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## 拔节期淹水玉米的生理性状和产量形成

### Physiological characters and yield formation of corn (*Zea mays* L.) under waterlogging stress in jointing stage

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中文关键词: [叶绿素](#) [排水](#) [作物](#) [淹水](#) [历时](#) [生长](#) [灌浆](#) [产量](#)

英文关键词: [chlorophyll](#) [drainage](#) [crops](#) [waterlogging stress](#) [lasting days](#) [growth](#) [grain fill](#) [yield](#)

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中文摘要:

为了探明夏玉米拔节期对淹水历时的响应规律,采用大田环境下无底测坑试验,在玉米拔节期设置不同的淹水天数(1、2、3、5、7d),分析了淹水历时对夏玉米生长发育、灌浆过程、物质分配及产量性状的影响。结果表明,玉米拔节期淹水抑制玉米的营养期发育,淹水1、2、3、5、7d的平均株高分别比非涝渍环境下玉米(CK)降低2.26%、2.26%、2.45%、11.36%和10.17%;平均叶面积指数LAI分别降低23.79%、18.93%、13.04%、32.74%和34.27%;玉米拔节期淹水5d以上,植株矮而黄。在植株生理反应方面,淹水3d后测定结果表明,淹水1、2、3d的叶绿素质量分数比CK高,根系活力增强,而淹水5d和7d叶绿素质量分数和根系活力下降。玉米灌浆至乳熟期叶绿素测定结果表明,淹水5d以上处理的叶绿素质量分数仍较CK降低10.87%,表明受淹5d以上,叶绿素质量分数降低并无法恢复。玉米拔节期受淹影响其后期灌浆过程中的籽粒质量,同一时间的淹水1、2和3d与对照籽粒质量比较接近,淹水5d较低,淹水7d为最低。玉米穗长和穗粗随淹水历时呈减小的趋势,但各处理间无显著差异(P<0.05)。淹水使玉米出现较长的秃尖,淹水1、2、3、5d的秃尖长度为CK的2倍左右,淹水7d的秃尖长度为CK的5倍;淹水历时越长,玉米穗长、穗粒质量、穗质量和百粒质量的减幅就越大,淹水1、2、3、5、7的玉米产量分别降低16.58%、16.65%、26.11%、34.32%和39.01%。玉米拔节期淹水5d以上,严重影响玉米正常生长,造成产量显著降低。研究结果为涝渍灾害监测和灾损快速评估以及涝渍排水标准确定提供参考。

英文摘要:

Abstract: Maize jointing stage is an important period for reproductive growth and vegetative growth and also in this stage, corn is sensitive to waterlog. In the study area in the jointing stage of corn, frequent waterlog in field often occur causing damage of corn yield. Therefore finding out the upper threshold for number of days that corn can endure waterlog, and understand the corn physiological reaction after flooding can help to develop management tools to improve corn production. The bottomless pit measurement was set at different waterlogging days (1, 2, 3, 5, and 7 d) to determine the corn response to waterlogging duration and the effect of waterlogging duration on corn growth, grain fill, dry mater distribution and yield characteristics. At the vegetative growth stage, the results showed that the average plant height of corn with 1, 2, 3, 5, and 7 days of waterlog was reduced by 2.26%, 2.26%, 2.45%, 11.36% and 10.17%, respectively, and the LAI (leaf area index) was decreased respectively by 23.79%, 18.93%, 13.04%, 32.74% and 34.27% as compared with the CK (control treatment). With the waterlogging duration more than 5 days at the jointing stage, the plants became dwarf and the leaves turned yellow. For plant physiological response, three days after each flooding duration test showed that chlorophyll content of leaves with the flooding duration of 1, 2, and 3 days was higher ( $p < 0.05$ ) than CK, and root activity increased. But the chlorophyll content of leaves and root activities of flooding duration of five and seven days decreased as compared to the CK. The result also showed that with the flooding duration more than 5 days, chlorophyll content of leaves from corn filling stage to milk-ripe stage was 10.87% lower ( $p < 0.05$ ) than that of the CK. Therefore once the waterlogging duration was more than five days at the jointing stage, chlorophyll content of leaves would stay lower and not be recovered. For the reproductive growth stage, flooding duration at the corn jointing stage affected the grain quality of post filling. The result indicated that compared with the CK, the grain yield of waterlogging duration with 1, 2, and 3 days was rather similar, but with 5 days, it was lower ( $p < 0.05$ ) and it was the lowest with flood duration of 7 days. The ear rows and ear width of corn decreased with the increase of the number of days of flooding, but it was not significantly different as compared to the CK. The corn ear tip-baren had significant difference ( $p < 0.05$ ) than the CK. The corn ear tip-baren from waterlogging duration of 1, 2, 3, and 5 days was about two times higher than the CK, the flooding duration of the 7 days was five times higher than the CK. The ear length, ear weight, ear grain weight and hundred-grain weight of corn decreased as the waterlogging day increased. The yield of corn with 1, 2, 3, 5, and 7 waterlogging days were reduced by 16.58%, 16.65%, 26.11%, 34.32% and 39.01%, respectively. Therefore waterlogging duration over 5 days not only affected the normal growth of corn, but also reduced the yield significantly. The research provided information for waterlogging monitoring, fast evaluation of damage and waterlogged field drainage standard determination.

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