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# Towards a sustainable sugarcane industry in India

## Appendices

Mid-term results on Solidaridad's programme: Increasing water use efficiency in sugarcane growing in India

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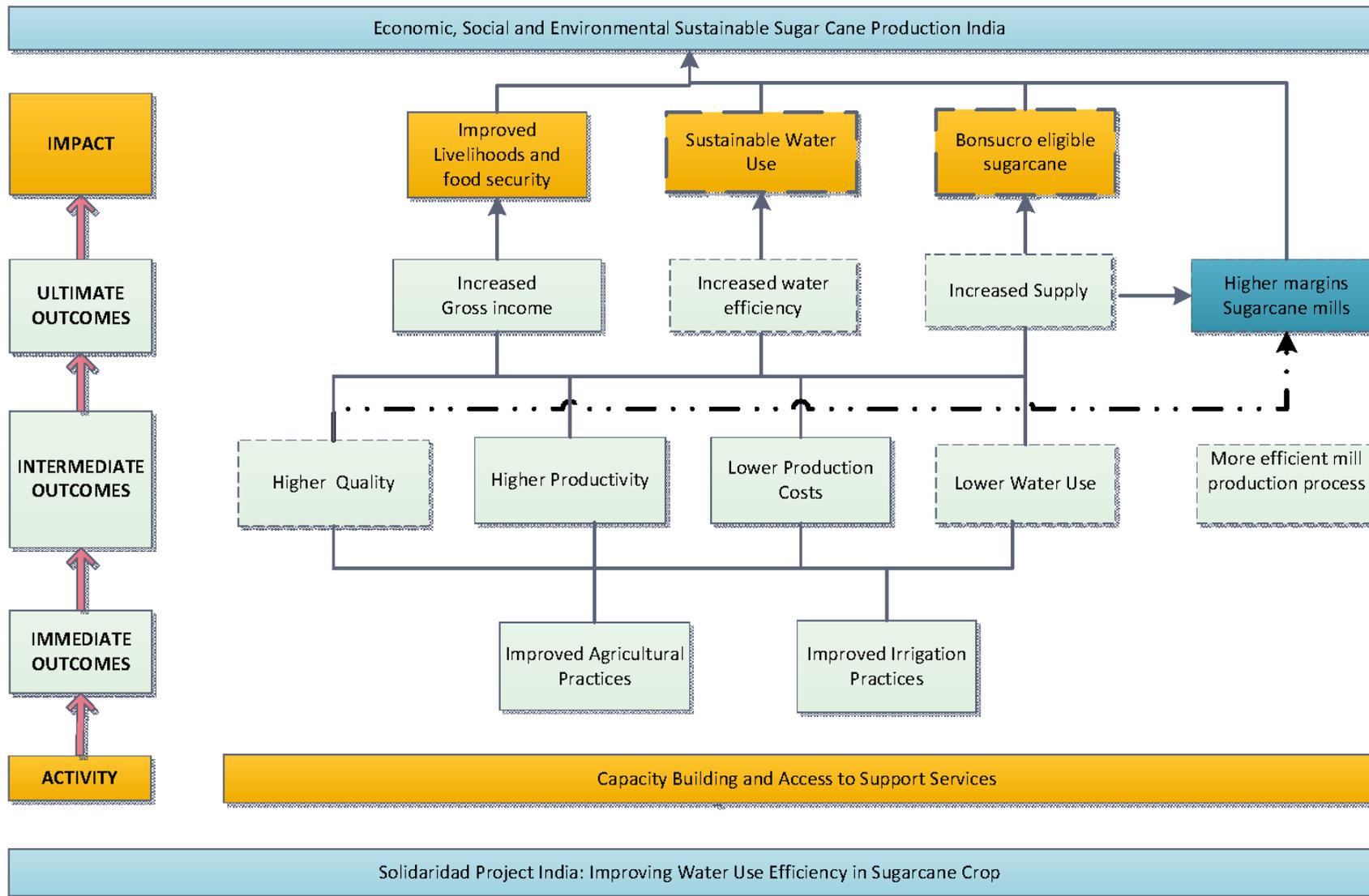
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Photo: C. Plaisier

# Appendix 1 Intervention Logic FDW



# Appendix 2 Mid-Term Survey

**August 1, 2018 --> NB: coding & question # / variable names identical with Baseline of 2016. New questions --> new numbers/coding.**

**Questions on production and harvest of cane relate to the last season (2017-2018) and if indicated as well to the season before (2016-2017)**

## **Sections**

A	General characteristics
B	Farm characteristics & Sugarcane production characteristics
CA	Labour
CB	Mechanization
D	Agricultural practices sugarcane
E	Irrigation practices
F	Inputs for sugarcane production
G	Household income and diversification
H	Livelihoods
I	Trainings, appreciation and changes in practices
J	Risk and investment

## **Instructions for enumerators (do not read)**

1. All questions need to be answered. Please check before you leave the place.
2. If a respondent does <u>not know</u> the answer, write down -999.
3. If a respondent does <u>not want</u> to answer, write -888.
4. If the question does <u>not apply</u> to the respondent, write NA.
5. And if an answer is '0', put '0', for example at the 'costs questions'.
6. Make sure the respondent feels free to talk and diminish any noise and interference.
7. If we ask a question about "last harvest" this means the last cultivation and harvest season of 2017-2018. Questions relate to both) plant crop and ratoon.

**For enumerator to answer – check supervisor**

- A Date of interview (dd-mm-yyyy): ..... Start time: .....
- B Name of enumerator.....
- BB Ryot number
- C Respondent will receive / has received training in

1. Year 1 (2016) (no farmers trained, year of baseline)
2. Year 2 (2017)
3. Year 3 (till August 2018)
4. year 4 (from August 2018)
5. year 5 (2019)
6. Year 6 (2020)

D Command area of mill:

1. Koppa Unit mill	(Karnataka, Mandya and Tumkur districts)
2. Kirshnaveni Mill	(Telangana, Mehaboobnagar district)
3. Trident Sugar Mill	(Telangana, Zaheerabad district)

E Division, please circle the correct code (See table):

-000-

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## Introduction to respondent

My name is .....

I am here on behalf of the India research institute Q&Q and Wageningen University in the Netherlands. We are carrying out a research on the livelihoods and agricultural practices of sugarcane farmers in Telangana and Karnataka. You have been selected to be part of this survey because the international NGO Solidaridad works here in partnership with the mill you supply your produce to or supplied to in the past.

We also interviewed you two years ago, in 2016. We came back to see how you are doing and to ask you more or less the same questions. With all the results of all the farmers we can then track any changes in the past two years and whether your situation and farming has improved. Your selection to take part in this survey was done at random, that means based on coincidence, If you agree to participate, the survey will take approximately 60 to max 90 minutes. We hope that the research will give important insights to improve the livelihoods of sugarcane farmers in these states and in an increased water use efficiency. And we hope it will provide insights and learnings to improve future work of similar initiatives.

The researchers will keep your responses confidential. Your name will never be used anywhere to ensure confidentiality.

You are not obliged to answer questions if you do not want to. We hope we will go through the entire survey but you are free to stop to interrupt the interview at all times. You will not receive any direct benefit if you join this study; your participation is voluntary which we highly appreciate. We hope that the research outcomes and your perspective will benefit the sugarcane producers in the Telangana and Karnataka states.

Do you have any questions for me? You may ask questions about this study any time.

Are you willing to participate?

1=yes

2=no

Thank you.

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**SECTION A HOUSEHOLD AND RESPONDENT IDENTIFICATION**

*This section is about some personal and household characteristics of you and your household.*

1 Name of the farmer.....pre-filled

2 Fathers name: .....pre-filled

***Enumerator: this should be the person on your list, if he/she is not available check whether someone of the household is available and who is actively involved in sugarcane production with knowledge on the cultivation process, production costs of the last year (2017-2018) (e.g. a caretaker, employee, or knowledgeable family member). Check with your supervisor if you doubt.***

3 Is the name of the respondent in front of you different than the name mentioned at 1 and 2?

0. No --> **go to question 6.**

1. Yes

4 What is the name of the respondent in front of you: .....

5 What is his/her fathers' name: .....

6 If there is a name under 3 and 4, why is the farmer different from 1?

1. The original respondent is no longer alive, or no longer farming

2. The original respondent is available, but not really actively involved

3. The new respondent is a different member of the same household with thorough knowledge on sugarcane production and its costs

4. Other, specify:.....

District: .....

Village: .....

Taluka.....(Q&Q: better to use a predefined list with codes, can the mill provide such a list? Or based on the sampling)..**we have put list based**

Mandal: .....(Q&Q: better to use a predefined list with codes, can the mill provide such a list? Or based on the sampling)..**we have put list based**

Phone number .....

---

7 Gender of the respondent

- 0. Male
- 1. Female

8 What is your position in the household

- 1. Household head
- 2. Spouse
- 3. Other adult (e.g. grandparents, brother, etc)
- 4. Child

What is your highest level of education?

- 1. Did not go to school
- 2. Started primary school but could not complete and stopped at level .....
- 3. Primary school (upto 5<sup>th</sup> standard)
- 4. Middle school (Upto 8<sup>th</sup> standard)
- 5. Matriculation (Upto class 10<sup>th</sup>)
- 6. Intermediate (upto Class 12<sup>th</sup>)
- 7. College, please specify the level.....
- 8. Other education..... (please specify)

11 How many people are part of your household, including you?

- 2. 1-3 persons
- 3. 3-5 persons
- 4. 5-7 persons
- 5. 7-9 persons
- > 9 persons

**Enumerator: household = lives under one roof / eat from the same kitchen (include the respondent and his/her spouse)**

*=== end of section A ===*

**Section B Farm characteristics**

We want to get to know your farm and different sugarcane plots better. Therefore we will ask you questions about what you do on the farm and on your plots where you grow sugarcane. We want to ask information on your sugarcane production about the last year combined for all sugarcane plots.

9. The questions relate to the last cultivation and harvest season (2017-2018).

	<p>9. Did you cultivate sugarcane in ... (see row)?</p> <p>0. No          1. Yes only sugarcane (--&gt;. 1mm)          2. Yes and other crops (--&gt; 1mmm)</p>	<p>1mm.</p> <p><b>If not</b>, why not (MC)</p> <p>1. Sugarcane is no longer profitable / poor remuneration.          2. The costs of cultivation increased in the past 1-2 years.          3. I did not have enough resources to purchase inputs for sugarcane.          4. I do crop rotation for the nutrients of the soil          5. Lack of irrigation water and facilities: severe drought          6. The weather conditions are more favourite for other crops than sugarcane          7. I have access to more water for irrigation use (canal source) so I can cultivate more water intense crops          8. no labour availability          9. The mill paid very late /not yet at all for my cane sold to them.          10. Other, specify:</p>		
		Answer 1	Answer 2	Answer 3
<b>2017-2018</b>				
<b>2016-2017</b>				

10 For how many years on average do (did) you cultivate sugarcane? .... number of years

**Enumerators: check: they may have several subplots, so ask for the total sugarcane acreage**

	12. Crops cultivated	13. Area (in acre)		14. Intercropping with sugarcane  0.No 1. Yes	15. What is the type of soil?  0. Black 1. Red 2. Both	16. Did you conduct a soil test?  0.No 1. Yes
		Own	Leased			
1	Sugarcane (all plots)			NA		
2	Rice / paddy					
3	Ginger					
4	Fruits					
6	Potatoes					
7	Vegetables					
8	Pulses					
9	unirrigated farm land					
10	Other, specify:					
11	Other, specify:					

**Enumerator: the following questions are about sugarcane production and sales. If no sugarcane cultivated in the season 2017-2018, skip these questions: NA**

**Enumerator 1: the following questions refer to the sugar d.**

17 In which month was your last harvest?

1. January
2. February
3. March
4. April
5. May
6. June
7. July
8. August
9. September
10. October
11. November
12. December

18. We now ask you per sugarcane plot whether you cultivated plant or ratoon crop and what your harvest was.

**Enumerator: some farmers have several plots with sugarcane, we would like to know which type of crops (plant or ratoon) respondent cultivated and the harvest per plot.**

	<b>Sugar plot (owned only)</b>	<b>Type</b> 0) <i>Plant</i> 1) <i>Ratoon 1</i> 2) <i>Ratoon 2</i> 3) <i>Ratoon 3</i> 4) <i>Ratoon 4</i> 5) <i>Ratoon 5</i>	Plot size per plot (acre)	Harvest in metric tons per plot
1	Sugarcane Plot one			
2	Sugarcane Plot two			
3	Sugarcane Plot three			
4	Sugarcane Plot four			
5	Sugarcane Plot five			
6	Sugarcane Plot six			
7	...			
8	...			

- 
- 19 How much did you supply in total to **this mill** at your last harvest 2017-2018? (NOT PER ACRE, BUT TOTAL)
- \_\_\_\_\_metric tons
- 20 What was the price that you received per ton of your sugarcane crop in 2017-2018?
- Rs\_\_\_\_\_per ton
- 21 How satisfied are you with your the last sugarcane production of 2017-2018?
1. Very dissatisfied
  2. Dissatisfied
  3. Not satisfied nor dissatisfied
  4. Satisfied
  5. Very satisfied
- 22 Do you believe the quality of your sugarcane produce improved in the *last years*?
0. No -> **go to question no 23.**
  1. Yes
  2. I don't know
- 22a If yes, how could the quality of your produce increase? (MC)
1. I apply better agricultural practices
  2. There was hardly to no occurrence of pest & diseases compared to other years
  3. There is more water available for irrigation (natural source, canal)
  4. I have invested in drip irrigation / drip irrigation with fertigation
  5. I receive my harvest orders in time
  6. I have mechanized certain activities of the production and harvest process.
  7. Other, specify:
- 23 In the recent years, have you seen an increase or decrease in production per ha/acre of sugarcane?
0. Large decrease (< 50%) --> **go to question 23b**
  1. Decrease (-10-50%) --> **go to question 23b**
  2. No change (0%) --> **go to question 26**
  3. Increase (10-50%) --> **go to question 23a**
  4. Large increase (>50%) --> **go to question 23a**

---

23a If there was an increase, what caused the **increase** in production per ha/ sugarcane in the last season? (MC)

1. I apply better agricultural practices
2. There was hardly to no occurrence of pest & diseases compared to other years
3. There is more water available for irrigation (natural source, canal)
4. I have invested in drip irrigation / drip irrigation with fertigation
5. I receive my harvest orders in time
6. I have mechanized certain activities of the production and harvest process.
7. Other, specify:

23b if there was a decrease, what caused the decrease in production per ha/sugarcane in the last season? (MC max 3)

1. Water shortage
2. Lack of inputs
3. Low quality of seed
4. Unavailability of labour
5. No machines available
6. Delayed harvest (late cutting order)
7. Other, specify:

26 What was the age of your sugarcane crop when you harvested it?

1. Less than 10 months
2. 11 months
3. 12 months
4. 13 months
5. More than 13 months

27 Were you satisfied with the **profit** you made from sugarcane (2017-2018)?

**Enumerator: profit = gains, so revenue minus costs (i.e. not the total price received for yields)**

1. Very dissatisfied
2. Dissatisfied
3. Not satisfied nor dissatisfied
4. Satisfied
5. Very satisfied

---

28 In the last few years, have you seen an increase or decrease in the profit levels of your sugarcane in the last season 2017-2018?

**Enumerator: profit = gains, so revenue minus costs (i.e. not the total price received for yields)**

0. Large decrease (< 50%)
1. Decrease (10-50%)
2. No change (0%)
3. Increase (10-50%)
4. Large increase (>50%)

29 Do you have any costs besides your seed, input, labour and **harvest** (e.g. transportation, irrigation, bank?)

0. No --> **please go to question 31.**
1. Yes

30 What other types of (running) costs in sugarcane cultivation do you have? More answers possible

1. Transportation cost
2. Interest costs for a sugarcane loan & investment
3. Other, specify: .....

31 How do you feel about last year's rainfall for sugarcane production 2017-2018?

1. Below average of expectation
2. Normal
3. Above average of expectation

31a Did you experience any change compared to 1-2 years ago in availability (access) to water for irrigation? (MC)

0. natural water availability for irrigation is the same
1. natural water availability deteriorated
2. natural water availability improved because of access to canal
3. Other, specify:

32 What are the main challenges for you related to sugarcane production, in order of importance?

**More options possible but max 5**

**Enumerator: you may prompt but preferably not.**

	Challenges	1 =yes this is a challenge for me
1	Unavailability of labour	
2	Unavailability of agri inputs	
3	No resources to buy agri inputs	
4	Delay in payment for produce from the mill	
5	Transportation issues of produce to the mill	
6	Unavailability of water for irrigation	
7	My drip irrigation is in bad condition	
8	Attack of diseases and insects / pest	
9	Poor quality of soil	
10	No facility for soil testing	
11	Delay in getting cutting order	
12	Low price of cane	
13	(no) electricity / blackouts	
14	Other ... ..	
15	Other ... ..	

33 Are you member of a farmer group?

- 0. No           --> **please go to question 38.**
- 1. Yes

34 What farmer group are you member of?

- a. Sugarcane farmer group
- b. Water management farmer club
- c. Credit and savings group
- d. Other, specify: .....

34a Are you a lead farmer? (i.e. progressive farmer, for example with demonstration plot/equipment to function as an example for other farmers)

- 0. no
- 1. yes

=== end of section B ===

## Section CA Labour in sugarcane production

38 The following questions are about how much time is spent on sugarcane growing and harvesting activities of the last cultivation season 2017-2018. We ask you about how much time you spent per activity in the production process and for both own labour (farmer and family members) and hired labour.

### Enumerator:

- Fill out -999 when the farmer does not know
- Fill out NA when not applicable
- Fill out '0' when 0

**Enumerator 1: the question concern total land, so the number of labour for all sugarcane plots -- >if no sugarcane, skip this questions**

**Enumerator 2: the work of farmer himself counts as labour**

**Enumerator 3: if the farmer has only ratoon, don't fill in the activities applicable to plant crop**

**Enumerator 4: the number of days required is per acre for the last season (2017-2018)**

#	Activity	Total days required per acre	Of which: family (including the farmer))	Of which: Hired labour days (number of days)
1	Ploughing (plant crop only)			
2	Land preparation (plant crop)			
3	Furrows & bunding (plant crop)			
4	Fertilization/manure (both)			
5	Sowing (plant crop)			
6	Hoeing (both)			
7	Weeding (both) <i>Manual, Pre-emergent &amp; post-emergent</i>			
8	Irrigating (both)			

9	Trash shredding/mulching (ratoon)			
10	Carrying / transport (to mill (both)			
11	Other (e.g. tying, propping) Specify: .....			
12	Harvest labour costs (per ton) in INR			

39 How much hours is a regular and typical labour day (including breaks, travelling)?  
.... hours

=== end of section CA ===

### Section CB Mechanisation in sugarcane production

39b The following questions are about **mechanisation and if there are several steps in the production and harvest process where you have mechanized activities in the last season, 2017-2018 and since when.** 2017-2018. We ask you about each per activity in the production process.

Do you have any activities on your farm which are mechanized?

- 0.** No not at all --> **go to question row 9 and 10 in the table below.**
- 1. Yes --> fill in the table x below

Why don't you have farm mechanization? (MC)

- 0. I have never considered to mechanize farm activities
- 1. It is too expensive
- 2. There are no machines available
- 3. There is sufficient labour around
- 4. High selling price of power tillers and spare parts
- 5. Other, specify: .....

**If you have activities mechanized, please fill in the following table.**

#	Machinery / activities	Mechanization 0.No 1.Yes <b>I borrow equipment</b> <b>2. Yes, I have my own equipment</b>	If yes, since when? 0. I have always mechanized this activity 1. Since this year, 2017-2018 2. Since once year, 2016-2017 3. Two years ago
1	<b>Land preparation machinery</b>		
2	<b>Sugarcane planting machinery (tractor)</b>		
3	<b>Intercultivation equipment (for example, tractor, power weeder, mini plough)</b>		
4	<b>Plant protection machinery (eg knacp sack sprayer)</b>		
5	<b>Harvesting (tractor)</b>		
6	<b>Ratoon manager (tractor)</b>		
7	<b>Disc off barrower</b>		
8	<b>Trash incorporator (tractor)</b>		
9	<b>Water meter</b>		
10	<b>Soil moisture indicator</b>		

=== end of section CB ===

#### **Section D      Agricultural practices sugarcane only.**

**Enumerator: If no sugarcane produced in 2017-2018, skip this section**

40    How do you plough?

0. I do not plough
1. I use a rented tractor
2. I use my own tractor
3. I use my own livestock
4. I use rented livestock

---

41 What do you use for planting fresh crops?

1. Setts --> **go to question 41a**
2. Seedlings --> **go to question 42**

41a If you use sets, do you directly plant single bud setts?

0. No
1. Yes

42 What is the name of the variety?

1. CO8632
2. CO8603
3. 93V29
4. What the mill provides me with
5. Other, specify: .....
6. I do not know

43 Do you use seed nurseries?

0. No --> **please go to question 47.**
1. Yes

43a if yes, how do you access seed nurseries?

0. I have them myself
1. From the mill
2. From a colleague sugarcane farmer
3. Other, specify: ...

45 Do you use shade houses (green house) for raising seedling nursery?

0. No
1. Yes my own shade house
2. Yes, I rent a shade house
3. I don't know

- 
- 47 What is the row to row spacing?
1. 2 feet
  2. 3 feet
  3. 4 feet
  4. More than 4 feet
- 49 Do you apply chemical fertilizers at your sugarcane crop?
0. No
  1. Yes --> **please go to question 51.**
- 50 Why don't you apply chemical fertilizers? *Multiple answers possible*
1. I don't have financial resources to buy the fertilizers
  2. I don't have access / no availability
  3. I prefer to use organic fertilize
  4. I do not see the benefits of it
  5. I am not used to of doing so
  6. I do not know
- 51 How do you apply chemical fertilizer at your sugarcane crop? *Multiple answers possible*
1. Broadcasting
  2. Spray
  3. With irrigation water
  4. With irrigation water + fertigation
  5. Other\_\_\_\_\_
- 52 How often do you apply chemical fertilizer? *Multiple answers possible*
1. Once in a season
  2. Twice in a season
  3. 3 times in a season
  4. 4 times in a season
  5. 5 times in a season
  6. More than 5 times in a season

---

53 Do you follow the guidelines of the government/factory or sugar institute regarding quantity and time of application?

- 0. No
- 1. Yes
- 2. I do not know these guidelines

54 Do you apply any organic fertilizer at your sugarcane crop?

- 0. No           --> **please go to question 58.**
- 1. Yes

55 What kind of organic fertilizer do you use? *Multiple answers possible*

- 1. Cattle manure
- 2. Compost
- 3. Press mud

56 What is the source of your organic fertilizer? *Multiple answers possible*

- 1. My own farm
- 2. The mill supplies me
- 3. The government supplies me
- 4. Other farmers
- 5. Other: .....

57 How often do you apply organic fertilizer per cultivation season?

- 1. 0-1 times per season
- 2. 2-3 times in a season
- 3. 4-5 times in a season
- 4. I do not know

---

58 Why don't you apply organic fertilizer? *More answers possible*

0. I did not know it was possible to use as an agri-input
1. I am not convinced of the benefits of it for my crop
2. I prefer chemical fertilizer
3. I do not have access to organic fertilizer
4. I do not have the resources to purchase organic fertilizer
5. Other, specify: .....

58a Do you use a mulch trash?

- 0 no
- 1 yes --> **go to question 62.**

58b Why don't you mulch trash?

- I don't know how to
- I have never heard of trash mulching
- I don't have the financial resources to rent a trash shredder
- There is no trash shredder available in the neighbourhood

59 Do you have access to a trash shredder?

0. No
1. Yes, I own a trash shredder
2. Yes, I can use someone else's service s

62 What kind of pesticides do you apply?

1. Chemical pesticides
2. Organic pesticides
3. Both chemical and organic pesticides
4. I do not apply chemical fertilizers --> skip to question 4z

---

63 How often do you apply pesticides per cultivation season?

- 1 0-1 times per season
- 2 2-3 times per season
- 3 4-5 times per season
- 4 6-7 times per season
- 5 8-10 times per season
- 6 I do not know

64 Do you apply pesticides preventive or curative?

- 1 Preventive
- 2 Curative
- 3 Both

65 Why don't you apply pesticides at your sugarcane crop?

- 1 I do not have the financial resources to buy pesticides
- 2 I do not have access / no availability
- 3 I do not believe in the benefits of it
- 4 I am not used to do so
- 5 I learned that it is not healthy for my crop and for my health
- 6 Other, specify: .....

66 Did you have any pests or diseases at your crop last season 2017-2018?

0. No --> go to question 69.
1. Yes

67 What kind of diseases/pests did occur?

**Enumerator: show card**

- 1 Red rot
- 2 Top borer
- 3 Pyrilla
- 4 Early Shoot borer
- 5 White fly
- 6 Other specify: .....

---

68 What did you do when you noticed your crop was affected?

*Enumerator: Multiple answers possible*

- 1 I uprooted and burnt the affected clumps immediately
- 2 I sprayed pesticides
- 3 I harvested my crop as soon as possible
- 4 I kept the field free from standing water
- 5 I did not ratoon
- 6 I did not collect seed setts from the affected plants
- 7 Other: ..... (specify)

69 Do you burn your land after harvest?

0. No
1. Yes

*== end of section D ==*

**Section E Irrigation practices (ALSO ASK IF NO SUGARCANE IS CULTIVATED IN THE LAST SEASON in 2017-2018)**

The following questions are about irrigation practices. It concerns only the water and water source used for watering the crops. So not for domestic use.

70. What kind of irrigation systems do you know, use and would like to use?

	<b>System</b>	<b>Known to farmer?</b>  <i>0=unknown 1=known</i>	<b>Used irrigation system (for most/all plots)</b>  <i>0=no 1=yes</i>	<b>For which crop <i>Multiple answers</i></b>  <i>1=sugarcane 2=paddy 3=ginger 4=fruits 5=potato 6=vegetables 7=pulses 8=other</i>	<b>Preferred irrigation system **</b>  <i>1=yes preferred system</i>
1	Furrow irrigation				
2	Surface drip irrigation				
3	Sub surface drip irrigation (15-30 cm depth in root zone)				
4	Drip irrigation combined with fertigation				
5	Other, specify: .....				

**\*\* Enumerators: if used and preferred systems are different, ask:**

71 If your preferred system is different than your adopted irrigation system, why is that?

- 1 The investment is too costly
- 2 I cannot access a loan
- 3 I do not have the technical knowledge
- 4 I have other priorities

**Ask ONLY to those who use Furrow irrigation**

72 Please let us know what is your source of water, method of transportation, frequency, amount spent and water quality.

	In case of:	Source of water	Method
		<ol style="list-style-type: none"> <li>1. Bore wells</li> <li>2. Canal</li> <li>3. Directly from river</li> <li>4. Other</li> </ol>	<ol style="list-style-type: none"> <li>1. Electric pump</li> <li>2. Diesel pump</li> <li>3. Any other...</li> <li>4. Gravity</li> </ol>
1	furrow irrigation		

**Ask ONLY to those who use drip irrigation:**

73 Please let us know some information about the method of irrigation.

#	In case of:	Since when (mention which year, e.g. 2016)	How were you able to invest in this system? (MC)	How do you maintain and repair the system?	What is the condition of your irrigation system?
			<ol style="list-style-type: none"> <li>0. A loan</li> <li>1. A financial subsidy</li> <li>2. A hardware subsidy by the mill</li> <li>3. I saved</li> <li>4. A gift</li> <li>5. Other:</li> </ol>	<ol style="list-style-type: none"> <li>0. I do not maintain</li> <li>1. I hire labour</li> <li>2. I know how to do it myself</li> </ol>	<ol style="list-style-type: none"> <li>0. Bad</li> <li>1. Average</li> <li>2. Good</li> </ol>
1	surface drip irrigation based on electricity				

2	sub surface drip irrigation based on electricity				
3	Drip irrigation with fertigation				

74 How do you know when to irrigate your sugarcane plots? Do not prompt - More answers possible

- 1) From my own experience
  - 2) I look at the plant
  - 3) I look at the condition of the soil
  - 4) I follow an irrigation schedule
  - 5) The mill taught me when to irrigate: I follow the guidelines of the mill
  - 6) The government/extension mill taught me when to irrigate
  - 7) An NGO/charity taught me when to irrigate
  - 8) I just guess
  - 9) I know from the moisture meter / indicator
  - 10) Other, specify: .....
- I do not know

75 What challenges do you face in your current irrigation system?

**Enumerator: you may prompt but not necessarily. MC but max 5.**

	Possible challenges	Applicable 1=yes
1	I do not see any challenges	
2	There are water shortages	
3	It is too labour intensive	
4	It is too costly (the price of the water)	
5	There is not enough availability of electricity	
6	Fuel is too costly (if not applicable, put NA)	
7	I do not know how to maintain my irrigation system	
8	I do not have resources to maintain my irrigation system	
9	I do not know how to operate my irrigation system	
10	Other: .....	

11	Other: .....	

== end of section E ==

**Section F Inputs for sugarcane production - 2017-2018 season (if no sugarcane cultivated, skip this question)**

**Enumerator 1: own land and leased land + Sugarcane only**

Enumerator 2: ask quantity used per acre

		<b>Used at the last cultivation last season 2017-2018</b>	<b>Quantity used per acre</b> <i>(number of bottles, bags, etc)</i>	<b>Unit</b> <i>(Bottles, bags, etc)</i>	<b>Content</b> <i>(e.g. (50 kg, 100 kg, 100 ml, etc)</i>	<b>Price per item last season</b>
		<i>Type names</i>	<i>Total quantities (e.g. 1, 2, 3 etc)</i>	<i>Bag/bottle/...</i>		<i>Price per unit in INR</i>
<b>76a. Type of planting material</b>	6a.1	Single bud Setts				
	6a.2	2 bud setts				
	6a.3	Seedlings				
	6a.4	Others, .....				
<b>76b. Type of Chemical fertilizer</b>	6b.1	Urea				
	6b.2	DAP				
	6b.3	SSP (single super phosphor)				

	6b.4	MOP				
	6b.5	Other, .....				
<b>76c. Type of Biological fertilizer</b>	6c.1	Manure				
	6c.2	Compost				
	6c.3	Press mud				
	6c.4	Other /.....				
	6c.5	Other /.....				
<b>76d. Type of Weedicide</b>  <i>a) pre-emergent spray before the weeds emerges, so preventive</i>  <i>b)Or after: post emergent: you spray when the weedicides occur</i>	6d.1	Pre-emergent				
	6d.2	Post emergent				
	6d.3	Other, .....				
	6d.4	Other, .....				

== end of section F ==

## Section G Household income and diversification

77 Please estimate the percent of your household income that

- a) came from sugarcane last year (versus the total that include other cash crops, dairy, animal husbandry and off-farm incomes) and
- b) came from other activities on your farm (include other cash crops, dairy and animal husbandry)
- c) came from non-farm activities

**Enumerator 1: the total should be 100%! Check.**

**Enumerator 2: if this question is too difficult, explain with e.g. stones/ candies/wood or something alike.**

77a	Income % from sugarcane production 2017-2018  <i>Circle the right answer</i>  <i>If &gt;75%: go to question 7f</i>	77b	Income % from other farm related activities 2017-2018:  <i>Circle right answer</i>	77c	Income % from non-farm activities  <i>Circle right answer</i>
1	< 25%	1	< 25%	1	< 25%
2	25%	2	25%	2	25%
3	25%-50%	3	25%-50%	3	25-50%
4	50%	4	50%	4	50%
5	50-75%	5	50-75%	5	50-75%
6	75%	6	75%	6	75%
7	> 75%	7	> 75%	7	> 75%

**Enumerator: this question should only be answered if respondent has farm income next to sugarcane**

78. You mentioned to have other farm-income sources next to sugarcane (see table 7b).  
Please indicate what other income sources you have. Multiple answers possible

1. Other cash crops, specify: .....
2. Dairy
3. Animal husbandry
4. Seedling production/breeding / nursery for sales
5. Trash shredding services for other farmers
6. Drip irrigation maintenance services for other farmers
7. Provision of labour to other farmers
8. Provision of farm equipment to other farmers
9. Other, specify: ....

**Enumerator: this question should only be answered if respondent has non-farm income**

---

79. You mentioned to have other non-farm income sources next to farm income (see table 79c). What other non-farm income sources do you have?

1. I do not have non-farm income
2. I have a shop
3. I work for government
4. A family member works for the government
5. I work as an employee
6. A family member works as an employee
7. Remittances
8. Others, specify: .....

80. Where did you spend the profit of your entire last sugarcane harvest on? (MC)

1. I did not have any profit
2. I bought agri-inputs (seed, fertilizer, etc) for cultivating the next crop
3. I invested in a drip irrigation
4. I invested in maintenance of my irrigation system
5. I bought a tractor
6. I purchased new land
7. I gave a party
8. Other, specify: .....
9. Other, specify: .....

### **Loans/credit**

81. Have you taken any credit/loan in the last year?

**Enumerators: credit is defined as a loan of cash– does not include in-kind gifts**

0. No → **Please go to question 82a.**
1. Yes

82. Who provided you with this credit?

1. Bank
2. Post office
3. Micro finance institute
4. Cooperatives

- 
5. Sugar mill
  6. Local money lender
  7. Family
  8. Government
  9. Others\_\_\_\_\_

82a. Did you follow a training on financial literacy in the past 2-3 years?

**0. No --> go to question 83.**

1. Yes

82b. Could you access the loan as a result of the training on financial literacy?

0. No

1. Yes

83. Was the loan a production loan or investment loan (term loan)?

1. Crop loan (e.g. inputs, seeds, pesticides, etc) --> **go to question 85.**

2. Investment loan (e.g. tractor, irrigation system)

3. Both

4. Other, specify:....

84. For what agricultural purpose did you use the credit?

**(Instruction to the enumerator: multiple answers are possible)**

1. Drip irrigation surface

2. Drip irrigation subsurface

3. Other irrigation system, specify: .....

4. Maintenance of drip irrigation system

5. Water pump

6. Electricity

7. Fertilizer

8. Farm machinery (like tractor) etc

9. Other, specify\_\_\_\_\_

---

**Savings**

85. Do you and your household maintain any savings (including bank savings accounts, such as, micro-banking)

- 0. No --> **Please go to question 87**
- 1. Yes

**Subsidies**

87 Do you and your household receive any subsidies?

- 0. No --> **Please go to Section H**
- 1. Yes

88 Where do you receive subsidy from?

- 1. Government
- 2. NGO
- 3. Others \_\_\_\_\_

89. What did you receive subsidy for? Please go through the following options:

	<b>Subsidy received for</b>	<b>0=no 1=yes</b>
1	surface drip irrigation	
2	sub surface drip irrigation	
3	Other irrigation system, specify: .....	
5	Electricity	
6	Water Pump	

== end of section G ==

---

**Section H      Livelihoods**

90. How do you feel about your overall economic situation compared to last year?

- 1. Much worse
- 2. Worse
- 3. Same
- 4. Better
- 5. Much better

91. What is the primary source of drinking water for your household? (1 answer)

- |   |                        |    |  |
|---|------------------------|----|--|
| 1 | Interior plumbing      | 8  | Private outside tap/spigot             |
| 2 | Hand pump              | 9  | Public tap                             |
| 3 | Water merchant         | 10 | Well with pump                         |
| 4 | Water truck            | 11 | Well without pump (artesian well)      |
| 5 | Rainwater              | 12 | River, lake, spring, pond, stream, dam |
| 6 | Neighbour's tap/spigot | 13 | Bottled water                          |
| 7 | Neighbour's well       | 14 | Other, specify: .....                  |

92. Do you have access to electricity?

- 0. No
- 1. Yes

93. What is your main source of energy for cooking? (1 answer)

- 1. No cooking arrangements
- 2. Firewood and chips
- 3. Dung cake
- 4. Kerosene
- 5. Charcoal
- 6. Coke or coal
- 7. Gobar gas
- 8. LPG
- 9. Electricity
- 10. Other, specify: .....

- 
94. Does your household possess any casseroles, thermos, or thermoware?
0. No
  1. Yes
95. Does your household possess a television and a VCR/VCD/DVD player?
1. No, neither one
  2. Yes, only one
  3. Yes, both
96. Does your household possess a mobile handset and a telephone instrument (landline)?
1. No, neither one
  2. Yes, only a mobile
  3. Yes, a landline, regardless of mobile
  4. Smartphone
97. Does your household possess a sewing machine?
0. No
  1. Yes
98. Does your household possess an almirah/dressing table?
0. No
  1. Yes
99. Does your household possess a bicycle, motorcycle/scooter, or motor car/jeep?
1. No, none
  2. Yes, bicycle only, no motorcycle/scooter or car
  3. Yes, a motorcycle/scooter but no car (regardless of bicycle)
  4. Yes, a motor car/jeep (regardless of others)

---

100. Did you face any difficulties the last year in procuring food for you and your family?

- 0. No
- 1. Yes

Enumerator: mention that you are almost through, two more sections to go.

*== end of section H ==*

**Section I                      Trainings received related to sugarcane**

100a do you have access to / are you exposed to a demonstration plot on sugarcane cultivation?

- 0. No--> **go to question 100g.**
- 1. Yes

100b If yes, since when?

- a. This year, 2018
- b. Last year, 2017
- c. Two years ago 2016
- d. For more years / more than 2 years ago

100c If yes, what practices are used at the demo plot you have access to / you have visited? (MC)

- a. Drip irrigation system
- b. Trash mulching
- c. Wide row spacing
- d. Intercropping
- e. Bio compost
- f. Other:

---

100d If yes, how helpful is this demo plot for you in increasing your knowledge about good agricultural practices in sugarcane?

1. Not helpful at all
2. Not helpful
3. Neutral
4. A bit helpful
5. Very helpful

100f If yes, how helpful is this demo plot for you in increasing your knowledge about good agricultural practices for *other crops than sugarcane*?

1. Not helpful at all
2. Not helpful
3. Neutral
4. A bit helpful
5. Very helpful

100g Do you receive assistance from the extension worker from the mill?

**0. No --> go to question 101**

**1. yes**

100h If yes, how satisfied are you about the expertise and knowledge of this extension worker for improving your agricultural practices and production in sugarcane?

1. Very dissatisfied
2. Dissatisfied
3. Neutral
4. Satisfied
5. Very Satisfied

100i According to you, did the knowledge of the extension worker on good agricultural practices and sugarcane production increase / improved recently?

- 1.No it did not improve/increase at all.
- 2.No it did not improve/increase.
- 3.Neutral
- 4.Yes a bit improvement
- 5.Yes very much improved/increased

100j. Do you receive assistance from the lead farmer? (lead farmer: demonstration plot, new activities/ equipment / example or role model for other farmers)

0.no --> go to question 101.

1.yes

100k If yes, how satisfied are you about the expertise and knowledge of the lead farmer in improving your agricultural practices and production in sugarcane?

1. Very dissatisfied
2. Dissatisfied
3. Neutral
4. Satisfied
5. Very Satisfied

101 We will now ask you if you have ever received a training related to sugarcane farming in the past and if yes, what kind of training. You could think of a training, but also of an exchange visit to another farmer, or a practical course in the field of another farmer. Or you could have been exposed to another learning stimulating activity (e.g. a movie, or a book, etc.)

<p>Type of trainings:</p>	<p>a. Did you ever follow the training (ask for every training mention in the table)?</p> <p>0.no --&gt; go to question 9c</p> <p>1.yes</p>	<p>b. When did you follow this training?</p> <p><b>Month/year</b></p>	<p>c. Source of training?</p> <p>1. <i>The sugarcane mill I supply to / the extension worker of the mill</i></p> <p>1b. <i>The lead farmer</i></p> <p>2. <i>The university / research center</i></p> <p>3. <i>The government</i></p> <p>4. <i>An NGO / charity</i></p> <p>5. <i>Other, specify: ...</i></p>	<p>d. How satisfied are you with this training?</p> <p>1.very dissatisfied</p> <p>2.Dissatisfied</p> <p>3.Neutral</p> <p>4.Satisfied</p> <p>5.Very satisfied</p>	<p>e. Would you recommend this training to other producers?</p> <p>0=no</p> <p>1=yes</p> <p>3= I don't know</p>	<p>f. Helpful / Assisting in improving their farming?</p> <p>1.Very unhelpful</p> <p>2.Unhelpful</p> <p>3.Neutral</p> <p>4.Helpful</p> <p>5.Very helpful</p>	<p>g. Did you change your farming activities in sugarcane as result of the training? in practices sugarcane after having followed the training?</p> <p>0=no</p> <p>1=yes</p>	<p>h. Did you change your farming activities in other crops as a result of the training?</p> <p>0=no</p> <p>1=yes</p>
---------------------------	---	---	---	--	---	--	--	---

1.Good agricultural practices sugarcane								
2.irrigation methods and techniques + maintenance								
3.farm mechanization								
4.trash shredding								
5.financial literacy								
6.Other, specify:								
7.Other, specify:								

102 If the respondent has followed any of the above mentioned trainings, please fill in the following table.

**if no trainings received: skip this table**

<b>Specific topics of good agricultural practices training</b>	How satisfied are you with this topic training?	Helpful / Assisting in improving?	Did you change your farming activities in sugarcane as result of the training?	Did you change your farming activities in other crops as a result of the training?	Would you recommend other sugarcane farmers to change their usual practices to the good agricultural practices?
	1.very dissatisfied 2.Dissatisfied 3.Neutral 4.Satisfied 5.Very satisfied	1.Very unhelpful 2.Unhelpful 3.Neutral 4.Helpful 5.Very helpful	0=no 1=yes	0=no 1=yes	0=no 1=yes 2=I don't know

Seed (quality, varieties, seedlings, nursery, seed rate, shed, treatment)					
Manure and fertilizers & bio compost					
Integrated pest management					
Intercropping					
Drip irrigation					
Trash mulching					
Other, specify					

**FOR ALL RESPONDENTS:**

103. On what kind of topics in sugarcane *would you like* to be trained on?

**More answers possible.**

1. I do not want a training
2. Mechanization of my farm
3. Irrigation systems
4. 3a. Maintenance of irrigation systems
5. Good agricultural practices
6. Intercropping

- 7. Trash shredding and mulching
- 8. Soil testing
- 9. Financial Farm management
- 10. Other, specify: .....
- 11. I do not know

103a Do you receive any **other** support in sugarcane cultivation? *Like trainings, financial assistance, input provision, advisory services*

- 0. No                               --> **go to Section J.**
- 1. No, not anymore           --> **go to question 103b**
- 2. Yes                             --> **go to question 103b**

103b What is the source(s) of this other support? *More answers possible*

- 0. Government / extension services
- 1. The mill I supply my produce to
  - a. If yes, specify:
- 2. An NGO / charity
  - a. If yes, please specify which: .....
- 3. Other, specify.....

== end of section I ==

**Section J       Risk and Investments**

*We now ask you your opinion on some statements. There is no good or wrong. You may answer whatever you want to. Feel free to indicate whether you agree or disagree. This is the last section.*

104 Do you agree or disagree with the following towards investments?

**Enumerators: please put an 'X' in the box**

#	Statements	Strongly disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly agree 5
1	I will not make any investment because you never know what will happen.					
5	I'm only willing to invest in new agricultural practices after I have find the mill technology reliable					
3	Investing in agriculture/new agricultural practices is very risky; I rather do not do it.					

106 This question is about your preference for receiving money today or in one year.

**Please remember that it is just a question.**

Would you prefer to receive today or would you prefer to receive in one year:

**Enumerator: when a farmer choses the next year, so if he shifts, you can stop**

	Would you prefer to receive today	Or	would you prefer to receive in one year:	
1	500 INR		500 INR	
2	500 INR		550 INR	
3	500 INR		600 INR	
4	500 INR		650 INR	
5	500 INR		700 INR	
6	500 INR		750 INR	
7	500 INR		800 INR	
8	500 INR		850 INR	

9	500 INR		900 INR	
10	500 INR		950 INR	
If only chosen 500 ... for today, which amount would you choose to receive in one year? ..... ..INR				

== end of section J ==

**A) That was the last question in this questionnaire. Thank you very much for your time and effort to help us understand more about sugarcane production and producers. Is there anything else you would like to tell us or ask us?**

Do you have any questions or comments? .....

**B) Enumerator: please read through questionnaire to make sure no questions were left unanswered before leaving your farmer! Thank you!**

End time of the interview:.....

# Appendix 3 Descriptives tables

## Tables Chapter 6 Personal and Household Characteristics

**Table A3.1** Share of income from sugarcane production (in %)

	Mill 1	Mill 2	Mill 3
<25%	0	0	0
25%	1	0	1
25-50%	19	0	1
50%	36	0	5
50-75%	12	2	10
75%	1	1	8
>75%	31	97	75

\*\*\* ( $\alpha = 0.01$ ), \*\* ( $\alpha = 0.05$ ) and \* ( $\alpha = 0.1$ )

**Table A3.2** Willingness to invest

I will not make any investment because you never know what will happen (in %).

Statement investment	Survey	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Applies drip irrigation <sup>b</sup>	Baseline	6	66	14	12	1
	Midterm	44	32	22	2	0
Does not apply drip irrigation	Baseline	10	45	26	19	0
	Midterm	3	68	29	0	0
Total <sup>a</sup>	Baseline	9	50	23	17	0
	Midterm	26	48	25	1	0

<sup>a</sup> Farmers are significantly less likely to invest in the mid-term compared to the baseline survey

<sup>b</sup> There is no significant correlation between applying drip irrigation and willingness to invest

**Table A3.3** Risk attitude

Investing in agriculture or new agricultural practices is very risky; I would rather not do it (in %).

Statement risk	Survey	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Applies drip irrigation <sup>b</sup>	Baseline	4	44	30	17	5
	Midterm	30	43	20	5	2
Does not apply drip irrigation	Baseline	18	42	28	10	2
	Midterm	27	64	8	0	1
Total <sup>a</sup>	Baseline	14	43	28	12	3
	Midterm	29	52	15	3	2

<sup>a</sup> Farmers are significantly less risk-loving in the mid-term compared to the baseline survey

<sup>b</sup> Farmers who apply drip irrigation are significantly less risk-loving

**Table A3.4** Time horizon

I chose INR500 today or INRX next year

Time horizon choice	Survey	Total		Mill 1		Mill 2		Mill 3	
		Mean	Std. Dv.	Mean	Std. Dv.	Mean	Std. Dv.	Mean	Std. Dv.
INR needed to choose to receive in 1 year rather than INR500 today <sup>a</sup>	Baseline	929	236	903	236	1,063	388	914	79
	Mid term	787	128	707	80	938	22	924	61

<sup>a</sup> Farmers have significantly longer time horizons in the mid-term compared to the baseline. Farmers with drip irrigation have significantly shorter time horizons.

## Trust in investment

Statement trust	Survey	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Applies drip irrigation <sup>b</sup>	Baseline	4	44	30	17	5
	Midterm	30	43	20	5	2
Does not apply drip irrigation	Baseline	18	42	28	10	2
	Midterm	27	64	8	0	1
Total <sup>a</sup>	Baseline	14	43	28	12	3
	Midterm	29	52	15	3	2

<sup>a</sup> Farmers have significantly less trust in investments in the mid-term compared to the baseline survey

<sup>b</sup> Farmers who apply drip irrigation are significantly less trustful in investments

**Table A3.5** Ratoon numbers per plot

Ratoon	Baseline		Midterm	
	Number of plots	In %	Number of plots	In %
Ratoon 1	404	43%	346	30%
Ratoon 2	368	39%	289	25%
Ratoon 3	176	19%	511	45%
Ratoon 4	2	0%	0	0%
Total	950		1146	

**Table A3.6** Ratoon numbers per mill (in %)

Ratoon	Baseline				Midterm			
	Mill 1	Mill 2	Mill 3	Total	Mill 1	Mill 2	Mill 3	Total
Ratoon 1	44	10	46	100	1	20	79	100
Ratoon 2	57	2	41	100	5	3	92	100
Ratoon 3	44	1	55	100	88	0	12	100
Ratoon 4	0	0	100	100	0	0	0	0

## Tables Chapter 7 Cultivation practices

**Table A3.7** Planting practices (in %)

Inputs	Total		Mill 1		Mill 2		Mill 3	
	Mean baseline	Mean mid term						
Setts used for planting	98%***	87%	100%	100%	88%***	18%	98%*	96%
<i>Of which</i>								
CO86032	61%***	43%	28%***	9%	70%***	12%	99%	99%
93V29	0%***	1%	0%***	2%	0%	0%	0%	0%
Whatever the mill provides	22%***	36%	46%	49%	0%***	87%	0%	0%
COM0265	11%***	0%	23%***	0%	0%	0%	0%	0%
2003V646	2%***	0%	0%	0%	17%***	0%	0%	0%
Directly plant single bud sets	46%***	9%	9%	13%	47%***	4%	92%***	5%
Seed nurseries	1%***	9%	3%*	6%	0%**	4%	0%***	14%
<i>Of which</i>								
Shade house	0%	25%	0%	62%	0%	60%	0%	2%

\*\*\* ( $\alpha = 0.01$ ), \*\* ( $\alpha = 0.05$ ) and \* ( $\alpha = 0.1$ )

**Table A3.8** Pest and diseases occurrence (in %)

Pest and disease	Total		Mill 1		Mill 2		Mill 3	
	Mean baseline	Mean mid term						
Reported pest or disease	90%***	60%	96%***	99%	85%***	25%	84%***	23%
<i>Occurrence:</i>								
Red rot	51%***	43%	69%***	81%	65%***	22%	22%***	3%
Top borer	25%***	39%	26%	77%	40%	17%	18%	0%
Pyrrilla	7%***	3%	7%	5%	7%**	2%	7%***	1%
Early shoot borer	25%***	6%	12%	12%	3%	3%	51%***	0%
White fly	0%***	14%	0%***	20%	0%	1%	0%***	11%

\*\*\* ( $\alpha = 0.01$ ), \*\* ( $\alpha = 0.05$ ) and \* ( $\alpha = 0.1$ )

**Table A3.9** Intercropping (in %)

Inputs	Total		Mill 1		Mill 2		Mill 3	
	Mean baseline	Mean mid term						
<i>Of total sample</i>								
Rice	1%***	0%	1%*	0%	4%***	0%	0%	0%
Ginger	0%	0%	0%	0%	0%	0%	0%	0%
Fruits	0%	0%	0%	0%	0%	0%	0%	0%
Vegetables	0%*	0%	0%	0%	0%	0%	1%*	0%
Pulses	1%	0%	0%	0%	1%	1%	1%*	0%
Potatoes	0%	0%	0%	0%	0%	0%	0%	0%

**Table A3.10** Preferred irrigation systems (in %)

Inputs	Total		Mill 1		Mill 2		Mill 3	
	Mean baseline	Mean mid term						
Furrow	67%***	47%	96%	97%	52%***	1%	35%***	1%
Surface drip	4%***	23%	1%**	0%	19%***	81%	3%***	30%
Subsurface drip	1%	1%	0%	1%	0%	0%	2%	0%
Drip irrigation with fertigation	28%	30%	2%	3%*	29%	19%	61%*	68%

\*\*\* ( $\alpha = 0.01$ ), \*\* ( $\alpha = 0.05$ ) and \* ( $\alpha = 0.1$ )

**Table A3.11** Input costs per tonne of sugarcane (in INR)

Inputs	Total		Mill 1		Mill 2		Mill 3	
	Mean baseline	Mean mid term						
Planting material	62***	35	35**	39	111***	44	77***	27
Chemical fertilizer	96***	55	103***	63	145***	59	71***	45
Organic fertilizer	86***	61	34***	30	131*	73	136***	97
Weedicide	23***	8	8	9	34***	9	38***	7

**Table A3.12** Sugarcane productivity change (in %)

Change	Total	Mill 1	Mill 2	Mill 3
Large decrease (<-50%)	3	2	43	13
Decrease (-10 - -50%)	34	12	7	26
No change	13	24	8	25
Increase (10-50%)	41	60	14	35
Large increase (>50%)	9	1	28	1

\*\*\* (α = 0.01), \*\* (α = 0.05) and \* (α = 0.1)

**Table A3.13** Sugarcane production satisfaction (in %)

Satisfaction production	Total		Mill 1		Mill 2		Mill 3	
	Mean baseline	Mean mid term						
Very dissatisfied	20	9	0	1	49	0	40	22
Dissatisfied	19	14	19	2	42	2	9	34
Not satisfied nor dissatisfied	15	34	17	40	3	57	18	18
Satisfied	45	39	63	55	6	41	33	20
Very much satisfied	1	4	1	2	0	1	2	7

\*\*\* (α = 0.01), \*\* (α = 0.05) and \* (α = 0.1)

**Table A3.14A** Sugarcane production costs per acre

Production costs/acre (INR)	Total		Mill 1		Mill 2		Mill 3	
	Mean baseline	Mean mid term						
Labour cost <sup>1</sup> per acre produced	24,432***	33,087	22,930***	28,191	17,042***	48,031	29,092	33,669
Input cost per acre produced	34,028***	16,484	30,889***	8,916	38,842***	31,500	36,187***	20,388
Total production cost per acre produced	58,460***	49,572	53,819***	37,107	55,885***	79,531	65,278***	54,057
Total margin per acre	42,746***	72,233	53,969***	65,080	10,485***	74,056	40,658***	80,521**

**Table A3.14B** Sugarcane production costs per tonne

Production costs/tonne (INR)	Total		Mill 1		Mill 2		Mill 3	
	Mean baseline	Mean mid term						
Labour cost <sup>2</sup> per tonne produced	601***	828	492***	767	683***	911	707***	874
Input cost per tonne produced	1,199***	476	706***	277	1,742***	605	1,614***	679
Total production cost per tonne produced	1,800***	1,304	1,198***	1,043	2,425***	1,516	2,321***	1,553
Total margin per tonne	524***	1,444	1,073***	1,510	141***	1,353	-21***	1,394

\*\*\* (α = 0.01), \*\* (α = 0.05) and \* (α = 0.1)

<sup>1</sup> Only hired labour

<sup>2</sup> Only hired labour

**Table A3.15** Sugarcane price

Satisfaction production	Total		Mill 1		Mill 2		Mill 3	
	Mean baseline	Mean mid term	Mean baseline	Mean mid term	Mean baseline	Mean mid term	Mean baseline	Mean mid term
	Price per tonne sugarcane (INR)	2324***	2748	2272***	2553	2566***	2869	2300***

\*\*\* ( $\alpha = 0.01$ ), \*\* ( $\alpha = 0.05$ ) and \* ( $\alpha = 0.1$ )

## Tables chapter 8

**Table A3.16** Gross sugarcane income

Gross Income (INR)	Total		Mill 1		Mill 2		Mill 3	
	Mean baseline	Mean mid term						
	Gross income	84,969***	176,105	140,925***	98,052	35,417***	187,656	32,916***
Gross income per acre	37,465***	64,672	44,759***	60,869	10,504***	57,964		71,907
Gross income per tonne sugarcane	346***	1,239	816***	1,418	142***	999	-172***	1,107

\*\*\* ( $\alpha = 0.01$ ), \*\* ( $\alpha = 0.05$ ) and \* ( $\alpha = 0.1$ )

**Table A3.17** Gross sugarcane income change in the last few years (in %)

Change	Total	Mill 1	Mill 2	Mill 3
Large decrease (<-50%)	1	1	0	3
Decrease (-10 - -50%)	33	22	18	53
No change	20	13	31	25
Increase (10-50%)	44	63	50	18
Large increase (>50%)	1	2	1	1

**Table A3.18** Gross sugarcane income satisfaction (in %)

Satisfaction production	Total		Mill 1		Mill 2		Mill 3	
	Mean baseline	Mean mid term	Mean baseline	Mean mid term	Mean baseline	Mean mid term	Mean baseline	Mean mid term
	Very dissatisfied	6	4	0	1	37	0	2
Dissatisfied	40	22	35	3	30	16	54	47
Not satisfied nor dissatisfied	22	35	22	35	6	55	29	27
Satisfied	31	39	42	59	25	28	14	17
Very much satisfied	0	1	1	2	1	1	0	0

# Appendix 4 Regression tables and models

## Regression tables chapter 6

**Table A4.1** Regression results drip irrigation

Drip irrigation	Impact (+)	Drip irrigation	Impact (-)
Mid-term survey	+***	Years of cultivation experience	-**
Education	+***		
Owened sugarcane area	+***		
Subsidy	+***		
Sugarcane farmer group	+***		
Mill 2	+***		
Mill 3	+***		
Engagement with program (mill 1 only)	+**		
Willingness to invest	+** <sup>a</sup>		
Income % from sugarcane	+*		

\*\*\* ( $\alpha = 0.01$ ), \*\* ( $\alpha = 0.05$ ) and \* ( $\alpha = 0.1$ )

<sup>a</sup> Result is not robust to different estimation methods

**Table A4.1.1** Regression model drip irrigation

Variables in equation	$\beta$
Mid-term survey	0.256***
Willingness to invest	0.027**
Time horizon	0.000
Risk loving	-0.010
Plant crop only	-0.024
Years of cultivation experience	-0.003**
Gender	-0.003
Head of household	-0.025
Household size (categorical)	0.001
Education	0.091***
Owened sugarcane area	0.017***
Leased sugarcane area	-0.007
Owened other area	0.003
Leased other area	-0.001
Income % from sugarcane	0.046*
Subsidy	0.095***
Sugarcane farmer group	0.062***
Mill 2	0.522***
Mill 3	0.703***
Engagement with program (mill 1 only)	0.063**
Constant	-0.227***
Observations	1392

\*\*\* ( $\alpha = 0.01$ ), \*\* ( $\alpha = 0.05$ ) and \* ( $\alpha = 0.1$ )

**Table A4.2** Regression results share of chemical fertiliser in total fertiliser costs

Share of chemical fertiliser	Impact (+)	Share of chemical fertiliser	Impact (-)
Willing to invest	+***	Mid-term survey	-***
Gender	+**	Time horizon	-*** <sub>a</sub>
Head of household	+***	Risk-loving	-** <sub>a</sub>
Owned sugarcane area <sub>a</sub>	+*	Mill 2	-***
		Mill 3	-***

\*\*\* ( $\alpha = 0.01$ ), \*\* ( $\alpha = 0.05$ ) and \* ( $\alpha = 0.1$ )

<sub>a</sub> Result is not robust to different estimation methods

**Table A4.3** Regression results burning

Burning	Impact (+)	Burning	Impact (-)
Mid-term survey	+***	Willing to invest	-***
Time horizon	+**	Household head	-***
Owned sugarcane area	+*** <sub>a</sub>	Owned other area	-** <sub>a</sub>
Leased sugarcane area	+* <sub>a</sub>	Mill 2	-***
Subsidy	+*	Mill 3	-**

\*\*\* ( $\alpha = 0.01$ ), \*\* ( $\alpha = 0.05$ ) and \* ( $\alpha = 0.1$ )

<sub>a</sub> Result is not robust to different estimation methods

**Table A4.4** Regression results productivity

Productivity	Impact (+)	Productivity	Impact (-)
Owned other area	+***	Owned sugarcane area	-***
Income % from sugarcane	+***	Leased sugarcane area	-***
Education	+**		
Household size (categorical)	+*		
Subsidy	+*		

**Table A4.4.1** Regression model productivity

Productivity	B <sub>model B</sub>
Share of chemical fertilizer	6.714
Burning of land	4.256
Mid-term survey	1.829
Plant crop only	-1.970
Years of cultivation experience	-0.188
Gender	-2.786
Head of household	3.811
Household size (categorical)	3.400**
Education	7.396**
Owned sugarcane area	-5.208***
Leased sugarcane area	-2.404**
Owned other area	4.461***
Leased other area	0.296
Income % from sugarcane	9.647**
Subsidy	4.947*
Sugarcane farmer group	4.291
Mill 2	4.291
Mill 3	-4.190
Engagement with program (mill 1 only)	5.689
Intercropping (if producing other crops only)	-20.555
Constant	23.700***
Observations	1594

\*\*\* ( $\alpha = 0.01$ ), \*\* ( $\alpha = 0.05$ ) and \* ( $\alpha = 0.1$ )

**Table A4.5** Regression results production costs per tonne

Production costs	Impact (+)	Production costs	Impact (-)
Owned sugarcane area	+***	Share of chemical fertilizer	-***
Mill 2	+***	Mid-term survey	-***
Mill 3	+***	Income % from sugarcane	-***
		Subsidy	-***
		Education	-***
		Owned other area	-**
		Sugarcane farmer group	-*

**Table A4.5.1** Regression model production costs per tonne

Costs per tonne	B
Share of chemical fertilizer	-606.168***
Burning of land	-46.501
Mid-term survey	-599.913***
Plant crop only	95.414
Years of cultivation experience	-1.759
Gender	82.862
Head of household	95.201
Household size (categorical)	-48.439
Education	-283.968***
Owned sugarcane area	200.710***
Leased sugarcane area	30.510
Owned other area	-25.408**
Leased other area	-12.833
Income % from sugarcane	-193.103**
Subsidy	-359.771***
Sugarcane farmer group	-133.478*
Mill 2	534.022***
Mill 3	455.487***
Engagement with program (mill 1 only)	59.123
Intercropping (if producing other crops only)	-47.743
Constant	1966.111***
Observations	1596

\*\*\* ( $\alpha = 0.01$ ), \*\* ( $\alpha = 0.05$ ) and \* ( $\alpha = 0.1$ )

**Table A4.6** Regression results gross income

Gross income	Impact (+)	Gross income	Impact (-)
Productivity	+***	Total costs per tonne	-***
Mid-term survey	+***	Leased sugarcane area	-***
Owned sugarcane area	+***	Intercropping	-*
Subsidy	+**		
Owned other area	+*		

**Table A4.6** Regression results gross income per acre

Gross income per acre	Impact (+)	Gross income per acre	Impact (-)
Productivity	+***	Leased sugarcane area	-***
Mid-term survey	+***	Income % from sugarcane	-**
Owned sugarcane area	+***	Mill 2	-**
Share of chemical fertilizer	+***	Total costs per tonne	-**
Burning of land	+**	Leased other area	-*

**Table A4.7** Regression results gross income per tonne

Gross income per tonne	Impact (+)	Gross income per tonne	Impact (-)
Mid-term survey	+***	Total costs per tonne	-***
Owned sugarcane area	+***	Leased sugarcane area	-***
Mill 2	+***		
Mill 3	+***		
Burning of land	+*		
Subsidy	+*		

**Table A4.7.1** Regression model gross income per tonne

Profit per tonne	$\beta^{\text{model}}$
Productivity	0.170
Total costs per tonne	-1.093***
Share of chemical fertilizer	53.300
Burning of land	87.742**
Mid-term survey	434.406***
Plant crop only	-22.150
Years of cultivation experience	-0.155
Gender	31.470
Head of household	21.899
Household size (categorical)	-1.945
Education	-36.712
Owned sugarcane area	55.226***
Leased sugarcane area	-454.939***
Owned other area	6.149
Leased other area	6.005
Income % from sugarcane	44.430
Subsidy	62.034**
Sugarcane farmer group	-12.663
Mill 2	387.292***
Mill 3	207.950***
Engagement with program (mill 1 only)	-64.971
Intercropping (if producing other crops only)	67.237
Constant	1955.481***
Observations	1589

\*\*\* ( $\alpha = 0.01$ ), \*\* ( $\alpha = 0.05$ ) and \* ( $\alpha = 0$ )

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