2016 IEEE International Conference on Functional-Structural Plant Growth Modeling, Simulation, Visualization and Applications (FSPMA 2016)

FSPMA 2016

7 - 11 November , 2016

Qingdao , China

Identification of flowering patterns specific to strawberry varieties using longitudinal data analysis

Marc Labadie, Béatrice Denoyes, Yann Guédon
marc.labadie@bordeaux.inra.fr

Research focus

Plant development is commonly defined as a combination of processes which are subject to environmental, physiological and genetic constraints. Although flowering in strawberry was carefully physiologically and genetically described, little is known concerning the developmental processes along time. The objective of this study was to identify phenological phases that characterize varieties in production condition.

Methods

To this end, we studied six seasonal varieties. Thirty two plants per genotype were phenotyped weekly during 28 weeks for their number of newly emerged flowers, leaves, crowns and stolons (these latter corresponding to the runnering process). We propose a new modelling framework based oen multiple change-point models for the identification of phenological phases on the basis of plant follow-up data. Two multiple change-point models were built for each variety, one for flowering and another one for vegetative growth.

Results

The flowering models show successive flowering phases that depends on variety: a first high intensity flowering phase spanning over about 4 weeks followed either by a single medium intensity flowering phase or two successive phases, a low intensity one followed by a second high intensity flowering phase The varieties differs both by the occurrence or not of a second high intensity flowering phase and by the intensity of flowering in each phase. The vegetative growth models are characterized by jumps of lower amplitude between phases compared to the flowering models.

Conclusion

Our results provide evidence that a longitudinal data analysis, here based on multiple change-point models, enables to decipher complex dynamic developmental traits such as flowering and vegetative growth. By comparing the flowering models between the six varieties, we were able to assign these varieties to three categories which mainly differ by the occurrence or not of a second high intensity flowering phase. A direct extension would be to build multiple change-point models directly on the basis of multivariate plant follow-up data, combining flowering, vegetative growth and runnering variables. This would allow identifying global developmental phases relying on the different developmental processes in competition within plants.