

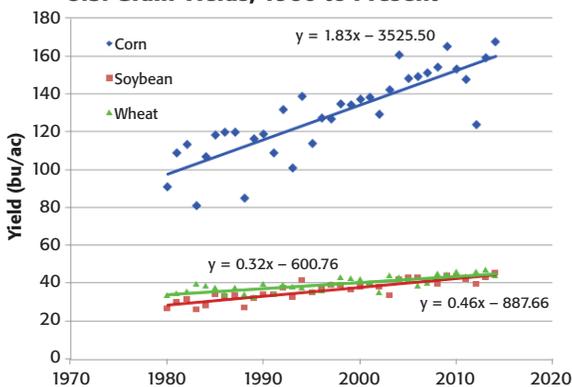


The Impact of High Yields on Deficient Soils

Since 1980, corn yields have increased by more than 1.8 bu/ac per year. Soybean and wheat yields have increased by more than 0.45 and 0.3 bu/ac per year, respectively. In 2014, record U.S. corn and soybean yields are expected. Some Midwest farmers are already reporting corn yields in some fields approaching 300 bu/ac (Figure 1).

Figure 1.

U.S. Grain Yields, 1980 to Present



However, in recent years, the International Plant Nutrition Institute (IPNI) has been reporting a steady decline in soil test nutrient levels. These nutrients include phosphorus (P), potassium (K) and sulfur (S). This leads to many questions. Are farmers keenly aware of revised nutrient removal rates? Are they keeping up with yield trends in determining removal amounts? Are we creating a soil nutrient crisis?

IPNI reports that median soil tests for P and K were down by 6 and 4 ppm, respectively, between 2005 and 2010. It would require about 210 lbs/ac of MAP and 50 lbs/ac of MOP to replenish these deficient soil test levels.

Are We Keeping Up with Soil Nutrient Replenishment?

In 2014, U.S. farmers are expected to harvest an average of 171.5 bu/ac corn and 46.5 bu/ac soybeans, both record-setting yields.¹ Record yields equal record removal of nutrients, and should indicate a need for record soil nutrient replenishment. Each bushel of corn removes about 0.67 lb nitrogen (N), 0.35 lb P₂O₅, 0.25 lb K₂O and 0.08 lb S from the soil. A bushel of soybeans will remove 3.3 lbs N, 0.73 lb P₂O₅, 1.2 lbs K₂O and 0.18 lb S. In a corn-soybean rotation, based on trend line yields of 180-bushel corn and 50-bushel soybeans, it would take 191 lbs MAP/ac and 175 lbs MOP/ac to replace the P and K removed in the harvested grain (see Table 1). As yields approach 210 and 60 bu/ac for corn and soybeans, respectively, it will require nearly 226 lbs MAP/ac and 208 lbs MOP/ac to

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Table 1. Nutrient uptake and removal rates, with fertilizer replacement values for a corn-soybean rotation, based on trend line yields.

Yield (bu/ac)	P ₂ O ₅	K ₂ O	S	MAP	MOP	MicroEssentials SZ* (S Source)
Corn: Soybean		Crop Nutrient Removal (lb/ac)		Fertilizer Replacement (lb/ac)		
150:40	82	86	19	157	143	192
180:50	100	105	23	191	175	234
210:60	117	125	28	226	208	276
Corn		Crop Nutrient Uptake (lb/ac)		Total Fertilizer Replacement (lb/ac)**		
150	81	210	23	156	350	225
180	97	252	27	187	420	270
210	113	294	32	218	490	315
Soybean		Crop Nutrient Uptake (lb/ac)		Total Fertilizer Replacement (lb/ac)**		
40	44	92	14	85	153	144
50	55	115	18	106	192	180
60	66	138	22	127	230	216

*When MicroEssentials[®] SZ[™] is used as a sulfur source at the indicated rates, most of the needed P₂O₅ would be supplied by this source.

**Total fertilizer requirement includes fertilizer plus soil-supplied nutrients.

¹September USDA WASDE Report

replace the nutrients removed and avoid soil test reductions. Applying fewer nutrients than are removed in the grain will cause soil test levels to decline over time. In many cases, fields with declining soil test levels may no longer be able to sustain optimum yields, especially when conditions are right for much above trend line average yields.

Crops Require More than Just Removal Rates of Nutrients

It is important to keep in mind that crops require higher amounts of nutrients than those removed by the grain at harvest (Table 1). Nutrients from the soil and added fertilizers supply these uptake needs. About 80% of the P and 30 to 40% of the K taken up by corn and soybeans are removed in the grain. The good news is that the additional 20% P and 60 to 70% K are retained in the stover and get recycled for future crops. The bad news is that failure to replenish nutrients removed by the harvested grain leaves fewer nutrients in the soil to support uptake requirements, especially in years when grain yields may be very high.

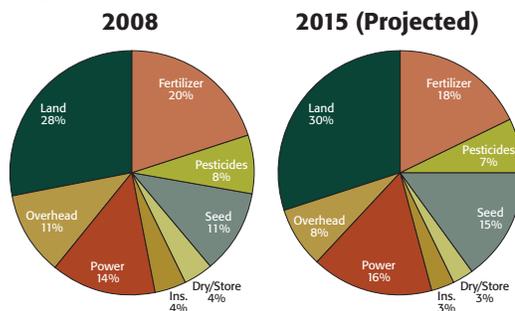
Dealing with Lower Crop Prices

Record crop yields often lead to lower crop prices, simply because supply outweighs demand. But is this the time to cut back on fertilizer? The answer is no. Higher yields may lead to lower prices, but total income may not be reduced dramatically. A corn grain yield of 200 bu/ac sold at \$3 per bushel brings in the same income as 150 bu/ac at \$4 or 120 bu/ac at \$5. The real hurt in this scenario may be to those whose yields are below trend line. The question to ask is why? Is there a nutrient limiting crop yield that doesn't necessarily show visual deficiency symptoms? There may be a "hidden hunger" in these fields. Proper soil and tissue testing may be the only way to determine deficiencies. Of course, genetics, rainfall, drainage and any number of a myriad of other factors may be the limiting factor, some of which may be out of our control. Soil (and tissue) testing over a period of several years, during which one can look for trends, is the best way to determine if one is following proper nutrient management.

Up to 60% of yield is dependent on soil fertility, but is fertility 60% of the cost of production? Although the total cost of corn production has risen substantially over the past 15 years, the relative cost of fertilizer has not. Extrapolating from the University of Illinois "farmdoc" website (<http://www.farmdoc.illinois.edu/>), farmers in Illinois are projected to allocate about 18% of corn production costs to fertilizer in 2015. This compares to 15% spent in 2001 and 20% in 2008. Land costs/Rental remain the highest-cost item, at 30% projected for 2015. Power costs and seed costs come in at 16% and 15%, respectively.

Total cost of production was \$381 in 2001, \$520 in 2008, and is projected to be \$833 in 2015 (Figure 2).

Figure 2.



In fact, a lot of the changes in fertilizer costs are due to changes in cost of nitrogen sources. The cost per ton of DAP and MOP has risen by 9 and 4%, respectively, since 2010; ammonia has risen 75% and urea has risen 46%. Corn price was down by \$0.09 per bu (a 3% drop) during this same period. (This decline is offset by the nearly 5% increase in trend line crop yield.) Because P and K have had only modest increases of late, they are still a good value, ensuring there is adequate nutrition for future crops and for the entire growing season (Table 2).

Table 2. Changes in price of corn and fertilizer sources from June 2010 to September 2014

	Change from June 2010 to Present			
	Sep '14	Jun '10	Change	% Change
Nearby Corn Price (\$/bu)	\$3.38	\$3.47	-\$0.09	-3%
Tampa Ammonia (\$/mt)	\$640	\$366	\$274	75%
NOLA Granular Urea (\$/st)	\$349	\$239	\$110	46%
Central Florida DAP (\$/st)	\$438	\$403	\$34	9%
Corn Belt MOP (\$/st)	\$417	\$400	\$17	4%

Sources: FMB, Fertecon, Fertilizer Week, CME

The Future of Soils

Grain prices have been relatively high over the past few years for a number of reasons. But have we become complacent in recent years by these higher crop prices? Are we still striving for the highest economic yields? Are we replenishing our soils to account for nutrient removal, even in the higher-yielding or even record-yielding years? Whether you're a farmer or a consultant, you should invest the time to evaluate yield-limiting factors, and use soil and tissue testing to determine if you are providing season-long plant nutrition. Remember, record yields equal record removal — and should be followed by record replenishment. Talk to your local retailer to build a crop nutrient management plan that will get the most out of your investment.

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