

Uneven Ripening of 'Concord' Grapes

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For production of high quality grape berries, the whole cluster should ripen at one time. The lack of uniform ripening within a cluster is termed "uneven ripening," and is characterized by the presence of green berries in an otherwise mature ripe cluster. Uneven ripening of 'Concord' is a major problem in the South, often prohibiting production. Northwest Arkansas is the southern boundary for commercial 'Concord' production and even in this region severe problems with juice quality can develop due to uneven ripening.

Uneven ripening was severe in 1980 and work was initiated to determine differences between ripening and nonripening berries. At harvest in 1980 (Sept. 2), fruit samples were collected and sorted into three maturity categories: pre-veraison green, post-veraison green, and ripe. Pre- and post-veraison green fruit were separated on the basis of firmness. Pre-veraison fruit showed no softening, which indicates the initial stages of fruit maturation (veraison), and post-veraison green fruit had softened but had not started to develop color.

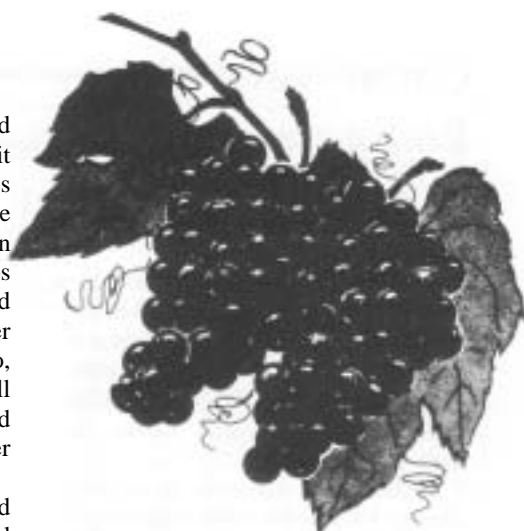
At harvest (Sept. 2) in 1980, differences in seed number and seed maturity were evident between maturity categories (Table 1). Normally ripening fruit contained the highest number of seeds per berry with no difference between pre-veraison and post-veraison green fruit. However, all the seeds in berries which had entered veraison were mature (brown seed coat color) as compared to 26.3 percent immature seeds in preveraison green fruit.

Fresh weight and percent soluble solids content increased with berry maturity while percent acidity decreased (Table 1). IAA (indoleacetic acid), a naturally occurring hormone which can retard fruit ripening, was similar among the three fruit maturity categories. However, ABA (abscisic acid), a hormone which promotes ripening, differed between the maturity categories. Nonripening fruit had low ABA content; however, once the fruit entered veraison, ABA increased, and in the ripe maturity category, ABA levels approached 100 µg/100 g fresh weight.

To investigate the influence of seed number and seed maturity on fruit maturation, three replicate fruit samples of the three maturity categories were collected during veraison (July 28) in 1981 and subdivided into five groups based upon seed content: one-seeded berries with zero or one mature seed per berry, and two-seeded berries with zero, one, or two mature seeds per berry. All berries were deseeded, weighed and frozen in liquid nitrogen for later analysis.

At veraison in 1981, fruits were sorted on the basis of seed number and seed maturity. Berries containing only one seed were in the pre-veraison stage of development if that seed was immature (Table 2). However, if the seed was mature (as indicated by a dark brown seed coat color), then fruits were distributed through the three maturity categories. Some of the fruit (17%) containing one mature seed remained in the pre-veraison green category which suggests that the seed matures prior to the onset of the berry quality changes associated with veraison.

Of the berries containing two seeds, those with both seeds immature or those containing one mature and one immature seed were in the pre-veraison green category (Table 2). All berries contain-



ing two mature seeds had entered veraison with none remaining in the preveraison category. The fact that 100 percent of the two-seeded berries containing one mature and one immature seed were present in the pre-veraison category suggests that both seeds must mature before the onset of veraison.

In this study, fruit ripening did not commence until ABA increased in the berry tissue. Also, ABA did not start accumulating until the seeds had matured (data not shown). For two-seeded berries, ABA did not increase until both seeds matured, suggesting an association of immature seeds with suppression of ABA accumulation and delayed ripening.

Table 1. Characteristics of 'Concord' Grapes In Different Maturity Stages at the Time of Harvest, September 2, 1980.

Fruit Maturity	Seeds Per Berry (no.)	Immature Seeds (%)	Fresh Wt. (G)	Soluble Solids (%)	Acidity Tartaric (%)	IAA (µg/100gfw)	ABA (µg/100gfw)
Pre-veraison Green	1.94 a	26.3b	1.91 c	8.7c	1.16c	2.1 a	16.5c
Post-veraison Green	1.96a	0.0a	2.35b	10.5b	0.96b	2.2a	31.3b
Ripe	2.25b	0.0a	3.00a	16.7a	0.65a	2.7a	96.2a

Means within columns followed by the same letter are not significantly different as determined by Duncan's Multiple Range Test at the 5% level.

Table 2. Influence of Seed Number and Seed Maturity on the Fruit Maturity Distribution of 'Concord' Grapes During Veraison, July 28, 1981

No. Seeds Per Berry	Seed Category No. Mature Seeds	Maturity Distribution in Each Seed Category (%)		
		Pre-veraison Green	Post-veraison Green	Coloring
1	0	100	0	0
1	1	17	54	29
2	0	100	0	0
2	1	100	0	0
2	2	0	26	74