

## AN EFFECTIVE QUALITY CONTROL PROGRAM

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### Scope of Subject Matter

Because Quality Control embraces all aspects of seed production it would be well at the start to outline the general area of this discussion. We will not concern ourselves here with the genetic purity of the seed crops under discussion. This is the domain of the plant breeder and of stock maintenance and control personnel.

Neither will we concern ourselves with agronomic factors affecting seed quality except for purposes of illustration. This responsibility of the field department is too large a subject to cover in this report without neglecting our principal theme.

Our area of discussion will concern itself primarily with the need, scope, organization, and operation of a company service designed to control the quality of seed from the time it is delivered to the plant in field-run condition until it is shipped to the customer in final processed form.

I would like to review with you a more or less generalized program which can be adapted to fit normal quality control requirements of most seed processors and to illustrate this review with slides and data on some quality control procedures developed by the Asgrow Seed Company for the production and processing of graden pea seed.

### Organization of the Program

The first step an organization must take to get the ball rolling is an administrative decision to improve its quality control program and to provide a policy outline of its purpose and scope. These depend in large part upon the type or organization involved. For example, if a State or Federal department is engaged in the production of seed of the best possible quality for use as breeder stock, then high processing standards may be set to obtain this quality level. If, on the other hand, a commercial seed house is engaged in the production of seed, the company objective would be to set its quality standards at a level which will permit it to produce a uniformly high standard of seed quality at a reasonable profit. And this, gentlemen, is quite an undertaking.

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A progressive organization which decides to set up a formal quality control program does not really start from scratch. It already has an active program of some sort involving a number of people. These include those who sample crops in the warehouse, those who make decisions on processing procedures, those who check the processed product for market suitability, and those who buy and sell the seed during the normal course of operation.

The best place to start, therefore, in the implementation of the company decision, would be to review and to standardize those quality procedures already in use, including the reorientation of individuals involved to the necessity for unvaried compliance in carrying out these procedures. This first effort toward improving the company's quality control effort is sound management procedure because it demonstrates to personnel already involved how to do a better and more consistent job with familiar routines and does not arouse opposition as might be the case if a request were made to switch to a more complex series of new quality control procedures without some advance preparation.

After they have become familiar with the more disciplined routines, the position is reached where new or needed improvement in procedures will be accepted. A satisfactory vehicle for this step would be a small manual designed and written for a two-fold purpose: (1) to improve the technical knowledge of your warehouse samplers, millmen, and sample room analysts and, (2) to introduce more reliable equipment and procedures than those presently being used. To illustrate this step let us examine the table of contents of a manual of this type written in 1954 to standardize sampling and sample analysis procedures at nine Asgrow branches engaged in the production of garden pea seed.

#### Table of contents

1. Sampling theory
2. Sampling and sample analysis equipment
3. Types of crop samples
4. Classification of tare types
5. Sample analysis procedures
6. Quality control forms

#### Establishing Standards

Now all this may sound very involved and it would be if an attempt were made to switch over to a new program like this in one step. But the truth is that if you wish to obtain a uniform standard of quality your people must learn the rules and use the tools necessary for its measurement. For purposes of illustration let us see what it takes to set up and operate an acceptable processing control program. For this purpose we

will skip the first 3 subjects mentioned in the table of contents for the sample room manual because it is obvious that this group is familiar with the sampling theory and with the tools and equipment used in drawing and analyzing various types of crop samples. Let us review, then, a suitable method for the classification of tare types and establishment of processing standards using the garden pea as the sample species:

#### TARE TYPES IN GARDEN PEA SEED

##### Free Foreign Material

Trash  
Buds & Berries  
Free weed  
Dirt  
Clod  
Rock

##### Adhering Foreign Material

Muddy  
Greasy  
Adhering weed seed  
Water stain  
Fungus stain  
Moldy-rotted

##### Mechanical Damage

Crack  
Hairline crack  
Chipped  
Broken or split

##### Insect Injury

Weevil sting  
Weevil window  
Weevil cut  
Chewed

##### Physiological Tare

Burned  
Shrivel  
Physiological spot  
Weather check  
Loose hull  
Bleach

##### Mixtures and Off-types

Smooth-wrinkled  
Canner-freezer  
Commercials  
Crop offs  
Crop rounds  
Field hybrids

Having learned to recognize most of the common types of tare in garden pea seed, what do we do about it? The answer: evaluate and tabulate the answers to the following questions about each:

1. When did it get into the crop?
2. Can something be done to prevent its entry in the first place?
3. Can it be removed in total or in part by routine processing procedures?
4. Can it be removed in total or in part by a specialized processing procedure?
5. Does it defy removal by known processing methods?
6. Have customers complained about it?
7. How much will the customer tolerate if all of it cannot be removed?

With the above information recorded for each type of tare, the relative importance of each as a possible source of customer complaint is catalogued and its processing removal characteristics are learned. This is all the information needed to begin writing a set of processing standards for garden pea seed.

Processing standards are tabulations of acceptable tolerances for each type of tare in the crop which must be met before it can be placed in trade channels as a standard quality product. As an example let us prepare a set of processing standards for free foreign material in peas.

It is obvious here that tare like plant trash, free weed seed, and dust should have a tolerance near zero since these types are easily removed by air and screening in ordinary milling.

How about dirt clods? In normal milling clods larger or smaller than the crop seed are removed by scalping and screening so that only crop-size pieces remain. The presence of a few clods the size of the crop will cause no planting difficulty because they will flow through the drill with the seed. The principal objection to the presence of crop-sized clod is that the customer is paying for this weight at the seed price and will complain if too many are present.

Soft volcanic rocks or smooth surfaced pebbles of a round or blocky configuration react much like clods. With hard sedimentary rock, however, the pieces may be the same diameter as the crop but much longer and may fall through the scalping screens lengthwise, thus remaining in the crop. These can cause damage from jamming in the gates or fluted feeds of drills. Another bad feature of rock is its unfortunate habit of accumulating in the bottom of the drill box due to its heavier specific gravity characteristics than the pea seed. By the time the customer has planted a few acres the accumulation of rocks in the drill may produce a violent complaint even though the crop itself averages only a few pieces per bag.

Because the customer will object to paying for crop-sized clod and rock at pea seed prices and wants nothing in the crop capable of damaging his planter the goal is to set tolerances for crop-sized clod and rock at levels low enough that the customer will not be likely to make an issue out of it and high enough that it can be met without excessive milling or remilling. Here you must pick your own level and try it on for size: like 1/4 of 1%, 1/10 of 1%, 1/16 of 1% or what have you? For long rock, however, the tolerance must be very low, preferably zero.

One by one we evaluate the different tare types and compile a preliminary set of tolerances which we hope will be acceptable to most

customers and with which we can live. These are not hewn in stone. Changes will be made because of processing problems and customer complaints, but after 2-3 years a reasonable and workable set of processing standards will evolve.

Up to this point we have been talking about physical and physiological tare present in the crop. The other side of the coin involves factors associated with crop performance. Among these are (1) germination, (2) vigor, (3) moisture content. Setting standards for germination is easy because we have a base in the Federal minimum germination standards which the USDA lists in its "Rules and Regulations Under the Federal Seed Act" for all vegetable seed. The germination standard which you first select for your company should be above the minimum Federal germination standard but conservative, since the average level for the respective varieties and crops which you grow will be determined not by decision but by your general proficiency as an organization to reach and maintain these levels. You may also wish to formalize a set of germination standards for purchase of seed crops from growers, or dealers.

With respect to vigor we must candidly recognize that vegetable seed may vary in vigor from crop to crop for many reasons associated with genetic makeup, exposure to unfavorable agronomic factors during growth and maturation, seed size, physiological maturity when harvested, moisture content, physiological age, etc. For many vegetable species a fair estimate of the vigor of a lot may be ascertained by use of first count procedures which have been set up by the Association of Official Seed Analysts in their "Rules for Testing Seeds". For many species first count data is not a usable measure of vigor. This is a field of active current research.

#### Activation of Centralized Checking Procedures

Now we have:

- (1) People at each processing plant capable of drawing and analyzing samples in a standard manner, using the same procedures and nomenclature.
- (2) A set of processing and performance standards to control the quality level of the plant output.

Now we need a checking system to make sure that seed processed by each plant meets the established quality standards. This requires use of a master form for recording the data of all sample analyses run on each crop throughout its processing history. This record is used by the processing supervisor to guide successive processing operations and

subsequently by quality control to check the final processed crop for adherence to established company standards.

When processing is completed a copy of this record is forwarded to quality control (Q.C.) headquarters with a representative sample of the final processed crop. Here the tare levels and other pertinent data listed on the crop analysis record are cross-checked against the sample and against permissible tolerances and performance standards in order to reach a final decision on its acceptability. A second form is then used to report back to the processing plant (and to Administration and Sales) whether the crop was found to be above or below standard.

#### Problem Crop Upgrading Procedures

Results of all laboratory tests for purity, germination, vigor, dormancy, moisture content, etc., should be scrutinized routinely by quality control headquarters so that tests failing to meet minimum standards may be red-flagged for remedial action with minimum loss of time.

With most seed crops the majority of germination problems are due to physiological injury resulting from exposure to adverse agronomic or weather conditions during maturation and harvest. Many procedures have been developed for upgrading germination performance of various species. One of the most successful involves differential air flotation of sized segments of the crop. We will illustrate this technique with an actual upgrading study of a pea seed crop.

With peas low germinations are usually associated with presence of variable amounts of two types of tare. The first is burn and shrivel of relatively immature elements of the crop due to drought, high temperature or other conditions contributing to premature ripening of the seed. Since immature seed is principally involved, burn and shrivel is concentrated in the smaller seeded elements of the crop. If the crop is sized with a series of 3 or more screens and the sizes tested separately for germination a typical seed-size and germination distribution pattern results. Germination of the respective sizes can then be improved by using air flotation to lift out the lightest and most shriveled seed.

The second type of tare is loose hull which usually appears in relatively mature elements of the crop following exposure to free moisture of sufficient amount and duration to swell the seed. On redrying the seed coat forms a loose hull around the cotyledons, becoming extremely susceptible to mechanical damage.

Since mature seed is principally affected by the loose-hull condition, and the condition itself further accentuates seed size, loose hull is usually concentrated in the larger seeded elements of the crop. Sizing

over screens with subsequent testing for germination produces a typical germ distribution pattern opposite to that of shriveled crops.

The presence of both types of tare in the same crop produces the expected intermediate pattern with low germinations at both size extremes.

With these relationships in mind, a standard procedure for checking samples of low germinating crops for upgrading feasibility becomes immediately apparent. Samples of crops, red-flagged by Q.C. for substandard germination performance, may be submitted to Q.C. headquarters for germination upgrading studies, further processing being held in abeyance pending outcome of the tests. Results may be reported back to the branch with recommendations as to the best processing method for upgrading the crop.

To recapitulate, a workable quality control program must have a set of standards for each factor contributing to seed quality. The basic quality standards may be listed as follows:

#### Basic Seed Quality Standards

##### Performance Factors

Germination

Vigor

##### Processing Factors

Moisture Control

Tare tolerances

Standard processing methods

Upgrading routines

Treating procedures

A group of quality control procedures are then needed to insure adherence to the established standards. Principal procedures involved in this program are:

#### Quality Control Procedures

1. Standard sampling and sample analysis techniques
2. In-plant processing control
3. Centralized checking of current crop for adherence to standard
4. Centralized checking of carryover for continued adherence to standard
5. Identification and upgrading of problem crops

## Prizes and Contributions

### Winners List:

Bean Guessing Contest - portable tape recorder

Mrs. Carl Thorp, Thorp Seed Co., Clinton, Illinois

### Prize Drawings

Transistor Radio - Virgil Frevert, Crippen Mfg. Co., Alma, Michigan

Plano Tackle Box - Joe Dudney, Tennessee Crop Imp. Assoc.,

Nashville, Tennessee

Instamatic Camera - E. Berkeley Glenn, Va. Dept. of Agriculture,

Richmond, Virginia

Electric Razor - Carl Thorp, Thorp Seed Co., Clinton, Illinois

Registration Refunds for bringing more than 9 other people -

J. C. Hackleman - Ill. Crop Imp. Assoc., Urbana, Illinois

Robert Rawlings - Ark. Rice Growers Assoc., Stuttgart, Arkansas

### Plus

Twenty six winners of one of the following prizes:

1. "Seed Processing and Handling" Handbook #1 - Seed Tech. Lab.
2. Two dollar bill
3. Two pre-copper half dollars

The following firms contributed the money for purchasing the prizes:

Seedboro Equipment Company, Chicago, Illinois

Sanders Seed Company, Cleveland, Mississippi

Stults Scientific Engineering Corp., Springfield, Illinois

Hulsey Seed Laboratory, Decatur, Georgia

The Wax Company, Amory, Mississippi

Delta and Pine Land Company, Scott, Mississippi

Burrows Equipment Company, Evanston, Illinois

These companies purchased the 130 dozen doughnuts, 70 gallons of coffee and 40 cases of "cokes" consumed by the participants:

Gustafson Manufacturing Company, Minneapolis, Minnesota

Universal Dynamics Corporation, Alexandria, Virginia

Crippen Manufacturing Company, Alma, Michigan

A. T. Ferrell & Company, Saginaw, Michigan

Morton Chemical Company, Chicago, Illinois

Carter-Day Company, Minneapolis, Minnesota

Sutton, Steele and Steele Inc., Dallas, Texas



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