Selection of Fertilizers

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What type of fertilizer should you buy and apply? The answer to that question is not an easy one. Economics is important, but quality, rather than cost per unit of nutrient, should be the deciding factor in fertilizer selection. The cost of fertilizer usually is small in relation to the total cost of producing a crop.

Fertilizer quality cannot be defined in rigid terms. If you know the composition and properties of fertilizers and their behavior in the soil, you have a guide for choosing them for specific purposes.

Characteristics that should be appraised before a fertilizer is selected are: solubility, effect upon soil pH, form of nitrogen, the salt index, and cost per unit of available nutrient.

Solubility. Fertilizer compounds differ greatly in their solubility in water. These differences are usually unimportant for application in the solid form. High solubility, however, is one of the major considerations for the grower who purchases solid fertilizer for dissolving in irrigation water, or for application in foliar sprays. Let's compare the solubility of a few fertilizers.

Solubility of Some Fertilizers

Compound	Pounds soluble in 100 gallons of water
ammonium nitrate	1617
urea	902
ammonium sulfate	623
diammonium phosphate	574
monoammonium phosphate	312
muriate of potash	283
potassium nitrate	263
sulfate of potash	92

Recently attention has been given to the production of fertilizers that have low initial solubility and release nutrients to the soil and plant gradually over an extended period of time.

Effect upon soil pH. Fertilizer nutrients may be divided into three classes according to their influences on the soil reaction (pH): (1) acidic—pH below 7.0, (2) neutral—pH of 7.0, and (3) basic—pH above 7.0.

Use of anhydrous ammonia and ammonia compounds will eventually have an acidifying effect on the soil. This soil acidifying action tends to bring into solution or make available some minor elements such as iron, manganese, copper, zinc, and molybdenum. This does not mean that the entire soil becomes acidic, just the area around each fertilizer particle or concentration of particles. This acidifying effect is usually of short duration.

Phosphates are generally neutral in their effect on soil pH, and potassium carriers are basic.

Form of nitrogen. The form of nitrogen applied influences directly the nutrition and growth of the plant. In general, plant roots assimilate two common forms of nitrogen—nitrate (NO_3) and ammonia (NH_3). Most plants seem to prefer the nitrate form.

Nitrate and ammonium are readily absorbed and utilized by plant roots. Under favorable conditions, ammonium nitrogen is converted to the nitrate form by nitrifying bacteria in the soil. Therefore, the ammonium forms are not available as rapidly as the nitrate forms. Under adverse soil conditions (temperature below 50˚F, too wet or too dry, high salt concentrations, etc.) the conversion of ammonium to nitrate is retarded or halted, and the soil accumulates high levels of ammonium. These high levels may become toxic to plants. Urea is quite soluble and is rapidly broken down to a usable form of nitrogen.

Besides uptake by plants, nitrogen is also removed from the soil by leaching and volatilization. Leaching means the nitrogen is washed or flushed out of the soil by irrigation or rain water. Volatilization means the nitrogen escapes as gas.

Nitrate nitrogen is sometimes leached from the soil, and ammonium is sometimes volatilized if it is not converted to the nitrate form. Ammonium is rarely leached because it is usually adsorbed to the clay particles of the soil. Nitrate does not become attached.

Stabilized ammonium fertilizer is slowly converted to the nitrate form. Since that nitrate is available to the plants over a longer time, it is less subject to leaching or conversion to nitrogen gas.

Salt index. Seedling injury or "fertilizer burn" occurs when the soil solution in contact with the seed or root contains a high concentration of salts. The plant seedling, because of the high salt concentration, is unable to absorb moisture from the soil solution.

Salt injury may result from a high rate of salt-forming fertilizers, improper placement of fertilizers, irrigation with saline water, or farming on saline soils.

Determination of the salt index of a fertilizer is a means of measuring its tendency to cause seedling injury or plant "burn." The lower the salt index of a fertilizer, the less likely it is to cause damage.

Fertilizers with the highest salt indexes generally supply nitrogen as the primary nutrient, high potash materials have intermediate salt indexes, and phosphate materials have the lowest.

Salt Index of Some Fertilizer Materials

Material	Salt index
ammonium sulfate (21% N)	53.7
ammonium nitrate (35% N)	49.3
muriate of potash (50% K)	31.9
urea (46% N)	26.7
sulfate of potash (45% K)	14.1
anhydrous ammonia (82% N)	9.4
diammonium phosphate (21% N, 23% P)	7.5
monoammonium phosphate (12% N, 27% P)	6.7
superphosphate (9% P)	6.4
superphosphate (21% P)	3.5

Research results. Here is a summary of some research about fertilizers:

• Anhydrous ammonia, whether dissolved in irrigation water or not, causes a surface "sealing" when applied to a calcareous soil. The symptoms of the seal are similar to a sodium-affected soil—poor drainage, which causes water to pool or stand on the soil surface.

• Phosphates move very little in the soil, and the secondary orthophosphate (HPO_4) is the phosphorus form used most by plants in our soils.

• Phosphates are readily and rapidly "fixed" by our alkaline soils. Liquid phosphates are fixed much more rapidly than the dry or granulated forms.

• The polyphosphates seem to be no better or no worse than the usual phosphate forms. There is speculation that the polyphosphates serve as a chelating agent. If so, they would have decided advantages.

Cost per unit of nutrient. Several factors cause fertilizer nutrients to vary in cost, such as the different manufacturing processes required in their manufacture, shipping and handling costs are greater per unit of nutrient in low analysis fertilizers than in high analysis fertilizers, the physical form of the fertilizer, whether gas, liquid, or solid affects handling cost. The size of purchase also affects unit cost. In general a low-analysis fertilizer in a small package is expensive in comparison with high-analysis fertilizers in ton lots in bulk form. The farmer who uses several tons of fertilizer each year has more options in buying fertilizer than the person with a lawn, garden, or flower bed. The home owner usually has the choice of buying a pound or two of low-analysis fertilizer or a 50-pound bag of high-analysis fertilizer.

Soil testing is done by NMSU for a nominal fee. Soil sample boxes, information sheets, and instructions for taking samples are available from NMSU Soil Testing Lab, New Mexico State University, Las Cruces, New Mexico, 88003. Special instructions and information sheets are available for soil tests for lawns, vegetables, and ornamentals; orchard, fruit, and nut trees; and cropland.

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