

# Resistance performance of new bananas hybrids and fertilization effect on Black Leaf Streak Disease severity

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Black Leaf Streak Disease (BLSD) is considered as the most serious threat of the banana production in the Latin American-Caribbean region. The cultivation of resistant hybrids is considered as an appropriate control practice for many growers. The BLSD severity at plant scale is closely related to the varietal susceptibility to BLSD and to the growth of the plant. Some resistance components (incubation period, lesion growth rate, infection efficiency) and the foliar emission rate were identified by a modelling approach as main factors explaining BS severity (Landry *et al.* 2016). In the framework of the cooperative CABARé project (<http://cabare.cirad.fr>) which focused on innovative BLSD control based on the cultivation of resistant hybrids, we aimed to evaluate under field conditions **the resistance performance of new bananas hybrids** created by CIRAD and INIVIT and to evaluate **the effect of fertilization on BLSD**.

**Resistance efficacy of 4 new hybrids:** the performance of resistance of 4 bananas hybrids created by CIRAD and INIVIT (CIRAD 916, CIRAD 918, INIVIT Pb-2012, INIVIT Pb-2006) was evaluated in Cuba in 2 contrasted environmental conditions (at Sto Domingo, central province, at Guira de Melena, western) and in Dominican Republic in one location (La Vega, central area). The plant growth (leaf emission rate) and BLSD severity (methods of Stover modified by Gaulh) were evaluated monthly on 20 plants/hybrid cultivated in one block of 200 plants/hybrid, during 2 crops cycles in Cuba and one cycle in Dominican Republic and compared with BLSD severity on FHIA 18 and FHIA21 hybrids and susceptible control (Grande naine in Cuba and Macho Por Hembra in Dominican Republic). At harvest, production assessment (bunch weight, number of hands, number of fingers of the second hand and perimeter of the central finger) was measured and the evaluation of the consumption preference was realised with 35 consumers in Cuba (INIVIT).

**Fertilization:** the effect of 4 fertilization programs until flowering (every 15 days after the 2d or 3d months with T1: without any fertilizer; T2: 50g nitrogen from the 2d month; T3: 50g nitrogen + 200g potassium after the 3d month; T4: 50g nitrogen + 200g potassium + 50g magnesium; T5: 200 g potassium + 50g magnesium) was evaluated in one location/country, respectively on 3 hybrids in Cuba (CIRAD 918, INIVIT Pb-2012, FHIA18) and 2 in Dominican Republic (CIRAD918, FHIA21). The BLSD severity, the plant growth and the production were evaluated with the same methodology presented above.

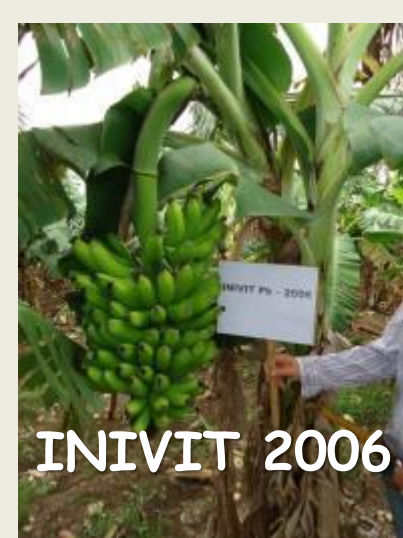
The statistical analyses linked to the data were performed with the tutorial R (R Development Core Team, 2014).

## Resistance performance

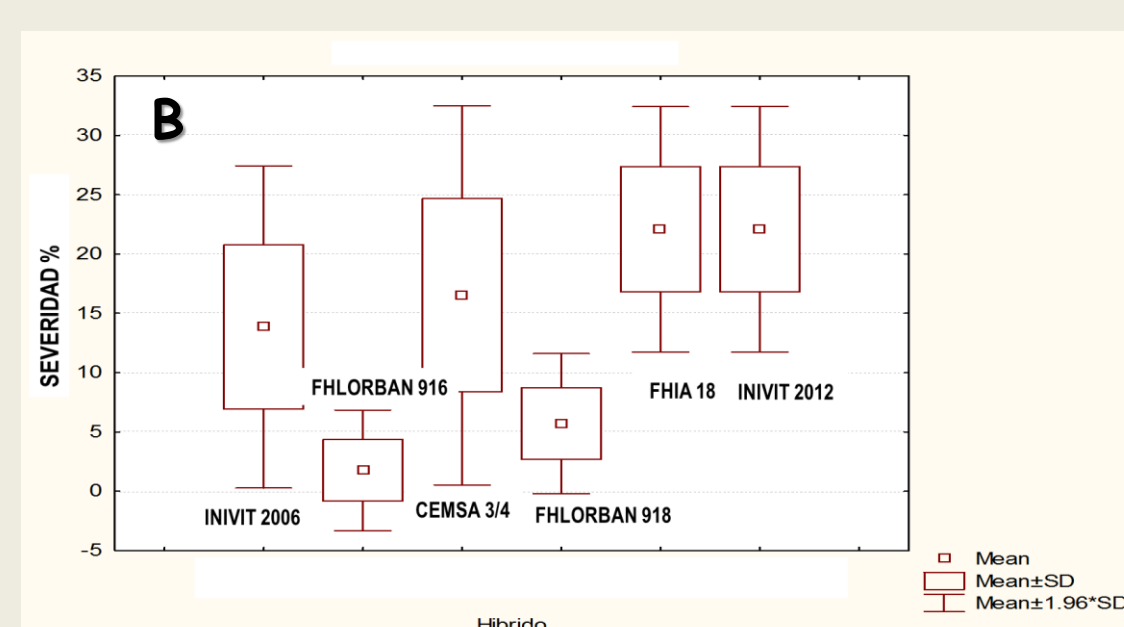
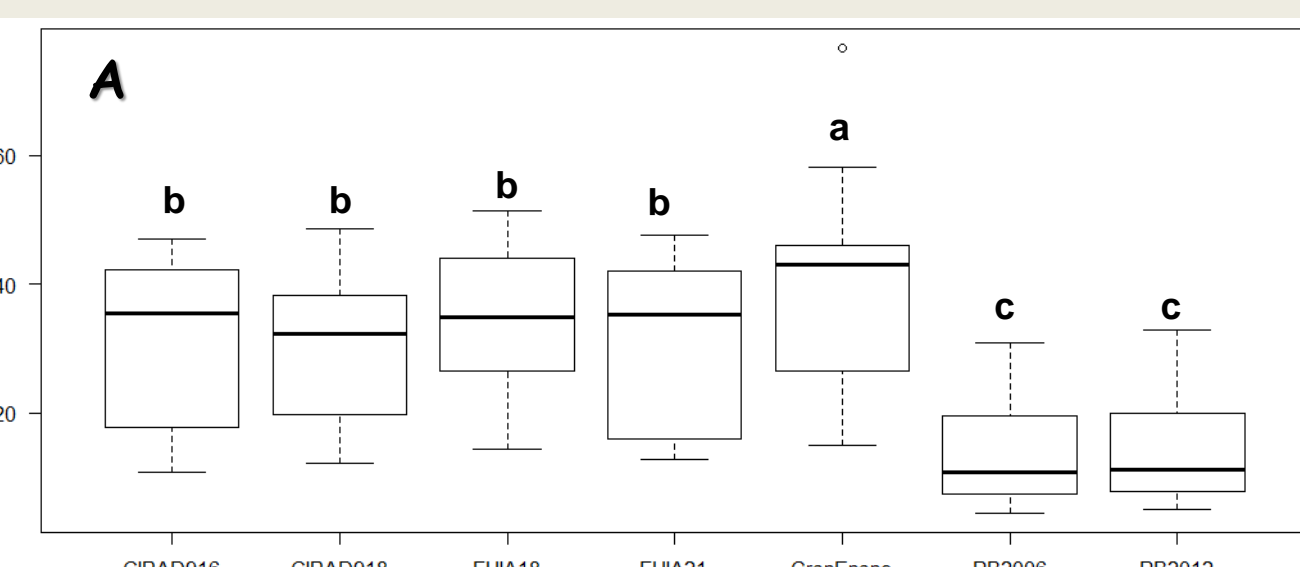
## Innovative BLSD control

## Fertilization

- BLSD severity was significantly lower for 4 new hybrids (INIVIT Pb 2006, INIVIT Pb 2012, CIRAD 916, CIRAD 918) than for the control



Mean BLSD severity in 4 new banana hybrids in Cuba during 1<sup>st</sup> cycle at INIVIT (A) and Guira de Melena (B)

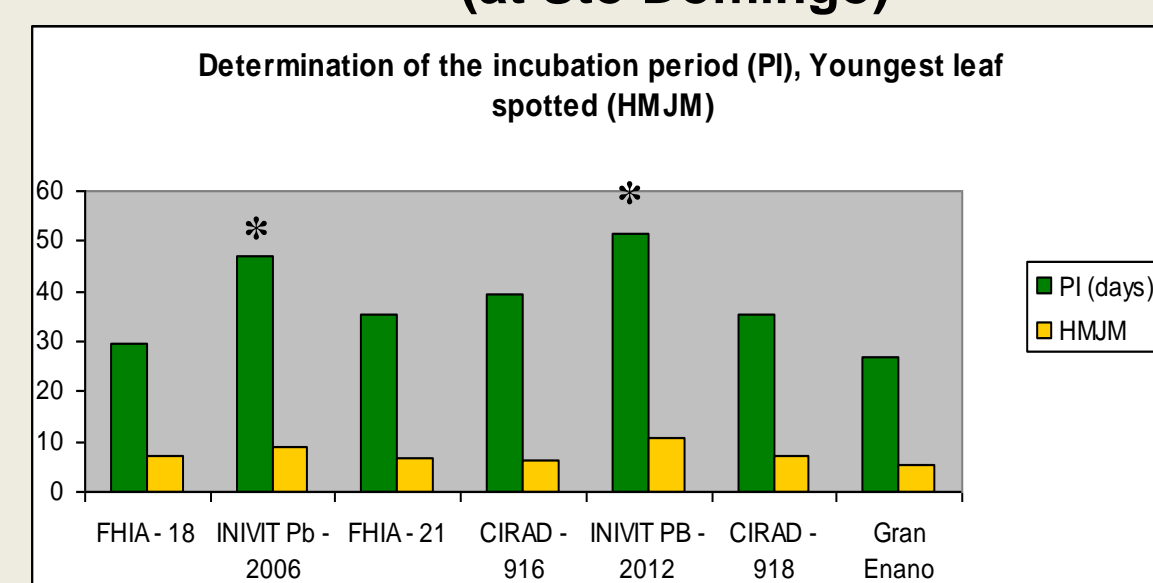


Tukey multiple comparisons of means 95% family-wise confidence level

- The resistance performance of the 4 hybrids depends on the plant growth (leaf emission rate) and their resistance components

A slower lesion extension for CIRAD 916, a longer incubation period for INIVIT-2006, INIVIT 2012, CIRAD918, INIVIT 2006 (at Guira) a longer incubation period for INIVIT-2006, INIVIT 2012 (at Sto Domingo)

Cultivars	Period of transition from streaks (stages 1 & 2) to spots (stage 4) in days
INIVIT-2006	56,0 ± 10,4
CIRAD-916	35,0 ± 13,6
CIRAD-918	29,1 ± 18,5
FHIA 18	25,7 ± 7,8
INIVIT-2012	25,6 ± 7,5
CEMSA 3/4	22,2 ± 13,7

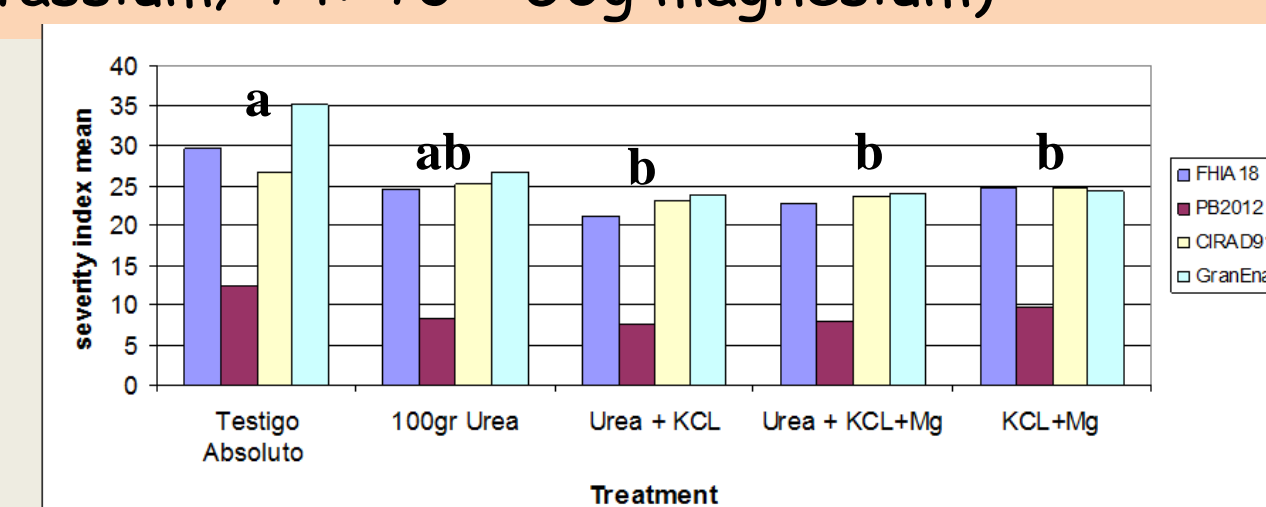


- The fruit taste of 3 hybrids (INIVIT Pb-2006, INIVIT Pb 2012, CIRAD 916) was appreciated by consumers



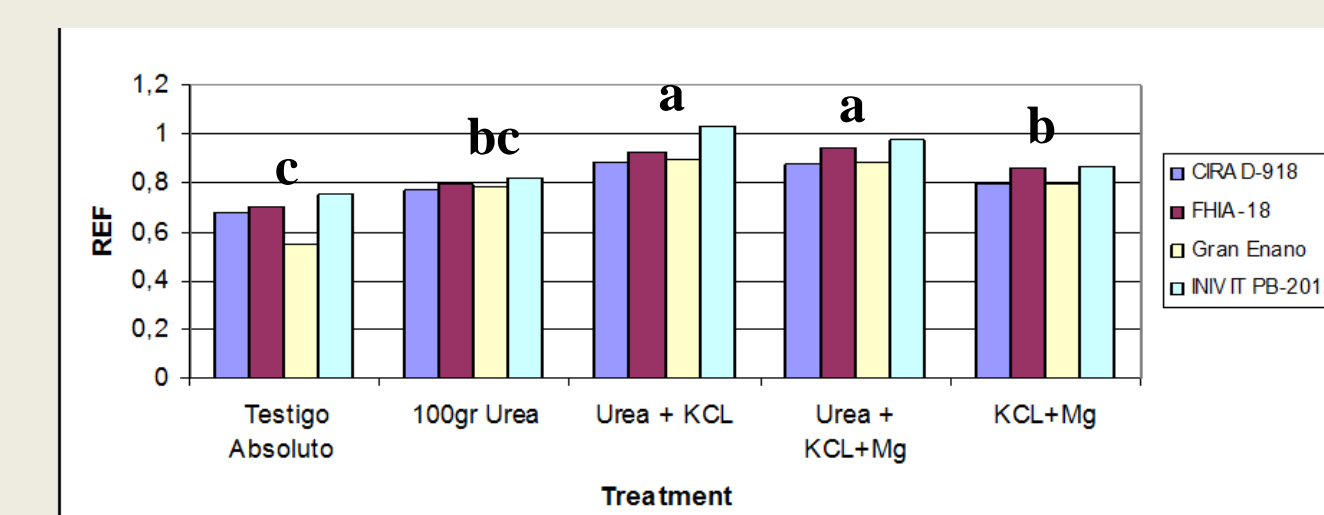
CIRAD 916 and INIVIT Pb-2006 were rated with a good taste respectively by 100 % and 87% of Cuban consumers surveyed

- The fertilization allowed for any hybrid a significant decrease of BLSD severity, especially for the 2 more complete programs (T3: 50g nitrogen + 200g potassium; T4: T3 + 50g magnesium)



The BLSD severity decreased with the level of fertilization especially for INIVIT 2012, FHIA18 and Grande naine, during the 1<sup>st</sup> cycle in Cuba

- The fertilization allowed a better growth of the plant (more rapid emission leaf) providing a lower BLSD severity for any hybrid

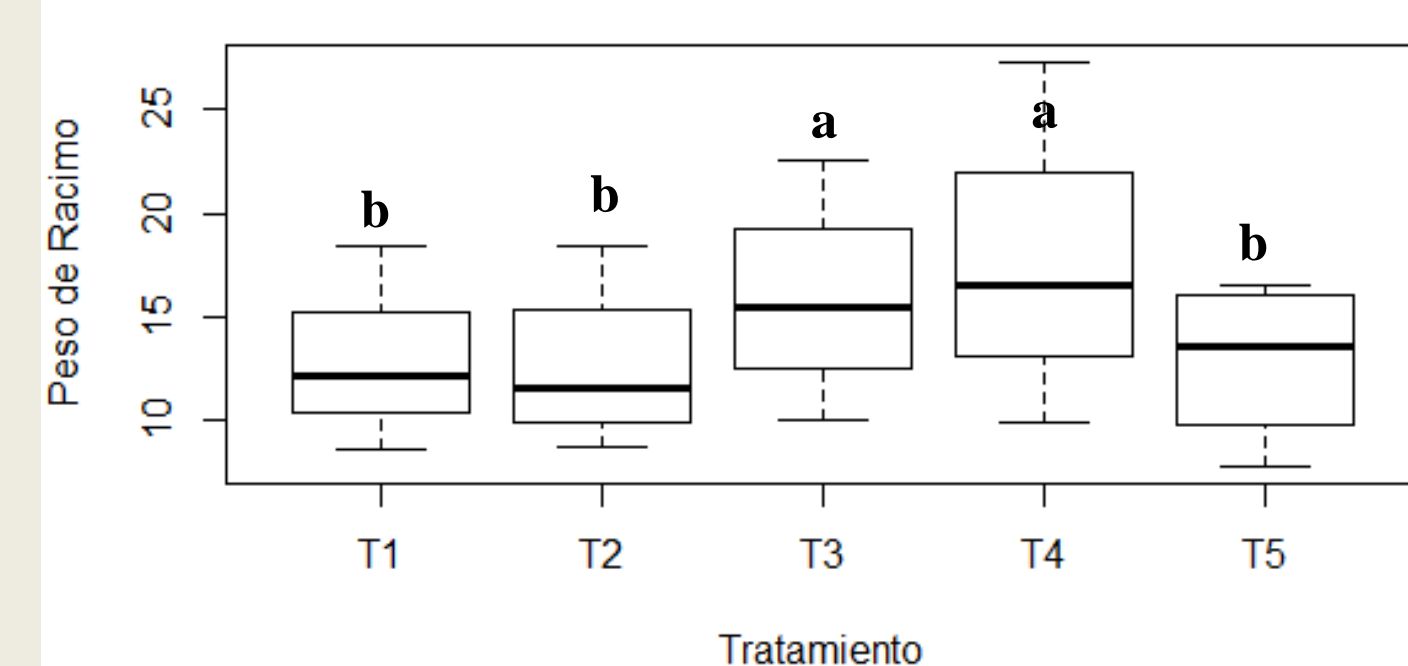


The mean leaf emission rate increased with the level of fertilization especially for INIVIT 2012, CIRAD 918 and Grande naine, during the 1<sup>st</sup> cycle in Cuba

Tukey multiple comparisons of means 95% family-wise confidence level for the 5 fertilisation treatments

- The fertilization allowed a better production (bunch heavier, more hands) especially for the two more complete program (N,K,Mg)

Average of bunch weight for the 5 fertilization programs (2d cycle, in Cuba)



- The effect of fertilization on BLSD severity, banana growth and production depends on the initial level of soil fertility.



In Dominican Republic, no statistical difference was detected between the fertilization treatments, probably due to the high content of soil nutritional elements on the experimental plot.

## Conclusions

The performance of resistance of 4 new hybrids (CIRAD 916, CIRAD918, INIVIT Pb-2006, INIVIT Pb-2012) was shown in 3 locations and can be explained by genetic resistance components such as a long incubation period, a slow lesion extension. The BLSD severity on these hybrids can be significantly lower in Cuba with a complete fertilization program (nitrogen+potassium+magnesium), allowing a more rapid leaf emission of plants.

A complete fertilization program (N, K, Mg) allowed to increase the bunch weight of 30% (2d cycle), for any hybrid.

Landry C., Bonnot F., Ravigné V., Carlier J., Rengifo D., Vaillant J., Abadie C. Development and Bayesian calibration of a host-pathogen model : case of Black Sigatoka disease of bananas. 2016 (submitted at Ecological Modelling)

