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The Role of Barley and Wheat Landraces after Introduction of Triticale, the Gamo Highlands in Southern Ethiopia

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Abstract Triticale (×*Triticosecale* Wittmack), an intergeneric hybrid of wheat (*Triticum* spp.) and rye (*Secale cereale*), was introduced to Ethiopia in 1970 (Pinto 1974), while improved varieties of barley (*Hordeum vulgare* L.) and wheat were introduced in the 2000s. This paper explores the uses people have assigned to barley, wheat, and triticale in the current food culture in southern Ethiopia. The aim of this study is to analyze the factors that have contributed to the continued cultivation of barley and wheat landraces after the introduction of triticale. Barley, wheat, and triticale play an essential role as ingredients in daily meals as well as in feast meals. Two landraces of barley and one landrace of tetraploid wheat are currently grown in the area of study. Local people highly valued these landraces for their taste, market value, and short cultivation period. They have sustained the diverse food culture that existed before the introduction of triticale, despite changes in the frequency of meals and combination of ingredients. The continued cultivation and preference of landraces can be understood in terms of a combination of cultural, ecological, and economic conditions.

Keywords: Barley; Food culture; Landraces; Triticale; Wheat.

Introduction

This paper portrays the current food culture in the Gamo Highlands in southern Ethiopia, where the high-yielding triticale (×*Triticosecale* Wittmack) was introduced in the 1970s. The purpose of this study is to analyze the factors that have contributed to the continued cultivation of barley (*Hordeum vulgare* L.) and wheat (*Triticum* spp.) and elucidate the uses people have assigned to each crop in this food culture. This study aims to illustrate the livelihoods of the rural communities in the Gamo Highlands that have accepted the new crop and maintained a diverse farming system and food culture. By examining the factors that influence each farmer's selection by identifying their high-demand cultural and social traits, this study provides useful information for the conservation of landraces, breeding, and the introduction of new traits.

I. Diversity of barley and wheat in Ethiopia

In 2018, Ethiopia's cereal production had a high proportion of maize, teff (*Eragrostis tef*),[1] sorghum, wheat, and barley (FAO 2020).[2] Describing the diverse traits of barley and wheat, Harlan (1969) and Vavilov (1992) pointed out that Ethiopia had unique traits of barley, such as irregular barley and deficiens barley. Ethiopia is said to have been of interest

as a secondary center of genetic diversity for barley and tetraploid wheat.

Until the late 20th century, the production of tetraploid wheat, mainly durum wheat (*Triticum durum* DESF.) amounted for 60–70 percent of the total wheat production in Ethiopia (Shiferaw et al. 2014). Improved varieties of bread wheat (*Triticum aestivum* L.) were expanded for cultivating in the mid-1980s and the production of durum wheat began to decrease as the demand for bread wheat increased due to urbanization and rising incomes (Shiferaw et al. 2014).

Addisu & Shumet (2015) classified barley landraces according to agronomic characteristics, and examined the genetic diversity within the population of barley landraces collected from fields in three districts named Chencha, Dita, and Bonke in the Gamo Highlands. They reported that 15 barley landraces were identified in Chencha district among the districts chosen for their study, where this study dealt.

Zemede (2000) summarized the morphology, cultivation, and utilization of barley in Ethiopia. He found that hulless barley cultivation, which highly valued by women and selectively maintained because of the little labor for preparation needed, has been diminishing, while the spread of the more cold-tolerant and higher yielding hulled barley is increasing.(3) The importance of conserving landraces based on farmers' experiences and knowledge has been reported. For example, Samberg et al. (2013a) pointed out that farmers' interviews provide sufficient information to explain patterns of gene flow that cannot be properly understood through genetic data alone.

II. Changes in dietary culture and cultivation systems driven by the introduction of triticale to Ethiopia

Triticale (×*Triticosecale* Wittmack) is an artificial hybrid of wheat (*Triticum* spp.) and rye (*Secale cereale*). It was trialed in Ethiopia in 1970 (Pinto 1974). As a crop that combines the merits of rye's environmental stress and disease tolerance and wheat's high yield and cooking versatility (Fraś et al. 2016; Zhu 2018), it is expected to make a significant contribution to increase grain production (Peña 2004).

Yazie (2014), who studied the advantages of triticale cultivation in Amhara region, northern part of Ethiopia, found that it is used for injera,(1) bread, roasted grain, local beer, and boiled grain. He claimed that roasted grain made from triticale was valued lower than that of barley and wheat. Ashenafi (2008), who did similar research, also found that injera, bread, traditional beverages, distilled alcohol, boiled grain, and non-fermented chapati-like bread are made from triticale.

Dagnachew et al. (2014) and Bezabih et al. (2019), who conducted studies on triticale breeding in Ethiopia, selected genotypes with stable and high-yielding varieties in different growing environments. Samberg et al. (2013b) focused on the ongoing phenomenon of improved wheat and triticale replacing barley in the Gamo Highlands due to their high-yield potential and high market value.

Study Area

This study was conducted in Dorze Laka na Maldo village, Chencha district, Gamo zone, Southern Nations, Nationalities and People's Region. The village is located in the northeastern part of the Gamo Highlands, which are approximately 100 km long and 30 km wide from southwest to northeast and reach an altitude of approximately 4,000 m (Samberg et al. 2010, 2013b) (Figure 1). The Dorze, an ethnic group, lives in the area and speaks

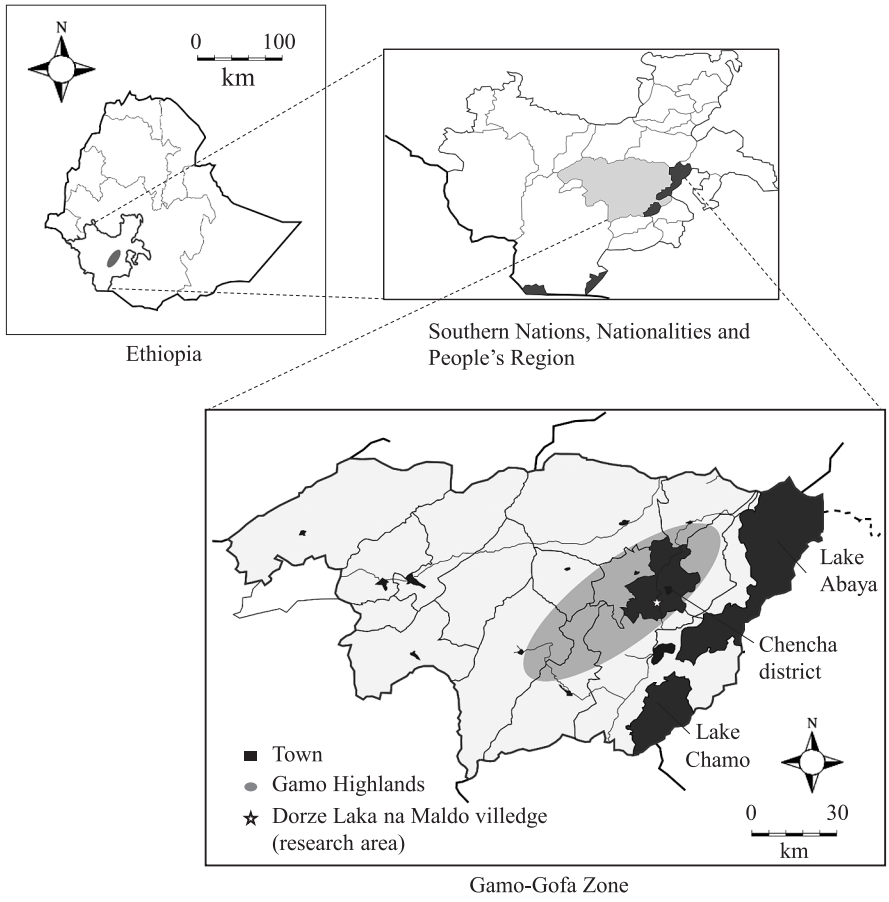

Figure 1 Administrative map of Gamo zone and Gofa zone, and study area, southern Ethiopia

Dorze language (*Dorzeththo*), which belongs to the North Omotic branch. The average annual temperature was 16.9°C, and the average annual minimum temperature was 11.6°C and the average annual maximum temperature was 24.3°C (Wakshum & Sharma 2018). The major cultivated plants in the study area are broad bean, chick pea, Irish potatoes, cabbage, and enset,[(4)] as well as barley and wheat (4x, 6x). Triticale is a recent addition to this list. In this study area, located 2,500 m to 2,560 m above sea level, it is difficult to grow teff whose cultivation limit is around 1,800 m to 2,100 m (Gamboa & Ekris 2008). Injera made from teff, a type of a flatbread, is recognized throughout Ethiopia as a cuisine for guests. Figure 2 shows an agricultural calendar for the major cereals based on the interview of respondents and direct observations.

The average annual rainfall between 2004 and 2014 was 1,412 mm (Wakshum & Sharma 2018). There are two rainy seasons a year in the region. The first one is between March and April, and the second one between June and September. People divide the farming period into two seasons based on the rainy season: the *gabba* period characterized by seeding in February and harvesting in June, and the *sira* period when seeding is done in July and harvesting takes place from November to February. *Sira* is the main harvest period. Potatoes and two-rowed or irregular barley can be grown during the two seasons on farmlands inside the compound or close to the compound.

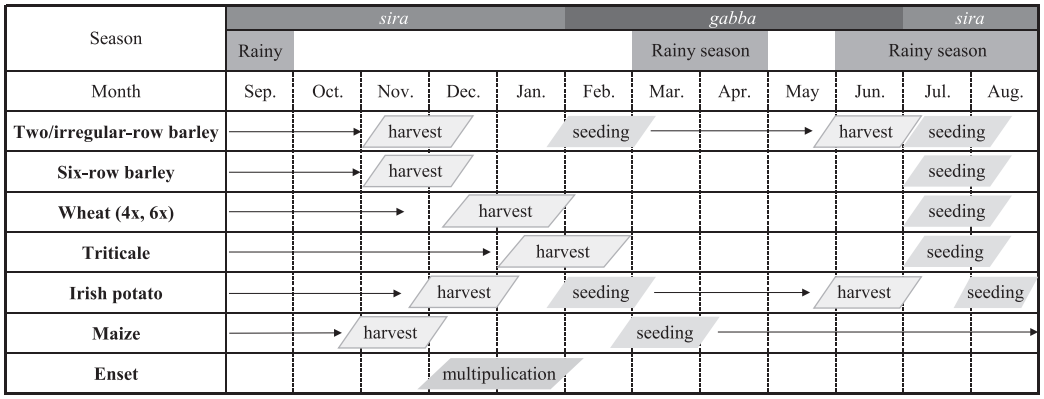

Figure 2 Crop calendar in research area based on interviews and direct observations

Most agricultural households had other income sources. These included men working on weaving, construction with bamboo, day labor and in some cases, migrating to provincial cities or the capital city of Addis Ababa. In the case of women, they engage in selling crops at the markets, merchandizing, and spinning thread out of cotton.

Methods

Fifty households were randomly selected from 317 households. A household survey was conducted to record the family structure and their occupations, farm size, and crop varieties planted during *sira* in 2017 for harvest in February 2017, *gabba* in 2017, for harvest in July 2017, and *sira* in 2018, for harvest in February 2018. I also collected data on sale amounts, sowing, yield, and livelihood (45 valid responses). Semi-structured interviews were conducted with the heads of households to learn about their triticale consumption practices. The household survey was conducted in the Dorze language with the help of an interpreter, who was born in the study area.

I stayed in household M and observed their daily activities. There are 8 people in the family: 40-year-old husband, 35-year-old wife, 4 daughters with age 12, 11, 9, and 7, and 2 sons with age 6 and 4 as of June 2018. They accepted me as a member of the household and allowed me to live in their house. I conducted my fieldwork in this manner, eating, sleeping, cooking, and working on the farm alongside my hosts. Amharic and Dorze language were the primary language of communication. I asked the second daughter, who was in Grade 6 as of June 2018, to keep a food diary in Amharic script for 10 months between September 2017 and July 2018. She was to record the names of staple and side dishes, beverages, and their ingredients.

The people in the study area often buy household items at the two regular markets in Dorze and Chencha. The Dorze market (2,430–2,450 m above sea level) holds on Mondays and Thursdays, and is a 30-minute walk (2.5 km) from Laka Square in the center of the study area. I recorded the selling price of grain traded at the Dorze regular market on any Thursday of November 2019 to March 2020. I interviewed several sellers with whom became acquainted and found out their prices.

This paper is based on three periods of fieldworks over a total of 15 months; August 2017 to February 2018, June 2018 to July 2018, and October 2019 to March 2020. Except as

noted, italicized letters refer to the Dorze language.

Results

I. Overview of agricultural practice

The household survey showed that 38 households engaged in agriculture, 34 of which grew triticale during the 2018 *sira* period, which is similar to planting crops in July 2017. It was found that 31 households grew a combination of multiple crops such as triticale, barley, and wheat. Twenty-four households grew a combination of triticale, barley, and wheat, 4 households grew a combination of triticale and barley, 2 households grew a combination of triticale and wheat, and 1 household grew a combination of barley and wheat. Household M has 1.12 ha of cultivated land, of which 0.48 ha was cultivated for triticale, 0.37 ha for wheat and 0.36 ha for barley from July 2017 to February 2018. These three crops are planted, not mixed, but side by side in separate plots. No significant differences in farming practices were observed between barley, wheat, and triticale. Low-producing areas were re-rotated or fallow the following year. The study area is not suitable for growing maize, but some farmers planted it in small plots.

II. The daily diet: The utilization of barley, wheat, and triticale

Eight dishes made by combining in various ways of barley, wheat, triticale, maize, or fermented enset starch, were identified (Table 1, Figure 3). These dishes were eaten before the introduction of triticale and were prepared with ingredients other than triticale. By ingredient, I mean crops such as barley, wheat, and triticale regardless of the variety.(5) Generally speaking, Ethiopia's food culture is characterized by both whole grain eating and flour-eating that utilizes grains as flour. The coexistence of flour-eating and grain-eating is observed in this region as well.

Table 1 Combination of ingredients for daily food and occasional food

Ingredient /dish	Daily food								Occasional food		
	Boiled grain (*nufuro*)	**Roasted grain (*shashi*)**	**Local beer (*danna*)**	**Steamed dumpling (*kashika*)**	**Unleavened bread (*uwethi*)**	**Small bread (*ambasha*)**	**Steamed flour (*petela* / *posese*)**	**Stiff porridge (*awoza*)**	**Porridge with coasely ground grain (*oyisa kathi*)**	**Thickly bread (*dabbo*)**	**Injera/ flatbread (*budena*)**
Barley	×	○	○	×	×	×	×	×	○	×	×
Wheat (4x, 6x)	○	○	○	○	○	○	× (1)	○	×	○	×
Triticale	○	○	○	○	○	○	× (1)	× (2)	×	× (3)	○ (4)
Maize	○	○	○	○	○	○	○	○	×	×	× (5)
Fermented enset starch	×	×	×	○	○	×	○	×	×	×	×

○ stands for a single ingredient or a combination of other grains, and × stands for a single ingredient that cannot be made by itself but can be made by combining with the ingredient listed side by the symbols. (1) denotes maize or fermented starch from enset, (2) denotes wheat or maize, (3) denotes wheat, (4) denotes teff or maize, and (5) denotes teff.

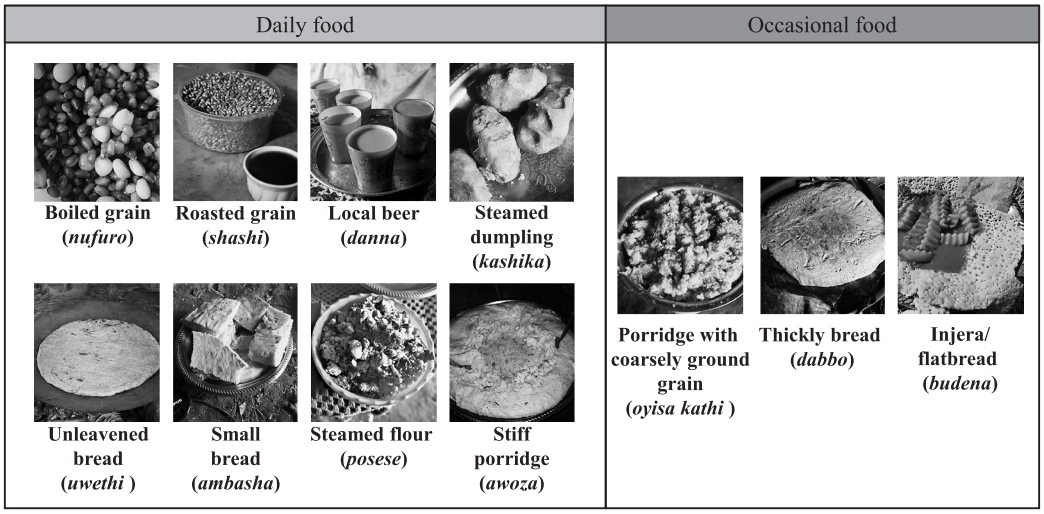

Figure 3 Representative dishes which are eaten in study area

There are six dishes that can be made with barley, wheat, or triticale. When the grains are boiled without grinding, people call it *nufuro*. It is made with wheat, triticale, and maize alone or a combination of them. When the grains are roasted without grinding, people call it *shashi*. People made it by barley, wheat, triticale, and maize. *Nufuro* and *shashi* are commonly eaten as a snack with coffee. A beverage called *danna* is made from ground grains after germination and the flour boiled in sufficient water, then fermented for 2–3 days. It is drunk as an everyday beverage and at celebrations. Barley, wheat, triticale, and maize are sometimes taken on their own, or mixed together. *Kashika* is made by adding water to maize flour, wheat, triticale, or fermented starch from enset alone or combinations of them, and steaming them in dumplings-like shape. *Uwethi* is a type of unleavened bread shaped like pizza, made by flattening them and baking them on both sides. These dishes are one of the most traditional staple dishes in Dorze village. There is *ambasha*, which is a bread with 15 cm in diameter and 3 cm thick. It is made from wheat flour, triticale, and maize alone or combination of them, left to ferment overnight or for a few days before baking wrapped in enset leaf. The dishes—*kashika*, *uwethi*, and *ambasha*—are served with steamed or boiled vegetables such as kale and beats, in addition to a source by milled chilies and spices.

There are two dishes that cannot be substituted for triticale: steamed flour (*petela* or *posese*) and stiff porridge (*awoza*). Steamed flour is made by rubbing flour together with both hands and steaming the small chunks formed with potatoes or kale. The dish has different names depending on the main ingredients: *petela* for fermented enset starch, or *posese* for maize flour. Sometimes fermented enset starch or maize flour is mixed with triticale or wheat flour, but not made from triticale or wheat alone. Stiff porridge is made by stirring wheat or maize flour with boiling water and fermented milk. It is eaten with fermented milk, ground chili, and spices put in a hollow made in the center of the dish. Although triticale is sometimes added to wheat or maize flour, it was never made from triticale only.

The food survey, conducted from September 2017 to July 2018, showed the proportions of staple foods, they often eat *kashika* and *posese* (Figure 4). Household M mainly

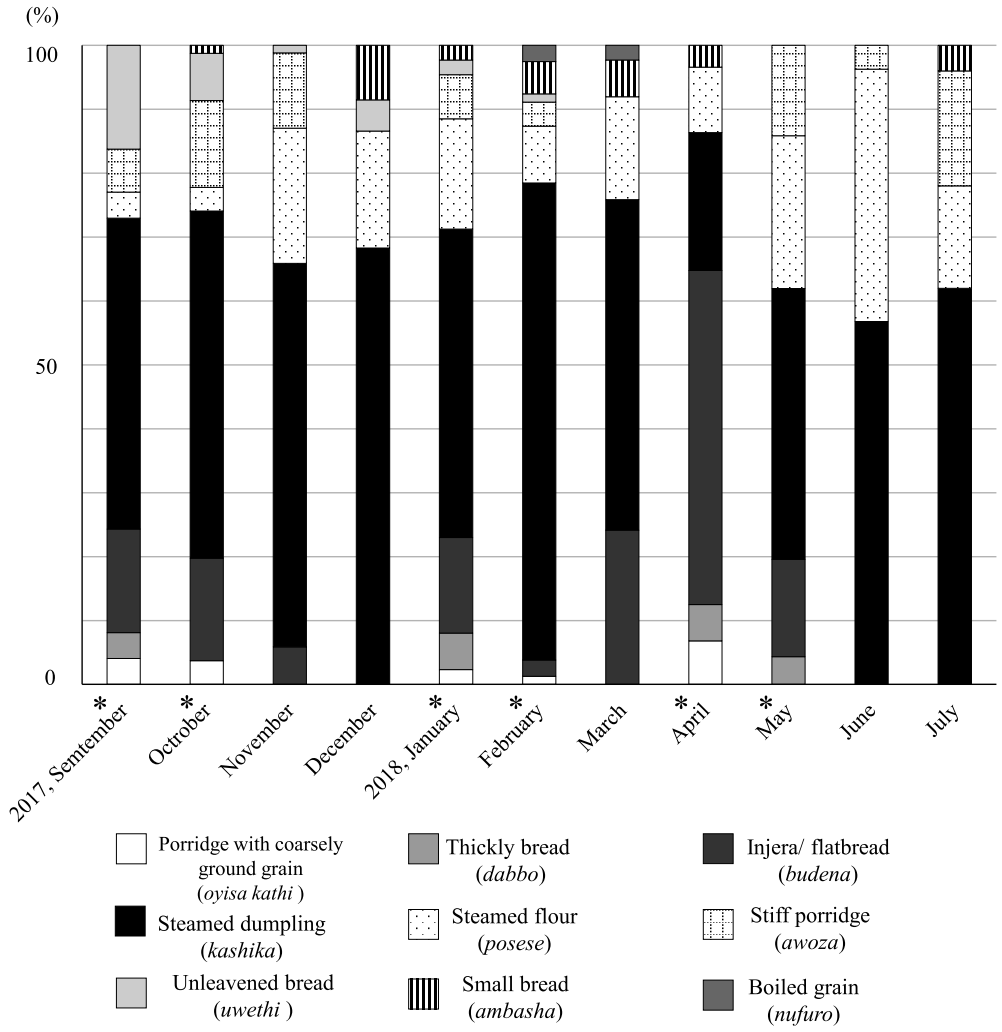

Figure 4 Percentage of staple foods by month in household M (recorded for 17 days from 1st to 17th of July 2018). The mark of star implies the month with feasts.(6)

purchased maize from the market and used it or a combination with maize and other grains for making staple foods, which indicates that no seasonality was observed in the staple food ingredients and kinds of foods. They commonly use harvested barley, wheat, and triticale for making roasted grains and boiled grains, which coincided with the harvest season and the time of use.

Barley was the major crop before the introduction of triticale. People used it to make stiff porridge and steamed dumplings with fermented enset starch. On the other hand, the children in household M said that they never used barley to make stiff porridge and steamed dumplings.

III. A holiday feast: The utilization of barley, wheat, and triticale

The Ethiopian Orthodox Church, which is rooted in the study area, has days of

celebration and fasting period. The food survey showed that they prepared and consumed porridge with coarsely ground grain (*oyisa kathi*), thick bread (*dabbo*), or injera (*budena*) on feast days and the day before the fasting period (Figure 4).[6]

The people use barley to make *oyisa kathi*, wheat for *dabbo*, and triticale for *budena* (Table 1, Figure 3). *Oyisa kathi* is made from coarsely ground barley cooked in fermented milk and mixed it with spice scented butter. There is no substitute for barley. They use fully matured grains of barley. The *dabbo* is a bread 30 cm in diameter and less than 5 cm thick. People prefer to make it from 100 percent wheat. Local varieties of tetraploid wheat with the reddish brown seed, known as *zo'o*, can be used to make it. However, people who want white bread use improved bread wheat varieties called *lakache* and *cuquno*. *Budena*, a type of flatbread, is made from flour of triticale, teff, or maize dissolved in water, fermented for 2–3 days and then baked thin like a crepe. Raw meat, egg, and vegetables are used to prepare a side dish that is wrapped in small piece of *budena*. The desired triticale varieties for making *budena* vary from person to person. The results of the dietary survey in household M showed that they also consumed *budena* on non-celebratory days in October and November 2017 and between February and May 2018 (Figure 4).

IV. Cultivated varieties

Farmers distinguish between barley, wheat, and triticale by their respective names. Barley is called *bangga*,[7] wheat (4x, 6x) is called *gistte*, and triticale is called *bashekala*. Nine barley landraces were identified through interview to the farmers, two of which are currently cultivated in the study area (Table 2). There are irregular-row (two or four-row) hulled barley with dark red or white husk called *gisso*, and two-row and hulled barley named *ochcho* with white or black husk and kernels. Even before the introduction of triticale, there were landrace of tetraploid wheat called *zo'o*, which have reddish brown husk and dark purple kernels.

It is averred that triticale was introduced in the 1970s, a period that is strongly linked with the deposal of Emperor Haile Selassie and institution of socialist government. The agronomic features of each triticale variety are *qarunxo*,[8] the ivory-colored kernels with awn, *zo'o* with reddish brown husk and kernels, and *buluso*, ivory-colored kernels without

Table 2 Characters of barley, wheat, and triticale varieties grown in the study area

Crop	Local name	Character					
		Kernel row number	Caryopsis type	Husk color	Kernel color	Awn	Era period of cultivation start
Barley (*bangga*)	*gisso*	irregular	covered	dark red or white	white	—	before the 1970s
	ochcho	two	covered	black or white	black or white	—	before the 1970s
	bira	six	covered	white	white	—	2000s
	funchi	six	covered	white	white	—	2010s
Wheat (4x, 6x) (*gistte*)	*zo'o**	—	—	reddish brown	dark purple	—	before the 1970s
	*lakache***	—	—	white	yellow	—	2000s
	*cuquno***	—	—	white	white	—	2000s
Triticale (*bashekala*)	*qarunxo*	—	—	white	ivory	long-awn	1970s
	zo'o	—	—	reddish brown	reddish brown	long-awn	1970s
	buluso	—	—	white	ivory	short-awn	2010s

*tetraploid wheat, **hexaploid wheat.

awn. In the 2000s, improved varieties of barley and bread wheat were introduced. They are six-row and hulled barley variety called *bira* and *funchi*. Bread wheat varieties such as *lakache* with the yellow kernels, and *cuquno* with white kernels were also cultivated.

V. Evaluation of landraces as ingredients for food

An interview of wife in household M on the best *shashi* showed her preference for broad beans, barley, wheat, and triticale in that order. She stated that the broad beans and barley contain "vitamins." According to her, the *ochcho* landrace is the best barley, and triticale has no "vitamins." I noticed the use of the word "vitamin" when they talk about nutritional value, in addition, the phrase "contains no vitamins" implies a negative meaning. *Ochcho* is a two-row and hulled barley landrace that can be easily dehulled by rubbing roasted seeds by both hands,[9] and has relatively large seeds. People rate it highly because of the little effort needed to prepare it and its taste.

The informants argue that *zo'o*, a tetraploid wheat landrace, is the best ingredient for making *danna* due to its moderate alcohol content and its sweet taste. It is prepared as a daily beverage and for celebrations. *Zo'o* is the only wheat sold in its germinated seed form in the local market, and is widely used for making local beer.

VI. Market price

A prolonged period of rainfall, which continued into the harvest season in January 2020, affected the sale prices of grain at the Dorze market (Table 3). As a result, the price of barley has been rising since January, because it is not readily available in the market. Triticale is traded at lower price due to discolored products. On the other hand, recently harvested wheat is said to be unsuitable for baking bread and traded at a lower price than that harvested in the previous year. The table shows that barley landraces *ochcho* and tetraploid wheat *zo'o* have maintained a high market value compared to other crops.

VII. A cropping system that incorporates landraces

Through an interview with the head of the extension office in Chencha district, I found

Table 3 Sale price of grain at the Dorze Market held every Monday and Thursday (recorded on Thursdays from November 2019 to March 2020. 1 birr worth as 0.0268 USD in October 2020).

Crop	Variety (times of interview)	Sale price (Birr/1,325–1,450 cc)	
		November to December (pre-harvest)	January to March (post-harvest)
Barley (*bangga*)	*ochcho* (5)	20	22–25
	gisso (4)	11	13–14
	bira (2)	N.D.	15
Wheat (4x, 6x) (*gistte*)	*zo'o* (3)	25	25
	cuquno (5)	25	20–25
	lakache (5)	25	24–25
Triticale (*bashekala*)	*qarunxo* (4)	16	15
	zo'o (2)	16	14
	buluso (5)	16	15–18

that he has recommended planting potatoes and the improved barley in that order due to the relatively short growing season and high yield. On the other hand, wife in household M said that it would be desirable to plant potatoes in February or March and leave some of the potatoes as seed potatoes for the next season until September. Thereafter, they can plow the land and grow landraces of barley, such as *ochcho* and *gisso* in October, and harvest them in January. Improved varieties of barley take at least five months to harvest, however, these barley landraces are considered ideal for two-seasons because of their short sowing-to-harvest time of three months. They are an important ingredient of roast barley in the cropping system.

Discussion

I. The potential for future changes in food culture driven by the introduction of triticale

The study area is relatively unsuitable for agriculture, and people have traditionally cultivated barley and wheat, while maintaining a diet centered on enset, which is suitable to this area. While integrating triticale into the traditional food culture and maintaining a diverse food culture, the food culture has also changed.

Teff, which is an Ethiopian origin crop, is given high cultural and economic value, especially in the Ethiopian highlands (Tadessa 2017). Injera made from teff is recognized as a celebratory dish throughout Ethiopia today. People in the study area purchase teff used to make injera because the area is not suitable for teff cultivation. Since the introduction of triticale, injera made from triticale has become a part of the daily diet. It is possible that people in the study area will be able to produce triticale as an ingredient themselves to make injera, and that injera made from triticale will be recognized as a part of their daily diet.

The farmers are believed to have cultivated cold-tolerant barley as a main crop before the introduction of triticale. In addition, barley was used in various dishes. However, the introduction of improved varieties of wheat and triticale has changed the crops and varieties grown. This has also led to changes in the type and frequency of dishes and combinations of ingredients. The current food culture might continue to shift as time goes by.

II. The hulless and hulled barley landraces currently grown

The number of barley varieties reported in previous studies and the number of varieties known to local people far exceed the number of barley landrace varieties currently known to be cultivated. The two varieties currently being cultivated are *gisso* with the irregular-row (two or four-row) hulled barley, and *ochcho*, the two-row and hulled barley. Barley is generally referred to as *bangga* in the study area which means hulled barley. With the spread of improved hulled barley varieties that offer superior yield and cold-tolerance, two landraces are expected to be maintained selectively. People appreciate them because they have a short harvest time of three months and can be grown in cooler and higher altitudes. The *ochcho*, one of the landraces, is recognized for the ease with which the kernels can be removed when roasted.(9) Moreover, *ochcho* shares similar properties with the hulless barley when roasted, making a viable and preferred option.

III. The role of barley and wheat that people value highly

There are strong concerns that local varieties of barley will be replaced by triticale

or improved wheat due to their high-yield potential and high market value[10] (Samberg et al. 2013b). However, based on the results of this study, it was difficult to draw such a conclusion. There are four reasons why barley and wheat will continue to be grown in terms of cultural preferences besides viewpoints of previous research. First, there is a continued use of barley and wheat in the daily diet, which means that triticale has not replaced these ingredients, but has expanded the choice of ingredients. Second, barley and wheat have specific cuisines that no other crop can substitute. Barley is always used to make *oyisa kathi*, and wheat is used to make *dabbo*. These foods are strongly related to religious feast. The third reason is the low regard given to the taste and nutritional value of triticale in the study area. A similar study conducted in the Amhara region, northern Ethiopia also reported low ratings for roasted grain made from triticale compared to those made from barley and wheat (Yazie 2014). The fourth reason is the high market value placed on barley landrace like *ochcho* and tetraploid wheat like *zo'o*, as well as barley landraces such as *ochcho* and *gisso*, which have short sowing-to-harvest periods and integration into the cultivation system.

Barley and wheat are essential ingredients in the Ethiopian Orthodox Church celebrations, which are rooted in the study area, in addition to everyday meals. The landraces of barley and tetraploid wheat will continue to be grown alongside triticale and improved varieties of barley and wheat, due to cultural preferences, environmental suitability, and their high market value.

Conclusion

The Dorze people have successfully integrated triticale into their pre-introduction food culture and have re-shaped their current dietary culture. Although the frequency of meals and the combination of ingredients might have changed, they have maintained the cultivated varieties and diverse food culture that was present before the introduction of triticale. Triticale is not an ingredient in all dishes and people gave barley, wheat, and triticale respectively a role as an essential ingredient in their daily meals as well as in festive meals. The case of the landrace barley named *ochcho* showed that people selected the landrace because of its environmental suitability and preferences. The locals have a high appreciation and preference for the taste of landraces, whose market value tends to be high. The landraces of barley have been integrated into the cultivation system because of its short cultivation period. In summary, the continued cultivation and preferences for landraces can be attributed to cultural preferences, ecological considerations due to their ability to be cultivated in cooler, higher altitude conditions with unstable rainfall, and economic reasons relating to their high market value.

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Notes

(1) Teff (*Eragrostis tef*) is a crop of Ethiopian origin and a preferred ingredient for injera, which is

a type of flatbread.

(2) Global cereal production in 2018 was in this order: maize, rice, wheat, barley, and sorghum (FAO 2020).

(3) According to Zemede (2000), hulless barley cultivation is limited to Showa, Gonder, and Tigray in central-northern Ethiopia. The cultivation of hulless barley was also observed in the Gamo region, the study area (Engels 1991, 1994).

(4) Enset (*Ensete ventricosum*) is a perennial crop in the Musaceae family, that is grown in southern Ethiopia for food purposes. People use the starch accumulated in the leaf stalk and underground corms.

(5) In some cases, they have the desired ingredient, the variety for each dish. However, it was observed that other varieties and crops are used in the preparation of dishes.

(6) According to the feast and fasting calendar set by the Ethiopian Orthodox Church, there is the Ethiopian New Year on September 11th, *Masqal* on September 27th, Dorze *masqal* on October 9th, Ethiopian Christmas on January 7th, *Timqat* on January 19th, the feast before fasting on February 11th, Easter on April 8th, the church of Giyorgis on April 29th, and the church of Maryam on May 10th.

(7) According to Fujimoto (2005), Malo people distinguish between hulless barley called *murk'a*, and hulled barley called *bangga*. They live in southwestern Ethiopia and use the same language group, North Omotic branch, as the Dorze.

(8) The word *qarunxo* means awn in the Dorze language, and is also used for the awn of barley and wheat. In addition, *zo'o* means red, and *buluso* means hairless.

(9) Zemede (2000) reported the barley which has the similar characteristics with *ochcho* landrace cultivated in study area. He classified into partially hulled barley.

(10) Samberg *et al.* (2013b) did not specify the name of barley in the article. To compare the state of barley landraces' cultivation in the different area, I need to learn which varieties of barley that they argued.

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