PANICLE DIFFERENTIATION AND MAIN STEM LEAF NUMBER IN CULTIVATED RICE GENOTYPES AND RED RICE BIOTYPES.

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Panicle differentiation (PD) is an important developmental stage in rice (*Oryza sativa* L.). At this developmental stage, plant switches from vegetative to reproductive development and source-sink relationship start allocating part of the photoassimilates for spikelets and kernels growth. From a crop management perspective, PD is also a key moment during the developmental cycle of rice, as second nitrogen dressing is recommended at this developmental stage (SOSBAI, 2005). The identification of PD stage is destructive (STANSEL, 1975), which is a disadvantage because of the need of dissecting plants and trained personal. The search for plant morphological indicators for PD that are easily identifiable with non-destructive methods to overcome these disadvantages is a good research goal to pursue.

In small grains, such as rice, the number of accumulated or emerged leaves on the main stem (NL) is often represented by the Haun Stage (HS), which is the number of fully expanded leaves plus the ratio of the length of the expanding leaf to the penultimate leaf (HAUN, 1973). The main stem NL in rice is related to the timing of several plant developmental stages such as tillering (WATANABE et al., 2005), PD (WATANABE et al., 2005), booting and anthesis (COUNCE et al.. 2000; WATANABE et al., 2005). YIN & KROPFF (1998) reported that at PD, there are still about three leaves to appear until flag leaf appearance on the main stem. FREITAS et al. (2006) demonstrated that PD occurres when main stem has seven fully expanded leaves and this value did not vary among three genotypes in three sowing dates. However, STRECK et al. (2006a, b) showed that final leaf number (FLN) varied among seven rice cultivars and among sowing dates. Combining the results by YIN & KROPFF (1998) and STRECK et al. (2006a, b), it implies that the NL at PD varies among genotypes and sowing dates, which is conflicting with the results reported in FREITAS et al. (2006). These conflicting results constituted the rationale for this effort.

The objective of this study was to determine the main stem HS and the number of leaves left to emerge until flag leaf at panicle differentiation in some cultivated rice genotypes and red rice biotypes in different sowing dates. Red rice was included in the study because it is a major weed of paddy rice in Southern Brazil.

A two-year field experiment was conducted during the 2005-2006 and 2006-2007 growing seasons, at the field area, Plant Science Department, Federal University of Santa Maria, Santa Maria, RS, Brazil (latitude: 29º 43'S, longitude: 53º 43'W, and altitude: 95m). In 2005-2006, plants were grown in 12 liter (30cm diameter and 26cm height) pots and in 2006-2007, plants were grown both in pots and in a paddy rice. Plots in the paddy rice were composed of four 1m rows spaced 17cm among rows. Soil type at experimental site was a Rhodic Paleudalf (USDA Taxonomy).

For the pot-grown plants, three sowing dates (day/month/year) were used each year: 25/09/2005, 26/11/2005 and 02/02/2006 in the 2005-2006 growing season, and 08/11/2006, 13/12/2006 and 16/01/2007 in the 2006-2007 growing season. Each replication was a pot with 10 plants. The experimental design was a completely randomized, with four replications. Nine cultivated rice genotypes (IRGA 421, IRGA 416, IRGA 417, IRGA 420, BR- IRGA 409, BRS 7 TAIM, EEA 406, EPAGRI 109 and a hybrid (not commercially released yet) and two red rice biotypes (awned yellow-hull and awned black-hull) were used in the pot experiment. In the paddy rice, two sowing dates were used (13/12/2006 and 16/01/2007) with two cultivated rice cultivars (IRGA 421 and EPAGRI 109). The experimental design was a completely randomized block with four replications. The wide

range of sowing dates within each year was chosen to have plants growing and developing under different temperatures and photoperiods, which render rice plants to have different FLN (STRECK et al., 2006b), and correspond to sowing dates before, during, and after the recommended sowing time for this location, which is from 01 October to 10 December (SOSBAI, 2005).

Five plants/pot in the pots and five plants in the central row of the field plots were tagged with colored wires one week after emergence. plants located in the central part of the pots were selected. Panicle differentiation (Stage R1 of the COUNCE et al., 2000 scale) was identified by sampling four plants from each genotype on a daily basis. PD was identified by cutting the main stem length wise and a 2mm long white and a fuzzy panicle similar to a small cotton ball was visible (STANSEL, 1975). When 50% (2 out of 4) plants were at R1, the main stem HS was measured in the five tagged plants per replication. The main stem final leaf number (FLN) was also measured on the main stem of the tagged plants when the colar of the flag leaf was visible.

When pooling all data, results showed that the greater the main stem FLN the greater the HS at R1 (Figure 1a, 1c). A slight and weak positive relationship between the number of leaves still to emerge at R1 and FLN (Figure 1b, 1d) was also observed. The HS at R1 varied from 8.9 leaves in the very early cultivar (IRGA 421) to 15.5 leaves in the late cultivar (EPAGRI 109) in the 2005-2006 growing season. The variation was smaller in the 2006-2007 growing season (from 8.8 to 13.7 leaves). Other rice genotypes and red rice biotypes were intermediate between those two. These results are not in agreement with the ones reported by FREITAS et al. (2006) that R1 occurs when the number of expanded leaves on the main stem is 7. The main stem number of leaves that still have to emerge at R1 varied from 1 to 6, in the 2005-2006 growing season and from 1 a 3 in the 2006-2007 growing season which is also not in agreement with results previously reported (YIN & KROPFF, 1998).

The difference of main stem leaf number at R1 between this study and the study by FREITAS et al. (2006) varied from 2 to 8 leaves and can have considerable impact on fertilizer management in a rice field. The second nitrogen dressing is recommended at R1 (SOSBAI, 2005). If R1 is estimated based on main stem leaf number, the 2 a 8 leaves difference corresponds to 1 to 4 weeks difference in a calendar day, which can affect the nitrogen use efficiency. Another impact of such difference is when the main stem leaf number is used to estimate the end of photoperiod-sensitive phase in rice, which ends at around R1 (YIN et al., 1997).

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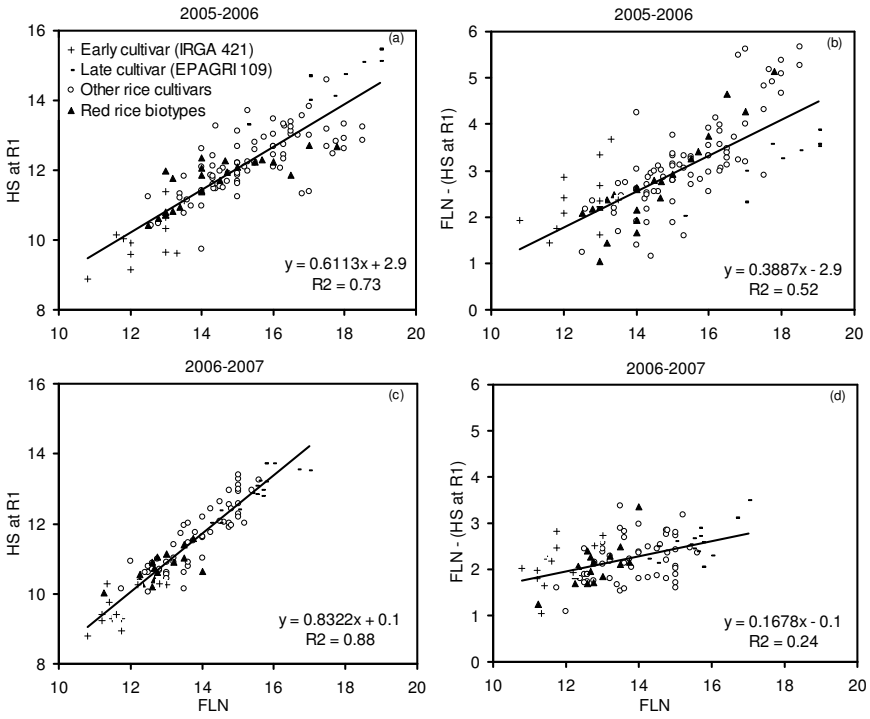

Figure 1. Relationship between (a, c) main stem Haun Stage at panicle differentiation (HS at R1) and main stem final leaf number (FLN) and between (b, d) the difference between main stem final leaf number and HS at R1 [FLN – (HS at R1)] and FLN. Santa Maria, RS, Brazil, 2005-2007. Data of nine cultivated rice genotypes and two red rice biotypes are pooled. Each point is one replication (average of five plants).