New Jersey

Maximum Corn Yield Research Evaluates Chloride Fertilization

By J.R. Heckman

Chloride (Cl) supply is not generally considered to be a limiting factor for corn production in most field environments. However, the adoption of more intensive production practices and higher yield levels may increase the need of corn for Cl.

EXCEPTIONALLY high yielding environments provide ideal conditions for the study of the agronomic importance of Cl nutrition of corn. Experiments with Cl fertilization of corn were conducted in New Jersey using maximum corn yield research methods similar to those developed by Dr. Roy Flannery during the 1980s.

The experiment attempted to achieve a minimum stress field environment by use of irrigation and effective control of insects, diseases and weeds. Pioneer Hybrid 3245 at 43,560 plants per acre was established using an equidistant 12 by 12 inch spacing pattern. Applications of nitrogen (N), phosphorus (P) and potassium (K) fertilizer were made at planting and were also sidedressed during the growing season. The total N, P_2O_5 and K_2O applications were 500, 268 and 405 lb/A for the season, respectively. Boron (B), copper (Cu), manganese (Mn) and zinc (Zn) were also applied at planting to ensure that these micronutrients were not limiting. Chloride treatments were 0, 45, 90, 180, and 360 lb Cl/A. The Cl source was potassium chloride (KCl). Combinations of KCl, potassium hydroxide (KOH), and potassium sulfate (K_2SO_4) were used to apply equal amounts of K to all plots.

Grain and Stover Yield Response

Grain yield and ear size were generally increased by Cl fertilization, as presented in **Table 1**. In 1990, yield of Cl-fertilized treatments averaged 17 bu/A more grain than the check yield of 180 bu/A. In 1991, the check yield was 302 bu/A and yields increased with each rate of added Cl up to 360 lb/A . . . a yield of 328 bu/A. In 1992, Cl-fertilized treatments averaged 8 bu/A more grain than the check yield of 231 bu/A. Yield levels in this experiment were 2 to 3 fold higher than previous studies that did not report yield increases from Cl fertilization of corn.

Table 1. Corn grain yield, stover yield and ear size as affected by Cl fertilization.

Cl, lb/A	Grain, bu/A	Stover, tons/A	Ear size, lb
		1990	
0	180	4.73	0.27
45	194	5.00	0.27
90	205	4.87	0.31
180	189	4.87	0.28
360	200	5.14	0.30
		1991	
0	302	5.31	0.42
45	310	5.00	0.45
90	308	4.60	0.45
180	316	4.91	0.45
360	328	4.82	0.46
		1992	
0	231	5.05	0.29
45	232	5.05	0.30
90	242	5.22	0.30
180	238	5.05	0.30
360	240	5.27	0.31

Chloride fertilization did not increase stover yield. In 1991, when grain yield

Dr. Heckman is Soil Fertility Specialist, Plant Science Department, Cook College, Rutgers University, Brunswick, NJ 08903.

showed the largest increases from Cl fertilization, stover yield was decreased. This suggests that the grain yields were improved by partitioning a higher proportion of the plant's total dry matter to the grain.

Plant Nutrient Concentrations

Large increases in Cl concentration of the ear-leaf were produced by increasing rates of Cl fertilization. Although leaf tissue Cl concentrations were strongly influenced by Cl fertilization, there was no change in Cl concentration in the grain. Grain yield was positively correlated with ear-leaf Cl concentrations, shown in **Figure 1**. The relationship was strongest in 1991 when the higher grain yield was produced. There was no effect of Cl rate on the concentration of other nutrients in the ear-leaf (data not shown). In 1991, when grain yield was greater than 300 bu/A, the ear-leaf nutrient concentrations were 2.83 percent N, 0.29 percent P, 2.34 percent K, 0.48 percent Ca, 0.20 percent Mg, 0.22 percent sulfur (S), 8 ppm B, 9 ppm Cu, 31 ppm Mn, and 23 ppm Zn.

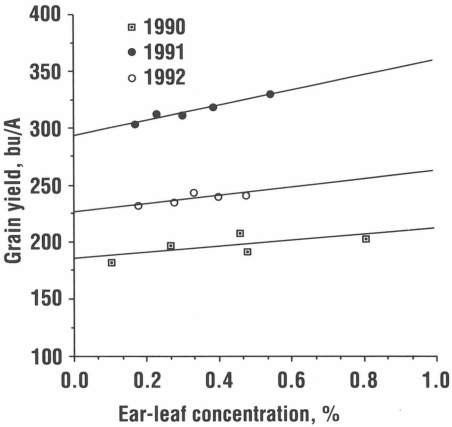

Figure 1. The relation of corn grain yield and Cl concentration in ear-leaf tissue.

Stalk Rot and Lodging

The incidence of stalk rot was not influenced by applied Cl in 1991, but there was a linear decrease in lodging with increasing Cl rates, **Table 2**. In 1992, increasing Cl rates resulted in a linear decrease in incidence of stalk rot. Retention of water in the plant and delayed maturity may be reasons for such a response.

Table 2. Chloride effects on incidence of stalk rot and lodging in corn.

Treatment, lb Cl/A	Stalk rot,% 1991	Stalk rot,% 1992	Lodging, % 1991
0	6.8	10.9	12.7
45	7.2	9.4	12.3
90	7.3	4.7	11.8
180	8.0	4.2	9.3
360	6.2	4.2	7.0

Summary

Maximum yield experiments suggest that Cl supply may be an important yield limiting factor for high yield corn. Fertilization of corn with Cl in an intense cropping system may increase grain yield and reduce stalk rot and lodging. Results also suggest that corn may benefit from both the Cl and the K that are present in the most common K fertilizer, KCl. ■

Global Potassium Trade . . . from page 17

removed by agricultural production, respectively.

Even in regions where replacement apparently balances removal, there will undoubtedly be large areas where removal exceeds fertilizer replacement. For example, the prairies of western Canada remove about 10 times as much K in crops as is returned in K fertilizers. However, many of their soils are rich in K and do not, as a rule, require K fertilization. In areas where K deficiency is severe, removal will often exceed replacement unless good fertilization practices are followed.

Summary

In summary, nutrient balances can be a valuable tool to focus attention in areas where possible nutrient deficiencies are developing. Building and maintaining soil nutrient reserves at levels sufficient to support optimum plant growth are essential to offset the net losses in plant available nutrients that can occur in the normal course of agricultural production. ■