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*Research Article*

## Community's knowledge on "Teff" *Eragrostis tef*, (Zucc.) Trotter) farming practice and processing at central Ethiopia

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### Abstract

Documentation and its transfer system of that indigenous knowledge on the production and processing of "Teff" from communities of different "Teff" growing agroecology of Ethiopia is limited. The present study aimed to document Community's Knowledge on "Teff" *Eragrostis tef*, (Zucc.) Trotter) farming practice and processing at Central Ethiopia: Chafe Donsa, Minjar Shankora, Ada'a Barga and Ejere districts of (Amhara and Oromia Regional States). The study methods were followed purposive and random sampling, interviewing selected elder people (women and men) who have long history on knowledge of "Teff" production by means of a semi-structured questionnaire and focus group discussion. Accordingly, 64.44% of the respondents were farmers who were producing "Teff" for long period and have knowledge on it (all are males). Whereas, the rest 35.56% were users that they were used directly from their farm or by bought (all are females). Regarding farmland preparation, all farmers were agreed that the farmland of "Teff" need special care before sowing the "Teff". In addition, farmers were followed different step at "Teff" harvesting time, put sheaves of "Teff" on the farmland that locally called "Dekel" 2-3 days, piled on the farmland, which traditionally called "Zememen", piled the sheaves for 1-3 months at trashing site and after accomplished threshing of different crops they threshed "Teff" on the prepared areas and store the grain. Majority of mothers (users) 75% were reported that they preferred stored grain due to its traditional diet "Injera" was became flavor good, softy and knead with a little amount of water during baking. Concerning; the knowledge 96.6% of farmers and 56.3% of mothers were said they gained from their families (father and grandfather, mother and grandmother) respectively. All farmers and users were agreed that indigenous knowledge on "Teff" production and management system were immemorial practiced. However, the community has kept this knowledge and passed it to generation and scientific community. Therefore, the users of "Teff" at different level and scientific institutions have to be aware of keeping and giving accreditation to farmers' knowledge. Besides, they have to be done for the effective implementation of fair and equitable sharing of benefits arising from the utilization of genetic resources and associated community knowledge.

**Keywords:** "Teff", Indigenous Knowledge, Farmers, Users

**Abbreviation:** ABS (Access and Benefit Sharing), m.a.s.l., Meters above mean sea level, Indigenous Knowledge~ Community Knowledge

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## INTRODUCTION

### Background

Ethiopia is endowed with great diversity of plant, animal and microbial genetic resources due to its dramatic geological history, broad latitudinal spread and immense altitudinal range. This situation favors the country to be the center of origin and diversity for many economically important crops such as *Eragrostis tef*, *Guizotia abyssinica*, *Enset ventricosum*, *Coffea arabica*, *Catha edulis*, *Rhamnus prinoides*, *Hagenia abyssinica*, *Coleus edulis*, *Coccinia abyssinica*, *Brassica carinata*, *Triticum durum* and *Hordeum vulgare* (Vavilov, 1951). Moreover, more than 80% of the Ethiopian population earns their livelihood from crop cultivation and livestock rearing activities. The sufficient consumption of cereals is central to the well-being of virtually all Ethiopian households. Almost two-thirds of all calories consumed come from cereal grains, while more than 40 percent of the value of the average household food basket in Ethiopia is made up of cereals. The diverse cropping systems of the country provide a range of cereals, with “Teff”, Wheat, Maize, Barley, and Sorghum each being locally important in specific areas for food security. Nationally, “Teff” Wheat, and Maize in particular are at the center of the increasingly vibrant agricultural output markets of Ethiopia (Minten et al., 2012). On another hand, traditional farming systems of those cultivated crop species co-existed with local environmental factors and flow of genes among genotype has been taking place with minimum interference. This circumstance has helped in the development of new variations and of increasing diversity within the crops. In addition, the role of indigenous knowledge in creating and shaping crop diversity within the system is vital, particularly in light of changing climate (Kebu, 2011). “Teff” belongs to the grass Family, Poaceae. “Teff” is an indigenous staple food of ancient times and it is believed to be domesticated first by Pre-Semitic inhabitants in Ethiopia between 4000 and 1000 B.C. It is one of the most important cereal crops for farm income and food security in Ethiopia. It is also highly nutritious cereal crop of cultural heritage and national identity in Ethiopia (CBI, 2015; Crymes, 2015; EIAR, 2013). In addition, “Teff” is an endemic tropical cereal crop of Ethiopia and it has been cultivated for thousands of years in high lands as (Abebe, 2001) cited in (Abraham, 2015) reported. Besides, “Teff” has strong inseparable traditional and cultural ties for second African population nation of Ethiopia with more than 90 million people (Abraham, 2015). Therefore, “Teff”, is one of the crops that have been cultivated for a long period in Ethiopia, and relatively “Teff” able to provide reliable yield under unreliable agroclimatic conditions as compared to other crops due to its adaptability of various agroclimatic environments (Seyfu, 1993; Kinfemichael & Fisseha, 2009).

“Teff” is mainly grown for its grain, which is used to make “Injera” a flat, spongy and slightly sour pancake. *Injera* is the most commonly eaten food in almost all households of the country. The straw of “Teff” is used as livestock forage and used to reinforce mud or plasters in the construction of houses both in rural and urban areas (Gemedo, 2012). Furthermore, “Teff” begins life as a tiny grain about the size of a poppy seed. It is estimated that over 6 million Ethiopian farmers grow “Teff” and that the crop covers more than 20% of all land under cultivation. Similarly, as Central Statistical Agency (CSA, 2013), reported agricultural sample survey indicated that 6.3 million households are engaged in the growing of “Teff” including both male and female-headed households. It is touted as Ethiopia’s second gift to the world after Coffee. “Teff” accounts for about two-thirds of the daily protein intake in the Ethiopian diet [www.ethiopianholidays.com](http://www.ethiopianholidays.com). “Teff” production has increased sequentially by 24.5% between 2003/2004 and 2012/2013 cropping years (CSA, 2013). Whereas, “Teff” based farming system is an indigenous and sustainable agricultural system. Farmers have a wealth of indigenous knowledge on the production of “Teff”. While, documentation of that indigenous knowledge and practices on the production of “Teff” from communities of different “Teff” growing agroecology of Ethiopia is limited and communities, who have conserved “Teff” for a long period have not been benefited from the utilization of the genetic resource. Therefore, this study aims to record Community’s knowledge on “Teff” *Eragrostis tef*, farming practice and processing at Central Ethiopia, that give concrete evidence on the impact of “Teff” patent envisaged in the economic, social, moral and cultural values of Ethiopia and its agrarian community. It also documents indigenous knowledge and practices associated with “Teff” production and processing methods for equitable benefit sharing from the utilization of the resource. Finally, this documentation was added value for conservation and better-quality production of the crop.

## MATERIALS AND METHODS

### Study Area

“Teff” can grow in altitudes ranging from near sea level to 3000 m.a.s.l., but the best performance occurs between 1100 and 2950 m.a.s.l. Consequently, “Teff” is mostly concentrated in the center and the northwest of the country. East Gojjam, East Shewa, West Shewa and North Shewa are the four most important “Teff” producing zones all in Amhara and Oromia regional states (Yihenew et al, 2013). Therefore, our documentation was carried out at Chafe Donsa, Minjar Shankora, Ada’a Barga and Ejere districts of (Amhara and Oromia Regional States) on selected Kebeles (**Figure 1**).

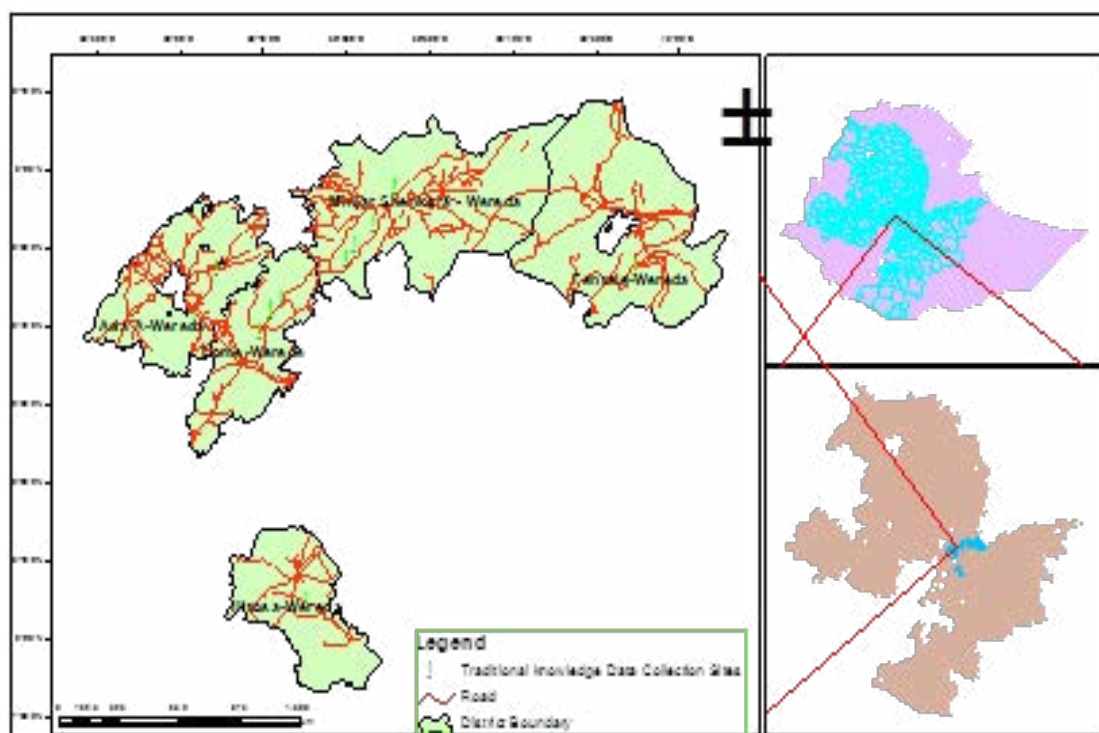


Figure 1. Map of the study areas.

## Methods of Data Collection

Documentation of indigenous knowledge associated with the production and processing methods of “Teff” were collected from Chafe Donsa, Minjar Shankora, Ada’a Barga and Ejere districts. The study was conducted by interviewing purposively selected elderly peoples of selected Kebeles of the four districts listed above. Accordingly, ten representatives (villages) were taken from each selected kebeles of “Teff” producing areas in order to document the knowledge. During the interview session from those informants, elders who have long history on indigenous knowledge and practices of “Teff” production were selected purposively and recorded their knowledge by using video camera with the help of Cameraman. This helps for the preparation of documentary film in order to transfer the knowledge for the coming generation and giving concrete evidence for the indigenous knowledge and practices of “Teff” production have been alive with Ethiopian farmers for a long period. Generally, on this study 48 respondents (31 M and 17 F) were participated from those 4 districts.

## Data analysis

Information from questionnaires was entered into computer and analyzed by using statistical software Statistical Package for Social Science (SPSS) version 23 and descriptive statistical analysis was used to summarize the data. Moreover, collected data were summarized using video recorder, arranged as documentary film by experts from communication directorate of Ethiopian Biodiversity Institute.

## RESULT

### House hold characteristics

Elders and other community members whom living for a long period in the selected districts were involved for documentation of indigenous knowledge on production and its processing for human food. Accordingly, 64.44% of the respondents were farmers who were farming “Teff” for long periods and have knowledge on it (all are males). Whereas, the rest 35.56% were users that they were used directly from their farm or by bought “Teff” from market (all are females).

### Educational level of respondents

Out of the total farmers, 31% were illiterates, who could neither read nor write. Similarly, out of the total users, 43.8% were accounted for illiterates (Table 1).

### The age distribution of the respondents

The age distribution of the farmers shows that one-fourth (27.6%) of them were found within the age 56-60 years whereas, the age of the users 25%, were accounted within the age (41-45) years (Table 2).

As respondents were listed, the variety of “Teff” preferred based on adaptability in their locality due to agroecology variation and market price. Regarding, 27.6% of the farmers were listed by local name as Manga, Kuncho, Bosat and Tikur “Teff”; 24.1% of them were reported that Kay “Teff”,

**Table 1:** Educational background of farmers and Users.

Educational background	Farmers		Users	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Illiterate	9	31.0	7	43.8
Informal education	6	20.7	4	25.0
Primary School	8	27.6	3	18.8
Secondary School	6	20.7	2	12.5
Total	29	100.0	16	100.0

**Table 2:** Age distribution of the respondents.

Age distribution (farmers)	Frequency	Percent	Age distribution (users)	Frequency	Percent
20-25	1	3.4	20-25	1	6.3
26-30	-	-			
31-35	1	3.4	26-30	2	12.5
36-40	3	10.3	36-40	2	12.5
41-45	5	17.2	41-45	4	25.0
46-50	3	10.3	46-50	2	12.5
51-55	1	3.4	51-55	1	6.3
56-60	8	27.6	56-60	3	18.8
66-70	1	3.4	61-65	1	6.3
>70	6	20.7	> 70	0	0
Total	29	100.0	Total	16	100.0

Magna, Bosat Kora, Bunign and Enat “Teff” they preferred in their locality. Likewise, Magna, Kuncho, Enat and Kay “Tef;” were accounted 17.2% equally with Kuncho, Magna, Bosat, Dagim and Kora. Whereas, the rest 13.8% of the farmers were counted Kora, Bosat, Tikur, Enat and Key “Teff”. Despite, 56.3% of the users were preferred that Magna, Kuncho, Bosat, Key and Enat “Teff” based on the “*injera*” quality. Whereas, the rest 43.7% of the users were preferred Magna, Bost, Kora, Dagim, Kuncho, Key and Enat “Teff” in their locality. Furthermore, among the listed “Teff” varieties the most preferable one was reported by farmers and users listed in (Table 3).

According to these results, 27.6% of farmers were preferred only Magna “Teff” based on its productivity and its high price in local market. Whereas, the users were preferred it for its good quality of “*injera*” in terms color and softness when they were made. In other hand, 27.6% of farmers were preferred three varieties of “Teff” such as Magna, Kuncho and Bosat in its yield, high price in the market and fast growth which take three to four months for harvesting. While, as indicated in the Table 3 the Key “Teff” variety that preferred in the second place by users due to their popularity known by the community for long periods with its quality of “*injera*” and used for different food preparation like “Kita, Ganfo etc.

### Preparation of farmland for “Teff”

Indigenous knowledge and practices of farmland preparation for “Teff” in contrast to other crops were different. Regarding this, all farmers were agreeing that the farmland

of “Teff” need special care before sowing it. Besides, all farmers were traditionally followed the following methods:

First methods, they were sowed legume plant species at the end of summer which is locally called “*Inkir*”; (Figure 2).

Farmers’ indigenous knowledge in relation to science, legume plant species have important positive effects on soil fertility and the sustainability of agricultural production and they fix atmospheric nitrogen and make it available for agricultural crops. They also improve the physical soil properties and contribute to carbon sequestration by increasing the soil carbon content (Elsiddig, 2004). In otherwise, a rhizobia bacterium, the key player in nitrogen fixing, ensures nitrogen is available to agricultural and garden crops with its symbiotic relationship with the legume. So that, legume species determines the productivity of the nitrogen fixing nodule formed on the legume root contributing to the process of nitrogen fixation (Birhanu et al., 2018). Therefore, communities have understood through their indigenous knowledge practice in their crop farming system and still using this knowledge.

Second method, all farmers were cleared the farmland from any other plant species and make it level; Third method, ploughing 3-5 times and again clear of weeds from the prepared farmland; Fourth method, all of them were Sowed the seeds of “Teff” over the soil by strew and Fifth method, all farmers were reported that they were trampled/ram down the soil by cattle in order to attach each other. The gaps between rows are also levelled and weeds are removed. As results, all farmers were concluded that why

**Table 3:** Preferable "Teff" among varieties listed by respondents.

"Teff" Varieties preferred by farmers	Frequency	Percent	"Teff" Varieties preferred by users	Frequency	Percent
Magna	8	27.6	Magna	4	25
Magna, Kuncho and Bosat	8	27.6	Key "Teff"	3	18.75
Key "Teff" /Tikur "Teff"	6	20.7	Kuncho & Key "Teff"	3	18.75
Bosat	4	13.8	Kuncho, Bosat, Magna & Kora	3	18.75
Kuncho	3	10.3	Kuncho	2	12.5
-	-	-	Bosat	1	6.25

**Figure 2.** Farmland preparation by legume plant species.

they were giving special attention for the preparation of farmlands of "Teff" cultivation, which is due to the grain is very small, grows with shallow roots, the seeds were buried under the soil, weeds have dominated and unable to germinate if the farmland is not properly managed. In addition, they were responded that if the weeds were germinated with "Teff" the germinated "Teff" will not survive. Consequently, all farmers were revealed that ram down the soil by cattle to level the farmland and attach the soil particles. Accordingly, they done these to avoid the land from locally named "fal", if not the small grain of "Teff" were dumped under unlevelled and in the hole and as a result, the sowed grain cannot able to germinate. However, in contrast to other crop species farmers were gave special attention to the farmland of "Teff" in terms of ploughing style and its management. Likely most of the farmers (69%), were ploughing 3-4 times namely "*Sintako*, *Kurxa*, *Dirdaro* and *Facasa* (A/Oromo)" in sequential order. While the rest 31% of farmers were reported that ploughed 4-5 times depending on local climatic condition, soil type and nature of farmland. Consequently, after the farmland had properly ploughed 3-4 or 4-5 all farmers were agreed to strew the seed of "Teff" over the prepared farmland. Regarding germination, 41.4% farmers were reported that after four days it being to germinate, followed by 37.9% of them were responded by considering weather condition (if it is rain day during "Teff" sowed) germination is seen after seven days, while the rest 20.7% of farmers called that germination appeared after five days.

After "Teff" germinated the next step that was done by farmers were weeding. Accordingly, a minimum of two and a maximum of three times weeding takes place (**Table 4**). However, the picking style was uprooted by knife or stick at first weeding due to similarity between grasses and "Teff" at early germination, it means it is difficult to uproot separately by hand and hands carried out second weeding time.

Regarding "Teff" harvesting time, it was employed by traditional ways. Harvesting was done manually by sickle. Concerning this, depending on the varieties and local climate conditions, 51.7% of the farmers were revealed that "Teff" was matured within the three months and harvested at 4<sup>th</sup> month after it had sowed, whereas 48.3% of them were reported that it was harvested at 5<sup>th</sup> month.

After accomplished harvesting all (100%), farmers were agreed that followed the following six steps carefully:

**Step1:** They were harvested, put sheaves of "Teff" on the farmland that locally called "*Dekel*" 2-3 days in order to dry and prevent decay (**Figure 3**).

**Step 2:** after "*Dekel*" dried, it was piled on the farmland, which traditionally called "*Zememen* or *Jamami*" it has stayed there for 15-20 days until the threshing area ready (**Figure 4**).

**Step 3:** At the end of the 20<sup>th</sup> day, they were transported "*zememen*" to thrashing areas on animals back or another means of local transportation (**Figure 5**).

**Table 4:** Weeding time after “Teff” germinated.

Weeding time	Frequency	Percent
after “Teff” germinated at 15-20 days	8	27.6
after “Teff” germinated at first month	1	3.4
after “Teff” germinated at 15-20 days for 1st time and after 1 month the 2nd	14	48.3
after germinated 2-3 times which at 15th day, 1 month and 2 months	2	6.9
we used herbicides once rather than hand weeding	4	13.8
<b>Total</b>	<b>29</b>	<b>100.0</b>



**Figure 3.** Harvested sheaves of “Teff” put on the farmland (“Dekef”).



**Figure 4.** “Dekef” Pilled on farmland in order to well dried until transported (“zememen”).



**Figure 5.** The dried “Teff” sheaves transported on animal back to threshing site.

**Step 4:** Farmers were piled the sheaves that had transported on animals back for 1-3 months at trashing site locally named as “Amharic *Awudima*”, Afan Oromo *Oogdi*” (Figure 6).

**Step 5:** All of them were prepared “*Awudima*” (the threshing floor) for threshing “Teff” by different locally available materials (animal dung mixed with water made plastered). The plastered “*Awudima*” with dung contributed to reduce the loss of the tiny grain or seed of “Teff”. Regarding, threshing time they were threshed early in the morning by cattle or human labour for the sake of separate grain from bran. While, threshing at the sunny time, the grain is not easily separated from the straw because the straw broken with the grain.

**Step 6:** All of them were reported that after accomplished threshing of different crops they threshed “Teff” on the prepared areas “*Awudima*” (Figure 7).

Subsequently, the straw/bran is then removed and the grain is collected for further winnowing. Then the hull of “Teff” is tiny, cleaning and separating hulls from the

grain needs meticulousness. The process involves further winnowing by hand or by using locally called “*lamida*” a wooden spoon like equipment and winnowing brush so that the tiny residues can be separated by wind. After they had separated the grain from bran by sifting, all farmers were reported that the grain would be stored in different locally made storage. Besides, 96.6% of farmers were agreed on stored “Teff” grain was different from early threshed after harvesting one. While, the minor 3.4% of them were told, it does not matter. Regarding value in price, the local community or consumers obviously prefer and accordingly pay higher price for “Teff” grain stored for long period locally called “*karmo*”. The majority (89.7%) of respondents were reported “*chid*” (bran) is used as a plastering mixture with the clay paste (for construction), animal feed and income generation.

The mothers from the study areas were mentioned the qualities of such grain for making “*Injera*” (Traditional diet of Ethiopia) depend on variety of “Teff” and its management. Consequently, “Teff” grain most commonly is consumed after being stored for several months and only a rare case



**Figure 6.** Pilled “Teff” at threshing site for up to a month.



**Figure 7.** Threshing “Teff” traditionally by animal on threshing site “*Awudima*”.

that it would be used immediately after harvested. All mothers were agreed that the “Teff” grain stored for several months was different in quality from early threshed after harvested. Subsequently, majority of mothers (users) 75% were stated the reason to prefer the “Teff” grain stored for several months due to its traditional diet “*Injera*” was became flavor good and softy and knead with a little amount of water during baking. Whereas, the rest 25% of mothers were reported they preferred due to its good flavor and softy “*Injera*”. Concerning, the source of knowledge 96.6% of farmers and 56.3% of mothers were said they gained from their families (father and grandfather, mother and grandmother) respectively. The rest 3.4% of farmers and 43.7% of mothers were gathered from their parents and local community. In other word, for the question, how long have been practiced this knowledge, all of the farmers and mothers were responded it is immemorial.

This indigenous knowledge is passed from generation to generation and still alive. Nevertheless, Dutch (The Netherlands) company, Soil and Crop (S & C) has patented this knowledge on the production and processing of “Teff” in the European Union. In its application, the company claimed high falling number (better flour quality) from grain stored for longer time than recently harvested grain as new finding. The traditional “Teff” consumers obviously prefer and accordingly pay higher price for “Teff” grain stored for long period. Firstly, the transfer was based on an earlier Memorandum of Understanding (MoU), which was signed between EARO (now called Ethiopian Institute of Agricultural Research – EIAR), S&C, which owned HPFI, and Larenstein University (Ashenafi Endale, 2012). Based on this, the University bought 12 varieties of “Teff” genetic resources, each in 120Kg packages, from the Debre Zeit Agricultural Research Centre (DARC), part of the Ethiopian Agricultural Research Centre (EARO).

Secondly, in order to avoid confusion between new researches that can be planned by the company and the traditional knowledge, as per the agreement it entered with the Ethiopian government, the company should submit research proposal to the Ethiopian Institute of Biodiversity Conservation (IBC) now called Ethiopian Biodiversity Institute (EBI) and gets approval. Then, the agreement made between the Institute of Biodiversity Conservation (IBC) and Dutch Company called Health and Performance Food International (HPFI B.V) access to “Teff” *Eragrostis tef*, (Zucc.) Trotter genetic material. The “Teff” rip-off followed a seemingly innocent research proposal from the Larenstein University, in the Netherlands, in collaboration with the Dutch Soil and Crop Company, S&C., but not implemented as the agreement (Ashenafi, 2012; Abenet, 2010). Later, the patent obtained illegally by the Dutch company Health Performance Food International

(HPFI B.V) from the European Patent Organization was sold to Vennootschap Onder Firma (V.O.F), gives the company a monopoly control over the new and favorable market potential created for “Teff” in the European countries. This leads to a hindrance to the “Teff” market share of Ethiopia in Europe, which prevents Ethiopia from gaining benefits from the opportunity created for “Teff” market as super grain. Meanwhile, the Company, currently using the “Teff” patent, keeps on utilizing “Teff” genetic resource and its associated indigenous knowledge without the consent of country of origin. This act is in violation of relevant international agreements (i.e., Convention on Biological Diversity, the International Treaty on Plant Genetic Resource for Food and Agriculture and Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits arising from their utilization to the Convention on Biological Diversity). Consequently, Ethiopian farmers’ does not gain access to benefit from the utilization of the genetic resource and their indigenous knowledge associated with genetic resource. As a result, the patent obtained by the company discourages the Ethiopian farmers to cultivate “Teff” genetic resources. Similarly, the patent on “Teff” has been adversely affecting the sovereign rights of the country over its own genetic resources and associated traditional knowledge.

## CONCLUSION AND RECOMMENDATION

### Conclusion

“Teff” *Eragrostis tef*, (Zucc.) Trotter is an annual grass crop and important cereal harvested for grain in Ethiopia. The grain is a daily staple food for a majority of the country’s population. In Ethiopia, “Teff” is principally cultivated to harvest the economic part of the grain for own consumption. The grains are used to bake “*injera*” after milled, a type of Ethiopian bread which are the most beloved national dish. Farmers were cultivated a variety of “Teff” from those Magna, Kuncho, Bosat, Degim, Enat, Qey tef, Tikur tef, Kora and Bunign were listed.

“Teff” is believed to have originated in Ethiopia between 4000 and 1000 BC. It is domesticated primarily as a cereal crop in Ethiopia. Regarding to, cultivation “Teff” need special attention in contrast to other crops. Indigenous knowledge practiced by farmers were shown the preparation of farmland, weeding time and style, harvesting time and style, why pilled after harvested, preparation of “*Awudima*” for threshing and the purpose of grain stored. Ethiopian farmers were inherited this indigenous knowledge from their families (father and grandfather) and local communities. In Ethiopia, farmers’ indigenous knowledge on “Teff” production and management system were immemorial practiced.



Ethiopian mothers and consumers obviously prefer and accordingly pay higher price for “Teff” grain stored for long period. They were mentioned that the qualities of such grain for making “Injera”. In conclusion, “Teff” grain most commonly is consumed after being stored for several months and only a rare case or in critical food problem that it would be used immediately after harvest. This indigenous knowledge has already been inherited from their families for several generations.

Respondents and many generations of farmers before them, have always harvested, put sheaves of “Teff” on the farmland “Deke”, pilled “Zememen” and finally pilled “Teff” at threshing site. Finally, the patent protection, directly or indirectly, affects the country’s agricultural development in general and food security in particular and discourages the Ethiopian farmers to cultivate as well as to conserve “Teff” genetic resources.

### Recommendation

The Ethiopian farmers have tried to pass their indigenous knowledge and practices through family line without any charge of money. The communities subjected to indigenous knowledge for the production and management system of “Teff” cultivation. The local people are highly dependent on traditional farming system. However, the community has kept their knowledge and passed it to generation and scientific community. Therefore, the respected government bodies (institutions) at different level and scientific institutions have to be aware of in keeping and giving accreditation to farmers’ knowledge. Besides, they have to be done for the effective implementation of fair and equitable sharing of benefits arising from the utilization of genetic resources and associated community knowledge.

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## AVAILABILITY OF DATA AND MATERIALS

The datasets associated with this article can be accessed from the corresponding author on reasonable request.

## COMPETING INTERESTS

We, the authors, declare that we have no conflict of interest on the research, authorship, and publication of this article.

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