6. Diverging quality preferences along the supply chain: implications for variety choice by potato growers in Ethiopia

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Abstract

Improving the introduction of new potato varieties requires aligning the preferences of all supply chain actors. In Ethiopia, the majority of ware potato growers source their seed from the informal supply system. Using a case study on specialised seed growers and a survey among ware potato growers and downstream chain actors, we explore the quality attributes that could influence the variety choices of farmers and downstream actors. Especially, we analysed the link between the seed and ware potato supply chains, farmers' evaluation of local and improved potato varieties, and quality differences between the local and improved varieties. We found that farmers' variety choices are well-aligned with traders' preferences but varieties supplied by the specialised seed potato growers are not well accepted by ware potato growers. As a result, ware potato farmers continue to grow local varieties, which are inferior in terms of production-related quality attributes, but superior regarding market-related quality attributes. The results imply that enhancing production-related quality attributes is not enough to induce farmers to accept new potato varieties. We recommend breeding institutes and seed potato growers to put more emphasis on market-related quality attributes to enhance choice alignment in the full potato chain.

Keywords: quality preferences, production related quality attributes, market related quality attributes, variety choice

6.1 Introduction

Vertical coordination in food chains has become increasingly important due to consumers' demand for a higher quality product, and because competition in national and global markets has shifted from price-based to quality-based (Henson and Jaffee, 2008; Swinnen and Maertens, 2007). In international food chains, retailers and large processors have taken up the coordination role of aligning decisions on quality, for instance, by imposing their own food quality and safety protocols (Narrod *et al.*, 2009). In domestic markets in developing countries, aligning quality preferences is more difficult as chain actors tend to operate independently.

Potato is increasingly demanded in developing countries because of population growth (Pretty *et al.*, 2003) and growth in fast food restaurants (Stewart *et al.*, 2004), but also because consumers perceive potato as a healthy food (Jemison *et al.*, 2008). Ethiopia is experiencing both population growth and a rise in the number of fast food restaurants (Gildemacher *et al.*, 2009a). Aligning quality decisions is usually more difficult in the potato chain than in other chains. First, production of potato is more complex than of other crops, because of the difference in agro-ecological requirements for seed and ware potato production[1]. Second, producers of seed potatoes are often disconnected from producers of ware potatoes because ware potato growers use either their own (farmer-saved) seeds or seeds sourced from other ware potato growers, not from the specialised seed potato growers[2]. Third, lack of common quality grades and standards or formal mechanisms in trading quality declared seeds makes the alignment of quality decisions between seed potato growers and ware potato growers a challenge.

The objective of this paper is to provide insights in quality attributes influencing variety choices and alignment of quality preferences between different actors in the Ethiopian potato supply chain. We explore how differences in quality attribute preferences affect the choice for specific varieties. To do so, we address four separate but related questions: (1) How are the specialised seed potato growers connected to the ware potato growers? (2) How do ware potato farmers characterise the currently used potato varieties? (3) How do quality attributes of the improved seed potato varieties compare with the local varieties? (4) Which quality attributes influence ware potato growers' choice for specific varieties and how does this relate to the preferences of downstream actors?

While seed potato supply systems of developing countries have received much academic attention in recent years (Gildemacher *et al.*, 2009a,b; Hirpa *et al.*, 2010, 2012; Ortiz *et al.*, 2013; Schulte-Geldermann *et al.*, 2012), and have been the focus of much work by the International Potato Centre (CIP), much less attention has been paid to the linkage between the improved seed supply chain and the ware potato supply chain. This paper aims to combine economics/marketing and agronomic concepts to answer the above research questions.

The paper is organised as follows. The next section presents an overview of the Ethiopian potato sector and a conceptual framework, followed by a materials and methods section. The final sections provide the results and discussion and conclusion.

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[1] Seed potatoes are often grown in cooler areas to reduce the incidence of pests and diseases.

[2] Seed growers in this study refer to seed potato farmers who grow improved varieties released by the Ethiopian research institutes or by the International Potato Centre (CIP).

6.2 Overview of the Ethiopian potato sector

Potato is considered one of the spearheads of agricultural policy by the Ethiopian government because of its potential for food security and income generation. However, despite favourable government policies and good weather conditions, the productivity and market performance of the potato crop is still low. Over the last two decades, the increase in potato production has mainly come from area expansion (Figure 6.1). Modern varieties that could have enhanced smallholder productivity and commercialisation have not been widely adopted by the ware potato growers.

The Ethiopian Institute of Agricultural Research (EIAR) and CIP have put in substantial effort to improve the performance of the potato sector. With the help of international research organisations, EIAR has released 18 new potato varieties in the last two decades. Nonetheless, the adoption rate and area cultivated (by ware potato growers) with these varieties have been very low. Instead, smallholders continue to grow the local varieties.[3] The usual explanation for the low performance of the Ethiopian potato sector is poor seed supply systems (Gebremedhin *et al.*, 2008). Three types of seed supply systems – informal, alternative and formal – co-exist in Ethiopia (Hirpa *et al.*, 2010). Yet, more than 98% of potato growers source their seed from the informal seed market.

Why is the contribution of the specialised seed supply chain so low? Three explanations have been put forward. One explanation might be that there is not enough supply of improved potato seeds. A second explanation might relate to the demand-side: the demand for improved seeds by ware potato growers might still be low. A third explanation may be the lack of information about supply and demand conditions.
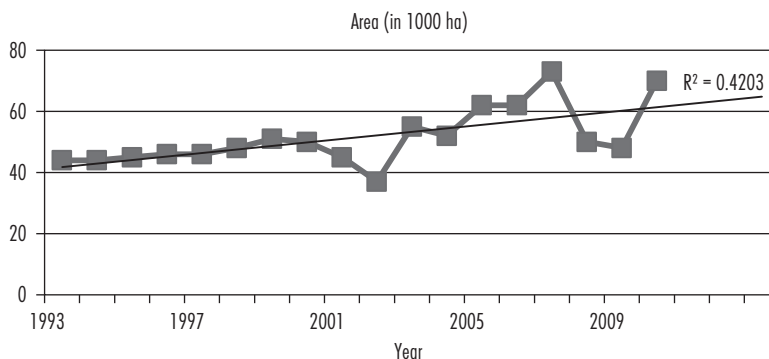

Figure 6.1. Area expansion and production of potatoes in Ethiopia between 1993 and 2010 (FAOSTAT, 2013).

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[3] There are no indigenous potato varieties in Ethiopia. However, we use the term local to refer to those varieties for which no official record exists on when and by who they were first introduced.

In assessing these possible explanations, we used a case study approach to explore the supply-side conditions. In this case study, we focused on the specialised seed potato growers who are organised and supported by breeding centres and non-governmental organisations (NGOs) to multiply seed potatoes at commercial scale. The conditions on the demand side have been explored on the basis of a survey among ware potato growers and other actors on the downstream side of the potato chain.

6.3 Conceptual framework: quality preferences alignment

Several models can be found in the literature showing relationships between a good and quality. Lancaster (1966) was the first to define quality as a function of the characteristics of the good rather than the function of the good. That is, utility is provided by the individual attributes rather than the good *per se*. The Lancaster model of quality is based on objectively measurable properties of goods that are relevant to consumer choices. Preferences for a good can thus be determined by the relative weights assigned to the various attributes.

In a supply chain context, quality preferences of different chain actors may not be fully aligned due to several factors. First, different chain actors may perceive quality differently based on what they demand from and like about a particular product (Ruben *et al.*, 2007). Diverging perceptions (e.g. regarding the importance of specific quality attributes) among different actors can make the alignment of quality a complex and challenging task. Second, alignment of quality preferences requires some kind of coordination. Coordination is defined by Malone and Crowston (1994: 90) as 'the process of managing dependencies between activities'. Coordination combines information exchange and specific decision-making processes (Bijman and Wollni, 2009). Without information exchange, actors cannot know each other's preferences, and without a proper decision-making process, the preferences of different actors in a chain cannot be aligned. That is, the type of decision making process and the extent of information exchange can affect the alignment of quality preferences in a supply chain. Based on the above, we operationalise quality preferences alignment as the matching of preferences for particular quality attributes among different actors in a supply chain.

When a specific variety does not have the production- and market-related quality attributes as preferred by both farmers and traders, misalignment of preferences is present. The question then is which quality attributes influence growers' variety choice and how does this relate to the preferences of the downstream actors. In order to answer this question, it is necessary to characterise the production- and market-related quality attributes of the currently used varieties, and understand the quality differences across the varieties.

6.4 Materials and methods

Because different supply chain actors may define quality differently, we systematically analyse quality using two categories of quality attributes: production-related and market-related. Attributes like yield, disease tolerance, maturity period, drought resistance, and crop management intensity are production-related, because they determine production practices. Such attributes are expected to be used as criteria for selecting varieties for the production of seed potatoes. However, in the ware potato market, quality attributes such as tuber size, stew quality, cooking quality[4], colour, shape and shelf life are important. We call these attributes market-related because they determine sales options, and are more likely to define the criteria for selecting varieties for the production of ware potatoes.

For potato, variety type largely determines the intrinsic quality attributes (Howard, 1974; Jemison *et al.*, 2008). However, objective information on quality attributes of local varieties is lacking. In situations where no objective quality information is available, farmers' knowledge can be used to describe the quality attributes of different varieties (Cavatassi *et al.*, 2011). Thus, our study first addresses the question 'How do ware potato farmers characterise currently used local and improved potato varieties in terms of production- and market-related quality attributes?'

The main goal of characterising existing potato varieties was not to say whether a particular variety is good or bad. Rather, variety is generally considered as the main signal for potato quality, particularly between growers and their immediate buyers. But in Ethiopia variety names are short-lived and can simply die out; and hence, what seem more stable are the quality characteristics each variety possesses, not variety *per se*. Our research strategy was, therefore, designed in a way to effectively capture the most important quality attributes each variety possesses. Breeding centres can thus use this information to develop appropriate varieties that can satisfy the requirements of ware potato growers.

The extent of quality preferences alignment in the potato supply chain is measured by how the improved varieties grown by the specialised seed potato growers are linked to the demands of ware potato growers, and the extent to which these varieties are liked by downstream actors in the chain. To do so, the quality preferences of ware potato growers are measured by their decision to grow specific varieties over others, and the preferences of traders are measured by their preferences for specific quality attributes.

6.4.1 Case study

The focus of our case study was on seed growers who were organised in cooperatives and who were growing potato seed of improved varieties for commercial purpose.

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[4] Stew quality refers to the taste of ware potatoes when they are boiled in a mix (i.e. a stew) with other vegetables. Cooking quality refers to the taste of the potato when consumed boiled without mixing with vegetables.

Such cooperatives were mainly located in the central highlands due to the good agro-ecological conditions (cool and high altitude). Cooperatives were initiated and supported by the Holeta Agricultural Research Centre (HARC). Based on the recommendation of HARC, we purposely selected two districts, Welmera and Jeldu. Subsequently, we selected 2 cooperatives from Welmera district and 1 cooperative from Jeldu district.

To gather data, personally administered semi-structured interviews were held with different stakeholders: leaders of the three cooperatives, eight cooperative members, and three experts from HARC and the Welmera district agricultural office. In addition, we observed the member farms and the storage facilities of the cooperatives. Parts of the questions to the cooperative leaders were related to quality improvement activities by seed growers, market access and support from external parties. Questions for members were related to production and marketing seed potatoes. The questions for the research centre and the agricultural development office were related to the type of support offered by the specialised seed growers. Ten storage facilities were visited, in two rounds, to observe how seed potatoes were stored and to get information on the time between entering of storage and sales of potatoes. The first visit was in November 2009, the time when potatoes were being harvested, and the second visit was in April 2010, the time when seed potatoes would be sold to ware potato growers.

6.4.2 Survey of farmers

We carried out the farmers' survey in the spring of 2011 among 350 ware potato farmers in the Rift Valley region of Ethiopia. Although potatoes can be produced in different parts of the country, our study focuses on the Rift Valley region for two main reasons. First, ware potato farmers in the region are the main suppliers of ware potatoes to the major cities of Ethiopia. For instance, the Shashemene spot market, in the centre of our study region, is considered as the main trade hub of ware potatoes (Emana and Nigussie, 2011; Tefera *et al.*, 2011). Second, to characterise the different potato varieties, it is necessary that the farmers in the survey have the same understanding of the currently used varieties. In Ethiopia, variety names lack standardisation and are often attached to local languages (Cavatassi *et al.*, 2011). Thus, focusing on one region avoids problems arising from confusion over variety names.

The ware potato farmers were randomly selected from the land ownership register obtained from the Office of Agriculture and Rural Development at the Shashemene, Shala, and Shiraro districts. The main objective of this part of the study was to characterise the different potato varieties, both the improved and local varieties.

Characterisation of the different potato varieties was carried out as follows. First, we identified seven potato varieties, and the classification was done by farmers, triangulated with information from agricultural agents. The varieties were: Aga Zer, Nech Abeba, Key Dinch, Key Abeba, Gudane, Jalene, and Bule. The latter three are improved varieties that were released by the Ethiopian Institute of Agricultural

Research (EIAR) while the others were local varieties for which no documentation was found on how and when these varieties were first introduced in the region. Second, to better understand the main characteristics each variety possesses, we classified quality into two dimensions: production-related and market-related.[5]

To understand the factors influencing their decision to grow a particular variety, ware potato farmers were asked the following question in relation to each variety: 'What was the main reason that led you to grow this variety in the previous season?' Farmers were asked to pick only one from nine different production- and market-related attributes described earlier. This would force farmers to reveal the most important reason for selecting one variety over others.

6.4.3 Survey of downstream actors

The main objective of this part of the survey was to understand the quality preferences of different actors in the downstream part of the potato supply chain. We carried out this survey in the summer of 2011 among 10 stationed wholesalers, 13 retailers, and 11 big hotels located in Addis Ababa. Because collecting wholesalers supply potatoes to the central market of Addis Ababa, we purposely selected the traders at the central market.[6] The question for the downstream actors was as follows: 'Please distribute 100 points over the different quality attributes that you may take into account when you are buying ware potatoes. Give the highest value to the most important quality attribute, the second highest value to the second most important quality attribute, etc.' Accordingly, the mean rank of each quality attribute would be computed to identify the highly ranked attributes, and compare it with the attribute considered most important by farmers in selecting a particular variety.

6.5 Results and discussion

6.5.1 Case study

The three seed potato cooperatives in Jeldu and Welmera areas were largely organised around farmers who used to participate in farmer research groups. HARC played a key role in the formation of the seed potato growers' cooperatives as part of its strategy to institutionalising the transfer of agricultural technologies to farmers. We observed two widely grown improved seed potato varieties, Jalene and Gudane, in the study area, which were released by HARC in 2002 and 2006 respectively. HARC was also the main provider of technical assistance to the specialised seed growers.

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[5] Unobservable characteristics of potatoes were not considered in our analysis as information on these attributes is rarely conveyed in the supply chain.

[6] Collecting wholesalers are traders who are located close to ware potato farmers and they supply potatoes to stationed wholesalers. Stationed wholesalers are traders who buy potatoes from collecting wholesalers and distribute it to retailers, hotels and restaurants. Stationed wholesalers are located close to retailers and final consumers (thus at the central market in Addis Ababa).

This indeed had helped the growers to improve their seed quality and productivity. In addition to providing technical assistance, HARC served as an intermediary in the marketing of seed potatoes. However, the main buyers of the potato seeds were NGOs (such as World Vision) and government agencies (particularly from the Ministry of Agriculture). Farmers reported that the demand for improved potato seeds from the private sector (traders) had been minimal. NGOs and state agencies distributed seed potatoes to ware potato farmers across the country.

Members of the cooperatives grew seed potatoes on a relatively large scale, average production per grower was 25 tons, and the maximum amount produced by a farmer in the study period was 170 tons. However, the amount of seed potatoes sold via the cooperatives was, on average, 4.6 tons. The cooperatives had difficulties to find buyers for the seed potatoes produced by their members. Thus, growers had to sell the remaining seeds as ware potatoes in the local market, usually at a lower price. In the improved seed market, we observed that the private sector hardly played any role. Growers' reliance on NGOs and government agencies for selling their seeds is an indication of the vulnerability of the improved potato seed industry. We observed major volatility in the buying behaviour of these institutional buyers, resulting in high uncertainty for the growers.

During and before 2008/2009, members of the three seed potato cooperatives reported to have sold their seed potatoes to NGOs and government agencies at reasonable prices (up to 600 Ethiopian Birr per 100 kg). These relatively high prices induced incumbent and new seed growers to increase the production of seed potatoes. Subsequently, the number of farmers participating in the specialised seed potato market had significantly increased. For example, in Jeldu district, the number of seed potato cooperatives grew from one to four, with a total supply of about 12,500 tons. In addition, existing seed cooperatives increased their production level. For example, Derara Improved Seed Potato Growers' Cooperative in Jeldu district had doubled its seed production from 1,250 tons in 2008/2009 to 2,600 tons in 2009/2010. However, in 2009/2010 there was hardly any demand for seed potatoes from the institutional buyers. During our visit in April 2010, the two seed potato cooperatives from Welmera district did not receive any purchase request from the usual institutional buyers. Similarly, the seed cooperative in Jeldu could only sell 480 tons out of the total 2,600 tons of improved seed potatoes in storage. We observed the frustration of farmers who had been waiting for a buyer for seven months, keeping their seed potatoes in diffused light stores. A farmer who had still 180 tons of seed potatoes in storage described his frustration as follows:

> Last year, I only produced a small amount of seed potatoes and was able to sell all of them. I was a bit disappointed last season that I grew only on a small plot of land. This season, I decided to use all my land for growing seed potatoes and I did that. Now, it is April. I have been waiting for a buyer since December. If I don't find a buyer in the next couple of weeks, I will lose everything that I was hoping for all the season. I am frustrated.

> I don't know what I need to do. Please help us! Inform our desperate situation to the media, to the government that we are losing everything.

This example shows that the specialised seed potato growers are poorly connected to the ware potato growers. Nonetheless, our case study analysis does not necessarily imply that there was excess supply of improved seed potatoes in Ethiopia. It simply highlights the presence of poor coordination between the specialised seed sector and the ware potato sectors in the country.

6.5.2 Survey

From the original sample of 350, questionnaires from 4 farmers could not be used. Thus, our sample for analysis consists of 346 farmers. Table 6.1 summarises the characteristics of the ware potato farmers sample. The average age was 37, the average years of school education was 6, average land holding was 1.5 ha, and the average animal holdings in number of livestock units was 8. The average family size was 10, with a dependency ratio of 1.3, implying a high number of economically inactive members in a household. Over 33% of the respondents had two or more wives. Farmers who practiced polygamy were older (42 years) and less educated (4 school years), and had a larger family size (14). In terms of access to information technology, 67 and 65% of the ware potato farmers had a mobile phone and radio, respectively. As can be observed in Table 6.1, potato contributed to almost 50% of the total household income in the 2009/2010 production season.

Table 6.2 presents the description of chain actors at the central market, Addis Ababa. In the 2009/2010 transaction season, the mean purchased volume was 957 tons for stationed wholesalers, 42 tons for retailers, and 7 tons for hotels. Although stationed wholesalers did not have a direct transaction with potato farmers, they knew the region where the potatoes came from; they stated that 65% of the potatoes were bought from the Shashemene area, our study region. However, the hotel managers did not know the production region; they buy directly from stationed wholesalers based on a prearranged contract. This means that although production region or variety names are used to signal quality to traders, this signal becomes less relevant for final customers, such as hotels and restaurants. Thus, traders play an important role in translating the final customers' quality preferences into demand for specific varieties or potatoes from specific regions.

6.5.3 Farmer-based characterisation of improved and local varieties

Characterising the quality attributes of local and improved varieties using farmers' knowledge can provide better insights into the quality differences among currently used varieties in general and between the main improved and local varieties in particular. The research question addressed in this part was 'How do ware potato farmers characterise currently used varieties in terms of production- and market-related quality attributes?'

Table 6.1. Characteristics of sampled potato farmers (n=346).

Variables	Total
Male headed households (% yes)	96
Marital status(% yes)	
Unmarried	3.5
Widow	0.3
Married (only one wife)	63
Married (>=2 wives)	33.2
Other demographic characteristics	
Age (years)	36.8
Family size	9.6
Education of the respondent (years in school)	5.7
Highest education in the family (years in school)	8.3
Dependency ratio[1]	1.3
Wealth (as approximated by)	
Land (owned) in ha	1.5
Total livestock units TLU[2]	8.1
Access to information	
Presence of a mobile phone (% yes)	66.8
Presence of a radio (% yes)	65
Presence of a TV (% yes)	9.5
Income from potato sales (2009/2010)	
Mean value (in birr)[3]	9,905
% of potato income from total income	49

[1] Measures the ratio between dependents and labour force within the family.

[2] TLU = tropical livestock units (250 kg), used as a common unit to describe livestock numbers of various species as a single figure: oxen/cow = 1 TLU; calf = 0.25 TLU; heifer = 0.75 TLU; sheep/goat = 0.13 TLU; young sheep/goat = 0.06 TLU; donkey = 0.7 TLU.

[3] 1 US$ ~12.60 birr.

Table 6.2. Potato buyers' knowledge of production region (buyers at the central market Addis Ababa).

Mean values	Hotels (n=11)	Stationed wholesalers (n=10)	Retailers (n=13)
Amount purchased in 2009/2010 (in tons)	6.8	956.8	42.1
Knows production region of potatoes purchased (% yes)	0	100	15.4
If yes, potatoes purchased originated from (in %)			
West Arsi Zone (the study area)	0	65	70
East Arsi zone (South East)	0	28	26.5
Holeta area (West)	0	11.7	7
Gojam (North West)	0	5.3	0

Farmers' assessment of production-related quality attributes of the local and improved varieties is reported in Table 6.3. The improved varieties, with the exception of Bule, scored higher than the local varieties as to yield. Likewise, the improved varieties scored the highest in terms of disease tolerance. Regarding drought tolerance, the most common local varieties were assessed similar to the improved varieties. However, differences exist concerning maturity period. While Gudane and Jalene require on average 123 days to mature, Nech Abeba, the dominant local variety, matures on average in 101 days. As to the intensity of crop management, the local varieties Nech Abeba and Aga Zer scored higher than the improved varieties Gudane and Jalene, implying that the local varieties require more time for land preparation, planting and weed control than the improved varieties. New varieties tend to be more demanding in terms of crop management than local ones, which is not the case in our results. This might be because the farmers in our survey only grew the improved varieties on a small scale; they would not recognise the extent of crop management practices needed to grow improved varieties as they would do for local varieties, which were grown on a relatively large scale.

Table 6.4 presents farmers' assessment of market-related quality attributes. The mean scores for cooking quality and taste appear to be similar; Agar Zer, Bule, and Jalene scored the highest in terms of cooking quality and taste. All the improved varieties scored the highest in storability, while the local variety Nech Abeba scored the highest in stew quality. However, although the improved varieties could be stored for longer periods than the local varieties, ware potato farmers generally do not keep potatoes after harvest because of lack of modern storage facilities and the high risk of quality losses in the traditional storage facilities. In terms of tuber size, Jalene and Gudane, followed by Nech Abeba, scored the highest. In terms of colour of appearance, Bule and Key Dinch are red, while the others are white/yellowish. As to shape, also a dichotomy can be found, with Agar Zer and Key Dinch having an oval shape, while

Table 6.3. Farmer based characterisation of improved and local potato varieties: production related quality attributes (mean scores).

Variety	Yield (100 kg per Timad)	Maturity period (days)	Tolerance to disease (scale 1-5)	Tolerance to drought (scale 1-5)	Management intensity (scale 1-5)
Aga Zer	26.5 (10.5)	88 (10)	3.7 (1.2)	3.8 (1.1)	3.7 (1.0)
Nech Abeba	31.2 (11.8)	101 (15)	3.5 (1.2)	3.9 (1.2)	4.3 (0.9)
Key Dinch	21.7 (8.3)	70 (11)	2.6 (1.2)	2.8 (1.2)	2.9 (1.1)
Key Abeba	21.5 (7.8)	82 (15)	1.8 (0.9)	2.2 (1.1)	3.1 (1.2)
Gudane[1]	43.8 (18.3)	122 (16)	4.1 (1.0)	3.8 (1.2)	3.7 (1.3)
Jalene[1]	45.7 (20.1)	123 (18)	4.2 (1.2)	3.7 (1.3)	3.7 (1.3)
Bule[1]	24.4 (11.9)	112 (20)	3.8 (1.1)	3.5 (1.4)	2.8 (1.3)

[1] Improved varieties; standard deviations are given in brackets.

the others having a round or semi-round shape. Because the scores for taste and cooking quality were similar, and storability was not considered important, taste and storability were dropped from further analysis.

6.5.4 Comparison of improved and local varieties

We statistically tested the difference in production-related quality attributes within the varieties using Friedman Test, which is commonly used in the literature to compare overall mean ranks of ordinal data (Friedman, 1937). However, we only focused on Nech Abeba and Agar Zer (local varieties) and Gudane and Jalene (improved varieties) as these varieties were the most commonly grown by ware potato farmers. Among the four varieties, the Friedman Test results suggest (see Appendix 6.1) the presence of overall significant differences related to the mean ranks of yield, maturity period, and disease tolerance, but no significant differences regarding drought tolerance and crop management intensity. That is, farmers do not perceive that these varieties vary as to drought tolerance and intensity of crop management, while they perceive a difference in yield, maturity period, and disease tolerance. In terms of market-related quality attributes, the Friedman Test result also shows (see Appendix 6.2) that there is an overall significant difference between the mean ranks of tuber size, stew quality, and cooking quality.

The results in Appendix 6.1 and 6.2 show the presence of an overall significant difference in the mean ranks of production- and market-related quality attributes. As the Friedman Test results do not tell which varieties differ, we were also interested to know the quality difference among the varieties. A post-hoc test can determine whether significant differences exist between pairs of the different varieties (Sheldon *et al.*, 1996). Subsequently, we run a multiple comparison using the Wilcoxon Signed-Rank Test. Accordingly, the paired results between Agar Zer and Nech Abeba, Agar

Table 6.4. Farmer based characterisation of improved and local potato varieties: market-related quality attributes (mean scores).

Variety	Tuber size (scale 1-5)	Stew quality (scale 1-5)	Cooking quality (scale 1-5)	Storability (weeks)	Taste (scale 1-5)	Colour
Aga Zer	3.4 (0.7)	3.8 (1.0)	4.6 (0.8)	11.5 (5.5)	4.7 (0.6)	white
Nech Abeba	3.9 (0.3)	4.8 (0.6)	3.9 (0.9)	8.7 (5.3)	3.9 (0.9)	white
Key Dinch	2.3 (0.9)	2.5 (1.1)	3.1 (1.1)	11.1 (5.6)	3.2 (1.1)	red
Key Abeba	2.2 (1.1)	2.6 (1.1)	2.2 (1.0)	8.5 (4.5)	2.0 (1.0)	white
Gudane[1]	4.4 (0.6)	3.3 (1.0)	3.5 (1.1)	13.0 (7.6)	3.3 (1.0)	white
Jalene[1]	4.8 (0.4)	3.4 (1.1)	3.9 (1.1)	11.9 (6.6)	4.0 (0.9)	white
Bule[1]	3.0 (1.0)	2.2 (1.3)	3.8 (1.4)	15.6 (7.6)	4.2 (1.1)	red

[1] Improved varieties; standard deviations are given in brackets.

Zer and Jalene, and Nech Abeba and Gudane are not significantly different regarding disease tolerance, stew quality, and cooking quality, respectively. Furthermore, the two improved varieties, Gudane and Jalene, do not significantly differ in terms of yield and maturity period. In all the remaining combinations, the results are highly significant (Table 6.5). The results show that, with the exception of cooking quality related to Nech Abeba and Gudane, the improved and local varieties are significantly different in terms of the main production- and market-related quality attributes.

In sum, the results of Table 6.3, 6.4, and 6.5 confirm that ware potato farmers indeed see quality differences among varieties, particularly between the improved and local varieties.

6.5.5 Quality attributes influencing variety choice

Having characterised the quality attributes of the local and improved varieties, we now turn to address the specific question 'Which quality attributes influence ware potato growers' choice for specific varieties and how does this choice relate to the preferences of downstream actors?'

As can be observed in Table 6.6, 80% of farmers grew the local variety Nech Abeba. It appears that farmers who grew Nech Abeba were largely motivated by the high market demand, which accounted for 57%. This implies that farmers' decision to grow a specific variety is influenced by the market demand more than the price. This makes sense because price is largely determined by the supply and demand conditions and is uncertain at the time farmers make the decision to grow a specific variety. The second most grown variety was the local variety Agar Zer (48%). The main reason for growing this variety appeared to be its good cooking quality. It is also interesting to see

Table 6.5. Comparison of production- and market-related quality attributes across varieties (Wilcoxon Signed Ranks Test).

Variety[1]	Tuber size		Stew quality		Cooking quality		Yield		Days to mature		Disease tolerance	
	Z-score	Sign.	Z-score	Sign.	Z-score	Sign.	Z-score	Sign.	Z-score	Sign.	Z-score	Sign.
AZ & NA	-9.26	0.000	-8.81	0.000	-9.82	0.000	-5.56	0.000	-11.48	0.000	-0.75	0.451
AZ & GD[2]	-7.94	0.000	-2.66	0.008	-4.90	0.000	-4.29	0.000	-7.46	0.000	-4.77	0.000
AZ & JL[2]	-11.38	0.000	-2.55	0.011	-3.93	0.000	-5.84	0.000	-9.75	0.000	-4.41	0.000
NA & GD[2]	-6.71	0.000	-5.64	0.000	-1.05	0.293	-4.25	0.000	-6.27	0.000	-3.40	0.001
NA & JL[2]	-11.37	0.000	-7.80	0.000	-2.85	0.004	-6.22	0.000	-8.71	0.000	-4.35	0.000
GD & JL	-4.74	0.000	-2.75	0.006	-2.93	0.003	-0.51	0.609	-0.86	0.389	-2.70	0.007

[1] Local varieties: AZ = Aga Zer; NA = Nech Abeba. Improved varieties: GD = Gudane; JL = Jalene.

[2] Comparisons between local varieties and improved varieties.

that production-related quality attributes have received low importance in farmers' variety choice. Of the farmers who grew Nech Abeba, only 20% stated that they were motivated by its high yield. Likewise, 14% of farmers who grew Agar Zer claimed that early maturity was the main reason for growing this variety. Of the local varieties, Key Dinch, which was grown by 21% of the respondents, appeared to have been chosen for its production-related attributes; 73% of farmers stated that early maturity was the main factor in their decision to grow this variety. Variety Key Dinch seemed to have been used as a 'hunger breaker' because of its shorter maturity period compared to the other potato varieties.

Key Abeba and Bule were the least preferred varieties. This confirms the results displayed in Tables 6.3 and 6.4. Farmers assessed that Key Abeba is highly susceptible to disease and has low stew and cooking quality, while variety Bule has a long maturity period and the lowest stew quality. As expected, varieties Jalene and Gudane appeared to have been preferred because of their better yield and disease tolerance characteristics. However, not many farmers grew these varieties in the 2009/2010 production season. The results suggest that farmers' decision to grow the local varieties was mainly motivated by market-related quality attributes while their decision to grow the improved varieties was largely based on production-related quality attributes (Table 6.6).

Table 6.7 provides an overview of downstream actors' preferences for market-related quality attributes. We only focused on the preferences of downstream actors in the central market, Addis Ababa, because 65% of the ware potatoes available in Addis Ababa were supplied by the collecting wholesalers in our study area. Stationed

Table 6.6. Factors influencing ware potato growers' variety choice.

Variety	% farmers who grew (n=346)	Reasons for growing a specific variety in the 2009/2010 production cycle (in %)						
		High market demand	High price	Good cooking quality	Storability	High yield	Early maturity	Disease tolerance
Aga Zer	48.3	20.4	18	34	7.2	5.4	14.4	0.6
Nech Abeba	79.5	57.1	17.5	1.7	2.2	20.4	1.1	0
Key Dinch	20.5	9.9	2.8	9.9	0	4.2	73.2	0
Key Abeba	3.8	46.2	20.4	5.3	7.7	7.7	12.7	0
Gudane[1]	9	9.7	6.5	12.9	3.2	51.6	0	16.1
Jalene[1]	19.7	2.9	4.4	1.5	4.4	72.1	0	14.7
Bule[1]	1.2	0	0	100	0	0	0	0

[1] Improved varieties.

Table 6.7. Downstream actors' preferences for market-related quality attributes (mean scores from 100 points).

Quality attributes	Total (n=34)	Hotel (n=11)	Stationed wholesaler (n=10)	Retailer (n=13)
Colour	37.3	35.4	30.3	44.2
Tuber size	32.8	32.6	38.2	28.8
Storability	7.2	5.0	11.5	5.8
Tuber shape	6.9	15.8	6.0	0
Stew quality	6.2	6.8	6.7	5.4
Price	5.8	2.1	2.0	11.9
Cooking quality	4.1	2.3	5.3	4.6

wholesalers had high priority for tuber size, followed by tuber colour and storability. Retailers mostly preferred tuber colour, followed by tuber size. For hotels, tuber colour received the highest weight, followed by tuber size and shape. Generally, cooking quality, price, stew quality, and storability were assigned low scores by traders. As to stew quality, this result is surprising because most urban households consume potatoes in stew. One possible explanation is that stew quality characteristics might have been captured in tuber size. Generally, tuber size and colour are the most important quality attributes influencing downstream actors' preferences for specific varieties.

With regard to tuber size, 80% of wholesalers, 46% of retailers and 36% of hotel managers preferred large tubers. Generally, large tuber size is preferred to small, medium, and very large tuber size (Table 6.8). In terms of colour, there is not much difference between the most common local and improved varieties. However, with tuber size, the two main improved varieties appeared to have very large tuber size compared to the local varieties (Table 6.4).

Taking the above results together, we can better explain why certain varieties are more preferred than others. It appears that the local variety Nech Abeba was more popular among both farmers and downstream actors compared to the improved varieties currently available. Improved varieties Jalene and Gudane appeared to have a very large tuber size, which is not what trader prefer. According to the stationed wholesalers and retailers in Addis Ababa, very large tubers tend to have lower quality when used in stew, which is an important quality attribute for household consumers. Furthermore, household consumers in general buy in small quantities from retailers, and very large tubers could create measurement problems.

Even though ware potato farmers attempted to align their quality preferences with those of downstream actors by growing the preferred local variety Nech Abeba, this cannot reduce quality concerns arising from poor crop management, storage

Table 6.8. Desired tuber size by downstream actors (%).

	Hotel (n=11)	Stationed wholesaler (n=10)	Retailer (n=13)
very large	27.3	20.0	15.4
large	36.4	80.0	46.2
medium	36.4	0	15.4
small	0	0	23.1

condition, and transportation. Stationed wholesalers at the central market, Addis Ababa, reported a number of problems – premature tubers, spoilage losses, blackened tubers, and physical damage. We also observed these quality problems when we visited the potato market in Addis Ababa. Traders have responded to these quality concerns by applying various coordination mechanisms. For example, collecting wholesalers attempted to monitor the quality of potatoes by visiting specific ware potato farms and by involving themselves in the harvest and transport activities. For the 2009/2010 production season, 56% of the farmers reported that harvesting was carried out by the collecting wholesalers. The dyadic relationship between collecting wholesalers and stationed wholesalers was based on trust, where close personal ties and repetitive interactions appeared to have played an important role in governing the relationship (Table 6.9). Accordingly, 60% of the stationed wholesalers had their own preferred suppliers among the collecting wholesalers. Also, 82% of the hotels and 92% of the retailers in the central market, Addis Ababa, had their own preferred suppliers among stationed wholesalers. Written contracts were only used to govern the transactions between big hotels and stationed wholesalers (Table 6.9).

6.6 Conclusions

Table 6.9. Coordination mechanisms used for the transaction between downstream actors.

Type of coordination mechanism	Hotel (n=11)	Stationed wholesalers (n=10)	Retailers (n=13)
Preferred supplier (% yes)	81.8	60	92.3
Written contract (% yes)	33.3	0	0

Using a case study on the specialised seed potato growers and a survey among ware potato growers and downstream actors, the study has provided insights in the alignment of the quality preferences of different actors along the Ethiopian potato

supply chain. To better understand which quality attributes influence variety choices, the paper has analysed the link between the specialised seed potato growers and the ware potato growers, has characterised different potato varieties, and has compared local and improved potato varieties.

The case analysis showed that improved potato varieties Jalene and Gudane were widely grown by the specialised seed growers in the highlands. Despite claims of insufficient supply of potato seed of improved varieties (Hirpa *et al.*, 2010), no evidence of insufficient supply was found during the study period. However, these varieties were not very popular among ware potato farmers in the study area. Common explanations for low demand among ware potato growers are a lack of information on how to grow improved varieties and a lack of information on the availability of improved varieties. While ware growers themselves did not buy tubers of these improved varieties, most of the demand comes from institutional buyers like NGOs and government agencies (which distributed the tubers among ware growers in other regions). This demand from institutional buyers, however, turned out to be erratic, leading to high frustration among growers of potato seeds. On the basis of the case study results we can conclude that coordination between two essential parts of the potato supply chain – between seed potato growers and ware potato growers – is poorly developed. This brings us to the second major question of this article: why do ware potato growers choose local varieties above improved varieties? This question entailed the analysis of the extent of alignment of preferences between ware potato growers and downstream actors in the supply chain. But first we had to characterise the main quality attributes of the different varieties, especially distinguishing between production-related and market-related quality attributes.

Seven main varieties were identified and characterised using farmers' knowledge. The aim of such characterisation was to systematically capture the most important quality attributes each variety possesses. Obviously, variety as such is not that important as it is usually short-lived. What matters most are the main quality attributes, which are more stable and determine variety choice. Breeding centres use information on quality attributes to develop new varieties that could satisfy the requirements of ware potato growers and downstream actors.

Farmers' characterisation of the different potato varieties show that there are significant quality differences between the improved and local varieties, particularly with respect tuber size and stew quality (market-related attributes) and yield, maturity period and disease tolerance (production-related attributes). Further analysis shows that the improved varieties are more preferred in terms of their production-related quality attributes while the local varieties are more preferred regarding their market-related quality attributes. We found that ware potato farmers continue to grow local varieties as they consider these having better market-related quality attributes. As a result, demand for improved varieties is low. This result is in line with other literature on commercialisation and variety choice (Asfaw *et al.*, 2012). Commercialisation implies that variety choice is influenced by market requirements.

Among Ethiopian breeding institutes, however, the focus of variety development has always been on yield, disease tolerance, and agro-ecology adaptability to overcome food insecurity challenges in the country (Gebremedhin *et al.*, 2008). Although production-related quality attributes are still important criteria in the selection of specific varieties by the ware potato growers, if varieties do not also possess the quality attributes considered important by downstream actors, ware growers will not choose them. Our results show that even though improved varieties have better production-related quality attributes, ware potato farmers' appeared to have opted for the local varieties due to their superior market-related quality attributes. Thus, ware potato growers continued to grow the local variety Nech Abeba in order to satisfy the quality demanded by downstream actors. In other words, the quality preferences of the ware potato growers and those of the downstream actors are well aligned, while the quality preferences of the breeding institutes + seed potato growers are not well aligned with the preferences of the other actors in the potato chain.

Finally, potato has become an important source of cash for smallholders in Ethiopia. In the case examined, potato contributed about 50% of total household income in the 2009/2010 production season. Thus, research on variety development needs to take into account the quality preferences of downstream actors to enhance the uptake of improved varieties by ware potato farmers. Varieties with better market-related quality attributes would create better market opportunities for the specialised seed potato growers and enhance the uptake of modern potato seeds by the ware potato growers in the Rift valley region, which contributes at least 65% of the ware potato supply to the capital, Addis Ababa.

Acknowledgements

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Appendix 6.1. An overall difference in mean ranks test of the production-related quality attributes across main varieties.

(Friedman Test)

Variety	Yield	Disease tolerance	Drought tolerance	Maturity	Management practices
Aga Zer	1.73	1.8	2.29	1.19	2.27
Nech Abeba	1.83	2.29	2.58	2.13	2.62
Gudane[1]	3.25	2.77	2.61	3.31	2.56
Jalene[1]	3.19	3.13	2.53	3.37	2.55
N	24	63	56	67	56
χ^2	34.5	43.6	2.6	157.6	3
df	3	3	3	3	3
Sig	0.00	0.00	0.464	0.00	0.391

[1] Improved varieties.

Appendix 6.2. An overall difference in mean ranks test of the market-related quality attributes across main varieties.

(Friedman Test)

Variety	Tuber size	Stew quality	Cooking quality	Storability	Taste
Aga Zer	1.37	2.41	3.18	2.6	3.44
Nech Abeba	2.08	3.49	2.26	1.82	2.14
Gudane[1]	2.96	1.9	2.02	2.71	2.01
Jalene[1]	3.58	2.2	2.54	2.88	2.41
N	98	58	71	41	75
^{2}	200.7	61.4	38.7	19.6	69.6
df	3	3	3	3	3
Sig	0.00	0.00	0.00	0.00	0.00

[1] Improved varieties.