Production and Marketing Report

Eating Quality and Other Characteristics of New Mexico Pecan Cultivars Harvested over Three Years

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Summary. This work is the result of 3 years of collaborative research between Mississippi State Univ. and New Mexico State Univ. Physical, chemical, and sensory characteristics were studied to assess eating quality of popular New Mexico pecan *(Carya illinoinensis)* cultivars. The force and energy necessary to break (shear) pecan nuts, and Hunter 'a' and hue angle values varied with harvest year and cultivar. All other traits, including sensory evaluation results, varied only with cultivar. 'Ideal' was of light color, small size, and not as firm as the others, while 'Burkett' was soft and slightly rancid. 'Wichita' was the cultivar rated best by panelists, despite its slightly darker color. 'Western Schley' and 'Salopek' were also acceptable, although not as acceptable as 'Wichita'.

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Research conducted at Mississippi State Univ. Use of trade names does not imply endorsement of the products named nor criticism of similar ones not named Approved for publication as Journal article no. J-8649 of the Mississippi Agricultural and Forestry Experiment Station, Mississippi State Univ., Mississippi State, MS 39762. Research completed as part of the Mississippi Agricultural and Forestry Experiment Station project no. MIS- 1029. We thank the Western Pecan Growers Association for their partial support Thanks also to Sabrina Hunt and Donna Bland for their typing and editing, and to all participants in the taste panel for their time and patience. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked advertisement solely to indicate this fact.

Increasing nut consumption has been the task of the marketing boards that administer their respective federal marketing orders. The new food pyramid encourages consumption of fruit, vegetables, and nuts (USDA, 1992). From 1987 to 1992, 6% of all new food products introduced contained nuts (Horwich–Allen, 1994), About 80% of the world's pecan crop is from the United States, with New Mexico producing >10% of the 352 million pounds harvested in 1993 (USDA, 1995).

All nuts, including pecans, are good protein sources, contain no saturated fats, and are cholesterol-free, low in sodium, and high in unsaturated fatty acids [National Pecan Sheller's Association (NPSA), 1988], Unsaturated fatty acids comprise about 95% of the total fatty acids in mature pecans (Herrera, 1983). Pecans are also a good source of calcium, iron, phosphorous, potassium, magnesium, and various vitamins.

Quality of food products, including pecans, is determined by parameters that the consumer perceives as important for consumption.The main quality parameters in shelled pecans are size, color, flavor, aroma, and texture (Heaton and Beauchat, 1980; Heaton et al., 1975; Love and Young, 1970; Schaller, 1971;Smith and Loustalot, 1944), A good pecan nut has a light amber color, is fairly large, is crunchy, and has a typical sweet odor and flavor(not rancid or bitter) (NPSA,1988)

Various factors influence pecan nut quality including cultivar, preharvest conditions, temperature, soil type, rainfall, harvest conditions, harvest time, storage conditions, and moisture content, Previous work by Silva et al. (1990) showed that optimum harvest of pecans from New Mexico was 2 weeks before normal harvest, but this depends on cultivar.

The objectives of this study were to analyze five New Mexico pecan cultivars harvested over 3 years for nut color, moisture content, sheer force, total energy, oil content, fatty acid profiles, and sensory traits. These traits will lead to recommendations as to the best pecan cultivar and influence of environmental conditions on nut quality.

Materials and methods

'Ideal', 'Wichita', 'Western Schley', 'Salopek, and 'Burkett' pecans were harvested during 1991, 1992, and 1993 at optimum harvest from a farm in Las Cruces, N.M. In-shell pecans were shipped overnight to the Mississippi State Food Processing Laboratory and stored at 2C for 3 days before shelling Kernels were stored at 2C for sensory and at –18C for physical and chemical analysis.

The average moisture content of the kernels was measured following the Association of Official Analytical Chemists (AOAC) method 27.005 (AOAC, 1984), Crude oil (ether extract) and fatty acid profiles (by gas chromatography) were measured following AOAC methods (AOAC, 1984).

Kernel color was determined using a spectrocolorimeter (Labscan 6000 0/45°; Hunter Lab Associates, Reston, Vs.) by measuring 'L (brightness), 'a'(red-green), and 'b' (yellow-blue). The hue angle (color) was calculated as the tan-' (b/a) (Little, 1975), and the saturation indexer chroma was calculated as $(a^2+b^2)^{1/2}$. Shear force (firmness) was measured using a texture test system (FTC, Rockville, Md.) with a CS-1 shear cell. The ram stroke was 20 s and the load range was 44N(100 lb,). The peak height of the texturegram was used as the measure of shear force (Bourne, 1982). The area under the texturegram was calculated as the total energy needed to shear nuts.

A panel of 12 members was used to rate pecan nuts on appearance, texture, and taste. A

Table 1. ***Average Hunter color 'L', 'a', 'b' hue angle, and chroma values of pecan cultivars over 3 years***

Cultivar	L	a	b	Hue angle [tan^{-1}(b/a)]	Chroma SI = $(a^2+b^2)^{1/2}$
Ideal	35.8^{NS}	9.0b^{Z}	15.2^{NS}	60.1 a	17.6 b
Salopek	37.9	10.1 ab	15.7	58.0 b	18.6ab
Wichita	36.5	11.1a	15.8	55.6 c	19.3a
Burkett	36.0	8.9 b	15.0	59.8 a	17.4b
Western Schley	37.5	9.5 ab	15.7	58.9 a	18.3ab

[Z]Mean separation within columns at P 0.05.
[NS]Nonsignificant at P > 0.05

Table 2. ***Shear force, total energy, moisture content (wet basis), and oil content (wet basis) of pecan cultivars for 3 years.***

Cultivar	Shear force (N)	Total energy (J/g)	Moisture content (%)	Oil content (%)
		1991		
Ideal	229 aA[z]	91 aA	6.50 aA	67.2 abB
Salopek	201 bA	80 bA	5.95 bA	66.7 bB
Wichita	231 aA	92 aA	6.35 aA	70.1 aB
Burkett	NA[y]	NA	NA	NA
Western Schley	NA	NA	NA	NA
		1992		
Ideal	160 aB	64 aB	3.89 bcC	71.3 abA
Salopek	151 bB	60 abB	4.08 bC	70.6 bA
Wichita	157 abB	63 aB	3.73 cc	74.0 aA
Burkett	135 cB	54 bB	4.62 aA	64.4 cB
Western Schley	166 aB	66 aB	4.55 aB	68.4 bA
		1993		
Ideal	238 abA	95 aA	5.35 aB	67.4 aB
Salopek	212 bA	85 bA	4.80 cB	67.0 aB
Wichita	256 aA	102 aA	5.00 bcB	61.3 cC
Burkett	184 cA	73 cA	4.70 CA	68.7 aA
Western Schley	225 bA	90 abA	5.20 abA	64.3 bB

[z]*Mean separation within columns and within years at P 0.05.*
[y]*NA = data not available.*

Table 3. ***Average content ('%) of major fatty acids of the oil of pecan cultivars for 3 years.***

Cultivar	16:0	18:0	18:1	18:2	18:3
			% Fatty acids		
Ideal	5.7 cd[z]	2.0[NS]	65.7[NS]	24.7[NS]	0.74[NS]
Salopek	6.0 bc	2.7	63.7	25.7	0.94
Wichita	6.8 a	2.1	55.5	330	1.49
Burkett	5.4 d	1.9	61.7	28.9	1.03
Western Schley	6.3 ab	1.9	57.2	32.2	1.10

[z]*Mean separation within columns at P 0.05).*
[NS]*Nonsignificant at P > 0.05.*

Table 4. ***Appearance, texture, taste, and overall sensory ratings[z] of pecan cultivars for 3 years.***

Cultivar	Appearance	Texture	Taste	Overall
		1991		
Ideal	2.92 bB[y]	3.33 aA	3.50 abA	300 bA
Salopek	3.42 abB	4.00 aA	3.17 bA	3.42 abA
Wichita	4.17 aA	3.75 aA	4.25 aA	4.08 aA
Burkett	NA[x]	NA	NA	NA
Western Schley	NA	NA	NA	NA
		1992		
Ideal	1.92 cC	2.75 cA	3.17 bcA	3.08 bA
Salopek	4.00 abA	3.67 abA	3.92 abA	3.75 abA
Wichita	4.75 aA	4.33 aA	3.92 abA	4.00 aA
Burkett	2.17 cA	3.17 bcA	3.08 cA	3.08 bA
Western Schley	3.75 bA	3.67 abA	4.17 aA	4.08 aA
		1993		
Ideal	3.50 bA	3.17 bA	3.83 aA	3.33 abA
Salopek	4.08 abA	4.17 aA	3.75 aA	3.83 abA
Wichita	4.33 aA	3.75 abA	3.92 aA	4.08 aA
Burkett	2.25 cA	3.42 abA	3.33 aA	3.25 bA
Western Schley	3.67 abA	3.75 abA	3.42 aA	3.42 abA

[z]*1= Dislike, 3 = neither like nor dislike, and 5 = like.*
[y]*Mean separation within columns and within years at P 0.05.*
[x]*NA = data not available*

five-point rating scale was used in each category, with 5 = excellent and 1 = poor (Larmond, 1977).

Data were analyzed using the general linear model procedure for analysis of variance. Duncan's multiple range lest was used to compare significant differences *(P* < 0.05) among means.

Results and discussion

There was no year to year variation (P > 0.05) in Hunter color (Table I), but there were differences among cultivars. Brightness ('L') of nuts did not differ for cultivars, averaging more than 36.5, 'Wichita' yielded the reddest ('a') nuts, while 'Ideal' and 'Burkett' were the least red. Hunter 'b' (yellowness) values did not vary with cultivar. 'Ideal', 'Burkett', and 'Western Schley' had higher hue angle values, whereas 'Wichita' had more intensive color or chroma. When Hunter 'L' and hue-angle values were compared to USDA standards for grades of shelled pecans, all cultivars were within the golden (light) category, the highest color grade for pecans (USDA, 1969). This indicated the high color quality of nuts produced by these cultivars for 3 years of harvest.

Shear force and total energy (Table 2) values varied with harvest year and cultivar. Lower values for shear and total energy were found for all cultivar kernels harvested in 1992. Nuts harvested in 1992 contained less water and more oil (Table 2), exception for 'Burkett', and therefore are more brittle and less resistant to shear forces. Environmental conditions may have also played a role. 'Wichita' and 'Ideal' were the firmer nuts, while 'Burkett' required less shearing force.

There was a significant interaction between year and cultivar in moisture and oil content (Table 2). 'Burkett' was lower in oil in 1992 but higher in 1993, while 'Wichita' was lower in oil in 1993, Since oil and protein are the only two constituents that vary significantly in pecans and nuts (on a dry basis), it is reasonable to assume that the cultivars lower in oil are highest in protein, 'Wichita' and 'Western Schley' contained the highest amount of palmitoleic acid (C16:n9) (Table 3).

Appearance, texture, taste, and overall sensory ratings (Table 4) did not vary with year except for'ideal', which varied in appearance scores for 3 years. 'Wichita' scored the highest on appearance and 'Burnett" the lowest, Texture scores did not differ among varieties in 1991 and 1993; however, 'ideal' and 'Burkett' scored lower in texture in 1992. 'Ideal' and 'Burkett' also scored lowest in taste in 1992, Furthermore, overall sensory ratings were lowest for 'ideal' and 'Burkett' in 1992. Overall scores for 'Ideal' were also lower in 1991. 'Wichita' was the preferred cultivar for the 3 years of study. This was the result of its good appearance and taste and its firmer meat, 'Ideal' and 'Burkett' were the least preferred, scoring average on the taste panel

This work shows that, if conditions are the same and if nuts are properly handled and stored,

'Wichita' would be the preferred cultivar of the five cultivars studied based on food quality. 'Western Schley' and 'Salopek' also scored highly and could be high-quality options to 'Wichita'.

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