Cold Tolerance in Aerobic Conditions: is it different to Flooded?

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Abstract

Aerobic production (non-flooded, well-watered) is considered the next step in improving water productivity in southern New South Wales, Australia. While understanding of cold-induced sterility at the early microspore stage is relatively well understood under flooded conditions, its response to aerobic conditions is limited. In a glasshouse experiment, 18 genotypes were exposed to cold temperature (15/21°C) for 14 days at the early microspore stage under aerobic and flooded conditions. Fifteen of the lines had a consistent expression of spikelet sterility between the aerobic and flooded conditions. A highly significant ($p<0.01$) genotype by water regime interaction was present and was largely the result of Japanese line, Tachiminori, which had a four-fold increase in spikelet sterility under aerobic conditions compared to the flooded (27%). Spikelet sterility between the two water regimes was highly correlated (r=0.73**) which indicates that current selection methods under flooded conditions are suitable for the selection of cold tolerance at the early microspore stage. In the dissection of the floral traits, a significant ($p<0.05$) correlation was found between spikelet sterility and number of dehisced anthers in flooded (r=-0.92**) and aerobic conditions (r=-0.68*). The association between filled pollen in anther and spikelet sterility was found in flooded (r=-0.73**), but not in aerobic conditions which indicates the existence of some inherent differences in in the underlying physio-morphological causes of spikelet sterility. Currently, glasshouse and aerobic field screening of the 2*M205//Millin/Lijiangheigu breeding population is underway to validate current screening methods.