Crop management and varietal strategies to design more efficient and high quality soybean in southwestern France

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CROP MANAGEMENT AND VARIETAL STRATEGIES TO DESIGN WATER EFFICIENT AND HIGH QUALITY SOYBEAN IN SOUTHWESTERN FRANCE

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Introduction

Water is the main factor limiting soybean production in France (Merrien, 1994). Drought occurring mainly during the flowering – seed filling period is responsible for a substantial decrease in soybean yield. In southern France, this crop is usually sown around 1-15 May and flowering takes place under high evaporative demand and low rainfall, leading the crop to be often irrigated. Two main strategies which can be combined should increase soybean productivity and/or reduce irrigation: (i) selecting genotypes tolerant to dehydration; (ii) planting early enough to avoid drought at the most susceptible growth stages. However, a major disadvantage of growing crops during low-evaporative demand periods is joint low temperature conditions. In addition, being a photoperiod sensitive species, soybean can be affected by time lag in early planting. Many studies have been conducted and reviewed on planting date of soybean (Hu and Wiatrak, 2012) but most of them concern U.S. conditions with late maturity group (MG) cultivars and it appears a lack of specific references for SW France conditions. The aim of the present work was to determine the effect of early sowing on soybean yield and development for contrasting cultivars, through multi-environment experiments conducted in SW France.

Materials and Methods

A 4-yr field experiment was conducted between 2010 and 2013 on 4 locations under various pedoclimatic conditions. At least 3 cultivars (max. 8) of contrasted maturity groups from 00 to II/III were compared every year for 3 planting dates with at least 3-weeks intervals: VEP (Very early planting, around 15 March), EP (Early planting, around 15 April) and CP (Conventional planting, around 15 May). Irrigation was managed to meet maximal ET according to tensiometers. Numerous variables were collected to evaluate the interest of early planting, *e.g.* phenological stages, yield, grain protein and oil %.

Results and Discussion

The effect of planting dates on yield was displayed for 3 years (2010-2012) and 2 cultivars of contrasted maturity groups (MG 0 and II). For both cultivars, EP resulted in the highest average yield and the most stable one on 3 years and 3 locations.

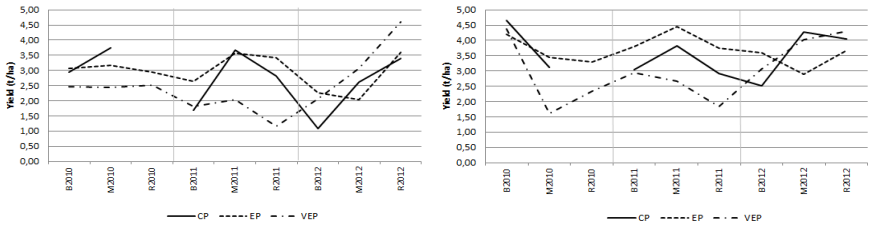

Figure 1. Impact of planting dates on yield for 2 cultivars (left: Sarema MG 0, right: Ecudor MG II)

VEP was of interest in a few situations as in 2012 where early spring was favorable to emergence in terms of moisture and temperature. Late MG cultivar exhibited higher yields than MG_0 for the 3 planting dates (+0.69 t/ha) and especially for the VEP (+0.95 t/ha). Early plantings also had impacts on crop phenology.

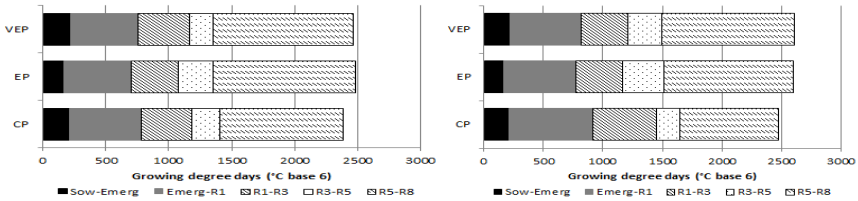

Figure 2. Impact of planting dates on phenology for 2 cultivars: average of growing phase duration on 3 years (2010-2012) and all sites (left: Sarema MG 0, right: Ecudor MG II)

Plant behavior is difficult to decipher although early plantings seem to enhance development during vegetative period and slow down grain filling period, probably all due to photoperiod. This response to early planting could be interesting with a strong development late MG genotype but unfavorable with early MG cultivar with low development potential.

Conclusions

More advanced results are expected from the SOJAMIP project gathering French research teams and professional partners. Crop modeling (STICS) is currently ongoing to help analysing combinations of « genotype x environment x management » to further design ideotypes adapted to SW France under conditions of restricted water availability.

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