

Acidification of Vineyard Soils by Nitrogen Fertilizers

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Applying Nitrogen Fertilizers

In vineyards, it is recommended that nitrogen fertilizers be applied in split-applications. Spreading the fertilizers around the dripline of the vine, rather than banding it throughout the row will reduce the likelihood of severe acidity in small zone in the row. Nitrogen fertilizers should be applied at budbreak (one-half of the recommended amount) and post-bloom (remainder of the recommended amount). Only a limited amount of nitrogen fertilizer should be applied in dry spring months, and during droughts to prevent fertilizer salt build up in the soil.

Nitrogen is an essential nutrient in vine growth, and grapes need 40-80 lbs/A of actual N in the growing season. Excessive N, however, can be detrimental to plant growth due to acidity associated with N fertilizers. The primary source of acidity is a product of the conversion of ammonium (NH_4) to nitrate (NO_3) in the soil. This conversion is a result of microbial activity and happens whenever an ammonium containing fertilizer (or forming fertilizer as in the case of urea) is applied. If excessive rates of N are applied, then more acidity is produced than what was actually necessary. Limestone must be added to offset the acidity of all ammonium containing fertilizers. Plants have the ability to take up both the nitrate and ammonium form of nitrogen, so the ultimate effect of N fertilizer additions on soil pH will be dependant on plant processes. The figures below represent the best estimate of the acidity produced from fertilizer additions, but other soil and plant reactions (nitrate leaching, uptake and removal of basic cations, acidic precipitation) also cause soil acidification. Calculations presented in the article should not be a substitute to regular soil testing to monitor soil pH in the rooting zone.

To prevent excessive soil acidification by nitrogen fertilizers:

- do not exceed the recommended rate of nitrogen for your vineyard blocks
- apply nitrogen under the dripline rather than a narrow band
- use the least acidifying nitrogen fertilizer you can afford
- apply lime when needed

Nitrogen is available in different forms such as urea, ammonium sulphate, and ammonium nitrate. Depending on the form of the N, some of these fertilizers are more acidifying than others, so different amount of lime are needed to counteract acidity.

Nitrogen fertilizers

ALKALINE FERTILIZERS

- Potassium nitrate (13% N)
- Calcium nitrate (15.5% N)

Because all of the nitrogen in these fertilizers are in the nitrate form, these fertilizers are not acidifying so there is no need to apply lime to neutralize acidity. In fact, these sources actually have a liming effect equivalent to adding 3 and 2 lbs of agricultural limestone per lb of N for potassium and calcium nitrate, respectively. If a grower has acid soils and is in need of potassium, it would be recommended that potassium nitrate be applied to help ameliorate soil pH. If the soil is very acidic, additional limestone will also be needed.

SLIGHTLY ACIDIFYING FERTILIZERS

- Urea (46%)
- Ammonium nitrate (34%)
- Urea ammonium nitrate solutions (32% and 28%)

These products are slightly acidifying because they contain ammonium or produce ammonium when applied to the soil. For every pound of actual nitrogen applied, 1.8 lbs of pure calcium carbonate are required to neutralize the acidity. Kentucky limestone is approximately 67% pure, so approximately 2.7 lbs of agricultural limestone would be needed. For example for a bag of urea (50 lbs) you would need to apply 135 lbs of agricultural limestone.

MODERATELY ACIDIFYING

- Diammonium phosphate (DAP) (18% N, 46% P₂O₅)

Diammonium phosphate is the primary phosphorous fertilizer available in the US, and has a moderate acidifying effect when applied. For every lb of N added as DAP, 5.25 lbs of limestone are needed for complete neutralization. For example, a 50 lb bag of DAP, would need 260 lbs of agricultural limestone. If phosphorus fertilizer is recommended, triple superphosphate (0-46-0) can be used and does not impact soil pH. Triple superphosphate, however, may not be available in many locations.

SEVERLY ACIDIFYING

- Ammonium sulfate (21% N, 24% S)
- Mono-ammonium phosphate (MAP) (11.3% N, 52% P₂O₅)

These fertilizers are very acidifying and should be avoided if possible. Approximately 8 lbs of agricultural limestone is needed to neutralize the effects of these fertilizers. For example, if the grower applied a 50 lb bag of MAP or ammonium sulfate, 400 lbs of lime would have to be applied.

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