Impact of Powerlines on Cost of Crop Production

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A field study was conducted to determine the direct costs incurred by crop producers whose fields are traversed by overhead electric transmission lines. Primary data were collected on the machinery time loss working around powerline support structures, the crop area loss beneath support structures, and yield loss beneath powerlines. Results indicate that the cost of time loss and area loss are affected by the support structure's location in the field and its orientation to the crop rows. The single greatest cost is due to cotton yield loss beneath a 500-kv wire.

Increased urban and rural demand for electric services has been accompanied by a growth in the number of electric transmission lines which cross the countryside. Inevitably, lengthy segments of these powerlines pass directly through productive agricultural land. The objective of this study was to determine the direct costs incurred by crop producers whose fields are traversed by overhead electric transmission lines. The impact of two types of transmission lines (115/230-kv wooden H-pole, 500-kv steel lattice tower) on the production costs of five field crops (cotton, rice, soybean, grain sorghum, and double-cropped wheat-soybeans) is assessed based on a field study in Eastern Arkansas. These results should provide information useful in negotiating settlements whenever right of way is sought for the construction of new electric transmission lines, or whenever cropland traversed by powerlines is sold or leased.

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Hypothesized Effects

Previous powerline studies have been designed around the hypothesis that powerlines create direct costs for farmers due to one or both of the following effects:

1. A powerline support structure is a physical obstruction that impedes machinery field operations and precludes a certain area from being cropped (pole effects).

2. The electric transmission lines themselves have a negative impact on crop yields either by causing crop stress due to a high-voltage electromagnetic field or by impeding aerial application of agrichemicals to the growing crop (wire effects).

The hypothesized pole effects identified above result in two types of losses for the crop producer: (1) Time loss—a support structure impedes field operations, resulting in increased labor and machinery time (required to work around support structures) throughout the cropping season. (2) Area loss—a support structure precludes a certain area directly beneath it from being planted or harvested, resulting in decreased crop production. By contrast, the hypothesized wire effects result in yet another potential loss: (3) Yield loss—depressed or reduced yields may occur in the vicinity of the powerline due either to ineffective application of agrichemicals by airplane or due to crop stress caused by electromagnetic field beneath transmission wires.

Previous Studies

Previous investigations have used a variety of methods to assess time and area loss caused by an electric transmission line support structure in a field (pole effects). Separate studies sponsored by Ontario Hydro[10] and Doane Agricultural Service[3] used field-collected data to determine how support structure size, structure location in the field, orientation of the structure to row-crops, size of machinery complement, and type of crop grown affected area loss and time loss in crop production. Gustafson et al.[6] used low-altitude aerial photography of 2,803 support structures over 17 powerline segments in the Midwest in order to relate land loss from crop production to type, size, placement, and orientation of support structures. Fortin and Vigneault[4] describe the development of a computer program that simulates land loss and time loss based on parameters obtained from field data and laboratory simulation studies. A set of related studies conducted for the American Electric Power System investigated the impact of high-voltage electromagnetic field on crop yields and biological processes (wire effects). Hodges and Mitchell[8] measured plant height and dry matter of oats, corn, and soybeans at distances ranging between 50 and 300 ft from