

# Maize for Life

Gül Ebru Orhun

Çanakkale Onsekiz Mart University, Bayramiç Vocational College

**Abstract** Maize is one of the most popular cereals in the world and forms the staple food in many countries including USA, Africa etc. Health benefits of maize are offered by presence of quality nutrients in it. It not only provides the necessary calories for daily metabolism, but also is a rich source of vitamins A, B, E and many minerals. Also maize oil is useful. Maize oil is the most widely consumed in the world because this oil is generally less expensive than most other types of vegetable oils. Recently, many researches have discovered the strong antioxidant potential mostly in maize oil. Health benefits of maize oil include controlling diabetes prevention of heart ailments. It has reduced hypertension and prevented neural-tube defects at birth. The aim of this article is to revise maize and maize products.

**Keywords** Maize, Product, Oil, Silage, Food, Cereal, Health

## 1. Introduction

The plant (*Zea mays* L.) is a monoic annual plant which belongs to maideas tribe and the grass family of gramineae, and their cells have 2n chromosomes. Maize is the third most important crop after wheat and rice and is grown in more countries than any other crop in the world. It is cultivated virtually in all parts of the world except Antarctica. It has very specific water and climatic requirements in order to thrive. Most importantly, for the plant to germinate it needs a temperature ranging from 15 to 20°C (1).

This plant is the largest grown (785 million tons) cereal in the world with doubled grain yield per unit area compared to wheat and barley. In Turkey, corn is produced on approximately 550 thousand hectares with annual production of 3.5 million tons, of which nearly half is produced in the Mediterranean region. The share of corn production as second crop in the Mediterranean region is very high (9).

Maize is also used as food and raw material for industrial use. In industrialized countries, a larger proportion of the grain is used as livestock feed and as industrial raw material for food and non-food uses. On the other hand, the bulk of maize produced in developing countries is used as human food, although its use as animal feed is increasing. Maize is the largest food crop of the United States, which is responsible for 40 percent of the world's production.

The major chemical component of the maize kernel is starch, which provides up to 72 to 73 percent of the kernel weight. After starch, the next largest chemical component of the kernel is protein. Protein content varies in common

varieties from about 8 to 11 percent of the kernel weight. Most of it is found in the endosperm (6). The oil content of the maize kernel comes mainly from the germ. Oil content is genetically controlled, with values ranging from 3 to 18 percent. After carbohydrates, proteins and fats, dietary fibre is the chemical component and vitamins (provitamin A (carotenoids), niacin, vitamin E and vitamin C found in the greatest amounts.

Meal is a primary product obtained from maize. The meal from maize can be obtained by manual or mechanically milling. The other products include: tortillas, maize flours, chips and several types of snack, breakfast cereal, thickness, pastes, syrups, sweeteners, grits, maize oil, soft drinks, beer, whisky, etc.

Maize is the most important raw material for industrial starch. Maize starch is a maize product and it is employed in the manufacture, ceramics, dyes, plastics, oil cloth, paper and paper boards and in textiles, cosmetics, pharmaceutical industries. The derivatives of maize starch include glucose or corn syrup, corn sugar, dextrans and industrial alcohol, which are employed in different industries.

## 2. Maize Products

### 2.1. Maize Starch

Maize starch plays a leading role in determining the texture of many foods, which is vital to both the consumer and the food manufacturer, as a major factor that governs the acceptability and palatability of most food products (3). Include paper manufacture, textile, adhesives and packed foods, and as the starting material for the manufacture of syrups and dextrose sugar by hydrolysis. The starch obtained from the wet milling of waxy maize, also called "amioca", which consist mainly of amy1 pectin, is non-jelly and has

\* Corresponding author:  
eborhun@gmail.com (Gül Ebru Orhun)

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clear, fluid, adhesive properties. Heated and dried maize starch/water slurries yield pre-gelatinized starch, known as "instant starch" as it thickens upon addition of cold water. Glucose and dextrose are used in beer, cider, soft drinks, pharmaceuticals, confectionary, baking and jams. The dextrins are products obtained by the breakdown of the solid dry starch, which is heated with chemical products like mineral acid almost always hydrochloric acid (7).

Maize starch is used as an adhesive in pigment coating for paper and paperboard. The most commonly used pigments are clay, calcium carbonate and titanium dioxide. The primary purpose of coating is to enhance the printability and appearance of the paper.

## 2.2. Maize Flour

Maize flour can be used exactly as wheat flour in making bread, breakfast meals and more. Maize flour, also called corn flour is highly rich in protein, dietary fibre and very low in fat. Maize flour is by far the most widely eaten flour after wheat and rice flour. It is uniquely rich in dietary fibre, protein, vitamin B6, magnesium and omega 6 acids, vital for good heart and fight against infections. Fortified maize flour has been used in the eradication of malnutrition in some parts of the world.

## 2.3. Maize as Livestock and Poultry Feed

The maize grain gives the highest conversion ratio to meat, milk and eggs when is compared with others grains used as livestock feed, this is due its high starch and low fibre content which make it a very concentrated source of energy for livestock production. Although there is not available statistic for maize and livestock use, it is believed that greater

portion is used as poultry feed in tropical countries. Yellow maize is preferred for livestock feed and it is used as whole grains, cracked or coarse ground, dry or wet or steamed and generally supplemented with vitamins and others proteins. It is expected that use of maize in formulated feed will increase in the future.

## 2.4. Why Maize is Important for Silage?

1. Maize silage is an energy rich forage that can be used in the ration instead of expensive concentrates.
  2. Maize silage is highly palatable.
  3. Maize silage contains fibre for rumination and energy for milk production and body condition.
  4. Maize is harvested less frequently than grasses and legumes.
  5. Maize maintains consistent quality over a wide harvest window.
  6. Maize is harvested directly without the need for in field wilting.
  7. Maize silage has high dry matter and energy, which compliments grass-based rations.
- The use of QPM (Quality Protein Maize) as animal feed promise good potential and it still remains to be exploited particularly for swine production. So far, there is some use of QPM for pig feed and it has been reported that the use of QPM as an ingredient in pig feed could help to reduce costs. However, it is possibly that the unavailability of sizeable quantities of QPM grains in the market, and the fact that cultivation of QPM has not been taken up on a commercial scale.

## 2.5. Maize Products for Industry

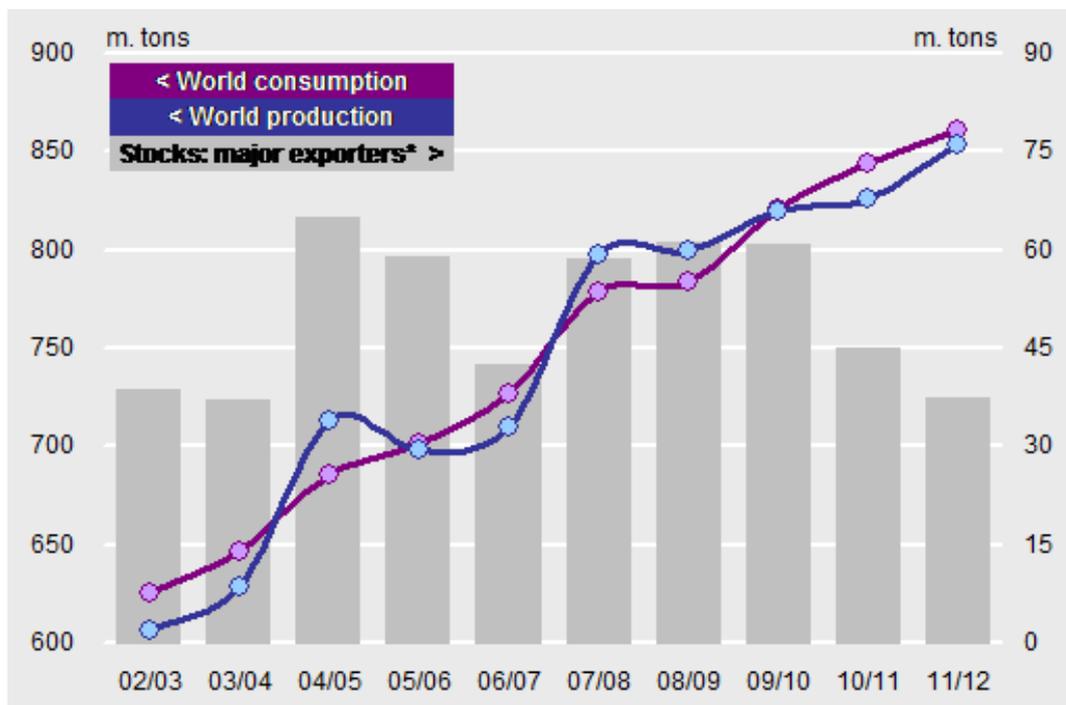


Figure 1. Maize production graph (4)

Basically, there are two milling process used for the maize industry for making various food, feed or industrial products. They are:

1. The wet milling process normally produce pure starch, sweeteners (dextrose, fructose, glucose and syrups including high fructose syrups), proteins, industrial starch, fibres, ethanol and maize oil from the germ. The most important by-products are animal feed and this industry usually uses the flint and dent maize types.

2. The dry milling process is also used to produce a wide variety of food and non food products. In general, the process of maize starts with milling, even the maize which is used at household level. Except the maize eaten as kernel on the cob and popcorn all other products from maize are based on milled maize (14).

As seen in the figure (1), maize production and consumption have been increasing worldwide. According to IGC (International Grains Council) the world's corn production was 811 million tons in 2010. The corn production will not be sufficient to cover the increasing consumption needs that is expected to be 845 million ton (2, 4).

## 2.6. Maize Oil

Maize oil is very important product of the maize milling industry. USA is the largest maize oil production country all over the world with its maize oil production taking up over 50% of the world total production. The maize oil is prone to be absorbed by human bodies and the absorption ratio is as high as %97. Thus, it is an ideal edible oil and healthcare oil. In families of Europe and USA valuing the diet nutrition and health, they generally choose maize germ oil as the major edible oil (15).

Industrial uses for corn oil include soap, salve, paint, rustproofing for metal surfaces, inks, textiles, and insecticides. Corn oil and free fatty-acids - industrial uses; chemicals and insecticides, lecithin (for pharmaceuticals, cosmetics, linoleum, printing inks, etc.), paint and varnish, printing ink, rubber substitutes, rust preventative (surface coatings), soluble oil (leather and tanning use), textiles (14). Corn oil is also one source of biodiesel and used biofuel. Corn oil biodiesel is suitable for use in diesel engines.

## 3. Discussion

There are many products from maize that have been taken over by industry and manufactured and marketed at commercial scale. Several of these products already mentioned are now industrialised on a small or large scale. In the USA over 1 000 different items can be found on the shelves of a typical supermarket and they are derived wholly or partially from maize. These products include: tortillas, maize flours, chips and several types of snack, breakfast cereal, thickness, pastes, syrups, sweeteners, grits, maize oil, soft drinks, beer, whisky, etc.

Maize oil is very useful for health. Because, it is rich in

linoleic acid and oleic acid; these of the three essential fatty acids. Linoleic acid is unsaturated fatty acid that humans and other animals must ingest for good health (1, 5).

Some researcher from University of Illinois at Urbana-Champaign have pointed out that corn contains important chemicals called lectins. This unique group of proteins and glycoproteins attribute various health benefits of corns. Several lectins have been found to possess anticancer properties in vitro, in vivo and in human case studies; they are used as therapeutic agents, preferentially binding to cancer cell membranes or their receptors, causing cytotoxicity, apoptosis, and inhibition of tumor growth (11). Because the body requires them for various biological processes but it cannot synthesize them from other food components. Oleic acid is the major dietary monoenic acid. It might have a slight and controversial positive effect on LDL-cholesterol (13, 12). Some researchers found that the cholesterol absorption was 38% higher after consumption of the sterol-free corn oil than after consumption of commercial corn oil with identical fatty acid content in a study of 10 healthy subjects. And when corn oil phytosterols were added back to sterol-free corn oil at a concentration of 150 mg/test meal, cholesterol absorption was reduced by 12% after inclusion of 300 mg phytosterols (8).

Maize is a vital plant for people and animal in various areas. Thanks to improving technology, maize grain has earned different usage possibilities in the food and feed industry (14).

## 4. Conclusions

Maize is an important cereal crops in the world. It provides staple food to many populations. In developing countries maize is a major source of income to farmers among whom many are resource-poor. All studies have demonstrated maize and maize products are needed for life.

In addition, maize and maize oil have used any area (agricultural, industrial, medicinal etc. But corn oil may have a mildly anticoagulant effect, the potential benefit of which is discussed the combination of corn oil and diet with a particular constitution may cause adverse effects on the renal tubules in pregnant and/or lactating rats, suggesting that corn oil gavage as a vehicle can be a confounding factor in the reproductive toxicity studies, depending on the diet (10).

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