Fertilizer Facts for Kentucky

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Circular 624

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Fertilizer Facts for Kentucky

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Kentucky farmers used nearly three-quarters of a million tons of commercial fertilizer in 1968. That's over twice the tonnage they purchased in 1945. But that's not the whole story —in 1945 each 100-pound bag of fertilizer purchased contained, on the average, just over 20 pounds plant nutrients. In 1968 this had nearly doubled. Each 100 pounds of fertilizer now contains, on the average, nearly 36 pounds of plant nutrients. Total plant nutrient consumption was over one-fourth million tons in 1968, a drastic increase from the 60,000 tons used in 1945. These trends in fertilizer used on Kentucky farms are shown in Figures 1-3 below; they point out the increase in use of fertilizer for crop production which has taken place in Kentucky.

Why has fertilizer use increased at such a pace? Many factors are responsible, such as the availability of more highly concentrated fertilizers, a more efficient fertilizer marketing system, better machinery, and the like. However, the cost-price squeeze which Kentucky farmers have operated under quite likely has been a major reason for increased fertilizer consumption. In trying ways to increase production efficiency, the farm producer has become aware that he can profit from adequate use of fertilizers. Money spent for fertilizer and lime is favorably related to greater cash receipts from crops sold. This trend for crop receipts to increase as more fertilizer and lime is used is shown in Figure 4. In today's agriculture in Kentucky the use of fertilizer for increasing crop production is an integral part of profitable farming systems.

KENTUCKY FERTILIZER LAW

All materials offered for sale as fertilizer in Kentucky must have the guaranteed chemical content clearly labeled on the bag or on a tag attached to the bag for bagged fertilizers, or on the invoice for bulk fertilizers, either dry or fluid. The label for dry mixed fertilizer shown in Figure 5 is an example of an acceptable label for field or agricultural grades. If plant nutrient content other than nitrogen, phosphorus, and potassium is claimed by the seller, the nutrients claimed must also be

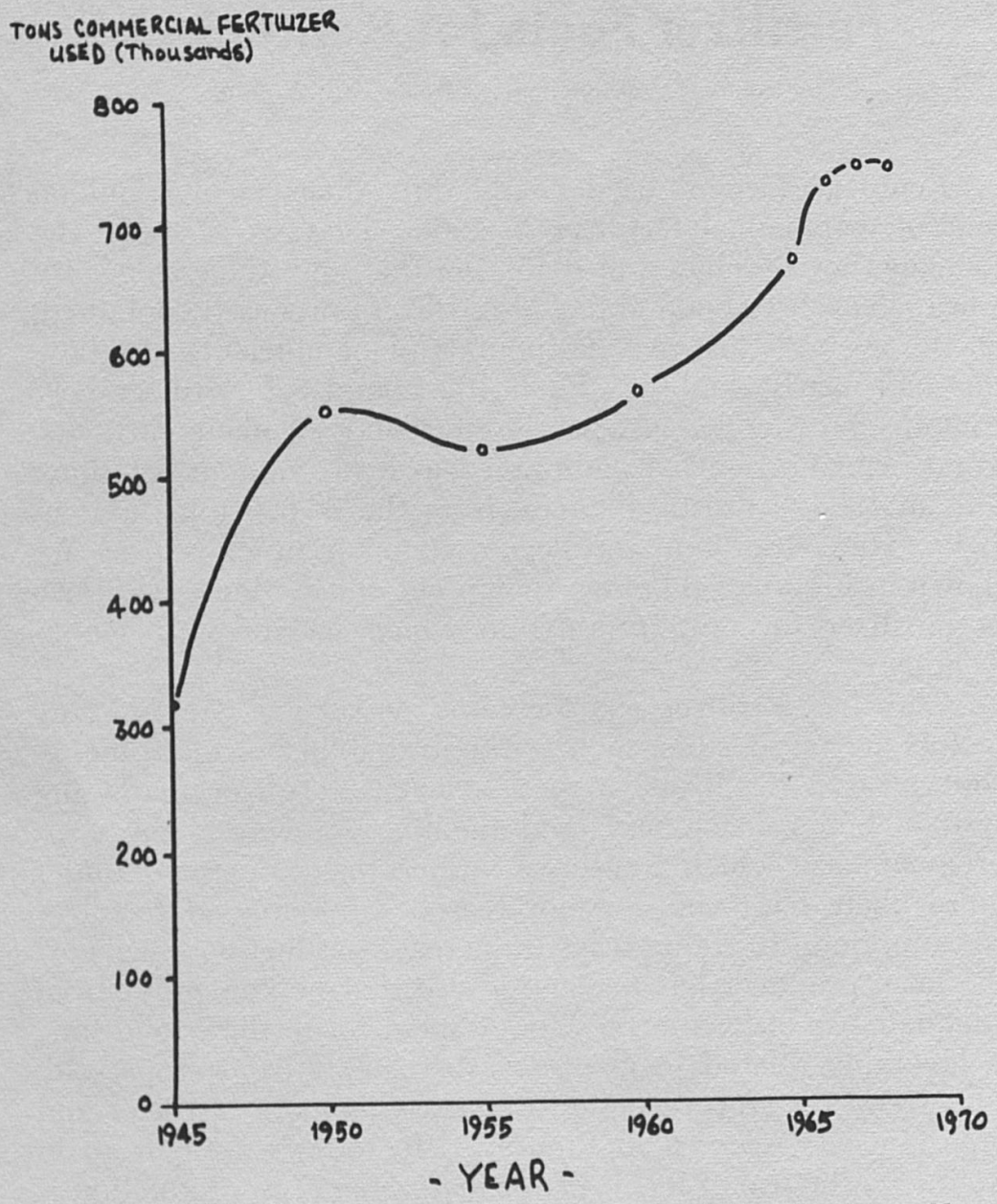

Figure 1.—Total Consumption of Commercial Fertilizers in Kentucky Since 1945

included on the label as part of the guaranteed analysis. The three grade numbers shown at the top of the label are part of the brand name of the fertilizer, and refer to percent content of nitrogen, available phosphoric acid, and soluble potash in that order. Nitrogen is guaranteed as nitrogen (N), phosphorus as available phosphoric acid (P_2O_5), potassium as potash (K_2O). Source of potassium (for example, sulfate or muriate) must be shown. The percent content of all guaranteed nutrients means

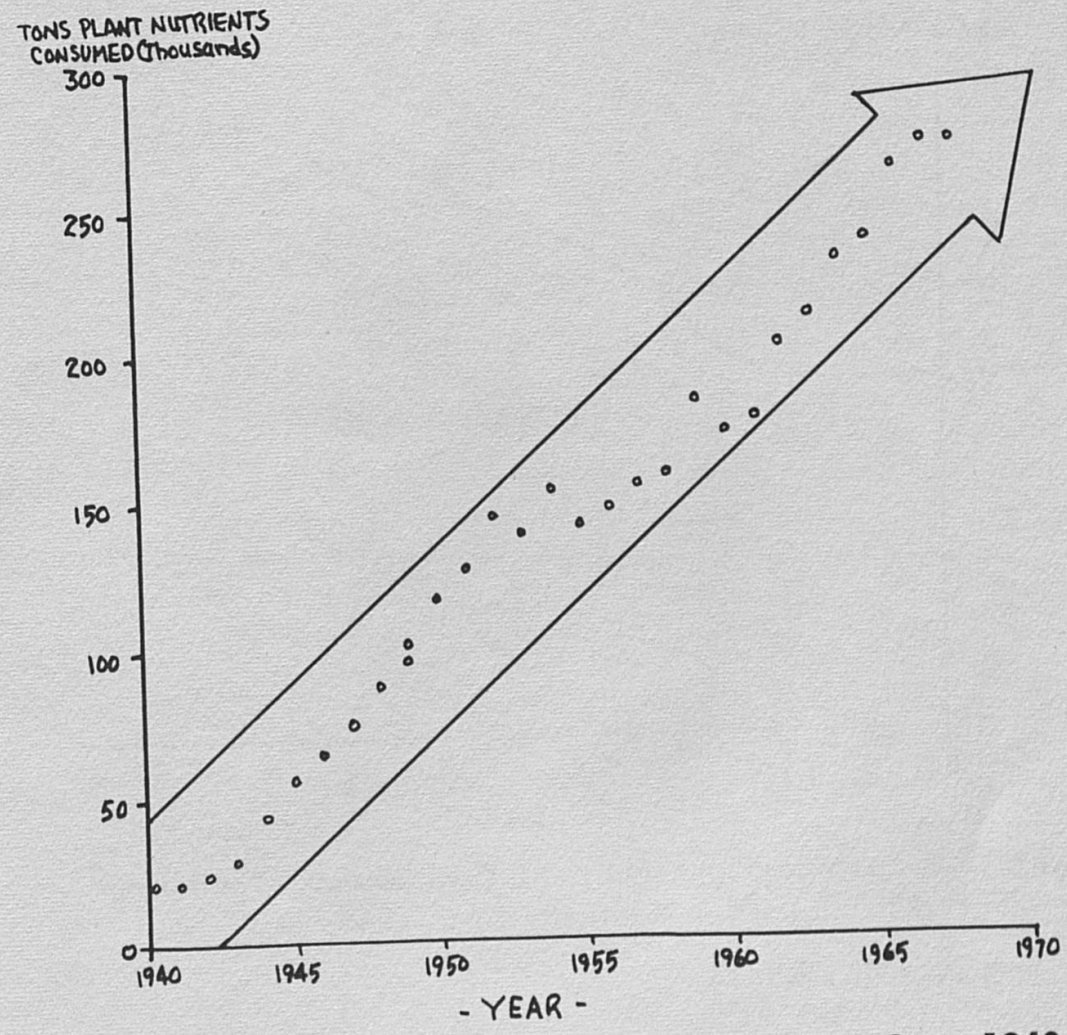

Figure 2.—Plant Nutrient Consumption in Kentucky Since 1940

that 100 pounds of the fertilizer would contain the number pounds of nutrient as shown by the percent guarantee. For example, the "Granular 5-10-15" shown on the label in Figure 5 means there are 5 pounds nitrogen, 10 pounds available phosphoric acid, and 15 pounds potash per 100 pounds fertilizer.

If this same analysis were guaranteed on an invoice for a fluid mixed fertilizer, again this would mean for each 100 pounds of fluid, there would be 5 pounds N, 10 pounds P_2O_5, and 15 pounds K_2O. Keep in mind that the guarantee on fluid fertilizers is in plant food content per 100 pounds of the fluid, and *not* on gallons of the fluid (a rough rule-of-thumb to convert gallons to pounds is that each gallon of fluid fertilizer weighs 10 pounds). To prevent possible confusion between gallons and pounds of fluid fertilizers, always purchase fluids by the pound instead of by the gallon.

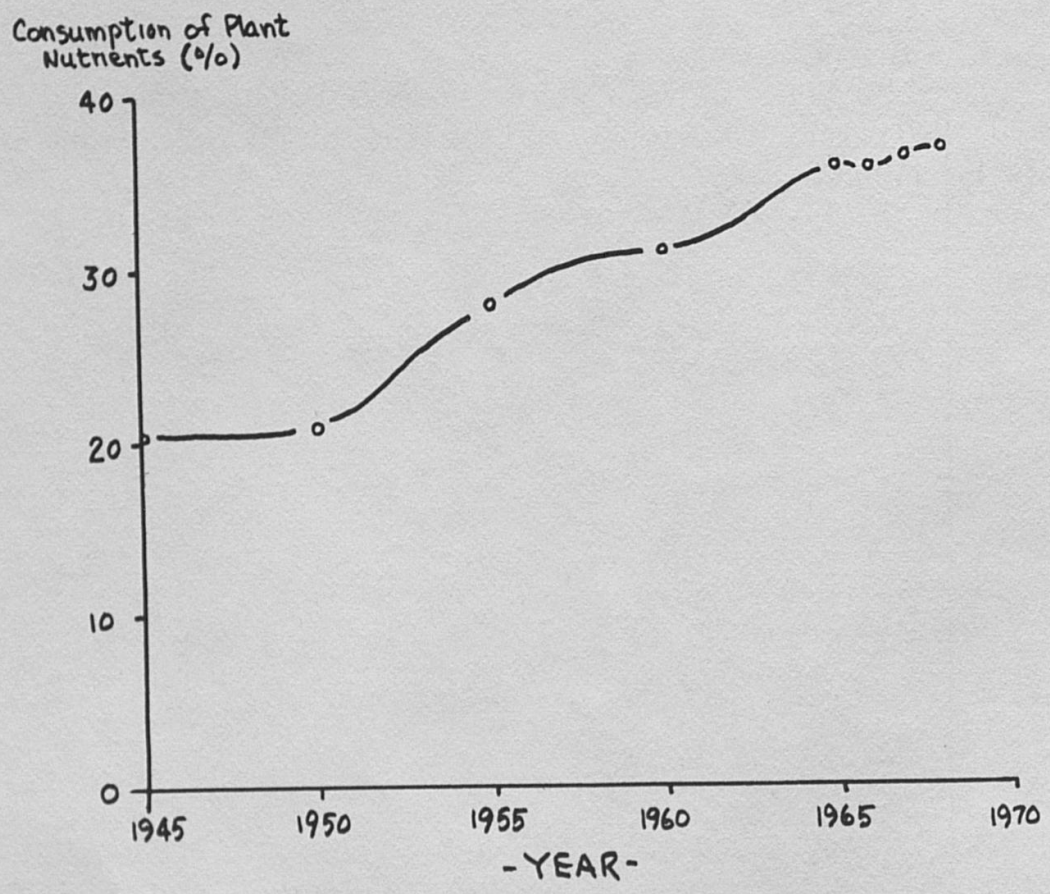

Figure 3.—Average Plant Nutrient Composition of all Commercial Fertilizers Used in Kentucky Since 1945

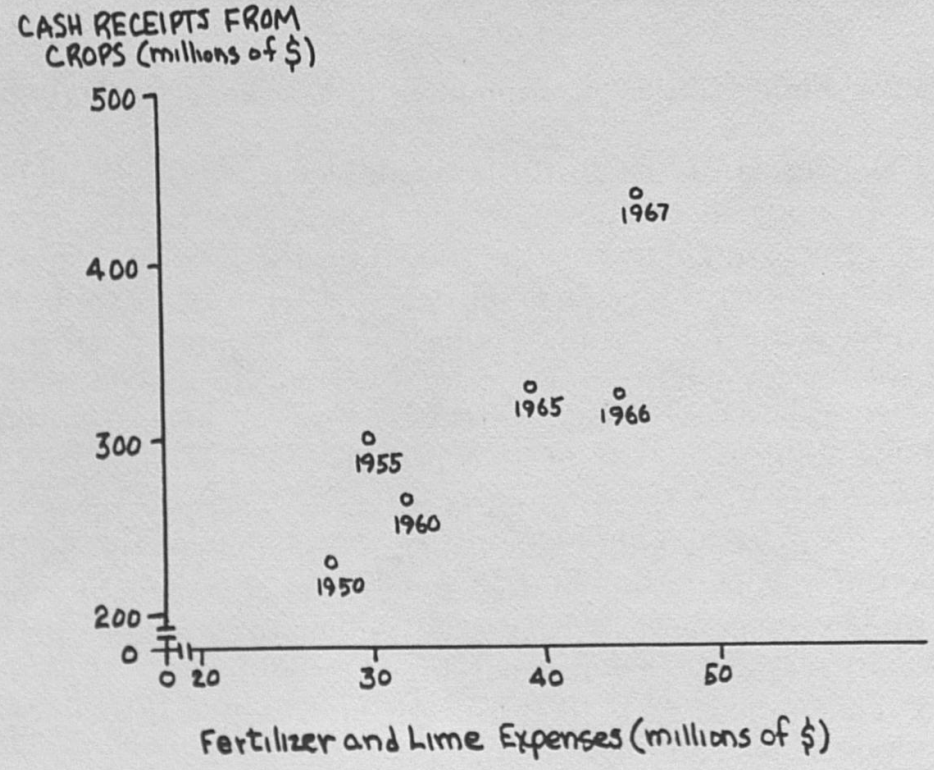

Figure 4.—Increase in Expenditures for Fertilizer and Lime as Related to Increased Cash Receipts for Crops Sold

The table below shows which other elements can be claimed in fertilizers sold in Kentucky, and the minimum percent which can be claimed.

Element	*Minimum content (%)*
Calcium (Ca)	1.00
Magnesium (Mg)	0.50
Sulfur (S)	1.00
Boron (B)	0.02
Chlorine (Cl)	0.10
Cobalt (Co)	0.0005
Copper (Cu)	0.05
Iron (Fe)	0.10
Manganese (Mn)	0.05
Molybdenum (Mo)	0.0005
Sodium (Na)	0.10
Zinc (Zn)	0.05

Occasionally a material is offered for sale as a so-called "soil conditioner" and carries no guarantee of plant food content. The profitable use of such materials is highly questionable. It is always best to buy a material for which plant food content is guaranteed. Then you know the plant food value of the product.

More detailed information on the Kentucky Fertilizer Law can be obtained from the Division of Regulatory Services, Kentucky Agricultural Experiment Station, Lexington, Kentucky 40506.

OXIDE AND ELEMENTAL LABELING

By law, the content of all plant nutrients sold in Kentucky, except for phosphorus and potassium, must be expressed on the elemental basis. This includes nitrogen. It means that the guaranteed content of all nutrients except phosphorus and potassium is in terms of pounds of pure element per 100 pounds of fertilizer. Phosphorus and potassium have traditionally been, and are presently, guaranteed on an oxide basis instead of the pure element basis. Phosphorus content is guaranteed as P_2O_5 and potassium content is guaranteed as K_2O. Since P_2O_5 contains only 44 percent of the pure element phosphorus, this means that each pound of guaranteed P_2O_5 contains only 0.44

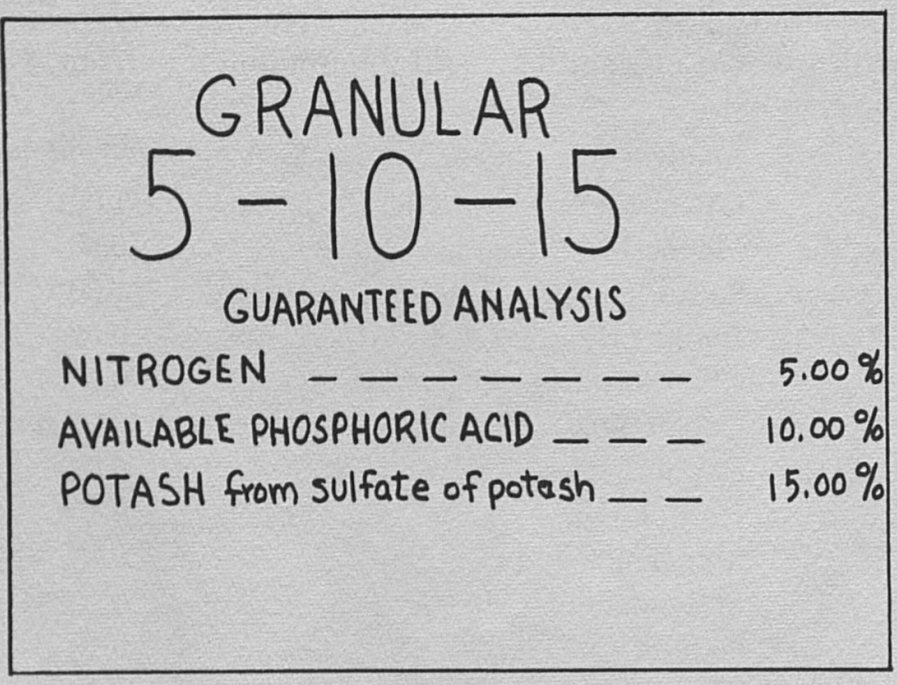

Figure 5.—Example of the Fertilizer Label for Fertilizers Sold in Kentucky

pound of pure phosphorus. By the same token, K_2O contains only 83 percent pure potassium, which means there is 0.83 pound pure potassium for each pound of K_2O guaranteed on the bag. This is sometimes confusing in interpreting soil test results in order to make fertilizer recommendations. Always be sure you know which basis your recommendations are on—the oxide or elemental.

The following conversion factors simplify converting oxide to element or element to oxide:

pounds oxide P_2O_5 x 0.44 = pounds elemental phosphorus
pounds elemental P x 2.29 = pounds oxide P_2O_5
pounds oxide K_2O x 0.83 = pounds elemental potassium
pounds elemental K x 1.20 = pounds oxide K_2O

FORM OF FERTILIZERS

Both dry and fluid fertilizers are available to Kentucky farm producers. There is no particular agronomic difference between dry and fluid fertilizers on a pound-for-pound plant food basis. This means that so long as the same amount of plant nutrients is applied to a particular soil-crop-climatic

situation there should be no difference in agronomic effectiveness between fluid and dry fertilizers except in a few instances where dry mixed fertilizers have been over-ammoniated. In over-ammoniated dry fertilizers, the water-solubility of phosphorus is reduced. This is not a factor of major concern, however, unless the water-solubility of phosphorus drops below 40 to 50 percent. Most field experiments under soil-climatic-cropping conditions prevalent in the southeastern United States have shown 40 to 60 percent water-soluble phosphorus to be adequate for most agronomic crops. For short season horticultural crops such as Irish potatoes or snap beans, use of more highly water-soluble phosphates can be an advantage. Nitrogen and potassium in dry and fluid fertilizer are generally comparable in water-solubility.

There are also no particular agronomic differences between pulverized and granulated or mixed fertilizers and fertilizer materials so long as they have been properly manufactured and are comparably applied on a pound-for-pound plant nutrient basis.

Sometimes a question arises concerning the effectiveness of applying fertilizer in the form of foliar sprays directly on the crop as contrasted to the prevalent method of applying fertilizers to the soil for subsequent crop use. For foliar application, the plant food content of the spray has to be very low or the plants will "burn." This means that several applications of a foliar spray are necessary per season. This also limits the amount of primary plant nutrients which can be applied as a foliar spray, and as a result the total pounds of N-P-K needed for most profitable production cannot feasibly be applied to most crops. In some instances of micro-nutrient deficiences, foliar applications can be effective since only very small amounts of micro-nutrients are actually needed.

Both dry and fluid fertilizers are commonly sold as either mixtures or materials. Mixtures are fertilizers containing more than one primary nutrient (N,P, or K) while materials are fertilizers containing only one primary nutrient. Trends in forms used in Kentucky are shown in Figure 6.

Dry Mixed Fertilizers

Dry mixed fertilizers are manufactured and sold as either pulverized, granulated, or bulk blended mixtures. They can be bought either bagged or in bulk.

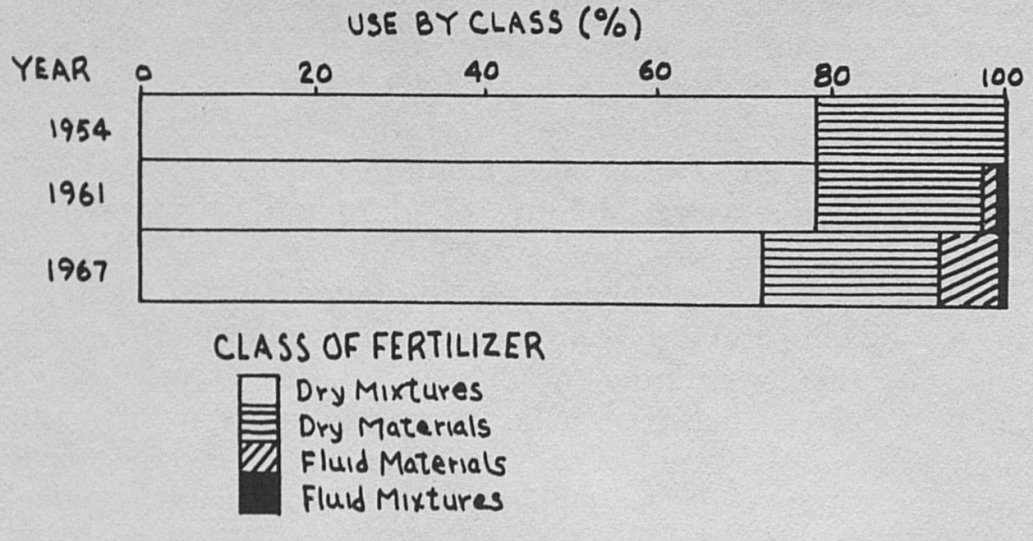

Figure 6.—Fertilizer Use Trends in Kentucky, by Class of Fertilizer

Pulverized mixtures have the advantage of uniformity of grade and a low cost of production. Usually pulverized mixtures contain calcium and sulfur, since ordinary superphosphate (20% P_2O_5) is a common ingredient and contains sizable amounts of gypsum (calcium sulfate). Their main disadvantage is commonly a low analysis and a less desirable physical condition than granular mixtures. Granular mixtures are more free flowing than pulverized mixtures. They also supply calcium and sulfur when ordinary superphosphate (20%) is used in making them. Granulated mixtures are also more uniform in plant food content per granule. Their main disadvantage is a high cost of manufacturing. Over-ammoniation can decrease the solubility of phosphorus in either pulverized or granular dry mixtures.

Bulk blended mixtures are made by physically mixing fertilizer materials (those containing only one primary nutrient) and certain mixed fertilizers. Either pulverized or granular products can be blended in this manner. Granular bulk blended mixtures have the advantages of good physical properties and low cost of production. Grades can also be blended to fit the exact ratio desired. The main disadvantage is the possibility of non-uniform blending unless proper equipment and properly selected materials are used.

As indicated in Figure 7, bagged dry mixtures are by far the most commonly used form of mixed fertilizer in Kentucky.

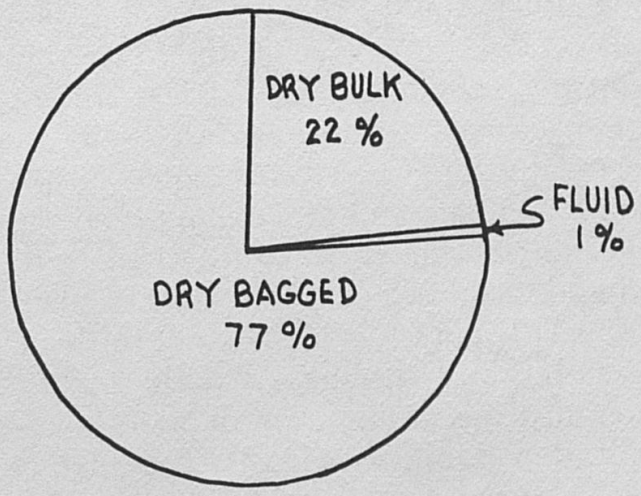

Figure 7.—Use of Mixed Fertilizers, by Class, in Kentucky, 1967

Dry Fertilizer Materials

As indicated above, fertilizer materials are those containing only one of the primary nutrients (N,P, or K). Examples of dry materials commonly sold in Kentucky and their primary nutrient content are shown in the following table:

	Primary nutrient contained	*Content of primary nutrient*
Amonium Nitrate	Nitrogen	33.5% N
Ammonium Sulfate	Nitrogen	20-21% N
Sodium Nitrate	Nitrogen	16.0% N
Muriate of Potash	Potassium	60-62% K_2O
Sulfate of Potash	Potassium	48-50% K_2O
Ordinary superphosphate	Phosphorus	20.0% P_2O_5
Triple superphosphate	Phosphorus	46-48% P_2O_5

Fluid Mixed Fertilizers

Mixed fertilizers in the fluid form are now available in some sections of Kentucky. They are of two types—clear mixtures and suspensions (either a true suspension or a slurry). Both are commonly manufactured by so-called hot-mix or cold-mix processes. Hot mixing refers to the great amount of heat which is produced by mixing phosphoric acid with ammonia to make the fertilizer. When a base blend from a hot-mix plant is used

in making other grades, the process is called cold-mix since no heat is produced. The main difference between clear and suspension mixtures is analysis. Clear mixtures are of lower analysis because plant nutrients, especially potash, crystallize and "salt out" at higher concentrations. Suspensions are made by adding a small amount of a gelling-type clay to a clear base solution. This thickens the mixture to about the consistency of motor oil and enables greater amounts of plant nutrients to be added, especially potash, which do not settle out of the solution very fast because of the increased thickness. Both clear and suspension mixtures are uniform in plant food content. Special equipment, depending on whether the mixture is a clear fluid or a suspension fluid, is required for their application. This involves using a tank applicator with properly designed pumps, hoses, nozzles, and circulation equipment for the type of fluid mixture used. When properly designed application equipment is used, fluid mixtures can readily be applied either broadcast or in the row.

Fluid Fertilizer Materials

The most common fluid materials available in Kentucky are the nitrogen solutions and anhydrous ammonia. The nitrogen solutions range from about 20 to 32 percent total nitrogen, while anhydrous ammonia contains 82 percent total nitrogen.

Nitrogen solutions commonly are made from a mixture of ammonium nitrate and urea solutions. This means that about half the total N is present as urea, about one-fourth in the ammonium form, and one-fourth in the nitrate form. All the N in anhydrous ammonia is in the ammonia form.

Keep in mind that while anhydrous ammonia is a liquid in the tank, it immediately vaporizes to ammonia gas when it is released from the applicator hose. For this reason special precautions have to be taken in its use. This involves observing safety precautions to avoid the anhydrous ammonia gas from contacting your body, since it can be poisonous and cause serious skin burns. More specific safety details can be obtained from the dealer who sells the anhydrous ammonia or from the dealer who sells the application equipment. From the agronomic standpoint, anhydrous ammonia must be properly put into and sealed into the soil, or it will be lost to the atmosphere, since it emerges from the injector as a gas.

DECIDING WHAT FERTILIZER TO USE

There is no standard answer which will indicate what fertilizer should be used for all circumstances. This will depend on the individual situation of the customer. The first step in formulating a fertility program is to determine what and how much is needed. A soil test is the best method for determining this information. Since soil acidity greatly affects the efficiency of fertilizer use by the crop, acidity should be adjusted to tolerable levels by use of agricultural limestone before application of fertilizers. For detailed information on how much lime and fertilizer to apply, see *Lime and Fertilizer Recommendation Guide*, Circular 619, University of Kentucky Cooperative Extension Service.

After deciding how much fertilizer to use, one of the most important factors to consider is cost applied on the field per pound of nitrogen, phosphorus, potassium, or any other nutrient to be purchased. Other items to consider are availability of the fertilizer (what you want, when you want it, where you want it), and the services provided by the fertilizer dealer (credit, custom application, custom blending, soil testing, etc.).

Whatever fertilizer you decide is best, be sure to use the correct amounts for the crop to be grown, so that you can expect a profitable return from your fertilizer investment.

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