ONLINE SUPPLEMENT

Eliciting Supplier Cooperation for Value Chain Decarbonization: A Field Experiment with Smallholder Farmers in India

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Appendix S1. Illustrative quotes from the pre-experiment field interviews

The farmers' experience with the firm's original sourcing program	
[1]	"When <Field Officer> first visited and checked my field and told me I should water my <Crop X> only certain fixed times during the agricultural season, I did not believe him...But I listened to his advice over the years because he has studied these matters, plus he was traveling this distance to visit and inspect my field 4-5 times during the agricultural season and only then give advice. That has saved me so much water, not to mention better yield and quality over the years now." (Farmer #10)
[2]	"I had grown <Crop X> a few times before but did not get good yield, also when I sold at the mandi (center) buyers never worried much about quality. Prices were not great as it was volume selling. But since I became a [program] member I got guidance on when to sow, how to prepare land, how much seed to use, when to water, even right time to harvest and especially advice on pest problems at critical <Crop X> growing stage, when <Field Officer> comes and visits…Now the yield and quality of <Crop X> has improved a lot…Last year another company offered to buy my <Crop X> because of good quality but I did not sell to them, I sold to the <Firm> because it was their advice that helped me and they gave good price too." (Farmer #05)
[3]	"The company cannot benefit unless we farmers benefit – it's a relationship where we walk together. The company is good at understanding this so helps its member farmers to grow better <Crop X> and also keep costs low by using less seeds, water…The advice they give is useful…sometimes I ask <Field Officer> to check my other crops in the neighboring fields when he comes for visit but his focus is the <Crop X>…Some companies these days offer advice on phones but how will they know what my agricultural problems are unless I have shown them crops on my field." (Farmer #17)
The farmers' priorities not addressed by the firm's original sourcing program	
[4]	"Agriculture takes many years of experience to get it right. I have been doing this for more than 45 years and still learn new things sometimes…Every field is different, my farm is different from my neighbor's and from my brother's – nature of soil is different, water level is different…Agricultural advice is only useful if you tell things specific to my field and soil conditions. Otherwise, the government also gives lots of general advice, sometimes on radio and sometimes in village meetings…What is true in textbooks does not work in the field; unless you visit my field, see and touch my crops, check my soil, then that advice is useful for me. Otherwise, it's just a friendly chat over a cup of tea but no good for agricultural activities." (Farmer #06)
[5]	"The government extension officer took my soil sample last year, but I never got a report back telling me what they found. It [the service] was no good…it would only help if someone can bring the report and explain to me what I should do, what does my soil need, to produce good crops…I studied only till class 5. When I was born it was usual for a farmer to start helping on farms and not waste time in school. I have seen a relative's soil test report, but we don't understand how to use it." (Farmer #03)
[6]	"Last few years it's not been easy to be a farmer – the weather changes suddenly often bringing rains when it's bad for crops. Last year my neighbor lost one entire crop because of badly timed rain. And pests are a big issue. These days we see new types of pests on crops, and we don't always know what to do...I learnt farming from my father and he from his. But they had not seen these problems then." (Farmer #02)
[7]	"New things are always coming up – new tools, new farming techniques, and the seasons are unpredictable but worst of all new pests and insects keep coming…So agricultural advice is useful especially as I don't meet the government's district extension officer many times in a year…In the past the <Firm> once brought agronomy scientists who visited my village, came to my field and told me many useful things about how to do better agriculture…he was not trying to sell me anything so I trust his advice…I showed him all my growing crops and he checked the growth and recommended good practices that would work for my farm and the crops I was growing…getting good knowledge on all my crops from somewhere trustworthy is important for the advice to be useful." (Farmer #14)
The farmers' attitude towards adoption of the climate-friendly practices	
[8]	"One must always respect the environment, but I have to sustain myself too…It is always good for me to know good practices that don't harm the environment, but you must first explain how it relates to my land and soil… I must think about the effects and how it will affect my income… Farming is my primary family income so I can't change everything overnight and suffer large productivity loss… first <Firm> must check and advise how it will affect my land and crops." (Farmer #04)

Appendix S2. Pre-experiment survey questions used in this study

Section 1. Surveyor, participant and survey details

- Date of the survey; name of the surveyor; survey start and end time; surveyor id; farmer id; name of the field officer associated with farmer; the farmer's contact number registered with the firm; agricultural center the farmer is associated with; state of residence; district of residence; village of residence; confirmation of farmer consent; confirmation of briefing about data protection, anonymity and consent for voluntary participation.

Section 2. Farmer's socio-demographic data

1. What is the farmer's age? ________ years
2. How many family members live in this household (i.e., eat and cook together, share other family responsibilities, or contribute to the family income)? (number)
3. What is the highest level of education completed by any member in the farmer's household (including the member farmer)? (Choices: Did not go to school; Primary education: Class 1- Class 5; Secondary education: Class 6 - Class 10; Higher secondary: Class 11- Class 12; Vocational (e.g., diploma, ITI) ; BA/BSc/Hons; Masters/MBA; Other)
4. Is agriculture the main source of income for the farmer's household? (yes/no)
5. If agriculture is not the main source of income, then what other key ongoing sources of income does the farmer's household have? (names of at most two key non-agricultural sources of income, text response)
6. What is the total land the farmer is using this agricultural season for agricultural purposes? (hectares)
7. What is the total land the farmer owns this agricultural season for agricultural purposes? (hectares)

Section 3. Farmer's agricultural practices

1. What key crops did the farmer grow in the previous Rabi and Kharif season, in the last 12 months? (names)
2. What key crops does the farmer plan to grow this Rabi season? (names)
3. What is the total land the farmer has allocated for growing <Crop X> for the <firm's program> this agricultural season? (hectares)
4. Please detail the farmer's agricultural practices for <Crop X> in the previous agricultural season in terms of:
   (a) Tillage (count)
   (b) Inorganic fertilizer (DAP): Quantity per hectare used (kg/hectare)
   (c) Inorganic fertilizer (urea): Quantity per hectare used (kg/hectare)
   (d) Organic fertilizer (farmyard manure): Quantity per hectare used (MT/hectare)

Section 4. Farmer's preferences, beliefs and perceptions

1. Please ask the farmer to rate on a scale of 1-5 (1=not important at all to 5=very important): (a) How much does the farmer perceive the potential value of the firm providing customized advice for <Crop X> in the future to be? (b) How much does the farmer perceive the potential value of the firm also providing broader customized advice beyond <Crop X> in the future to be?
2. Based on the farmer's experience outside the program, please rate on a scale of 1-5 (1=never to 5=frequently) to what extent has the farmer accessed a soil testing service before?
3. If the farmer has used a soil testing service before, why did they or why did they not find the service useful (at most two key reasons to be recorded as text response)?

Appendix S3. Scientific studies linking firm-recommended practices with emissions reduction

Firm-recommended practice	Link to GHG emissions reduction
Reducing tillage of land	Tillage refers to turning over of the soil for crop cultivation. It is measured as the number of times that a farmer ploughs their land. Scientific literature has documented that farmers tend to do too much tillage relative to what is appropriate for minimizing negative environmental impact and preserving long-term soil health without having to compromise on their agricultural productivity (Bhan and Behera 2014, Rahman et al. 2021). • Excessive tillage has a negative impact on CO_2 emissions as ploughing of soil is generally done using tractors and machinery running on diesel. Reducing tillage thus reduces unnecessary burning of diesel (Moitzi et al. 2019), which leads to a reduction in overall agriculture-related GHG emissions. • Excessive tillage also has a negative long-term impact on the soil's structure and organic carbon content. Reducing tillage can thus improve the soil's organic content and long-term fertility, while also enhancing the soil's ability to sequester carbon over multiple agricultural seasons by improving its biological activity (Haddaway et al. 2017).
Reducing inorganic fertilizer use	Appropriate use of inorganic fertilizer can enhance agricultural productivity. However, scientific literature has documented that farmers tend to use too much inorganic fertilizer (easily and cheaply available, often with government subsidies) relative to what is appropriate for minimizing negative environmental impact without compromising on agricultural productivity (Cole and Sharma 2017, Cui et al. 2018, Duflo et al. 2011, Islam and Beg 2021). • Inorganic fertilizers are responsible for a substantial fraction of agriculture-related GHG emissions in the form of N_2O (Menegat et al. 2022). It is generally possible to reduce these emissions without compromising on agricultural productivity (Lal et al. 2021), e.g., through better tailoring of inorganic fertilizer use to a specific farm's soil requirements (as determined through a soil test that can be made available to the farmer) so that only the necessary amount of each kind of inorganic fertilizer is used. • Further reduction in inorganic fertilizer use can be achieved by using an organic fertilizer (e.g., farmyard manure often available as a by-product of a farmer's livestock-related to agricultural activities) to substitute for some of the soil nutrients for which farmers often rely only on inorganic fertilizers (Menegat et al. 2022). This also has the additional long-term benefit of enhancing soil fertility and sequestering more organic carbon in soil over time, a benefit that farmers are often not aware of (Han et al. 2016, Liu et al. 2020, O'Brien and Hatfield 2019).

Appendix S4. Power analysis for minimum detectable effect size

Our experimental design involved 362 villages, which were divided into three groups using stratified randomization: the base program as a control group (127 villages), Intervention A (120 villages), and Intervention B (115 villages). Our analysis includes all 2,605 participants (farmers across the 362 villages) that had signed up for the firm's Crop X sourcing program for the year 2022-2023. Prior studies using randomized controlled trials (RCT) to study behavior change among farmers have also often involved comparable sample sizes, e.g., a sample size of 1,440 farmers from 105 villages in Islam and Beg (2021), 5,884 farmers from about 200 villages in Kondylis et al. (2017), and 1,723 farmers from 80 villages in Cole and Fernando (2021). Following established practice in field experiments (Duflo et al. 2007, Glennerster and Takavarasha 2013), we calculate minimum detectable effect (MDE) for each our primary outcome variables using the formula:

$$\mathrm{MDE} = \left(t_{1-\kappa} + t_{\alpha/2}\right)\sqrt{\frac{1}{P(1-P)} \cdot \frac{\sigma^2}{N} \cdot (1 + (m-1) \cdot \mathrm{ICC})}$$

where

- 1-κ is the statistical power for the two-sided test
- α is the significance level for the two-sided test
- N is the total number of participants in the experiment
- P is the fraction of participants subjected to treatment
- m is the average number of participants per cluster (village)
- σ is the standard deviation for the outcome variable
- ICC is the intra-cluster correlation for the outcome variable

We set the statistical power parameter (1-κ) to 80% for a two-tailed test and carried out the above calculation for a significance level (α) of 0.05 as well as 0.10.

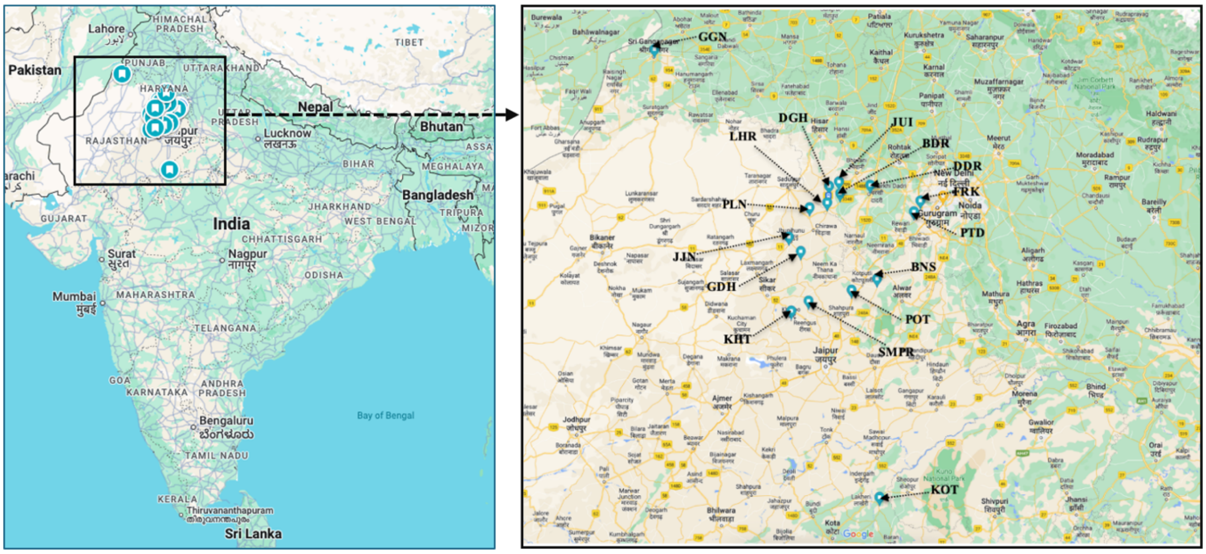
For three of our primary outcomes - *Land Allocated, Tillage* and *Inorganic Fertilizer* - we calculate ICC using our pre-experiment data (with the "loneway" command in Stata), following the recommendation of McKenzie (2012). For the remaining primary outcome of *Continuation*, we use the post-experiment data from our control group for the ICC calculation as pre-experiment data for this variable were not collected.

The resulting MDE sizes based on the above approach are shown below for each outcome variable:

Outcome	**ICC**	**MDE at α = 0.05**	**MDE at α = 0.1**
Continuation	0.22	0.21 SD	0.18 SD
Land Allocated	0.53	0.20 SD	0.17 SD
Tillage	0.62	0.21 SD	0.19 SD
Inorganic Fertilizer	0.38	0.17 SD	0.15 SD

These calculated MDE sizes for our context are comparable to effect sizes found in prior RCTs with farmers in similar agricultural settings. For example, previous studies have reported effect sizes of 0.13 SD (standard deviation) for adoption of agricultural advice (Cole and Fernando 2021), 0.36 SD for adoption of sustainable land management practices (Kondylis et al. 2017), and 0.76 SD for adoption of fertilizer management practices (Ruzzante et al. 2021).

Appendix S5. Geographic location and details of the centers and villages in our sample



Center	Overall Sample		Base Program		Intervention A		Intervention B	
	Number of villages	Number of farmers	Number of villages	Number of farmers	Number of villages	Number of farmers	Number of villages	Number of farmers
BDR	10	156	4	88	3	23	3	45
BNS	36	188	12	59	12	55	12	74
DDR	27	224	9	73	8	92	10	59
DGH	19	127	7	45	6	58	6	24
FRK	25	170	9	64	8	57	8	49
GGN	39	81	13	20	13	26	13	35
GDH	31	206	11	69	10	78	10	59
JJN	19	173	7	71	6	42	6	60
JUI	20	212	6	34	9	69	5	109
KHT	26	330	9	128	8	101	9	101
KOT	21	88	7	44	7	34	7	10
LHR	19	256	6	102	6	119	7	35
POT	16	125	6	25	6	75	4	25
PTD	11	95	4	26	4	40	3	29
PLN	19	41	8	15	6	16	5	10
SMPR	24	133	9	51	8	41	7	41
Total 16 Centers	**362**	**2605**	**127**	**914**	**120**	**926**	**115**	**765**

Appendix S6. Post-experiment survey questions used in this study

Section 1. Surveyor, participant and survey details

- Date of the survey; name of the surveyor; survey start and end time; surveyor id; farmer id; name of the field officer associated with farmer; the farmer’s contact number registered with the firm; agricultural center the farmer is associated with; state of residence; district of residence; village of residence; confirmation of farmer consent; confirmation of briefing about data protection, anonymity and consent for voluntary participation.

Section 2. Farmer’s agricultural practices

1. Please detail the farmer’s agricultural practices for <Crop X> in the latest agricultural season in terms of:
   (a) Tillage (count)
   (b) Inorganic fertilizer (DAP): Quantity per hectare used (kg/hectare)
   (c) Inorganic fertilizer (urea): Quantity per hectare used (kg/hectare)
   (d) Organic fertilizer (farmyard manure): Quantity per hectare used (MT/hectare)
2. Based on their experience this year, does the farmer intend to continue in the program next year (yes/no)?
3. If the farmer says they intend to continue in the program next year, how much land do they expect to allocate for <Crop X> cultivation for the program next year (in hectares)?

Section 3. Farmer’s preferences, beliefs and perceptions

1. As part of our survey, we want to understand if the farmer is willing to adopt newer agricultural technologies. On a scale of 1-7, (1 = not willing at all and 7 = very willing) based on their experience with the program this year, how willing is the farmer to adopt climate-friendly practices recommended by the firm in future?
2. On a scale of 1-7, (1 = did not invest at all and 7 = invested a lot) based on their experience with the program this year, to what extent does the farmer think the firm had invested in building a relationship with them?
3. On a scale of 1-7, (1 = not satisfied at all and 7 = very satisfied) based on their experience with the program this year, how satisfied is the farmer with the program this year?
4. On a scale of 1-7, (1 = not likely at all and 7 = very likely) based on their experience with the program this year, how likely is the farmer to recommend other farmers (family or friends) to join the program next year?
5. The following is a hypothetical situation. Please ask the farmer to answer truthfully about which option they would prefer for each choice. There are no right or wrong answers, we are trying to understand the general valuation of <firm’s program> and services in the farmer’s local area. Suppose the farmer is provided with a choice of paying a monetary annual fee for the services they received through the <firm’s program> this year. What is the maximum amount of money the farmer would be willing to pay if given these choices: 50 Indian Rupees; 100 Indian Rupees; 150 Indian Rupees; 200 Indian Rupees; 250 Indian Rupees?

Appendix S7. Delving deeper into use of different kinds of fertilizers by the farmers

	(1) *Inorganic fertilizer: DAP* (Post)	(2) *Δ Inorganic fertilizer: DAP* (Post-Pre)	(3) *Inorganic fertilizer: Urea* (Post)	(4) *Δ Inorganic fertilizer: Urea* (Post-Pre)	(5) *Organic fertilizer: Farmyard manure (MT/hectare)* (Post)	(6) *Δ Organic fertilizer: Farmyard manure (MT/hectare)* (Post-Pre)
Intervention A	-4.008***	-3.454***	-4.279*	-2.134	0.394*	0.190
	(1.459)	(0.986)	(2.373)	(1.504)	(0.224)	(0.170)
Intervention B	-10.423***	-9.054***	-9.701***	-7.262***	1.442***	1.561***
	(1.757)	(1.413)	(2.442)	(1.306)	(0.323)	(0.292)
Observations	2,416	2,416	2,416	2,416	2,416	2,416
Farmer and village level controls	Yes	Yes	Yes	Yes	Yes	Yes
Center FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors clustered at the village level (our unit of randomization) are reported in parentheses. The coefficient estimates for the farmer- and village-level controls, the center fixed effects and the constant terms are not shown to save space (available upon request). Supplier farmers in our context use two kinds of inorganic fertilizers: DAP and urea. Digging further into the analysis of their average use as reported in panel B of Table 3, this table provides detailed analysis of the two kinds of inorganic fertilizers separately as well as the associated change in use of organic fertilizer (as explained in Appendix S3). The findings demonstrate two ways in which reduction in inorganic fertilizers took place because of our interventions. The first was by reducing excessive inorganic fertilizer usage considering the appropriate quantity required by the soil-specific condition for crop growth. The second was by using greater quantity of organic fertilizers as the farmers learnt to substitute inorganic fertilizers with organic nutrient options such as farmyard manure. The sample size used here is 2,416 farmers instead of 2,605 in our original sample due to two reasons together leading to 189 observations (7% of the original sample) being dropped. First, 24 farmers could not be surveyed post-experiment due to their unavailability (although there is no statistical difference in attrition rates across the experimental groups). Second, there were missing values for one or more of the control variables in 165 cases (although findings remain similar if we simply exclude the control variables with missing values to employ the complete sample in analysis).

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix S8a. Average GHG emissions reduction per incremental dollar invested in Interventions A and B (relative to the base program)

		Intervention A	Intervention B	Data sources, assumptions and details of the calculations
1	Average reduction in DAP fertilizer used by the farmers (in kgs per farmer)	5.32	13.94	This calculation involves taking the estimate for the average reduction in use of DAP per farmer in kgs per hectare from column (2) in Appendix S8 and multiplying it with the average farmer's plot size of 1.54 hectares allocated for growing Crop X for the firm as per the firm's records.
2	Average GHG emissions reduction from reduction in DAP fertilizer used by farmers (in CO_2-equivalent kgs per farmer)	3.60	9.45	The fraction of nitrogen in DAP fertilizer by weight is 0.18. We use this to calculate three emission components (IPCC 2019). The first is direct N_2O emissions from the soil due to microbial conversion of nitrogen. The second is indirect N_2O emissions from nitrogen emitted via volatilization and redeposition. The third is indirect N_2O emissions from nitrogen lost to water via runoff after application. The fraction of susceptible nitrogen is multiplied by the respective "Tier 1, N_2O-N" emissions factor (for dry climate with annual precipitation <1,000 mm) to estimate "N_2O-N" emissions. These are then converted to equivalent N_2O emissions using the IPCC-recommended factor of 44/28, expressed as CO_{2e} terms using the relative global warming potential of 298 for N_2O.
3	Average reduction in urea fertilizer used by the farmers (in kgs per farmer)	3.29	11.18	This calculation involves taking the estimate for the average reduction in use of urea per farmer in kgs per hectare from column (4) in Appendix S8 and multiplying it with the average farmer's plot size of 1.54 hectares allocated for growing Crop X for the firm as per the firm's records.
4	Average GHG emissions reduction from reduction in urea fertilizer used by the farmers (in CO_2-equivalent kgs per farmer)	6.60	22.45	This is analogous to the DAP fertilizer calculation above except for two things. First, the fraction of nitrogen in urea (by weight) is 0.46. Second, for urea there is an additional component - the direct CO_2 emissions from urea hydrolysis post application, calculated using an emission factor of 0.2 per unit (IPCC 2019, Islam and Beg 2021).
5	Average reduction in the extent of tillage carried out by the farmers (in tillage count per farmer)	0.108	0.403	This is the estimated average reduction in tillage per farmer taken from column (6) in panel B of Table 3.
6	Average GHG emission reduction from reduction in tillage by the farmers (in CO_2-equivalent kgs per farmer)	7.58	28.28	We multiple the average reduction in tillage from the previous row by an assumed diesel use aversion rate of 17 liters per hectare (Adewoyin and Ajav 2013, Moitzi et al. 2019). We multiply this further by the average farmer's plot size of 1.54 hectares for growing Crop X. Finally, to get the reduction in CO_2 emissions per farmer, we multiply this by CO_2 emissions reduced per liter of diesel use averted, assumed to be 2.68 kgs/liter.
7	***Total incremental average GHG emissions reduction realized by the farmers (calculated as the sum of the above three in CO_2-equivalent kgs per farmer)***	***17.78***	***60.17***	This is the sum of the three kinds of emission savings calculated above: those from reduced usage of DAP, those from reduced usage of urea, and those from reduced land tillage.
8	Cost to the firm for providing free soil testing to the farmers (in INR per farmer)	700.00	700.00	Providing the soil test costs the firm 700 INR per farmer as per the firm's records, and the firm provided this service to the farmer for free in both Intervention A and Intervention B.
9	Cost to the firm for providing the agronomist support to the farmers (in INR per farmer)		600.00	Assumes a cost allocation of 400 INR from salary and 200 INR from travel expenses per farmer visit by the agronomist.
10	Total incremental average cost of the intervention relative to the base program (calculated as sum of above two, in INR per farmer)	700.00	1,300.00	This is the sum of the two kinds of costs of investments made by the firm: cost of the soil test service in the case of Intervention A and cost of soil test service and firm provided agronomist support in the case of Intervention B.
11	Effective GHG emissions reduction per INR (in CO_2-equivalent kgs per INR)	0.03	0.05	
12	Effective GHG emissions reduction per dollar (in CO_2-equivalent kgs per dollar)	2.11	3.84	This calculation uses the average exchange rate of approximately 83 INR/USD for December 2023.
13	***Effective cost per unit of emissions reduction achieved (in dollars per CO_2-equivalent tons)***	***474.36***	***260.29***	

Notes: This table documents three kinds of potential emissions reduction achieved in either intervention relative to the base program. For Intervention A, the average GHG emissions reduction relative to the base program was 17.78 CO_2-equivalent kgs per farmer, and its incremental cost was 700 INR (USD 8.43) per farmer, implying an average effective cost of USD 474 per CO2-equivalent tons for emissions reduction. For Intervention B, the incremental average GHG emission reduction relative to the base program was 60.17 CO_2-equivalent kgs per farmer and the incremental cost was 1,300 INR (USD 15.67) per farmer, implying a lower cost of USD 260 per CO2-equivalent tons for emissions reduction.

Appendix S8b. Average cost savings realized by a farmer in Interventions A and B (relative to the base program)

		Intervention A	Intervention B	Data sources, assumptions and details of the calculations
1	Average reduction in DAP fertilizer used by the farmers (in kgs per farmer)	5.32	13.94	This calculation involves taking the estimate for the average reduction in use of DAP per farmer in kgs per hectare from column (2) in Appendix S8 and multiplying it with the average farmer's plot size of 1.54 hectares allocated for growing Crop X for the firm as per the firm's records.
2	Average cost saving from reduction in DAP fertilizer used by the farmers (in INR per farmer)	127.66	334.64	This is calculated based on the cost savings resulting from the reduced use of DAP, by assuming the price of one bag of DAP as 1200 INR and the size of one bag of DAP as 50 kgs as per the firm's records.
3	Average reduction in urea fertilizer used by the farmers (in kgs per farmer)	3.29	11.18	This calculation involves taking the estimate for the average reduction in use of urea per farmer in kgs per hectare from column (4) in Appendix S8 and multiplying it with the average farmer's plot size of 1.54 hectares allocated for growing Crop X for the firm as per the firm's records.
4	Average cost saving from reduction in urea fertilizer use by the farmers (in INR per farmer)	20.45	69.59	This is calculated based on the cost savings resulting from the reduced use of urea, by assuming the price of one bag of urea as 280 INR and the size of one bag of urea as 45 kgs as per the firm's records.
5	Average reduction in land tillage carried out by the farmers (in tillage count per farmer)	0.108	0.403	This is the estimated average reduction in tillage per farmer taken from column (6) in panel B of Table 3.
6	Average cost saving from reduction in land tillage by the farmers (in INR per farmer)	254.47	949.55	This calculation is based on the cost saving resulting from reduced use of diesel from reduced tillage. We take the average reduction in land tillage by the farmer (from the previous row) and multiply it by the averted rate of diesel burnt per hectare assumed as 17 liters per hectare (Adewoyin and Ajav, 2013, Moitzi et al. 2019). To get the average quantity of reduced use of diesel per farmer we multiply by the average farmer's plot size of 1.54 hectares allocated for growing Crop X for the firm as per the firm's records. Finally, we calculate the average cost saving by multiplying with the price of diesel assumed as 90 INR/liter.
7	***Total incremental average cost saving per farmer (calculated as the sum of the above three, in INR per farmer)***	***402.58***	***1,353.77***	This is the sum of the three kinds of cost savings listed above for the two interventions relative to the base program: those from reduced usage of the two kinds of inorganic fertilizers (DAP and urea), and those from reduced tillage.
8	Additional cost saving from the free soil testing service for farmers who would have otherwise purchased it (in INR per farmer)	700.00	700.00	This was a conservative estimate based on the firm's internal cost for providing a soil test to the farmer. If the farmer were to procure the soil testing service externally, it would likely cost at least 700 INR, but it was provided to the farmer for free in both intervention A and intervention B.

Notes: This table documents the cost savings accruing to the average farmer in Intervention A or Intervention B relative to the base program from multiple sources: reduced use of the inorganic fertilizers, urea and DAP and reduced use of diesel due to reduction in tillage. The calculation reveals that Intervention A generated 403 INR (USD 4.85) in cost savings for the average farmer, while Intervention B generated 1,354 INR (USD 16.31) in cost savings for the average farmer. Further cost savings of 700 INR (USD 8.43) would also have been realized from getting access to free soil testing service through the firm for farmers who would have otherwise paid for procuring a similar service externally on their own instead.

Appendix S9. Exploratory regression analysis for additional outcome variables not included in Table 4

	(1) *Satisfaction with the program* (7-point Likert scale)	(2) *Would recommend program to others* (7-point Likert scale)	(3) *Reasonable hypothetical annual fees* (INR/annum)
Intervention A	0.717^{***}	0.628^{***}	33.697^{***}
	(0.115)	(0.082)	(3.841)
Intervention B	2.168^{***}	1.726^{***}	86.857^{***}
	(0.128)	(0.109)	(4.581)
Observations	2,416	2,416	2,416
Farmer and village level controls	Yes	Yes	Yes
Center FE	Yes	Yes	Yes

Notes: Robust standard errors clustered at the village level (our unit of randomization) are reported in parentheses. The coefficient estimates for the farmer- and village-level controls, the center fixed effects, and the constant terms are not shown to save space (available upon request). The outcome variables for columns (1)-(2) are based on seven-point Likert scale questions from our post-experiment survey: *Satisfaction with the program rating* captures how satisfied a farmer was with the firm's program and *Would recommend program to others* captures how likely a farmer would be to recommend the firm's program to other farmers. The outcome variable used in column (3), *Reasonable hypothetical annual fees*, is measured using a post-experiment survey question asking farmers to select the maximum amount they would be willing to pay from one of five possible choices when provided with a choice of paying a monetary annual fee for the services they received through the program that they would consider reasonable in a hypothetical scenario (the five choices being 50 INR, 100 INR, 150 INR, 200 INR and 250 INR per annum). The sample size is 2,416 (instead of 2,605 farmers in our original sample) as 24 farmers were not available to be surveyed post-experiment (though there is no statistical difference in attrition across the experimental groups) and there were missing values for one or more of the control variables for 165 farmers (with the findings again remaining robust to simply excluding the controls with missing values).

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix S10a. ACME-based mediation analysis exploring the possibility of a relational mechanism for Intervention A

	(1) *Continuation* (Post)	(2) *Continuation* (Post)	(3) *Δ Land allocated* (Post – Pre)	(4) *Δ Land allocated* (Post – Pre)	(5) *Δ Tillage* (Post – Pre)	(6) *Δ Tillage* (Post – Pre)	(7) *Δ Inorganic fertilizer* (Post – Pre)	(8) *Δ Inorganic fertilizer* (Post – Pre)
Intervention A	0.022 (0.024)	0.005 (0.023)	-0.038 (0.093)	-0.121 (0.098)	-0.099*** (0.034)	-0.078** (0.034)	-2.751*** (1.002)	-2.293** (0.992)
Perception of firm investment in relationship		0.023*** (0.007)		0.114*** (0.026)		-0.029** (0.012)		-0.631** (0.274)
ACME		0.017 [0.006, 0.030]		0.084 [0.043, 0.127]		-0.021 [-0.042, -0.003]		-0.459 [-0.925, -0.049]
Fraction of Total Effect Mediated		0.533 [-6.153, 8.638]		-0.674 [-14.094, 11.702]		0.213 [0.133, 0.631]		0.166 [0.101, 0.520]
ρ at which ACME = 0		0.077		0.107		-0.064		-0.074
Observations	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682
Farmer and village level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Center FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Notes***:** Robust standard errors clustered at the village level (our unit of randomization) are reported in parentheses. The coefficient estimates for the farmer- and village-level controls, the center fixed effects, and the constant terms are not shown to save space (available upon request). The sample included in the regressions here comprises only of farmers that were either in the base program or in Intervention A. 95% confidence intervals in brackets for ACME and fraction of total effect mediated.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix S10b. ACME-based mediation analysis exploring the possibility of a relational mechanism for Intervention B

	(1) *Continuation* (Post)	(2) *Continuation* (Post)	(3) *Δ Land allocated* (Post – Pre)	(4) *Δ Land allocated* (Post – Pre)	(5) *Δ Tillage* (Post – Pre)	(6) *Δ Tillage* (Post – Pre)	(7) *Δ Inorganic fertilizer* (Post – Pre)	(8) *Δ Inorganic fertilizer* (Post – Pre)
Intervention B	0.061*** (0.023)	0.030 (0.022)	0.494*** (0.108)	0.273** (0.129)	-0.395*** (0.060)	-0.317*** (0.060)	-8.378*** (1.162)	-6.520*** (1.061)
Perception of firm investment in relationship		0.016* (0.009)		0.112*** (0.035)		-0.040** (0.018)		-0.946*** (0.293)
ACME		0.032 [-0.004, 0.064]		0.223 [0.085, 0.352]		-0.077 [-0.155, -0.008]		-1.855 [-3.066, -0.672]
Fraction of Total Effect Mediated		0.519 [0.292, 1.889]		0.452 [0.314, 0.765]		0.195 [0.152, 0.278]		0.220 [0.175, 0.301]
ρ at which ACME = 0		0.051		0.080		-0.060		-0.085
Observations	1,621	1,621	1,621	1,621	1,621	1,621	1,621	1,621
Farmer and village level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Center FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors clustered at the village level (our unit of randomization) are reported in parentheses. The coefficient estimates for the farmer- and village-level controls, the center fixed effects, and the constant terms are not shown to save space (available upon request). The sample included in the regressions here comprises only of farmers that were either in the base program or in Intervention B. 95% confidence intervals in brackets for ACME and fraction of total effect mediated.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix S11. Illustrative quotes from the post-experiment field interviews

The farmers' experience with the firm's program following Intervention A	
[1]	"Productivity and quality of my <Crop X> has improved a lot. The soil test report this year in particular helped me add to my soil the required balanced nutrients and add fertilizers in appropriate quantities…My knowledge of <Crop X> improved and I am more aware of the [climate-friendly] practices...The soil testing facilities from the company are very helpful as I was able to reduce fertilizer costs...Through the <Field Officer> the company has built good relations but I will hesitate to adopt practices if it reduces my crop productivity by a large amount...May be I will adopt for a year on a trial basis because of the good relations with the company..." (Farmer #16)
[2]	"The <Field Officer's> visits are planned for critical crop growing stages. This year he also got my soil sample as the company offered the soil testing service for free. As a result the <Field Officer> was able to show me what my soil was lacking and also his advice for <Crop X> was more relevant, tailored for my soil conditions...I also added more farm yard manure (organic fertilizer) to the soil based on the soil test report and <Field Officer's> advice...<Crop X> productivity was the best this year compared to other crops and I am always assured that I will get the best price from the <Firm> compared to other buyers in the market." (Farmer #20)
[3]	"I considered adopting the [climate-friendly] practices that the company recommended. Their advice based on the soil report was useful but for me the trust I have on the <Firm> because of the relationship built by the field staff - that is more fundamental." (Farmer #21)
[4]	"The <Field Officer's> advice on the quantity of <Crop X> seed required to be applied for my fields has saved me both cost of seed purchased as well as quality because of how I was able to manage soil nutrients. I have seen the result myself as well as the regularity of the support I have received. I feel assured that the company cares about farmers, and I am more open to the [climate-friendly] practices they recommended..." (Farmer #22)
The farmers' experience with the firm's program following Intervention B	
[5]	"This time <Agronomist> came and advised me on my agricultural matters - I have faith in what they say. If any person from a company, I am not familiar with turns up and offers advice for my agricultural matters I would suspect the information he provides whereas I now readily listen to <Field Officer> or <Agronomist> advice as I know the company has built a good relationship with us over time that has proven to be beneficial for us. I valued that the company invested in sending knowledgeable, trained and expert staff to visit us and trust their advice reliably much more than any advice I would receive from my peers or neighbors." (Farmer #03)
[6]	"The <Agronomist's> visit was especially helpful. I was able to ask questions to understand my soil's nutrients and its health in more details such as nitrogen, magnesium and zinc content. I no longer had to guess-work how much fertilizers I need to add, and I saved costs by adding the appropriate quantity of fertilizer for good productivity. The company's initiative to not only provide soil testing service but also send the <Agronomist> to provide us information and advice showed it wants to invest in us farmers...I also reduced tillage because the <Agronomist> advised that excess tillage does not benefit productivity but increases cost and harms my soil in the long term...I trust his advice and adopted reduced tillage even though I have been practicing higher tillage since I started farming." (Farmer #01)
[7]	"I reduced tillage and also started using farmyard manure (organic fertilizer) according to proper methods. I was not aware before that higher tillage harms the soil nor did anyone point out the appropriate method for adding organic inputs...The <Agronomist> visit gave me the opportunity to ask about these things in detail. But just knowledge and awareness is not enough. I have to be sure that the advisory comes from a trustworthy source...The company has been providing good seeds and <Crop X> sale price last few years and now I trust the <Firm's> staff completely...Unlike other <Competitor firm> who only sends its staff to sell their seeds for its own profit without ongoing support for or investing in farmers and the relationship, <Field Officer> and <Agronomist> have provided so much support that there is a strong relationship - I can rely on any advice they give as the <Firm> provided support has benefitted me..." (Farmer #04)
[8]	"Every year for the past few years the <Firm> has been providing continuous support for <Crop X>. I have seen the ongoing commitment to building this relationship with farmers. This year I received additional support from <Field Officer> and <Agronomist>...The support is timely and reliable and I did not hesitate to take up their advice because in my experience the company wants to profit but by creating more benefit for farmers...The company recommends various practices because it wants farmers to be more productive...The <Agronomist> visit was not targeted at just <Crop X> but also for other crops, so the company was not focusing on just its own <Crop X> profits but also on things that will benefit the farmer in the long term for the ongoing relationship...I have adopted their recommendations for the [climate-friendly] practices and will see what the ongoing results are...I have recommended other farmers to join this program." (Farmer #11)

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