spect to reaction is due to the fact that acids and alkalis differ in strength, or in degree of acidity or alkalinity. Muriatic and sulphuric acid are strong, but acetic acid (the acid in vinegar) and carbonic acid, which is an important constituent of the soil solution, are weak ones. Sodium and potassium hydroxides are strong bases, but iron and aluminum hydroxides are only feebly basic. Salts formed when a strong acid and a strong base combine (for example, sodium chloride) are neutral. The salt resulting from the combination of a strong acid and a weak base (iron and aluminum sulphate, for example) is acid in reaction, and one formed from a strong base and a weak acid is alkaline. Cardonic acid is a very weak acid, so calcium carbonate is alkaline in reaction (pH 8.0 to 8.5)

Chemical Reaction in Soils

The solid silt and clay portions of the soil consists of complicated mineral salts, the alumino-silicates. These soil contituents have acidic and basic properties. Although relatively insoluble in water, they are capable of reacting with the soluble salts in the soil solution and with lime. They are the reservoir from which the "active" or soluble acidity is derived.

To illustrate the type of transformations which occur in soils, the alumino-silicates can be represented by X. In an acid soil the mineral fraction can be called Acid X, and in a neutral or alkaline soil it becomes Calcium X, Potassium X, Sodium X, etc.

When ammonium sulphate is added to an acid soil, the following reaction occurs:

Acid X + Ammonium Sulphate ⇄ Ammonium X + Sulphuric Acid.

The active acidity of the soil is increased because sulphuric acid is a strong acid and extremely soluble. Additional acidity results as the soil micro-organisms transform the ammonium radicle to nitric acid, another strong water soluble acid. Ammonium sulphate has more power to create acidity than any other fertilizer material. Ammonium nitrate, ammonium phosphate, and urea are acid forming also.

When sodium nitrate is applied to an acid soil it reacts with the acid clay complex in the following manner:

Acid X + Sodium Nitrate ⇄ Sodium X + Nitric Acid.

There is a temporary increase in active acidity, but the ultimate effect is to reduce soil acidity because Acid X becomes Sodium X. The nitrate is absorbed and utilized by the plant. All other nitrate fertilizers tend to reduce soil acidity.

Cyanamid is the trade name for calcium cyanamid. The nitrogen is converted into urea by the soil, provided the soil is not strongly acid. The nitrogen ultimately goes to the nitrate form. The calcium becomes lime hydrate. Whenever 100 pounds of cyanamid is used, it is equivalent to applying 70 pounds of lime. So soil acidity is reduced by cyanamid.

Superphosphate is the principal phosphatic fertilizer used on turf. It is a soluble form of calcium phosphate. In practice superphosphate does not have a marked effect on soil reaction. The tendency is to reduce the acidity because the calcium combines with the acid clay fraction (Acid X) to form a calcium clay (Calcium X). The phosphate radicle is taken up by the plant or reacts with soluble aluminum or iron to form the corresponding phosphate. Both are much more

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Range Ball Retriever

Fonken Mfg. Co., Burbank, Calif., now is in production of its ball retriever sufficiently to serve the enlarging market for the device which has been used on California practice ranges for about 4 years with marked satisfaction. The Fonken machine uses revolving plastic discs to pick up balls.