Some Aspects of Seed Grading*

Application of Chemical Methods to Control Purchase of Raw Material by Cottonseed Mills Presents Important Field for Chemists

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THE majority of those connected with the cottonseed crushing industry are in general agreement that the present seed grading plan marks, and in itself, constitutes an advance toward the rational purchase of cottonseed . . . a goal, the attainment of which will do more to improve the status of this industry than anything that we can at present visualize.

Since most of us are closely connected with this industry, we are indirectly affected by its condition. But to the chemists in particular, this grading plan means more than this. At the same time it marks a new era in the application of our science to this industry, not only offering an opportunity to function in a new field, but wholly changing the status of the chemist to mill relationship; it opens a new field of information, rich in its own significance and in its bearing upon other cottonseed crushing problems with which we all, more or less, have been thrown into intimate contact; lastly, it presents a problem which will require all of our ingenuity and capacity to solve successfully.

First, consider the new service we are called upon to offer. It has been felt, perhaps since the very inception of the industry, that successful management to a great degree is contingent upon an exact and opportune knowledge of raw material, in this case . . . cottonseed, value. Many devices have been tried in an effort to supply this information. Probably the first of these to be made use of was past crushing experience. This is still being used, but as it is accumulated it points out its own defects and limitations. Aside from its apparent inaccuracy, it entirely fails insofar as it leads to a tentative conception that all seed are of equal value, something that is manifestly not true. Everyone knows that seed vary from place to place and from time to time and that crushing experience representing an average condition offers no information or measure of this variation. Under this management method, seed buying in which quality and yields were at all considered, soon became a guess as to how much more or less than the average, a certain lot of seed was worth.

Many methods have been tried and used in attempting to eliminate this guess. The mill test was often applied, in which exact quantities of seed were worked and the yields obtained therefrom carefully measured . . . This, of course, offers an approximation, but it was clumsy, expensive and at times, particularly during the crest of the seed movement, impossible to undertake. Besides, the information was always past history and of little value as an index of what might be expected in the immediate future. This effort toward solution has, in the past, called forth sporadic use of chemical analysis. Development along this line was slow due to the impossibility of determining how accurate an analysis might be, and further to the difficulty of translating the chemical analysis into its manufacturing import.

Early Grading Plans

ONE answer to the problem was the early adoption of a seed grading plan applicable at the time of seed receipt. This plan as you know . . . from the quantitative side, was based upon the amount of moisture and foreign matter present in the seed and, indiscriminately mixed, in the qualitative and quantitative phases, upon the percent of damaged and immature seed present. The plan, rough at best, served only to protect the buyer from excessive loss through exceptionally low quality seed. It made no attempt to differentiate one sound seed from another, between which we know there can be a great difference in value. Its qualitative phase was only in the remotest manner indicative of seed condition. The long life of

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this grading plan is perhaps best explained by the difficulties inherent in the grading of a commodity so variable in composition and quality and yielding so many products as does the cottonseed.

As early as 1912, the Bureau of Markets undertook a survey of the chemical constituents of cottonseed. About 1913 or 1914, the investigation was abandoned as not being promising with reference to the establishment of grades. Again in 1924, the grading problem received government recognition when G. S. Meloy, Senior Marketing Specialist of the Department of Agriculture, was invited to meet with the industry then in convention here in New Orleans with the idea of establishing, if possible, grades for both cottonseed and linters. Mr. Meloy first undertook and solved the linter problem, and it was not before 1926 that the seed were given any consideration. The first tentative plan offered by Mr. Meloy was based upon the percentage of meat as a measure of the quantitative value of cottonseed, while the percentage by number of discolored seed was suggested as the measure of quality. In 1927, the percentage of free fatty acid in seed was substituted for that of discolored seed. The development of this plan was slowed and eventually stopped by the impossibility of obtaining a mechanical means for quantitatively separating the meats from the hulls of cottonseed. Mr. Meloy's studies were interrupted by a South American trip during 1928. In the meantime, some of our industry had been studying and investigating the possibility of quantitative seed grading by means of chemical analysis. The possibility of making use of chemical analysis along with certain basic assumptions pertaining to the relative value of ammonia and oil was adopted by Mr. Meloy upon his return, as the most promising means of grading. The first official recommendation to this effect was proposed before the convention of the Interstate Cottonseed Crushers Association in May, 1928. From this proposal, the present plan has evolved.

It is worth pointing out here that the use of chemical analysis as the means of grading is neither perfect nor complete . . . Quantitatively, it gives no direct information on the yields of two products, lint and hulls, which together, amount to from ten to fifteen percent of the seed value. One of its prime assumptions is an average relationship between the value of oil and cake, which like most averages, is rarely applicable. The information that chemical analysis supplies is not what can be gotten from seed, which in fact determines seed value, but rather what seed contain. The criterion of quality is the condition of oil with respect to its acid content, which is still only a very indirect measure of the relative qualitative value of seed. Considering these things, we might well picture the calling forth of the chemists' aid as a step in the evolution toward . . . and not necessarily the final solution of the seed grading problem. The chemist has been asked to perform this new and additional service for the industry, but the issue is still in the balance. There has been and still is much doubt as to whether chemical methods when applied to individual samples can be made accurate and uniform enough to support a grading plan. Although in the past there has been much needless exaggeration of the analysis error caused by its confusion with the sampling error, we know that up to the present the results from chemical analysis alone have not proven entirely satisfactory. Unless rapid improvement in this respect is possible, the grading plan and the opportunity to function in this new field is inevitably doomed to the limbo of "noble experiments."

Seed Analysis at Present

THE present status of seed analysis is about as follows:

A committee from the Bureau of Chemistry and Soils and the Bureau of Agricultural Economics headed by Messrs. Meloy and Jamieson after two years work ending more than a year ago offered a method of analysis, which after cooperative modification and improvement by that committee and the Chemists' Committee of the National Cottonseed Products Association, appears to be accurate to approximately 0.20% in oil and 0.05% in ammonia. Looking over the experience of the past year, it is found that when duplicate samples were sent to different laboratories, and sometimes to the same laboratory, the reported results were often much farther apart than this limit of accuracy would indicate they should be. In some cases when one and the same sample was analyzed twice by one laboratory, variations of about 1.0% in oil and 0.15% in ammonia were reported. This can indicate only that either some error of procedure or some unusual laboratory condition has entered into the analysis. The elimination of these wide variations is at least to some extent the responsibility of the individual chemist.

Such variations, besides being in conflict with and nullifying the prime object of the analysis, may lead to the development of situations having serious consequences to the mill operator. On buying seed, it is usually found that the sellers, particularly those who store large quantities of seed in one house, expect the seed to run uniform in index and incidentally, at the level of the highest preceding analysis. If,

because of a change, real or otherwise, or for any other reason it becomes necessary to run a second test upon a seed shipment and this test does not check the first reported results, then all parties concerned soon come to the conclusion that to get any desired result, it is only necessary to repeat the test often enough. Under such conditions, the only analysis acceptable to the seller is that which corresponds to a premium on seed. The penalties or discounts become no longer enforceable and we have no grading plan. Further, variations in analysis might impair the prestige of a mill operator. Chance low and high results can easily lead to the creation of an unknown reputation as either an acceptable or unacceptable purchaser.

Accuracy of Averages

SOMEWHAT in contrast to the wide variations and apparent inaccuracy of the individual analysis is the accuracy of information, based upon averages. The accuracy of average chemical information, even when only a relatively few analyses go to make up this average, is fairly well substantiated. It appears that the variations occurring in the single test are of a compensating nature. Illustrative of that is a test in which one laboratory on analyzing twenty-five samples in duplicate found variations in the duplicate tests, which in one instance were as high as 0.33% in oil and 0.10% in ammonia. However, the averages of the first as compared with that of the second of these duplicate determinations are no farther apart than 0.02% in both oil and ammonia. In another test of the same sort, where variations in duplicate tests were as high as 0.7% in oil and 0.14% in ammonia, the averages agree to within 0.17% in oil and .01% in ammonia.

A more remarkable indication of the trustworthiness of average chemical information is seen in the results of two tests, each involving twenty-five samples of as many different seed shipments. In each test, two samples were taken, each sample being taken by a different method. The analyzed results of individual samples representing the same seed shipment, differed from one another by as much as 1.6% in oil and 0.25% in ammonia. Still the averages of the different samples agreed in one test to within 0.1% in oil and 0.02% in ammonia, and in the other test to within 0.26% in oil and 0.01% in ammonia. Still another indication has to do with the oil and ammonia accounting of four mills at which the oil and ammonia content of all products, as well as of seed, were determined. When the oil in seed is compared with the oil in products plus the oil produced, the average accounting for the four mills is 101.1% with a maximum of 102.0% and a minimum of 100.0%. Comparing the ammonia in products with the ammonia in seed, the average accounting was 99.7% with a maximum of 101.6% and a minimum of 98.5%.

While average information is irrelevant to the operation of a grading plan, it is of quite some importance to the mill. If correct, through a balance between raw material and finished products, in terms of oil and protein content, a new method of mill accounting becomes available. Again with this information, it is possible to refer our present methods for measuring efficiency back to a determinable and definite basis. This basis, namely, the constituents and the condition of the seed, we already know . . . influences the efficiency of the mill when that efficiency is expressed in our present terms of extraction standard, quality of oil, yield of cake, etc. Lack of seed information has been in the past . . . the last and always unfailing source of alibi for poor results. Almost invariably, the inexplicable in mill operation has been unhesitatingly referred to and satisfactorily explained by seed peculiarities.

Correlative Applications

THERE are other uses to which average information may be put. For example, it may be used to determine the deterioration that has taken place in seed during mill storage. However, with reference to deterioration, it not only measures what has taken place, but it may serve as a guide and as a warning as to whether or not a specific lot of seed is liable to deteriorate. In addition, there is quite a mass of information of indirect benefit that becomes available through the chemical analysis of seed which at first glance appears to be purely theoretical, but which doubtless has real practical value and in itself, is highly interesting. I have reference to the information which the analysis offers us on the quality of seed being produced in certain seed growing territories. Anyone who has been long connected with the cottonseed crushing industry has, before very long contact, developed certain conceptions about the quality of seed from a limited and peculiar territory. Very often, they influence the actual management of the business. It is astonishing how many of these conceptions have been either modified or destroyed by the information which one year's operation of the grading plan has made available. It is surprising, too, to learn through the operation of the grading plan that there seem to be regular types of seed existing over relatively large territories for which it is easy to account. I have in mind two situations in Texas.

Starting from the Brazos River on the north and going southward to the Rio Grande, we

find a regular and gradual change in seed, in which the oil content slightly diminishes and the ammonia content slightly increases. Starting from the coast line and going westward, there is a gradual and progressive increase in the ammonia content of seed. It so happens that the rain-fall map of Texas shows a progressive decrease from east to west, along lines parallel to the Gulf. The correlation of seed to weather, in particular . . . rainfall, is here so regular that you could almost plot the rain-fall map of Texas, using the ammonia content in seed as the basis of information. The southern tip of Texas is an arid section of which a strip along the Rio Grande has been artificially irrigated. It is actually possible to mark the map line . . . separating the irrigated from the unirrigated section by the difference that exists, in the average chemical analysis of seed. The unirrigated portion of the valley grows a higher ammonia and lower oil content seed than the irrigated portion.

It is all this secondary, but still valuable information that makes desirable the grading of seed by use of chemical analysis. From the standpoint of utility, the multiple function of chemical analysis is very impressive. Because of this, it will doubtless have a decided effect upon the relationship of the chemist to the mill. At present, the superintendents and managers in most of our mills picture the chemist's prime . . . if not sole function to the pointing out of mistakes that are up to the superintendent to correct. Now for the first time, the chemist is offering information which will help in the explanation, solution and avoidance of mill problems and difficulties. You will find most of the mills making a real effort to utilize the information offered by the seed analysis. The new possibilities offered will inevitably bring about a change of the mill management's viewpoint. They will make the chemist the operating ally, rather than the judge of the mill operation, which in turn will lead to a reduction of any existing resistance to further application of chemistry to mill problems.

These many ramifications of the chemical analysis indicate the present type of grading plan to be one, which if effective, will work not only to the benefit of the farmer, but also to the mutual benefit of the chemist and the mill. The industry has offered the opportunity. It is the job of the chemists to provide the means. So far, and perhaps of necessity, progress in proving the efficacy of chemical analysis has been slow. Nothing will contribute more to this progress than wholehearted cooperation and a sustained effort by the individual chemist to apply all his skill to the everyday seed analysis.

Palm Oil Industry of Nigeria

The Bureau of Foreign and Domestic Commerce has received from Trade Commissioner Schwarz, Accra, Gold Coast, an extensive report dealing with the many phases of the palm oil industry of Nigeria. This report is available for the asking to those interested and who may transmit requests to this section.

Some of the high lights of the report are the following: The revelation that the native women and children in the oil palm belt of Nigeria crack out by hand well over a quarter of a million tons of palm kernels annually; that the barter of products for merchandise was officially abolished a year ago, but still lingers on in some sections due to native volition, preference and custom. Tree climbing in palm nut gathering assumes the aspects of a profession in some parts of Nigeria. The government is experimenting with an orderly planting program to eliminate stands of "bush" palms. The standards of quality of palm oil and kernels have been vastly improved by enforcement of grading regulations and last year this inspection was extended to 400,000 tons of produce. The installation of bulk palm oil loading and storage facilities is progressing steadily at different river points.

The government is now engaged in a scheme to promote the attainment of better quality native oil by the introduction of modified mechanical equipment and the offer of a subsidy to approved mills that may be constructed. To date, however, advantage has not been taken of the government's offer. Adoption of mechanical equipment by natives is meeting with more success. A detailed description is given in the report of native methods of producing soft and hard oils; also data are included giving exports, relative importance of different ports, average monthly prices at various stations.

Procter & Gamble Co., Cincinnati, is sponsoring a new radio broadcast program over the National Broadcasting System's chain. Beginning July 7 Eddie East and Ralph Dumke, "The Sisters of the Skillet," started a series of broadcasts three days a week from 8:45 to 9:00 P.M. over the NBC-WJZ network.

The total area sown to sesame seed in India during the 1930-31 season is estimated to be 5,551,000 acres and the production to be 523,000 tons. Last season the acreage was 5,345,000 acres and the production 455,000 tons.