

Farmers in northeast China look for profitable alternatives to corn

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Image 1: Farmer in Beilin district, Heilongjiang province, planting soybean on a windy May day (2016).

Finally, after nearly a decade of stockpiling corn and other grains, China has laid out plans to reduce its stocks and simultaneously its corn acreage. Instead, the government is encouraging farmers to

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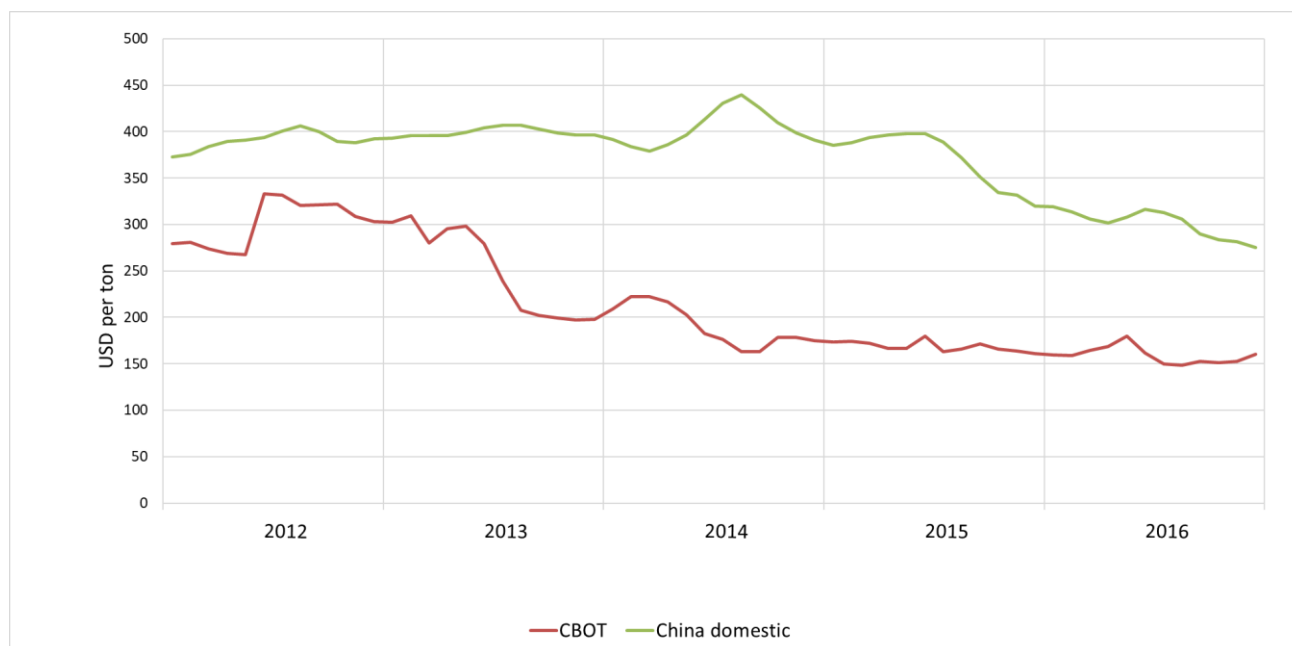
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plant other feed crops such as corn silage, sorghum, and soybeans to supply a growing domestic meat and dairy sector and lessen dependency on feed imports. Likewise, farmers are frustrated with low corn profitability, but do the other crops promise more money in the pocket at the end of the season? In this article, we will look at the evolution of corn in Heilongjiang province (part of the northeast China “Corn Belt”) as a case study based on expert interviews and farmer focus groups for how this important shift in policy is affecting Chinese growers in the short run.

Previously domestic corn production was driven by high domestic corn prices. From approximately 2012-2016, the national corn stockpiling program purchased corn (and other grains) at 75 percent above international market prices, even surpassing 100% in 2014 and 2015 (see Figure 1). Additionally, they had been subsidizing the transport, drying and storage costs in many corn-producing provinces. Policy always takes time to translate to farmers, and despite the end of the corn reserve program in December 2015, China’s year-on-year corn output increased 4 percent in 2015/2016. Corn stocks also peaked in 2015/16, ending at 114.4 million metric tons.

Since this peak in 2015/16, corn acreage and stocks have slowly been going down though. According to the [recent WASDE-USDA report](#), in 2016/17 Chinese corn stocks decreased by 9.5 million metric tons from the previous year, and in 2017/18 stocks are estimated to be reduced by another 20.1 million metric tons. That still means China has over 40 percent of global corn inventories.

At the same time, soybean output increased by 9 percent and reached more than 12.5 million tons, mainly due to government soybean support policies in the country's northeastern areas. The largest reductions in corn area are targeted for the Northeast provinces, including Heilongjiang, Jilin, Liaoning and Inner Mongolia. Farmers there have been encouraged to shift corn acreage to alternative crops such as corn silage, sorghum, and soybeans. The transformation from corn to corn silage is part of the 2016-2020 National Crop Adjustment Plan and the [recent annual Document No. 1 plans](#). The 2016-2020 Plan is quite ambitious, as it would require decreasing corn acreage by approximately [8.2 million acres](#) (approximately 9% of 2015 levels) and increasing corn silage acreage by approximately 4.1 million acres by 2020 (Note: US has approximately 6 million acres of corn silage). Since corn silage acreage was estimated to be only 1.6 million acres in 2015/16, that goal would mean a 260% increase. This of course brings up the question—*who is going to eat all that corn silage?* According to back-of-the-envelope calculations that would mean you could feed 18 million dairy cows or cattle (assuming they eat 21 pounds DM corn silage/day/cow). Furthermore, since transporting corn silage long distances is prohibitively expensive, it’s questionable whether expanding corn silage in remote (northeast) regions makes sense.

Figure 1. China domestic corn price v. CBOT price (USD per ton): 2012-2016

Note: The CBOT price is the FOB Gulf of Mexico price (USDA Market News), and the China price is the average monthly price across several provinces (Ministry of Agriculture, China Animal Husbandry Association).

Local provinces support alternative crops

Each province is tasked with how to incentivize and support farmers to move away from corn. In Heilongjiang province (HLJ), the top corn grain-producing province, they introduced several subsidies to encourage the change. In 2015, HLJ province planted over 14.3 million acres of corn grain, the most corn in recent past. In 2016, farmers were still unclear about the profitability of alternative crops, and they had been planting continuous corn for nearly a decade. Following national trends, HLJ corn acreage fell to 11.2 million acres in 2016/17, while corn silage was just above 170 thousand acres.

During field visits conducted in spring 2016, farmers were hesitant to quickly change all of their corn grain acreage to silage because they were unsure of the market buying it, the price, storage, and in general, how to harvest corn silage. This is an important issue, because unlike corn grain that can be harvested manually if needed, silage needs to be chopped at the correct time and dry matter content. Often the local governments and larger dairy and beef operations purchase the silage and pay harvest, transport and storage costs.

Next, we look at how farmers in Heilongjiang might have fared in 2016 given the competing policies to shift away from corn to corn silage or soybeans. In particular, we look at the annual production costs, revenues, and profitability of a farmer who grew only corn in 2015, but decided to switch to corn silage or soybeans in 2016.

Production costs and profitability of corn, soybeans, and corn silage

Using *agri benchmark*⁵ farm data on production cost and systems, we look at how the economics of a 115-acre corn farm in the northeast Chinese Corn Belt might have changed between 2015 and 2016 under different crop rotations. The five crop rotations considered were: 1.) 100% corn grain, 2.) 100% corn silage, 3.) 50% corn, 50% corn silage, 4.) 100% soybeans, and 5.) 50% corn, 50% soybean. We assumed 100% soy rotation in order to do a static analysis comparison but recognize that it is not a realistic crop rotation for more than a couple of years.

The *agri benchmark* case study farm⁶ is located near Suihua in Heilongjiang province (46-48 ° N, 127 ° E). This region has flat topography and deep, black soils (Mollisols). It receives an average of 18-23 inches of precipitation per year (500-600 mm) while 60% of precipitation falls in July and August. With a continental climate and an average annual temperature of about 37° Fahrenheit, it can get up to 80s in July and August. The main growing season for corn is from April to October.

This typical farm is unusual in size and management level though. While farms tend to be a bit bigger in the northeast provinces of HLJ and Jilin than in the rest of the country, the average size farm there is still only 7.5 acres. This farm also has higher than normal yields, even though this region (Suihua) has some of the highest yields in the country at about 140 bushels per acre (2015 HLJ Statistics Yearbook). The farmers interviewed for this typical farm reported that 2015 and 2016 corn yields were 167 and 162 bushels per acre, respectively, while 2016 corn silage yields were assumed to be in the vicinity of 24 tons per acre. This is also higher than government pilot area yields of 17-21 tons per acre. It should be noted that dry matter content is often not consistently measured, but is assumed to be 30-35% dry matter and stored in some type of horizontal silo. Finally, 2016 soybean yields were reported to be about 38 bushels per acre, while the average soybean yield in Suihua was 31 bushels per acre. Keep in mind both corn and soybeans are non-GM varieties. We realize that all yield data seem to be high – however, since we are only looking at the relative performance of these crops this issue should not hamper the outcome.

The 2016 corn price used in this calculation was 4.59 USD per bushel (181 USD per ton), soybean price of 14.35 USD per bushel (527 USD per ton), and corn silage price of 42 USD per ton. These

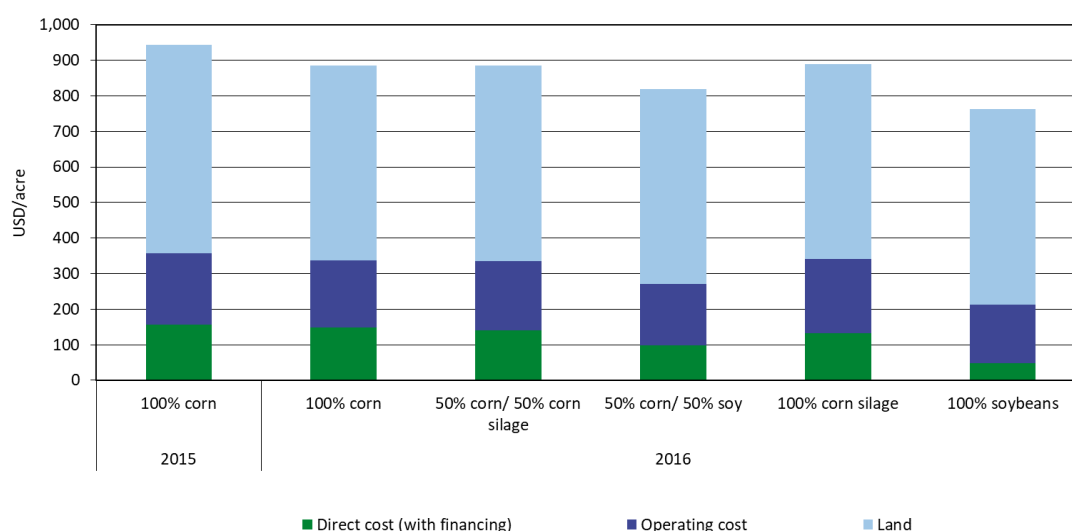
⁵ *agri benchmark* Cash Crop is a global non-profit network of agricultural economists. Its aim is to generate and disseminate reliable and usable data and analysis on major trends in global crop production for decision makers. For more information please visit www.agribenchmark.org.

⁶ The *agri benchmark* farm data represents a virtual or “typical” farm based on a focus group approach where local researchers (e.g. university extension staff), farm advisors, and producers collect economic production cost and system data for a farm in the represented region.

prices were reported by farmers during the CAAS survey in Heilongjiang last year. This results in a soybean-to-corn ratio of 3.12, which in the US favors soybeans over corn.

Looking at production costs (Figure 2), corn grain and corn silage have nearly the same direct costs (seed, fertilizer, and chemicals). In operating costs (labor including contractors, diesel, energy, and machinery), corn silage harvesting costs were reported to be about 25 USD per acre more than corn grain, not including hauling or handling. Cash costs were estimated to be more than 100 USD per acre lower for soybean versus corn, mostly due to lower input costs (seed, fertilizer, and chemicals). Depreciation costs for machinery, buildings, and equipment was quite similar, as was opportunity cost of land and family labor, since the same land rental rates (note: land costs below include rents and opportunity costs of own land) and family labor input was applied for all rotations. Due to little practical experience in soybean production in China there are no cost savings and/or corn yield improvements calculated for the corn in the corn – soybean rotation.

Figure 2. Estimated 2015 vs 2016 corn, soybean, and corn silage: direct, operating and land costs (USD per acre)



What will happen with land rents?

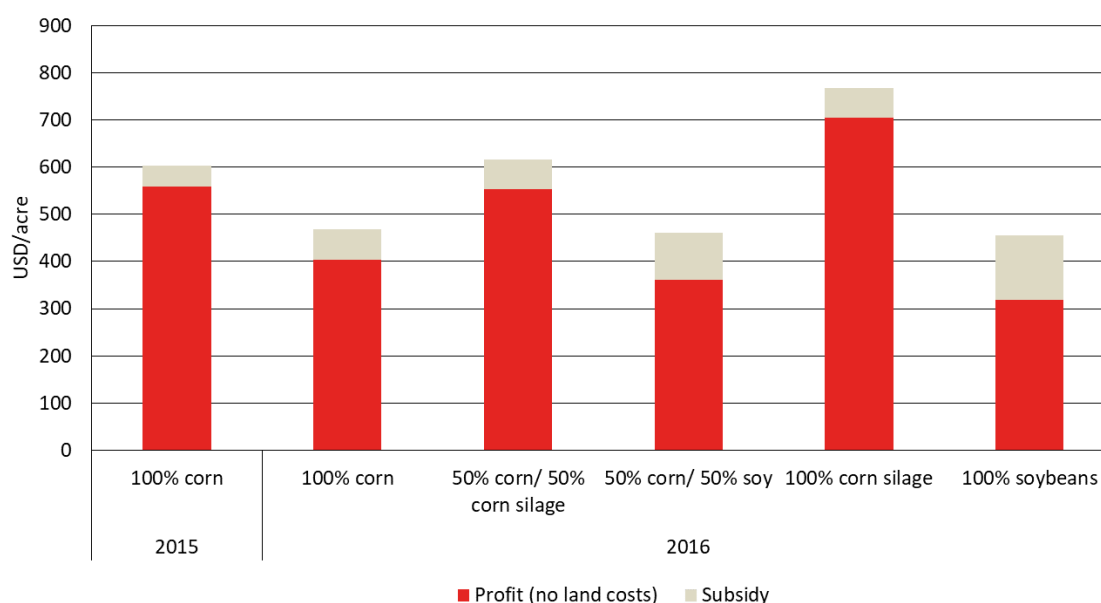
During the good years of high domestic corn prices, land rents went up on the highly productive black soils in the Northeast provinces. In this calculation, we used the same 2016 land rental rates for all scenarios (532 USD per acre). On large farms like the model farm analyzed here, rents make up more than half of the total production costs (Figure 2). Since land rents are a residual, if commodity prices decrease, land rents are expected to drop too. In *agri benchmark* interviews with farmers, some farmers reported that rents decreased by about 6% between 2015 and 2016 in this region. Still, changes in commodity prices and land profitability might not be immediately clear to

landlords. China's rural household land system allocates a small piece of land (e.g. 20 mu or 3.3 acres, 6 mu equals 1 acre) to each household or person for a certain period of time, and also gives them temporary leasing rights. Therefore, large farms must rent from various smallholders. Our calculations though show that *only* with corn silage would it be profitable to lease land and produce (i.e. the other crops cannot cover these still "high" land rents). At the same time, the current rent level may also be an obstacle for future land consolidation in this region - unless growers indeed make the switch to corn silage in large portions.



Image 2. A 2-row corn planter with fertilizer side-dressing in Suihua city, Heilongjiang province (May 2016).

Figure 3. Estimated 2015 vs 2016 corn, soybean, and corn silage profitability and subsidies, no land costs (USD per acre)



Corn silage puts more money in the pocket, despite higher soybean subsidy

Figure 3 shows profitability (revenues minus cash, depreciation and opportunity costs of machinery and labor) without land costs, since they are assumed the same for all crops. It also shows crop subsidies, which are considerably important. In 2016, there were at least two subsidy programs in HLJ that corn farmers could receive-- the support and protection payment (which was designated for all grain producers) plus the corn production subsidy (which was higher in 2016, as the local government tried to assuage the lower market prices); and farmers reported a subsidy of 63 USD per acre for planting corn. Farmers growing corn silage as part of the “corn to silage” pilot program also received a subsidy of 63 USD per acre.

The corn silage rotation had the highest profitability in 2016 (768 USD per acre after subsidies); followed by 50% corn and 50% corn silage; 100% corn; 50% corn and 50% soybean; and 100% soybeans. Surprisingly, soybeans came in last despite receiving the highest subsidy among the three crops (137 USD per acre). In fact, the subsidy payment accounted for almost half of soybean’s profitability. As such, only with this subsidy was soy nearly as lucrative as corn. After subsidies, corn silage was 300 and 313 USD per acre above corn and soybeans, respectively

Just looking at this calculation one would assume that the switch to corn silage will be a quick moneymaker for any farmer. However, a major caveat for growers is whether there is sufficient local demand for corn silage (recall the 18 million cows calculation) because it’s not economical to ship this product for long distances. In case there isn’t enough local demand, corn silage prices will

go down rather quickly and so will profitability of producing it. Our calculation suggests that in such a scenario a shift to a more US-style corn – soybean rotation will become a probable option.

Subsidies and beyond

Provincial governments are expected to continue tweaking the local subsidies to motivate further switching to soybeans, feed and silage crops. At the moment, the soybean subsidy (assuming all else equal) puts it on equal footing as corn, but in order to make it as profitable as corn silage, it would need to be approximately 380 USD per acre.

Besides increasing subsidies, improving overall productivity of soybeans is another potential goal for policy makers. Firstly, the relatively low yields of this rather “new” crop might be attributed to less advanced production systems and less management experience when compared to corn. Therefore, more training and field trials would contribute to better yields. Secondly, most global soybean breeding is based on genetically modified, Roundup Ready varieties, and therefore conventional varieties often tend to be lower performing. In return this implies that investing in soybean breeding and/or motivating international breeding companies to invest in conventional breeding for China would be another option. Nonetheless, given current breeder rights, this a highly political issue. Finally, one has to consider that our calculations – as stated above – do not yet contain any rotational benefits for soybeans, such as more corn yield, less fertilization in corn, and lower corn tillage costs with soy as a previous crop compared to continuous corn. Once growers actually start to appreciate those benefits the overall performance of soybeans will improve as well.