Projected U.S. Corn Exports, Acreage and Production Under E-10, E-12 and E-15 Ethanol Policies

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July 19, 2010

This article examines how U.S. corn exports, acreage and production may be affected over the next decade by expanding the proportion of ethanol allowed to be mixed in U.S. fuels from 10% (i.e., E-10), to 12% (E-12) or 15% (E-15). July 2010 USDA World Agricultural Supply-Demand Estimates (WASDE) and 2010 USDA Agricultural Projections are used as a basis for this analysis. United States' supply-use projections for grain and livestock were taken "as is" from USDA sources with only minor adjustments for the 2010 through 2019 period. Information on 2010 USDA Agricultural Baseline Projections are available from the USDA's Economic Research Service (http://www.ers.usda.gov/briefing/baseline/).

Expansion in allowable ethanol fuel blends from E-10 to either E-12 or E-15 is projected to have a marked impact on total supplies and uses of both corn and distillers grains – a byproduct of the dry corn milling process used to product ethanol. This analysis combines U.S. corn and distillers dried grain with solubles (DDGS) (quantified in corn equivalents) into one inclusive supply-use balance sheet, showing the projected joint impact and tradeoffs of expanded ethanol production in terms of both increased use of corn for ethanol production and of increased availability of DDGS for feed and export use.

The specific focus of this article is two fold. First, this analysis focuses on how U.S. corn exports may be affected by increasing ethanol blends if corn acreage is held at levels originally projected by the USDA for the 2010-2019 period. The second part of this analysis examines the increase in U.S. corn acreage that would be needed to supply enough corn to meet USDA corn export projections as well as other projected U.S. corn uses for the next decade.

A key assumption in this analysis is that DDGS substitutes for corn in livestock feed rations on a pound-for-pound or 1-for-1 basis. It is also assumed initially that as ethanol production from corn increases under E-12 and E-15 scenarios, domestic uses of total U.S. corn + DDGS (in corn equivalents) will be maintained over time at the expense of foreign uses (i.e., U.S. corn exports). This assumption is relaxed in the second part of the analysis, with U.S. corn acreage and production allowed to expand to cover all uses of corn in the U.S. at the levels projected by the USDA in its 2010-19 U.S. Agricultural Projections.

Another key assumption is that alternative uses of corn and DDGS will be rationed by competitive market forces in such a manner so that ending stocks of U.S. corn will not be drawn down below 1 billion bushels over the next decade under normal corn production scenarios (i.e., no unforeseen crop production shortfalls occur).

Finally, it is also assumed that all DDGS produced in a particular marketing year are used in that same period, i.e., that ending stocks of DDGS effectively equal zero at the end of each U.S. corn marketing year during the MY 2010-11 through MY 2019-20 period. The initial assumptions regarding a) the priority of domestic uses in the U.S. as opposed to exporting U.S. corn overseas for foreign use, and b) of maintaining minimal U.S. corn ending stocks levels, are both critical determinants of the results of the following analysis.

See the June and July 2010 AgMRC Renewable Energy and Climate Change newsletter articles on "Measuring Supply-Use of Distillers Grains in the United States" and "Distillers Grain Supply-Use Under E-10, E-12 and E-15 Ethanol Blends" for an explanation of how the USDA Agricultural Projections for 2010-19 were adopted for use in this and previous papers on how to combining projected U.S. corn and

DDGS production into one "Corn plus DDGS $_{\text{corn-equivalent}}$" supply-demand balance sheet (http://www.agmrc.org/renewable_energy/agmrc_renewable_energy_newsletter.cfm).

USDA Agricultural Projections for 2010-2019

As stated by the USDA Economic Research Service (http://www.ers.usda.gov/briefing/baseline/), the USDA Agricultural Projections for 2010-19, released in February 2010, provide long run projections for the United States farm sector for the next decade. The following analysis incorporated updated USDA WASDE U.S. corn supply demand report estimates for July 2010 with the original baseline assumptions to examine changes in U.S. bioenergy policy as pertains to U.S. ethanol production and use.

U.S. Ethanol & DDGS Production Under Differing Ethanol Use Policy Scenarios

For each 1% increase of ethanol allowed in U.S. gasoline blends, it is assumed in this study that 1.3 billion gallons more ethanol will be produced each year with requisite increases made in the U.S. Renewable Fuels Standard (RFS). Figure 1 illustrates how increases of 1% in allowable U.S. ethanol use in blended fuels (i.e., from E-10 to E-11, etc.) would affect U.S. ethanol production in each U.S. corn marketing year through MY 2019-20. The ability of the U.S. ethanol industry to quickly increase production capacity to supply the amount of ethanol to supply higher ethanol blends will be limited in the short term.

This analysis assumes that the maximum amount of ethanol that may be produced in the U.S. in MY 2010-11 would equal 13.524 billion gallons per year (bgy), i.e., the existing capacity listed by the Renewable Fuels Association as of July 15, 2010 (http://www.ethanolrfa.org/bio-refinery-locations/). Maximum ethanol production capacity for MY 2011-12 is assumed to equal 14.602 bgy, i.e., the ethanol production capacity in MY 2010-11 plus the additional 1.078 bgy of capacity under construction as new or expanding refineries on July 15th. However, it is assumed that by MY 2012-13 enough additional ethanol plant / production capacity could and would be developed to supply the amount of ethanol needed for up to the E-15 ethanol blend regime. After the initial period in which U.S. ethanol plant capacity would be increased to meet U.S. bioenergy policy targets, total U.S. ethanol production would be projected to increase to as much as 21.36 billion gallons by for the MY 2015-16 through MY 2019-20 period under an E-15 ethanol inclusion policy regime.

Increases in U.S. ethanol production associated with higher gasoline blend proportions would also bring about increases in DDGS production (Figure 2). For each 1.3 billion gallons of addition ethanol produced (i.e., plus 1% of allowable ethanol in gasoline fuel blends), an additional 464.3 million bushels (mb) of corn is projected to be used to produce the ethanol (1.3 bln. gal ÷ 2.8 gallons of ethanol per bushel). If for each bushel of corn used in ethanol production, 17 pounds of DDGS are produced, then a 1% increase in allowable ethanol mixture in gasoline blends will produce 7,893.9 million pounds of DDGS (3.95 million short tons). The same "scaling up" effect for ethanol production during the MY 2010-11 and MY 2011-12 periods represented in Figure 1 is reflected in the "scaling up" of DDGS production in Figure 2. Whereas with current U.S. ethanol policy (i.e., E-10), 44.5 million tons of DDGS production from U.S. corn are projected for MY 2015-16, for E-15 an additional 19.7 million tons (i.e., to a total of 64.2 million tons per year) of DDGS would be produced during the same marketing year.

Figure 1. U.S. Ethanol Production from Corn
Assumed Adjustments from Baseline RFS to E-15

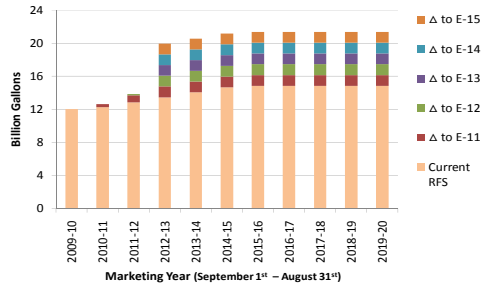
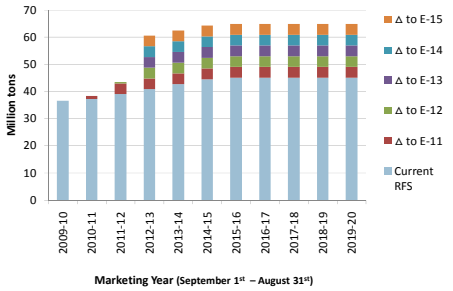


Figure 2. U.S. DDGS Production: Corn Ethanol
Changes from Baseline RFS to E-15 (17 lb DDGS / bu)



Baseline E-10 Scenario for U.S. Corn Plus DDGS Supply-Demand

The expanded, combined U.S. corn and DDGS supply-demand balance sheet in Table 1 is patterned after U.S. corn supply-demand tables in monthly USDA WASDE reports (http://www.usda.gov/oce/commodity/wasde/). Along with standard WASDE report estimates of corn usage for ethanol production, non-ethanol food, seed and industrial use, exports, and feed and residual use, this table also provides estimates of DDGS production, feed use and exports. A "1 pound of DDGS to 1 pound of corn" weight relationship is assumed in this combined table, allowing for DDGS to be represented on the basis of 56 pound or corn equivalent "bushel" units (i.e., $DDGS_{ce}$). Combined U.S. corn and distillers grains supply-use projections for MY 2010-11 through MY 2019-20 are presented in the following analysis.

Table 1 shows that under the current E-10 ethanol fuel inclusion regulations, U.S. corn ethanol production use, $DDGS_{ce}$ production, feed use of corn and $DDGS_{ce}$, and exports of $DDGS_{ce}$ are projected to increase until MY 2015-16, but then remain steady through MY 2019-20. Exports of DDGS are assumed to be 21% of annual DDGS production throughout the MY 2010-11 through MY 2019-20 period (see Wisner 2010, http://www.extension.iastate.edu/agdm/crops/outlook/dgsbalancesheet.pdf).

This analysis assumes that all $DDGS_{ce}$ produced are used in the same marketing year because of their bio-degradable properties as a feed product. Consequently, it is assumed that there is no accumulation of ending stocks of $DDGS_{ce}$ at the end of the U.S. corn marketing year. As a result, only corn ending stocks are assumed to be non-zero in these corn + $DDGS_{ce}$ supply-demand tables.

Although it is assumed that appreciable ending stocks of U.S. $DDGS_{ce}$ do not exist (i.e.,equal to zero), $DDGS_{ce}$ feed use and exports are accounted for in figuring total use of corn + $DDGS_{ce}$. As a result, the % ending stocks-to-use of corn + $DDGS_{ce}$ is marginally smaller than for corn alone (i.e., because total use of corn plus $DDGS_{ce}$ is greater than total use of corn alone).

Impact on U.S. Corn Exports

Projected impacts in U.S. corn exports resulting from E-10, E-12 and E-15 ethanol fuel blend scenarios are presented in Figure 4. This analysis is based on the assumption that domestic uses of U.S. corn and DDGS will be fully met before corn is used for exports while maintaining minimum levels of U.S. corn stocks. In other words, no reductions in adjusted USDA Agricultural Projections are required to occur in the use of U.S. corn for domestic ethanol production, other FSI use, and livestock feeding in order to meet minimum targeted corn ending stocks targets of 1.00 bb the MY 2010-11 through MY 2019-20 period. As a result, any required reductions in U.S. corn usage will occur in the U.S. corn export category.

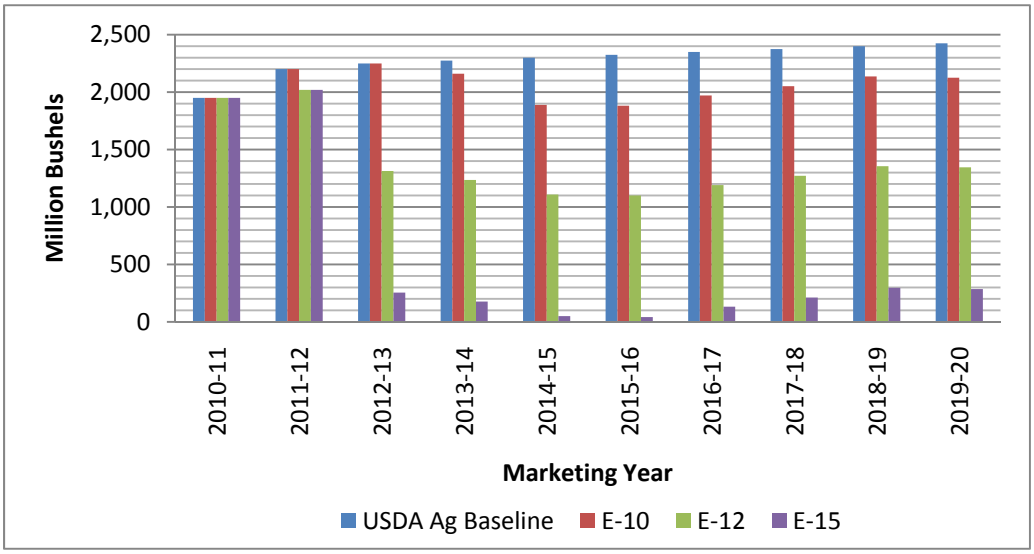
Corn Exports Under E-10: U.S. corn exports in this analysis are projected to decrease from a high of 2.25 billion bushels (bb) in MY 2012-13 to a low of 1.882 bb in MY 2015-16, and then to steadily increase to 2.126 bb in MY 2019-20.

Table 1. E-10 Ethanol Production Scenario – Combined U.S. Corn & Distillers Grains Supply-Demand Projections

Based on USDA Agricultural Projections for 2010-2019 Marketing Years & the July 9, 2010 USDA WASDE Report

	U.S. Corn Marketing Year (September 1st – August 31st)									
	2010-11	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**
Planted Acres (million acres)	87.9	90.0	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.0
Harvested Acres (million acres)	81.0	82.8	82.3	82.3	82.3	82.3	82.3	82.3	82.3	81.8
Yields (bushels per acre)	163.5	162.4	164.4	166.4	168.4	170.4	172.4	174.4	176.4	178.4
Supply (million bushels)										
Beginning Stocks: Corn	1,478	1,365	1,269	1,065	1,000	1,000	1,000	1,000	1,000	1,000
Production: Corn	13,370	13,447	13,350	13,695	13,859	14,024	14,189	14,353	14,518	14,593
Production: DDGS corn equivalents	1,427	1,427	1,460	1,525	1,590	1,611	1,611	1,611	1,611	1,611
Imports: Corn	10	15	15	15	15	15	15	15	15	15
Total Supply: Corn + DDGS corn equivalents	**16,160**	**16,253**	**16,273**	**16,299**	**16,464**	**16,650**	**16,815**	**16,979**	**17,144**	**17,219**
Use (million bushels)										
Ethanol Use: Corn	4,700	4,700	4,808	5,022	5,236	5,307	5,307	5,307	5,307	5,307
Non-ethanol FSI: Corn	1,360	1,350	1,350	1,350	1,350	1,350	1,350	1,360	1,365	1,375
Exports: Corn	1,950	2,200	2,250	2,160	1,888	1,882	1,971	2,051	2,136	2,126
Exports: DDGS corn equivalents	300	300	307	320	334	338	338	338	338	338
Feed & Residual: Corn	5,350	5,275	5,300	5,325	5,400	5,500	5,575	5,650	5,725	5,800
Feed & Residual: DDGS corn equivalents	1,127	1,127	1,153	1,204	1,256	1,273	1,273	1,273	1,273	1,273
Total Use: Corn	**13,360**	**13,525**	**13,708**	**13,972**	**14,286**	**14,482**	**14,582**	**14,692**	**14,797**	**14,907**
Total Use: Corn + DDGS corn equivalents	**14,487**	**14,652**	**14,861**	**15,061**	**15,130**	**15,312**	**15,476**	**15,641**	**15,806**	**15,881**
Ending Stocks: Corn	1,373	1,310	1,147	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Ending Stocks: DDGS corn equivalents	0	0	0	0	0	0	0	0	0	0
Total Ending Stocks Corn + DDGS corn equivalents	**1,373**	**1,310**	**1,147**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
%Ending Stocks-to-Use: Corn	10.3%	9.7%	8.4%	7.2%	7.2%	7.1%	7.0%	7.0%	6.9%	6.8%
%Ending Stocks-to-Use: Corn + DDGS corn equivalents	9.5%	8.9%	7.7%	6.6%	6.6%	6.5%	6.5%	6.4%	6.3%	6.3%

Figure 4. U.S. Corn Exports Under USDA Baseline & E-10, E-12 and E-15 Scenarios – No Corn Acreage Adjustments Allowed



Because of the full adoption by 2015 of the RFS of 15.0 billion gallons per year and the minimum ending stocks requirement of 1.00 bb, these projections of U.S. corn exports are 324 mb to 412 mb below original USDA Agricultural Projections of U.S. corn exports during MY 2014-15 through MY 2017-18 period. Under the E-10 scenario in this study, U.S. corn exports average 2.061 bb during each marketing year, and range from 1.882 bb to 2.25 bb over the MY 2010-11 through MY 2019-20 period. This compares to original average USDA Agricultural Projections of U.S. corn exports for the MY 2010-11 through MY 2019-20 period of 2.285 bb per marketing year, with a range of 1.95 bb to 2.425 bb.

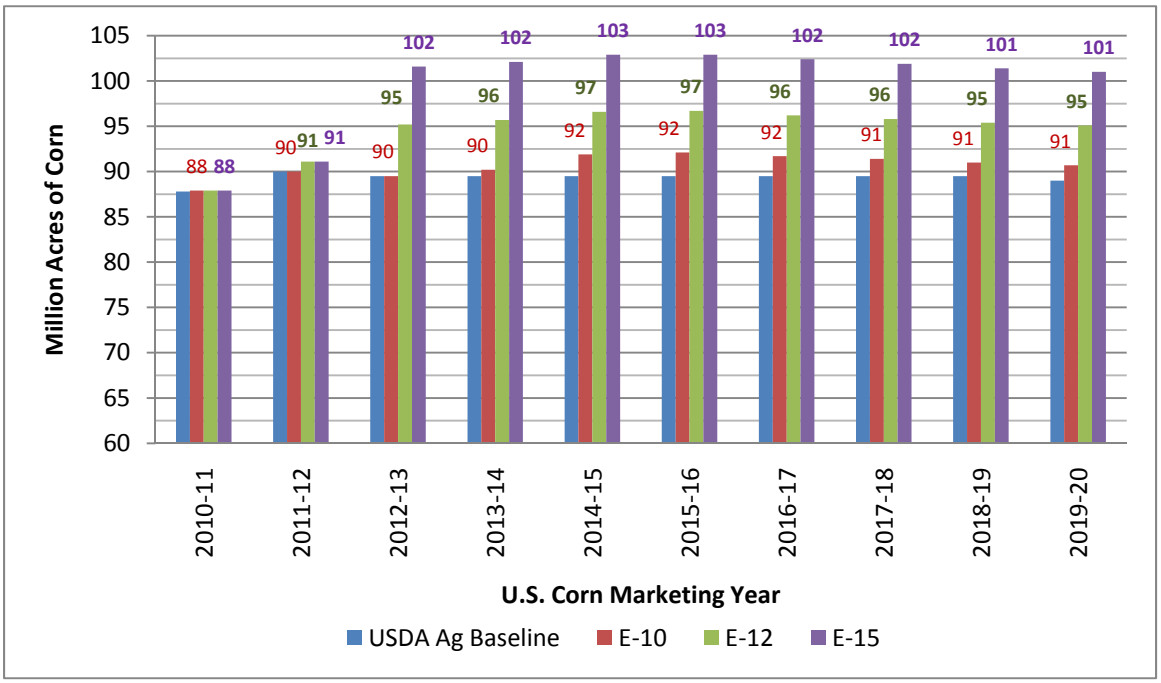
Corn Exports Under E-12: Under an E-12 ethanol production scenario, U.S. corn exports are projected to decrease from a high of 2.019 bb in MY 2012-13 to a low of 1.101 bb in MY 2015-16, and then to increase to 1.345-1.355 bb by MY 2018-19 and MY 2019-20. In the E-12 scenario, U.S. corn exports average 1.389 bb over the MY 2010-11 through MY 2019-20 period. This is 0.895 bb less than average U.S. corn exports of 2.285 bb per marketing year as estimated in the original USDA Agricultural Projections. See Appendix Table 2a for the full U.S. corn + $DDGS_{ce}$ supply-demand projections for the E-12 scenario for the MY 2010-11 through MY 2019-20 period.

Corn Exports Under E-15: Under an E-15 ethanol production scenario, U.S. corn exports are projected to decrease from a high of 2.019 bb in MY 2012-13 to a low of 395 mb in MY 2015-16, and then to steadily increase to 640-649 mb in MY 2018-19 and MY 2019-20. In the E-15 scenario, U.S. corn exports average 824 mb over the MY 2010-11 through MY 2019-20 period. This is 1.461 bb less than average U.S. corn exports of 2.285 bb per marketing year estimated in the original USDA Agricultural Projections. See Appendix Table 3a for the full U.S. corn + $DDGS_{ce}$ supply-demand projections for the E-15 scenario for the MY 2010-11 through MY 2019-20 period.

Corn Acreage & Production Increases Required to Meet USDA Corn Use Projections

Annual increases in U.S. corn acreage and production needed under E-10, E-12 and E-15 ethanol fuel blend requirements to meet the USDA's original projections of U.S. corn exports are represented in Figures 5 and 6.

Figure 5. U.S. Corn Planted Acreage Under USDA Baseline & E-10, E-12 and E-15 Scenarios – U.S. Corn Acreage Adjusted for Projected Full Corn + $DDGS_{ce}$ Usage

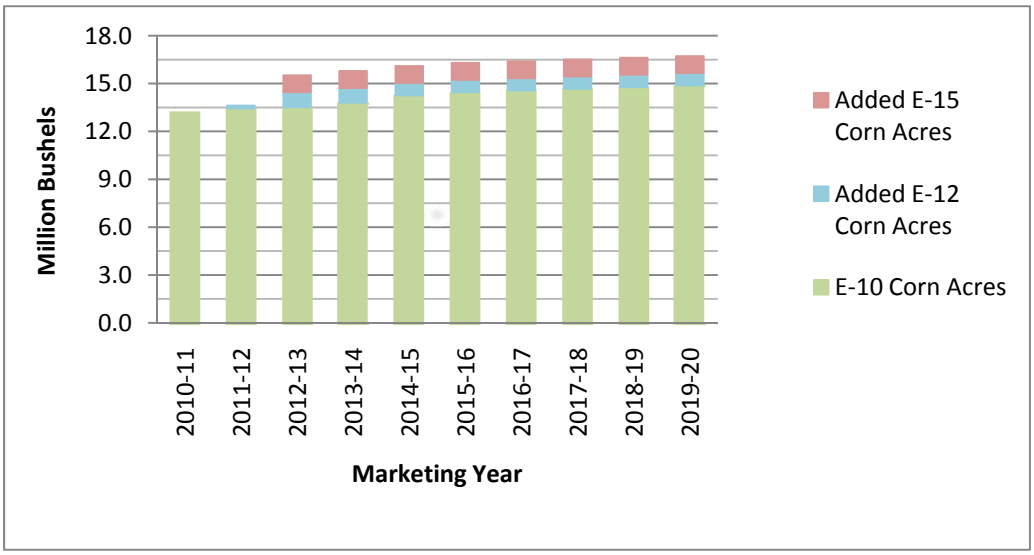


Corn Acreage & Production Increases Needed for E-10: In order to fully meet all USDA Agricultural Projections of U.S. corn use for the next decade (including U.S. corn exports) without dropping below minimum target U.S. corn ending stocks levels, increases would be required in U.S. corn acreage and production. Under the E-10 scenario, U.S. corn planted area would need to increase by an average of 1.44 million acres (ma) per marketing year (i.e., from an average of 89.34 ma to 90.63 ma annually), and U.S. corn harvested area would need to increase by an average of 1.38 ma per marketing year (i.e., from an average of 82.17 ma to 83.55 ma annually). This projection assumes that estimated increases in U.S. corn yield per acre of from 162.4 to 178.4 bushels per acre over the 10 year period were unchanged (see Appendix Table 1).

These acreage increases would be needed to produce an additional average of 244 million bushels of U.S. corn per marketing year that would in turn be used to fully meet all projected U.S. corn use estimated by the USDA for the MY 2010-11 through MY 2019-20 period. In particular, original USDA projections of U.S. corn exports would be maintained, along with corn-based ethanol use, non-ethanol FSI use of corn, and feed and residual corn use.

Corn Acreage & Production Increases Needed for E-12: Under the E-12 scenario, U.S. corn planted area would need to increase by an average of 5.23 ma per marketing year (i.e., from an average of 89.34 ma to 94.57 ma annually), and U.S. corn harvested area would increase by an average of 5.31 ma per marketing year (i.e., from 82.17 ma to 87.48 ma annually). These acreage increases would be needed to produce an additional average of 896 mb of U.S. corn per marketing year, that would in turn be used to fully meet all projected U.S. corn use estimated by the USDA for the MY 2010-11 through MY 2019-20 period. See Appendix Table 2b for the full U.S. Corn plus $DDGS_{ce}$ supply-demand projections with acreage adjustments for the E-12 scenario for the MY 2010-11 through MY 2019-20 period.

Figure 6. U.S. Corn Production Under E-10, E-12 and E-15 Scenarios – With Acreage Changes Allowed



Corn Acreage & Production Increases Needed for E-15: Under the E-15 scenario, U.S. corn planted area would need to increase by an average of 10.18 ma per marketing year (i.e., from an average of 89.34 ma to 99.52 ma annually), and U.S. corn harvested area would increase by an average of 10.26 ma per marketing year (i.e., from an average of 82.17 ma to 92.43 ma annually). These acreage increases would be needed to produce an additional 1.743 bb of U.S. corn per marketing year, that would in turn be used to fully meet all projected U.S. corn use for the MY 2010-11 through MY 2019-20 period. See Appendix Table 3b for the full U.S. Corn plus $DDGS_{ce}$ supply-demand projections with acreage adjustments for the E-12 scenario for the MY 2010-11 through MY 2019-20 period.

Conclusions

This article examines how U.S. corn exports or acreage may be affected over the next decade by expanding the proportion of ethanol allowed to be mixed in U.S. fuels from 10% (i.e., E-10), to 12% (E-12) and 15% (E-15). This analysis focuses on two scenarios that could occur in the U.S. corn market over the next decade. First, it focuses on the possible impact that E-10, E-12 or E-15 scenarios could have on U.S. corn exports, assuming that domestic uses of U.S. corn are fully covered in accordance with USDA Agricultural Projections for the MY 2010-11 through MY 2019-20 period, and that a reasonable minimal level of U.S. corn ending stocks is maintained (i.e., 1.00 bb). Second, this analysis then focuses on the increases in U.S. corn acreage and production that would be needed to fully meet both domestic and export use of U.S. corn while still maintaining these same minimum U.S. ending stocks levels over that MY 2010-11 through MY 2019-20 period.

This article builds on two earlier AgMRC pieces that focused on developing internally consistent U.S. corn + $DDGS_{ce}$ supply-demand balance sheets. Table 1 in the text and Appendices Tables 1, 2a, 2b, 3a and 3b represent various scenarios for E-10, E-12 and E-15 adoption of ethanol fuel blend mixes. Further explanation of the assumptions and mathematical relationships behind these supply-demand balance sheet are available from the author.

These results support the hypothesis that if E-12 or E-15 ethanol fuel blend standards become law in the U.S., sizable increases in U.S. corn acreage will need to occur over the next decade to avoid sizable decreases in other U.S. corn use categories, such as U.S. corn exports. If E-12 or E-15 ethanol fuel

inclusion standards are adopted in the U.S. and U.S. corn acreage and production is limited to the levels indicated in USDA Agricultural Projections for 2010-2019 (i.e., an average of 89 million planted acres and 13.945 bb over the 10 year period), then either U.S. corn exports or another category of corn use such as livestock feeding will need to be reduced by market forces. In this analysis it is assumed that domestic ethanol use, other FSI and feed and residual use of corn would continue essentially unchanged from USDA projections, but that U.S. corn exports would be reduced. Domestic grain transportation cost and logistical handling advantages would tend to support this assumption. However, the continued advantage of domestic over export use of U.S. corn is not assured given volatile energy costs and ongoing variability in world grain supply-demand conditions.

If sizable reductions in U.S. corn exports were to occur as a result of adopting E-12, E-15 or some other percentage fuel blend, it would likely have a major direct impact on world feedgrain markets, and indirect cross commodity market effects on competing oilseed, wheat and other grain markets. The U.S. on average annually supplies corn to nearly 60% of the world corn markets. If an E-12 or E-15 U.S. domestic bioenergy policy were to be adopted and U.S. corn acres did not adjust higher, then at least the potential of a dramatic cutback in U.S. corn exports would dramatically impact the world corn export market.

On the other hand, if U.S. corn producers choose to increase corn acres and subsequent corn production by the amounts indicated in the analysis above, then there is a strong likelihood that U.S. corn exports would not need to be reduced. However, potentially large amounts of U.S. crop acreage would need to shift to corn from other important U.S. crops such as various types of winter and spring wheat, grain sorghum, sunflowers, or soybeans. Such acreage changes would likely not occur without grain prices reflecting a spirited competitive bidding process – adding to the volatility and uncertainty of U.S. grain markets.

Finally, this analysis assumed that minimum level U.S. corn ending stocks of 1.000 bb in each marketing year would be maintained throughout the 2010-2019 period. This minimum level of ending stocks represents extremely tight ending stocks-to-use levels for both corn and for corn + $DDGS_{ce}$ of 6% to 7% after MY 2011-12. Historically, U.S. corn ending stocks-to-use levels in this range are considered quite low, and are typically associated with higher, more volatile U.S. corn prices. It may be prudent to target higher minimum U.S. corn stocks-to-use levels than those in this study in order to represent a more likely supply-demand balance for U.S. corn supply-demand.

Appendix Table 1. E-10 Ethanol Scenario with Acreage Adjustments – U.S. Corn & DDGS S/D Projections

Based on USDA Agricultural Projections for 2010-2019 Marketing Years & the July 9, 2010 USDA WASDE Report

	U.S. Corn Marketing Year (September 1st – August 31st)									
	2010-11	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**
Planted Acres (million acres)	87.9	90.0	89.5	90.2	91.9	92.1	91.7	91.4	91.0	90.7
Harvested Acres (million acres)	81.0	82.8	82.3	83.0	84.7	84.9	84.5	84.2	83.8	83.5
Yields (bushels per acre)	163.5	162.4	164.4	166.4	168.4	170.4	172.4	174.4	176.4	178.4
Supply (million bushels)										
Beginning Stocks: Corn	1,478	1,373	1,310	1,147	1,000	1,000	1,000	1,000	1,000	1,000
Production: Corn	13,370	13,447	13,530	13,810	14,271	14,467	14,567	14,677	14,782	14,892
Production: DDGS corn equivalents	1,427	1,427	1,460	1,525	1,590	1,611	1,611	1,611	1,611	1,611
Imports: Corn	10	15	15	15	15	15	15	15	15	15
Total Supply: Corn + DDGS corn equivalents	**16,160**	**16,262**	**16,314**	**16,497**	**16,876**	**17,093**	**17,193**	**17,303**	**17,408**	**17,518**
Use (million bushels)										
Ethanol Use: Corn	4,700	4,700	4,808	5,022	5,236	5,307	5,307	5,307	5,307	5,307
Non-ethanol FSI: Corn	1,360	1,350	1,350	1,350	1,350	1,350	1,350	1,360	1,365	1,375
Exports: Corn	1,950	2,200	2,250	2,275	2,300	2,325	2,350	2,375	2,400	2,425
Exports: DDGS corn equivalents	300	300	307	320	334	338	338	338	338	338
Feed & Residual: Corn	5,350	5,275	5,300	5,325	5,400	5,500	5,575	5,650	5,725	5,800
Feed & Residual: DDGS corn equivalents	1,127	1,127	1,153	1,204	1,256	1,273	1,273	1,273	1,273	1,273
Total Use: Corn	**13,360**	**13,525**	**13,708**	**13,972**	**14,286**	**14,482**	**14,582**	**14,692**	**14,797**	**14,907**
Total Use: Corn + DDGS corn equivalents	**14,487**	**14,652**	**14,861**	**15,061**	**15,130**	**15,312**	**15,476**	**15,641**	**15,806**	**15,881**
Ending Stocks: Corn	1,373	1,310	1,147	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Ending Stocks: DDGS corn equivalents	0	0	0	0	0	0	0	0	0	0
Total Ending Stocks Corn + DDGS corn equivalents	**1,373**	**1,310**	**1,147**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
%Ending Stocks-to-Use: Corn	10.3%	9.7%	8.4%	7.2%	7.0%	6.9%	6.9%	6.8%	6.8%	6.7%
%Ending Stocks-to-Use: Corn + DDGS corn equivalents	9.5%	8.9%	7.7%	6.6%	6.4%	6.3%	6.3%	6.3%	6.2%	6.2%

Appendix Table 2a. E-12 Ethanol Scenario – Combined U.S. Corn & DDGS S/D Projections

Based on USDA Agricultural Projections for 2010-2019 Marketing Years & the July 9, 2010 USDA WASDE Report

	U.S. Corn Marketing Year (September 1st – August 31st)									
	2010-11	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**
Planted Acres (million acres)	88.0	90.0	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.0
Harvested Acres (million acres)	81.8	82.8	82.3	82.3	82.3	82.3	82.3	82.3	82.3	81.8
Yields (bushels per acre)	163.5	162.4	164.4	166.4	168.4	170.4	172.4	174.4	176.4	178.4
Supply (million bushels)										
Beginning Stocks: Corn	1,478	1,274	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Production: Corn	13,370	13,447	13,350	13,695	13,859	14,024	14,189	14,353	14,518	14,593
Production: DDGS corn equivalents	1,466	1,583	1,656	1,717	1,778	1,798	1,798	1,798	1,798	1,798
Imports: Corn	10	15	15	15	15	15	15	15	15	15
Total Supply: Corn + DDGS corn equivalents	**16,199**	**16,319**	**16,201**	**16,426**	**16,652**	**16,837**	**17,002**	**17,167**	**17,330**	**17,406**
Use (million bushels)										
Ethanol Use: Corn	4,830	5,215	5,737	5,951	6,165	6,236	6,236	6,236	6,236	6,236
Non-ethanol FSI: Corn	1,360	1,350	1,350	1,350	1,350	1,350	1,350	1,360	1,365	1,375
Exports: Corn	1,950	2,019	1,314	1,236	1,108	1,101	1,191	1,271	1,355	1,345
Exports: DDGS corn equivalents	308	332	348	361	373	378	378	378	378	378
Feed & Residual: Corn	5,319	5,151	5,145	5,173	5,251	5,352	5,427	5,502	5,577	5,652
Feed & Residual: DDGS corn equivalents	1,158	1,251	1,308	1,356	1,405	1,421	1,421	1,421	1,421	1,421
Total Use: Corn	**13,459**	**13,735**	**13,546**	**13,710**	**13,874**	**14,039**	**14,204**	**14,369**	**14,533**	**14,608**
Total Use: Corn + DDGS corn equivalents	**14,617**	**14,986**	**14,854**	**15,066**	**15,278**	**15,459**	**15,624**	**15,789**	**15,953**	**16,028**
Ending Stocks: Corn	1,274	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Ending Stocks: DDGS corn equivalents	0	0	0	0	0	0	0	0	0	0
Total Ending Stocks Corn + DDGS corn equivalents	**1,274**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
%Ending Stocks-to-Use: Corn	9.5%	7.3%	7.4%	7.3%	7.2%	7.1%	7.0%	7.0%	6.9%	6.8%
%Ending Stocks-to-Use: Corn + DDGS corn equivalents	8.7%	6.7%	6.7%	6.6%	6.5%	6.5%	6.4%	6.3%	6.3%	6.2%

Appendix Table 2b. E-12 Ethanol Scenario with Acreage Adjustments – Combined U.S. Corn & DDGS S/D Projections

Based on USDA Agricultural Projections for 2010-2019 Marketing Years & the July 9, 2010 USDA WASDE Report

	U.S. Corn Marketing Year (September 1st – August 31st)									
	2010-11	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**
Planted Acres (million acres)	87.9	91.1	95.2	95.7	96.6	96.7	96.2	95.8	95.4	95.1
Harvested Acres (million acres)	81.0	83.9	88.0	88.5	89.4	89.5	89.0	88.6	88.2	87.9
Yields (bushels per acre)	163.5	162.4	164.4	166.4	168.4	170.4	172.4	174.4	176.4	178.4
Supply (million bushels)										
Beginning Stocks: Corn	1,478	1,274	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Production: Corn	13,245	13627	14,467	14,734	15,051	15,247	15,348	15,458	15,563	15,672
Production: DDGS corn equivalents	1,466	1,583	1,656	1,717	1,778	1,798	1,798	1,798	1,798	1,798
Imports: Corn	10	15	15	15	15	15	15	15	15	15
Total Supply: Corn + DDGS corn equivalents	**16,199**	**16,499**	**17,137**	**17,466**	**17,844**	**18,061**	**18,161**	**18,271**	**18,376**	**18,486**
Use (million bushels)										
Ethanol Use: Corn	4,830	5,215	5,737	5,951	6,165	6,236	6,236	6,236	6,236	6,236
Non-ethanol FSI: Corn	1,360	1,350	1,350	1,350	1,350	1,350	1,350	1,360	1,365	1,375
Exports: Corn	1,950	2,200	2,250	2,275	2,300	2,325	2,350	2,375	2,400	2,425
Exports: DDGS corn equivalents	308	332	348	361	373	378	378	378	378	378
Feed & Residual: Corn	5,319	5,151	5,145	5,173	5,251	5,352	5,427	5,502	5,577	5,652
Feed & Residual: DDGS corn equivalents	1,158	1,251	1,308	1,356	1,405	1,421	1,421	1,421	1,421	1,421
Total Use: Corn	**13,459**	**13,916**	**14,482**	**14,749**	**15,066**	**15,263**	**15,363**	**15,473**	**15,578**	**15,688**
Total Use: Corn + DDGS corn equivalents	**14,617**	**15,167**	**15,790**	**16,105**	**16,470**	**16,683**	**16,783**	**16,893**	**16,998**	**17,108**
Ending Stocks: Corn	1,274	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Ending Stocks: DDGS corn equivalents	0	0	0	0	0	0	0	0	0	0
Total Ending Stocks Corn + DDGS corn equivalents	**1,274**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
%Ending Stocks-to-Use: Corn	9.5%	7.2%	6.9%	6.8%	6.6%	6.6%	6.5%	6.5%	6.4%	6.4%
%Ending Stocks-to-Use: Corn + DDGS corn equivalents	8.7%	6.6%	6.3%	6.2%	6.1%	6.0%	6.0%	5.9%	5.9%	5.8%

Appendix Table 3a. E-15 Ethanol Scenario – Combined U.S. Corn & DDGS S/D Projections

Based on USDA Agricultural Projections for 2010-2019 Marketing Years & the July 9, 2010 USDA WASDE Report

	U.S. Corn Marketing Year (September 1st – August 31st)									
	2010-11	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**
Planted Acres (million acres)	87.9	90.0	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.0
Harvested Acres (million acres)	81.0	82.8	82.3	82.3	82.3	82.3	82.3	82.3	82.3	81.8
Yields (bushels per acre)	163.5	162.4	164.4	166.4	168.4	170.4	172.4	174.4	176.4	178.4
Supply (million bushels)										
Beginning Stocks: Corn	1,478	1,274	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Production: Corn	13,245	13,447	13,350	13,695	13,859	14,024	14,189	14,353	14,518	14,593
Production: DDGS corn equivalents	1,466	1,583	2,078	2,140	2,201	2,221	2,221	2,221	2,221	2,221
Imports: Corn	10	15	15	15	15	15	15	15	15	15
Total Supply: Corn + DDGS corn equivalents	**16,199**	**16,319**	**16,624**	**16,849**	**17,075**	**17,260**	**17,425**	**17,589**	**17,753**	**17,829**
Use (million bushels)										
Ethanol Use: Corn	4,830	5,215	7,129	7,343	7,557	7,628	7,628	7,628	7,628	7,628
Non-ethanol FSI: Corn	1,360	1,350	1,350	1,350	1,350	1,350	1,350	1,360	1,365	1,375
Exports: Corn	1,950	2,019	255	177	50	42	132	212	296	286
Exports: DDGS corn equivalents	308	332	436	449	462	466	466	466	466	466
Feed & Residual: Corn	5,319	5,151	4,811	4,839	4,917	5,018	5,093	5,168	5,243	5,318
Feed & Residual: DDGS corn equivalents	1,158	1,251	1,642	1,690	1,739	1,755	1,755	1,755	1,755	1,755
Total Use: Corn	**13,459**	**13,735**	**13,546**	**13,710**	**13,875**	**14,039**	**14,204**	**14,369**	**14,533**	**14,608**
Total Use: Corn + DDGS corn equivalents	**14,617**	**14,986**	**15,187**	**15,400**	**15,613**	**15,793**	**15,958**	**16,123**	**16,287**	**16,362**
Ending Stocks: Corn	1,274	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Ending Stocks: DDGS corn equivalents	0	0	0	0	0	0	0	0	0	0
Total Ending Stocks Corn + DDGS corn equivalents	**1,274**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
%Ending Stocks-to-Use: Corn	9.5%	7.3%	7.4%	7.3%	7.2%	7.1%	7.0%	7.0%	6.9%	6.8%
%Ending Stocks-to-Use: Corn + DDGS corn equivalents	8.7%	6.7%	6.6%	6.5%	6.4%	6.3%	6.3%	6.2%	6.1%	6.1%

Appendix Table 3b. E-15 Ethanol Scenario with Acreage Adjustments – Combined U.S. Corn & DDGS S/D Projections

Based on USDA Agricultural Projections for 2010-2019 Marketing Years & the July 9, 2010 USDA WASDE Report

	U.S. Corn Marketing Year (September 1st – August 31st)									
	2010-11	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**
Planted Acres (million acres)	87.9	91.1	101.6	102.1	102.9	102.9	102.4	101.9	101.4	101.0
Harvested Acres (million acres)	81.0	83.9	94.4	94.9	95.7	95.7	95.2	94.7	94.2	93.8
Yields (bushels per acre)	163.5	162.4	164.4	166.4	168.4	170.4	172.4	174.4	176.4	178.4
Supply (million bushels)										
Beginning Stocks: Corn	1,478	1,274	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Production: Corn	13,245	13,627	15,526	15,793	16,109	16,306	16,406	16,517	16,622	16,731
Production: DDGS corn equivalents	1,466	1,583	2,078	2,140	2,201	2,221	2,221	2,221	2,221	2,221
Imports: Corn	10	15	15	15	15	15	15	15	15	15
Total Supply: Corn + DDGS corn equivalents	**16,199**	**16,499**	**18,619**	**18,948**	**19,325**	**19,542**	**19,642**	**19,752**	**19,858**	**19,968**
Use (million bushels)										
Ethanol Use: Corn	4,830	5,215	7,129	7,343	7,557	7,628	7,628	7,628	7,628	7,628
Non-ethanol FSI: Corn	1,360	1,350	1,350	1,350	1,350	1,350	1,350	1,360	1,365	1,375
Exports: Corn	1,950	2,200	2,250	2,275	2,300	2,325	2,350	2,375	2,400	2,425
Exports: DDGS corn equivalents	308	332	436	449	462	466	466	466	466	466
Feed & Residual: Corn	5,319	5,151	4,811	4,839	4,917	5,018	5,093	5,168	5,243	5,318
Feed & Residual: DDGS corn equivalents	1,158	1,251	1,642	1,690	1,739	1,755	1,755	1,755	1,755	1,755
Total Use: Corn	**13,459**	**13,916**	**15,541**	**15,808**	**16,125**	**16,322**	**16,422**	**16,532**	**16,637**	**16,747**
Total Use: Corn + DDGS corn equivalents	**14,617**	**15,167**	**17,182**	**17,498**	**17,863**	**18,076**	**18,176**	**18,286**	**18,391**	**18,501**
Ending Stocks: Corn	1,274	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Ending Stocks: DDGS corn equivalents	0	0	0	0	0	0	0	0	0	0
Total Ending Stocks Corn + DDGS corn equivalents	**1,274**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
%Ending Stocks-to-Use: Corn	9.5%	7.2%	6.4%	6.3%	6.2%	6.1%	6.1%	6.0%	6.0%	6.0%
%Ending Stocks-to-Use: Corn + DDGS corn equivalents	8.7%	6.6%	5.8%	5.7%	5.6%	5.5%	5.5%	5.5%	5.4%	5.4%