

交替隔沟灌溉与施氮量对日光温室黄瓜光合作用、生长及产量的影响

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摘要 以黄瓜“津育5号”为试材,研究了交替隔沟灌溉和施氮量(零氮肥、优化氮肥和常规氮肥)对日光温室黄瓜(冬春茬、秋冬茬)光合作用、生长特性、产量形成和果实品质的影响。结果表明:交替隔沟灌溉下,植株上、中、下叶位叶片的净光合速率(P_n)略低于常规灌溉下的相应叶位,而蒸腾速率(T_r)显著降低,上、中叶位叶片的瞬时水分利用效率(WUE)有所提高;交替隔沟灌溉下植株光合作用的限制因素是气孔因素,交替隔沟灌溉下施氮量的增加有助于促进黄瓜功能叶片 P_n 和WUE的提高。与常规灌溉相比,交替隔沟灌溉下叶片叶绿素含量和植株总生物产量有所降低,但根生物产量、根冠比以及根和果实器官的干物质分配比例增加,经济产量持平,经济产量水平的水分利用效率(WUE_y)显著提高。交替隔沟灌溉有利于植株根系发育和果实形成。交替隔沟灌溉下随施氮量的增加,叶片叶绿素含量、叶绿素a/b、比叶重、植株总生物产量和经济产量呈增加趋势,果实Vc含量和可溶性糖含量升高,但优化氮肥与常规氮肥处理间差异不显著,氮肥施用对 WUE_y 无显著影响。冬春茬黄瓜的经济产量和生物产量显著高于秋冬茬。

关键词: 日光温室 黄瓜 交替隔沟灌溉 氮肥 光合作用 水分利用效率 干物质分配

Abstract: This paper studied the effects of alternative furrow irrigation and nitrogen (N) application rate (no N, optimal N, and conventional N) on the photosynthesis, growth characteristics, yield formation, and fruit quality of cucumber (*Cucumis sativus*) cultivar Jinyu No.5 in a solar greenhouse in winter-spring growth season and autumn-winter season. Under alternative furrow irrigation, the net photosynthetic rate of upper, middle, and lower leaves was appreciably lower and the transpiration rate decreased significantly, and the transient water use efficiency of upper and middle leaves improved, as compared with those under conventional irrigation. Stomatal factor was the limiting factor of photosynthesis under alternative furrow irrigation. The photosynthesis and transient water use efficiency of functional leaves under alternative furrow irrigation increased with increasing N application rate. Comparing with conventional irrigation, alternative furrow irrigation decreased leaf chlorophyll content and plant biomass, but increased root biomass, root/shoot ratio, and dry matter allocation in root and fruit. The economic output under alternative furrow irrigation was nearly the same as that under conventional irrigation, whereas the water use efficiency for economic yield increased significantly, suggesting the beneficial effects of alternative furrow irrigation on root development and fruit formation. With the increase of N application rate, the leaf chlorophyll content, chlorophyll a/b, specific leaf mass, plant biomass, economic yield, and fruit Vc and soluble sugar contents under alternative furrow irrigation increased, but no significant difference was observed between the treatments optimal N and conventional N. N application had little effects on the water use efficiency for economic yield. The economic yield and biomass production of the cucumber were significantly higher in winter-spring growth season than in autumn-winter growth season.

Key words: solar greenhouse cucumber alternative furrow irrigation nitrogen photosynthesis water use efficiency dry matter allocation

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