

Determinants for traditional vine multiplication and supply under different farming systems in southern Ethiopia



B. Biazin, M. MacEwan, M. Cherinet, R. Brouwer, J. Low and A. Aragaw
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1. Background and objectives

- Ethiopia is the fourth largest producer of sweetpotato in the world (FAOSTAT, 2014).
- Sweetpotato is the third important root crop after enset and potato in Southern Ethiopia (Birhanu, 2014).
- However, sweetpotato production is constrained by lack of access and availability of quality planting materials (Degu *et al.*, 2015; Mudege *et al.*, 2018; Bentley, 2018).
- Most producers rely on local traditional vine multipliers (TVMs) who operate under different farming systems.

This study aims at understanding:

- Existing traditional vine multiplication and supply methods in the different farming systems.
- Biophysical, socio-economic, and institutional determinants for participation in seed multiplication and supply.



2. Description of the study area

➤ This study was undertaken at four locations with different farming systems and agro-ecologies:

Attributes	Study district and Kebele			
	Dilla	Chuko	Hawassa	Sodo
Farming system	Multi-storey agroforestry	Perennial and annual crops	Annual and perennial crops	Annual crops (roots and cereals)
Dominant crops (in priority)	Coffee, enset, fruits, maize, SP, vegetables	Khat, enset, maize, haricot bean, SP	Maize, enset, haricot bean, SP	SP, maize, teff, haricot bean, taro, enset, cassava, yam
Altitude (m)	1500-2500	1250-2000	1500-1700	1800-2000
Rainfall (mm)	1200	980	950	1200
Main SP seasons	May/June-Oct/Nov	May/June-Oct/Nov	May/June-Oct/Nov	Oct/Nov-May/June

➤ *Contribute to year-round availability of roots at Main markets like Hawassa*



3. Methods of data collection and analyses

➤ The study employed a combination of different tools at four farming systems (sites) and two groups (vine users and suppliers):

1. Focus group discussions (FGDs) - 12 FGDs (3 per site)
2. Household survey (278, 139 users and 139 suppliers)
3. Multi-stakeholders Framework Analyses (one per site)
4. Transect walks (15 transects)
5. Field measurements on vine and root yields - 12 TVMs
6. Vine sampling from TVMs for virus testing
7. Agro-meteorological analyses

➤ Analyses with:

1. Descriptive statistics;
2. Chi-square test for farming systems and user/supplier groups;
3. Binary logistic regression to identify determinants for participation in vine multiplication.
4. Laboratory analysis for virus contamination
5. Meteorological models to identify drought probability



4. Status and trends in sweetpotato production

- SP acreage showed differences across the study sites.
- In Hawassa and Sodo, SP acreage *increases* due to market access, drought tolerance, high root yield and risk of maize production.
- In Dilla, SP acreage *decreases* due to dominance of cash crops, low root yield under shade, and rise of rental price of land.
- Results from the FGDs and HH survey matched except Chuko.

Study area	Perceived trends in area coverage	Proportion of households (%)		Chi-Sq test	Perception of the user FGD	Perception of the supplier FGD
		Users (n=36)	Suppliers (n=36)			
Dilla Zuria	Increasing	14	14	NS	Decreasing	Decreasing
	Decreasing	50	58			
	No change	36	28			
Aleta Chuko	Increasing	67	36	**	Decreasing	Increasing
	Decreasing	17	56			
	No change	17	8			
Hawassa	Increasing	62	84	*	Increasing	Increasing
	Decreasing	26	16			
	No change	12	0			
Sodo Zuria	Increasing	88	88	NS	Increasing	Increasing
	Decreasing	12	10			
	No change	0	2			

5. Traditional vine multiplication methods

- Vine multiplication systems differ across farming systems
 - SP intercropping with Enset is more important at Hawassa while sole cropping is most important at other sites.
 - The highest acreage of vines was allocated at Chuko (0.27 ha).
- Most multipliers harvest roots after collecting vines, but root yield is generally very low at Dilla.

Method of vine multiplication	Variable	Dilla	Chuko	Hawassa	Sodo
Intercropping with Enset/coffee	Frequency (%)	50% (2)	31% (2)	78% (1)	26% (3)
	Mean land area (m ²)	456	960	953	524
Intercropping with maize (overlay)	Frequency (%)	8% (3)	6% (4)	0	46% (2)
	Mean land area (m ²)	325	19	0	670
Intercropping with khat	Frequency (%)	0 (4)	11% (3)	6% (4)	0 (4)
	Mean land area (m ²)	0	318	310	0
Sole cropping	Frequency (%)	55% (1)	67% (1)	17% (2)	63% (1)
	Mean land area (m ²)	464	2680	1875	1050



6. Traditional vine dissemination/supply systems

- Own source and TVMs are preferred over DVMs and FTCs in terms of access and affordability.
- TVMs are the least in terms of getting quality vines.

Source of vines	Rank for access and affordability (user FGDs)				Rank for quality (user FGDs)			
	Dilla	Chuko	Haw.	Sodo	Dilla	Chuko	Haw.	Sodo
Own production	1	1	1	1	2	2	3	3
TVMs	2	2	2	3	4	4	4	4
DVMs	4	4	4	4	1	3	1	1
FTCs	3	3	3	2	3	1	2	2



7. Vine marketing and quality indicators

- According to TVMs, the price of vines is ever increasing (91% in Dilla, 94% in Chuko, 90% in Hawassa and 97% in Sodo, n=32-36 per site).
- Mean vine price per cutting was \$0.0034, \$0.0026 and 0.0020 at Chuko, Dilla and Sodo, respectively when the vines were sold at farm gate in 2017/2018.
- Perceptions on customers quality criteria for vine quality selection differ in different farming systems.

Study site	Respondents (%) who reported different quality indicators as criteria for vine selection (multiple responses)					
	Stem and leaf color	Variety	Vine length	Vine age	Disease and pest damage	Damage by domestic animals
Dilla	97	36	94	69	47	44
Chuko	100	47	97	89	100	97
Hawassa	64	39	64	42	42	45
Sodo	54	50	54	52	50	50
Chi-square	*	NS	*	*	*	9 *



8. Gender roles in vine production and marketing

➤ Women in men-headed HHs have high roles in application of organic fertilizers and collection of vines for livestock while their roles in land preparation, planting, weeding and harvesting were moderate or low across study areas.

Vine users buy vines from the TVMs or traders

➤ Vine trade is done at farm gate and local markets

Buying from	Market place	Modes of marketing	Gender roles
TVMs	Farm gate	plots or loads (donkey or man loads)	Men dominate selling and buying irrespective of the volume
	Local market	loads	Women dominate as sellers and buyers
Traders	Farm gate	plots	Men dominate selling and buying (high volumes)
	Local markets	By loads	Women dominate medium and low volumes marketing while men dominate the high volume marketing



9. Determinants for vine multiplication and supply

- Perception on challenges for vine multiplication and supply differ across sites except for the suitability of land and access to appropriate varieties.
- Drought (except Dilla), land scarcity and water for irrigation were mentioned by majority of the TVMs as main challenges.

Challenges	Respondents who mentioned the challenge (%)				Chi-Square
	Dilla	Chuko	Hawassa	Sodo	
Drought	47	94	100	88	**
Land scarcity	78	83	39	73	**
Water for irrigation	19	78	84	58	**
Suitable land	47	56	33	52	NS
Appropriate varieties	31	42	39	35	NS
Pest and diseases	17	33	29	60	**
Lack of labor	17	44	16	46	*
Lack knowledge and skills	22	14	3	44	**
Distance to the market	0	22	29	33	*
Low price and profitability	0	89	10	29	*



9. Determinants for vine multiplication and supply

- Soil characteristics, presence of shade and swamps/moisture retention ability are important land attributes for vine multiplications across the study sites.
- More than half of the TVMs mentioned that they apply supplementary irrigation during vine multiplications at least some times.

Site attributes affecting suitability for vine multiplication	Respondents by Study area			
	Dilla (n=36)	Chiko (n=36)	Hawassa (n=32)	Sodo (n=35)
Soil fertility	100	100	90	100
Soil color	100	92	42	65
Presence of shade (coffee, enset or other trees)	67	92	100	58
Swampiness and residual moisture	63	94	52	33
Access to irrigation water sources	67	58	52	81



9. Determinants for vine multiplication and supply

- Household's participation in vine supply is positively associated with: Age of household head, education, membership in farmers associations, perception on lack of planting material and access to extension.
- It is negatively associated with fear for late onset of the rainfall

Variable	Coefficient	St.error
Age	0.23*	0.12
Educational status	0.9*	0.84
Membership in Kebele Administration	-.248ns	.404
Membership in religious leadership	.060ns	.371
Membership in farmers marketing/producers associations	1.142*	.639
Membership in traditional leadership	-.200ns	.407
Experience in Sweetpotato production	0.81ns	0.42
Late onset of the rainfall perceived as a challenge for SP production	-1.668*	.567
Lack of suitable land for vine production	-.631ns	.400
Lack of planting material during the main planting season as a challenge	1.940**	.454
Access to extension support	.711*	.375
Constant	39.010	5.684E4



11. Conclusion

- The increasing acreage of sweetpotato by households is much associated with better climate adaptation, high-yielding characteristics, better income as compared to maize, and increased acceptance as food and feed.
- The farming systems dictate the primary vine multiplication and supply systems.
- Vibrant traditional vine multiplication and supply system exists across the different farming systems; but with low volumes and low quality of planting materials.
- Although there are significant roles of women in vine multiplications and marketing, women have less access to extension.
- Own vine production is a very important and preferred seed conservation and supply system across the different farming systems.
- Future seed system interventions with TVMs should recognize the interaction of socio-economic, biophysical and institutional determinants.





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