

ASSESSMENT OF TECHNICAL AND FINANCIAL FEASIBILITY OF SEED POTATO MULTIPLICATION USING AEROPONICS AND FIELD TECHNIQUES IN MALAWI

Paul Demo¹, M.Chiipanthenga², O.J.Mwenye², F.Chipungu², L.Chimwala¹, G.Chinoko¹, W.Mbewe² and N.Kumar³. ¹International Potato Center (CIP), P.O. Box 31600 Lilongwe 3, Malawi
²Department of Agricultural Research Services, Bvumbwe Station, P.O. Box 5748 Limbe Malawi ³Universal Industries Ltd, P.O. Box 507 Blantyre, Malawi. Contact: p.demo@cgiar.org

1. Background

April 2013

In Malawi, lack of quality seed potato was a major constraint in production. Farmers obtained planting materials from informal seed sources. From 2006/2007, the use of positive selection technique was introduced to farmers. Although positive selection proved very useful in improving quality of on-farm saved seed, the incidence of potato viruses detected as latent infection in selected tubers was relatively high. Production of higher quality seed required use of innovative techniques. This study was conducted to evaluate technical and financial feasibility of seed potato production using tissue culture, screen-house and field techniques.

2. Materials and methods

In 2011/2012, aeroponics seed tubers (G0) produced from in-vitro plantlets under screen house conditions in Malawi and Kenya were field planted at Tsanganano on 0.67 hectare at 90cm x 25cm spacing to produce generation 1 (G1) and generation 2 (G2) seed tubers. Field generation 3 (G3) seed was produced from October 2012 planting at Mbawa. Potato varieties planted were Zikomo (CIP381381.20), Thandizo (CIP381381.13), and Chuma (CIP395015.6). Data collected were number of seed tubers planted, number of plants harvested, number of seed tubers harvested, seed tuber weight at harvest and cost of inputs. Cost of informal seed produced from local cultivar Rosita by farmers was recorded. Mean number of tuber produced per seed planted and per harvested plant, mean seed tuber weight, were computed. Cost per seed tuber was obtained by dividing total cost of inputs by total number of tubers produced.



Fig 1: Potato Plants in Aeroponics System



Fig 2: Potato Seed Tubers in Aeroponics

3. Results

Over all mean number of seed tubers produced per seed tuber planted was 6.2 ± 0.9 across the three varieties. The overall mean number of tubers obtained per sampled harvested plant was 11.1 ± 2.7 across the three varieties, resulting in a mean yield gap of 44%. Mean weight of individual seed tuber harvested was 44 ± 7 g (Table 1). Cost of seed produced decreased from USD 0.30 (Mk 50.10) per G0 seed tuber to USD 0.034 (Mk 5.68) per G2 seed tuber (Table 2). Farmers were selling degenerated tubers saved as planting material from their ware potato crops of local cultivars at USD 0.04 (Mk 6.68) per tuber.

Table 1: Mean number of seed tubers produced in the field per planted seed and per harvested plant, yield gap and mean weight of individual tuber harvested

Potato Varieties	Mean (\pm SD) No. tubers produced per seed tuber planted	Mean (\pm SD) No. tubers harvested per plant	Gap between No. tubers per harvested plant and per seed planted (%)	Mean (\pm SD) weight per tuber harvested (g)
Zikomo (CIP381381.20)	7.1 ± 1.7	9.0 ± 1.9	21	50 ± 9
Thandizo (CIP381381.13)	5.4 ± 2.4	10.8 ± 2.0	50	47 ± 3
Chuma (CIP395015.6)	6.1 ± 0.5	14.4 ± 3.2	58	36 ± 3
Mean	6.2 ± 0.9	11.1 ± 2.7	44	44 ± 7

Table 2: Cost of production of aeroponics seed (G0), 2011/2012 field generation 1 (G1) and 2 (G2) seed potato tubers

Seed generation	Cost per seed tuber		Cost per kg seed tubers	
	Malawi Kwacha	US dollar*	Malawi Kwacha	US dollar
Farm gate seed cost excluding seed transport to storage location and travel for field inspections and supervision				
G0 seed	50.10	0.300	-	-
G1 seed	13.36	0.080	284	1.70
G2 seed	5.68	0.034	120	0.72
G3 seed**	2.04	0.0122	43	0.256
Cost of seed at storage site (154 km away from farm) including travel cost for field inspections and supervision				
G1 seed	16.70	0.10	356	2.13
G2 seed	8.35	0.05	177	1.06

*: Exchange rate: USD 1= Mk167. **: cost of G3 seed from a scenario where 450,000 tubers are produced per ha.
 SD= Standard Deviation

4. Discussion and conclusions

Profit and competitiveness heavily depend on achieving the highest seed multiplication ratio. This can be obtained through best production management at tissue culture, screen-house, field and seed storage levels, and through minimizing yield gap shown in Table 1. A scenario of 450,000 seed tubers produced at field generation 3 (G3) resulted in a very competitive production cost of USD 0.0122 per tuber (USD 0.256/kg) that could enable seed growers fix selling price with a 100% gross profit margin, at USD0.0244/tuber (USD0.512/kg) while maintaining competitiveness. Profit and competitiveness was guaranteed with at least 8.2 and 5.4 seed tubers produced per planted seed in production of field generation 2 and generation 3 seed, respectively. It was concluded that the use of aeroponics and field techniques was technically and financially feasible.



Fig 3: Seed crop grown from aeroponics seed, 2012



Fig 4: G1 seed potato harvesting, 2012

5. Acknowledgments

Irish Aid for funding, Scottish Government through James Hutton Institute for co-funding, Government of Malawi and potato project partners

6. Citations

Ian M. Saini. 2008. Survey of Virus Incidence in Farmers' Self-Supply Informal Potato Planting Materials in Dedza and Ntcheu Districts of Malawi. M.Sc. Thesis. Norwegian University of life science
 International Potato Center (CIP). 2011. Cost of seed production with aeroponics system determined, page 17. In: Revitalizing Seed and Table Irish Potato Production in Malawi through Capacity Strengthening, Technology Development, and Public-Private Partnerships. Annual Report 2010/2011