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覆膜旱种降低水、陆稻锰素吸收提高锰素利用效率

Plastic film mulching cultivation decrease absorption of manganese and improve its use efficiency in upland and paddy rice

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中文摘要:

揭示覆膜与裸地旱种对水、陆稻锰(Mn)素吸收利用的差异。以陆稻中旱3号和水稻武香粳99-8为供试材料，以传统淹水种植方式为对照，设置覆膜和裸地2种旱种方式，研究了覆膜旱种和裸地旱种对Mn素吸收利用的影响。结果表明，陆稻中旱3号覆膜旱种的产量较对照显著降低9.0%，而水稻覆膜旱种的产量较对照无显著差异，陆稻和水稻裸地旱种的产量分别较水种显著降低11.7%和8.0%。旱种使稻株的含Mn量、稻米中的含Mn量和Mn素累积量均减少，而Mn素物质生产效率、Mn素籽粒生产效率和Mn素收获指数均增加，旱种还使M n素在稻株穗部分配比例增加，在叶片和茎鞘中的分配比例表现不一。与武香粳99-8相比，中旱3号生育后期稻株含Mn量提高13.1%～20.6%，Mn素累积量较少5.2%～9.6%，Mn素物质生产效率和Mn素籽粒生产效率降低，Mn素收获指数增加。水种时中旱3号稻米中Mn含量明显低于武香粳99-8，而旱种时则表现相反。表明旱种稻株对Mn素吸收利用因种植方式和品种类型不同而有较大差异。

英文摘要:

Abstract: To meet the challenge of drought in China, water-saving techniques have been developed and applied in rice (Oryza sativa L.) growing areas since the last decade of 20th century, such as the dry-cultivated technique for paddy rice and the acreages of upland rice in rained areas, which has played a positive role in stabilizing and promoting food production. Manganese (Mn) as a trace element is both essential for rice growth and the essential trace elements in the human body. However, the effect of cultivation patterns on Mn absorption and use efficiency of upland and paddy rice rarely has been reported. The objective of this study was to evaluate the difference between upland rice cultivar Zhonghan3 (japonica) and paddy rice cultivar Wuxiangjing99-8 (japonica) which were grown in the farm of the Yangzhou University under three cultivation patterns of moist cultivation (MC, control), plastic film mulching cultivation (PFMC), and bare cultivation (BC). The MC was based on conventional irrigation for high-yielding rice production, that is, keeping a water layer in the field from transplanting to regreening, alternating wet and dry soils during the other growth periods, and stopping the water supply obe week before harvest. The total quantity of irrigation was 5,213 m3 ha-1. In the PFMC treatment, the field was dry-plowed, and then, the beds (1.5 m in width) were made and mulched, the beds were fully watered from transplanting to one week after transplantation while the plants were alive. The DC treatment was the same as the PFMC treatment, except for not mulching before transplanting. Totally, water of 723 m3 ha-1 was supplied at the vigorous tillering, booting, and heading stages, and no water was irrigated during the other growth periods. From heading to maturity, the soil moisture was monitored by tensiometers that were installed in the field. The soil water potential was normally at -15 to -25 kPa. The results showed that, compared with the MC, the grain yield was significantly lower by 9.0% under PFMC for upland rice, but no significant difference was found between PFMC and MC for paddy rice, and grain yield was significantly reduced by 11.7% and 8.0% under BC for both upland and paddy rice. Dry cultivation lowered the Mn content in plants and in grain under PFMC and BC and lowered the amount of Mn absorption in plants, resulting in higher Mn use efficiency of matter production（MUEp）, higher Mn use efficiency of grain yield production (MUEg) and Mn harvest index (MHI). The proportion of Mn in leaves and sheaths were both disordered and in ears increased under dry cultivation for Zhonghan3 and Wuxiangjing99-8. Compared with Wuxiangjing99-8, Zhonghan3 exhibited higher Mn concentration by 13.1-20.6% from heading to maturity, lowered Mn accumulation in plants by 5.2%-9.6% at the later growth stage, lowered MUEp and MUEg and resulted in higher MHI. The Mn content in grain was significantly lower for zhonghan3 than for Wuxiangjing 99-8 under moist cultivation, but it showed the opposite under dry cultivation. The results suggest that the effect of dry cultivation on the absorption and use efficiency of Mn varies largely with the cultivation patterns and variety types.

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