Table 4. Composition trends from grape to wine for Florida hybrid and muscadine grape (B = bunch, M = muscadine).

	Brix	Titratable acidity	pH	Total phenols
Initial Compositional Analyses on Grapes Performed After Crushing				
After Pressing	Unchanged	↑ ↑ B M	Variable	↑ ↑ B M
Must	Adjusted to 21° brix	Unchanged[y]	Unchanged	Unchanged
Wine	Fermented to dryness			
	↓ ↓ B M	↓ ↑ ↓[z] B M M	↓ ↓ B M	↑ ↑ B M

[z]For must TA > 0.8%.
[y]Unless diluted by amelioration.

and ease of extraction, should be harvested at mid or moderately late season. Whereas, muscadines, because of acid reduction during ripening, less readily extractable acid (particularly by an immediate press) and pronounced muscadine character when overmature should be picked at early or midseason ripeness. The stage of maturity can be determined by a carefully chosen 100 berry samples from representative vines. Harvest should be limited to the pH range of 3.0 to 3.5 as reflected by pH analysis of hand pressed berries, if a light press, or blended samples for pomace treatments or a hot press is planned. Provided that these pH criteria are met, sugar/berry is a practical means of following grape ripening, although the wine harvest will normally occur 7 to 10 days before s/b values peak.

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CURRENT STATUS OF THE BLUEBERRY INDUSTRY IN ALACHUA COUNTY AND DELINEATION OF PROBLEM AREAS ASSOCIATED WITH SOIL ACIDITY AS AFFECTED BY HIGH pH IRRIGATION WATER

G. H. BRINEN
Universiy of Florida, IFAS
Alachua County Extension Service
Gainesville, FL 32609

S. A. BIENERT AND T. E. CROCKER
Universiy of Florida, IFAS
Fruit Crops Department
Gainesville, FL 32611

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Absract. **Soil pH in Alachua County blueberry plantings was surveyed in the spring of 1986 with a portable pH meter and it was found that 10 out of 35 growers had plantings with pH higher than the recommended range of 4.0 to 5.2. Of these, one had increased soil pH as a result of irrigating with a drip system. The others had planted in higher pH soils. The use of tensiometers for irrigation management was introduced to growers. County blueberry acreage increased from 285 to 489 since 1985 and is projected to increase to 702 by 1987. Early raobbiteye blueberry (*** *Vaccinium ashei*** **) cultivars 'Climax', 'Beckyblue', 'Aliceblue' and 'Bonia' as well as 'Sharpblue' highbush blueberry (*** *V. corymbosum*** **) account for over half of the acreage planted and almost all of the projected increase. The majority of plantings are less than 5 acres with fruit marketed primarily as pick-your-own. However, nearly all increased acreage was a result of expansion by larger-scale growers who marketed primarily through commercial channels.**

The first plantings of improved blueberry culivars in Florida were established in Alachua County in 1961. By 1973 most of Florida's 100 acres were located in Alachua County. Plantings continued to increase but were small-scale aond marketed on a pick-your-own (PYO) basis directly to consumers.

In 1983 one area grower sold early blueberries to northern markets and received nearly 10 times the then-

current PYO price. Other growers received similar high prices in 1984 and 1985 and this led to the first large-scale commercial plantings. A statewide survey conduced in 1985 revealed that a total of 285 acres were planted in Alachua County (1).

Blueberries require a well-drained, acid soil for optimum growth. Soil pH should be between 4.0 and 5.2 (3). Woodland soils with a native pH above 5.5 should probably not be considered for commercial blueberry growing. Soils that have been limed, but have a native pH within the acceptable range can be planted after sulfur has been applied to return the pH to original levels. Soils high in calcium or phosphorus should also be avoided.

Soil texture and moisure holding capacity are important considerations. Light, deep sandy soils are generally not suitable for blueberry production because irrigation requirements are too great (2). In Alachua County, soils on and near lower flatwoods, offer the best potential for production. They include Millhopper, Lochloosa, Sparr, Tavares, Pelham, Mulat, Pomona, Wachula and Newman soils. They occur predominately N.E. of a diagonal line drawn through Gainesville from I-75 at the Sante Fe River to Orange Lake. Over 90% of the County's bluebverry plantings have been established on these soils.

Growers have observed increases in soil pH due to high-pH irrigation water. Over 1983 to 1984, the soil pH in 4 plantings rose from just below 5.2 to over 6.0 and as high as 7.5 in drip irrigation wetting potterns in plant root zones. Plants demonstrated iron deficiency symptoms, including intervenal chlorosis in new leaves and shoot dieback.

Florida groundwater has a pH above 7.0 and contains dissolved calcium carbonate which raises soil pH if applied in large quantities (2). Growers had to irrigate heavily due to dry weather during much of 1983 and 1984 which apparently led to deposition of calcium carbonate and increase in soil pH. This can occur fairly rapidly in sandy soils with low buffering copacity, such as those on which most blueberries are planted. Drip irrigation does not move water far laterally in our sandy soils so that the typical pattern formed is a deep 15 to 20 inch diameter cylinder. It takes a large quantity of water to get this cylinder wet. For example, if 4 gallons are applied to obtain this 20 inch cylinder then the soil will be wet down to 23 inches and the irrigation rate will be 3.0 acre inches (2). Such a rate may raise the soil pH considerably in one season.

The effects of high carbonate water can be minimized by taking care not to over-irrigate. Growers should apply only enough water to just slightly exceed the root-zone water holding capacity (2). Acids or acid-forming materials, like sulfur, can be applied to the soil to counteract the bases applied in irrigation water. Sulfuric ocid is formed when bacteria act on the sulfur. Acid-forming fertilizers, like ammonium sulfate, do not have nearly the acid-producing effect of elemental sulfur. Normally, 440 lb. of sulfur per acre are applied to raise soil pH one unit before planting. In planted fields no more than 300 lb. per acre should be applied at one time to prevent damage to plants. More can be applied after waiting 4 months.

The liming effect of high-carbonate water can be neutralized by adding acid before applying to the crop. The amount of acid depends on the quantity of bases in the water and the strength of the acid used. One milli-equivalent of acid will neutralize one milli-equivalent of bases. It is probably only necessary to neutralize 80 to 90 percent of the bases. Sulfuric, hydrochloric or phosphoric acids can be utilized. Injection of acid may only be practical for drip irrigation systems.

Blueberry growers who experience an increase in their soil pH first should apply sulfur to lower soil pH. They then should install an injection system to inject acid to neutralize the carbonates in high-pH irrigation water. The specific soil pH requirements of blueberries mske prompt identification of a soil pH problem and effective irrigation management critical concerns in blueberry production, especially young plant establishment.

Research with various crops, other than blueberries, has shown tensiometers to be useful instruments for irrigation management (4). In sandy soils optimum crop production has been obtained by scheduling irrigation using tensiometers when soil tension levels reach the range of 20 to 30 centibars (cb).

A short-term project aimed at helping blueberry growers to better establish new plantings was proposed to IFAS Extension Administration in the Fall of 1985. The project was funded for 6 months and began in January of 1986. The primary objectives of the project were to identify blueberry plantings where soil pH was high and to test the use of tensiometers for irrigation management. Current and projected total acreage, acreage of cultivars planted, size of plantings, use of irrigation systems and method of marketing were also to be determined.

Materials and Methods

A Fisher Acumet portable pH meter was used for measuring soil pH in the field. Eight 6-inch and 8 12-inch Irrometer tensiometers were placed in plantings to monitor soil tension levels. One full time technician was hired to take readings and service the tensiometers.

Each planting was sampled twice from Feb. through June. A soil sampling tool was used to draw 8 cores from plant root zones (6 to 8 inches deep) in irrigation patterns down two rows and the odjoining row middles. The cores for each were mixed together in a plastic pail and 2 ounces by volume were taken and mixed with 4 ounces of deionized water (2:1 water to soil) in a plastic cup. The pH was read while the solutions were stirred and readings for all 4 samples were recorded.

Two tensiometers, one 6 and one 12 inches long, were placed at the edge of plant root zones wihin the irrigation patterns in 8 plantings. Two plantings had drip, 4 overhead, one microsprinkler and one no irrigation. Growers were asked to observe soil moisture readings in the tensiometer when they thought it was time to irrigate. The tensiometers were serviced every 3 weeks and readings were compared to observe soil moisture.

A grower meeting was held to demonstrate use of tensiometers for irrigation management, as well as use of the portable pH meter for field pH determination. Acid injection to lower high pH irrigation water was also discussed and demonstrated at that meeting.

Results and Discussion

Of the 38 plantings where soil pH was sampled over this 5-month period, 10 had pH readings above 5.2. Nine

of these plantings were high in pH before planting. The one had been irrigating with drip and may have raised pH over the previous year. Four had earlier applied sulfur. The others have since also applied sulfur. Generaly, there was little change in pH over the sampling period. The time may have been too short to see any changes due to irrigation with high pH water.

Tensiometers placed in plantings were monitored and serviced 3 times during this period. Readings of soil tension were consistently near 10 cb or below at all locations and depths. Readings at 6 inches were higher during and just ofter irrigation or rainfall than at 12 inches. The reverse was true between irrigations and during dry periods. Growers observed tensiometer readings and most indicated that they needed to irrigate when soil water tension was between 10 and 20 cb. This range is lower than the 20 to 30 cb range recommended in sandy soils for general crop production. Young blueberry plants may be more sensitive to water stress and may require higher soil moisture levels. Tensiometers show potential for determination of blueberry plant water needs and irrigation management.

At present 17 plantings are irrigated with drip systems, 10 by overhead and 4 by microsprinkler. Nine have no permanent irrigation system. Two growers have different plantings with drip in one and overhead in the other. There seems to be no consensus as to which system works best. More research needs to be done to determine which system is best for blueberries.

The survey conducted indicated that blueberry acreage had increased from 285 to 489. Fuhermore, it indicated that growers planned to plant more in 1987, raising the total to 702 acres. Table 1 shows a breakdown of blueberry acreage by farm size. At this time 23 of the 38 plantings are 5 acres or less. However, this accounts for only 8.7% of the acreage. Over 70% of the acreaoge, or 345, acres is accounted for by 5 growers who have more than 20 acres. These, and especially the grower who has 190 acres planted, will account for almost all of the projected increase.

The most widely planted blueberry cultivars are the early rabbiteyes 'Beckyblue', 'Climax', and 'Aliceblue' which account for 89.4, 82.6 and 67.5 acres, respectively (Table 2). This is a total of 239.5 acres or 49% of all planted.

Acreage of the recently released early rabbiteye cultivar, 'Bonita' is 13.8, but will increase as it replaces 'Aliceblue'. 'Aliceblue' has produced erratic yields apparently because of a pollination problem.

Table 1. Size breakdown of blueberry plantings in Alachua County, 1986.

Size of farm (acres)	Farms (No.)	Total acreage	Total acreage (%)
5 or less	23	42.6	8.7
6-10	6	41.0	8.4
11-20	4	60.0	12.3
29-50	4	155	31.7
50 or more	1	190	38.8

Table 2. Blueberry cultivars in production in Alachua County, 1986.

Cultivar	Acreage	Percent of total
Delight	2.5	0.5
Tifblue	4.9	1.0
Bluegem	10.8	2.2
Bonita	13.7	2.8
Woodard	6.1	3.3
Sharpblue	44.0	9.0
Aliceblue	67.0	13.7
Climax	83.1	17.0
Beckyblue	89.5	18.3
Unclassified	153.5	31.4

Acreage in 'Sharpblue' is at 43.85 and will increase because this cultivar is the earliest to fruit. It and the early rabbiteyes account for nearly all of the increased and projected acreage. The other cultivars are later maturing and are generally grown in small PYO plantings and older parts of larger plantings. Note that 153.3 acres, or 31.4% are unclassified because some growers did not know the breakdown of cultivars.

Of the 38 growers identified, 28 sell or will sell PYO and 8 will sell through commercial channels. Two sell both PYO and through commercial channels. Acreage that is or will be marketed PYO is less than 100.

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