Determination of drought critical periods for upland rice in Brazilian savannahs

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Introduction – For a drought breeding program to be efficient, it is determinant to know how different drought patterns are distributed in the TPE ('target population of environments'). If the frequency of different environment patterns for drought is known, then

• yields from different trials can be 'weighted', depending on how well each trial samples the TPE or

• special drought treatments or 'out-of-season' drought treatments can be managed to ensure a sampling of a given drought pattern.

Objective – To determine the drought stress patterns and their frequency for 2 different upland rice genotypes (short and medium cycle duration: SC and MC) for Goias State, to be compared then with the stress pattern frequency of main Embrapa upland rice breeding station in Brazilian Savannas (CNPAF- 16.5°S 49.3°W , Goias State).

Material and Methods – Simulations were performed for each location (12 sites), planting date and year using available weather data. Simulated daily stress index (ratio of actual on potential evapotranspiration) was averaged over each 100 degrees days. Stress index pattern over the season was clustered across simulations (site X year X sowing date combinations) to determine the drought patterns and their frequency for a given genotype (SC or MC).

Results - Fig. 1 shows the drought patterns for the 2 different rice genotypes. For both genotypes, the terminal stress has the highest impact on simulated yield (Fig.1 & 2). For Goias, rice short cycle, the most frequent stress patterns are "Low" and "Initial Reproductive" stress. Meanwhile, it seems that CNPAF breeding station is a rather 'low stress' site compared to Goias TPE (Fig.3).

For rice medium cycle, the predominant stress pattern in Goias is "Initial Reproductive". However, In CNPAF, the "Initial Reproductive" is quite rare, with the higher frequency only in the first and last planting date. The predominant stress patterns for this site is "Low" stress (Fig.4).

Conclusion – While the main breeding station for rice (CNPAF) in Goias state do sample for drought in the whole state, a more reliable screening for drought would be to grow out-of-season trials at this location, and manage the drought with irrigation.

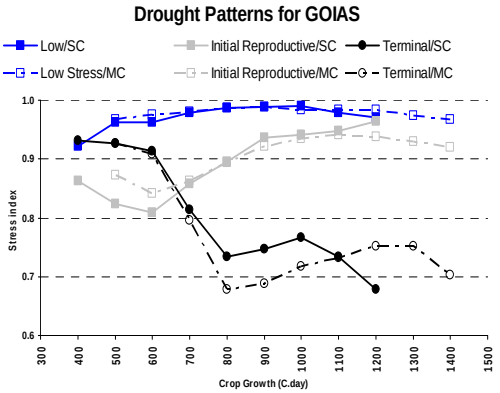

Fig. 1 – Stress patterns for Goias State for upland rice short-SC (solid line) and medium cycle-MC (dashed line).

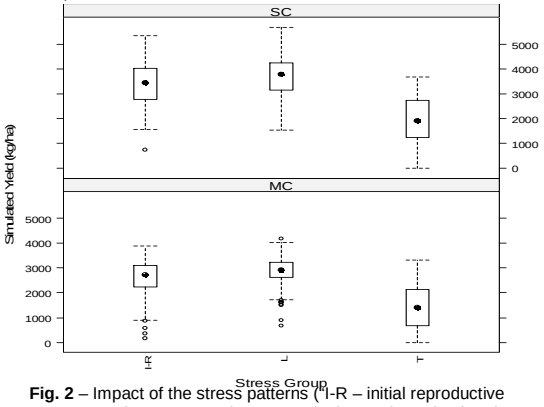

Fig. 2 – Impact of the stress patterns ("I-R – initial reproductive stress, "L" – low stress and "T" – terminal stress) on simulated yield of upland rice short (SC) and medium (MC) cycle.

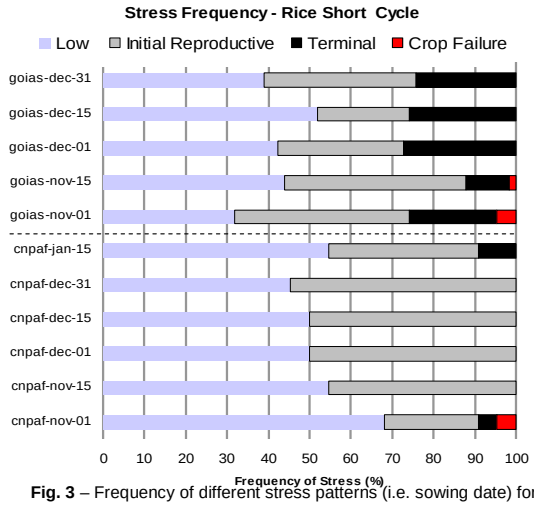

Fig. 3 – Frequency of different stress patterns (i.e. sowing date) for 'short cycle' rice in Goias State and CNPAF breeding station.

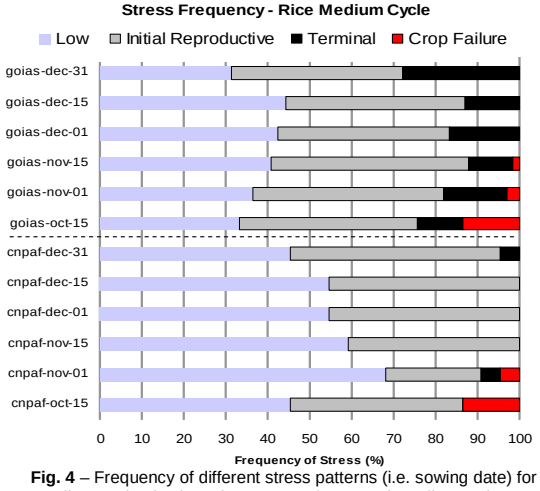

Fig. 4 – Frequency of different stress patterns (i.e. sowing date) for 'medium cycle' rice in Goias State and CNPAF breeding station.