1-1-1969

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NOV., 1969

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IN
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NEW DEVELOPMENTS IN SEED PROCESSING AND HANDLING

In bringing to your attention new developments in seed processing, I find it necessary to outline briefly the equipment used for seed separation.

The air and screen machine is considered the basic piece of equipment in most processing plants. It is considered basic for two reasons. It is usually the first machine used in the processing line. Seed are first cleaned with this machine and are then conveyed to other machines for the final cleaning and separation. In cases where only one machine is needed or can be afforded, then the air and screen machine is the logical choice. This machine uses screens of perforated metal and woven wire mesh to make separations by size and shape The size of this machine varies from the small two-screen farm model with one air blast to the large commercial types having 4, 5 or even 8 screens and two sources of air. There are over 200 sizes of screens from which any combination may be selected.

When seeds are harvested with a combine, they may contain a high percentage of foreign material, consisting of trash, stems, leaves and freshly killed insects. If this material is green then the seeds will be difficult to handle and dangerous to store until this material has been removed. In cases like this it is necessary to use a scalper prior to the cleaning operation.

After the seeds have been scalped to remove most of the foreign material, further conditioning of the seed may be needed. It may be necessary to put the seeds through a debearder in order to break some seeds apart, remove awns and points of attachment, and remove excess chaff from the seed. This delivers the seed to the cleaners in a condition that will allow accurate cleaning and close grading.

Some seeds must be hulled before cleaning. This is done with special hulling equipment.

material are placed side by side close enough to touch lightly. The rolls are mounted in an incline position and turn in opposite directions, outwardly when viewed from the top. The seed mixture is fed onto the rolls at the high end of the machine. As the seed travel downhill between the revolving rolls, the rough seed are caught by the velvet like rolls and thrown over the sides. The smooth seed continue bouncing downhill between the rolls and discharge from the end.

With some seeds there exists a difference in degree of roundness. These seeds may be separated by using a spiral separator. The seeds to be separated are fed onto the spirals from a hopper at the top. Going down the inclined flights, the round seeds travel at a much faster speed. The momentum of the round seeds increase until they gain enough speed to run over the edge of the inner flights into the outer flight. The other seeds continue sliding down the inner flights to the bottom and are discharged through another spout.

Buckhorn is a definite problem in clover and alfalfa seed. It is also somewhat difficult to remove the seed of buckhorn from these crops with any of the machines previously mentioned. It happens that the seed coat of buckhorn seed is mucilaginous and when moistened with water will pick up any foreign material with which it comes in contact. The buckhorn machine was developed to utilize these characteristics. The machine wets the seed to make it sticky and then applies finely ground sawdust that adheres to the buckhorn seed. This changes the relative size and specific gravity of the buckhorn seed in relation to the clover and alfalfa seed. This makes it possible for a separation to be made on other types of machines.

There are a few relatively new developments in seed processing and handling. Along with these, I might bring to your attention expanding interests in already established areas of seed processing.

Electrostatic separators have been receiving considerable attention as a

recent development in the seed industry. The electrostatic process was developed primarily for use in the area of mining; but has found application in the grain milling industry. We are attempting to determine if it has successful application in the field of seed separation. Successful separation of materials is dependent upon the components of a mixture possesing differing electrical properties. It has been found that relative humidity of the air and moisture content of the seed must be within certain limits before a separation can be attempted. Why some seed separations can be made while others can not, and why all lots of the same mixture do not always react the same are a few of the many unanswered questions concerning this process. Separations that can be made by this process include white clover from pigweed, dock from red clover and hulled Johnson grass from sesame.

The magnetic seed cleaning process is not new when measured by the length of time the process has been available for use. However, its general use has not become as widespread as that of other types of seed separators. Because of renewed interest and study, this process will be discussed under new developments. In the magnetic separation process, iron powder is mixed with moistened legume seed which contain rough, granular, or gelatinous-coated weed seed or other rough material. The iron powder sticks to these materials which are pulled out of the crop seed when the mixture is passed over a magnetized drum. The cleaner is most commonly used on legume seeds containing dodder or buckhorn. It has been determined that all iron powders are not equally effective, and that all hulled Johnson grass can be removed from alfalfa and red clover seed by this process. To my knowledge that is the only way it can be accomplished.

The use of air lift elevators or pneumatic conveyors to convey certain seed has been a tremendous improvement over bucket elevators and other types used.

One big advantage of this type elevator is the fact that it is completely self-cleaning. Seedsmen have noted the wide usage of pneumatic elevators with small-seeded legumes and grasses and are asking about the practicability of using this type of conveying system for larger agricultural seeds. In an attempt to answer these questions for the seedsmen, tests were made involving corn and soybeans. The tests revealed that practically all handling operations damage extremely dry or very wet seed to some extent. It is unfortunate that seed containing the right amount of moisture for safe handling has too much moisture for safe storage.

Another rather recent development in the handling of seed is the Continuous Bucket Elevator with an internal discharge. It has two distinct advantages over other types of bucket elevators. Since there is no space between buckets, the speed of operation can be greatly reduced. As a result of the slowed down operation, there is no seed injury even with very fragile seeds. The reduced speed of this type elevator in comparison with other bucket types does not imply that there is a loss in capacity. Self cleaning is another advantage of this type elevator. The seed are fed directly into the buckets as they pass under the feed hopper. The discharge is complete from directly above the discharge spout. There is also no boot to contain a residue of seed that has so often been a source of contamination on other bucket types.

I would like to take a few minutes to indicate to you the ways I feel the Mississippi Seed Technology Laboratory could be of assistance to a group like this. Our program is divided into three phases of work: research, service and training.

Seed research is the primary objective of the Seed Technology Laboratory. Research is being conducted in all phases of seed technology. In the field of seed testing, research projects are being conducted on the use of seed and seed-

ling characteristics which may be used for identification in certain crops, the tetrazolium test, vigor testing in corn and grain sorghum, and other closely related projects.

Of primary interest to this group would be the research being conducted in the field of seed processing and handling.

Combine harvesting of corn is usually cheaper than harvesting by more conventional methods. However, should this method find use in the harvesting of seed corn, several serious questions would be raised, one of which would include the effect of combining on seed injury. A project is being conducted to find the answers to these questions.

A blending project is being conducted to determine the mechanical procedures necessary to blending a lot of seed to a homogeneous or uniform condition. It includes the development bins, mechanical dividers and other facilities with which seed lots may be more adequately blended.

In addition to these, projects are also being conducted on drying, storage and moisture determination. As previously mentioned, work is also being done on the electrostatic separation of seed, and the effects of air lift elevation on the viability of corn and soybeans.

Better ways of cleaning seed and improving the quality is also of primary importance in our seed research. Tests have shown the gravity separator to be useful in improving the germination in some lots of carry-over corn by removing the light weight kernels which were also of low vigor. The forestry people considered the removal of empty pine seeds from the full ones by the gravity table. This proved to be a money-saving process as 20 percent cold storage space was saved.

Apparently there is no end to the unsolved problems of seedsmen. As a result we are called upon quite often for processing information. Many of the

requests for processing information are accompanied by seed samples of 5 to 10 pounds in size. Obviously, these are much too small to test on the commercial size equipment.

To get around this difficulty a laboratory or model testing section has been set up which contains working scale models of practically all the major types of processing equipment. If a seedsman would like to know whether a certain disc or cylinder will remove this or that weed and will send as much as a five pound sample, the laboratory can supply him with that information.

The models do not always perform exactly like the commercial size equipment. But despite these limitations, we are finding them very useful.

Although the laboratory was initiated principally for research and the appropriated funds are chiefly for research, the facility offered an opportunity to develop a unique seed training program. As developed, it has three main objectives:

1. To provide some general seed training to all agricultural students regardless of their major field of study.
2. To provide a separate and entire seed curriculum for the training of seed specialists.
3. To further the training of persons already engaged in the seed trade through annual short courses for specialized seed groups.

We are attempting to realize these objectives through a curriculum set up under the Agronomy Department in which B. S., M. S., and Ph D. degrees are offered and through annual short courses for the seed groups.

In addition to taking most of the courses prescribed for Agronomy majors, the Seed Technology student gets extra courses in Business Law, Accounting, Agricultural Engineering, and seven "seed" courses. He learns, among other things, how to produce hybrid seed corn, how male sterile cytoplasm and restorer factors are utilized, the effect of boron on seed production of legumes,

some of the problems associated with foundation seed production, the importance of the plant breeder to the seedsman and farmer, the importance of seed treatment and proper drying and storage.

He learns the operation of combines, the principals on which seed separation are made, how to operate equipment in the seed plant, how to disassemble them if necessary, and how to clean them thoroughly.

The student is taught how to draw samples, run purity tests, determine germination, run moisture tests, identify and control important weeds. Considerable time is spent on the study of State and Federal seed laws, the seed trade organizations, seed trade magazines, and government market reports. Every student is given the opportunity of working in the Laboratory when not in class. This provides the Laboratory with needed help and the student with additional experience and financial assistance. When the student graduates he doesn't know everything by any means, but we think he is well enough trained that he can step into private industry and make himself immediately useful to his employer.

The graduate students get the same training as the undergraduates plus more plant breeding, statistics, botany and most important - the research problems. These graduate students, supervised and counseled by the staff produce a considerable amount of research. To date we have been able to provide an assistantship to every graduate student who wanted one and who was qualified on the basis of scholastic requirements set up by the University.

There have been about 40 men who have graduated from the Seed Technology curriculum. They are located in seven states; hardly any two having the same type position but practically all in some phase of the seed business.

To meet the objective of training for on-the-job seedsmen, we provide a short course, sponsored by the Mississippi Seedmen's Association, each spring.

This short course is usually attended by about 225 seedsmen from all segments of the seed trade and from 25 or 30 states and 3 or 4 countries. The seedsmen - students have the opportunity of observing the operation of all machines, running any and all equipment, and testing seeds.

The "graduates" of this short course now number well over 1800.

Through these three phases of our work at the Mississippi Seed Technology Laboratory, we feel that we have something to offer you; through our research by studying basic problems, through our service by supplying you with processing information and our willingness to accept your problem as ours, and through our training by providing well trained men to step into any phase of seed work.