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CORN HYBRIDS FOR HIGH pH SOILS

Several of our corn test plots were conducted on high pH (calcareous) soils in past seasons. Corn is relatively inefficient in extracting iron from high pH soils where it is often tied up as insoluble iron oxide. Barley and wheat, by contrast, are efficient in extracting iron from these soils.

It has been estimated that 25-30% of the world's land surface has calcareous (high calcium, high pH) soils (Wallace and Lunt, 1960), the largest portion of which is in the U.S. Most of the U.S. corn acreage (77,000,000 acres per year on the average) is grown on noncalcareous soils, where high pH is not a factor in hindering crop growth. In the west, however, a considerable number of corn fields, or parts of fields, are grown on land which has high pH. Under these arid, irrigated conditions, the effectiveness of iron acquisition from the soil, plus enzyme reduction systems within the plants become important considerations in corn hybrids.

The active iron (ferrous form, Fe++) in plants is found concentrated to a large degree in the chloroplasts of the cells. Typically, iron in the soil is in the ferric (Fe+++) form. In calcareous soils, plant roots secrete low molecular weight, ferric specific, iron-chelating compounds called siderophores, many of which are mugineic acids (MA's). These MA's solubilize and grab onto the ferric iron so that plant roots can take it up. After taken up, the roots must have an enzyme system which reduces the ferric iron (Fe+++) to ferrous iron (Fe++) which in turn can be utilized by the chloroplasts in the plant cells.

Many corn plants are genetically weak or inefficient in developing and secreting MA's to make iron acquisition possible. They are also weak in manufacturing enzymes to reduce the ferric form of iron to the ferrous form. As a result, the plants readily become stressed because of iron deficiency causing yellowing of the leaves and reducing plant size, plant health and grain yield. At times, iron stressed plants may be found to have taken up a lot of the ferric form of iron. This form, however, is inactive in the plants and because the enzyme reduction system isn't working to create the ferrous form, the plants remain stressed.

Hence, NK's corn research and screening program is conducted to search for hybrids which can utilize iron under these high pH conditions. Several iron efficient hybrids have already been identified on calcareous sites in the west. 4693, N91-R9 and N7992 are examples of corn from our screening program.

POTASSIUM DEFICIENCY

Hidden hunger is hard to spot in corn, and yet guarding against a potassium shortage is very important.

As Unocal's Green and Rush demonstrated, the amount of potassium, or K, may appear adequate in the lab (on the ammonium acetate extraction test) but not be available during the plant's rapid-growth stage.

Corn utilizes up to 6-8 lbs. of K per day while growing from the 5-leaf state (12") to about 20 leaves (tasseling). After tasseling, it's too late to get potassium into the plants, even if a small amount is still being utilized. In deficient plants, when the bottom leaves "fire-up", or turn brown, it means the potassium has moved to the higher leaves that are most actively photosynthesizing sugars.

The Unocal scientists showed that potassium resides in the soil in three states: fixed, exchangeable and soluble. The plants can't use the first two forms, so you have to know how much soluble K your crop can draw on daily. The equilibrium between the forms constantly changes in the soil cation exchange complex.

Check your soil with a K availability test. If you lack exchangeable K, you can at least partially correct the situation. Soluble K can be applied in solution to the growing crop.

Shallow root development in corn, a common condition in late-planted silage fields, will accentuate a K deficiency. In the hot summer, upper growth tends to be faster than root growth. The failure to grow adequate rooting means that not enough potassium can be extracted from the soil to sustain healthy top growth.

Some hybrids are more sensitive to low K levels and fire-up faster than others. But don't be surprised to see dried-up lower leaves during the earing and grain fill period when K is not readily available. Another note: spider mites and leafhoppers (carrying corn stunt) may hurt K-deficient corn faster than they would a healthy crop.

NITROGEN USE BY CORN

Studies show that corn needs nitrogen all season long. Small plants need small amounts, demand that increases with growth and then tapers off after grain filling. But figure on your crop using one-third of its N after tasseling.

Researchers at the University of Nebraska did a study on late nitrogen use in corn after tasseling and found that plants not only use but lose nitrogen in the healthy, mature states. Where else does it go? They aren't sure, but some may be volatilizing out the leaves.

This brings up an important management point. Don't let your corn run out of nitrogen while it is finishing off. As with potassium, nitrogen can "translocate" from the lower leaves to the top.

It is a good plan to keep both the nitrogen and potassium levels up while finishing out your corn crop. With a moderate plant population of 30,000-31,000 plants per acre, the crop's demands will be balanced for both high yields and quality.

CORN IS SMARTER THAN YOU THINK

NK research and university extension specialists learned it takes more heat units to reach physiological maturity in a warmer growing season than it does during a colder growing season. In fact, hybrids vary by area in the number of heat units needed to reach physiological maturity. Corn hybrids can and do adjust for the growing season.

Thus, the Growing Degree Unit (GDU) system is not absolute. Instead, it's a relative guide for relating the difference in hybrid maturity and between growing seasons. Corn hybrids are indeed smarter than we give them credit for.

GUARDING AGAINST WATER STRESS

A lot of corn in the San Joaquin Valley goes through water stress at the 5-7 leaf (10-18" tall) stage. Stress on the plants at this stage of growth can reduce the number of rows of kernels the ears develop. For example, 16-row ears can become 14-row ears, and 18-row ears can become 16-row ears. This stress reduces yield potential whether the crop is grown for grain or silage. A suggestion is to plan ahead and get the water on the crop before the stress occurs. Also, water stress during the fast growth stage (18" to tasseling) can reduce plant size.

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SUMMER FORAGES

Here are some suggestions for supplemental summer forages.

NK 300

This stress tolerant forage sorghum, when planted in May or June, typically grows to 6-7 feet tall, is very leafy and has large compact heads full of grain. It has strong stalks and can be ratooned back for a second cutting when planted early. Growers worried about corn leafhoppers and stunt disease in their silage corn, may want to consider this forage crop which will not be bothered by leafhoppers. Typical yield in the 22-25 ton per acre range on the first cutting and about two-thirds that capability on the second cutting is normal.

Trudan 8

An exceptional summer forage with high tolerance to heat and drought. This high-protein potential forage has a lower prussic acid potential than sorghum-sudangrass crosses. A multi-use crop, it is grown for grazing, hay, greenchop or haylage. Plant at 50 lbs. per acre under irrigation for top quality and yield. Fertilize with nitrogen at the rate of 40-60 lbs. per acre for each cutting.

Sordan 79

A sorghum-sudangrass hybrid with exceptional early vigor for rapid establishment. It adapts well to heavy, droughty or alkaline soils and has a proven ability to help reclaim alkaline soils. Use for highly palatable and nutritious hay, grazing or greenchop. Seed a bit heavier than with Trudan 8 and fertilize similarly.

FUSARIUM TOLERANT CORN HYBRIDS

For years, the California Delta and lower Sacramento Valley have been hotbeds for fusarium ear rot on grain corn. Fusarium moniliforme is the major culprit.

According to Dr. Michael Davis, a University of California Extension plan pathologist, "Fusarium ear rot is the most damaging disease of corn in the Sacramento Valley."

"In addition to decreasing yields," he adds, "ear rot affects grain quality, limits the use of certain cultivars and causes concern about toxins in corn used for feed."

Western flower thrips are said to be the vectors that carry the spores into the young developing ears. Typically, a nutrient imbalance permits diseases to attack plants more vigorously.

We screen our hybrids in areas of known fusarium to weed out susceptible hybrids. For example, for many years, we have had replicated corn plots in the California Delta, planted on soils with high organic matter, low pH, low calcium availability and low soluble potassium content—excellent conditions for fusarium ear rot. Our various research trials ensure that only the cleanest of fusarium-tolerant NK hybrids will be marketed.

INCREASING ALFALFA'S NUTRITIVE QUALITY

Improving alfalfa's nutritive quality is now a major effort, both for traditional trifoliate, as well as the new multi-leaflet alfalfa varieties. Many alfalfa quality experts are now saying that forage which tests 30% ADF (acid detergent fiber), 40% NDF (neutral detergent fiber) and 20% CP (crude protein) is ideal.

NK Brand alfalfa breeders have believed for a number of years that improved quality could be achieved with multi-leaflet varieties of alfalfa. Some trifoliates such as new Sequoia also have excellent quality. The goal is to increase the total leafiness of these new, improved varieties whether trifoliate or multi-leaflet.

FORAGE QUALITY

Much emphasis is now placed on forage quality for dairy cattle. The two major forage crops are corn silage and alfalfa.

Most growers in the West understand the effect of stage of maturity on these crops. According to Dwayne R. Buxton, forage specialist at Iowa State University, "No single factor impacts forage quality more than plant maturity."

As forages get older, a higher percent of the forage is cell wall material high in hemi-cellulose, ligno-cellulose and lignin. These materials interfere with digestion and lower milk production. Immature forages tend to be much more readily digestible.

The genetic background of the varieties we plant also affects the amounts and quality of these materials. Silage hybrids like N8214 and N7992, along with alfalfas like Tulare and Sequoia, help provide the genetics for improved forage quality.