Best Management Practices for Colorado Corn

Primary Authors: Troy Bauder
Department of Soil and Crop Sciences
Colorado State University

Reagan Waskom
Department of Soil and Crop Sciences
Colorado State University

Contributing Authors: Joel Schneekloth
Colorado State University Cooperative Extension

Jerry Alldredge
Colorado State University Cooperative Extension

Technical Writing and Support: Marjorie Nockels Ortiz
Layout: Debbie Fields

Graphic Design: Nancy Reick, Kendall Printing

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Potassium

Although potassium (K) is a macronutrient, K or potash (fertilizer), is not often required on Colorado soils. Deficient situations are mainly found in sandy fields with low organic matter levels. Fields grown frequently to silage are more likely to need K because four to five times more K is removed by silage than grain.

Table 13. Suggested potassium application rates for Colorado soils.

ppm K - top 12" of soil NH_4OAc* or AB-DTPA	Relative level	Fertilizer rate lb K_2O/A
0 - 60	low	60
60 - 120	medium	30
> 120	high	0

*Ammonium acetate or ammonium bicarbonate - DTPA extractions

Irrigation waters in Colorado also may contain some K and beef manure contains approximately 30 to 40 lbs K_2O/ton. Both are sources of K that will be taken up by the plant.

Broadcast application of KCl (potassium chloride) is an accepted method for correcting K deficient situations. Some starter blends also contain K, but the cost per unit is often much higher. Starter fertilizer blends that contain more than 20 lbs/A of N and K should not be applied with the seed. Recommended placement is 2 inches to the side and 2 inches below the seed.

Sulfur

Sulfur (S) is a secondary nutrient adequately supplied by Colorado soils and irrigation waters in many situations. Both surface and well water contains appreciable SO_4-S and may supply adequate S for corn. Sulfur application decisions should not be made based on a soil test alone, growers should invest in a water analysis test. Only sandy soils with less than 1% organic matter and less than 10 ppm SO_4-S in the irrigation water may respond to S fertilizer application.

Because plants only utilize the sulfate form of S, applying the elemental form may not be an effective nutrient source for the first year it is applied. Band application (2 inches x 2 inches) of SO_4-S or other S fertilizers are most effective. Ammonium thiosulfate (12-0-0-26S) is an effective material for a starter at planting; an application of 5 to 10 lb S per acre is adequate for band applied S on responsive soils. Double rates when broadcast.

Potassium in corn

- Most Colorado soils have adequate K
- Taken up by plant as K^+ ion
- Corn grain removes approximately 0.22 lb K_2O/bu, and silage removes 7 lb K_2O/ton silage

Potassium is mobile in plants and deficiency shows up on older leaves first. Yellowing and burning begins on the tips and margins.

Photo D.G. Westfall

Sulfur in corn

- Deficiency is uncommon in most Colorado soils
- S is immobile in plant
- Uptake in the form of sulfate (SO_4) ion
- Irrigation water frequently contains SO_4

Sulfur deficiency symptoms usually seen on young plants include uniform chlorosis of plant and stunted growth.

Photo H. Wood, S. Dakota State

Micronutrients

Corn plants use micronutrients in small amounts; however, deficiencies can be just as yield limiting as macronutrient deficiencies. Zinc (Zn) and iron (Fe) are the only two micronutrients with confirmed deficiencies in Colorado. There have been no confirmed deficiencies of boron (B), copper (Cu), manganese (Mn), molybdenum (Mo) or chloride (Cl) in Colorado corn. Zn and Fe availability decreases with increasing soil pH.

Zinc deficiency in corn. Symptoms include yellow striping on young leaves that occurs across the leaf blade. Affected plants also have shortened inter-nodes.

Photo R.H. Follet

Zinc

Zinc deficiencies are often found on soils that have been leveled for irrigation where subsoil is exposed or on soils with high levels of free lime. Most Zn deficiencies are usually reported on soils with pH levels higher than 7.0. Several sources of Zn fertilizer are available, but the material needs to be at least 40 to 50% water soluble to be effective. Banding of zinc sulfate or an equivalent source is a very effective application procedure.

Table 14. Suggested zinc rates for band and broadcast applications to irrigated and dryland corn.

ppm Zn - top 12" of soil AB-DTPA or DTPA	Relative level	Fertilizer rate, lb Zn/A* Banded	Broadcast
0.1-0.9	low	2	10
1.0-1.5	marginal	1	5
>1.5	adequate	0	0

*Rates are based on zinc sulfate applications

Iron deficiency in corn. Yellow inter-veinal striping of younger leaves occurring along the length of the blade.

Photo R.L. Croissant

Iron

Iron deficiencies also occur on leveled or eroded sites where the subsoil has been exposed or on highly calcareous soils. Correcting Fe deficient soil can be difficult. Foliar spray application of a 1% ferrous sulfate solution at 20 to 30 gallons per acre is not always completely effective in correcting chlorosis, and several applications may be necessary. Generally, soil applications of most liquid Fe fertilizers are not economical for corn on Colorado soils. Broadcasting Fe fertilizers is also ineffective, but seed-row applied granular fertilizer has been shown to correct deficiencies.

Incorporation of manure or biosolids in exposed subsoils may correct both Zn and Fe deficiencies and is the best remedy for Fe deficiency when needed. For fields with severe Fe deficiency, hybrid selection may be a good option. Check with your seed dealer for availability of corn hybrids that are more tolerant to Fe deficiencies.

Silage considerations

When growing silage corn frequently in a rotation, soil fertility management has a few special considerations. When silage is harvested, the entire plant is removed and all the nutrients and crop residue go with it. Because of this removal, silage corn has a higher N requirement than grain corn and other nutrients (especially potassium) may need more frequent and higher rates of application. Equally important, silage harvest removes valuable crop residues (leaves, stalks). Loss of these materials makes the soil more prone to erosion and over time and can deplete organic matter. Fields in these rotations will benefit from manure or compost applications and winter cover crops to help maintain their long-term productivity.

Packing corn silage

Dryland considerations

Dryland corn production requires the same basic nutrients as irrigated, but in smaller amounts because of reduced yield potential. Nitrogen and P applications will produce the most consistent economical yield responses, with zinc being necessary in many areas. Use the same equation provided in on page 54 to calculate N rates with a reasonable yield expectation. Except in the wetter areas of Eastern Colorado, yield responses to N applied above 100 lb N/acre are unusual. Because dryland corn production requires no or reduced tillage in Colorado, placement is critical to prevent P fixation and N losses to immobilization with higher residue and volatilization if surface applied. Surface or subsurface banding N is most effective to prevent N losses while subsurface banding P is essential.

In no-till situations, many growers prefer to apply most if not all N and P at planting. This strategy works well as long as N, K and S rates are kept below a total of 20 lbs/acre when placed directly with the seed (pop-up). When placed at least 2 inches away from the seed, the full N supply can be applied without hurting germination and stand.

Because soils in dryland corn production areas typically don't have applied manure, their organic matter levels tend to be lower then soils in irrigated areas. This leads to a much greater need for zinc fertilizer, therefore dryland corn producers should pay close attention to soil zinc levels.

Dryland corn grown under no-till in rotation with wheat.