GLOBALG.A.P. US National Technical Working Group (NTWG) Topic Guideline:

Mass Balance

Introduction



The **US National Technical Working Group (NTWG)** has developed this guideline to assist producers in meeting the principles and criteria in GLOBALG.A.P. standards including Integrated Farm Assurance (IFA), Harmonized Produce Safety (HPS) standard and Produce Handling Assurance (PHA). The content and examples illustrate the general approach of meeting the GLOBALG.A.P. standards. Producers should develop and utilize specific procedures, documents, and records that are relevant to their own operations.





** This guide is non-normative and does not create additional GLOBALG.A.P. certification requirements. It was developed by the GLOBALG.A.P. U.S. NTWG to support U.S. producers in applying GLOBALG.A.P. requirements.

What is Mass Balance?

Mass balance is a formal way of measuring inputs and outputs, accounting for any losses during the production process over a specific period of time. It needs to balance the harvested and delivered/received (including purchased) quantities with the losses during handling and sorting, the amount in storage, and the remaining product that is sold.

Or simply, mass balance is a comparison of production and shipping records, ensuring no anomalies.

Why do a Mass Balance?

➤ To ensure that the certification accurately reflects the scope of the production of the operation.

➤ To demonstrate that what you sold as originating from "certified" production processes could have reasonably come from the registered farms/facility.

➤ To strengthen trust in the GLOBALG.A.P. certification and ensure the integrity of your GLOBALG.A.P. certification.

➤ To identify where product losses occur to support continuous improvement and detect areas for increased profitability.

When to do a Mass Balance?

Frequency is determined by the producer. For example, the mass balance can be conducted daily, weekly, per lot, seasonally, or annually.

➤ Generally, most producers conduct the mass balance at the end of the season, with all records from harvest and delivery available, including information from handling facilities, where applicable.

➤ Consider large volume changes, higher number of growers, seasonality of crops, crop growth cycle, etc.

➤ **For example:**

- Short-season crop (e.g., cherries) → one seasonal calculation
- Long-season crop (e.g., oranges) → monthly calculations (2–3 times per season)

The Mass Balance calculation

A producer/facility calculates the below (all converted to the same unit of weight or volume):

Harvested

The amount of product produced is determined generally through harvest records.



+

Delivered/Received

Delivered/received product is calculated from records of purchased products and confirmed with delivery records.

=



Waste

From this total number, subtract the amount of product waste/loss during handling (sorting grading, trimming, etc.) based on waste records, pack-outs, or other records.

+

Stored

Then, subtract any volumes in storage from inventory records (also confirmed roughly visually).

+

Sold

The resulting number should *approximately* equal the amount of product sold based on shipping and sales records, converting weight or volume unit.

Action Steps

STEP 01

➤ Determine what is in the scope of the audit.

- Products, locations, harvest (or not), handling (or not)

STEP 02

➤ Determine the timeframe of the mass balance.

STEP 03

➤ Collect harvest/receiving, on-hand, and shipping information for the given timeframe.

STEP 04

➤ Conduct the calculation using steps 1 - 6 presented in the mass balance calculation section:

- Harvested + Delivered/Received = Sold + Stored + Waste (all converted to the same unit of weight or volume).
- In some cases, where handling is excluded and no additional products are purchased, the calculation could be as simple as harvested = delivered.
- For initial certification, the auditor checks for the systems in place to perform mass balance. However, if product is not yet sold, a complete mass balance calculation may not be possible.

STEP 05

➤ Consider any production anomalies (e.g., weather events that lead to packing losses) that affect quantities.

STEP 06

➤ Make any production adjustments based on the findings.

- For example, where inventory records were not up to date, an inventory tracking system is implemented.

Documents to Review

- **Harvest records:** delivery notes, invoices for purchased products, truck tickets, bin records, bales produced, etc.
- **Sales records** that account for total volume sold (e.g., shipping records, invoices, donations, dumped, pack-outs, etc.)
    - When pack-outs are used, this supports mass balance for the handling process. However, producers will additionally need harvest and delivery/receiving information.
- **Storage quantities:** inventory logs (e.g., apples, grapes, potatoes, etc.)
- **Waste and/or loss from production:** sorting waste, dump records, damage reports, known conversion factors (e.g., for hops, lettuce, etc.)



Documentation

The principles and criteria do not require a documented standard operating procedure. There is no example template that will fit all operations as mass balance must be tailored to the unique situation of each individual operation. Operations should record:

- **Product** (crop)
- **Timeframe of mass balance**
- **Date of mass balance check**
- **Quantity harvested**
- **Delivered/ Received product** (purchased)
- **Shipped product**
- **Stored product**
- **Waste/Loss**

All converted to weight or volume as needed

Key Takeaways

Mass balance is a calculation, not just a record.



Certified producers must maintain accurate documentation.





Auditors check consistency across harvested, stored, waste/loss and sold product.



Proper mass balance protects the credibility of GLOBALG.A.P. certification.

Resources

- GLOBALG.A.P. Educational Video Series: Introduction to Mass Balance
- IFA v6 GFS Audit Method and Justification Guideline for fruit and vegetables

References to Principles & Criteria

All Major Must Criteria

IFA FV-GFS 08.01	Sales records are available for all quantities sold for all registered products.
IFA FV-GFS 08.02	Quantities (produced, stored, and/or purchased) are recorded and summarized for all products.
IFA HOP 08.01	Sales records are available for all quantities sold for all registered products.
IFA HOP 08.02	Quantities (produced, stored, and/or purchased) are recorded and summarized for all products.
HPSS 13.1	Are sales records available for all quantities sold and all registered products?
HPSS 13.2	Are quantities (produced, stored and/or purchased) recorded and summarized for all products?
HPSS 13.3	Are conversion ratios and/or loss (input-output calculations of a given production process) during handling calculated and controlled?
PHA 5.1	Are all incoming product quantities accurately recorded and regularly summarized to facilitate a mass balance audit?
PHA 5.2	Are conversion ratios used for mass-balance calculated, validated, and recorded?

Integrated Farm Assurance v6 GFS for fruit and vegetables
Harmonized Produce Safety Standard v1.2
Produce Handling Assurance v1.2

Examples**

01

10 acres of apples, all from GLOBALG.A.P. certified production, no handling:

- ➤ Product: Apples
- ➤ Timeframe: 2025 season for apples
- ➤ Date of mass balance calculation: September 23, 2025
- ➤ Harvest: 40 tons, calculated by adding all truck tickets
  - (*# total bins x weight/bin converted to tons*)
- ➤ Delivered: No outside purchases
- ➤ Sales: 35 tons to local retailers, calculated from invoices
  - (*total boxes x weight/box converted to tons*)
- ➤ Waste: 5 tons, calculated by dump record of rejected product
  - (*# total bins x weight/bin converted to tons*)
- ➤ Stored: No stored product
- ➤ Calculation: 40 tons harvested = 5 tons waste + 35 tons sold

02

100 acres hops, per lot/field, all from GLOBALG.A.P. certified production, picking (harvest), and facility handling included:

- ➤ Product: Hops - Centennial
- ➤ Timeframe: 2024 - Field 5-10 (100 hectares) Lot# 24CEN5-XXX-005 - 24CEN5-XXX-010 (XXX represents the grower number)
- ➤ Date of mass balance calculation: 09/15/2025
- ➤ Harvest: 2200 bales, calculated from production logs
- ➤ Delivered: No outside purchases
- ➤ Sales: 800 bales (400 bales to 1st buyer, 400 bales to 2nd buyer) from Purchase Orders
- ➤ Waste: None, green waste is processed out during the picking process, only hops enter dryer. Dried hops are baled whole cone
- ➤ Stored: 1400 bales, in room 1
- ➤ Calculation: 2200 bales from harvest = 800 bales sold + 1400 bales stored

*** Disclaimer that the mass balance exercise will look different for each farm or operation depending on the scope, size, and complexity.*

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GLOBALG.A.P. US National Technical Working Group (NTWG)
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National technical working groups (NTWGs) consist of GLOBALG.A.P. Community Members, qualified experts, and relevant stakeholders in a specific country. Participants may include producer organizations, certification bodies (CBs), retailers, supply chain members, and more.

Together, **NTWG** members work to identify adaptation and implementation challenges based on local legislation or structural conditions. They then develop guidelines, helping producers and CBs to apply and audit against GLOBALG.A.P. principles and criteria (P&Cs) at a local level.



Interested in joining the **US NTWG**?

Visit www.globalgap.org/about/ntwgs or contact northamerica@globalgap.org.

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