SPROUTING CONTROL OF POTATO VARIETIES USING COLD STORAGE

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Preferred type of presentation: oral presentation

Low temperature storage of potato is an alternative to anti-sprouting agents for sprouting control. However, this may lead to accumulation of reducing sugars in the tuber, a condition known as cold induced sweetening (CIS). Reducing sugars may interact with amino acids, particularly asparagine during processing at high temperatures to produce undesired products such as acrylamide, undesired color and flavours. CIS thus alters processed potato quality, which is commercially unacceptable. The main objective of the present study is to identify varieties adapted to storage at low temperatures. Six varieties (Lady-Claire, Kiebitz, Verdi, Agria, Markies and Pirol) were planted, harvested and stored at 4 and 8°C and 85% RH during 3 seasons (2015, 2016 and 2017). After 3 months of storage, the potato quality was assessed as follows: (1) frying test with color evaluation of 10 crisps per sample (2015, 2016 and 2017), we use a scale ranging from 1 (=crisps fully dark) to 9 (=crisps clear), a score above 7 is considered as an acceptable result by the industry, (2) glucose titer measurement in potatoes using a glucometer (Accu-Check® glucometer) (2016 and 2017) and (3) characterization of genetic and enzymatic mechanisms involved in CIS: asparagine content measurement (K-ASNAM Kit, Megazyme) and gene expression evaluation (qPCR). The results revealed that all factors (varieties, temperature of storage and interaction between variety and temperature) are significantly accountable for the differences in crisps color (ANOVA, $p < 0.001$). Among the six varieties and the two temperature of storage tested, the varieties Pirol, Markies and Agria stored at 4°C showed a colour quality of crisps lower than the other varieties (Lady Claire, Kiebitz and Verdi) stored at the same temperature. At 4°C, we obtained less than 4 crisps out of 10 with acceptable color (score > 7) compared to 7 crisps and more for the potatoes stored at 8°C. All varieties stored at 8°C showed no significant differences for the colour score after frying. The glucose content was higher for the varieties stored at 4°C with an average of 94 mg/dl as compared to an average of 11 mg/dl for the same varieties stored at 8°C (ANOVA, $p < 0.05$). A higher glucose content was observed in the varieties Pirol, Markies and Agria stored at 4°C, with an average glucose content of 168 mg/dl compared to 12 mg/dl for the same varieties stored at 8°C. However, this effect was not significant (ANOVA, $p>0.05$). In summary, our study allowed the identification of 3 varieties (Lady Claire, Kiebitz and Verdi) with limited CIS-abilities, suitable for storage at cold temperatures. We also observed that the expression of the gene responsible for conversion of sucrose to reducing sugars (Vacuolar invertase) is temperature dependent, and correlates with the glucose content of the different varieties at 4°C and 8°C respectively. In addition, we observed that the asparagine content is not affected by temperature.

Keywords: potato, sugar, sweetening, color, gene