基于恒水位蒸发皿蒸发量的膜下滴灌棉花灌溉指标

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Optimal irrigation index for cotton drip irrigation under film mulching based on the evaporation from pan with constant water level.

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摘要
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摘要

为探索新疆膜下滴灌棉花简易方便的高效灌溉指标,于2008—2009年在乌鲁木齐开展了2个生长季的人工控水试验.在棉花蕾期和花铃期均设2个灌水周期和2个灌水水平,分析了不同水分处理对棉花产量、耗水量和水分利用效率的影响.结果表明: 各处理的棉花耗水过程与蒸发皿蒸发量具有较高的相关性,高产棉田\[2008年处理T_4(蕾期和花铃期灌水周期分别为10和7 d,相应灌水定额分别为30.0和37.5 mm)和2009年处理T_1(蕾期和花铃期灌水周期均为7 d,相应灌水定额分别为22.5和37.5 mm)\]苗期、蕾期、花铃期和吐絮期的蒸发皿-作物系数(K_p)分别为0.29～0.30、0.52～0.53、0.74～0.88和0.19～0.20; 2008年处理T_4的产量(5060 kg·hm^{-2})和水分利用效率(1.00 kg·m^{-3})最高,2009年处理T_1的产量(4467 kg·hm^{-2})和水分利用效率(0.99 kg·m^{-3})最高; 蕾期蒸发皿7和10 d的平均累积蒸发量分别为40～50和60～70 mm,花铃期蒸发皿7 d的累积蒸发量为40～50 mm.在新疆棉区灌45 mm出苗水、苗期和吐絮期不灌水,蕾期和花铃期当蒸发皿蒸发量达到45～65和 45 mm 时开始灌溉,灌水定额通过阶段累积蒸发量与蒸发皿-作物系数K_p(蕾期、初花期、盛花期和末花期分别取0.5、0.75、0.85和0.75)相乘确定时,在获得高产的同时可节约灌溉水资源,提高水分利用效率,可以作为当地膜下滴灌棉田简易方便的高效灌溉指标.

关键词: 滴灌 籽棉产量 水分利用效率 灌水指标

Abstract:

A field experiment with two irrigation cycles and two irrigating water quotas at squaring stage and blossoming-boll forming stage was conducted in Urumqi of Xinjiang Autonomous Region, Northwest China in 2008-2009, aimed to explore the high-efficient irrigation index of cotton drip irrigation under film mulching. The effects of different water treatments on the seed yield, water consumption, and water use efficiency (WUE) of cotton were analyzed. In all treatments, there was a high correlation between the cotton water use and the evaporation from pan installed above the plant canopy. In high-yield cotton field (including the treatment T_4 which had 10 days and 7 days of irrigation cycle with 30.0 mm and 37.5 mm of irrigating water quota at squaring stage and blossoming-boll forming stage, respectively in 2008, and the treatment T_1 having 7 days of irrigation cycle with 22.5 mm and 37.5 mm of irrigating water quota at squaring stage and blossoming-boll forming stage, respectively in 2009), the pan crop coefficient (K_p) at seedling stage, squaring stage, blossoming-boll forming stage, and boll opening stage was 0.29-0.30, 0.52-0.53, 0.74-0.88, and 0.19-0.20, respectively. As compared with the other treatments, T_4 had the highest seed cotton yield (5060 kg·hm^{-2}) and the highest WUE (1.00 kg·m^{-3}) in 2008, whereas T_1 had the highest seed cotton yield (4467 kg·hm^{-2}) and the highest WUE (0.99 kg·m^{-3}) in 2009. The averaged cumulative pan evaporation in 7 days and 10 days at squaring stage was 40-50 mm and 60-70 mm, respectively, and that in 7 days at blossoming-boll forming stage was 40-50 mm. It was suggested that in Xinjiang cotton area, irrigating 45 mm water for seedling emergence, no irrigation both at seedling stage and at boll opening stage, and irrigation was started when the pan evaporation reached 45-65 mm and 45 mm at squaring stage and blossoming boll stage, respectively, the irrigating water quota could be determined by multiplying cumulative pan evaporation with K_p (the K_p was taken as 0.5, 0.75, 0.85, and 0.75 at squaring stage, early blossoming, full-blossoming, and late blossoming stage, respectively), which could be the high efficient irrigation index to obtain high yield and WUE in drip irrigation cotton field and to save irrigation water resources.

Key words: drip irrigation seed cotton yield water use efficiency irrigation index.

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