Relative Maturity on Maize: Does it really represent duration of maize growth period?

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Introduction

Maize phenological stages duration knowledge allows elucidating the effect of factors and also the impact of specific agronomic practices that affect grain yield. Estimation of relative maturity (RM) has been used by breeding programs as a tool for hybrid selection and is considered by farmers as a relevant trait for maize production systems. However, the RM does not indicate the duration of specific crop stages, such as vegetative or reproductive periods. This information is relevant to understand genotypic differences in grain yield, especially for hybrids with similar RM's.

Materials and Methods

Several experiments were conducted during 2010 and 2013 in order to identify genotypic differences in 1- duration of several phenological stages: sowing to emergency, emergency to anthesis, anthesis to silking, effective grain filling period (from R2 to physiological maturity), and dry down period, 2- morphological trait: total leaf number, plant height, and ear height, 3- yield components: kernel number (KN) and kernel weight (KW) and 4- grain yield sensitivity to stress. Experiments included a combination of irrigated and non-irrigated conditions, and planting dates (early and late planting).

Objectives

- **To identify phenological stages and their relative effect on the duration of the crop cycle.**
- **To quantify the yield component for a group of hybrids with similar RM.**

Results and Discussion

Figure 1 shows that relative maturity has a strong association with grain moisture at harvest but low or no relation with grain yield. Sometimes, greater relative maturity is associated with higher performance.

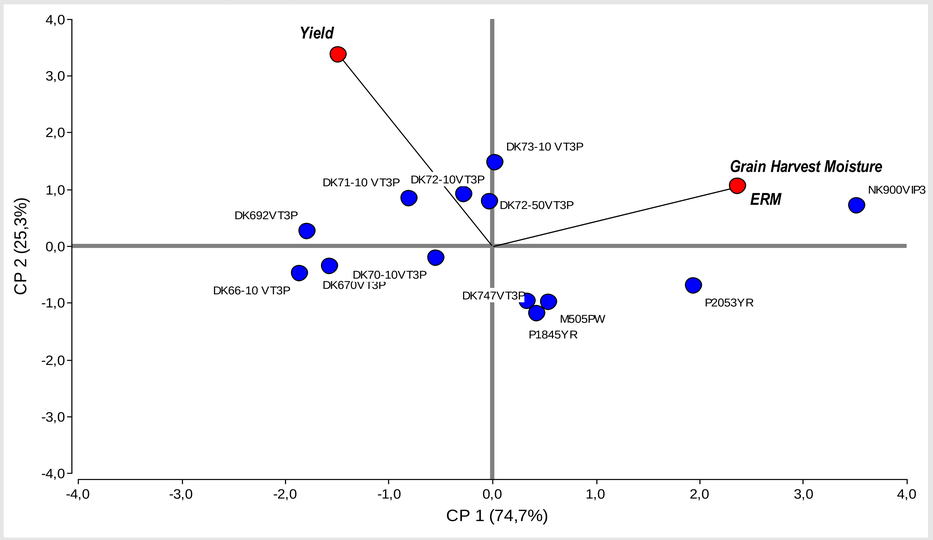

Figure 1. Biplot analysis shows the relationships between variables (Yield, Grain Harvest Moisture and Relative Maturity Estimated). Blue dots represent the hybrids considered in this analysis.

Figure 2. RM is associated with the grain moisture at harvest. The RM range of Dekalb's (DK) portfolio in Argentina for the temperate corn region is ~4,3 and for the entire corn market is ~8,9.

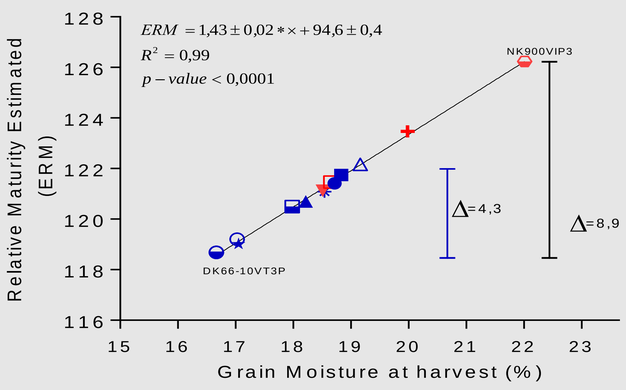

Figure 2. Relation between ERM and grain moisture at harvest. Symbols represent each hybrids, blue= Dekalb hybrids, red= competitors. These are the main corn hybrids in the market. Each point is the average from 35 locations and reps by locations, planted during 2013/14 in the temperate corn region,. Balanced Data Set.

Figure 3. The RM range in Argentina is narrower compared to the 40+ points in the U.S. (80 to 126 RM).

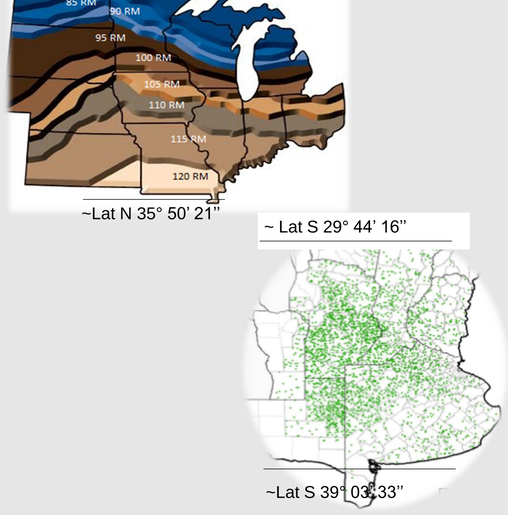

Figure 3. Argentina temperate corn distribution and U.S. RM corn map. The U.S. has a broader scale in corn RM's hybrids for same latitude range.

Figure 4. This study indicates that flowering time is almost similar for all DK temperate hybrids (differences below 3 days), planting to R6 stage show small differences between them but dry down phase is high variable between hybrids.

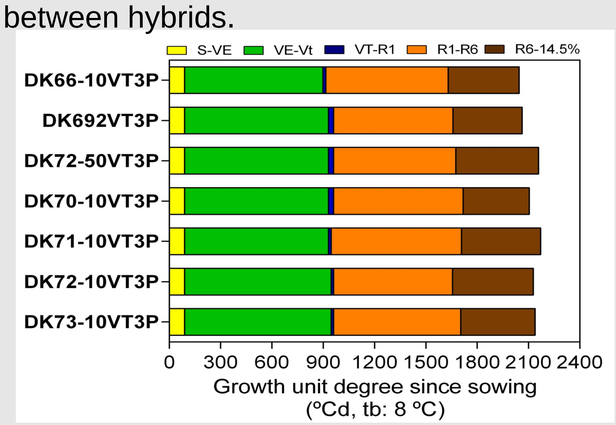

Figure 4. Physiological stages. Each phase is represented by horizontal bar. Yellow= planting to emergence stage (1 leaf visible); green= emergence to anthesis, blue= anthesis to R1 (interval silking-anthesis –ASI), orange= R1 to R6, and brown= R6 to 14,5 grain moisture.-drydown phase-. The main differences between hybrids are due to drydown phases.

Figure 5. There is genetic difference in the dry down phases, however this stage is highly affected by environment factors, mainly relative humidity, vapor pressure and air temperature.

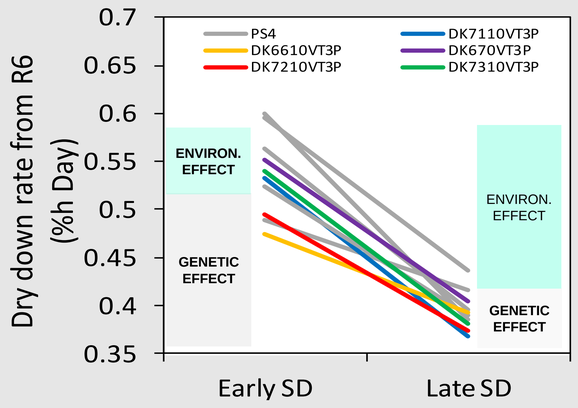

Figure 5: Drydown rates and the genetic and environment contribution to the drydown rates for early and late sowing date (SD).

Figure 6. There is more variability in how hybrids determine yield (kernel set and weight) within a similar crop cycle than differences from RM points.

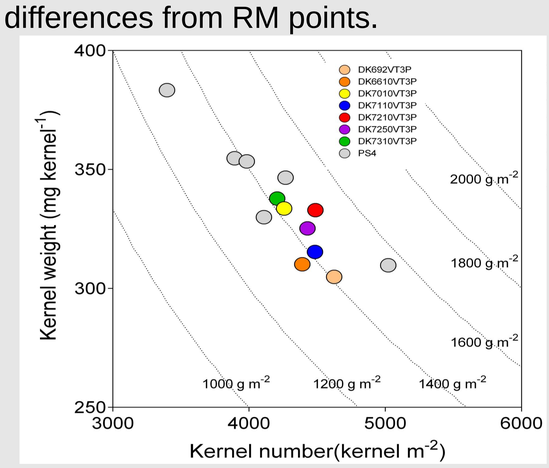

Figure 6. Numerical yield components, relation between grain weight and kernel number, iso yield line are represented with dotted lines. Hybrids show for a similar yield differences between how it conform the yield, some with more kernel number and other with more kernel weight.

Figure 7. There are genotypic differences in the sensitivity of grain yield to stress and the duration of the critical period for grain yield.

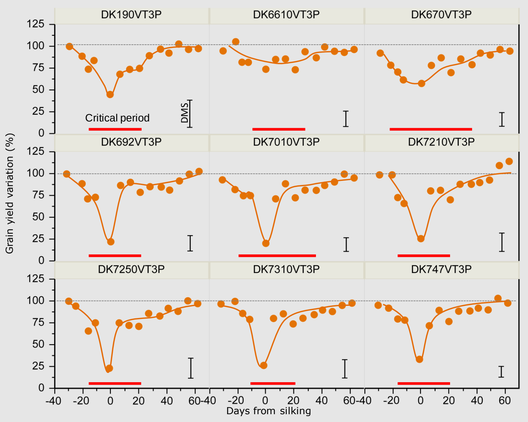

Figure 7. Variation in grain yield compared to the control in Dekalb hybrids undergoing brief episodes (7 days) of shade (80% reduction IPAR) along the crop cycle. Tested during the 2012/13 growing seasons in Pergamino under optimal conditions (irrigation and N). The horizontal bars indicate DMS between treatments.

Conclusions

- ❖ RM could only be used as criteria for determining genotypic differences in grain moisture at harvest time.
- ❖ Differences in RM among hybrids were mainly related to dry down duration, and in a lesser extent, to vegetative and reproductive stages duration.
- ❖ Contrary to the other stages evaluated, drydown phase was highly affected by environmental factors (air temperature, relative humidity and vapor pressure).
- ❖ There was a wide range of variation in KN and KW among hybrids with similar RM.
- ❖ There was significant genotypic differences in the sensitivity of grain yield to stress and the duration of the critical period for grain yield.

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