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**Participatory Variety Selection of Improved Finger Millet (*Eleusine coracana*)  
(L.) Gaertn.) Varieties at Debube Ari District, South Omo Zone, Southern Ethiopia**

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**ABSTRACT**

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*Finger millet is a staple food crop in drought-prone areas of the world and is often considered a component of food security strategies in Ethiopia, however, its yield is low in the South Omo zone due to different production problems such as lack of improved varieties, lodging, and moisture stress in dry areas. A participatory selection of finger millet varieties was conducted at Kaysa, Baytesimal, and Alga kebeles of Debube District, South Omo Zone during the 2019 cropping season to identify high-yielding finger millet variety/ies. The field experiments were carried out in a randomized complete block design with three replications. The combined analyses of variance results revealed that there were significant ( $p < 0.05$ ) differences among varieties based on the recorded parameters except the harvest index. The maximum combined mean grain yield obtained for the varieties Tadesse, Tesema and Kako-1 ( $3746.75\text{kg ha}^{-1}$ ,  $3691.94\text{kg ha}^{-1}$ , and  $3593.42\text{kg ha}^{-1}$ ) respectively. While the minimum grain yield was recorded to variety, BKFM-0010 ( $1341.18\text{kg ha}^{-1}$ ). Regarding farmers' preferences, variety Kako-1 and Tesema had higher grain yield followed by variety Tadesse. Based on data from researchers and farmers, varieties Tadesse, Tesema, and Kako-1 were the best varieties for the test agro-ecologies. Therefore, varieties; Tadesse, Tesema and Kako-1 could be recommended and popularized for use in test areas and similar agro-ecologies.*

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## 1. INTRODUCTION

Finger millet (*Eleusine coracana*) is a small, seeded cereal grown in low rainfall areas of the semi-arid tropics of the world. It is a hardy crop capable of providing a reasonable grain yield in circumstances where most crops give negligible yield. Finger millet is a staple food crop in drought-prone areas of the world and is often considered a component of food security strategies. Among millets, it ranks third in importance after sorghum and pearl millets. Its wide adaptability to diverse environments and cultural conditions makes it a potential food crop (FAOSTAT 2015). Finger millet is a dietary staple food crop in potentially drought-exposed regions of the world, and it is highly considered as an important component in ensuring food security. The crop's grain possesses excellent storage quality, which can be preserved without any harm for years, confers it a perfect food grain quality. Crop leftovers are an excellent source of dry matter for the livestock, especially in dry seasons. After harvesting, the crop residue makes good animal feed and consists of up to 61% total digestible nutrients (Weir 1996).

Finger millet straw is used for livestock feed in many countries; however, it is mainly grown for food (Upadhyaya *et al* 2006) and also for the brewing of gluten-free beverages (Bano *et al* 2015). Finger millet grain is nutritionally rich as it contains high levels of protein and minerals (Upadhyaya *et al* 2006). As suggested by David *et al* (2014), the proximate composition of finger millet moisture (6.99%), ash (2.37%), crude protein (10.28%), crude fiber (3.10%), crude lipid (0.83%), carbohydrate (76.43%) and mineral-like potassium (14.19 mg/g), sodium (6.86 mg/g), copper (0.10 mg/g), calcium (1.13 mg/g), magnesium (6.25 mg/g), zinc (0.22 mg/g), manganese (0.32 mg/g), iron (0.11 mg/g) and lead (0.001 mg/g). It contains an

appreciable amount of the essential amino acid methionine which is lacking in most foods (Mamo *et al* 2018). Finger millet is suitable for designing and developing value-added nutritive food products. Woldemichael and Admasu (2017) reported that germination was effective in starch and protein hydrolysis; while fermentation was more effective in reducing phytate, consequently increasing mineral bioavailability.

Its annual world production was about 30.5 million tons, out of these, 12.4 million tons were produced in Africa mainly eastern and southern African (FAOSTAT 2015). In Ethiopia, finger millet is the 6<sup>th</sup> important crop after tef, wheat, maize, sorghum and barley. It comprises about 5% of the total land devoted to cereals. According to CSA (2016/17), it was produced on 406,592 ha of land, from which 599,963 tons are obtained at the national level. It is mainly grown in North Gondar, West Gojam, some parts of Tigray, and West Wollega. It is widely grown in the Amhara region, it covers 198,835ha of land and giving 291,775 ton in the region, which is 48.62% of the total national production. The yields of finger millet are low in Ethiopia due to different production problems including lack of improved varieties, little research emphasis given to the crop, non-adoption of improved technologies, poor attitude to the crop, disease like blast which is the most serious disease, lodging and moisture stress in dry areas, threshing, lodging and milling problem are some of the most serious production constraints in finger millet production in Ethiopia (Tsehaye and Kebebew 2002).

Some varieties of finger millet were released by the different research centers of the nation. Farmers have no sufficient information about the released varieties both agronomic practice and their

economic importance because the varieties were released without the participation of farmers and the released varieties had not yet evaluated in the targeted area. Participatory varietal evaluation and selection are being conducted in many crops like rice and barley (Ceccarelli and Grando 2007; Fufa *et al* 2010). Participatory variety selection of different field crops in Ethiopia. For example, Courtois *et al* (2001) evaluated the effect of participation of farmers by comparing only the rankings of varieties by farmers and breeders at the same locations and reported a strong concordance between farmers and breeders in environments that have been producing contrasting plant phenotypic performance in rice. Cleveland *et al* (1999) and Danel *et al* (2007) reported that farmer selection criteria vary with environmental conditions, traits of interest, ease of cultural practice, processing, marketability of the product, ceremonial and religious values. Therefore, the objectives of this study were to evaluate and select the improved finger millet varieties which are high yielding and farmers preferred finger millet varieties in South Omo Zone.

## 2. MATERIALS AND METHODS

### 2.1. Description of study site

The experiment was carried out during the 2019 main cropping season at Kaysa, Baytesimal, and Alga Kebles, in the South Ari District, South Omo Zone. The altitudes, latitude and longitude of the study area were, 1405 m.a.s.l, 5° 43' 46" N and 36° 37' 5" E for Kaysa location, 1337 m.a.s.l, 5° 45' 7" N and 36° 32' 44" E for Baytesimal location, and 1452 m.a.s.l, 5° 47' 43" N and 36° 32' 38" E for Alga location respectively. The district (woreda) area had average annual rainfall of 1343 mm and temperature ranges from 16.3°C to 27.7°C respectively.

### Experimental treatments and design

Thirteen (13) finger millet varieties were

included in the study area (Tesema, Tadese, Kako-1, Bareda, Gute, Gudetu, Addis01, BKFM-0010, Boneya, Wama, Bako- 09, Diga-1 and Urji.). The experimental field was prepared following the three (3) conventional tillage practices prior to planting. The trial was established in a randomized complete block design (RCBD) with three replications. Each experimental plot had ten rows with the spacing of 40 cm between each row and the plot size had four-meter length and five-meter width spaced at one meter with a gross area of 20 m<sup>2</sup>. In accordance with the design, a field layout was prepared, and each treatment was assigned randomly to experimental plots within each block and replications. Seed rate, the seed was applied at the recommended seed rate of 10 kg/ ha. Sowing season was from early March to mid of April months in the Belg season in mid land altitude areas. The sowing was carried out in rows using the method of hand drilling manually with a recommended seed rate of 10 kg/ha with a spacing of 40 cm between rows and made tinning between plants with the spacing of 10 cm at the time of the first weeding time. Fertilizer rate, Fertilizer was applied at the rate of 100 kg/ha NPSB and 100 kg urea, respectively. NPSB fertilizer was applied at the time of planting, and urea fertilizer was applied in spilt form, half at the time of planting and half at the time of tillering stages. Weeding was done by hand weeding as manually. The first-hand weeding was done after the emergence of the plant from twenty (20) to twenty-five (25) days after planting and thinning was done plant to plant with a distance of ten centimeters (10 cm). The second-hand weeding practice was done after the emergence of the plants from forty-five (45) up to fifty-five (55) days after planting.

### Participatory variety selection

Zone, District and Kebele agricultural and natural resource office experts were participated at the selection time. The

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selected farmers were participated at selection of the improved finger millet varieties at the maturity stage and set their selection criteria and ranking was done based on their selection criteria.

### **Data collection**

Days to Maturity, it was recorded as the number of days from emergence to stage when 50% of the tillers per plot had matured ears (detected by yellowing of leaves). Plant height, it was recorded by measuring the height of plants from ground level to the tip of inflorescence (ear) at the dough stage. Productive tiller per plant, the number of tillers per plant was the number of basal tillers that bear mature fingers and recorded from five randomly taken plants of each plot at harvest. Finger length, it was recorded from the base of the ear to the tip of the finger at each five randomly taken plants of main tillers at the dough stage, number of fingers per plant, it was recorded by counting each finger from the selected every single plant from the five randomly selected fingers of plants at harvest. Biomass, biomass yield was recorded from the weight of the above-ground parts and measured by sensitive balance at harvest after sun drying. Grain Yield, the grain yield was determined by harvesting plants from the selected middle rows of each plot. The seeds were weighed using a sensitive balance and approximately adjusted to a moisture content of 12.5 %. Harvest index, harvest index was estimated from the proportion of seed weight to the above-ground biomass weight at harvesting (GY/BM). Farmer rank, farmers rank their varieties by seating criteria at maturity by simply observing all the tested varieties according to their set of parameters. Researcher rank: ranking varieties after analyzing the data collected above.

### **Data Analysis**

Data such as days of maturity, plant height, finger length, number of fingers per plant, productive tiller per plant,

biomass, grain yield and harvest were subjected to Analysis of Variances (ANOVA) using the General Linear Model (GLM) procedure of the Statistical Analysis System (SAS) software. The significance differences between and between treatments were delineated using LSD (least significance difference) (5%) and the farmer's preference ranking was made directly by counting the number of interests of the participants according to the variety's selection criteria.

## **3. RESULTS AND DISCUSSION**

### **3.1. The combined mean performance of finger millet varieties for growth, Yield and yield -related traits:**

The combined analyses of variance results revealed that there were significant ( $p < 0.05$ ) differences among varieties under rain fed condition at Kaysa, Baytesimal and Alga districts on days of maturity, plant height, finger length, number of fingers per plant, productive tiller per plant except the harvest index. Among the evaluated varieties, kako-1(98 days) was early maturing, as BKFM (153 days) was late maturing variety (Table 2). The maximum plant height was recorded in BKFM-0010 (109cm) and the minimum plant height was obtained from Bako-09 (82 cm) (Table2). The maximum finger length was obtained from BKFM-0010 (9.71cm) were as the minimum finger length was obtained from Kako-1 (5.04 cm (Table3,). The maximum number of fingers per plant was recorded in the Urji variety (9.22), and the minimum number of fingers per plant was recorded in the Wama variety (5.94) (Table 3). The maximum number of productive tillers per plant was obtained from Tadesse (7.55) and the minimum number of productive tillers per plant was recorded in the Wama varieties (4.65) (Table 3). Among the finger millet varieties, the maximum biomass was recorded from Tesema



(34277.78kg $ha^{-1}$ ) and the minimum biomass was recorded from the variety BKFM-0010 (27148.15kg $ha^{-1}$ ) (Table4,). From the tested varieties, the maximum grain yield was obtained from Tadesse (3746.75kg $ha^{-1}$ ) and the minimum grain yield was obtained from BKFM-0010 (1341.18kg $ha^{-1}$ ) (Table4,).

#### **Performance of finger millet varieties at each location for growth, yield, and yield -related traits:**

Among the tested varieties, kako-1(95, 100, 99.3 days), matured early compared to other varieties across locations which will be best fit the early maturing finger millet production system and variety BKFM-0010(153, 154 days) was a late mature type and best suited for late-maturing finger millet production system across locations (Table2,). The current work disagreed for the physiological maturity for the variety Kako-1 with that of the observation by Molla (2010), who stated that variety Boneya, matured early compared to other varieties which were best suited for the early finger millet production system, and variety Bareda was late mature type and best fit for the late-maturing finger millet production system. The maximum plant height BKFM-0010 and (107.67,109.33,110.01 cm) across location and the minimum plant height at each location was recorded from Addis - 01(73.33) Gudetu (81.33cm) and Bako-09 (69cm)at Kaysa , Baytesimal and Alga location respectively (Table2,) This result is in agreement with similar findings of Tarekegne *et al* (2019), reported that there were the presence of sufficient variability which could be attributed to the genetic potential of the varieties used among the evaluated varieties and for the traits under study (Table2,) . From the tasted varieties the maximum finger length was recorded from Diga-1 (11.33cm, 10.53 cm) at Kaysa and Baytesimal and BKFM-0010 (8.13cm) at Alga location, while the minimum finger length was recorded from Kako-1 (4.93cm cm, 5.2 cm) at Kaysa and

Baytesimal and Gudetu (4.1cm) at Alga location respectively (Table). This finding is similar to the finding of Tsehaye and Kebebew (2002) and Fakrudin *et al* (2004), reported that there were presences of genetic variability in finger length of finger millet varieties. The maximum finger per plant was recorded to variety Urji (10.43, 8, and 9.33) at Kaysa, Baytesimal and Alga locations, respectively, and the minimum number of fingers per plant was recorded from the BKFM-0010 (6.4) Gudetu (5) and Wama (4.33) at Kaysa, Baytesimal and Alga locations respectively (Table-3). Previously Molla (2010) reported similar results with the current findings concerning the number of fingers per plant in finger millet germplasm. From the varieties, the maximum number of productive tillers per plant was recorded from Tadesse in Kaysa and Alga (8, and 7.66) and Kako-1 at Baytesimal (8) while the minimum number of productive tillers per plant was recorded from the Wama variety (3.86) Diga-1(6.33) and wama (3.86, 3.43) at Kaysa and Alga locations respectively and Kako (3.43) at Kaysa, Baytesimal Alga location respectively (Table3,). The current work disagreed for the productive tiller per plant traits for the variety Tadesse, and Kako-1 with that of the observation by Tarekegne *et al* (2019), he stated that variety Bareda, Degu had the maximum number of productive tillers per plant compared to the other tested varieties. Among the finger millet varieties, the maximum biomass was recorded from the Tesema variety (32,667 kg $ha^{-1}$ , 30,000kg $ha^{-1}$  at Kaysa and Baytesimal kebele and Tadesse (40,000kg $ha^{-1}$ ) at Alga location respectively. While the minimum biomass was recorded from variety BKFM -0010 (22000 kg $ha^{-1}$ ) at Kaysa location and Urji (24444kg $ha^{-1}$ , 25583 kg $ha^{-1}$ ) at Baytesimal and Alga location (Table 4). The current work disagreed for the biomass traits for the variety Tadesse and Tesema with that of the observation by Tarekegne *et al*

(2019), reported that variety Wama, Gute and Bareda had the maximum biomass compared to the other tested varieties. The maximum grain yield was obtained from varieties, Tadesse (3666.7 kg $ha^{-1}$ , 3962.5) kg $ha^{-1}$  at Kaysa and Alga location and Kako-1 (3236.1 kg $ha^{-1}$ ) at Baytesimal location, respectively. While, the minimum Grain yield was obtained from

varieties, BKFM-0010 (1322.3, 1122.2kg $ha^{-1}$ ) at Kaysa and Baytesimal location and Bared (1470.8kg $ha^{-1}$ ) at Alga location respectively (Table4,). This result agreed with the previous works of Andualem (2008), reported that, there were presences of a significant difference among varieties in yield-related parameters of finger millet varieties.

Table 1: Mean square values of traits of finger millet varieties over locations

SV	DF	PH	FL	FP <sup>-1</sup>	PTP <sup>-1</sup>	DM	BM	GY	HI
Rep	2	3.25 <sup>ns</sup>	0.18 <sup>ns</sup>	0.12 <sup>ns</sup>	0.15 <sup>ns</sup>	1.56 <sup>ns</sup>	9.25 <sup>n</sup> <sub>s</sub>	103090 <sup>ns</sup>	0.012 <sup>ns</sup>
Variety	12	660.16 <sup>*</sup>	23.1 <sup>*</sup>	7.83 <sup>*</sup>	5.15 <sup>*</sup>	1344.1 <sup>*</sup>	5.85 <sup>*</sup>	5727812 <sup>*</sup>	0.0079 <sup>*</sup>
Location	2	10.23 <sup>*</sup>	65.43 <sup>*</sup>	36.59 <sup>*</sup>	23.28 <sup>*</sup>	824.03 <sup>*</sup>	7.19 <sup>*</sup>	5677395 <sup>*</sup>	0.01 <sup>*</sup>
Loc*variety	24	175.77 <sup>*</sup>	5.1 <sup>*</sup>	2.84 <sup>*</sup>	2.8 <sup>*</sup>	183.28 <sup>*</sup>	2.45 <sup>*</sup>	829954 <sup>*</sup>	0.0027 <sup>n</sup> <sub>s</sub>
Error	76	13.58	0.19	0.49	0.38	1.06	1.38	29433	0.0032

**NB:** \* indicates significance at ( $p < 0.05$ ) and "ns =non-significant different. SV=source of variation, Loc= location, DF=degree of freedom, PH=plant height, FL=finger length, FP<sup>-1</sup> finger per plant, PTP<sup>-1</sup>= productive tiller per plant, DM=days of maturity, BM= biomass, GY= grain yield, HI=harvest index.

Table 2: The mean value of growth-related traits on days of maturity and plant height at each location

Varieties	DM (days of maturity)				PH (cm)			
	Kaysa	Baytesimal	Alga	Combined	Kaysa	Baytesimal	Alga	Combined
BKFM	153 <sup>a</sup>	154 <sup>a</sup>	154 <sup>a</sup>	153 <sup>a</sup>	107.67 <sup>a</sup>	109.33 <sup>a</sup>	110.01 <sup>a</sup>	109 <sup>a</sup>
Bako-09	122 <sup>d</sup>	125 <sup>fg</sup>	125 <sup>g</sup>	124 <sup>e</sup>	88.33 <sup>de</sup>	88.67 <sup>f</sup>	69 <sup>f</sup>	82 <sup>g</sup>
Gute	103 <sup>f</sup>	125 <sup>fg</sup>	125 <sup>g</sup>	117 <sup>h</sup>	99 <sup>abc</sup>	104 <sup>abc</sup>	110 <sup>a</sup>	104 <sup>b</sup>
Urji	112 <sup>e</sup>	127 <sup>ef</sup>	127 <sup>f</sup>	122 <sup>f</sup>	106.67 <sup>a</sup>	103 <sup>bc</sup>	90 <sup>c</sup>	99 <sup>c</sup>
Tesema	124 <sup>d</sup>	120 <sup>h</sup>	120 <sup>i</sup>	121 <sup>f</sup>	101.67 <sup>ab</sup>	106 <sup>ab</sup>	100 <sup>b</sup>	102 <sup>bc</sup>
Gudetu	121.33 <sup>d</sup>	134 <sup>c</sup>	134 <sup>c</sup>	130 <sup>bc</sup>	94.33 <sup>cde</sup>	81.33 <sup>g</sup>	89.33 <sup>cd</sup>	88 <sup>e</sup>
Boneya	113.33 <sup>e</sup>	123 <sup>g</sup>	123 <sup>h</sup>	119 <sup>g</sup>	101 <sup>ab</sup>	96.33 <sup>de</sup>	80 <sup>e</sup>	92 <sup>d</sup>
Diga-1	111 <sup>e</sup>	124 <sup>g</sup>	124.33 <sup>g</sup>	119 <sup>g</sup>	90.33 <sup>e</sup>	86.67 <sup>fg</sup>	100 <sup>b</sup>	92 <sup>d</sup>
Wama	98 <sup>g</sup>	139 <sup>b</sup>	139 <sup>b</sup>	125 <sup>d</sup>	102 <sup>ab</sup>	99.67 <sup>cd</sup>	110 <sup>a</sup>	103 <sup>b</sup>
Kako-1	95 <sup>h</sup>	100 <sup>j</sup>	99.33 <sup>k</sup>	98 <sup>i</sup>	84.33 <sup>e</sup>	90 <sup>f</sup>	86.67 <sup>d</sup>	87 <sup>ef</sup>
Bareda	137 <sup>b</sup>	128 <sup>de</sup>	128 <sup>d</sup>	131 <sup>b</sup>	95.67 <sup>bcd</sup>	91 <sup>ef</sup>	100 <sup>b</sup>	95 <sup>d</sup>
Addis01	128 <sup>c</sup>	130 <sup>d</sup>	130 <sup>d</sup>	129 <sup>bc</sup>	73.33 <sup>f</sup>	88 <sup>f</sup>	89.33 <sup>cd</sup>	83 <sup>fg</sup>
Tadesse	123 <sup>d</sup>	115 <sup>i</sup>	115 <sup>j</sup>	117 <sup>h</sup>	99.67 <sup>b</sup>	88.33 <sup>f</sup>	110 <sup>a</sup>	99 <sup>c</sup>
CV (%)	1.41	0.83	0.39	0.82	5.4	3.4	1.93	3.86
LSD (0.05)	2.8	1.67	0.83	0.96	8.7	5.4	3.11	3.46

NB: DM =days to maturity, PH=plant height, Means with the same letters for traits are not significantly different at ( $p < 0.05$ )

Table 3: The mean value of finger length, number of fingers per plant and productive tiller per plant across location

Varieties	FL (cm)				NFP <sup>-1</sup>				PTP <sup>-1</sup>			
	Kaysa	Baytesimal	Alga	Combined	Kaysa	Baytesimal	Alga	Combined	Kaysa	Baytesimal	Alga	Combined
BKFM	10.53 <sup>ab</sup>	10.46 <sup>a</sup>	8.13 <sup>a</sup>	9.71 <sup>a</sup>	6.4 <sup>e</sup>	7.66 <sup>ab</sup>	7 <sup>c</sup>	7.02 <sup>d<sup>ef</sup></sup>	4.7 <sup>6d</sup>	6.66 <sup>b</sup>	7 <sup>ab</sup>	6.14 <sup>d</sup>
Bako-09	7.43 <sup>de</sup>	6.53 <sup>c</sup>	4.56 <sup>e</sup>	6.17 <sup>de</sup>	8.66 <sup>b</sup>	6 <sup>d<sup>e</sup></sup>	5.33 <sup>de</sup>	6.66 <sup>efg</sup>	6.6 <sup>bc</sup>	6.66 <sup>b</sup>	3.63 <sup>f</sup>	5.41 <sup>f</sup>
Gute	10.16 <sup>b</sup>	10 <sup>a</sup>	6.53 <sup>c</sup>	8.9 <sup>b</sup>	7.33 <sup>d</sup>	5.66 <sup>ef</sup>	6.66 <sup>cd</sup>	6.55 <sup>fgh</sup>	6.3 <sup>bc</sup>	6.66 <sup>b</sup>	3.6 <sup>f</sup>	5.53 <sup>ef</sup>
Urji	10.46 <sup>ab</sup>	7.53 <sup>b</sup>	4.66 <sup>e</sup>	7.55 <sup>c</sup>	10.43 <sup>a</sup>	8 <sup>a</sup>	9.33 <sup>a</sup>	9.22 <sup>a</sup>	6.26 <sup>bc</sup>	7 <sup>ab</sup>	5.66 <sup>cd</sup>	6.31 <sup>cd</sup>
Tesema	7.73 <sup>de</sup>	6.73 <sup>c</sup>	5.26 <sup>d</sup>	6.57 <sup>d</sup>	10 <sup>a</sup>	6 <sup>de</sup>	7.66 <sup>bc</sup>	7.88 <sup>bc</sup>	7.83 <sup>a</sup>	6.66 <sup>b</sup>	6.5 <sup>bc</sup>	7.00 <sup>ab</sup>
Gudetu	8.66 <sup>c</sup>	4.93 <sup>d</sup>	4.1 <sup>f</sup>	5.9 <sup>e</sup>	7.8b <sup>cd</sup>	5 <sup>f</sup>	6.66 <sup>cd</sup>	6.48 <sup>fgh</sup>	7.33 <sup>ab</sup>	7 <sup>ab</sup>	6 <sup>c</sup>	6.77 <sup>bc</sup>
Boneya	7.16 <sup>e</sup>	5.13 <sup>d</sup>	5.13 <sup>d</sup>	5.81 <sup>ef</sup>	8.33 <sup>bc</sup>	6.33 <sup>cde</sup>	6.66 <sup>cd</sup>	7.11 <sup>def</sup>	7.06 <sup>abc</sup>	6.6 <sup>b</sup>	5 <sup>de</sup>	6.22 <sup>cd</sup>
Diga-1	11.33 <sup>a</sup>	10.53 <sup>a</sup>	6.33 <sup>c</sup>	9.4 <sup>a</sup>	10.33 <sup>a</sup>	7.33 <sup>ab</sup>	7.66 <sup>b<sup>c</sup></sup>	8.44 <sup>b</sup>	7.33 <sup>ab</sup>	6.33 <sup>b</sup>	4.66 <sup>e</sup>	6.11 <sup>de</sup>
Wama	10.66 <sup>ab</sup>	7.8 <sup>b</sup>	5.335 <sup>d</sup>	7.93 <sup>c</sup>	7.5 <sup>cd</sup>	6 <sup>de</sup>	4.33 <sup>e</sup>	5.94 <sup>h</sup>	3.86 <sup>d</sup>	6.66 <sup>b</sup>	3.43 <sup>f</sup>	4.65 <sup>g</sup>
Kako-1	4.93 <sup>g</sup>	5.2 <sup>d</sup>	5 <sup>de</sup>	5.04 <sup>g</sup>	7.33 <sup>d</sup>	5.8 <sup>de</sup>	5 <sup>e</sup>	6.04 <sup>gh</sup>	6.56 <sup>bc</sup>	8 <sup>a</sup>	6.33 <sup>bc</sup>	6.96 <sup>b</sup>
Bareda	8.06 <sup>cd</sup>	10.33 <sup>a</sup>	8 <sup>a</sup>	8.8 <sup>b</sup>	7.66 <sup>cd</sup>	7 <sup>bc</sup>	6.66 <sup>cd</sup>	7.11 <sup>def</sup>	7.93 <sup>a</sup>	6.68 <sup>b</sup>	4.33 <sup>ef</sup>	6.31 <sup>cd</sup>
Addis-	5.73 <sup>f<sup>g</sup></sup>	5.26 <sup>d</sup>	5.2 <sup>d</sup>	5.4 <sup>fg</sup>	8.66 <sup>b</sup>	6.53 <sup>cd</sup>	7.66 <sup>bc</sup>	7.62 <sup>cd</sup>	6.06 <sup>c</sup>	7 <sup>ab</sup>	6 <sup>c</sup>	6.35 <sup>cd</sup>
Tadesse	5.93 <sup>f</sup>	6.06 <sup>c</sup>	7.26 <sup>b</sup>	6.42 <sup>d</sup>	7 <sup>de</sup>	5.66 <sup>ef</sup>	9 <sup>ab</sup>	7.22 <sup>de</sup>	8.0 <sup>a</sup>	7 <sup>ab</sup>	7.66 <sup>a</sup>	7.55 <sup>a</sup>
CV (%)	6.27	6.25	4.57	6.20	6.48	7.06	13.29	9.816	10.27	10.11	9.25	9.91
LSD (5%)	0.88	0.78	0.44	0.41	0.90	0.75	1.45	0.66	1.1	1.54	1.06	0.58

NB: FL = number of fingers per plant, NFP<sup>-1</sup> = number of fingers per plant, PTP<sup>-1</sup> = productive tiller per plant.

Means with the same letters for traits are not significantly different at ( $p < 0.05$ )

Table 4: The mean value of Biomass, Grain yield and Harvest index across location

Varieties	BM (kg ha <sup>-1</sup> )				GY (kg ha <sup>-1</sup> )				HI			
	Kaysa	Baytesimal	Alga	Combined	Kaysa	Baytesimal	Alga	Combined	Kaysa	Baytesimal	Alga	Combined
BKFM	22000 <sup>e</sup>	26111 <sup>bcd</sup>	33333 <sup>bcd</sup>	27148.15 <sup>e</sup>	1322.3 <sup>f</sup>	1122.2 <sup>d</sup>	1579 <sup>g</sup>	1341.18 <sup>h</sup>	0.06	0.043	0.04	0.090
Bako-09	26667 <sup>abcd</sup>	28611 <sup>abcd</sup>	29584 <sup>d</sup>	28287. <sup>de</sup>	2783.3 <sup>c</sup>	2161.1 <sup>c</sup>	3166.7 <sup>d</sup>	2703.70 <sup>c</sup>	0.1	0.076	0.11	0.098
Gute	25000 <sup>bcd</sup>	27222 <sup>abcd</sup>	31667 <sup>cd</sup>	27962 <sup>de</sup>	2626.7 <sup>c</sup>	1555.6 <sup>d</sup>	2441.7 <sup>e</sup>	2207.96 <sup>e</sup>	0.11	0.057	0.07	0.082
Urji	27333 <sup>abcde</sup>	24444 <sup>d</sup>	29583 <sup>d</sup>	27120.37 <sup>e</sup>	2733.3 <sup>c</sup>	1558.3 <sup>d</sup>	1641.7 <sup>fg</sup>	1977.77 <sup>f</sup>	0.1	0.063	0.05	0.073
Tesema	32667 <sup>ab</sup>	30000 <sup>ab</sup>	42500 <sup>a</sup>	34277.78 <sup>a</sup>	3366.7 <sup>b</sup>	3150 <sup>a</sup>	3662.5 <sup>b</sup>	3691.94 <sup>a</sup>	0.10	0.10	0.10	0.11
Gudetu	28333 <sup>abcd</sup>	25000 <sup>cd</sup>	37917 <sup>abc</sup>	30416.67 <sup>bcd</sup>	2630 <sup>c</sup>	2566.7 <sup>bc</sup>	2458.3 <sup>e</sup>	2551.66 <sup>cd</sup>	0.09	0.10	0.06	0.086
Boneya	29667 <sup>a</sup>	34167 <sup>abc</sup>	39583 <sup>ab</sup>	33898.15 <sup>ab</sup>	3166.7 <sup>b</sup>	2611.1 <sup>bc</sup>	3570.8 <sup>c</sup>	3190.27 <sup>b</sup>	0.09	0.076	0.09	0.18
Diga-1	31000 <sup>ab</sup>	26389 <sup>bcd</sup>	32917 <sup>bcd</sup>	30101.85 <sup>cde</sup>	1276.7 <sup>f</sup>	14444 <sup>d</sup>	1975 <sup>f</sup>	1565.37 <sup>g</sup>	0.04	0.054	0.06	0.052
Wama	32000 <sup>a</sup>	26944 <sup>abcd</sup>	37917 <sup>abc</sup>	32287.04 <sup>abc</sup>	2066.7 <sup>d</sup>	2369.4 <sup>c</sup>	3104.2 <sup>d</sup>	2513.42 <sup>d</sup>	0.06	0.088	0.08	0.16
Kako-1	30333 <sup>abc</sup>	28333 <sup>abcd</sup>	32500 <sup>bcd</sup>	30166.67 <sup>cde</sup>	3363.3 <sup>b</sup>	3236.1 <sup>a</sup>	3577.5 <sup>b</sup>	3593.42 <sup>a</sup>	0.10	0.11	0.11	0.12
Bareda	28667 <sup>abcd</sup>	28667 <sup>abcd</sup>	37083 <sup>abc</sup>	30990.74 <sup>abed</sup>	2666.7 <sup>c</sup>	1419.4 <sup>d</sup>	1470.8 <sup>g</sup>	1852.31 <sup>f</sup>	0.09	0.053	0.03	0.062
Addis-01	23333 <sup>de</sup>	25833 <sup>cd</sup>	32500 <sup>bcd</sup>	27222.2 <sup>e</sup>	1596.7 <sup>e</sup>	2605.6 <sup>c</sup>	3041.7 <sup>d</sup>	2414.62 <sup>d</sup>	0.26	0.100	0.098	0.15
Tadesse	24000 <sup>cde</sup>	29444 <sup>a</sup>	40000 <sup>ab</sup>	32722.2 <sup>abc</sup>	3666.7 <sup>a</sup>	2633.3 <sup>a</sup>	3962.5 <sup>a</sup>	3746.75 <sup>a</sup>	0.15	0.08	0.07	0.12
CV (%)	13.45	8.55	12.86	12.32	5.33	6.70	6.87	6.68	8.09	8.09	6.57	4.32
LSD (0.05)	6294.7	3985.2	7616.8	3493.73	229.87	246.78	341.53	161.07	NS	NS	NS	NS

NB: BM =biomass, GY= grain yield, HI= harvest index. Note: Means with the same letters for traits are not significantly different at ( $p < 0.05$ )

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### **Farmers' Evaluation Results of Tested Finger Millet Varieties:**

The full participation of farmers was a key tool for the evaluation and adoption of improved varieties of different crops. The selection of the finger millet variety was carried out at the maturity stage of the crop by organizing a field day /field visit /. The direct variety selection result of the farmers' selection criteria is described here under (Table 6,). The selection criteria that farmers depended on for selection were lodging resistance, seed color, number of fingers per plant and early maturity. At the time of criteria selection, women and men farmers participated directly and the interest of selection depends on the demand to generate income in the local market and home consumption and the

selection criteria were the same in all locations. These may be due to the common trait of interest, ease of cultural practice, processing, and cultural value. At all three locations (Kaysa, Baytesimal and Alga kebeles) Tadesse, Tesema and Kako-1 finger millet varieties were preferred for good seed color, lodging resistance and a greater number of fingers per plant (Table 6). Finally, farmers and their respective experts selected Tadesse, Tesema and Kako-1 varieties as first, second and third choice of their interest respectively. In addition, farmers and the respective district and staff members of the Agricultural and Natural Resource Development Office requested and decided to multiply and promote the seeds of the selected varieties to the end-user.



Figure 1. Picture was taken during the vegetative stage.





Figure 2. Picture was taken during the selection of the farmers' varieties according to their criteria on field visit (field day)

Table 5: Direct ranking of Finger millet varieties selection criteria used by farmers at three locations

Varieties	Kaysa participants						Baytesimal participants						Alga participants					
	SC	LR	FP	ERl	Total	Rank	SC	LR	FP	ERL	Total	Rank	SC	LR	FP	ERL	Total	Rank
Tesema	10	8	6	12	36	2	15	10	8	14	47	2	4	5	3	6	18	2
Tadesse	16	14	15	14	59	1	16	10	8	15	49	1	5	7	6	6	26	1
Kako-1	6	5	4	20	35	3	14	5	10	17	46	3	4	2	3	8	17	3
BKFM-	0	2	4	0	6	13	0	0	5	0	5	13	0	1	2	0	3	13
Bako-09	3	6	3	9	21	3	1	4	4	5	14	4	3	3	1	5	12	4
Gute	2	1	4	2	9	9	0	1	3	2	6	11	3	2	3	2	10	6
Urji	7	4	3	2	16	5	4	3	2	2	11	6	5	2	1	3	11	5
Gudetu	1	2	3	2	8	10	1	2	3	2	8	9	2	1	3	3	9	7
Boneya	3	3	4	5	15	5	3	2	4	4	13	5	0	2	3	3	8	8
Diga-1	2	1	1	2	4	12	2	1	1	0	4	12	2	2	1	2	7	9
Wama	2	4	3	4	13	7	2	3	2	3	10	7	2	1	2	1	6	10
Bareda	0	3	2	2	7	11	0	3	2	2	7	10	0	0	2	2	4	11
Adiss-01	3	2	2	4	11	8	3	1	2	3	9	8	2	0	1	2	5	12

NB: SC=seed color, LR=loading resistance, FP= finger per plant, ERL= earliness (maturity)



#### 4. CONCLUSION

Participatory variety selection was done at Kaysa, Baytesimal and Alga kebeles South Ari District, South Omo Zone, Southern Ethiopia during the 2019 main cropping season. Analysis of variance results revealed that significant differences observed between the finger millet varieties for all the parameters studied. The mean grain yield value of the three locations for the studied varieties showed that, varieties Tadesse, Tesema and Kako-1 were the well-adapted and preferred varieties. In these experiment trials, the farmer's preference coincided with the research findings for most of the selected varieties. Research findings and farmers' variety selection criteria are most important to consider for proper variety selections. Due to this, the preferred varieties were found to be well adapted and promising to the tested areas and similar agro-ecologies and thus could be demonstrated and popularized to the small-scale farmers.

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