ARE DORMANCY MANAGEMENT AND PHYSIOLOGICAL AGE THE ACHILLES' HEEL OF AEROPONIC MINITUBER PRODUCTION IN SEED POTATO VALUE CHAINS IN SSA?

[1]Charles Lung'aho, [2]Miriam Mbiyu, [2]Moses Nyongesa, [2]Susan Otieno, [2]John Onditi and [3]Elmar Schulte-Geldermann
[1]nternational Potato Center (CIP) SSA, P.O. Box 75 Chimoio, Mozambique
[2]Kenya Agricultural Research Institute-Tigoni, P.O. Box 338-00217, Limuru Kenya
[3]nternational Potato Center (CIP) SSA, P.O. Box 25171-00603, Nairobi, Kenya
Corresponding author email: c.lung'aho@cgiar.org

1. SUMMARY

Aeroponic minutuber production technology has the potential to break the seed potato bottleneck in many Sub-Saharan African (SSA) countries due to several advantages that it offers especially those related to high multiplication rates; typically (1:50-100). However, the Achilles' heel of aeroponic minituber production is probably the large variation in physiological age of resulting tubers due to sequential harvesting that is spread over several months within a production cycle. Problems associated with variation in dormancy and physiological age in aeroponic minituber production are discussed and some approaches that may overcome these challenges to ensure that the promise of aeroponic minituber production is realized are presented.

2. AEROPONIC TECHNOLOGY FOR POTATO MINITUBER PRODUCTION

- Aeroponics is a method of soil-less culture in growth-controlled environments in which the underground parts of the plant are enclosed in a dark chamber and supplied with a nutrient solution by way of a mist device.
- The technology is currently being advocated for by many institutions as the technology that will eventually remove the seed bottleneck in the developing countries in SSA, leading to increased potato productivity.
- In aeroponic minituber production, the large volumes of seed result from sequential harvesting of tubers usually from about 8 weeks after planting depending on the cultivar and thereafter every 10-14 days (Otazu, 2010).
- Depending on the cultivar, as many as 10 harvests or more may be done during the production cycle. This means that the harvests may be spread over a twenty week period or more.
- The harvested minitubers are generally of various sizes and can range from1 to 30 g depending on the variety, nutrition, harvesting intervals and growing conditions.

Foliage of plants growing in an aeroponic unit

Production of minitubers under aeroponic conditions

Variability in physiological age among tubers harvested at different times in aeroponic minituber production

Variability in crop growth due to differences in physiological age of minitubers at planting time

3. THE PROBLEM OF DORMANCY AND PHYSIOLOGICAL AGE IN AEROPONIC MINITUBER PRODUCTION

- A major disadvantage of sequential harvests in aeroponic minituber production systems is that at the end of the production season, the minitubers are not of uniform of dormancy and physiological age.
- In the absence of cold storage, and other dormancy management practices, harvests of aeroponic minitubers are usually at various physiological stages (dormant, apical dominance, multiple sprouting or senile) at the end of the production cycle which impacts crop performance negatively.
- Minitubers harvested during the first months of harvest will sprout first; the ones harvested last will sprout later.
- Planting minitubers with large differences in physiological age results in crops with large variations in important yield parameters such as date of emergence, stem numbers, canopy growth pattern, maturity date, total yield and tuber size distribution.
- The final result is sub-optimal yields, sometimes less than 50% of potential yields. This that can be uneconomical for the minituber grower easily jeopardizing uptake and commercialization of the minituber technology.

4. SOME OPTIONS FOR IMROVEMENT-THE USE OF PLANT GROWTH REGULATORS

- Assuming that minitubers require to be planted soon after the production cycle, then long dormancy would be required for minitubers harvested early in the season while little or no dormancy would be required for tubers harvested towards the end of the production cycle.
- During the late phase of the production cycle, plant growth regulators (PGR) such as GA_3 could be used to shorten the dormancy and advance the growth vigour of the resulting tubers (Van Ittersum, 1993).
- During the early phase of production, PGRs such as Paclobutrazol could be applied to prolong the dormancy period (Tesgaw, 2006).
- For tubers that are harvested mid season, a careful balance between dormancy prolonging and dormancy shortening PGRs is required.
- The promise of aeroponics minituber technology can, thus, only be realized if dormancy and physiological age are judiciously manipulated to ensure that aeroponic minitubers are in the correct physiological stage at the time of planting

5. REFERENCES

- Otazu, V. 2010. Manual on quality seed potato production using aeroponics. International potato Centre (CIP). Lima, Peru. 44 pp
- Tsegaw, T. 2006. Response of paclobutrazol and manipulation of reproductive growth under tropical conditions. PhD Thesis University of Pretoria.
- Van Ittersum, M.K. and Scholte, K. 1993. Shortening dormancy of potatoes by haulm application of gibberellic acid and storage temperatures regimes. Amer. Potato J. 70:7-9

6. ACKNOWLEDGEMENTS

The authors are grateful to International Potato Centre and Kenya Agricultural Research Institute for logistical support