Soil fertility management for forage crops

Establishment

Soil fertility management for forage crops is a continuous process that begins well before the forage crop is established. In the pre-establishment phase, the soil conditions are adjusted to provide optimum soil fertility when the crop is established. The fertility program during the establishment phase should deal with last minute, small adjustments in soil fertility and any requirements such as a starter fertilizer for getting the plants established. After the crop is established, the fertility program should focus on maintenance of good fertility levels in the soil for the life of the forage stand.

This fact sheet will deal with the establishment phase of soil fertility management for forages. The soil fertility management time-line is illustrated in Figure 1.

If the pre-establishment fertility goals have been met, few things need to be taken care of at the establishment phase. In the establishment phase, the primary goals of soil fertility management are to fine tune the soil pH or nutrient levels and to assure that the conditions are optimum to establish the crop.

When only a small amount of limestone is needed to make an adjustment in the soil pH, it should be applied after primary tillage and worked into the surface before planting. If a large amount of limestone is needed, the lime application should be split and some mixed deep into the soil with primary tillage, and the rest should be applied after primary tillage but worked into the surface. These measures will give the best distribution of limestone and will assure that the surface pH where the seedlings are developing will have a better pH level.

If a soil test taken just before establishment indicates the need for additional fertilizer, the size of the requirement will determine how this should be applied. For instance, if the pre-establishment goals have been completely met and there is no soil-test recommendation, there usually is no need to apply any fertilizer. If the soil test recommends addition of only a small amount, the recommend amount can be banded at planting or broadcast on the soil surface. But, if the soil-test indicates a need for a large amount of fertilizer, the best approach would be to split the fertilizer application with the bulk of the nutrient needs met with plow-down fertilizer or manure. A small amount of the total fertilizer requirement, such as 20-40-40 per acre, should be banded at planting or applied to the surface to meet the immediate needs of the crop as it is established.

STARTER FERTILIZER FOR FORAGE SEEDINGS

Applying a small amount of fertilizer near to the seed at planting time is a well accepted practice in corn production. This practice is known as starter fertilizer. The strategically placed source of nutrients for the young plant has been shown to consistently provide an early growth response and often a yield increase in corn. However, the response of forage crops to a starter fertilizer has not been as consistent. Generally, it is assumed that a starter fertilizer will give a beneficial response only under very adverse conditions such as soils that are very cold and wet, soils with poor physical properties, and soils that are very low in fertility. If a starter fertilizer is used for a forage seeding, there are at least three major management considerations. (1) The starter fertilizer should have a high phosphorus content. Many fertilizers meet this requirement. Dry fertilizer examples include: 10-20-10, 10-20-20, 10-10-10, and 8-32-16. Fluid fertilizers

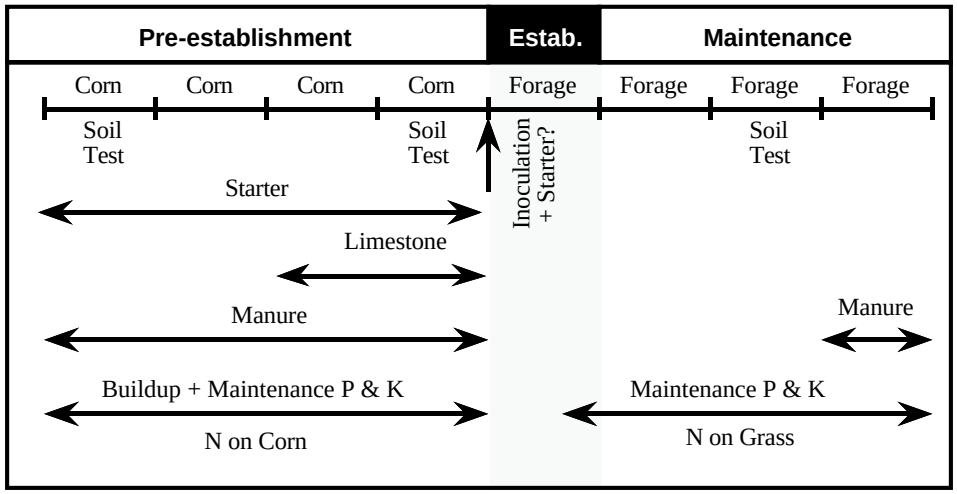

Figure 1. Soil fertility management time-line for corn-forage rotation.

include: 10-34-0, 7-21-7, and 9-18-9. A fertilizer containing urea should not be used as a starter. (2) The starter should be banded 1 inch directly below the seed. This is especially important for legume seedings. (3) Finally, the rate should be kept below about 60 pounds of nitrogen plus potash in the starter band. This is an important precaution to avoid reduced germination and salt damage to the seedling. If a starter fertilizer can not be banded as described above, a small amount of fertilizer can be broadcast as a starter. However, the broadcast method is less effective than band placement because it will only give a beneficial response under very adverse environmental conditions—when the soil fertility level is low. Routinely broadcasting a small amount of fertilizer as a starter is not recommended under most conditions.

INOCULATION OF LEGUMES

Legumes have the ability through a symbiotic relationship with rhizobia bacteria to fix nitrogen from the air in a form that is available to the plant. This process fixes enough nitrogen to completely meet the needs of the legume for nitrogen. For this process to take place, the plant roots of the legume must be infected by rhizobia bacteria that are specific for each species of legumes. In many soils, rhizobia bacteria are present to infect the plant roots, particularly if the same legume species has been grown in the field in the recent past. However, a general recommendation is that all legumes be inoculated with the proper rhizobia species at seeding. Inoculation is very inexpensive and thus provides good insurance that the plant will have adequate nodulation and thus good nitrogen nutrition. The inoculant must be specific for the legume being planted. Since the inoculant contains living bacteria, the inoculant should be kept in a cool dry place. The best storage place is in a refrigerator. The worse place to store inoculant is on the dashboard of a truck because heat and direct sunlight will kill the bacteria.. Finally, all inoculants have an expiration date. After this date the inoculant may not have adequate live bacteria to do an adequate job of inoculation. Always be sure to check this date before using an inoculant.

Inoculant can be applied in several ways. The most common method is to mix the inoculant with the seed just before planting. A sticker may be used to ensure that the seed is well coated with inoculant. Some seed is pre-inoculated when purchased. The same handling precautions hold for pre-inoculated seed as for the inoculant itself. Another way inoculant is commonly applied is by direct soil application. In this method the inoculant is applied in a granular form through an insecticide or fertilizer box on the seeder. Fluid preparations of inoculant can be directly applied by spraying them in the seed row. Fluid seeding, where the seed is suspended in liquid fertilizer and sprayed on the prepared seed bed, has also become popular. It is important with this method of seeding that the seed not be left in contact with the fertilizer solution too long, because the prolonged exposure can reduce the effectiveness of the inoculation. More details on inoculation can be found in Agronomy Facts # 11 “Inoculation of Forage and Grain Legumes.”

pH is extremely critical for this symbiotic relationship between the legume and the rhizobia to be successful. Thus establishing a soil pH between 6.5 and 7.0 at seeding is critical. It is sometimes recommended that nitrogen fertilizer be added at seeding time to take care of the needs of the legume until it is adequately nodulated to meet it nitrogen requirements. Generally, this has been found to be unnecessary. In fact, adding nitrogen from fertilizer or manure can reduce nodulation.

For grass forages some nitrogen, 20 to 40 lbs. per acre, should also be applied at seeding. An additional 30 to 50 lbs. of nitrogen can be applied in the late summer of the seeding year if production warrants. In no-till seedings in sod, such as pasture renovations, no nitrogen should be applied at planting. Nitrogen applied in these situations will stimulate the existing grasses and can provide too much competition to the new seeding resulting in a seeding failure.

SUMMARY

At establishment the fertility program should deal with any last minute small adjustments in soil fertility and any requirements for getting the plants established such as a starter fertilizer. If the soil fertility goals were met in the pre-establishment phase little or no fertilizer or manure should be required at establishment. In general, forage crops do not respond to starter fertilizers unless the conditions at planting are very adverse. The most important aspect of fertility management for establishment of legume forages is proper inoculation to assure adequate nitrogen nutrition of the crop.

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