Summary of the World Soy Protein Conference

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The World Soy Protein Conference, attended by over 1100 delegates from 46 different countries, opened with welcoming remarks by *K. Fangauf,* president of the Conference, *W.B. Tilson,* president of the American Soybean Association, and *J. Baltes,* president of Deutsche Gesellschaft für Fettwissenschaft. These men encouraged the delegates to take a more active, positive attitude toward progress in developments of society and to help establish nutritional standards by which this developing area of the food industry will be allowed to grow. They also noted that, since a part of the Conference was to deal with the political aspects of nutrition, the delegates should engage in discussion which would provide guidelines and decision-making tools for future legislation. They said that the main thrust of this Conference was to deal with the problem of converting the natural protein of soybeans directly into human foods.

The Conference was honored by the presence of a number of governmental dignitaries who participated in many Conference activities. Addressing the Conference were *Earl Butz,* U.S. Secretary of Agriculture, and Minnesota Senator *Hubert H. Humphrey,* former U.S. Vice President. In addition, two U.S. Senators, *Carl Curtis* of Nebraska and *Walter D. Huddleston* of Kentucky, attended the Conference and gave brief statements encouraging the delegates to work hard at their tasks.

The first plenary session was devoted to a discussion of world protein markets. *U.S. Secretary of Agriculture Butz* addressed the Conference and noted a distinction between protein deficiency and protein desire. The increased desire (demand) for protein has increased bean prices, but he noted that price levels must remain high enough to assure profits if the producer is to continue reinvesting in production of the commodity. *Secretary Butz* pledged that the U.S. is determined to be a global supplier of farm commodities but in return asked that U.S. producers be assured of the freedom to market through a liberal and expanding system of world trade.

Butz said that U.S. agriculture has moved in the direction of a free market system, allowing freedom for producers to respond to the demand. An international food policy that is effective and workable must include an expanding system of trade. In the next generation, he noted, we must learn how to feed another three billion people well, not just feed them on a subsistence diet but feed them well. That is a great challenge to all of us, a challenge to "make eating an exciting experience." *Secretary Butz* quoted from Ghandi when he said, "Even God may not approach a hungry man except in the form of bread." The language of food crosses every boundary and that is the language we speak. Therefore, expand the horizons of peace—the charge from *Secretary Butz.*

J. Coppock keynoted the first plenary session. He briefly noted that, while soybeans have long been a food source in the Orient, the western world has been slow in adopting it for direct human consumption. He explained the emerging role of the soybean as a vital protein source and emphasized the challenges to improve yields, adapt the crop to more tropical conditions, and improve qualities of processed soybean products.

In the second plenary session, discussion focused on commercial soy processes and products—how a range of products from full-fat soy flour to defatted flour can be used to increase proteins in a variety of bakery products and how soy concentrates and isolates can be used in meat products both to increase protein content and to improve eating quality. Also discussed in this session were new soy products, such as extruded textured soy protein, meat extenders, and spun fiber textured products used as meat substitutes. All papers in this session stressed the nutritional quality of the products in terms of protein efficiency ratio, amino acid composition, and the elimination of various inhibitors. *F. Horan,* in describing the growth of the U.S. soybean industry from 5 million bushels 50 years ago to 1.5 billion bushels this year, called attention to the fact that the main use of soybeans is still for the feeding of livestock. Only ca. 3% protein currently is used in foods. Special processing is required to prepare protein to meet various specifications of the food industry. Methods used to produce flour and grits, spun fibers, textured proteins, concentrates, and isolates were described adequately and well.

The second part of the second plenary session was composed of discussions on the nutritional and functional properties and quality criteria of soy protein products. *W. Pringle* discussed the preparation of full-fat soy flour, which contains 40% protein, 20% oil, and 7% moisture. He noted that the functional and nutritional properties vary with the heating of the beans prior to grinding; unheated flour contains active enzymes and other factors that improve the color, softness, and shelf-life qualities of bread, while heated flour has excellent nutritive value and partially denatured protein.

R.L. Kellor described the products of defatted soy flour and grits which are the easiest forms of soy protein to produce in modern processing plants. These products have superior nutritional values and possess functional qualities which make them versatile ingredients in other food products.

K.F. Mattil described soy concentrates with 70% protein and isolates with 90-95% protein and the special techniques by which they are manufactured. He urged that food chemists try several soy products to determine which work best in a particular food system.

M.M. Hamdy dealt with extruded textured protein which has been used extensively in pet and human foods as extenders, noting that by careful processing, high quality, safe, and economical protein food can be prepared. Textured soy proteins are an excellent example of man's creative ability to engineer a supplementary food that is nutritious, palatable, and also economical, he stated.

D. Rosenfield described spun fiber textured products, especially those made by the Miles process, into essentially a simulated meat which resembles meat both in taste and texture. He noted that spun fibers also are used as extenders in meat, such as ground beef. He pointed out that meat analogues also add an important variety to the diet.

H. Gremli spoke about the interaction of flavor compounds with soy protein, describing the methods of determining the binding or interaction of flavors. He noted that alcohols do not react with protein but that aldehydes, especially unsaturated aldehydes, react strongly.

E.H.M. Gruell's paper described some of the interesting work done in the identification of flavor compounds. By studying soy protein solubilities, it may be possible to develop new protein products directly from soybeans. Though the new products described are not yet marketed, they do conform to governmental specifications.

In the third plenary session, regulatory controls were the topic of discussion. In every area of the world on all

governmental levels, there exist regulations relating to the use of soy products in foods. The theme set by speakers in this session was the need for cooperation among processors, consumers, and government in the development of regulations which will encourage, rather than inhibit, the development for food products from soybeans.

V.O. Wodicka described the role of the U.S. Food and Drug Administration (FDA) in the process, noting that the FDA, in effect, prepares a list of acceptable products which the U.S. Department of Agriculture (USDA) then can pass upon as acceptable or unacceptable for use in poultry and meat products. He noted that the FDA is trying to make a variety of plant protein products available to the consumer and hopes not to impose burdensome regulations on a new and expanding soy protein technology.

H.C. Mussman explained that the USDA has proposed several changes in existing regulations to provide for more flexibility. These would describe textured soy protein products and would permit their use, providing labeling is adequately descriptive. Comments now are being reviewed and evaluated prior to final implementation of the regulations. He said that the USDA will change regulations as new data become available and that the Department will work with the industry and others to encourage the development of new uses of protein resources.

A.G. Ward described the responsibility of the manufacturer in the United Kingdom for safety and avoidance of deception, describing a rather complex system of food regulations. The accession of the U.K. into the European Economic Community creates problems in attempting to harmonize food laws, especially to accommodate soy protein foods.

J.N. Czarnecki described the role of industry in the regulatory process. He noted that textured soy protein is permitted in nonspecific products and that, while different states have different and often complicating regulations, industries under the USDA and FDA are working to develop a rational set of rules. He suggested that this Conference take the lead in encouraging world-wide cooperation in the development of regulations controlling the use of soy proteins in foods.

T. Watanabe spoke of activity in Japan in the development of soy protein foods. He described several new developments in that country, including the development of texturized soy protein by freezing, the removal of beany flavors, and others. He stressed the overriding concern that regulations will not be imposed prematurely upon their rapidly developing industry.

Senator Hubert Humphrey of Minnesota spoke to the delegates on Tuesday morning. He was forceful in his concern that the scientists and technologists gathered at the Conference be aware that their activities will be conditioned by the political viewpoint and that they should, rather than talking only to themselves, spread the message of their work to the people of the world. He stressed that the vast majority of people, hidden in urban areas, are poorly educated on the subject of food, food supplies, and nutrition. The Senator also spoke of the food supply as a source of world tension and the need of adequate food and nutrition in the quest for peace. He noted that the world depends upon the U.S. for food and that the U.S. depends upon the rest of the world for imports, such as oil, to produce these foods. He called for an end to blackmail politics. The world carry-over of foods and feed grains is only ca. 27 days, and *Humphrey* expects some form of national or international food policy with plans to set up stragetic food reserves. Expanding trade makes it mandatory that all governments allow the use of protein products when they are properly identified and properly used. Food is the new currency of international trade; and, he noted, we can starve in the midst of plenty if there is no way to transport our products and distribute them. "The age will be known," *Humphrey* said, "as the protein crisis decade. We cannot afford to let happen to food what has happened to energy." He called for a world-wide protein research network with the first step being the establishment of a joint Sino-American protein research institute. These two nations produce 90% world's soybeans; and, he said, it behooves such cooperation in the development of this crop. This cooperation should have the joint objectives of a breakthrough in per acre yields of at least 50% over the present yields and the development of varieties that flourish in other areas, especially the tropics.

At the conclusion of the plenary session, *A. Mergell* of the German Seedcrushers Association presented a $5000 check to *Tilson* of the American Soybean Association to be used to promote research in soybean breeding.

The fourth plenary session covered soy flour in bakery goods, mixed flour, and concentrates in meat products, textured protein in meat and meat-like products, including the introduction of blends of ground meats and packaged texturized protein at the retail level. There is obviously a well-developed use of soy in breads, dairy products, and meats; and there is more and more tendency among scientists to engineer foods to meet special needs and consumers' demands.

R.H. Cotton discussed the addition of soy to breads and bakery products. Today white bread in the U.S. contains 1.5-2 lb soy flour/100 lb wheat flour. It can be used up to ca. 3% without much change in absorption, mix, or loaf volume, as compared with non-fat dried milk solids as the additive. Larger amounts of soy flour, for example up to 12%, require less mixing and the addition of some emulsifiers. Taste panels can detect no difference in white bread when up to 2% soy flour is used. Flavor limits its use at higher levels. Last year 50 million lb soy products were used in bread, ca. 7 million in doughnut mixes, and 14 million in cocktail-type crackers and similar products. A cake-type product, called Astrofood Cake, contains 2 1/2-4% soy flour and appears to be quite acceptable in school lunch programs. Future soy products with improved flavor should find a much expanded market in bakery products.

T. Jakubczyk described his work in Poland with soy flours in various types of bread. The addition of soy flour increased the nutritional values, as well as produced breads with better loaf volumes and retarded staling.

J. Rakosky, Jr., described the use of soy grits, flours, concentrates, and isolates in coarse and fine ground meat products. In general, meat-soy products had reduced shrink, better dimensional stability, better taste, and were juicier.

D. Wilding, in his paper on textured proteins and meat-like products, predicted a market for 2-4 billion lb hydrated textured soy proteins by 1980. Textured proteins are used in meat products to lower costs, improve functionality, reduce shrink, give better stability, hold fat and moisture, and give added nutritional properties.

The development of a meat-soy blend that is retailed at supermarkets was described by *M. Wolford.* This product consists of 25% rehydrated textured soy protein and 75% ground beef and in some places outsells plain hamburger. The retail price is ca. 20% below the straight ground beef price. The cooked product has the same protein content as ground beef but is lower in fat, calories, and cost.

R. Ohlson described how positive action in Sweden resulted in the legal recognition of soy proteins as ingredients, not additives, which reduced the discriminatory tax on products by 75%. This program also changed the bad image which soy proteins had in the news medium.

A.A. Levinson and *J.F. Lemancik* talked about soy protein in a variety of foods, mentioning that ca. 30 products now are available on the market. Users will have to determine which ones best meet their needs in such products as coffee whiteners, soy milks, cream toppings,

baby foods, puddings, cheese-like foods, margarines, pancakes, waffles, doughnuts, cake mixes, cookies, toppings, snack foods, crackers, pie crusts, pasta products, high protein soups, soy nuts, gravies, dusting powders, soy sauces, breakfast cereals, candies, and confections. No one soy product offers all the desirable characteristics for a particular application.

The fifth plenary session dealt with the use of soy products in national and international food programs.

F. Senti noted that over 100 million people in 90 developing countries have been reached by U.S. food aid programs since 1954. Soy protein products were introduced into the overseas donation program in 1965 as a component of foods to meet special needs of certain population groups, particularly children. The first formulated soy food was a corn-soy-milk (CSM) product. Over 2.8 billion lb CSM were purchased by the USDA since 1966. Two modifications (instant CSM and instant sweetened CSM) also have been distributed. A wheat-soy blend (WSB), at a lower cost, is available. Several other soy fortified foods have been supplied to the overseas food program. In fiscal year 1973, over 1 billion lb soy fortified foods will have been distributed. The USDA pioneered the use of soy proteins at home and abroad in cooperation with Agency for International Development programs. Soy protein foods also play an important role in domestic food assistance programs. Textured proteins are increasingly popular in school lunch programs.

The Memphis school system has successfully used textured vegetable protein in its lunch programs, according to *J.T. McCloud.* He cited the advantages of these products as being: (A.) handling ease, (B.) long shelf-life which permits quantity purchases, (C.) dry storage which is cheaper than refrigerated storage, (D.) no objections by the students to its addition in foods, (E.) good absorption qualities which allow the purchase of ground beef with 30% fat rather than 22% fat, (F.) an innovative approach to the school food services, and (G.) source of large quantity of protein at low cost.

M. Higgins, representing CARE, described in vivid detail the use of soy proteins in that organization's efforts. She stressed that precooking and the use of a sweetener for acceptability by the consumer were vital to successful use. She also called for less waste due to spoilage, misappropriation, and mislabeling, suggesting that better packaging may be of help in eliminating such wastes.

G.H.W. Hutton outlined the World Food Program's efforts to distribute $1.2 billion in food, primarily for work projects. The U.S., he said, is the only country to offer soybean protein products.

F.R. Ellis discussed the Food for Peace program in the U.S. The Title I part was on concessional credit terms, while Title II was a free program. Title II supplied foods to voluntary agencies around the world, and soy fortified and blended foods evolved through this program. The American processors, he pointed out, made tremendous contributions to this joint program. He also called for joint responsibility for family planning and food planning, calling attention to our biological urges to reproduce and to eat. In the future, the U.S. contributions to this food program will be continued, even if it requires some export control to make products available. Ultimately, commercial viability of the products is important to such a program; the difficult problem is eventually to sell a product of higher quality at a higher price.

G.K. Parman said that the thrust of the Agency for International Development's food aid program is to help developing countries become self sufficient in food. He cited work being done at the University of Illinois and the University of Puerto Rico to develop tropical varieties of soybeans and to develop methods to use the beans directly as food.

Four speakers used the sixth plenary session as a forum for the discussion of nutritional aspects of soy protein foods.

G.G. Graham and *J. Baertl* talked about the effectiveness of soy cereal foods and reported that a variety of cereal-soy combinations can be used as the only protein source in diets of growing children. More careful, sophisticated processing can further enhance the value of such foods.

F. Balla also discussed protein requirements in comparison with the protein qualities of several foods with and without soy added.

G. Karpati described a number of Hungarian foods containing soy products.

J. Rackis's paper presented a very complete review of the many biological and physiological factors in soy protein products.

In addition to the plenary sessions, there were four round-table discussions. These panels attempted to answer many of the questions which arose during the plenary sessions.

Round-Table I, with *H. Wolff* as chairman, dealt with soy protein in cereal products. The discussion centered around the economics involved. There was general agreement that a special governmental subsidy program is essential to an expanded use of these products in many parts of the world. It was further agreed that the technology for increased use of soy in cereal products is available but has not been implemented.

Soy protein in meats and meat by-products was the topic for Round-Table II, chaired by *W. Henry. R.G. Schweiger* discussed the use of isolates and concentrates in meat. *S. Kikuchi* presented a brief history of soy protein isolates in Japan and stressed the importance of quality. *K. Yasuda* emphasized that the development of textured vegetable protein products is necessary to avoid meat shortages, noting that the problem of acceptance has been in the areas of flavor, color, texture, and labeling. *A. Frouin* stressed the necessity of a quantitative method for the detection of edible soy protein. He reviewed various methods, but the one that gave most favorable results was an electraphoretic method combined with a physical separation. Added levels of 1% soy can be detected with accuracy suitable for commercial quality control. *A. Lacourt* indicated that considerable education of regulatory officials and consumers in France was necessary before wide acceptance of soy products there. *L. Roberts* discussed the development of an objective test to explain the physical and functional qualities of soy proteins in comminuted meats.

Round-Table III, with *E. Meyer* as chairman, centered its discussion around the use of soy protein in dairy-type foods, beverages, and other products. The crucial problem in these areas seems to be flavor. Current research may be close to resolving this problem. Also discussed was the problem of empirical standards for nutritional adequacy as related to nutritive requirements. There is a great need for soy protein products having a diversity of functional properties to fill the needs for varying end uses. Cheese-like and other simulated dairy products are generating a great deal of current interest.

Round-Table IV, chaired by *A. Altschul,* focused upon the nutritional aspects of soy protein foods. It was noted that though the quality of protein varies in different foods, it is generally good in all products prepared for food use. For maximum nutritional value, soy protein should be supplemented with methionine, preferably in the form of another protein high in this amino acid. Several antinutritional factors have been identified in raw soybeans, but these factors are inactivated in processing used to prepare soy food proteins. For acceptance by consumers, soy protein products must be adapted as ingredients of foods familiar and acceptable to each country or region. Although

a potential source of food proteins, single-cell microorganisms produced on petroleum substrates are not an immediate competitor of soy or other vegetable proteins as sources of supplementary food proteins.

The closing plenary session was devoted to future developments and prospects. *H.L. Wilcke*, discussing future developments in research and technology, drew attention to the need for a change in attitudes from marketing a commodity to providing a food substance. He spoke of the need to reduce bean flavor, to do more work on color, and to learn more about protein fractions and methods of producing soy proteins for special purposes. Among the other problems facing researchers and technologists in the future, *Wilcke* pointed out, are the upgrading of by-products, reducing overall costs, developing newer, more efficient methods of producing isolates and concentrates with less pollution problems, adapting dairy processing technology to make new types of textured soy products, and attaining higher yields by learning more about how the soybean grows.

R.W. Fischer expounded upon the future of soy protein in the marketplace. He talked about nontraditional protein sources that will supply a greater share of the world's protein: (A.) soy protein will replace cows' milk in calf milk feed, (B.) soy protein will be used to extend and supplement milk for human consumption, (C.) use of soy protein in other dairy products will be expanded, (D.) soy protein also then will be used to expand and supplement meat, fish, and poultry, (E.) soy protein will be used in bread in lower income countries and in fancier bakery products in other countries, and (F.) soy will continue to be the preeminent source of protein in weaning foods and in foods for undernourished people. *Fischer* predicted that the use of soy protein in specialty foods will be 2-2.5 million tons in 1985.

In summary, we have had 1100 delegates here from 46 countries. This has been an affable, congenial, busy meeting, and we have developed a great sense of euphoria. However, we must not get carried away with it. Most of these problems are tough, hard ones. Developments are going to be slow but sure. At a time when we need more research in these areas than ever before in history, a look at the record will show that research funds are generally less today than they were yesterday. We need to do something about this! We also need to tell the food story to the media, work with regulatory agencies to develop rules that encourage development of food products containing soy proteins, and work with consumers and nutritionists to develop new foods and new food products containing optimum quantities of a highly nutritious protein. Together we can meet the protein demands of increased affluence and increased populations and make *Fischer's* prediction of 2-2.5 million tons of soy food proteins by 1985 turn out to be much too conservative. We all salute the American Soybean Association for taking the leadership to sponsor this Conference and express our gratitude to the many workers and speakers who made it great.