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## ABSTRACT

Soya beans and lfe brown beans were evaluated for their physical characteristics (seed size, seed shape, textile colour and weight) before and after cooking with hot plate. The cooking time of the lfe brown beans seed was 52 minutes and soya beans seed did not cook after 180 minutes of boiling.

The chemical analysis revealed that the proximate composition for whole soya beans, dehulled soya bean, roasted soya bean flour and lfe brown bean were; CP. 22.69%, 24.56%, 20.94%, 27.75% and 19.44% respectively, while values were 7.42% for whole soya beans seed, 2.22% for dehulled soya beans, 5.86% for roasted beans, 1.88% for soya milk and 5.47% for lfe brown. The ash content were 4.90%, 4.75%, 3.85%, 1.50% and 3.6% for whole soya bean seed, dehulled soya bean seed, roasted soya bean flour, soya milk and lfe brown. The samples had EE of 22.28%, 25.78%, 24.71%, 15.37%, and 4.98%, respectively and their NFE were 42.68%, 42.69%, 44.64%, 46.50% and 66.51% respectively.

The mineral measured in the bean samples were Na: 0.04%, 0.02%, 0.12%, 0.03%, 0.03%; K: 0.43%, 0.49%, 0.51%, 0.33% and 0.29%; P 0.4%, 0.38%, 0.44%, 0.24% and 0.13% respectively. Ca content was 0.77%, 0.5%, 0.35%, 0.39% and 0.24% respectively. While Mg was 0.03%, 0.14%, 0.25%, 0.15% and 0.12% respectively. Fe content was 22.68 mg/kg, 20.93 mg/kg, 24.56 mg/kg, 20.75 mg/kg and 9.35 mg/kg respectively. Zn was 12.55 mg/kg, 14.12 mg/kg, 13.08 mg/kg, 20.75 mg/kg and 7.35 mg/kg respectively. This study also shows that lfe brown absorbed more water than soybeans, soybeans were also smaller than lfe brown and the weight of lfe brown was also higher than soybeans. There were variability in the chemical composition of various beans samples.

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## CHAPTER ONE

## INTRODUCTION

The soybean (U.S.) or soya bean (UK) (*Glycine max*) (Multilingual Multiscript Plant Name Database. Retrieved September, 2012.) is a species of legume native to East Asia, widely grown for its edible bean which has numerous uses. The plant is classed as an oilseed rather than a pulse by the Food and Agricultural Organization (FAO).

Fat-free (defatted) soybean meal is a significant and cheap source of protein for animal feeds and many pre-packaged meals; (Swarthmore College Computer Society, 2012). Soy vegetable oil is another product of processing the soybean crop. For example, soybean products such as textured vegetable protein (TVP) are ingredients in many meat and dairy analogues (Riaz and Mian, 2006). Soybeans produce significantly more protein per acre than most other uses of land (National Soybean Research Laboratory., 2012).

Traditional non-fermented food uses of soybeans include soymilk, and from the latter tofu and tofu skin.

Fermented foods include soysauce, fermented bean paste, natto, and tempeh, among others. The oil is used in many industrial applications. The main producers of soy are the United States (35%), Brazil (27%), Argentina (19%), China (6%) and India (4%) (USDA, 2012). The beans contain significant amounts of phytic acid, alpha-linolenic acid, and the isoflavones genistein and daidzein.

The soybean [*Glycine max* (L.) Merrill, family Leguminosae, subfamily Papilionoidae] originated in Eastern Asia, probably in north and central China. It is believed that cultivated varieties were introduced into Korea and later into Japan some 2000 years ago. Soybeans have been grown as a food crop for thousands of years in China and other countries of East and South East Asia and constitute to this day, an important component of the traditional popular diet in these regions.

Although the U.S.A. and Brazil account today for most of the soybean production of the world (see Table 1), the introduction of this crop to Western agriculture is quite recent. Soybeans are primarily an industrial crop, cultivated for oil and protein. Despite the relatively low oil content of the seed (about 20% on moisture-free basis), soybeans are the largest single source of edible oil and account for roughly 50% of the total oilseed production of the world (FAO, 1992).

With each ton of crude soybean oil, approximately 4.5 tons of soybean oil meal with a protein content of about 44% are produced. For each ton of soybeans processed, the commercial value of the meal obtained usually exceeds that of the oil. Thus, soybean oil meal cannot be considered a by-product of the oil manufacture. The soybean is, in this respect, an exception among oilseeds.

It can be calculated that, the quantity of protein in the yearly world production of soybeans, if it could be totally and directly utilized for human consumption, would be sufficient for providing roughly one third of the global need for food protein. This makes the soybean one of the largest potential sources of dietary protein. However, the bulk of soybean oil meal is used in animal feeds for the production of meat and eggs. Despite considerable public and commercial interest in soybean products as food, the proportion of soybean protein consumed directly in human nutrition is still relatively small (FAO, 1992).

## 1.2 Production

World production of soybeans has increased by a factor of eight in the last half century to reach its present level of over 100 million metric tons per year (Table 1). The leading producers are the U.S.A. (45%), Brazil (20%) and China (12%). Much of this phenomenal growth was due to the sharp increase in the U.S.A. production between 1950 and 1970, and to the introduction of the soybean to Brazilian agriculture in the sixties.

An important factor in this development was the considerable improvement in the yields, through plant breeding and advanced agro technical practice. Consideration of the economic advantages of soybeans has led many countries to start large scale production of this crop. The consequences of these efforts are now beginning to be seen. The share of the "rest of the world" in the production scene has been growing steadily to reach the present level of 23% (FAO, 1992).

Table 1. World production of soybeans COUNTRY

### COUNTRY PRODUCTION

( million metric tons ) kilogram/hectare

1976 1986 1987 1988 1976 1988

U.S.A. 34.4 52.8 52.3 41.9 1721 2270

Brazil 11.2 13.3 17 18 1750 1859

China 12.1 16.6 12.2 10.9 855 1443

WORLD 62.1 94.4 100.2 92.3 1384 1909

Source: FAO Production Yearbook, 1992

### 1.3 Marketing

Soybeans are marketed as most other major bulk commodities. Spot and future prices are governed by offer and demand. With the exception of periods of disastrous drought in the major producing areas, supplies have been able to keep abreast of the increasing demand. Consequently, the price of soybeans on the international market has remained remarkably stable, despite inflation.

Over 25% of the world production of soybeans is traded, unprocessed, on the international market. Most of the trading is done by a small number of large companies. The U.S.A. is the leading exporter, with approximately 75% of the traded volume. The leading importer is Japan. In addition, very considerable quantities of soybeans are processed in the countries of production, for export as meal or oil. In fact, some countries favour the export of meal and/or oil over the export of unprocessed beans, as a matter of foreign commerce policy. As an example, exports of soybean meal from Brazil far exceeds the quantity of raw soybeans exported by that country.

The peculiar meal/oil ratio of soybeans, as mentioned before, may create an exportable surplus of one of the two products. This type of imbalance between the local demands for oil and protein explains part of the international commerce of soybean meal and oil.

Soybeans are sold by grade and the price is adjusted accordingly. In the U.S.A., soybeans are classified as grains and as such, their grading is regulated by the U.S. Grain Standards Act. The criteria for grading are test weight (weight per unit volume, lb./bushel), damaged seeds and calor (proportion of green, brown or black beans). The purchaser may include additional quality parameters according to the end use.

Moisture content is an absolute requirement and it is always specified in the contracts and certificates, regardless of grade.

Soybean production and trade quantities are often expressed in bushels. Although the bushel is a unit of volume, it can be converted to weight, assuming a standard weight-per-bushel value. One metric ton of soybeans is normally equivalent to 36.7 bushels. Conversely, one bushel of soybeans weighs 60 pounds or 27.24 kilograms.

### 1.4 Agricultural Characteristics

Soybeans grow well on almost all types of soil, with the exception of deep sands with poor water retention. The optimal soil pH is 6.0 to 6.5, therefore liming may be required. With respect to climate, the soybean grows best in temperate zones. The soybean is a so-called short-day plant, meaning that flowering occurs when the nights begin to lengthen. The breeding of varieties with different maturation periods (maturity groups) has permitted optimal production in a wide range of latitudes. Recently, a worldwide program, known as the International Soybean Variety Experiment (ISVEX) and headed by the International Soybean Program (INTSOY) of the University of Illinois at Urbana-Champaign, demonstrated the feasibility of growing soybeans in subtropical and tropical regions as well. It was found that, given adequate variety selection and under experimental conditions, the yields obtained at tropical and subtropical locations were comparable to those observed under temperate climate conditions (about 1950 kg. per hectare). Although the yields obtained in actual production by farmers are much lower, the results of this remarkable experiment expand considerably the limits of the potential soybean growing areas of the world.

Rainfall in the range of 500 to 700 mm. is required for good yields. Adequate water supply is especially important during the period of pod and seed development ( pod filling stage ). Irrigation is now considered an essential factor for increased profit and security to the farmer.

An important characteristic of the soybean plant is its nitrogen fixation capability through symbiosis with nodulating bacteria in the soil. It has been estimated that up to 50% of the total nitrogen of the plant may be supplied by the nitrogen fixing mechanism.

Soybeans are planted in late spring to early summer. Full maturity is reached in early-to-mid-autumn. At this point, the leaves start to yellow and drop and the seeds begin to lose moisture. The decision when to harvest is important. Ideally, soybeans should be harvested when the water content of the seed is 13%, the maximum safe moisture level for long-range storage. If the moisture content at harvest is higher, forced-air drying of these seeds will be required prior to storage. On the other hand, if the seeds are too dry, extensive splitting and cracking of the beans may occur in the course of mechanical harvesting. Another factor to be considered is the respiration losses of the seeds between maturation and harvesting. Respiration rate is strongly moisture-dependent, being higher at high moisture content. Therefore, respiration losses may be considerable if harvesting is delayed too long when, for example, the rate of natural drying of the seeds is low, due to humid weather.

The use of heated-air dryers provides extra flexibility with respect to harvesting time and rate of harvesting, independently of weather conditions.

### 1.5 Physical Characteristics and Morphology of the Soybean

The shape of the soybean seed varies from almost spherical to elongated and flat. The industrial varieties grown for oil are nearly spherical while the elongated varieties are the ones used as a vegetable. The colour of the seed may be yellow, green, brown or black. Industrial varieties are yellow and the presence of seeds of other colours in a lot is considered a defect. Seed size is expressed as the number of seeds per unit volume or weight. Industrial soybeans weigh 18-20 grams per 100 beans. The seeds of "vegetable" varieties are considerably larger.

Seed structure consists of the seed coat (hull) and two cotyledons, plus two additional structures of lesser weight: the hypocotyl and plumule. The cotyledon represent 90% of the seed weight and contains practically all the oil and protein in its palisade-like cells. Microscopic examination of these cells reveals the presence of protein bodies (also known as aleuron grains) and lipid bodies (or spherosomes) which constitute storage bodies for proteins and oil, respectively. Protein bodies measure, on the average, 10 microns while the lipid bodies have, typically 0.2 to 0.5 microns in diameter.

The hull, which accounts for roughly 8% of the seed weight, holds the two cotyledons together and provides an effective protective layer.

### 1.6 Objective of the Study

The objective of this study is to determine the physical and chemical characteristics of IFE brown beans, soybeans and some of its products. Also to determine the nutritional value of these legumes.

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