The Change in Fertilizers

BEN F. GRAFTON

Louisiana Polytechnic Institute

In 1955 the Soil Science Society of America passed a resolution to change fertilizer guarantees to the elemental basis for all plant nutrients; but until recently, there was very little additional action taken.

The change is endorsed by the American Society of Agronomy, Crop Science Society of America, Association American Fertilizer Control Officials, American Society for Horticultural Science, and other scientific organizations.

Currently, fertilizer is labeled as required by state laws. All states require manufacturers to print a guaranteed analysis on the fertilizer bag or attached tag. The analysis of complete fertilizers is expressed in percentages (by weight) of N, P_2O_5 and K_2O.

Nitrogen is legally expressed on the elemental basis as "total nitrogen." This change to the elemental expression was made in 1916. Until that time, nitrogen in fertilizer was expressed as NH_3. However, it was not until 1939 that the law became effective in all states. Phosphorous is expressed on the oxide basis as "available phosphorus acid." This term designates the available phosphorus pentoxide (P_2O_5). Postassium is expressed as "soluable potash" or potassium oxide (K_2O).

Actually fertilizers do not contain P_2O_5 or K_2O. Phosphorus exists most commonly as mono-calcium phosphate, but also as other calcium or ammonium phosphates. Potassium is ordinarily in the form of potassium chloride or sulfate. Furthermore P_2O_5 and K_2O are not involved in plant nutrition or as forms of these elements in the soil. Plant roots absorb most of their phorphorus in the form of the H_2PO_4— ion and their potassium as the K ion.

Nutrients cannot be put into fertilizers as the elements N, P, and K, but as chemical compounds. That is why we do not and cannot have fertilizers containing 100 per cent plant nutrients, if expressed on the elemental basis.

The important information in a fertilizer guarantee is the actual amount of plant nutrient in the bag. The elemental expression is best for this purpose. The oxides do not convey the chemically correct information.

What are the advantages of the change? First, greater uniformity, simplicity, and accuracy will result by expressing all nutrient contents of fertilizers, soils, and plants on the elemental basis. Plant composition is usually expressed as elements. The same has been true in animal science and in the analysis of feeds, insecticides, and other materials.

Second, the elemental expression states the actual concentrations of the active ingredients, in a manner that can be applied correctly to all fertilizers, regardless of the chemical forms in which the ingredients occur.

Third, we talk N-P-K, but presently we express them as N-P_2O_5-K_2O in the case of fertilizers. We say that plants remove so many pounds of N-P-K, and then recommend adding so many pounds of N-P_2O_5-K_2O to replace the elements.

Fourth, at least seven different terms are used for P_2O_5 such as: phosphorus pentoxide, phosphoric acid, phosphate, phosphorus, etc.

Fifth, elemental expressions indicate the actual proportions of N, P, and K in fertilizers. Oxide expressions make the amount of P appear about 2.3 times as large as it really is, and that of K about 1.2 times as large. It is no wonder that so many have misunderstood the meaning of fertilizer labels up to now.

There are disadvantages of the change (though outweighed by the advantages). Before the complete change-over can be made, revision of state fertilizer laws will have to be made. Dual labeling probably will be needed during the change-over.

Changing to the elemental expression will make it appear that the analysis is being lowered. Many farmers may be skeptical of the new labels.

There will be additional costs in changing labels on fertilizer bags. It will also cost industry and educational institutions extra effort and money to explain the change to farmers.

Textbooks, bulletins, and other materials will have to be changed to include the new system.

Some important steps have been taken toward changing to the elemental expression. Some states have adopted a Model State Fertilizer Bill that provides for switching to the elemental expression after a public hearing and if and when a sufficient number of surrounding states are ready to change.

In another step, a group of industry representatives, fertilizer control officials, state and USDA scientists developed an elemental guarantee policy for secondary elements and micronutrients in 1961. The group unanimously agreed that these plant nutrients should be indicated on an elemental basis. Only the change of P and K remains before we have complete uniformity.

Several states recently put into effect a double-listing system in reporting their soil test analysis. Fertilizer recommendations also will be given to farmers in both elemental and oxide values for P and K.

To get a majority of farmers to understand the change of expression from oxide to elemental P and K, the educational effort must become part of the program of all agronomic industries and agricultural institutions. As one farmer recently put it, "We no longer have to be sold on an idea over a period of years. You show us a definite need to accept a new idea and we will accept it." We see the results of this statement every day.

There is no doubt that farmers can and will accept the elemental system of expressing fertilizer guarantees when it is presented to them in an easy yet accurate manner.

Simple conversion tables and charts will be provided to farmers and others to show the ease of changing values from the oxide to element. The table below is an example of these. It gives the conversion from oxide to element for P and K, in either per cent or pounds.

P_2O_5 AND K_2O CONVERSION TABLES

Pounds or % as Oxide	Give the following Pounds or Percent	
	As P	As K
1	0.44*	0.83**
5	2.18	4.15
8	3.49	6.64
10	4.37	8.30
12	5.24	9.96
14	6.11	11.62
18	7.86	14.94
20	8.73	16.60
24	10.56	19.92

**To change % K_2O_5 to % K multiply % P_2O_5 by O.44

*To change % P_2O_5 to % P multiply % K_2O by 0.83

Adult Farmer Educaton

RALPH A. BENTON

Southern Illinois University

Land-grant colleges have three primary functions to perform: teaching, research, and extension. It is recognized that most non-land-grant colleges and universities are limited largely to the function of teaching. This role has been accepted by the National Association of Colleges and Teachers of Agriculture and the organization has adopted as a major objective the improvement of college teaching. Some non-land-grant schools do engage in research which is usually somewhat limited in scope. Still others have farm and laboratory facilities which are used mainly for demonstrational purposes. The third area, that of agricultural extension service, as such, is nonexistent in non-land-grant colleges.

However , a second objective of the NACTA is "to make available college instruction in agriculture to the greatest number of people". I would like to expand this a bit and suggest that the services of the agriculture school or department personnel be made available to young and adult farmers in the area served by your school. Adult education enrollments in courses of all kinds have risen rapidly in recent years. This holds true for adult farmer classes also. It should be made clear that the concept of adult education held by most people excludes full-time school and college work which leads to a diploma or degree.

Because of the rapidly changing technology in agriculture and the move towards "big business" in farming, as well as other problems, farmers are greatly in need of the latest agricultural information and are seeking it from numerous sources. The agriculture department of the non-land-grant school can render valuable service at this point.

One focal point of contact in the service area of a college is the department of vocational agriculture in the public high school. Since 70 to 80 per cent of the students in most college departments of agriculture and schools of agriculture have had vocational agriculture in high school, the vocational agriculture department is a good potential center for organizing adult farmer classes. Working relations with vo-ag teachers may make it possible for one of a college staff to appear as a consultant at one or more meetings in a series of adult farmer meetings being conducted by the vocational agriculture instructor.

This type of activity more nearly approaches agricultural extension service than any that the college renders but in reality is essentially a community service. That this type of service is workable and sought after is being demonstrated here at Southern Illinois University. In the usual series of ten meetings in an adult or young farmer course, the local teacher of vocational agriculture may request and have the services of the School of Agriculture staff at no more than two meetings, either as a guest speaker or as a consultant.

During the past two years, members of the SIU staff participated, by invitation, in nearly 100 different meetings sponsored by vo-ag departments, the Illinois Agricultural Extension Service, the Soil Conservation Serice and private business, as well as workshops and field days on campus. Approximately 5000 different persons were reached in this manner, the greatest number of which were farm people.

The costs incurred in appearing on adult farmer programs, mostly travel, have to be met. In our case, a University car may be checked out and milage is charged to the Division of Technical and Adult Education whose budget allows for this. Other schools and colleges might have other arrangements.

It is recognized also that such service rendered is in addition to a full resident load since there is no released time for this activity. However, a formula is used to give credit to each participating staff member on his total service load. ISU looks upon this service as an obligation to the area served, and feels that it definitely is good public relations.