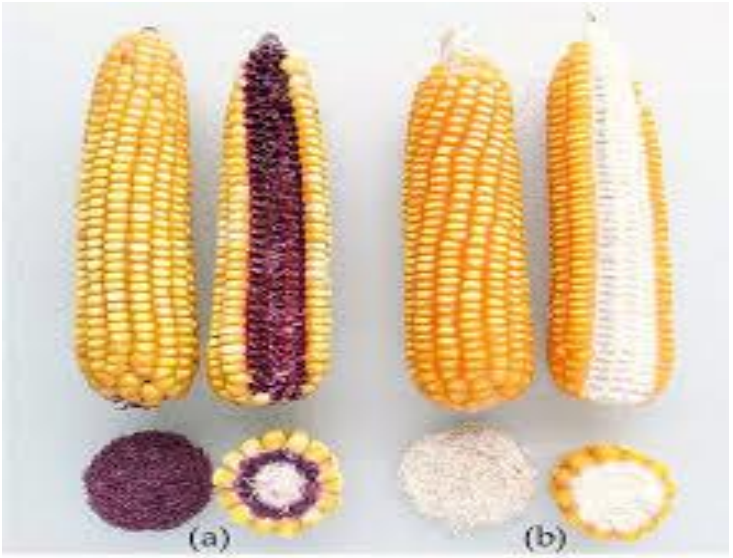
# Corn-onomics



Zea Mays Indentata (1)

**Yellow** is a hue, a tone we readily associate with emotions of happiness, amusement, envy or even cowardice. In the ancient days of Middle Kingdom of China, yellow could only be worn by the emperor in contradiction of it's use during the day of Hitler's obligating Jew's to wear a yellow star of identity. In Christianity, it is associated with the Pope and the golden keys of the kingdom. Yet, it prevails in the likeness of our faith in religious of other provocation of foods naturally supplied from the earth and even the color of birds of our skies. Good things come of thee in yellow. Bananas, egg yolks, daffodils, and canaries all carry biological pigments or traits which have deemed them to behold the color yellow in the likeness of corn. It's even a hue found within the beautiful wings of fluttering butterflies.

Today, yellow corn has become a cash crop of choice globally as it takes approximately 100 days for corn to grow at a rate of 173 to 183 bushels per Arce. In historical comparative, it used to take Native American's 24 hours of labor to cultivate a bushel of corn and today Iowa's soil and farmers require six minutes of man labor to grow the same amount. Corn, which has become a major food resource in many regions has a long history in his making into what we dine on regularly in the U.S. and abroad. And in time, it has evolved into a multitude of products and by-products both categorically able to dually sustain and improve the economic value of this common vegetable. It is grown on every continent except Antarctica, is the ingredient in more than 4000 everyday grocery items as a bushel can sweeten 400 can sodas. Between 2016 and 2017 alone, about a billion tons of corn was produced. It has been a leading crop of Iowa for more than 150 years, which produces more than the entire country of Mexico.

History & The Corn Plant

The Maize domestication theory happened in Balsas River Valley of South central Mexico. The ancient grass believed to have been found 9000 years or so ago, was transformed into what is known as corn through influence of human intervention. European Colonization resourcefully carried it to other parts of the America's expanding it's usage as a food. There is a variety of 'maize' found near Cuscu and Machu Pichu at Salineras de Maras on the Inca Sacred Valley in Peru, in June 2007. As we explore corn and it's dynamic use in industry we first must recognize the structure of it as it's tall stalks extend upright to visibly seen along the sides of roads in farmlands around the country.



Field Corn (2)

## HISTORY & THE CORN PLANT

Tassel: top part of the plant and it attracts bees and other insects
Ear: cover the silk, husk, kernel and cob of the corn plant
Silk: grows from top of corn husk and may be green, yellow or brown
Husk: green leaves surrounding corn ears protects kernels of the corn
Leaves: numerous leaves on the stalk
Stalk: main body of the plant, the stalk can grow several feet high and is sturdy to support ears of the corn
Root: holds crop in place

Marketed today are five types of corn: Flint, Flour, Popcorn, Dent and Sweet. Zea Mays Indentata, field corn, is Indian corn found in white, red, purple, brown or multi-colored kernels original corn grown by Indians seen at harvest time and Halloween. Dent corn are those having a defined 'dent' within it's kernels and is hidden in use for items such as corndogs, whereas, Sweet corn is typical field corn and is 40% of the worlds corn consumption. Popcorn, in turn, is the oldest form of corn. As dry corn kernels, housing starch endosperm shells consist of 14 – 20% moisture, expand as puff-up when heated, we are able to partake of popcorn treats. Our access to popcorn is due to the invention of steam-powered machines during the 1890's by *Charles Cretor* which were popcorn. This business thrived during the Great Depression and became a source of income for farmers. Though these steam-machine makers have been modified they are in full use today.

Scientist identify the common market place cobs as the hybrid derivative of the original plant from allowing pollen from one corn plant to pollinate itself created an inbred plant with special characteristics. This hybrid became popular across the corn belt having a higher yield resulting from it's resistance to insects and pest. It cost more to produce, but is worth it as it develops with stronger stalks which are resistant to the varied weather conditions the farm environment exposes crops to enabling it to withstand strong winds or heavy rain. It is best for machine pickers to harvest.

As corn is a tropical crop, it is still perfect for our environment especially in the Midwest zones of Indiana, Illinois, Ohio, and Iowa which product 50% of U.S. corn and stake claim to being the Midwest 'popcorn' capital of the world.

## MANUFACTURED CORN

Primarily, corn has become micro-managed scientifically for it's use as a (1) flour, (2) syrup, (3) livestock feed, (4) ethanol produced and use to make (5) plastic.

Iowa livestock are recorded as consumers of 292 million bushels of corn and it is estimated back in 2012 thru 2013 by the USDA that 4.5 billion bushels of corn in U.S. would produce 14 billion gallons of ethanol. It is also the corn starch within each kernel that is cooked with alpha and gluco-amylase enzymes to convert into simple sugars fructose and glucose. Here we have identified the pre-cursors of the evolution onto the exploration of full use of corn outside of it's general consumption as a human food resource.

When the basic corn seed is manufactured, it bares the result of a multitude of by products which are then further processed to distribute it's content for marketable use in industry's such as plastics, condiments, alcohol, biofuel, foods among other uses.

**Flour stored in Silos**

Typically, corn is stored in massive size containers termed 'silos'. This enormous external containers are used to keep corn for commonly one to three months, however, it can remain for up to 12 months. While stored, it is required to remain within the proper temperature, have adequate ventilation with centrifuge fans to prevent spoilage or becoming hazardous with bacterial growth. It the silos are not controlled it can attract insects, build internal moisture, or gain exposure high temperatures. Having the stored crop build moisture or becoming wet inside the silo can cause temperature spikes without cooling ability which would result in a fire.

Inside each storage container, there may be heated air dryer which provides the onset of 'dehydrating' and producing a dry shelled corn. This product is usually fed through a grinder producing 'corn flour'. It is then sent to be manufactured into a variety of outcomes.

1. It can be mixed with soy and shipped as US Food Aid
2. Corn flour can be chemically broken down into a corn starch and sugars
3. Soaked within a cook area soaked in enzymes and water created a mash, which after the bacteria is killed, is sent to fermentation tank where yeast is added enable fermenting into a beer or Corn Whiskey; a by-product of this is Ethanol

4. The starch's sticky composition can be mixed into products for poison pellets, kitchen sink glue etc....



Livestock Feed (3)

## CORN BY-PRODUCTS

a. Cornstarch

As corn is steeped for 30 to 40 hours it begins to ferment slightly as it is then separated from the endosperm and the resulting 'germ' is washed repeatedly to remove starch and gluten. Then combination is then screened off known as 'starch milk'. After centrifuging, the force mill steam this mix into two fractions: (1) Gluten Overflow and (2) Starch Underflow. The starch milk is dried and put inside silos for bagging as cornstarch which is used to manufacture sweetener, paper & textiles, and as food thickener and stabilizer. It can also be found in foods such as sausages or tablets (pills).

This germ can be dried and taken to 'silo' for later use or further prepared for 'corn oil' extraction.

b. Starch Plastics

Plastic celluloid was first develop in the late 1860's using resources such as gun cotton and camphor from laurel trees. Today it is the byproduct of 'corn' during it's manufacturing process within the separation of simple sugar from the endosperm. The addition of 'bacteria' cultures causes fermentation into lactic acid. 'Lactide' molecules bond into polymer chains which form pellets of 'polylactic acid plastic'. This can then be spun into fibers or melted into any form.

In the 1990's Cargill joined with Japanese Plastics, Teigin ltd to produce plastic using an external company. Now the Blair, Nebraska company produces PLA which is a bioplastic used for items such as foam products, gift cards, containers, paper cups, or bottling.

c. Starch Sugars

Corn is also ground down in water releasing 'germ' which floats to the top as an oil based product. The germ is then squeezed and corn oil removed. The remainder is grinded finely into a fiber which is filtered to separate the liquid +

starch [99.7%]. This starch is then further manufactured into a combination compound of corn syrup which is separated into glucose + fructose sugars. Fructose especially is an inexpensive ingredient of soda, candies, ketchup, and baby formula that has the ability to restrict hormones affecting our appetite.

d. Starch Corn Oil

Mechanical presses and/or solvent extraction is used to capture crude oil from the germ. This crude oil is refined and filtered removing 'free fatty acids' and 'phospholipids'. The remaining oil is used as food and cooking oil. It is also raw material for margarine product and it's remainder slated to be used as animal feed or to be combined with gluten feed.

Starch oil protein comes from corn through a specific separation process.

e. Livestock feed

The stalk, husk, and cob or an ear of corn are known as fodder when combined. After processing, it is (1) baled, (2) used for animal bedding or (3) organic matter or left on the field for microorganism to enjoy.

Components of animal feed is also the result of the corn manufacturing process as excess water is removed from dried cornstarch to be sold as corn gluten having high value in protein and as fiber in pellet form. It is primarily used as 'poultry' feed and it's added 'corn steep liquor' may be sold for cattle feed or as a pellet binder.

f. Corn alcohol

Corn whiskey is made from natural corn mash obtaining a high percent of it's straight corn base. It is then distilled to the makers desired strength [proof] as it is not required to be aged in wood. This product must adhere to a set of unique regulations in its production. If this basic alcohol is charred in oak barrels the result is that of Bourbons and American Whiskeys.

Lately, alcohol has become an infusion to recipes adding to limiting use and sales increases. It is not just a beverage additive but used for chocolate mixes, chicken braising, marinades, seafood sauce, and fruit liqueur dips.

## RENEWABLE BIO-FUELS

Since the 1970's Arab Oil embargo, the U.S. has sought and invested billions into developing alternatives to reduce it's reliance upon foreign petroleum. It has evolved interest in ethanol production, air and wind natural use and delved into other means of energy supplementation. Additional resources would prevent suffrage through gasoline shortages and price shock. Outside of the global efforts to increase ethanol output, the **global biofuel market** is valued at U.S. $141.56 billion dollars in 2020. It is anticipated to rise to a U.S. dollar value of $245.48 billion by 2027.

There are four forms of Renewable Biofuels:

A. Cellulosic Biofuels

Cellulosic ethanol is **ethanol (ethyl alcohol) produced from cellulose (the stringy fiber of a plant) rather than from the plant's seeds or fruit**. It can be produced from grasses, wood, algae, or other plants. Cellulosic fuels offer economic, environmental, and national security benefits. This ethanol is an 'oxygenate' and octane-boosting additive that improves efficiency of gasoline combustion and reduces emissions of certain regulated pollutants. However, it's development would be a sense of reform of Renewable Fuel Standards and discourage corn ethanol industry.

The commercial production of cellulosic biofuels would enable the U.S. a means of lowing its greenhouse gas emissions, cause a reduction of its reliance on petroleum, and create new opportunities for growth in the agriculture and technology sectors. After billions of R & D investment dollars this concept is on the edge of it's success, yet, only a few companies have been able to go beyond technical and economic challenges to open commercial facilities. Improving the necessary technology is both difficult and costly. Cellulosic ethanol is at a dollar value 5x's the per gallon cost of standard corn ethanol plants. Publicized high-profile failures have made 'venture' capital and private equity financing for these plants even harder to obtain. These dilemmas has caused the production of cellulosic biofuels to lag behind the levels outlined in the 2007 RFS [renewable fuel standards] legislation.

The process of manufacturing cellulosic biofuel requires two enzymes that breakdown cell walls and access sugars in the cellulose of plant material. There is the use of the enzymes but also consideration of facilities and machinery designed for it's specific use in separating and other chemical procedures necessary. This generates added expense obstacles in (1) technology and (2) economics.

To defer the additions expense by generating 'co' products along with the cellulosic ethanol and some producers have attached themselves ideas such as "bolt-on" which increased corn oil yield and creates higher protein feed product for the livestock industry. The 'bolt-on' cost are absorbed in corn expenditures which lower the overall cost of the cellulosic project.

Those corn ethanol producers having interest in this 'newer' paradigm in cellulosic biofuel have dubbed their manufacturing facilities with additional tools to enable a joint venture of ethanol and cellulosic biofuel in-house production. There are very few, yet, there are plans to expand at all four facilities as they fine-tune their technologies an ID zones of improvement.

B. Conventional biofuel: Ethanol

U.S. corn production can result in 37 billion gallons of ethanol which is approximately 26% of our 137 billion gallon-per-year gasoline consumption par the EIA [Energy Information Administration]. Ethanol refineries are believed to utilize 45 million pounds of corn per week.

As the manufactured alcohol is separated from the solids to purify the ethanol. Ethanol is an alternative fuel used as ethanol, unleaded fuel, diesel or as a nitrogen fertilizer. The industry met it's 7.5 billion gallon goal slated for 2012 back in 2007. And this industry continues to grown and gain momentum.

The highest level of perfection in isolating 'ethanol' as biofuel in prior years has pushed exploration of corn growing methods. Hybrid corn seed greenhouse experimenting is the direct result of the impact the modification of corn and it's use has generated. In pharmaceutical research, the special proteins housed within each kernel is driven scientist and others onto patterning non-traditional growth processes well beyond that of the modern day greenhouse corn. Organic is only the beginning toward more selective options through which researchers maintain control of sunlight, insect invasion, temperature controls, and control of other variables which impact traditional farming environments.

C. Biomass- based diesel

> Biomass-based diesel is defined as a renewable transportation fuel, transportation fuel additive, heating oil, or jet fuel that meets the definition of either biodiesel or non ester renewable diesel that reduces GHG emissions by 50% or more.

D. Advanced biofuel

> Advanced biofuels (D5) are produced from **any type of renewable biomass (sugarcane, biobutanol, bionaphtha) except corn starch ethanol**

**In conclusion**, it is suggested in research that the environmental cost are greater and the benefits fewer, than using corn for food. Soil nutrients fluxes in it's provision of nutrient and carbon storage in the soil. Thus, it is higher value and best use as a food option. Despite this conclusive research, the need for functional alternatives to gasoline has spurned the growth in use of corn and research for timely adherence to government mandates for a blend of automotive fuels with biofuels readily accessible for purchase. The success of these varied projects and the ensuing positive outcomes has concluded with the establishment of numerous companies and subsidiaries which are recognized within the dynamic stock market.

1. Aemetis (AMTX) $8.84 per share
2. Alto Ingredients (ALTO) $4.46
3. Future Fuel (FF) $8.09
4. Gevo (GEVO) $5.24
5. Green Plains (GPRE) $35.60
6. REX American Resources (REX) $77.25

7. Green Plains Partners (GPP) $12.83 hybrid corn (4)



You may also be inspired to venture into new territory using the multitude of online videos dispelling assumptions you may hold regarding the value of researching alternatives and furthering production use of this basic vegetable item. Or, you can participate through association with the many functional organized bodies whom managed the business of 'corn' globally. If this eludes your interest, there is always the entertainment provided through Stephen King text and movie, "Children Of The Corn" which as a dated 2018 version entitled, "Children Of The Corn: Runaway".

**Just a few organized bodies and products:**

Corn Utilization & technology Conference June 6-8th 2022

National Corn Growers Association

Commodity Classics: Nourish The Future Conference March 12, 2022 in New Orleans, LA

Cluboenologicque.com

Georgia Moon Corn Whiskey

Heaven Hill Distillery

Stillhouse Original Whiskey

***This is not an endorsement of alcohol based products nor does the writer encourage alcohol use.**

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