BASIC RESEARCH COMMITTEE REPORT FOR 1924-25

By E. R. Barrow

The committee met at 9 A.M. Monday, Nov. 10th, in the Directors' Room of the Cosmos Club. The following members were present: Dr. David Wesson, New York, Mr. H. J. Morrison, Cincinnati, Mr. P. S. Tilson, Houston, Mr. L. N. Geldert, *Secretary*, Memphis, Mr. E. R. Barrow, *Chairman*, Memphis.

After a two-hour discussion of the four major problems of the Basic Research Program, which was proposed at the committees' conference in October, 1921, both with reference to results accomplished and new recommendations to be offered, the committee adjourned to pay its official respects to Dr. E. D. Ball, Director of Scientific Work, Department of Agriculture, according to appointment.

Dr. Ball received the committee most cordially and for forty-five minutes discussed the progress of the investigations with which he was thoroughly familiar, and assured the committee, as he had done at our previous conference, that the only limitations upon the Department's cooperation would be the lack of sufficient appropriations and the necessary legal authority. In this discussion, he laid great stress upon the economies of government under the present administration, and intimated that there might be a necessity for a still further reduction in the Department's activities.

The committee then called upon Dr. C. A. Browne, Chief of the Bureau of Chemistry, and together with Dr. Geo. S. Jamieson, Chemist in Charge Oil, Fat and Wax Laboratory, repaired to a nearby café for luncheon. While at luncheon the group was joined by Dr. Powers, one of the oldest men in point of service with the Bureau of Chemistry and one of the most able organic chemists in America. For the past year Dr. Powers has been engaged in the study and analysis of the cotton plant, root, stem, leaves, fiber and seed. Very briefly he outlined his work and some of the interesting discoveries made.

The most notable and interesting point is the extraction and identification of a substance known as trimethylamine, having a fishy odor, being non-poisonous, and to which he attributes the attractiveness of the cotton plant for the boll-weevil. Having identified the substance, it was then found that herring brine provided a practical and abundant source of this compound. Quantities have been prepared and sent to the Delta Experiment Station at Tallulah, from which most gratifying results have been reported. Dr. Coad reports that the weevil will leave the cotton plant for this substance placed upon other foliage, which would undoubtedly provide a means of decoying and poisoning the weevil more easily. Several members of the committee recognized in the odor of this compound the

characteristic odor of raw cottonseed soap stock. The committee then adjourned to Dr. Browne's office, where the entire afternoon was spent in conference with the different men engaged in researches related to cottonseed products.

Dr. E. W. Schwartze, pharmacologist, outlined his studies of the gossypol content of cottonseed kernels, together with the feeding experiments to determine its poisonous effect upon animals. In the first stage of these investigations it was found that gossypol was contained in the kernels of every sample of cottonseed examined, the samples being collected from a widely scattered territory, varying from 0.27% in Texas seed (Lone Star) to 1.018% in Sea Island. A fairly true relationship was found to exist between the gossypol content and the oil content of the seed. The second stage of the investigations consisted of feeding experiments on cats, rabbits and rats. In all of the experiments gossypol was separated from cottonseed kernels and fed in other rations to healthy animals in large doses, and in each instance the animals soon exhibited symptoms of cottonseed meal poisoning, many dying. The data and results of these experiments are carefully recorded in published bulletins.

The results of these tests seem to bear out the conclusion that the toxicity of cottonseed kernels is due to their gossypol content. While the cottonseed industry has been reluctant to admit that cottonseed or any of its products possess a toxic principle, yet cases of cottonseed and meal poisoning have been known, and with certain classes of animals their use is attendant with certain dangers which are not inherent in products of a similar nature. While perhaps discouraging for the time being, their investigations will undoubtedly clear up much of the diversity of opinion regarding the causes of the injurious effects when found and establish a basis for further investigations, leading to a complete control or elimination of this toxic substance. This conclusion seems to find confirmation in the fact that cottonseed poisoning is less feared in Texas and the Southwest than it is in the Gulf and Atlantic States, where the oil content is higher and a correspondingly high gossypol content was found.

Dr. Schwartze expressed the belief that a process of treatment or manufacture might be found to completely detoxify cottonseed meals. It should be said that all investigators working upon this project have experimented with cottonseed kernels, and that no one has so far ever been able to extract gossypol from cottonseed meal. It is known of course that the toxicity of cottonseed meal is much less than that of the seed or kernels. This is explained by the theory that gossypol is oxidized to a less toxic form during the cooking process and exists in the meal as a sparingly soluble compound designated as D-gossypol. Dr. D. B. Jones, of the Protein Investigation Laboratory, outlined his studies on the proteins of cottonseed meal.

The principal protein of cottonseed meal is known as globulin, and was separated from several samples of commercial meal. Digestion experiments *in vacuo* were conducted upon the separated globulin in comparison with the animal protein casein which is regarded as the standard of measure in digestive experiments, and it was found that with pepsin and trypsin the protein of cottonseed meal gave fully as high a percentage of digestion as did casein, corresponding to practically 100% digestibility. Dr. Jones concludes that the proteins of cottonseed meal are comparable to meat proteins, and suggests the possibility of the development of a suitable meat substitute. Further studies have been made of the effect of the addition of gossypol upon the digestibility of globulin and casein *in vacuo*, and it was found in both instances the addition of gossypol greatly reduced the digestibility of the protein.

In the case of globulin it was found to be 83% digestible, which corresponds to the average of digestive experiments on the proteins of cottonseed meal *in vivo*.

Dr. Geo. S. Jamieson, Oil, Fat and Wax Laboratory, outlined his investigations upon the constituents of crude cottonseed oil, having previously reported the method developed for the estimation of the amount of neutral oil in any given sample. Dr. Jamieson's investigations for the past year have been upon the settlings or non-oil constituents from crude oil in which he has found phosphatide, a plant lecithin, and a vegetable mucilage, but has been unable to obtain any evidence of the presence of a true gum. The study of their constituents is interesting from the fact that it is the non-oil constituents of crude oil which supply the emulsifying agents upon the addition of caustic soda and thereby have a very important bearing upon the losses obtained in refining. Dr. Jamieson is continuing this work and is hopeful of being able to supply a basis upon which might be developed a means of controlling and reducing refining losses.

Mr. George F. Bidwell, Cattle Food Investigation Laboratory, who for a number of years has had very close contact with the Interstate's committee on cottonseed meal standards and definitions, was present and expressed satisfaction with the present status of this question. He emphasized particularly, however, that the Industry for its own protection should concentrate effort on perfecting a more uniform product which will stand up to guarantees and stated that his department would look with favor upon some plan of certification of cottonseed meal shipments which was the subject of several articles in the October *Cotton Oil Press*. As tersely expressed by Mr. Bidwell, "41.5% cottonseed meal, plus a check for the deficiency, is not the equivalent of a guarantee of 43%."

Dr. Bidwell has developed in his laboratory a very rapid, simple and accurate method for the determination of absolute moisture in organic products, which will supply a long felt want and which will undoubtedly re-

place the present unscientific, inaccurate and unreliable method whenever the importance of the moisture content enters into the valuation of any commodity. The absence of such a reliable determination is all that has prevented the settlement of differences in protein content being made on a dry basis. The committee visited Dr. Bidwell's laboratory on Tuesday morning and witnessed a demonstration of this method.

Dr. Marion Dorsett, Chief, Biochemical Division of the Bureau of Animal Industry, received the committee very cordially, and outlined a policy of the fullest coöperation in keeping with the limitations of the Bureau, which relates to animal products and their bearing upon other products having a kindred nature and use. The subject of interest to this committee under investigation in this Bureau is the problem of rancidity in fats and their physiological effects.

Mr. William C. Powick was invited before the committee and outlined the work he has been engaged in for the past year. This included the study of the products formed during the development of rancidity, together with the correlated investigations of the effect of air, light and metals upon the development of rancidity. The identity of the compounds developed in rancid fats have been quite clearly defined, and at the present time the work under Mr. Powick is confined to a study of the physiological effect of rancid fats upon animals—white rats being used for the experiments. Mr. Powick has so far been able to observe that the rats fed upon the rancid fats are not thriving so well as those fed upon sweet, wholesome fat of the same origin. A rather peculiar and interesting contradiction has developed in these investigations, namely, Dr. Steimetz has recently published the result of investigations proving that freshly refined cotton oils are lacking in A-vitamines, which deficiency is readily supplied by exposure of the oil to light. As light is known to produce rancidity in fats and oils, this inconsistency regarding its nutritive value is yet to be reconciled. In this connection, Dr. Jamieson has recently made some interesting experiments consisting of the exposure of photographic plates in a dark room to the influence of refined cotton oil which had previously been exposed to light, in comparison with oils which had not been so exposed. In the former case a well-defined photographic impression was developed, while the unexposed oil produced no effect. This might seem to indicate that light exposed oils have some property of radio-activity.

Mr. Robert Kerr, Meat Inspection Laboratory, and Messrs. George E. Holm and George R. Grunback of the Bureau of Dairying, have made extensive studies of the subject of rancidity, but the time limitations of the committee prevented a review of their work.

Dr. W. W. Stockberger, Chief, Bureau of Plant Industry, has been temporarily detached from the Bureau of Plant Industry, and Mr. A. F. Sievers, who for the past year has been engaged in the analysis of cotton-

seed of different varieties from a number of locations, in coöperation with the Office of Crop Acclimatization, is temporarily on assignment to California. This problem is the development of varieties of cottonseed which will yield fiber of the maximum value, together with the maximum percentage of oil, and the effect of cultural conditions. While the results, so far tabulated, are insufficient for definite conclusions, they strongly indicate that if the work is extended through a number of years it will be possible to establish some definite facts regarding the relationship of seed values to varieties, and to general cultural conditions. Dr. Stockberger personally assured the writer that the work would be continued along even more extended lines during the present season. The writer again offered the gratuitous service of the firm of which he is a member, in handling some of the analytical determinations, as was done on all the samples (about 250) examined last year. At 12.30 P.M. the committee repaired to the Cosmos Club, where it had invited to luncheon those men in the Department who had been interested in, and actively engaged on, the program of research.

Those present besides the members of the committee, were: Dr. C. A. Browne, Chief, Mr. D. B. Jones, Mr. George S. Jamieson, Mr. George F. Bidwell, of the Bureau of Chemistry; Dr. Marion Dorsett, Mr. George E. Holm, Mr. William C. Powick, Mr. George R. Grunback, of the Bureau of Animal Industry; and Dr. W. W. Stockberger, of the Bureau of Plant Industry.

This luncheon, which was strictly informal, afforded a most favorable opportunity for a closer personal contact and an informal discussion of many phases of the work, and was thoroughly enjoyed by all.

The committee was unanimous in its opinion that this meeting in Washington, the first since 1921, was exceedingly profitable and valuable. On the other hand, the scientists engaged in the research investigations, looked upon the visit of the committee as affording them new inspiration and incentive in their work. Much valuable work has already been accomplished, and much is under way, or projected. The disposition of the Department is to coöperate with our Industry to the extent of its limitations. It remains for the Industry to direct and utilize these powerful allies to its best advantage. The committee is unanimously and firmly of the opinion that such conference as has just been held should be held at least once a year, and it is hopeful that the Interstate Cottonseed Crushers' Association, through its officers, will recognize the value and importance of this work to the extent of insisting that the close contact already established be maintained.

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