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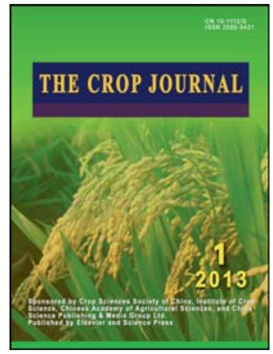

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Influence of plant architecture on maize physiology and yield in the Heilonggang River valley

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Abstract: The size and distribution of leaf area determine light interception in a crop canopy and influence overall photosynthesis and yield. Optimized plant architecture renders modern maize hybrids (*Zea mays* L.) more productive, owing to their tolerance of high plant densities. To determine physiological and yield response to maize plant architecture, a field experiment was conducted in 2010 and 2011. With the modern maize hybrid ZD958, three plant architectures, namely triangle, diamond and original plants, were included at two plant densities, 60,000 and 90,000 plants ha^{-1}. Triangle and diamond plants were derived from the original plant by spraying the chemical regulator Jindele (active ingredients, ethephon, and cycocel) at different vegetative stages. To assess the effects of plant architecture, a light interception model was developed. Plant height, ear height, leaf size, and leaf orientation of the two regulated plant architectures were significantly reduced or altered compared with those of the original plants. On average across both plant densities and years, the original plants showed higher yield than the triangle and diamond plants, probably because of larger leaf area. The two-year mean grain yield of the original and diamond plants were almost the same at 90,000 plants ha^{-1} (8714 vs. 8798 kg ha^{-1}). The yield increase (up to 5%) of the diamonds plant at high plant densities was a result of increased kernel number per ear, which was likely a consequence of improved plant architecture in the top and middle canopy layers. The optimized light distribution within the canopy can delay leaf senescence, especially for triangle plants. The fraction of incident radiation simulated by the interception model successfully reflected plant architecture traits. Integration of canopy openness is expected to increase the simulation accuracy of the present model. Maize plant architecture with increased tolerance of high densities is probably dependent on the smaller but flatter leaves around the ear.

Keywords: Maize; Light interception; Yield; Light interception model; Leaf senescence

1. Introduction

Canopy architecture is an important factor determining yield of many crops as a result of interplant competition for light distribution and absorption, particularly in a dense population [1]. Canopy functions (e.g. photosynthesis) improve as leaf area index (LAI) increases until LAI reaches approximately 4 for many maize (*Zea mays.* L.) hybrids, but decrease with further LAI increase [2, 3]. Correspondingly, grain yield of maize first increases and then decreases with increasing plant densities. Modern maize hybrids, which have erect leaves above the ear and flat leaves below the ear, can tolerate high plant densities, thus yielding better [4–6]. These cultivars have been

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