

Short research article

FEASIBILITY OF SACK POTATO PRODUCTION AS A NEW TECHNIQUE USED IN SOME URBAN PARTS OF ZIMBABWE

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ABSTRACT

Potato, following rice, wheat and maize and is among the most important food crops in the world. In Zimbabwe, the potato crop species is paving its way to staple production in the face of recurrent droughts. The study utilised two instruments for data collection, namely questionnaires and structured interviews. The first questionnaire for the producers of sack potato was distributed to fifty respondents. It enquired about personal information, inputs and adherence to best practices, technicalities, viability and sustainability of the technique. Another questionnaire for consumers reaching twenty respondents targeting consumers was also effected focusing on product quality, acceptability and consumer perspective on sack potatoes. Data was collected in parts of Harare and surrounding areas. Most respondents were in the age range 25-55 years, which is most economically active group. Low yields were cited by 25% of respondents as a major limitation encountered. These low yields were reportedly a result of lack of technical knowledge by 16.7% of the sample as most of them were new to the field. Another 16.7% reported labour problems especially in filling the sacks while some observed land degradation, 8.3%, when soil was collected in the forests for sale to potato producers yet some experienced water shortages, 8.3%. Other limitations identified were high costs and lack of access to the right type of soil by 8.3% of the sample while 8.3% reported that the bucket system of watering was strenuous. Another 8.3% especially those at early stages of planting reported that there were no problems at all with the technique. From the interviews it was discovered that sack potato production in Zimbabwe may still require more research before full implementation. The feasibility of large scale commercial production and the optimum size of sack or container also need investigation so as to avoid unnecessary wastage of soil media. There may be cases of misrepresentation of potential yield performances of sack potato production in Zimbabwe.

Keywords: [*Solanum tuberosum*, food security, *Solanacea* family, best practices]

1. INTRODUCTION

Potato, (*Solanum tuberosum* L., *Solanaceae*) is a starchy, tuberous, perennial plant being the world's fourth most important food crop, next to wheat and maize. However, this plant is considerably more efficient in its use of water and soil nutrients than the cereals (Kipple and Ornelas 2014). Scientists in the food industry believe potatoes could become far more important in the future, as a healthy staple that helps feed the growing world population as the area under production is increasing day by day (Haydar *et al.*, 2009). The UN general assembly recognises this fact and seeks to focus world attention on the role of potato in defeating hunger and poverty (Hossain, 2008).

In Zimbabwe, potato is paving its way to staple production in the face of recurrent droughts. According to Dinar *et al.*, 2008, strategies to cope with climate change must take into account selection of crop species that suit prevailing climatic conditions. In other words a prudent food security strategy should examine the promotion of other carbohydrate-rich plants that compliment staple cereals. Potato has a great potential in crop diversification for both commercial and food security purposes (Manzira 2012).

52 Zimbabweans are adopting various technologies and means to place potato on the table.
53 One of these is production in sacks. The technique involves use of sacks of roughly 120 ×
54 60cm dimension instead of growing them in the field. Soil media is periodically topped up
55 until a stage it can set tubers. Agronomic practices generally recommended for field
56 production apply although subtle differences in requirements are continually being observed
57 and studied. This study explores various aspects of how the technique is being implemented
58 in parts of Zimbabwe as a baseline study. The reasons for failure of the technique were also
59 examined as well as the consumer perception on the product. This paper reports on the
60 main findings, statistics, difficulties and misconceptions as well as present the opinion of
61 specialists in potato production gathered through the interviews as well as opinion from
62 consumers.

63 2. MATERIALS AND METHODS

64 The study utilised two instruments for data collection, namely questionnaires and structured
65 interviews. The first questionnaire targeting mainly the producers of sack potato was
66 distributed to fifty respondents. Sample size was estimated to exceed the minimum
67 recommended statistical sample size of thirty, since there are not yet official statistics
68 pertaining the technique in the country. Agronomists, seed agents, extensionists as well as
69 officers from the ministry of women and gender affairs assisted in identification of
70 respondents. The questionnaire for producers enquired about four aspects namely, personal
71 information, inputs and adherence to best practices, technicalities, viability, returns and
72 sustainability of the technique.

73 Structured interviews targeting specialists in the potato industry reaching up to twelve
74 respondents as listed in Table 1 consisting of specialists in the field of potato production e.g.
75 agronomists, seed agents, extensionists etc were also carried out. The structured interviews
76 basically aimed at extracting the specialist perspective on sack potato production.

Table 1. Respondents of structured interviews

	Name of line	Number
1	Agronomists	2
2	Chemical sales agents	3
3	Extension officers	3
4	Officers from ministry of women affairs	2
5	Crop Breeder	1
6	Potato Seed Specialist	1

77
78 A smaller questionnaire for consumers reaching twenty respondents targeting consumers
79 was also effected. The consumer questionnaire focused on product quality, acceptability and
80 consumer perspective of sack potatoes. Data was collected in parts of Harare and
81 surrounding areas.

82 2. RESULTS AND DISCUSSION

83 2.1 PRODUCER QUESTIONNAIRES

84 Out of fifty questionnaires two were spoilt and were not fully completed.

85 2.1.1 Personal information

86
87 Out of forty-eight respondents 75% were women while 17% were men and 8% were both
88 men and women, that is, enterprises that were run by especially husband and wives teams

89 and or cooperatives. The age group distribution of the sample is shown in Fig 3.

The age groups and frequencies (%) in the sample

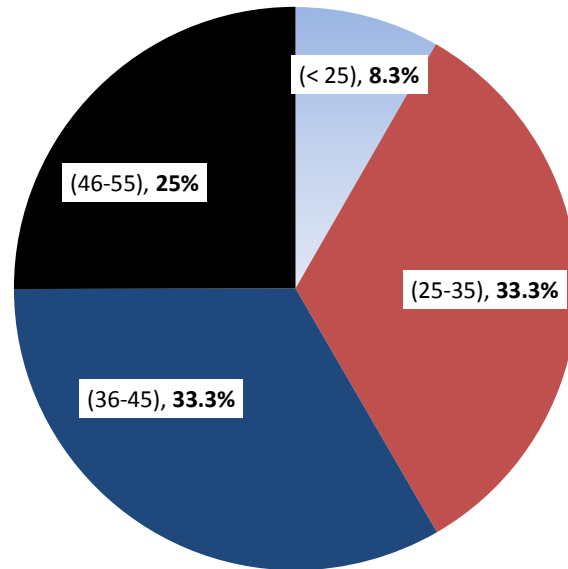


Fig 3. Age group proportions in the sample.

Most respondents were in the age range 25-55years, which is most economically active. The respondents reported various sources of ideas to produce potato in the sack namely neighbours, relatives and friends (66.7%) women groups and awareness campaigns (8.3%), media (16.7%) and lastly some 8.3% heard from a 'consultant' who came to tell them of the technique and also sell them seed, sacks and chemicals. So, 75% were trained and the rest embarked on production without receiving any training but relying on information from friends, relatives and the media. However only 50% reported that they felt adequately empowered for the project and the other 50% felt they were not

2.1.2 Inputs and adherence to best practices

Commitment in the use of inputs namely certified seed, chemical sprays and fertilisers in the sample might be a sign of determination to achieve positive results. In total production costs ranged 100us to approximately 9000usd spent by potato producers in the sample.

2.1.2.1 Seed

On the type of seed used, 66.7% used certified seed, while 16.7% used uncertified seed and 16.7% did not know the type of seed they used. The unknown seed type was either provided by a trainer and the type was not specified or was obtained from door-to-door vendors or was sourced from an open market. In terms of quantity of seed 16.7% of respondents used half a 15kg pocket or less of seed, while 58.4% used 1-2 pockets. Most who used such small quantities were testing to see if the technique works and were hoping to use the potato in their household and sell the excess tubers. Two much bigger enterprises, one church and humanitarian-based planted 40pockets and the other a family business with members who run restaurants dotted in and around Harare and were hoping to cut costs of buying potato by carrying out with sack production. They planted 12 pockets.

2.1.2.2 Chemicals

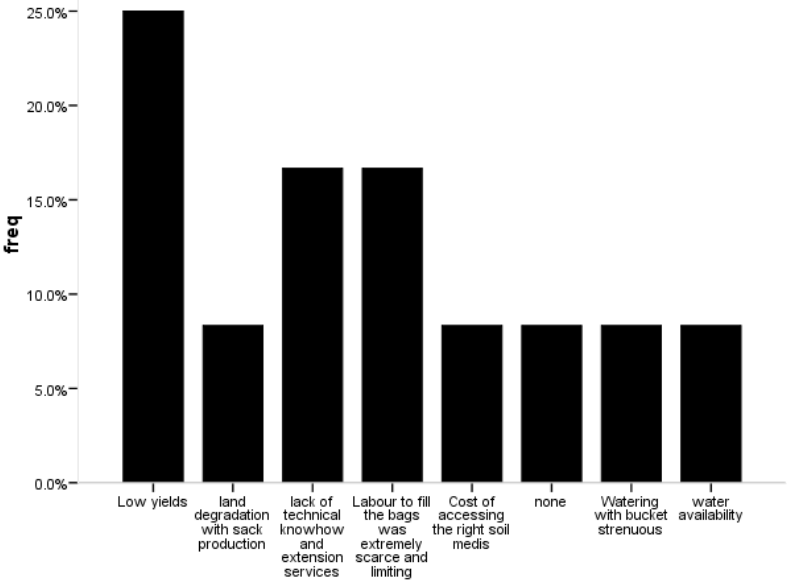
Nearly ninety-two percent used chemicals and the rest produced organically. Almost the whole range of most fertilisers common and special, chemical sprays namely nematicides,

fungicides, pesticides and adjuvants recommended for potato were reported as used by the respondents.

2.1.3 Technicalities and extension

Most of the respondents were invited through outreach programs through the government ministry of women and gender affairs targeting women, youths and their empowerment. Fifty percent received some sort of training from various organisations working through the ministry for women and gender affairs, non-governmental organisations and individual ‘consultants’ in all cases for a fee ranging from 10-35usd. Ten percent were provided with production manuals, seed and some chemicals, although some were not aware what kind of seed it was.

Graph showing reasons for limitations faced with sack potato



What are the major limitations you faced with sack potato production

Various limitations were encountered and it seems 25% experienced much lower yields than expected. These low yields were reportedly a result of lack of technical knowhow and extension services by 16.7% of the sample. Some reported labour problems especially in filling the sacks, 16.7% while some observed land degradation when soil was collected in the forests for sale to potato producers, 8.3% and yet some experienced water availability problems, 8.3%. Other limitations identified were high cost of buying the right soil, 8.3% and the strain associated with the bucket system of watering, 8.3%. There were some 8.3% who reported no problems at all associated with the technique commonly those who were at early stages of production.

One of the two big enterprises in the study, which was humanitarian and church-based making an effort to feed poor members of the church raised over 10 000 sacks in a single season staggered at three time points in the season. This particular enterprise had been producing field potato and was attracted to the yields that were reported with sack potato production, however with disappointment. The other big enterprise involved two women a mother and daughters with restaurants raising over a thousand sacks aiming to cut the cost of buying potato by producing sack potato. Both enterprises cited lack of technical knowhow and extension as reasons for their failure.

2.1.4 Profitability, returns and sustainability

Ninety-two percent of the respondents were first timers while just over eight percent had produced in the field. This outcome was a surprise because the technique has been in circulation for around five years. This might be a sign that those who try it were not repeating it the next season. In the study, 83.3% mentioned that they were not going to repeat production in the following seasons due to various difficulties encountered mainly low yields and returns. Around 75% found the technique not profitable while 25% did not know yet as they had not yet harvested although some were hopeful. Those who wanted to repeat they either thought they could adopt and adhere to best practices and try again or seek extension services.

2.2 RECOMMENDED BEST PRACTICES

In this study, a literature search was carried out for recommended best practices for potato production in containers. In general, and from observations from literature, it seems regarding the size of container or sack, it seems the ones used locally are much larger than the ones encountered in literature (Unwins, 2014; Royal Horticultural Society, 2014; Kenosha potato. 2014). In the same vein nowhere in literature has large scale commercial sack potato production been reported for home garden scale production for home use. In actual fact, the technique is not optimised for such scales. These incorrect recommendations are resulting in huge losses for aspiring producers some of whom have been encountered in this study. Some ideal practices extracted from literature are listed below.

2.2.8.1 Variety selection

Almost any potato variety will set tubers, but not all varieties will “bulk” or mature the tuber to proper size (Kenosha Potato, 2014). Only purchase of certified seed is recommended for all potato production enterprises. It is recommended that planting whole tubers be done rather than cut them as a cut piece is much more likely to dehydrate and develop disease (Kenosha Potato, 2014; Potatoes Production Guidelines South Africa. 2013)

2.2.8.2 Soil media and moisture balance

It is generally difficult to keep the soil well hydrated, but not water logged in sack production. Watering needs to be adjusted to plant growth stages. Compost and or a mix of light filling materials is recommended (Kenosha Potato, 2014; FAO, 2014).

2.2.8.3 Soil temperatures

Very much like tomato, potato vines prefer warm soil temperatures. The soil in the bags is exposed to greater temperature swings between sunny days and freezing nights will significantly lengthen the growth cycle. Typical garden soil will “bake” into a solid rock inside the bag and prevent tuber bulking (FAO, 2014)..

2.2.8.4 Harvest timing

Best results for tuber storage are obtained by waiting until the vines have dried out completely and the skins have hardened to prevent damage during harvest and storage operations (Potato Production Guidelines South Africa, 2013).

2.3 INTERVIEWS

Various facts, aspects and problems were raised from interviews of specialists, the major one being that farmers were obtaining lower yields than expected and various reasons for this were examined.

2.3.1 Lower than expected yields

It was reported that the much advertised yields ranging 10-15kg (a pocket to a pocket and half) were not being achieved much to the concern of producers. Some were not getting any reward from their farming efforts. The reasons were grouped and found to do with mainly

lack of extension and technical knowledge, inputs and seed issues, soil and media issues, dishonest brokers etc. The problems also resulted in poor product quality and environmental problems.

2.3.1.1 Inputs and seed issues

It was observed from interviews that, although it is recommended in general that certified seed should be used for potato production, it seems seed used by some for sack production was from random sources not specific, as also shown even by the statistics. This may be contributing to the low yields they were experiencing. Some seed was supplied by the 'trainers' and was not of a known source to the farmer, and yet some farmers were obtaining the right seed and fertilisers but incorrect chemical combinations. All these problems arose because of poor extension services and technical knowledge, although they received assurance for sure success from the media and advertisements.

2.3.1.2 Soil media issues

It was reported from interviews that there was no recommended texture and type of suitable soil for the technique of sack potato production and there was lack of reliable source of the right soil media. When the soil media type is not specified and a farmer uses any soil type they ended up getting disappointing results from their farming efforts. Sometimes, it was reported that, for instance some soils were hardening if they were too clayey resulting in lack of percolation to downward soil layers. This affected the roots and yield set. In other instances when the soil media was too loose all the nutrients were leached to the bottom of the sack. In such cases, it seemed the crop was not responding to fertiliser application. As a solution there was need for guidance to the right soil media type and correct irrigation practices. The nematode problem was also often reported to be overlooked.

Soil media type and irrigation scheduling for production in containers are still under research from literature reports (Kenosha Potato, 2014). It was observed that those who had experience of growing potato for example in the field almost got the water balance right as they were aware of varying requirements at different growth stages. The new comers were observed to almost always apply too much water just because they were advised to apply an average of 5l per day. This resulted in watery tubers of an unpleasant quality, to an extent that some consumers think sack potatoes typically are watery.

It is a possibility that sack potatoes may require small water quantities applied at a time typical of drip irrigation. Such research should have been carried out before dissemination or at least it should have been indicated that it is a sack production is still being researched upon.

2.3.1.3 Lack of extension and technical knowledge

Lack of knowledge and technical support was reported as the main cause of poor performance by sack potato producers. Solid and basic knowledge of potato production would have been of great value. Those who are obtaining good yields are observed to receive continued support throughout the production phases e.g. some continued to consult reputable chemical sales agents. Even though they were not obtaining the maximum pocket and a half but at least yields that were comparable to field-based production. From the producer questionnaire responses, some farmers were embarking on potato production without any training received. In future it is important to strengthen extension networks for better results.

2.3.1.4 A long growth cycle for sack potato resulting in a poor product

The agronomists and especially seed sales agents noted that a lot of farmers who ordered varieties with a three-month growth cycle, complained that they ended up waiting for up to six months to realise a normal harvest and yield. This might be due low temperatures experienced in sacks as compared to field-produced potato which experienced ground heat which biologically helps the maturation process. They also reported that inexperienced farmers who tried to harvest at the recommended three months, faced storage difficulties as the tubers could not store for long thus downgrading market value resulting in more losses. Consumers received such product with apprehension.

2.3.1.5 Dishonest brokers and unscrupulous players

Some trainers provided all the required inputs, bags, fertilisers, chemicals for a lump sum of money, which would have been convenient if they followed up to offer support on how to apply their packages. For example a lot of them acquired the necessary chemicals but failed to carry out correct calibrations for smaller plots with disastrous results. It seems that the technique has become brisk business for some brokers as chemical prices are deliberately hiked or some unknown or untested chemicals are being sold to farmers. Some trainers might have inflated the expected yields just to attract customers thus wastening the disappointments by producers.

2.3.1.6 Environmental issues

Some specialists reported that due to lack of free space, some sites used by farmers received a lot of shading from trees resulting in tall and highly vegetative plants which delay or do not set yield or reduce quality. Environmental degradation caused by sourcing soil randomly in the environment was also of concern.

2.4 CONSUMER QUESTIONNAIRES

2.4.1 Quality, acceptability and consumer perspective of the sack potato

It seems consumers believe sack potato tubers typically have too much water, are white fleshed, of poor quality that be easily damaged. Some describe a mushy or spongy taste typical of diseased tubers. Some go to the extent of concluding they are GMOs and harmful to the body. Yet with thorough research and extension the technique can be optimised to achieve the best quality. The whitish colour might have been due to bad harvest timing as some varieties according to (Manzira, 2012), may develop a secondary flesh colour after they mature, which is different from the one in immature tubers. Bad harvest timing might interrupt these secondary developments.

Because of low temperatures it is learnt that maturation can be delayed to twice the length of lifecycle in the field incurring more production costs. The best season of production in Zimbabwe when enough heat units are available to allow varieties to mature in their normal time still has to be researched upon. The watery taste likewise, might be because of incorrect irrigation routines. Some reported that they could not store sack potato for more than a week without them going bad and it might still be because of bad production practices. The technique might have a long way to go before it is ready for full implementation in Zimbabwe.

4. CONCLUSIONS

Sack potato production in Zimbabwe may still require more research before full implementation otherwise it may cause disillusionment among would-be farmers, in terms of the right soil media, irrigation cycles and water requirements, the potential yield levels and whether they exceed that of field-produced potatoes. The feasibility of large scale commercial production and the optimum size of sack or container also need investigation so as to avoid unnecessary wastage of soil media.

There may be cases of misrepresentation of yield performances of sack potato production in Zimbabwe. Best practices for general potato production needs to be disseminated to would-be farmers to empower them to make their own judgements for critical activities like harvest timing, watering regimes, chemical calibration for application rates on small a scale basis. Lastly the technique may be beneficial for household food security if more research work is carried out.

DECLARATION OF CONFLICT OF INTERESTS

There Are no conflicts of interests regarding this work.

ACKNOWLEDGEMENTS

The Director of potato seed coop, Msasa, is appreciated for information regarding potato seed and best practices as well as participating the study. Sales agronomists from Zimbabwe Fertilizer Company are acknowledged for valuable information pertaining sack potato producers. Lastly, the potato breeder in the national program, as well as extension officers and officers from the ministry of women affairs are greatly appreciated for all the assistance rendered to this work.

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