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Center for Agricultural Policy and Trade Studies North Dakota State University

AGRICULTURAL POLICY BRIEF

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Economic Analysis of the 2012 Drought

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Introduction

The USDA lowered the estimate for corn and soybean yields in the July 2012 crop outlooks. That triggered a substantial rise in commodity prices. Corn future prices increased 50% from \$5.46 /bushel to \$8.20/bushel since mid-June while soybean future prices increased 20% from \$13.86/bushel to \$16.63/bushel. The estimated yield for corn was lowered 12% from 166 bushels/acre to 146 bushels/acre for corn while that for soybeans was lowered 7% from 45 bushels/acre to 40.3 bushels per acre. In the August 5th forecast, both corn and soybean production estimates were again lowered. This time corn yields were lowered from 146 bushels/acre to 123.4 bushels/acre and soybean yields were lowered from 40.3 bushels/acre to 36.1 bushels/ acre. Crop reports since August 5 have not changed production estimates.

Table 1 shows continuous deterioration of corn and soybean production potential in the United States. Crop conditions for corn have deteriorated substantially during July. In the July 1st report, 22% of the U.S. corn crop was in the poor-very poor categories, that category increased to 45% in the July 22nd report, almost 50% of the U.S. corn crop. The deterioration has continued in the July 29th and the August 5th reports. The USDA's definition of Very Poor is "extreme degree of loss to yield potential, or complete or near crop failure" and Poor is "heavy degree of loss to yield potential which can be caused by excess soil moisture, drought, disease, etc. The soybean conditions are almost the same as corn with poor-very poor categories increasing from 22% in the July 1st report to 39% in the August 5th report.

The last serious corn crop loss in the United States occurred in 1993, a 22% decrease in production. The corn crop was reduced 29% in 1983 and 34% in 1988. The U.S. soybean crop production fell 20% in 1983 and 24% in 1988. So far this year, the USDA is estimating a 26% loss in corn production and a 20% loss in soybean production.

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Table 1. USDA Corn and Soybean Crop Reports from June 10 to August 19					
Corn	Very Poor	Poor	Fair	Good	Excellent
	-----Percent-----				
August 19	26	25	26	20	3
August 12	26	25	26	20	3
August 5	25	25	27	20	3
July 29	23	25	28	21	3
July 22	21	24	29	23	3
July 15	16	22	31	27	4
July 8	12	18	30	34	6
July 1	7	15	30	40	8
June 24	4	10	30	45	11
June 17	2	7	28	52	11
June 10	2	6	26	54	12
Soybeans					
August 19	16	21	32	27	4
August 12	16	22	32	26	4
August 5	16	23	32	25	4
July 29	15	22	34	26	3
July 22	13	22	34	27	4
July 15	10	20	36	30	4
July 8	9	18	33	35	5
July 1	7	15	33	39	6
June 24	4	11	32	45	8
June 17	3	9	32	48	8
June 10	2	8	30	51	9

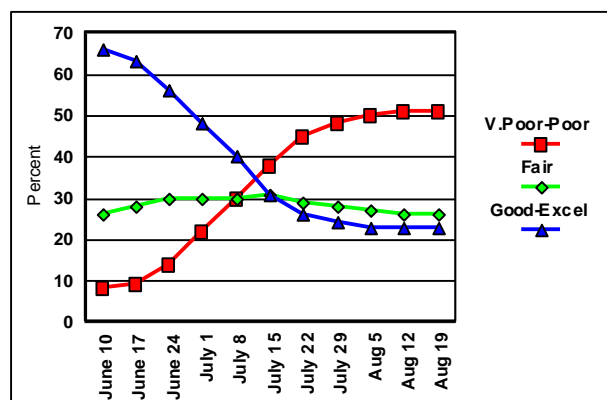


Figure 1. USDA's Corn Crop Condition Reports

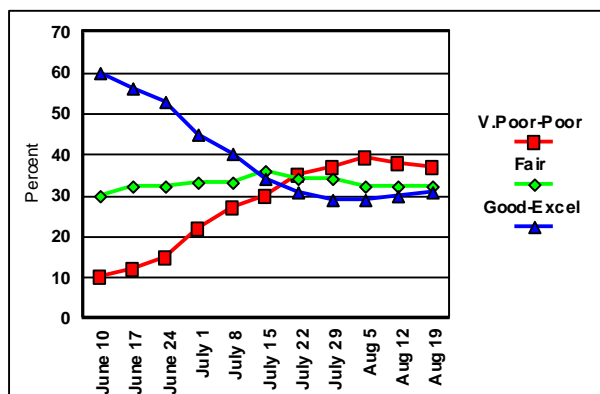


Figure 2. USDA's Soybean Crop Condition Reports

Figures 1 and 2 shows the USDA crop condition reports for corn and soybeans, respectively. The latest yield estimates were released on August 19. Conditions have continued to worsen slightly for both corn and soybeans; poor-very poor category for corn increased from 45% to 51% between July 22 and August 19 and 35% to 37% for soybeans during the same time period.

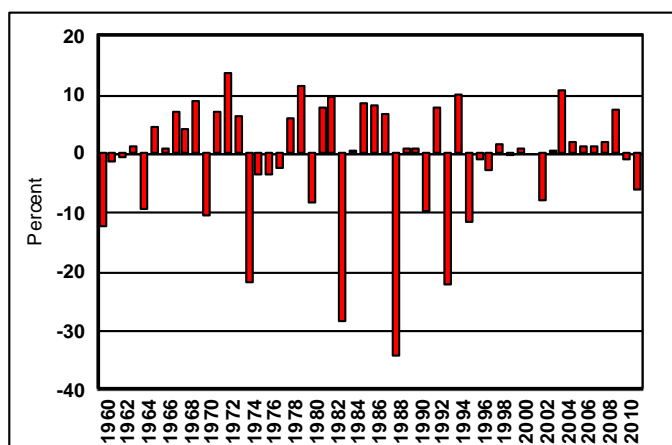


Figure 3. Percent Variation From Average for US Corn Production, 1960-2011

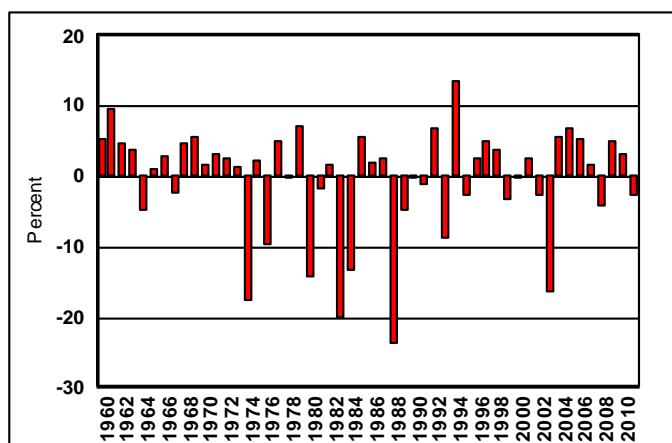


Figure 4. Percent Variation From Average for US Soybean Production, 1960-2011

Figures 3 and 4 present the historical percent variation in corn and soybean production from average production levels, respectively. The distributions are asymmetric: more years with above average yields than those with below average yields. However, the magnitude of below average yields is much larger than that of above average yields. For the distribution of corn yield, only 3 years have large crops exceeding 10% above normal production levels and 26 years have production levels between normal and a 10% larger crop. On the reduction levels, corn has had 8 years with greater than a 10% production decrease and 14 years with a less than 10% reduction in corn production. Soybeans had one year with production 10% larger than normal and 30 years with production above average. On the other side, soybean production was less than 80% of normal in two years (1983 and 1988) and between 90% and 80% of normal in four years (1974, 1983, 1984 and 2003). During the remaining years, soybean production was between normal and 90% of normal.

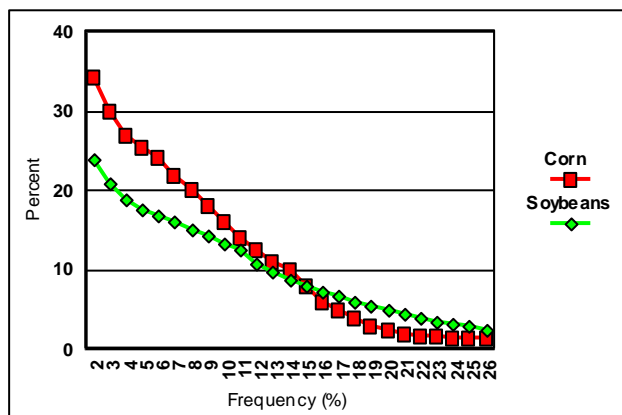


Figure 5. Observed Frequency of Production Shortfalls, Corn and Soybeans

Figure 5 shows the frequency of production shortfalls of corn and soybeans for the 51 years (1960-2011). During that time period, 3% of the time corn production fell 30% or more from average. Eight percent of the time production fell by 20%, 10% of the time production was 15% short of average. A 10% and 5% decreases occurred 14% and 17% of the time, respectively. Soybean production is more stable than corn when large losses occurred.

An Econometric Simulation Model

The Global Corn and Soybean Econometric Policy Simulation Model operational at the Center for Agricultural Policy and Trade Studies, NDSU is used for this study. The world is divided into six regions in the model, the U.S., Argentina, Brazil, China, the European Union (EU) and the rest of the world (ROW). Commodities considered in this study are corn and soybeans, which compete with each other for crop-land. Wheat also competes with corn for crop-land. However, it is not included in the model since the competition is limited in only Plains states in the U.S. Supply, demand, and carry-over stock equations are estimated for the crops in all the countries/regions. The behavioral equations are equated, based on changes in the prices of the crops, so that the aggregated demand for all the countries/regions is equal to the aggregated supply for each crop. The model is used to forecast production, consumption, exports, and price of each crop over the next 10 years. It is assumed that U.S. and world agricultural policy remains unchanged, normal weather patterns continue, and there are no dramatic macroeconomic or political changes in the simulation period.

The behavioral equations of corn and soybeans were estimated for the countries/regions and included in the model. The behavioral equation is supply, demand and carryover stocks of each crop. Full details can be found in *The 2012 Outlook of the U.S. and World Corn and Soybean Industries, 2011-2021*.

A base scenario and three drought scenarios were developed to estimate the potential impact of the drought of 2012 on corn and soybean prices, production, and exports. The scenarios were based on historical corn and soybean production variations (Figures 3 and 4) in the United States between 1960 and 2011. Table 2 shows the total projected U.S. production and percentage production shortfalls for corn and soybeans under the various drought scenarios.

Table 2. Production Shortfalls and Total Production Under Various Drought Scenarios for U.S. Corn and Soybeans				
	Corn		Soybeans	
	percent	million bu	percent	million bu
Base		12,710		3,270
Drought 1	10	11,439	9	3,004
Drought 2	22	10,074	16	2,740
Drought 3	34	8,767	24	2,406

Drought 1 scenario could be expected to occur 12%-14% of the time or once every 7 years. Drought 2 scenario could happen 4% to 8% of the time or once every 14 years and drought 3 scenario could occur once every 33 years.

Data

Historical harvest area, yield, production, feed use, import demand, domestic consumption, and carry-over stocks data were obtained from the PS&D database from the Economic Research Service (ERS) for the years 1980 to 2011. Corn and soybean prices and corn use for ethanol were obtained from ERS. Actual gasoline prices, as well as forecasted prices were obtained from the U.S. Department of Energy, and cattle on feed numbers were obtained from the National Agricultural Statistics Service (NASS). All price data were converted to real terms using the GDP deflator (International Monetary Fund). Ethanol production data were obtained from ERS and the Renewable Fuels Association website.

Results

Prices of Corn and Soybeans

Figures 6 and 7 show the projected corn and soybean prices in the United States under the various scenarios. Under the base scenario, corn price for 2012 and 2013 is projected to be \$6.87/ bushel and \$7.13/bushel, respectively. Under the drought 1 scenario, a 10% production drop, the price of corn is projected to be \$7.83/bushel in 2012 and \$7.89/bushel in 2013. Under the drought 2 and drought 3 scenarios, corn prices are projected to be \$8.80/bushel and \$10.14/bushels in 2012, respectively. In 2013 the corn price is expected to \$8.77/bushel for the drought 2 scenario and \$9.77/bushel under the drought 3 scenario. The impact of the 2012

drought should continue until 2015 as world ending stocks are slowly increased. Recent futures prices have been as high as \$8.30/bushel. Current corn futures are in the \$7.90 to \$8.00 range.

Under the base scenario, soybean price for 2012 is projected to be \$12.78/bushel. Under the drought 1 scenario, soybean prices are projected to increase by \$1.18/bushel to \$13.96. Drought 2 conditions, a 16% drop in production, would increase soybean price \$2.13/bushel to \$14.91. Under the drought 3 scenario, a 24% drop in production, soybean price is expected to be \$15.48/bushel in 2012. Projected prices will be slightly lower in 2013, and again in 2014, but the impact of the drought does not disappear until 2015.

These increases in the prices of corn and soybeans are also contributed by historically low carry-over stocks. Average carry-over stocks for corn during the past 12 years have been 1.5 billion bushels, while it is 649 million bushels in 2012. Soybean carry-over stocks have averaged 240 million bushels over the same time period. Carry-over stocks of soybeans in 2012 have been estimated to be 115 million bushels. The only time in recent history that stocks have been this low is 1995 for corn and 2003 for soybeans.

Based on the price impact above, the current drought which could reduce corn production by 26% may increase corn prices to over \$8.80/ bushel in 2012 and a bit lower in 2013. Soybean price under the current drought could be \$15.40 in 2012 and \$15.00 in 2013.

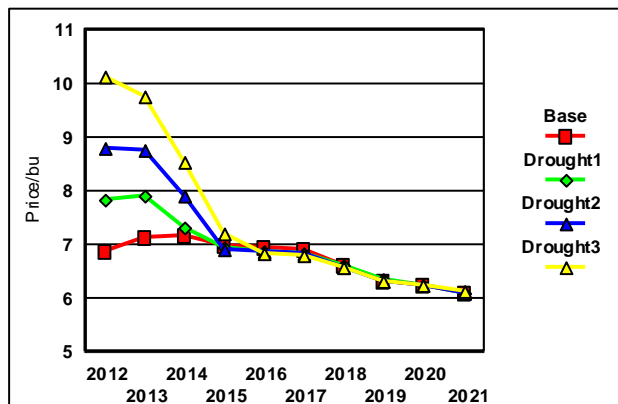


Figure 6. Projected Corn Prices Under Various Scenarios, 2012-2021

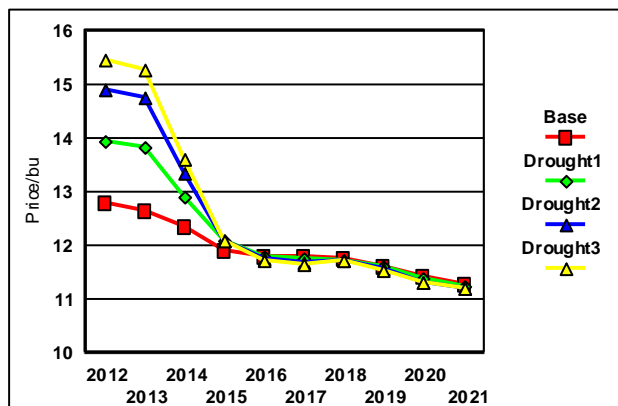


Figure 7. Projected Soybean Prices Under Various Scenarios, 2012-2021

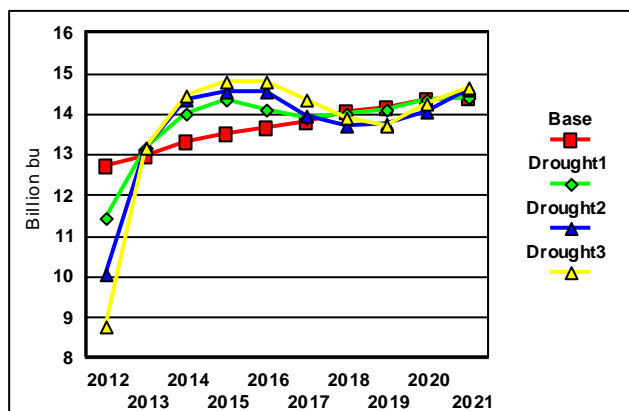


Figure 8. Projected Corn Production Under Various Scenarios, 2012-2021

Corn Production and Exports

Figure 8 presents the projected corn production under the base and three alternative scenarios. Production under the three scenarios (drought 1, drought 2, and drought 3) is expected to be 11.4 billion bushels, 10.1 billion bushels and 8.8 billion bushels, respectively, for 2012. The drought should have little impact on production in 2013 as most regions return to normal production. Because of the higher price levels in 2013 and 2014, corn production may be higher than the base scenario during 2014 through 2017. U.S. and world carry-over stocks are expected to increase.

The major impact of the reduced U.S. production will be U.S. corn exports. It is assumed that the U.S. continues to produce corn-based ethanol to meet the 10 percent mandate under the Energy Independence and Security Act of 2007. In addition, feed use for corn remains price inelastic in the short run. Figure 9 shows the expected U.S. corn exports. In 2012, it is projected that exports fall from 1.7 billion bushels under the base scenario to 1.4 billion bushels under the drought 1 scenario. Under the drought 2 scenario, exports are expected to fall to 305 million bushels. Under drought 3 the model projects that the United States would run out of corn and become an importer. U.S. exports are also lower in 2013, however exports should fully recover in 2014. The drought of 2012 could reduce U.S. exports to almost zero since livestock feeding and ethanol production remains unchanged in the short run.

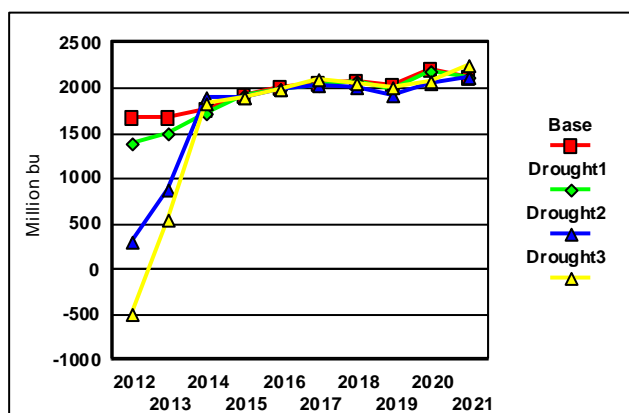


Figure 9. Projected Corn Exports Under Various Scenarios, 2012-2021

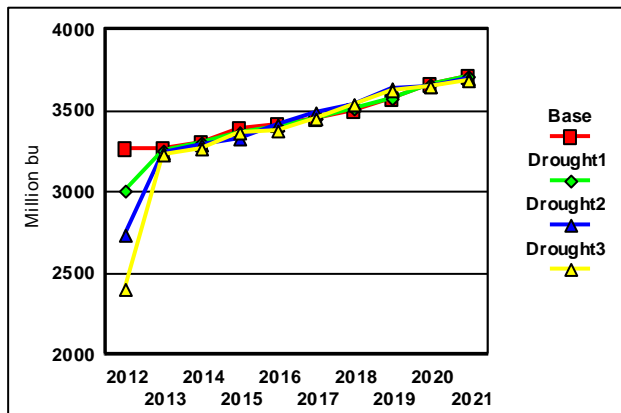


Figure 10. Projected Soybean Production Under Various Scenarios, 2012-2021

Soybean Production and Exports

The impact on soybeans production under the various scenarios is shown in Figure 10. Soybean production under drought 1 and drought 2 is projected to be 3 billion bushels and 2.7 billion bushels respectively, for 2012. Under the drought 3 scenario, production could fall by 24%, to 2.4 billion bushels. Soybean production is expected to return to the baseline in 2013 and beyond.

Projected U.S. soybean exports are shown in Figure 11. The drop in exports is not as dramatic as corn. U.S. exports of soybeans are expected to decrease from 1.5 billion bushels in 2012 under the base scenario to 1.2 billion bushels under drought 1. Exports are expected to drop to 1.0 billion bushels under the drought 2 scenario and 711 million bushels under the drought 3 scenario. The current drought could lower U.S. soybean exports to about 750 million bushels.

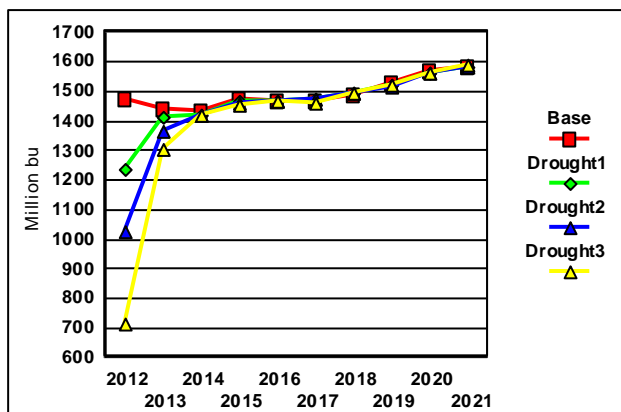


Figure 11. Projected Soybean Exports Under Various Scenarios, 2012-2021

Summary and Implications

Early in 2012 the USDA projected a 14.8 billion bushel corn crop. In late July that estimate was lowered to 13.0 billion bushels and was further lowered to 10.8 billion bushels in August. In 2011, the United States produced 12.4 billion bushels of corn, used 6.3 billion bushels for food, fuel and other industrial uses, and fed 4.8 billion bushels for livestock. Exports in 2011 were 1.6 billion bushels.

The USDA soybean production numbers were at 3.4 billion bushels in early June which were lowered to 3.1 billion bushels in late July and 2.7 billion bushels in August. In 2011 the United States produced 3.1 billion bushels of soybeans, crushed 1.6 billion bushels and exported 1.3 billion bushels. In recent years the United States exported 16% of the corn crop and 40 % of the soybean crop.

The recent crop condition reports indicate that about one half of the corn crop and about 38% of the soybean crop are in very poor or poor condition. This report indicates that there would be a 26% drop in corn production and a 20% drop in of soybean production.

Three scenarios were developed to project possible impacts of the drought of 2012. Those scenarios were drought 1, losses of 10% of the corn crop and 9% of the soybean crop; drought 2, losses of 22% of the corn crop and 16% of the soybean crop; and drought 3, 34% of the corn crop and 24% of the soybean crop. Corn price for 2012 under the base scenario was \$6.87/bushel. That increased to \$7.83/bushel under the drought 1 scenario, \$8.80/bushel under the drought 2 scenario, and \$10.14/bushel under the drought 3 scenario. Soybean price under the base scenario was \$12.78 in 2012. That increased to \$13.96/bushel under the drought 1 scenario, \$14.91/bushel under the drought 2 scenario and \$15.48/bushel under the drought 3 scenario.

Assuming that U.S. corn production decreases by 26% and soybean production decreases by 20%, based on the current USDA estimates, corn prices could be \$8.80/ bushel in 2012 and \$8.76/bushel in 2013, and soybean price under this scenario would be about \$15.40/bushel in 2012 and \$15.00/bushel in 2013. Current new crop bids in eastern North Dakota/ northwestern Minnesota are in the \$7.30 to \$7.60 range for corn and \$16.30 to \$16.50 range for soybeans.

Assuming that the United States continues to produce ethanol from corn, the impacts on corn price is expected to be larger than on soybeans. The increased price could significantly impact U.S. ethanol production as well as the livestock industry. Further, there will be significant decrease in corn exports under the drought 1 and drought 2 scenarios. In the drought 3 scenario, the United States is expected to import corn to meet the domestic demand for corn for ethanol production and livestock feed. Historically, low carry-over stocks of corn and soybeans in the United States is another reason for the large increases in the prices of corn and soybeans.

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