Fairtrade Standard for Cocoa

Guidance Document Yield Estimates

Practical Guidelines for Small-Scale Producer Organizations (SPOs) to Accurately Estimate Member and PO Yield

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1. Introduction

1.1 Purpose of this Document

The purpose of this document is to assist Producer Organizations (POs) to **accurately estimate yields** of their members and the PO, which is a requirement in the Fairtrade Standard for Cocoa[1]. According to requirement 2.1.1, as PO you need to:

1. Use a consistent and credible methodology that uses farm level data;
2. Record once a year, the estimated and actual individual and total production of your organization;
3. Compare estimated with actual production and/or sales at both member and organizational level to check there are not significant differences;
4. Investigate why there is a difference, if significant differences are recorded at either individual member or organizational level, and
5. Take measures to prevent recurrence as applicable.

This document provides guidance on each of these steps (see Chapter 3). The methods explained in this document are based on current practices of POs in Côte d'Ivoire and Ghana.

1.2 Definition of Estimated Yields

The **yield crop** is the volume of crop grown per unit of land area or per tree per year. The **estimated yield** refers to the crop yield in a complete season (including main and light crop season). For cocoa, the field

[1] Version 07.07.2023_v2.1

estimate is indicated in **kilograms of dry cocoa beans**, which are the beans when they are sold by the PO or member to a buyer.

1.3 Benefits of Accurately Estimating Yields

Having accurate yield estimations will benefit the PO and members.

Benefits for the PO
Having accurate information on member production is essential for you as PO to operate as a successful business with clear oversight of its cocoa supply. Accurate member production records enable you to:

- Forecast your total available supply of Fairtrade certified volumes for the next cocoa trading season.
- Improve trust with buyers because the PO can better indicate how much cocoa will be available for sale.
- Provide confidence to buyers of Fairtrade cocoa supply and legitimacy.
- Bring transparency to the supply chain.
- Target training and support needs to members for cocoa productivity improvement.
- Work towards a living income because you can better estimate household income.

Benefits for Members
Having accurate yield estimates, will help members to:

- Estimate the need for agro inputs (fertilizers, pesticides, and associated labor).
- Estimate how much labor is needed for weeding and harvesting.
- See the impact of farming practices on production.
- Adopt sound agricultural practices.
- Access credit or loans to finance farm inputs.

2. Useful Information to Know

2.1 Benchmark Data

When making estimates, it is good to know certain benchmarks, which are standards or points of reference against which estimates may be compared. Every (field) officer involved in yield estimates should know these numbers to have a feeling if data is correct or not.

General information

- When the recommended planting spacing of 3x3 meters is observed, 1 hectare has 1,111 trees[2].
- When the recommended planting spacing of 2.5x2.5 meters is observed, 1 hectare has 1,600 trees. Côte d'Ivoire recommends 2.5x2.5m while Cameroon, Ghana and Nigeria recommend 3x3m.

[2] The Cocoa Board (COCBOD) in Ghana sets the number at 1,100 trees per hectare.

1 hectare
planting distance 3m by 3m → 1,111 cocoa trees

1 hectare
planting distance 2.5m by 2.5m → 1,600 cocoa trees

- 1 bag contains 64 kg of cocoa. On average, about 25 pods give 1 kg of marketable cocoa beans (1 pod = 0.04 kg of cocoa beans). That means you need 1,600 pods to fill 1 bag.

25 cocoa pods
1 pod ≅ 0.04 kg of cocoa

1 kg of cocoa beans

1,600 cocoa pods

1 bag of cocoa beans
64 kg

- Average yields in West Africa are 200 to 700 kilograms[3] per hectare or 3 to 11 bags.
- A productive tree of improved planting material should produce 25 or more pods per year. 25 pods per tree means approximately 1,100 kg per hectare for 1,100 trees and 1,600 kg for 1,600 trees.

2.2 Factors Influencing Yield

There are multiple factors that affect the cocoa yield, including

- **Fixed factors when setting up the farm**
  - planting materials used
  - age of trees
  - geographical zone
  - spacing between trees
- **External factors**
  - occurrence of pests and diseases
  - the weather

[3] Asare, R., Afari-Sefa, V., Gyamfi, I., Okafor, C., Mva Mva, J. 2010. Cocoa seed multiplication: an assessment of seed gardens in Cameroon, Ghana and Nigeria. STCP Working Paper Series No. 11.

  - labor availability
  - erosion on the farm
- **Good agricultural practices**
  - pesticides used
  - fertilizer used
  - pruning
  - weeding
  - water management, irrigation, and erosion control
  - time of harvest
  - number of shade trees, type of shade trees, percentage canopy on the farm

3. Steps to Estimate Yields

To comply with requirement 2.1.1, you need to estimate yields and you need to analyze the results and take action if necessary. The steps to follow are described below.
Before you start implementing all steps, it is strongly advised to have within the PO **one person responsible** for the whole process (yield estimates, comparing estimates with actuals, etc.). This person should have a thorough understanding of crop production, is computer literate, and comfortable with numbers. Also every farmer group should have one person responsible for the whole process. This can be a field officer or member. That person can also assist (other) members in estimating yields.

It is also strongly advised to develop **procedures** in which you describe the methodology used, who will do the estimates, when the estimates are done, and how results are reported. You can use information from this document to develop your procedures.

3.1 Step 1: Using a Consistent and Credible Methodology

Yield estimates are useful if they reflect as close as possible the expected yield. A consistent and credible methodology will help to get accurate estimates.

- For a methodology to be **consistent**, it means that every year the same steps are used to estimate yields and that those estimating yields all follow the same procedures.
- For a methodology to be **credible**, it means that it is based on data and not guesses, data used is collected in a reliable and impartial way, and sample sizes, in case they are used, are representative.

3.1.1 Selecting a Methodology

As PO, **you should select one methodology for yield estimation and ensure everyone in the PO uses that methodology**. Keep in mind that the audit will check the methodology used.

There are several ways to estimate yields of members of which some are very accurate while others are

less accurate. There are two main factors to consider:

1. **Type of data used:**
    a. Using previous actual yield data or
    b. Using data collected in the field (based on pod count).
2. **Level of data collection:**
    a. Using estimated yields for each individual farmer or
    b. Using averages of sample groups of farmers who live in the same area.

Depending on your choice, **the following methods** are possible:

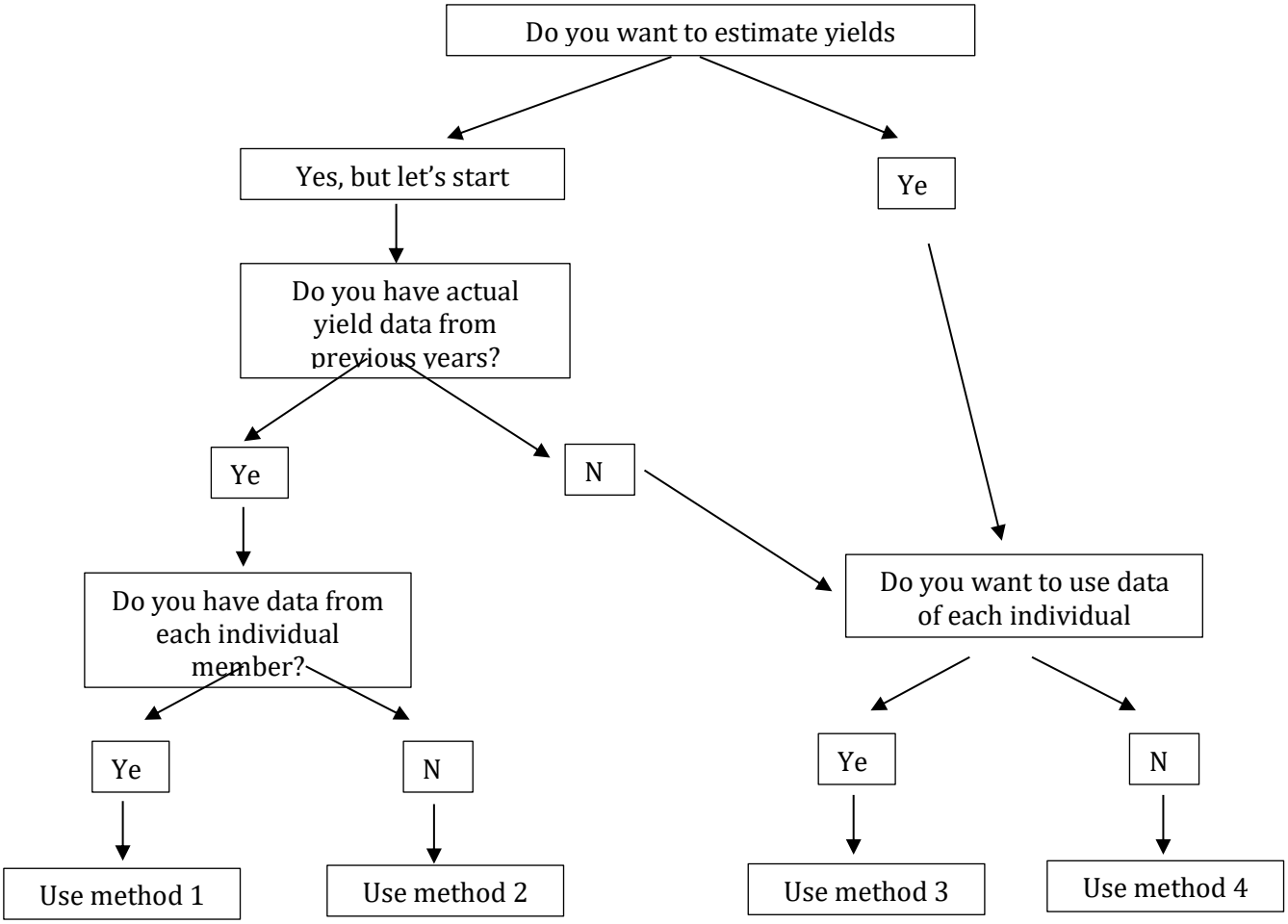
- Method 1: Using previous actual yield data for each individual farmer.
- Method 2: Using previous actual yield data from previous years of sample groups of farmers.
- Method 3: Using data collected in the field for each individual farmer.
- Method 4: Using data collected in the field of sample groups of farmers.

Generally, methods based on previous yields are less accurate then methods based on data collected in the field. This is because the situation in the field can vary per season. Further, methods in which yields are estimated for each single member are more accurate then when using samples groups of farmers because also per member, yields per hectare can vary. This means that method 3 is the most accurate, while method 2 is the least accurate.

When selecting a method, you as PO need to consider the following:

1. The **technical capacity** within the PO to use the selected method. Some methods are easier to use than others. In case you as PO do not do any estimates yet, you can select a simple method and move towards a more complicated method when having more experience.
2. Do you want to use data of each **individual farmer** OR do you want to use data of **samples** of farmers? This will depend on the number of people available to use the selected method and your available resources. When using samples, you will need fewer human resources than estimating yields of each member.
3. Existence of data on **previous yields**.

The diagram below can help you in deciding which method to use. You start at the top and work your way down depending on the answers to the questions.



It is possible that in the past, you have asked members to estimate their yields without using a consistent and credible methodology. This is **no longer sufficient** to comply with requirement 2.1.1. Members can still do their own yield estimate but under the condition that they all use the same method, which means that you probably need to build the capacity of your members in the pod count method.

3.1.2 Deciding on the Period to Apply the Method

Once you have selected a method, you need to decide on the best period to implement the selected method because some methods are time sensitive. You can use methods based on existing data (method 1 and 2) at any time.

For methods based on **data in the field** (method 3 and 4), you should estimate yields twice per year **right before the beginning of the harvest**: in September/October before the main crop season and in March/April before the light crop season. When doing the yield estimate further before the harvest, pods are still smaller, and some may never reach maturity which would lead to an over-estimate of the yield.

Doing the estimates twice per year will give you a more accurate estimate than when you only do it once per year. In case you only have the capacity to do the estimations once, do it a few weeks before the main crop season because the largest part of the total yield is produced during that season.

3.1.3 Testing the Method

You should test the selected method to see if it is applicable in the field. When you have developed procedures, you can ask a few field officers to test the procedures in the field to check if all steps are clearly described and if all necessary information is there. Keep in mind to test in the period your method is appropriate to use (see above).

Another aspect you should check is the results that you get when using the selected methodology. You should verify that the estimated yield reflects the reality by comparing the estimated and the actual yield. You can do this by comparing the estimated yield with the actual yield of previous year(s) and at the end of the season when the actual yield of that season is known (see also Chapter 3.3).

3.1.4 Training Those Using the Method

Whatever method you select to estimate yields, you should not assume that everyone can use it correctly. Therefore, train those working with the methodology one or two weeks before they will go into the field so they can apply right away what they have learned. In case those using the method have used it before, organize a refresher course in which you go over all steps of the procedures again and discuss the challenges observed during the last time the method was used. Generally, the better people can use the method, the better the estimates. POs that have estimated yields over a longer period (at least 5 years) all confirm that every year their estimates are getting better, and the differences between estimated and actual yield are getting smaller.

Especially when using a new methodology, it is a good idea to have those doing the yield estimates work together for a week. Let two or three people go to the same farms together and let everyone estimate the yields for those farms. The people within a group can compare their results with each other to check if they all have approximately the same estimates. After a week, contact your team to check if anyone had challenges and coach where necessary.

3.2 Step 2: Recording Estimated and Actual Yields

Before you start estimating yields, you should decide **how to record the estimated and actual yields**. Especially when you use a method for which you need to go into the field, the easiest is to use a **digitized data collection tool** which sends the collected data to the secretariat once the mobile device is connected to the internet. The mobile device can also **store data on previous yields** which is useful to check the accuracy of the estimation.

3.2.1 Taking a Sample Group of Farmers

Instead of using data for every individual member, you can work with sample groups of farmers, which means that you use average data of a selected group of farmers. The better your sample, the more accurate your data will be. The most important with a sample is that it is **representative for the entire group** which means it should include male and female farmers, farmers with smaller farms and those with larger farms, those who have well applied good agricultural practices and those who have applied less well, etc. Because agroecological zones can differ, POs often take sample groups from different zones or sample farmers for every group.

A general rule for sample taking is to take the root of the total number of people in the group. For example, if a group consists of 25 farmers, you will take $\sqrt{25}$ which equals 5 farmers. You can then look at the gender division within the group to decide how many male and female farmers to select. If for example the group of 25 farmers consists of 21 males (84%) and 4 females (16%), it means you select 4 male (84% of 5 = 4.2) and 1 female farmers (16% of 5 = 0.8) from your sample group of 5.

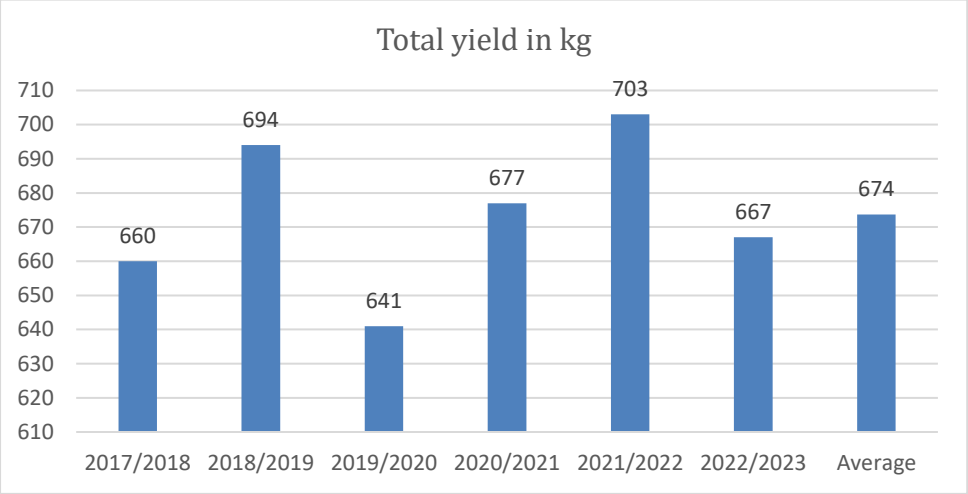
For the actual selection, you can use the membership list and select every X^{th} farmer on the list. In the example of a group of 25 farmers, it means you select every 5^{th} member so get 5 selected members. Depending on how members are listed, you can select farmers of different age, with different farm sizes, or different yields from previous seasons. For example, if you rank your members according to farm size and select every 5^{th} member, you know for sure that you will select members with different farm sizes.

3.2.2 Methods Based on Previous Yields

With this method you can either take the average or look at trends based on yields from previous years. The more years you have data on, the more accurate your estimate will be.

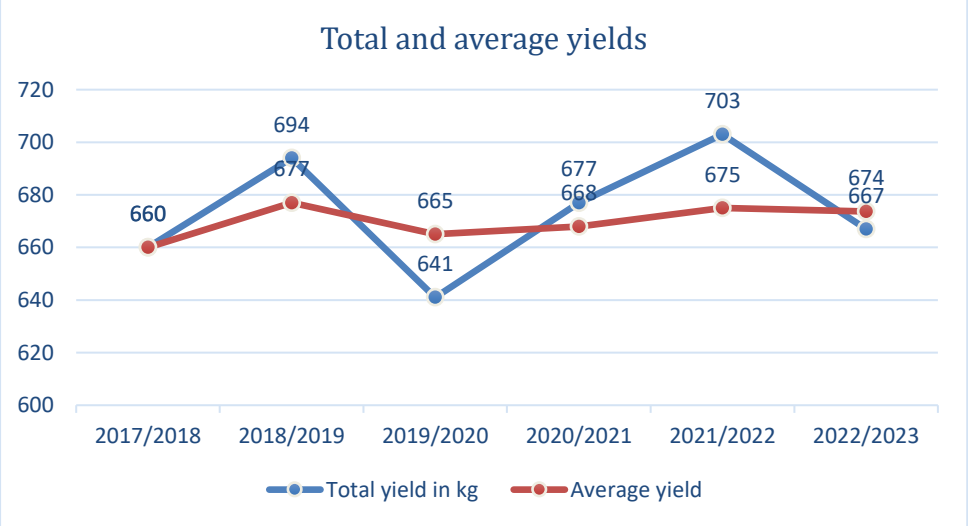
For this method, you do not go into the field to collect data, but you simply use data that is already in your system. When using this method, you assume that the circumstance of the farmer and the field has remained the same. If yields are stable over the past few years, this method will probably give you a fairly accurate estimate, unless circumstances change drastically. However, the moment yields fluctuate over the years, using the average might not generate an accurate estimate.

Taking the average
You can simply calculate the average of the past few years. In this case, the yield estimation would be 674 kg, based on actual yields of the past 6 years.



Looking at trends

You can plot the actual yields and averages over the previous years in a graph and look for trends. In this case, throughout the years, the averages are between 660 and 677 kg so the estimated yield should be between these margins.



Using samples

In case your PO does not have yield data of every member, you can use samples of farmers (see Chapter 3.2.1). In that case you calculate the average yields per hectare for the sample group and use that as an average for each member of your organization. You can also take samples of homogenous groups, meaning that you group farmers that are similar in terms of land size, age, gender, years of membership, etc.

3.2.3 Methods Based on Field Data (Pod Count Method)

Instead of relying on data of previous years, you can also go into the field to collect data. The following

method is based on pod count. You can use this method for each member, or you can take an average for the group, based on a sample.

Estimating yield for each member

Below, all steps are described to estimate yields for each single member of your PO. The results of each step should be recorded. At the end of this document, you will find examples of recording sheets. In case you use a digitized system, field officers can record data on their mobile devices. The advantage is that calculations are done automatically which will reduce the risk on errors. It will also make it easier to analyze the data to check for example why a member has a low or high yield. When estimating yield for each member, the following steps need to be taken for each member:

1. **Determine the productivity tree density** (the number of productive trees per area). Productive trees are those trees that carry at least 25 pods (please confirm if only productive trees should be counted).
    a. **Know the total area cultivated.** Use GPS coordinates or use what is indicated on the official land title of the farm (be aware of splitting of farm).

Example: the farm measures 1.2 hectares.

    b. **Decide how many sample areas you would like to use.** If the farm is homogenous (trees in the farm are of the same age and planting distances are fairly equal), you can use one sample area. If the farm is not homogenous, you can have several sample areas in different parts of the farm.

Example: the farm has two distinct areas so the number of samples will be 2.

    c. **Measure your sample area(s).** Measure an area of 10mx10m on the farm for each sample you will take. Ensure that the area is a representative part of the farm, so not an area with newly planted trees or an abandoned area.

Example: we will measure two areas of 10x10m, one area in each of the distinct areas.

    d. **Count the number of productive trees in your sample area(s).** This will give you the number of productive trees per 100m^2.

Example: We count 8 trees in sample area 1, and 10 trees in sample area 2.

    e. **Calculate the average of the samples.** If you only have one sample area, it will be equal to your average. If you have more than one sample area, you add all trees that you counted in your sample areas and divide it by the number of sample areas.

Example: 8 trees (from area 1) + 10 trees (from area 2) = 18 trees / 2 samples = 9.0

    f. **Calculate the number of productive trees per hectare.** Multiple the number of productive trees per 100m^2 by 100 to get the number of productive trees per hectare (because one hectare is 100x100m).

*Example: 9.0 trees (from step 1e) * 100 = 900*

Irrespective the recommended spacing (3x3m or 2.5x2.5) this means that lots of trees are not productive or that the farm is under-populated.

    g. **Calculate the number of productive trees on the total cultivated area.** Adjust the number of productive trees to the actual size of the farm by multiplying the number of

productive trees per hectare (calculated under step 1f) by the size of the farm (see step 1a).

*Example: 900 trees * 1.2 hectares = 1,080 productive trees in total.*

2. **Calculate the average pods per productive trees.** Take a sample from the sample trees to determine the average pods on productive trees.
    a. **Determine on how many trees to count pods**. Take the average number of productive trees per hectare (calculated under step 1f). Divide by 100 to know on how many trees to count pods.

Example: 1,080 trees / 100 = 11 trees (round the number up).

    b. **Count the pods on the number of trees** calculated in the previous step (2a). Do not count pods smaller than 5 cm (called cherelles).

Example: Tree 1 has 28 pods, tree 2 has 36 pods, tree 3 has 32 pods, etc.

    c. **Calculate the average number of pods per productive tree**. Take the total number of pods and divide by the number of sampled productive trees.

Example: We have counted pods on 11 trees. The total number of pods on those 11 trees is 346 pods. 346 pods divided by 11 trees = 31.5 pods per productive tree.

    d. **Calculate the total number of pods on trees in the total area cultivated.** Take the average number of pods per productive tree (calculated under step 2c) and multiply it by the number of productive trees on the total cultivated area (calculated under step 1g).

Example: 31.5 pods times 1,080 trees = 34,020 pods.

3. **Calculate the estimated yield.**
    a. **Calculate the average number of cocoa production per tree** (measured in kg per tree). Take the average number of pods per productive trees (see step 2c) and multiply it by 0.04 kg, because 1 pod equals approximately 0.04 kg.

*Example: 31.5 pods * 0.04 kg = 1.26 kg*

    b. **Calculate the estimated yield per hectare** (in kg/ha). Take the average number of cocoa production per tree (step 3a) and multiply by the number of productive trees per hectare (see step 1f).

*Example: 1.26 kg * 900 = 1,134 kg/ha.*

    c. **Calculate the estimated yield for the total cultivated area in kg.** Adjust the yield per hectare to the actual size of the farm by multiplying the estimated yield per hectare (calculated under step 3b) by the size of the farm (see step 1a).

*Example 1,134 * 1.2 hectares = 1,360.8 kg.*

    d. **Adjust with cocoa already harvested**. In case pod counting is done just before harvest, ask the farmer about the quantities harvested in kg in the previous few weeks and add this to the number of estimated yield calculated under step 3c.

When all data is in, you as PO can calculate the total estimated yield for the PO by adding all the data from each member to get the total estimated yield in kg.

Estimating yield using sample farmers

Doing estimates for each member is a lot of work, especially when members are not capable (yet) to do the estimates themselves. For each farm of the sample farmers, you:

1. Follow step 1a to 1f so each sample farmer will have an average number of productive trees per hectare.
2. Calculate the average number of productive trees per hectare for the group by adding all averages and dividing them by the number of people in your sample.
3. Continue with step 2a to 2c and 3a to 3b. You now have the estimated yield per hectare for all your sample farmers.
4. Calculate the average estimated yield in kg per hectare by adding all the estimated yield per hectare for all your sample farmers and dividing it by the number of sample farmers.
5. Calculate the average quantities in kg per hectare that were already harvested by adding all cocoa that has been in harvested in kg and divide it by the total cultivated area of your sample farmers.
6. Add the average estimated yield in kg per hectare to the average quantities in kg per hectare that were already harvested to get the average estimated yield in kg per hectare.

3.2.4 Adjusting Yield Estimates

There are multiple factors that affect the final yield, as listed in Chapter 2.2. It is possible to adjust the estimated yields immediately or during the season by considering any of these factors. This is especially relevant when using method 1 or 2 (using previous actual yield data) or 4 (using data from sample farmers).

Immediate adjusting: Some POs that are experienced in yield estimates, have developed formula that take into consideration the main factors that will affect actual yields. For example, based on data from previous years, they know that farmers who do not prune their farms have yields that are in general 5% lower. In that case, estimated yields from those members are adapted with 5% less. For example, the estimated yield of a farmer is 369 kg, but the internal inspection shows that the farmer is not pruning, the estimated yield will be reduced with 5%, meaning it will be 351 kg instead. Adjusting estimated yields using certain parameters will increase the accuracy of your estimates. However, it is only advised to be used by POs with ample experience in yield estimates and good databases on the parameters.

Adjusting during the season: Especially when using existing data on actual yields (method) or there are several weeks between doing the pod count (method 3 and 4) and harvest, it is necessary to continuously monitor production and factors effecting yield, as listed above. The monitoring can be done by the farmer and/or field officer. Important is to record any adjustments including the reason for adjustments.

Some POs has developed detailed procedures to adjust field estimates to help the PO to make more accurate estimates. The procedures are based on data of previous years and experiences of farmers and field officers. See Annex 1 for an example of how to adjust yields.

3.3 Step 3: Comparing Estimated and Actual Yields

You should verify that the estimation reflects what is observed in the field by comparing the estimated yield and the actual yield. According to the Fairtrade Standard for Cocoa “Significant difference” refers to a deviation of no more than 20% from the originally estimated production to the actual production and/or

sales to the PO. However, most POs are stricter and accept a lower difference between 10% and 15%. Keep in mind that a difference can mean that the actual yield is higher or lower.

To make an accurate comparison, you need to do this at member level, meaning for each farmer you need to compare the estimated yield with the actual yield. You can calculate the difference using the following formula:

$$\frac{\text{Actual yield minus estimated yield}}{\text{Estimated yield}} \text{ X } 100\%$$

Keep in mind:

- If the actual yield is higher than the estimated yield, the percentage should be positive.
- If the actual yield is lower than the estimated yield, the percentage should be negative.

If the percentage falls within your accepted range, you do not have to take action. If the percentage is higher than your accepted maximum deviation, you continue with step 4 and 5 as described below.

For example, the estimated yield is 550 and the actual yield is 620:

$$\frac{620 \text{ minus } 550}{550} \text{ X } 100\% = 12.72\%$$

If the accepted difference is 15%, there is no need to take action. If the accepted difference is 10%, you need to investigate why there is a difference and take action to avoid the difference in the future.

You can argue why it is necessary to act if the actual yield is higher than the estimated yield because that is good, isn't it? It will definitely be nice for the farmer because higher yields mean a higher income. But it also means that as farmer you do not have a good grip on your farm management. This also applies for the totals of the entire PO. The more accurate your estimates, the more professional you are perceived by your clients.

3.4 Step 4: Investigating Causes for Differences

When there is a (large) difference between the estimated and actual yield there are three main possibilities:

1. The method to estimate yield was not applied correctly.
2. The actual yield was affected by any of the factors listed in Chapter 2.2.
3. The recorded actual yield is not correct.

1. The method to estimate yield was not applied correctly

It is possible that the method to estimate yields was not applied correctly. For example when using data on previous yields, it is possible that data was mixed up or data of previous years is not accurate. When sample farmers are used, it is possible that the sample was not representative enough for the group. When data from the field is used, it can happen that non-productive trees were included, pods were not accurately counted, or that data was collected too early (meaning: too far before harvest started).

2. The actual yield was affected
As can be seen in Chapter 2.2, there are several factors that will influence the actual yield. When using existing data on actual yields (method 1 and 2), these factors will have a strong influence on the actual yield. For example, pesticides were not used this season while they were used in previous seasons or non-productive trees were replanted and new cocoa trees have started producing pods this season. When data from the field was used (method 3 or 4), most of these factors will already show when the pods are counted. Only if something out of the ordinary happens, like a pest invasion or heavy storm, actual yields can be different. Whatever method you will use to estimate yield, you always need to monitor the situation on the field to avoid any surprises.

3. The recorded actual yield is not correct
As PO you will get data on actual yields that are based on the sales of members to the dedicated sales point (a Licensed Buying Company or the Cooperative). However, sales to other buyers, also called **side-selling**, will **not appear in the records** of the farmer. Therefore, it is possible that the actual yield is very close to the estimated yield, but the farm records show a difference between estimated and actual yield.

The most important when investigating causes is to **never assume** but rather check the facts. You can take the following steps to identify causes:

1. **Check if the method to estimate yields was well applied.** Check the data that was used and check how the sample of farmers was taken (if used). If necessary, contact the person who collected the data to check what was done exactly. Check if they understand the method (meaning: they know how to use it correctly), if it was possible to apply the method, and if they were willing and committed to use the method.
2. **Check factors that could have affected the yield.** To find out what has happened, the farmer is the first source of information. In addition, field officers or lead farmers who know the situation of the individual farmers well can also provide reliable information. In case it concerns GAP, check why practices were not applied: does the farmer lack the capacity, it is not possible to apply the practice, or is there no willingness or commitment.
3. **Check if the actual yield is different from what was recorded.** Contact the person who has monitoring the situation on the farm after the estimate was done.

3.5 Step 5: Taking Measures to Prevent Recurrence

Depending on the reasons for differences between estimated and actual yields, action can be taken.

1. The method to estimate yield was not applied correctly
If there is not a full understanding of the method, you can organize a refresher training for those using the method. If the challenge is the possibility to use the method, check what went wrong and how it can be corrected, especially when using digitized systems. If people find it too cumbersome to use the method, organize discussions about the importance of accurate yield estimates, for members and for the PO.

2. The actual yield was affected

Depending on the factor(s) that influenced the yield, you can take action. In case of external factors, field officers can discuss with the farmer how to avoid this will happen again or how to reduce the negative effects when it happens again. For the application of GAP, you take action depending on the reason. Solutions can include providing access to youth teams or service providers that can apply the GAP for the farmer (pruning, pesticide application, weeding), facilitating access to agro inputs or equipment (pruning equipment, pesticide application equipment), training or coaching, etc.

3. The recorded actual yield is not correct

The first thing you need to check is if it was possible for members to sell cocoa to the designated buyer (a Licensed Buying Company or the PO). Especially in Ghana it happens that designated LBC do not have enough cash to buy cocoa whereby farmers are forced to sell elsewhere. If this is the reason, the PO should start discussions with the designated LBC to find solutions or, if this happens season after season, consider changing to another LBC.

If side selling is the reason, the PO should raise awareness among members about the consequences of side selling for the members and the PO. Negative consequences of side selling include not getting any Fairtrade Premium and damaging the image of the PO as a reliable business partner if the PO cannot comply with the quantities in the contract with the final buyer.

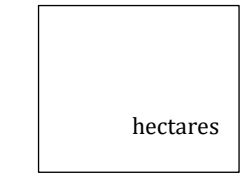
Recording Sheet

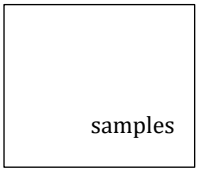
Step 1: Number of Productive Trees in Cultivated Area

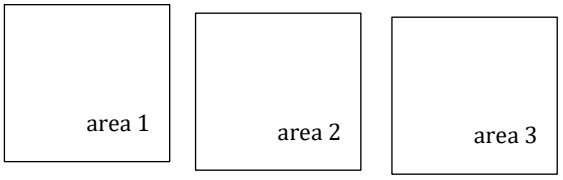
Name of farmer: _____ Farmer code: _____

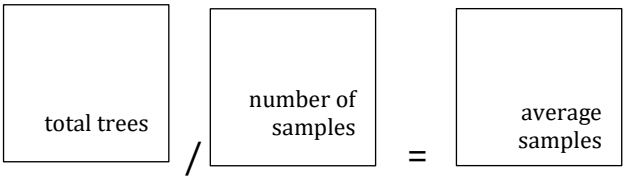
Executed by (name): _____ Date: _____

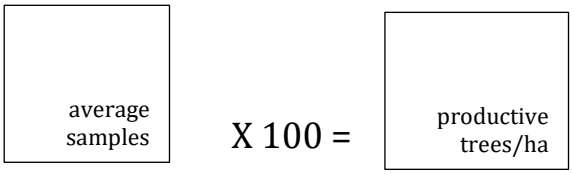
Step
(a) Total area cultivated in hectares. *Guidance: Use GPS coordinates or use what is indicated on the official land title of the farm.*
(b) Number of samples to take. *Guidance: If the farm is homogenous (trees in the farm are the same age and planting distances are fairly equal), you can use one sample area. If the farm is not homogenous, use two sample areas in different parts of the farm.*
(c) Count the number of productive trees in sample areas. *Guidance: Measure an area of 10mx10m on the farm for each sample. Ensure that the area is a representative part of the farm, so not an area with newly planted trees or an abandoned area.*
(d) Calculate the average of the samples. *Guidance: You calculate the average by adding the result of all sample areas (total number of trees counted), and then divide by the total number of samples.*
(e) Calculate the number of productive trees per hectare. *Guidance: Take the (average) number of productive trees from your sample area (result 1d). Multiple the number of productive trees per 100m^2 by 100.*
(f) Calculate the number of productive trees in the cultivated area. *Guidance: Multiply the number of trees per hectare (result 1e) by total cultivated area (result 1a).*











Recording Sheet
Step 2: Number of Pods in Cultivated Area

Name of farmer: _____ Farmer code: _____

Executed by (name): _____ Date: _____

Step
(a) Number of trees to count. *Guidance: Take the average number of productive trees per hectare (calculated under step 1e). Divide by 100 to know on how many trees to count pods.*
(b) Count the pods on each tree. *Guidance: Select trees standing close to each other. Do not count pods smaller than 5 cm (called cherelles).*
(c) Calculate the average number of pods per productive trees. *Guidance: Add the number of pods counted in step 2b and divide by the number of trees whose pods you have counted (see step 2b).*
(d) Calculate the total number of pods on trees in the total area cultivated. *Guidance: Take the average number of pods per productive tree (calculated under step 2c) and multiply it by the number of productive trees on the total cultivated area (calculated under step 1f).*

productive trees/ha / 100 = trees to count

Tree	Number of pods
Tree 1	
Tree 2	
Tree 3	
Tree 4	
Tree 5	
Tree 6	
Tree 7	
Tree 8	

Tree	Number of pods
Tree 9	
Tree 10	
Tree 11	
Tree 12	
Tree 13	
Tree 14	
Tree 15	
Tree 16	

total pods / trees to count = average pods/tree

average pods/tree X productive trees = total pods on trees

Recording Sheet
Step 3: Estimated Yield

Name of farmer: _____ Farmer code: _____

Executed by (name): _____ Date: _____

Step	
(a) Calculate the average number of cocoa production per tree. *Guidance: This is measured in kg per tree.* Take the average number of pods per productive trees (see step 2c) and multiply it by 0.04 kg, because 1 pod equals approximately 0.04 kg.	average pods/tree X 0.04 = average kg/tree
(b) . Calculate the estimated yield per hectare (in kg/ha). *Guidance:* Take the average number of cocoa production in kg per tree (step 3a) and multiply by the number of productive trees per hectare (see step 1e).	average kg/tree X productive trees/ha = yield in kg/ha
(c) Calculate the estimated yield for the total cultivated area in kg. *Guidance:* Adjust the yield per hectare to the actual size of the farm by multiplying the estimated yield per hectare (calculated under step 3b) by the size of the farm (see step 1a).	yield in kg/ha X hectares = yield in kg
(d) Adjust with cocoa already harvested *Guidance:* In case pod counting is done just before harvest, ask the farmer about the quantities harvested in kg in the previous few weeks and add this to the number of estimated yield calculated under step 3c.	yield in kg X harvest in kg = total yield in kg

Appendix 1: Adjusting yields

Lastly, the estimated volume is adjusted on the basis of observations made at farm level and information obtained from the farmer at 12 observation points (see annex for yield assessment sheet):

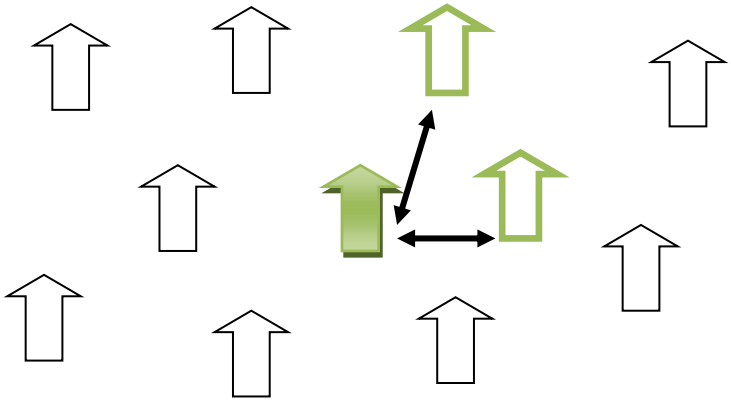
1. The previous harvest

This information is collected initially on the basis of the farmer's deliveries to the cooperative. Interviews are then conducted with the farmer to assess any deliveries outside the cooperative. All this information makes it possible to estimate the farm's actual production and to compare this result with the estimated volume.

- If **Estimated Volume >Actual Production**, the score is **-10**
- If **Estimated Volume ≤ Actual Production**, the score is **10**

2. Density

This involves determining the average distance between the two closest cocoa trees in the farm.



The densities that can have a positive impact on production are:

- 3m X 3 m or approximately 1089 feet
- 2.5m X 3 m or approximately 1320 feet

} **Note = 10**

The densities that can have a negative impact on production are:

- 4m X 4 m or approximately 625 feet **=-05**
- 3m X 4 m or approximately 825 feet **= 05**
- 2.5m X 2.5 m or approximately 1600 feet **=-10**

3. Age

Generally speaking, the optimum age for cocoa production is between 8 and 25 years. Before and after this period, production is low.
As a result, a score of:

- **10** is awarded when the farm is between **8 and 25 years** old
- **05** when the farm is **less than 8 years and more than 25 years old**
- **-05** if the farm is **over 26 years old**

3. The use of pesticides

Pest control is a key factor in good productivity. The use of pesticides is not essential to ensure healthy plants. What's more, our farmers are encouraged to use agronomic pest control (GAP) and biological pest control first and foremost. Phytosanitary treatments are only used as a last resort. However, the use of pesticides already guarantees that the farm provides a hostile environment for the development of pests.
As a result,

- a score of 10 is awarded when the farmer has used pesticides
- a score of -10 is awarded when the farmer has not used pesticides

4. Applying fertilizer

Of all the factors that have a significant impact on productivity, fertilizer is the most important. These results are visible on all parts of the plant, and according to specialists from fertilizer companies, production can increase by 25% when fertilizer is used correctly.

As a result,

- a score of 10 is awarded when the farmer has used fertilizer
- a score of -10 is awarded when the farmer has not used any fertilizer

5. The presence of pests and diseases

This is an important aspect that needs to be assessed in the process of estimating volumes. This is done by observing the entire farm to identify the presence of cocoa pests and diseases such as:

- Brown rot
- Insect pests (green and tiger bugs, Mirids, stem borers, etc.)
- Parasitic plants (Lauranthus)

The next step is to assess, from a general point of view, whether the presence of these pests and diseases is low or abundant, in order to assign a score.
As a result,

- a score of -10 is awarded when the presence of these pests and diseases is non-existent or low
- a score of 05 is awarded when the presence of these pests and diseases is average
- a score of 10 is awarded when the presence of these pests and diseases is high

6. The presence of Swollen shoot

Swollen shoot is one of the diseases that also attack cocoa trees. But given the irreversible damage caused by this disease and its highly contagious nature, it constitutes a reporting point in its own right. This disease, caused by a virus, is capable of decimating an entire farm in four years if nothing is done to contain the attack.
As a result,

- a score of 10 is awarded when there is no Swollen shoot in the farm
- a score of -10 is awarded when Swollen shoot is present in the farm

7. The plant variety used

In Côte d'Ivoire, more than 80% of farms are created from plant material whose genetic origins and performance are unknown. This type of material is known as “Tout Venant” and does not necessarily guarantee high yields, unlike the improved variety known as “Cacao CNRA” developed and popularised by research, which can achieve yields of over 1,500 kg/Ha.
As a result,

- a score of 10 is awarded when the CNRA variety is used in the farm
- a score of -10 is awarded when the CNRA variety is not used in the farm

8. Soil quality

Soil plays a vital role in agricultural production. As well as being the support on which plants grow, it provides a food reserve thanks to the organic matter it contains, guaranteeing optimum plant production. In the absence of in-depth soil analysis equipment, we have limited ourselves to observing and assessing the presence of organic matter at this point.
As a result,

- a score of 10 is awarded for the presence of organic matter in the farm
- a score of -10 is awarded when there is very little organic matter in the farm

9. The yield of the zone

The yield of the production zone is information that allows us to assess the results we obtain by calculation in a general way. This is a benchmark that must be taken into account when assessing our methodology. Our interviews with ANADER in Divo showed that the yield in the area is 480kg/Ha.
As a result,

- If Estimated Yield > Zone Yield, the score is -10
- If Estimated Yield ≤ Zone Yield, the score is 10

10. Rainfall

Rainfall is generally good in the Divo area. The average annual rainfall is 1469 mm. During the implementation of the methodology for estimating volumes, we simply ask farmers to give us a qualitative assessment of the level of rainfall (abundant, average or low).
As a result,

- a score of 10 is awarded when the level of rainfall is judged to be Abundant
- a score of 05 is awarded when the rainfall level is judged to be Average
- a score of -10 is given when the level of rainfall is considered to be Low

11. Pruning

Pruning is one of the agricultural practices that significantly influences cocoa tree productivity. This involves freeing the cocoa tree of unproductive, dry, hanging branches and suckers. Observations are made over the entire farm to assess how well the pruning has been carried out.
As a result,

- a score of 10 is awarded when pruning has been carried out on more than half of the farm, i.e. more than 50%
- a score of -10 is awarded when less than half, i.e. less than 50%, of the farm has been pruned

The adjustment coefficient is obtained by adding the total points divided by 100.

Courtesy of the Société Coopérative Agricole de Kamés(SCOOPAKAM) in Divo, Côte d'Ivoire

Observation criteria	Comments	Rating criteria	note xx
Previous harvest	Information on the grower's actual production	• If volume is > actual production = -10 • If volume is ≤ actual production = 10	
Density	Determining the density of the production area	• 4/4 = 625 = -5 • 3/4 = 825 = 5 • 3/3 = 1089 = 10 • 2.5/3 = 1320 = 10 • 2.5/2.5 = 1600 = -10	
Age	Real information The age of the plot	• 0-7 years old = 5 • 8-25 years old = 10 • From 26 years = -05	
Use of pesticides	Check whether the grower has used insecticide/fungicide	• Yes = 10 • No = -10	
Applying fertilizer	Whether or not the grower uses fertilizer	• No = -10 • Yes = 10	
Pests and diseases	Assessing the level of attack in the plot	• Non-existent or weak = -10 • Medium = 5 • Abundant = 10	
Plant variety	Information on the variety used CNRA or Tout Venant	• Yes = 10 • No = -10	
Soil quality	Observe for presence of organic matter	• Yes = 10 • No = -10	
Zone Yield	Compare production to yield in the zone	• If estimated yield > zone yield = -10 • If estimated yield ≤ zone yield = 10	
Rainfall	Assess rainfall levels in the area	• Low = -10 • Medium = 5 • Abundant = 10	
Size	Observe the level of pruning on the plot	• Less than 50% = -10 • More than 50% = 10	

Swollen shoot	Observe if the disease is present in the plot	• Yes = -10 • No = 10	
TOTAL POINTS out of 120 =			
ADJUSTMENT COEFFICIENT (Total points / 100) = 7349>			

Courtesy of Société Coopérative Agricole de Kamés (SCOOPAKAM) in Divo, Côte d'Ivoire