**Farmers' Finger Millet Seed Management Practices in Dera, Sekota, and Mecha, Amhara Region, Ethiopia**

Getasew Msganaw1\* and Wossen Tarekegne2

1\*Sekota Dry Land Agricultural Research Center, P.O. Box 62, Sekota, Ethiopia

2Bahir Dar University, College of Agriculture and Environmental Sciences, Bahir Dar, Ethiopia

\***Corresponding author**; getasewdtu21@gmail.com

**ABSTRACT:** Farmers in the Amhara Region of Ethiopia rely heavily on finger millet due to its nutritional value and adaptability as a staple crop. This study critically evaluates seed management practices among finger millet farmers in the region, focusing on seed sourcing, selection, sorting, and storage methods across three districts: Dera, Mecha, and Sekota. 264 farmers were surveyed using semi-structured questionnaires complemented by key informant interviews and focus group discussions. Results highlight a significant reliance on informal seed sourcing, with only a small percentage purchasing seeds annually. Gender disparities in seed management practices were evident, with male farmers predominating in seed sorting and selection activities. The findings revealed challenges, including low seed quality, limited access to improved seed varieties, and ineffective storage practices leading to seed degradation. Farmers indicated the need for seed quality, management education, and access to better seed systems. Recommendations include implementing formal seed certification programs and enhancing farmers' knowledge of quality seed selection and post-harvest handling to improve finger millet production and ensure regional food security.

**Keywords:** finger millet, seed storage, seed management, seed quality, seed vigor,

# **1. INTRODUCTION**

Finger millet (Eleusine coracana) is a vital cereal crop for food security and livelihood in Ethiopia, especially in the Amhara Region, which is one of the major producers of this crop. Known for its resilience to drought and its nutritional value, finger millet serves as a staple food for rural communities and plays a significant role in the local economy. As a crop that is integral to subsistence farming, effective seed management practices are essential for ensuring sustainable production and improving yields. In Ethiopia, farmers predominantly rely on both formal and informal seed systems for their planting material. The formal seed system includes certified seeds produced by government or private agencies, which are intended to meet quality standards for better yield potential. However, the informal seed system, where farmers save seeds from previous harvests or exchange them within the community, remains the primary source of planting material for most farmers in the Amhara Region. Studies indicate that while farmers may access formal seed sources occasionally, challenges such as high costs, limited availability, and inadequate extension services often drive them to depend on informal sources (Desta, *et al*., 2021). Recent findings have highlighted the significance of seed quality in determining the productivity of finger millet in the region. Seeds obtained from informal sources are often of lower physical purity, poorer physiological quality, and reduced seed vigor compared to those from formal sources (Tesfaye *et al*., 2022). This difference in seed quality can result in reduced germination rates and lower crop yields, undermining the potential for food security and income generation. Furthermore, poor seed storage, inadequate processing methods, and a lack of awareness of seed selection criteria are some of the key factors contributing to the suboptimal quality of finger millet seeds in the Amhara Region (Mekonen S., & Tsegaye M, 2020). In light of these challenges, this study was initiated to assess the farmers' finger millet seed management practices in Amhara Region, Ethiopia

## **2. MATERIAL AND METHODS**

## 2.1. Description of the Study Areas

The study on the finger millet seed system was conducted in three districts of the Amhara Region; Dera, Mecha, and Sekota during the 2023/24 cropping season. These districts are major contributors to finger millet production in the region. Dera, located in the South Gondar Administrative Zone, lies approximately 35 km west of Bahir Dar. It is bordered by Lake Tana to the west, Fogera to the north, and the Abbay River to the south, which separates it from the West Gojjam Zone. The district experiences a bimodal rainfall pattern, with a shorter rainy season from March to April (*belg*) and a heavier rainy season from June to September (*kiremt*). The main crops grown in Dera include maize, teff, and wheat. Mecha, situated in the West Gojjam Zone, is 35 km from Bahir Dar and features a mix of highland and semi-highland areas. The district includes 32 rural kebeles and 6 urban towns, with Merawi as the district capital. Mecha receives substantial rainfall between June and September and is home to the Koga Dam, which provides irrigation to 7,000 hectares of land. The population of North Mecha exceeds 331,000, with the majority living in rural areas. Sekota, located in Waghimera Zone, is about 120 km from Lalibela and 500 km from Bahir Dar. The district experiences unimodal rainfall, with heavy rains between June and September. Sekota spans 53,532 hectares, with nearly half of the land under cultivation. Agriculture is the primary livelihood, with sorghum and tef being the predominant crops. The district has a population of approximately 157,745, and more than 98% of the population is involved in farming activities.

Table 1: Geographical description and weather data of study districts

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Location | Elevation (masl) | Latitude | Longitude | ARF (mm) | AT (°C ) |
| Mecha | 1960 | 11° 25'20″N | 37°10'20″E | 1200-1800 | 17.5-20 |
| Dera | 1560-2600 | 11°23'15″ -11°53'30″N | 37°25'45″-37°54'10″E | 1000–1500 | 13-30 |
| Sekota | 2200 | 12 o 26' 01″N | 38 o 41'44.71″E | 400-900 | 15-28 |

Note: ARF= Annual rainfall; AT= Annual temperature.

2.2. Sampling Procedures, Sample Size and Participants

The study was done based on the data obtained through multi-stage sampling techniques. Three-stage sampling techniques were used to select sites and to draw sample farmers. The administrative levels were selected from higher to lower purposively. First, three districts were selected from Waghimera, south Gondar, and west Gojam zones through purposive sampling technique, this is due to their high potential for finger millet production. Second, six peasant associations were selected based on their potential for finger millet production purposively. Hamusit and Wal peasant association were selected from the Sekota district, Wenchit and Geregera peasant association from the Dera district, and Enamert and Enguti from the Mecha district were selected for individual household surveys. Third, a total number of finger millet-growing farmers was selected with random sampling techniques. The sample size in each peasant association was determined according to the proportion of farmers’ population in each peasant association. The sample size was, therefore, determined according to the formula provided by Yamane (1967) to determine the sample size of the study, using 0.05 sample error and 95% level of confidence.

N =

Where: n is the sample size, N=Number of total house hold in the peasant association, and e is the level of precision considered. The minimum level of precision is acceptable at 10%. However, for this study, a 5% precision level was used.

In addition, six focus group discussions and individual interviews were conducted using 18 key informants who had in-depth knowledge about the areas, the farms, crops, and local conditions and problems in the peasant association. Selection of this group was done in consultation with development agents and a peasant association leader who resided in the area and had knowledge of the farmers around. Key informants included males and females, as well as young and old farmers who planted many crop varieties. Additional information was also collected from relevant governmental organizations to back up information captured through individual interviews and group discussions. A total of 264 households were surveyed across the three districts: 110 households in Dera, 63 in Mecha, and 91 in Sekota. This distribution of samples reflects the focus on key finger millet-producing areas within the Amhara Region.

## 2.3. Data Types and Sources

Primarily, the data for this study were collected from primary sources using multiple data-gathering instruments such as semi-structured household-level surveys/questionnaires. The six focus group discussions and individual interviews were conducted using key informants who had in-depth knowledge about the areas, the farms, crops, local conditions, and problems in the peasant association. Additional information was collected from relevant governmental organizations to back up information captured through individual interviews and group discussions. Enumerators who speak the local language were recruited and trained. The questionnaire was pre-tested on a few selected samples and then based on the result it was refined. Secondary data was also collected from published and unpublished sources.

## 2.4. Data Collection Method

primary data was collected through focus group discussion and individual interviews on household characteristics (household type, distribution of household by educational status, age, and family size), household resource base characteristics, farmers’ adoption and seed source, farmers’ agronomic practices and perceptions, contractual seed production practices, partners’ involvement, and coordination.

## 2.5. Methods of Data Analysis

Statistical analyses for social data were performed in the SPSS (Version 22) computer package (IBM, 2012); relationships were explored through frequencies and descriptive statistics. Statistical Package of Social Science (SPSS) version 22 was used to code, tabulate, and analyze the data gathered from the field survey. To summarize the socioeconomic traits of the respondents, simple descriptive statistics were utilized to differentiate the mean, percentage, and standard deviation.

# 3. RESULTS AND DISCUSSION

## 3.1. Socioeconomic and Demographic Attributes Sampled Households

The data in Table 2 reveals a clear gender disparity in household headship across the three districts. Accordingly, the household distribution in the district obtained male-headed 94.5%, 100%, and 84.5%, as well as female-headed 5.5%, 0%, and 15.5% were found in order of Sekota, Mecha, and Dera.Hence,the overall gender distribution was91.7% and 8.3% male and female-headed households, respectively. This data suggests that women in these districts, particularly in Sekota and Mecha, may face significant challenges in decision-making and economic empowerment within their households. The high proportion of male-headed households could potentially limit women's access to resources and opportunities. The average age of 47 years suggests that the majority of respondents are within their prime working age. This aligns with the general understanding that individuals between 25 and 64 years are typically considered the economically active population. The average number of family members over 15 years of age differs across the three districts. Sekota, Mecha, and Dera districts indicate data of females: 1.55, 1.97, and 1.25 as well as data of males represented 1.89, 1.83, and 1.78, respectively. This variation in family size has significant implications for agricultural labor and productivity. As noted by (Wossen *et al*., 2021), older family members are crucial for crop production, while younger members often contribute to livestock herding. Larger family sizes can provide a more substantial labor force, which can be beneficial for labor-intensive agricultural practices, as highlighted by (Menale Kassie *et al*., 2015).

However, it's important to consider that larger family sizes may not always translate to increased productivity. Factors such as land availability, access to technology, and education levels can also influence agricultural outcomes. The provided data highlights the importance of education in shaping farmers' decision-making and agricultural practices in the study areas of Sekota, Mecha, and Dera. The findings of literacy rates were: Dera (56.4%), Sekota (42.7%), Mecha (100%), and overall showed (62.1%). Additionally concerning this formal education has seen Dera: 15.9%, Sekota: 3.3%, and Mecha: 27% numerical points. Literacy and formal education enable farmers to access and understand agricultural information, such as weather forecasts, market prices, and best practices. As noted by (Benyam Tadesse *et al*., 2021) and (Mekonnen Duressa, 2022), education is positively correlated with the adoption of technology, which can significantly enhance agricultural outcomes.

**Table 2:** Demographic characteristics of the sample households (n=264)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variables |  | Dera district | | Sekota district | | Mecha district | |
| Mean | Std. | Mean | Std. | Mean | Std. |
| Family members | Males > 15 years old | 1.89 | 1.31 | 1.78 | 1.55 | 1.83 | 0.70 |
| Female > 15 years old | 1.55 | 0.96 | 1.25 | 1.17 | 1.97 | 0.53 |
| Male <15 years old | 0.82 | 0.84 | 0.85 | 0.96 | 0.68 | 0.69 |
| Female <15 years old | 1.05 | 1.05 | 1.07 | 1.11 | 0.68 | 0.56 |
| Total | 5.33 | 1.74 | 4.96 | 1.47 | 5.19 | 1.06 |
| Age of HH | Male | 44.26 | 11.22 | 46.26 | 9.61 | 51.97 | 9.23 |
| Female | 45.53 | 7.71 | 43.4 | 8.9 | 0.0 | 0.0 |
| The education level of the HH |  | Freq. | % | Freq. | % | Freq. | % |
| Illiterate | 48 | 43.6 | 52 | 57.3 | 0 | 0.0 |
| Read and Write | 36 | 32.7 | 28 | 30.8 | 41 | 65.1 |
| Adult education | 9 | 8.2 | 8 | 8.8 | 2 | 3.2 |
| Completed Primary | 0 | 0.0 | 0 | 0.0 | 2 | 3.2 |
| Non completed primary | 16 | 14.5 | 3 | 3.3 | 15 | 23.8 |
| completed secondary | 1 | 0.9 | 0 | 0.0 | 0 | 0.0 |
| Non completed secondary | 0 | 0.0 | 0 | 0.0 | 3 | 4.8 |
| Total | 110 | 100 | 91 | 100 | 63 | 100 |

## 3.2. Household Economic Base of Respondents

### **3.2.1. Area allocated and livestock ownership**

Farmers, on average, cultivate 1.52 hectares of land for finger millet during 2022/2023 cropping season. A significant portion (74%) of this land is owned by the farmers themselves, while the remaining is acquired through hiring and sharecropping arrangements. The average farmer has 26 years of experience in cultivating finger millet, indicating a high level of expertise and knowledge. At the same time, the average livestock ownership, measured in Tropical Livestock Units (TLU), is 3.96. This suggests that livestock plays a significant role in the farming system, providing manure for fertilizer, draft power, and additional income. For the Dera, Sekota, and Mecha districts, the farmers' livestock were in TLU 3.14, 2.34, and 6.4, respectively (Table 3). The findings showed that Mecha district farmers had, on average, more livestock in TLU than those in Sekota and Dera districts. Mecha district has the highest livestock holdings, with a larger deviation suggesting more variation in livestock ownership compared to the other districts. To mitigate issues about the uniqueness of finger millet farming, experience plays a crucial role in seed production. According to (Kifle, 2023), greater agricultural experience is associated with higher levels of farming knowledge and proficiency. The average farming experience is relatively high, particularly in the Mecha district (30.25 years), with a smaller deviation compared to the other districts. Mecha district has on average the largest area of land (1.76 hectares) cultivated by farmers on their farms. However, Farmers in the Sekota district tend to hire more land (0.22ha) compared to those in Dera or Mecha. The average production in the Dera district during the 2022/23 cropping season was 1.16 tons per hectare, with farmers using a 48.29 kg per hectare finger millet seed rate next to maize. The relatively low yield in **Dera district** can be attributed to a combination of environmental, agronomic, and management factors. A high seed rate of **48.29 kg per hectare** might increase competition among plants for nutrients and resources, and when combined with issues like poor soil fertility, water stress, pest infestations, and inadequate management practices, it could result in lower-than-expected yields. The combination of factors, rather than the seed rate alone, likely contributed to the suboptimal production of **finger millet** in Dera during the 2022/23 cropping season. The decision to use a **48.29 kg per hectare seed rate** for **finger millet** in **Dera district**, which is higher than the recommended amount, likely stems from a mix of risk mitigation, historical practices, local environmental conditions, and possible gaps in knowledge. While the higher seed rate may seem like a way to improve crop establishment, it can lead to challenges like overcrowding, resource competition, and poor crop growth. However, farmers may view it as a necessary strategy to overcome specific local challenges such as poor soil fertility, water stress, pest problems, or seed quality issues, even if it doesn't necessarily align with the optimal seed rate recommendations.

Sekota district farmers allocated less land for finger millet than those in the Dera and Mecha districts farmers. The average amount of land allotted for finger millet from the 2022/23 cropping season was 0.43 hectares. The result showed that land allocated for finger millet was Highest in the **Dera district** (0.67 ha), followed by Mecha and Sekota districts. As per the survey results in Table 5, the farmers in Sekota district planted 18.49 kg of seed per hectare on average from 2022/23, and the average yield of finger millet per hectare was 0.68 tons. Farmers in the Sekota district use such a low seed rate despite achieving relatively good yields. Farmers in Sekota may have extensive local knowledge about the ideal seed rate for their specific area. Over time, they may have experimented and observed that **18.49 kg/ha** is the optimal amount of seed for achieving good yields under local conditions. Traditional agricultural knowledge often adapts to the specific challenges faced by farmers in each district. The yield difference between **districts** can largely be attributed to **differences in farming practices** and **environmental conditions.** In Mecha district, the farmers used a finger millet seed rate of 40.32 kilograms per hectare for planting in 2022/2023 and gained an average yield of 0.6 tons per hectare. Compared with that in the Sekota district, the finger millet seed rate was greater in the Mecha and Dera districts, where growers grow. The results of the descriptive statistics indicate that this causes seed waste and lowers yield. According to the result, the average yield per hectare in the study district is quite low mainly due to lack of improved varieties and agronomic packages.

Table 3: Area coverage, Yield, and Farming experience of respondents

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Dera district | | Sekota district | | Mecha district | |
| Farmers resource base | Mean | Std. dev. | Mean | Std. dev. | Mean | Std. |
| Farming experience | 25.52 | 11.18 | 23.63 | 7.98 | 30.25 | 9.88 |
| Livestock in TLU | 3.14 | 0.8 | 2.37 | 0.74 | 6.4 | 1.99 |
| Seed rate (kg/ha) | 48.29 | 15.3 | 18.49 | 4.79 | 40.32 | 8.12 |
| land cultivated in 2022/23 in hectares | |  |  |  |  |  |
| own farm | 1.15 | 0.83 | 0.64 | 0.22 | 1.76 | 0.59 |
| hired farm | 0.06 | 0.15 | 0.22 | 0.23 | 0.19 | 0.23 |
| Share farm | 0.27 | 0.28 | 0.42 | 0.26 | 0.0 | 0.0 |
| Total farm cultivated (ha) | 1.48 | 0.8 | 1.26 | 0.17 | 1.96 | 0.46 |
| Amount of land allocated in 2022/23(ha) | |  |  |  |  |  |
| Finger millet | 0.672 | 0.31 | 0.43 | 0.15 | 0.48 | 0.12 |
| Rice | 0.077 | 0.23 | 0.0 | 0.0 | 0.0 | 0.0 |
| Maize | 0.473 | 0.3 | 0.0 | 0.0 | 0.89 | 0.21 |
| Teff | 0.289 | 0.19 | 0.249 | 0.19 | 0.21 | 0.2 |
| Sorghum | 0.0 | 0.0 | 0.306 | 0.17 | 0.0 | 0.0 |
| Barley | 0.006 | 0.04 | 0.008 | 0.03 | 0.09 | 0.14 |
| Faba bean | 0.0 | 0.0 | 0.019 | 0.05 | 0.0 | 0.0 |
| Field pea | 0.0 | 0.0 | 0.017 | 0.05 | 0.0 | 0.0 |
| Wheat | 0.003 | 0.02 | 0.184 | 0.19 | 1.03 | 4.37 |
| Yield (tons)/ha in 2022/23 |  |  |  |  |  |  |
| Rice | 0.32 | 0.911 | 0.0 | 0.0 | 0.0 | 0.0 |
| Finger millet | 1.169 | 0.458 | 0.689 | 0.09 | 0.603 | 0.226 |
| Maize | 1.699 | 0.887 | 0.0 | 0.0 | 1.955 | 0.57 |
| Teff | 0.363 | 0.351 | 0.502 | 0.329 | 0.192 | 0.166 |
| Sorghum | 0.0 | 0.0 | 0.78 | 0.163 | 0.0 | 0.0 |
| Barley | 0.014 | 0.092 | 0.052 | 0.201 | 0.188 | 0.324 |
| Faba bean | 0.0 | 0.0 | 0.131 | 0.34 | 0.0 | 0.0 |
| Field pea | 0.0 | 0.0 | 0.072 | 0.184 | 0.0 | 0.0 |
| Wheat | 0.019 | 0.191 | 0.594 | 0.455 | 0.593 | 0.579 |

Note: Share farming is where two parties (the landowner and share farmer) carry on separate farming businesses on the same area of land without forming a partnership or company. Both parties share the benefits/risks of farming

### **3.3. Finger Millet Farmers' Preferences and Seed Marketing**

Table 4 shows the **mean sales (tons)** and **crop preference ranking** as a percentage of farmers' sown crops for three districts: Dera, Sekota, and Mecha. Respondents in Dera district sold 0.29 tons of finger millet seeds on average to the local market. But in Sekota district, farmers get money from the neighborhood market by selling an average of 0.018 (Std. =0.029) tons of finger millet seeds, and in Mecha district, too, the farmers sold 0.22 (Std. =0.15) tons of finger millet seeds to the local market on average. According to the respondents' preferences, in Mecha district finger millet was ranked first (36.5%), second (46.0%), and third (17.5%). **Mecha district** shows a preference for **Maize** (especially in terms of sales), but **Finger Millet** remains an important crop. **Wheat** and **Barley** also play a role. However, in Dera district, the farmers ranked finger millet as their preferred crop (70%), second (21.8%), third (7.3%), and fourth (0.9%) to determine its relative value. **Dera district** has a clear preference for **Finger Millet**, which is both the most grown and most sold crop. **Maize** and **tef** are also important, but not as dominant as Finger Millet. In the Sekota district Finger millet was ranked first by 63.7% of the farmers and second by 20.9% of the farmers, according to the statistics. **Sekota district** favors **Finger Millet** as the most important crop, but the overall crop preference ranking is more spread out. **Tef** and **Wheat** are significant as well. The number of ranks across the district is varied due to the crop diversity difference cultivated in the area by the respondents. The sales data indicates that in Dera and Mecha, Maize and Finger Millet are the primary crops, with a significant role in both food consumption and the local economy. In Sekota, Finger Millet dominates both in terms of ranking and importance’s, but other crops like tef and wheat also have their share of the market. In summary, the crop preferences and sales vary across districts, with Finger Millet being the most significant crop in Dera and Sekota, while Maize takes a leading role in Mecha.

Table 4: Amount of sales (tons) and crop preference (rank) as a percentage of farmers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Crop type | | Dera district | | | | | | Sekota district | | | | | | | Mecha district | | | | |
| Mean | | | | Std. | | Mean | | | | Std. | | | Mean | | Std. | | |
| Rice | | 1.568 | | | | 0.426 | | 0.00 | | | | 0.00 | | | 0.00 | | 0.00 | | |
| Maize | | 6.597 | | | | 0.511 | | 0.00 | | | | 0.00 | | | 11.82 | | 0.247 | | |
| Finger millet | | 2.968 | | | | 0.267 | | 0.180 | | | | 0.029 | | | 2.28 | | 0.153 | | |
| Teff | | 1.098 | | | | 0.130 | | 0.030 | | | | 0.010 | | | 0.87 | | 0.099 | | |
| Wheat | | 0.009 | | | | 0.009 | | 0.070 | | | | 0.017 | | | 3.41 | | 0.275 | | |
| Sorghum | | 0.00 | | | | 0.00 | | 0.070 | | | | 0.017 | | | 0.00 | | 0.00 | | |
| Faba bean | | 0.00 | | | | 0.00 | | 0.020 | | | | 0.010 | | | 0.00 | | 0.00 | | |
| Barley | | 0.00 | | | | 0.00 | | 0.080 | | | | 0.004 | | | 0.96 | | 0.161 | | |
| Field pea | | 0.00 | | | | 0.00 | | 0.010 | | | | 0.008 | | | 0.00 | | 0.00 | | |
| Crops | Dera district | | | | | | Sekota district | | | | | | | | Mecha District | | | | | |
| 1st | | 2nd | 3rd | 4th | | 1st | | 2nd | 3rd | 4th | | 5th | 6th | 1st | 2nd | | 3rd | 4th | |
| F. Millet | 70.0 | | 21.8 | 7.3 | 0.9 | | 63.7 | | 20.9 | 15.4 | 0.0 | | 0.0 | 0.0 | 36.5 | 46 | | 17.5 | 0.0 | |
| Rice | 7.3 | | 5.5 | 1.8 | 0.9 | | 0.0 | | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Maize | 6.4 | | 67.3 | 20.0 | 6.4 | | 0.0 | | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 47.6 | 33.3 | | 19.0 | 0.0 | |
| Teff | 16.4 | | 6.4 | 60.9 | 5.5 | | 11.0 | | 37.4 | 23.1 | 3.3 | | 0.0 | 0.0 | 39.7 | 15.9 | | 36.5 | 7.9 | |
| Sorghum | 0.0 | | 0.0 | 0.0 | 0.0 | | 25.3 | | 29.7 | 45.1 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Barley | 0.0 | | 0.0 | 0.0 | 0.9 | | 0.0 | | 0.0 | 0.0 | 6.6 | | 0.0 | 3.3 | 0.0 | 68.3 | | 3.2 | 28.6 | |
| F. Bean | 0.0 | | 0.0 | 0.0 | 0.0 | | 0.0 | | 4.4 | 3.3 | 0.0 | | 9.9 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| F. Pea | 0.0 | | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 7.7 | | 3.3 | 6.6 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Wheat | 0.0 | | 0.0 | 0.0 | 1.8 | | 0.0 | | 12.1 | 9.9 | 27.5 | | 6.6 | 0.0 | 31.7 | 20.6 | | 23.8 | 23.8 | |

(Source: survey data, 2023/24), the number of ranks varied across the district due to the different respondents growing different numbers of crops and ranking them differently variety.

**3.4. Farmers' Timing and Reasons for Purchasing Finger Millet Seeds**

The data in **Table 5** sheds light on farmers' purchasing habits and reasons for purchasing finger millet seeds in the Dera, Sekota, and Mecha districts. In **Dera district** a significant proportion of farmers (60.9%) do not purchase finger millet seeds, indicating that they may rely on their seed for planting. In Sekotadistrict the percentage of farmers purchasing seeds (50.5%) is higher than in Dera but still substantial, with 49.5% not purchasing finger millet seeds. In Mechadistrict, all farmers (100%) in Mecha purchase finger millet seeds, reflecting perhaps a lack of locally saved seeds or an emphasis on buying seeds for better quality or variety. In **Dera district,** most farmers in Dera (24.5%) purchase finger millet seeds rarely (every 3 or more years), with fewer purchasing seeds annually (8.2%). This suggests that farmers in Dera may rely more on saved seeds or longer intervals between seed purchases. In the **Sekota district, a** majority of farmers (60.4%) purchase finger millet seeds every year, which indicates that farmers in Sekota may face challenges in saving seeds, or there is a regular need to replace seeds to ensure quality. A smaller percentage (31.9%) purchase seeds every other year, while 7.7% purchase seeds rarely. **Mecha District**, Similar to Sekota, a large portion of farmers in Mecha (38.1%) purchase seeds every year, with another 36.5% purchasing seeds every other year. The remaining 25.4% purchase seeds rarely, though the overall trend suggests a consistent need to buy seeds.

In Dera district, the most common reason for purchasing seeds in Dera is **"Replace old seed"** (23.6%), which suggests that farmers are replacing older, potentially less productive seeds to maintain crop yields. A smaller percentage (3.6%) purchase seeds to **"Replace old varieties"**, which may indicate a desire to adopt new cultivars. Only a few farmers (12.7%) buy seeds for **"Better seed quality"**, and only 0.9% buy seeds because they have **"No own seed"**. In Sekota district, the predominant reason for purchasing seeds is to "Replace old varieties" (37.4%), suggesting that farmers may be looking for improved or more suitable varieties for their conditions. A smaller number (15.4%) purchase seeds to "Replace old seed" and none of the farmers in Sekota mentioned "Better seed quality" as a reason for purchasing finger millet seeds. A few (4.4%) purchase seeds because they "Have no own seed", which indicates that some farmers may be lacking their own saved seeds. In Mecha district the majority of farmers in Mecha (60.3%) purchase seeds to "Replace old varieties", highlighting a strong desire for improved cultivars or newer varieties. A significant number of farmers (25.4%) buy seeds to "Replace old seed". Only a few (14.3%) buy seeds due to "Better seed quality". Interestingly, all farmers in Mecha (100%) purchase seeds because they have "No own seed", suggesting that there is no significant practice of saving finger millet seeds in this district, making it necessary to purchase fresh seeds annually.

Farmers in Mecha district are entirely dependent on purchasing seeds, while in Dera and Sekota, seed saving or local production is more common, though a significant number still buy seeds to replace old or poor-quality seeds. Mecha and Sekota farmers tend to purchase seeds regularly (annually or every other year), while Dera farmers purchase less frequently, indicating more reliance on self-saved seeds. The main reasons for purchasing seeds vary across districts. Replacing old varieties is the dominant reason in Mecha and Sekota while replacing old seeds is more common in Dera. The need to buy seeds due to lack of own seed is especially notable in Mecha, where it is the only reason given by farmers. These findings suggest that farmers in each district face different challenges and have distinct practices related to seed sourcing, influenced by factors like seed quality, availability, and local agricultural conditions.

Table 5: Farmers’ time and reason for purchasing finger millet seeds (n = 264)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | | Dera district | | Sekota district | | Mecha district | |
| Freq. | % | Freq. | % | Freq. | % |
| Do you purchase finger millet seed? | Yes | 43 | 39.1 | 46 | 50.5 | 63 | 100 |
| No | 67 | 60.9 | 45 | 49.5 | 0 | 0 |
| Total | 110 | 100 | 91 | 100 | 63 | 100 |
| Time purchased | Every year | 9 | 8.2 | 55 | 60.4 | 24 | 38.1 |
| Every other year | 7 | 6.4 | 29 | 31.9 | 23 | 36.5 |
| Rarely(3 or more) | 27 | 24.5 | 7 | 7.7 | 16 | 25.4 |
| Reason for purchasing | Replace old varieties | 4 | 3.6 | 34 | 37.4 | 38 | 60.3 |
| Replace old seed | 26 | 23.6 | 14 | 15.4 | 16 | 25.4 |
| Better seed quality | 14 | 12.7 | 0 | 0 | 9 | 14.3 |
|  | No own seed | 1 | 0.9 | 4 | 4.4 | 63 | 100 |

## 3.5. Seed Management and Protection

## 3.5.1. Seed sorting

Table 6 provides an overview of farmers' seed sorting practices and the timing of sorting in three districts: Dera, Sekota, and Mecha. The data highlights who is responsible for seed sorting and when the sorting takes place, revealing notable differences across the districts. Seed sorting is an important task for good-quality seed production. A total of 3.6% sample households from Dera district do not separate grain from seed; this is in contrast to 79.1% of female farmers, 16.4% of male farmers, and 0.9% of children. These farmers sort finger millet seeds before planting (88.2%), just after threshing (7.3%), and while harvesting (0.9%). Sorting grain from seeds was a major responsibility of (61.9%) male and female farmers in the Mecha district. According to the results, the farmers sorted the finger millet on the farm during harvesting 68.3%) and at physiological maturity before harvesting (31.7%). In the Mecha district, 60.4% of farmers said that seed sorting from grain was the responsibility of both male and female farmers and 39.6% said that female farmers solely. A total of 36.3% of those farmers in Sekota district completed this task during harvest, 56% did so shortly after threshing, and 7.7% did so right before planting. Overall, the seed sorting practices and timing show significant regional variation. In Dera, seed sorting is predominantly a female-led activity done right before planting, while in Sekota and Mecha, sorting is more of a collaborative effort between men and women, with sorting taking place at different stages of the harvest process.

Table 6: Farmers' seed sorting practices and time of sorting from grain

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Seed sorting | | Dera district | | Sekota district | | Mecha district | |
| Freq. | % | Freq. | % | Freq. | % |
| Who responsible  for seed sorting | Female farmers only | 87 | 79.1 | 36 | 39.6 | 3 | 4.8 |
| Male farmer only | 0 | 0 | 0 | 0 | 21 | 33.3 |
| Both male and female farmers | 18 | 16.4 | 55 | 60.4 | 39 | 61.9 |
| Children | 1 | 0.9 | 0 | 0 | 0 | 0 |
| Does not sort | 4 | 3.6 | 0 | 0 | 0 | 0 |
| Total | 110 | 100 | 91 | 100 | 63 | 100 |
| Time of sorting | During harvesting | 1 | 0.9 | 33 | 36.3 | 20 | 68.3 |
| Before harvesting | 0 | 0 | 0 | 0 | 43 | 31.7 |
| Just after threshing | 8 | 7.3 | 51 | 56 | 0 | 0 |
| Just before planting | 97 | 88.2 | 7 | 7.7 | 0 | 0 |
| Does not sort | 4 | 3.6 | 0 | 0 | 0 | 0 |
| Total | 110 | 100 | 91 | 100 | 63 | 100 |

**3.5.2. Seed cleaning**

Table 7 provides insights into farmers' seed cleaning methods and the reasons behind these practices across three districts: Dera, Sekota, and Mecha. Seed cleaning is a postharvest activity during seed production and is used to improve the physical quality of seeds. Sampled farmers from the Dera, Sekota, and Mecha districts, approximately 100%, 70.3%, and 60.3%, respectively, used winnowing as their method of seed cleaning. In Dera district, all farmers (100%) use winnowing as their primary method of seed cleaning, with no reported use of sieving or a combination of methods. However, sieving was the other cleaning strategy used by the farmers in Sekota (29.7%) and Mecha (12.7%). In Sekota district, winnowing is the predominant method (70.3%), but a significant portion (29.7%) also uses sieving. In Mecha district, winnowing is still the most common method (60.3%), but there is a notable portion (27%) using both winnowing and sieving for cleaning seeds. This variation suggests that while winnowing is universally used, farmers in Sekota and Mecha districts are more likely to adopt additional methods like sieving to ensure cleaner seeds. The survey describes the reasons farmers in three districts (Sekota, Dera, and Mecha) clean their seeds. Removing inert matter is the most common reason across all districts, with Sekota having the highest percentage (82.4%) of farmers citing it. Inert matter refers to anything that is not a viable seed, such as dirt, stones, and chaff. While removing small/broken seeds are important in Dera and Mecha, but not mentioned in Sekota. Additionally removing weeds/other crops is less common overall, with Sekota and Mecha reporting this more frequently than Dera. This information is valuable for understanding the agricultural practices in these regions and could be used to improve seed-cleaning techniques and ultimately increase crop yields. The respondents stated that their reasons for cleaning the seeds were to remove inert.

Table 7: Proportion of farmer’s seed cleaning method and reason for seed cleaning

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Seed cleaning | | Dera district | | Sekota district | | Mecha district | |
| Freq. | % | Freq. | % | Freq. | % |
| Methods of seed cleaning | Winnowing | 110 | 100 | 64 | 70.3 | 38 | 60.3 |
| Sieving | 0 | 0 | 27 | 29.7 | 8 | 12.7 |
| Both | 0 | 0 | 0 | 0 | 17 | 27 |
| Total | 110 | 100 | 91 | 100 | 63 | 100 |
|  | Reason for seed cleaning |  |  |  |  |  |  |
| Reasons for seed cleaning | Remove inert matter | 54 | 49.1 | 75 | 82.4 | 48 | 76.2 |
| Remove weeds/other crops | 6 | 5.5 | 16 | 17.6 | 10 | 15.9 |
| Remove small/broken seed | 50 | 45.4 | 0 | 0 | 5 | 7.9 |
| Total | 110 | 100 | 91 | 100 | 63 | 100 |

**3.6. Seed Replacement**

Table 8 provides an analysis of seed replacement practices, reasons for seed replacement, and the sources of seeds used by farmers in the Dera, Sekota, and Mecha districts. In Dera district, 30% of farmers replace finger millet seeds, while 70% do not. Sekota District: 80.2% replace seeds, with 19.8% not replacing them. Mecha district: 59.3% of farmers replace seeds, while 30.7% do not replace seeds in other categories. In Sekota, seed replacement is more common, suggesting a greater reliance on improving or renewing seed stock compared to Dera. Dera and Mecha might face challenges related to using old seeds, potentially affecting yields or introducing less resistance to pests or diseases. Dera district: Farmers replace a variety of seeds, with a notable shift from red millet to black (53.7%) and some instances of replacing white with black (2.4%). Sekota District: More common shifts include black replacing black (41%), and white replacing red (10%). Mecha district: Farmers replace white with red (41.8%) and red with black (48.4%). Dera is experiencing a diversity of variety replacements, which could be driven by a desire for better yield or market preferences. In Mecha, the replacement of white with red and red with black suggests a focus on improving grain quality, possibly linked to market demands or local preferences. For example, growers switch from black to red because the latter variety produces “*injera*” of a higher caliber than the former. Dera district: 61.7% replace seeds because they don't have quality seeds. 19.1% replace seeds due to the old age of the seed stock. Sekota District: 38.4% replace seeds due to a lack of good-quality seeds and 34.2% replace seeds of old variety. Mecha District: 25% replace seeds due to lack of quality seeds and 28.3% replace seeds to replace old varieties. In addition to this 13.3% replace seeds for the high quality of *Injera.* In Dera district, the farmer who replaced red with black indicated that the red finger millet variety had a greater injera quality than the black finger millet variety. Dera faces a significant challenge in accessing quality seeds, which may lead to poor yields if farmers are continually using old or non-optimal varieties. In Sekota and Mecha, the emphasis on replacing seeds for quality and variety improvements suggests greater opportunities for agricultural enhancement, especially if farmers can access better seed varieties.

Dera district: Only a small percentage (4.5%) of farmer’s source seeds from the market, with most relying on other farmers (16.4%). Sekota District: A significant portion of seeds (41%) comes from other farmers, while the market plays a minor role (1.8%). Mecha District: Again, the majority of seeds come from other farmers (7.3%), with the market providing a very small portion (0.9%). The reliance on other farmers as a primary seed source suggests a strong community-based system for seed exchange. However, the small market share indicates that formal seed markets may not be well-developed in these regions. Improving the seed market infrastructure could provide farmers with better access to high-quality seeds, thereby improving overall crop performance. The data highlights significant differences in seed replacement practices, reasons for replacement, and sources. The result indicates the importance of seed sorting and replacement for maintaining crop quality and productivity. While, Dera faces challenges in seed quality and availability, Sekota and Mecha show more active engagement in replacing seeds for variety improvement and higher yields. Strengthening seed access, improving the quality of seeds, and developing local seed markets are key areas for policy intervention to enhance agricultural productivity in these districts.

Table 8: Farmer's seed replacement and the seed source for replacement

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Seed replacement | | | Dera district | | | | Sekota district | | | | Mecha district | |
| Freq. | | % | | Freq. | | | % | Freq. | % |
| Do you replace  Seed of finger millet? | No | | 77 | | 70 | | 18 | | | 19.8 | 64 | 100 |
| Yes | | 33 | | 30 | | 73 | | | 80.2 | 38 | 59.3 |
| Variety was replaced by the farmers' | black by Necho | | 7 | | 17.1 | | 0 | | | 0 | 0 | 0 |
| black by black | | 4 | | 9.8 | | 41 | | | 41 | 0 | 0 |
| white by red | | 1 | | 2.4 | | 10 | | | 10 | 23 | 41.8 |
| white by white | | 0 | | 0 | | 12 | | | 12 | 0 | 0 |
| white by black | | 1 | | 2.4 | | 21 | | | 21 | 10 | 15.6 |
| red by red | | 6 | | 14.6 | | 0 | | | 0 | 0 | 0 |
| red by black | | 22 | | 53.7 | | 16 | | | 16 | 31 | 48.4 |
| Total | | 41 | | 100 | | 100 | | | 100 | 0 | 0 |
| Why do farmers replace seeds? | replace old seed | | 9 | | 19.1 | | 20 | | | 27.4 | 9 | 15 |
| high quality of *Injera* | | 1 | | 2.1 | | 0 | | | 0 | 8 | 13.3 |
| high market demand | | 0 | | 0 | | 0 | | | 0 | 4 | 6.7 |
| replace old variety | | 7 | | 14.9 | | 25 | | | 34.2 | 17 | 28.3 |
| brewing purpose | | 1 | | 2.1 | | 0 | | | 0 | 0 | 0 |
| low yield | | 0 | | 0 | | 0 | | | 0 | 7 | 11.7 |
| no own quality seed | | 29 | | 61.7 | | 28 | | | 38.4 | 15 | 25 |
| Total | | 47 | | 100 | | 73 | | | 100 | 60 | 100 |
| Seed source | Variety | | | | | | | | | | | |
| Nacho | | | Red | | | | Black | | | White | |
| N | % | | Freq. | | % | | Freq. | % | | Freq. | % |
| Market | 2 | 1.8 | | 1 | | 0.9 | | 1 | 0.9 | | 0 | 0 |
| Other farmers | 5 | 4.5 | | 18 | | 16.4 | | 8 | 7.3 | | 2 | 1.8 |

3.7. Respondents' Good Seed Traits

Table 9 lists the characteristics of good finger millet seeds, along with the frequency and percentage of responses for each characteristic, as well as their ranking based on their importance. The most crucial qualities of high-quality finger millet seeds are viewed differently by farmers in different districts. The five most important characteristics of good finger millet seeds, according to the survey data, are high yield, disease resistance, drought resistance, low fertility tolerance, and marketability. High yield ranked first with 17.2% of responses, followed by disease resistance at 15.3%. Drought resistance and low fertility tolerance both received 8.7%, ranking third and fourth, while marketability was fifth with 8.0%. These factors were identified as the key qualities that contribute to the desirability of finger millet seeds. In the Dera district, farmers identified the five most important quality parameters of high-quality seeds were lodging tolerance (12.7%), tillering capacity (9.1%), marketability (11.6%), disease resistance (16.5%), and high yield (16.5%); however, in Sekota district, the farmers identified disease resistance (12.9%), insect resistance (11.5%), drought tolerance (20.2%), fertility tolerance (20.2%), and seed color (9.3%) above all other qualities. These characteristics are ranked based on their importance as indicated by the frequency and percentage of responses from the survey. The most important factors seem to be high yield, disease resistance, and drought resistance, followed by low fertility tolerance and marketability. This information is valuable to understand the specific needs and priorities of farmers in the region, and targeted interventions can be developed to improve seed quality and enhance agricultural productivity.

Table 9: Five most important characteristics of good finger millet seeds

|  |  |  |  |
| --- | --- | --- | --- |
| Characteristics | Responses | | Rank |
| Freq. | Percent |
| Large seed size | 77 | 7.1 | 6 |
| Early maturing | 4 | 0.4 | 16 |
| Straw palatability | 15 | 1.4 | 13 |
| Spike length | 13 | 1.2 | 15 |
| High tillering capacity | 50 | 4.6 | 10 |
| High straw yield | 61 | 5.6 | 9 |
| *Injera* quality | 40 | 3.6 | 12 |
| *"Wuha mansat”* | 14 | 1.3 | 14 |
| Marketability | 88 | 8.0 | 5 |
| Disease resistance | 168 | 15.3 | 2 |
| Insect resistance | 64 | 5.8 | 8 |
| Drought resistance | 96 | 8.7 | 3 |
| High yielding | 189 | 17.2 | 1 |
| Brewing quality | 15 | 1.4 | 13 |
| Low fertility tolerance | 95 | 8.7 | 4 |
| Seed color | 67 | 6.1 | 7 |
| High germination percentage | 42 | 3.8 | 11 |
| Total | 1098 | 100 |  |

3.8. Seed Storage and Protection

The data presented in Table 10 shows the storage methods and protection measures for grain seeds across three districts: Dera, Sekota, and Mecha. The frequencies and percentages are provided for each type of storage method and protection measure. Dera district: The majority of farmers (97.3%) store grain in dibignit (*gotera*) in the house, a traditional storage method, while a small percentage (1.8%) use sacks in the house. A very small number (0.9%) use underground pits. Sekota district: All farmers (100%) store grain in sacks in the house. This is the sole method used in Sekota. Mecha district: A significant portion of farmers (49.2%) store grain in sacks in the house, while another 41.3% use dibignit (*gotera*) in the house. Dera district: Most farmers (90%) store seeds in dibignit (*gotera*) in the house, while 9.1% use sacks in the house. A very small number (0.9%) use underground pits in the house. Mecha district: The majority (54%) use sacks in the house to store seeds, with 31.8% using dibignit (*gotera*) in the house. A small percentage (9.5%) store seeds in dibignit (*gotera*) outside the house. In all three districts (Dera, Sekota, and Mecha), no protection measures are reported to be used for seeds, grain, and spikes. Concerning safeguarding the finger millet spike, seed, and grain against storage pests, all the farmers did nothing. The lack of protection measures suggests that farmers may be unaware of or unable to afford more effective protection methods, such as pest control or environmental control measures (e.g., moisture reduction). This could impact food security and farming sustainability in these districts. The lack of protection may also contribute to lower seed quality, thereby reducing yields in subsequent harvests, and impacting food supply and farmer income. There may be a need for interventions aimed at improving storage practices and protection measures. Providing access to better storage facilities, education on protection methods, or subsidies for modern storage solutions could help reduce losses.

Sekota district: All farmers (100%) store seeds in sacks in the house, similar to their grain storage method. This is a result of the district being a dry land area and farmers storing finger millet seed in sacks to keep it safe. In those three study districts, the farmers have not taken any precautions against storage pests for spikes, seeds, or grains because finger millet seeds can be stored for a long period. According to (Dida *et al*., 2007) and (Anuradha *et al*., 2010) finger millet has excellent storage qualities. Dibignit (*gotera*) appears to be the most popular storage method for both grain and seeds in Dera, which suggests a strong reliance on traditional storage techniques. In Sekota, sacks are the preferred method for grain and seeds, highlighting a more modern and perhaps more standardized approach to storage. Mecha district shows a blend of traditional and modern methods with a significant portion using sacks, but also a reliance on dibignit for seeds. This could indicate differing levels of resource availability, access to modern storage solutions, or local agricultural practices.

Table 10: Farmers' storage methods and protection measures for grain seeds

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Storage | Dera district | | | Sekota district | | Mecha district | |
| Freq. | | % | Freq. | % | Freq. | % |
| Storage method for grain |  | |  |  |  |  |  |
| Sacks in the house | 2 | | 1.8 | 91 | 100 | 31 | 49.2 |
| Dibignit(*gotera*) in the house | 107 | | 97.3 | 0 | 0 | 26 | 41.3 |
| Underground pit in the house | 1 | | 0.9 | 0 | 0 | 0 | 0 |
| Sacks and dibignit(*gotera*) in the house | 0 | | 0 | 0 | 0 | 6 | 9.5 |
| Total | 110 | | 100 | 91 | 100 | 63 | 100 |
| Storage method for seed |  | |  |  |  |  |  |
| Sacks in the house | 10 | | 9.1 | 91 | 100 | 34 | 54 |
| Dibignit(*gotera*) in the house | 90 | | 90 | - | - | 20 | 31.8 |
| Underground pit in the house | 1 | | 0.9 | - | - | 0 | 0 |
| Dibignit(*gotera*)outside the house | 0 | | 0 | 0 | 0 | 6 | 9.5 |
| Total | 110 | | 100 | 91 | 100 | 63 | 100 |
| Protection measures for seed, grain, and spike | | |  |  |  |  |  |
| No measure taken | | 110 | 100 | 91 | 100 | 63 | 100 |
| Total | | 110 | 100 | 91 | 100 | 63 | 100 |

3.9. Seed Diversity, Management and Varietal Loss

In the Dera district farmers stopped sowing the finger millet varieties Necho (0.9%), Mecha (0.9%), Tesema (0.9%), *Nechi* (0.9%), and *Tikur* (0.9%) between the years 2009 and 2013. The reasons for this were deliberate loss (0.9%), low yield (1.8%), lodging (0.9%), and low fertility tolerance (1.8%). However, from the year 2019 to 2023, farmers stopped growing Nacho (0.9%), white (6.4%), and black varieties because of diseases (2.7%), low yields (5.4%), poor *injera* quality (3.6%), low marketability (2.7%), low straw yield (2.7%), and poor “*Injera*” and brewing quality (3.6%). According to Table 11, Farmer abandonment of the Red (77%) and White (66%) varieties in the Sekota district occurred during the year 2009–2013 cropping season because of accidental loss (35.2%) and low-yielding (95.1%) varieties. However, farmers ceased cultivating native white (84.6%), red (82.4%), and black (15.4%) varieties between 2019 and 2023 because of deliberate loss (17.6%), accidental loss (17.6%), low yield (100%), and scarcity of farmland (100%) as shown by Table 12. According to the FGD participants, farmers prioritized other crops due to the above reasons over finger millet, leading to neglect and a decline in cultivation. This information provides valuable insights into the need for interventions that address these challenges, such as improving seed quality, enhancing cultivation practices, promoting the value of finger millet to farmers and selecting varieties that are more resilient to diseases and better suited to market demands.

**Table 11:** Finger millet varieties stopped growing by farmers from 2009-2013

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Years | Variety | Dera district | | Sekota district | | Mecha district | |
| Freq. | % | Freq. | % | Freq. | % |
| Varieties Stopped from production from 2009 to 2013 | Necho | 2 | 50 | 0 | 0 | 0 | 0 |
| Mecha | 1 | 25 | 0 | 0 | 0 | 0 |
| Black | 0 | 0 | 0 | 0 | 4 | 30.8 |
| White | 1 | 25 | 65 | 45.8 | 3 | 23.1 |
| Red | 0 | 0 | 77 | 54.2 | 6 | 46.2 |
| Total | 4 | 100 | 142 | 100 | 13 | 100 |
| The reason to stop producing from the years 2009 to 2013 | Low fertility tolerance | 1 | 20 | 0 | 0 | 6 | 46.2 |
| Lack of variety | 1 | 20 | 0 | 0 | 0 | 0 |
| Low yield | 2 | 40 | 87 | 41.1 | 0 | 0 |
| Lodging | 1 | 20 | 0 | 0 | 0 | 0 |
| Accidental loss | 0 | 0 | 32 | 15.2 | 7 | 53.8 |
| Land size limitation | 0 | 0 | 91 | 43.3 | 0 | 0 |
| Total | 5 | 100 | 210 | 100 | 13 | 100 |

Table 12: Finger millet variety stops growing by farmers from 2019-2023

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variety | Dera district | | Sekota district | | Mecha district | |
| Freq. | % | Freq. | % | Freq. | % |
| Variety stop grew in 2019-2023 |  |  |  |  |  |  |
| Necho | 1 | 11.1 | 0 | 0 | 0 | 0 |
| White | 7 | 77.8 | 77 | 46.4 | 5 | 50 |
| Black | 1 | 11.1 | 14 | 8.4 | 5 | 50 |
| Red | 0 | 0 | 75 | 45.2 | 0 | 0 |
| Total | 9 | 100 | 166 | 100 | 10 | 100 |
| Reason to stop grew 2019-2023 |  |  |  |  |  |  |
| Disease | 3 | 13 | 0 | 0 | 0 | 0 |
| Lack the variety | 1 | 4.3 | 0 | 0 | 0 | 0 |
| Low seed yield | 5 | 21.7 | 91 | 42.5 | 14 | 66.7 |
| Low injera quality | 4 | 17.4 | 0 | 0 | 0 | 0 |
| Low market demand | 3 | 13 | 0 | 0 | 0 | 0 |
| Low straw yield | 3 | 13 | 0 | 0 | 0 | 0 |
| Low brewing and injera quality | 4 | 17.4 | 0 | 0 | 0 | 0 |
| Land size limitation | 0 | 0 | 91 | 42.5 | 0 | 0 |
| Accidental loss | 0 | 0 | 16 | 7.5 | 5 | 23.8 |
| Deliberate loss | 0 | 0 | 16 | 7.5 | 2 | 9.5 |
| Total | 23 | 100 | 214 | 100 | 21 | 100 |

### 

### **3.10. Seed Selection**

Table 13 presents the results of a survey regarding farmers' practices of varietal/seed selection, including whether they engage in this practice, who is responsible for it, and at which stages of the growing process selection occurs. Farmers are engaging in a variety of conventional breeding practices, such as seed selection. The majority of farmers (83%) engage in varietal or seed selection, which suggests that a significant portion of the farming community is actively involved in ensuring the quality and suitability of seeds for future planting. This could be an indication of a desire to improve yields, select for better traits, or adapt to local environmental conditions. The 17% who do not practice seed selection could be due to a lack of awareness, resources, or preference for purchasing commercial seeds rather than saving and selecting their own. This group may face challenges in seed quality or may not perceive the need for such practices. Timing of Seed Selection: Pre-harvesting selection (34.8%) is the most common time for seed selection, which indicates that farmers are proactive in identifying suitable plants for seed saving before harvesting. This could allow them to choose the best plants that have had time to fully mature and express desirable traits. Harvesting (28.4%) is the second most common time, which suggests that farmers may make final decisions about seed selection when they are harvesting the crop, possibly when they can evaluate the plants' overall performance. At threshing (17.4%) indicates that some farmers choose seeds during the threshing process, likely after the plants have been fully harvested and processed. This could be due to the desire to pick the best seeds from the harvested grain. Storage (1.1%) represents the least common time for selection, which implies that very few farmers wait until after storage to select their seeds. This could indicate that by the time the seed is stored, farmers are satisfied with their selection or find it impractical to re-select during storage.

The majority of farmers practicing seed selection could contribute to the overall improvement in crop yield and quality. By selecting seeds from plants that show desirable traits (e.g., resistance to pests, higher yields, or better drought tolerance), farmers may increase the productivity and resilience of their crops. The focus on selecting spikes and plants suggests that farmers are aiming for the best genetic material. This practice can help ensure better-quality seed for future planting seasons, potentially improving crop success in subsequent years. The practice of seed selection is essential for seed security, as it allows farmers to save seeds from year to year and reduce their dependency on external seed sources. This is particularly important in areas where access to high-quality seeds may be limited or expensive. The fact that farmers are involved in selecting seeds well before harvest (pre-harvesting and harvesting) demonstrates an active interest in preserving high-quality seeds for future use. The 17% of farmers who do not engage in seed selection may be at a disadvantage in terms of seed quality, as they may rely on external sources for seeds, which could be costly or less adapted to local conditions. This group may also face challenges in maintaining genetic diversity or selecting traits that are specifically beneficial to their local environment. There is a clear opportunity for agricultural extension services to support farmers, particularly those who do not practice seed selection. Providing training on best practices for seed selection could enhance the overall productivity of the farming community. Farmers who select seeds at later stages like at threshing or storage could benefit from education on the advantages of early-stage selection, ensuring better seed quality and reducing the risk of storing poor-quality seeds.

Table 13: Farmers’ practices of varietal/seed selection and stages of selection

|  |  |  |  |
| --- | --- | --- | --- |
| Selection practice | | Frequency | Percent |
| Do farmers practice varietal/seed selection? | Yes | 219 | 83 |
| No | 45 | 17 |
| Total | 264 | 100 |
| Time of selection | pre harvesting | 92 | 34.8 |
| at harvesting | 75 | 28.4 |
| at threshing | 46 | 17.4 |
| at storage | 3 | 1.1 |

3.11. Seed Security

Seed security is a crucial aspect of agricultural sustainability and food security, encompassing the availability, access, and quality of seeds necessary for farmers to cultivate crops effectively. Understanding seed security involves differentiating between acute and chronic seed insecurity, which can significantly impact agricultural productivity and livelihoods. In the Dera district, 43.6% of the farmers had secured seeds for the 2024/25 cropping season; the remaining farmers had not secured because of drought (0.9%), consumption (30.9%), and insufficient seed production (14.5%). These farmers were not secured frequently (31.8%), occasionally (11.8%), and every other year (12.7%). Seed help (9.1%), credit services for seed purchases (7.3%), variety changes (20.9%), increasing seed output (3.6%), and separating seeds from grains (12.7%) were among the suggestions made by farmers to reduce seed insecurity. Forty-four percent of the farmers in the Sekota district had access to seeds. From the remaining producers 46.2% of farmers every year 3.3% every other year and 6.6% infrequently seed unsecured this result suggests that the causes of seed insecurity were drought (40.7%), consumption (7.7%), and inadequate seed production (7.7%). Farmers recommend changing varieties (3.3%), increasing seed yield (16.5%), providing seed aid (8.8%), and practicing good agronomic and pest management (27.5%) as ways to reduce the degree of seed insecurity (Table 14).

In the Mecha district, most of the finger millet growers (44%) were unsecured every year (38.1%) followed by every other year (31.7%). The survey results indicated that consumption (34.9%), insufficient seed production (15.9%), diseases (9.5%), selling all out (6.3%), and drought (3.2%) were the reasons for farmer seed insecurity (Table 14). To solve this problem, the respondents suggested that proper agronomic and pest management (20.6%), changing varieties (20.6%), properly harvesting (12.7%), separating seeds from grain (7.9%), providing seed aid (4.8%), and increasing seed yield (3.2%) should be solutions to reduce seed insecurity. According to Practitioners (2015), seeds must meet acceptable standards in terms of the quality of the variety. Quality encompasses both physical attributes (like germination rates) and genetic characteristics (such as plant type and growth duration).

Table 14: Farmers’ suggestions to reduce seed insecurity

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Seed security | | Dera district | | Sekota district | | Mecha district | |
| Freq. | % | Freq. | % | Freq. | % |
| Are you seed-secured? | Yes | 48 | 43.6 | 40 | 44 | 19 | 30.2 |
| No | 62 | 56.4 | 51 | 56 | 44 | 69.8 |
| Total | 110 | 100 | 91 | 100 | 63 | 100 |
| Unsecured time | Every year | 35 | 31.8 | 42 | 46.2 | 24 | 38.1 |
| Every other year | 14 | 12.7 | 3 | 3.3 | 20 | 31.7 |
| Rarely(>3years) | 13 | 11.8 | 6 | 6.6 | 0 | 0 |
| Reason for seed insecurity | Drought | 1 | 0.9 | 37 | 40.7 | 2 | 3.2 |
| Consumption | 18 | 16.4 | 7 | 7.7 | 22 | 34.9 |
| Insufficient seed production | 32 | 29 | 7 | 7.7 | 10 | 15.9 |
| Selling all-out | 9 | 8.2 | 0 | 0 | 4 | 6.3 |
| PH problem | 1 | 0.9 | 0 | 0 | 0 | 0 |
| Disease | 0 | 0 | 0 | 0 | 6 | 9.5 |
| Suggestion to reduce seed insecurity | Proper agronomic and pest management | 15 | 13.7 | 25 | 27.5 | 13 | 20.6 |
| Seed aid | 6 | 5.5 | 8 | 8.8 | 3 | 4.8 |
| Change varieties | 15 | 13.6 | 3 | 3.3 | 13 | 20.6 |
| Increasing seed yield | 4 | 3.6 | 15 | 16.5 | 2 | 3.2 |
| Separation of seed from grain | 22 | 20 | 0 | 0 | 5 | 7.9 |
| Properly harvest | 0 | 0 | 0 | 0 | 8 | 12.7 |

**4.** **CONCLUSION AND RECOMMENDATION**

Finger millet is an important crop in Ethiopia, as a staple food crop. The crop has high nutritional value and is adaptable to diverse agro-ecologies, which makes it an essential food security crop for smallholder farmers. However, the study highlights the challenges faced by the finger millet seed system and quality analysis in the Amhara Region of Mecha, Dera, and Sekota districts. Finger millet farmers in the Amhara region should be encouraged to source high-quality finger millet seeds, by strengthening the formal seed system sector value chain to be more assured in terms of quality. Subsequently, the majority of the finger millet farmers obtained their seeds from the informal seed supply; so, there is a need to boost their knowledge of the importance of using quality seeds in successful farming activities. This is because the majority of farmers had below the primary level of education. Improved seed production technologies should be availed to these farmers in an attempt to boost high-quality seed supply through education and training on seed selection criteria and proper post-harvest handling techniques of the seed. In addition to this Explore the feasibility of implementing a seed certification program to ensure the quality and genetic purity of seeds distributed through seed system channels. Therefore, recognizing the need for a diverse and integrated seed system, including formal, informal, and community-based approaches, ensures a more robust and resilient seed supply.

**ACKNOWLEDGEMENTS**

The authors gratefully acknowledge the financial support from the Amhara Agricultural Research Institute and Bahir Dar University, which enabled the successful completion of this research. Sincere thanks are also extended to the farmers, Bureau of Agriculture and Rural Development of the Amhara Region, Amhara Seed Enterprise, Ethiopian Seed Enterprise, Adet Agricultural Research Center, and the Development Agents at the peasant associations for their invaluable contributions of primary and secondary data.

# REFERENCES

Anuradha, D. Desai, Sharduli, S. Kulkarni, Sahoo, A.K., Ranveer, R.C. and Dandge, P.B. (2010). Effect of supplementation of malted ragi flour on the nutritional and sensorial quality characteristics of cake. *Adv. J. Food. Sci. Technol, 2*, 67-71.

Benyam Tadesse, Y. T. (2021). Assessment of challenges of crop production and marketing in Bench-Sheko, Kaffa, Sheka, and West-Omo zones of southwest Ethiopia. *Heli, 7*, 1-14.

Desta, M., Ayalew, B., & Mekonnen, A. (2021). Seed systems and quality management in Amhara Region, Ethiopia: A review of challenges and opportunities. Ethiopian Journal of Agricultural Research,. *12*(4), 89-101.

Dida, M.M., Bennetzen, M.D., Gale, and Devos, K.M. (2007). The genetic map of finger millet, Eleusine coracana. *Theor. Appl. Genet, 114*, 321-332.

Kifle, T. (2023, Fabruary 01). *Seed Systems, Adoption, and Impact of Improved Crop Varieties on Household Food Security in Central Ethiopia.* Retrieved March 19, 2024, from Addis Ababa University Institutional repository: ttps://etd.aau.edu.et/items/50199ef7-608-498b-b890-27de68c89968

Mekonen, S., & Tsegaye, M. (2020). Seed quality and storage practices in Ethiopia: A case study from the Amhara Region. *Journal of Seed Science and Technology, 29*(3), 75-84.

Mekonnen Duressa, a. A. (2022). Popularization of Finger Millet Production, Value Addition, and Marketing in Wayu Tuka Wereda, East Wollega Zone 16. *Mod. Phyto, 16*, 83–92.

Menale Kassie, H. T. (2015). Production risks and food security under alternative technology choices in Malawi: Application of a multinomial endogenous switching regression. *J. Agric. Econ., 66*, 640-659.

Tesfaye, G., Teshome, D., & Habte, H. (2022). Seed quality and management practices of finger millet farmers in the Amhara Region of Ethiopia. *Agricultural Systems, 183*, 9-47.

Wossen Tarekegne, Firew Mekbib and Yigzaw Dessalegn. (2021). Farmers ’ Finger Millet [ Eleusine coracana ( L .) Gaertn ] Seed Management Practices . *Journal of Agriculture and Environmental science*, 1-8.