VEGETATIVE AND REPRODUCTIVE EFFECTS OF CULTAR APPLIED TO ‘CAPE FEAR’ AND ‘DESIRABLE’ PECAN TREES

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Abstract. Cultar (paclobutrazol:β-[(4-chlorophenyl) methyl]-α-(1,1 dimethylethyl-1H-1,2,4, triazole-1-ethanol), a gibberellin biosynthesis inhibitor, was applied as a soil drench to 12 year old ‘Cape Fear’ and ‘Desirable’ pecan [Carya illinoensis (Wagenh.) C. Koch] trees on 7 February 1986. Cultar applied at 0.65 g a.i./cm² trunk cross-sectional area (TCA) to ‘Cape Fear’ had no effect on vegetative growth during 1986, but reduced trunk diameter growth and shoot growth during 1987. Yield, nut wt. and percentage kernel were not significantly altered during 1986 or 1987. Yield was extremely variable from tree to tree whereas nut wt. and percentage kernel were fairly consistent among treatments during both 1986 and 1987. The effects of Cultar at 0, 0.33, 0.65 and 1.29 g a.i./cm² TCA on ‘Desirable’ pecan were analyzed by regression. The only significant effects associated with Cultar were a linear or quadratic decline in yield during 1986 and linear reduction in percentage kernel during 1987.

Lack of a method for tree size control is a major impediment toward achieving an efficient culture and management system of pecan orchards. The majority of the pecans from the southeastern United States are produced on large, old trees (> 50 years) planted at relatively low densities (15 x 15 m or greater). Maximum production per hectare at 50 years was 364.5 ± 50.8 cm². Four trees were treated with Cultar at 0.65 g a.i./cm² TCA (7.08 g a.i. per tree), and 4 trees were treated with water.

‘Desirable’ pecan trees were spaced 12.1 m within and between rows. Pretreatment TCA was 364.5 ± 50.8 cm². Four trees were treated at each of the following concentrations: 0 g a.i./cm² TCA (0 g a.i. per tree); 0.33 g a.i./cm² TCA (2.85 g a.i./tree); 0.65 g a.i./cm² TCA (5.69 g a.i./tree); 1.29 g a.i./cm² TCA (11.38 g a.i./tree).

Trunk diameter growth, shoot growth, yield, average nut wt. and percentage kernel were determined for all treatments during November 1986 and 1987. February and March 1987 was 6.7 cm, but was abundant between 1 April and 30 June was 6.7 cm, but was abundant between 1 July and 1 Sept. (49.2 cm).

The ‘Cape Fear’ pecan trees were spaced 12.1 and 7.6 m, within and between rows, respectively on a diagonal. Pretreatment tree cross-sectional area (TCA) was 454.4 ± 48.9 cm². Four trees were treated with Cultar at 0.65 g a.i./cm² TCA (7.08 g a.i. per tree), and 4 trees were treated with water.

Vegetative growth and yield data of ‘Cape Fear’ were analyzed as a completely randomized design. Means were compared by a t-test (P < 0.05). Data of ‘Desirable’ were analyzed by regression. Significance of a linear or a quadratic component was assessed at (P < 0.05).

Results and Discussion

The trees in this study were planted in a high density orchard system and were beginning to encroach upon one another (i.e. ‘Cape Fear’, 12.1 x 7.6 m within and between rows, respectively on a diagonal; ‘Desirable’ 12.1 m on a square). It has been suggested that paclobutrazol should be applied shortly before trees reach desired size and before encroachment (1, 12, 13, 14). The timing of Cultar application was therefore appropriate.

No significant treatment effect occurred for ‘Cape Fear’ the growing season following the 0.65 g a.i./cm² TCA

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Table 1. Trunk diameter growth, shoot growth, yield, nut wt. and percentage kernel of Cultar-treated and control ‘Cape Fear’ pecan trees. Cultar was applied 7 February 1986.

<table>
<thead>
<tr>
<th>Cultar (g.a.i./cm²)</th>
<th>Trunk diameter growth (cm)</th>
<th>Shoot growth (cm)</th>
<th>Yield (kg)</th>
<th>Nut wt (g)</th>
<th>Percentage kernel (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4.7a 5.0a</td>
<td>18.6a 16.5a</td>
<td>18.1a 14.0a</td>
<td>9.5a 7.4a</td>
<td>52a 52a</td>
</tr>
<tr>
<td>0.65</td>
<td>3.5a 2.1b</td>
<td>17.4a 9.2b</td>
<td>6.5a 17.8a</td>
<td>10.0a 8.4a</td>
<td>54a 52a</td>
</tr>
</tbody>
</table>

*Cultar concentration 0.65 g a.i./cm² TCA = 7.08 g a.i./tree.
*Mean separation by t-test, (P < 0.05).

Cultar application (1986) (Table 1). In 1986, yield was ca. 3-fold for untreated trees, but the great tree to tree variations precluded a significant difference. The following year (1987), trunk diameter growth and shoot growth were significantly less for Cultar-treated trees. Conversely, in 1987 yield and nut size were slightly greater with Cultar. Percentage kernel was similar (52-54%) for both treatments in 1986 or 1987.

Cultar applied to ‘Desirable’ pecans at 0, 0.33, 0.65 and 1.29 g a.i./cm² TCA did not significantly impact vegetative growth. In 1986, yield was reduced in a linear and a quadratic manner, but nut wt. and percentage kernel were not altered. A significant decline in vegetative growth and yield did not occur in 1987, although both parameters were substantially greater for control trees. Cultar did not significantly affect nut wt. but in 1987 Cultar reduced percentage kernel.

Although several reports have documented an increased fruit size or yield with the application of paclobutrazol on nectarine (4) and pear (7), conflicting reports exist concerning pecan (1, 12, 13). Andersen and Aldrich (1) reported that paclobutrazol (0.05 to 2.60 g a.i./cm² TCA) did not alter yield or nut wt. of young ‘Cheyenne’ trees. Wood (12) found that yield of ‘Cheyenne’ and ‘Desirable’ declined the third year after the paclobutrazol application. Conversely, yield of 10-year-old ‘Shoshoni’, ‘Desirable’ and ‘Cape Fear’ (analyzed collectively) increased with paclobutrazol concentration 2 of the 4 years after application but r² was ≤ 0.10 in both cases. Contradictory results have also been obtained for 75 year-old ‘Stuart’ pecans in that nut yield declined the third and fourth year after a trunk injection of paclobutrazol, and yield was increased the second year after a soil application (13). Undoubtedly, some of the variation in yield, nut size and nut quality of pecan attributed to paclobutrazol may be ascribed to the confounding effect of alternate bearing.

The obvious advantage of the use of this growth retardant is that tree size can be controlled with some accuracy. However, Andersen and Aldrich (1) showed that most vegetative responses were inhibited by paclobutrazol in a curvilinear manner. The greatest variability occurred at low doses (i.e. ≤ 0.8 g a.i./cm² TCA). Undesirable characteristics associated with a paclobutrazol-induced dwarfing are a reduction in leaf area and increased leaf shading (1, 12, 13), nonuniform growth control (especially in large trees) (13) and the tendency to promote sprouting on the trunk (1). Another concern is the persistence of paclobutrazol in the tree and soil which appears to be at least 3 to 4 years (1, 12, 13) and overdosing may be a problem. Foliar sprays are an alternative method of application on peaches and apples. Although growth control of apples and peaches have been achieved by soil applications, the results have been less consistent than foliar sprays (8).

Much larger sample sizes must be used in future experiments with paclobutrazol to compensate for alternate bearing and for tree to tree variation of pecan trees. Additionally, more long-term studies concerning different application methods are required. Although paclobutrazol typically reduces vegetative growth of pecan, the effect on reproductive growth has no yet been confirmed.

Table 2. Trunk diameter growth, shoot growth, yield, nut wt. and percentage kernel of Cultar-treated and control ‘Desirable’ pecan trees. Cultar was applied 7 February 1986.

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<th>Percentage kernel (%)</th>
</tr>
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<tr>
<td>0</td>
<td>2.7 4.1</td>
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<td>6.2 4.5</td>
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<td>16.2 9.6</td>
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<td>9.7 7.0</td>
<td>49 38</td>
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<tr>
<td>1.29</td>
<td>2.4 3.3</td>
<td>14.2 7.0</td>
<td>0 1.2</td>
<td>— 7.5</td>
<td>— 41</td>
</tr>
<tr>
<td>Significance*</td>
<td>N.S. N.S.</td>
<td>N.S. N.S.</td>
<td>L Q N.S.</td>
<td>N.S. N.S.</td>
<td>N.S. L</td>
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</tbody>
</table>

*Cultar concentrations: 0.33 g a.i./cm² = 2.86 g a.i./tree; 0.65 g a.i./cm² = 5.73 g a.i./tree; 1.29 g a.i./cm² = 8.59 g a.i./tree.
*Statistical significance levels were assessed by regression (P < 0.05); NS = non significant; L = significant linear component; Q = significant quadratic component.

Fusarial wilt of banana (also known as Panama disease) is recognized as one of the most destructive plant diseases in recorded history (11). Race 1 of the pathogen was responsible for decimating plantations of the Gros Michel cultivar (AAA) in tropical America during the early and mid-1900s; these epidemics resulted in the current monocultures of Cavendish cultivars (AAA and resistant to race 1) which are currently used by the export industries. Race 1 also affects AAB dessert cultivars (e.g., Pome and Silk) and is found in banana-growing regions throughout the world (12, 15). Race 2 affects cooking bananas such as Bluggoe (ABB) and certain tetraploids (11, 13) whereas race 3 does not affect or is weakly pathogenic on banana (17). Race 4 is virulent on both race 1 and 2 suscepts as well as Cavendish cultivars and has caused great concern among export producers who depend upon the latter cultivars (12, 15). Race 4 has been reported relatively recently in the subtropics (Canary Islands; Queensland, Australia; South Africa; Taiwan) and tropics (Mindanao, Philippines) of the eastern hemisphere. In addition, race 4-type virulence was tentatively identified in the western hemisphere in 1987 in Jamaica (Stover and Ploetz, unpublished). Thus, depending on the races of FOC found in a given area, fusarial wilt may threaten production of several cultivars. Knowledge of the race structure of local populations of FOC is needed before recommendations can be made on the cultivars which can be safely planted in an area.

Backyard plantings of banana have existed in Florida for over 100 yr, but the occurrence and importance of commercial plantings have fluctuated according to market phases. It is probable that isolates in VCG 0124 originated outside Florida. The usefulness of plantlets when banana germplasm is screened for resistance to fusarial wilt is discussed.

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