination through the planting season. Accelerated aging is being used as a vigor test in some labs.

Measuring leachate or conductivity test may also have some application. As seed deteriorate, the membranes lose their integrity, allowing cellular materials to "leak out" at a more rapid rate thus measuring conductivity or resistance of steep water gives an indication of seed quality.

Low temperature germination indicates the quality of cotton seed.

Seedling growth rate has some application. There are other tests that have specific application to one seed kind like the cutting test for estimating germination of cottonseed and free fat acidity. You must decide which of these tests you need in your quality assurance program and develop your program accordingly.

The Association of Official Seed Analysts has published a Vigor Testing Handbook. This publication contains the procedures of vigor tests that have been researched and are being used in the seed industry. These are available from the Secretary-Treasurer of AOSA.