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苗期与拔节期淹涝抑制夏玉米生长发育、降低产量

Waterlogging at seedling and jointing stages inhibits growth and development, reduces yield in summer maize

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中文摘要:

为了探明夏玉米对不同淹涝时期与历时的响应规律，采用防雨棚下有底测坑试验在夏玉米的苗期、拔节期、抽雄吐丝期和灌浆期分别设置不同的淹涝天数（2、4、6、8、10 d），分析了淹涝时期与历时对夏玉米生长发育及产量性状的影响。研究结果表明，淹涝对夏玉米株高的影响随着淹涝时期的后移而减小，苗期淹涝对株高影响最大，拔节期次之，抽雄吐丝期影响较小，且随着淹涝历时的增加株高呈降低趋势，而灌浆期淹涝对株高无显著性影响。苗期淹涝解除后，因玉米前期的补偿生长能力强，受涝处理的株高与对照（CK）间的差异随生育进程的推进逐渐减少；而拔节期淹涝植株的补偿生长能力较弱，各处理灌浆期的株高与CK间的差异仍较大。不同淹涝处理叶面积指数（LAI）的变化趋势与株高一致，任一生育期发生淹涝，其LAI随着淹涝历时的增加逐渐降低。与CK相比，苗期、拔节期、抽雄吐丝期和灌浆期淹涝使株高、LAI平均分别降低5.49%～45.26%、2.38%～35.62%、1.60%～8.23%、0.63%～5.15%和17.36%～62.42%、14.81%～46.56%、4.40%～17.34%、1.97%～15.39%。淹涝对夏玉米生长发育进程也具有明显影响，特别是在生长前期，苗期淹涝对玉米生育进程的影响最大，其次为拔节期，抽雄吐丝期影响很小，灌浆期无影响。此外，任一生育阶段发生淹涝，其果穗长、出籽率、穗粒质量、穗粒数、百粒质量和产量均随淹涝历时的增加呈降低趋势；苗期、拔节期、抽雄期和灌浆期淹涝分别减产17.98%～54.97%、9.12%～100%、2.58%～28.63%和5.93%～20.28%，其淹涝历时分别达到2、4、6、4 d时就会造成显著减产，减产率分别为17.98%、21.34%、12.99%和13.52%。可见苗期和拔节期是夏玉米淹涝的关键时期，生产上应避免该生育期发生淹涝。该研究可为对夏玉米农田排水方案的合理制定、洪涝灾害损失的评估以及抗灾减灾能力的提高提供参考。

英文摘要:

An experiment about different waterlogging duration (2, 4, 6, 8, 10 d) which was set up at seedling, jointing, tasseling and grain-filling stage, respectively was conducted in lysimeters with a rain shelter, and the effects of waterlogging timing and duration on the growth, development and yield characters of summer maize were analyzed. The results sh that the influence of waterlogging on plant height reduced with the postponement of waterlogging timing. Waterlogging occurring at the seedling stage had the greatest impact o plant height, followed by the jointing stage. The tasseling stage imposed a little effect, and plant height decreased when the waterlogging duration was increased, but waterloggir occurring at the grain-filling stage imposed no significant effect on the plant height. After waterlogging at the seedling stage, the difference in plant height between waterlogged treatments and the control (CK) gradually reduced with the advance of the growing process because the early stage of maize had a strong ability of compensatory growth. The difference in that during the jointing stage was still great at the grain-filling stage due to the weak compensatory growth. The changing trend of the leaf area index (LAI) in various waterlogged treatments was similar to the plant height. and grain-filling stages caused plant height to be averagely decreased by 5.49%-45.26%, 2.38%-35.62%, 1.60%-8.23% and 0.63%-5.15% respectively. It also made LAI to be reduced by an average of 17.36%-62.42%, 14.81%-46.56%, 4.40%-17.34% and 1.97%-15.39% respectively. Waterlogging had an obvious influence on the process of growth and development in summer maize, especially at the early growing stage. waterlogging at the seedling stage resulted in the greatest im on growth process of summer maize, followed by the jointing stage, waterlogging at tasseling stage had little effect, and waterlogging at grain-filling stage did not affect the growt process. In addition, waterlogging occurring at any growing stage, resulted in ear length, seed-producing percentage, grain weight per ear, grain number per ear, 100-grain weight grain yield of summer maize decreasing with increased waterlogging duration. As waterlogging occurring at the seedling stage, jointing stage, tasseling stage and grain-filling sta the grain yield of summer maize was reduced by 17.98%-54.97%, 9.12%-100%, 2.58%-28.63% and 5.93%-20.28%, respectively. When the waterlogging duration at the seedling stag jointing stage, tasseling stage and grain-filling stage reached 2, 4, 6, and 4 d respectively, the waterlogging would cause a significant decline in grain yield with the reduction rate 17.98%, 21.34%, 12.99% and 13.52% separately. Therefore, the seedling stage and jointing stage are a critical period of waterlogging for summer corn, and waterlogging should be avoided during that stage. This study will provide a theoretical basis for the rational design of a drainage scheme in summer maize farmland, loss assessment of a flood disaster, a improvement of disaster prevention and mitigation.

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