

Investigation of Biotic and Abiotic Factors Affecting
Double-Cropped Corn (*Zea mays* L.) Production in Virginia

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ABSTRACT

Double-cropping of corn (*Zea mays* L.) for grain following the harvest of a small grain crop has been under evaluation in Virginia as an alternative cropping strategy (Brann and Pitman, 1997). Historical evapotranspiration records from the Virginia State Climatology Office (1997) indicated that delayed planting of corn results in a higher probability of moisture availability during critical developmental stages. Double-cropping of corn may provide additional benefits in terms of herbicide options, spreading economic risk, rotation, and soil quality. To assess the potential constraints on late planted corn imposed by insects and diseases, double-cropped corn was evaluated in Montgomery County, Virginia from 1998 to 2000. Abiotic (climate and soil) factors were investigated through a spatial site suitability analysis for Virginia. Finally, a weather-based modeling framework was used for development of a corn-European corn borer (ECB) interaction model. Field experiments were conducted using a 2x2x3 factorial design with two near-isoline hybrids (NK4640 and NK4640Bt), insecticides at planting (tefluthrin in all years, 1998-2000; and imidacloprid in 1999 and 2000), and fungicide treatments (azoxystrobin or propiconazole). Response variables included yield, moisture at harvest, grain test weight, damage by European corn borer (*Ostrinia nubilalis*), damage by corn earworm (*Heliothis zea*), disease progress curves for gray leaf spot (*Cercospora zea-maydis*), and number of plants exhibiting virus symptoms. The Bt hybrid performed significantly better than the non-Bt hybrid for yield and test weight in double-cropped corn in 1998 and 2000, but not in 1999. In 1999 and 2000, comparisons were also made to full season corn grown in Montgomery County. In the full

season corn experiments, yield and test weights of Bt hybrids were significantly higher than those of non-Bt hybrids, though the difference was less than observed in double-cropped corn experiments at these locations. A spatially referenced site suitability analysis was performed for full season and double-cropped corn in Virginia using weighted abiotic factors and constraints. Input data included gridded monthly climate data (Daly et al., 1994), National Elevation Data (NED), National Land Cover Data (NLCD), and the Virginia State Soil Geographic (STATSGO) database. Additional grids were derived from these sources including slope, aspect, Thornthwaite potential evapotranspiration (PET), and PET minus precipitation (PET-P). Maps were generated to characterize the overall relative suitability for corn production for individual and combined components. The site suitability analysis confirmed previous observations that the length of the growing season is a limiting factor for late planted corn in the mountainous region of Virginia. PET and PET-P were used to identify areas of the state having a lower average moisture deficit during the silking months for double-cropped corn compared to full-season corn. It is concluded that double-cropped corn production is a viable option in Virginia where abiotic factors are not constraining, particularly growing season length and moisture availability during the sensitive stages of development. The findings of the site suitability analysis are in general agreement with the experiences of researchers and producers in Virginia. In addition, second generation ECB populations can result in severe pressure for corn planted later than typical planting dates. Late season ECB can be effectively managed by planting a Bt hybrid.