Master Consultant Neal Kinsey on . . .

# Soil Fertility & Fertilization

*by Neal Kinsey*

There are those in agriculture who insist that if you will only use the program they recommend, regardless of your farm's condition, there will be no need to purchase phosphate and potassium and perhaps any other fertilizers anymore. Names of actual farmers successfully using such programs can be provided by the salesman. Some of these farmers have actually been able to maintain yields without the use of fertilizer for several years. Keep in mind that it is possible, under the proper conditions, to achieve excellent results without adding more fertilizer. But on most farms the proper conditions do not exist, and hardship would ultimately result for those involved in such a program.

If a program to eliminate fertilizer is begun on highly fertile soils, it can look great for several years. If that same program is tried on a soil with very low fertility levels, that farmer is likely to become a victim within a few years — usually less than three. On a highly fertile farm it is possible to grow crops — sometimes several crops — without the use of fertilizer. But it is not possible to grow those crops without a sufficient level of soil fertility.

In a given year, the farmer may be able to produce excellent crops without additional fertilizer, but this will not be accomplished without a sufficient level of fertility in the soil. Furthermore, that fertility must be maintained above a certain level, or the crops produced there will not continue to do their best. The only way to accurately determine whether this level is still there each year is by use of a soil test that provides a detailed fertility analysis. These tests should then make it possible to correctly identify soils that produce well versus soils with poor yields, just by looking at each soil analysis. Using such a detailed analysis of the soil, the formulation of a fertility program that will work best in all types of situations is possible.

Using very detailed soil sampling and analysis techniques, farmers utilizing our testing program have tried various products in comparison to the normal methods of maintaining fertility levels. In every case, as crops were removed, the fertility levels would eventually begin to decline until yields were affected. The number of years that it took to noticeably affect the fertility depended on the nutrient levels present in the soil when the program was begun. For most soils, it required three years or less to see a decline in the general fertility levels, and on those with very low fertility, it happened the very first year. But for some of the best soils, the levels remained high for five years or longer without showing decline in general fertility.

These comments are not intended to even imply that there is no place for specialty products such as biological stimulants or broad-based nutrient materials that help to solve various needs or problems for a given soil. We discuss using various materials in *Hands-On Agronomy*, but readers should understand that there are circumstances surrounding changes in soil fertility which can sometimes be used falsely (whether intentionally or unintentionally) when a farmer decides to try a program which claims to eliminate the need for fertilizers or soil amendments.

For example, as low calcium levels are increased by applying needed limestone, low phosphate levels will also tend to increase in the soil. Also when high magnesium levels and the soil pH drop at the same time, potassium levels will tend to increase. In actual fact, these increases can be expected to occur just by properly supplying the needed nutrients to the soil, and are not dependent on a specific product to eliminate the need for those materials.

As another example, calcium levels, expressed as pounds of calcium per acre, can be shown to "increase" just by pulling the soil sample from the lighter areas of the field (shows lower exchange capacity and lower amount of available calcium) before using a program, and from heavier areas after using the program (shows a higher exchange capacity and higher amount of available calcium). Again, such situations have been used to claim a product or program decreases the need for limestone, whether or not the individual may have intended to be deceitful. If the cation exchange capacity on a soil test from the same field reads significantly

*Neal Kinsey during the filming of the* Hands-On Agronomy Video Workshop.

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higher than previous tests, it is most likely due to sampling in areas of the field with a higher clay content. Soils with a high clay content generally contain more pounds of calcium as a result of the clay's ability to attract and hold more of it.

No matter what program of soil fertility is used, you can never "get something for nothing." What is taken from the soil must be returned or eventually a price will have to be paid. It is only possible to receive from the soil in the same manner that fertility continues to be provided to it.

Farmers who have access to — or have in the past used — plenty of manure or compost on their farms come closest to being able to grow a crop without additional fertilizer. But even in such cases, most farmers still are not able to adequately supply all of the necessary nutrients for the crops they are striving to grow. For example, sulfur and boron seldom increase from manure application, due to very low levels in the manure and their tendency to leach from the soil. Some clients who have used manure and/or compost annually for several years have shown no increase in copper, manganese and/or zinc, while others show significant increases after two or three years. Soils can react differently to the very same type of fertilization. The real key to whether or not a farm needs additional fertilizer depends on the current level of fertility in the soil and on what elements are contained in that soil to be released through the action of the biology and chemistry of the soil.

On soils that have moderate or higher fertility levels, the approach to maintaining adequate fertility should always be to "feed" the soil and let the soil "feed" the crops to be grown there. This "feeding" is done by providing the necessary nutrients in the proper amounts for the soil on which crops of whatever kind are to be grown.

Feed the soil and let the soil feed the plants. Programs which recommend a certain number of pounds of any nutrient per acre for a crop, no matter what the soil conditions, have forgotten this basic principle. Establishing the necessary levels of nutrients in each soil should be based on the specific needs of that soil. This is accomplished by use of broadcast applications, especially in regard to any "long-term influence" types of fertilizer.

Some fertilizers are "soil builders," providing long-term influence toward fertility of the soil (these will build the available nutrient levels in the soil under proper conditions). Other fertilizers are only "plant feeders" (no soil build-up). Such fertilizer programs are trying to second guess the basic soil needs and provide a "shortcut" to production. They strive to by-pass the biology of the farm soil and put on only what the plant itself will take up. This includes side-dressing, in-row fertilization, and trying to establish various ratios of one nutrient to another based solely on the measurement of the level of one or more of the elements present in that soil.

Such programs may have to be used in certain cases for short-term situations, but for a program intended to build the soil fertility levels, these will not generally be as satisfactory, and should be avoided wherever possible. Some fertilizer salesmen will insist that building a quality soil is too expensive, but those who have accomplished such will verify that it is not. In fact, in the long run it is by far the most economical method of maintaining top fertility and crop yields.

Keep in mind that the soil is alive with biological activity. This soil life is a vital part of building and maintaining soil fertility for growth and production. When you try to feed the plant and neglect the rest of the soil's biological life year after year, it is a mistake which will rob nutrients from all such living organisms and restrict them from performing whatever they are specifically designed to accomplish in the soil. The soil is the plant's stomach. Feed the soil to keep it vibrantly alive and working as it should. Feed the soil and the soil will do by far the best job of feeding the plants to be grown there.

It is generally understood that fertilizers, limestone, manures and any other materials can add to the fertility level of a soil when supplied in the amounts actually needed. But what seems hardest for most growers to comprehend is that when too much is applied any one of these same nutrients can damage soil fertility levels. This specifically has to do with the fact that overuse of any of the major or secondary nutrients (lime, N, P, K & S) can affect the availability of the micronutrients or trace elements to the crop. These trace elements, especially if levels are borderline in the soil, can be tied up by the "glut" caused from an unusually large amount of a specific nutrient in the area where the plant roots must feed. This can happen either from broadcasting far too much of a product, or from too much side-dress or in-row material. For example, too much nitrogen ties up available copper, and too much calcium can tie up iron, manganese copper, zinc and/or boron.

The same thing can happen in regard to the use of manures. The P & K levels in a good productive soil that receives manure can be raised enough to increase the availability of these nutrients in larger amounts than the crop takes out. Compost can do the same thing.

When it comes to applying manure or compost, don't overdo a good thing. Too much can be detrimental to crop yields, just the same as not using enough can hurt production on a field. As a rule of thumb, fields that already test high in phosphates and/or potassium should not receive indiscriminate applications of manure or compost. Only when a soil test shows the soil is ready to receive more manure or compost should an application of either one be considered.

For example, if a farmer continues to apply manure or compost, increases unneeded phosphate availability, and copper or zinc levels are barely adequate in comparison, the phosphate can interfere with the uptake of these two minor elements. This overuse can cause the crop being grown there to be short of these needed micronutrients, and the problems that result from it. For example, copper provides resilience to the plant and is necessary along with potassium and manganese for strong stalks and wood. Zinc is needed for moisture uptake by the plant. Excessive phosphate levels in the soil will impede the uptake of zinc and may also affect copper levels in crops such as citrus. This can affect the productive ability of the plants growing there and also the nutritional value when consumed by animals or mankind.

As potassium levels continue to rise from too much manure or compost, boron and manganese uptake can be restricted. If excessive enough (especially in lighter soils), a magnesium deficiency can be caused by too much available potassium

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in the soil. In addition, on some soils, manure or compost can unduly increase available zinc levels. When not too high, this is fine, but when zinc is already very high in a soil, this can begin to cause problems associated with zinc toxicity, and particularly phosphate tie-up.

Keep in mind that where manure or compost has been used repeatedly and must be stopped, the amount of nitrogen which would have been supplied by the manure must be made up from other sources on those crops with high nitrogen requirements.

Too much manure and/or compost, just like anything else that is excessively used, can cause problems. Those who have access to large amounts of manure or compost with only a small acreage or a garden need to especially heed the lessons of too much manure. Not only can excessive use of manure increase P and K levels and hinder the uptake of micronutrients in the soil; it can also contribute to health problems for those who rely heavily on those areas for sustenance. Some indications that the problem is very advanced in gardens include bitter tasting cucumbers, squash and even turnips in certain cases.

The only sure way to know how much manure is enough on any soil is to take an accurate soil test, and, if the soil tests relatively high in fertility, a fertilizer analysis of the manure you are using. This should be an analysis which shows the saturation each soil contains in terms of calcium, magnesium, potassium and sodium. Phosphate content should be measured. Combined with an analysis which shows the content of major and secondary elements in the manure or compost to be used, it is then possible to know what conditions are present in the soil and what can be expected to happen if the material is applied.

Still, there is no need to shy away from the use of compost and manure in the fields or on the garden. So long as a proper analysis of each soil is completed, and so long as that analysis is correctly interpreted in terms of the amount needed.

Too much of a particular type of fertilizer can hurt yields and/or crop quality just as much as too little fertilizer can hurt them. Some growers fail to learn this until it is too late. Be safe with fertilizer and manure applications. Know you can use them profitably before they are applied. Only by developing a program of detailed testing and analysis on your soils can you know this for sure.

If you have a program of soil fertility that is working well for you, continue to develop and perfect it. If you don't have such a program, now is the time to begin one. As a sign in the office of one of my clients reads, "Stand for something — or you will fall for anything." Base your stand on high fertility levels, not just high rates of fertilizer. ❖