Evaluation of two major potato varieties under aeroponic conditions in Rwanda

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Introduction and background

In Rwanda, potato is an important food and cash crop. Annual consumption of potato is very high at 125 kg per person per year and it is the country's second most important source of energy after cassava (RIU, 2010). Potato is one of the best crops for seeing the yield-depressing effect of seed-borne pathogens (Chiarappa, 1992). There is no cure once a plant or tuber is infected by bacterial wilt, viral diseases or some other potato diseases (Peter et al., 2007). The only efficient control measure is prevention of initial infection using healthy potato seed and crop rotation. Using healthy and quality seed is essential for growing an optimal potato crop (Parveen et al., 2010). The challenge is to produce seed without it becoming infected. One contribution intervention to solve this problem is to adopt a soil-less seed production system.

Aeroponics is a soil-less method that can be used to produce potato minitubers. The method can be used to produce higher yields, up to 10-times higher than the conventional method, as well as reduce the rate of soil-based disease infections (Otazu, 2010). However, potato cultivars respond differently to aeroponics and proper plant spacing needs to be determined for each variety (Otazu, 2010). This study was conducted to assess the adaptability of important potato varieties in Rwanda to the aeroponics system and determine the optimum plant density for each variety.

Methodology

Two commercial potato cultivars (Kigega and Kinigi) were evaluated under three plant densities in an aeroponics greenhouse at Rwanda Agricultural Board (RAB), Kinigi station. The experiment was laid out as split-plot in a randomized complete block design with plant densities (14, 17 and 21 plants per m^2) in the main-plots and varieties in sub-plots with four replications. The nutrient solution consisted of potassium nitrate, magnesium sulfate, potassium phosphate, calcium nitrate, and the micronutrient product known as Fetrilon Combi. Data were recorded on two morphological parameters, plant height and node number of plants, in each sub-plot. Tubers with the size of 25 mm in diameter were harvested by hand and counted. Harvesting was done at 7 day intervals for both varieties. Data were analyzed using GenStat Discovery version 3.0 (2003) to compute analyses of variance for each parameter measured. Mean comparisons were done using the least significant difference (LSD) test at the 0.05 level of probability to determine significant differences among treatments.

Results and discussions

The analysis of variance (ANOVA) showed that there were highly ($p<0.01$) significant differences among the two varieties for plant height and number of nodes per plant, both measured at 3, 5, 7, 9, 11 and 13 weeks after transplanting. Highly significant ($p<0.01$) differences were also observed among the varieties for days to maturity and mini-tubers produced per plant. No significant density or density×variety interaction effect was observed for any of the traits measured . Plants of the Kinigi variety were taller than those from Kigega; approximately 50% taller at 3, 5, 7 and 9 weeks after transplanting. Consequently, Kinigi was earlier in maturity, taking only 77 days after transplanting to produce minitubers compared to 126 days for Kigega. On the average, plants in Kinigi had 2.5 more nodes per plant than Kigega, yielding 36 mini-tubers per plant compared to only 7 mini-tubers in Kigega (figure 1). The non-significance of density×variety interaction effect indicated that both varieties exhibited similar response to increasing plant population in the aeroponics conditions. The significant differences for plant heights between the two varieties were attributed to a more positive response of Kinigi to the aeroponics conditions.

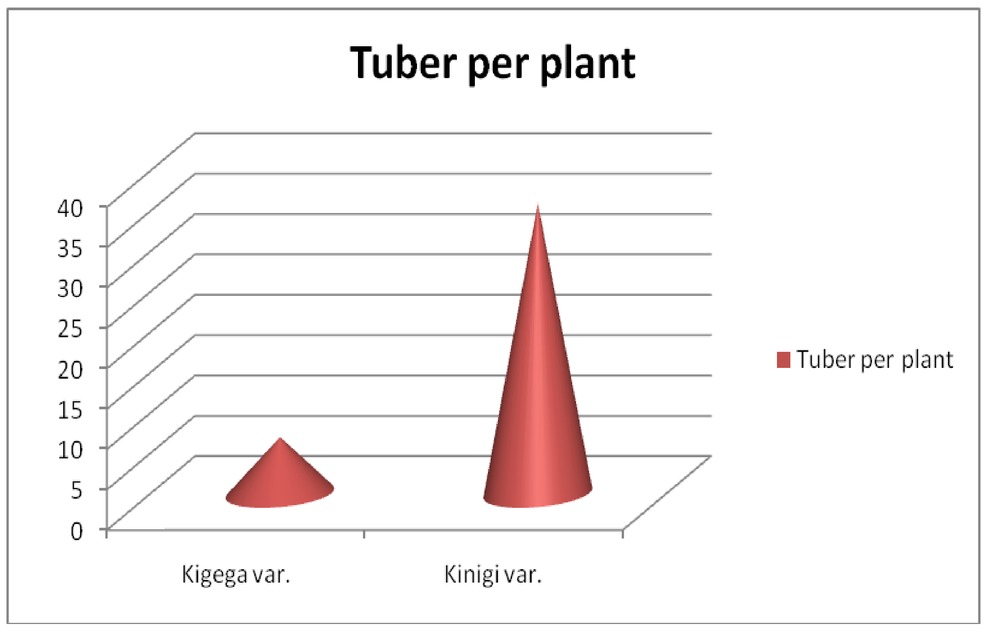

Figure 1. Mini-tubers per plant of two potato varieties under aeroponic conditions

Conclusion

Response under aeroponics is cultivar dependent and requires testing different varieties to select the most adapted for production in this system as well as investigating the effects of other factors such as nutrient solution content and supply systems. The data showed that, Kinigi was more adapted and productive in the aeroponics environment than Kigega and that plant population density had no significant influence on productivity in the system. There is a need to incorporate the aeroponic system with responsive varieties into the potato seed program to guarantee high-quality seeds to Rwandan farmers.

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