ORAL PRESENTATIONS OF THE TECHNICAL SESSIONS

Technical session A:
Climate Change and Potato Agri-food Systems

1. **Assessing risk of potato crops in southern Chile under projected climate scenarios using the SUBSTOR-Potato model**

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The aim of the present study was to assess the yield of potato in southern Chile under projected climate scenarios. The study had two steps, i) the crop simulation model SUBSTOR-Potato (in DSSAT 4.7) was calibrated with the cultivar Patagonia-INIA and ii) application of the model to assess the impact of climate scenarios on potato yields. Experimental data collected during 2016-2017, under irrigated conditions, was used to calibrate the genetic coefficients of the cultivar Patagonia-INIA. Tuber yields from 2005-2015 and 12 locations were used to evaluate the model under rainfed conditions. For the model application, a seasonal analysis (30 years of weather) was performed for a factorial experiment under rainfed conditions including six planting dates (from August to October) and seven climate scenarios (baseline and six future scenarios). The six future scenarios (30 years of daily data generated for 2040-2070) were the product of three Global Circulation Models and two Representative Circulation Pathways (RCP 4.5 and RCP 8.5). Cultivar coefficients for Patagonia-INIA were identified (G2: 2000, G3: 24.6, PD: 0.8, P2: 0.5, TC: 20). The evaluation of the model showed that SUBSTOR-Potato predicted potato yield well for the Patagonia-INIA (0.93 Willmott index, 0.75 R2, 24% nRMSE, and 0.61 modelling efficiency). The analysis of variance for the seasonal analysis reveals that dry tuber yield was significantly ($P<0.001$) affected by the scenarios, planting date and its interaction. The present study highlights the necessity to develop strategies to improve potato production systems in Southern Chile.

2. **Sustainable potato agriculture to challenge climate change in the Andes through supplemental calcium nutrition and breeding for frost tolerance**

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Collaborative research in Peru sought to challenge negative impacts of climate change by fostering sustainable potato production. Two approaches were used: first calcium amendments to increase crop yield and, second to enhance frost tolerance in native potatoes. All the multi-year, multi-location experiments and field trials were conducted in the Andean and Altiplano regions of Peru. The results showed that gypsum (Calcium Sulphate), a very affordable and locally available source of calcium, had positive effects on yield and tuber size. Crop yield was significantly increased in about 30% of the more than 1200 native cultivars assessed; gains in yield varied by cultivar, ranging from 10 to 100% over the controls. Breeding efforts for enhancing frost tolerance also started at the US Potato Genebank. These aimed to introgress extreme frost tolerance and acclimation capacity from wild potato species *S. commersonnii* (cmm) into Peruvian native landraces. Seeds of the seven breeding families generated were sent to Peru where, after multi-year and multi-location selections, evaluations and field tests, a number of promising genotypes were identified. They exhibited not only a good level of frost tolerance but also equal or better yield when compared to local cultivars. A couple of elite selections with good hardiness, attractive tuber shape and productivity are now in the process of being released as new varieties by the Peruvian National Program (INIA) in Puno. Likewise, INIA-Cusco has used these selections as parental lines to successfully introduce frost tolerance to their own potato breeding materials.

3. The impact of climate change on future potato yield and water use efficiency in South Africa and possibilities for adaptation

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In South Africa, potato is grown throughout the year in a range of environments. Climate change is expected to increase temperatures, the incidence of heat stress and dry spells, but lower the risk of frost in some areas. Increased atmospheric CO_2 is expected to enhance photosynthesis and reduce water use of potato. However, the impact of these factors on yield and water use efficiency (WUE) are non-linear and interacting. A simulation study was conducted to assess the impact of climate change on future yields, WUE and possibilities for adaptation in all production regions of the country. Climate predictions between 1960 and 2050 were obtained by downscaling global circulation model outputs, which were used as inputs for a crop model (LINTUL-POTATO) to calculate potential yield and evapotranspiration. Simulation results showed that in most regions potato will benefit considerably from increased CO_2 levels through higher yields and reduced water use, assuming other inputs are optimal. However, when the crop is grown in hot periods, this benefit is counteracted by more heat stress and higher evapotranspiration, leading to lower yields and WUE. This especially applies to interior regions of the country, where expected temperature increases are most severe. In most regions, potato growers will likely respond to climate change by advancing planting to avoid heat stress. Despite the fact that potato is a heat-sensitive crop grown under relatively warm conditions in South Africa, the impact of climate change on yield and WUE is expected to be positive in most regions.