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## Culinary Preparation and Use of Soybeans and Soybean Flour

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AND MAXINE MCDIVITT



Baked soybeans.

COLUMBIA, MISSOURI



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A study of Chinese records of four thousand years ago would reveal that even at that time the importance of the soybean as human food was well established. The people of China have lived for many hundreds of years crowded together in a not too fertile land. Meat, milk, eggs and cheese, animal foods upon which we depend for protein, are scarce and in many cases non-existent. In vast areas of China, and in other countries of the Orient, the soybean has provided almost the sole source of protein. It is used in numerous ways; as a curd or cheese, a milk, a vegetable, and as a basis for the various breads, sauces, and seasonings which make up the Chinese diet.

The soybean was first introduced into Europe in 1712 by Engelbert Kaempfer, a German botanist who had spent two years in Japan. It was considered a curiosity and as such was studied, named, and classified, but not cultivated commercially until early in the twentieth century.

Early study and cultivation of the plant had centered in Vienna and it was here during the first World War that the young Viennese physiologist Dr. Laslo Berczeller began his work of adapting the soybean to the food habits of the Western world so that the starving masses in Europe might be better fed. In 1922, he patented a process for removing the bitter taste and preventing development of rancidity of the fat of the soybean, even after milling. His new flour was introduced into a number of European countries and into the United States. In most of these countries, prospective users were indifferent to the new product. Only in Germany, was the importance of this protein rich food recognized. At the outbreak of the second World War, Germany had huge supplies of the beans together with processing equipment, not only in Germany itself, but also contracted for in the nearby Balkans. The soybean and its products were forming an important part of the diet of the German armed forces in the early years of the war. Over two hundred recipes for the use of soybean products were given in the Army Soya Cookbook.

The soybean is not new, even in the United States. In 1804, a Yankee Clipper ship brought in several bags of beans which had been intended as a reserve food supply in case the voyage from China was slower than expected. Here, too, they were regarded chiefly as a curiosity until 1898 at which time the government began collecting and distributing small quantities of seeds to growers.

By 1907 there were only twenty-three varieties of soybeans known in the United States. At the present there are over two thousand distinct types. Of these, over a hundred highly desirable varieties are widely grown or are being developed for distribution in the United States. Since 1934, a number of Agricultural Experiment Stations have been growing and testing types of soybeans which are particularly adapted for use as vegetables, either green or dried. Some 18 to 20 varieties have been rated as excellent.

The first World War gave impetus to the new industry of processing soybeans for an oil for industrial purposes and for a high protein livestock feed called soybean meal. During this period, the first soybean flour was put on the market as a wheat flour substitute. This flour had a penetrating "beany" flavor and was not desirable.

With the development of debittering processes, soybean flour appeared again on the market in 1926 as a health food. It was well fitted for this purpose and by 1935 was widely used by hospitals and physicians for special dietary needs. By 1941, twenty-five million pounds of soya flour were produced in the United States.

At the present time many soy products are used in manufactured foods, not as substitutes for scarce ingredients but because of their own particular advantages. Baked goods containing soy products brown admirably and retain their moisture well. Meat and soy mixtures hold fat and do not shrink upon cooking as does meat alone. The incorporation of soy products into foods increases the nutritive value at a moderate cost.

The acceptance of soy products for use in home cooked foods is the next step towards making this important food an integral part of our national diet.

#### PURPOSE OF INVESTIGATION

The purpose of the investigation reported in this publication is to present suggestions, precautions, and tested recipes for the use of soybeans which are now being grown in Missouri and of soybean products available on the retail market. Much time has been devoted to evaluating varieties of soybeans so that recommendations might be made in regard to differences in palatability and cooking qualities. In the investigation of soya flours, we have studied the effect of substitution of the three types of soya flour for part of the wheat flour and of one type of soya flour for another in baked products. On the basis of these studies we have developed recipes and made recommendations for incorporating soya flours into existing home recipes. The workers in this laboratory feel that only recipes for products of quality equal or superior to those now in use should be presented in introducing a new food. Accordingly, in this bulletin, we have included only recipes rated as excellent by the judges.



## NUTRITIVE VALUE OF SOYBEANS

**Protein.**—Perhaps, from a nutritional point of view, the protein in soybeans is most significant. The protein content while always high, may vary from 30 to 50 percent. Soybean varieties and certain conditions during growth influence the quantity of protein present.

That soybeans contain more protein than other beans is important, but the outstanding nutritional quality of this protein is far more important. Numerous animal feeding experiments have been conducted to compare the growth promoting properties of soybeans with other foods. These demonstrate that the quality of the protein in soybeans is superior to other vegetable proteins and comparable to animal proteins.

Osborne and Clapp<sup>1</sup> made chemical analyses of glycinin, the chief protein of soybeans. They found the composition, that is, the amino acid content, of glycinin similar to casein, the principal protein in milk.

Hayward<sup>2</sup> gives the following figures for amino acid content of glycinin and casein:

Amino Acids	Soybean Glycinin percent	Milk Casein percent
Glycine	0.97	0.45
Valine	0.68	7.20
Leucine	8.45	10.50
Proline	3.78	6.70
Phenylalanine	3.86	3.20
Aspartic Acid	3.89	1.40
Glutamic Acid	19.46	15.55
Tyrosine	1.86	4.50
	4.55	
Arginine	5.12	3.81
Histidine	1.39	2.50
Lysine	2.71	5.95
Tryptophane	1.94 to 2.84	1.50
Cystine	0.74 to 1.45	0.25
Methionine	1.84	3.25 to 3.53

Chemical analyses may show the protein of soybeans contains nearly an optimum proportion of amino acids\* essential to the nutrition of man and animals. It remains for biological tests to prove that human beings, as well as animals, can digest and utilize soybean proteins effectively.

1. Osborne, T. B., and S. H. Clapp. Hydrolysis of glycinin from the soybean. *American Journal Physiology*, 19, 468, (1907).

2. Hayward, J. W. The proteins of soybeans and soybean oil meal, in *The Composition and Nutritive Properties of Soybean and Soybean Oil Meal*, Third Ed. Soybean Nutritional Research Council, Chicago, (1940).

\* Proteins vary widely in their nutritive value, depending upon the quantity of certain amino acids they yield on digestion. The proteins in most foods are deficient in one or more essential amino acids. The essential amino acids are those the human being must obtain from foods. One food protein thus may supplement another by supplying one or more essential amino acids.

Biological tests demonstrate that soybean protein is well utilized in the animal body. Everson and Heckert<sup>3</sup> fed albino rats protein from various sources. Their results show protein from the two varieties of soybeans they used, Bansei and Funk Delicious, was superior to the protein of all the other legumes they studied. In their experiments, cooked soybeans supported growth in rats that compared favorably with the growth of rats fed beef liver and casein from milk. Everson and Heckert computed the biological value of each protein they tested by determining the gain or loss in weight of the experimental animals per gram of protein consumed. Their findings are summarized in the following table:

BIOLOGICAL VALUE OF VARIOUS PROTEINS

Efficiency of Protein, Gain or Loss in  
Weight per Gram of Protein Ingested

Source of Protein	Vine Ripened	Vine Ripened
	Raw	Heated 45 min. at 15 lbs. pressure
Casein	...	1.628
Beef liver	...	1.481
Peanut meal	...	.796
Cottonseed	...	.888
Soybeans, Bansei	.609	1.482
Soybeans, Funk Delicious	.471	1.418
Lima beans	.037	1.165
Navy beans	Rats died	.851
Kidney beans	Rats died	.787
Green peas	.760	.362

Zucker and Zucker<sup>4</sup> investigated the nutritive value of cotton, peanut, and soy seeds. They compared the ability of these three seeds to promote a normal rate of growth in young rats. They found the growth promoting qualities of the protein in soybeans outstanding.

Jones and Divine<sup>5</sup> fed young rats patent flour supplemented with peanut, cottonseed, and soya flours at three levels. They mixed 5, 10, and 15 percent of each flour being tested with 95, 90, and 85 percent patent flour. They concluded peanut and cottonseed flour proteins are good supplements for the protein in patent flour, but soy flour is better.

While experiments on animals furnish most of the evidence that the nutritional qualities of soybean proteins are noteworthy, a few

3. Everson, Gladys, and Ada Heckert. Biological value of some leguminous sources of protein. *Journal American Dietetics Association*, 20, 81, (1944).

4. Zucker, Theodore F., and Lois Zucker. Nutritive value of cotton, peanut and soy seeds. *Industrial and Engineering Chemistry*, 35, 868, (1943).

5. Jones, D. B., and J. P. Divine. The protein nutritional value of soybeans, peanut, and cottonseed flours and their values as supplements to wheat flour. *Journal of Nutrition*, 28, 41, (1944).

tests on human beings indicate that man also thrives on soybean proteins. Kung and Fang<sup>6</sup> determined the nitrogen metabolism of preschool children when fed soybean milk and cow's milk. They found no marked differences in the ability of preschool children to utilize the protein from soybean milk or cow's milk. Although adults appear to utilize soybean protein very well, the percent digested is not quite as high as that of meat and eggs.<sup>7</sup>

**Carbohydrate.**—Unlike other cereal products, soybeans have little starch. The total percent carbohydrate in soybeans is about 30. Sugar, approximately 7 percent, is the most important available carbohydrate. Sugar gives flavor to the soybean, but it affects the quality of products when soya flour or soy grits is combined with other foods. It likewise may affect the fermentation in bread, the cure in sausage, or the flavor of foods.

**Fat.**—Soybeans average about 20 percent fat. Soybeans are thus an important industrial source of fat or oil. The oil is extracted from the beans and used for many purposes: in shortening, cooking oils, margarines, soaps, paints, and other products. In soybeans and full fat flours, the fat is important as a source of energy and other nutritional factors, as essential fatty acids\* and lecithin, a fatty substance containing phosphorous.

**Minerals.**—Soybeans contain appreciable quantities of calcium and phosphorous. Much of the phosphorous is present in the form phytin, which is probably not available. Some of the calcium in soybeans may combine with phytin and thus become unavailable to the animal body.

The iron content of soybeans is higher than that of many other foods, but the most significant thing about the iron of the soybean is that it is well utilized in the body. Adolph and Kao<sup>8</sup> fed animals iron-free diets with various supplements as a source of iron. They determined the hemoglobin content of the blood of the experimental animals and found it to be normal in animals fed soybean products. Sherman, Hart, and Elvehjem<sup>9</sup> give the following values for the availability of iron in some common foods:

6. Kung, L. C., and N. Y. Fang. A preliminary report on the nitrogen metabolism of preschool children. *Chinese Journal Physiology*, 9, 375, (1935). (*Experimental Station Record*, 76, 273, (1937)).

7. Cahill, William M., Laurence J. Schroeder, and Arthur H. Smith. Digestibility and biological value of soybean protein in whole soybeans, soybean flour, and soybean milk. *Journal of Nutrition*, 28, 209, (1944).

8. Adolph, W. H., and H. Kao. Hemoglobin building properties of soybeans products. *Chinese Journal of Physiology*, 6, 257, (1932).

9. Sherman, W. C., E. B. Hart, and C. A. Elvehjem. Further studies on the availability of iron in biological material. *Journal of Biological Chemistry*, 107, 383, (1934).

\* Fats are made up of fatty acids and glycerol. Many of the fatty acids we need can be produced by the body but a number of them must be supplied by the diet for the maintenance of normal skin condition. These nutritionally essential fatty acids are not widely distributed in fats but two of them, linoleic and linolenic acids occur in appreciable quantities in soybeans.

FOOD	
Pork liver .....	66%
Pork heart muscle .....	86%
Beef liver .....	80%
Beef heart muscle .....	70%
Beef skeletal muscle .....	50%
Oysters .....	25%
Toasted soybeans .....	60%
Nontoasted soybeans .....	80%
Alfalfa .....	27%
Spinach .....	20%

**Vitamin A.**—Vitamin A is present in soybeans but the quantity is not high. Green soybeans contain more Vitamin A than the dry, mature beans, but neither contains sufficient quantities to classify the soybean as an important source of this vitamin.

**The B Complex Vitamins.**—Zucker and Zucker<sup>4</sup> are emphatic that nutritionists, in seeking substitutes for animal proteins, must find good proteins that also contain the B complex vitamins. They feel that in the American dietary, animal proteins furnish good quality proteins and important quantities of niacin and riboflavin. They find soybeans have, in addition to a good quality of protein, appreciable supplies of the B complex vitamins.

Burkholder,<sup>10</sup> working at Yale University, also reports there are significant quantities of the B vitamins in soybeans. The following table shows his values for the B complex vitamins and ascorbic acid for six varieties of soybeans; values are given for green and mature beans:

VITAMINS IN EDIBLE VARIETIES OF SOYBEANS.

Data for B Vitamins are Given as Micrograms per Gram of Dry Matter.  
Ascorbic Acid is Expressed as Milligrams per Gram of Green Raw Beans.

Variety	Thiamin		Ribo- flavin		Pyri- doxine		Biotin		Niacin		Panto- then		Ascor- bic Acid
	G*	M**	G	M	G	M	G	M	G	M	G	M	G
Aoda .....	5.6	9.6	4.1	2.3	2.9	6.3	0.66	0.63	46	20	11	11	0.24
Bansei .....	6.6	8.4	3.5	2.4	3.3	6.2	0.42	0.62	44	23	12	12	0.21
Green Giant	7.6	8.5	3.6	2.1	4.2	7.4	0.52	0.69	26	19	11	14	...
Hokkaido ..	6.6	9.5	3.0	2.3	3.2	6.6	0.54	0.51	37	20	12	11	0.18
Toku .....	5.6	9.0	3.1	2.1	3.5	5.4	0.66	0.72	40	19	12	12	0.19
Willomi ....	6.2	9.2	4.5	2.4	3.9	6.3	0.43	0.49	48	20	13	12	0.23
Means for six varieties .	6.4	9.0	3.5	2.3	3.5	6.4	0.54	0.61	40	20	12	12	0.21

\*G = Green or immature.

\*\*M = Mature.

4. Zucker, Theodore F., and Lois Zucker. Nutritive value of cotton, peanut, and soy seeds. *Industrial and Engineering Chemistry*, 35, 868, (1943).

10. Burkholder Paul R. Vitamins in edible soybeans. *Science*, 98, 188, (1943).

Burkholder states that vitamin values of soybeans compare favorably with wheat and with meats, except the riboflavin and niacin content are lower than meat. To verify his conclusions, he compares the vitamin content of soybeans, wheat, ham, and beef round as follows:

COMPARISON OF VITAMINS IN MEAT, WHEAT, AND MATURE SOYBEANS.  
Data Expressed as MG per Gram of Dry Matter.

Food	Thiamin	Riboflavin	Pyridoxine	Biotin	Niacin	Pantothen
Beef round . . . .	2.1	7.5	2.6	.08	160	17.0
Pork ham . . . . .	19.0	4.8	0.4	.12	63	6.5
Tenmarq wheat	7.0	1.3	2.6	.17	62	7.6
Soybean (av.)	9.0	2.3	6.4	.61	20	12.0

**Ascorbic Acid.**—Although there are small quantities of ascorbic acid in fresh, green soybeans, it is not present in mature beans. Soybean sprouts are the only soybean product that can be considered a source of vitamin C.

### THE PLACE OF SOYBEANS IN AMERICAN DIETS

Like milk, eggs, meat, fish, or cheese, soybeans have a place as a good protein food in the American diet. Although soybeans, as a human food are new in this country, the peoples of China, Manchuria, and wartime Germany, use soybeans, or soy products regularly to supplement their cereal diets. Soybeans are now produced extensively in the United States. From the standpoint of national economy and of interest in good nutrition, it is desirable that American people learn to utilize both the soybean and its products.

The army is using soy products extensively in various rations. Many men in the armed forces will probably learn to like soybeans. Is it not important that American women learn how to use these new unfamiliar food products with skill and intelligence?

Evidence is abundant that the soybean is an exceedingly nutritious and economical food. Whether the soybean or its product which appears at the family table at meal time is attractive and good, depends upon the knowledge and skill of the homemaker. If she chooses a good variety of beans and selects good recipes, her family will like and enjoy them.

Food left on the plate neither satisfies hunger nor nourishes the body. A good cook and a wise mother can arouse the interest of a family in new foods. A homemaker of this type realizes some individuals require time to form a liking for unfamiliar food products or time to modify eating habits. The homemaker, therefore, should not be alarmed or uneasy if, in the beginning, her family does not receive soybeans with great enthusiasm. She will continue to incorporate them in the family diet at intervals. If the quality of the beans or soy products is good, if they are cooked thoroughly and

seasoned well, the homemaker may have confidence that the family will find soybeans acceptable and eventually relish them.

Soy products are new to most people in this region. From our experience in presenting them to various and large groups of people, we feel that the homemaker would do well to follow the ten basic practices for using soya flour and grits devised by the United States Bureau of Human Nutrition and Home Economics.<sup>11</sup>

These are:

1. Make soy an ingredient in familiar recipes; it is a good mixer.
2. Recognize that soy, like many other foods, has a flavor of its own. The more you use it, the more you'll like it.
3. Use relatively small amounts. This way, soy changes the familiar food less and may be more acceptable than when used in large quantities.
4. Combine with foods of similar texture, for example—soy grits with cereals, ground meat, bread crumbs; soy flour in soups, sauces, creamy puddings, quick breads. In some recipes, either flour or grits will do.
5. Have same high standards for food mixed with soy as for other foods.
6. Batter containing soy may appear stiffer than usual. This is not so noticeable in the finished products. You may need more liquid but add with caution.
7. Add soy to give richness to bland foods—white sauce, soups, cornstarch puddings.
8. Give soy mixtures the taste test. Be generous with salt, onion, other seasonings.
9. Enjoy the rich brown crust soy gives to such foods as breads and potato cakes.
10. From first to last, when considering cost, remember that soy may be replacing expensive protein rather than less expensive grain or cereal foods.

#### Green Soybeans

Green or immature soybeans of the vegetable type are similar to green peas or lima beans in appearance and flavor. As they are ready for use in late August or September, a time when other green vegetables are less plentiful, they make a welcome early-fall green vegetable.

The beans are ready for use when the pods are plump, but still green. In most varieties of soybeans this period lasts from ten days to two weeks. The garden supply of green beans may be lengthened by plantings made at two week intervals or by planting varieties with different maturing habits. The pods on a single plant usually mature uniformly enough to warrant pulling the entire plant, thus making the picking of the pods a less tedious process.

11. Kirkpatrick, Mary E. Ten rules for use of soya. *Journal of Home Economics*, 36, 286, (1944).

Since sweetness is a desirable quality in soybeans, just as it is in green peas and lima beans, it is important that the beans be used as promptly as possible after they are pulled if the best flavor is to be expected. The sugar concentration falls appreciably if the beans are kept at room temperature.<sup>12</sup>

The green pods of all varieties of soy beans are very tough and tend to stick to the bean. Hulling may be made easier by boiling the pods for five minutes. The beans may then be easily squeezed from the pods.

One of the most delightful features of soybeans used in the immature state is their bright green color. They should retain this color after cooking. While the cooking time will vary from ten to twenty minutes with the variety and the stage of maturity, it is a mistake to expect the beans to be soft and mealy. When done they should retain some of their firmness. Since the beans are quite rich and have a pleasant nutty flavor they may be served simply with only butter or meat drippings as seasoning or combined with other vegetables in a salad.

As with new peas and lima beans, the frozen soybeans resemble the fresh beans much more than do the canned ones. The quick frozen green soybeans prepared in this laboratory were judged excellent. The flavor and texture were good and the color a bright attractive green. The canned soybeans, although acceptable, had lost much of their characteristic color and flavor.

### Soybean Sprouts

Considerable magazine and newspaper space has been given recently to articles about soybean sprouts, their nutritive value, methods of sprouting, and recipes for their use. Five varieties of soybeans, including both vegetable and field types were sprouted in this laboratory using three different methods.

It was decided that in spite of the high nutritive value of the sprouts, they have only the limited place of a "specialty food" in most diets because of the difficulties encountered in their preparation. If however, they are to be sprouted, some general recommendations can be made.

1. Select seeds of high germinating strength, for the seeds that do not sprout will decompose.
2. Field varieties sprout more satisfactorily than vegetable varieties.
3. Since the beans sprout best at a temperature of 70° to 80° F. and tend to spoil at high temperatures, the preparation of sprouts in the summer is difficult.
4. The use of chloride of lime or some weak household laundry bleach is advisable to keep down bacterial growth and spoilage.

12. Woodruff, S., and H. Klaas. *A Study of Soybean Varieties with Reference to Their Use as Food*. University of Illinois Experiment Station Bulletin 443.

5. A common clay flower pot provides one of the easiest and most satisfactory containers for sprouting since it provides easy drainage and darkness.

The method preferred in this laboratory was essentially the same as that given in the U. S. Department of Agriculture bulletin<sup>13</sup> on soybeans.

"One-fourth pound (one-half cup) of dry beans of some varieties weighs about a pound when sprouted and may make as much as 5 or 6 cups of sprouts. Other varieties may yield only 2 to 3 cups. Flower pots 6 to 7 inches in diameter at the top and 6½ to 7 inches high are large enough to allow for the expansion in volume. Rust-proof wire netting or cheesecloth can be used to cover the hole in the bottom of the pot to prevent the beans from falling through and at the same time allows for drainage.

"Sort the dried soybeans, discarding shriveled and dead-looking ones. Wash the good beans thoroughly; then soak them overnight in 1½ cups of lukewarm water. In the morning drain the beans, put them in the flowerpot, and cover them with dampened cheesecloth. Put a piece of damp cardboard over the top of the pot and weight it down. Keep the pot in a dark place at about 78° to 80° F.

"Three times a day pour water over the soybeans, draining it off immediately. Take care not to break the tender sprouts as they appear. Each evening sprinkle the beans with chlorinated lime solution to keep down mold growth and bacterial spoilage. The solution is made by dissolving 1 teaspoon of calcium hypo-chlorite in 3 gallons of water. This amount will treat 5 to 6 pounds of dry beans and may be stored to use with successive sproutings.

"Soybean sprouts are ready for use when they are 2 to 3 inches long. Both beans and sprouts are eaten. The loose skins may be removed by washing thoroughly. Sprouts can be served raw in salads, or they can be cooked in various ways or used in such dishes as omelets, stews, fricassees, or chop suey. They are very tender and lose their crispness if put into hot dishes more than a few minutes before serving.

"Two good ways of cooking soybean sprouts are:

1. Boil sprouts gently in a small amount of salted water in a covered pan for 10 to 12 minutes. Drain and season with salt, pepper, and a little table fat.
2. Melt a small amount of fat in a frying pan. Add the sprouts and a little hot water, cover, and cook for 10 minutes, stirring frequently. Leave the cover off for the last few minutes to allow the sprouts to brown. Season with salt. Onions may be combined with the sprouts if desired."

13. Drown, M. J. *Soybeans and Soybean Products as Food*. U. S. Department of Agriculture Misc. Pub. 534, 12, (1943).



Raw soybean sprouts may be used much as any other fresh vegetable in vegetable salads. They combine particularly well with tomato, celery, lettuce, green pepper, carrot, and onion.

### Dry Mature Beans

The cooking qualities of eleven garden varieties of soybeans, Bansei, 81044-Select, Chusei, Imperial, Hokkaido, Higan, Rokusun, Funk Delicious, Kanro, Goku, Easycook, and two field varieties, Boone and Illini were tested.

The soybeans were picked over, washed, and soaked over night in twice their volume of water. The water which was not absorbed was poured off; fresh water was added, and the beans were cooked by two methods:

1. In a partially covered sauce pan until tender.
2. In a 2 or 3 quart pressure sauce pan at 15 pounds pressure for 20 minutes.

The first method required from 2½ to 3 hours to obtain a tender product. The beans showed a great tendency to foam or "boil over" when the pan was covered, and the color of both beans and liquid was quite dark. This darkening in color was probably caused by the minerals in Columbia water since the color was lighter when distilled water was used. The use of distilled water shortened the cooking time.

Soybeans cooked by steam pressure had lighter color and a more desirable texture than those cooked in a sauce pan. In all cases the judges expressed a preference for the beans cooked by this method. The judges agreed fairly well in their opinions of the qualities of the cooked beans, their greatest difference being an individual preference for sweetness or blandness in beans.

At least four of the five judges rated the garden varieties as follows:

Very Good	Good	Poor
Bansei	Rokusun	Kanro
81044-Select	Imperial	Easycook
Higan		Hokkaido
Funk Delicious		

## COMPARATIVE COOKING QUALITIES OF 13 VARIETIES OF SOYBEANS.

Variety	Dry Cooked		Cooked Product			
	Meas.	Meas.	Appearance	Flavor	Texture	
Bansei	½ C	1½ C	Fair (lost skins)	Good (sweet)	Good (tender)	
Boone*	½ C	1¾ C	Fair	Fair	Fair	
Chusei	½ C	1¾ C	Good	Poor	Fair (firm)	
Easycook	½ C	1¾ C	Good	Poor (weedy)	Poor (firm)	
Funk Delicious	½ C	1½ C	Good	Good (bland)	Good	
Goku	½ C	1¾ C	Fair	Poor (weedy)	Poor (firm)	
Higan	½ C	1¾ C	Good	Good (sweet)	Good	
Hokkaido	½ C	1½ C	Poor	Poor	Poor	
Illini*	½ C	1¾ C	Good (small)	Good (bland)	Fair (firm)	
Imperial	½ C	1¾ C	Fair	Good (not sweet)	Good (slight- ly firm)	
Kanro	½ C	1¾ C	Fair	Very poor (weedy)	Poor (hard)	
Rokusun	½ C	1¾ C	Good (slight- ly dark)	Good (bland)	Good (slight- ly mealy)	
81044—Select	½ C	1¾ C	Good	Good (sweet)	Good	

\*Field varieties.

The field varieties, Boone and Illini, are quite acceptable, but were judged only fair when compared to the vegetable types. Varieties of soybeans that are rated acceptable can be used in any way that navy beans are used: that is, seasoned with meat broth or drippings, baked, or in a soup. The varieties of beans which hold their shape on cooking are most suitable for salads.

## RECIPES

## Baked Soybeans

6 servings

Most varieties of soybeans can be used to good advantage in baked beans; however, preference was expressed for the varieties with softer texture. Best results are obtained if the beans are soaked over night and cooked until tender before seasonings are added.

Temperature: 350° F.

3 cups cooked soybeans (1 c. dry)

¾ teaspoon mustard

1¼ teaspoons salt

½ teaspoon pepper

Time: 1¾ to 2 hours

3 tablespoons molasses

½ cup tomato catsup

½ cup hot water

¼ pound diced salt pork or bacon

Combine all the ingredients except the salt pork and place in a baking dish. Cook pork in a frying pan until light brown. Add the drippings to the beans and place the squares of pork on top. Bake in a moderate oven (350° F.).

**Soybean Soup**

4 servings

Soybean soup made from either the whole or the mashed beans is a nourishing dish for luncheon or supper. The flavor blends especially well with either ham stock or bacon. Small bits of meat may be added.

1 cup cooked soybeans ( $\frac{1}{2}$ c. dry)	1 tablespoon flour
$\frac{1}{6}$ medium carrot, diced	1 tablespoon fat
$\frac{1}{6}$ medium onion, chopped	$\frac{1}{2}$ teaspoon salt
2 cups soup stock (fat free)	1 cup milk

Add vegetables and beans to soup stock and cook together slowly until vegetables are tender. Blend flour, melted fat, and salt in a double boiler; add milk and cook over boiling water until thickened. Add this sauce to soup stock and vegetable mixture.

Since soup stock may or may not be salty, the salt in this recipe may need to be adjusted. The amount given was found to be satisfactory for ham stock.

**Soybean Salad**

4 to 6 servings

2 cups soybeans	2 hard cooked eggs
$\frac{1}{4}$ cup chopped sweet pickles	$\frac{1}{2}$ teaspoon salt
2 tablespoons diced onion	mayonnaise to blend
$\frac{1}{4}$ cup diced celery	

Combine soybeans, sweet pickles, onion, celery, and diced egg. Add mayonnaise and mix lightly. Serve on lettuce or other salad greens.

**SOYBEAN PRODUCTS AS MEAT EXTENDERS**

Soybean flour and grits have been widely publicized as meat extenders in the past year. This has been caused by:

1. The current meat shortage.
2. The fact that soy products "take up" or absorb the meat drippings and fat and thus prevent shrinkage in such products as sausage, hamburger, and meat loaves. This enables more servings to be made from a pound of meat.
3. The high nutritive quality of the soybean.

However, in spite of these very logical reasons for the use of the above mentioned soy products, our experience in extending meats with flour and grits was not very satisfactory. The criticism made by the judges was that they were conscious of the fact that the meat was "being stretched". This was not true when cooked soybean pulp was used in meat loaf or meat patties.

We feel that if an extender is to be used, meat dishes containing soy products compare favorably in texture and flavor with those made with crumbs, rice, or potatoes. From the standpoint of nutrition, the use of soy products as meat extenders is desirable.

One of the most popular dishes made with grits was scrapple. Fried mush made from half cornmeal and half soy grits proved quite popular, also. In both cases, the addition of soy grits made browning easier.

## RECIPES

**Soybean Meat Loaf with Parsley Sauce**

8-10 servings

Temperature: 350° F.

Time: Approximately 45 minutes

2 cups ground lean beef

1 cup milk

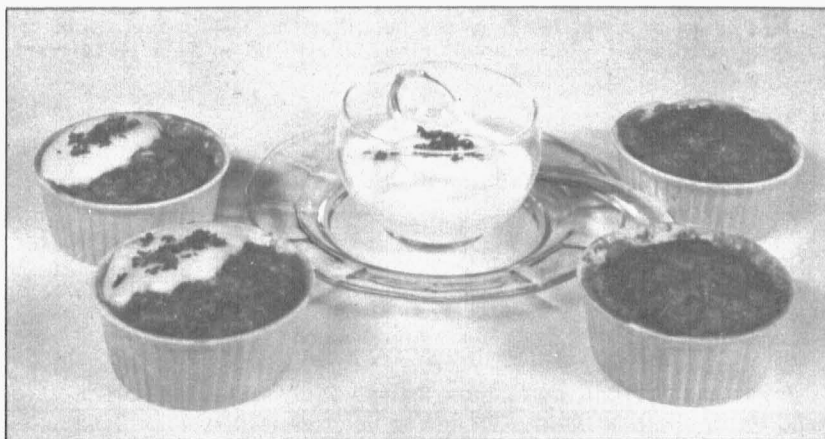
1½ cups cooked soybeans

2 teaspoons salt

2 eggs

1½ tablespoons onion

Cook soybeans until tender and put through a food chopper. Combine ground meat and cooked soybeans thoroughly. Add egg, milk, salt, onion and mix. Place in greased muffin tins, and bake in a moderate oven (350° F.). Serve with parsley sauce.



Soybean meat loaf with parsley sauce.

**Parsley Sauce**

2 tablespoons butter

½ teaspoon salt

2 tablespoons flour

1 cup milk

Melt butter in top of double boiler. Add flour and salt, and mix until smooth. Stir in milk gradually and cook over boiling water, stirring until the sauce becomes thick and smooth. Top with minced parsley.

**Fried Soy Mush**

8 to 10 servings

Fried mush and scrapple are universally popular dishes but are not served as frequently as they might be because of the long time required to fry them to the crisp brown stage. The addition of a small amount of soya grits gives a product which browns much more readily and has a pleasing nutty flavor.

½ cup cornmeal

2 cups boiling water

½ cup soya grits

1½ teaspoons salt

1 cup cold water

Mix dry ingredients with cold water and pour into boiling water. Cook over direct heat, stirring constantly for five minutes; then cover and cook over hot water for 1 hour. Mold in a loaf pan rinsed in cold water and cover to prevent a crust from forming; chill over night. When ready to use, slice in  $\frac{1}{2}$  inch slices and fry in hot fat until crisp and brown.

#### Soy Scrapple

8 to 10 servings

1 pound pork (bony pieces or sausage meat)	$\frac{1}{4}$ cup soya grits
3 cups water	$\frac{1}{4}$ teaspoon black pepper
$\frac{3}{4}$ cup cornmeal	$3\frac{1}{2}$ teaspoons salt

Simmer the meat in the water until very tender. Strain off the broth and allow it to cool. Remove meat from the bones and chop or grind through a food grinder.

Skim the fat from the broth and add enough water to make 3 cups.

Mix the cornmeal, soya grits and seasonings and add slowly to the boiling broth. (Lumps may be prevented by moistening the dry ingredients with a small amount of the cold broth and adding this to the hot liquid). Cook over direct heat, stirring constantly for five minutes; then cover and cook over hot water for 1 hour. Add the chopped meat. Mold in a loaf pan which has been rinsed in cold water and cover to prevent a crust from forming; chill over night. If stored in a refrigerator or a cold place, scrapple can be kept satisfactorily for a week or ten days. When ready to use, slice in  $\frac{1}{2}$  inch slices and fry in hot fat until browned on both sides.

### SOYA FLOURS

Soya Flour is quite different in composition from wheat flour, as it contains a high percent of complete protein and no starch or gluten. The war with its quick demand for a food rich in adequate protein to supplement the meat supply, is, in part, responsible for the appearance in our markets of many soy products with varying qualities and desirability. The soybean industries have made much progress in improving the quality of their flours, but in the future we may expect better quality and standardization.

The great problem which confronts one who desires to use soya flour today is that different brands of flour on the market are not properly labeled as to the fat content. Some labels give such information as "defatted", or "high protein soy product"; others give the percent composition of soya flour and sometimes state "high fat". If women are to use soya flour successfully, the manufacturers must label flours according to fat content.

The tentative specifications for soya flours used by the Federal Surplus Commodities Corporation in purchasing soybean protein concentrate food products are:<sup>14</sup>

1. **Full fat food flour**—dehulled and debittered; processed by grinding and air-separating the bean meats. Free from foreign material, not more than 3 percent fiber, not more than

14. Dickson, A. M. *Soybean proteins for food*. Reprint, The Soybean Digest, 7, (1942).

10 percent moisture, free of rancidity, not less than 18 percent fat, approximately 40 percent protein, and not less than 95 percent through a 120 mesh screen.

- "2. **Low fat food flour**—dehulled and debittered; expeller processed, hammer-mill ground, and air separated: Free from foreign material, not more than 3 percent fiber, not more than 10 percent moisture, free of rancidity, not less than 5 percent or more than 9 percent fat, and not less than 45 percent protein, and not less than 95 percent through a 120 mesh screen.
- "3. **Low fat food flour**—dehulled and debittered; solvent extracted, cooked, and either rolled and bolted or hammer-mill ground, and air separated: Free from foreign material, not more than 3 percent fiber, not more than 10 percent moisture, free of rancidity, not more than 4 percent fat, not less than 49 percent protein, and not less than 95 percent through a 120 mesh screen."

An Illinois Extension Bulletin<sup>15</sup> states that fat content can be estimated by determining the weight of a cup of soya flour.

In this laboratory numerous weighings were made on twelve different brands of soya flour. Each flour was analyzed to determine the percent fat. On the basis of the weights per cup and laboratory analyses for fat, we find a cup of full fat flour weighs 57 to 66 grams; a cup of low fat flour weighs 75 to 78 grams; and a cup of minimum fat flour weighs 91 to 110 grams. These weights of a cup of soya flour correspond to approximately 7½ cups per pound for a full fat flour; 6 cups per pound for a low fat flour; and 4½ cups per pound for a minimum fat flour. One full fat flour examined does not conform to this rule.

Since the type of soya flour may affect the amount of liquid required in a recipe, it is desirable for the homemaker to know the type flour she is using. This is particularly important if she is substituting soya flour into one of her own recipes. The substitution of a full fat flour into a basic recipe requires no liquid adjustment, but the liquid may need to be increased when low and minimum fat flours are used. This is true in the case of muffins. Other than a possible change in liquid it is not necessary to change the proportion of ingredients when substituting any type of soya flour into a basic recipe. However, in most cases, additional salt improves flavor.

The amount of soya flour which may be incorporated into a recipe to give a satisfactory product depends upon the individual taste, and the type of product. Whole wheat muffins containing fifty percent soya flour were rated good by some of the judges. Others preferred less soya. In recipes using whole wheat flour or ingredients

15. Faulkner, E. C. *Ways of Using Soybeans as Food*. University of Illinois Extension Service in Agriculture and Home Economics. (1943).

ANALYSES\* OF 12 BRANDS OF SOYA FLOUR AND COMPARATIVE WEIGHT  
PER CUP\*\*

Flour	Moisture percent	Ash percent	N percent	Protein percent	Fat percent	Average Wt. per Cup/Grams
Minimum Fat Flours						
Mel K-Soy . . . . .	9.30	6.63	7.95	49.69	0.67	91.7
Nutrisoy . . . . .	9.39	6.73	7.69	48.06	0.70	109.9
Vivasoy . . . . .	7.64	6.71	7.58	47.38	0.74	108.8
Soyafuff . . . . .	7.65	6.43	7.83	48.94	0.98	101.8
Low Fat Flours						
Stoy . . . . .	6.66	6.60	7.69	48.06	6.01	75.9
Lee . . . . .	7.98	6.13	7.37	46.07	6.70	76.0
Soyalose . . . . .	6.55	6.29	7.59	47.44	7.45	78.2
High Fat Flours						
Fat-T-Soy . . . . .	6.38	5.68	7.02	43.88	16.99	65.9
Orange Blossom . . . . .	7.14	5.40	6.19	38.69	20.94	62.9
Soyarich . . . . .	5.60	5.43	6.64	41.50	20.99	62.7
Battle Creek . . . . .	5.79	5.24	6.37	39.82	21.09	81.3
Land-O-Soy . . . . .	6.50	5.39	5.80	36.25	21.67	57.2

\*Chemical Analyses by Department of Agricultural Chemistry.

\*\*Average of 20 weighings.

with distinctive flavors, it is possible to use more soya flour than with recipes using white flour or other bland ingredients. The characteristic soya flavor is less prominent in foods which are served hot than in those served cold.

The workers in this laboratory recommend as desirable the following proportions of soya flour or grits to total flour in the various products tested:\*

Apple sauce cake . . . . .	25%
Cooked cereal	
Cornmeal mush . . . . .	50%
Oatmeal . . . . .	12½-25%
Ground whole wheat . . . . .	12½-25%
Cookies . . . . .	15-33%
Cornbread . . . . .	17%
Muffins (plain) . . . . .	25%
Muffins (whole wheat) . . . . .	50%
Scrapple . . . . .	25%
Spice cake . . . . .	25%
Spoon corn bread . . . . .	25%
Yeast rolls (white) . . . . .	12½%
Yeast rolls (whole wheat) . . . . .	12½%

\*In this laboratory percent substitution is calculated on the basis of the total flour or cereal in a recipe as 100 percent. For example, in a recipe containing 1 cup whole wheat flour, ¾ cup white flour, and ¼ cup soya flour, we express the percent soya as 12½.

### Biscuits

The standard biscuit is delicate, light, fluffy, flaky, and white. The substitution of soya flour changes these characteristics. Soy biscuits have a crumb which is moist, flaky, and yellow in color, and a crust which is golden brown. Soya flour used in excess of 25% gives a flavor which is objectionable to most people.

#### Soy Biscuits

12-16 biscuits—2 inches

Temperature: 425° F.	Time: 10 minutes
1½ cups sifted general purpose flour	3 teaspoons baking powder
½ cup sifted soy flour	5½ tablespoons fat
½ teaspoon salt	⅞ cup milk (approximately)

Mix and sift dry ingredients. Cut in fat with 2 spatulas or knives using a criss-cross motion until the particles are about the size of grains of wheat. Add liquid gradually and stir with a fork or spoon until a soft dough is formed. Turn onto a lightly floured pastry cloth or board and knead approximately 20 strokes. Roll ½ inch thick. Cut with a floured cutter. Bake in hot oven (425° F.).

#### Soy Apple Sauce Cake

12 servings

Temperature: 360° F.	Time: Approximately 30 minutes
1½ cups sifted all purpose flour	½ cup shortening
½ cup sifted soya flour	¾ cup sugar
1 teaspoon soda	1½ cups thick applesauce (sweetened)
2 teaspoons baking powder	1 cup raisins
1 teaspoon cinnamon	½ cup nuts (optional)
½ teaspoon cloves	
1 teaspoon salt	

Sift flour, soya flour, soda, baking powder, spices and salt together three times. Cream shortening well and gradually blend in sugar. Stir in, alternately, apple sauce and flour mixture, beating after each addition until well blended. Stir in raisins. Turn into a cake pan which has been lined with oiled paper. Bake in a moderate oven (360° F.). (If unsweetened apple sauce is used increase sugar 2 tablespoons).

#### Soy Meringue Spice Cake

10 servings—2x3 inches

Temperature: 350° F.	Time: 40-45 minutes
¼ cup shortening	1 teaspoon baking powder
¾ cup brown sugar (remove 3 tablespoons for meringue)	¼ teaspoon soda
1 egg yolk	½ teaspoon cinnamon
¾ cup cake flour	⅛ teaspoon cloves
¼ cup soya flour	½ cup sour milk
½ teaspoon salt	½ teaspoon vanilla

Cream shortening; add sugar gradually, and cream until light and fluffy. Add egg yolk and beat vigorously. Sift dry ingredients together twice.

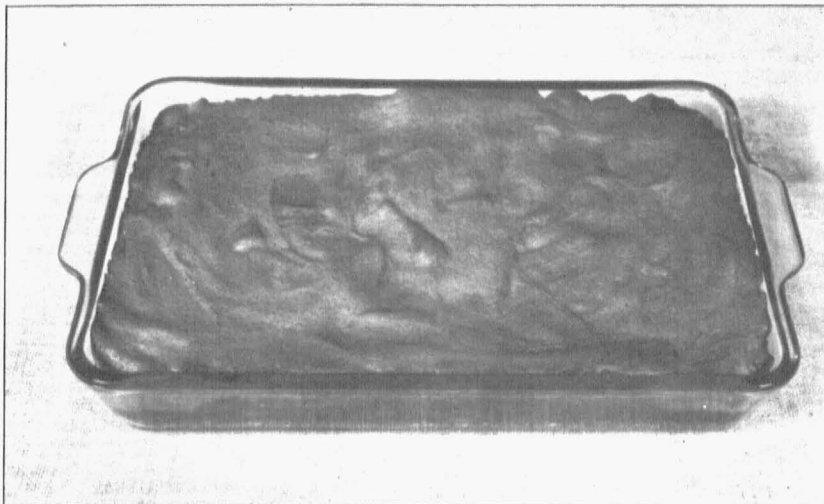


Add alternately with milk and vanilla, beating after each addition. Pour into a 6 x 10 inch pan lined with oiled paper. Cover with meringue. Bake in moderate oven (350° F.).

#### Brown Sugar Meringue

3 tablespoons brown sugar  
 1 egg white  
 ¼ cup chopped nut meats

Beat egg white and sugar together until the meringue forms soft peaks. Spread meringue over cake batter and sprinkle with nuts.



Soy meringue spice cake.

#### Soy Brownies

16 to 20 brownies

Temperature: 325° F.

Time: 30 minutes

½ cup sifted all purpose flour	1 cup sugar
¼ cup sifted soya flour	2 eggs
½ teaspoon baking powder	½ teaspoon vanilla
½ teaspoon salt	2 squares chocolate
⅓ cup shortening	½ cup nuts

Sift all purpose flour, soya flour, baking powder, and salt together twice. Cream shortening; gradually blend in sugar and add well-beaten eggs. Beat until smooth and fluffy. Add vanilla and stir in melted chocolate. Add flour mixtures in 3 portions, stirring after each addition. Add nuts with last few strokes. Pour into an 8 inch square pan which has been lined in the bottom with waxed paper and greased. Bake in a moderate oven (325° F.). Cut into squares while hot.

**Soy Oatmeal Drop Cookies**

18 cookies—1½ inches

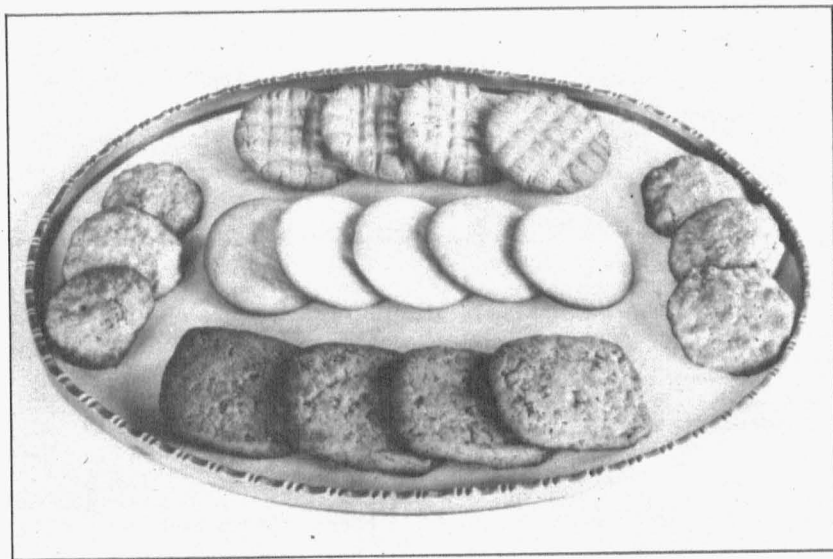
Temperature: 400° F.

Time: 10-15 minutes

½ cup sifted all purpose flour  
 3 tablespoons sifted soya flour  
 or soya grits  
 ¼ teaspoon salt  
 ½ teaspoon baking powder  
 ½ teaspoon cinnamon  
 ¼ cup shortening

½ cup sugar  
 1 egg  
 ¾ cup rolled oats  
 3 tablespoons milk  
 ¼ cup raisins (optional)  
 ¼ cup nuts (optional)

Sift flour, soya flour or grits, baking powder, cinnamon, and salt together twice. Cream shortening, blend in sugar, and add slightly beaten egg; beat until smooth and light. Stir in rolled oats. Add half the flour and stir until it is dampened; then add the milk, the remainder of the flour and raisins, and stir until well mixed. Drop from a teaspoon on to an oiled baking sheet. The cookies should be placed far enough apart so they will not run together when they spread. Bake in a hot oven (400° F.).



Soy cookies.

**Soy Sugar Cookies**

36 cookies—2½ inches

Temperature: 400° F.

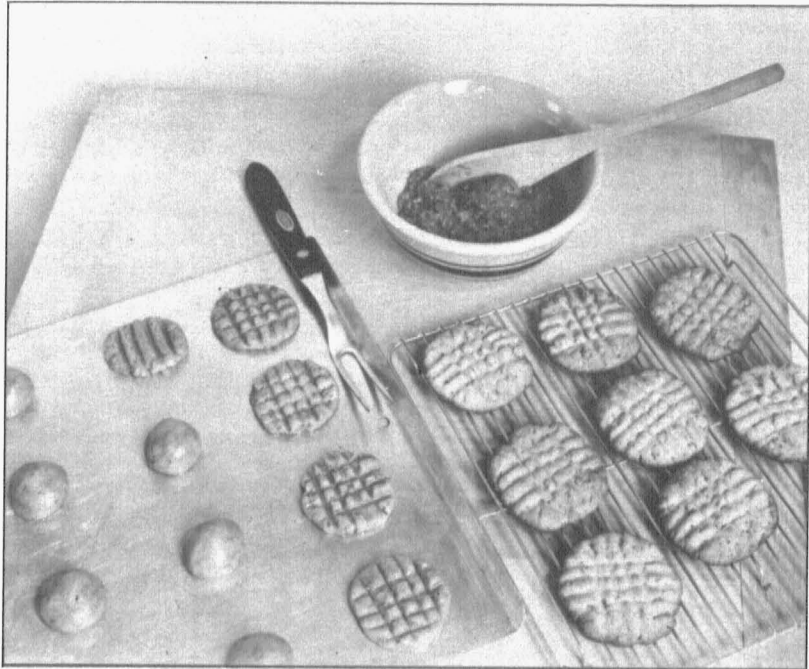
Time: 10-15 minutes

1¾ cups sifted all purpose flour  
 ½ cup sifted soya flour  
 1½ teaspoons baking powder  
 ¼ teaspoon salt  
 ½ teaspoon cinnamon

½ cup shortening  
 1 cup sugar  
 2 eggs  
 1 tablespoon cream

Sift together all purpose flour, soya flour, salt, baking powder, and cinnamon. Cream shortening thoroughly. Add sugar to shortening

gradually and continue creaming until the mixture is light and fluffy. Add well beaten eggs and beat thoroughly. Blend the flour in gradually. Chill until firm enough to roll. Roll  $\frac{1}{8}$  inch thick on slightly floured board. Cut with  $2\frac{1}{2}$  inch floured cutter and sprinkle with sugar. Bake on ungreased baking sheet in a hot oven ( $400^{\circ}$  F.).



Soy peanut butter cookies.

### Soy Peanut Butter Cookies

18 cookies— $2\frac{1}{2}$  inches

Temperature:  $400^{\circ}$  F.

Time: 7-10 minutes

$\frac{3}{8}$  cup shortening

$1\frac{1}{8}$  cups sifted all purpose flour

$\frac{3}{8}$  cup peanut butter

$\frac{3}{8}$  cup sifted soya flour

$\frac{1}{2}$  cup granulated sugar

$\frac{3}{8}$  teaspoon salt

$\frac{1}{2}$  cup brown sugar

$\frac{1}{2}$  teaspoon soda

1 egg

1 teaspoon vanilla

Cream shortening and peanut butter. Mix granulated and brown sugar and blend into creamed shortening. Add eggs and vanilla; beat until smooth. Sift together twice: flour, soya flour, salt, and soda, and add to above mixture, mixing thoroughly. Roll portions of dough in palms of hand until a small ball is formed. Place ball on ungreased baking sheets about  $1\frac{1}{2}$  inches apart. Flatten with tines of fork. Bake in hot oven ( $400^{\circ}$  F.).

**Soy Peanut Butter Bran Cookies**

72 cookies—1½ to 2 inches

Temperature: 400° F.

Time: 7-8 minutes

1½ cups sifted all purpose flour

½ cup peanut butter

½ cup sifted soya flour

½ cup brown sugar (firmly packed)

3¼ teaspoons baking powder

1½ cups granulated sugar

½ teaspoon salt

2 eggs

1½ cups all bran

5 tablespoons milk

½ cup shortening

Sift flour, baking powder, and salt; stir in the bran. Cream shortening thoroughly. Add peanut butter and cream together until smooth. Add sugar gradually, creaming well. Add eggs and beat thoroughly. Add flour mixture alternately with milk. Shape into 1½ inch rolls; wrap in waxed paper and chill. Cut in ¼ inch slices. Bake on ungreased cookie sheet in hot oven (400° F.).

**Soy Corn Bread**

12-18 servings

Temperature: 400° F.

Time: 20-25 minutes

1⅔ cups cornmeal

2 cups buttermilk or thick sour milk

⅓ cup soya grits

2 eggs

1½ teaspoons salt

4 tablespoons melted fat

1 teaspoon soda

Sift together dry ingredients. Combine well beaten eggs, milk, and melted fat, and add immediately to sifted dry ingredients. Stir until well mixed. Pour into a hot, oiled pan. Bake in a hot oven (400° F.). A crustier product is obtained if a heavy iron skillet or cornstick pan is used.

**Soy Spoon Corn Bread**

4-6 servings

Temperature: 375° F.

Time: 30-40 minutes

6 tablespoons cornmeal

2 cups milk

2 tablespoons soya grits

2 eggs

½ teaspoon salt

1 tablespoon butter

Heat milk to scalding; add butter and salt. Mix soy grits with cornmeal and slowly stir this mixture into the hot milk. Cook for 5 minutes, stirring constantly. Remove from heat and cool; then stir into well beaten eggs and mix thoroughly. Turn into a buttered baking dish. Bake in a moderate oven (375° F.) until the top is golden brown. Serve from the baking dish with a spoon while hot. Add butter or syrup.

**Muffins**

Soya Muffins were the only product in which we found it necessary to adjust the liquid in the basic recipe. The amount of liquid a soya muffin mixture requires depends upon the amount and type of soya flour used. The following table shows the liquid adjustment for the substitutions recommended by this laboratory.

FORMULAE FOR PLAIN AND WHOLE WHEAT MUFFINS SHOWING SUBSTITUTIONS  
WITH THREE TYPES OF SOYA FLOUR

Type product	Proportion of Ingredients							Egg
	Wheat flour	Soya flour	Salt	Baking Powder	Sugar	Liquid	Fat	
Plain Muffins—								
Basic recipe .....	2 C all purpose		1 t.	3 t.	2 T.	1 C	¼ C	1
Soya substitution								
Full fat flour .....	1½ C “ “	½ C	1 t.	3 t.	2 T.	1 C	¼ C	1
Low fat flour .....	1½ C “ “	½ C	1 t.	3 t.	2 T.	1½ C	¼ C	1
Minimum fat flour ..	1½ C “ “	½ C	1 t.	3 t.	2 T.	1½ C	¼ C	1
Whole Wheat Muffins—								
Basic recipe .....	2 C whole/wheat		1 t.	4 t.	2 T.	1 C	¼ C	2
Soya substitution								
Full fat flour .....	1 C “ “	1 C	1 t.	4 t.	2 T.	1 C	¼ C	2
Low fat flour .....	1 C “ “	1 C	1 t.	4 t.	2 T.	1¾ C	¼ C	2
Minimum fat flour ..	1 C “ “	1 C	1 t.	4 t.	2 T.	1¾ C	¼ C	2

### Soy Muffins

#### 10-12 muffins

Temperature: 375° F.

Time: 25-30 minutes

1½ cups sifted flour

1 egg

½ cup sifted soya flour

1 cup milk for high fat soya flour

1 teaspoon salt

or

3 teaspoons baking powder

1¼ to 1½ cups for low or minimum fat flours

2 tablespoons sugar

4 tablespoons shortening

Mix and sift dry ingredients. Combine the beaten egg, milk, and melted fat. Pour liquid into the dry ingredients, all at once, and stir just enough to combine. The mixture should have a rough appearance. Fill greased muffin pans about one-half full and bake in moderate oven (375° F.).

### Soy Whole Wheat Muffins

#### 20-24 muffins

Temperature: 375° F.

Time: 23-27 minutes

1¾ cups whole wheat flour (stirred)

1¾ cups milk for low or minimum fat soya flours

1¾ cups sifted soya flour

or

1 teaspoon salt

5 teaspoons baking powder

1¼ cups milk for high fat soya flours

3 tablespoons sugar

2 eggs

5 tablespoons melted fat

Sift soya flour, salt, baking powder and sugar together twice. Add whole wheat flour and stir gently. Combine eggs, milk, and melted fat. Pour liquid into dry ingredients, all at once, and stir just enough to combine. The mixture should have a rough appearance. Fill greased muffin pans about one-half full and bake in a moderate oven (375° F.).

### Pastry

Soy flour gives pastry a yellowish color, but the product is tender and crisp. If used in excess of 25%, the soy flavor is objectionable to most people. We recommend the use of soy flour in pastry for meat or vegetable pies rather than in fruit or cream pies.



Soy whole wheat muffins.

### Soy Pastry

Temperature: 400° F.

Time: 12 to 15 minutes

1½ cups sifted all purpose flour

1 teaspoon salt

½ cup sifted soya flour

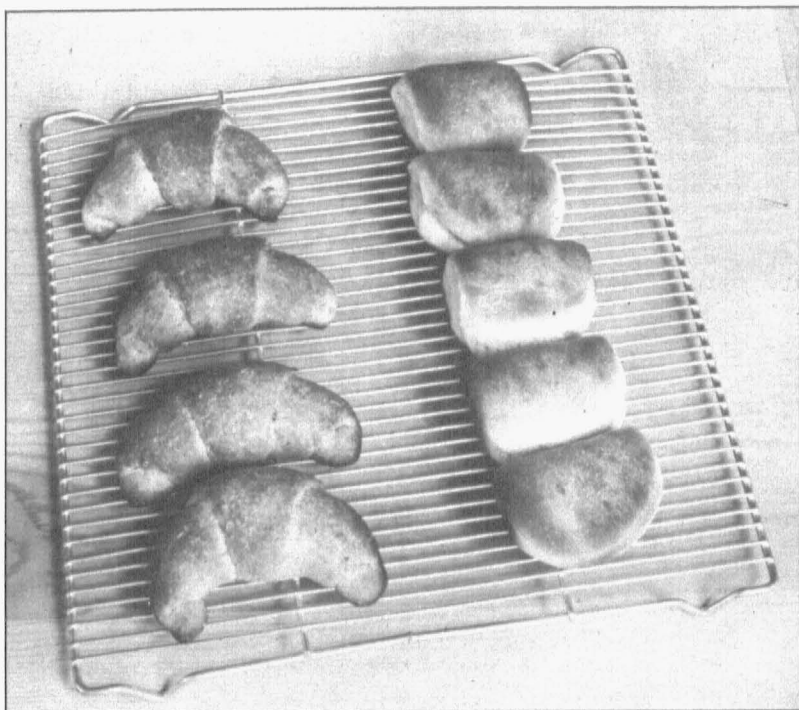
⅓ to ½ cup cold water

¼ cup fat

Sift all purpose flour, soya flour, and salt together. Cut the fat into the flour mixture with 2 spatulas or knives using a criss-cross motion until the particles are about the size of small peas. Add cold water a few drops at a time mixing lightly with a fork. The mixture should be just moist enough so that the particles will stick together when pressed gently between the fingers. Shape the fat-flour mixtures into a ball with as little manipulation as possible. Chill. Place on a lightly floured pastry cloth or board and roll to about ⅛ inch in thickness. Bake in a hot oven (400° F.) until golden brown in color.

### Yeast Breads

For some time commercial bakers have been adding a small amount of soya flour to their white bread because it gives a particularly attractive brown color to the crust. The amount of soya used, however, has been insignificant from the standpoint of changing the nutritive value of the bread.



Soy rolls.

In the laboratory tests we found that soya flour could be substituted for as much as 12½ percent of the flour in both white and graham rolls. Since products containing soya flour brown readily the baking temperature should be reduced. The rolls were baked at 375° F. These rolls were golden brown and when served hot were scored excellent by all who sampled them. The judges gave a lower score and commented on the characteristic soy taste in the cold rolls. For this reason we felt that it would be wiser to use soya flour in rolls, which are usually served hot, than in bread.

Since the amount of flour used in rolls and bread is always variable depending on humidity, size of egg, etc.—the variation in amount of flour used due to the difference in absorption of low or minimum fat soya flour was not sufficient to necessitate a change in the recipe.

### Soy Rolls

#### 30-36 rolls

Temperature: 375° F.	Time: 15 minutes
1 cake yeast	1½ teaspoons salt
¼ cup lukewarm water	1 egg
1 cup milk	½ cup soya flour
4 tablespoons fat	3 to 3½ cups sifted flour
2 tablespoons sugar	

Soften yeast in the lukewarm water. Scald the milk and add fat, sugar, and salt. Cool to lukewarm. Add soya flour and white flour to make a batter. Add yeast and egg. Beat well. Add enough more flour to make a soft dough. Turn out on a lightly floured board and knead until satiny. Place in a greased bowl, cover and let rise until double in bulk (1½ to 2 hours). When light, punch down and shape into rolls. Let rise until double in bulk (½ to ¾ hour). Bake in a moderate oven (375° F.).

### Soy Graham Rolls

#### 30-36 rolls

Temperature: 375° F.	Time: 15 minutes
1 cake yeast	1½ teaspoons salt
¼ cup lukewarm water	1 egg
1 cup milk	½ cup soya flour
½ cup fat	2 cups whole wheat flour
¼ cup sugar	1½ to 2 cups white flour

Soften yeast in the lukewarm water. Scald the milk and add fat, sugar, and salt. Cool to lukewarm. Add soya flour and whole wheat flour to make a batter. Add yeast and egg. Beat well. Add enough white flour to make a soft dough. Turn out on a lightly floured board and knead until smooth. Place in a greased bowl, cover and let rise until double in bulk (1½ to 2 hours). When light, punch down and shape into rolls. Let rise until double in bulk (½ to ¾ hour). Bake in a moderate oven (375° F.).

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