# Yeast Assimilable Nitrogen (YAN) Optimization for Fermentation of Cold Climate Cultivars

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**Background and Rationale:** In addition to sugars, adequate yeast assimilable nitrogen (YAN) concentration is required for successful alcoholic fermentation of grape musts. While a concentration of 150 mg/L N is generally considered the minimum required for yeast to complete alcoholic conversion, recommendations for 'optimal' YAN levels vary widely and are under scientific dispute. As evidence grows that excessive YAN concentrations (>400 mg/L N) may reduce expression of key volatile compounds, fine-tuning YAN concentrations by cultivar to optimize varietal expression and typicity is becoming an important consideration in quality wine production. A recent survey of hybrid wine grapes suggested that YAN concentrations vary by cultivar, region, and vintage, just as it does in *V. vinifera* cultivars (Stewart, 2013). Further, the types and concentrations of primary amino acids was found to be much more variable in hybrids than in *V. vinifera*, where arginine dominates. This work will further elucidate the chemical and sensory impacts of YAN concentration on fermentations of key cold-hardy winegrape cultivars.

**Treatments:** YAN concentrations were measured at crush (reds) or press (whites), and one lot of must left at base YAN levels as a control fermentation. An additional one or two lots, depending on fruit volume, were adjusted upward in increments of 50mg/L YAN per lot (Table 1). In some cases, cultivar series were adjusted to higher YAN levels to allow comparison with the same cultivar grown in other regions (eg, UVM Marquette.)

**Table 1: 2014 Wine grape cultivars and YAN levels**

| Cultivar | NGP Site | Base YAN (mg/L N) | YAN treatments (mg/L N) |
|---|---|---|---|
| Frontenac | Willsboro | 331 | 350, 400 |
| Frontenac gris | Willsboro | 320 | 350, 400 |
| | Black Diamond | 340 | 350, 400 |
| La Crescent | Willsboro | 150 | 250 |
| | Black Diamond | 216 | 250, 300 |
| | UVM | 150 | 250 |
| Marquette | Willsboro | 296 | 350, 400 |
| | UVM | 200 | 300, 350 |
| MN 1200 | Willsboro | 229 | 250, 300 |
| Prairie Star | Willsboro | 150 | 300 |
| | UVM | 150 | 250, 300 |
| St. Croix | Willsboro | 228 | 250, 300 |
| | UVM | 150 | 200, 250 |

**Methods:**

**Wine Production & Analysis:** Wines were produced at Cornell's Vinification & Brewing Lab (V&B) in 2014 following standard production methods. YAN was measured using an enzymatic spectrometer method at crush for reds and pressing for whites, and was adjusting with additions of ammonium in the form of diammonium phosphate (DAP). When enough fruit was available, fermentations were performed in duplicate. All musts were analyzed for titratable acidity (TA), pH, and soluble solids using standard methods, and organic acids (tartaric, malic, and acetic) via HPLC. Finished wines will be analyzed for TA, pH, % ethanol, organic acids, and residual YAN.

**Sensory Evaluation:** Following bottling, sensory difference tests will be performed for each cultivar to assess the impact of region and YAN concentration.

**Results:** In preparation for the 2014 harvest, data from routine YAN analyses run on grapes harvested in 2012 and 2013 were compiled to provide an initial picture of YAN variation among cold-hardy cultivars and regions. Concentrations of ammonium ions (AMM), primary amino nitrogen (PAN), and yeast assimilable nitrogen (YAN) for riparia-based hybrids Frontenac gris, Frontenac, La Crescent, and Marquette harvested from sites in New York (Geneva, Trumansburg, Willsboro, Watkins Glen and Clayton), the University of Vermont, and the Connecticut Agricultural Research Station were included. (Figures 1-4.)

**Figure 1. Concentration of ammonium ions, primary amino nitrogen, and yeast assimilable nitrogen (mg/L) in Frontenac Gris grapes harvested in 2012 and 2013 in various New York vineyards.**

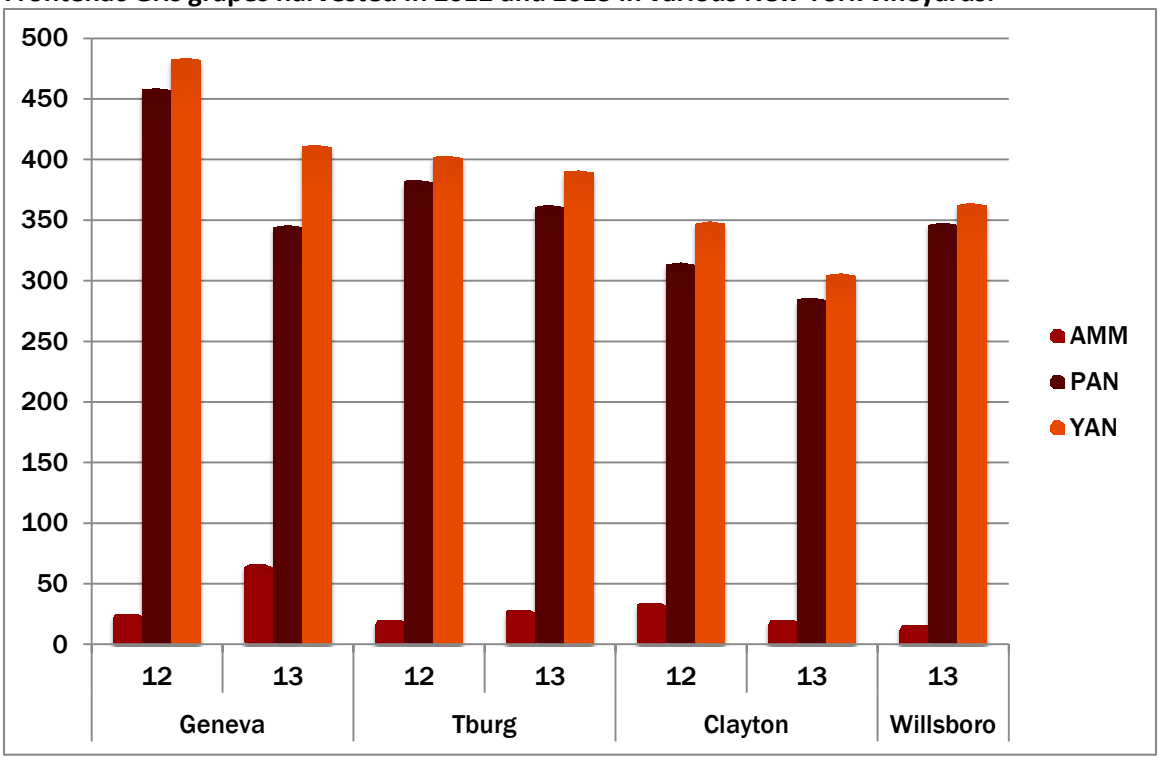


**Figure 2. Concentration of ammonium ions, primary amino nitrogen, and yeast assimilable nitrogen (mg/L) in Frontenac grapes harvested in 2012 and 2013 in selected northeastern vineyards.**

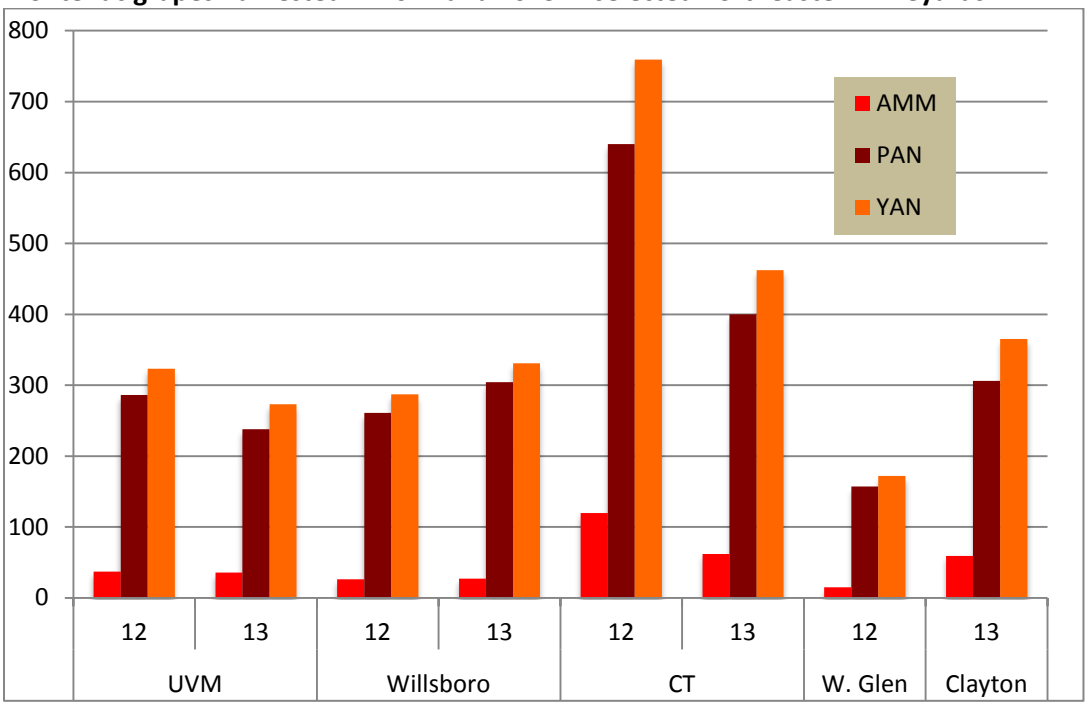



**Figure 3. Concentration of ammonium ions, primary amino nitrogen, and yeast assimilable nitrogen (mg/L) in La Crescent grapes harvested in 2012 and 2013 in selected northeastern vineyards.**

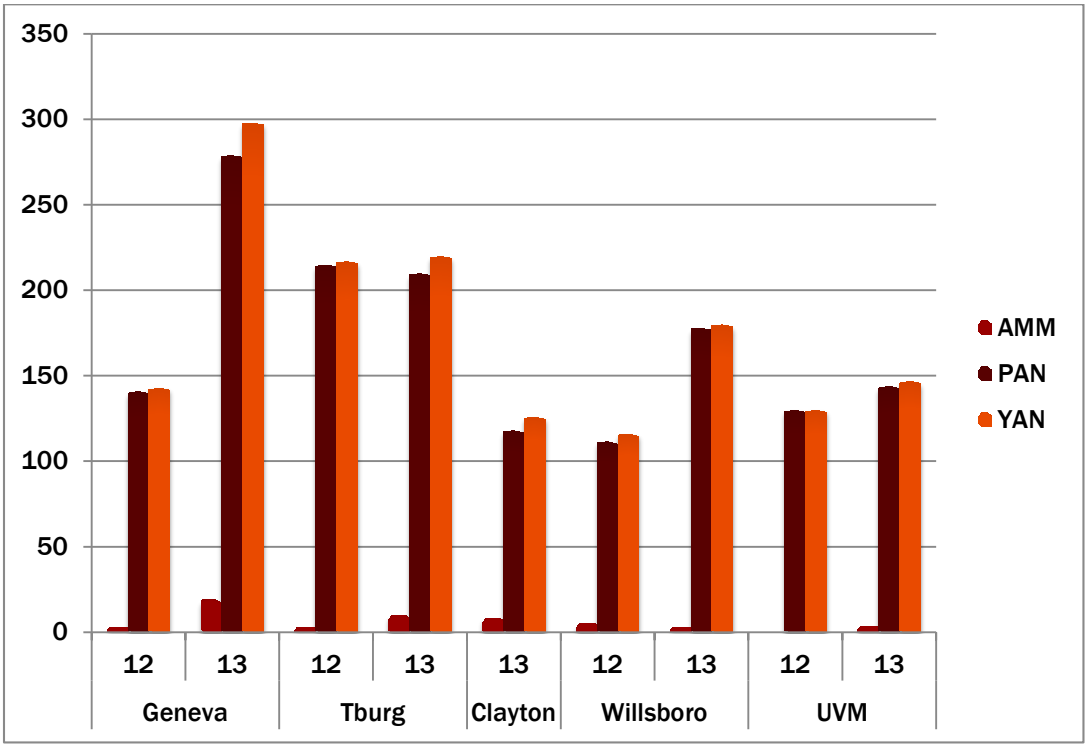
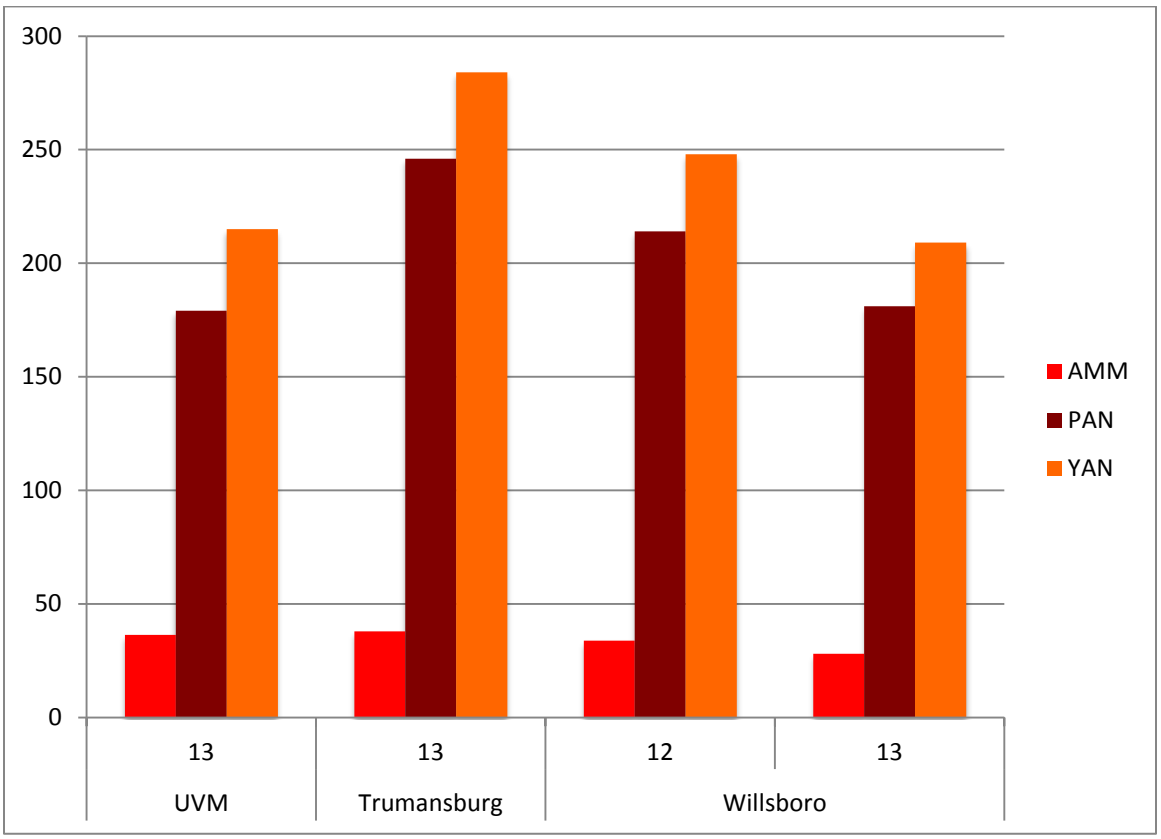


**Figure 4. Concentration of ammonium ions, primary amino nitrogen, and yeast assimilable nitrogen (mg/L) in Marquette grapes harvested in 2012 and 2013 in selected New York vineyards.**




**What the results mean:** As expected, the variables that dictate YAN concentration in hybrids are not easily extrapolated from observational data. In all cases, AMM levels are relatively low, such that PAN concentration has the greatest influence on total YAN (calculated as the sum of AMM + PAN). In a survey of grapes harvested in 2012 and 2013, La Crescent was the only grape with average YAN levels below the recommended minimum of 150 mg/L; Frontenac gris showed the highest average YAN, with concentrations ranging from 300 to almost 500 mg/L.

**Works cited:**

Stewart, A.C.H. 2013. Nitrogen composition of interspecific hybrid and Vitis vinifera wine grapes from the Eastern United States. Purdue University, United States -- Indiana.