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Genetic Studies on the Factors Controlling Heading Date and Its Synchrony in Hokkaido Rice Varieties

（北海道イネを用いた出穂性と穂揃い性に関する遺伝解析）

生物資源科学専攻　植物育種科学講座　植物育種学　坂口俊太郎

1. Introduction

Rice is a crop with multiple tillers and each tiller develops at a different stage. The period from first panicle heading to last panicle heading is called heading synchrony. Heading synchrony is the important agronomic trait which influences rice yield and grain quality. Several studies have reported on phenotypic variation in heading synchrony, but relatively little has been studied about the genetic basis of heading synchrony. Hokkaido varieties are known to have low synchronous heading, while it might be a unique adapted trait to avoid synchronous cold damage. In this study, I focused on Hokkaido varieties and elucidated environmental and genetic control of heading synchrony.

2. Materials and methods

I used Hokkaido varieties and RILs from a cross between Hokkaido varieties. Heading synchrony was examined in two years using four different environments, Hokkaido, Mie, and a greenhouse with two different day length conditions. With genome-wide 634 SNP markers among RILs, I attempted to detect QTLs for heading synchrony. Expression levels of florigen of each tiller were quantified to test associations with heading synchrony.

3. Results and discussion

I verified that heading synchrony was strongly correlated to heading earliness, and the early heading of Hokkaido varieties was the main cause of their low synchronous heading. I also found that environmental conditions in Hokkaido contributed to lower synchronous heading. Since the effect of day length on heading synchrony was confined, I assumed that temperature was the main factor for controlling heading synchrony. Although I could not detect QTL specifically involved in heading synchrony, my result indicated that heading synchrony had genetically diverse among the rice varieties.

I quantified expression levels of florigen to understand the mechanism on the varied degrees of heading synchrony. The results indicated that different expression levels of florigen and asynchronous floral initiations of tillers might cause a non-simultaneous transition of the growth phase in the plant.

This study revealed that heading synchrony was controlled by environmental factors as well as genetic factors. These results may contribute to the improvement of heading synchrony as a breeding trait.