

Gender, rainfall endowment, and farmers' heterogeneity in wheat trait preferences in Ethiopia

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- Conclusions and Policy Implications



Introduction

- Ethiopia is the largest wheat producer in SSA (CSA, 2021).
 - About 5 million smallholder farmers cultivating wheat
 - About 2.1 million ha allocated to wheat
 - Harvest at 5.8 million tons a year
- Wheat breeding programs face challenges in meeting the diverse interests of farmers across various agroecologies and rainfall patterns.
- Farmers often seek wheat varieties that can withstand both biotic and abiotic stresses, especially in the context of climatic shocks.
- Men and women farmers within households may have varying trait preferences.



Introduction (2)

- Many initiatives related to crop improvement programs primarily emphasize technical aspects, often overlooking social dynamics and demand-side factors (*Badstue et al., 2022; Barrett et al., 2022; Voss et al., 2021*)
- During the Green Revolution, there were significant achievements in productivity and other outcomes (*Evenson and Gollin, 2003; Gollin et al., 2021*)
- However, the focus on a few dominant cereals during this period also contributed to malnutrition, and unequal distribution of benefits, particularly favouring men and better-off farmers (*Krishna and Veettil, 2022; Pingali, 2012*)
- The existing seed system often lacks a feedback mechanism, resulting in insufficient consideration of the diverse interests and preferences of both men and women farmers.
- Studies like Badstue et al. (2022), Barrett et al. (2022), and Voss et al. (2021) emphasize the need to bridge this gap and consider social dynamics within the seed system.



Introduction (3)

- Development actors and policymakers increasingly recognize the importance of gender and social inclusion for equitable development outcomes.
- Early economics literature often relied on the unitary household model, assuming that all household members share identical preferences and reaching unanimous decisions (*Becker, 1973*).
- This paper employs rigorous empirical methods to analyse wheat trait preferences of both men and women farmers.
- We also investigate the heterogeneous trait preferences among households who experience rainfall surplus and rainfall deficit conditions.



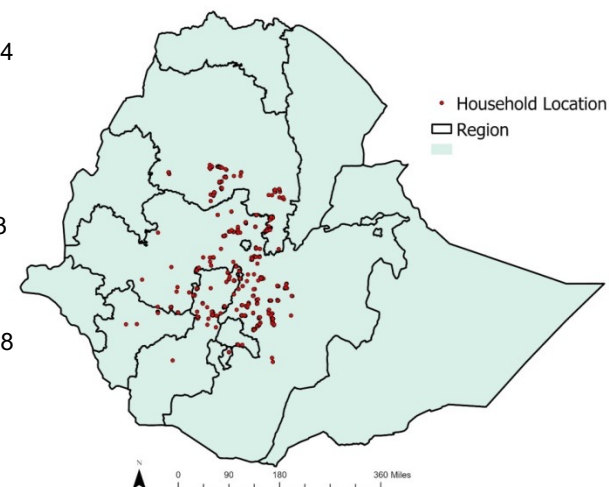
Data and Methods

- We used both household survey and historical Rainfall data
- Primary household survey conducted in Ethiopia between June and August 2021 as part of the AGG Project
- Random sampling of households in three main wheat-producing regions: Amhara, Oromia, and SNNP.
- Three-stage sampling process:
 - First, identification of districts growing wheat on land above 2,000 hectares.
 - Second, selection of districts based on wheat agroecology
 - Third, selection of major wheat-producing kebeles within sample districts and 10-18 households were selected from each Kebele
- Data collected from 1,088 sample households.



Distribution of sample households by region and zone

Agroecological zone	Amhara		Oromia		SNNP		Total	
	Kebeles	HHs	Kebeles	HHs	Kebeles	HHs	Kebeles	HHs
Tepid to cool humid mid-highlands	1	3	22	237	1	14	24	254
Cold to very cold humid sub-Afro-								
Alpine			1	7			1	7
Hot to warm moist lowlands	1	13					1	13
Tepid to cool moist mid-highlands	12	122	12	149	1	7	25	278
Hot to warm sub-humid lowlands			1	2			1	2
Tepid to cool semi-arid mid								
highlands			2	18			2	18
Tepid to cool sub-humid mid								
highlands	15	59	28	184	7	145	50	388
Tepid to cool sub-moist mid								
highlands	4	46	8	81	1	1	13	128
Total	33	243	74	678	10	167	117	1088



Rainfall data

- Monthly rainfall data was obtained from the Climate Hazard Group InfraRed Precipitations with Station (CHIRPS) through GPS Coordinates.
- Generated monthly rainfall data for the period of 21yrs (2001-2021).
- Following Funk et al. (2015), rainfall shocks are estimated as normalized deviation in a single season's rainfall from the expected average seasonal rainfall over the 21 years, and calculated as:

$$R_{wt} = \left| \frac{r_{wt} - \bar{r}_w}{\sigma_{rw}} \right|$$

r_{wt} = Rainfall at Ward w at time t

$\bar{r}_w$ = Mean rainfall

σ_{rw} = Standard deviation

$$\text{Rainfall surplus} = \begin{cases} 1 & \text{if } r_{wt} > \bar{r}_w \\ 0 & \text{Otherwise} \end{cases}$$



Method of Data Analysis

- Both men and women household members were surveyed about the importance of six specific traits in wheat varietal choice.
- Respondents were interested in more than one traits of improved varieties.
- Traits preferences are not mutually exclusive.
- We therefore used the Multivariate Probit Model (MVP).

A given respondent in a household decides to seek the k^{th} trait if the net benefit (utility) from the k^{th} trait is greater than the other alternative traits.

$$Y_{ik}^* = U_k - U_m > 0$$

$$Y_{ik} = \begin{cases} 1 & \text{if } Y_{ik}^* > 0 \\ 0 & \text{Otherwise} \end{cases} \quad \text{where } k = 1, 2, 3, \dots, 6 \text{ and } k \neq m$$



Gendered Wheat Trait Preferences

Wheat traits	Men (%)	Women (%)	Difference (%)
High yield	81.20 (1.25)	80.51 (1.20)	0.68 (1.73)
Good adaptation	74.90 (1.38)	72.79 (1.35)	2.10 (1.93)
High straw yield	54.17 (1.59)	45.31 (1.51)	8.85*** (2.19)
Disease resistance	67.58 (1.49)	63.79 (1.54)	3.79* (2.09)
Bold grain	48.78 (1.59)	47.24 (1.51)	1.54 (2.20)
Good cooking & taste quality	26.02 (1.40)	32.26 (1.42)	-6.24*** (1.99)
Observations (N)	984	1088	

Trait preference differences by rainfall endowment and gender

Traits	Men respondents			Women respondents		
	Rain deficit	Rain surplus	Diff (%)	Rainfall deficit	Rainfall surplus	Diff (%)
High yield	87.72 (3.08)	80.34 (1.34)	7.37* (3.88)	85.83 (3.90)	79.86 (1.29)	5.98 (3.83)
Good adaptation	85.09 (3.35)	73.36 (1.49)	11.52*** (4.30)	86.67 (3.11)	71.07 (1.46)	15.59*** (4.28)
High straw yield	34.21 (4.46)	56.78 (1.68)	-22.57*** (4.91)	25.00 (3.97)	47.83 (1.61)	-22.83*** (4.77)
Disease resistance	58.77 (4.65)	68.74 (1.57)	-9.96** (4.65)	55.83 (4.55)	64.77 (1.62)	-8.94** (4.65)
Bold grain	41.23 (4.63)	49.77 (1.70)	-8.54* (4.98)	44.17 (4.55)	47.62 (1.61)	-3.46 (4.83)
Good taste & cooking quality	23.68 (3.99)	26.32 (1.49)	2.63 (4.37)	43.33 (4.54)	30.89 (1.49)	12.44*** (4.51)
Observation (N)	984			1088		

MVP: Wheat trait preference determinants for Men respondents (selected vars)

Selected Variables	T1	T2	T3	T4	T5	T6
Farm size (ha)	0.039 (0.05)	0.084* (0.05)	0.006 (0.04)	-0.061 (0.04)	0.082** (0.04)	-0.011 (0.04)
Livestock owned (TLU)	0.012 (0.01)	0.012 (0.01)	0.027** (0.01)	-0.016 (0.01)	-0.001 (0.01)	0.005 (0.01)
Men respondent is member of farmer group (1=yes)	0.083 (0.14)	-0.07 (0.12)	-0.029 (0.11)	0.372*** (0.12)	0.102 (0.11)	0.362*** (0.11)
Women respondent is member of farmer group (1=yes)	0.066 (0.18)	0.155 (0.16)	0.292* (0.15)	0.033 (0.16)	-0.194 (0.14)	-0.154 (0.15)
Men respondent is member of <i>Eddir</i> (1=yes)	0.733*** (0.17)	0.427*** (0.15)	0.274* (0.16)	-0.480*** (0.16)	-0.198 (0.14)	0.155 (0.15)
Women respondent is member of <i>Eddir</i> (1=yes)	-0.149 (0.15)	0.351*** (0.13)	-0.095 (0.12)	0.095 (0.13)	-0.411*** (0.12)	-0.154 (0.12)
Men respondent is member of <i>Equb</i> (1=yes)	0.903** (0.45)	0.24 (0.31)	0.213 (0.29)	0.767** (0.31)	0.251 (0.26)	-0.184 (0.29)
Women respondent is member of <i>Equb</i> (1=yes)	-0.673* (0.38)	-0.4 (0.32)	0.041 (0.32)	-0.012 (0.34)	0 (0.29)	-0.045 (0.32)
Rainfall shock (Index)	-0.249** (0.12)	0.014 (0.11)	0.372*** (0.11)	0.238** (0.11)	0.149 (0.10)	0.356*** (0.11)
Rainfall surplus (dummy: 1=yes)	-0.464** (0.20)	-0.380** (0.18)	0.496*** (0.17)	0.072 (0.15)	-0.009 (0.15)	-0.268 (0.16)

Note: T1=high yield, T2= good adaptation to climate change, T3= high straw yield, T4= disease resistant, T5= bold grain and T6= have good taste and cooking quality. Standard errors in parentheses. Significance levels correspond with *** $p < .01$ for 1%, ** $p < .05$ for 5% and, * $p < .1$ for 10%.

MVP: wheat trait preference determinants for women respondents (selected vars)

Selected Variables	T1	T2	T3	T4	T5	T6
Farm size (ha)	-0.001 (0.04)	0.056 (0.04)	0.06 (0.04)	0.022 (0.04)	0.061* (0.04)	-0.031 (0.04)
Livestock owned (TLU)	0.01 (0.01)	0.012 (0.01)	0.012 (0.01)	-0.019* (0.01)	-0.009 (0.01)	-0.014 (0.01)
Men respondent is member of farmer group (1=yes)	0.176 (0.13)	-0.059 (0.12)	-0.141 (0.11)	0.331*** (0.12)	0.001 (0.11)	0.251** (0.11)
Women respondent is member of farmer group (1=yes)	-0.092 (0.16)	0.366** (0.15)	-0.263* (0.14)	-0.058 (0.15)	-0.031 (0.14)	-0.004 (0.14)
Men respondent is member of Eddir (1=yes)	0.512*** (0.16)	0.619*** (0.15)	0.115 (0.14)	-0.665*** (0.15)	-0.17 (0.14)	0.035 (0.15)
Women respondent is member of Eddir (1=yes)	0.034 (0.14)	0.134 (0.13)	-0.112 (0.12)	0.145 (0.12)	- (0.12) 0.276**	0.079 (0.12)
Men respondent is member of Equb (1=yes)	0.692* (0.38)	-0.07 (0.30)	0.242 (0.27)	0.145 (0.28)	0.306 (0.26)	-0.295 (0.28)
Women respondent is member of Equb (1=yes)	-0.409 (0.34)	-0.0871 (0.32)	0.271 (0.29)	0.319 (0.32)	-0.188 (0.29)	-0.0945 (0.30)
Rainfall shock (Index)	-0.03 (0.11)	-0.02 (0.10)	0.402*** (0.10)	0.164 (0.10)	0.188** (0.09)	0.300*** (0.10)
Rainfall surplus (dummy: 1=yes)	-0.269 (0.18)	-0.508*** (0.17)	0.557*** (0.16)	-0.0237 (0.15)	-0.177 (0.14)	-0.555*** (0.15)

Note: T1=high yield, T2= good adaptation to climate change, T3= high straw yield, T4= disease resistant, T5= bold grain and T6= have good taste and cooking quality. Standard errors in parentheses. Significance levels correspond with *** $p < .01$ for 1%, ** $p < .05$ for 5% and, * $p < .1$ for 10%.

Correlation coefficient of error terms obtained from the MVP model estimation of the traits

Traits	Men		Women	
	Correlation	Std	Correlation	Std
High yield and Good adaptation	0.448***	(0.07)	0.422***	(0.06)
High yield and High straw yield	0.009	(0.06)	0.003	(0.06)
High yield and Disease resistance	-0.025	(0.06)	-0.166**	(0.06)
High yield and Bold grain	0.076	(0.06)	0.007	(0.06)
High yield and Good taste & cooking quality	0.083	(0.07)	0.118**	(0.07)
Good adaptation and High straw yield	0.002	(0.06)	0.098**	(0.06)
Good adaptation and Disease resistance	-0.025	(0.06)	-0.037	(0.06)
Good adaptation and Bold grain	0.065	(0.06)	0.111**	(0.06)
Good adaptation and Good taste & cooking quality	0.122**	(0.06)	0.057	(0.06)
High straw yield and Disease resistance	0.019	(0.06)	-0.019	(0.06)
High straw yield and Bold grain	0.351***	(0.06)	0.146***	(0.05)
High straw yield and Good taste & cooking quality	0.287***	(0.06)	-0.113**	(0.06)
Disease resistance and Bold grain	0.233***	(0.06)	0.205***	(0.05)
Disease resistance and Good taste & cooking quality	0.02	(0.06)	0.197***	(0.06)
Bold grain and Good taste & cooking quality	0.325***	(0.06)	0.346***	(0.06)

Conclusions

- High yield and good adaptation are the most preferred wheat traits by both male and women farmers.
- Significant differences in trait preferences between men and women household members are observed in other traits.
- Men prefer traits related to straw yield and disease resistance, while women favor traits like taste and cooking quality.
- In rainfall-deficit areas, adaptation to climate variability is preferred.
- In rainfall-surplus areas, disease resistance trait was preferred.





**Thank you
for your
interest!**