

1 Original Research Paper
2 FEASIBILITY OF SACK POTATO PRODUCTION AS A NEW TECHNIQUE
3 USED IN SOME URBAN PARTS OF ZIMBABWE

4
5 ABSTRACT

6 Potato, (*Solanum tuberosum*) is the world's fourth important food crop, following rice, wheat
7 and maize is among ten most important food crops on the world (Kipple and Ornelas 2014). In
8 Zimbabwe, the potato crop species is paving its
9 way to staple production in the face of recurrent droughts. The study utilised two
10 instruments for data collection, namely questionnaires and structured interviews. The first
11 questionnaire for the producers of sack potato was distributed to fifty respondents. It
12 enquired about personal information, inputs and adherence to best practices, technicalities,
13 viability and sustainability of the technique. Another questionnaire for consumers reaching
14 twenty respondents targeting consumers was also effected focusing on product quality,
15 acceptability and consumer perspective of sack potatoes. Data was collected in parts of
16 Harare and surrounding areas. Most respondents were in the age range 25-55 years, which
17 is most economically active group. Low yields were cited as a major limitation encountered.
18 These low yields were reportedly a result of lack of technical knowledge. Some reported
19 labour problems especially in filling the sacks while some observed land degradation when
20 soil was collected in the forests for sale to potato producers yet some experienced water
21 shortages. Other limitations identified lack of access to the right type of soil. From the
22 interviews it was discovered that sack potato production in Zimbabwe may still require more
23 research before full implementation. The feasibility of large scale commercial production and
24 the optimum size of sack or container also need investigation so as to avoid unnecessary
25 wastage of soil media. There may be cases of misrepresentation of yield performances of
26 sack potato production in Zimbabwe.

27 Keywords: [*Solanum tuberosum*, food security, Solanaceae family and best practices]

28
1. INTRODUCTION

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

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38 In Zimbabwe, the potato ~~erop species~~ is paving its way to staple production in the face of
39 recurrent droughts. According to Dinar et al., 2008, strategies to cope with climate change
40 must take into account selection of crop species that suit prevailing climatic conditions. In
41 other words a prudent food security strategy should examine the promotion of other
42 carbohydrate-rich ~~erops plants~~ that compliment staple cereals. Potato has a great potential in
crop

43 diversification for both commercial and food security purposes (Manzira 2012).

44 Zimbabweans are adopting various technologies and means to place potato on the table.

45 One of these is production in sacks. The technique involves use of sacks of roughly 120 x x
46 60 cm dimension instead of growing them in the field. Soil media is periodically topped up
47 until a stage it can set tubers. Agronomic practices generally recommended for field

48 production apply although subtle differences in requirements are continually being observed
49 production. This study explores various aspects of how the technique is being implemented
73 in parts of Zimbabwe as a baseline study. The reasons for failure of the technique were also
74 examined as well as the consumer perception on the product. This paper will reports on the
75 main findings, statistics, difficulties and misconceptions observed as well as . It will also
give presents opinion of

76 specialists in potato production gathered through the interviews as well as opinion from
77 consumers.

78 2. MATERIALS AND METHODS

79 The study utilised two instruments for data collection, namely questionnaires and structured
80 interviews. The first questionnaire targeting mainly the producers of sack potato was
81 distributed to fifty respondents. Agronomists, seed agents, extensionists as well as officers
82 from the ministry of women and gender affairs assisted in identification of respondents. The
83 questionnaire for producers enquired about four aspects namely, personal information,
84 inputs and adherence to best practices, technicalities, viability, returns and sustainability of
85 the technique.

86 Structured interviews targeting specialists in the potato industry reaching up to twelve
87 respondents as listed in Table 1 consisting of specialists in the field of potato production e.g.
88 agronomists, seed agents, extensionists etc were also carried out. The structured interviews
89 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

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91 A smaller questionnaire for consumers reaching twenty respondents targeting consumers

92 was also effected. The consumer questionnaire focused on product quality, acceptability and

93 consumer perspective of sack potatoes. Data was collected in parts of Harare and

94 surrounding areas.

95 2. RESULTS AND DISCUSSION

96 2.1 PRODUCER QUESTIONNAIRES

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

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99 2.1.1 Personal information

100 Out of forty-eight respondents 75% were women while 17% were men and 8% were both

101 men and women, that is, enterprises that were run by especially husband and wives teams

The age groups and frequencies (%) in the sample

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(. 25), 8.3%

(25-35), 33.3%

(36-45), 33.3%

(46-55), 25%

UNDER PEER REVIEW

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168 circulation for around five years. This might be a sign that those who try it were not
169 repeating it the next season. In the study, 83.3% mentioned that they were not going to
170 repeat production in the following seasons due to various difficulties encountered mainly low
171 yields and returns. Around 75% found the technique profitable while 25% did not know yet
172 as they had not yet harvested although some were hopeful. Those who wanted to repeat
173 they either thought they could adopt and adhere to best practices and try again or seek
174 extension services.

175 2.2 INTERVIEWS

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

179 Lower than expected yields

180 It was reported that the much advertised yields ranging 10-15kg (a pocket to a pocket and
181 half) were not being achieved much to the concern of producers. Some were not getting any
182 reward from their farming efforts. The reasons were grouped and found to do with mainly
183 lack of extension and technical knowledge, inputs and seed issues, soil and media issues,
184 dishonest brokers etc. The problems also resulted in poor product quality and environmental
185 problems.

186 2.2.1 Inputs and seed issues

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

195 2.2.2 Soil media issues

196 It was reported from interviews that there was no recommended texture and type of
197 suitable soil for the technique of sack potato production and there was lack of reliable
198 source of the right soil media. When the soil media type is not specified and a farmer uses

199 any soil type they ended up getting disappointing results from their farming efforts.
200 Sometimes, it was reported that, for instance some soils were hardening if they were too
201 clayey resulting in lack of percolation to downward soil layers. This affected the roots and
202 yield set. In other instances when the soil media was too loose all the nutrients were
203 leached to the bottom of the sack. In such cases, it seemed the crop was not responding to
204 fertiliser application. As a solution there was need for guidance to the right soil media type
205 and correct irrigation practices. The nematode problem was also often reported to be
206 overlooked.

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

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

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220 2.2.3 Lack of extension and technical knowledge

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

230 2.2.4 A long growth cycle for sack potato resulting in a poor product

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

239 2.2.5 Dishonest brokers and unscrupulous players

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

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249 2.2.6 Environmental issues

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

254 2.2.8 RECOMMENDED BEST PRACTICES

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

264 2.2.8.1 Variety selection

265 Almost any potato variety will set tubers, but not all varieties will "bulk" or mature the tuber
266 to proper size. 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.

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.

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.

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.

2.3 CONSUMER QUESTIONNAIRES

2.3.1 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 (???) , 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.

3. 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.

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