Assessing the potential of participatory extension approaches for promoting climate smart agriculture: Insights from smallholder women farmers in Gujarat, India

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Transformation Towards Sustainable Agri-Food Systems

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Need for adopting climate smart agriculture practices

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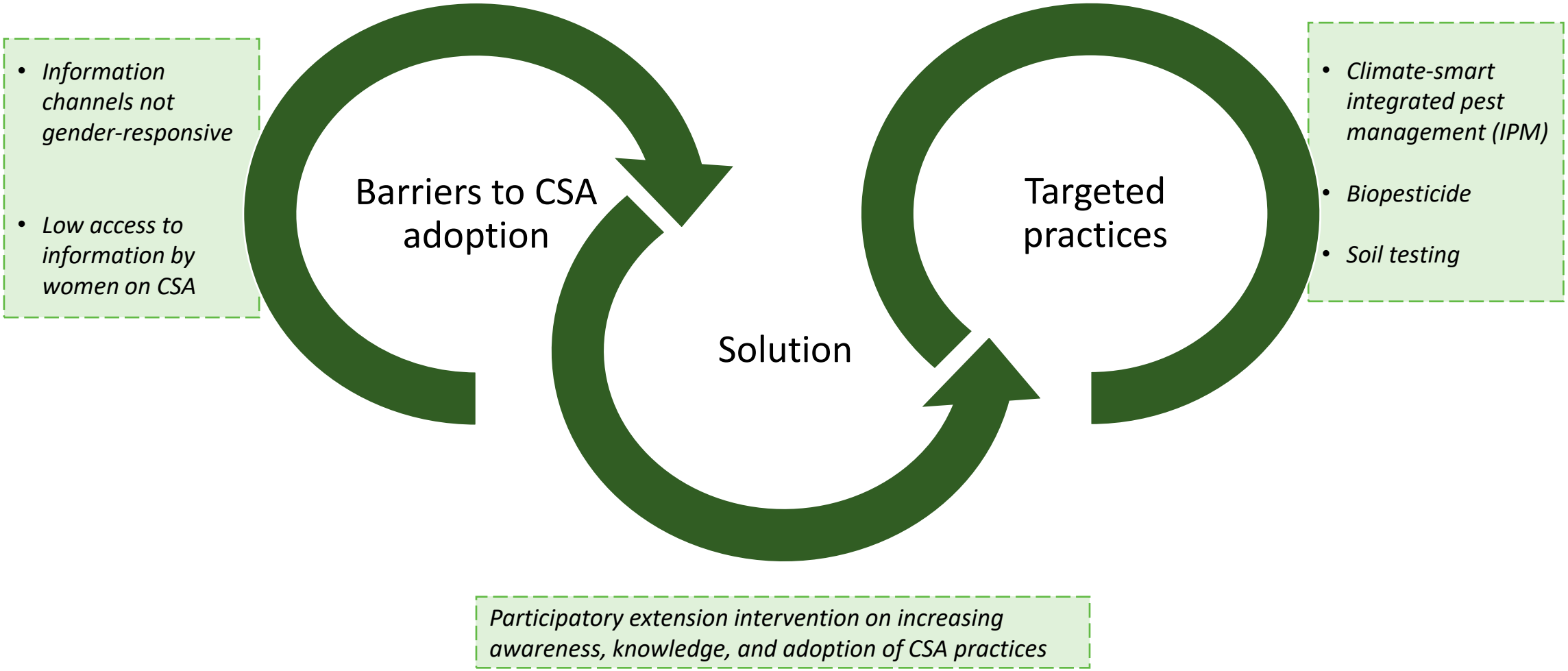
Study context



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Study design: Clustered Randomised Control Trial

Experiment to measure change in outcome variable- Farmer **knowledge, awareness and adoption of selected CSA practices**
Three Treatment Arms (93 villages)
(based on extension approach)

Only Posters: 40 villages

Only Video: 30 villages

Both Poster & Video: 23 villages

Control Arm (with no outreach): 40 villages

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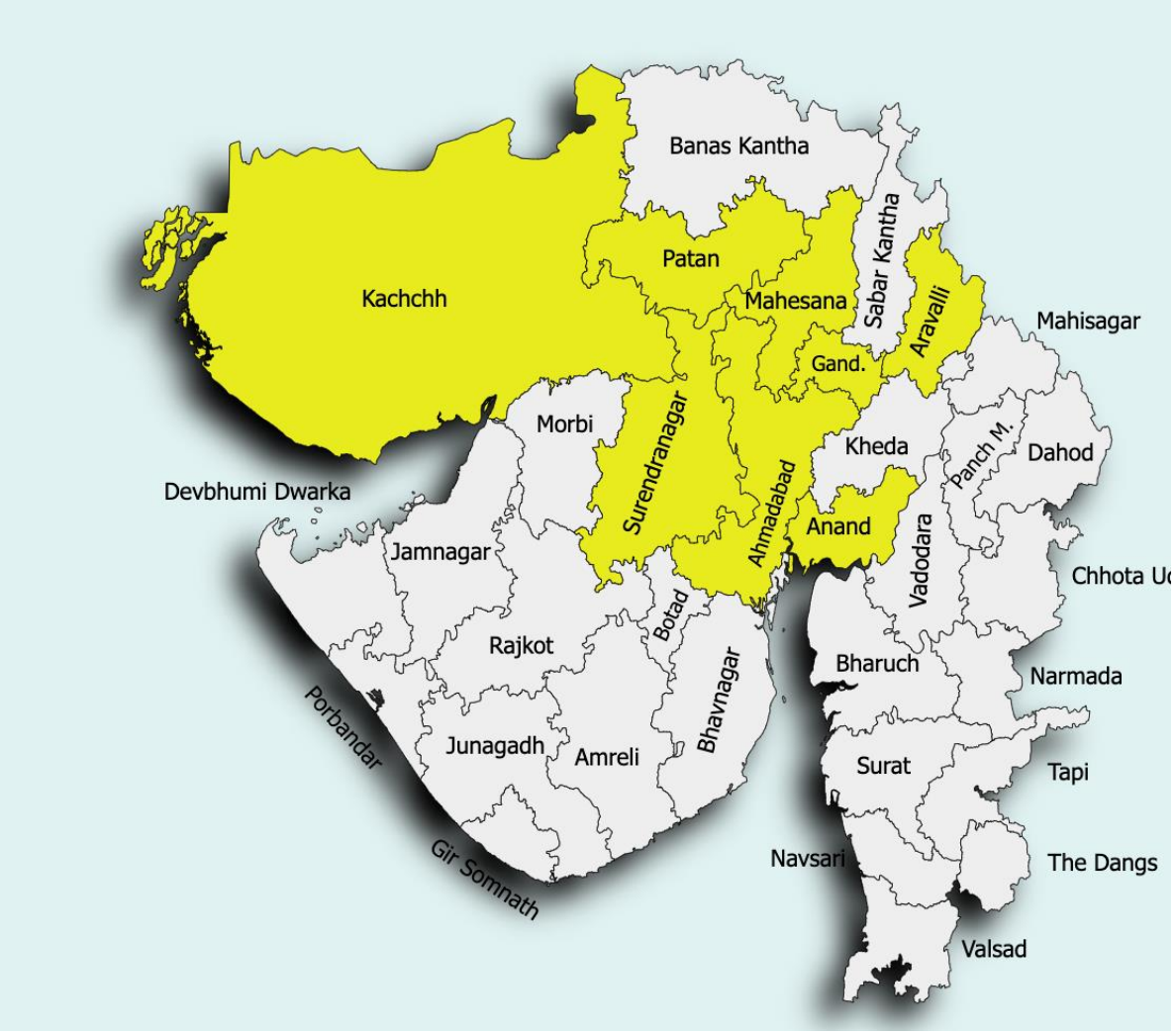
Study design: Clustered Randomised Control Trial

Study location: 8 districts of Gujarat



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****: 2254 respondents (14% attrition)*

Study Timelines

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

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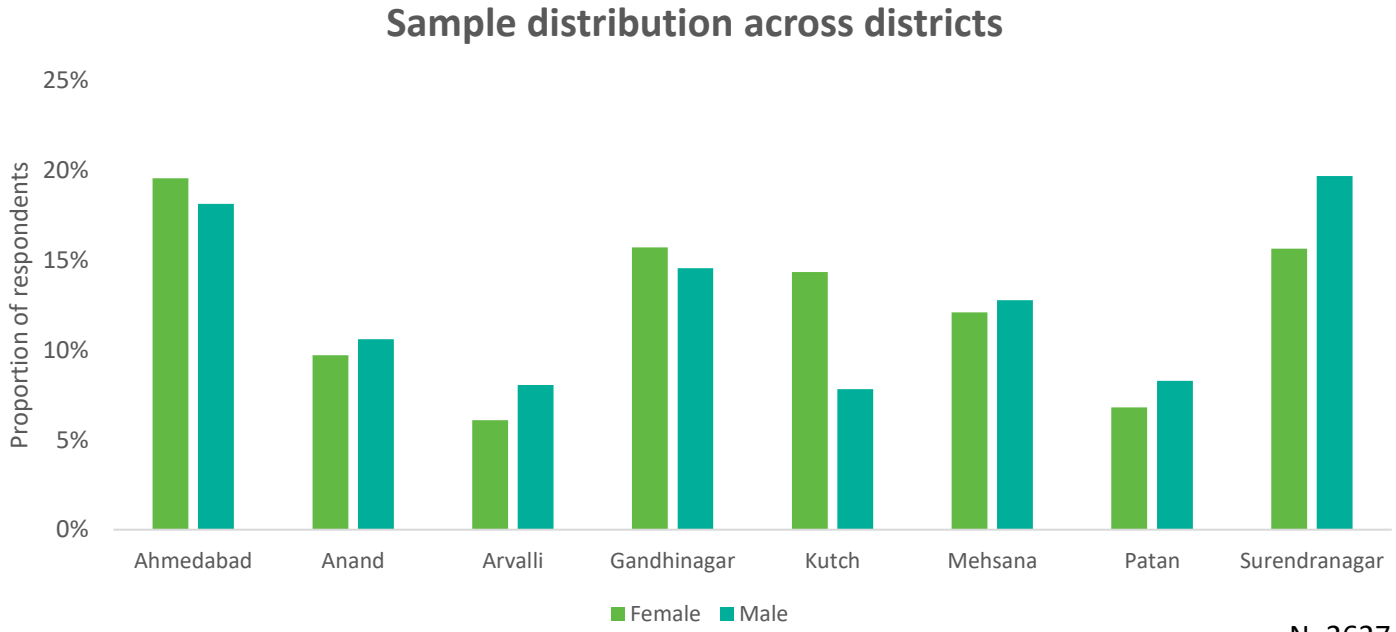
Sample distribution

- 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

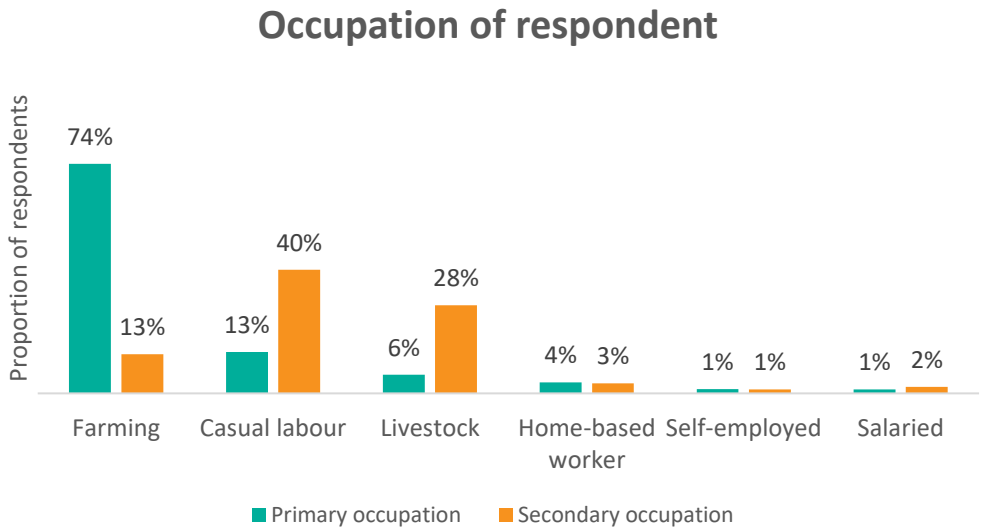


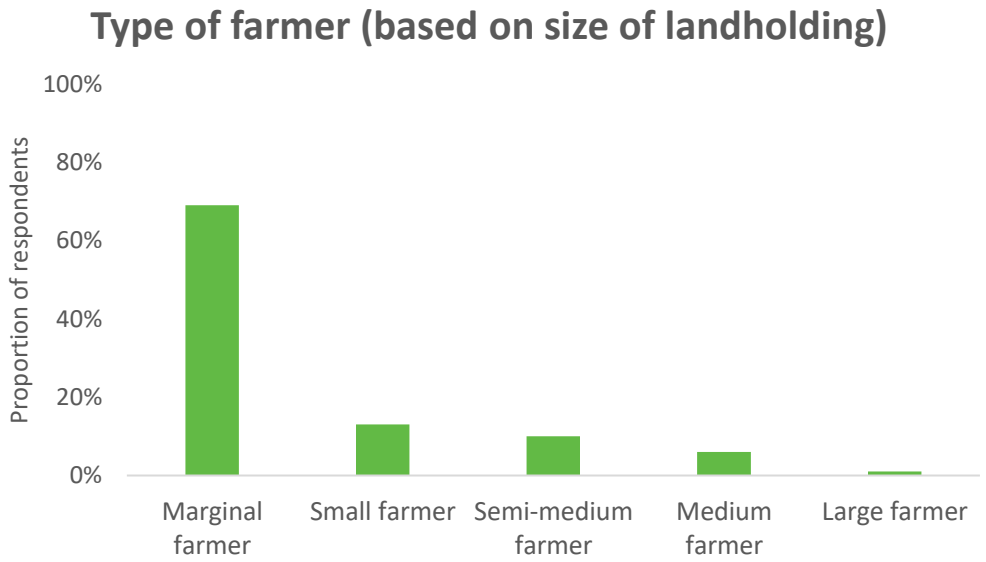
N=2627

Sample distribution by treatment	Baseline	Endline
Control	790	678
Treatment 1 (Poster)	796	688
Treatment 2 (Video)	591	506
Treatment 3 (Video+Poster)	450	382
Total	**2627**	**2254**

Respondent characteristics

- 17% **female headed households**
- **Average age:** 44 years
- **Religion:** Predominantly identify as Hindu (91%), Muslims (9%)
- **Caste**: General (53%), SC (19%), OBC (16%), ST (10%)
- Majority of the respondents (83%) **married;** 15% women widowed
- 97% households have been involved in farming for at least five years
- 87% of the total recorded parcels by all HHs are self-owned, 8% are involved in sharecropping, and 2% rented land
- Farming- **primary occupation** for 74% respondents; 46% involved in off-farm activities
- **Average number of members** per household- 6
- **Education:** No formal education (48%), lower primary (33%), primary (4%), secondary (9%), post secondary (4%)
- Only 36% women reported access to formal sources of agricultural information and extension services





N=2627

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Balance tests

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	0.214	0.156	0.162	0.137	0.059	0.053	0.077
No formal education	0.493	0.528	0.433	0.482	-0.034	0.060	0.011
Lower primary (Less than class 8)	0.317	0.331	0.338	0.320	-0.014	-0.022	-0.004
Primary (till class 8)	0.045	0.029	0.056	0.046	0.016	-0.012	-0.001
Secondary (till class 10)	0.099	0.084	0.110	0.106	0.015	-0.012	-0.007
Post secondary (Class 11 and higher)	0.047	0.029	0.062	0.046	0.018	-0.015	0.001
% Involved in off-farm work	0.453	0.429	0.441	0.500	0.023	0.011	-0.047
Access to formal sources of extension	0.340	0.294	0.381	0.330	0.046	-0.041	0.010
Marginal farmers	0.639	0.664	0.656	0.694	-0.025	-0.018	-0.055
Small farnmers	0.149	0.134	0.123	0.144	0.015	0.026	0.005
Semi-medium farmers	0.134	0.106	0.118	0.109	0.029	0.016	0.025
Medium farmer	0.073	0.084	0.090	0.042	-0.011	-0.017	0.030
Large farmers	0.006	0.013	0.013	0.011	-0.007	-0.007	-0.005
Area of agricultural land (in hectares)	1.214	1.246	1.352	1.071	-0.033	-0.139	0.143
Number of years household has been involved in farming	29.305	25.857	31.392	25.704	3.449	-2.087	3.601
Own land	0.771	0.739	0.790	0.746	0.032	-0.019	0.024
Renting in/Sharecropping in	0.078	0.109	0.069	0.120	-0.031	0.009	-0.042
Communal land	0.030	0.036	0.028	0.004	-0.006	0.002	0.026*
Renting/Leased out	0.050	0.025	0.041	0.046	0.025*	0.009	0.005
Wealth Quintile 1	0.188	0.177	0.156	0.239	0.011	0.032	-0.051
Wealth Quintile 2	0.171	0.208	0.172	0.197	-0.036	-0.000	-0.026
Wealth Quintile 3	0.186	0.186	0.200	0.211	0.000	-0.014	-0.025
Wealth Quintile 4	0.205	0.177	0.226	0.180	0.028	-0.021	0.025
Wealth Quintile 5	0.214	0.227	0.205	0.151	-0.013	0.009	0.063

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.*

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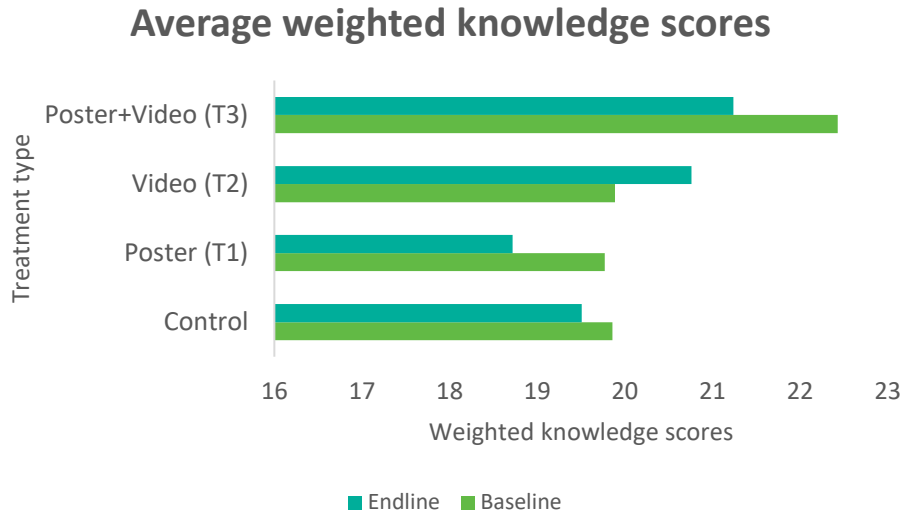
Impact of extension approaches on knowledge around CSA practices

- Knowledge test- 20 questions (10 soil test & 10 IPM and bio-pesticides)
  - *Participants respond to the same set of knowledge questions at both baseline and endline, and across treatment groups*
  - *Assign weight (inverse of the probability of answering a question correctly) to raw knowledge scores to generate standardized scores*
- Higher proportion of respondents could correctly answer statements (questions) that were framed "correctly"
- Average scores higher for soil testing as compared to IPM
- Estimate treatment effects (ITT using mixed effects model) for each of the extension approaches
  - *Videos (alone)- effective tool for agricultural extension*



Repeated measures mixed effects model to estimate ITT effects on weighted knowledge scores			
	Coefficient	95% CI	
Poster	-0.49 (1.00)	-2.45	1.46
Video	**1.82* (1.07)**	**-0.27**	**3.92**
Both (Poster+Video)	-1.22 (1.18)	-3.55	1.10

* p < 0.10, ** p < 0.05, *** p < 0.01; Standard errors in parentheses

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Socio-economic factors affecting knowledge around CSA practices

- Level of education of respondent – **positively** associated with higher scores
  - *Especially for those educated up to primary level (class 5) and beyond*
- Size of landholding & households from privileged economic groups (higher levels on the wealth index) – **positively** associated with higher scores
- Female-headed households – **negatively** associated with knowledge scores
- Households involved in farming for longer period likely to have **lower** scores
- Respondents involved in off-farm activities – score **lower**

Independent variables	**Coefficient**	**95% CI**	
Area of agricultural land in past 12 months (in hectare)	**0.42*** (0.11)**	0.19	0.65
Education level completed- Lower primary (Base=No formal education)	**0.66* (0.50)**	-0.31	1.63
Education level completed- Primary (Base=No formal education)	**3.75*** (1.02)**	1.74	5.76
Education level completed- Secondary (Base=No formal education)	**3.15*** (0.73)**	1.71	4.59
Education level completed- Post secondary (Base=No formal education)	**3.78*** (1.08)**	1.65	5.91
Respondent involved in off-farm activities	**-0.98** (0.43)**	-1.83	-0.13
Female headed households	**-1.17* (0.60)**	-2.36	0.01
No. of years for which household has been involved in farming	**-0.02** (0.01)**	-0.04	0
Wealth index- Low (Base=Lowest quintile)	0.25 (0.73)	-1.18	1.69
Wealth index- Medium (Base= Lowest quintile)	0.09 (0.72)	-1.31	1.5
Wealth index- High (Base= Lowest quintile)	**1.40* (0.71)**	0	2.81
Wealth index- Highest (Base= Lowest quintile)	**1.52** (0.74)**	0.05	2.98
Constant	19.10*** (0.85)	7.42	20.78
N	2931		

* p < 0.10, ** p < 0.05, *** p < 0.01; Standard errors in parentheses

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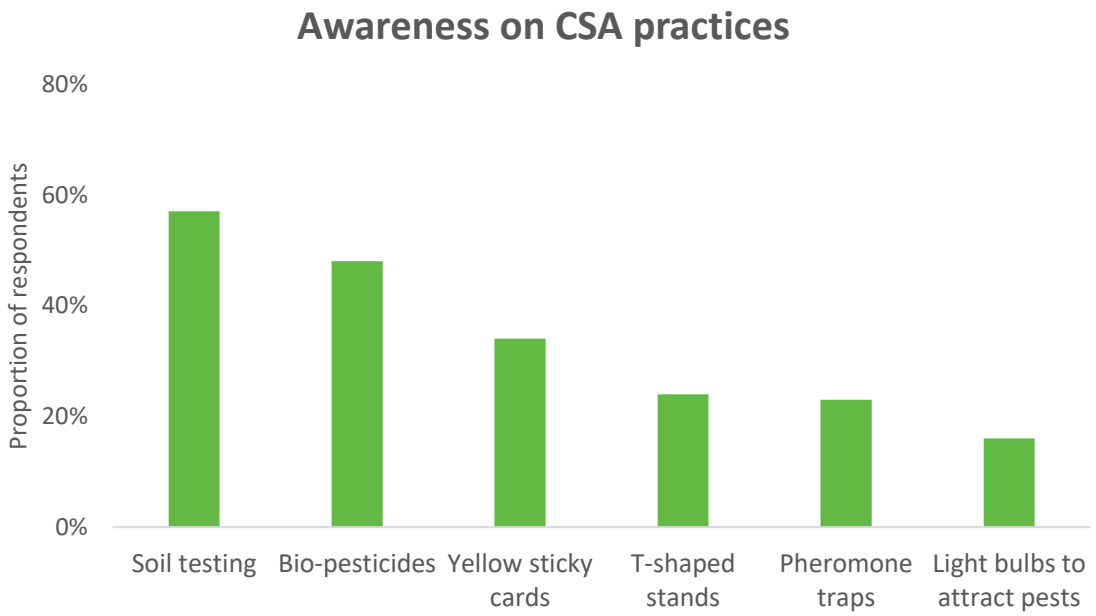
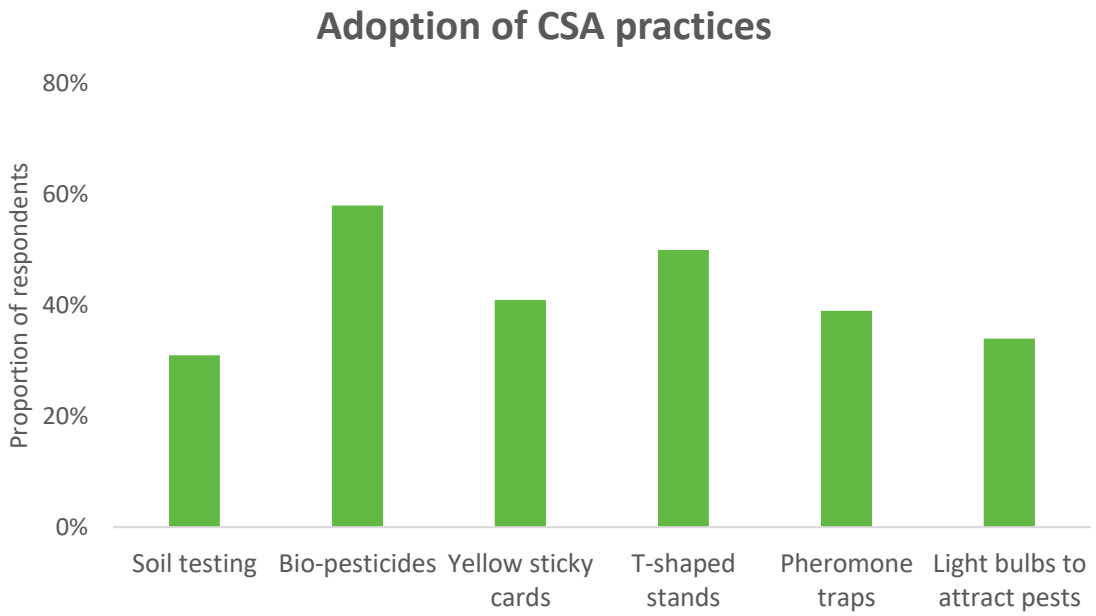
Awareness and adoption of featured CSA practices

- 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





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Impact of extension approaches on awareness and adoption of featured CSA practices

- All information delivery mechanisms were effective in enhancing awareness about featured CSA practices
- Limited impact on adoption of CSA practices
  - *Soil testing- higher likelihood of adoption for those who were shown videos and both posters and videos, as compared to control group*
  - *Use of T-shaped stands- higher likelihood of adoption among those who were shown posters or videos only*
- Heterogenous effects:
  - *Access to formal agricultural information sources– **positively** associated with awareness and adoption of CSA practices*
  - *Education level of respondent – **positively** associated with awareness and adoption*
  - *Respondents from higher wealth quintiles and those involved in off-farm activities- **less** likely to **adopt** CSA practices*

CSA practice		Poster	Video	Both (Poster+Video)
Soil testing	Awareness	**0.2*** **	**0.17*** **	**0.19*** **
		(0.04)	(0.04)	(0.04)
	Adoption	0.02	**0.09***	**0.10***
		(0.04)	(0.05)	(0.05)
Biopesticides	Awareness	**0.24*** **	**0.30*** **	**0.30*** **
		(0.04)	(0.04)	(0.04)
	Adoption	0.02	-0.01	-0.07
		(0.06)	(0.06)	(0.07)
Yellow sticky cards	Awareness	**0.28*** **	**0.37*** **	**0.38*** **
		(0.03)	(0.04)	(0.04)
	Adoption	-0.00	-0.04	0.02
		(0.08)	(0.08)	(0.09)
Pheromone traps	Awareness	**0.16*** **	**0.18*** **	**0.26*** **
		(0.03)	(0.03)	(0.04)
	Adoption	-0.05	-0.00	-0.01
		(0.09)	(0.09)	(0.10)
T-shaped stands	Awareness	**0.23*** **	**0.30*** **	**0.16*** **
		(0.03)	(0.03)	(0.04)
	Adoption	**0.18***	**0.20***	-0.03
		(0.10)	(0.11)	(0.12)
Light bulbs	Awareness	**0.11*** **	**0.11*** **	**0.14*** **
		(0.03)	(0.03)	(0.03)
	Adoption	-0.06	0.02	**-0.24***
		(0.13)	(0.13)	(0.13)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; Standard errors in parentheses

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Summary

- Both videos & posters are viable information delivery mechanisms to address information constraints among women
- Many women could not recall seeing the poster and/or videos - extension material needs to be designed in a gender-responsive way to facilitate better recall and participation- continuous engagement and capacity development
  - *Higher recall for videos (63%) as compared to poster (57%)*
- Access to formal sources of agricultural information is crucial for adoption of CSA practices
  - *Need for strengthening public extension services- more trainings for women farmers and more extension workers (especially female staff) at local levels*
  - *Create information systems that leverage women-led collectives to deploy participatory extension approaches- position women as agents of change*
  - *Integrating agriculture extension programs and adult literacy programs for women*
- Address issues of low productivity, high risk and lower social status associated with farming- incentivize investment in agriculture
- Need for effectively communicating the potential impacts of climate change on agriculture and the role of CSA in enhancing resilience- demonstrating local evidence
- Knowledge and awareness act as catalysts for behaviour change- adoption often takes time- long-term handholding support

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Thank you for listening

Look forward to your questions, comments & ideas to develop this work further…

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