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学位論文全文に代わる要約
Extended Summary in Lieu of Dissertation

氏名：
Name
Emelie Casayuran Ablaza

学位論文題目：
Title of Dissertation

Studies on Late Summer Sowing Cultivation for High Quality Wheat Production in Southwest Japan
(西南日本における高品質小麦生産のための夏播き栽培に関する研究)

学位論文要旨：
Dissertation Summary

The conventional wheat growing season in southwest Japan is from November to June. However, the high temperature and rainfall during the reproductive to grain filling phase from April to June affects grain quality. Thus, wheat cultivation from September to January with late-summer sowing is being developed. Late-summer sowing results in a shorter cropping period and advantages for pest and disease avoidance.

In late-summer sowing, wheat seeds shall undergo vernalization for physiological reasons. Seeds or seedlings are the most vulnerable stages of plant growth to nutrient deficiencies, it is important therefore that the wheat seeds, seedlings, be enriched before these are sown. In soaking seeds during vernalization process, providing wheat germ with nutrients is essential for vigorous germination and faster growth rate.

Given the harmful nature of chemical farming in crop production, investigations on the alternative option of using natural materials are increasing. In the study, natural minerals such as rocks as well as spring and seawater were tested.

The objective of this dissertation is to establish production technology using non-chemical materials to increase yield and quality of wheat for late-summer sowing cultivation.

The first study investigated the effects of vernalization with ultrasonic activated water on flour quality of wheat. Treatment 1 had the seeds soaked on quartz porphyry solution and was exposed to ultrasonic treatment for 10 and 30 minutes. Treatment 2 had the seeds soaked in plain water and had undergone ultrasonic treatment for 30 minutes. Control section had the seeds soaked in plain water without ultrasonic treatment. Seeds were all subjected to vernalization before planting. Results showed that treatment 1 which had undergone ultrasonic treatment for ten minutes had faster growth rate; higher yield, protein content, milling and flour quality. Thus, ultrasonically-activated quartz water for ten minutes improved yield and processing qualities of wheat grain.

The second study deals with the use of sedimentary rock to determine its potential effect on the soil quality, growth response and grain yield of Miyakou 1 and 2 for late summer sowing. Application rate of 300kg/10ares was added to soil and was planted with Miyakou 1 and Miyakou 2 wheat varieties. Sedimentary rock improved soil pH, MgO, humus and CEC. Number of spikes per plant, 1000-grain weight and total yield were increased by sedimentary rock. It also influenced increased protein content, early heading and harvest of Miyakou 2 variety. Results indicate that sedimentary rock is suitable for Miyakou 2 variety grown in late summer without.

In the third study, distilled water (DS, control), electrokinetic treatment (EKT) water, seaweed yeast extract (SYE) water and mineral spring water (SW) were tested for their physical and chemical properties. Each test waters were used in the vernalization of wheat seeds, and were grown under phytotron conditions simulating late summer sowing condition. Using SYE water, wheat had shorter duration of vegetative growth. It also

exhibited early heading and maturity, resulting to shortest development period. Thousand-grain weight was significantly heavier in SYE wheat (25.77 g) as compared to control (19.26 g). Wheat vernalized with EKT water had the longest spike and highest number of grains per spike. The results suggest that vernalization and natural waters influenced wheat growth and development.

Management practices such as fertilizer, reduced tillage and seeding rate were important in wheat production. Pneumatic fertilizer drill was tested to determine the performance of the machine and its influence on the growth, quality and yield of late-summer sowing wheat. This machine was developed as a multi-row fertilizer drill equipped with a rational feeding system. There were two plots under the study; Plot I with a seeding rate of 8 kg/10 a and Plot II with 16 kg/10 a, 40 kg of basal fertilizer was applied for each plot with the following fertilizer components; N 16 kg, P_2O_5 and K_2O 10 kg. The results obtained are summarized as follows: working performance of a pneumatic fertilizer drill had an effective operation capacity of 0.80 ha/h and a field operation capacity of 0.32 ha/h using working width of 2.5 m at ground speed of 0.91 m/s, and yields of wheat were found to be 24.2 to 38.7 kg/a for 275 to 451 plants/m^2 of spikes under a seeding rate of 8 to 16 kg/10a.