Physiological Response of Aged Rice Seeds to Flooding During Germination and Crop Establishment

Swarna Herath[1*], Frederickson D. Entila[2], Evangelina S. Ella[2], Pompe Sta.Cruz[3], Aurora M. Baltazar[3], R.F. Hafeel[1], K.H.C.H. Kumara[1], Abdelbagi M. Ismail[2] and David E. Johnson[2]

[1] Rice Research Station, Ambalantota, Sri Lanka
[2] International Rice Research Institute, Los Baños, Laguna, Philippines
[3] University of the Philippines Los Baños, Laguna, Philippines

Abstract

The Key component of weed management in direct seeded rice is early flooding, Therefore, this study was conducted to understand the response of seed storage duration and storage conditions on germination under flooding. The present study was carried out using 4 rice genotypes such as KhaoHlanOn (KHO), Khaiyan, IR64 and IR42 with three different storage durations: 5, 10 and 15 months and two storage conditions; controlled storage (Seal Jar) at 25 °C and relative humidity of 60-70 % and ambient storage (uncontrol storage -27-35 °C). Dry seeds were sown in dry soil in 1 cm soil depth and flooded to 5 cm water depth and 0 cm (saturated soil) maintained as control. Germination %, seedling vigor, growth and seedling survival were assessed at 21 d after sowing. Lipid peroxidation and total phenolic content were assayed in dry seeds before sowing and amylase activity was assayed in germinating seeds at 4 d after sowing. Flooding decreased germination, seedling vigor and survival in 15 months old seeds; greater decreased was associated with the seeds stored at ambient conditions than controlled storage conditions. Higher malondialdehyde (MDA) content, lower phenolic content and lower amylase activity of age seeds were associated with their lower germination and seedling survival. The prolong seed storage at ambient condition resulted in increased MDA content and deceased amylase activity. MDA content of dry seeds which were stored at controlled conditions before sowing negatively correlated with seedling survival ($r = -0.75^{***}$) under flooding condition at 21 d after sowing. Controlled storage seeds showed higher phenolic content and which was positively correlated with seedling survival ($r = 0.56^{**}$) under flooded condition. Five months stored tolerant rice genotypes ((KHO) and Khaiyan) had lower MDA and phenolic content, dry seeds before sowing and higher germination, seedling vigor, survival, and higher amylase activity under flooding conditions. Seed storage time and ambient storage condition negatively affects the seedling survival and amylase activity under flooding conditions. Combination with flooding tolerant rice genotypes and pre- seed management are important to achieve improved crop establishment, especially areas prone to early flooding condition.

Keywords: Amylase activity, MDA content, Seed age, Storage durations, Total phenolic content

[*]***Corresponding Author:*** swarnherath@gmail.com