Vital Signs Protocol
Maize Yield Measurements
and Farm Field Soil Sampling
Version 1.1
May 2014
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1 Introduction

It is important to track crop yields and management practices, as well as the soil health of the fields, within Vital Signs Landscapes using scientifically rigorous and robust tools and methodologies. The data obtained from farmers’ reports of yields from household surveys serve as one estimate but can often be unreliable due to problems with estimates of field areas or the crop harvest from specific fields. These self-reported estimates serve as a complement to the Vital Signs crop harvest sampling and farm field area measurements. The objective of this protocol is to provide guidelines for field selection and random placement of the sampling quadrant that provide an unbiased estimate of crop yields. In addition, instructions for sampling the top soil within the harvested area are provided that will allow a comparison of soil fertility and crop yields.

Three to five major crops will be selected for yield estimates within each of the landscapes – the selection should be based on a few criteria – the % of farmers growing the crop; the area devoted to that crop; and importance to income generation from ag-business activities. This list will be developed for each landscape after consulting the teams and reviewing previous agricultural surveys completed in the area.

1.1 Definitions of Key Technical Terms

1.2 Standard Conventions Used in this Document

The following conventions are used throughout this document:
The use of bold in the text indicates a critical point. Please pay special attention to terms, sentences and paragraphs marked in bold as they are key to the understanding of the protocol.

## 2 ROLES AND RESPONSIBILITIES

The following table introduces the roles and responsibilities of the members of a Vital Signs field team:

<table>
<thead>
<tr>
<th>Role</th>
<th>Responsibility</th>
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</table>
| Country Director          | ● Supports team with a complete understanding of the protocol manual  
                          | ● Trains technicians  
                          | ● Leads technicians in fieldwork and sampling, and assists with measurements as required                                              |
| Technical Manager         | ● Supervises teams  
                          | ● Assist with field selection for crop harvest as required  
                          | ● Ensures equipment is well-managed and team is safe  
                          | ● Ensures consistency and quality of measurements  
                          | ● Ensures data are uploaded to the VS server daily (or weekly if internet access is limited)  
                          | ● Ensures back-ups and data entry sheets are properly archived                                             |
| Enumerators               | ● Selects fields for harvest estimates based on the detailed protocol  
                          | ● Conducts crop yield harvests  
                          | ● Conducts short questionnaire on field management.  
                          | ● Takes soil sample for area of harvest  
                          | ● Enter and uploads data  
                          | ● Prepares soil sample for drying  
                          | ● Clean and store equipment                                                                                   |
| Africa Field Director     | ● Helps train technicians and ensures consistency of protocol implementation across Vital Signs countries  
                          | ● Reviews data when uploaded  
                          | ● Approves protocol updates and sends out update notifications to field teams                                |
| Protocol Manager          | ● Receives and archives comments about the protocol from the field team                                                                        |
3 EQUIPMENT LIST

The following equipment is required to carry out the activities described in this crop harvest and farm field soil sampling manual. Before traveling to the field to carry out sampling, use this list to ensure you have all the equipment needed for the day.

If a tablet is been used to record data, at least one on-site backup to a laptop and, preferably, at least one off-site backup should be made at the end of each day.
Each interviewer should have the following on their person:

- Copy of farm field roster and sketch map from previously COMPLETED Agricultural Management Survey for the households in the landscape
- Paper Copy of the Maize Yield estimate survey (at least two copies per household visited)
- Tablet with Maize Yield Survey form downloaded
- Identity card
- Letter of introduction
- Instructional book/manual (for interviewer and for questionnaire)
- Pencil, rubber eraser, and sharpener
- Writing board and notebook
- Soil auger (for sampling soil to 20cm)
- Bucket for mixing soils
- Plastic bag for storing soil sample
- Permanent marker for placing code on soil sample bag
- Compass
- Tape measure (or twine) for delimiting area to be harvested
- Machete (or tool for harvesting the particular crop)
- Ruckseck/gunny bag
- Suspension balance
- Suspension frame (tripod for weighing the gunny sack)
- Scale (for weighing cobs)
- Manila envelopes or paper bags (or material to tie cobs together for weighing)
- (OPTIONAL) drying oven
4 FIELD SELECTION

For each household that has been enumerated using the Agricultural Management survey, at most two fields for the specific crop in question will be selected per household for crop yield measurements. The fields will be selected based on the field roster and farm sketch from the Agriculture Management survey that was already completed for each household. The enumerator will discuss with the farmer each of the fields mentioned in the roster and map to find out:

- if any of those fields are currently planted with (the crop of interest for the harvest exercise; eg. for May-July in the SAGCOT region we will be interested in maize and/or paddy rice.
- If the crop(s) of interest are in the fields, are the ready to harvest or 2 to 4 weeks before harvest time.

If the crop of interest is not currently found on any of the households’ fields, then no crop yields will be measured for that household.

If 1 or 2 fields are present that currently have the crop of interest and the crop is ready for harvest, then both are measured.

If more than 2 are measured, the random number table will be used to randomly select two fields for harvesting.

4.1 Selection of Major Staple Crop Field for Soil Sampling

To select the first field for crop harvest and soil sampling, the enumerator must discuss with the farmer, or any household member knowledgeable of all the farm fields, to fill in the new survey on Crop Yield estimates. This will require looking at the previously completed Agriculture Management Survey for that household.

**Question 1: WHAT IS THE FIELD NAME IN THE AGRICULTURAL MANAGEMENT SURVEY?**
- The first column lists field ID’s (M1 – M8). If the Agricultural Management survey is available, turn to Section 2 “FIELD ROSTER”, and fill in the names of each of the fields.

**Question 2: Is this field size larger than 100 m²? (or 0.025 acres)**

The enumerator determines if the field is larger than 100 m² (0.025 acres). The enumerator should reference the agriculture survey, Section 2, FIELD ROSTER, Question 3, AREA (ACRES) FARMER’S ESTIMATE. If the field is larger than 0.025 acres, this question should be marked ‘1.’ If not, it should be marked ‘2.’ and the enumerator should move on to the NEXT FIELD.

**Question 3: Is maize cultivated in this field during the CURRENT Season?**
The crop for this question may vary by each landscape. We ask about current activity on the field. Mark a ‘1’ (for yes) if the field currently contains the given crop. Mark ‘2’ (for no) otherwise.

**Question 4: Is the maize ready for harvest or at least 2 to 4 weeks before harvest?**

Mark a ‘1’ (for yes) if the field is ready to be harvested. Mark a ‘2’ (for now) if:
- The crop has already been completed harvested
- The crop is more than one month from harvest time.

**Question 5: Is this field eligible for testing?**

The enumerator should refer back to the responses for questions 2, 3, and 4. Mark ‘1’ in question 5 if both:
- Question 2, 3, and 4 are marked ‘1’

**Question 6: Is this field selected for testing?**

Recall that only two fields will be selected for testing. Refer to the responses to Question 5:
- If no field is marked with a ‘1’ in Question 5, no crop yield estimates will be conducted at the household
- If 1 or 2 fields are marked with a ‘1’ in Question 5, then mark the fields with a ‘1’ in Question 6. All fields will be selected for crop yield measurements
- If more than 3 fields are marked with a ‘1’ in Question 5, then two fields will be randomly selected. Follow the process outlined below for the random selection.

**4.2 Random selection of crop fields for crop harvest:**

The cultivated fields marked with “1” in Question 5 are eligible for selection.

- In order to select the two fields for harvest you will need to have a random number table with you (provided by the supervisor, example in Appendix 1) and follow the instructions below.

**4.2.1 Example Selection of a Field for Soil Sampling**

The fields eligible for the first field selection are chosen from those that are larger than 100 m^2 (Question 2), crop cultivated in the current season (Question 3) and ready for harvest (Question 4).

In this example, there are five fields (Main, River, Forest, House, Other) and all are larger than 100 m^2. Maize is grown in all fields except for the main field, and the house field is more than one month away from being harvested. In this scenario, Question 2 should be marked with a ‘1’ for all fields, and Question 3 should be marked with a ‘2’ for the main
field, and a ‘1’ for all others. Question 4 should be marked ‘2’ for the house field, and a ‘1’ for the river, forest, and other field (Question 4 may be left blank for the main field). Finally, we mark all the eligible first fields for selection (Question 5). As there are more than two fields that have been marked as eligible, we must randomly select which fields to select.

Use the random number table provided by the supervisor, starting with the first row. To select the field(s), look for the first number in the random number table that matches the field ID number of the eligible fields. In this example, the only eligible fields are M2, M3, and M4. The first number that matches is number 4 – this field will be selected for crop harvests.

Next, we select the second field for testing from the remaining eligible fields. Looking at the random number table and starting again from left to right, number 4 is the first number that matches the field ID number of one of the fields.

However, we have already selected field 4, so we cross out that number and continue on the number line. Number 3 is the next number, so field M3 will also be selected.
## Vital Signs Crop Yield Measurement 0.3.2

<table>
<thead>
<tr>
<th>FIELD ID</th>
<th>WHAT IS THE FIELD NAME IN THE AGRICULTURAL MANAGEMENT SURVEY?</th>
<th>Is this field size larger than 100 m²? (or 0.025 acres)</th>
<th>Is MAIZE cultivated during the Current Season?</th>
<th>Is the MAIZE ready for harvest or at least 2 to 4 weeks before harvest?</th>
<th>Is this field eligible for YIELD MEASUREMENT?</th>
<th>Is this field selected for YIELD MEASUREMENT?</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>Main Field</td>
<td>YES...1</td>
<td>YES...1</td>
<td>USE 2. FIELD ROSTER</td>
<td>MARK WITH &quot;1&quot; IF ELIGIBLE</td>
<td>MARK WITH &quot;1&quot; IF SELECTED</td>
</tr>
<tr>
<td>M2</td>
<td>Field by the River</td>
<td>NO...2</td>
<td>NO...2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M3</td>
<td>Field by the forest</td>
<td>NO...2</td>
<td>NO...2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M4</td>
<td>Other field</td>
<td>NO...2</td>
<td>NO...2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M5</td>
<td>House Field</td>
<td>NO...2</td>
<td>NO...2</td>
<td></td>
<td></td>
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<tr>
<td>M6</td>
<td></td>
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<td>M7</td>
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<tr>
<td>M8</td>
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</tbody>
</table>
5 QUESTIONS FOR SELECTED FIELDS

At this point, there are three possible scenarios. Follow the instructions for each:

- **No fields have been selected.** At this point, the survey is complete.
- **One field has been selected.** Proceed with filling out sections B, C, CC, and D for the field and continuing with the crop yield measurement.
- **Two fields have been selected.** Proceed with filling out sections B, C, CC, and D and continuing with the crop yield measurement for the first field. Get another Maize Yield Measurement Entry Form, and proceed with sections B, C, CC, and D for the second field.

  *If two fields are selected, make sure to label each page in the upper right hand corner with the appropriate field ID.*

For each of the two fields that have been selected for crop harvest, ask the following questions in Section B, Field Characteristics.

**Question 1: Field ID**

Write down the Field ID of the selected field in Section B, Field Characteristics. For example, if in the previous section, field ‘m3’ is marked a ‘1’ in Question 7, then write ‘m3’ in Field ID in Section B. Write down the field ID in the upper right hand corner of each subsequent page.

**Q103: Name of the variety:** record the name of the variety, being as specific as possible. Ideally this would be as distinct as the variety (for example a cultivar name + number for an improved seed type, or a local name for local seeds). Probing may be necessary to get a distinct name (asking where the seeds were bought from, coordinating with local ag extension agents to get a sense of what seed varieties have been used in the area, etc)

**Q103A: Type of seed used:** traditional, local seeds are seeds obtained locally and normally of local varieties. They can be own seeds or obtained e.g., from neighbors. They are the most commonly sown/planted. Hybrid/improved seeds are mostly sold in shops. Make the distinction newly improved seeds (“2=New improved seeds”), bought specifically for the new season, and improved seeds that were saved from a precedent season (“3=Saved/recycled improved seeds”).

**Q106: Planting data:** ask the farmer what was the planting date of the designated variety on his field. If the farmer does not recall the exact day, ask the farmer if this happened rather at the “beginning”, in the “middle” or at the “end of the month”. In the “DAY” section, write down 1 for the beginning of the month, 15 for the middle of the month, and
Vital Signs Crop Yield Measurement 0.3.2

30 for the end of the month. If the farmer still has no idea, write “90” in the “DAY” section for “Don’t know”.

**Q107 to Q115 deal with the use of inorganic fertilizers such as DAP, Urea, etc. for basal application.**

**Q107: Basal fertilizer application:** ask farmers if they used inorganic fertilizer on the field during this last growing season as a basal application.

**Q109: Type of basal fertilizer:** ask the respondent what type of inorganic fertilizer was applied. Select all that apply. For instance, if the farmer used 100 Kg of NPK and 50 Kg of Urea as basal fertilizer, circle both of them in Q109.

**Q110: Amount of basal fertilizer applied (Kg):** record the total quantity of basal fertilizer that the household used **on this specific field only** during the reference period. First, report the fertilizer code used in Q109 (for instance “423” for NPK and “422” for Urea). Then ask for the amount of fertilizer applied (for 100 Kg for NPK and 50 Kg for Urea). Use Kg as the unit of measure; convert other measures such as bags, tins, etc. into Kg.

**Important note:** It is critical that the enumerator record the quantities of fertilizer specifically used on this field only (as opposed to the total quantity used at farm field or farm level, which would inflate erroneously fertilizer application rates).

**Q112 to Q116 repeat the previous questions for a possible second type of inorganic fertilizer that was used for topdressing.**

**Q117 to Q121 repeat the previous questions for a possible organic fertilizer.** Organic fertilizers are fertilizers from animal waste products and crop residue/compost.

**Q122/Q122B/Q123/Q124: Weeding management:** ask the farmer if they weeded, what technique they used, and how many times they weeded. Note that chemical weeding includes both herbicides used to kill weeds and other unwanted plants that grow on the field as well as fungicides, used to kill fungus that might grow on plants. If the farmers didn’t weed, ask why.

**Q125: 75% flowering:** ask the farmer the approximate date of 75% flowering on the field, as best as possible. If the farmer does not recall the exact day, ask the farmer if this happened rather at the “beginning”, in the “middle” or at the “end of the month”. In the “DAY” section, write down 1 for the beginning of the month, 15 for the middle of the
month, and 30 for the end of the month. If the farmer still has no idea, write “90” in the “DAY” section for “Don’t know”.

**Q126: Stand quality:** ask the farmer about the quality of its crop stand (whether they are expecting a poor, average or excellent yield based on the appearance of the crop stand.

*If the response to Q126 is ‘1 = poor’, ASK QUESTIONS Q126A AND Q126B*

**Q126A,** ask what is the PRIMARY contributing factor to the poor stand quality. SELECT ONE from:

- pests
- insufficient rainfall
- too much rainfall
- weeds
- low soil fertility/other soil problems
- Other (specify)

**Q126B,** SELECT ALL contributing factors to the poor crop stand from (including the answer to Q126A):

- pests
- insufficient rainfall
- too much rainfall
- weeds
- low soil fertility/other soil problems
- Other (specify)
- Other (specify)

**Q127. Percentage of field area devoted to the main crop:** this question attempts to determine how much of the field is assigned or devoted to the main crop or crop of interest. The area of cultivation may be different than the field size reported in the AGRICULTURAL MANAGEMENT SURVEY. Using the original recorded field size, indicate how much of the field has been cultivated with the crop. This percentage may be above 100% if the crop cultivation area has expanded beyond the original field dimensions as recorded in the AGRICULTURAL MANAGEMENT SURVEY.

**Q128: Estimates of the crop production in the field (current season):** ask the farmer to evaluate, as best as possible, the total quantity (kg) of the designated crop he is planning to harvest on the field, for this season.

**Q128A: Intercropping (current season):** ask the farmer if this crop is grown by itself, as a pure stand, or in association with other crops.
Q128B: Crops intercropped with the main crop (current season): if the field is intercropped, select all other crops that are grown with the main, designated crop.

Q128C. Percentage of field area devoted to the main crop WHEN INTERCROPPED: We have already asked about how much of the field this question attempts to determine how much of the field is assigned or devoted to the main crop or crop of interest. In the right side of Figure 3 (Intercropped Maize and Beans), we are interested in determining the area

**Question 201: Slope**

Ask the respondent about the slope of the field. Is it flat, with moderate slope, or with steep slope?

- Flat (<8%)
- Moderate slope (8-22%)
- Steep slope (>22%)

**Question 202: Erosion**

Erosion refers to the loss of topsoil from rain, wind, animals or people. Indicate yes if all or some of the field is suffering from erosion.

Are there visible signs of soil erosion (sheet, rill or gully)?

Soil erosion:

- 1 None
- 2 Slight
- 3 Moderate
- 4 Severe

Ask the respondent if he is using any methods to prevent erosion on the field. Also ask about the main method used to protect the field from erosion and record the code.
**Question 203: Surface condition score (0-10)**

This question is derived from the soil condition questions for the E-plot sampling but instead of applying it to a one meter quadrat apply it to the circular plot (Figure 2) from which the four soil samples are taken. Please indicate the cover of each in the circular plot, where 1=10%, 2=20%, ..., 10=100%. If no cover is present, it should be left blank.

- Rooted plants
- Litter cover
- Downed wood
- Stone or gravel
- Dung
- Disturbed soil (generally means tilled)
- Undisturbed, bare & porous soil
- Undisturbed, bare but sealed soil
- Sodic soil
- Microfloral crust
- Termite mound
6 IN-FIELD MEASUREMENTS

Because crop harvests will need to be undertaken, only a portion of the field will be harvested. This portion is called a ‘quadrat’. Follow the instructions below to determine where to place the quadrat, and how large the quadrant should be.

6.1 Random placement of sampling quadrants in selected fields

It is impractical to measure the crop yield from the entire field, so a small section of the field is sampled. This small section is located through random placement of a quadrant, meaning that the placement of the quadrant should not be biased by the visual inspection of the field. Only one quadrant will be sampled per field.

For ease of sampling, the quadrat will be placed near the center of the plot. Go the center of the plot (the same location and method used when taking the GPS coordinates of the center of the field in the Ag Management Survey).

Once the center point of the field has been reached, the location of the quadrat will be offset randomly. The offset will be determined by 1) direction and 2) distance.

Direction

At the center of the field, determine the direction by spinning a pencil on the clipboard. Place the clipboard on the ground. Place the pencil on the center of the clipboard. Spin the pencil on the clipboard. The pencil will stop spinning and point towards a direction. This will be the direction to walk towards from the center of the field.

Distance

Using the random number table, select the first number. Multiply this number by 3. This will be the number of paces to walk.

![Random Number Table]

1 Some crops, like onion, cocoa and cassava, will not follow the standard protocol and have instead specific guidelines for the quadrants.
In the above example, the first line was used for the field selection, so it is skipped. In the next line, an 8 is the first number. Multiply 8 by 3 to get 24.

From the center of the field, walk to a new point in the field using the direction and number of paces. If a zero is selected, there is no need to walk any paces. If the edge of the field reached and you have not completed your pacing, simply turn around and complete the pacing back towards the center of the field. This point of the field becomes the quadrat location.

If the quadrat turns out such that either of the conditions below hold – then offset the quadrat to avoid these conditions.
- There are obstacles in that location such as trees, soil conservation structures, a rocky surface
- The point is not representative of the main part of the field. For example if a small section of the field, less than 10% appears to be prone to flooding, has slope significantly different from the other part of the field; has shallow or superficial rocky layer such as laterite that is not found in the rest of the field

MAKE SURE THE SAMPLING POINT IS AT LEAST 2 M FROM THE EDGE OF THE FIELD. If it is not then move the point directly into the field, perpendicular to the field border to the 2 m limit.

**Q130.A RECORD THE GPS POINT OF THE SAMPLE LOCATION (Section C: QUADRAT ESTIMATES)**

### 6.2 Size of the quadrant

The size of the quadrants will vary by crop type and site. For crops with large spacing, the quadrant size should be increased and for crops with smaller spacing, it should be reduced. For maize, the quadrant size is **3m x 3m**.

### 6.3 Harvesting and measurements

Utilize the following questions in Section C Quadrant Estimates as you follow the below instructions on measuring out the quadrant and harvest the crop:

Using the twine or measuring tape, mark out the area of the quadrat. Record the size of the quadrat in Question 130A.

*Question 130.1 & 130.2: Quadrant estimates (on field, all households)*
The size of the quadrant to measure the MAIZE yields should be $3 \text{m} \times 3 \text{m} = 9 \text{ m}^2$.

**Question 132: What is the number of plants in the sample quadrant?**

Within each quadrant, first count the number of plants in the sample, and record the number in q132.

**Q104: Space between ridges (cm):** with the measuring tape, measure the distance between ridges. Take these measurements between five different ridges in the field and record the average.

**Q105: Space between seeding holes (cm):** with the measuring tape, measure the distance between plants. Take these measurements between 4 plants in 5 different rows and record the average.

**Important note:** make sure to report these distances in centimeters (cm) and not in inches.
Harvest the entire quadrant area and the cobs/pods by removing them from the stovers [Figure 3]. Count the number of cobs/pods that are harvested, and record the number [Figure 4].

Figure 3 – Harvesting cobs
Question 133: What is the number of cobs/pods in the sample quadrant?
After harvesting all of the cobs, record the number of cobs that had been harvested [Fig 4].

Q134: Total fresh weight of all the cobs in the quadrant:
Remove the cobs from the plants and record the total fresh weight of the cobs. Put the maize cobs in gunny bags and determine the total cob fresh weight (kg) by weighing using a suspension balance as in Figure 5.
Q136: What is the fresh weight of 10 cobs weight (KG)?

Select a representative subsample of 10 cobs and weigh them. The best way to make a representative subsample is to divide all the cobs in 5 categories according to their size [Figure 6]. Then take 2 cobs from each category.

Weigh and record the weight of the 10 cobs, by placing them into a manila bag. Note that the weight of the bag must be known, and subtracted from the weight of the cobs. Not all 10 cobs may fit in the bag, so multiple weighing may be required [Figure 7].
Figure 6 - Categorizing maize cobs in order to take a representative subsample
Q137: WHAT IS the fresh weight of grain from 10 cobs composite subsamples THRESHED (g)?

Thresh the grains from the cobs and record the fresh weight of the rice to the nearest gram. Thresh the grains, being careful not to lose any - a small error in sampling may lead to a large error in calculating the yield.

After recording the fresh weight of grain (Q137), place these grains into the crop sample bag for drying. Label the crop sample bag with the following information: E- PLOT ID, HHID, FIELD ID, CROP NAME (e.g., MAIZE), AND DATE OF SAMPLING.

Complete the following questions about the crop in the ENTIRE field.

Q138: Pest damage: ask the respondent is the field has suffered from pest damage (yes/no).

Q139: Other damage: ask the respondent is the field has suffered from animal, theft, flooding, dry spells or any other damages.
7 SOIL SAMPLE COLLECTION

Once the harvest sample has been taken, the topsoil will be sampled. The steps below follow the farm field soil sampling protocol. Subplot 1 should be located at the center of each quadrat.

1. Remove surface litter from Subplot 1. Take a soil sample to 20 cm from the center of Subplot 1 by using the soil probe.
2. Place the soil sample in a bucket.
3. Record auger depth restrictions (in cm), if present. (SECTION CC, QUESTION 1)
4. Move on from the center point to Subplot 2 by pacing 12 meters (or using a measuring tape or a pre-marked chain). This second subplot should be located directly uphill from the center point (if there is no slope, then move North from the center to Subplot 2).
5. Take a soil sample with the soil probe to 20 cm.
6. Place the soil sample in the same bucket as the sample from Subplot 1.
7. Subplots 3 and 4 are offset 120 and 240 degrees from Subplot 2, respectively. The angles can be estimated using the sampling plate or a disc marked with the angles as indicated in Figure 1.
8. For Subplots 3 and 4, take soil samples to 20 cm and place the samples into the same bucket with the samples from the other two subplots.

Note: If one of the sub-plots falls outside of the agricultural field, place the sub-plot 2 m within the farm field boundary.
Note: It is possible that the quadrant is located near the edge or corner of the field refer to figure 3 for instructions on how to deal with this scenario.

Figure 3. If the quadrant is close to the edge or corner of the field (1), either one or two of the subplots may be located outside the field AND outside the 2 meter buffer (2). Try first to rotate the orientation of the subplots (3) so that more subplots are located within the field and buffer. If a subplot is still outside of the field, move that subplot inside the 2 meter buffer of the field (4). This subplot will be closer to the center subplot than the other two, and may or may not be inside the quadrant.

9. When all the subplots have been sampled, mix the soil from the four subplots in the bucket thoroughly.

10. Place all the topsoil (0-20 cm) collected in a plastic bag. Label the bag and place a label tag inside the bag. Label the bags with: *E-Plot ID, HHID, field ID, depth of sample, and date of sampling.*
11. Air dry the soil as described for the E-plot soil health samples, and once it is dry pass through a 2 mm sieve. Place the soil in a plastic bag with a label on the inside and outside with the label code. Include *E-Plot ID, HHID, field ID, depth of sample, and date of sampling.*
8 KEY EDITING CHECKS

At this point, the field measurements are complete. Ensure that the KEY EDITING CHECKS have been reviewed by the enumerator before leaving the field. A Manager or Supervisor should perform a secondary review after the enumerator has completed their review. In terms of timing, it would seem best for the manager/supervisor to review the forms before leaving the field, however, this may not be logistically possible. At a minimum, the manager or supervisor should review the forms before the team leaves the landscape.

1) Field ID
   Ensure that the Field ID has been correctly matched to the Ag Survey, and that each data sheet has the field ID filled out in the upper right hand corner of each page.

2) # of Entry Sheets
   Check that the number of entry sheets matches the number of fields. Recall that each household may have up to two fields where crop yield measurements will be conducted. If there are two fields, there should be two entry sheets completed.

3) Crop Sample
   Check that you have the Crop Sample bag, and that it has been properly labeled.

4) Soil Sample
   Check that you have the Soil Sample bag, and that it has been properly labeled.

If there is another field to visit at the household, proceed to the next field.

The protocol now moves back to instructions for the dry weight crop yield sample taken from the quadrant.
9 DRY WEIGHT MEASUREMENTS

Yields are usually reported on a dry weight basis. After the fresh weight is measured and recorded, the dry weight of the harvest is measured by taking a subsample of the fresh material and drying it to a given moisture content. The composite subsample taken on the quadrant (Q137) is then taken to the facilities for drying.

**Important note:** If the farmer selected for dry weight measurement has several fields, the team should then measure dry weights for each field separately. Each field will have its own dry weight section as a part of its own questionnaire.

**Q141: Dry weight of the grains (from the subsample of 10 cobs) (g):** take these grains for drying for 3-4 days in the sun or in an oven at 60-70 °C and weigh them to the nearest gram.

**Q141A: Method used to dry the grain (g):** record what method was used to dry the grain (oven or sun drying method).
7. BIBLIOGRAPHY
8. APPENDIX

Appendix 1: Random Number Table

|    | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
|----|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1  | 8  | 0  | 9  | 4  | 5  | 2  | 5  | 8  | 2  | 6  | 4  | 1  | 3  | 1  | 7  | 4  | 3  | 3  | 6  | 2  | 0  | 1  | 8  | 9  | 7  | 2  | 1  | 3  | 4  |
| 2  | 3  | 5  | 6  | 3  | 2  | 1  | 9  | 8  | 2  | 1  | 1  | 0  | 0  | 4  | 5  | 2  | 6  | 1  | 8  | 2  | 7  | 5  | 1  | 2  | 6  | 2  | 7  | 1  | 0  | 9  | 5  |
| 3  | 1  | 3  | 3  | 0  | 6  | 3  | 3  | 1  | 3  | 7  | 5  | 3  | 9  | 6  | 9  | 3  | 8  | 7  | 8  | 6  | 8  | 1  | 5  | 1  | 5  | 3  | 6  | 5  | 8  | 3  | 4  |
| 4  | 3  | 5  | 6  | 5  | 0  | 0  | 1  | 6  | 2  | 2  | 4  | 8  | 6  | 4  | 3  | 2  | 4  | 7  | 8  | 6  | 6  | 0  | 9  | 5  | 5  | 2  | 8  | 5  | 1  | 6  | 2  |
| 5  | 7  | 8  | 6  | 0  | 9  | 2  | 5  | 5  | 8  | 9  | 6  | 2  | 0  | 7  | 1  | 2  | 1  | 9  | 2  | 4  | 5  | 4  | 5  | 3  | 5  | 3  | 0  | 8  | 5  | 8  | 9  |