Amenity benefits and public policy: An application to the Georgia Pecan Industry

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Abstract

Most agricultural production results in both marketable and non-marketable products. Most policy decisions however, tend to be made based only on the market value, which ignores the non-marketable value or amenity benefits. One type of amenity benefits is farmland amenities which are attributes of farmland that are uniquely provided by actively farmed land. Examples include the scenic beauty of rolling pasture, orchards and the cultural value of farming as a way of life. Farmland also produces non-farm amenities, such as open space, wildlife habitats, and groundwater recharge. Most amenity benefits are classified as public goods in that they are non-excludable and non-rival in terms of use. Thus, most amenities do not have a market value associated with them so that their value can not be captured by landowners and therefore are subject to market failure. This failure leads to government intervention in an effort to encourage and support agriculture with programs for farmers through various public policies. Failure to include amenity benefits results in under-allocation of resources like land towards pecan production.

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Introduction

Pecans have historically been part of the diet of the Native Americans. The pecan served as a staple of the Native Americans diet long before the Europeans arrived. Later, pecans were traded for furs and tobacco (Rosengarten, 1984). The pecan tree, the only commercially grown nut tree indigenous to North America is also the most popular tree nut in the U.S. Large scale production started in the U.S. in the late 1880s along the Mississippi delta and in the early 1900's, before spreading all over the southern United States (Taylor, 2001). Currently, the U.S. is the world-leading producer of pecans, producing, on average, 75 % of the total world pecan supply, followed by Mexico, Australia, Israel and the Republic of South Africa, respectively (Herrera, 2003; Johnson, 1998).

The main U.S. pecan growing region is the 15 states in the southeastern and southwestern U.S. with Georgia, Texas and New Mexico as the top main producers. Production areas in the U.S. are defined into two categories: the Southeastern area includes Georgia, Alabama, Florida, Mississippi, North Carolina, South Carolina; and the Southwestern area includes Texas, New Mexico, Arizona, Oklahoma, Louisiana, Arkansas, and California (Hubbard et al., 1987). Texas accounts for one-third of the U.S. pecan farms (with almost twice as many trees as Georgia), however Georgia has the greatest output (USDA, May 2003). According to Hubbard et al. (1987), Georgia has an initial comparative advantage in the pecan industry. Acreage for commercial pecan production is mostly fixed, so that changes in the volume produced each year are due to pecan physiology and weather conditions during the growing season. The pecan is classified as a specialty crop and therefore, has a niche market. Pecans and other specialty

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crops represent a relatively small portion of agricultural crops in the U.S. (Mohammed, 2005).

In Georgia, pecans contribute significantly to the Georgia economy. In 2003, pecans contributed $69 million in total farm value to the economy. The farm value of pecans tends to follow a similar pattern to that of total farm production in the sense that there is a distinction between alternate bearing years of the pecan tree. Pecan trees have an alternate bearing pattern meaning one year a tree will have a heavy crop while the next year will be lighter. Higher production volume is correlated to higher value of production (Swickard, 2005). Georgia produces more pecans than any other state, harvesting about $80 million worth annually, which accounts for about 40 percent of total U.S. production (USDA, October 2003). In recent years though, a negative pecan trend is resulting from a declining amount of land for growing pecans. Georgia, one of the main pecan states, is also one of the fastest growing and Lee county, one of the largest producers in the state, is also one of the fastest growing counties, percentage-wise, which leaves little room for large pecan orchards.

For the past half a decade, pecan production has been erratic despite its alternate bearing nature. Overall, production has been trending downward since 2002 when only 45 million pounds were produced, and in 2006, only 40 million pounds were recorded. This downward trend has also been observed with other pecan producing states such as Texas, Louisiana and can be blamed to many factors including pest and disease and weather. Due to this shortage in supply, prices have been very strong, ranging from 93 cents per pound in 2002 to over 210 cents per pound in 2006. Although production is forecast to increase in 2007, the negative price impacts from increasing production are

not expected to be large enough to restrain an increase in the total pecan production value (Fonsah, 2007).

Pecans increased in production in the U.S. from 2.2 million pounds in 1922 to over 400 million pounds in 1999. The U.S. saw the largest crop in 1999 with 4.06 million pounds of pecans produced that season. The years since, production has been lower whether it is an "on" year or not. Pecans contribute significantly to the agricultural economies of the producing states and to the U.S gross domestic product. The industry has been reported to make an annual contribution of $400 million to the U.S. economy (Crocker, 1989). The U.S. pecan industry operates on a competitive free-market basis, mainly because neither the state nor the federal governments pay subsidies to influence the supply or price of pecans (Wood, 2000).

Since the 1980's, pecan consumption has been stagnant and has actually trended downward since 1998. On the other hand, the U.S. became a net importer of pecans in the 1980's. The balance of trade turned negative as imports began to exceed exports during the 1980's and since the 1990's imports have comprised a large percentage of total U.S. supply. In the mid-1980's in-shell pecan imports increased 37 percent which was around the same time that exports began to increase (Swickard, 2005). After the North America Free Trade Agreement (NAFTA) was implemented in 1994, imports increased 50 percent. Shelled imports in the U.S. expanded roughly 350 percent before NAFTA in the mid-1980's, but only 31 percent afterward (Peña, 2001).

Pecan exports increased eight percent from 1980-1990 and have been steadily increasing since 1990. The U.S. exports a significant amount of pecans to Canada, Mexico, and Europe (Johnson, 1998). In-shell exports were almost non-existent until

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2000 and since 2003 China has become the second largest export market for U.S pecans (USDA, May 2003). Pecan markets in China have been growing quickly since 2001. The pecan trade relationship between the United States and Mexico is considered complementary in that exports to Mexico have increased while imports to the U.S. have increased as well (Peña et al., 2001). Imports from Mexico boost total supply and stock levels. It is believed that the higher quality pecans produced in Mexico are exported to the U.S. to supplement for low production years and lower quality pecans.

Population and rapid economic growth in the United States has resulted in the conversion of a significant amount of agricultural land to urban uses. Georgia is the fourth fastest growing state in the United States in terms of population, but also still has an economy tightly linked to agriculture. Yet, Georgia has no statewide program to preserve farmland and protect the segment of the economy that depends on agriculture from the pressures of development (Lavigno et. al. 2004). In order to curb this continuing trend, several states have designed policies and programs to help preserve agricultural land. This is mainly done to preserve open space, preserve soil characteristics or preserve the food production capability of the region (Fishel, 1982; Plaut, 1980). Economically, government intervention can be justified because of the failure of the market to fully consider open space and environmental amenity benefits from agriculture in allocating land (Gardner, 1977).

The population in Georgia is growing, and therefore farmers and landlords are expanding their production and construction respectively, to meet the growing local food and housing needs. This creates land use pressures on both sides of the urban-rural edge. When making land use decisions, it is important for decision makers to take into

consideration the public benefits that various land uses provide the community. Public benefits are also referred to as non-market values, amenity benefits, ecological services or environmental benefits. This study uses the term amenity benefits. Amenity benefits refer to benefits such as access to local food, green space, lifestyle and viewscapes (Irwin et al. 2003).

Objectives

The main objective was to determine the effects of amenity benefits on the pecan supply function and how this affects public policy with regard to land allocation / size of the pecan industry in the Georgia. The specific objectives are;

1) estimate the U.S. pecan supply function (excluding exports) and use this to determine the MC function

2) estimate the amenity benefits function and use this to determine the marginal amenity benefit function

Literature Review

Pecans are an important source of income for many farmers in the Southeast. Hence, it is important to understand how pecan supply responds to different policies (Elnagheeb and Florkowski, 1993). Previous pecan studies focused on pecan quality at the retail level (Williams, et al.), predicting pecan prices (Epperson and Allison, 1980), estimating pecan price flexibilities (Wells, et al., 1984), evaluating the impact of pecan crop forecasts on pecan prices and value (Shafer, 1989) and differences in pecan prices by variety (Okunade and Cochran, 1991).

The positive effects of agricultural amenities have been evaluated by various economic studies; examples include Halstead (1984), Bergstrom et al. (1985), Beasley et al. (1986), Bowker and Didychuk (1994)), Hackl and Pruckner (1997), Ready et al. (1997), Ready and Abdalla (2005) and Fleischer and Tsur (2003). These studies estimated how the public valued varying levels of urban development on farmland and how the public valued farmland when different quantities were being preserved. These studies used ordinary least squares (OLS) in the analysis and estimated a household willingness to pay (WTP) for preserving farmland. Lopez et al. (1994) estimate how the value of amenity benefits from farmland can affect public policy decisions as applied to the Connecticut dairy industry. Their finding indicates that failure to consider amenity benefits results in under-allocation of resources in the dairy industry. We follow this idea to investigate how amenity benefits affect the Georgia pecan industry.

The intrinsic beauty of trees in the landscape of a home or community is difficult to quantify. However, a reasonable estimate is that trees increase the value of a home by about 1% per year. Pecan trees are extremely valuable not only to the producers but also

to the citizenry in general. The industry currently has an annual value approaching $50 million. The trees provide oxygen, sequester carbon dioxide and buffer our personal environment against wind, rain and sun. Furthermore, the pecan orchards are a major attraction for visitors and residents alike (Mexal 2003). The eight non-commensurable values defined by Hartman et al. (2000) have been categorized into five general headings: carbon sequestration, oxygen release, pollution control, altered microclimate and beauty enhancement by Mexal et al. 2003 as shown in Table 1 below.

Table 1. Summary of pecan's noncommensurable benefits

Commodity	Noncommensurable Value
Leaves and shucks(prunnings)	Organic matter addition
Carbon sequestration	41,500 vehicles
Oxygen release	1 million people
Pollution control	Emission reduction credits($120 million)
Climate control	$30/tree
Beauty	1%/year/home
Total benefit	Priceless

Adapted from Mexal, Herrera, Sammis and Zachritz: Guide H-654 2003

The levels of amenity services/ benefits are not uniform across agricultural land uses. Evidences for such differences in the amenity benefits associated with diverse agricultural activities are provided by Drake (1992) and Brunstad et al. (1999). The latter distinguish between benefits from tilled land, woodland and pasture. More recently, Fleischer and Tsur (2008) developed a unified framework for the analysis of rural-urban land allocation, while taking into account the heterogeneous amenity values of farmland across crops. They estimated demand functions for housing and agricultural-production land uses, as well as the willingness to pay for agricultural amenities (Kan et al. 2008).

Data and Methods

Quantity, price, fertilizer prices for pecans and value of farmland for Georgia were obtained from USDA-NASS for the years 1980-2008. Population, income and agricultural wage rate data were obtained from the U.S. census bureau. The quantity, price for pecans, fertilizer prices and wage rate were used to estimate the supply-demand equation for pecans by least squares. The results obtained were then used to determine the marginal cost function. Agricultural land values were obtained from USDA-NASS.

Estimates of total willingness-to-pay to prevent moderate levels of development on agricultural land were obtained from Bergstrom and Volinsky (2004) as the product of benefits per household and the number of households in Georgia. Bergstrom and Volinsky (2004), found that Georgia residents placed high preference on preserving prime farmland near urban areas used to produce human food. Assuming 100,000 acres are preserved, they also found the willingness-to-pay per household to preserve this amount of land type to be $62. The assumption of amount to be preserved is based on the study by Dorfman et al. (2003). Data for households were obtained from the U.S. Census Bureau. These were used to measure amenity benefits, which together with population, income and value of farmland were used to estimate the amenity benefits equation by non-linear least squares. From this equation, we obtained marginal amenity benefits function which when subtracted from marginal cost yields the marginal social cost function.

Methods

This paper adopts the model developed by Lopez et. al.(1994). We estimate two equations; the pecan supply and the amenity benefit equations for Georgia. The supply equation is represented as

$$Q_t = f (Q_{t-1}, realP_t, t, FPIE)$$

where,

Q_t = the quantity of Georgia utilized production - all pecans in year t, 1000 pounds, (U.S.
   Department of Agriculture, Georgia Agricultural Statistics Service)

Q_{t-1} = Georgia utilized production in year t-1, 1000 pounds, (U.S. Department of
   Agriculture, Georgia Agricultural Statistics Service)

realP = real price of Georgia pecans in year t, cents per pound, deflated by CPI,
   1992=100 (U.S. Department of commerce, Bureau of census)

t = trend variable, (1, . . ., 29)

FPIE = fertilizer price index divided by the energy index

The model is represented as a partial adjustment model due to inflexibilities in the short run. The inflexibilities arise because of asset fixity in that it takes time for the pecan trees to start bearing nuts after planting, about ten to twelve years. The model is thus;

$$\ln Q_t = \alpha_0 + \alpha_1 \ln Q_{t-1} + \alpha_2 \ln realP + \alpha_3 t + \alpha_4 \ln FPIE + e_t$$

Many studies use the cost of fertilizer and wage rate to represent input cost. We used fertilizer price index and wage rate which were both deflated by the index energy. Using this equation, we can estimate the inverse supply equation. The supply equation was estimated by ordinary least squares. According to Lopez et al. (1994), the amenity benefits equation can be modeled as;

$$AB = \alpha L^{\beta_0} POP^{\beta_1} Inc^{\beta_2}$$

This equation was linearized by taking logarithms to get

$$\ln AB_t = \alpha + \beta_0 \ln L_t + \beta_1 \ln POP_t + \beta_2 \ln Inc_t + \mu_t$$

where

AB_t = amenity benefits from preserving farmland in Georgia in year t, in dollars, obtained

as the Willingness-to-pay for farmland preservation per household multiplied by

the number of households in Georgia in year t

L_t = value of cropland in year t

POP_t = Georgia population in year t, (U.S. Department of commerce-Bureau of

Economic Analysis)

Inc_t = per capita income in year t, (U.S. Department of commerce-Bureau of Economic

Analysis)

α and β_i = parameters to be estimated

μ_t = the error term.

The amenity model was also estimated by ordinary least squares after linearizing.

Results

Table1. Estimated Coefficients for the U.S. Domestic Supply of Pecans 1980-2008

Dependent variable	Explanatory variable	Parameter Estimate	Standard Error	t-value
$\ln Q_t$	Intercept	14.61	1.25	11.70
	$\ln Q_{t-1}$	0.38	0.11	3.39
	realP	0.87	0.17	5.22
	t	0.03	0.005	5.69
	FPIE	-1.03	0.42	-2.44
$R^2 = 0.749$	$N = 28$	$\hat{\rho} = -0.02$		

The model was estimated initially with wage rate, which was however not significant and was dropped from the regression to improve the significance of the other parameters. The rest of the parameters have the expected signs and are significant at the 5 percent level. The estimated short-run regression is therefore given as

$$\ln Q_t = 14.55 + 0.37 \ln Q_{t-1} + 0.86 \ln realP + 0.03t - 1.03 \ln FPIE$$

The coefficient on $\ln Q_{t-1}$ in the partial adjustment model is normally given as $(1 - \lambda)$, where λ is the degree of partial adjustment. The coefficients on lnrealP and lnFPIE are the short-run elasticities. Dividing the short-run equation by the adjustment factor yields the long-run supply equation below, which was used to obtain the inverse supply equation

$$\ln Q_t = 23.10 + 0.59 \ln Q_{t-1} + 1.37 \ln realP + 0.05t - 1.63 \ln FPIE$$

This paper is still in progress and we could not obtain all the required amenity benefit values. The amenity benefit equation was therefore not estimated in this paper. The amenity benefits are however expected to be positive with regard to quantity, (Q) of pecan production, that is, the marginal amenity benefit $(MAB) = \partial AB / \partial Q \succ 0$. Assuming a perfectly competitive market for pecans, equilibrium production (Q^*) will be obtained where $P^* = MC$ if we don't consider amenity benefits. Considering amenity benefits results in a higher output (Q^a) because then marginal social cost, $(MSC) = MC - MAB$ is less than MC so that the supply curve shifts to the right.

Discussion

        The relative value of farmland amenities varies from region to region depending on several factors. The total amount of farmland, both preserved and unpreserved, will determine the relative scarcity of farmland amenities in a region. As unpreserved farmland is converted to other uses, the amenity values of remaining farmland increase. In addition, other rural land offering similar amenities (e.g., scenic views of woodland and wetlands) could reduce the value of some farmland amenities (scenic farm views). Demand for farmland will be influenced by the population within a region which in turn determines the amenity benefits. The characteristics of people living in the region will influence demand for farmland as well.

        Failure to include the non-market value (amenity benefits) into demand-supply analyses means that we do not observe the real supply curve. In this paper, we expect a positive MAB which will shift the supply curve to the right. This means that failing to include amenity benefits results in under-allocation of resources like land towards pecan production. In essence we will be operating below optimal social welfare when we produce where price equals marginal cost.

References

Beasley, S., W. Workman, and N. Williams. "Amenity values of urban fringe farmland: a contingent valuation approach." *Growth and Change*, 17(Oct 1986):70-78.

Bergstrom, J., B. Dillman, and J. Stoll. "Public environmental amenity benefits of private land: the case of prime agricultural land". *Southern Journal of Agricultural Economics*, 17(Jul 1985):139-149.

Bergstrom, J. C. and Volinsky, D. *Public Preferences and Values for Purchase of Agricultural Conservation Easement (PACE) Programs in Georgia.* Department of Agricultural and Applied Economics, The University of Georgia.

Bowker, J. and D. Didychuk, D. "Estimation of nonmarket benefits of agricultural land retention in eastern Canada." *Agricultural Resource Economics Review*, 23(Oct 1994):218-225.

Brunstad, R.J., I. Gaasland, and E. Vardal, E. "Agricultural production and the optimal level of landscape preservation." *Land Economics*, 75(4):538-546, 1999.

Crocker, J. *Pecan Promotion Research Act*. The Pecan Grower No. 1(1989):1-3.

Drake, L. "The non-market value of the Swedish agricultural landscape." *European Review of Agricultural Economics*, 19(1992):351-364.

Dorfman, J. H., B. Lavigno, B. Barnett, and J. Bergstrom. "Is there a Private Market for Farmalnd Preservation?" Conference on Compensating Landowners for Conserving Agricultural Land. *Proceedings Paper.*

Elnagheeb, A. H. and W. J. Florkowski. "Modeling Perennial Crop Supply: An Illustration from the Pecan Industry" *J. Agr. and Applied. Econ.*, 25 (July 1993): 187-196.

Epperson, J. E. and J, R. Allison. "Price Futures for the United States Pecan Industry." *HortScience*, 15(4):475-478, 1980.

Fishel, W.A. "Urbanization of Agricultural lands: A Review of the National Land Study." *Land Economics* 58(May): 236-59.

Fleischer, A. and Tsur, Y. (2003). Measuring the recreational value of open space. *Journal of Agricultural Economics*, 54(2):269-283.

Fleischer, A. and Y. Tsur. "The amenity value of agricultural landscape and rural-urban land allocation." *Journal of Agricultural Economics* (2008 Forthcoming).

Fonsah, E. G - 2007 Georgia Vegetable, Fruit, and Nut Situation and Outlook. Internet site: http://www.caed.uga.edu/agforecast2007/presentations/31-Veg%20Outlook%20Fonsah.doc (Accessed Dec 31, 2008).

Gardener, B.D. "The Economics of Agricultural Land Preservation." *American Journal of Agricultural Economics* 59(Dec.): 1027-36.

Hackl, F. and G. J. Pruckner, G.J. "Towards more efficient compensation programs for tourists' benefits from agriculture in Europe." *Environmental and Resource Economics*, 10(1997):189-205.

Halstead, J. "Measuring the nonmarket value of Massachusetts farmland." *Journal of Northeastern Agricultural Economics*, 13(Apr 1984):12-19.

Hartman, J.R., T.P. Pirone, and M.A. Sall. *Pirone's Tree Maintenance.* 7th ed.   New York:Oxford Univ. Press, 2000, 545 p.

Herrera, E. *Economic Importance of the Pecan Industry*. Guide Z-501. Las Cruces, NM: New Mexico State University, Cooperative Extension Service, 2003.

Hubbard, E. E., J. C. Purcell, and S. L. Ott. *Purchasing and Marketing Practices of Georgia Pecan Accumulators and Shellers*. The Georgia Agricultural Experiment Station Research Report No. 544, December 1987.

Irwin, E. G., C. J. Nickerson, and L. Libby What are Farmland Amenities Worth? *CHOICES,* 2003.

Johnson, D.C. *Economic Trends in the U.S. Pecan Market with an Overview of the U.S. and World Tree Nut Complex*. In Fruit and Tree Nuts: Situation and Outlook Report. FTS-282. Washington DC: United States Department of Agriculture, Economic Research Service, 1998.

Kan, I., D. Haim, M. Rapaport-Rom, and Shechter, M. "Environmental Amenities and Optimal Agricultural Land Use: The Case of Israel." Discussion Paper No. 9.08, The Hebrew University of Jerusalem: The Department of Agricultural Economics and Management, 2008.

Lavigno, B., J. Dorfman, B. Barnett, and J. Bergstrom. "Farmland and Preservation in Georgia: Three Possible Roads to Success." Working Paper, Dept. of Agr. and Applied Econ., University of Georgia, 2004

Lopez, R. A., M. A. Altobello, and F. A. Shah ""Amenity Benefits and Public Policy: An Application to the Connecticut Dairy Sector"." JAAE **26**(2): 12, 1994.

Mexal, J. G., E. A. Herrera, T. W. Sammis, and W. H. Sachritz (2003). Noncommensurable Values of the Pecan Industry, New Mexico State University.

Mohammed, I. "The Relationship Between Pecan Price and Cold Storage Inventories: A Seasonal Cointegration Approach" Ph.D. dissertation, University of Georgia, 2005

Okunade, A. A., and M. J. Cochran. "Functional Forms and Form-level Demand for Pecans by Variety." S. J. Agr. Econ. 23(2):95-102, 1991.

Peña, J. G., P. Rosson III, and F. J. Adcock. "U.S. Pecan Imports and Exports and the Effect on Trade." Texas A & M University, Extension Agricultural Economics Faculty Paper Series. March 6, 2001.

Plaut, T.R. "Urban Expansion and Loss of Farmland in the United States: Implications for the Future." *American Journal of Agricultural Economics* 62(August 1980): 537-48.

Ready, R. and C. Abdalla, C. "The amenity and disamenity impacts of Agriculture: Estimates from a hedonic pricing model." *American Journal of Agricultural Economics* 87(2):314–326, 2005.

Ready, R., M. Berger, and G. Blomquist, G. "Measuring amenity benefits from farmland: hedonic pricing vs. contingent valuation." *Growth and Change*, 28(1):43-58, 1997.

Rosengarten Jr, F. *Book of Edible Nuts*. Walker Publishing Co, Inc. 1984.

Shafer, C. E. "Price and Value Effects of Pecan Crop Forecasts, 1971-1987*." S. J. Agr. Econ*., 21(1):97- 103, 1989.

Swickard, K. "Analyzing Consumer Willingness to Pay for a Pecan Snack Product" M.S. Thesis, University of Georgia, 2005.

Taylor, S. *Pecans in Bakery Foods*. National Pecan Shellers Association Technical Bulletin No. 23(8), August 2001.

United States Department of Agriculture - National Agricultural Statistical Service, Washington DC, May 2005.

United States Census Bureau. "State and County Quickfacts." U.S. Census Bureau. February 2004. Available: http://quickfacts.census.gov/qfd/states/13000.html

United States Department of Agriculture - National Agricultural Statistical Service, Washington DC, October 2003.

U. S. Department of Agriculture – National Agricultural Statistics Service (USDA-NASS). 2002. "2002 Census of Agriculture." Internet site**: http://www.nass.usda.gov/census/census02 /volume1/us/st99_2_ 031_031.pdf.**

U. S. Department of Agriculture –National Agricultural Statistics Service. 2005. "Noncitrus Fruits and Nuts 2003 Preliminary Summary." Fr Nt 1-3 (05). January 2005, pp 70-72.

U. S. Department of Commerce- Bureau of census.

U.S. Department of Agriculture - Georgia Agricultural Statistics Service.

U.S. Department of Agriculture – Bureau of Economic Analysis.

Wells, G. J., S. E. Miller, and C. S. Thompson. "Farm Level Demand for Pecans Reconsidered." *S. J. Agr, Econ.*, 16(1):157-160, 1984.

Williams, F. W., M. G. LaPlante, and E. K, Heaton. "The Consumer Market for Pecans and Competing Nuts." *S. J. Agr. Econ.*, 4(1): 101-106.

Wood, B.W. " Price: Production Relationship and Production Characteristics of U.S. Pecan Industry." Proceedings of the 92nd Southeastern Pecan Growers Association Annual Convention, March 14-16, 2000, pp. 117-132.