poorer in quality. Amelioration with sugar syrup tends to reduce the already mild, fruity character of 'Stover' and, although desirable economically, may reduce wine quality-treatments, K (unameliorated) vs C (ameliorated). By judicious blending of 'Stover' with higher flavored wines a range of wine types could be produced, as is done with 'Thompson Seedless' in California, but blending was outside the scope of this study.

Were we to recommend a procedure for 'Stover' wine based on our personal preferences, it would approximate treatment M. This wine differs mainly in source of grapes and residual sugar from treatment K_1, preferred by the judges, which probably more closely reflects the preference of the potential Florida consumer.

'Stover' is not the ultimate in a Southeast wine grape, although it is quite acceptable for home or small scale wine making. Breeding efforts resulting in new grapes with improved cultivation characteristics should lead to a gradual improvement in winemaking potential. With wine consumption in Florida at 1.65 gallons/capita, a little above the national average of 1.85 (13) and locally produced wines presently an unmeasurable fraction of this consumption, the opportunity exists to take greater advantage of 'Stover' and its successors.

Literature Cited

1. Amerine, M. A., H. W. Berg and W. V. Cruess. 1972. The Technology of Wine Making. 3rd ed. AVI Publ. Co., Inc., Westport, CT.
2. Amerine, M. A. and E. B. Roessler. 1976. Wines: Their Sensory Evaluation. W. H. Freeman and Co., San Francisco, CA.
3. A.O.A.C. 1970. "Official Methods of Analysis," 11th ed., Assoc. Offic. Agric. Chem., Washington, D. C.
4. Banholzer, C. 1977. Cold fermentation. *Am. Wine Soc. J.* 9(2) :27-29.
5. Bates, R. P. and J. A. Mortensen. 1969. Processing research with Florida grown grape cultivars. *Proc. Fla. State Hort. Soc.* 81:182-197.
6. Bates, R. P. 1977. Home wine making in Florida. Food Sci. Fact Sheet, FS-3. *Coop. Exten. Ser. IFAS, Univ. of Fla.*
7. Becker, H. and G. H. Kerridge. 1972. Methods of small-scale wine making for research purposes in both hot and cool regions. *J. Austr. Inst. Agric. Sci.* 38(1):3-6.
8. Brailow, A. 1973. Wine making with the Eastern wine varieties. 1972 Wine Meeting for Amateurs. *N. Y. State Agr. Expt. Sta. Spec. Rept. No.* 12.
9. Eakin, J. H., Jr. and D. L. Ace. 1975. Winemaking as a hobby. *Penn. State Univ., College of Agric.*
10. Gallander, J. F. and A. C. Peng. 1973. Wine making for the amateur. Coop. Exten. Ser., Ohio State Univ. Bull. 549.
11. Grosz, E. A., Jr., R. P. Bates and J. A. Mortensen. 1973. Wines from Florida grapes. *Proc. Fla. State Hort. Soc.* 86:264-270.
12. Hiaring, P. E. 1977. Change the rules. *Wines & Vines* 58(9):4.
13. Mathis, K. and R. L. Degner. 1977. Grape production in Florida. The current marketing environment. *Agr. Mkt. Res. Cent. Food and Resource Economics Dept., IFAS, Univ. of Fla.*
14. Mortensen, J. A. 1968. 'Stover', an early bunch grape for Central Florida. *Fla. Agr. Exp. Sta. Circ.* S-195.
15. Robinson, W. B. 1974. Homemade Wine. Information Bull. 84, *N. Y. State Coll. of Agri. and Life Sci., Cornell Univ., Ithaca, N. Y.*
16. Stover, L. H., J. M. Crall and J. A. Mortensen. 1977. Marketing Florida bunch grapes as fresh fruit. *Proc. Fla. State Hort. Soc.* 90 (in press).
17. U.S. Treasury Dept. 1961. Wine. Part 240 of Title 26, Code of Federal Regulations. U.S. Gov't Printing Office. 0-627702.

Proc. Fla. State Hort. Soc. 90:199-201. 1977.

QUALITY CHARACTERISTICS AND NUTRITIONAL COMPOSITION OF BONIATOS (IPOMOEA BATATAS). I - CULTIVAR QUALITY[1]

D. D. GULL
IFAS, Vegetable Crops Department, University of Florida, Gainesville, FL 32611

R. A. CONOVER
Agricultural Research and Education Center, University of Florida, Homestead, FL 33030

Additional index words. sweetpotato, composition, Vitamin C.

Abstract. **Six cultivars of boniatos were grown at Homestead during three production seasons. Cultivars were 'Del Valle', 'Green Stem Original', 'Red', 'Five Fingers', 'White', and 'Rojo Blanco'. Boniatos were harvested at maturity and analyzed for specific gravity, total solids, vitamin C. and internal color. 'Five Fingers' had the highest specific gravity and total solids; vitamin C content and color were also relatively high. Cultivars 'Red', and 'White' were intermediate in quality. Although 'Del Valle' and 'Green Stem Original' both had very good color their specific gravity, total solids, and vitamin C content were low. 'Rojo Blanco' was the least desirable of the group based upon the internal quality characteristics measured.**

Boniatos, also known as 'Cuban' sweet potatoes are a cultivated form of the regular sweet potato (*Ipomoea batatas* Lam.). In the Southeast U. S. and Latin America, the most preferred boniatos are those having white flesh, high solids and bland flavor. They have been grown in parts of the tropical world for centuries, but have not gained acceptance in the U. S. until well after the Cuban migration beginning in the 1960's. Production in Florida has been of no consequence until recently when unofficial estimates ranging up to 12,000 acres annually have been made. Most boniatos are marketed in Florida and U. S. cities which have concentrations of Latin Americans but a significant portion of the crop is exported to Puerto Rico.

Little is known concerning the composition of boniatos. Major criteria for quality evaluation have been whiteness of flesh, dry matter content, and low sugars. Yellow fleshed sweet potatoes contain high levels of Vitamin A but unfortunately boniatos contain very small amounts because of the white flesh.

In general, few pure line cultivars of boniatos are grown in Florida and almost nothing is known about their origin. All are known only by common names which reflect some easily distinguishable characteristic.

There has been no organized program to identify, maintain, or improve quality characteristics of boniatos. Presumably the quality of boniatos could be improved by the same cultural practices and varietal development programs

[1]Florida Agricultural Experiment Stations Journal Series No. 817.

used to improve the quality of orange-fleshed sweet potatoes. A breeding program for varietal improvement of boniatos has been initiated at the U. F. Agricultural Research and Education Center (AREC) in Homestead.

Cultural practices are known to have an effect on sweet potato composition. Increasing soil moisture content results in a decrease of dry matter, color, and protein (2). Dry matter content is affected by soil pH but carotene is not affected (3). Dry matter is also reduced by increasing rates of nitrogen fertilizer (3). High specific gravity of sweet potatoes may be a good measure of quality but it is very difficult to determine because of the variability of root intercellular spaces (5, 7). These intercellular spaces are cultivar dependent rather than dependent on location, time of harvest, or years (7).

The continued decline in per capita consumption of sweet potatoes or boniatos can be expected unless a quality product is readily available (6). The purpose of this study was to evaluate 6 cultivars or lines of boniatos during spring, summer and fall production seasons and measure internal quality characteristics.

Materials and Methods

Cultivars used in this study are currently in commercial production in Dade County. 'Rojo Blanco' is the only one which has been officially released as a named cultivar (9). All plantings were made with vine cuttings. Plantings were made on Rockdale soil (pH 7.6) at the Agricultural Research and Education Center, Homestead on September 12, 1975, December 11, 1975 and June 15, 1976. Plots were replicated 4 times. These plantings were harvested on March 10, 1976 (spring), June 15, 1976 (summer) and October 27, 1976 (fall), respectively.

Because of heavy rains and attendant leaching during the summer and fall rainy season, the fertility program varied among the plantings. Our intentions were to apply 120 lbs N, 106 lbs P and 200 lbs K per acre. This amount was supplemented as needed following leaching rains with top-dressings of a mixture of equal amounts of ammonium and potassium nitrates. Although the fertility program was a bit uncertain, it was uniform within each planting and the crop response did not indicate either a deficiency or excess of fertilizer.

Roots were graded at harvest as to marketable, culls, and decay, and a representative sample was transported to Gainesville, cured for 2 days and then stored at 15°C for 2 weeks prior to analysis for quality and nutritional composition. Specific gravity was determined by the weight in water and air method.

Total solids were determined by the standard AOAC method (4) on pooled polar wedges from 10 roots. Vitamin C was determined by the Barakat method (1). Flesh color of a blended and deaerated sample from 10 roots was evaluated using a digital Hunter Color Difference Meter (HCDM).

Results and Discussion

Specific gravity of the roots is listed in Table 1. For each cultivar, there were a few roots which had a specific gravity less than 1.0 because of excessive intercellular spaces. These roots were not included in the analysis. No attempt was made to ascertain the extent of intercellular spaces by cultivar. 'Five Fingers' had a significantly higher specific gravity than other cultivars tested. 'Red' also had a relatively high specific gravity; 'Rojo Blanco' was intermediate and 'Green Stem' had the lowest value. Specific gravity was not affected by production season.

Table 1. Specific gravity of boniatos produced during three seasons. Average of 4 replications.

Cultivar	Harvest			Cultivar Mean
	Spring	Summer	Fall	
Five Fingers	1.080	1.079	1.089	1.083a[z]
Red	1.060	1.053	1.048	1.054b
Rojo Blanco	1.034	1.057	1.049	1.047c
White	1.047	1.048	1.034	1.043cd
Del Valle	1.033	1.042	—	1.038d
Green Stem	1.033	1.031	1.024	1.029e
Harvest Mean	1.048	1.052	1.049	

[z]Mean separation between cultivars by Duncan's multiple range test, 5% level.

There was very good agreement between specific gravity (Table 1) and total solids content of roots (Table 2). Total solids is a more accurate measurement if intercellular spaces are of any consequence. 'Five Fingers' had a significantly higher solids content that the other cultivars tested. 'Rojo Blanco' had intermediate solids content and 'Green Stem' had low solids. Boniatos harvested in the summer or fall had significantly higher solids content than those from the spring harvest. Possibly light intensity and temperature are factors which account for this seasonal difference because sweet potatoes are a heat-tolerant crop and thrive under such conditions. Solids content of 'Five Fingers' ranged from 33 to 38% with a mean of 35%. 'Rojo Blanco' had a range of 25 to 32% with a mean of 29%. Whatley (10) reported that 'Rojo Blanco', grown in Alabama, had a normal dry matter content of 30-32%. Although no statistical correlation was calculated, presumably specific gravity could be used as a fairly accurate measure of total solids provided that roots with excessive intercellular spaces were first removed.

Table 2. Total solids of boniatos produced during three seasons. Average of 4 replications.

Cultivar	Harvest			Cultivar Mean
	Spring	Summer	Fall	
	per cent			
Five Fingers	32.7	34.8	38.5	35.3a[z]
White	30.5	33.2	33.0	32.2b
Red	30.0	34.1	31.7	31.9bc
Rojo Blanco	25.0	29.8	32.5	29.1cd
Del Valle	25.4	30.4	—	27.9d
Green Stem	24.8	29.9	25.9	26.9d
Harvest Mean	28.1b	32.0a	32.3a	

[z]Mean separation between cultivars and harvests by Duncan's multiple range test, 5% level.

The regular Vitamin C content of orange-fleshed sweet potatoes is about 21 mg/100 g (8). Boniatos tested, with the exception of 'Rojo Blanco', contained a higher concentration than sweet potatoes (Table 3). 'Red' had a Vitamin C content that ranged from 26 to 34 mg with a mean of 29 mg. Roots of this cultivar had a very high content when harvested in the summer, as did 'White'. Overall, Vitamin C was not affected greatly by season of harvest. A cultivar differential did exist and the low mean value for 'Rojo Blanco' resulted from the unusual low content at the summer harvest.

Internal color of boniatos is listed in Table 4. Color values are stated only as HCDM "L" where 0 is black and 100 is white. Whitest colored boniatos were produced from the summer harvest and darkest ones from the spring harvest. Light and temp could account for this difference.

Table 3. Vitamin C content of boniatos produced during three seasons. Average of 4 replications.

Cultivar	Harvest			Cultivar Mean
	Spring	Summer	Fall	
		mg/100g		
Red	26.4	33.5	26.6	28.8a[z]
White	26.4	30.4	23.8	26.9b
Five Fingers	24.4	27.4	23.6	25.1bc
Del Valle	26.4	21.3	—	23.8cd
Green Stem	23.3	18.3	25.4	22.3d
Rojo Blanco	21.3	15.2	24.8	20.4d
Harvest Mean	24.7	24.3	24.8	

[z]Mean separation between cultivars by Duncan's multiple range test, 5% level.

Table 4. Internal color of boniatos produced during three seasons. Average of 4 replications.

Cultivar	Harvest			Cultivar Mean
	Spring	Summer	Fall	
		HCDM value L		
Red	60.4	67.0	58.2	61.9a[z]
Del Valle	54.9	67.7	—	61.3a
Green Stem	57.4	68.4	57.0	60.9a
White	57.0	66.3	58.5	60.6a
Five Fingers	55.3	64.3	59.4	59.7a
Rojo Blanco	37.6	60.4	58.3	52.1b
Harvest Mean	53.8c	65.7a	58.3b	

[z]Mean separation between cultivars and harvests by Duncan's multiple range test, 5% level.

Flesh color between cultivars was fairly uniform except the very dark roots of 'Rojo Blanco' obtained from the spring harvest. Roots of 'Rojo Blanco' from summer and fall harvests were only slightly darker than for the other cultivars.

External appearance is a very important factor in the acceptability of any cultivar. 'Rojo Blanco' has the most pleasing appearance because of the uniform shape and red skin of the roots. In comparison with the other cultivars tested, it more nearly approached the appearance of regular sweet potatoes. From the standpoint of internal quality, 'Rojo Blanco' should be improved so that internal qualities including solids, Vitamin C and color conform to the external appearance.

Literature Cited

1. Barakat, M. Z., S. K. Shehab, N. Darwish and A. El-Zoheiry. 1973. A new titrimetric method for the determination of vitamin C. *Analyt. Biochem.* 53:245-251.
2. Constantin, R. J., T. P. Hernandez and L. G. Jones. 1974. Effects of irrigation and nitrogen fertilization on quality of sweet potatoes. *J. Amer. Soc. Hort. Sci.* 99(4):308-310.
3. ————, L. G. Jones and T. P. Hernandez. 1975. Sweet potato quality as affected by soil reaction (pH) and fertilizer. *J. Amer. Soc. Hort. Sci.* 100(6):604-607.
4. Horwitz, W. 1965. Official Methods of Analysis of the Association of Official Agr. Chemists. Tenth ed. AOAC Washington.
5. Kushman, L. J. and D. T. Pope. 1968. Procedure for determining intercellular spaces of roots and specific gravity of sweet potato root tissue. *HortScience* 3:44-45.
6. Mathia, G. A. 1975. An economic evaluation of consumer characteristics affecting sweet potato consumption. *J. Amer. Soc. Hort. Sci.* 100(5):529-531.
7. Pope, D. T., L. J. Kushman and R. J. Monroe. 1970. Consistency of intercellular spaces in four sweet potato cultivars. *J. Amer. Soc. Hort. Sci.* 95(4):508-509.
8. Senti, F. R. and R. L. Rizek. 1975. Nutrient levels in horticultural crops. *HortScience* 10(3):243-246.
9. Watts, B. K. and A. L. Merrill. 1963. Composition of foods. USDA-ARS *Agr. Hdb. No. 8.* Washington DC.
10. Whatley, B. T. and R. B. Phills. 1977. 'Rojo Blanco' sweet potato. *HortScience* 12(3):265.

Proc. Fla. State Hort. Soc. 90:201-204. 1977.

SENSORY ACCEPTANCE OF TOMATO SALAD-TYPE YOGURT SYSTEMS FROM OILSEED/DAIRY COMBINATIONS

R. H. SCHMIDT, R. F. MATHEWS AND S. M. DAVIDSON
Department of Food Science and Human Nutrition, University of Florida, IFAS, Gainesville 32611

Abstract. **Yogurt systems were prepared from whole milk fortified with oilseed protein (soy protein isolate or peanut flour) and from oilseed protein/nonfat dry milk blends. Nonfat dry milk replaced oilseed protein in control preparations. Unflavored; tomato and spice; tomato, spice and vegetable; and fruit flavored tomato and spice; tomato, spice and vegetable; and fruit flavored yogurt systems were compared by sensory evaluation. The effects of heat processing and homogenization on sensory acceptance and texture measurement of tomato flavored yogurt systems were evaluated. Addition of tomato flavoring improved the sensory flavor rating of oilseed fortified yogurt systems. Addition of diced cucumbers, celery and tomatoes to tomato flavored yogurt did not significantly affect preference ratings. Tomato and fruit flavored oilseed fortified yogurt systems were considered inferior to similarly flavored controls by difference analysis. Tomato flavored yogurt systems made from soy protein/nonfat milk blends received higher preference ratings than did soy protein fortified yogurt systems. Heat processing at 70C for 10 min and homogenization improved sensory acceptance of tomato flavored oilseed fortified yogurt systems. Soy protein fortified yogurt systems had higher objective texture values than did other yogurt systems evaluated. Reprocessing lowered objective texture values.**

Formulated oilseed/milk blends may be a vehicle for expanding the utilization of oilseed protein resources. However, certain flavor and texture limitations of oilseed proteins, make acceptance less than favorable (6, 9). Sensory acceptance of oilseed milks (3, 5, 8) and of oilseed/milk combinations (7) can be improved by lactic fermentation to yogurt-like systems and by selection of flavoring agents. However, the flavors used have been primarily limited to fruit flavorings.

Recent industrial trends in the use of yogurt in the formulation of low fat salad dressing (1) facilitate a wider

[1]Florida Agricultural Experiment Stations Journal Series No. 837.