Learning her way: Experimental evidence on participatory video-based extension for climate-smart agriculture in Gujarat, India

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Supported by

Presentation outline

- Introduction
- Experimental design and data
- Results
- Summary & recommendations

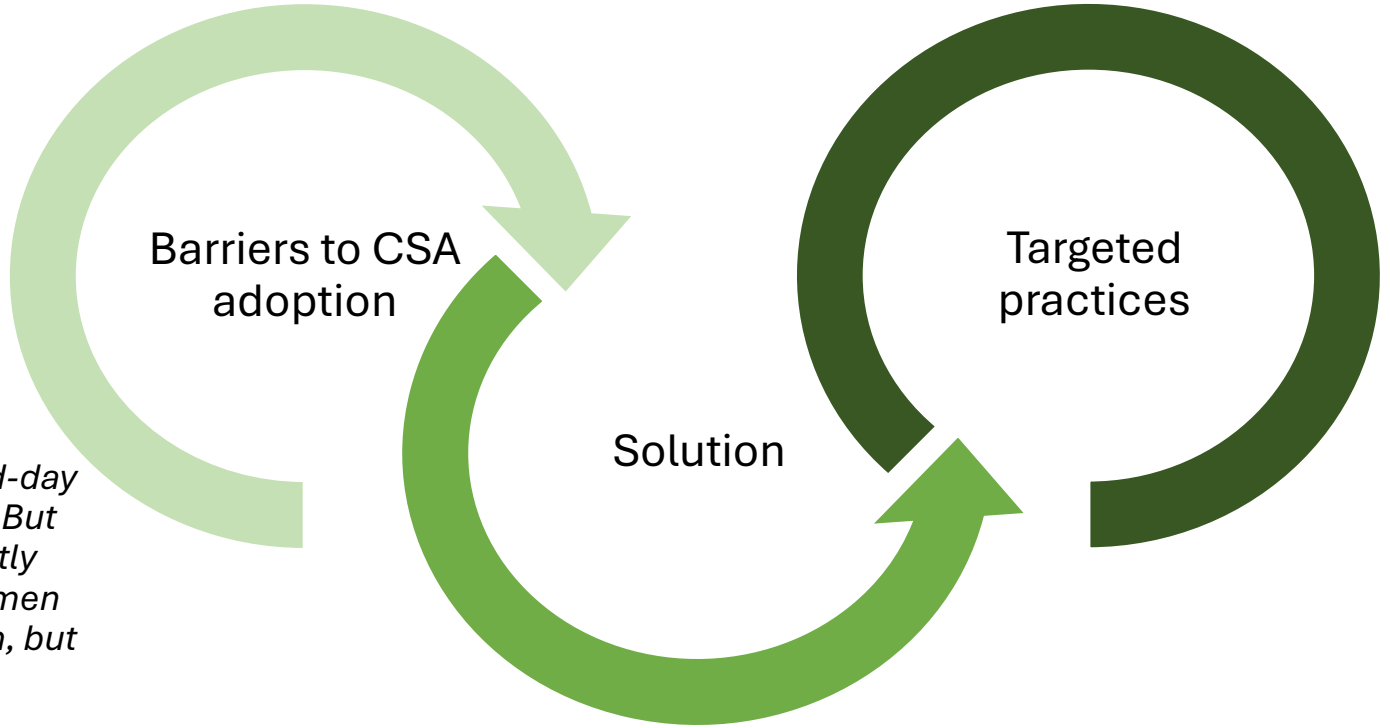
Motivation

- Vulnerability of agriculture to climate change risks continue to grow (Bakht et al., 2020; Bhuiyan et al., 2017).
- Climate change impacts affect farmers inequitably. Smallholder farmers (Joshi, 2015; Tripathi & Mishra, 2017; Bryan et al., 2017), and particularly women (Paul & Kumar, 2016; Dhenge, Shirke, & Sarap, 2016; Wagstaff, 2017; Kristjanson et al., 2017) are more vulnerable – limited access to information, collateral & other resources.
- Despite potential benefits, limited adoption of CSA practices in India, especially by women farmers. Limited evidence on gendered adoption of CSA practices and the associated constraints, especially related to information and extension particularly among women farmers (Lipper et al., 2014).
- Women farmers' have limited access to formal extension (Aker et al., 2016;Alvi et al., 2021; Mulungu et al., 2025; Spielman et al., 2021) and information on CSA practices and innovative technologies (Paul & Kumar, 2016)- leading to lower adaptive capacities and resilience.
- Add to the expanding body of research to better understand the conditions under which ICT-based advisory services are likely to be most effective for women farmers, and for nuanced or complex information on agricultural practices like IPM (Aker, 2008, 2011, 2016; (Aker et al., 2016; Mwambi et al., 2023; Spielman et al., 2021).
- Need for more evidence on *phygital* approaches (Nakasone et al., 2014; van Campenhout et al., 2020)

Formative research

- Information channels not gender-responsive
- Low access to information by women on CSA

"In the case of Anganwadi (mid-day meals), female agents come. But for agriculture, they are mostly men. However, we prefer women as we can talk easily with them, but not with men."



- Climate-smart integrated pest management (IPM)
- Biopesticide
- Soil testing

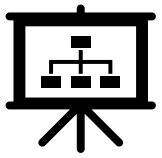
Participatory extension intervention on increasing awareness, knowledge, and adoption of CSA practices

Research questions

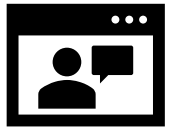
- **RQ1:** Are gender-responsive and participatory ICT-based (posters and videos) extension approaches effective in promoting awareness, knowledge and adoption of recommended CSA practices among smallholder women farmers?
- **RQ2:** Are videos more effective than posters/traditional extension?
- **RQ3:** Is it more effective to combine traditional extension (posters) with videos?
- **RQ4**: Do treatment effects differ depending on resource endowments (size of landholding) and decision-making power (empowerment)?

Study design: Clustered randomized controlled trial (RCT)

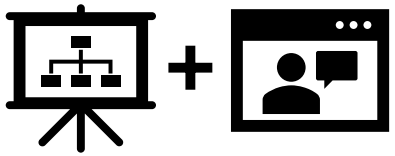
Three Treatment Arms (93 villages)



Only poster (T1)- 40 villages



Only video (T2)- 30 villages

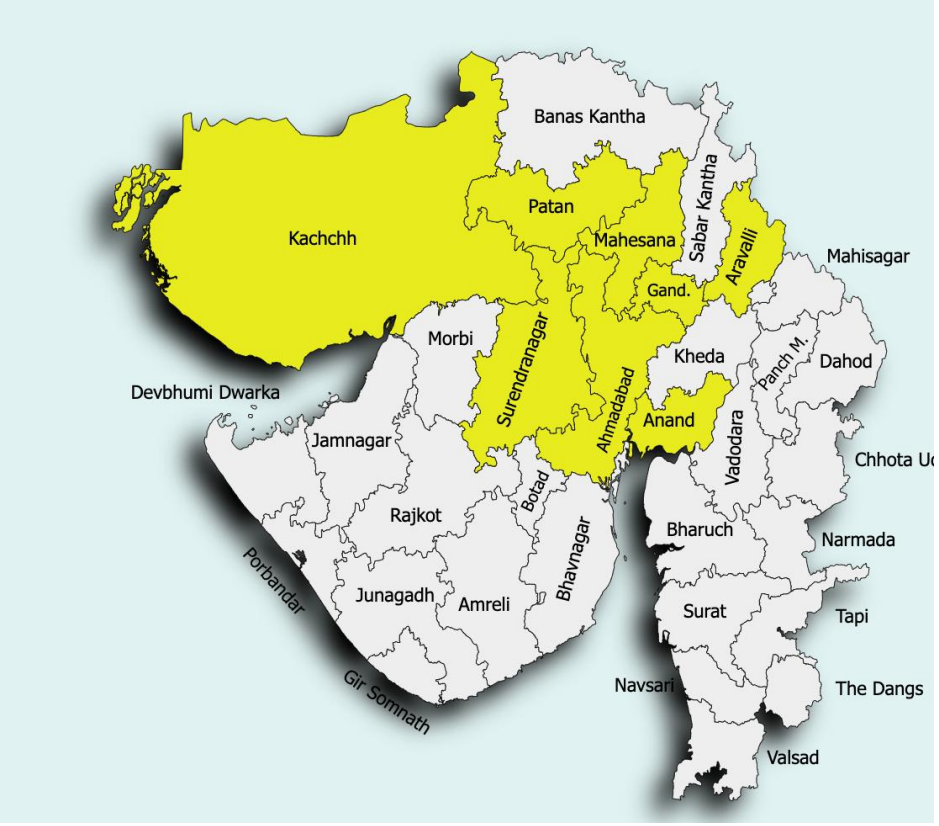


Poster + video (T3) - 23 villages

Control arm (with no outreach)- 40 villages

Data collection

8 districts of Gujarat: Ahmedabad, Anand, Arvalli, Gandhinagar, Kutch, Mehsana, Patan, Surendranagar



Study Sample

Participants:

- SEWA members (females) who self-identified as agricultural decision-maker from households involved in agriculture *(over the past 12 months)*

Sample Size:

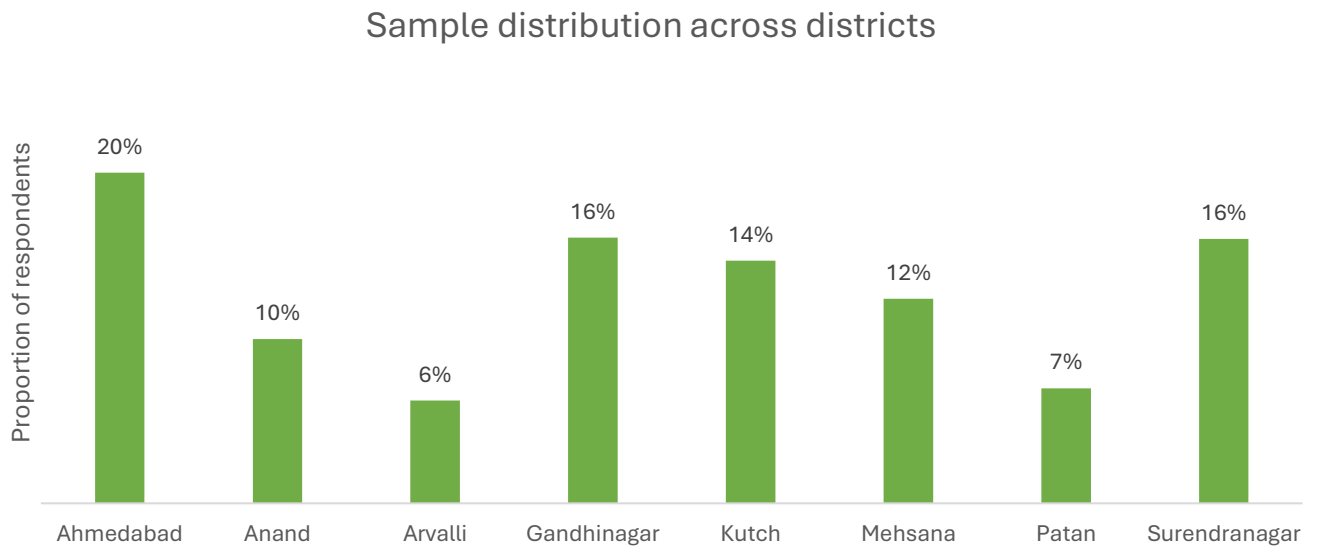
- **Baseline** : 2627 respondents (18-20 respondents/ village)
- **Endline**: 2249 respondents (14% attrition)

Study Timelines

- **Baseline** : Mid-April to Mid-August 2022
- **Intervention rollout**: November 2022-February 2023
- **Endline** : Mid-April to early-August 2023

Sampling

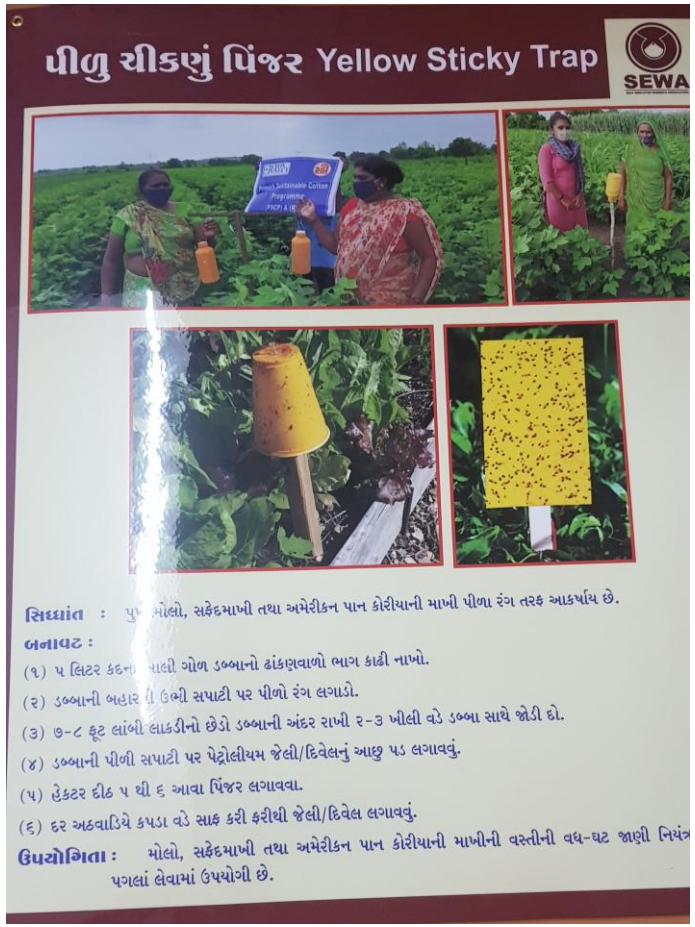
- 20 women respondents per cluster (village), therefore, only villages across districts that had at least 30 SEWA members (eligible villages) were included in the sampling frame- to have a buffer sample
- Number of villages in each district to achieve the required sample size were sampled proportionate to the number of eligible villages from each district in the sampling frame to ensure adequate representation
- Respondents in a village were selected using systematic random sampling based on the membership lists



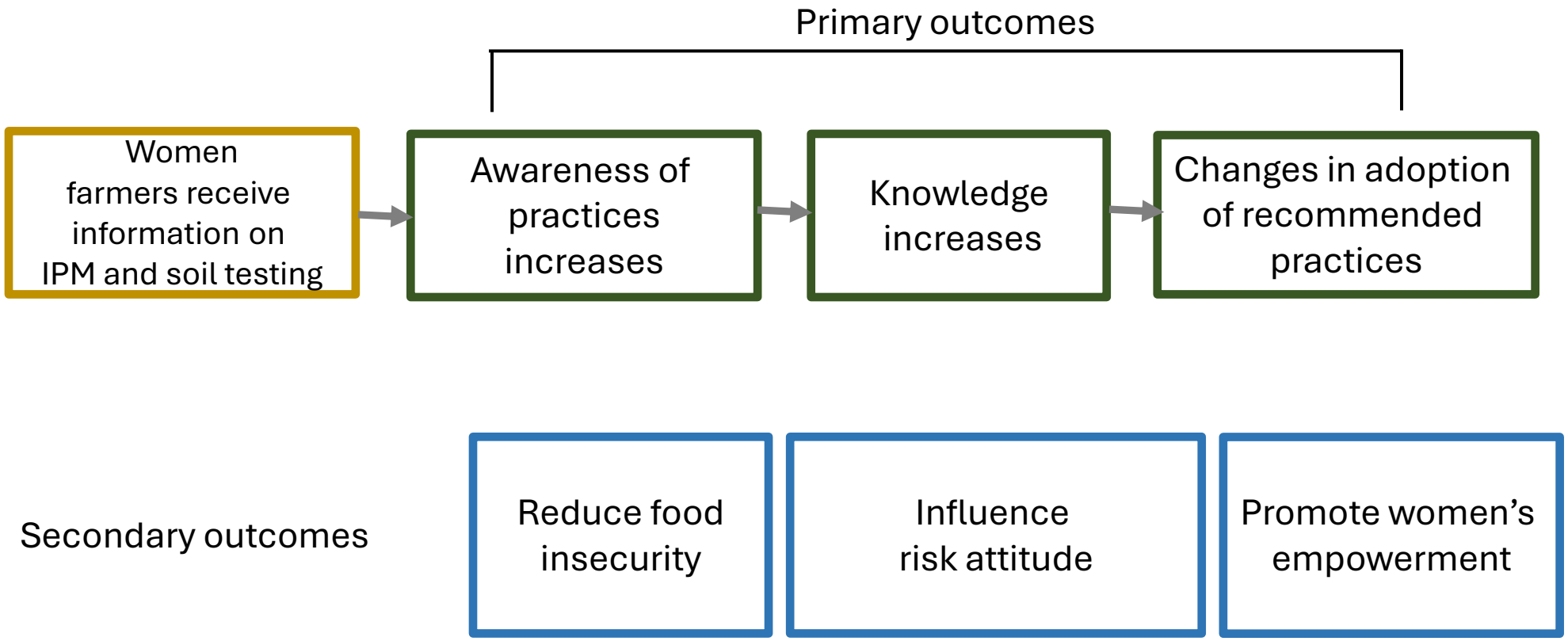
Sample distribution by treatment	Baseline	Endline
Control	790	676
Treatment 1 (Poster)	796	686
Treatment 2 (Video)	591	506
Treatment 3 (Video+Poster)	450	381
Total	**2627**	**2249**

Intervention

Examples of training content



Key outcomes



Variable description

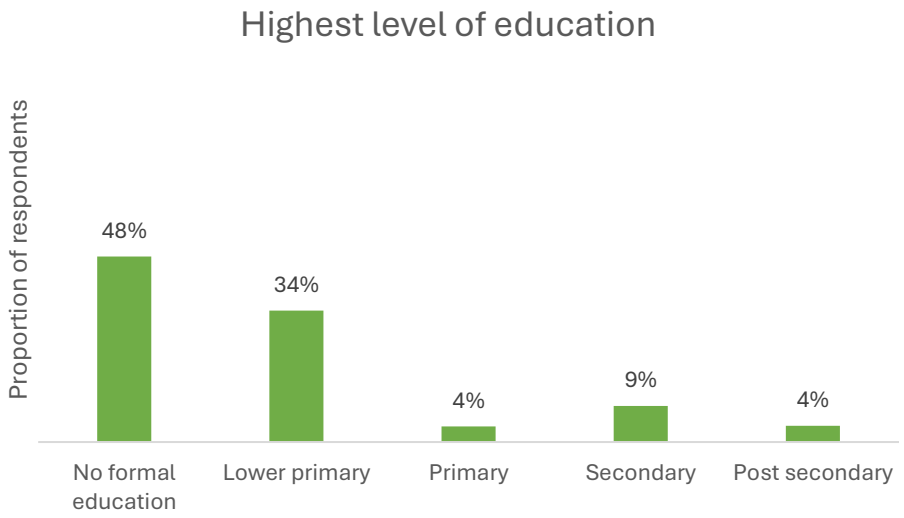
- **Awareness**
  - Awareness of overall CSA practices (count of 20 practices)
  - Awareness of any of the 6 recommended practices (dummy variable)
  - Awareness of recommended IPM practices (dummy variable)
  - Awareness of soil testing practices (dummy variable)
- **Knowledge**
  - Raw scores (out of 20)
  - Weighted scores
- **Adoption**
  - Adoption of overall CSA practices (count of 20 practices)
  - Adoption of any of the 6 recommended practices (dummy variable)
  - Adoption of recommended IPM practices (dummy variable)
  - Adoption of soil testing practices (dummy variable)

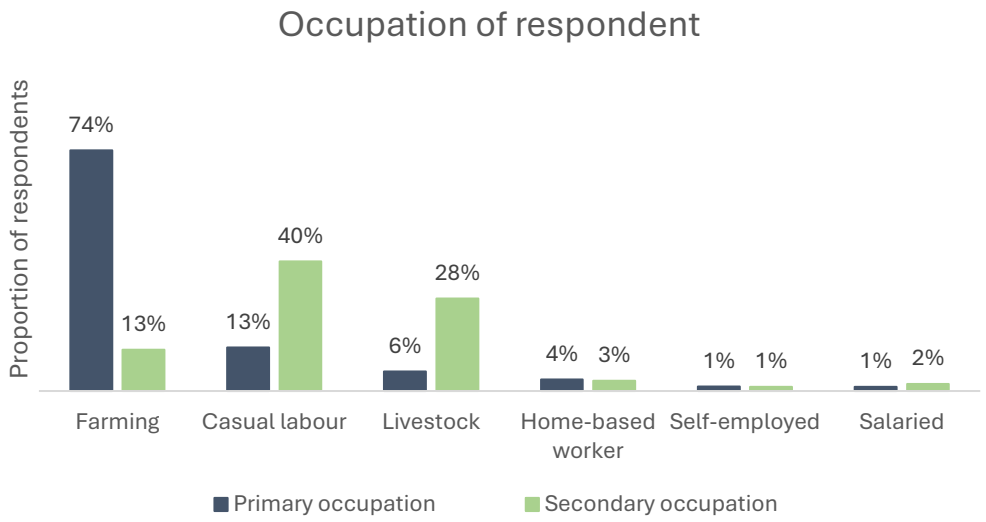
Baseline controls: Gender of HH head (female=1), Caste (privileged=1), size of landholding (hectare), access to formal extension, HH size, livestock ownership, wealth index, age of respondent, education level of respondent, respondent works on their farm, respondent works outside family farm, respondent is member of a group, respondent has adequate work balance, respondent has access to credit source

Endline controls: Access to personal phone, HH has faced any climate shock in the last 5 years, respondent is willing to be the first to try any new hypothetical agricultural practice/technology, HH is located within 1 km of another treated HH

Sample description (1/2)

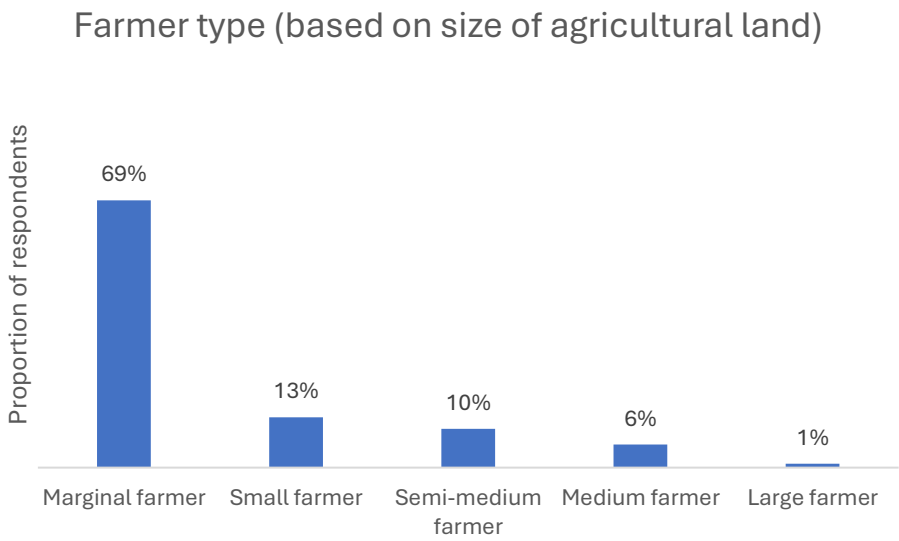
- 17% women were **household heads**
- **Average age -** 44 years
- Predominantly identify as Hindu (91%), Muslims (9%)
- **Caste**: Privileged/General (53%), SC (19%), OBC (17%), ST (10%)
- **Average number of members** per household- 6
- Majority of the women respondents (83%) **married**
- 74% women respondents work on their family farm
- 46% women also work outside their family farm





Sample description (2/2)

- 87% of the total recorded parcels by all HHs are self-owned, 8% are involved in sharecropping, and 2% rented land
- Around 23% households own more than one parcel of land; average **landholding size** 1.12 hectare
- 71% owned **livestock** (buffaloes-82% and cows-42%)
- 36% had access to formal sources of extension-includes government extension workers, CSOs, mass media, CBOs
- Popular sources for accessing inputs- local shops (average distance-12 kms)
  - *Only 11% relying on government facilities/shops*



Randomization balance

Variable	(1) Control Mean	(2) Poster Mean	(3) Video Mean	(4) Video+Poster Mean/	t-test Difference (1)-(2)	t-test Difference (1)-(3)	t-test Difference (1)-(4)
% of female-headed households	0.212	0.165	0.180	0.145	0.047	0.032	0.066
% of households belonging to privileged caste	0.533	0.566	0.526	0.484	-0.033	0.007	0.049
Household size	5.587	5.778	5.557	5.774	-0.191	0.030	-0.187
Area of agricultural land (in hectares)	1.123	1.145	1.157	1.024	-0.022	-0.033	0.100
Marginal farmers	0.663	0.690	0.708	0.709	-0.027	-0.045	-0.047
Small farmers	0.151	0.133	0.111	0.135	0.018	0.040	0.016
Semi-medium farmers	0.120	0.094	0.103	0.100	0.026	0.017	0.020
Medium farmer	0.062	0.072	0.069	0.048	-0.010	-0.007	0.015
Large farmers	0.004	0.010	0.010	0.008	-0.006	-0.005	-0.003
Livestock ownership	0.703	0.731	0.696	0.807	-0.028	0.007	**-0.104****
Wealth Quintile 1	0.166	0.196	0.178	0.256	-0.030	-0.012	**-0.090***
Wealth Quintile 2	0.186	0.216	0.170	0.203	-0.029	0.016	-0.017
Wealth Quintile 3	0.206	0.181	0.194	0.198	0.024	0.012	0.008
Wealth Quintile 4	0.207	0.174	0.215	0.178	0.033	-0.008	0.029
Wealth Quintile 5	0.204	0.207	0.211	0.133	-0.002	-0.007	**0.071***
Access to formal sources of extension	0.349	0.358	0.362	0.321	-0.009	-0.013	0.028
FIES(out of 8)	3.666	3.551	3.482	4.008	0.115	0.183	-0.342
Age of respondent (squared)	2185.614	2184.533	2114.411	2023.336	1.081	71.203	162.278
No formal education	0.494	0.493	0.423	0.524	0.002	0.071	-0.030
Lower primary (Less than class 8)	0.327	0.359	0.356	0.303	-0.032	-0.029	0.024
Primary (till class 8)	0.041	0.034	0.049	0.043	0.007	-0.008	-0.001
Secondary (till class 10)	0.092	0.085	0.107	0.088	0.006	-0.015	0.004
Post secondary (Class 11 and higher)	0.046	0.028	0.065	0.043	0.017	-0.019	0.003
% Involved in farm work	0.746	0.717	0.763	0.825	0.028	-0.017	**-0.079****
% Involved in off-farm work	0.466	0.443	0.472	0.486	0.023	-0.006	-0.020
% Empowered	0.433	0.411	0.465	0.461	0.021	-0.032	-0.028
Knowledge score (Raw score out of 20)	10.857	11.135	10.968	11.123	-0.278	-0.112	-0.266
Number of CSA practices farmers are aware of (out of 20)	13.376	13.732	13.628	13.263	-0.356	-0.253	0.113
Number of CSA practices farmers have adopted (out of 20)	11.349	11.419	11.401	11.195	-0.070	-0.052	0.154

The value displayed for t-tests are the differences in the means across the groups. Standard errors are clustered at variable village. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

Estimation strategy

- We compare the three treatment groups against the control group using the following ANCOVA specification (McKenzie, 2012):

$$Y_{ij,endline}=\beta_0+\beta_1 T1_{ij}+\beta_2 T2_{ij}+\beta_3 T3_{ij}+\beta_4 Y_{ij,baseline}+\beta_5 X_{ij,baseline}+\epsilon_{ij}$$

  - $Y_{ij,endline}$ is the outcome of interest (for the dependent variable, we ran separate models for awareness, knowledge score and adoption of recommended practices) for individual *i* in village *j* at endline
  - $T1_{ij}$,$T2_{ij}$ and $T3_{ij}$ are dummy variables that take the value of 1 if farmers *i* in village *j* was assigned to treatment arms T1, T2 and T3, respectively, and takes the value of 0 otherwise
  - Coefficients β_1, β_2 and β_3 capture the ITT effects of T1,T2 and T3
  - $Y_{ij,baseline}$ is the baseline measure of the outcome variable
  - X_{ij} is a vector of baseline control variables

- For outcomes variables captured only at endline (adoption of specific recommended practices), we do not include baseline values of the outcome variables.
- In all regressions, we cluster the standard errors at the level of randomization that is the cluster (village)

Impact on awareness of CSA practices (count variable for 20 broad practices)

	(1)	(2)	(3)	(4)
	Intent to Treat (ITT)		Treatment on Treated (TOT)	
Poster (T1)	0.9710	1.2307*	0.9910	0.8781
	(0.7379)	(0.6788)	(0.8126)	(0.7504)
Video (T2)	1.6176**	1.7347**	1.7243*	1.8615**
	(0.7657)	(0.7009)	(0.8951)	(0.8110)
Video+Poster (T3)	-0.2352	0.0202	0.0123	0.2509
	(1.0158)	(0.9299)	(1.1825)	(1.0177)
Baseline outcome variable	-0.1128*	-0.1391**	-0.0424	-0.0800
	(0.0651)	(0.0587)	(0.0748)	(0.0663)
Observations	2249	1781	1766	1405
R^2	0.023	0.130	0.016	0.137
Baseline controls	No	Yes	No	Yes
Control mean	10.55		10.38	

Standard errors clustered at the village level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Impact on awareness of recommended practices (dummy variable)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	At least one of the six practices				Pest management practices				Soil testing			
	Intent to Treat (ITT)		Treatment on Treated (TOT)		Intent to Treat (ITT)		Treatment on Treated (TOT)		Intent to Treat (ITT)		Treatment on Treated (TOT)	
Poster (T1)	0.0482	0.0654	0.0486	-0.0203	0.0940*	0.0792*	0.1159**	0.0771	0.0268	0.0807	0.0014	-0.0395
	(0.0462)	(0.0430)	(0.0492)	(0.0620)	(0.0510)	(0.0459)	(0.0557)	(0.0781)	(0.0461)	(0.0489)	(0.0500)	(0.0694)
Video (T2)	0.0987**	0.1123**	0.0956	0.0448	0.1765***	0.1733***	0.1866***	0.1682**	0.0525	0.0949*	0.0294	0.0059
	(0.0498)	(0.0440)	(0.0584)	(0.0714)	(0.0529)	(0.0492)	(0.0621)	(0.0848)	(0.0519)	(0.0502)	(0.0611)	(0.0799)
Video+Poster (T3)	-0.0192	0.0335	0.0010	-0.0354	0.0627	0.0810	0.0996	0.0766	-0.0398	0.0317	-0.0315	-0.0646
	(0.0643)	(0.0549)	(0.0750)	(0.0683)	(0.0676)	(0.0636)	(0.0776)	(0.0804)	(0.0645)	(0.0550)	(0.0783)	(0.0750)
Observations	2249	1781	1766	1405	2249	1781	1766	1405	2249	1781	1766	1405
R^2	0.009	0.175	0.007	0.183	0.018	0.176	0.020	0.189	0.004	0.158	0.001	0.167
Baseline controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Control mean	0.69		0.69		0.55		0.54		0.56		0.58	

Standard errors clustered at the village level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Other factors that influence awareness

- Respondents from **wealthier households** (higher quintiles of the wealth index) and households with bigger **landholdings** were more aware.
- Experience of any kind of (self-reported) **climate shock** in the last 5 years is positively associated with higher awareness
- Farmers from **large households** were less likely to be aware of the CSA practices
- Awareness was higher for women who worked **on farm** and for those who were involved in **off-farm** activities.
- **Education** is positively associated with higher awareness
- **Work balance** and access to **credit** (A-WEAI)- positive impact on awareness around CSA
- Women with access to personal **smartphones**, and those categorized as **risk loving** were more aware

Impact on knowledge (1/2)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Raw scores				Weighted scores			
	Intent to Treat (ITT)		Treatment on Treated (TOT)		Intent to Treat (ITT)		Treatment on Treated (TOT)	
Poster (T1)	-0.1007	-0.0479	-0.1335	-0.1003	-0.4530	-0.2521	-0.6894	-0.4147
	(0.1564)	(0.1449)	(0.1722)	(0.1582)	(0.7577)	(0.7395)	(0.8525)	(0.8438)
Video (T2)	-0.0218	-0.1674	0.1222	-0.0075	-0.4231	-1.2005	0.3298	-0.4145
	(0.1920)	(0.1760)	(0.2225)	(0.2009)	(0.9053)	(0.8321)	(1.0432)	(0.9681)
Video+Poster (T3)	0.1152	0.1238	0.2203	0.2309	1.2848	1.5477	2.0228	2.3656
	(0.1709)	(0.1840)	(0.1988)	(0.2279)	(1.3038)	(1.4110)	(1.6237)	(1.7782)
Baseline outcome variable	0.1564***	0.0910***	0.1433***	0.0818***	0.2994***	0.2210***	0.2875***	0.2195***
	(0.0183)	(0.0207)	(0.0211)	(0.0231)	(0.0404)	(0.0441)	(0.0430)	(0.0467)
Observations	2249	1781	1766	1405	2249	1781	1766	1405
R^2	0.034	0.087	0.032	0.094	0.047	0.087	0.047	0.092
Baseline controls	No	Yes	No	Yes	No	Yes	No	Yes
Control mean	9.84		9.85		19.91		19.95	

Standard errors clustered at the village level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Impact on knowledge (2/2)

- Without including baseline household and individual characteristics, effect of video+poster (T3) on knowledge is higher than only posters (weak evidence at 10% significance level) among treated respondents (ToT)
- When including baseline household and individual characteristics, effect of video+poster (T3) on knowledge is also higher than only videos (weak evidence at 10% significance level)
- Respondents from households with **female heads** and respondents involved in **off-farm** activities likely to have lower knowledge scores
- **Education** is positively associated with better performance in the knowledge test
- Respondents belonging to highest **wealth** quintile- higher raw scores

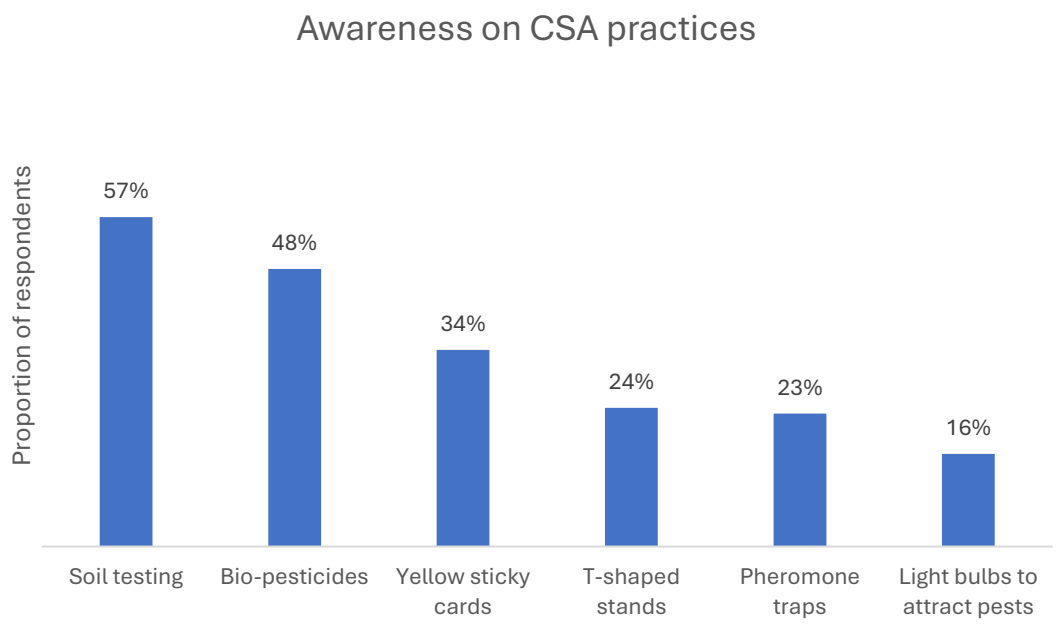
Impact on adoption of CSA practices (count variable for 20 broad practices)

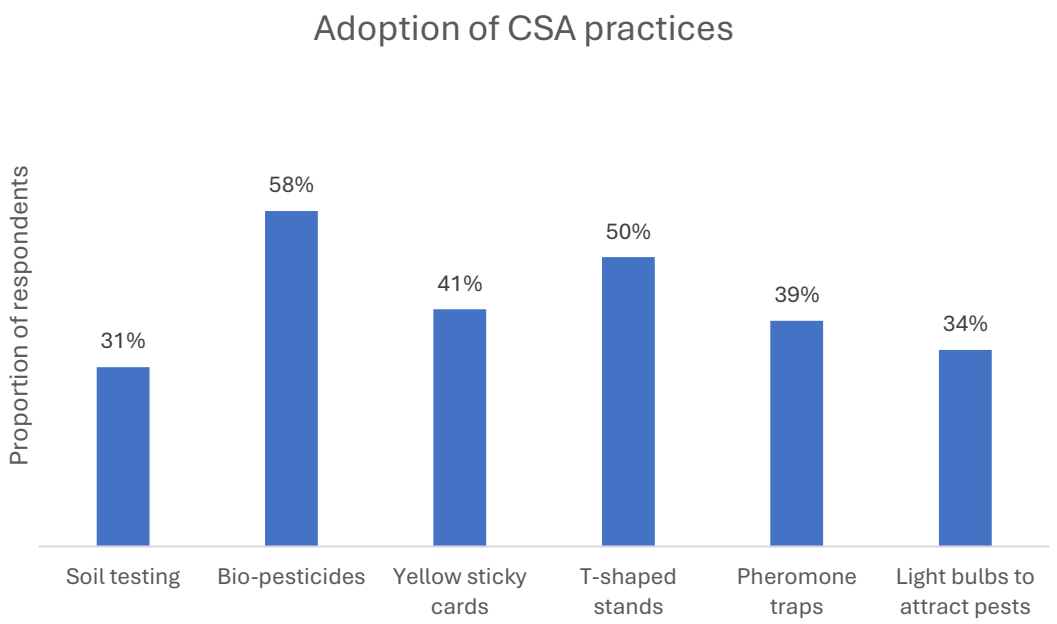
	(1)	(2)	(3)	(4)
	Intent to Treat (ITT)		Treatment on Treated (TOT)	
Poster (T1)	0.6141	0.7178	0.6815	0.6301
	(0.5358)	(0.5038)	(0.5814)	(0.5651)
Video (T2)	1.0034*	1.1584**	1.2224*	1.3566**
	(0.5982)	(0.5821)	(0.6634)	(0.6342)
Video+Poster (T3)	0.0034	-0.0301	0.2634	0.2243
	(0.7191)	(0.6752)	(0.8115)	(0.7315)
Baseline outcome variable	0.0585	0.0120	0.1137**	0.0648
	(0.0474)	(0.0456)	(0.0527)	(0.0497)
Observations	2249	1781	1766	1405
R^2	0.011	0.135	0.020	0.145
Baseline controls	No	Yes	No	Yes
Control mean	7.76		7.54	

Standard errors clustered at the village level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Awareness and adoption of featured CSA practices: What we know so far...

- High awareness around soil testing but lower adoption- challenges in accessing soil testing facilities
- Higher share of farmers adopting bio-pesticides- can be prepared at home with easily available raw material
- Constraints to adoption of CSA practices- Information gaps, limited evidence on benefits of these practices, financial constraints, and insufficient labor for implementing practices





Impact on adoption of recommended practices (dummy variable)

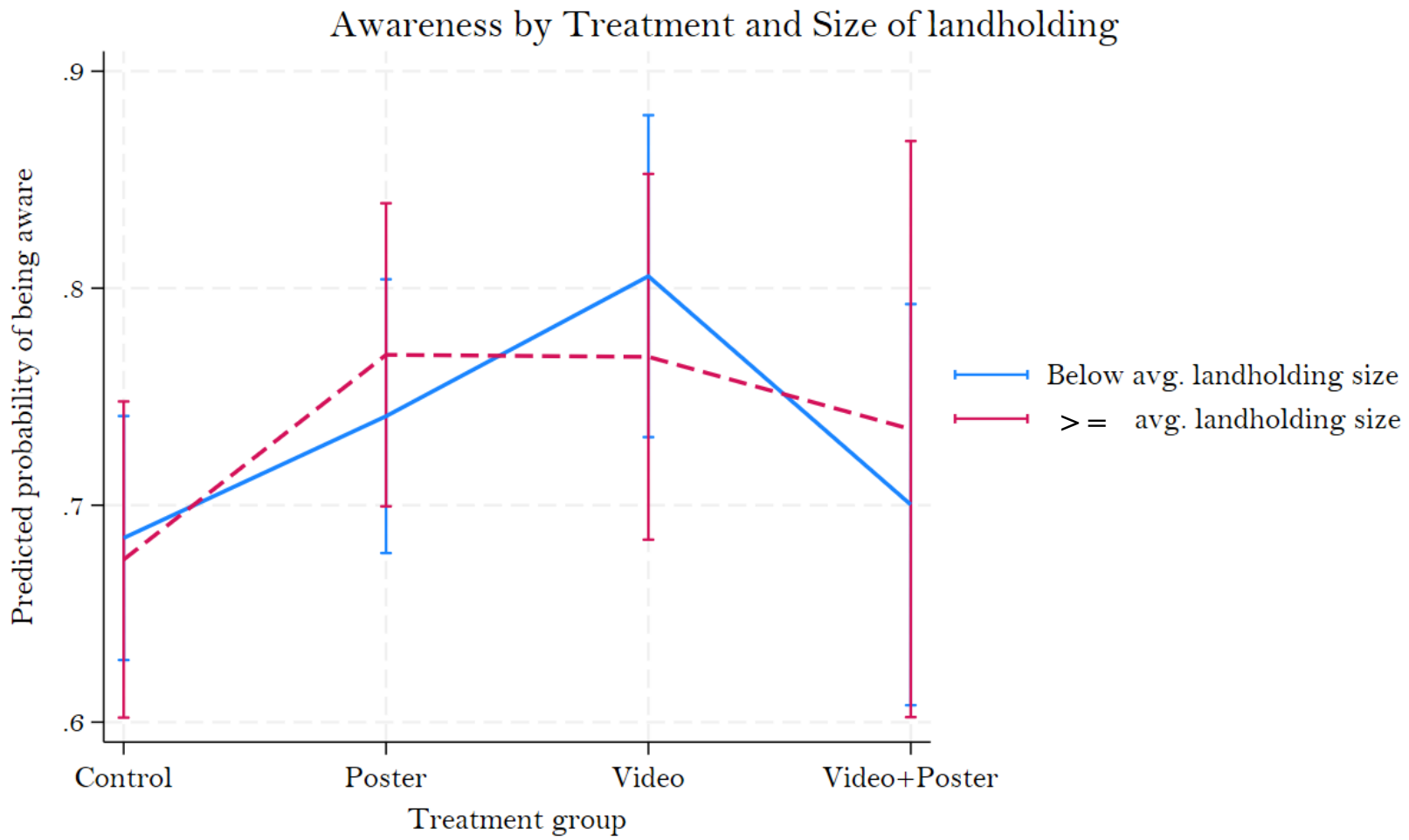
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Adopt at least one of the six practices=1				Adopt pest management practices=1				Adopt soil testing=1			
	Intent to Treat (ITT)		Treatment on Treated (TOT)		Intent to Treat (ITT)		Treatment on Treated (TOT)		Intent to Treat (ITT)		Treatment on Treated (TOT)	
Poster (T1)	0.0553	0.0619	0.0506	0.1272	0.0575	0.0423	0.0657	0.1371*	0.0063	0.0404	-0.0162	0.0757
	(0.0472)	(0.0484)	(0.0522)	(0.0782)	(0.0490)	(0.0582)	(0.0528)	(0.0804)	(0.0279)	(0.0274)	(0.0306)	(0.0526)
Video (T2)	0.1140**	0.1105**	0.1013*	0.1647**	0.1158**	0.0916*	0.1194**	0.1718**	0.0290	0.0631**	0.0166	0.0945*
	(0.0499)	(0.0465)	(0.0597)	(0.0829)	(0.0506)	(0.0552)	(0.0598)	(0.0843)	(0.0303)	(0.0319)	(0.0353)	(0.0547)
Video+Poster (T3)	0.0391	0.0246	0.0527	0.0805	0.0451	0.0095	0.0579	0.0755	-0.0007	0.0401	0.0116	0.0799
	(0.0644)	(0.0597)	(0.0743)	(0.0794)	(0.0640)	(0.0667)	(0.0745)	(0.0795)	(0.0333)	(0.0362)	(0.0406)	(0.0600)
Observations	2249	1781	1766	1405	2249	1781	1766	1405	2249	1781	1766	1405
R^2	0.007	0.152	0.005	0.156	0.007	0.148	0.008	0.157	0.001	0.076	0.001	0.074
Baseline controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Control mean	0.41		0.42		0.36		0.36		0.17		0.18	

Standard errors clustered at the village level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

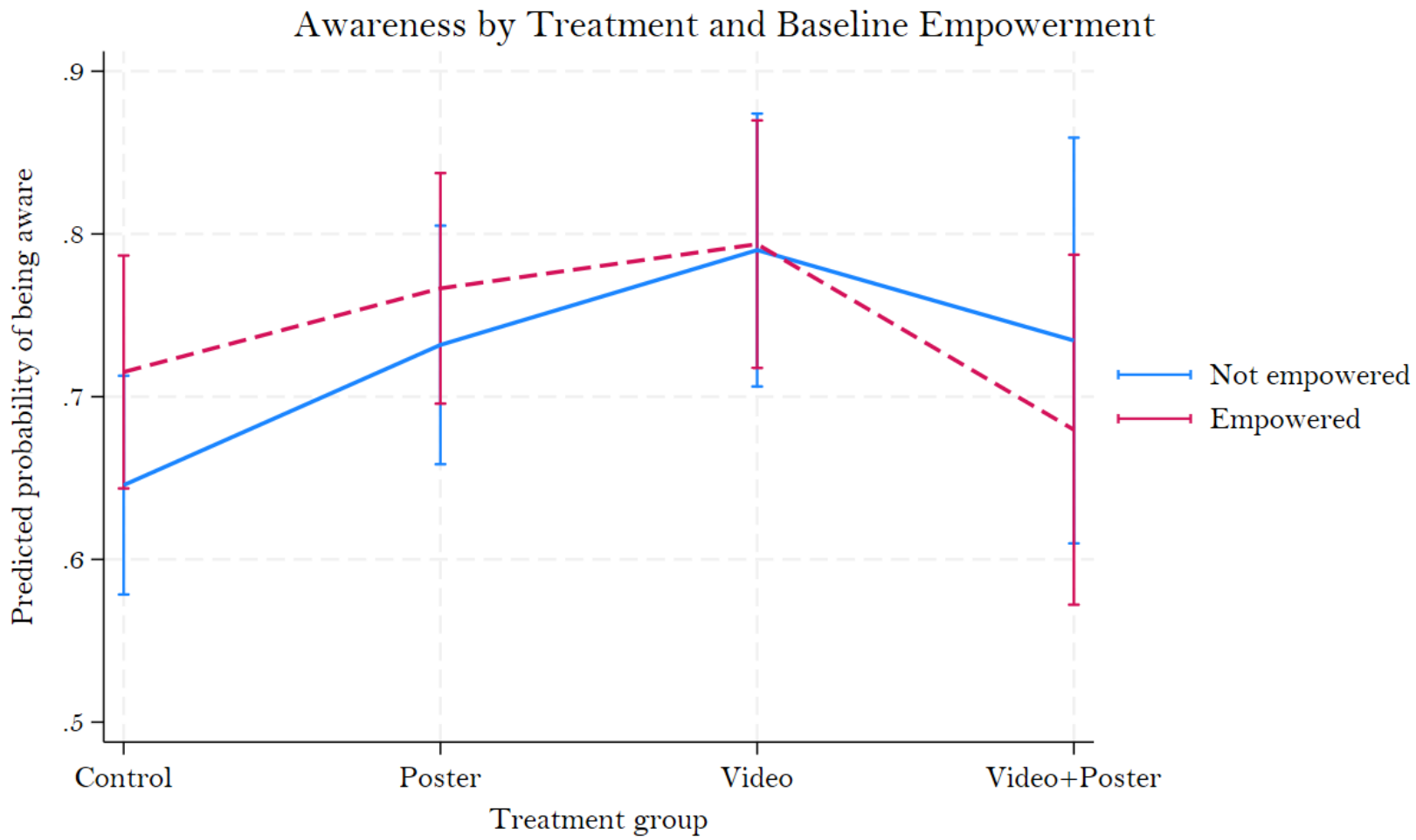
Other factors that influence adoption of CSA practices

- Respondents from **wealthier households** (higher quintiles of the wealth index) more likely to adopt- true for broad CSA practices and pest management practices, not as much for soil testing.
- Farmers who had access to **formal extension** sources were more likely to adopt soil testing.
- Experience of any kind of (self-reported) **climate shock** in the last 5 years is positively associated with higher adoption of recommended practices
- Adoption was higher for respondents who worked **on farm**; women who were involved in **off-farm** activities less likely to adopt recommended practices
- **Education** is positively associated with higher adoption of CSA practices
- Work balance and access to credit (A-WEAI)- positive impact on adoption of CSA but no effect on the recommended practices
- Individuals categorized as **risk loving** were more likely to adopt the featured practices
- Baseline **knowledge scores-** positive association with adoption

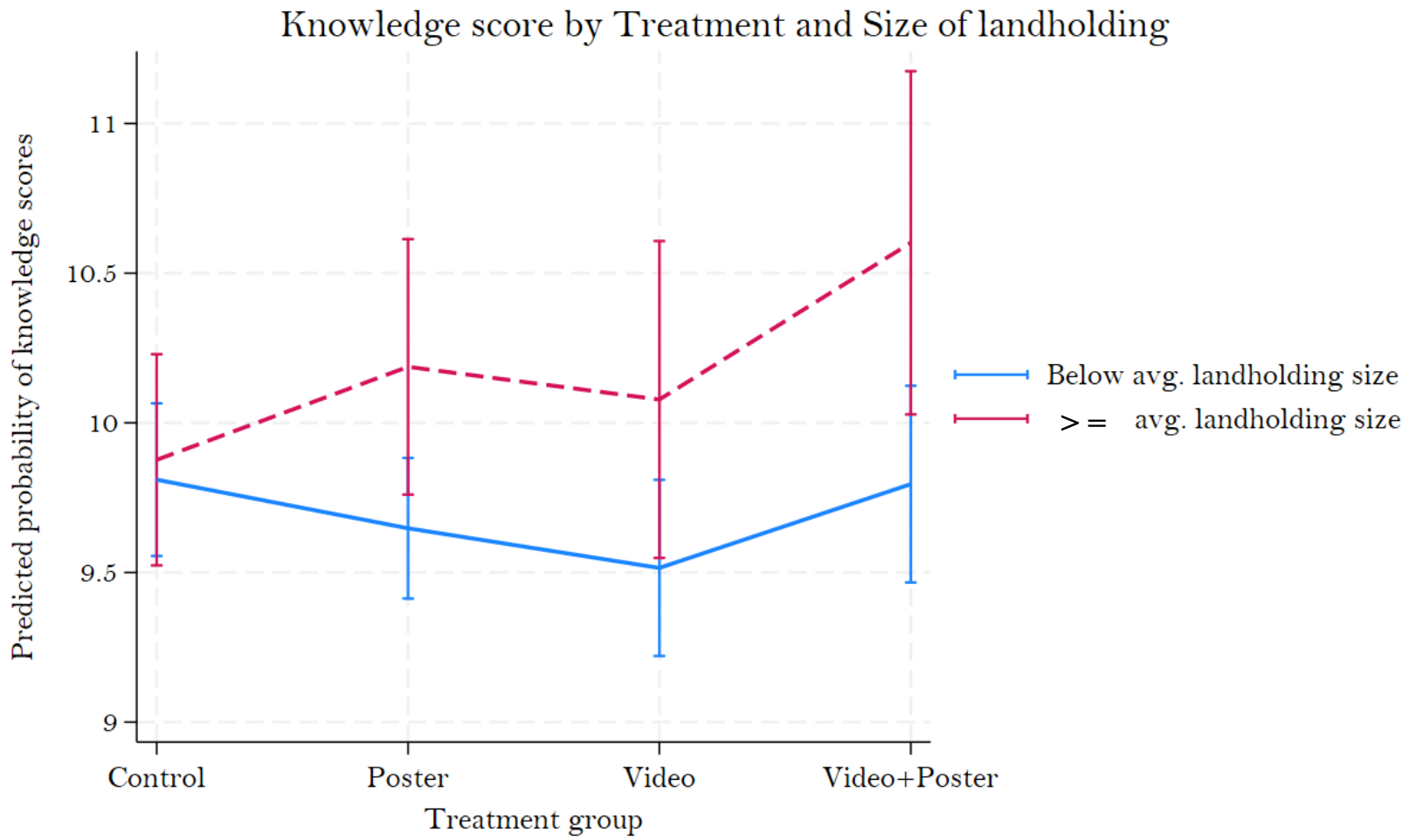
Heterogeneity in awareness of any of the recommended practices: By resource endowments (size of landholding)



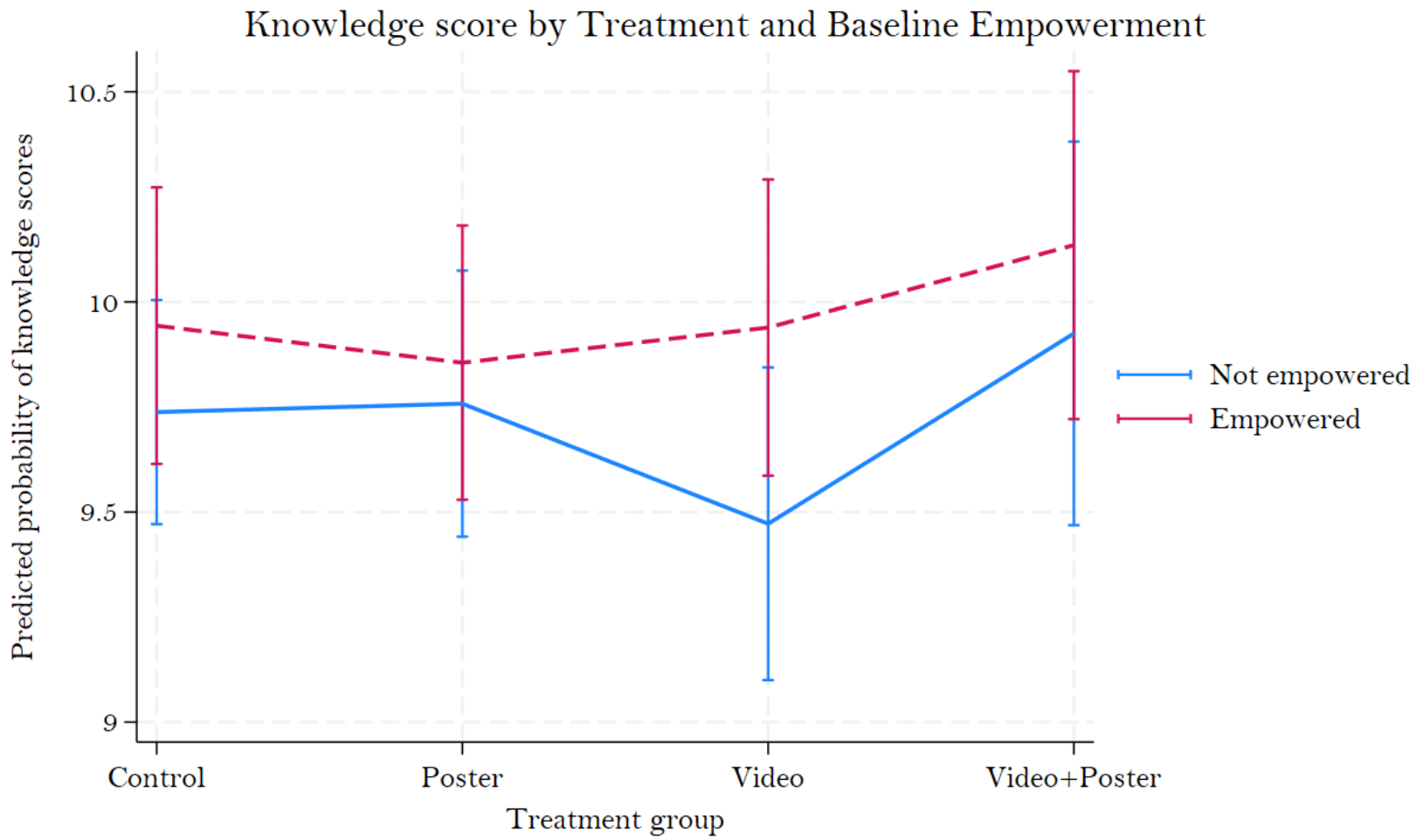
Heterogeneity in awareness of any of the recommended practices: By decision-making power (empowerment)



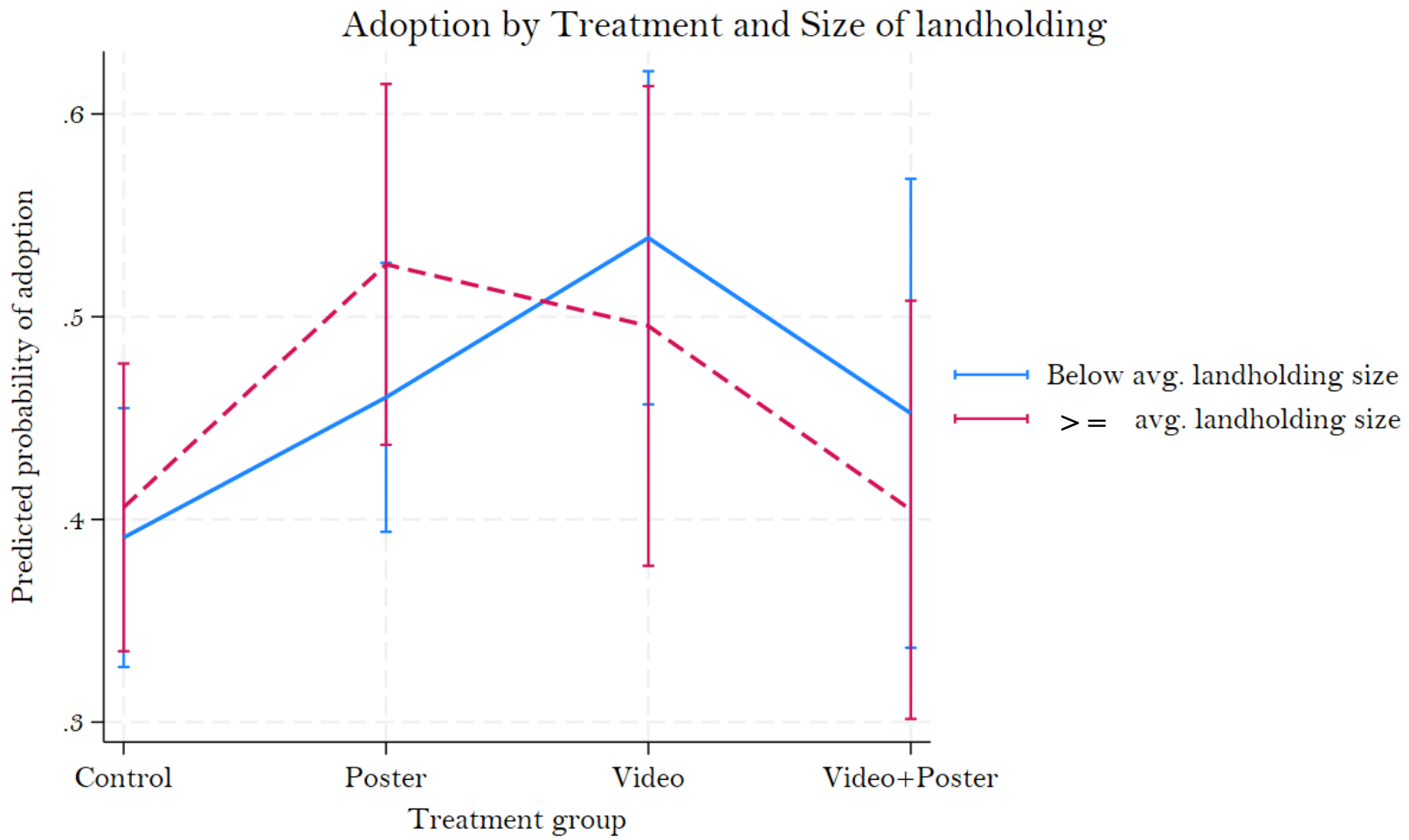
Heterogeneity in knowledge scores: By resource endowments (size of landholding)



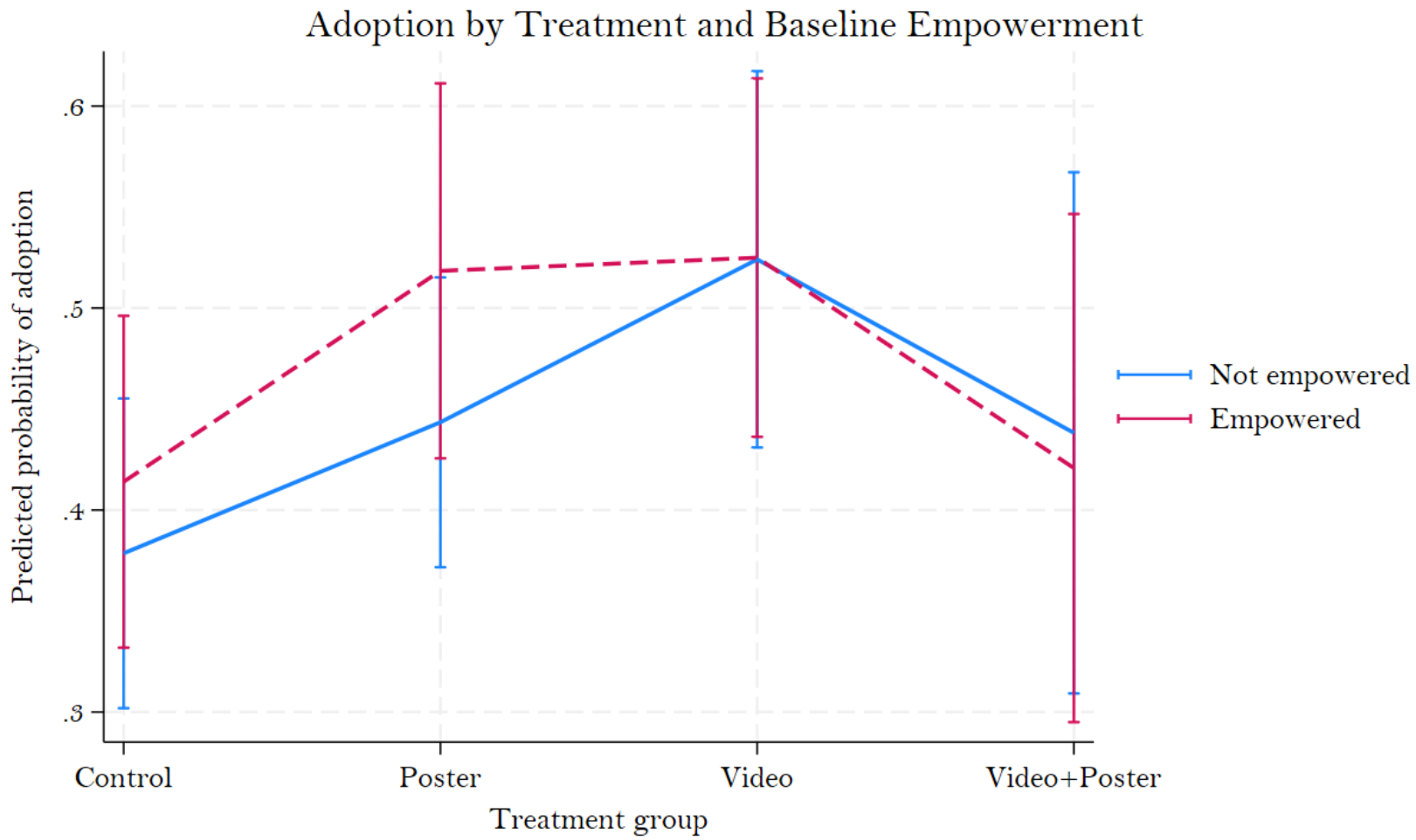
Heterogeneity in knowledge scores: By decision-making power (empowerment)



Heterogeneity in adoption of any of the recommended practices: By resource endowments (size of landholding)



Heterogeneity in adoption of any of the recommended practices: By decision-making power (empowerment)



Perception of the training material

- Feedback from various groups consistently highlighted that the content presented in the training material was entirely new to them.

We were not aware of soil testing, and solutions like Amrutpani, but only through the training material, we learned." - Farmer

- Use of local language and representation of local women farmers enhanced relevance of the content and made it relatable.

"We could connect with the content shown in the videos, as we grow the same crops as shown in the videos like cotton and castor."- Farmer

"In the poster, we could only understand the image but could not read the text. But in the videos, the language was Gujarati, so we could understand. We were able to connect better when we saw images and videos ."- Farmer

- A combination of posters and videos were appreciated by trainers.

"Not all Women can understand posters well, only educated women easily understand them. Therefore, it gets effective when we supplement them with videos and provide an explanation. We first show the poster, then explain the videos, and then women are able to connect with the content." – Aagevan (Trainer)

- Photos in the posters allowed participants to concentrate on specific details and connect to what was explained in videos.

Impact on secondary outcomes

- Food insecurity- calculated using FIES
  - Around 50% households at endline experienced some form of food insecurity
  - Treated HHs less likely to experience food insecurity- not significant
- Encourage farmers to adopt new practices- captured through risk attitudes
  - 23% respondents reported they will be the first to try a new practice/technology
  - No effect on risk taking attitude of farmers (promptly willing to try a new practice)
- Women's empowerment- A-WEAI
  - 37% women at endline were categorized as empowered based on their adequacies across A-WEAI domains
  - Women exposed to T3 were less likely to be empowered compared to control group

Summing up

- **RQ1:** Both posters alone and video alone are an effective way to increase awareness on CSA practices- pest management practices, especially. No effect of the treatments on knowledge levels on soil testing and IPM. Videos alone are an effective way of promoting adoption of CSA practices.
- **RQ2:** Video based dissemination more effective than posters/traditional extension in enhancing awareness.
- **RQ3:** No incremental benefit of combining the two methods for awareness and adoption. Weak evidence of positive effect of combining the two in increasing knowledge levels as compared to individual treatments.
- **RQ4**: **:** Awareness and adoption of recommended practices- videos useful for smallholder farmers and even less empowered farmers- help reduce information barriers. For knowledge, while larger farmers benefit from T3, combining video and posters may help bridge empowerment divide by increasing knowledge outcomes for all.

Policy recommendations

- Scaling of gender-responsive ICT-based extension through women's groups to reach smallholder women farmers effectively.
- Prioritize video-based dissemination for improving awareness and adoption of CSA practices- it can help overcome information barriers faced by resource-poor and less-empowered farmers.
  - Combine videos with posters or discussions to reinforce learning and bridge knowledge gaps, especially among less-empowered women.
  - Tailor messages to education levels.
- Integrate empowerment into extension strategies to strengthen women's decision-making, credit access, and workload balance alongside information delivery to translate awareness into action.
- Enhance enabling conditions for adoption by bundling ICT-based information interventions with access to inputs, credit, and formal extension services

Thank you

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