**Supplementary material A: Interview guide**

**Background characteristics of respondents** Community ………………….

1. Age……………………………………………
2. Highest level of education completed……………………………………………
3. Years of experience in vegetable farming………………………………………
4. Years at current vegetable farm………………………………………………….
5. What is the total size of your land?
6. < 1 acre
7. 1-3 acres

(c) 4-6 acres

(d) >6 acres

1. How many of the total is vegetable farm?
2. < 1 acre
3. 1-3 acres
4. 4-6 acres
5. >6 acres
6. What is the land tenure arrangement?
7. Own land
8. Family/community land
9. Rented/hired land
10. What type of vegetables do you grow?…………………………………………………………………………………………….
11. What other crops apart from vegetables do you grow?...................................................... ……………………………………….
12. Do you have good and bad soils on your farm? Yes [ ] No [ ]

**Knowledge and assessment of soil quality**

1. Have you observed any deficiency of any of the following nutrients on your farm?*(Please explain each of the nutrient to the respondent before ticking)*

Nitrogen: Yes [ ] No [ ]

Phosphorus: Yes [ ] No [ ]

Potassium: Yes [ ] No [ ]

1. What do you do when you observed any of the deficiencies?
2. ………………………………………………………………………………………………………………………………….
3. ………………………………………………………………………………………………………………………………….
4. ………………………………………………………………………………………………………………………………….
5. Do you use mineral fertilizers on your farm? Yes [ ] No [ ]
6. If yes, please list the type of mineral fertilizers used……………………………………………………………………………….

………………………………………………………………………………………………………………………………………

1. Do you use organic fertilizers on your farm?Yes [ ] No [ ]
2. If yes, please list the type of organic fertilizers used……………………………………………………………………………….

………………………………………………………………………………………………………………………………………

1. Which of the following **indicators** do you use to assess soil quality on your farm (topsoil, 0-25 cm depth), **how often** and **who does the assessment**? Please, **tick (✓)** all options that are applicable.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Indicators** | **NO** | **Yes** | **< 1 yr** | **1 yr** | **2-5 yrs** | **> 5 yrs** |  | **Self** | **Not self** *(Please, specify)* |
| **Chemical** |  |  |  |  |  |  |  |  |  |
| Nitrogen |   |   |   |   |   |   |   |   |   |
| Phosphorus |   |   |   |   |   |   |   |   |   |
| Potassium  |   |   |   |   |   |   |   |   |   |
| Acidity  |   |   |   |   |   |   |   |   |   |
| Do you use lime on our farm? |  |  |  |  |  |  |  |  |  |
| **Biological** |   |   |   |   |   |   |   |   |   |
| Soil organic matter |   |   |   |   |   |   |   |   |   |
| Residue breakdown |   |   |   |   |   |   |   |   |   |
| Soil smell |   |   |   |   |   |   |   |   |   |
| Presence of soil macro-fauna |   |   |   |   |   |   |   |   |   |
| Presence of specific weeds |   |   |   |   |   |   |   |   |   |
|   |   |   |   |   |   |   |   |   |   |
| **Physical** |   |   |   |   |   |   |   |   |   |
| Topsoil depth |   |   |   |   |   |   |   |   |   |
| Moisture holding capacity |   |   |   |   |   |   |   |   |   |
| Compaction |   |   |   |   |   |   |   |   |   |
| Soil color |   |   |   |   |   |   |   |   |   |
| Aeration |   |   |   |   |   |   |   |   |   |
| Soil workability |  |  |  |  |  |  |  |  |  |
|   |   |   |   |   |   |   |   |   |   |
| **Crop performance** |   |   |   |   |   |   |   |   |   |
| Crop growth |   |   |   |   |   |   |   |   |   |
| Crop yield |   |   |   |   |   |   |   |   |   |
| Color of leaves of growing crop |   |   |   |   |   |   |   |   |   |

1. Are there any assessments you conduct that I did not mention?
2. Yes
3. No
4. If yes, what are they and how often to you conduct them

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Indicators** | **NO** | **Yes** | **< 1 yr** | **1 yr** | **2-5 yrs** | **> 5 yrs** |  | **Self** | **Not self** *(Please, specify)* |
| ………………………………………………….. |   |   |   |   |   |   |   |   |   |
| ………………………………………………….. |   |   |   |   |   |   |   |   |   |
| ………………………………………………….. |   |   |   |   |   |   |   |   |   |
| ………………………………………………….. |   |   |   |   |   |   |   |   |   |
|   |   |   |   |   |   |   |   |   |   |

1. How often do you walk in your fields during the growing season with the intention of observing you crops?
2. Often
3. Occasionally
4. Never
5. Other, please
6. How often do you physically walk your fields during the growing season with the intention of observing your soil?
7. Often
8. Occasionally
9. Never
10. Other, please

**Characteristics of indicators used by Farmers categorize soils into perceived good and bad soil quality on farms.**

1. Please, state the characteristic(s) you use to categorize the indicators as good and bad (problem) soils on your farm

|  |  |  |
| --- | --- | --- |
| **Indicators (state local names)** | **‘Good’ quality soil (characteristics)** | **‘Problem’ soil (characteristics)** |
| **Chemical** |   |   |
| Nitrogen |   |   |
| Phosphorus |   |   |
| Potassium |   |   |
|   |   |   |
| **Biological** |   |   |
| Soil organic matter |   |   |
| Residue breakdown |   |   |
| Soil smell |   |   |
| Presence of soil macro-fauna  |  |   |
| Presence of specific weeds (Please, specify named of weeds) |   |   |
|   |   |   |
| **Physical** |   |   |
| Topsoil depth |   |   |
| Moisture holding capacity |   |   |
| Compaction |   |   |
| Soil color |   |   |
| Aeration |   |   |
| Soil workability |   |   |
|  |  |  |
| **Crop performance** |   |   |
| Crop growth |   |   |
| Crop yield |   |   |
| Color of leaves of growing crops |   |   |

**Effects of perceived soil quality on farm management**

1. Which of the following do you do/use on your perceived ‘good’ and ‘problem’ soils on your farms and why?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Management system** | **Good quality (Please, specify)** | **Why?** Please, state reason(s) | **Bad quality** (Please, specify) | **Why? Please state reason(s)** |
| Specific vegetables cultivated | . ………………………………………………. |  . ………………………………………………. |  . ………………………………………………. |  . ………………………………………………. |
| Fertilizers (mineral and/organic) | . ………………………………………………. |  . ………………………………………………. |  . ………………………………………………. |  . ………………………………………………. |
| Pesticides |  . ………………………………………………. |  . ………………………………………………. |  . ………………………………………………. |  . ………………………………………………. |
| Irrigation | . ………………………………………………. |  . ………………………………………………. |  . ………………………………………………. |  . ………………………………………………. |
| Tillage practices | . ………………………………………………. |  . ………………………………………………. |  . ………………………………………………. |  . ………………………………………………. |

**Soil quality management practices and constraints**

1. Please, state the type of management practices used to maintain the perceived good quality and bad quality soils on your farm and the constraints

|  |  |  |
| --- | --- | --- |
| **Practices and challenges** | **Perceived good quality soil** | **Perceived bad quality** |
| Management practices of soil quality | ………………………………………………………………………………………………………………….………………………………………………….. | ………………………………………………………………………………………………………………….………………………………………………….. |
| Constraints of soil quality management | ………………………………………………………………………………………………………………….………………………………………………….. | ………………………………………………………………………………………………………………….………………………………………………….. |

**End of Interview**

**Supplementary material B: Questionnaire**

Community ………………………. Date………………………

Please, estimate the condition of your ‘good’ and ‘bad’ (problem) soils as they currently exist by selecting the most appropriate response for each question below. In making your estimates, be sure to draw upon all your experience and knowledge. Also consider visual observations of soil and crops over time, results from soil test (if any), experiences during tillage and any other information that you have available to you. If you are not sure what the answer is to a particular question, make the best guess. Estimation of soil properties should refer to the topsoil (~0-25 cm depth)

**Information on perceived ‘good’ soils**

Where on your field is your ‘good’ soil located? Specific location:...............................................

**Soil indicators**

1. What would you estimate the texture of the topsoil of this field to be?
2. Clayey topsoil
3. Sandy topsoil
4. Silty topsoil
5. Loamy topsoil
6. How does the soil feel between your thumb and forefinger when moist?
7. Sticky
8. Gritty
9. Smooth
10. Equally gritty and smooth
11. When this soil is moist, what color is it? **(*Please,* *use Munsell color chart)***
12. Dark brown, very dark gray or black
13. Red, gray or brown
14. Brownish yellow pale brown
15. Yellow or light gray
16. What would you estimate the hoeing depth of this soil to be?
17. Greater than 20 cm depth
18. Between 10 to 20 cm in depth
19. Less than 10 cm in depth
20. About what degree of compaction best describe this soil?
21. Soil is loose, no hardpan present
22. Soil is moderately loose, hardpan barely noticeable
23. Soil packed down, thin hardpan or plough layer
24. Soil packed firm, moderately difficult to get into, hardpan present
25. Soil is very compact, difficult to get into, stubborn hardpan present
26. How will you describe the overall relief of the landscape where your farm is located?
27. Flat land
28. Gentle slope
29. Steep slope
30. Undulating
31. At approximately what rate would you estimate the rate of water entry into this soil?
32. Water soaks in immediately, no runoff or ponding
33. Water soaks in quickly, little runoff after heavy rain
34. Water soaks in slowly, some runoff after heavy rain
35. Little water soaks in, most runs off
36. Water does not soak in, sits on surface or runs off
37. What would you estimate the water-holding capacity of this soil to be?
38. Soil holds moisture well, an excellent buffer in dry weather
39. Soil dries moderately slow, a decent buffer in dry weather
40. Soil dries out moderately fast, drought in dry weather
41. Soil dries out very fast, droughty
42. What type of structure best describes this soil when it is moist?
43. Large proportion of smaller soil aggregates <4 mm
44. Very crumbly and small granular
45. Crumbly and granular
46. Cloddy with smaller aggregates
47. Very cloddy with big chunks
48. About what percentage of organic matter is in this soil?
49. Very high
50. High
51. Low
52. Very low
53. No visible organic matter present
54. How fast do crop residues breakdown by decomposition in this soil
55. Very rapid rotting of residues (2 weeks after harvest)
56. Rapid rotting of residues (3 weeks after harvest)
57. Slow rotting of residues (1 month after harvest)
58. Very slow rotting of residues (more than 1 month after harvest)
59. How much earthworm activity would you estimate in this soil?
60. Much activity. Many worm holes or castings present
61. Some activity. Few worm holes or casting present
62. No activity. No worm holes or castings present
63. How much termite activity would you estimate in this soil?
64. Much activity. For example, many termites mounds present
65. Some activity. For example, few termites mounds present
66. No activity. For example, no termites mounds present
67. What does this soil smell like?
68. Soil has an earthy, sweet, fresh smell
69. Soil has a slight earthy smell
70. Soil has no odor. Has a mineral smell
71. Soil has a slight sour, or chemical smell
72. Soil has a definite sour, or chemical smell

**Plant indicators**

1. What does the crop usually look like on this soil?
2. Normal color, large and tall, with dense stand
3. Somewhat discolored, small, with thin stand
4. Discolored, stunted, with uneven stand.
5. No crop grows on soil
6. What do plant roots usually look like in this soil
7. Deep, fully developed, many fine roots hairs
8. Shallow, limited development, few fine roots
9. Unhealthy, poorly developed, balled up
10. No plants grow on soil
11. What types of weeds grow on this soil? Please list as many as you can:
12. …………………………………………………………………………………………
13. …………………………………………………………………………………………
14. …………………………………………………………………………………………
15. Weeds not present
16. Which plants do well in this perceived ‘good’ quality soil?............................................

……………………………………………………………………………………………

1. Which plants do not do well in this perceived ‘good’ quality soil?.................................

…………………………………………………………………………………………..

**Other indicators**

1. Please, describe any other characteristics of this soil not addressed in the above descriptions
2. …………………………………………………………………………………………
3. …………………………………………………………………………………………
4. …………………………………………………………………………………………

**Information on perceived ‘poor’ soils**

Where on you field is your ‘problem’ soil located? Please, specify .................................................

**Soil indicators**

1. What would your estimate the texture of the topsoil of this field to be?
2. Clayey topsoil
3. Sandy topsoil
4. Silty topsoil
5. Loamy topsoil
6. How does the soil feel between your thumb and forefinger when moist?
7. Sticky
8. Gritty
9. Smooth
10. Equally gritty and smooth
11. When this soil is moist, what color is it? **(*Please,* *use Munsell color chart****)*
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30. Undulating
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33. Water soaks in quickly, little runoff after heavy rain
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35. Little water soaks in, most runs off
36. Water does not soak in, sits on surface or runs off
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39. Soil dries moderately slow, a decent buffer in dry weather
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8. Shallow, limited development, few fine roots
9. Unhealthy, poorly developed, balled up
10. No plants grow on soil
11. What types of weeds grow on this soil? (*Please list as many as you can*).
12. …………………………………………………………………………………………
13. …………………………………………………………………………………………
14. Weeds not present
15. Which plants do well in this perceived ‘problem’ soil?............................................

……………………………………………………………………………………………

1. Which plants do not do well in this perceived ‘problem’ soil?.................................

…………………………………………………………………………………………..

**Other indicators**

1. Please, describe any other characteristics of this soil not addressed in the above descriptions
2. …………………………………………………………………………………………
3. …………………………………………………………………………………………