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## THE USE OF TEST INFORMATION IN QUALITY CONTROL AND SALES

L. E. Everson <sup>1/</sup>

In April, 1869 a German nobleman and farmer brought some seed samples to Professor Knobbe (3) for identification. Apparently these samples had been taken from seed purchased for planting. Professor Knobbe found that one of the samples, a meadow fescue sample, contained only 30% of the species claimed on the seed tag. Some of the seed that Knobbe had previously obtained from seed merchants for planting in his experimental plots had been unsatisfactory. Therefore, when a group of farmers from Dresden, Germany came to him suggesting that he investigate the quality of seed marketed in Germany he gladly agreed to cooperate. To do this, Knobbe established the seed testing station in Thorandt, Germany in May 1869. Farmers were invited to submit samples to the station for testing. In addition, Knobbe obtained samples directly from seed merchants. In the testing of these seed samples Knobbe learned that seed merchants were adding cheap similar appearing seed to more expensive kinds of seed. Seed that had "died of old age" was mixed with new seed. Graded and stained sand was added to clover seed. Old discolored legume seed was "doctored up" through staining so it would appear to be good seed. Light oil was added to old turnip seed and sulphur dust was added to grass seed to improve the appearance of the seed. After Knobbe was certain of his findings he published the results of his tests. He referred to the marketing of seeds in Germany as swindle and deception and he asked merchants to stop their "unworthy paths of agriculture." German merchants responded by attacking Knobbe for his "imaginary claims." Apparently the reputation of seed merchants in England wasn't any better than in Germany because Knobbe refers to England as the "classic ground for the falsification of seed." Knobbe said that the merchandizing of seed would have to be regulated by law.

Justice (2) reported on the quality of seed marketed in the United States between 1890-1915. He reported that there were many records of seed adulteration, excessive weed seeds in seed lots and low germinations, particularly of vegetable seeds.

## Seed Law Enforcement

Seed laws were established to regulate the sale of seed in Europe, United States and in other countries of the world as Knobbe suggested. The enforcement of state and federal seed laws has undoubtedly encouraged improvement in the quality of seed sold to growers. However, many seedsmen now go beyond the requirements of state and federal seed laws in supplying growers with quality seed. Competition between seedsmen and the desire to establish a good reputation so growers will return to purchase seed year after year are undoubtedly big factors in the trend to quality seed. It is expected

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that this trend will continue and persons conducting research and public education in the field of seed technology must help the seedsmen in his efforts to improve the quality of seed available for planting.

Some of the test information that may be helpful to seedsmen in encouraging growers to purchase quality seed, rather than "bargain" or "cheap" seed, will be discussed here.

#### Pure Live Seed

The use of "Pure Live Seed" (i. e., purity x germination) has long been

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used as a measure of seed quality by seed testing laboratories in Europe. The author of this paper does not know who first introduced Pure Live Seed (P. L. S.) as a measure of quality. In the United States it was recommended by Porter (5) as an index value for adjusting planting rate. In 1956 Everson (1) suggested the use of P. L. S. in the selling of high quality seed. The following formula was suggested to determine the actual cost of P. L. S.

$$\frac{\text{Price per pound}}{\text{P. L. S.}} = \text{Cost per pound of P. L. S.}$$

#### Basic Information

Seedsmen are a prime source of information for the farmer or grower. This has been proven in many surveys. The seedsmen who is best qualified to answer the grower's questions, is also likely to have the largest number of growers as customers. However, innumerable combinations of seed, soil, and weather conditions can make problems difficult to solve. A seedsman has the best chance of solving grower's problems if he has basic information concerning structure of seeds, the physiological response of seeds and seedlings to prevailing conditions and knowledge of the influence of pathological organisms on seeds. The seedsman should also understand the relationship of seed structure to seed damage in combining and processing. Since seed damage affects yield and damaged seeds do not maintain viability in storage as long as non-damaged seeds, a seedsman must do all he can to avoid damage to the seed he intends to sell. Seedsmen may also avoid the purchase of seed lots with excessive seed damage by checking each lot for damage.

Most seedsmen are aware that seed size has some relationship to yield for some kinds of seed. Nevertheless, seed size is commonly overlooked by seedsmen. For some seed kinds, grading to size is a common practice. For other seed kinds, grading to size would result in a better looking product, little or no loss of seed and a better yield from the seed planted.

#### Special Tests, Quality Control, and Sales

Seedsmen are aware, or becoming aware, that special tests may be used to identify seed lots of high quality. Some seedsmen are also using the information obtained from special tests to promote the sale of their seed.

Brief statements follow concerning some of the special tests available to seedsmen.

Vigor tests. Persons conducting seed research on the relationship of vigor and yield have shown that the vigor of seed does relate to subsequent stand and yield. However, seed researchers are not agreed on the particular kind of vigor test to use on seed. Nevertheless, some seedsmen are promoting the sale of their seed by advertising it as "vigor rated."

Cold testing. Most seed corn companies in mid-western states have their corn seed cold tested. The results of cold tests provide some indication of the ability of corn seed lots to emerge from the soil when field conditions are unfavorable. . Most corn seed companies guarantee that the grower will obtain a stand and they replace the seed lot if the grower fails to get a stand. Such a guarantee would not be possible if corn seed did not receive a cold test, or some other comparable test.

Tetrazolium test. The tetrazolium test is a special test that provides quick information concerning the viability of seed lots. Its usefulness as a special test had long been recognized by seedsmen. However, the tetrazolium test was not recognized as an official test for labeling purposes by the Association of Official Seed Analysts (AOSA) until 1970. Crop species on which the tetrazolium test may be used must still be designated by AOSA. However, the adoption of the tetrazolium test for labeling purposes will undoubtedly mean that this special test will be more widely used by seedsmen.

Toxin ("N" and "T") test. In the summer of 1970 southern corn leaf blight (Helminthosporium maydis) became a serious threat to the corn crop in the United States. Corn plants with Texas male sterile (T) cytoplasm were especially susceptible to this organism, corn plants with normal (N) cytoplasm were relatively resistant. Since most of the corn seed produced in the United States for planting purposes in 1970 was T cytoplasm seed, it was evident that there was insufficient N cytoplasm seed available to plant the 1971 crop. State and Federal Seed Law Enforcement officials adopted the requirement that all seed corn marketed had to be labeled with the percentage if T cytoplasm seed present. This requirement created a serious problem for corn seedsmen because many of them had blends of N and T cytoplasm seed in which they did not know the percentage of T. To meet this problem the toxin, or N and T, test was developed. This test is based on the susceptibility of T, and relative resistance of N, cytoplasm seed and seedlings to the pathotoxin of southern corn leaf blight.

Infected seed test. T cytoplasm seed corn lots and blends of T and N seed produced in Mid-western states were commonly infected with H. maydis in 1970 and 1971. H. maydis infected seeds were either dead or the seedlings died after emergence from the soil. The germination test did not provide the necessary information. It was, therefore, necessary to develop the infected seed test and train technicians to identify the H. maydis organism on seeds and seedlings. This information was valuable to seedsmen and growers alike.



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The cold test was developed as a vigor test for corn seed; however, it can also be used to evaluate quality of other kinds of seed. The picture above illustrates cold test responses of three lots of cottonseed, all of which germinated above 80% in the regular germination test.

Fast green test. As early as 1957 Koehler (4) reported that pericarp damage to corn seed caused a loss in corn yield. In attempting to determine the percentages of damaged and non-damaged seeds in seed lots, Koehler found it difficult to separate some of the damaged kernels from non-damaged kernels. Therefore, he soaked corn seeds in a .1% solution of Fast Green FCF in water prior to separation. Fast Green can be used to advantage in quickly checking seed coat damage of many kinds of seeds. Not only is it useful in assessing the seeds after final processing but each step in the harvesting and cleaning of seeds can be checked to determine the degree of damage caused by the equipment.

Soybean stress test. Field emergence of carryover soybean seed lots are sometimes disappointingly low even though the germination tests are high. In this case, the germination test does not reflect the degree of seed deterioration in storage. The stress test was developed to help predict the field emergence of carryover soybean seed. For the stress test, soybean seeds are placed in a high humidity (99% R.H.) chamber set at 104°F for 30 hours. The seeds are then planted in sterile sand at 77°F. At the same time non-stressed seeds from the same lot are planted alongside the stressed seeds. After seven days, germination counts are made and the seedlings from the stress and regular germination test are evaluated.

Soybean hypocotyl elongation. Some varieties of soybeans are good emergers from a deep depth of planting. Other varieties are poor emergers. The ability to emerge quickly, or from a deep planting, is a desirable characteristic of any soybean variety. Therefore, plant breeders are now breeding for good emergence. The ability to emerge can be checked by planting soybean seed of a given variety four inches deep in moist sand and maintaining the planting at a 77°F temperature for ten days. During the ten day period seedlings from good emerging varieties will emerge from the sand, seedlings from poor emerging varieties will not emerge. But plant breeders or seedsmen with a number of selections or crosses to check need to use a more discriminating procedure. To do this, seeds from the crosses in question can be planted in toweling, placed in a 77°F germinator in an upright position and the seedlings measured after eight to eleven days.

#### Future Tests of Seed Quality

The purity analysis, noxious weed check and germination test are indispensable measures of seed quality and will continue to provide necessary information for labeling. However, efficiency in agriculture is now a necessity for the grower as well as the seedsmen. Additional measures of quality are essential if we are going to provide the grower with seed which will give maximum yield.

A special test may be applicable to a number of seed kinds. Conversely, a special test may be applicable to only one kind of seed. Therefore, in the future we may anticipate many additional special tests, some "tailor made" for a specific kind of seed or situation.

Seedsmen, as well as seed technologists, have theorized about the possibility of developing a "Quality Index." To obtain such an index it has been suggested that two or more kinds of test results (e.g. purity, germination, cold test and a vigor) might be combined. A grower could then pick the seed lot with the best chance of producing maximum yield by checking only one figure--the Quality Index. Seedsmen will give more consideration in the future to the possibility of using a Quality Index based on some combination of factors.

A toxin was produced to check the susceptibility or resistance of emerging corn seedlings to southern corn leaf blight (*H. maydis*). It now appears that the production of toxins to test the susceptibility of seeds and seedlings to many plant diseases may be conducted in the laboratory. For the plant breeder this will speed up the process of checking new lines for susceptibility since most of this work is now done on plants in the field or in the greenhouse.

Most seed laboratories are qualified to provide seed testing services for labeling purposes or to check seed samples for enforcement purposes. Most laboratories, however, do not have the professional staff nor facilities to conduct seed research, develop special tests nor carry information to people (public education). Professional personnel and research facilities are expensive. Therefore, it is not economically possible to staff and equip all seed laboratories. It is feasible, however, to provide regional laboratories with the support necessary to adequately staff and equip them. This will assure the development of better measures of quality in the future and help insure against threats to agricultural production in the future.

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