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Pre - Conditioning Considerations

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PRE-CONDITIONING CONSIDERATIONS

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The title is very descriptive of the ideas to be conveyed. That is; "pre" - meaning before; "conditioning" - meaning those activities required to prepare a lot of seed for marketing and planting, and "considerations" - meaning, continuous and careful thought and activities based upon knowledge. Thus, a summary of this discussion can be made in a single sentence - Before conditioning each seed lot there are several facts that should be determined and decisions made based upon this knowledge.

There are many decisions that must be made concerning every bag or truck load of field run seed which arrives at a conditioning plant. Eight of the more important decisions; presented as questions, are:

1. Can the seed be cleaned to company quality standards?
2. Do the seed need drying or pre-conditioning?
3. What conditioning equipment will be used?
4. What is the best cleaning sequence?
5. How will the equipment be set-up initially?
6. What is the disposition of the clean-out and clean seed?
7. Are seed additives needed?
8. Are there special conditioning requirements?

These questions are answered actively or passively on every lot of seed. Professional seed conditioners answer them actively. Equipment operators answer them passively.

So much for theory; a conditioning manager must know the specific characteristics of every seed lot, before he/she starts the conditioning process, to most correctly answer the questions above (Figure 1). Further, the decisions should be made on the basis of knowledge and facts, not ignorance and guesses. In commercial seed

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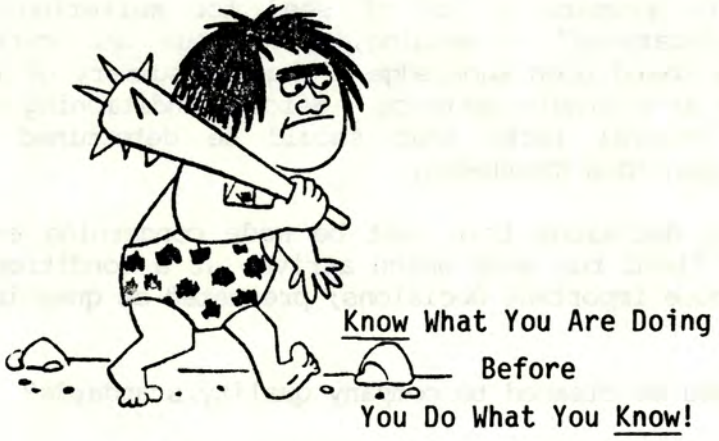
1. Seed kind
2. Moisture content
3. Flow characteristics
4. Frequency of contaminate contamination



5. Differences in physical characteristics.
6. Lot homogeneity
7. Amount of damaged seed
8. Quality potential

Figure 1. Physical characteristics of each seed lot that should be determined before the seed are cleaned.

businesses particularly, personnel are rewarded for their application of knowledge to a much greater degree than the attainment of knowledge, although, knowledge attainment necessarily comes before its application.

The remainder of this discussion is devoted to a more detailed consideration of the important characteristics of each seed lot and suggestions concerning how these characteristics can be determined. Formally, the determination of these characteristics is called a pre-conditioning diagnosis; practically its called a pre-cleaning exam (Figure 2). Regardless of how the characteristics are determined the information gained from an exam is of no immediate value unless it is used to make specific decisions about each seed lot!

There are eight characteristics of every seed lot that should be known before seed conditioning begins. These are: (a) seed kind,(b) seed moisture content, (c) flow characteristics of the seed-mass, (d) frequency of occurrence of contaminants, especially seed of restricted and prohibited noxious weeds, (e) differences in physical characteristics between the good seed and the undesired materials, (f) homogeneity of the seed lot, (g) the amount of damaged seed and (h) quality potential of the cleaned seed. No one of these characteristics is more important than all others for every seed lot!

Let us examine each of these factors in greater detail to emphasize their importance and the methods which can be used to make workable estimates of each factor.

Seed Kind: The kind of seed determines the general physical characteristics which can be used to make a separation, therefore, the machine(s) which can be used for conditioning. Often the variety can make a major difference in the specific adjustments made on the machines as well as the machines used. The number of people working in the seed industry who can not, on sight, identify some of the important crop and weed seeds is rather amazing. Some examples are wheat and rye: ryegrass and tall fescue; sweet sorghum and johnson grass, and dodder and arrowleaf clover. While it is possible to effectively condition seed without knowing the seed kind, it is difficult to believe that any seed conditioner will be effective in making the best decisions concerning the possibility of mechanical injury, the cleaning sequence, the need for drying, etc., if he doesn't know what kind of seed is to be cleaned.

Seed Moisture: Seed with moisture contents in the range of 14-18% are less subject to mechanical injury but will not flow through the equipment as rapidly as seed having 10-12% moisture. On the other hand, essentially all seed must be below 13% moisture for safe storage. The actual seed moisture content is not known on a majority of the agronomic crop seed at the time they are conditioned! The seed are simply assumed to be dry enough for conditioning and storage if

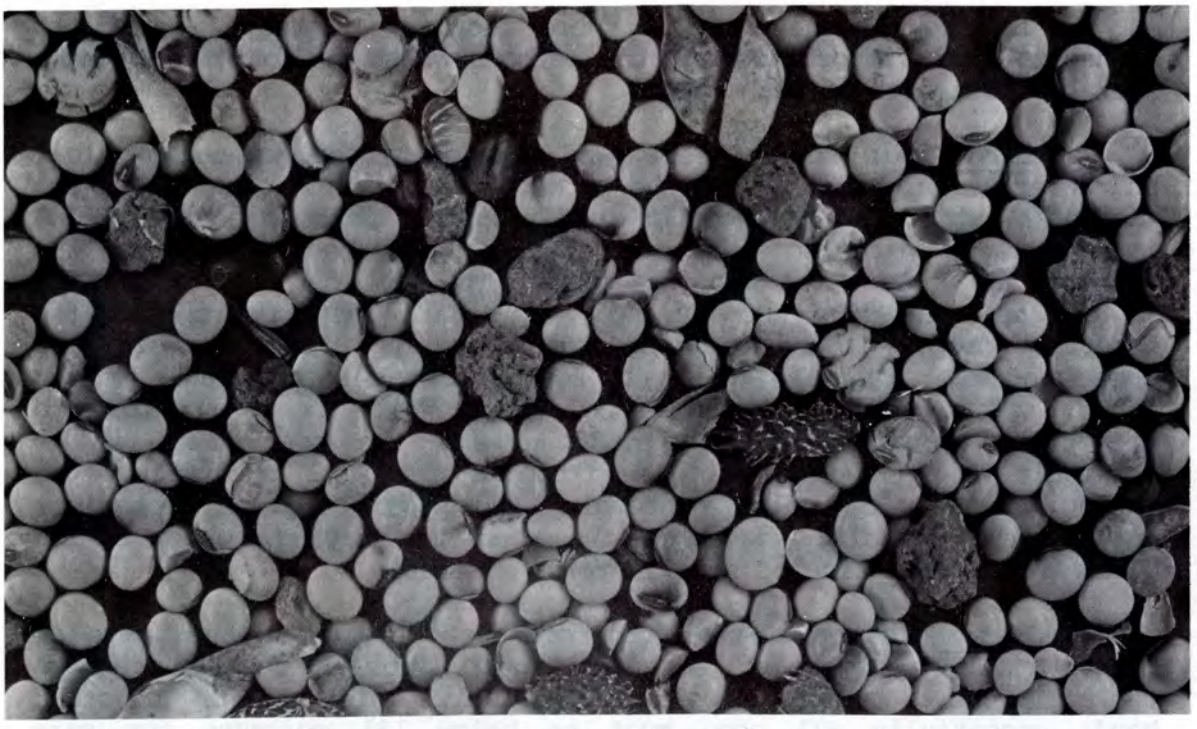


Figure 2. (Above) Performing a pre-cleaning examination; (below) a close-up view of combine run soybean seed used to determine the lot's characteristics.

they were dry enough to be harvested. While this assumption is probably valid 99% of the time, why make an assumption when exact knowledge can be obtained so easily? Among the array of moisture testers available, most are very easily operated and accurate for determining seed moistures within the range of 8 to 28%. Organizations which receive and/or condition seed at moisture contents above 25% or below 7% will need an air-oven to accurately determine seed moisture.

Flow Characteristics: The ease and uniformity with which the seed mass will flow, without mechanical force, is its flowability. A large sample of the entire lot must be used to determine flowability because compaction must be considered in addition to the presence of inert material and natural seed appendages. If flowability is based upon a sample, it should be drawn by hand because probes often exclude large pieces of inert materials which are most likely to cause problems.

Seed must flow uniformly through the elevating and cleaning equipment to make an effective separation. As a general rule, a lot of seed which has an angle of repose greater than 45^{o} should be pre-cleaned or pre-conditioned before attempting separation by the air-screen or other conditioning machines. Anyone who has spent a day poking seed into an elevator or through a bin opening will testify for the need of predetermining the flowability of the seed lot.

Most seed lots which have been harvested and threshed mechanically will flow through a properly designed processing plant. However, an occasional lot of many seed kinds may lack the desired flow characteristics due to natural appendages on the seed, high quantities of stems or straw, high moisture content, or poor threshing. Such lots require pre-cleaning before attempting to separate the good seed. Scalping, drying, de-bearding, re-threshing or use of a hammermill may be required to obtain the desired flow characteristics of the seed mass.

Frequency of Occurrence of Contaminants: This refers to the ratio between the good seed of a lot and undesirable materials. When examining the seed to be cleaned, one may identify several undesirable contaminants, i.e., weed seed, other crop seed, or inert matter. Depending upon the quality standards to which the seed must be cleaned, certain contaminants can be ignored. All clean seed will contain a fractional percentage of inert matter. Many seed lots may contain small amounts of other crop seed or common weed seed after cleaning because the cost of removing these contaminants exceeds the value added by their removal.

Although a visual examination will provide an estimate of the frequency of contamination, a detailed purity analysis is useful for making this determination, particularly when a low frequency of

noxious weed seed is involved. Identifying one johnsongrass seed in a pound of sudangrass is not likely when a quick visual examination of a handful of seed is the primary method of conducting a pre-cleaning examination.

As an example, if the pre-cleaning examination reveals the presence of an occasional oat seed in a lot of non-certified wheat seed, the occasional oat could be ignored. However, if the wheat seed are to be certified, it will be necessary to remove the oat seed. The presence of this oat seed would require the use of length grading equipment, therefore, increasing the cost of conditioning the certified seed. This same example is equally valid for common weed seed and inert matter. Generally the quality standards set by management or, in some cases, by regulation determine what contaminants must be removed from each seed lot.

Differences in Physical Characteristics: A mechanical separation of good seed from its contaminants is possible only when there is a mechanically distinguishable difference in one or more physical characteristics of the good seed and that of each contaminant (Figure 3). What is a mechanically distinguishable difference? The answer depends primarily upon the machines and adjustments available along with the operator's skill in running them. The effectiveness in achieving the desired separation is directly associated with the uniformity of the physical difference identified and the feed rate.

There are eight primary physical characteristics by which mechanical separations can be effected. These are: length, width, thickness, shape, surface texture, weight (density), color and electrical charge. Every seed and particle of contaminating material in a seed lot possesses these physical characteristics; therefore, separations are possible only when mechanically measurable, physical differences exist.

Contaminants which have physical characteristics similar to those of good seed are of greatest concern. When examining the seed lot, particular emphasis must be placed on determining the presence of contaminants such as noxious weed seed, nematode galls, etc., which could cause the seed to be unsalable even though the mechanical purity exceeds 99%. Noxious and common weed seed, seed of other crops or varieties, damaged seed, and inert matter having similar physical characteristics to those of the good seed are of descending importance in most seed lots.

Determination of the basic physical differences by which a particular separation can most effectively be made requires: a knowledge of the specific physical characteristics of the good seed and other contaminating materials. This means that at least a visual examination of a sample from each seed lot must be made.

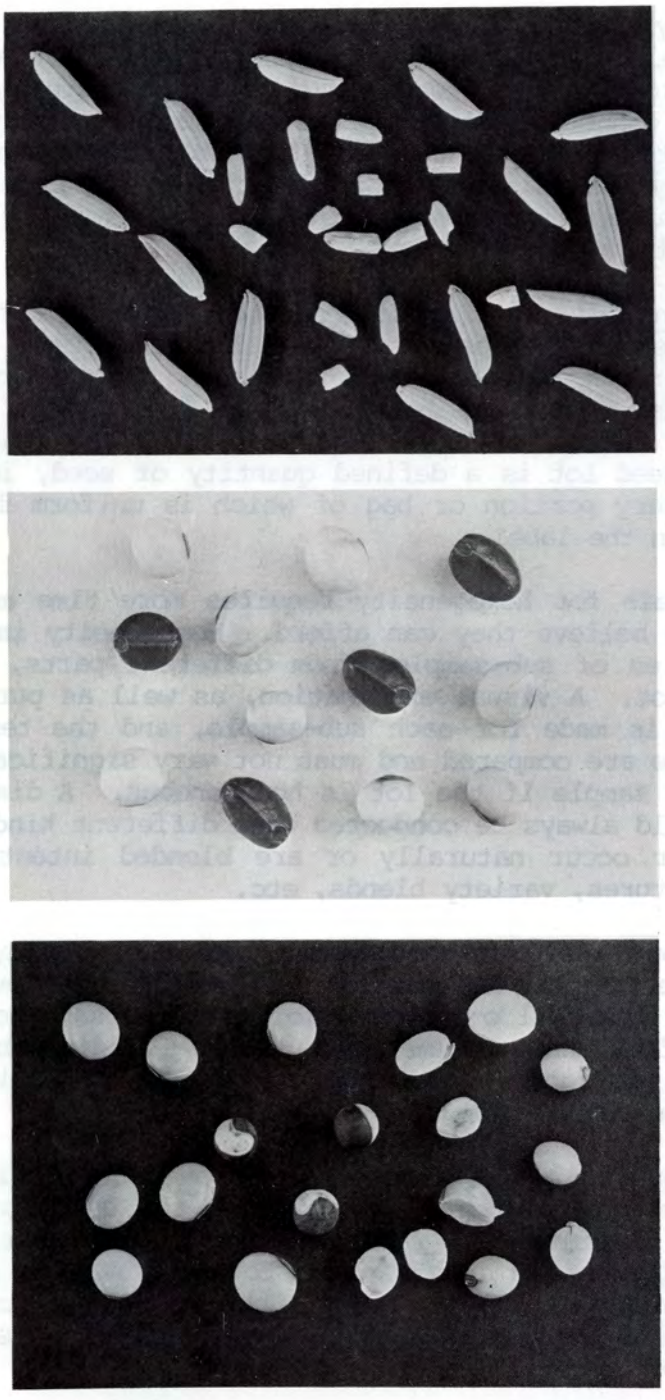


Figure 3. Commercial scale operations can easily separate whole grain and cross broken rice (above); with a lenght separator; separate soybean and giant morning glory (middle) with some difficulty due to differences in shape, but cannot separate soybean and balloon vine seed (below) because of insufficient physical differences.

Ideally, the conditioning manager will have an opportunity to "test" clean each lot of seed with hand screens and model equipment (Figure 4). This permits a precise diagnosis concerning what contaminants can and cannot be separated and an estimate of the clean seed loss required to remove the contaminating materials. The results of a standard purity analysis are desirable but do not provide the needed information for determining physical differences among the good seed and contaminants.

Homogeneity: Most conditioners do not test for lot homogeneity, rather they assume that seed lots harvested from the same field and cleaned through the same set of cleaning and/or grading machines are homogeneous. They are not. Lack of homogeneity is one of the most frequent causes of seed law violations at least for honest seedsmen. A seed lot is a defined quantity of seed, identified by a lot number, every portion or bag of which is uniform for the factors which appear on the label.

Diagnosis for homogeneity requires more time and effort than many companies believe they can afford. Homogeneity is determined by drawing a series of sub-samples from different parts, i.e., bags or bins, of the lot. A visual examination, as well as purity and germination tests, is made for each sub-sample, and the test results for each sub-sample are compared and must not vary significantly from that of a composite sample if the lot is homogeneous. A diagnosis for homogeneity should always be conducted when different kinds or varieties of seed either occur naturally or are blended intentionally, i.e., lawn grass mixtures, variety blends, etc.

The source of non-homogeneous lots can usually be traced to one of three errors on the part of the conditioning manager. These are: assuming that all or any two lots are the same (open end lots), ignoring the fact that contaminants rarely are distributed uniformly through a lot; or ignorance of the realities of blending non-uniform solid particles such as seed.

Just one rain shower or two combines can significantly alter the physical and biological properties of the seed harvested from a single field. Failure to recognize the natural variation brought about by conditions and events prior to the time the seed are first bulked often means trouble. It is much less costly to change a lot number when seed quality may have changed than it is to re-tag an entire lot after receiving a stop sale order.

A false assumption made by many seed conditioners is that the seed harvested from a single production field is uniform. Another false assumption is the belief that conveying the seed from combine to truck, truck to storage bin, storage bin to air-screen holding bin,

Figure 4. Test cleaning a seed lot permits more efficient cleaning operations.

etc., blends or mixes the seed to uniformity. Routine handling and conveying of most seed lots has not, does not and will not have a significant effect on their homogeneity.

Damaged Seed: There are three principal causes of damaged seed: insects, diseases and mechanical damage. Only the more severely damaged of these seed can be separated mechanically, regardless of the source of damage. What is a severely damaged seed? It is a seed or particle which has had one of its physical characteristics altered sufficiently to permit a separation; for example, soybean splits, weevil eaten wheat or rotten corn seed. On the other hand, damage such as cracked seed coats, abrasions, surface molds, etc., is usually not sufficient to permit mechanical separation, although, the damage may be quite evident to the eye.

A visual diagnosis, aided by magnification, may be needed to determine the need for fumigation and/or application of pesticides, as well as the possibilities for mechanical separation of the damaged seed. When insects are active in a sample, the seed lot should be fumigated before entering the conditioning plant and, depending upon the insect, an insecticide applied after the seed have been cleaned. On the other hand, the application of fungicides should be based solely upon the farmer's need for the protection provided. Seed which are so diseased that a fungicide is needed to protect them in storage should be rejected for commercial planting purposes. Pesticides protect seed; they will not bring them back to life.

Quality of the cleaned seed: "Seed of any quality can be sold if the price is right," is a time honored but business bankrupting philosophy of some seed companies. Today, most successful seed companies strive to attain their own or imposed seed quality standards. Specifically in terms of physical purity, seed conditioning personnel are responsible for meeting or exceeding the quality standards. Experienced seed conditioners can, based upon a pre-cleaning exam, judge the final physical quality level of a seed lot before it is cleaned.

Some seed lots can not be cleaned mechanically to the point of having no weed or other crop seed. The equipment available is not important. Weather damaged or discolored seed of good biological quality is unattractive to the potential buyer and may not meet company quality standards even though they meet state regulatory or certification quality standards. The seed conditioner cannot do much after the seed are cleaned and in the bag when these or related problems are encountered?

Does the conditioner have a responsibility to company management to identify and notify the appropriate persons before such seed lots are conditioned? If the cleaned seed will contain a small number of noxious weed or other crop seed, should they be packaged in company

bags? Can sub-standard seed be sold without adversely affecting the company's reputation? Ideally the answers would be yes, no and no but only each conditioner knows the honest answers.

In summary, no two seed lots are exactly alike, indeed no two truck loads of the same lot are exactly the same. Thus, every truck load of seed brought to the conditioning plant should be subjected to a pre-cleaning exam before conditioning starts. One final consideration you should make before deciding whether or not to make a pre-conditioning exam - its your job on the line.