

Trade-off Analysis on Rice Grain Quality and Productivity by Alternative Wet Drainage

間断灌漑による米の品質と収量に関するトレードオフ関係の分析

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1. Introduction

Pursuit to achieve higher output in rice should not disregard the quality traits. In fact, if characteristics such as taste, texture, aroma, or appearance do not concern by consumers; any other outstanding characteristic in newly developed rice varieties may be considered worthless.

Effect of reduced water regimes (water stress) on quality of rice, unlike yield has been documented, but to a lesser extent. Study by Gu et al. (2001) indicates moderate water deficit during grain filling stage contributes for yield elevation which reflected on its quality traits such as; protein contents, alkali digestibility and amylose contents. Nonetheless, there is potential that application of water saving techniques apart from effectively used water, potentially reduce the yield. However, a meta-study suggested that alternate wet drainage (AWD) decreased yields by 5.4%; whilst, under mild AWD (i.e. soil water potential ≥ -20 kPa) yields were not significantly reduced (Carijjo et al., 2017). As that, to find trade-off between yield and quality should be a way forward for quality oriented rice production. Therefore, the objective of this study was to assess grain quality traits as affected by different phases of mild AWD as one of water saving techniques.

2. Materials and methods

Glasshouse trial was conducted in mid of July–October 2017 designed as to GRD with 8 replications with pots rearrangements were made every 3 weeks to minimize sunlight and field variations. Three (3) safe (≈ 20 Kpa) alternate wet drainage (AWD) irrigation were imposed at 3 different phases of rice cultivation (Fig.1) The

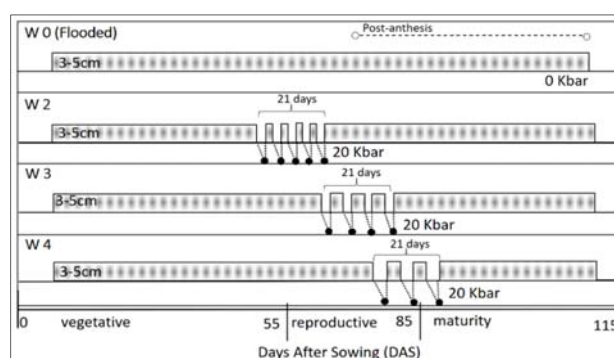


Fig.1 Safe AWD and control set.

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“Koshihikari” *japonica* seed variety was grown and fertilizers were applied at the rates of 130:100:100 for N, P₂O₅, and K₂O accordingly. The irrigations on daily basis maintained 3–5 cm of ponding depth whilst during AWD phases at 0/5 cm accordingly. Two quality traits were reported; chalkiness and protein contents. Statistical analysis of data was carried out using SigmaPlot software 12.0 version (Systat Software, San Jose, CA).

3. Results and Discussions

Post-anthesis AWD treatment (W4) portrayed low productive tillers with higher filled grain and yield (Table 1). These in agreement with Yoshida et al., (1981) which indicated that higher productive tillers potentially lead to inconsistency in assimilates and nutrients mobilizations at panicles and grains. Reductions of certain physiology and productivity parameters compensated with grain quality in terms of chalkiness and protein contents (Fig.2). The W4 treatment reported were lowest in chalkiness rate with considerably high rate of protein contents (PC). Our preliminary results also coherent with Yang and Zhang (2010) which emphasized on post-anthesis controlled soil drying improves remobilization of carbon reserves and grain filling, the latter potentially contributed towards higher grain quality formations.

References

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Table 1. Physiology and yield

Treatment	Panicles tillers ratio	Filled (%)	Yield (t/ha)
W0	0.89a	77.6a	5.1a
W2	0.93a	84.1a	4.4ab
W3	0.93a	78.3a	4.3b
W4	0.78b	81.8a	4.8ab
P>f	**	ns	*

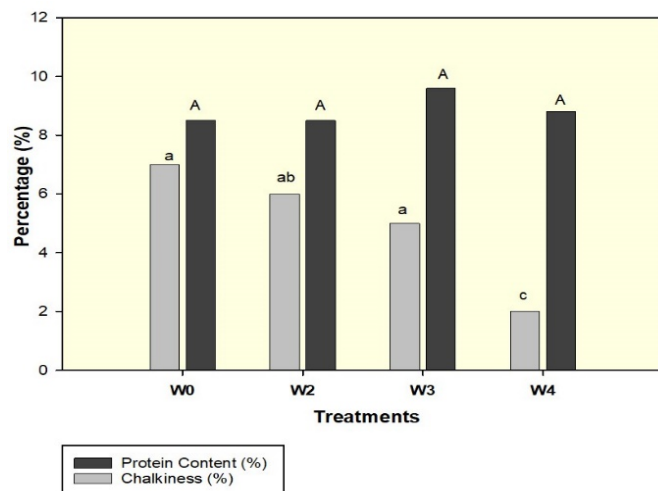


Fig. 2 Rice quality evaluations