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Quality Assurance - Drying Throgh Marketing Emphasis: Hybrid Corn Seed

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Comments

Procedures for establishing and effective quality control program for production, harvesting, drying, and conditioning of seed corn.

QUALITY ASSURANCE - DRYING THROUGH MARKETING
EMPHASIS: HYBRID CORN SEED

John Launer [1/]

An effective quality control program for the production, harvesting and conditioning of seed corn should be designed to coordinate the efforts of all employees toward the production of a top quality product. During this discussion, time will not permit me to discuss in detail every step or operation involved; however, I hope that the highlights, which I will discuss and which have been discussed during this conference will stimulate further thinking and discussion on the continued improvement of our quality control or quality assurance programs.

A good definition of quality control is to provide or assure that only seed of known and acceptable quality are marketed. Aside from the separate quality control programs employed during planting and pollination, the specific purposes of this program should entail the following points:

1. To check each operation from harvest to finished seed in the warehouse for errors or irregularities that might affect the quality of the finished product.

2. To record data on each operation to use as a reference for greater efficiency and for the production of a higher quality product.

3. To check each finished size of each variety and lot for kernel uniformity, germination, seed finish, kernels per pound or per unit, plantability and proper labeling.

4. To establish standards for each operation, and to alter these standards only when weather conditions greatly affect the finish and quality of the seed.

Obviously the person responsible for quality control at the seed plant should have a thorough knowledge of the production methods, conditioning systems and, if possible, the genotypic differences or characteristics of the varieties produced.

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Factors Affecting Seed Quality

Three factors which affect seed quality are the environmental, biological and human factors. For the most part, the environmental factors affecting quality are ones that are controlled by nature. Careful planning and timely planting can help to avoid the stress of heat during pollination, the loss in seed quality due to freezing conditions, and damage to seed from improper handling of high moisture corn at harvest time.

Rigorous monitoring and timely applications of an appropriate pesticide can control or deter the biological factors which have an effect on quality.

The third factor is human. We have the ability, as I pointed out, in terms of the partial control of the environmental and biological effects on quality, of being able through sound and timely management to avoid or minimize the environmental and biological factors. We also have the ability to take the seed, which nature has given to us, and by proper handling and conditioning to improve or upgrade the quality of that seed. Unfortunately, we also have the ability to err, which may lead to the down grading or decline of the quality of this seed.

A continuing challenge in quality control is communication. Effective communication between production personnel and quality control personnel at all levels is a must - it is a two-way street.

In an effective quality control program an error is not an error if detected in time or reported and a record made. At that point, sound management decisions based on documentation can then be made to take corrective action.

Post-Harvest Quality Assurance

Diligent observation of the harvested corn seed ears by trained personnel is a must for the removal of off type ears and those ears which are mechanically damaged or diseased. Typical examples of off type ears and male ears should be on display as a visual guide for the people doing the ear sorting. These examples should be changed and updated for each new variety being harvested.

Ear Sorting

Careful and timely inspections made during the green and dry sort operations and during the drying and shelling operations provide an indication of the quality that can be expected in the finished product and also an indication of the amount of seed that can be expected at the completion of conditioning. These inspections also provides information for improving any operation that might be responsible for affecting the quality of the finished product.

Previous speakers have discussed mechanical separations. Obviously, the green and dry ear sort is a "mechanical" separation, which has a great bearing on seed quality. The cost of conditioning is generally directly affected by the organization and efficiency of the work done in these operations.

In part, what I have said up this time is that high quality seed is produced in an environment conducive to good pollination, free from weeds and insects, and is harvested in a timely and careful manner.

It goes without saying that all of the good traits established through harvest and ear sorting require considerable time and money.

The quality control practices after ear sorting also have a great effect on determining if the production remains quality seed or becomes "grain."

In addition to the concerns during production, harvesting and drying of seed corn, quality control is also vitally interested in bulk seed storage, conditioning, bag storage and the various tests and records involved in the monitoring of these steps to assure the farmer that he is receiving the highest quality seed possible and, obviously, to avoid or prevent complaints on the seed.

Shelling and Bulk Storage

As seed are moved into bulk storage whether it be in flat or bin storage, composite samples should be obtained from each sheller or dryer bin for each variety and lot. These samples should be taken on a periodic basis during 4 to 6 hours of operation. Samples should be taken more often if there is any indication that the quality of the seed is declining.

The composite samples are obtained from the sheller, either by an automatic sampler or by periodically drawing samples from the shelled seed discharge and thoroughly mixed in a container. In the event samples cannot be obtained from the sheller, it is a must that the seed be sampled prior to going into bulk storage. Composite samples should also be taken as the bin is being filled.

If bin probing is required, the bin should be probed by using a long probe and sampled in several locations in the bin center to obtain a uniform sample, which would be more representative of the seed. Obviously, if the bin is large the quantity of seed sampled represents a relatively small percentage of the binned seed.

Seed stored directly from the sheller for finishing during the winter months must be checked periodically for possible storage damage. Two types of storage damage are most common. One results from rain or snow leaking or blowing in bin roofs or bin walls. The second results

from condensation of moisture as the temperature of the seed in the center of the bins remains higher than the atmospheric temperature. This damage is most common during the late fall and winter in bins that were filled with "warm" seed.

Dry, unfinished seed only spoils in storage, or loses seedling vigor, when the atmospheric temperature is considerably below the temperature of the seed in the center of the storage. When there is a difference between the atmospheric temperature and the seed temperature in the center of the bin, convection currents are set up which results in migration of moisture from the central areas to the upper surface of the bin. As this warm rising air comes in contact with the cold seed near the top surface, moisture condenses and is absorbed by the top layers. If the top layer is cool enough to reduce the temperature below the dew point, liquid water is deposited on the surface of the kernels and mold will eventually develop (Figure 1).

Periodic checks of storage temperatues and seed moisture are necessary to monitor the seed and the information obtained is used to manage the bin aeration programs.

All seed bins should be thoroughly cleaned and free of any contaminants from previous seed storage. The bins should also be treated with an insecticide prior to filling with new seed.

Seed being held for an extended period of time should be monitored for insect activity and treated accordingly with an approved insecticide to avoid any seed damage and a buildup of insect activity. Good rodent control is also an important quality control function.

Shelled corn samples are examined carefully for diseased or discolored kernels, exposed germs and for all mechanical damage such as capped or tipped kernels. In the event that any of this damage exceeds established tolerances, the sheller or precleaning operation should be examined to determine if the damage can be reduced. Quite often excessive kernel damage can be avoided by proper regulation of the flow of seed ears to the sheller and by adjusting the shelling speed to obtain the maximum shelling efficiency with the least amount of damage.

It is important that seed of <u>like quality</u> be "batched" or put together into shelled corn storage.

During the flow of the harvest operation, seed having lower quality or finish as determined first by visual observations and subsequently by the quality control tests made for all operations, should be stored separate from high quality, well finished seed. With careful and accurate analysis of the quality control checks on this seed, proper management decisions can be made to utilize the seed in the most efficient and economical manner.

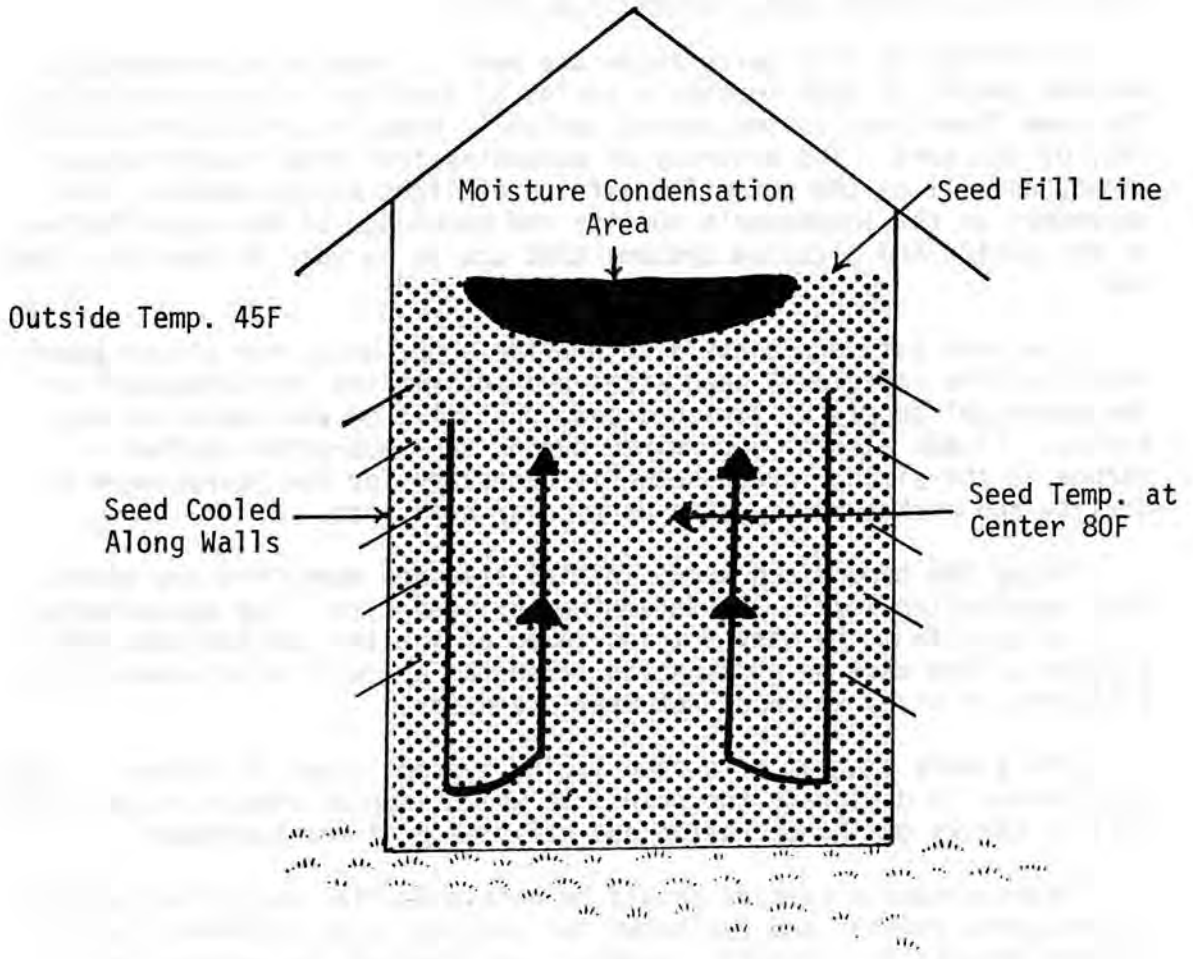

Figure 1. Pattern of moisture migration in a seed bin loaded with warm (80F) seed as outside temperature begins to cool. Seed at top can be badly damaged by condensation. Proper aeration can prevent moisture migration in a bin.

Size Class Estimates and Plantability Checks

Estimates of size percentages are made by passing an accurately weighed amount of seed through a series of hand test screens utilizing the same dimensions as the screens actually used in conditioning (sizing) of the seed. The accuracy of estimates from hand length separations, as well as the potential lifting of light weight kernels, are dependent on the inspector's ability and knowledge of the capabilities of the sizing and cleaning systems that are to be used to condition the seed.

The size estimate tests also provide opportunity for closer examination of the individual seed sizes and information for management on the potential supply of finished seed that will be available for marketing. It can also be determined during this operation whether a change in the sizing screen setup is necessary for the improvement of quality and marketability of a particular seed size.

Using the hand sized seed, initial standard warm test and vigor test germination levels are determined by seed size. The accumulation of this data from the many samples taken of the the shelled seed will provide a firm base on germination strength, and will also prevent the finishing of sizes which do not meet standards.

The simple diagram of a seed sizing system, shown in Figure 2, uses an asterisk to designate the points at which samples should be taken for quality checks on the operation and efficiency of the equipment.

Representative samples should be obtained after every step of the conditioning process and evaluated for quality, size uniformity and correct dimensions. Finally, samples are obtained for germination and accuracy of plantability tests.

The tests made during the sizing operations should be on a regular scheduled basis of every hour or hour and one half. If any change in quality is noted, the frequency of sampling should also be changed. At any point seed is found to be outside tolerance, it should be isolated and rerun or standardized, or discared if not salvageable.

Plantability tests using laboratory seed plate or plateless testing equipment are conducted prior to and during the bagging of each size to determine the proper plate recommendations.

Importance of Sampling

Up to this point I have made reference to sampling and composite samples. Proper and adequate sampling of seed is important to be able to evaluate the seed lot regardless of what phase the seed is in during the conditioning period. The test results can only be as representative

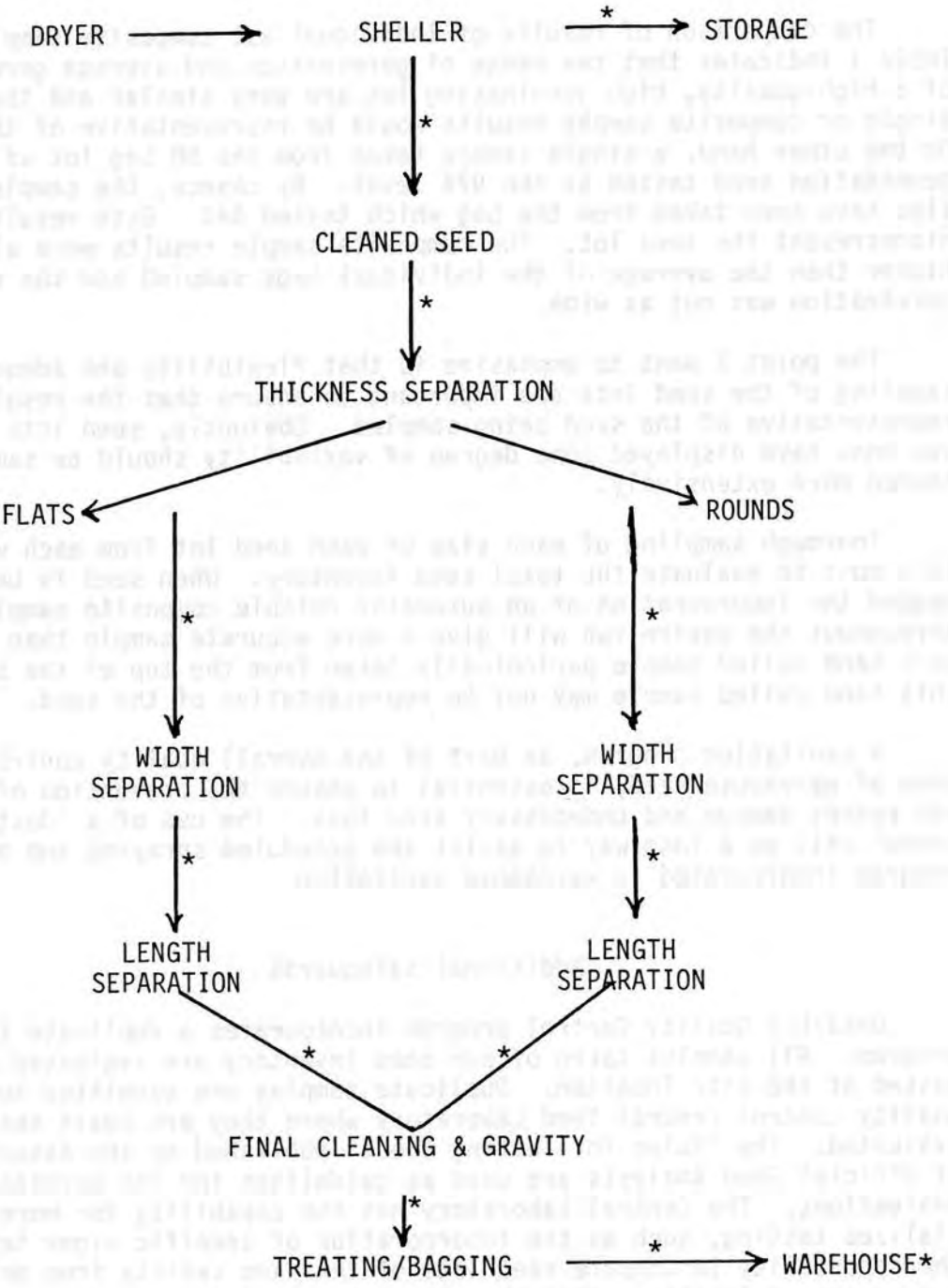

Figure 2. Operational sequence and sampling points (*) for corn seed from dryer to warehouse.

as the sample taken.

The comparison of results of individual vs. composite sampling in Table 1 indicates that the range of germination and average germination of a high quality, high germinating lot are very similar and that the single or composite sample results would be representative of the seed. On the other hand, a single sample taken from the 50 bag lot of marginal germination seed tested at the 97% level. By chance, the sample could also have been taken from the bag which tested 84%. Both results would misrepresent the seed lot. The composite sample results were also higher than the average of the individual bags sampled and the range of germination was not as wide.

The point I want to emphasize is that flexibility and adequate sampling of the seed lots are important to ensure that the results are representative of the seed being sampled. Obviously, seed lots which you know have displayed some degree of variability should be sampled and tested more extensively.

Thorough sampling of each size of each seed lot from each warehouse is a must to evaluate the total seed inventory. When seed is being bagged the incorporation of an automatic dribble composite sample taken throughout the entire run will give a more accurate sample than relying on a hand pulled sample periodically taken from the top of the bag. This hand pulled sample may not be representative of the seed.

A sanitation program, as part of the overall quality control program of warehouse seed, is essential to ensure the prevention of insect and rodent damage and unnecessary seed loss. The use of a "dust pan and broom" will go a long way to assist the scheduled spraying and baiting program incorporated in warehouse sanitation.

Additional Safeguards

DeKalb's Quality Control program incorporates a duplicate testing program. All samples taken of our seed inventory are evaluated and tested at the site location. Duplicate samples are submitted to the Quality Control Central Seed Laboratory where they are again tested and evaluated. The "Rules for Testing Seeds" published by the Association of Official Seed Analysts are used as guidelines for the germination evaluations. The Central Laboratory has the capability for more specialized testing, such as the incorporation of specific vigor tests and the opportunity to compare seed lots of the same variety from more than one source or location, than the site laboratories.

Seedsmen not having these types of facilities can utilize the seed testing services offered by the many private and state seed laboratories as a part of their quality control program.

Table 1. Illustration of differences that can occur in results obtained from individual and composite samples.

Single bag samples consisted of 1 sample drawn from the lot with one test done on the sample.

Individual samples consisted of 50 samples from different bags with one test done on each packet taken from the lot.

Composite samples consist of combining all 50 packets, mixing well and conducting 4 tests on the composite sample made from the lot.

	Avg. Germination	Range	No. Tests
High Germ. Lot			
Single bag sample	98	--	1
Individual bag sample	98.6	95-100	50
Composite sample	98.0	94-100	4
Marginal Germ Lot			
Single bag sample	97	--	1
Individual bag sample	92.5	84-100	50
Composite sample	95.2	91-98	4

Vigor Tests

Vigor tests are a vital part of any quality control program. The results of these tests are to be used as a part of the Internal Quality Control program and not as a part of the seed label. Proper evaluation of test results can prevent lots from being marketed, which may have been judged satisfactory under standard test conditions but have displayed poor or variable results in vigor tests.

There are several different types of tests which can be applied to corn seed to interpret the "vigor" of the seed such as speed or rate of germination, cold test, seedling growth rate, accelerated aging or tetrazolium tests.

The cold test is used quite extensively in our quality control program for testing all sizes of all seed lots at each location. This test can be geared to volume testing and our field trials have shown a farily close correlation in terms of slower emergence and lower stand establishment when seed displaying a lower cold test are planted in a cool, wet soil. Extended cold tests of 10, 12, or 14 days beyond the 7 day standard cold incubation period are utilized for special evaluation of seed lots.

As with the standard warm test, close visual attention is paid to the developing plant structures for any abnormalities or lack of vigor of the plumule or the root system.

The rate of emergence and final stand establishment as compared to the predicted laboratory standard warm and cold test germination levels are illustrated in Figure 3. In all cases, the lower vigor lots, as established by laboratory tests, produced erratic emergence and lower final stands when subjected to less than favorable field conditions.

The utilization of the accelerated aging test in our laboratory is to evaluate specific seed lots for which cold and warm tests may be at variance or have provided inconclusive information. Normally, I have observed that accelerated aging test results of corn seed parallel the cold test results.

Tetrazolium testing is a time consuming test as far as seed preparation is concerned. However, it is quite beneficial as a further aid in evaluating seed lots for any abnormalities which can not be identified under the standard test conditions or for detecting freeze damage and to further define a vigor level. Under normal operations we will have or will allow the time for a complete standard warm and cold test evaluation of the seed prior to making a final decision.

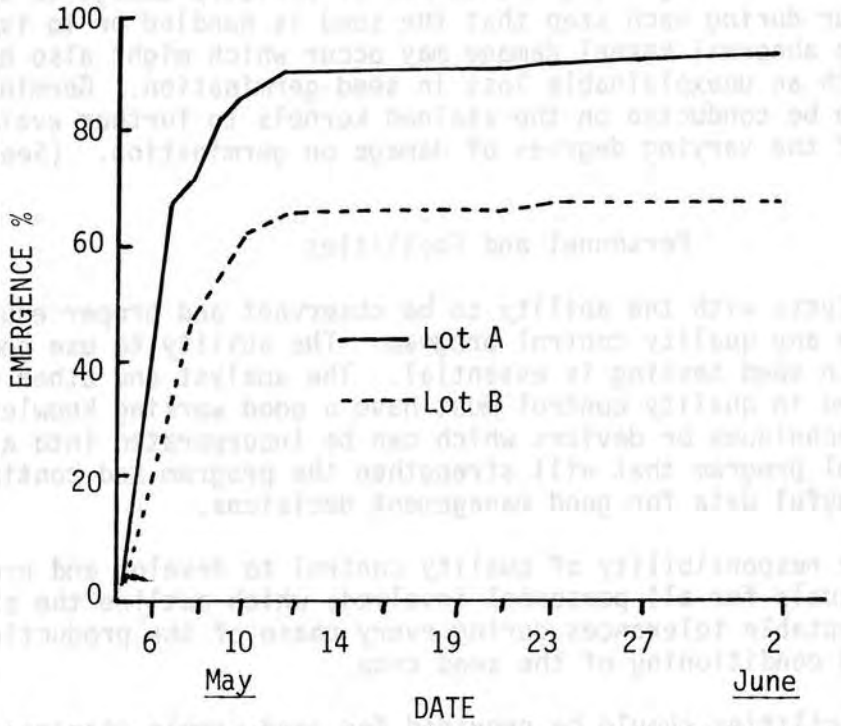

Figure 3. Emergence of two lots of corn seed in field tests. Planting date was April 22. Quality test results were as follows: Lot A - warm test, 94%; cold test, 87%: Lot B - warm test, 92%; cold test, 62%.

Fast Green Test

The use of the fast green stain technique for evaluating mechanical damage in our quality control laboratory program provides the production personnel information regarding the amount of pericarp damage to seed which may occur during each step that the seed is handled or to isolate the area where abnormal kernel damage may occur which might also be associated with an unexplainable loss in seed germination. Germination tests can also be conducted on the stained kernels to further evaluate the effects of the varying degrees of damage on germination. (See Figure 4).

Personnel and Facilities

Good analysts with the ability to be observant and proper equipment are crucial in any quality control program. The ability to use good common sense in seed testing is essential. The analyst and other personnel involved in quality control must have a good working knowledge of the various techniques or devices which can be incorporated into a quality control program that will strengthen the program and continue to provide meaningful data for good management decisions.

It is the responsibility of quality control to develop and provide procedural manuals for all personnel involved, which outline the standards and acceptable tolerances during every phase of the production, harvesting and conditioning of the seed crop.

Proper facilities should be provided for good sample storage, not only to comply with the various Federal and State Seed Laws, but to provide an immediate source of seed for additional testing of a seed lot should that be necessary prior to the arrival of freshly drawn new samples of the lot in question. Samples of the various seed lots are also used for observation and comparison as might be needed.

Records

Records are all important to substantiate the various quality checks made and to provide a convenient way for management to make or alter decisions pertaining to the seed crop. They are also necessary to comply with Federal and State Seed Laws as well as the Weights and Standards Laws. Records of the seed lots are used as long as the lots are in inventory. Much of the information is established during the time of conditioning, but the germination of the seed lot is continually updated.

The information developed by quality control provides the basis for accurate labeling of the seed lots with a current analysis of the seed. The analysis tag or label, which contains this information is designed to comply with the labeling standards as established by the seed laws

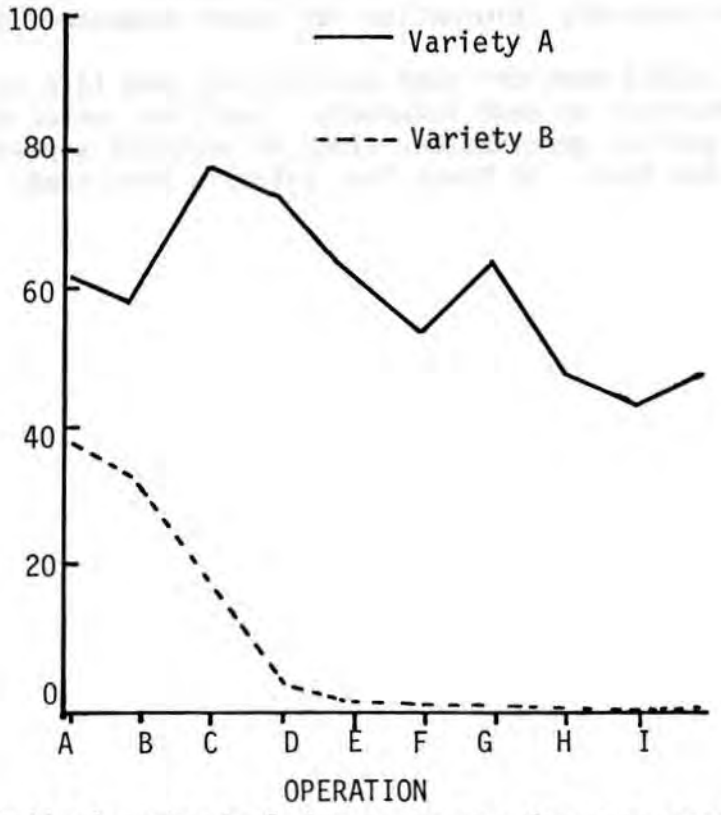

Figure 4. Hypothetical mechanical damage curves for corn seed indicating accumulation of damage through sequence of nine conveying and conditioning operations.

and provides, to our customers, a true picture of the contents of the seed package.

Summary

A good, effective and thorough quality control program is the basis for "SEED QUALITY ASSURANCE", which is so important to the farmer - our customer. Whether the program is big or small, it should be designed to provide the necessary information for sound management decisions.

We at DEKALB consider seed quality and seed life as being a company asset as important as seed inventory. Seed lots which do not have acceptable purity, germination, vigor or physical appearance are not seed, they are feed - 30 times less valuable than seed.