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Understanding of the interactive effect of waterlogging and shade on cotton (*Gossypium hirsutum* L.) growth and yield

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Abstract

Under the current climatic variability, extreme weather events with multiple stresses have become more frequent. Cotton, a relatively waterlogging sensitive crop, often experiences significant yield losses under persistent summer rainfall followed by extended cloudy weather. In two years of field experiments, we studied individual and interactive effects of soil waterlogging (WL) and shade on cotton growth and yield, hypothesising that low light conditions would amplify WL damage in cotton. The crop was exposed to WL, shade (50% reduction in photosynthetic photon flux) and WL + shade at peak flowering. Waterlogging was imposed by extending irrigation time from 8 h to (96 h and 120 h, in 2012-13 and 2013-14, respectively), while the plants were shaded for 6 days or 9 days in 2012-13 and 2013-14, respectively. Waterlogging significantly inhibited cotton growth and yield during both seasons, although yield reduction in shaded (9 days) cotton was significant only in 2013-14. Under individual stresses, both WL and shaded plants had similar reductions in lint yield (15% and 18%, respectively), compared with controls (non-waterlogged, non-shaded). The interactive effect of WL and shade was significant only when the effect of WL alone on cotton yield was relatively small, suggesting that shade exacerbated moderate WL but intense WL acted on yield independently of light levels. Yield reductions were the result of lower number of final bolls produced, while boll weight remained unaffected. Increased post-waterlogging fruit abscission of WL and / or shaded cotton restricted the total number of bolls produced. In addition, these stresses (individual or combined) significantly impaired leaf nitrogen acquisition, photosynthesis and the consequent development of new fruiting nodes.

Keywords: fruit abscission; lint yield; N uptake; photosynthesis; shade; waterlogging

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