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BENEFITS OF GOOD ORCHARD FLOOR MANAGEMENT ON THE GROWTH AND PRODUCTION OF YOUNG PECAN TREES IN THE SOUTHEAST

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ABSTRACT

Pecan, *Carya illinoensis* Wang. K. Koch 'Desirable', trees planted in 1986 and subjected to different orchard floor management regimes both with and without irrigation were measured yearly for growth and yield. Trees receiving total chemical weed control grew larger and cummulatively produced approximately four times as many pecans by the 8th leaf as compared to weed infested trees (4243 vs 1086 kg/ha). Irrigation increased growth in 6 of 8 years but only increased yield in 1 of 4 years in an area of relatively high rainfall. Trees which were weedy for the first 2 or 3 years and then rotated to total chemical weed control or trees which were weedfree for the first 2 or 3 years and then allowed to go weedy produced intermediate yields compared to the extremes of total chemical weed control continuously or no weed control continuously.

INTRODUCTION

Pecan orchard floor management has evolved over the years to arrive at the current sod-strip system used by many growers in the Southeastern U.S. This method calls for a relatively weedfree strip in the tree row and a sod roadway between rows which is maintained for sprayer traffic (Alabama Coop. Ext. Ser. 1993, Worley 1989). The weedfree strip can vary in width the grower wants to invest in weed control. A strip one to two meters on either side of the tree is commonly used. Several heribicides are registered for use in pecan orchards which, when used in combination, can provide complete weed control under pecan trees.

Until recently, the effects of weeds on young pecan tree growth and yield was not known. Research conducted in Alabama over the past 8 years documents the adverse effects of letting weeds, especially grasses, grow uncontrolled around newly planted pecans (Patterson, et al. 1990, Patterson and Goff 1994). Tree growth and yield were decreased significantly if weeds were not controlled around newly planted trees through the 8th leaf and possibly longer. Nutrient deficiencies have been found in pecan leaves from trees which have not received adequate weed control, even though the recommended amounts of fertilizer and lime were applied each year (Goff et al. 1991). Mechanical weed control, i.e. disking, was effective when the trees were irrigated, but inadequate when trees were not irrigated due to the soil drying influence of tillage (Patterson, et al. 1990). Mowing has not been effective since grasses, especially perennial grasses, are not controlled and continue to rob the tree of nutrients and water.

Low growing weeds like bermudagrass, *Cynodon dactylon* (L.) Pers., also influence the growth of young peach, *Prunus persica* L., trees (Weller et al. 1985). Weeds decrease both growth and yield of youngs pecans, but it is not known if weed control must be maintained from planting onward, or if control can be reduced at a point when the trees are well established. Continuing work in Alabama will help answer some of these questions.

METHODS AND MATERIALS

Pecan trees, cultivar Desirable, were planted at the Alabama Agricultural Experiment Station, Fairhope, Alabama in February 1986 and subjected to different weed management and irrigation regimes. Five weed management regimes consisted of 1) 'total' complete weed control with registered herbicides, 2) disking once monthly, 3) mowing twice per month, 4) grass control only with selective herbicides, and 5) none. Weed control treatments were applied to a 3- by 3-m area centered on the tree during the first 5 years of the study. This area was expanded to a 4- by 4-m area starting in 1991. One half the trees in this study were irrigated using five emitters per tree, each emitter delivering 3.8 L per hr, and operated when no rainfall had been received after a 4-day period (Curtis et al. 1986). All combinations of weed management regimes and irrigation (irrigated or not) were represented in a factorial arrangement using a randomized complete block design with four single tree replicates. Weed species infesting the study included bermurdagrass, yellow nutsedge (*Cyperus esculentus* L.), prickly sida (*Sida spinosa* L.), and several other species (Patterson et al. 1990). Herbicides used in obtaining the total chemical and grass control only treatments included oryzalin, norflurazon, fluazifop, simazine, diruon, and glyphosate. Soil fertility, pH, disease and insect control, and pruning were maintained for optimum pecan production.

In the original study design, additional trees were planted and subjected to the above treatments in order to allow rotation of weed management regimes after 2 and 3 yrs. While the basic weed management treatments have been used continuously since planting on one group of trees, additional trees which received the 'total' weed control regime for the first 2 or 3 yrs were rotated to the none (no control) regime. Likewise, trees which received the none

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regime for the first 2 or 3 yrs were rotated to the 'total' weed control regime. These rotational or "flip-flop" treatments were installed to determine if a grower could delay weed control practices for the first 2 or 3 yrs or discontinue weed control after the first 2 or 3 yrs without adverse effects. Irrigation was discontinued after the 1992 growing season, leaving the study with only one irrigation variable. Fairhope receives an average of 175 cm rainfall per year.

Data collected included tree stem diameter 65 cm above ground measured at planting in February 1986 and yearly thereafter and nut production starting in 1990.

RESULTS AND DISCUSSION

Cummulative tree growth during the first 4 yrs of the study was rapid for all treatments (Table 1). Trees receiving orchard floor management regimes of total chemical control or disking grew larger than trees receiving mowing, grass control only, or no control in each year except the year of establishment (Table 1). Mowing was no better than no control as perennial grasses were not killed by this treatment and continued to regrow after mowing. Irrigation increased overall growth in each year except the year of establishment. Within each irrigation regime, total weed control was worth at least one years growth compared to the no weed control trees.

Cummulative tree growth by treatment slowed and equilibrated once trees began bearing in 1990, but the size difference between treatments obtained in the first 4 yrs remained (Table 2). Total weed control with herbicides continued to provide the fastest growth. Irrigation also provided overall increase in tree diameter, even in an area of relatively high rainfall.

Pecan yields were somewhat reflective of tree growth in that larger trees produced more nuts sooner and continued to do so from 1990 through 1992 (Table 3). Under irrigation, trees subjected to total chemical and disking floor management regimes produced yields higher than trees receiving mowing, grass control only, and no control regimes. When not irrigated, yields from disking treatments decreased below yields of total chemical control treatments. Tillage drys the soil, helping to rob the tree of moisture needed for pecan production. Irrigation increased overall yield in 1991 only. Although not analyzed, yield from total chemical treatments were numerically higher than yield from other weed management regimes in 1993 when irrigation was not used.

When averaged over irrigation regimes, pecan yield from "flip-flop" treatments fell inside the extremes of yields produced by total chemical control and no weed control (Figure 1). These treatments will be continued to determine if yield from any delayed weed control treatment will catch up to yield from trees which have received total chemical control continuously.

SUMMARY

Weed control around young pecan trees in the Southeastern U.S. increases growth and nut production. Trees which have received good orchard floor management produce a larger crop earlier. Preliminary data show trees receiving delayed weed control or trees from which weed control was discontinued after the first 2 or 3 years will not produce yields equal to continuous total weed control for several years. At some point in the future the yield from trees which were initially weedy and changed to total control after 2 or 3 yrs may equal yield from trees which have received total weed control continuously. However, the yield loss until that time will probably exceed the costs of weed control inputs required initially.

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Table 1. Pecan diameter as influenced by weed control and irrigation in nonbearing trees, Fairhope, Alabama

Irrigation and weed control program	Year				Total growth increase[a] %
	1987	1988	1989	1990	
	cm				
Irrigated Total	2.3 a[b]	4.6 a	6.8 a	9.5 a	400
Disking	2.3 a	4.2 ab	6.3 a	8.9 a	368
Mowing	2.1 ab	3.0 c	4.2 c	6.3 c	232
Grass only	2.1 ab	3.8 b	5.6 b	8.0 b	321
None	2.0 b	2.8 c	4.5 c	6.8 c	258
Mean of irrigated	2.2 A	3.7 A	5.5 A	7.9 A	316
Not irrigated					
Total	2.1 ab	4.0 a	6.3 a	8.9 a	368
Disking	2.2 a	3.9 a	5.6 b	7.8 b	310
Mowing	2.1 ab	2.8 c	4.0 cd	6.0 cd	216
Grass only	2.1 ab	3.4 b	4.7 c	6.9 bc	263
None	2.0 b	2.9 c	3.9 d	5.7 d	200
Mean of not irrigated	2.1 A	3.4 B	4.9 B	7.1 B	271

[a]Cumulative increase between planting in Feb., 1986, at which time the average tree diameter was 1.9 cm, and Feb., 1990.

[b]Means in column followed by the same letter are statistically equivalent according to Duncan's multiple range test at the 5% level of probability.

Table 2. Pecan stem diameter as influenced by weed control and irrigation in bearing trees[1], Fairhope, Alabama

Irrigation and weed control program	Year			Cumulative Growth Increase[2] %
	1991	1992	1993	
	cm			
Irrigated				
Total	11.9	14.5	16.4	76
Disking	10.8	12.8	15.2	71
Mowing	8.6	11.1	13.4	113
Grass only	9.4	11.9	13.6	70
None	8.4	11.4	13.1	93
Mean of irrigated	9.8	12.3	14.3	85
Not irrigated				
Total	11.2	13.9	16.0	80
Disking	9.6	12.1	14.5	86
Mowing	7.8	9.7	12.5	108
Grass only	8.2	10.7	13.0	88
None	6.9	8.9	10.6	86
Mean of not irrigated	8.7	11.1	13.3	90
LSD (.05) weed control	1.7	2.2	1.9	
LSD (.05) irrigation	0.8	1.0	0.9	

[1]Tree stem diameter measured in February each year.

[2]Determined from 1990 until Feb. 1993.

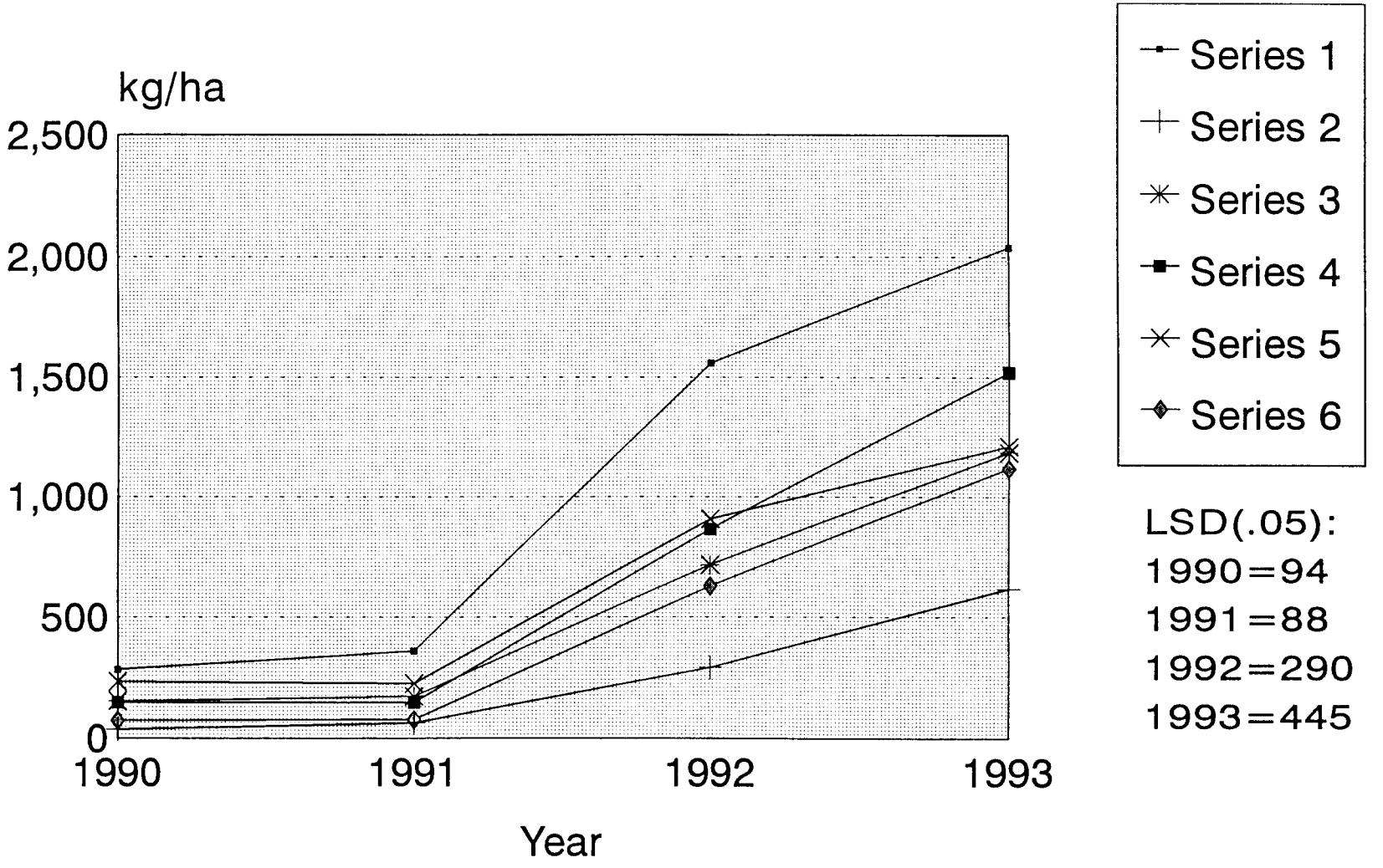
Table 3. Pecan yields as influenced by weed control and irrigation[1], Fairhope, Alabama

Irrigation and weed control program	Year				Cumulative
	1990	1991	1992	1993[2]	
	kg/ha				
Irrigated					
Total	254	436	1628	2072	4390
Disking	262	454	1316	1752	3784
Mowing	11	57	430	1015	1513
Grass only	49	134	545	1068	1796
None	27	86	308	739	1160
Mean of irrigated	121	233	846	—	
Not irrigated					
Total	315	286	1490	2006	4097
Disking	94	162	762	1235	2253
Mowing	53	91	584	853	1581
Grass only	116	75	395	1093	1679
None	49	41	277	644	1011
Mean of not irrigated	125	131	701	—	
LSD (.05) weed control program	143	129	445	—	
LSD (.05) irrigation	NS	56	NS	—	

[1]Yields obtained in November each year.
[2]Irrigation treatments discontinued in 1993.

Pecan Yield from Continuous and Flip-Flop Weed Control

Fairhope, Alabama--Averaged over irrigation variables



Series: 1 = total continuously, 2 = weedy continuously, 3 = total 2yr fb weedy
4 = weedy 2yr fb total, 5 = total 3yr fb weedy, 6 = weedy 3yr fb total