CORN IN THE UNITED STATES

History

Corn has been an important part of the Americas since well before their discovery by Columbus in 1492. Corn is first thought to have been grown over 5600 years ago in Mexico, by the Mayan and Aztec tribes. Young corn was used as a vegetable, and the dry kernels were ground into flour and used for baking. Corn use spread, and by the time Columbus discovered the Americas, corn production was occurring from the Andes Mountains in South America to Southern Canada. Columbus received corn as a gift from the Indians he encountered in the Caribbean and carried it back to Spain, where it quickly caught on and became a staple. With a short time, it was grown in Europe and throughout the world.

Corn became a staple of this country with the first Pilgrims who arrived at what they would call Plymouth. These settlers might have died during that first winter from starvation if they hadn’t been given some corn to eat by the Native Indians. They also showed the Pilgrims how to prepare the corn into bread, soup, pudding and fried corn cakes, as well as showing them how to grow corn and care for the plants. Since then corn has been a major crop, both as animal feed as well as for human consumption.

Corn production was severely limited in the early years of our country by land, labor and varieties. Farmers would by seed at the general store, and after that growing season’s crop, keep back their best ears to use as seed corn for the next year. This led to small yields because of inbred lines and traits. However, technological advances such as
tractors and implements enabled farmers to plant more acres of corn in less time and helped to increase total production to an average of about 29 bushels an acre in 1900.

Beginning in the 1920’s researchers began to develop hybrid corn that allowed for greater production numbers. This was done by cross breeding corn traits, which led to increased yields and total production, which in turn led to fewer acres being needed to be put into corn production. Beginning after World War Two fertilizer began to become common in fields, due to new technologies and production plants developed during the war. These new advances were able to lower the cost, and increase the availability of manufactured nitrogen. Pesticides also began to be introduced after World War Two and helped to increase yields. Genetic advances continued to push the limits of production, increasing yields from about 36.9bu/acre in 1951 to about 113bu/acre in 1982. New developments in the 1980’s, such as Roundup® Ready technology, and the genetically modification of crop traits, causing the plant to become resistant to insects, helped push yield averages even higher. Today the average corn production yield is around 130 bushels per acre.

**Production**

Corn production today is very different from what it was in the early 1900’s or even the 1950’s. Corn production is mechanized, with farmers using tractors and implements to till the ground rather than horses and moldboard plows. In the fall, combines roam the fields rather than farmers with horse drawn carts picking each ear.

Over time the practices that the farmers use to till the soil has also changed, with most farmers abandoning the old method of plowing the field under in the fall to cut down on wind and water erosion. Nowadays most farmers use a type of conservation
tillage that only works the ground in the spring before planting, and maybe after harvest to till the organic matter under. This process requires the application of chemicals at least once in the spring and then maybe again later after the plants have emerged.

Another practice is no-till, where the field is not worked, but rather the seeds are planted when the ground is ready. This has been made available with the new technology that has made corn plants resistant to certain chemicals such as Roundup® or Liberty®. When the field begins to fill with weeds, the farmer just has to apply a chemical to kill everything but his crop. This allows the farmer to spend less time in the fields, fewer hours in the tractor working the ground, and can provide greater profits.

A third form of farming that is starting to emerge is organically grown corn, which uses no chemicals of any kind, but rather relies on mechanical and biological means to control the weeds and pests. This type of farming has grown steadily over recent years, but certain requirements must be met in order to sell the grain as organically grown.

With all the advances of technology and genetics, the average number of acres planted in the past 10 years has on average, remained about the same. In 1992 the least number of acres were planted in the U.S., with about 79,311. The high point during the past 10 years was in 1998 when 80,166 acres were planted. Production from these acres has averaged in the 9 billion bushels, ranging from the high point in 1994 with over 10 billion bushels being harvested, to the low point the year before in 1993 with only about 6 billion bushels being produced. During this time the average corn yield has also increased from a low of 100 bushels per acre in 1993, to a high of 138 bushels per acre in 1994, but on average has been about 130 bushels per acre.
The 2002 crop production year was about average when compared to the past 10 years. Over 79 million acres were planted to corn, with the total production being about 9 billion bushels. The nation’s average for yield per acre was about 130bu/acre, lower than the previous year, but just about on average for the past ten.

Non-Biotech corn was planted on a majority of these acres, taking up 67 percent of the total land planted, or about 53 million acres. This was followed by biotech corn at about 22 percent, or 17 million acres and herbicide tolerant seed with roughly 9 percent and 7 million acres. Stacked traits rounded out the majority of acres planted with 2 percent, or just a little under 1.6 million acres.

Biotech corn usage in the U.S. has steadily increased over the past few years, mainly because of lower costs and greater availability to farmers. This is true in the main corn producing states of Iowa, Illinois, Minnesota and Nebraska. From 2000 to 2002 the percent of biotech corn planted in Iowa grew from 30 percent to 41 percent. This 11 percent increase is an average of just over 3.5 percent per year. When put into acres it means that each year about 420,000 more acres were planted with biotech seed. Illinois saw a 5 percent grown in the amount of biotech seed planted in the same period, from 17 percent in 2000, to 22 percent in 2002. Minnesota had a 7 percent growth, from 37 percent to 44 percent, while Nebraska saw the largest increase, from 34 percent to 46 percent, for a 12 percent growth. As a whole the U.S. saw about a 9 percent growth in the amount of biotech corn being planted for this time. This growth will continue to climb as more and more technology becomes available to farmers, and as the price for this new technology decreases with time.
Iowa once again led in total production of corn in the U.S. in 2002, with farmers planting over 12 million acres, and harvesting close to 2 billion bushels. Averaging 165 bushels per acre, Iowa’s average was well above the nation’s average, but was second only to that of California, which averaged 170 bushels per acre. Illinois was second in total production with farmers planting over 11 million acres and turning in a total yield of just about 1 and a half billion bushels, averaging about 136 bushels an acre. Minnesota rounded out the top three by planting just over 7 million acres and harvesting a total of a little over 1 billion bushels. Minnesota’s average yield per acre was higher than Illinois, at about 157 bushels per acre.

**Consumption**

With new technology and discoveries, corn and corn products are being used to make things that farmers 100 years ago would never have been able to imagine. Today corn is used to make fuel for cars, fabric for clothes, and even plywood to build houses. However, the main use of corn today is much like that of 100 years ago, for feed for animals.

In 2002 feed for animals was the largest part of U.S. corn consumption, using 58 percent of the entire crop, or about 5.6 billion bushels. Of that 1.5 million bushels were fed to beef, 1.4 billion bushels to poultry, 1.2 billion bushels to swine, and 700 million bushels was fed to dairy cattle. In Iowa alone, livestock consumed about 500 million bushels, or about 25 percent of the total amount of corn grown in the state. Hogs were fed a majority, 54 percent, of the grain, while cattle consumed 29 percent, chickens consumed 12 percent, and dairy cattle consuming 5 percent.
Exports made up the second biggest chunk of consumption of grain, with 19 percent, or close to 1.9 billion tons heading to overseas markets. This was followed by ethanol, with took up 9 percent of consumption, or about 900 million bushels. Ethanol is an additive that is added to gasoline to help engines burn cleaner, and in turn pollute less of the environment. Demand for ethanol has increased over the years, with more and more states requiring that it be added to gasoline rather than other additives. Production has also increased from about 10 million gallons in 1980 to just about 2 billion today. This has led to a boom in ethanol production, with new facilities sprouting up all over the nation. Farmers are often driving forces behind these projects, seeing ethanol as a way to add value to their corn, and get a higher price for it than they would at the local co-op or elevator.

High fructose corn syrup took up about 6 percent, or about 545 million bushels. Two hundred and fifty million bushels were processed into starch for industrial uses such as paper, textiles, and plastics. Starch was also used for food purposes such as candies, soups and baked good. Sweeteners used up 212 million bushels, and can be found in cakes, ice cream, cookies, even soda. Cereal products used 187 million bushels for breakfast cereals, chips, and other corn foods. Alcohol production used 131 million bushels for beverages and about 20 million bushels were used as seed for the next year.

**Commercialization**

The corn market in the U.S. is very commercialized, from the time the farmers buy the seed, to when they decide to sell the grain. This means that many important decisions that must be made in order to make sure everything from growing, to selling goes smoothly.
The marketing channel starts with the bags of seed corn the farmers buy every year to use to plant their crops. Some of this seed is moderately priced, in the 70-80 dollar range, but as you begin to add technology and advancements, like Roundup Ready® and YieldGard®, the price jumps to about 150 dollars for a bag. Seed corn is just one input that farmers used to grow their crop. They also apply fertilizer such as potassium, or phosphorus to their fields to replace the nutrients that the plants the previous year have used up.

After the corn has germinated and grown up out of the ground, the farmer may decide to spray certain chemicals on the field. This may range from chemicals such as Buctril® or atrazine that will kill grasses and broadleaf weeds, but will not hurt the corn, to the more expensive chemicals like Roundup®, that will kill everything in the field except the corn, providing the plant has the resistant gene in its makeup.

Once the corn has been harvested in the fall, the farmer may either store the corn in bins at home, store it at a local co-op or elevator to sell later, or may even sell it right away to the co-op or elevator. This all depends on whether the farmer likes the price at the time. The price is set at the Chicago Board of Trade, where buyers and sellers gather from all over the globe to buy and sell corn. From the determined price that is set in Chicago, elevators and co-ops set their price. This is lower than what is offered in Chicago because of the basis. The basis is the cost of transportation to grain handling centers near and around Chicago.

When the farmers do decide to sell their grain, they usually sell it to the local co-op or elevator, or to a near buy ethanol plant or processing center. However, most co-ops and elevators can’t process grain, so they in turn must sell it to someone else. When they
have sold grain to a processing center or terminal, the co-op or elevator uses trucks or even railcars to move the grain. At the processing centers, these cars and trucks are unloaded and the grain is then used. If the grain is sent to terminals, large processing centers located on major rivers or bodies of water, the grain is unloaded and stored. When an order comes into a river terminal, the grain is loaded up on large barges and is shipped downstream to port terminals where it is then loaded on cargo ships and sent around the world.

Increased usage of biotech has led to tougher standards when it comes to shipping corn to foreign markets. Certain nations and organizations, like the European Union, do not accept biotech corn. This means that the farmers must inform the co-op or elevator at the time of delivery whether or not they have biotech corn. The co-op or elevator must then keep this corn separate from non-biotech corn. This has led to many places not accepting bio-tech crops at all in order to avoid the problem of keeping them separate.

**Trade**

In 2001-2002 the United States led the world in corn production with 9.5 billion bushels, or just about 40 percent of all corn produced in the world. China was second with just about 4.5 billion, or 19 percent of the world production. The European Union was third with 1.5 million or 7 percent, followed by Brazil with 1.4 billion or 6 percent, and Mexico rounding out the top five with 3 percent, just a little over 800 million bushels.

It was no surprise that with domestic consumption only using about 7.6 billion bushels, that the U.S. was also the leading corn exporter in 2001-2002, with just about 1.9 billion, good for a 63 percent share of the total corn exported in the world. China and
Argentina each exported close to 340 million bushels of corn, good for a respective 12 percent share. Hungary came in fourth with 4 percent, or just over 100 million bushels exported, and South Africa rounded out the top five exporters with just fewer than 50 million bushels, or 2 percent of the total exports.

The leading importer of corn during the same time was Japan, importing 22 percent of the world’s grain, or roughly 645 million bushels. South Korea followed at second with close to 340 million bushels, or 12 percent of imports, followed by Egypt with close to 200 million bushels, 7 percent, Taiwan with 180 million bushels, 6 percent and Mexico and Canada both importing 5 percent or close to 160 million bushels. The European Union imported roughly 4 percent of total exports, with about 120 million bushels followed by Malaysia with 95 million bushels, Colombia with 3 percent or 75 million bushels, and Algeria and Saudi Arabia importing about 2 percent of the world’s exports of corn, with totals of 55 million and 51 million respectively.

The most common destination for U.S. corn was Japan, importing close to 600 million bushels followed by Taiwan, who received roughly 200 million bushels. Mexico, helped by the North American Free Trade Agreement, NAFTA, imported just over 187 million bushels of corn. Egypt was the fourth most common destination, importing 186 million bushels. Canada, also taking advantage of NAFTA, imported just over 100 million bushels, and Colombia rounded out the top six, importing about 69 million bushels.

**Trade Agreements**

The United States has many trade agreements with countries around the world, including Chile, Morocco, the European Union, and Cuba, but the most important
agreement would have to be the North American Free Trade Agreement. With this agreement, Canada and Mexico import more corn than any other nation other than Japan.

NAFTA first began implementation on January 1, 1994, after the leaders of the United States, Mexico, and Canada signed it into effect. NAFTA immediately eliminated all non-tariff barriers to agriculture trade between the United States and Mexico, and many tariffs were canceled, with all to be phased out over a span of 5 to 15 years. By the year 2008 all tariffs and barriers to agriculture products must be lifted on any goods transported between the Canada, Mexico, and the U.S.

In the years before NAFTA, the United States began to see a decrease in the total amount of exports to Mexico. However, during the time of NAFTA, the United States has seen exports to Mexico grow by 100.4 percent from 1993-2002. In 2000 this resulted in a $1.47 billion trade surplus for the United States.

When people see this growth they might think that with the increased imports from the United States, the production from Mexican farms has decreased. In fact, from 1993 to 2001, total farm production in Mexico has grown by about 50 percent. This is evidence that free trade works between the neighbors and can benefit both.
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CORN IN MEXICO

History

The history of corn, or maize as it is also known in Mexico, is one that stretches back thousands of years, and has many different stories and myths about its origins. The following is a Huichol myth about maize’s origins.

1 “...The Mother of Maize changed her dove appearance to a human one; She introduced to the young man her five daughters, who symbolize the five maize sacred colors: white, red, yellow, spotted and blue. As the young man was hungry The Mother of Maize gave him a kettle filled with tortillas and a pot filled with atole; he didn't believe that those could satiate his hunger, but the tortillas and atole were renewed magically, in a way that he couldn't finish them. The Mother of Maize asked him to choose one of her daughters and he took the Girl of Blue Maize, the most beauty and sacred of them all...”

"Mitos y arte huicoles," published by Sep/Setentas and written by Peter T. Furst and Salomón Nahmad.

Corn is a product of thousands of years of cultivation, and special breeding to become what it is today. Corn was originally developed from a wild grass known as teosinte, originally growing in the southern part of Mexico about 7,000 years ago. The kernels of this plant look very different from that of corn today. As you can see in the pictures below, the kernels were very small, and were not fused in rows like they are today on the ears of corn. Over time, the Native Americans were able to produce corn that looked similar to todays, only much smaller. The ears were only a few inches long, and only had about eight rows of kernels. With continued cultivation and selection

1 http://www.mythinglinks.org/ip~maize.html
techniques, the Native Americans were able to increase the size of the ear, as well as improve the yields of each crop.

Very slowly over time as production increased, it allowed more and more people to stay in the same place. This meant that a family was able to support themselves by staying in one place and growing food, rather than migrate and look for food to support their diet. The increased production also allowed for the population to grow, with towns and cities sprouting up around areas where food was plentiful.

Corn not only became the main staple for the Native Americans, but also provided a basis for their economy, and became part of their culture. The Aztecs, the tribe of Indians who ruled central Mexico when the Spanish arrived, developed a sophisticated system of growing the crop.

The Aztecs lived in the middle of five different lakes, and the land around the lakes were fertile, but was not large enough to produce enough food for the constantly growing empire. The Aztec then developed irrigation systems which allowed them to

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2 http://www.nativetech.org/cornhusk/cornhusk.html
farm on terraced hillsides, and also began to use fertilizer to enrich the soil. Their most important and significant development was the creation of chinampas. Chinampas were made by reclaiming swampy land around the lakes, and turning them into artificial islands. The chinampas were made by digging canals through marshy shores and islands and then heaping the mud they had dug up onto huge mats made of woven reeds. These mats were then anchored by securely tying them to wooden posts driven into the bottom of the lake. Trees were then planted at the corners, and along the sides to secure the islands to the ground, and also to prevent erosion of the soil from the chinampas. On these islands the Aztecs planted corn and other plants.

The practices used by the Aztecs to plant the corn crop were very primitive, and very labor intensive, since they had no plows or any work animals, such as oxen or horses. Farmers planted the corn in soft soil using pointed sticks, and would manually care for the crop as it grew. When the plant was ready to be harvested, it would then be picked by hand, and transported through the canals to the city on canoe’s and boats.

**Agricultural Practices**

The way corn is produced in Mexico can vary quite a bit depending on what part of the country you are traveling in. In the northern parts of Mexico, production is more modern, whereas, in the southern parts; production is much like it was hundreds, even thousands of years ago.

Farmland in the northern part of Mexico is mostly commercialized, with farmers owning large areas of land. The land is heavily irrigated and modern production practices are used to grow the crops. Large farm equipment is used to plant and harvest
the crop, as well as new technologies, such as biotechnology and chemicals are common in the fields.

In central Mexico, family farms are more common. These are typically smaller than the large commercial farms of the north. There are roughly one million such farms, and farm about 40 percent of Mexico’s farmland. Most of these small farmers work in ejidos, or collective farms. Many of these farmers do not own the land, but have been given the right to farm it by the Mexican Government. Production practices here are similar to those of the commercial farms, but on a smaller scale. Chemicals and biotechnologies are rare, but machinery is used to grow the crops in certain areas. These farmers commonly grow corn, beans, vegetables and other crops. They produce the food mainly for their own families, and what they have in excess, they sell to the government or in local markets.

Farm practices in the southern regions of Mexico are very primitive and similar to that of when corn was first cultivated. Most farms here are subsistence with the families only producing enough corn to feed themselves. The fields are often intercropped, planted with several crops, in order to maximize the land they have, and also provide a variety of food for their families.

**Corn Production**

Corn production in Mexico has been fairly steady despite the numerous advances of technology. This lack of growth can be attributed to the cost of buying new technology that would increase the yield. A majority of the farmers are too poor to afford the chemicals or seed that can result in an increased yield.
The corn yield has steadily increased from roughly 18.1 millions tons in 1993, to about 19.2 million tons in 2002. The high point during the past 10 years was in 2001, when 20 million tons were produced, to a low of 17.7 million tons in 1999.

During the same time, the number of acres planted has remained relatively the same from, 8.24 million hectares in 1993, to 8.27 million hectares in 2002. The number of acres has varied from a low of 8.24 million hectares in 1993, to a high point of just about 9.2 million hectares the following year in 1994.

In 2003, the leading corn producing state in Mexico was Jalisco, located in the west central part of Mexico. The farmers in that state produced 2.8 million metric tons, with an average yield of 4.52 tons per hectare. Converted to bushels per acre, the production was roughly 72 bushels per acre and is similar to the average yield of production in Maryland. The next largest producer was the state of Sinaloa, in northern Mexico, with 2.7 million metric tons. The average yield per hectare was 9.09, which when converted, is about 145 bushels an acre, similar to the average of Utah. Other

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3 Compiled using data from Servicio de Informacion Estadística Agroalimentaria u Pesquera SIAP/SAGARPA. (con datos del SIACON)
leading states were México, in central Mexico, with 1.6 million metric tons and an average of 2.96 tons per hectare or 47 bushels per acre, Michoacan, in west central Mexico, with 1.4 million metric tons and an average of 3 tons per hectare or 48 bushels per acre. Chiapas, in far southern Mexico, produced roughly 1.4 million metric tons, but had the lowest average of tons per hectare produced in Mexico, with only 1.65 tons per hectare, or 26 bushels per acre. The state of Guerrero, in south central Mexico, produced about 835 thousand metric tons, with an average of 1.78 tons per hectare or 28 bushels per acre. The state of Veracruz, in eastern Mexico, produced the least amount of corn in Mexico, only 325 thousand metric tons. This amounted to an average yield of about 1.77 tons per hectare or 28 bushels per acre.

Overall, total Mexican production of corn is much smaller than that of the U.S. This can be explained by lack of technology and available land. However, much like the U.S., the Mexican government does give out a subsidy payment to help the farmers make ends meet. In 2002, the subsidy payment was a flat rate per hectare of about 875 pesos per hectare. When converted to U.S. dollars this equals about 98 dollars an acre. This payment was 5 percent higher than the same payment in 2001. According to the Mexican government officials, roughly 2.5 million farmers were eligible to receive the payments. Also included in the farm plan were provisions to give Mexican farmers incentives to switch their production from white corn, a crop that Mexico is suited to growing, to other crops that they are not sufficient in producing, like yellow corn, where the U.S. has a definite competitive advantage. However, many annalists were skeptical that the production of yellow corn would increase. Many problems, such as a lack of sufficient yellow seed varieties, a low willingness of farmers to change from their traditional white
corn production in favor of the yellow corn, and a general lack of knowledge of how to grow yellow corn among farmers would have to be solved before this change could take place. These problems hamper the transition process, and slow down the adoption of different farming technologies and cultural practices needed to make this transition to grow yellow corn.

**Consumption**

Corn production in Mexico is mainly for human consumption. This includes all white corn varieties. Corn consumption in Mexico in 2002 was about 25.6 million metric tons, with most going towards the production of tortillas. Tortillas are a main staple in the Mexican diet, and have a per capita consumption of about 126 kilograms per year.

Another part of corn consumption in Mexico is the corn used for livestock feed. These industries favor yellow corn over the traditional white corn for feed; so much of the corn used is imported under NAFTA.

**Trade**

Mexico has many trade agreements with countries around the world, but the most important agreement would have to be the North American Free Trade Agreement. NAFTA first began implementation on January 1, 1994, after the leaders of the United States, Mexico, and Canada signed it into effect. NAFTA immediately eliminated all non-tariff barriers to agriculture trade between the United States and Mexico, many tariffs were canceled, with all to be phased out over a span of 5 to 15 years. By the year 2008, all tariffs and barriers to agriculture products must be lifted on any goods transported between the Canada, Mexico, and the U.S.
When Mexico signed this treaty, there were several things that they hoped would happen. The first was to reduce the domestic price of corn. This would make corn cheaper and more available to much of its population. The second was to decrease output, which would allow the imported corn to have a place to be bought and sold. The third was to relocate labor, land and capital. This meant that labor, land, and capital that had been used to grow corn, could now be used to help promote other industries. The land and capital could now be used to promote and build new factories, and the people who were displaced from the loss of farms could have a job in the factories. The fourth effect was to let marginal lands, or lands that aren’t necessarily intended for farming corn to fallow, or be taken out of production. This would help to cut down on the environmental damage caused when the land was put into production.

Unfortunately, since NAFTA has gone into effect, the almost exact opposite has happened in Mexican corn production. Corn production has remained fairly stable, but more and more land was put into production. This resulted in a change in agricultural output, from 60 percent of cultivated land yielding 60 percent output, to 67 percent of cultivated land yielding only 36 percent of total output. Extensive environmental damage was also caused by both large and small farmers, who took land that should otherwise not be planted with corn, and put it into production. This has also had a reverse effect on the domestic side. Tortilla prices have increased, and more and more people have moved to larger cities in search of jobs. Overcrowding is now a bigger issue than ever, with Mexico City now the biggest city in the world. Another important issue is the elimination of the guaranteed price floor for the farmer’s corn. This eliminated any guaranteed price that the farmer would receive when they sold their crop.
Because of all of the changes that have taken place, hard feelings have begun to develop on either side of the border about trade between the United States and Mexico. Mexican farmers accuse U.S. farmers and businesses of dumping extra corn in Mexico at prices well below that of their domestically raised. In response, the Mexican government has imposed anti-dumping policies on imported corn. But is this really the case?

There are many myths and perceptions that you must first sort through in order to find the truth of the matter. One issue to consider is the amount of corn imported from the United States. As you can see in the graph below, the amount the Mexico has imported from the United States has grown considerably since NAFTA was signed in 1994. The farmers in Mexico charge that with this inflow of grain from the U.S., prices have continued to drop because it is cheaper to buy the U.S. corn than that raised in Mexico.

U.S. producers argue back that the importation of corn into Mexico has not hurt the farmers, because the imports are yellow corn for animal feed, and not the white corn that is grown for human consumption in Mexico. This is a fact that some have addressed, saying that it doesn’t matter what kind of corn it is, the sheer volume of U.S. imports has driven down the price. They also charge that because the price of U.S. yellow corn is so low, more and more amounts are being used to make food for human consumption.

In the end there are many issues that each side must work out to make NAFTA a success. The overall effect of NAFTA has been good to both Mexico and the U.S., providing new markets for each country. But with the problems that have arisen from the agreement, many on both sides are calling for an end to the agreement.
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