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Yield Performance and Adaptability of Anchote (Coccinia abyssinica) in Horro Guduru Wallaga, Ethiopia

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Article

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Abstract

Anchote (Coccinia abyssinica (Lam.) Cogn.) is a valuable root crop in western and southwestern Ethiopia, though its distribution and adaptation vary across the region. A field experiment was conducted in Horro Guduru Wallaga, Ethiopia, with eight accessions (Desta 01, 223098, 223101, Kuwe, 90801, 240407B, 223090, and 220563) using a randomized complete block design (RCBD) with three replications to evaluate their adaptability. Data were analyzed with SAS 9.3. Results showed significant differences among accessions due to genetic and environmental factors. The highest mean values were recorded at Abay Coman and Jimma Geneti, respectively: emergence percentage (92% and 94.5%), days to physiological maturity (124.33 and 123.17), vine number (5.11and 4.56), vine length (3.98m and 2.98m), internode length (15.44cm and 15.14cm), leaf number (75.18 and 73.84), leaf area (143.45 cm² and 136.45 cm²), total biomass (12.63kg and 10.63kg), storage root diameter (75.25mm and 72.25mm), total root weight (0.73 kg and 0.65 kg), marketable root yield (41.18 t/ha and 29.73 t/ha), unmarketable yield (3.94 t/ha and 2.97 t/ha), total yield (46.73 t/ha and 30.39 t/ha), and harvest index (83.62% and 79.86%). Desta 01 and other well-adapted accessions should be promoted for their superior adaptability and higher yield. Further agronomic and nutritional research is recommended.

1. Introduction

Among root and tuber crops, anchote [(*Coccinia abyssinica* (Lam.) Cogn.] is the most important endemic root crop in West Wallaga, Oromia, Ethiopia. It holds strong cultural, social, and economic significance for farming communities[1]. Predominantly grown by the Oromo people, anchote has potential to contribute to food security to other regions such as the SNNP Regional State[2]. Despite this value, it remains under-researched compared to other tubers.At least eight *Coccinia* taxa related to *C. abyssinica* occur in Ethiopia, but comprehensive taxonomic and ecological work is lacking ([3]; [4]). Although sub-Saharan Africa has about 27 species, Ethiopia cultivates only *C. abyssinica* for food [5]. Anchote shows high agro-morphological, biochemical, and genetic diversity [6]. Yield varies widely, ranging from 42–76 t ha^{-1} across accessions ([1], highlighting improvement potential.

Nutritionally, anchote is rich in calcium and protein and is traditionally believed to aid bone healing[5]. It is valued for pregnant and nursing women in western Ethiopia, where soups and porridges are prepared after childbirth [7]. In Wollega, it serves as a staple during food-scarce months [8]. The Oromo also use it in rituals, special guest meals, and animal fattening.

Despite these values, its cultivation is limited. Challenges include low awareness of nutritional and cultural importance, lack of improved cultivars, and poor knowledge of agronomic practices such as planting time, density, and ecological adaptation [9]). Anchote is a short-cycle, high-yielding crop, but production remains constrained by the absence of widely adaptable varieties.Institutional neglect further limits development. Targeted policies, breeding programs, and extension services are minimal [10]. Research on genetic diversity, trait associations, and agronomy is scarce, while evidence-based recommendations for nutrient management, water use, and pest/disease control are lacking. Studies on storage, processing, shelf life, and product diversification remain underdeveloped.

Nutritional profiling beyond basic composition is incomplete, hindering promotion as a health food[11]. Limited analysis of production constraints, market chains, consumer preferences, and economic potential constrains policy and investment [12]. Expanding cultivation to new areas could strengthen food security given anchote's nutritional richness and adaptability[13].Therefore, this study aims to evaluate anchote adaptability in terms of growth, yield, and yield components to support wider utilization and improvement.

2. Materials And Methods

2.1.Description of the study area:The experiment was carried out in two locations: Abay Coman and Jimma Geneti woreda. Abay Coman, the administrative center of the Abay Chomen district, is situated approximately 47 km from the zonal capital, Shambu, and 280 km from Addis Ababa,the capital city of Oromia. The district is located at 9°54'N latitude and 37°27'E longitude, with an elevation ranging between 880 and 2,400 meters above sea level. The area experiences an annual temperature range of 22°C to 27°C and receives between 510 mm and 1,530 mm of rainfall annually.Jimma Geneti Woreda, located in the Horro Guduru Wollega Zone of the Oromia Regional State, lies about 28.7 km from the zonal capital and approximately 275 km from Addis Ababa.The woreda lies within mid-to-high-altitude agro-ecological zones, with an elevation of 2,485 meters above sea level. It is

positioned at coordinates 09°04'N latitude and 37°0'E longitude. The district has an average annual rainfall of 1,832.06 mm, while temperatures range from a minimum of 14.6°C to a maximum of 23.19°C

Figure 1. Location map of the study area in Jimma Geneti Woreda, Belelbela Sorbo Kebele.

.2.2.Experimental materials, treatments, and design:The seeds of the anchote used for this experiments were obtained from the Debre Zeit Agricultural Research Center.They were one improved variety(Desta 01), and seven accessions 90801, 240407B, 220563, 223090, 223098, 223101, and Kuwe.The experimental layout was randomized using the proc plan/proc surveys elect procedure in SAS 9.3.And the experiment was arranged using a Randomized Complete Block Design (RCBD) with three replications. The experimental field was arranged in three blocks, each containing eight plots,with a 1-meter alley separating the blocks.Within each block, individual plots were spaced 0.5 meters apart to minimize interference. Each plot measured 2 m × 2 m (4 m²), with rows spaced 40 cm apart and plants spaced 10 cm within the rows.This setup resulted in a total of 24 plots, corresponding to the eight treatments.

Table 1
Anchote (*Coccinia abyssinica*) variety/accessions evaluated in the experiments

Collected area				
Accessions/variety	**Region**	**Zone**	**District**	**Types of accessions**
Desta 01				Released variety
90801	Oromia	Horro Guduru Wallaga	Abay Coman	Local variety
240407B	SNNPRS	Kaficho	Decha	Local variety
220563	Oromia	West Shoa	Bako Tibe	Local variety
223090	Oromia	West Wallaga	Gimbi	Local variety
223098	Oromia	Eest Wallaga	Guto Wayu	Local variety
223101	Oromia	Eest Wallaga	Jimma Arjo	Local variety
Kuwe	Oromia	East Wallaga	Sibu Sire	Local variety

2.3.Experimental procedures:Seeds were sown at a rate of three per hill, following the intended plot design. Planting was carried out in well-prepared beds, with seeds placed at a depth of 5 cm in the soil, arranged in five rows per bed. Direct seeding was employed, and all standard cultural practices including weeding, hoeing, and staking were meticulously followed.The harvest took place in April 2021. Maturity was determined based on physiological indicators, with harvesting completed on September 13, 2021, once more than 90% of the plants in a plot exhibited maturity (> 90% leaf withering).

2.4.Data collection:During the field experiment, growth data were collected from 10 randomly selected, pre-tagged plants in the center rows of the net plot. The number of days to maturity was recorded on a plot basis. Yield data were gathered from the net plot, while yield components were assessed either from the net plot or from ten randomly selected plants.

2.4.1.Phenological parameters:
Emergence Percentage (EP): Calculated by dividing the number of emerged seeds by the total seeds sown per plot and averaging across plots. This method is commonly used in seedling emergence studies to assess plant establishment

Days to Physiological Maturity

Defined as the time when 75% of the plants in a plot exhibited leaf yellowing, drying, or senescence, indicating the onset of physiological maturity .

2.4.2.Growth Parameters
Vine Numbers (VN)

At maturity or four months after sowing, the number of vines per hill was counted from 10 randomly selected plants per plot and averaged. This approach is standard in vine growth assessments .

Vine Length (VL)

Measured in meters from the base to the tip of 10 randomly selected plants per plot at maturity or four months after sowing; the average was recorded .

Vine Internode Length (VIL)

Length of the inter-nodes from the central portion of vines of 10 sample plants was measured in centimeters at maturity or four months after sowing; the average was calculated

Number of Leaves (NoL)

Total leaves of 10 randomly selected plants were counted at two, three, and four months after sowing, and the average was determined .

Leaf Area (LA)

Calculated as leaf length × leaf breadth (cm^2) from 10 leaves randomly selected from the middle portion of 10 plants at full maturity; the mean was recorded .

Total Biomass (TBM)

Determined at harvest by weighing total above- and below-ground biological yield per plot .

2.4.3.Yield and yield components
Storage Root Diameter (SRD)

Diameter of 10 randomly selected storage roots was measured in the middle in millimeters, and the mean per plot was calculated .

Total Storage Root Weight (TRW)

Weight of 10 randomly selected storage roots was measured in kilograms using a sensitive balance, and the average per plot was recorded .

Marketable Storage Root Yield (MRY)

Weight (kg) of storage roots free from disease, damage, or inappropriate size per plot .

Unmarketable Storage Root Yield (UMRY)

Weight (kg) of damaged, diseased, oversized, or undersized roots per plot .

Total Storage Root Yield (TRY)

Measured in tons per hectare from sampled plants across all plots .

Harvest index: It was recorded as the proportion of the dry weight of the root to the total mass weight of the plant ([14]). This was calculated as:

$HI = EY/BY \times 100$

Where, EY: weight of matured dry root (Economic Yield);

BY: weight of biological yield (above and below-ground dry weight).

2.5.Data analysis. Data were analyzed using the Statistical Analysis System (SAS) version 9.3 (SAS Institute Inc., 2014). Analysis of variance (ANOVA) was performed, and means were separated using the Least Significant Difference (LSD) test at a 5% significance level.

3. Results and Discussion

3.1.Days to 50% Emergence and Days to Physiological Maturity.The ANOVA results revealed a significant difference ($P < 0.05$) among varieties regarding days to 50% emergence and days to Physiological Maturity. The Desta 01 and 223098 accessions showed the best performance at and Abay Coman, with emergence rates of 92% and 94.5%, respectively. Notably, the highest emergence rate at was statistically comparable to those of the 90801 accession (90.5%) and the 220563 accession (90%). The 223090 accession achieved an emergence rate of 92.08% at Abay Coman. In contrast, the lowest emergence rates were observed in the 223101 accession, with values of 81.67% at and 78.67% at Abay Coman (Tables 2 and 3).The study found that anchote seeds emerged earlier under Abay Coman conditions than under Jimma Geneti, likely due to temperature differences, with soil conditions also influencing emergence.

The vegetation period for anchote ranged from 110 to 124 days on average, depending on the variety and the local agro-ecological conditions of and Abay Coman. At, the accessions 223098, Kuwe, 223090, and 220563 had statistically similar maturity dates, with the longest duration of 124.33 days recorded for the 223101 accession. The Desta 01 variety, however, reached physiological maturity the earliest, with a maturity date of 112.50 days, followed by the 90801 accession at 115.00 days. At Abay Coman, the Kuwe accession had the longest maturity duration (123.17 days), which was statistically equivalent to the 223101 accession (122.33 days). The Desta 01 variety again showed the shortest maturation time at 110.83 days (Tables 2 and 3). Variation in maturity dates could be affected by planting date and climatic conditions, consistent with [15], who reported potato vegetation periods ranging from 90 to 124 days.

3.2.Vine Number,Vine Length and Vine Internode Length. According to the ANOVA results, there were significant difference in vine number ,Vine Length and Vine Internode Length ($P < 0.05$) between the accessions.The plot at with the Kuwe anchote seed sown had the maximum number of vines (5.11). This treatment produced more vines than any other. The next highest value was recorded for accession 223101 (4.37), while accession 240407B produced the lowest value (3.50). Similarly, at the Abay Coman location, the greatest number of vines (4.56) came from accession Kuwe, followed by the Desta 01 variety (4.40). On the other hand, accession 223098 recorded the lowest value (3.11) (Tables 2 and 3).The highest mean vine lengths (3.91 m and 2.98 m) were recorded for accession 240407B at and Abay Coman, respectively.

The result for the Desta 01 variety (3.73 m) was statistically equal to the highest value obtained at. In contrast, accession 220563 had the shortest vine length (2.59 m) at, while at Abay Coman, the shortest vine length was recorded for accession 220563 (1.79 m) (Tables 2 and 3).According to the findings, accession 240407B had the longest mean vine inter-nodes at both and Abay Coman, measuring 15.44 cm and 15.14 cm, respectively, while all other treatments had shorter inter-nodes. Under conditions, the value of 15.44 cm was higher than the average vine internode length, with accession Kuwe following at 13.97 cm. At Abay Coman, accession Kuwe had the second-longest inter-nodes (13.77 cm). Conversely, accession 220563 had the shortest vine internode length at both (11.87 cm) and Abay Coman (10.60 cm) (Tables 2 and 3). The results from the Abay Coman location were statistically equivalent to the value (11.76 cm) from accession 223090. Similarly, the shortest value at was statistically equivalent to the results (12.53 cm and 12.89 cm) from accessions 223098 and 223090, respectively.

Significant variation in vine number among accessions aligns with previous research. [16] reported that combined phosphorus and farmyard manure application positively influenced yield components, including vine development. Higher vine numbers in accessions like Kuwe and 223101 suggest inherent traits for better vegetative growth, while lower numbers in 240407B may reflect less favorable agronomic characteristics. Vine number and vine length appear inversely related; shorter vines tend to have more vines. Higher vine internode lengths in 240407B and Kuwe suggest superior vegetative growth traits, whereas shorter inter-nodes in 220563 and 223090 may indicate lower adaptability. Selecting accessions based on environmental conditions is critical for optimizing anchote production, and further research is needed on genetic and environmental factors affecting vine internode length.

3.3.Number of leaves,leaf area and total biomass.Significant ($P < 0.05$) differences in Number of Leaves,leaf area and Total Biomass were observed due to environmental and varietal factors.The findings showed that accession Kuwe had the greatest mean number of leaves at and Abay Coman, with values of 75.18 and 73.84, respectively. The results for accession 223101 (61.42) and the Desta 01 variety (62.89) were statistically equal to the highest value observed at.The minimum values (47.49 and 42.51) were recorded for accessions 220563 and 223090 at and Abay Coman, respectively (Tables 2 and 3). The study found that the Desta 01 variety had the largest mean leaf area, with values of 143.45 cm² at and 136.45 cm² at Abay Coman, which were larger than those of all other treatments. At, the next largest leaf area (140.12 cm²) was recorded for accession 223101. The greatest value at Abay Coman was statistically equivalent to the values (136.12 cm² and 124.78 cm²) recorded for accessions 223101 and 223090, respectively.Accessions 90801 showed the smallest leaf areas, measuring 98.62 cm² at and 94.62 cm² at Abay Coman. At, this lowest value was statistically equivalent to the results from Kuwe (104.76 cm²) and 223098 (110.88 cm²). Similarly, the lowest value recorded at Abay Coman was statistically equivalent to the values (96.09 cm² and 95.75 cm²) from Kuwe and 223098, respectively (Tables 2 and 3).

The findings revealed that the Desta 01 variety had the highest mean total biomass at and Abay Coman, with values of 12.63 kg and 10.63 kg, respectively. The highest score at was greater than that of all other accessions. The highest values at were statistically equivalent to the values (12.53 kg, 11.70 kg, and 11.17 kg) recorded for accessions 220563, 223090, and 223098, respectively. The lowest total biomass values (7.93 kg and 6.49 kg) were recorded for accessions Kuwe and 223101 at and Abay Coman, respectively (Tables 2 and 3). The lowest value at was statistically equivalent to the values (9.27 kg, 9.16 kg, and 9.53 kg) from accessions 90801, 223101, and 240407B, respectively. Similarly, the lowest result at Abay Coman was statistically equivalent to the value (6.60 kg) from accession Kuwe (Tables 2 and 3).

More anchote varieties produced more leaves at both locations, indicating favorable conditions for vegetative growth. Notable variation in mean leaf area was observed, with Desta 01 having the largest leaves, followed by 223101, and smaller dimensions in 90801. Leaf area responds to abiotic factors such as light, temperature, soil nutrients, and moisture.Variation in total biomass among accessions indicates significant genotypic differences. Desta 01 consistently showed superior biomass, suggesting strong adaptability and vigor. High-performing accessions also included 220563, 223090, and 223098, while Kuwe and 223101 had lower biomass, likely due to genetic limitations or poor adaptation. These findings align with previous reports of genotypic variability in anchote and related root crops ([17]; [18]; [1]).

Table 2
Combined mean values for different traits of tested anchote varieties at Jimma Geneti in 2020/2021 main cropping season.

Treatment	Emergency Percentage	Days of Physiological Maturity	Vine Number	Vine Length	Vine Internode Length	Leaf Number	Leaf Area	Total Biomass	
Desta 01		92.00^{a}	112.50^{d}	4.34^{cb}	3.73^{a}	13.32^{cb}	62.89^{ba}	143.45^{a}	12.63^{a}
90801		90.50^{a}	115.00^{dc}	3.82^{cbd}	2.86^{bc}	13.18^{cb}	49.80^{b}	98.62^{d}	9.27^{dc}
240407B		89.75^{ba}	115.67^{bdc}	3.50^{d}	3.91^{a}	15.44^{a}	56.22^{b}	121.09^{bc}	9.53^{bdc}
220563		90.00^{a}	120.50^{bac}	3.99^{cbd}	2.59^{c}	11.87^{d}	47.49b	110.88^{dc}	12.53^{a}
223090		85.083^{bc}	121.50^{ba}	4.20^{cb}	2.86^{bc}	12.53^{cd}	48.85^{b}	130.78^{ba}	11.70^{ba}
223098		88.50^{ba}	123.83^{a}	3.66^{cd}	3.42^{ba}	12.89^{cbd}	51.67^{b}	102.76^{d}	11.17^{bac}
223101		81.67c	124.33^{a}	4.37^{b}	3.33^{bac}	13.37^{cb}	61.42^{ba}	140.12^{b}	9.16^{dc}
Kuwe		88.11^{ba}	122.17^{a}	5.11^{a}	3.53^{ba}	13.97^{b}	75.18^{a}	104.76^{d}	7.93^{d}
LSD $_{0.05}$		4.81	5.85	0.67	0.75	1.17	15.86	14.64	2.29
CV $_{\%}$		3.11	2.80	9.33	12.99	5.08	15.97	7.02	12.49

Keys:CV =Coefficient of Variations, LSD= Least Significance Difference.

Table 3
Combined mean values for different traits of tested anchote varieties at Abay Coman in 2020/2021 main cropping season.

Treatments	Emergency Percentage	Days of Physiological Maturity	Vine Number	Vine Length	Vine Internode Length	Leaf Number	Leaf Area	Total Biomass
Desta 01	82.00^{d}	110.83^{g}	4.40^{ba}	2.53^{b}	12.92^{cbd}	55.89^{bc}	136.45^{a}	10.63^{a}
90801	83.50^{d}	113.00^{f}	3.25^{c}	2.23^{c}	13.04^{cbd}	45.80^{bc}	94.62^{e}	7.27^{d}
240407B	89.08^{c}	116.00^{e}	3.55^{bc}	2.98^{a}	15.14^{a}	54.89^{bc}	119.76^{bc}	7.53^{d}
220563	88.67^{c}	118.50^{d}	3.44^{c}	1.79^{d}	10.60^{e}	44.49^{bc}	107.88^{dc}	8.20^{c}
223090	92.08^{b}	119.50^{c}	3.65^{bac}	2.06^{dc}	11.76^{ed}	42.51^{c}	124.78^{ba}	8.70^{c}
223098	94.50^{a}	121.17^{b}	3.11^{c}	2.02^{dc}	12.39^{cd}	45.67^{bc}	95.76^{de}	9.83^{b}
223101	78.67^{e}	122.33^{a}	3.82^{bac}	2.53^{b}	13.17^{cb}	58.42^{ba}	136.12^{a}	6.49^{e}
Kuwe	82.11^{d}	123.17^{a}	4.56^{a}	2.53^{b}	13.77^{b}	73.84^{a}	96.09^{de}	6.60^{e}
LSD 0.05	2.21	0.93	0.92	0.29	1.32	15.81	12.64	0.55
CV $_{\%}$	1.46	0.45	14.12	7.09	5.86	17.13	6.34	3.88

Keys:CV =Coefficient of Variations, LSD= Least Significance Difference.

3.4.Storage root diameter,total root weight and marketable yield.The analysis of variance revealed significant differences ($P < 0.01$) in the storage root diameter,total root weight and marketable yield of anchote across different varieties and locations. At and Abay Coman, the Desta 01 variety exhibited the largest root diameters, with values of 75.25mm and 72.25mm, respectively. However, the highest value at Jimma Geneti was statistically comparable to those of accessions 240407B (70.00mm), 223090 (69.87mm), and Kuwe (67.43mm). Similarly, the maximum root diameter at Abay Coman was statistically similar to the values of 240407B (67.00mm) and 223090 (70.20mm). In contrast, 223101 accession recorded the lowest values of 59.57mm and 56.57mm at Jimma Geneti and Abay Coman, respectively (Tables 4 and 5). These minimum values were statistically comparable to those of several other accessions.At Jimma Geneti, the Desta 01 variety (0.73kg) and accession 220563 (0.65kg) produced the highest root weights, with the latter being the predominant variety at this location. The highest value at Jimma Geneti was statistically comparable to the values obtained from accessions 223101 (0.70kg) and 223090 (0.68kg). At Abay Coman, the highest total root weight was recorded for Desta 01 (0.62kg), with values from 223101 (0.61kg) and 223090 (0.55kg) being statistically similar. In contrast, 240407B and Kuwe accessions recorded the lowest total root weights (0.45kg and 0.38kg, respectively) at both locations. The 220563 accession also ranked low at Jimma Geneti with a weight of 0.58kg. At Abay Coman, 240407B and Kuwe again yielded the lowest weights (0.41kg and 0.44kg, respectively), with the results being statistically comparable to those from other accessions (Tables 4 and 5).

The highest yields of marketable roots at Jimma Geneti and Abay Coman were observed in native accessions **90801** (41.18 t/ha) and 220563 (29.73 t/ha). Notably, the highest score at Jimma Geneti was statistically equivalent to the results obtained from several other varieties. At Abay Coman, **240407B** accession ranked second with a yield of 26.74 t/ha. The lowest marketable yield values were observed in **220563** (30.62 t/ha) at Jimma Geneti and **223090** (21.39 t/ha) at Abay Coman. The lowest yield at Jimma Geneti was statistically similar to the values from accessions 240407B (35.12 t/ha) and 223090 (36.18 t/ha). The lowest yield at Abay Coman, 21.39 t/ha, was recorded for **223090 accession** (Tables 4 and 5).

Significant differences in root diameter highlight genetic variability. Desta 01 had the largest roots at both sites, comparable to 240407B and 223090, while 223101 showed the smallest diameters, limiting storage organ development. This morphological diversity is important for yield and utilization and supports selecting superior accessions like Desta 01 and 223090 for breeding programs (([17];[18];[1])).Variation in total root weight was observed across accessions. 223101 and 223090 delivered the heaviest yields at both locations, with Desta 01 performing well at Abay Coman. Lighter roots were recorded in 240407B and

Kuwe, suggesting a need for further selection or improvement.Marketable root yields varied due to both genetics and environment. Accessions 90801 and 220563 produced the highest yields, indicating strong adaptability. These results are in agreement with [19], suggesting that genetic and environmental factors play significant roles in tuber bulking.240407B performed well at Abay Coman, highlighting site-specific adaptation, while lower yields in 223090 and 220563 suggest sensitivity to environmental variability. Selecting broadly adaptable genotypes like 90801 and 220563 could enhance stable root productivity ([20]; [21]; [22]).

3.5.Unmarketable yield,total yield and harvest Index.The results of the analysis of variance revealed significant differences ($P < 0.01$) in the unmarketable yield,total yield and harvest index across varieties and locations. At Jimma Geneti and Abay Coman, the Desta 01 (6.13 t/ha) and 220563 (3.94 t/ha) accessions yielded the highest unmarketable yields, followed by 240407B (2.97 t/ha). On the other hand, 223090 showed the lowest unmarketable yields at both locations, with values of 1.33 t/ha and 0.66 t/ha, respectively. The lowest values at both locations were statistically comparable to those of other accessions such as 223101, 240407B, and Desta 01 (Tables 4 and 5).

At Jimma Geneti, **Desta 01** (46.73 t/ha) and **220563** (30.39 t/ha) accessions produced the highest total yields. The highest value at Jimma Geneti was statistically similar to those of accessions **90801** (44.96 t/ha), **223098** (43.37 t/ha), and **Kuwe** (42.29 t/ha). Conversely, **240407B** ranked second with a yield of 26.74 t/ha at Abay Coman. At Abay Coman, **220563** (33.89 t/ha) and **223090** (21.39 t/ha) produced the lowest total yields. However, the lowest yield at Jimma Geneti (33.89 t/ha) was statistically comparable to those from accessions **240407B** (37.06 t/ha)(Tables 4 and 5). At Jimma Geneti, **Desta 01** (83.62%) and **220563** (79.86%) had the highest harvest indices, with the highest value at Jimma Geneti being statistically comparable to those of **223098** (77.26%), **220563** (76.74%), and **240407B** (74.55%). Similarly, at Abay Coman, **220563** recorded the highest harvest index at 79.86%, followed by **223090** (77.84%). On the other hand, the **Kuwe** accession and **Desta 01** at Abay Coman exhibited the lowest harvest index values, 63.53% and 67.74%, respectively. With the exception of the highest value, all scores obtained at were statistically comparable. At Abay Coman, the lowest harvest index values were statistically comparable to those of **223101** (68.07%) and **Kuwe** (64.74%)(Tables 4 and 5). These variations in harvest index may be attributed to the differences in root size and the overall adaptability of the accessions to the respective environments.

Higher unmarketable yields may result from a greater number of roots or small root size, consistent with [15]. Total yield increases were associated with more roots per plant and larger root size ([23]. Variations in harvest index (HI) reflect genotype and environmental influences on assimilate partitioning. High HI values in Desta 01 and 220563 indicate efficient allocation to storage roots, while lower values in Kuwe and Desta 01 at Abay Coman suggest reduced adaptability, confirming that root size, genotype, and environment are central to HI determination ([20]; [21]; [22]).

Table 4
Combined mean values for different traits of tested anchote varieties at Jimma Geneti in 2020/2021 main cropping season.

Treatments	Storage Root Diameter	Total Root Weight	Total Root Yield	Marketable Root Yield	Unmarketable Root Yield	Harvest Index
Desta 01	75.25^{a}	0.73^{a}	46.73^{a}	40.60^{a}	6.13^{a}	83.62^{a}
90801	63.87^{bc}	0.63^{bdc}	44.96^{ba}	41.18^{a}	3.78^{b}	72.49^{bc}
240407B	70.00^{ba}	0.45^{e}	37.06^{dc}	35.12^{ba}	1.94^{c}	74.55^{bac}
220563	63.67^{bc}	0.58^{d}	33.89^{d}	30.62^{b}	3.94^{b}	76.74^{bac}
223090	69.87^{ba}	0.68^{bac}	38.06^{bdc}	36.18^{ba}	1.33^{c}	70.86^{bc}
223098	63.83^{bc}	0.62^{bdc}	43.37^{bac}	41.03^{a}	3.01^{cb}	77.26^{ba}
223101	59.57^{c}	0.70^{ba}	41.28^{bdac}	39.53^{a}	1.75^{c}	70.07^{bc}
Kuwe	67.43^{bac}	0.60^{dc}	42.29^{bac}	39.82^{a}	2.49^{cb}	67.74^{c}
LSD (*0.05*)	8.06	0.09	7.42	6.60	1.78	9.19
CV (%)	6.90	8.46	10.34	9.92	33.27	7.07

Keys:CV =Coefficient of Variations, LSD= Least Significance Difference

Table 5
Combined mean values for different traits of tested anchote varieties at Abay Coman in 2020/2021 main cropping season

Treatments	Storage Root Diameter	Total Root Weight	Total Root Yield	Marketable Root Yield	Unmarketable Root Yield	Harvest Index
Desta 01	72.25^{a}	0.62^{a}	23.94^{de}	23.94^{fe}	1.21^{cd}	63.53^{c}
90801	61.87^{dc}	0.44^{bc}	24.96^{cd}	24.96^{dc}	1.86^{cbd}	70.15^{b}
240407B	67.00^{bac}	0.46^{bc}	26.74^{b}	26.74^{b}	2.97^{b}	70.55^{b}
220563	61.67^{dc}	0.65^{a}	30.39^{a}	29.73^{a}	5.93^{a}	79.86^{a}
223090	70.20^{ba}	0.55^{ba}	21.39^{f}	21.39^{g}	0.66^{d}	77.84^{a}
223098	61.83^{dc}	0.41^{c}	23.37^{e}	23.37^{f}	1.24^{cd}	72.26^{b}
223101	56.57^{d}	0.61^{a}	24.61^{cde}	24.61^{de}	2.08^{cb}	68.07^{cb}
Kuwe	65.43^{bc}	0.38^{c}	25.62^{cb}	25.62^{c}	2.62^{b}	64.74^{c}
LSD (*0.05*)	5.55	0.12	1.29	0.96	1.26	4.84
CV (%)	4.91	13.71	2.94	2.19	30.91	3.90

Keys:CV=Coefficient of Variations, LSD=Least Significance Difference

4. Conclusion

Based on the findings of this study, it is recommended that farmers in the study areas focus on growing the Desta 01 variety and other locally adapted anchote cultivars due to their superior adaptability and high yield potential. The results demonstrate that varieties such as Desta 01 outperform others in terms of growth, emergence percentage, physiological maturity, vine characteristics, root yield, and harvest index, especially in areas like Hereto and Abay Coman. These varieties show strong

environmental adaptability, which is crucial for resource-poor farmers. To enhance food security and productivity in the region, it is essential to promote the use of these high-yielding and locally available varieties, ensuring that they are accessible to farmers. Moreover, additional agronomic research and nutritional trials should be conducted to further optimize the growth and consumption of anchote, ultimately contributing to improved agricultural output and food security in the region. The study also highlights the importance of increased diversity in anchote varieties to meet the growing demands of the expanding population.

Declarations

Conflicts of Interest

The authors declare no conflicts of interest.

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Author Contribution

Biratu Abeshu:ConceptualizationBiratu Abeshu:Methodology: Biratu Abeshu:SoftwareBiratu Abeshu:ValidationAlemu Hailu:Formal AnalysisBiratu Abeshu:InvestigationAlemu Hailu:ResourcesAlemu Hailu:Data CurationBiratu Abeshu:Writing – Original DraftAlumu Hailu:Writing – Review & EditingAlumu Hailu:VisualizationAlemu Hailu:Supervision

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Data Availability

The raw data collected and analyzed during this study are available

References

1. Mengesha, D., Belew, D., Gebreselessie, W. & Sori, W. Growth and Yield Performance of Anchote [Cocciniaabyssinica (Lam.) Cogn]. *Response Contrasting Asian J. Plant. Sci.* **11** (4), 172–181 (2012).
2. Abera, G. & Haile, D. Yield and nutrient concentration of Anchote [Coccinia abyssinica (Lam.) Cogn.] affected by harvesting dates and in-situ storage. *Afr. J. Crop Sci.* **3** (5), 156–161 (2015).
3. Holstein, N. Monograph of Coccinia (Cucurbitaceae). *PhytoKeys* (54):1. (2015).
4. Dibaba, D. B., Olango, T. M., Asfaw, B. T., Mijena, D. F. & Terfa, M. T. Phenotypic Profiling of Anchote (Coccinia abyssinica (Lam.) Cogn.) Accessions Through Agro-Morphological and Physiological Markers. *Plants* **14** (15), 2334 (2025).
5. Yeshiwas, Y., Tadele, E. & Tiruneh, W. The dynamics of medicinal plants utilization practice nexus its health and economic role in Ethiopia: a review paper. *Int. J. Biodivers. Conserv.* **11** (1), 31–47 (2019).
6. Keno, O. L. Nutritional Composition of Anchote (Coccinia abyssinica (Lam.) Cogn.) and its Products: A Tip for Future Research and Development. *Ethiop. J. Agricultural Sci.* **34** (2), 104–114 (2024).
7. Gebeyehu, H. R. et al. Nutritional and anti-nutritional composition of anchote (Coccinia abyssinica ((Lam.) Cogn.) accessions in Ethiopia. *J. Agric. Food Res.* **15**, 100980 (2024).

8. Duresso, M. E. Study on ethnobotany and phenotypic diversity in anchote (Coccinia abyssinica (Lam.) Cogn.) landraces in Western Ethiopia. *Int. J. agricultural Sci.* **8** (2), 1402–1427 (2018).
9. Abera, G. & Guteta, H. Response of anchote (Coccinia abyssinica) to organic and inorganic fertilizers rates and plant population density in western Oromia, Ethiopia. *East. Afr. J. Sci.* **1** (2), 120–126 (2007).
10. Padulosi, S., Hodgkin, T., Williams, J. T. & Haq, N. Underutilized crops: trends, challenges and opportunities in the 21st century. In: *Managing plant genetic diversity Proceedings of an international conference, Kuala Lumpur, Malaysia, 12–16 June 2000: 2002*. CABI Publishing Wallingford UK: 323–338.
11. Gebru, M., Oduor, F., Lochetti, G., Kennedy, G. & Baye, K. Ethiopia's food treasures: revitalizing Ethiopia's underutilized fruits and vegetables for inclusion in the Food-Based Dietary Guidelines for improved diet diversity, nutrition and health of the population. (2019).
12. Gruère, G., Giuliani, A. & Smale, M. *Marketing underutilized plant species for the benefit of the poor: a conceptual framework* (Intl Food Policy Res Inst, 2012).
13. Temam, W. T. N. Analysis on Production Potential Of Anchote (Coccinia abyssinica) In East Wellega Zone, Oromia, Regional State, Ethiopia. *Int. J. Adv. Res. Biol. Sci.* **8** (12), 8–17 (2021).
14. Donald, C. & Hamblin, J. The biological yield and harvest index of cereals as agronomic and plant breeding criteria. *Adv. Agron.* **28**, 361–405 (1976).
15. Haile, B., Mohammed, A. & Woldegiorgis, G. Effect of planting date on growth and tuber yield of potato (Solanum tuberosum L.) varieties at Anderacha District, Southwestern Ethiopia. *Int. J. Res. Agric. Sci.* **2** (6), 2348–3997 (2015).
16. Anbesse, D. & Hailegeorgis, A. *Growth, Yield and Yield Components of Anchote (Coccinia Abyssinica L.) in Response to Farmyard Manure and Phosphorus Fertilizer Rates at Masha, South Western Ethiopia* (South Western Ethiopia, 2021).
17. Tsegaye, E. A. et al. Bacterial and fungal profile, drug resistance pattern and associated factors of isolates recovered from blood samples of patients referred to Ethiopian Public Health Institute: cross-sectional study. *BMC Infect. Dis.* **21** (1), 1201 (2021).
18. Arias Vilcapoma, H. Las medidas restrictivas de derechos en la investigación del delito de lavado de activos conforme a la legislación penal vigente. (2023).
19. Begna, T. Role of sorghum genetic diversity in tackling drought effect in Ethiopia. *Int. J. Adv. Res. Biol. Sci.* **8** (7), 29–45 (2021).
20. Bekele, T. Adaptability study of improved potato (Solanum tuberosum L.) varieties at Shebench district, south-western Ethiopia. (2018).
21. Misganaw, A. et al. Progress in health among regions of Ethiopia, 1990–2019: a subnational country analysis for the Global Burden of Disease Study 2019. *Lancet* **399** (10332), 1322–1335 (2022).
22. Engida, C. E. *Genetic diversity in yield traits and kernel composition of selected Ethiopian sorghum landraces* (University of the Free State, 2023).
23. Mohd Mehdi, M. M., Tahir Saleem, T. S., Rai, H., Mir, M. & Gyanendra Rai, G. R. Effect of nitrogen and FYM interaction on yield and yield traits of potato genotypes under Ladakh condition. (2008).

Figures

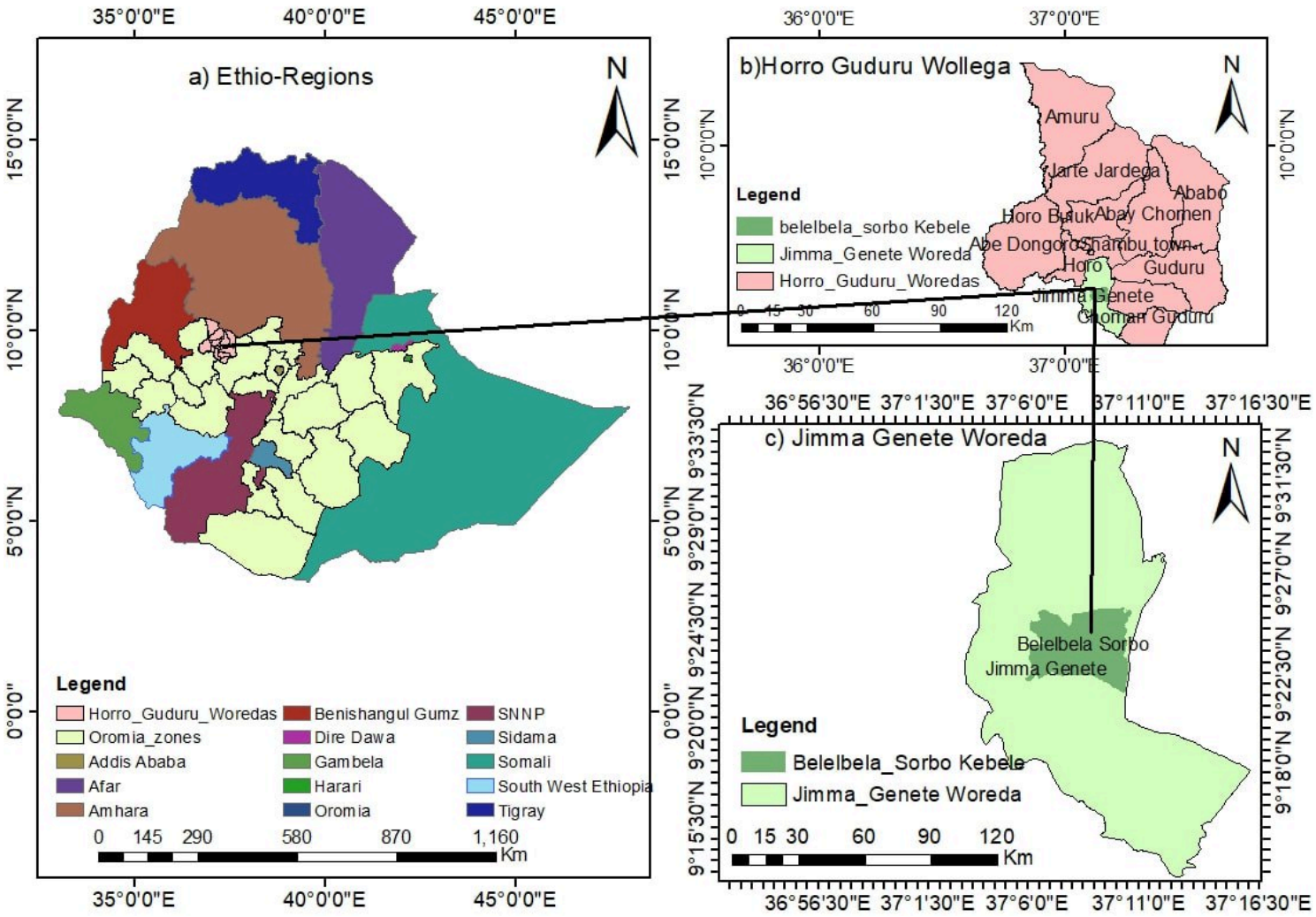


Figure 1

Location map of the study area in Jimma Geneti Woreda, Belelbela Sorbo Kebele.

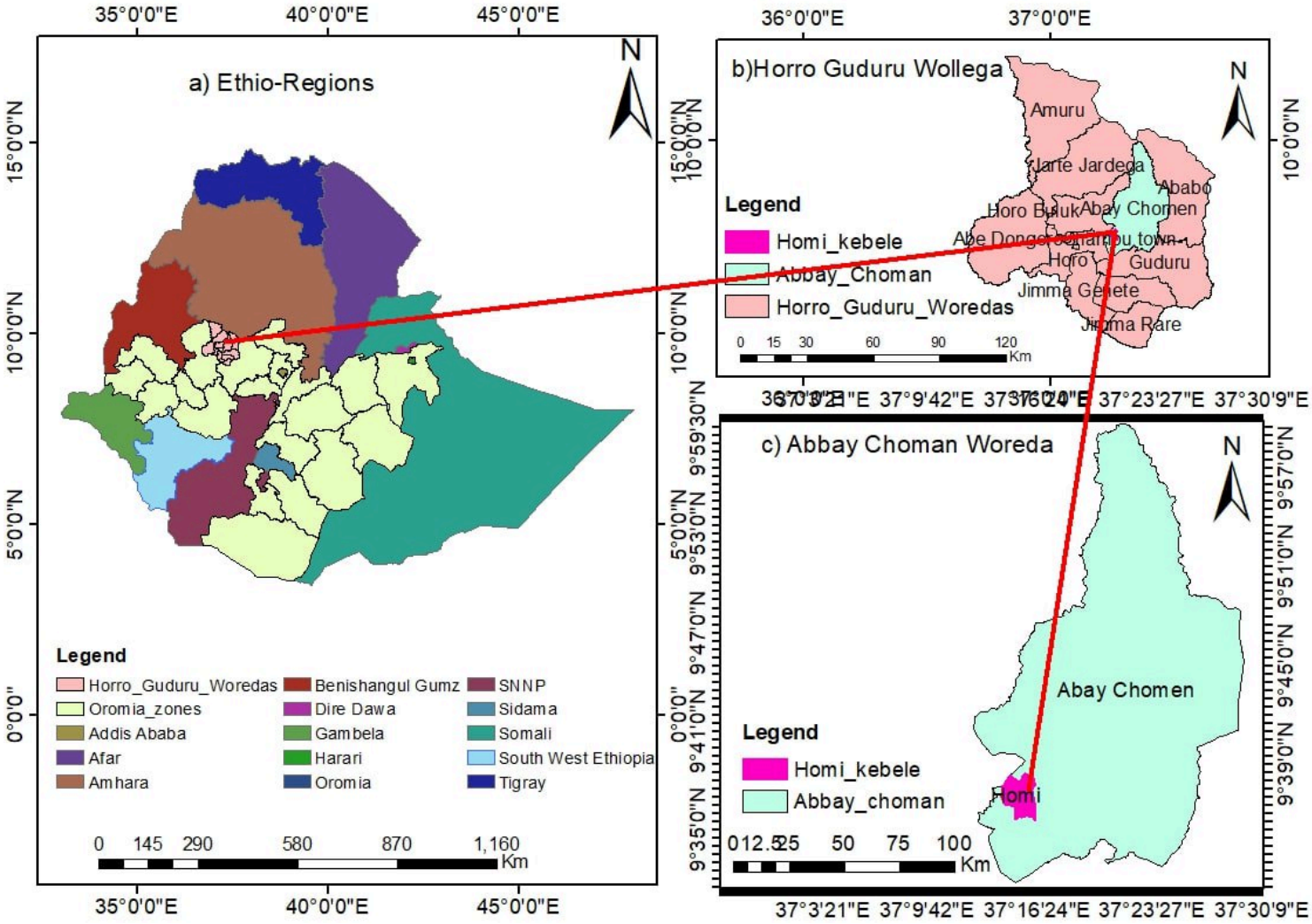


Figure 2

Location map of the study area in Abay Comman Woreda,Homi Kebele.

Supplementary Files

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- Data.xlsx