U.S. Soybean Industry

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I would like to welcome you to this soy protein seminar which is being put on cooperatively by the American Soybean Association, the Food Protein Council, and the Foreign Agricultural Service of the U.S. Department of Agriculture. We hope that the information presented will be useful to you as you consider soy protein as a protein source in human nutrition.

Soy, in many of its forms, is really an ancient food, especially in the Orient. However, it is a relatively new food for human beings in the United States. In addition, many of the products and the processes and technology by which they are produced, especially those covered in this seminar, are of fairly recent origin.

During the time that the soybean was struggling to become a major U.S. corp, an organization of American soybean farmers was formed. The group was devoted to furthering research to provide better varieties and better crop management and to widen the market for the soybean crop through market development. That was the American Soybean Association.

Today the American Soybean Association has 24 affiliated state associations in the major soybean growing states. Members are soybean growers or farmers. These farmers, through check-off systems, help fund the many activities of the association. The American Soybean Association is a nonprofit organization devoted to the research, market development, and legislative interests of the United States soybean growers. Among its objectives are collecting and disseminating the best available information on all phases of the soybean crop and industry, encouraging the expansion of present markets, and promoting new markets both at home and abroad for soybeans and their products, and the rendering of all possible services to the industry.

Since 1956 when the ASA began its first market development program, U.S. soybean growers have demonstrated their interest in maintaining and expanding markets by providing services to help buyers worldwide learn the most efficient means of using soybeans and their products.

Through these years we have had the excellent cooperation of the members of the soybean industry and their organizations, such as the Food Protein Council; and, of course, we have had the cooperation and assistance of the Foreign Agricultural Service. In addition, we have had the excellent cooperation and assistance of many organizations in the countries in which we conduct market development activities. On the behalf of the American Soybean Association, I thank the many organizations and ministries within the Soviet and Polish governments for the cooperation we have been given in setting up this seminar.

We hope this seminar will be a first—a start from which we may develop many programs of mutual benefit. We do not look on this seminar as an end in itself but as the first step toward the development of cooperative activities which will help people utilize soy products more effectively.

The U.S. soybean farmer is among the most efficient and productive in the world. Although he only produced three-quarters of a ton of soybeans per hectare in 1924, today he is producing an average of nearly 2 tons per hectare and has the potential already available to produce, on an average, 2.4 tons. In fact, many farmers have produced consistent yields of 3.4 to 4.5 tons per hectare.

Even without dramatic yield breakthroughs, world soybean production more than doubled between 1960 and 1970 from 25.1 million metric tons to 62.7 million metric tons. By 1985 world production of soybeans is expected to be about 85 million metric tons.

U.S. soybean production increased from 15.1 million metric tons in 1970 to 41.4 million metric tons in 1975, an increase of more than two and a half times. During that period, harvested acreage rose from 9.5 million hectares to 21.4 million hectares.

The U.S. soybean producer is learning and using new production techniques that will make his fertile hectares stretch further by producing more on each hectare. By making hectares stretch further, the U.S. should produce 50 million metric tons of soybeans by 1985, which is sufficient to provide enough soy protein for the projected protein demands of the world.

Soybeans thrive best in a climate with a warm growing season of 75 to 180 days. During the growing season the rainfall should be at least about 550 mm with rainy periods alternating with sunny periods. Soybeans prefer deep, well-drained soils varying in texture from sandy loams to clay loams, with a pH of 6 to 6.5. Generally soils that produce good crops of maize, wheat, or groundnuts are suitable for soybeans. In fact, in the Midwest area of the United States, presently the most productive soybean growing area, soybeans are grown in rotation with maize.

The main soybean growing areas of the United States have some very natural advantages. These include large acreages which lend themselves to high mechanization and intensive management, fertile soils, good growing climate, and fairly level topography. In addition, the agricultural sector of the United States is highly mechanized and as a result uses only 5% of the total labor force of the United States to produce the large volume of soybeans and other crops. In fact, one farmer these days produces, on the

average, the food and fiber for 56 other people.

However, we have just begun to scratch the surface in our search for ways to raise the yields of soybeans. Some researchers say that even now the actual yield potential of present varieties is between 4.75 tons per hectare and 5.45 tons per hectare.

Research is presently being conducted to raise that yield potential and also to make sure that potential is reached by a large proportion of the farmers.

One problem researchers are working to solve is that high levels of nitrogen fertilization inhibit normal symbiotic fixation by the soybean plant. They are trying to find a way to make the two systems more compatible so that the soybean plant will produce its normal 100 pounds of nitrogen per acre by symbiotic fixation while utilizing increased amounts of nitrogen fertilization to produce higher yields. Researchers are working on developing a semidwarf plant that will be high yielding and resistant to lodging.

Soybeans are inefficient users of sunlight compared to corn, sorghum, and sugar cane. Photosynthesis in soybeans is retarded by a process called photorespiration. Researchers are trying to find a way to inhibit this process and thereby make soybeans more efficient photosynthetically.

Diseases claim an average of 10 to 12% of the annual crop. Work is being done to develop new disease-resistant varieties as well as to develop new pesticides and fungicides. In addition, crop management experts are stressing the use of clean certified seed, which has much less chance of carrying the varying diseases and consequently will cut losses.

Harvesting losses have been known to cut yields by 8 to 10%. Part of the problem stems from the fact that equipment has been adapted to soybean harvesting rather than built specifically for the job. Work is being done on producing equipment that will cut harvesting losses to 1 to 2%.

Although the American Soybean Association does not conduct research itself, it does solicit funds for and finances research toward increasing yields, reducing losses, and improving the efficiency of production practices. It works closely with other organizations, such as the National Crop Improvement Council in coordinating research work and on delineating particular research needs and setting research priorities.

Traditionally, approximately one-half of the U.S. soybean crop has been sold on the international market. ASA's efforts are therefore devoted to seeing that there is an ample supply of soybeans for that market, seeing that the soy products are top quality products, and making sure our international customers are informed of the best and most efficient ways to use these products. ●

Nutritional Aspects of Soy Protein Products

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ABSTRACT AND SUMMARY

This paper is concerned with the nutritional properties of the soybean and of various food products derived from it. Although primary consideration is given to the protein, cognizance is made of other nutrients such as vitamins and minerals. Much of our knowledge concerning the nutritional properties of the soybean has been derived from experiments with animals, and such knowledge is frequently directly applicable to human nutrition. Nutritional experiments with human subjects pose special problems, the most difficult of which is acceptability. People will not eat a certain food simply "because it is good for them." Thus, the most serious hurdle to be overcome in the development of products containing soybean proteins is frequently not a nutritional one but one of consumer acceptance.

NUTRITIONAL VALUE OF THE PROTEIN OF INDIVIDUAL SOY PRODUCTS

General Considerations

Nutritionists generally regard the amino acid composition of a protein to give a reasonable approximation of the nutritional quality of that protein. The amino acid composition of a given protein may be compared with a suitable reference protein such as whole egg protein, which is assumed to be an "ideal" protein, or the amino acid composition may be compared with what is regarded as the amino acid requirements for the normal growth of young children (1). Such a comparison will reveal the essential amino acid which is most limiting in the test protein, and the extent to which this particular amino acid is deficient is referred to as the "chemical score." In the case of soybean protein (see Table IV for detailed tabulation of the amino