The Analysis

Agronomic Information From

Spectrum Analytic Inc.

Winter 2010

As we close another year we want to take this opportunity to say thank you for your business in 2010. The agronomy business continues to offer new challenges. We continue to see changes in the ag programs and cuts in funding to many of the federal and state offices we have used and relied upon in the past. Private business has also needed to change the way they are doing business, we are seeing reorganization in all areas of business today.

The latest IPNI Fertility of North American soils will be available in January, 2011. In this issue of The Analysis we have summarized the results and included the maps of P and K levels. Phosphorous soil test levels seem to have remained steady since 2005; there are some states that had decreases greater than 10 ppm and some states with increases of 10+ ppm. According to IPNI findings there are still states that have 18-70% of the samples below the critical P levels. Potassium is a different story, in some states they are seeing a greater than 20% decrease in soil K levels from just 5 years ago. This translates into 20-60% of the samples submitted below the critical K levels. We all remember the staves of the barrel and the Liebig Law of the Minimums. During the past several years we have seen increases in both crop yields as well as fertilizer costs. If growers want to maintain the high crop yields that they have seen in the past years they are going to need to maintain and build the soil P and K levels to the critical levels. Take a look at your soil survey that you will receive in January and see what percentage of your soil test levels are below the GOOD range. We also have the soil survey on our website that will allow you to look at multiple years' soil test status levels and the different soil test ranges to make a comparison to previous years. I challenge you to take a look at these multiple years, and make sure your soil test levels are where you want them to be. Make sure your fertilizer program is going the direction you want it to be going.

Another thing to keep in mind is plant analysis. Many farm programs now offer money back to growers if they use plant analysis. This is a great way to confirm with a chemical analysis that the crops are getting the necessary nutrients from the soil. When making winter calls with growers, put a plan together to take some plant tissue samples. This is something that will benefit both of you, and with the program dollars can be a minimal investment with a huge return. Remember, plant analysis helps to discover hidden hunger.

All the employees at Spectrum Analytic wish you and your employees and their families a Blessed and Merry Christmas. We hope that everyone enjoys the holidays together with friends and family and that everyone travels safely. In the upcoming year we will be facing new challenges once again, take these challenges and convert them into an opportunity. May the year 2011 bring another successful year to you and all your business ventures.

What's Inside...

Who To Contact...

Agronomy .... Scott Anderson, Bill Urbanowicz
Computer .... Wayland Reid
Chief Chemist .... Vernon Pabst
Sales/Marketing .... Mike Hall
Billing .... Donna Scott
Sample Results .... Donna Scott
Fertilizer & Feed .... Vernon Pabst
Lab Technicians .... Randy Johnson, Jim Armstrong, Wayne Jinks, Cynthia Cook

Soil Analysis Fertility Levels 2010

Bill Urbanowicz

Every five years the International Plant Nutrition Institute (IPNI formerly Potash & Phosphorous Institute PPI) puts together a summary of soil test levels of the United States and Canada. This study is a compilation of soil tests run through 60 cooperating labs either private or public. This year's summary is the result of an examination of nearly 4.5 million soil samples. In 2005 there were approximately 3.5 million samples submitted, so this year the results reflect an increase of 1 million samples. The detail of why there is an increase in samples is not a purpose of this study. The complete report will be available from IPNI in early 2011 if you are interested in more details of the study.

Phosphorous

The median Bray P1 level for North America is 25 parts per million (ppm) which indicates an overall decrease of 6 ppm since the 2005 report. Figure 1 shows the median Bray P1 soil test levels for each state. Figure 2 shows the change in median Bray P1 from 2005 to 2010. Figure 3 shows the percent of samples testing below the critical P levels for major crops in 2010.

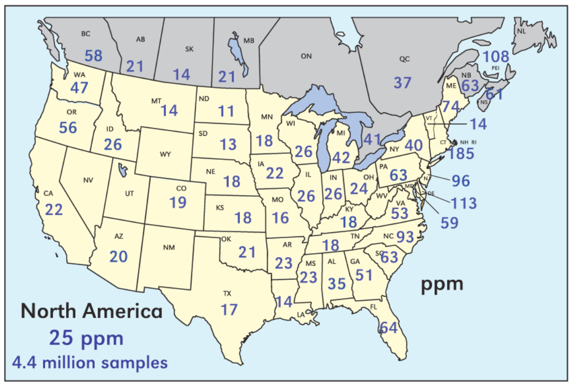


Figure 1. Median Bray P1 equivalent soil test levels in 2010 (for states and provinces with at least 2,000 P tests).

Potassium

The median K level for North America is 149 parts per million (ppm) which indicates an overall decrease of 5 ppm since the 2005 report. Figure 4 shows the median K soil test levels for each state. Figure 5 shows the change in median K from 2005 to 2010. Figure 6 shows the percent of samples testing below the critical K levels for major crops in 2010.

With the IPNI summary dealers were asked to submit soil samples for the 2010 crop, the date range of when the samples were taken may be different among dealers. Some of the differences may be due to the pool of samples that were taken; it may have been a different set of fields in 2005 than in 2010 depending on the submitters sampling cycle. The intensity of samples may have changed; some regular soil sample may have been converted to grid samples which will increase the number of samples submitted. There are several different extractants that were used; IPNI did their best to try to make a "correlation" between the different extractants. The amount of fertilizer that was applied may not have been sufficient for the needs of the crops that were harvested during this time, many areas have experienced 1 or more years of higher than normal yields.

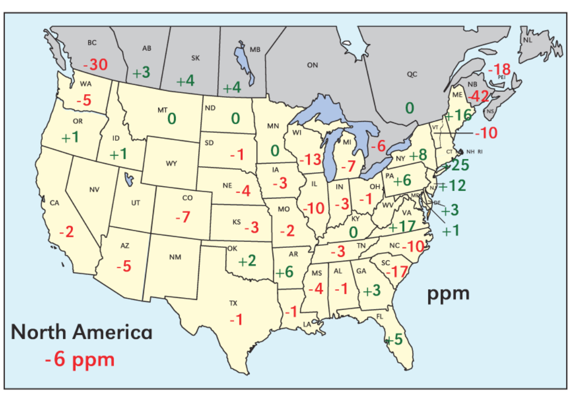


Figure 2. Change in median Bray P1 equivalent soil test levels from 2005 to 2010.

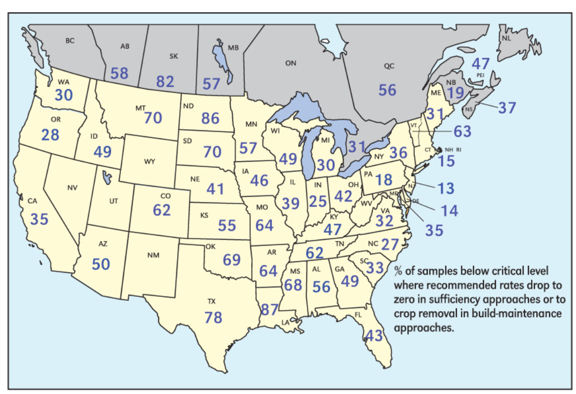


Figure 3. Percent of samples testing below critical levels for P for major crops in 2010.

Summary

It is important to remember that this is only a summary of the soil samples that were submitted. As a dealer, consultant or dealer that takes regular soil samples, you will have a much better handle on what is going on in your area with each of your individual clients. At Spectrum Analytic we have a new tool on our website that allows you to go in and query your soil samples for specific years, status levels, test run and nutrient levels. This tool allows you to compare different sampling years as well and nutrients that were tested to look for trends that may have occurred.

We hope that you will take a look at this summary and use our web based tool or any system you may have in house to analyze your soil test trends and be sure that you are getting the results that you are fertilizing for and not depleting you soil test levels. *(Maps from **Better Crops with Plant Food**, Wol. 94, Issue No. 4, 2010)*

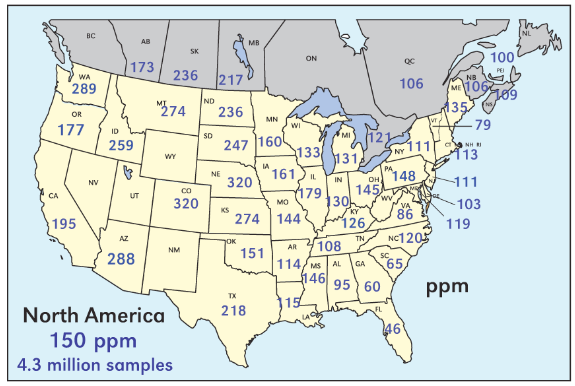


Figure 4. Median soil test K levels in 2010 (for states and provinces with at least 2,000 K tests).

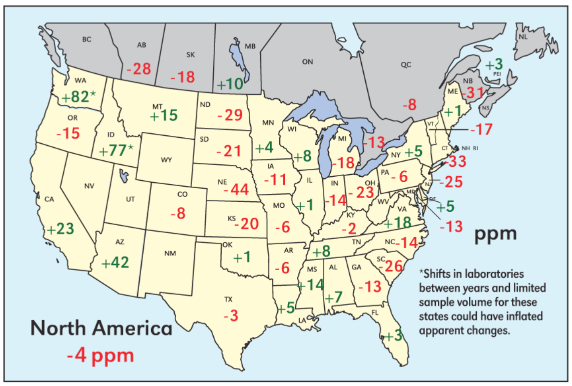


Figure 5. Change in median soil test K levels from 2005 to 2010.

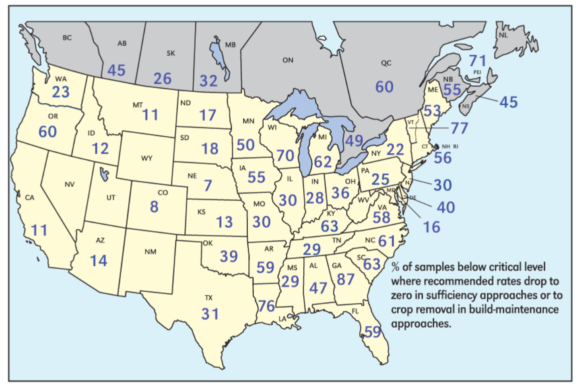
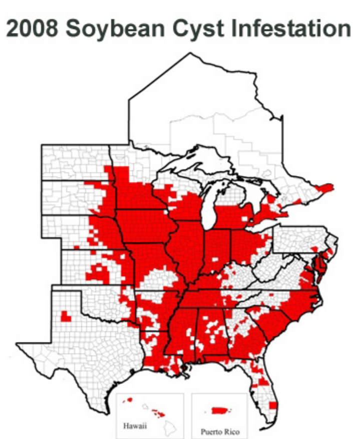


Figure 6. Percent of samples testing below critical levels for K for major crops in 2010.

Don't Forget About Soybean Cyst Nematodes

Scott Anderson

With all of the publicity about soybean rust in recent years, the threat of soybean cyst nematodes (SCN) may have dropped from many radar screens, but that doesn't mean that they disappeared. As this map shows, most of the prime farmland east of the Rocky Mountains has some level of SCN present in the fields. Luckily, we have some tools to identify the problems in your customer's fields.



A relatively simple soil test for SCN can identify the risk level of a field. However, like any other type of sampling, it has to be done correctly to get accurate information. In a recent article in "Ohio's Country Journal", Anne Dorrance, a plant pathologist with the Ohio Agricultural research and Development Center (OARDC) was quoted as saying "We've had growers come to us in the past saying they know they have SCN in their fields because of the yield loss, but their soil samples tell a different story. Now we know what's going on. SCN could be all over the board in a field and a farmer may just not pick up populations when he does the sampling."

She recommends that farmers probe the soil close to the root zones of the plants, not between the rows, to get a more accurate egg count. The library section of our web-site at www.spectrumanalytic.com contains a paper titled simply "Soybean Cyst Nematodes" which contains more information about SCN and its management.

It's difficult enough to raise profitable crops in most years. This is one problem that can be managed.

Lessons From Plant Analysis In 2010

Scott Anderson

We analyzed thousands of plant tissue samples this year and the survey listed here tells quite a story about the nutrient situation of our crops. In looking at the data, keep in mind that this is a biased survey. That's because most people don't send us samples of healthy appearing or growing plants. They more often are trying to find out why the crop is not performing as they would like or expect. Having said that, this year more customers than ever took our advise and sampled crops that they thought were "normal". As the following table shows, there were a lot of hungry crops in 2010.

2010 Plant Analysis Survey											
	Percent of Samples Below Normal										
Crop	**N**	**P**	**K**	**Ca**	**Mg**	**S**	**B**	**Cu**	**Fe**	**Mn**	**Zn**
Corn	30.8	19.2	22.5	15.9	**44.2**	26.0	27.8	6.3	2.6	9.4	26.3
Soybeans	**33.5**	13.8	**35.9**	22.4	**35.2**	7.9	0.2	16.2	0.0	2.6	0.7
Wheat	**34.4**	32.8	25.1	27.3	**88.0**	12.6	**85.2**	27.3	0.0	20.2	**63.9**
Alfalfa	3.0	7.1	**39.4**	5.1	**80.8**	20.2	5.1	1.0	0.0	13.1	4.0
Apples*	7.5	10.6	**40.3**	82.3	**41.2**	0.0	3.5	**65.5**	0.0	0.9	**62.8**
Grapes	22.6	**61.3**	**35.5**	**51.6**	**38.7**	29.0	9.7	**38.7**	16.1	3.2	6.5
Blueberry	**43.1**	12.1	15.5	8.6	31.0	8.6	12.1	**87.9**	24.1	0.0	**63.8**
Christmas Trees	20.0	**44.0**	21.0	**49.0**	**44.0**	12.0	**47.0**	**57.0**	3.0	0.0	10.0

Bold Values Are More Than 33% Below Normal
*Apple Ca uptake is not necessarily related to soil Ca

We have highlighted the values that indicate more than 33% of that crops nutrients were below normal, but that is an arbitrary choice. No crop producer would want a third of his crop to be nutrient deficient, so take notice of some of the other results as well as the highlighted ones.

Many of these samples had accompanying soil test results, the fertilizer program, and recent weather conditions. From this information it was apparent that the main reasons for these results were…

Acidic Soils
Weak Soil Tests
Weak Fertilizer Programs
Annually Cash-Rented Land (probably)

To be fair, some areas of the country suffered from too much rain, too little rain, or both at different times of the season, and this contributed to these problems. However, when nature goes against you, it hurts much worse when the soil needs lime and fertilizer.

It does not seem likely that the price of lime is the main reason for so many acid soils, so we assume that it is either due to lack of attention to soil tests, or the fact that so many acres are farmed on an annual cash-rental basis. The acid soils are a large part of the reason for the high number of low Mg levels. However, a lot of growers have to pay a little more for dolomitic lime and they apparently are not willing to use this inexpensive source of Mg. Of course this is a "pay me now, or pay me later" situation and they paid later with an Mg deficient crop. Another reason for a few of the low Mg levels is that some growers have gotten their soil K:Mg ratios out of balance. The soil should never have more K than Mg in it. When this happens, grasses (especially corn) are likely to have problems with Mg uptake, regardless of the actual Mg level of the soil. If the soil K:Mg ratio is higher than about 1.5:1 (in ppm or lb/a, not saturation), nearly all crops will have Mg problems... again, regardless of how high the soil Mg level is. This is because the excess K will prevent adequate uptake of Mg.

After emphasizing the problems of excess soil K, we see that low plant K uptake is probably the second most widespread problem. For a long time now, we have watched as the K fertility of farmland in general has deteriorated. This was happening before the price of potash spiked, but based on our experiences, that spike in prices appears to have further weakened potash use and aggravated the slide in soil K tests. As with lime, we suspect that annually cash-rented land is one of the main reasons for weak fertility programs in general.

While it is understandable that a grower might resist the idea of risking a medium to long-term investment in land that he might not be farming next year, poor fertility will cost him this year. Some of the soil samples that we see suggest that such land is so poor that it shouldn't be rented in the first place. Poor K programs seem to be most pronounced in Midwest corn-soybean rotations. Growers have long under-fertilized this rotation in the apparent belief that somehow soybeans are better than they really are at "scrounging" for nutrients in the soil. In recent years we have seen increasing numbers of soybean plant samples with K deficiencies. Potassium shortages are most pronounced in dry years, because dry weather severely limits K uptake. This is an ironic twist, because K is probably the primary nutrient in boosting the ability of all crops to best get through a drought. The result is that in a dry year, a poor K soil puts crop yields on an ever-increasing downward spiral. Notice in the survey that 33.5% of the soybean samples were low in N. In the vast majority of these cases, the fields had been in a corn-soybean rotation and lack of nodulation was not the problem. While some of the samples suffered from acid soil, many or most of them suffered from low K. This situation is entirely understandable when we realize that the only "reason" that nodules form on soybeans is to get some free sugar from the plants. A soybean that is low in K produces less sugar, which means that the rhizobia in the nodules go hungry and produce less N. Thus we get N deficient soybeans.

Notice also that the table shows us that a lot of wheat fields suffered from low B, Cu, Mn, and especially Zn. Small grains in general tend not to get the micronutrient attention that they should. Like K application, this has also seems to be an increasing trend in recent years. In our conversations with customers that have applied the needed micronutrients to wheat and other small grains, they report very large yield responses.

Space doesn't permit an in-depth discussion of all of the crops and their nutrient trends, but this information should put everyone on notice that there are significant areas for improved yields through proper fertilizer use.

What To Expect From The Nitrogen Use Efficiency Trait In Corn

Dr. Tom Bruulsema, Northeast Director, IPNI

The future demands crops that will produce more food using less N. Corn is already one of the most productive cereals, producing a lot of carbohydrate per unit of N applied. Several plant breeding companies have set goals to substantially increase the N use efficiency of their future hybrids. How will these differ from the hybrids of today?

Corn producers have already improved N use efficiency. This doesn't necessarily mean less N per acre. In the past 40 years in the Corn Belt, the amount of corn produced per unit of fertilizer N applied has increased by 78%, while N rates went up 30%.

How has this improvement in efficiency been achieved? Mainly by increasing yields, associated with: Greater N uptake, extending later into the season; Increased internal efficiency in the plant, yielding more grain per unit of N taken up; Small reductions in the crude protein (N) content of the grain.

Plant breeding companies have ramped up efforts to continue genetic improvement. Both conventional and biotech approaches are being applied. What are the traits that might contribute?

- Further increases in yield and tolerance to stresses like high plant populations;
- Roots that explore the soil more quickly and thoroughly;
- Transporters that assimilate nitrate and enzymes that convert it to amino acids more efficiently;
- Altered patterns of storage and remobilization of N within the plant;
- Ultimately, symbiotic N fixation—but that's an unknown, and a long way off.

These traits may require changes to the way nutrients are managed for corn. What will the right choices look like for source, rate, timing, and placement?

Source – Corn will likely continue to take up N as ammonium and nitrate. Physiologically, it takes the plant less energy to make protein from ammonium than from nitrate (even though corn is efficient at using nitrate). Increasing ambient carbon dioxide also favors ammonium uptake. Corn may start showing more preference for ammonium. So perhaps we can envision using sources that slow or prevent the conversion of fertilizer into nitrate, keeping it as ammonium later into the growing season.

Rate – Plant breeding won't likely improve our ability to predict what the soil might provide, or what the weather might remove from the soil by leaching, denitrification or other loss routes. These factors will likely remain the main determinants of the optimum rate to apply, though when yields increase some account will have to be made for increasing plant demand for N as well.

Timing – The corn plant needs N from start to finish. European studies show that continued N uptake beyond even a typical silage harvest date can be important for grain yield. Can we find ways to split the dose or control release

Continued of page 7

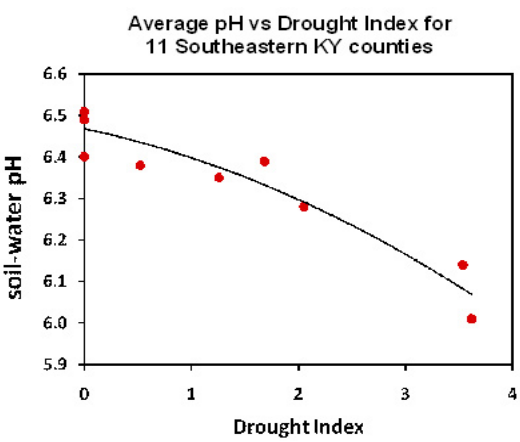
Drought Effects on Soil Test Results

Scott Anderson

The 2010 crop year has been very dry in some parts of the country. Soil samples taken after a severe drought can sometimes have a pH that is lower than you might expect. While this is an accurate result, it is normally temporary and will self-correct with increased soil moisture received through the winter and spring.

The University of Kentucky produced an informative graph that illustrates the typical pH changes that are seen after a droughty summer.

This Kentucky data shows



a maximum pH drop of about 0.5 pH units during an extreme drought, which is typical of loamy or clay-loam soil types. The amount of drop could be as much as 1.0 pH units in very sandy soils and almost unnoticeable in Midwestern heavy clay soils.

This pH change is caused by the upward movement of ionic elements in the soil (Na^+, K^+, Cl^-, NO_3^-, etc.). In other words, this is the opposite of leaching. As the soil dries out, water at the soil surface evaporates and is replaced by water deeper in the soil profile. As with downward water movement during leaching events, whatever is dissolved in the water moves with the water, so as this upward movement continues, these ions accumulate in the surface of the soil and depress the "water-pH" of the soil.

The term water-pH is in quotes, because it is one of two primary methods of measuring soil pH. Most soil labs measure the pH with de-ionized/distilled water (pure H_2O). This method is subject to this drought-induced pH depression. The other method of measuring soil pH is called a salt-pH. In this method, the lab uses mildly salty water, rather than pure water to determine the soil pH. You might be wondering why all labs haven't switched all of their pH testing to the salt-pH method in order to avoid this problem with droughty soils, but as usual, there are always trade-offs. One major trade-off is that the salt-pH will give you a lower pH than the water-pH in normal years, due to the salt that the lab puts in the water. This "universal" pH drop averages around 0.5 or 0.6 pH units in loamy soil. Therefore, the target pH for all crops would drop about that much. Lime recommendations should not change due to a change in methods, because a lab that switched testing methods would need to recalibrate their recommendation system to account for the difference in results. Of course, the major change would be with the user getting used to seeing lower pH results in normal years. At Spectrum Analytic we have chosen to continue using the water-pH method, because the drought effect is rare and small, but the confusion caused by changing our testing method would be large.

At this point, some might also wonder if their potassium tests taken after a drought are reliable, or if their fields are in danger of becoming too salty. Our experience with this is that there might be a slight K increase in some soils (again, more in sands), but that most increases would be minor and temporary, and probably not make much difference in a fertilizer recommendation. There are some types of clays which will contract and can cause the K level to decrease in drought conditions. This decrease would only be minor and temporary until the soil returned to "normal" moisture. As for the total soluble salts in the soil… If you were to determine the total soluble salts in a drought-affected sample, the result would be higher. However, like K, it would be rare for any increase to be a problem. And, in any event, the excess salt would be diluted by spring rains. Perennial forage crops that could be exposed to a slight salt increase should not be a problem either because alfalfa and other perennial forages will tolerate soil salt levels significantly higher than the drought effect has historically been seen to cause.

Not All Fertilizer Bands Play The Same Song

Dr. T. Scott Murrell, Northcentral Director, IPNI

The often used expression, "Same song, different verse," refers to something that is practically the same as something else. So often, P and K are used in the same sentence when people talk about banded fertilizer applications, as if both were different verses of the same song. Actually, P and K fertilizer bands play different "songs" because they behave differently in soil.

One of the primary reasons fertilizer is banded is to increase short-term efficiency of use by the plant. Bands of P are known to cause an increase in root proliferation, as are bands of N. Bands of K, however, do not have this effect. This means that bands of P will be explored more thoroughly by root systems than bands of K. The implication, of course, is that applying P and K together in a band will help make better use of the concentrated K supply, due to the increased root growth caused by P.

Bands of K may not remain as concentrated in soils over time as bands of P. There are a couple of reasons for this. First, crops like corn and soybean take up more K than P during the season. Corn takes up about two-and-a-half times as much K as P while soybeans take up about twice as much (expressed as K2O and P2O5). Secondly, K moves more in soils than does P, causing bands of K to become more diffuse over time relative to P. So, greater uptake combined with greater mobility limits the longevity of concentrated bands of K.

In the short-term, corn and soybean plants themselves redistribute K in soils to a greater extent than P. This occurs for a couple of reasons. First, K leaches from plant residue and unlike P, does not require microbial decomposition to be released. This means that K in the plant is returned to the soil more quickly than P. Secondly, a greater proportion of the K taken up by the above-ground plant biomass exists in the plant residues returned to the field. For corn, about 80% of the total K taken up is in the stover, compared to only about 30% for P. For soybean, the percentages are 45% for K and 20% for P. A lot of the K leached from plants occurs during senescence, before crop harvest, meaning that most of the K is redistributed into the crop row. Consequently, plants become effective redistributors of K in the soil, moving it from throughout the root zone and concentrating it to the row, particularly at the soil surface. While P is also redistributed in this manner, it is not done so to the degree that K is.

Just how long P and K bands will last in soil depends upon many factors. Soil mineral composition, rooting depth, environmental conditions, and soil wetting and drying cycles are but some of the many factors at play. To gain an idea of how long bands will last under a specific set of conditions, on-farm monitoring through soil testing is suggested. Select areas can be monitored frequently to gain a sense for band longevity, remembering that if bands are placed near crop rows, concentration of K by the plant may overwhelm detection of lower rates of banded K.

So the next time P and K bands are assumed to be the same, remember that they really have very different characteristics, both in the soil and in the way they interact with plants. Bands of P and K really do play different songs.

Nitrogen

Continued from page 5

for effective N uptake over a more extended period of time?

Placement – Could we envision a root trait that changes the depth from which N is captured? Roots operate most efficiently within the topsoil. It will still be important to get the applied N into that zone. But could we place other nutrients—like P and K—in a way that helps express the full potential of an NUE trait? Can we envision a trait that proliferates roots in zones where nutrients have been banded in ways that minimize losses to water and air?

There are good reasons to expect more genetic improvement of N use efficiency in corn. To make the most of it will require more agronomic experimentation with plant nutrition as well.

The Analysis is published as a service to agricultural dealers and crop consultants by Spectrum Analytic Inc.

If you have any questions or comments, please call 800-321-1562 or 740-335-1562 or Fax us at 740-335-1104.

Bill Urbanowicz
Editor

Excellence In Testing

- Personalized Service
- Quick Turnaround Time
- Experience
- Complete Analytical Services
- Accurate and Reliable
- Competitive Prices
- Quality

- Soil Analysis
- Fertilizer Analysis
- Lime Analysis
- Plant Analysis
- Feed Analysis
- Manure Analysis

The Analysis

Spectrum Analytic Inc.
1087 Jamison Road NW
Washington Court House, OH 43160

ADDRESS SERVICE REQUESTED