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Weed Control Increases Yield and Economic Returns from Young 'Desirable' Pecan Trees

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Abstract. Yields and economic returns above treatment variable costs were determined for young 'Desirable' pecan [*Carya illinoinensis* (Wangenh.) C. Koch] trees grown for nine seasons under ten combinations of orchard floor management practice and irrigation. Orchard floor management practices were 1) no weed control, 2) mowed, 3) total weed control with herbicides, 4) grass control only with herbicides, or 5) disking, and trees were either irrigated or nonirrigated. Total weed control with herbicides increased cumulative yield through the ninth growing season by 358% compared to no weed control. In the humid environment where this experiment was conducted, irrigation did not increase crop value obtained from the young trees, except for 1 year. At the end of the ninth season, total weed control with herbicides was the only treatment to have a positive net present value. These data indicate that establishment costs for young 'Desirable' pecan trees can be recovered as early as the eighth growing season if competition from weeds is totally eliminated.

Weed competition can reduce growth (Norton and Storey, 1970; Patterson et al., 1990; Smith et al., 1960), yield (Patterson and Goff, 1994), and nut quality (Daniell, 1974; Norton et al., 1970) in pecan. These effects have been attributed to competition of weeds, especially perennial grasses, for moisture and nutrients (Goff et al., 1991; Norton, 1970; Smith et al., 1960; Ware and Johnson, 1957, 1958). Several herbicides have been identified as effective in controlling weeds in pecan orchards (Aitken, 1974; Arnold and Aldrich, 1980; Daniell and Hawf, 1985; Norton et al., 1970; McEachern and Storey, 1984; Norton and Storey, 1970), and weed control recommendations are generally available. The benefits from improved weed control have not been fully established with regard to the economic feasibility of the various weed control practices. The primary purpose of this experiment was to establish the crop value from young 'Desirable' pecan trees grown under various weed control practices and to compare crop value to variable costs of treatment. These values could then be used to provide a basis for making objective recommendations to commercial pecan growers regarding the most economically viable and cost-effective weed control practice. An additional purpose was to evaluate weed control practice as it interacts with irrigation in a humid climate and to examine cost-effectiveness in this environment of irrigation on young pecan trees.

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Materials and Methods

'Desirable' pecan trees were planted in Feb. 1986 on a 9.1 × 10.7-m spacing. Trees were barerooted, whip-grafted, and 1.5 to 1.8 m tall at planting. The experiment was conducted at the Gulf Coast Substation at Fairhope in southwestern Alabama on a Malbis fine sandy loam (Fine loamy siliceous, thermic Plinthic Paleudults). The experimental area was infested with large crabgrass [*Digitaria sanguinalis*, (L.) Scop.], common bermudagrass [*Cynodon dactylon* (L.) Pers.], yellow nutsedge (*Cyperus esculentus* L.), pitted morningglory (*Ipomoea lacunosa* L.), prickly sida (*Sida spinosa* L.), horseweed [*Conyza canadensis* (L.) Cronq.], Carolina geranium (*Geranium carolinianum* L.), henbit (*Lamium amplexicaule* L.), cutleaf eveningprimrose (*Oenothera laciniata* Hill), and tall ironweed (*Veronica altissima* Nutt). Moderate to high populations of large crabgrass, common bermudagrass, and yellow nutsedge were present at planting. Lime and fertilizer were applied and incorporated before planting based on soil analysis. Subsequent postplant fertilizer and lime applications were uniformly applied to all plots based on composite leaf and soil samples taken in July to determine the following season's application, according to established recommendations (O'Barr et al., 1989). With regard to the treatments we are considering, the experimental design was a split plot with whole plots in a randomized complete-block design (RCBD). The whole-plot treatment factor was two levels of irrigation (irrigated or nonirrigated) assigned randomly to rows within each of four blocks. The rows were split into single-tree subplots, to which the subplot treatments were randomly assigned. The subplot treatments were five levels of orchard floor management practice. The orchard floor management practices were no weed control, mowing, total weed control with herbicides, grass control only with selective herbicides, and disking. Tree circumference was measured at planting and trees of similar size were blocked to reduce variability. The entire data set was analyzed with the GLM procedure (SAS Institute, Cary, N.C.) as a split-plot design, with years treated independently. Selected single-degree-of-freedom contrasts were completed along with a least significant difference (LSD) mean separation. Statistical significance was determined with a p value of 0.05.

Mowing and disking were performed during the growing season on a 2- and 4-week schedule, respectively. The total weed control with herbicides plots had the following treatments applied. The first growing season, a postemergence application of 1,1'-dimethyl-4,4'-bipyridinium ion (paraquat) and a preemergence application of 4-(dipropylamino)-3,5-dinitrobenzenesulfonamide (oryzalin) was applied in March at a rate of 0.7 and 2.2 kg a.i./ha, respectively. This application was followed with one application of *N*-(phosphonomethyl)glycine (glyphosate) at a rate of 3.4 kg a.i./ha in June. In September, another postemergence application of glyphosate at 0.7 kg a.i./ha was applied along, with a preemergence application of 4-chloro-5-(methylamino)-2-(3-(trifluoromethyl)phenyl)-3(2*H*)-pyridazinone (norflurazon) at a rate of 2.7 kg a.i./ha. During the second growing season, a preemergence application of 6-chloro-*N*,*N*'-diethyl-1,3,5-triazine-2,4-diamine (simazine) and oryzalin was applied in April at a rate of 2.8 and 2.2 kg a.i./ha, respectively. This was followed by a postemergence application of glyphosate at a rate of 3.4 kg a.i./ha in June. In September, a postemergence application of paraquat and a preemergence application of norflurazon were applied at a rate of 1.4 and 3.4 kg a.i./ha, respectively. The third through fifth years, oryzalin, simazine, and paraquat were applied in April at a rate of 2.2, 2.2, and 1.1 kg a.i./ha, respectively. This was followed by an application of glyphosate at a rate of 2.2 kg a.i./ha in May and an application of paraquat at a rate of 1.1 kg a.i./ha in July. Norflurazon and paraquat were applied in September at a rate of 3.4 and 0.7 kg a.i./ha, respectively. In the sixth season and thereafter, the total weed control with herbicides plots received *N*'-(3,4-dichlorophenyl)-*N*,*N*-dimethylurea (diuron) at a rate of 3.4 kg a.i./ha in place of simazine at the April preemergence application.

During the first through fourth years, the grass control only with herbicides plots received an application of oryzalin and butyl(R)-2[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoate (fluazifop-P-butyl) at a rate of 2.2 and 0.22 kg a.i./ha in April. This was followed with an application of fluazifop-P-butyl at a rate of 0.22 kg a.i./ha in July. In the fifth season and thereafter, the grass control only with herbicides plots received an application of 2-[1-(ethoxyimino)butyl]5-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one (sethoxydim), in place of the fluazifop-butyl, at a rate of 0.28 kg a.i/ha in April and July.

All herbicides were applied with a tractor-mounted boom-type sprayer using CO_2 as the propellant and delivering a carrier volume of 140 $L \cdot ha^{-1}$. All weed control treatments were initially confined to a 3 × 3-m area around the trees. In 1992, this was expanded to a 4 × 4-m area due to increase in tree size.

Irrigation was achieved with a drip irrigation system using five emitters per tree; each emitter delivered 3.8 $L \cdot h^{-1}$. Irrigation was applied daily during the growing season, except for any 4 days following a rain of 1.27 cm or more. Irrigation scheduling was based on monthly historical pan evaporation (PE) rates in the southeastern United States (Daniell, 1989). Based on the average PE for the given time frame, the irrigation system was run for the recommended time to replace 70% of the PE rate (Daniell, 1989.) All treatments were initiated in March 1986, at planting, and were maintained for the duration of this experiment. Other management practices, including pest control, were applied as normally recommended for commercial pecan orchards (Goff, 1989; McVay et al., 1991). In 1989, when trees first began bearing, pecans were harvested, dried to a kernel moisture content of 5% to 6%, weighed, and graded according to commercial grading standards (Driggers, 1989). Percentages of kernels in four classifications—#1, #2, #3, and reject—were determined, and the percentage in #1, #2, and #3 was summed to give total percent edible kernel. In-shell nut weight was also determined. Pecan samples and grading information, separate for each treatment and replication, were taken to a commercial pecan buyer, who established a market price based on this information. The assumption was that the pecans would be sold in wholesale commercial lots on the date we could have delivered them to market. Quoted prices were used in economic analyses. Treatment effects on yield and price were analyzed using analysis of variance and preselected contrasts of interest (Mize and Schultz, 1985).

Economic analysis. For economic analyses, treatment costs were calculated using average farm-distributor prices for chemicals, determined by using average costs from a telephone survey of three vendors at the beginning of each season. Variable application costs were determined, separately for each treatment, from extension service machinery cost tables, using equipment normally used by farmers for comparable operations (Westberry et al., 1992). Irrigation costs were also determined using extension service budgets (Westberry et al., 1992). In addition, herbicide treated areas were assumed to be 3-m wide strips down the entire row for the first 6 years. This was increased to 4-m wide strips for years 7 and thereafter due to growth of trees.

Economic effects of treatments were evaluated using Net Present Value (NPV) analysis. NPV analysis allows comparison of different income streams based on prevailing interest rates and inflation. The concept is that the difference in the value of a dollar now versus a dollar in the future depends on the rate of inflation expected, the prevailing interest rate, and the amount of time difference. For example, given a 5% rate of inflation and 5% interest, one dollar to be paid in a year would presently be worth only 90 cents. NPV analysis was used to account for effects of inflation and to allow for differences in cash flow between treatments to be reflected in the outstanding balance on a line of credit typically used to finance the establishment of a pecan orchard. Thus, treatments that resulted in early yield reduced loan balances earlier and avoided interest expenses. The credit line balance after 9 years is used in our evaluations.

Table 1. Estimated cost per hectare used for determination of debt.

Item	Amount
Cost of land	$1976
Long-term interest rate	10.0%
Long-term inflation rate	4.0%
Annual constant costs years 2–4	$312
Annual constant costs years 5–9	$490
Annual fixed costs	$371
Annual irrigation variable cost	$99
Annual irrigation fixed cost	$173
Establishment total cost	$1729
Minimum harvest quantity	112 $kg \cdot ha^{-1}$
Custom harvest rate	$0.55/kg

For economic analysis, we assumed annual inflation to remain low, at 4%. We assumed a long-term interest rates of 10% and a modest land cost of $1976/ha. Annual fixed and operating costs are listed in Table 1.

Results and Discussion

Yield and price received. Cumulative yield through the ninth growing season after planting was significantly affected by the orchard floor management practices, but was unaffected by irrigation (Table 2). Since there was no significant orchard floor management practice × irrigation interaction at this orchard site, main effects only were examined for cumulative yield. However, in 1991, an irrigation × treatment interaction was observed, with higher yields for the irrigated treatments ($P < 0.0428$) (Table 3). Total weed control with herbicides plots resulted in cumulative yields of 4584 $kg \cdot ha^{-1}$ of pecans, 358% higher than yields from trees with no weed control (1279 $kg \cdot ha^{-1}$) (Table 2). Cumulative yields from the total weed control with herbicides treatment were significantly higher than any other treatment. Disking resulted in the next highest yield with 3299 $kg \cdot ha^{-1}$ of pecans, significantly better than grass control only with herbicides (2003 $kg \cdot ha^{-1}$), no weed control (1279 $kg \cdot ha^{-1}$), or mowing (1725 $kg \cdot ha^{-1}$).

The lack of response to irrigation at this site was unexpected. Rainfall data is presented in Table 4. A drought occurred in 1990, with April–October rainfall being the lowest of any year in the experiment (Table 4). The response to the 1990 drought was seen in 1991, with reduced yields in 1991 from the nonirrigated trees (Tables 3 and 5). However, the drought of 1992 did not produce an irrigation response in 1993 (Table 2). This can be partially explained by the rainfall patterns in 1990 and 1992. In 1990, only 9 cm of rain fell in the nut filling stage (August–September) (Table 4), a time associated with high water demand. Conversely, in 1992 during the same period, 19 cm of rain fell (Table 4). In addition, November rainfall in 1992 was 30 cm compared to just 5 cm in 1990 (data not shown). The case can be made that the adequate rainfall amounts in late Fall 1992 allowed trees to continue to conduct photosynthesis and store needed reserve carbohydrates, which are critical for a return crop in pecans (Smith et al., 1986; Sparks, 1974; Wood, 1989).

Yearly comparisons showed similar trends to the cumulative data. In all years except for 1991, no response to irrigation was observed (Table 2). From 1989–90 and 1992–94, the total weed control with herbicides plots had higher yields and value/ha. In 1991, the irrigated and nonirrigated plots showed a similar trend. Trees in the irrigated plots with total weed control or disking had higher yields and values/ha compared to all other treatments (Table 5). The nonirrigated plots had higher yields and values/ha for the total weed control with herbicide plots compared to all other treatments (Table 5). No quality differences were observed for the irrigated or nonirrigated treatments in 1991 (Tables 3 and 5).

Contrasts comparing treatment effects on yield, price, and crop value (Table 2) help to explain how the effects occurred. The most obvious effect was that yield, and consequently crop value, was much lower in those treatments where weeds were present. The weeds vs. no weeds contrast is a pooling of those treatments where

Table 2. Effects of orchard floor management practice on yield and crop vlue of 'Desirable' pecan trees in selected years[z].

Orchard floor management practice	1989[y] Yield Kg/Ha	1989[y] Price $/Kg	1989[y] Value $/Ha	1990 Yield Kg/Ha	1990 Price $/Kg	1990 Value $/Ha	1992 Yield Kg/Ha	1992 Price $/Kg	1992 Value $/Ha	1993 Yield Kg/Ha	1993 Price $/Kg	1993 Value $/Ha	1994 Yield Kg/Ha	1994 Price $/Kg	1994 Value $/Ha	Cumulative Yield Kg/Ha	Cumulative Price $/Kg	Cumulative Value $/Ha
No weed control[x]	0b	0.00c	0.00b	35c	1.83	90c	289c	3.35	1110c	691c	1.92	1503c	200	0.68	147	1279c	1.74	3049c
Mowing	1b	0.25bc	0.93b	32c	1.80	80c	429c	3.40	1660c	934c	1.84	2002c	260	0.95	305	1725c	1.83	4271c
Total control with herbicides	19a	1.66a	35.23a	242a	2.15	599a	1540a	3.86	5968a	2039a	2.13	4355a	383	0.80	323	4584a	2.26	12366a
Grass control with herbicides	2b	0.27bc	3.79b	82bc	2.54	216bc	465c	3.83	1862c	1081bc	2.08	2278bc	267	0.61	180	2003c	2.08	4883c
Disking	6b	0.76b	11.45b	176ab	2.52	451ab	1026b	3.66	3921b	1493b	2.05	3122b	291	1.13	277	3299b	2.19	8716b
Significance of preselected contrasts of treatment effects: P>F																		
Treatment	.0001	.0006	.0001	.0024	.3754	.0041	.0001	.7375	.0001	.0001	.8060	.0001	.2352	.2024	.2675	.0001	.2923	.0001
Irrigation vs. no irrigation	.2658	.5008	.2807	.6565	.3307	.7398	.0636	.5148	.0908	.2547	.2931	.3577	.1870	.5180	.1261	.0930	.5091	.1332
Irrigation * treatment	.4117	.5126	.4009	.2685	.9243	.2500	.4148	.4473	.5900	.7729	.4146	.5868	.7338	.2162	.6775	.5083	.6946	.4175
Weeds vs. no weeds	.0001	.0001	.0001	.0002	.3782	.0003	.0001	.4495	.0001	.0001	.4215	.0001	.0686	.1615	.1542	.0001	.0697	.0001
Mowing vs no weed control	.8726	.4808	.8691	.9543	.9548	.9438	.3735	.9087	.4021	.2820	.7775	.3294	.4460	.2702	.1056	.3529	.7510	.3641
Herbicides vs no herbicides	.0002	.0101	.0003	.0314	.3592	.0412	.0003	.2327	.0005	.0012	.3364	.0004	.1449	.1603	.8863	.0006	.1797	.0008
Grass control with herbicides vs total control with herbicides	.0001	.0006	.0001	.0078	.4233	.0137	.0001	.9356	.0001	.0002	.8638	.0004	.1455	.4280	.1408	.0001	.5309	.0001
Grass control with herbicides vs mowing	.6602	.9491	.6116	.3519	.1390	.3528	.8146	.3824	.7562	.5177	.3733	.5871	.9255	.1597	.1962	.5612	.3766	.6475

[z]Data from 1991 not shown due to a treatment * irrigation interaction (P<.0428) (Table 3).

[y]LSD, where P<0.05, note: no letters indicates that no difference was observed.

[x]No yield prior to 1989 from any treatment.

Table 3. Analysis of variance for yields and grades of young pecan trees in 1991.

Orchard management	Yield (kg·ha^{-1})	Price ($/kg)	Value ($/ha)	Kernel (%)	Nuts (no./kg)
			Significance		
Treatment	0.0001	0.6539	0.0001	0.4976	0.6851
Irrigation vs. no irrigation	0.0428	0.6398	0.0366	0.3350	0.4257
Irrigation × treatment	0.0109	0.3528	0.0340	0.8917	0.9607

weeds were present (no weed control, grass control only with herbicides, and mowing) compared with those treatments where weeds were not present (total weed control with herbicides and disking). The contrast was highly significant from 1989–90 and from 1992–93 in yield and crop value (Table 2). In 1994, the no weeds grouping was higher but not significant at the 5% level ($P = 0.0686$). In 1991, an irrigation interaction was observed so the contrast was inestimable. Mowing vs. no weed control showed no differences, nor did the comparison of grass control with herbicides to mowing (Table 2). The grass control with herbicides treatment compared to the total control with herbicides treatment showed a difference for all years, except 1994, for yield and value/ha (Tables 2 and 5). Use of herbicides significantly improved yield compared to treatments where herbicides were not used (Table 2). This suggests that any possible phytotoxic negative effect from herbicide use was overridden by the positive effect from weed control. These contrasts illustrate that total elimination of weed competition resulted in greatly enhanced yields.

Price was unaffected by irrigation or orchard floor management for the cumulative or the yearly data except for 1989, which was the first year of any yields (Tables 2 and 3). The major effect that improved crop value was the increase in yield of young trees where weeds were controlled, not an increase in quality. Patterson et al. (1990) reported effects from this experiment on tree growth. The order of the orchard floor management practices in increasing growth was total > disking > grass control only > mowing = no weed control. This ranking is very similar to the ranking of treatments with regard to cumulative yield (Table 2). The similar-

Table 4. Rainfall received by year, month, total, longest drought, and pan evaporation (PE) during drought period at Gulf Coast Experiment Station, Fairhope, Alabama.

Year	April	May	June	July	Aug.	Sept.	Oct.	Total Apr.-Oct.	Longest drought (d)^z	Avg. daily PE during drought (cm·d^{-1})
1986	8.5	13.6	14.1	10.1	12.7	7.8	15.0	83	27	0.58
1987	1.6	31.4	39.6	13.1	31.7	6.1	0.6	124	47	0.48
1988	9.4	0.9	15.0	12.2	33.5	40.9	5.0	117	32	0.56
1989	7.3	17.8	47.0	22.7	5.5	11.4	5.8	117	17	0.51
1990	6.3	12.6	15.8	14.8	5.1	4.2	7.3	66	29	0.69
1991	23.1	34.9	16.8	21.9	17.1	7.9	5.8	128	20	0.47
1992	6.9	6.1	11.7	12.8	15.8	3.7	9.8	67	35	0.68
1993	6.5	14.8	8.6	20.5	19.2	12.7	13.5	96	32	0.61
1994	12.0	7.3	18.6	27.8	16.5	3.7	14.9	101	23	0.58

^{z}Number of days during the growing season (April–October) that daily rainfall totaled 0.58 cm or less.

Table 5. Effects of irrigation and orchard floor management practices on yield, price, value, and grades of young pecan trees in 1991.

	Irrigated^z					Nonirrigated				
Orchard management	Yield (kg·ha^{-1})	Price ($/kg)	Value ($/ha)	Kernel (%)	Nuts (no./kg)	Yield (kg·ha^{-1})	Price ($/kg)	Value ($/ha)	Kernel (%)	Nuts (no./kg)
No control	86 b	2.32	261 b	47	145	42 b	3.01	136 b	48	147
Mowing	57 b	3.16	178 b	48	135	85 b	2.32	269 b	49	134
Total control with herbicides	436 a	2.92	1280 a	46	137	286 a	3.01	894 a	47	139
Grass control with herbicides	137 b	2.98	436 b	48	140	74 b	3.35	249 b	51	139
Disking	453 a	3.04	1371 a	48	139	163 b	3.04	495 ab	48	148
					Significance					
Treatment	0.0001	0.5616	0.0002	0.7911	0.6820	0.0062	0.4449	0.0165	0.5981	0.8767
Weeds vs. no weeds	0.0001	0.6498	0.0001	0.7264	0.6433	0.0009	0.7007	0.0028	0.3195	0.7363
Mowing vs. no mowing	0.6580	0.1366	0.7116	0.5125	0.1730	0.4548	0.2192	0.5091	0.6989	0.5097
Herbicides vs. no herbicides	0.0552	0.7752	0.0975	0.5574	0.7970	0.0382	0.2837	0.0535	0.6580	0.5747
Grass control with herbicides vs. total control with herbicides	0.0005	0.9004	0.0023	0.4287	0.6744	0.0025	0.5437	0.0066	0.1470	0.9863
Grass control with herbicides vs. mowing	0.2342	0.7426	0.2626	0.7999	0.4531	0.8541	0.0788	0.9202	0.4774	0.8914

^{z}LSD, where $P < 0.05$; note: no letters indicates that no difference was observed.

Table 6. Financial summary, cumulative debt per hectare[z].

Year	No weed control	Mowing	Total weed control with herbicides	Grass control only with herbicides	Disking
			Irrigated		
1989	4743	4781	4839	4782	4773
1990	5642	5721	5338	5723	5165
1991	6577	6699	5310	6356	4940
1992	6109	6225	880	5577	1557
1993	5390	5623	–1398	4879	–489
1994	6308	6382	–803	5779	25
			Nonirrigated		
1989	4563	4601	4659	4602	4594
1990	5455	5534	5044	5290	5518
1991	6383	6505	5340	6251	6059
1992	6445	5549	1240	5871	4683
1993	6305	4618	–1430	5071	3773
1994	7197	5471	–699	6058	4526

[z]A negative numeral indicates a positive net present value (NPV); conversely, a positive numeral indicates amount of debt acquired per hectare.

ity of results with tree growth and with yield suggests a strong positive correlation of growth with early yields. It would appear that those treatments encouraging strong early growth encouraged earlier formation of large fruit-bearing surfaces and resulted in higher early production. We saw no evidence of excessive growth encouraging vegetativeness and delaying production. On the contrary, the strongest-growing trees had the highest yields.

Nut quality. No differences in quality as measured by percentage kernel and number of nuts per kilogram were observed in this study for irrigation or treatment effects (data not shown). In 1991, a yield response was observed but no quality differences were seen (Table 3).

Economic results. Cumulative debt was modeled for commercial sized orchards following each estimated treatment variable (Table 1). Actual treatment costs were subtracted from gross returns less harvest costs for each year pecans were produced in harvestable quantities (112 $kg \cdot ha^{-1}$).

Nonirrigated plots. Results were that cumulative debt was lowest overall for the nonirrigated in comparison to irrigated treatments (data not shown). Only the total weed control with herbicides treatment had a positive net present value at the end of the ninth growing season, 1994 (Table 6). In fact, it generated enough income to have a net present value of $1430/ha in 1993. Conversely, in 1994, all other treatments had higher cumulative debts, with the no weed control plots having a debt of $7197/ha. The disking treatment had a lower cumulative debt than the no weed control (Table 6). The grass control only with herbicides and mowing treatments had cumulative debts $1200 to $1700/ha lower than the no weed control plots.

Irrigated plots. Results under irrigated conditions were similar (Table 6). However, two treatments resulted in positive net present value by the end of the experiment. Although initial investment was higher under irrigation, as well as annual expenses other than weed control treatments, ending debt levels for all treatments were lower than under dryland conditions. Under irrigation, total cumulative debt in the absence of weed control was about $900/ha less than without irrigation (data not shown). However, under irrigation, weed control by mowing and grass control only with herbicides treatments did not provide a significant financial advantage. Total weed control with herbicides provided the highest net present value of the investment, although it was not significantly higher than the same treatment without irrigation (data not shown). Disking under irrigation also provided a significantly higher return than other treatments, although not so great a return as the total weed control with herbicides treatment (Table 6).

Results from this 9-year study indicate that a total reduction in weed competition can lead to increased yields and returns on investment in as few as 8 years under these conditions. These results were observed with a nonprecocious cultivar. It could be assumed that a highly precocious cultivar, used as a temporary tree, could be expected to have a greater impact on reducing the time for economic return on investment in young pecan trees.

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