



Smallholder farmers' legume technology adoption preferences and contributions to farmers' performance: Evidences from N2Africa project

Dagmawit Getachew, Yitbarek Tegegne, Workneh Kassa, Endalkachew Wolde-meskel,
Tamiru Amanu, Edward Baars

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1. Introduction



- Grains legumes occupy about 13% of cultivated land in Ethiopia, & are third-largest export crop (IFPRI, 2010).
- Ethiopia is the largest producer of both Chickpea & Common Bean (ICRISAT, 2011).
- Ethiopia ranks 6th in Chickpea production, and 14th in Common Bean production.
- However, production per ha is still below the potential production (IFPRI, 2010).

1. Introduction



- Studies on adoption of agricultural technologies have attracted attention largely because agriculture is the main source of livelihoods for developing countries (Mohammed & Lakew, 2013).
- Despite various studies and extension efforts **process of adopting agricultural technologies by farmers is still very slow** (Mohammed & Lakew, 2013) **which calls for further studies.**

1.2. Statement of the problem



There has been continued interest in studying and describing farmers' technology adoption behavior (e.g. Federet *et al.*, 1985; Marra *et al.*, 2003) and a set of factors have been identified like:

- farmer and household characteristics (age, gender, education level)
- psychological factors (e.g. attitudes and perceptions),
- socio-economic factors (e.g. farm size, livestock no. & income) and
- institutional factors (e.g. credit, extension, access to roads)

1.2. Statement of the problem



- But most adoption studies are based on *ex-post* analysis of adoption interventions.
- Farmers are rarely consulted, *a priori*, about their specific priority problems and **their preference** for type of intervention.
- As such there have been no studies that help to understand how **farmers' preference for different type of attributes** determines legume technology adoption.
- This study was, therefore, initiated to examine factors that **influence farmers' legume technology adoption preference** in the study areas.

1.3. OBJECTIVE OF THE STUDY



General objective

- The main objective of the study is to identify the factors that determine the farmers' preference for legume technology adoption.

Specific objectives

- To analyze key factors that **influence farmers' legume technology adoption preference** in the study areas,
- To assess the legume technology **attributes type that farmers prefer in their adoption decision** of legume technology in the study areas.
- To assess the impact of technology adoption on households' performance (e.g. Income) in the study areas

2. RESEARCH METHODOLOGY



2.1. Description of study area

- Under the N2Africa project two studies were conducted:
 - i) In Damot-Gale (Wolayita) and Boricha (Sidama) districts in SNNPR.**
 - **Damot-Gale District (Wolaita Zone)**
 - **Boricha district (Sidama Zone)**
 - II) In Sinana and Ginir woredas (Oromiya Regional State).**

2.2. Sampling procedure



- A two-stage sampling procedure was employed to select sample farm household.
- A combination of **purposive and random sampling technique** was employed.
- The areas were purposively selected wherein they **are potential legume production as indentified by N2-Africa project.**
- Once those areas identified as target population, **kebeles were selected randomly from the total sample.**

2.3. Sample Size Determination



The sample size of producers and consumers was determined using Yamane formula (1967)

$$n = \frac{N}{1 + Ne^2}$$

N= required sample size

E= precision error

N= total population

n=120 Chickpea producer in Damot-Gale

n=120 Common bean producers (80 for Boricha & 40 Damot-Gale)

2.4.Data Collection Method



The study employed both **qualitative and quantitative** methods.

- i) **Qualitative method:** Through inductive (in-depth) case study was conducted in the study areas.
 - The case study have included interviews with; individual farmers, development experts, focus group discussions (FGD) with farmers, interviews with NGO representatives.

- jj) **Quantitative method:** Through structured questioner

2.4.Data Collection Method...



In the **quantitative method** of data collection, two approaches were employed:

- a) Conjoint method
- b) Scenario based semi-experiment method

2.4.Data Collection Method...



a) Conjoint method *used*:

- *seed,*
- *fertilizer,*
- *payment,*
- *fungicide as the main conjoint profile variables.*

b) Scenario based semi-experiment *used*:

- *credit access,*
- *access to technology,*
- *Advice from development agent, and*

Also manipulated both under low and high technology input price scenarios.

An example of conjoint profile for Common Bean producers



We will show you 12 cards describing different Common Bean legume technology package. Please rate each card based on your preference on a scale from 1 to 5; 1 being least preferred and 5 being most preferred.

| Card Number | Common Bean Seed | Fertilizer | Payment Option | Fungicide |
|------------------------|----------------------|------------------|------------------|-----------------------|
| 7 | Nasir | Dap | 50% Pre Payment | With Fungicide |
| Least Preferred (1) | Not Preferred (2) | Undecided (3) | Preferred (4) | Most Preferred (5) |



An example of scenario based semi-experiment for Common Bean producers

Please indicate to what extent you are likely to adopt different technology packages?

| |
|--|
| <i>Improved legume seed</i> |
| <i>Less likely to adopt 1 2 3 4 5 Most likely to adopt</i> |
| <i>Inoculants</i> |
| <i>Less likely to adopt 1 2 3 4 5 Most likely to adopt</i> |
| <i>DAP fertilizer</i> |
| <i>Less likely to adopt 1 2 3 4 5 Most likely to adopt</i> |
| <i>Pesticides</i> |
| <i>Less likely to adopt 1 2 3 4 5 Most likely to adopt</i> |
| <i>Herbicides</i> |
| <i>Less likely to adopt 1 2 3 4 5 Most likely to adopt</i> |

2.5. Method of data Analysis

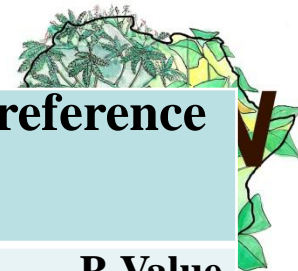


- OLS was employed to determine **predictors variables** on farmers technology adoption preference.
- Conjoint analysis was employed to assess legume technology **attributes type that farmers prefer in their** adoption decision.

3. Result and Discussion

3.1. Factors affecting Common Bean Producers' legume technology preference

| Boricha District (Sidama Zone) | | | | | Damot Gale District (Wolayta zone) | | | |
|--------------------------------|-------------------|--------------|---------------|--------------|------------------------------------|-------------------|---------------|--------------|
| Variables | Coefficient | S.E. | T-value | P-value | Coefficients | S.E. | T-value | P-value |
| (Constant) | 2.246 | 0.332 | 6.760 | 0.000 | 1.031 | 0.336 | 3.063 | 0.002 |
| Nasir | 0.188 | 0.128 | 1.468 | 0.142 | 1.412 | 0.136 | 10.386 | 0.000 |
| Ebado | 0.019 | 0.128 | 0.147 | 0.883 | | | | |
| Awassa Dume | 1.200 | 0.140 | 8.579 | 0.000 | 1.175 | 0.149 | 7.887 | 0.000 |
| Red Wolayita | | | | | 1.150 | 0.136 | 8.456 | 0.000 |
| Dap | 0.428 | 0.095 | 4.521 | 0.000 | 0.181 | 0.101 | 1.797 | 0.073 |
| 50% Payment | 1.350 | 0.114 | 11.820 | 0.000 | 0.525 | 0.122 | 4.316 | 0.000 |
| Fungicide | -0.359 | 0.095 | -3.795 | 0.000 | 0.181 | 0.101 | 1.797 | 0.073 |
| Land Size | 0.176 | 0.122 | 1.441 | 0.150 | -0.142 | -0.180 | -0.787 | 0.432 |
| Age Of HH | -0.009 | 0.008 | -1.161 | 0.246 | 0.023 | 0.008 | 2.828 | 0.005 |
| Credit Access | -0.124 | 0.114 | -1.079 | 0.281 | -0.104 | 0.117 | -0.890 | 0.012 |
| Cooperative membership | -0.203 | 0.240 | -0.847 | 0.397 | 0.274 | 0.108 | 2.535 | 0.218 |
| F-statistics (df) | F(10 629), 16.696 | | | | F-statistics (df) | F(10 309), 16.677 | | |
| R2 (Adj. R2) | .210 (.197) | | | | R2 (Adj. R2).351 (.330) | | | |



3.2. Factors affecting Chickpea Producers legume technology preference

| Variables | Coefficients | S.E | T-Value | P-Value |
|--------------------------|---------------------------|--------------|---------------|--------------|
| (Constant) | 0.369 | 0.298 | 1.240 | 0.215 |
| Habru | 1.663 | 0.081 | 20.479 | 0.000 |
| Arerti | 1.129 | 0.081 | 13.910 | 0.000 |
| Natoli | 0.308 | 0.081 | 3.798 | 0.000 |
| Dap | 0.038 | 0.057 | .653 | 0.514 |
| 50% Pre-Payment | 0.433 | 0.057 | 7.549 | 0.000 |
| With Fungicide | 0.429 | 0.057 | 7.476 | 0.000 |
| Age | 0.011 | 0.005 | 2.103 | 0.036 |
| Land holding (ha) | -0.342 | 0.144 | -2.378 | 0.018 |
| Credit access | 0.557 | 0.105 | 5.285 | 0.000 |
| Cooperative membership | 0.271 | 0.062 | 4.385 | 0.000 |
| F-statistics (df) | F(10, 949), 69.861 | | | |
| R2 (Adj. R2) | .424 (.418) | | | |

3.3. Conjoint analysis results

Relative importance of attributes for Common bean producers



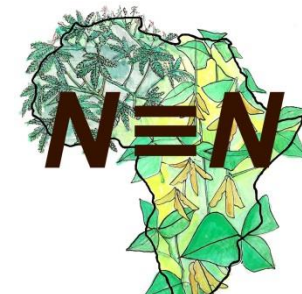
Relative importance of attributes in Boricha District (Sidama)

| Attributes | Boricha District |
|------------|------------------|
| SEED | 38.16 |
| PAYMENT | 33.35 |
| FERTILIZER | 15.05 |
| FUNGICIDE | 13.44 |
| | 100 |

Relative importance of attributes in Damot-Gale District (Wolayita)

| Attributes | Damot Gale District |
|------------|---------------------|
| SEED | 60.53 |
| FUNGICIDE | 16.67 |
| PAYMENT | 13.02 |
| FERTILIZER | 9.78 |
| | 100 |

Utility estimates of attribute levels



| Attributes | Attribute level | Boricha District | Damot Gale District |
|-------------------|-------------------|------------------|---------------------|
| | | Utility Estimate | Utility Estimate |
| SEED | Nasir | 0.003 | 0.544 |
| | Hawasa Dume | -0.166 | -0.869 |
| | Ebado | 0.347 | 0.044 |
| | Red Wolayita | -0.184 | 0.281 |
| FERTILIZER | Dap | 0.044 | 0.025 |
| | Dap & Inoculants | -0.044 | -0.025 |
| PAYMENT | 50% Pre-Payment | 0.559 | 0.2 |
| | 100% Pre-Payment | -0.559 | -0.2 |
| FUNGICIDE | With Fungicide | -0.009 | 0.156 |
| | Without Fungicide | 0.009 | -0.156 |
| (Constant) | | 2.866 | 3.194 |

Continued

Relative importance of attributes for Chickpea (Damot-Gale) producers



| Attributes | Relative importance |
|------------|---------------------|
| Seed | 60.14 |
| Fungicide | 15.74 |
| Payment | 14.65 |
| Fertilizer | 9.47 |
| Total | 100 |

Utility estimates of attribute levels for Chickpea producers



| Attribute | Attribute levels | Utility Estimate |
|-------------------|-------------------|------------------|
| SEED | Habru | 0.901 |
| | Arerti | 0.309 |
| | Natoli | -0.453 |
| | Local Variety | -0.757 |
| FERTILIZER | Dap | 0.011 |
| | Dap & Inoculants | -0.011 |
| PAYMENT | 50 % Pre-Payment | 0.199 |
| | 100% Pre-Payment | -0.199 |
| FUNGICIDE | With Fungicide | 0.197 |
| | Without Fungicide | -0.197 |
| (Constant) | | 2.841 |

4. Summary of Findings and Conclusion



The study has identified that for common bean producing farmers:

a) In Damot-Gale district the relative importance among legume technology package:

- 1) **seed is the highest relative importance,**
- 2) fungicide is the second important factor,
- 3) payment is the third and
- 4) fertilizer is the last important factor.

b) In Boricha District:

- 1) **Seed has the highest relative importance,**
- 2) payment is the second most important attribute,
- 3) fungicide is the third and
- 4) Fertilizer is the least important attribute for both Districts.

4. Summary of Findings and Conclusion



For Common Bean producers in Damot-Gale District socio-economic variables:

- **age of HH and credit access have** significant relationship with technology adoption preference.
- With respect to age, the regression result shows that age has a positive influence on adoption preference.
- **Credit access is negatively and significantly related to adoption preference** of legume technology in Damot-Gale (for Common Bean)
- In Boricha district all the four socio-economic variables were **found insignificant** to technology adoption preference.

4. Summary of Findings and Conclusion...



- Onyenweaku et al. (2010) study on fertilizer technology adoption of farmers in Nigeria also **found a negative relationship between credit and adoption** of technology.
- They suggested **that diversion of agricultural credit to non-farm uses** could be the reason.

4. Summary of Findings and Conclusion...



For Chickpea producers in Damot-Gale:

- The socio-economic variables; **age of HH, credit access, and cooperative membership** positively and significantly influence adoption preference.
- But land holding in hectares is found to be negatively related to legume technology adoption preference for Chickpea producers in Damot-Gale.
- Similar finding has been reported by Etoundi and Dia (2008) study which pointed out that increasing the area diminishes the probability of adopting the improved maize variety.
- The reason was that a big sown area with maize requires much manpower and huge resources.

4. Summary of Findings and Conclusion...



Preference for attribute level of common bean producers in

a) Damot Gale District;

- **Nasir seed variety, Dap, 50 percent pre-payment and with fungicide has got the highest preference.**

b) Boricha District;

- **Ebado seed variety, DAP, 50 percent pre-payment and with fungicide has got the highest preference.**

For Chickpea producers of Damot Gale District;

- **Habru seed variety, DAP, 50 percent pre-payment and with fungicide has got the highest preference.**

5. Recommendation for Future Intervention and Research



- 1) For future intervention there might be a **need for market segmentation** based on farmers' preference for different attributes of legume technology.
- 2) **Context of farmers** (which might also vary across times) might differ across different areas influencing their adoption preference. Hence it might be necessary to take into account in designing legume technology packages for adoption.
- 3) Future research need to confirm consistency of the findings across different areas and time scales. The findings might be more convincing if they are confirmed **across different time scales**. Hence, there might be a need for longitudinal research.