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Effects of Different Levels of Nitrogen and Planting Density on Growth of Rice

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[Introduction]

Although rice transplantation occupies most of Korea, it is the cultivation method that requires a lot of labor for nursing the seedlings and transplanting. Recently, 'Low-density transplanting cultivation(LDT)' had been expanding due to the decrease in the labor force in rural areas, as this can reduce the burden of transplanting. LDT is a technique to increase the seeding amount per a seedling tray and reduce the planting density in order to transplant with the minimum number of seedling trays in the same area. Studies of LDT has been conducted in Korea, resulting in the development of suitable seedling methods and planting density. It is recommended that the planting density is 50 to 60 hills per 3.3㎡ with small decrease in yield. But, a fertilization method suitable for this new technology has not been studied. Therefore, the purpose of this study is to analyze the growth under the different levels of nitrogen and planting density in order to set the appropriate nitrogen fertilizer level.

[Materials and Methods]

This study was conducted at the National Institute of Crop Science(NICS) in 2022. As for the variety, Sindongjin with many tillers and Hopyeong with few tillers were selected. During nursery, controls were sown with 130 g per tray and nursed for 30 days, and in LDT, 300 to 350 g per tray were sown and nursed for 15 days. The planting density was set to 80 hills per 3.3㎡ (30×14cm) for the control group and 50 hills(30×22cm) for LDT. Seedlings were transplanted into large stainless steel pots with a size of 110×70cm and treated with different nitrogen fertilization levels of 5, 9(standard), 13, 15kg per 10a in each pot. The nitrogen split rate of 50-20-30% was applied and the other management was followed the standard cultivation method in rice.

[Results and Discussion]

The research of growth was conducted at 3 day after heading. Culm length increased as nitrogen level increased. Compared to the standard N level(9kg/10a), they were 2 to 3% longer in 13kg, 15kg and 5% shorter in 5kg. As for panicle length, there was no change under different N levels, and panicle of Sindongjin was 2.1cm longer on average than that of the Hopyeong. The factor with the biggest change under N fertilization was the number of panicles. The number of panicle per hill increased by an average of 22% in 13kg and 34% in 15kg compared to the standard(9kg). The ratio of the number of panicle per ㎡ of 50 hills(LDT) compared to 80 hills(control) was 82% in standard N level(9kg). but, it increased by 92% in 13kg, and then decreased by 86% in 15kg. This tendency was greater in Hopyeong than Sindongjin. Hopyeong was secured 81% in standard N level(9kg), but in 13kg and 15kg, 94% and 90% secured, and the fertilization effects of Hopyeong was analyzed to be greater. On the other hand, in order to analyze the appropriate N fertilizeration in LDT, the control group(standard fertilization(9kg) + conventional planting density(80 hills)) and LDT group(50 hills) by N levels were compared. In both varieties, the number of panicles as many as the control group was secured in 13kg. Therefore, if 13kg of N ferilizer is applied at LDT, panicle number is secured and the yield is expected to increase. However, the final optimal N fertilizer level should be determined through yield and quality analysis later.

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