APPSA 2nd SCIENTIFIC CONFERENCE

2 - 4 April 2025 | Manthabiseng Convention Centre
Maseru, Kingdom of Lesotho

Determinants of Farm-level Adoption of Potato Production Technologies in Lesotho

Mpho Liphoto[1], Brian Muroyiwa[2], and Letlotlo Mathaha[3]

CCARDESA
Centre for Coordination of Agricultural Research and Development for Southern Africa

GOVERNO DE ANGOLA

THE WORLD BANK
IBRD · IDA | THE WORLD BANK GROUP

Introduction

- While potato is a staple for other countries, it is not a staple for Lesotho.
- Limited arable land is prioritized for production of staple food commodities (it is the 4th most important crop) (FAOSTAT, 2021).
- Potato technology adoption comes into main technology packages; seed potato production technology package and ware potato production package.
- The efficient adoption of the first drives the successful adoption of the latter, resulting in ultimate increased potato productivity and hence market participation.
- Socio-economic ecosystem for seed production technology package adoption is not necessarily the same as for ware potato technology package (Martinez , 2022; Agiro , 2011).
  - Potato seed production is an industrial activity while ware potato production can serve as a means of household subsistence provision and also entrepreneurial activity.

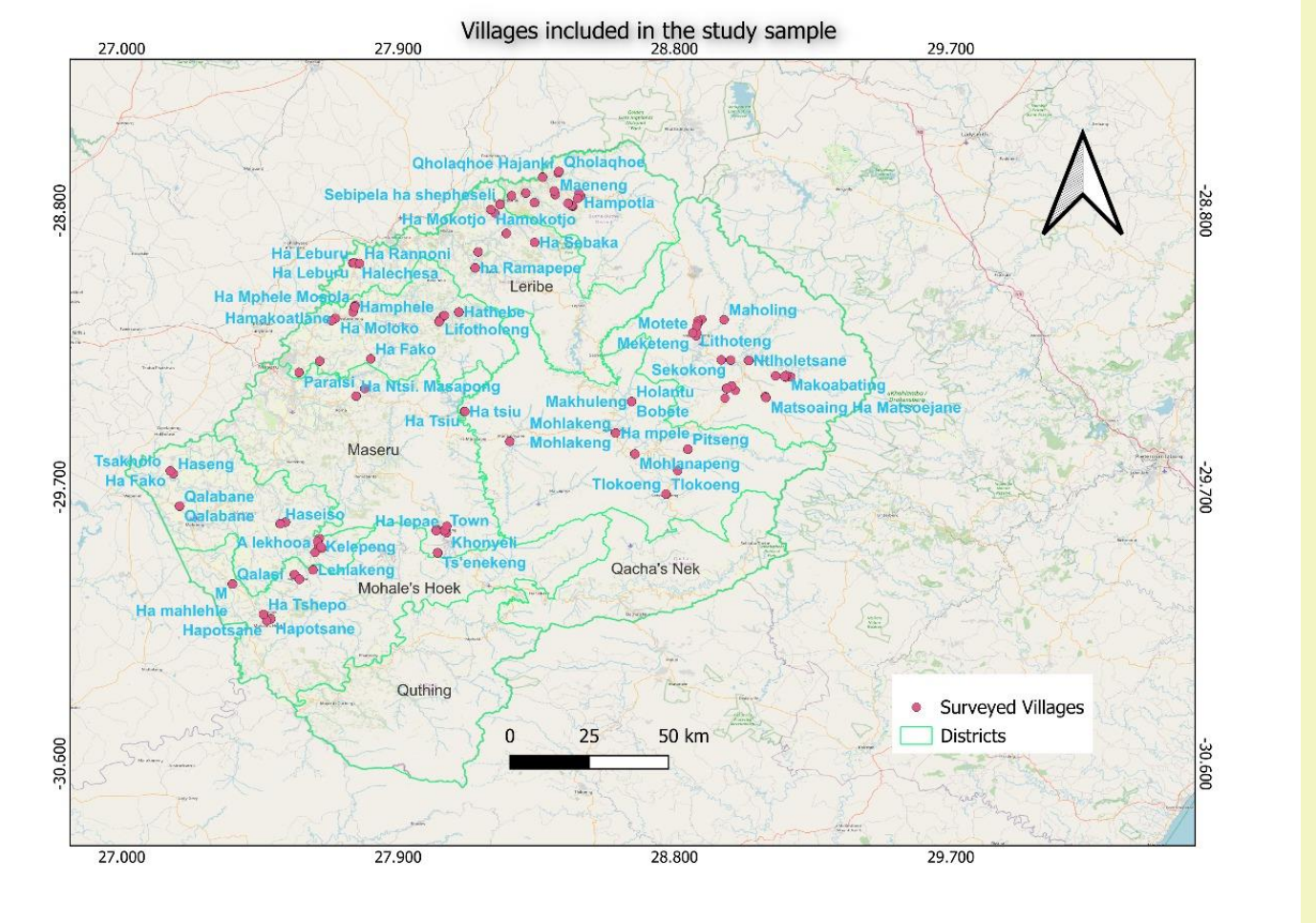
RESEARCH QUESTIONS

- What determines the decision to adopt seed potato and ware potato production packages?

- What determines the intensity of participation?

Data and Methodology

- Eight of the ten districts were sampled
  - Covered 543 potato farmers (seed and ware)
  - Food chain industry (109)
  - Traders (181)
- Analysis
- **Descriptive**
- **Econometrics (Heckman two-stage model)**
  - Probit model
  - OLS model



Synthesis of variables

- Dependent variables are potato seed production technology adoption and ware potato production technology adoption
- Explanatory variables
  - Demographic variable, gender, age, education, household size and head
  - Land ownership size
  - Others; extension service, association, access to credit, market access etc

Descriptive Stats and Chi-Square Tests

- Market information access promoted participation
- Group membership
- Storage challenge

Variables	Potato Production Participants		Non Participants		Total Sample		χ2-value	P-value
	Freq.	%	Freq.	%	Freq.	%		
Gender							0.144	0.705
Male	207	38.1	87	16.0	294	54.1		
Female	179	33.0	70	12.9	249	45.9		
Access to Market information							20.839	0.000***
Yes	190	35.0	111	20.4	301	55.4		
No	196	36.1	46	8.5	242	44.6		
Group Membership							10.078	0.002***
Yes	161	29.7	89	16.4	250	46.0		
No	225	41.4	68	12.5	293	54.0		
Credit Access							0.219	0.640
Yes	357	65.7	147	27.1	504	92.8		
No	29	5.3	10	1.8	39	7.2		
Storage Challenge							12.240	0.000***
Yes	160	29.5	91	16.8	251	46.2		
No	226	41.6	157	28.9	292	53.8		
Extension Access							0.196	0.658
Yes	51	9.4	23	4.2	74	13.6		
No	335	61.7	134	24.7	469	86.4		
Household Head							0.000	0.999
Yes	268	49.4	109	20.1	377	69.4		
No	118	21.7	48	8.8	166	30.6		

Estimation of determinants affecting Table Potato Production Participation 1st stage Heckman model *(probit model)*

- Market information access
- Group membership
- Storage challenges
- Household size (–ve)
- Educational level
- District
- Production purpose(consumption 0, Sell 1)

Variables	Coefficient	Std. err.	P>|z|
Altitude	-5.02e-12	2.88e-10	0.986
Market Information Access	0.486***	0.129	0.000
Group membership	0.231*	0.126	0.068
Credit Access	0.118	0.251	0.638
Storage Challenges	0.375***	0.123	0.002
Kind of fertiliser used	0.015	0.029	0.620
Household size	-0.007*	0.017	0.069
Farming experience	0.058	0.053	0.270
Land size	0.002	0.053	0.962
Income	-0.047	0.067	0.480
Extension Services access	-0.062	0.181	0.732
Household head	-0.021	0.137	0.877
Educational Level	0.158**	0.065	0.015
District	0.101***	0.029	0.000
Production purpose	-0.148**	0.066	0.026
Land Under potato	0.002	0.068	0.971
Constant	-0.296	0.399	0.457
Selection Variable: Market Participant			

Source: Own survey (2024).

***, ** and * indicate statistical significance level at 1%, 5% and 10%, respectively.

Intensity of Participation in Table Potato Production 2nd stage

- Altitude
- Market information
- Group membership
- Credit access (-)
- Educational level (-ve)

Variables	Coefficient	Std. err.	P>|z|
Altitude	1.08e-07*	5.61e-08	0.054
Market Information Access	63.588**	25.553	0.013
Group membership	49.746**	24.011	0.038
Credit Access	-73.737*	42.317	0.081
Storage Challenges	-5.090	24.248	0.834
Kind of fertiliser used	-2.031	5.396	0.707
Household size	-1.917	4.919	0.697
Farming experience	-11.695	9.957	0.240
Land size	3.036	9.830	0.757
Income	11.144	12.291	0.365
Extension Services access	-4.341	33.759	0.898
Household head	24.401	25.381	0.336
Educational Level	-23.961**	11.749	0.041
District	3.826	5.844	0.513
Production purpose	-14.700	12.438	0.237
Terrain	-12.828	10.907	0.240
Land Under potato	15.436	12.340	0.211
Constant	129.073	92.046	0.161

Outcome Variable: Amount Supplied, Std. Error = Standard error. Number of observations = 536; Uncensored observation = 150; Censored observation = 386. Log likelihood = -2907.364 Prob > chi2 = 0.0050; Wald chi2 (17) = 35.70; Sigma: 215.362, Rho: -0.126

Source: Own survey (2024).

Discussions

- The decision to produce table potato is influenced by **group membership.** availability of market information and solved storage challenges.

- Table potato production technology participation from OLS model is highly dependent on **the group/association membership**. Associations provide mentorship and extension guidelines for farmers to engage in potato production.
- On the other hand farmers who have access to credit and are highly educated are less likely to invest in table potato production. Farming is mainly for rural communities whose means of living is agriculture. Contradicts most technology adoption studies (Ketema et al, 2016)

Estimation of determinants affecting decision to participate (*probit model*) in Seed Potato Production

- Market Information Access
- Group membership
- Storage challenges
- Educational level
- District
- Production purpose (-ve)

Variables	Coefficient	Std. err.	P>|z|
Altitude	-1.48e-11	2.85e-10	0.959
Market Information Access	0.485***	0.129	0.000
Group membership	0.231*	0.126	0.068
Credit Access	0.121	0.251	0.630
Storage Challenges	0.374***	0.123	0.002
Kind of fertiliser used	0.014	0.030	0.636
Household size	-0.007	0.017	0.682
Farming experience	0.058	0.053	0.268
Land size	0.003	0.053	0.952
Income	-0.048	0.067	0.472
Extension Services access	-0.064	0.182	0.725
Household head	-0.021	0.137	0.878
Educational Level	0.161**	0.066	0.014
District	0.102***	0.029	0.000
Production purpose	-0.147**	0.066	0.026
Land Under potato	0.001	0.068	0.987
Constant	-0.295	0.400	0.461

Selection Variable: Market Participant

Source: Own survey (2024).

Estimation of Seed potato participation/production Intensity using OLS Model

- Group membership
- Income
- Production purpose (-ve)

Variables	Coefficient	Std. err.	P>|z|
Altitude	-2.68e-09	2.54e-08	0.916
Market Information Access	12.120	11.035	0.272
Group membership	15.583**	10.716	0.015
Credit Access	23.696	19.099	0.215
Storage Challenges	-7.951	10.629	0.454
Kind of fertiliser used	-2.661	2.435	0.275
Household size	2.212	2.223	0.320
Farming experience	-2.667	4.476	0.551
Land size	3.866	4.442	0.384
Income	6.412**	5.541	0.024
Extension Services access	8.581*	15.249	0.057
Household head	8.531	11.470	0.457
Educational Level	-3.159	5.200	0.544
District	-0.956	2.533	0.706
Production purpose	-14.616***	5.523	0.008
Terrain	-1.688	4.932	0.732
Land Under potato	-3.955	5.576	0.478
Constant	23.983	39.118	0.540

Outcome Variable: Amount Supplied, Std. Error = Standard error. Number of observations = 536; Uncensored observation = 150; Censored observation = 386. Log likelihood = -2601.041 Prob > chi2 = 0.2751; Wald chi2 (17) = 19.98; rho = 0.97674; Sigma: 97.278, rho: -0.102

Source: Own survey (2024).

***, ** and * indicate statistical significance level at 1%, 5% and 10%, respectively.

Discussion

- Seed potato production is unlikely to be adopted by subsistence farmers.
- Those engaged in seed production are likely to face storage challenges,; Seed production itself generate a need for storage that farmers do not have individually
- Unlike in ware potato, highly educated farmers are likely to engage in Seed potato production
- The OLS model outcome shows three main determinants of the actual adoption, Level of income, business enterprise intend and **group membership**

Discussion ---- Potato production and “money”

- Farmers’ association play a significant role in introducing and preserving agricultural culture, traditions and sustainable practices.
- They serve as platforms of knowledge exchange, skill development and collective action causing farmers under such umbrellas to succeed in technology adoption (Nyang et al, 2010)
- Money culture and industrialization of agriculture is what drives the success of potato industry.
- Wealth/income promote new agriculture technology package adoption (Ketema et al, 2016)

Conclusion

- Need for specialized strategies and policies for adoption of industrial Potato production
- Thorough optimization of the value chain for optimized gains
- Policy environment encouraging and promoting investment and innovation into entrepreneurship in potato value chains
  - Cottage industries on cassava in brazil (Chuzel, 2001).

We need more innovative entrepreneurship platforms in potato industry!!!

Acknowledgements

- APPSA- LESOTHO
- CARDESSA
- WORLDBANK
- DFS
- NUL