

HAUTE ECOLE DE GESTION DE GENÈVE

Market Overview - Corn

International Commodity Trading 2020



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Introduction

Corn also known as maize is a member of the grass family. It is an annual warm-weather plant. It grows in tropical and temperate climates around the world. The best temperature for corn germination is 30 degrees and it won't germinate if soil temperature is below 12 degrees. To be grown, corn seeds are deposited in an inch or two of soil. It takes between 5 to 25 days to germinate depending on temperature. Planting and harvesting seasons depends on the climate conditions and regions. In the USA (the largest producer) planting happens between April and June and harvesting happens between October and November. Its healthy height is generally between 1,5 and 2 meters. The grain color can be white, dark brown, purple or red.

History

Corn was first domesticated about 10'000 years ago in Mexico. In 1493, Christopher Columbus introduced corn seed to Europeans when he returned to Europe but they didn't know how to properly process it. Until 1800, corn was mostly eaten by the poor as it was cheap and it was also used to pay for slaves. Then, the industrial revolution helped the production of corn tremendously : Thanks to the iron plow, farmers could sow deep into the ground and on much larger scales. With trains, corn was no longer limited to local distribution and with the advent of canning, corn could be kept much longer. In the 1920s and 1930s, hybrid strains were discovered by scientists which accelerated the production of corn to a new level as it could be grown closer together. With hybrid strains, farmers produced more without more land. Production increased further with new industrial fertilizers and tractors. During the following decades, the number of bushels of corn per acre doubled and then each year it has kept increasing. Today, corn is mainly used for livestock feed (it is easy to digest and has high energy content) and ethanol (as biofuel). It is also used for high-fructose corn syrup (used in ketchup, candies and soft drinks), corn starch (used to thicken sauces when cooking), cereal, alcoholic beverages (whiskeys and spirits), deodorant, cough drops and more.¹

Its specifications

There are six varieties of corn:²

- Sweet corn : It is soft and the one which contains the most sugar. It is either fresh, canned or frozen and for human consumption.
- Popcorn: The grains are very hard and small and are consumed in a form of puffed-kernel.
- Flour corn : It is large and soft and it can be easily grinded.
- Dent corn : The grains are hard and used for livestock feed. (it's the most grown corn in the U.S)
- Flint corn : The grains are harder than dent corn.
- and Pod corn : The maize kernels on the cob are covered by leaves (it is mainly for ornamental purpose)

¹ cf. annexe number 1 (corn usage by segment)

² cf. annexe number 2 (pictures of the six varieties in the same order)

For commercial and marketing purposes, corn is allocated in different grades and classes based on physical descriptions and qualities.

In the USA, there are three classes of corn based on color :

- Yellow : only 5% or less of corn of other color
- White : only 2% or less of corn of other color
- And mixed : corn that doesn't meet the requirements for yellow and white.

Each class are divided into five grades (provided by the Official United States Standards for Grains) listed as below :

Grade	Minimum test weight per bushel in pounds	Maximum of damaged kernels or broken corn		
		Heat damaged kernels	Total damaged	Broken corn
U.S. No 1	56 (25.4 kg)	0.1%	3%	2%
U.S. No 2	54 (24.5 kg)	0.2%	5%	3%
U.S. No 3	52 (23.6 kg)	0.5%	7%	4%
U.S. No 4	49 (22.2 kg)	1%	10%	5%
U.S. No 5	46 (20.9 kg)	3%	15%	7%

The U.S. No 2 grade is approved as the most representative price for corn and other coarse grains in the world as well as the traditional representative price for corn produced in the USA.

If it doesn't meet the requirements for the five grades, it is called U.S Sample grade. Furthermore there are four special grades. It is added to show qualities or conditions : Flint, Flint and dent, Infested And Waxy.

The amount of moisture in grain is the most important part of corn and it will determine the value and the storability of grains.

Market structure

Over the past 30 years, the international corn economy has undergone major changes in production, use, and trade. These changes are due to a number of factors, ranging from rapid advances in technology in production and seed, to changes in domestic policies, international trade and the demand for ethanol.

It's no surprise that the USA has nearly 65% of the global corn market share. Corn is found in most US states, but production is concentrated in the Heartland region (which includes Illinois, Iowa, Indiana, South Dakota, Nebraska, Western Kentucky and Ohio, and Northern Missouri). The two major corn producing states are Iowa and Illinois, which represents a third of the US crop. Then comes the Asia-Pacific with 27% of market share. That shows an oligopoly. The global industry is fragmented because of the size of the market and the influence of the main players. The main players in the corn market are DowDuPont, Advanta Seeds, Monsanto, Syngenta AG and Bayer CropScience AG.

Supplier side

The largest corn producers are the USA, China, the European Union and Brazil. The largest exporting nations are the USA, Brazil, Argentina and Ukraine.

Consumer side

The largest corn consumers are the USA, China, the European Union and Brazil. The largest importing nations are Europe, Mexico, Japan, Vietnam and South Korea.³ As you can see on the chart⁴, the corn market has a high level of concentration for exports but a very low concentration for imports.

Trader side

There are around 4 companies, who account for the main part of Corn exchange. There is Cargill world largest corn trader, Archer Daniels Midland Company which is the largest biofuels producer in the world, Bunge and finally Louis Dreyfus also known to be a great actor in agricultural trading.

Key players

The corn market has a very large number of players and sectors because it is a high yield product. However, these are just a few large companies that control large quantities of production in the US supply chain. Let's look at which ones.

Stage of value chain and some key companies in U.S. food value chain



In addition, Some federal policies representing farmers encourage corn production. These policies are established to provide farmers with rights to government assistance to support them and protect their income.

³ cf. annexe number 3 (world corn production and consumption)

⁴ cf. annexe number 4 (world corn exports/imports)

Trade flows

Storage (before/after shipment)

Prior to transportation, farmers will stock the grain on farm storage, end users or commercial grain facilities. Corn is stored in silos, machinery storage buildings, warehouses or even livestock buildings. The most effective is the conventional grain silos because they are resistant to weather, pests and have integrated aeration systems.

Transport

Before shipment

One of the simplest parts of the supply chain is the packaging of corn. It can be packed in two ways: in bags or in bulk. As for sweet corn, it is packaged differently because it is a perishable food. It must be packaged with ice and water before it can be shipped.

The choice of "bulk" transport requires openings so that it cannot heat up inside and allows it to breathe and not to degrade. Any stored grain is likely to suffer a degradation of its technological, food and sanitary qualities. These will include bacteria, viruses, parasites, chemicals, and foreign bodies. The danger concerns the consumer, with consequences for public health, but also the product, affecting its economic value.

Shipment

As storage shipment can be a critical step. Indeed corn quality can be impacted during transportation too. The levels of temperature, moisture and aeration have to be cautiously measured in order to avoid any funged invasion, insect infection or impact on the grain quality.

After the harvest, farmers can keep a part of the grain for their own use such as feeding their animals but most of them will move the crops to other end-users or commercial.

Historically railroad is a primary source of transportation for grain in the US indeed the primary commodities carried by rail are corn.

The crops will be moved by rail, truck or vessels to subterminal elevators or bulk purchasers. Then the grains will be sent by the same ways of transportations to domestic end users or export elevators. Once they arrive to export elevators it can be exported by vessels or rail to international buyers. And last but not least grain will arrive to the final consumer by truck or by rail.⁵

Means of transport



Corn is the most transported commodity by U.S. freight railways than any other type of grain. In the last five years, 687,000 carloads of corn have been transported in this way. Railroads are very efficient for transporting large volumes of corn reliably and cheaply.



The truck way is an internal means of transport in the country. After harvest they are immediately transported and stock in silos or warehouses.

⁵ cf. annexe number 5 (corn export flow)



The maritime way is used to carry out the commodity all around the world. This is for longest export ways.

The Means of transport does not have a great evolution. In fact even if the quantity has increased and the distance from crop field to the final customer has increased too. The main transport (train or ship) has increased his capacity and the frequency of shipment to meet requirements for supply and offer.

Key drivers

There are a lot of factors that influence corn trade even though some are more powerful than others listed below. To get straight to the point the main influence is determined by offer and demand.

As we said before corn is most of the time planted during the spring period and harvest in autumn/fall. It means that the growing period is the most volatile period for corn. The explanation is simple, "Climate" Climate could increase drastically the offer or have an opposite effect and badly affect the supply quantity. The price will be directly affected by the gap between offer and demand. In Fact, heat or drought is the biggest fear for farmers and other stakeholder (trader, companies) involved in this market. The climate could also alter the quality of corn and have a direct impact on the price and quantity trade.

Another key aspect for the corn market is one of its biggest uses, almost 40% of corn product is used for making ethanol which is used for making engine fuel. It means that the use, price, and demand/ offer for corn is correlated to the price of other engine fuel and more precisely to crude oil.

Last but not least the production of corn still growing each year, guided by the growing demand behind livestock and biodiesel consumption.

We will go deeper in the next part to have a deeper idea of what influences the price of our commodity.

Description of the price

The price of corn is determined by the interaction of the supply and demand functions and government agricultural policies can influence them. The supply is composed of leftover stocks from the previous year, production during a crop year and international imports. The crop year in the USA is from September 1 to August 31. The demand is composed of feed and residual (used to feed livestock), exports and food seed and industrial (used for cereal, high fructose corn syrup and alcohol but the largest component is ethanol). Furthermore, ending stocks which are the stocks left when total demand is subtracted to total supply at the end of a crop year, influences season average price. If ending stocks increase compared to beginning stocks, supply would increase, and the price would decrease. On the other hand, if ending stocks decrease compared to beginning stocks, supply would decrease and the average price would increase.

Corn prices often reach their lowest price during harvest, which is normally in November. During harvest, this is when the most supply is available. So this is the time when producers sell the most. In the winter months after harvest, prices are less volatile, so supply and demand define corn prices.

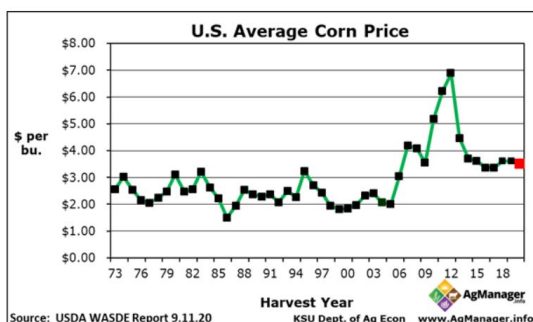
The price of corn is influenced by:

- Ethanol market : Corn is used in ethanol production. If the demand for ethanol goes down, there would be an oversupply of corn and prices would go down. USA is a producer of 50% of the worldwide ethanol production.
- Crude oil prices : Corn is used to make fuel so if crude oil prices increase, the demand for biofuels would rise as it is a cheaper alternative.
- Chinese demand : China is the number one consumer of energy and importer of petroleum. China is seeking biofuels. If the growth of China slows down, the price of can can likely be impacted downwards and vice versa.
- the US Dollar : Corn is quoted in US dollars as the USA is the number one corn producer.
- Climate : Heatwaves can reduce corn crops and increase the price. And also affect the quality of corn trade.
- Quality of crop. (good/excellent)
- Price of wheat and soybean

Corn is mainly traded at:

- the Chicago Board of Trade : CBOT was created in 1848 and merged with Chicago Mercantile Exchange Group (CME Group) in 2007. The latter is a derivative market which is the largest and most diversified in the world.
- the Bolsa de Mercadorias & Futuros (The Brazilian Mercantile & Futures Exchange)
- the Marché à Terme International de France
- the Budapest Commodity Exchange
- the Kanmon Commodity Exchange (Japan)
- and the Tokyo Grain Exchange.

Corn could be traded with future contract also symbolized with ZC letters, forward contract which means physical trade and finally corn could be traded through option contract symbolized with OZC contract.



The overall price since 73 seems to be stable, with an oscillation between 2\$ and 3\$/4\$ per Bushel. Even if the demand tends to increase the acres allocated for planting corn is growing too, and this is a reason why the price is still stable. But when we approached 2010 prices exploded. And the answer is sudden surge in demand for ethanol and also climate (drought 2012) has destroyed a huge part of corn supply and led to an increase of prices.

Cost curves

Transport cost

For local farmers, the cost of national transport across borders is one of the factors that determine the prices they receive. At the international level, it is the same, the cost of transport between exporting and importing countries will be an important factor.

On average, sea freight charges for maize represent between 25 and 40 percent of the landed cost. It is therefore normal that if world shipping prices fluctuate, the corn market will see its prices fluctuate as well.

Production cost

As we can see in the picture below we have the production costs and return per planted acre in the USA (excluding Government payments) for 2016-2019.

About the gross value of production, whether in the primary or secondary product, it has not stopped increasing during these 4 years.

Corn production costs and returns per planted acre in United States of America, excluding Government payments
(dollars per planted acre except where indicated)

	Base survey of 2016			
	2019	2018	2017	2016
Gross value of production				
Primary product grain	4 407.75	4 123.16	4 049.64	3 933.51
Secondary product silage	26.90	28.34	22.86	21.83
Total, gross value of production	4 434.65	4 151.50	4 072.50	3 955.34
Operating costs				
Seed	615.49	630.48	636.17	644.80
Fertilizer ^a	853.07	807.34	840.88	937.46
Chemicals	238.82	240.37	245.85	252.00
Custom services ^b	149.67	144.66	141.93	146.27
Fuel, lube, and electricity	232.32	237.89	207.98	187.71
Repairs	243.84	236.29	227.67	225.40
Purchased irrigation water	2.59	2.47	2.33	2.38
Interest on operating capital	24.65	24.04	12.09	5.51
Total, operating costs	2 360.45	2 323.54	2 314.90	2 401.53
Allocated overhead				
Hired labor	54.76	51.10	48.19	47.23
Opportunity cost of unpaid labor	224.86	212.84	199.98	195.14
Capital recovery of machinery and equipment	858.65	818.75	801.86	789.32
Opportunity cost of land	891.09	879.56	871.76	872.74
Taxes and insurance	91.67	88.71	88.12	86.86
General farm overhead	147.62	142.35	137.05	135.87
Total, allocated overhead	2 268.65	2 193.31	2 146.96	2 127.16
Costs listed				
Total, costs listed	4 629.10	4 516.85	4 461.86	4 528.69
Net				
Value of production less total costs listed	-194.45	-365.35	-389.36	-573.35
Value of production less operating costs	2 074.20	1 827.96	1 757.60	1 553.81
Supporting information				
Yield (bushels per planted acre)	1 124	1 169	1 200	1 168
Price (dollars per bushel at harvest)	27.54	24.87	23.68	23.68
Enterprise size (planted acres)	2 005	2 005	2 005	2 005
Production practices				
Dryland (percent of acres)	612	613	616	614
Irrigated (percent of acres)	88	87	84	86

Operating costs

If we look at it one by one, 5 of the 9 costs are lower in 2019 than in 2016. The biggest difference is in “Interest on operating capital” that almost grew 5 times more than in 2016. From 2016 to 2017, the total of the operating costs decreased but since 2018 they tend to increase again. However, they are still lower than in 2016.

Allocated overhead costs increase each year.

In summary, the revenues and costs have increased both over these 4 years. But we notice that revenues increase more than costs. About the net value, we can say that the farmers are below their break even point. Year after year they try to lower that threshold. We have another example of a cost-return budget of 2020 per Bushel in the Northeast Kansas in annex.⁶

Environmental and social factors

The biggest issue in corn production is water use and pollution. It takes 1,028 liters of water to produce 1 kg of corn grain. Then there are land use impacts. Land use causes biodiversity loss, generates greenhouse gases contributing to climate change and reduces soil health (soil erosion). In the USA, close to or exceeding 90 million acres of land have been planted to corn since 2010. Moreover, corn is mostly genetically modified in the USA and concerns are rising for human health and environmental impacts.

⁶ cf. annexe number 6 (example Corn Cost-Return Budget in Northeast Kansas 2020)

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ANALYST, Full Bio Follow Linkedin Follow Twitter Chuck Kowalski is an, STRATEGIES, trader who writes commentary on the futures markets He wrote about trading et KOWALSKI, commodities for The Balance Read The Balance's editorial policies Chuck, [sans date]. Here Are Some Great Tips on How to Trade Corn Futures. *The Balance* [en ligne]. [Consulté le 30 septembre 2020]. Disponible à l'adresse : <https://www.thebalance.com/keys-to-trading-corn-futures-809341>

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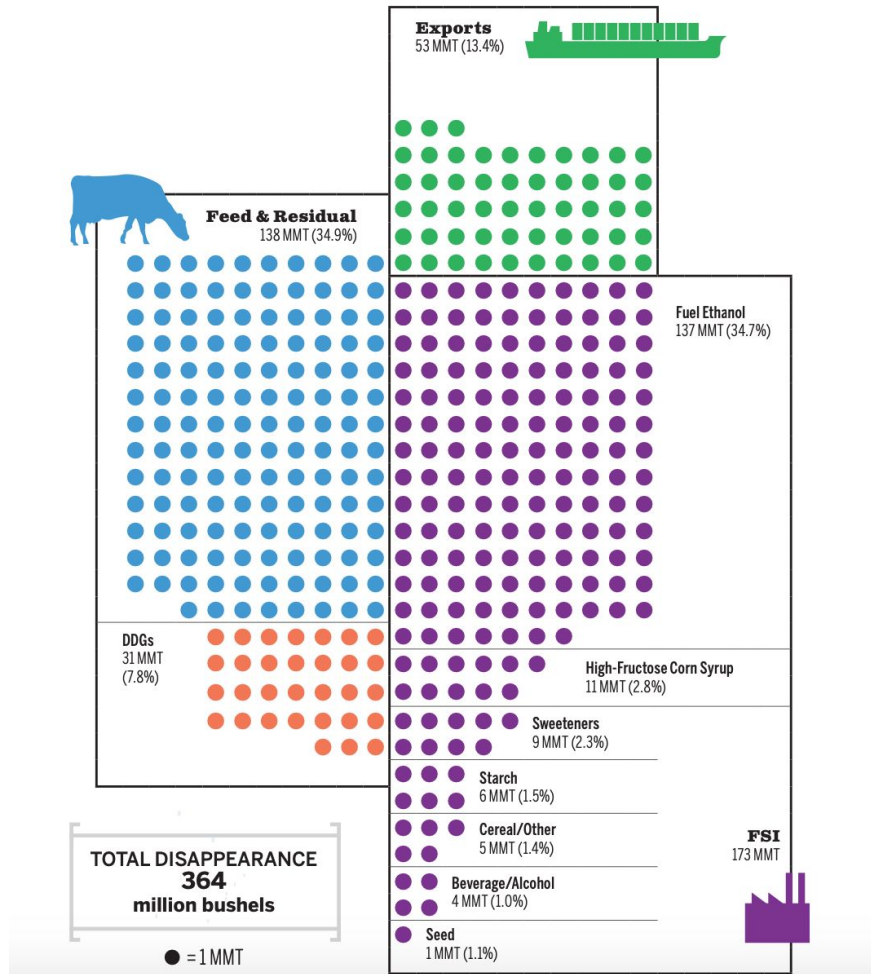
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Annexes

Nº1

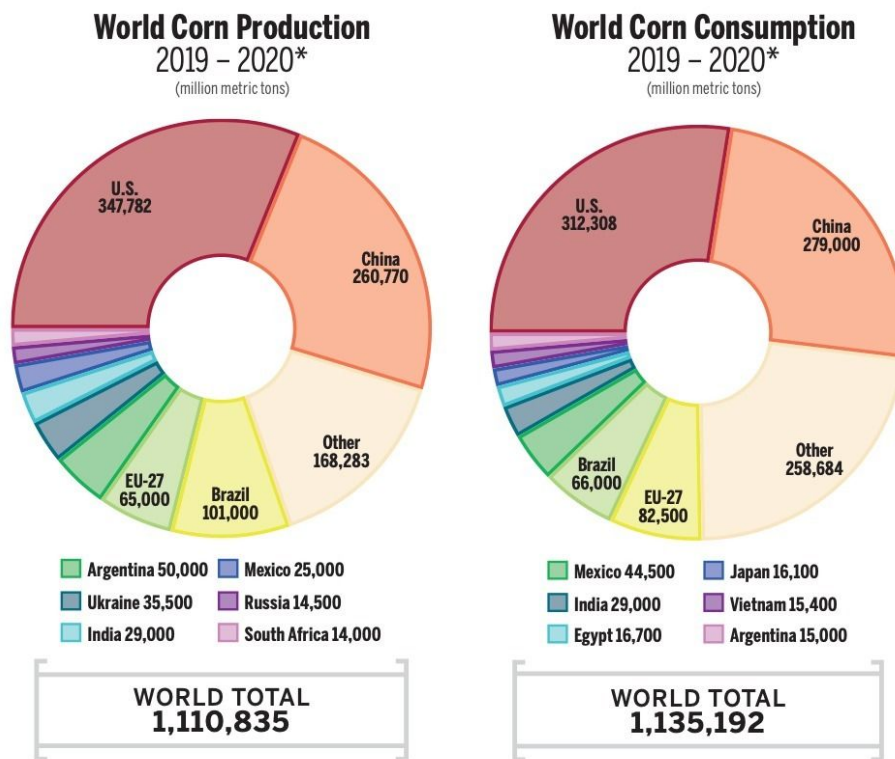
Corn Usage by Segment 2019 (million metric tons)



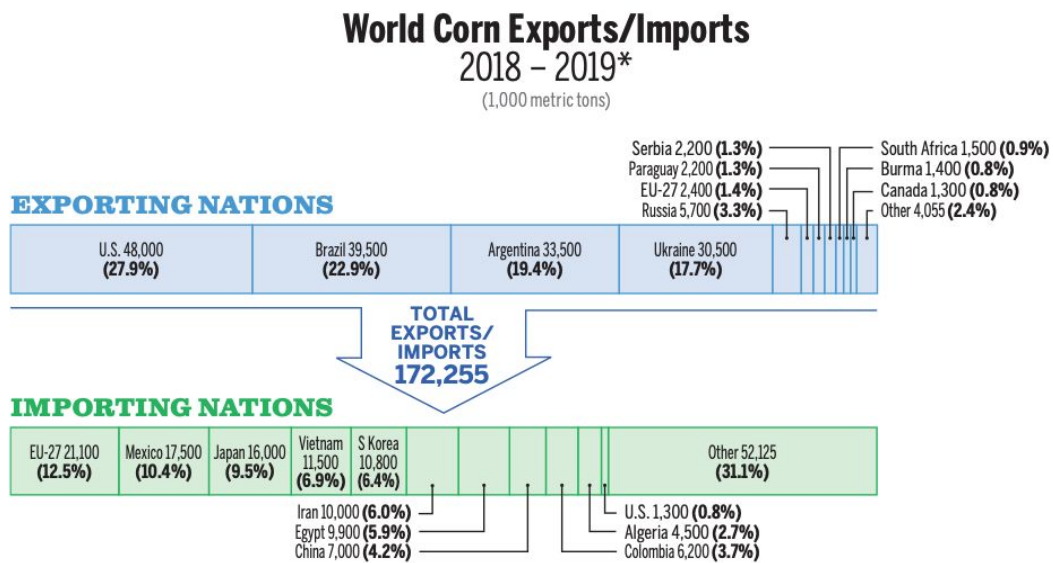
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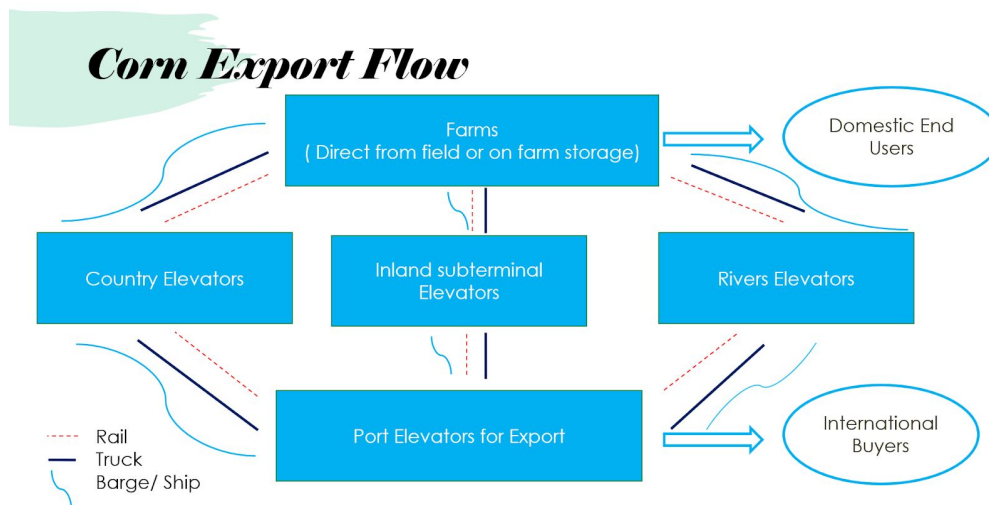
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Nº4



Nº5



Nº6

2020 Corn Cost-Return Budget in Northeast Kansas						Summary page
-----Average Yield						
<i>Gregg Ibendahl, Dan O'Brien, and Stewart Duncan</i>						Budget date: Oct-31-2019
item	unit	price	quantity	amount	Sub-total	your farm
INCOME						
Product						
Corn - Northeast KS	bu	\$3.88	145.00	\$562.24	\$562.24	_____
--TOTAL INCOME--					\$562.24	_____
EXPENSES						
Fertilizers						
Lime	lb	\$0.01	500.00	\$5.00		
Nitrogen	lb	\$0.28	146.07	\$41.71		
Phosphorus	lb	\$0.39	50.78	\$19.62		
Potassium	lb	\$0.32	36.00	\$11.39	\$77.72	_____
Herbicides						
Burndown				\$8.61		
Post-emergence				\$33.53		
Pre-emergence				\$32.96	\$75.11	_____
Seeds						
					\$70.83	_____
Crop insurance						
					\$15.64	_____
Miscellaneous						
					\$8.50	_____
Fungicides						
					\$21.19	_____
Crop consulting						
					\$6.50	_____
Labor (beyond custom field operations)						
					\$30.00	_____
Custom Field Operations						
Fertilizer application				\$23.13		
Harvesting				\$28.83		
Hauling				\$27.80		
Planting				\$16.92		
Spraying				\$19.55	\$116.23	_____
Interest on operating capital						
	6.0% on direct expenses			\$12.65	\$12.65	_____
Cash rent						
					\$99.00	_____
--TOTAL SPECIFIED EXPENSES--					\$533.37	_____
RETURNS ABOVE TOTAL SPECIFIED EXPENSES					\$28.87	_____