Letters to the Editor

Dear Editor:

Comments on Yield-nutrient concentration relationships in plants.

Many investigators have used plots of dry matter yield vs nutrient concentrations in plants to estimate “critical” concentrations. This writer and associates (4, 5, 6) have also found yield-concentration plots valuable to establish minimum concentrations that allow continued growth, to interpret nutrient concentrations and ratios in plants, to study effects of various yield-limiting factors, and to determine if the nutrient under study actually limits growth.

The paper of Laughlin, Martin, and Smith (2) is a good example of the need for yield-nutrient concentration plots to determine the nutrients which actually limit growth in an experiment. Yields (labeled Kg/ha, which I assumed should be metric tons/ha) and nutrient concentrations resulting from six rates of applied KCl and K$_2$SO$_4$ for bromegrass (Bromus inermis Leyss) are listed in Table 1 of their paper. The authors attempted to explain the tabular data, but the net result is far from satisfactory. Concentrations of nutrients are discussed extensively in the paper, and some rather confusing conclusions resulted.

The first statement made under Results and Discussion is, “A significant interaction between K source and rate occurred.” What actually happened (Fig. 1) was a modest yield response to applied K but a much larger response to the S in K$_2$SO$_4$. The two yield-K concentration curves for each cutting are reduced essentially to one yield-S concentration curve. This shows the main effects, those of yields being more dependent on S than on K and of K and S concentrations increasing in yield of each cutting. N, Ca, and Mg were diluted with increase in yield response to reciprocal relationships may have occurred among nutrients but it is not possible to separate these effects from the results.

A second example of the need for plotting yield-concentration relationships is the paper by Lutz (3), which included many papers concerning plant breeding, those dealing with nitrate concentrations in particular. In the recent paper on nitrate concentrations with consideration of yield levels is that of Grimes et al. (1). Most such papers are seriously deficient because of the marked effects of yield level on nitrate and other nutrient concentrations. Concentrations of K in the leaves also increased with ear corn yield response only to P rates of 0, 10, 20, 30, and 100 kg/ha supplied as phosphate rock acidulated to the extent of 20 and 40% CSP for 6 to 9 weeks (4, 5, 6) are much too low in terms of final grain yields because of continued dilution to maturity. The reciprocal relationships may have occurred among nutrients, but it is not possible to separate these effects from the results.

It seems to this writer that yield-concentration plots offer perhaps the best way of interpreting most plant analysis results.

One source of confusion in the literature is that nutrient concentrations are not usually defined in terms of the stage of growth at harvest. For example, the concentrations which were “critical” for growth of corn for 6 to 9 weeks (4, 5, 6) are much too low for grain yields because of continued dilution to the plant part sampled and time of sampling are important.

Yields and nutrient concentrations from corn or other factorial experiments from which only reported or derived multiple regression equations are...