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长秧龄机插稻氮素利用特性及其与环境温度的相关性

Nitrogen utilization in mechanical transplanted rice with long seedling age and its correlation with environmental temperatures

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中文摘要:

秧龄是决定机插稻产量的重要因素，适宜的秧龄是其获取高产的基础。麦（油）稻两熟区，由于茬口安排紧、插秧机械作业繁重、不利天气等因素的影响，常导致机插秧苗未在适宜秧龄期移栽，超秧龄现象普遍存在，对机插稻产量构成威胁。该文旨在阐明长秧龄机插稻对氮素的需求规律和利用效率。试验设置手栽稻为对照，系统研究了长秧龄机插稻生育期、植株氮素需求、吸收、转运的变化规律及其与环境温度间的相关性。结果表明，长秧龄机插稻生育期比手栽稻推迟4～13 d；孕穗至成熟期，中早熟品种氮素需求量小于手栽稻，中晚熟品种则大于手栽稻；孕穗至抽穗期，长秧龄机插稻叶片与茎鞘的氮素输出量、输出率呈下降趋势；抽穗至成熟期，长秧龄机插稻叶片氮素输出量、输出率、转换率升高；成熟期，穗部氮素吸收量降低。典型相关分析表明，稻株氮素需求量、孕穗至抽穗期茎鞘氮素输出量、输出率与有效积温的相关性最密切；叶片氮转换率与平均气温的关联性最紧密。长秧龄机插稻对氮素的吸收利用特性不仅与品种有关，而且与环境温度变化相关，生产中，可依据品种特性，在常规施肥基础上，适当减少中早熟品种长秧龄机插稻穗肥的施用比例，在保证安全齐穗的前提下，适当增大中晚熟品种穗肥的施用比例，采取有效的农艺调控，提高稻株对氮素的吸收利用率，尽量弥补超秧龄所造成的产量损失。该研究可为长秧龄机插水稻的大田氮肥管理提供参考。

英文摘要:

Abstract: As an important element determining grain yield, optimum seedling age plays a pivotal role in achieving high grain yield for mechanically transplanted rice. Rice seedlings which grow for a longer time are not suitable for transplanting by machine, and are called "long age seedlings." However, in wheat-rice rotation regions, rice seedlings are transplanted by machine at long seedling age due to the occurrence of unfavorable factors, such as a late harvest for the previous crop, the limitation of the number of transplanting machines, and the adverse weather, which has severely threatened the machine-transplanting rice yield. The objectives of this paper were to clarify the law of nitrogen demanding and allocation in mechanical transplanted rice with a long seedling age, providing references for rice cultivation under a mechanical transplanting pattern. With conventional artificial transplanting rice as a control, the field experiment was designed to investigate the changeable law for nitrogen requirement, transportation, and allocation in mechanical transplanted rice with a long seedling age. The growth duration of mechanical transplanting rice with a long seedling age was postponed by 4-13 d as compared with artificial transplanted rice. In the case of mid-early maturing cultivars, the amount of nitrogen requirement in mechanical transplanting rice with a long seedling age was less than that in artificial transplanting rice. However, mid-late maturing cultivars had the converse performance. When compared with artificial transplanted rice plants, the nitrogen export amount and rate of leaves and stems tended to dwindle from the booting to the heading stage as well as the nitrogen absorption amount of panicles at the maturity stage, whereas it was the contrary for the nitrogen export amount and rate and conversion rate of leaves from the heading to the maturity stage in mechanically transplanted rice. Canonical correlation analysis indicated that the nitrogen requirement amount of rice plants and nitrogen exportation amount and rate of stems and sheaths were closely related with effective accumulative air temperature, and the nitrogen conversion rate of leaves was intimately correlated with the daily mean air temperature. The characteristics of nitrogen requirement and utilization in mechanically transplanted rice plants with a long seedling age were dominated not only by genotypes but also by environmental temperature. Based on a conventional nitrogen fertilizer application for mechanically transplanted rice, the application ratio of earing fertilizer should be decreased appropriately for mid-early rice cultivars with a long seedling age while it should be enhanced for mid-late cultivars with a long seedling age on the premise of normal maturity. In addition, effective agronomic practices should be adopted to enhance nitrogen usage efficiency of mechanically transplanted rice with a long seedling age, which may gain compensation for the yield loss which resulted from mechanical transplanting at an over-optimum seedling age.

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