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Studies on establishment rate of direct seeded rice in relay intercropping system

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Abstract

Relay intercropping system of direct seeded rice and winter cereal is labor saving cultivation and has high land use efficiency in Japan. In this system, rice seeds are direct seeded into inter-row space of winter cereals (wheat or barley) in March or April. If the direct seeding of rice is conducted before stem elongation phase or using suitable seeder, these are little effect to yield of winter cereals. Though the seeds are generally thiuram treated, it's a matter that seedling establishment rate (SER) of direct seeded rice is low and unstable. The cause of low SER has not been revealed. In present study, with the aim to reveal causes of low SER, we conducted experiments and investigated the SER, and analyzed some factors that might affect SER. Experiment1: In 2015, 2016, we buried rice seeds underground, and investigated the transition of the seed survival rates (SSR). Seeds were thiuram-treated or non-treated. In 2 periods, SSR of thiuram-treated seeds were significantly higher than non-treated seeds. In 2016, thiuram-treated seeds were high in SSR (almost 75%) at April 30th, but low SER (10~27%) after harvest of winter cereals. Therefore, almost all of seed death might have been happen after germination. Analysis 1: We investigated the SER and cultivation conditions in Ibaraki pref. for several years. Meteorological factors were referred from the nearest point of AMeDAS. From mean temperature (MT) among 5days after and before the day, we divided the period of seeding ~June 20 to phase1~4. We defined each phase as below; Phase1: $MT \leq 10^{\circ}\text{C}$, Phase2: $10^{\circ}\text{C} < MT \leq 15^{\circ}\text{C}$, Phase3: $15^{\circ}\text{C} < MT \leq 20^{\circ}\text{C}$, Phase4: $MT > 20^{\circ}\text{C}$. We analyzed the correlation of SER and meteorological factors by each phase. Total number of days in phase 1~4 was significantly negative correlated with SER. In phase1, total rain fall and number of soil wetting days were significantly negative correlated with SER. In phase2~4, only MT was significantly positive correlated with SER. This result suggested that rainfalls in phase1 declined seed vigor to emergence from soil surface, by repeated water absorption and re-dry. From these present studies, it was suggested that one of factors of low SER of direct seeded rice in relay intercropping system is changing of water condition by rainfalls in phase1 ($MT \leq 10^{\circ}\text{C}$). To improve SER, it's necessary to consider something seed treatments such as prevent water absorption during phase1. However, 58~60% of seeds seemed to die during May. It's suggested that, if seeds are thiuram treated, almost all of seeds can germinate underground, but the seed vigor to emergence from soil surface are insufficient. Further studies are needed to reveal the rest causes that is happening during emergence from soil surface.

Keywords: rice, relay intercropping, establishment rate

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