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How Much Fertilizer Is Needed For Corn?

Kenneth L. Wells  
*University of Kentucky*

Keenan Turner  
*University of Kentucky*

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How Much Fertilizer Is Needed For Corn?
K.L. Wells and Keenan Turner

Corn producers are faced each year with the decision of how much money to invest in fertilizer for use on their crop. Differing philosophies used by those who make fertilizer recommendations often leave the grower bewildered as to what is best to do. It is not unusual for a producer to be told by his agricultural extension agent that he doesn’t need any phosphate and potash on fields which test high in these nutrients while other sources may recommend fertilizer use. The philosophy behind the zero P-K recommendation made by extension agents in such cases is based on University of Kentucky College of Agriculture research which over many years has shown that corn yields are not increased by adding P and K to soils which test in the upper range of the medium level or higher. This is called the "crop sufficiency" approach to making a fertilizer recommendation and results in a fertilizer recommendation for P and K only if soil tests are below that which research has shown necessary to get top yields. Research at UK has shown this approach to be valid regardless of yield goals or actual yields obtained. In other words, a soil testing on the line between medium and high levels of P and K can supply enough P and K for a 200 bushel per acre yield just as adequately as it can a 100 bushel per acre yield. Nitrogen is a different situation. Any corn producer knows that good yields of corn require the availability of ample N. But how much N is sufficient? Again, UK research on N response by corn has shown overwhelmingly that there is little relationship between N fertilizer rates based on some yield goal and yields of corn actually obtained. If a field already contains quite a bit of potentially available N (for example an old legume sod) high yields of corn can be obtained with minimal use of fertilizer N. In addition to residual soil N, soil drainage characteristics and type of tillage (conventional or no-till) also greatly influence the amount of N necessary for top corn yields and when it should be applied. Recommendations made by UK agricultural extension agents reflect these soil conditions, and rarely exceed 150 pounds fertilizer N per acre except on heavy textured, poorly drained soils where it may require 200 pounds N to get the same yield that could be obtained on lighter, drier soils with 100 pounds N.

A test was conducted by UK in Pulaski County during 1988 to monitor whether the crop sufficiency approach to recommending fertilizer for corn production is economically in the corn producers’ best interests. The soil in the field used
for the test was a sloping (6-12%) Frederick silt loam. This is a deep, well
drained soil formed largely from limestone, limited in yield potential mostly by
the steepness of slope which results in thinner topsoil and less rainfall
infiltration. The USDA-SCS Soil Survey Report of Pulaski County indicates that
this soil type has a long term yield potential for corn of 95 bushels per acre
under good management. Soil test levels in the field were; pH 6.7, very high P,
very high K, adequate calcium and magnesium, and marginal zinc. Because of the
marginal zinc level, 36 pounds per acre of actual zinc were broadcast over the
test area.

Pioneer 3320 corn was no-till planted into wheat stubble in this field on
May 11, 1988. It was harvested on October 12 at a moisture content of 21
percent. Final harvest stand population was 28,000 plants per acre. The test
was designed to determine whether corn would respond to additional P and K with
pre-existing high soil test levels, and to determine if this variety would
respond to high rates of N fertilization at a high population. Soil moisture was
limiting through the first half of the growing season, but was sufficient from
pollination until harvest. Results from this test are summarized in the
following table and show that there was no response to P and K, and in fact, not
even to N. The differences shown among the various treatment averages are due to
random variation within the experiment and are not due to the treatments.

The lack of response to N was probably due to alfalfa having been grown
until 1987, when corn was rotated into the field, thereby providing a sizeable
residual soil N content. Money spent on P and K for corn on soils such as this
one testing high in P and K would not have paid off. The existing soil test
levels were sufficient.

Table 1. Corn Yields and Fertilizer Costs for Various Rates of N-P$_2$O$_5$-K$_2$O

<table>
<thead>
<tr>
<th>Fertilizer Applied$^1/$</th>
<th>Fertilizer Cost$^2/$</th>
<th>Corn Yield$^3/$</th>
</tr>
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<tbody>
<tr>
<td>N</td>
<td>P$_2$O$_5$</td>
<td>K$_2$O</td>
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1/ All plots received 36 lbs Zinc/A, the cost of which was prorated over 4 years.

2/ Fertilizer costs used were: Ammonium nitrate, $165/T (.24/lb N); Triple superphosphate, $145/T (.16/lb P₂O₅); Muriate of potash, $140/T (.12/lb K₂O); Zinc sulfate, $720/T (1.00/lb Zn).

3/ Av of 4 replications/tmt

4/ prorated cost of zinc sulfate

K. L. Wells, Extension Soils Specialist