Profitability of Irrigated Improved Pecan Orchards in the Southern Plains

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Abstract

The objective was to determine if an irrigated improved pecan orchard is economical relative to agronomic systems commonly implemented by producers that have access to irrigation. Results show that the improved pecan orchard is more profitable than competitive enterprises after a twenty year time frame, but is sensitive to pecan price, pecan yield and attitude toward risk.

Introduction

Pecan [*Carya illinoinensis (Wangenh.)C. Koch]* trees are native to the southern United States and northern Mexico and are the only large-scale commercially grown tree nut, native to North America (Cochran, 1961). The United States leads the world in production with over 385 million pounds produced in 2007 with an estimated U.S. $433 million in cash receipts (USDA-NASS 2009). According to the 2007 Agricultural Census, acreage in pecan production is higher than any other nut tree in the U.S., excluding almonds, with 581,809 acres being reported. In the interest of farm income diversification, there is a significant increase in U.S. farm and landowners establishing new pecan orchards. In fact, for the state of Oklahoma, there was a 24% increase in farms reporting pecan acreage between 2002 and 2007 (USDA-NASS 2007).

According to the 2007 census of agriculture, eighty-four percent of the United States' native pecan acreage and fifty-six percent of the United States' planted improved pecan acreage are found in the southern Plains region. This creates the question why does an area that lends itself to produce pecans naturally, not have an equivalent percentage of the nation's acres of improved pecans?

Native pecans naturally occur in the bottomland along the Mississippi River and its tributaries along with other hardwood tree species (Flack, 1970). On the other hand, almost all improved pecan trees exist in orchards that were planned and planted on a grid by agricultural producers.

While almost all production practices are similar for managing native pecan orchards and improved pecan orchards there is one central difference. This difference is the irrigation that is typically used in conjunction with improved pecan orchards. Irrigation is very important during establishment years and to ensure good yields with high quality throughout the entire production life of the orchard. Along with other management practices, irrigation is essential to help maintain consistent production, reducing the economic impact of alternate bearing. Alternate bearing is a major problem faced in pecan production and occurs when a large crop is followed by one or more years of low to no crop (Crane et al., 1934; Lockwood and Sparks, 1978; Sparks, 1974). Several studies have evaluated different causes of alternate bearing (Barnett and Mielke, 1981; Monselise and Goldschmidt, 1982; Sparks, 1974, 1975, 1979, 1986, 2000, 2003; Wood. 1991; Wood et al., 2004) however the cause has not yet been identified. Environmental conditions such as drought during the growing season (Hunter, 1963) and during kernel development (Alben, 1958; Sparks, 1992) have been observed to induce alternate bearing.

Even though improved pecan trees are alternate bearing, like native pecan trees, there is a price difference between native pecans and improved pecans. According to the National Agricultural Statistics Service, the five year average price (2005-2009) in Oklahoma for native pecans was $0.96 per pound while during the same time period improved pecan price averaged $1.61 per pound.

Objectives

The overall goal of the project is to help producers determine whether or not they should plant irrigated improved pecan orchards. Specifically, the objective is to determine if irrigated improved pecan orchards are economical relative to alternative production systems commonly implemented by producers in the region who have access to irrigation.

Data and Methods

A net present value (NPV) model was developed and used to determine the profitability of planting an irrigated improved pecan orchard. The net present value model for an investment is:

(1) $$NPV = \sum_{n=1}^{N} \frac{R_n}{(1+i)^n}$$

where *NPV* is the net present value of the investment, R_n are the annual net cash flows projected for the investment, i is the opportunity cost of the investor's financial capital and N is the length of the planning horizon.

Pecan trees produce pecans for over a century however, a twenty year time period was chosen for the model. This time frame was chosen to capture the establishment period and several years of full production. It was projected that after twenty years the irrigated improved pecan orchard would have recovered the orchards specialized startup costs and would have a higher NPV than other alternative enterprises. The chosen production activities maximize expected net return to land, owner labor, and management for a representative 100 acre farm.

Soybeans and wheat for grain were selected as the alternative enterprises. These two crops were selected for a couple of reasons. Soybeans and wheat for grain are commonly grown irrigated crops in the southern Plain region. In addition, cropland rental rates are double of pasture land according to Oklahoma State University Cooperate Extension Service 2010-2011 survey of pasture and cropland rental rates. Because of this information, lower profitable enterprises that utilize pastureland were not used for comparison.

Establishment data comes from a twenty-five acre irrigated improved pecan orchard established on a farm, in southern Oklahoma, owned by The Samuel Roberts Noble Foundation. Many production activities are associated with establishing an irrigated improved pecan orchard (Table 1). This establishment process takes approximately 17 months and includes a considerable amount of planning. The land is cleared for the orchard, an irrigation source and system are established and trees are planted. Once the trees are planted, shelters are placed around the trunk of each tree to protect the tree from herbicide and wildlife damage. Trees require substantial training and maintenance during the first five years to ensure a successful pecan planting.

Between the period of orchard establishment and the year machinery is needed to harvest the pecan crop there are three years. During this time, production activities (Table 2) are performed to ensure the trees come into production as soon as possible and are in good condition. Throughout this time period it is essential the trees receive all the proper nutrients, prevention from insect damage and control of competitive grasses.

Production data used was gleaned from agricultural producers that have producing irrigated improved pecan orchards that cooperate with The Samuel Roberts Noble Foundation in southern Oklahoma and northern Texas. The production activities that take place in the orchard from year five to year twenty are outlined in Table 3. The table shows the trees still need to have received all the proper nutrients, prevention from insect damage and reduced competition from grasses. Starting with year five preparations are made for harvest as well as harvesting of the orchard. The orchard floor has to be cleaned of any fallen limbs prior to harvest. After fruit clusters show over 80% shuck-split trees are shaken by a three point attachment on a tractor. Then an all terrain vehicle pulling a rake picks up any small limbs prior to a tractor pulling a harvester used to pick the pecans off the ground. The pecans are then dumped into a wagon where they are taken to be cleaned and put into sacks to be sold. Once the pecan trees come into production the pounds of pecans harvested per acre increases at an increasing rate until the eleventh year (Table 4). At this point the production of the orchard has reached the maximum yield per acre and the trees begin to noticeably show alternate bearing production. Alternate bearing is exhibited by a large yield of pecans one year followed by a considerably smaller yielding pecan crop. This cycle is typical for pecan trees.

Production and economic data for the alternative enterprises, soybeans and wheat for grain, were utilized from enterprise budgets developed by the Oklahoma State Cooperative Extension Service. Output prices for each of the commodities were obtain from National Agricultural Statistics Service (NASS) and used in their respective enterprise budgets. The price used in each budget was the average price for each commodity for the period of 2005 to 2009 (Table 5).

Results and Discussion

Establishment of the irrigated improved pecan orchard and specialized machinery create a large capital outlay that takes many years to recover. However, the twenty year NPV model shows that after eighteen years the irrigated improved pecan orchard is competitive against other agricultural enterprises such as soybeans and wheat for grain found in the southern Plains region (Table 6).

Scenario analyses were conducted to determine how price changes in all commodities and yield changes for improved pecans would change the NPV and thus the adoption of improved pecans by agricultural producers (Table 7). The results show that improved pecans continue to have the highest twenty year NPV when maximum and minimum commodity prices from 2005-2009 are used. When expected yields are dropped by ten percent for improved pecans while maintaining the same yield expectations for the comparison crops improved pecans have the highest twenty year NPV. The exception is when the minimum 2005-2009 prices are used for all commodities. Under this scenario soybeans have the highest twenty year NPV. When expected yields are dropped by twenty percent for improved pecans while maintaining the same yield expectations for the comparison crops improved pecans have the highest twenty year NPV only when the maximum 2005-2009 price is used for all commodities. When the average and minimum price is used under this twenty percent drop in yield expectation soybeans has the highest twenty year NPV.

This study looked at the NPV of improved pecans and other alternative irrigated crops over a twenty year period. Improved pecans continue to produce after year twenty for another eighty years or more. In the 19^{th} year of the analysis the irrigated improved pecan enterprise had a net return to land, owner labor, and management of $2,321 per acre while the 20^{th} year, the alternate bearing year had a return of $1,423 per acre. This is compared to soybeans return of $175 per acre and wheat of $36 per acre. Therefore, as more years are added to the NPV calculation improved pecans become more profitable compared to the crops of wheat for grain and soybeans by a larger margin each year.

The irrigated improved pecan orchard could be considered more risky than the comparison enterprises for several reasons. There are large negative cash flows that occur early in the orchards life that create a large capital outlay and improved pecans are not as common of a crop in the southern Plains region as wheat for grain and soybeans. As a result of being less common, there is less available information regarding production practices. It is necessary to have the ability to withstand negative cash flows for a ten year period and be willing to adapt new management practices as they are developed for this developing industry. These two things would be considered a barrier to entry. If these obstacles can be overcome, irrigated improved pecans grown in the southern Plains region can be more profitable than common crops such as wheat for grain and soybeans.

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Table 1. Irrigated Improved Pecan Orchard Production Activities during Establishment Period

Month	Production Activity
August	Soil Testing
	Lay Out Orchard (35 trees per acre)
	Well Drilling or Pond Building (5 gal per min per acre of trees)
Sept	Pre-Order Trees
	Prepare Land by ripping or plowing
Oct	Brush Removal
	Discing
	Leveling with Dozer
	Pump House Construction
	Survey and Mark Planting location
	Install irrigation system
	Herbicide Application (Roundup)
February	Plant trees on grid
	Attach tree shelters
March	Herbicide Application (Roundup)
April	Fertilizer Application (.4 lbs Zinc per acre)
	Insecticide Application (Sevin)
	Fertilizer Application (.4 lbs Zinc per acre)
	Herbicide Application (Roundup)
May	Fertilizer Application (.4 lbs Zinc per acre)
	Fertilizer Application (.4 lbs Zinc per acre)
	Herbicide Application (Roundup)
June	Fertilizer Application (.4 lbs Zinc per acre)
	Insecticide Application (Sevin)
	Fertilizer Application (.4 lbs Zinc per acre)
	Herbicide Application (Roundup)
July	Fertilizer Application (.4 lbs Zinc per acre)
	Fertilizer Application (.4 lbs Zinc per acre)
	Herbicide Application (Roundup)
	Rotary Mow Orchard
August	Rotary Mow Orchard
December	Prune Trees to Train

Table 2. Irrigated Improved Pecan Orchard Production Activities during Years 2 - 4

Month	**Production Activity**
February	Fertilizer Application (100 lbs Urea per acre)
March	Herbicide Application (Roundup)
April	Fertilizer Application (.4 lbs Zinc per acre)
	Insecticide Application (Sevin)
	Fertilizer Application (.4 lbs Zinc per acre)
	Herbicide Application (Roundup)
May	Fertilizer Application (.4 lbs Zinc per acre)
	Fertilizer Application (.4 lbs Zinc per acre)
	Herbicide Application (Roundup)
June	Fertilizer Application (.4 lbs Zinc per acre)
	Insecticide Application (Sevin)
	Fertilizer Application (.4 lbs Zinc per acre)
	Herbicide Application (Roundup)
July	Fertilizer Application (.4 lbs Zinc per acre)
	Fertilizer Application (.4 lbs Zinc per acre)
	Herbicide Application (Roundup)
	Rotary Mow Orchard
August	Rotary Mow Orchard
November	Hand Harvest Pecans (Year 4)
December	Prune Trees to Train

Table 3. Irrigated Improved Pecan Orchard Production Activities during Years 5-20

Month	**Production Activity**
January	Purchase Harvesting Equipment (Year 5)
	Thin Away 1/3 of Trees (Year 18)
February	Fertilizer Application (100 lbs Urea per acre)
March	Herbicide Application (Roundup)
April	Fertilizer Application (6 lbs Zinc per acre)
	Herbicide Application (Roundup)
May	Fertilizer Application (6 lbs Zinc per acre)
	Herbicide Application (Roundup)
June	Herbicide Application (Roundup)
	Fertilizer Application (6 lbs Zinc per acre)
	Insecticide Application (Intrepid)
July	Herbicide Application (Roundup)
	Rotary Mow Orchard
August	Insecticide Application (Warrior)
	Insecticide Application (Warrior)
	Rotary Mow Orchard
October	Tractor Rake Debris
November	Shake Trees
	ATV Rake
	Run Harvesters
	Field Cleaner
	Take Pecans to Cleaner in Super Sacks

Table 4. Irrigated Improved Pecan Orchard Production Activities during Years 5-20

Year	Yield in Pounds per Acre
1	
2	
3	
4	30
5	121
6	241
7	362
8	482
9	603
10	723
11	964
12	1,300
13	1,700
14	1,300
15	1,700
16	1,300
17	1,700
18	1,300
19	1,700
20	1,300

Table 5. Commodity Prices from 2005-2009

	Enterprise		
Output Price	Improved Pecans	Soybeans	Wheat for Grain
Maximum	$1.90	$10.00	$6.93
Average	$1.61	$8.05	$5.23
Minimum	$1.35	$5.45	$3.39

Table 6. Net Present Value for Selected Agricultural Enterprises from 2010 to 2029 Using Average Commodity Yields & Average Commodity Output Prices

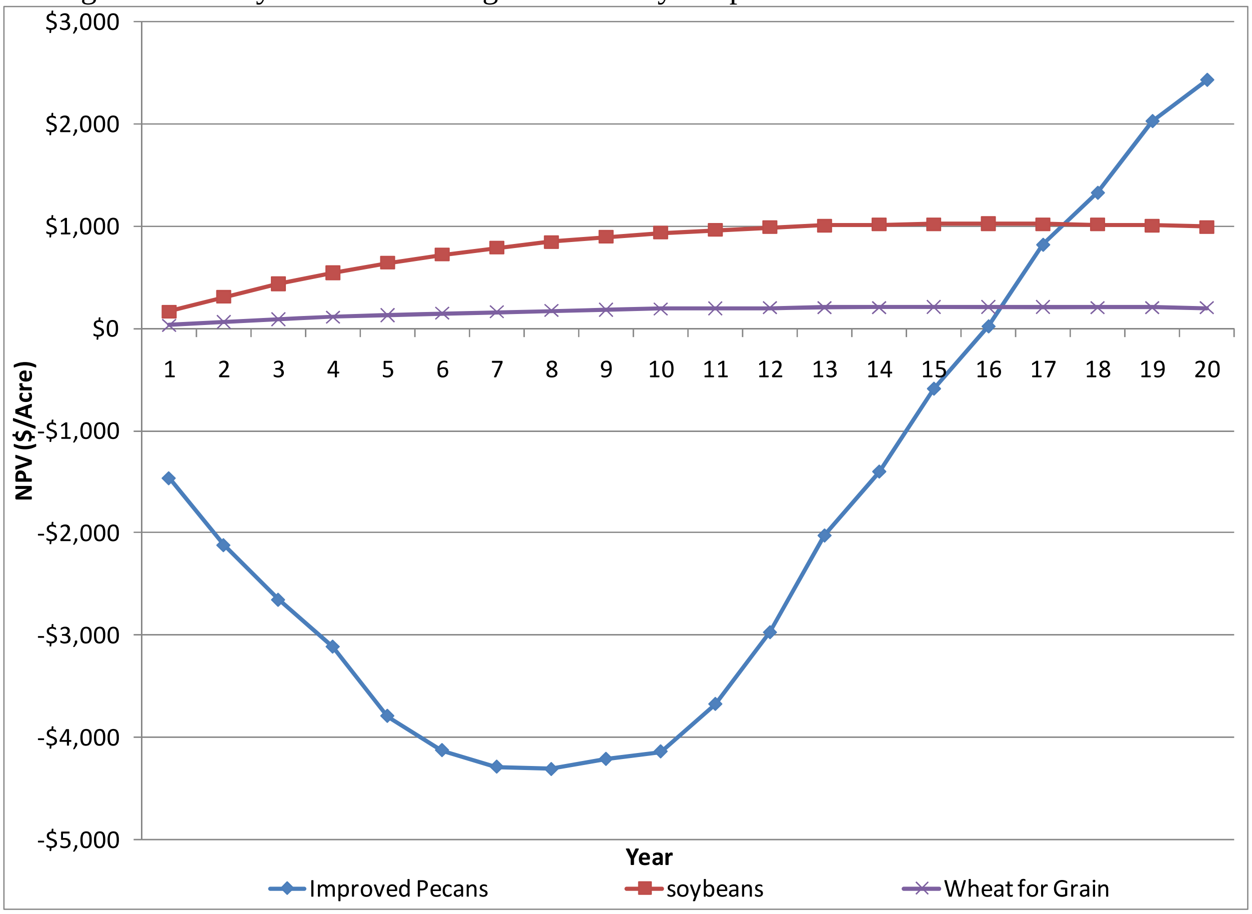

Table 7. Net Present Value for a Twenty Year Period Given Changes in Yield & Price

		Enterprise		
Pecan Yield	Output Price	Improved Pecans	Soybeans	Wheat for Grain
Average	Maximum	$4,443	$1,659	$ 878
Average	Average	$2,433	$ 994	$ 202
Average	Minimum	$ 632	$ 109	-$ 529
10% < Average	Maximum	$3,126	$1,659	$ 878
10% < Average	Average	$1,318	$ 994	$ 202
10% < Average	Minimum	-$ 303	$ 109	-$ 529
20% < Average	Maximum	$1,810	$1,659	$ 878
20% < Average	Average	$ 202	$ 994	$ 202
20% < Average	Minimum	-$1,239	$ 109	-$ 529