



HIP WP 1.5: On Vitality of Seed Potatoes Report 2021

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The goal of this project is to gain insight into the interaction between storage conditions and genotype regarding physiological ageing of seed potatoes during storage and their subsequent performance when planted in the field. Physiological ageing is being monitored through sprouting tests and molecular analysis using different metabolomics platforms is performed at different storage times to follow biochemical perturbances. The seed tubers are then planted in the field at different sites to carry out a full crop growth analysis.

Highlights:

During the years 2019, 2020 and 2021 seed tubers were produced on one site of the contrasting cultivars Agria (late, slow ager), Festien (late, fast ager), Innovator (early, fast ager) and Lady Claire (early, slow ager). Seed tubers were stored at 4.0, 7.5 and 10.5 °C during the first two storage seasons (2019/2020 and 2020/2021) and at 4.0, 10.5 and 17.0°C during the third storage season 2021/2022. The increase in range of storage temperatures during the last season should make it possible to also assess effects of planting extremely old seed tubers.

During all storage seasons, samples were taken to monitor the ageing of the seed tubers using sprouting tests and for metabolomics analysis of tubers and tuber parts (e.g., top eye, other eyes, remaining tuber parts or entire tubers). As expected, there were highly significant interactions between cultivar and storage regime for the various sprouting characteristics. One MSc thesis student has been involved in the project; she performed detailed modelling exercises of sprout growth based on the data of the first storage season (2019/2020).

In close collaboration with the HIP partners two field experiments were carried out at different sites in 2020 making use of the 12 combinations of cultivar and storage regime. During the field season regular assessments of canopy development, tuber development and physiological disorders were carried out. There were two harvests per site, one at seed tuber stage and one at table potato stage. At the final harvest, tuber size distribution was assessed making use of the phenotyping facilities of McCain. In 2021, three field experiments were carried out with a similar set-up, but with more frequent harvesting. In 2022, another three field experiments will be carried out with similar set-up, but with the intermediate storage temperature being replaced by a more extreme storage temperature in order to create larger effects during crop growth.

In the field seasons of 2020 and 2021, canopy structure, yield and tuber-size distribution were affected by the interaction between storage regime, cultivar and location, while the results were not always consistent across experimental sites. In both seasons the effects of storage temperature on crop performance were surprisingly small for all cultivars, despite huge differences in the physiological status of the seed tubers. For that reason, the decision was made to replace the intermediate storage temperature by a more extreme storage temperature during the storage season 2021/2022, which then for sure will result in large differences during the growing season for 2022. Meanwhile detailed analyses will be carried

out to understand why there is such a lack of impact of physiological age, by performing additional tests during the storage season of 2021/2022.

The samples taken during the 2019/2020 and 2020/2021 storage seasons were analyzed (as far as possible given the mishap with the storage facility, see Bottlenecks) in the metabolomics lab and all data were processed. Analyses showed that there were very different metabolic profiles for the different combinations of cultivar and storage regime and very different changes of these profiles over time for different combinations of storage temperature and cultivar, also depending on the part of the tuber analyzed. Some compounds have been identified that demonstrate very specific changes in relative abundance. We are currently analyzing these data in detail to understand the physiological mechanisms of dormancy, sprouting and ageing.

The team is also seeking synergy with the “Ketenproject” carried out by NAK and with other HIP projects by combining observations and analyses.

Bottlenecks:

The PhD candidate was ill for some time, but the experiments could be carried out as planned, thanks to the extra support of many, even though there were more field experiments in 2021 than in 2020.

There was an unfortunate malfunction of Polaris, the central PSG facility for storing samples at -80°C , which meant that the samples of the 2019/2020 storage seasons that had not been analyzed yet were no longer usable. Also, the samples of the storage season 2020/2021 were partly lost but the later samplings were still unaffected and could be analyzed. As we had many more samples than we could analyze anyway, this problem will result in a change in analysis strategy putting more emphasis on variation among tuber tissues and allowing to study the interaction between storage temperature and cultivar at the end of the storage season in more detail. Negotiations are going on with the insurance company for compensation which will hopefully also allow us to increase the number of samples we can analyze of the 2021/2022 storage season.

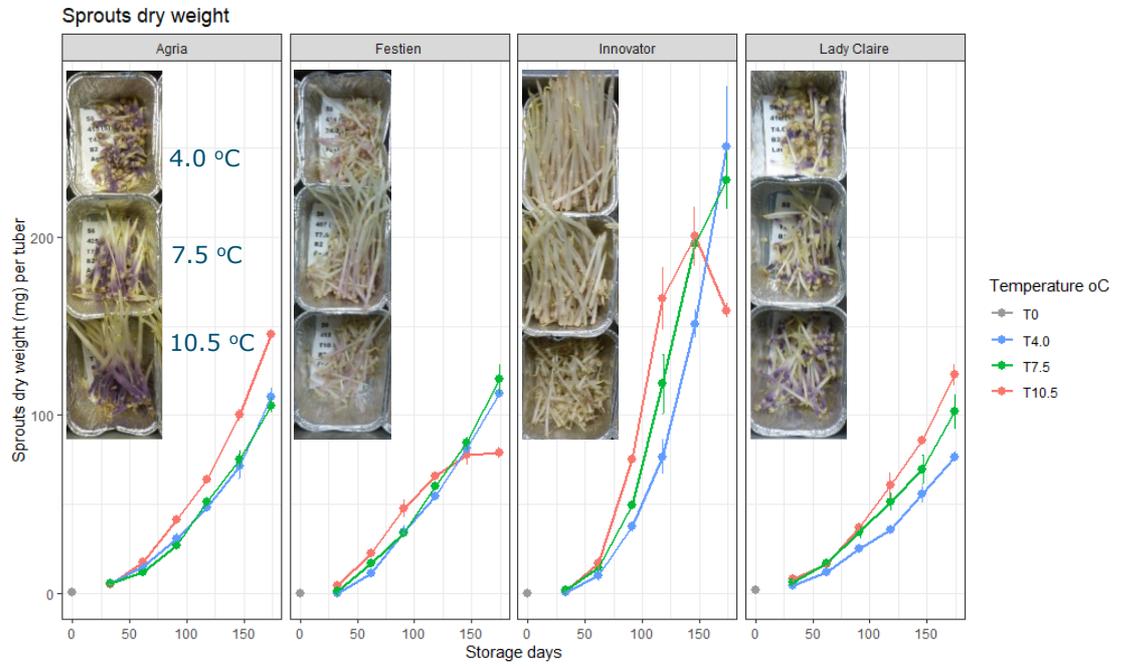
Planning:

In 2021, the project produced a new set of seed tubers of the same cultivars for the 2022 growing season. These seed tubers are currently being stored but with a different set of storage regimes. Samples are taken for sprouting tests. In 2022, three field experiments will be carried out with this material, again in close collaboration with the HIP partners. We will continue to make an in-depth analysis of the metabolomics data, which are very promising and hopefully validate key findings using the new samples from 2021/2022. The PhD candidate will also start the modelling exercises of the behaviour of the seed tubers during storage. Modelling of the performance of the seed tubers in the field will only be carried out if data of the 2022 field season will show large differences or will be based on different data sets available to the project.

Products:

Presentation of Chunmei Zou during the HIP meeting of 24 November 2021, a Video on the project and an MSc thesis report.

At the end of storage



Sprouting tests during the storage period involving the four contrasting cultivars (Agria, Festien, Innovator and Lady Claire) and three storage temperatures (4, 7.5 and 10.5 °C). Pictures shown are taken at the end of storage.