Global Potassium Trade

By T.L. Roberts

EXPORTS AND IMPORTS of agricultural produce can have large effects on the transfer of plant nutrients from one region of the world to another. The potassium (K) in food products that are exported is completely lost from the agricultural system of that country. These losses are largely offset by K fertilizer inputs. Imported foodstuffs can also return K to the agricultural system, depending on the social living conditions of the country and the methods of waste disposal.

Little K is retained in the human body. In areas where sewage is utilized for land application, some K is returned to the soil. However, sewage discharged to rivers will never enhance soil fertility unless this water is used for irrigation. In contrast, most of the K originating in animal feeds will benefit agriculture if the animal wastes are applied to the soil.

Regardless of the source, K inputs must balance K outputs or productivity will suffer. Whether it's a field, farm or country, removed plant nutrients must be replaced. The net balance of nutrient imports and exports plays a role in determining the long-term soil fertility and long-term sustainability of the farm or country that depends on it.

K Trade in Crop Products

Worldwide K trade in crop products has increased more than 30 percent since 1976. During the five years from 1986 to 1990, total K imports in crop commodities averaged 3.65 million tons. This included K found in fruits, vegetables, cereals, oilseeds, oilseed cake, fibers, pulses, coffee and tea, cocoa and coconut products, bran and sugar. As shown in **Figure 1**, cereals, oilseed cake, oilseeds, and coffee and tea dominate, accounting for 85 percent of all world K trade.

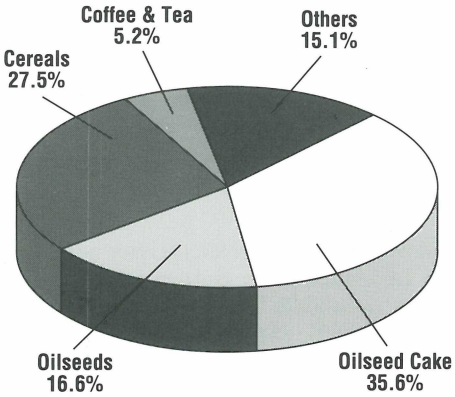

Figure 1. Four major crops dominate world K trade (1986-1990 average).

Although cereal grains are usually low in K, they are important to crop commodity K trade due to the large volume. In contrast, oilseed cake, oilseeds, coffee and tea are important due to their high K content.

K Trade in Livestock Products

Livestock commodities represent a relatively minor component of world K trade compared to crop commodities. From 1986 to 1990, K trade in livestock products was only 3 percent of K trade in crop products. However, like crop commodities, K trade in animal products steadily increased from an average of 85 thousand tons (1976 to 1980) to more than 119 thousand tons in the 1986 to 1990 time period.

Milk accounts for 42.8 percent of world animal commodity K trade, followed by fresh meat at 31.2 percent, and cheese and dried whey at 11.3 percent. Other animal

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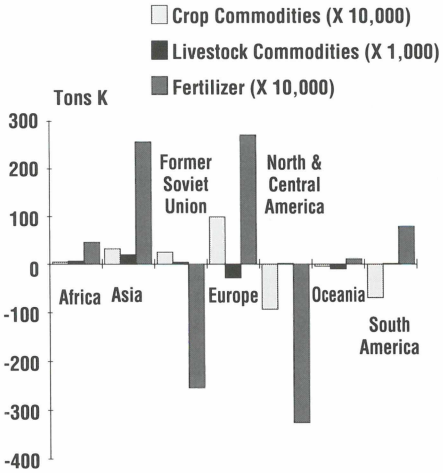

Figure 2. World balance (total K in imports minus total K in exports) of K in crop and livestock commodities, and in fertilizer averaged for the years 1986-1990.

products in order of decreasing importance are: meat meal and fat (5.8 percent), live cattle (4.2 percent), live pigs (1.8 percent), live sheep (1.2 percent), and eggs (1.3 percent).

K Trade in Fertilizers

World production of K in fertilizers averaged 26.0 million tons from 1986 to 1990, up from 23.9 million tons in 1976 to 1980. Three regions accounted for more than 90 percent of K production: the Former Soviet Union (FSU), 37 percent; Europe, 26 percent; and North and Central America, 30 percent. These three regions are also the world's largest exporters, being led by North and Central America, 42 percent, followed by Europe, 28 percent, and then the FSU, 19 percent. Only North and Central America and the FSU export more K than they import.

World K Trade Balance

Figure 2 shows the net balance (total K in imports minus total K in exports) for world trade of K in crop and livestock commodities, and in fertilizers.

Fertilizers dominate, accounting for more than 80 percent of K movement worldwide. Crop commodities represent 18 percent of global K trade and livestock less than 1 percent. Africa, Asia, Europe, Oceania, and South America are net sinks for K. The FSU and North and Central America are net exporters of K. The Americas as a whole are the only net exporters of commodity K.

While exports and imports of crop, livestock and fertilizer commodities depict gross movements of K on a global basis, they do not accurately reflect regional K balances. That is, they don't account for the K required to grow a crop, nor any K that may be lost through waste disposal, surface runoff, or other non-agricultural commodities. This explains why many soils throughout the world are deficient in K and require fertilization.

Table 1 compares K removed from the soil in crop and animal production to K fertilizer consumption for each of the major world regions during 1986-1990.

Worldwide, 99 percent of K removal is offset by K fertilization. Only the FSU and Europe have exceeded K removal with fertilizer addition. Fertilization balances K removal in North and Central America and Oceania, while the remaining regions have a net negative balance. Africa, Asia, and South America are only replacing an estimated 25, 46 and 60 percent of the K

(continued on page 19)

Table 1. Average K (000 tons) removed in crop and animal production compared to fertilizer consumption during 1986-1990.

	Africa	Asia	Former Soviet Union	Europe	North & Central America	Oceania	South America
Crop K	1,641	8,521	2,104	3,530	4,475	266	2,412
Livestock K	65	342	264	532	301	19	105
Total K removed	1,706	8,863	2,368	4,062	4,776	285	2,517
Fertilizer K consumption	430	4,038	5,921	7,246	4,873	226	1,501

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.

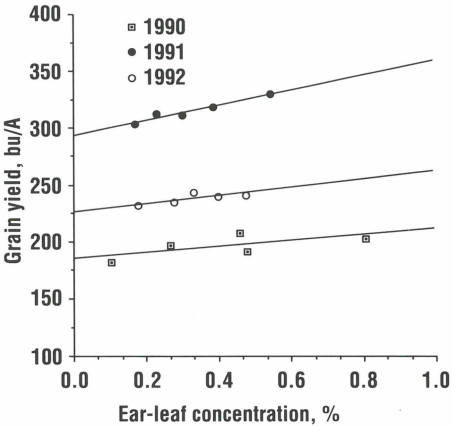

Figure 1. The relation of corn grain yield and Cl concentration in ear-leaf tissue.

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. ■