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Temporal Weed Interference with Young Pecan Trees

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Abstract. **Vegetation surrounding pecan (*Carya illinoinensis* Wangenh. C. Koch) trees in a 4.3 × 6 m area was either controlled with a nonresidual herbicide for the entire growing season, not controlled, or controlled at certain times during the growing season. After three growing seasons, trunk diameters were suppressed 54% when vegetation was not controlled, 47% when not controlled until 1 Aug., and 37% if not controlled after 1 June compared to entire growing season vegetation control. Trunk diameters were not significantly different from entire season vegetation control when vegetation was controlled from 1 June through fall frost or vegetation controlled from April until 1 Aug. Vegetation in the plots was typically dominated by cool season herbaceous dicots in May and June, and warm-season grasses during August and September.**

Vegetative groundcover surrounding trees competes for nutrients (Bould and Jarrett, 1962; Goff et al., 1991; Smith et al., 1959; Worley and Carter, 1972) and water (Patterson et al., 1990; Ware and Johnson, 1958), and in some instances may be allelopathic (Friedman and Horowitz, 1970; Meissner et al., 1989; Menges, 1987; Smith et al., 2001; Wolf and Smith, 1999). Tree growth during orchard establishment can be increased by maintaining a vegetation-free area surrounding the tree (Foshee et al., 1995; Patterson et al., 1990; Patterson and Goff, 1994; Smith et al., 2002; Wolf and Smith, 1999). Herbicides are the most common method to eliminate or reduce vegetation interference (Foshee et al., 1997; Merwin and Stiles, 1994; Merwin et al., 1994; Norton and Storey, 1970; Patterson et al., 1990; Patterson and Goff, 1994) although mulches (Foshee et al., 1996; Merwin et al., 1994; Smith et al., 2000) or cultivation (Foshee et al., 1997; Merwin et al., 1994; Patterson et al., 1990; Patterson and Goff, 1994; Smith et al., 1959) are also effective in reducing vegetation interference.

Research on pecan demonstrated that a 1.83-m-diameter (2.6-m^2) vegetation-free circle centered on the tree was sufficient to produce near maximum growth of nonbearing pecan trees in tall fescue (*Festuca arundinacae* Shreb.) or bermudagrass [*Cynodon dactylon* (L.) Pers.] sod (Smith et al., 2002, 2005). Current recommendations are to control vegetation surrounding the young pecan trees the entire growing season. However, there may be additional opportunities to reduce herbicide use without compromising tree growth by controlling vegetation only at critical times during the growing season. In young apple, controlling interfering vegetation early in the growing season produced tree growth similar to season-long vegetation control and better than late-season vegetation control (Merwin and Ray, 1997). In cherry, early-season vegetation control was more important than late-season control to increase shoot and trunk growth (Al-Hinai and Roper, 2001). No information exists relating temporal effects of vegetation control on pecan tree growth during orchard establishment. Our objective was to evaluate selected times of vegetation control on tree growth during establishment.

Materials and Methods

Roots of 1.5- to 2-m-tall 'Apache' pecan seedlings were trimmed to 45 cm long (McCraw and Smith, 1998; Smith and Johnson, 1981), planted in a Teller sandy loam (fine-loamy, mixed, thermic, Udic Argiustoll) at a spacing of 6 × 12 m, then irrigated to settle the soil surrounding the roots. Tops were pruned to1.2-m tall whips following planting. In 2002, trees received 225 g/tree of 19N–8.2P–15.8K at budbreak and 225 g/tree of 19N–8.2P–15.8K the first week of June. In 2003 and 2004, 680 g/tree of 13N–5.7P–10.8K were applied in March followed by 225 g/tree of 13N–5.7P–10.8K in June. During each growing season Zn was foliar applied to runoff at 2-week intervals until July at 863 mg·L^{-1} Zn from 36% $ZnSO_4$. Trees were irrigated as needed throughout the growing seasons with drip irrigation. Foliage-feeding pests were controlled as needed.

Vegetation control treatments included 1) control the entire growing season, 2) no control throughout the growing season, 3) control from April (pecan budbreak about 10 April) until 1 June followed by no control, 4) no control until 1 June, then control through fall frost (about 1 Nov.), 5) control from April until 1 Aug., then no control through fall frost, and 6) no control until 1 Aug., then control through fall frost. Vegetation control was by repeated applications of glyphosate [N-(phosphonomethyl)glycine] to maintain a 4.3-m-wide × 6-m-long area centered on the tree vegetation-free during the prescribed time period. Row middles were mowed as needed. Vegetation surrounding the trees, if present, was mowed the first week in June and first week in August each year. Treatments were replicated eight times in a completely randomized design.

Trunk diameter was measured annually during dormancy 0.75 m above the soil surface. The amount of vegetation groundcover was visually rated the first of May, June, August, and September each year. Weed species in the plots were extremely diverse with a single species rarely exceeding 10% surface coverage. Therefore, weeds were categorized as dicot or monocot rather than by species. Height of the groundcover was measured at three randomly selected sites in each 4.3 × 6-m plot when visual ratings were made, except the height measurement was inadvertently omitted in May 2003.

Results and Discussion

Trunk diameter was not affected by treatment after the first growing season (Table 1). Tree growth is typically small the year of transplanting, reducing chances that an effect of treatment could be detected. The second and third years following transplanting, trunk diameters of trees without vegetation control, those without vegetation control after 1 June, and without vegetation control until 1 Aug. were smaller than those with vegetation controlled the entire growing season. By the end of the third growing season, the no vegetation control treatment reduced trunk diameter 54% and no vegetation control until 1 Aug. suppressed trunk diameter 47% compared to the vegetation free treatment. Although trunk diameter was reduced when vegetation was not controlled until 1 Aug. compared to maintaining the area surrounding the tree vegetation free, the reduction was not as severe as when vegetation was uncontrolled the entire year. Thus, even late season vegetation control aided growth of young pecan trees. In the spring, trees grow

Table 1. The effect of controlling vegetation at selected times during the growing season on pecan tree trunk diameter.

	Trunk diam (mm)		
Treatment	2002	2003	2004
Vegetation free during the growing season	22	34	57
No vegetation control during the growing season	20	20***	26***
Vegetation free until 1 June, then no vegetation control	21	24**	36**
No vegetation control until 1 June, then vegetation free	21	30	48
Vegetation free until 1 Aug., then no vegetation control	23	34	55
No vegetation control until 1 Aug., then vegetation free	20	21***	30***

,*Significantly different from trees maintained vegetation free throughout the growing season at 1% or 0.1%, respectively, by the *t* test.

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rapidly. When vegetation was controlled until 1 June the reduction in trunk diameter (37%) compared to vegetation free was less than the two previously mentioned treatments after 3 years. Trunk diameter was not significantly different from the control when vegetation was not controlled until 1 June or vegetation was controlled until 1 Aug.

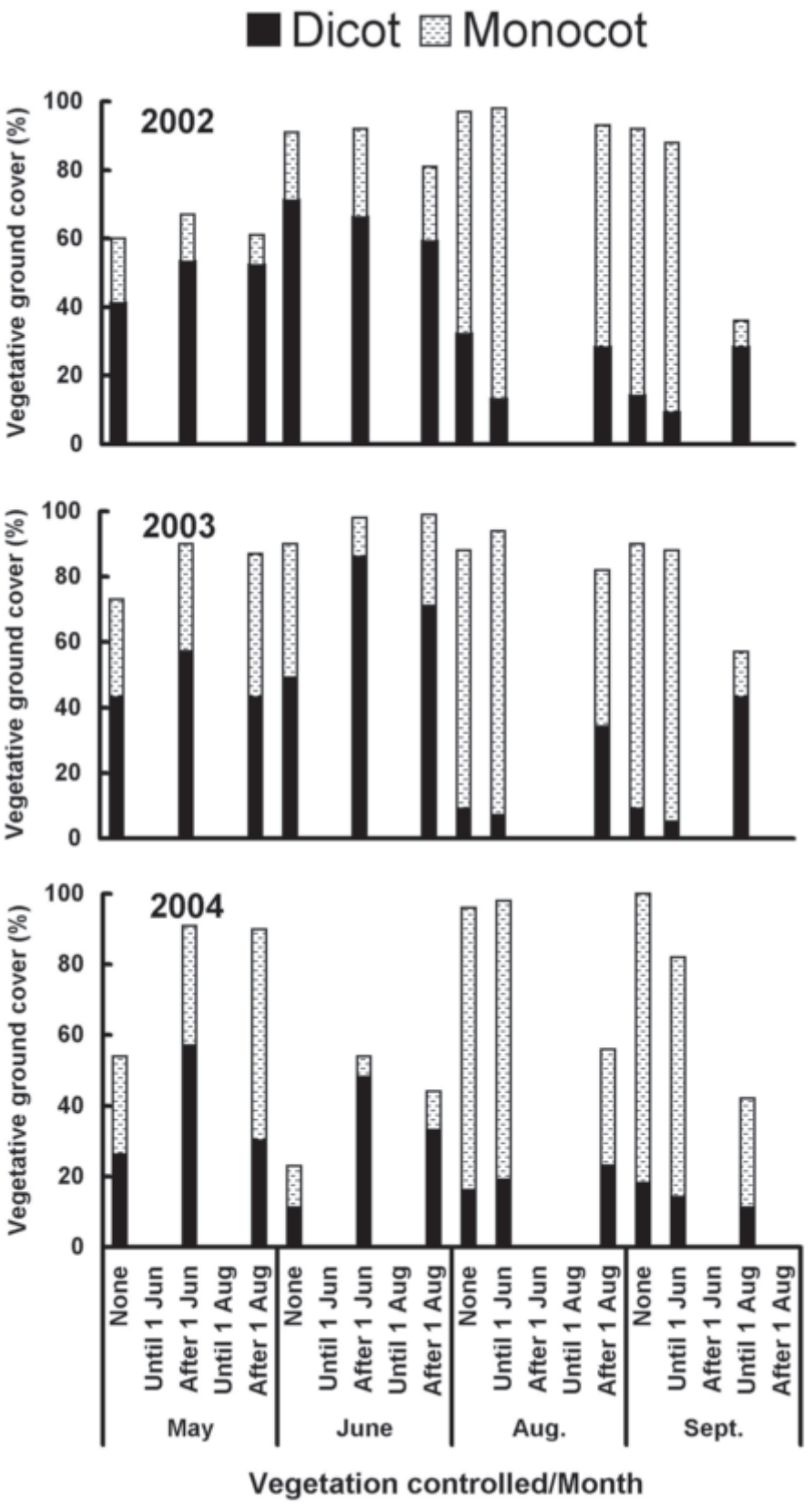

Fig. 1. Visual vegetation ratings for each treatment during the first week of the month indicated on the x-axis. Vegetation was divided into monocotyledonous and dicotyledonous plants for each rating time during the 3 years.

With few exceptions, dicots tended to be the dominate vegetation in all treatments through June, then monocots became the dominate vegetation type (Fig. 1). Plots without vegetation control experienced a similar shift in vegetation since the early species were typically cool season herbaceous annual plants, followed later in the season by warm season annual grasses. Plant species in the plots included some perennial herbaceous dicots and grasses plus biennial dicots, but these species were minute compared to the annual species. Glyphosate effectively controlled all weed species encountered, regardless of application date. We were unable to discern any clear pattern in weed species populations that established following vegetation control with glyphosate during different dates. Weed heights were similar among treatments (Fig. 2). In 2004, weeds tended to be taller in August and September than in 2002 and 2003. Rainfall was substantially greater with better distribution in 2004 than in 2002 and 2003.

It is clear from this study and others (Foshee et al., 1995; Patterson et al., 1990; Patterson and Goff, 1994; Smith et al., 2002; Wolf and Smith, 1999) that vegetation surrounding a tree reduces its growth. These data suggest that controlling vegetation the entire season may not be essential to obtain maximum growth. Trunk diameters of trees with no vegetation control after 1 Aug. were only 4% smaller after 3 years than trees with vegetation controlled the entire season. This suggests that interference from a predominately annual weed population during the latter part of the growing season will minimally affect pecan tree growth, if trees are provided with adequate irrigation and fertility.

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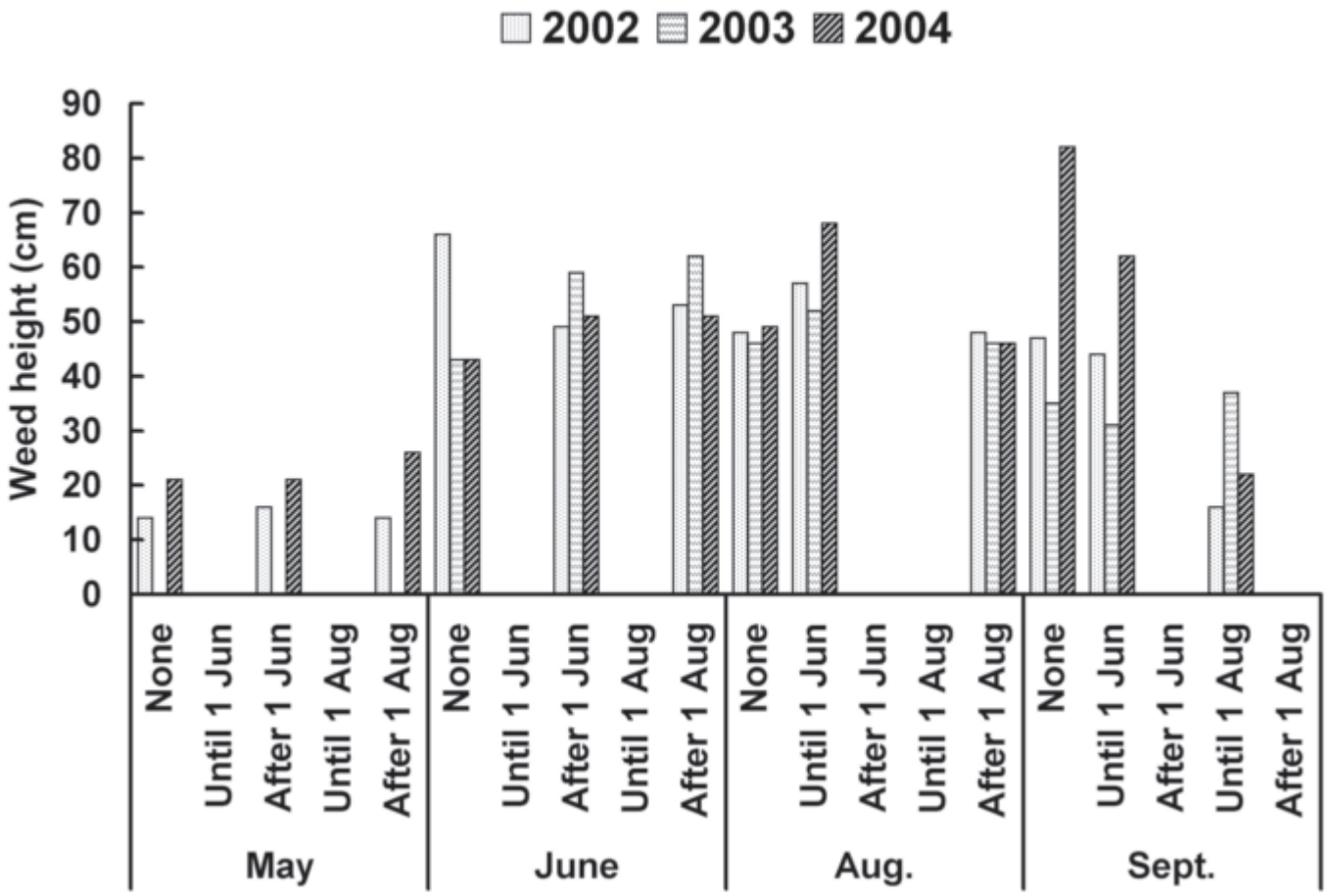

Fig. 2. Vegetation height for each treatment during the first week of the month indicated on the x-axis.

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