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Nutritional requirements for maintenance of healthy vines and highest quality grapes.

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A new collaborative agreement, a 3 year MII (2005-2008), was developed between the BC Wine Institute and a group of research scientists at the Pacific Agri-Food Research Centre in Summerland and Agassiz BC. The project is enabling systematic research to be initiated on nutritional requirements of vinifera cultivars under the unique growing conditions in the Okanagan Valley.

First year methods

As well as conducting a survey of the nutritional and soil nutrient status of a range of vineyards during the 2005 growing season, two large scale controlled experiments were initiated on the rate, timing and form of N-fertilization in a Merlot (Osoyoos) and Cabernet Sauvignon vineyard (Oliver-Osoyoos) located in the South Okanagan.

The following treatments were established in 2005 and are to be maintained for a minimum of 3 growing seasons.

1. Low N (approx 40 kg N/ha) applied early (budburst)
2. High N (approx 80 kg N/ha) also applied at budburst
3. Low N applied late spring (bloom)
4. High N as applied late spring at bloom
5. Low N applied late spring plus postharvest N (ground application)
6. Organic N (20mT/ha compost at 2% total N potentially supplies 400 kg N/ha, if 10% available/yr supplies 40kg N/ha).

All plots are receiving standard commercial irrigation. The experimental design was a randomized complete block design with 6 treatments, 8 replicates and 10 vines/plot (480 vines per site).

The following measurements were made during the 2005 growing season.

1. Plant N status – petiole, leaf blade N, SPAD readings throughout the growing season.
2. Plant vigour – canopy leaf density (veraison), pruning weights, stem diameter, bud winter hardiness (H. Quamme).
3. Crop quantity – yield components (average berry size, berries/cluster, average cluster weight, number of clusters/vine)
4. Crop quality – SS, TA, pH, yeast assimilable N.
5. Environmental parameters – daily temperature profile to allow degree day calculations.

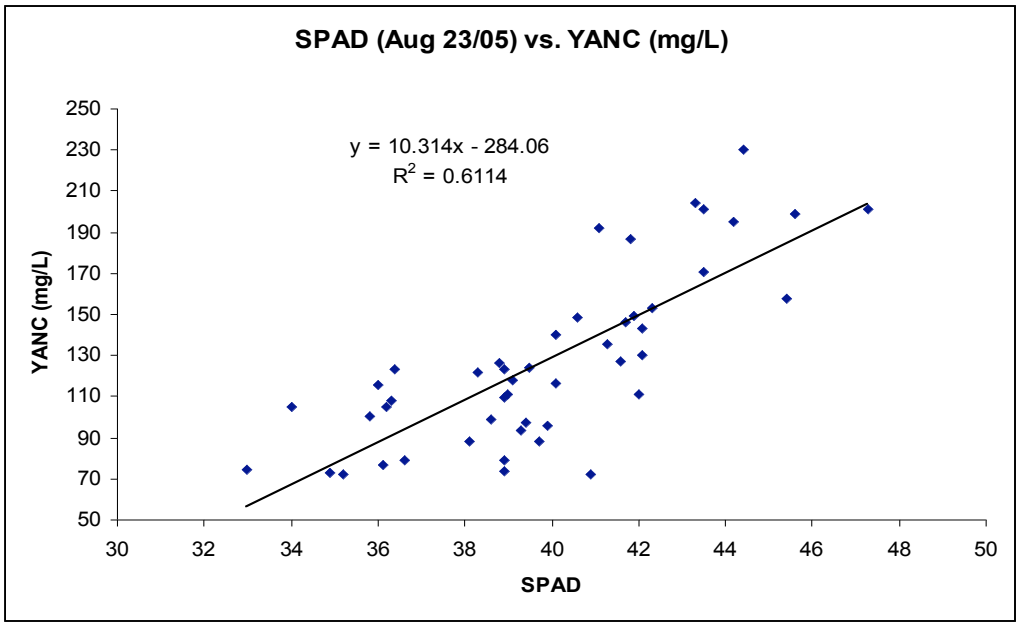
Preliminary results

Completion of laboratory and chemical analyses is presently underway for the first growing season. Some interesting preliminary results are already being observed.

N status

A wide range of N status is apparent between sites and cultivars, as indicated by yeast assimilable N concentration (YANC) at sites (Table 1) and YANC and SPAD chlorophyll readings at site 1 (Table 2). At controlled experimental site 1, yeast assimilable N has been affected by the N-treatments with higher and later N-applications increasing YANC with highest values observed for high N rates applied at bloom (Table 2). At this site, SPAD chlorophyll readings were also affected by N treatments with, for example, the early N fertilizer treatments increasing leaf green colour (SPAD – values) soon after fertilizer application on June 2, 2005. Similarly the leaf SPAD-reading after veraison on Aug. 23, 2005 parallel differences in berry YANC at harvest (Table 2). There was a close relationship between harvest YANC and leaf SPAD near veraison for site 1, indicating leaf colour at veraison may be a good indicator of YANC (Fig.1).

Fig.1.



At controlled experimental site 2, with the Cabernet Sauvignon cultivar, YANC values were in general higher but there were fewer systematic differences among treatments (Table 3). Similar to site 1, SPAD-readings on June 2, 2005 indicated greener leaves for recently fertilized treatments. These difference tended to disappear over time so that by Aug. 19, 2005 samples showed few colour differences among treatments. It may be that treatment differences show up more slowly on the Cabernet Sauvignon cultivar or that a longer time will be required to show differences when vines have a higher N content. It will be important to monitor these changes over the next few growing seasons.

Winter hardiness

An opportunity arose this winter to measure the winter hardiness of primary fruit buds in dormancy (Dec.5, 2005) by a thermal analysis between treatments with N status ranging from low (trt 1) to high (trt 4) at vineyard site 1. These results are interesting as they give some of the first locally determined lethal temperatures for grape buds. There were no differences in winter hardiness between N-treatments (Table 4). Fruit buds would have been killed at temperatures below -24^0 C for both treatments for this Merlot cultivar. It will be interesting to extend this research in the future to see if there are differences between treatments earlier and later in the season when grapes are not in deep dormancy.

Table 1. Average yeast assimilable nitrogen concentration (YANC) at selected study sites, 2005 harvest.

Site	Cultivar	Mean YANC (mg/L)
Site 1	Merlot	126.9
Site 2	Cabernet Sauvignon	245.6
Site 3	Merlot	77.9
Site 4	Merlot	139.4
Site 5-1	Pinot gris	213.4
Site 5-1	Pinot noir	177.0
Site 6	Merlot	235.0

Table 2. Average YANC as affected by treatment at Site 1 (Merlot).

Trt[Z]	Mean YANC (mg/L)	Leaf SPAD		
		June 2/05	June 13/05	Aug 23/05
1. Low N early	115.4 c	18.9b	36.5b	37.9cd
2. High N early	140.0 b	22.8a	40.0a	40.9b
3. Low N late	121.6 bc	17.4cd	33.4c	39.2bc
4. High N late	194.8 a	16.6d	33.2c	44.7a
5. trt. 2 + post harvest	106.5 c	16.6d	34.2c	39.9b
6. Compost N	83.2 d	18.4bc	37.5b	36.6d

[Z] See details in Methods.

Table 3. Average YANC as affected by treatment at Site 2 (Cabernet Sauvignon).

Trt[Z]	Mean YANC (mg/L)	Leaf SPAD		
		June 2/05	June 10/05	Aug 19/05
1. Low N early	244.8 abc	25.3a	38.4b	42.8ab
2. High N early	259.5 ab	26.0a	40.9a	43.9a
3. Low N late	249.4 ab	22.6b	37.9b	42.3b
4. High N late	265.4 a	23.3b	37.5b	43.7ab
5. trt. 2 + post harvest	220.4 c	22.6b	37.6b	42.5ab
6. Compost N	233.9 bc	23.9b	39.0b	42.8ab

[Z] See details in Methods.

Table 4. Differential Thermal Analysis (DTA) for mid-winter bud hardiness. Temperatures at which primary bud death occurred.

Trt	Temp. (ºC)
1. Low N early	-24.3 a
4. High N late	-24.1 a