Comprehensive Quality Control

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Every seed company uses different methods of Quality Control. Some have no system, other than that required by seed law enforcement. Other companies may go the seed certification route as the method of Quality Control. They utilize the expertise of the Crop Improvement Association and their manpower in the way of field inspectors and seed testing facilities. Still other companies may use a combination of both law enforcement and certification to control the quality of their product.

Comprehensive Quality Control goes above and beyond law enforcement and seed certification. Comprehensive Quality Control would normally be geared toward customer satisfaction and customer acceptance.

What is Comprehensive Quality Control?

Let's break this title down into the key words and examine them closely. First, "Comprehensive" means—including much or conclusive of all things. Secondly, "Quality" is a word which describes a characteristic element or attribute—that attribute may be good or it may be poor. For our discussion "quality" will mean a desirable trait. The third key word, "Control," means several things. We tend to think of this word as meaning authority to direct or regulate. Originally, the meaning of the word was to check or verify by comparison with a duplicate.

For a Comprehensive Quality Control Program to work, it must mean the same thing to all levels of personnel. For Quality Control to be effective, it must "elicit" the same meaning or define the method to the individual who is carrying out the work. For example, when I say that I have a quality tomato—what kind of reaction do I get. If we are talking about fresh market tomatoes, we have a completely different product as compared to a shipping tomato and our quality might be very low. If we try to ship a fresh market tomato, the produce arriving at the grocery store would probably arrive crushed and unusable.

Let's now establish that the subject of this talk will center around seed quality and all factors that relate to it.

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At the beginning, we should establish what we mean by good seed quality. Good seed quality can mean the same as "fit for use" or as far as a seedsman is concerned, it centers around the attributes of the seed. Dr. Delouche has a long list of seed attributes, however we will only mention the more important ones during this presentation. These attributes include "trueness to variety" or "genetic purity", "mechanical damage," viability or germination," "vigor," "disease infection," "insect damage," "treatment coverage," "size," "appearance," "moisture content," "incidence of contaminants," "uniformity" and "performance potential."

If we put these attributes together, they will all interrelate to one extent or another to give us what I consider to be the overall seed quality. For example, let's take two soybean seed lots—both with high germination potential. One of the seed lots has a high level of disease that can directly interfere with the potential to germinate and give us an overall low quality seed lot, whereas, the other seed lot may have low disease, which would combine with high potential germination to give it an overall high quality rating.

Feedback and Specifications

Many times when we think of quality we get lost in the dilemma of strictly thinking about the seed itself. However, what good does it do if you have the best hybrid or variety available but you cannot deliver it on time. Service has a large part to play in a Comprehensive Quality Control Program. If we were a service organization, such as an air line or taxi service, the quality characteristics would be based upon our ability to deliver customers to their destinations on time. Likewise, quality seed should deliver to the grower a substantial yield and satisfaction, so that he will return to purchase seed from your company in the future. To know his reaction to our seed we must have feedback. To derive feedback from our customers and make it important to all people, some special steps are necessary. We have to establish specifications, as substitutes for knowledge and fitness for use.

In primitive societies, there was little need for formal specifications. Producers and consumers were either the same or lived in the same village and conducted business in the village marketplace. They traded in products which were familiar to both and were available for inspection. Today, fitness for use cannot be achieved through such simple collaboration. For any seed product produced, the activities of design, production, sales, use, etc., are carried out by numerous persons employed through various phases and many times widely dispersed
geographically. For example, the producer of turf-type ryegrass, fescue or bluegrasses, which are grown, conditioned and packaged in the Northwest, does not get direct feedback from the customer.

The steps necessary to arrive at a final seed product packaged and available for the customer are many and varied. They begin with planting and extend through growing, cultural practices, harvesting, conditioning, testing, packaging and shipping. The people involved in these steps often have very little understanding of how their contribution affects the final goal—which is fitness for use.

If we look briefly at some of the people involved, we find that feedback is necessary to achieve the desired specification. For example, the breeder developing a new soybean variety has to know what type of market it will be going to. The grower, who may be responsible for the cultural practices and the harvesting of the seed crop has to know what cultural practices will give him the desired results and what is expected in the way of harvesting to achieve or minimize mechanical damage. What about the conditioner of the seed? If he is selling for a very sophisticated market, such as for use on golf courses, he may need to be very conscious of what sod quality is and what levels of weed contamination and types of weeds will affect the usability or fitness for use of the product. If he is simply conditioning the seed for retail outlets, then weed seeds may not be a big concern.

Taking a closer look at most of the steps involved in the progression of activities that lead to the final fit product, we can see some of the specifications that may be necessary to achieve a product that is fit for use (Figure 1).

When we compare specifications as a substitute for knowledge of the fitness for use, we must be careful. We can get ourselves into a real trap by establishing one set of specifications and sticking to them, and lose sight of improving quality as we can.

Let's compare an area or attitude with respect to quality in two different societies or systems. Currently, there is a lot of debate and talk about the quality of Japanese products versus U.S. products. This difference may be due to the attitude of managers in both situations. The Japanese are constantly upgrading their goals. The American manager assumes a certain rate of failure is inevitable, while the Japanese manager shoots for perfection—and sometime comes close.

The quality function is the entire collection of activities through which we achieve fitness for use—no matter where these activities are performed.
FIGURE 1
PROGRESSION OF ACTIVITIES AND SPECIFICATIONS
TO ACHIEVE FITNESS FOR USE

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breeding new cultivars</td>
<td>Taste, Grade, Disease resistance, Yield, etc.</td>
</tr>
<tr>
<td>Testing experimental cultivars</td>
<td>Adaption Customer acceptance</td>
</tr>
<tr>
<td>Planning for production</td>
<td>Area or location</td>
</tr>
<tr>
<td>Contracting</td>
<td>Field history Grower knowledge Equipment</td>
</tr>
<tr>
<td>Growing</td>
<td>Cultural practices</td>
</tr>
<tr>
<td>Conditioning</td>
<td>Precondition checks In process checks for inert, weeds, damage</td>
</tr>
<tr>
<td>Inspection</td>
<td>Germination Cold test Physical evaluation Plantability</td>
</tr>
<tr>
<td>Sale</td>
<td>Customer Reaction</td>
</tr>
</tbody>
</table>
Let's look at the progression of activities necessary to get seed from field to customer as in Figure 2, and pull out a specific example found in the feedback loops for a closer look. Consider field production and harvesting steps. These activities are under the direction of a production manager who may be the owner of a small company and has to double in many activities; or he may be the manager of an area for a larger company, but-again--has to double his duties among other things; or, he may be very specialized in a large company and be responsible strictly for the field production and harvesting operations. In any case, for the individual to be effective, he must have the basic knowledge, skills and equipment necessary to affect the quality. A big part of field production variables amount to training of the growers in cultural practices and operation of their equipment. If each grower is properly trained, he will have certain specifications to follow that will help him achieve his goal; however, to do this, he needs some type of feedback as to the type of operation that he is doing. In the case of soybeans, for example, a simple little device such as a small hand screen can give him some idea of the amount of mechanical damage he is actually inflicting upon the crop. He should have knowledge of how harvesting conditions will change as the day progresses. He should constantly check the condition of the seed and adjust his combine or harvesting equipment to reduce or keep damage to an insignificant level. When the combine operator fulfills the above, we have put him in a state of self-control.

**Self-control**

When work is organized in a way that will enable a person to have full mastery over the attainment of planned results, that person is said to be in a state of self-control and can properly be held responsible for the results.

Before a person can be in a state of self-control, several fundamental criteria must be met. He must be provided with:

1. Knowledge of what he is supposed to do; e.g., the level of acceptable mechanical damage in the case of the harvester.

2. Knowledge of what he is doing; e.g., the actual level of mechanical damage that he is inflicting upon the crop.

3. A means for regulating what he is doing in the event that he is failing to meet the goal. These means must always include both the authority and the ability to regulate either by: a) varying the process under his authority--such as how he is operating his machine; or b) varying his own conduct—that is his method of operating the equipment.
FIGURE 2. Feedback loops

Control subject = product quality

Variables affecting product quality
- Training of growers and operators
- Facilities, condition of monitoring equip.
- Condition of equipment
- Equipment and vendor quality
- Temperature and moisture, condition of warehouse, rodents
- Handling equip., trucker cooperation

The Managers (take action)
- Field production and harvesting
- Drying
- Conditioning
- Treating
- Storage
- Shipping
- Customer satisfaction

Inspector measures actual quality

Specification it records desired quality

Quality Report
Compares actual quality with specification

Customer satisfaction
If all the above parameters have been met, the person is said to be in a state of self-control and can probably be held responsible for any difference in performance or quality level of the product that is coming out of his process steps.

Everyone involved in running one or more phases of a production operation soon discovers that they might have to deal with a loss that relates directly back to a failure in the Quality Control Program (QCP).

Types of Defects

Failures in the QCP can be of two types. The more noticeable are those that are the result of sporadic "troubles." All continuing performances are subject to variation. Some of these variations are non-significant. Other variations are so significant that they trigger the alarm signal of the control system. Let's refer to the graph in Figure 3 showing the normal quality control system with confidence limits and what a sporadic loss looks like. A sporadic loss is one that shoots the quality or number of seed lots or samples that have significant defects, over a certain maximum level. These types of defects are easy to correct.

The other type of defect is one that goes unnoticed and is referred to as chronic trouble. Chronic troubles are those that basically go undetected and unnoticed, or are simply "lived with." The difference between the normal level or standard of quality and a new higher level that can be achieved, is regarded as a chronic "disease," for which a remedy can be found by determined men. When a new superior level of performance or quality is attained, as a result of such determination, it is called a "breakthrough."

To determine how a chronic trouble can be corrected, we have to do some comparisons between the nature of sporadic and chronic defects, as they relate to each aspect of an operation. Let's refer to Figure 4 which shows some distinctions between sporadic and chronic defects. It's easy to see that there is a large difference between the two types of troubles and how they are treated. However, for a company to make gains and improvements, they have to look at ways to tackle chronic problems. Let's consider one example of how a new level of quality can possibly be achieved. Some years back, it was very difficult to establish a pure production field of turf type ryegrass which would produce high quality (weed and other cultivar free) seed acceptable for use in elite golf course operations. A breakthrough that was significant some years ago involved a method in which seed production fields could be planted by using a herbicide, which normally kills the desired crop as well as the weeds that require control. The breakthrough involved the use of activated charcoal as a protectant to the planted seed rows and
Detection of change
Identification of cause of change
Corrective action to restore the status quo


FIGURE 3
### FIGURE 4
DISTINCTION BETWEEN SPORADIC AND CHRONIC DEFECTS

<table>
<thead>
<tr>
<th>ASPECT</th>
<th>NATURE OF SPORADIC DEFECTS</th>
<th>NATURE OF CHRONIC DEFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangible economic loss</td>
<td>Minor</td>
<td>Major</td>
</tr>
<tr>
<td>Extent of irritations caused</td>
<td>Substantial. Sudden nature of trouble attracts supervisory attention</td>
<td>Small. Continuing of trouble leads all concerned to accept it as unavoidable</td>
</tr>
<tr>
<td>Type of solution required</td>
<td>Restore the normal procedure</td>
<td>Change the procedure</td>
</tr>
<tr>
<td>Type of data needed</td>
<td>Simple data showing trend of quality with respect to one or two variables such as germination</td>
<td>Complex data showing relation to quality to numerous variables</td>
</tr>
<tr>
<td>Plan for collecting data</td>
<td>Routine</td>
<td>Specially designed</td>
</tr>
<tr>
<td>Data collected</td>
<td>By Production Manager</td>
<td>Often through special experimental procedures</td>
</tr>
<tr>
<td>Frequency of analysis</td>
<td>Very frequent. Review every lot</td>
<td>Infrequent. Data may be accumulated for several months before analysis is made</td>
</tr>
<tr>
<td>Analysis made by</td>
<td>Production Manager</td>
<td>Technical personnel</td>
</tr>
<tr>
<td>Type of analysis</td>
<td>Usually simple</td>
<td>Possible intricate</td>
</tr>
<tr>
<td>Action by whom</td>
<td>Production Manager</td>
<td>Production Manager</td>
</tr>
</tbody>
</table>
enabled the grower to apply a herbicide that had very good activity against many of the troublesome weeds and other perennial rye grasses native to the area. This procedure can be thought of as a breakthrough in production practices, which allowed the innovators to attain a new, lower level of weed seed contaminants in the products they were marketing.

**Breakthroughs**

An improvement is called a breakthrough if it meets two essential criteria.

1. A new superior level of performance, which has not previously been attained—a new level or "norm" can then be set.

2. The change is the result of human determination to attain the new level. It is not the result of luck—man—not chance is the master.

Let's back track briefly. We mentioned chronic defects or troubles above. With chronic defects, we have to realize that what they have in common is that we do not know the cause. Lacking the knowledge, the defect goes on and on—which is what makes it chronic. How to correct or take remedial action depends largely on the successful completion of diagnostic and remedial steps. There are three diagnostic steps:

1. A study of the symptoms surrounding the defects to serve as a basis of theorization about causes.

2. Development of theories about the causes of these symptoms.

3. Analysis and experimentation to establish the true causes; i.e., to test the reasoning.

The remedial journey normally begins when the true causes are known. It consists of three steps:

1. Development and testing of alternatives or remedies.

2. Selection and application of the remedy.

3. Revision of operations to hold the gain.

An example of breakthrough process can be seen in Figure 5.

**Justification of the QCP**

We have talked about ways of improving quality and how quality interrelates; however, we sometimes have the problem of selling a quality control program or the importance of it.
The difference between the old standard and the new standard is regarded as a chronic ailment which can economically be cured.

Breakthrough in attitude
Breakthrough in knowledge-diagnosis
Breakthrough in cultural practice
Breakthrough in results
Holding the new levels-control

Sporadic departure from standard

Old standard

New standard

FIGURE 5
The first step - and the hardest step - of having or attaining a comprehensive quality control program is selling it. Because the rewards of quality assurance are "hard" to measure, most businessmen are slow to appreciate them. This attitude is changing rapidly.

Good quality, which consumers can afford, may actually reduce costs and almost always increases productivity. The earlier you detect the defect, the earlier and greater will be the savings.

For example, if we track or follow the accumulating production costs for field corn, we can see how the cost can continue to build up. We have planting, growing, detasseling, harvesting, drying, shelling, storing, processing or conditioning, treating and bagging--each with a cost that accumulates as the seed moves from one step to the next. If at any time the seed lot is rejected, it will have accumulated a certain amount of cost. If it reaches the stage of being treated and bagged, it has lost all its value and nothing can be gained, such as a sale to an elevator for commercial grain. If the seed is shipped to a customer and then found to be defective, we have further costs that involve retrieving the seed, replacement and a potential loss of the customer, not to mention other more dreadful things.

Summary

In conclusion, we have to realize that an effective quality control or quality assurance program involves the whole process: beginning with the product design and continuing on to the marketplace. We may try to control quality by putting enough inspectors in the line to weed defects down to an acceptable level; but we have failed--if we need a lot of inspectors. We cannot inspect quality in—we must build it in.