FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

IFDC

Part 3: Operating a Blending Facility

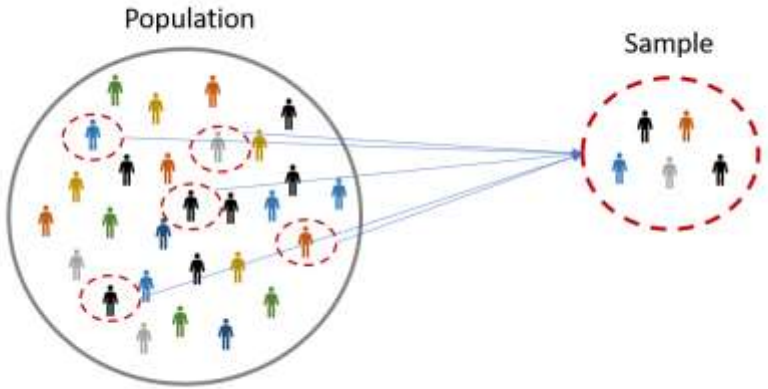
Session 3.7 Sampling

USAID
FROM THE AMERICAN PEOPLE

Purpose of taking samples

Sampling

- Because you cannot analyze a whole batch of raw materials or blended products, you need to **take samples** of the materials that **represent the batch**.
- **Raw materials**:
  - To verify the order from the supplier
  - To check compatibility
- **Blended products**: For quality control



FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

Taking samples

1. Determine the sample size
2. Determine which sampling equipment to use.
3. Put on Personal Protective Equipment (PPE)
4. Inspect the materials visually
5. Take the sample
6. Note the details (for your sample report)
7. Do any analysis or test
8. Store one sample

USAID
FROM THE AMERICAN PEOPLE

IFDC

Sampling equipment

Rotary sample divider

Sampling cup

Riffle divider

Double tube trier

Sampling equipment

Type of sampling equipment :

- **Sampling cup** >> Raw and blended material
- **Double tube trier** >> Raw material
- **Rotary sample divider** >> Blended materials
- **Riffle divider** >> Raw materials
- **Shovel or scoop** >> Raw materials that does not flow freely

Selection based on type material to sample

Sampling equipment – Double tube trier

- Also known as the spear
- Recommended for
  - Probe sampling
  - For raw materials
  - Materials that flow freely
  - Materials that are easy to penetrate

- Size of the holes must be a minimum of **3x the particle size** of the raw materials or blends
- https://www.youtube.com/watch?v=lGaBAhyhWkE

Sampling equipment – Sampling cup

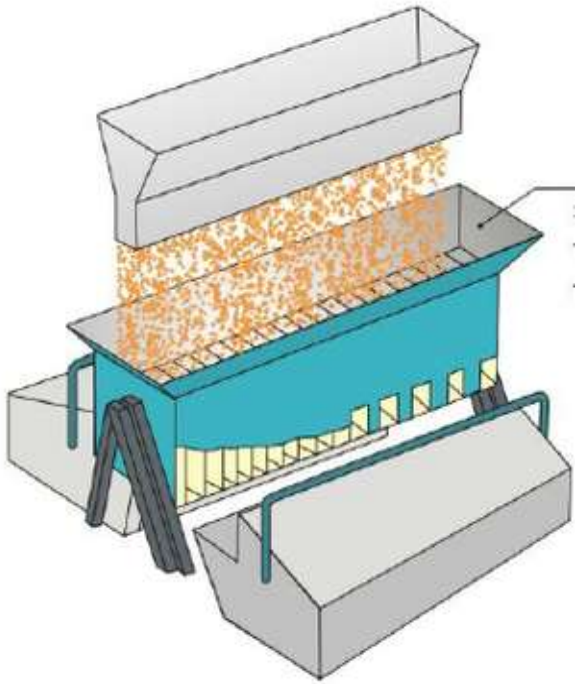
Using a sampling cup:

- Hold the sampling cup under the conveyor belt to catch the materials .
- Move the cup from left to right under the stream so you catch a sampling of the full stream.

Sampling equipment – Riffle box

Using a riffle box:

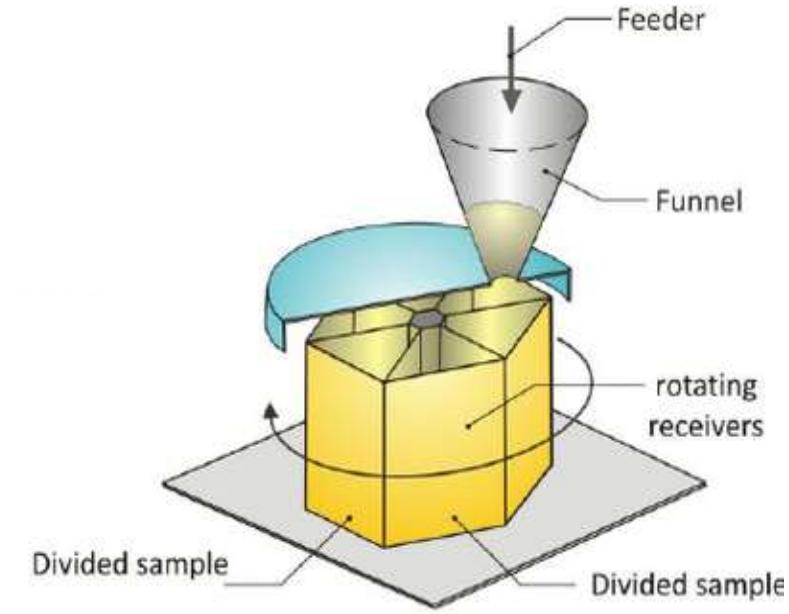
- To be used for raw materials
- To determine the % of particle sizes between set sizes, and used to measure SGN/UI of raw materials
- https://www.youtube.com/watch?v=QGmHCtaCRac



Sampling equipment – Sample divider

Using a riffle box:

- To be used for raw materials
- To determine the % of particle sizes between set sizes, and used to measure SGN/UI of raw materials
- https://www.youtube.com/watch?v=zj1aChZT5XY



Sampling equipment

Rotary sample divider

Sampling cup

Riffle divider

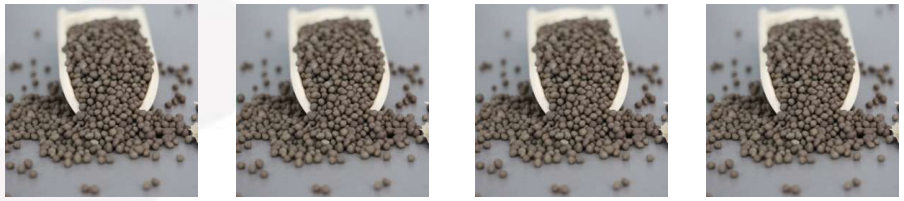
Double tube trier

Taking a representative sample

- Size of each sample
  (Grams per sample)

OR

- Number of samples



- Number of bags to sample

Taking a representative sample – Size

250g for physical analysis

500g for chemical analysis

Taking a representative sample

Number of bags to sample for bagged products

- **Less than 5 bags** >> take samples from each bag.
- **4 to 11 bags** >> take samples from 4 bags.
- **10 to 400 bags** >> take samples from a whole number above the square root of the number of bags. *For example, you have 230 bags. The square root of 230 is 15.17, which means you take samples of 16 bags.*
- **More than 400 bags** >> take samples of 20 bags.

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

Taking a representative sample

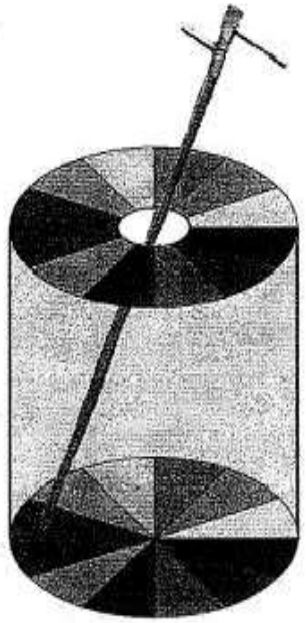
For bulk products

- Bay/bin sizes **25 tons or less** >> take a minimum of 10 sampling units.
- Bay/bin sizes **between 25 and 400 tons** >> take sampling units of the nearest whole number above the square root of 4 times the number of tons present. *For example, you have 300 tons. 4 times 300 tons = 1,200 tons. The square root of 1,200 is 34.6 which means you take 35 sample units.*
- Bay/bin sizes of **more than 400 tons** >> take 40 sampling units.

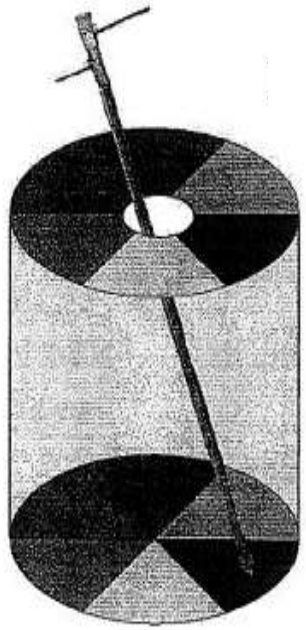
USAID
FROM THE AMERICAN PEOPLE

IFDC

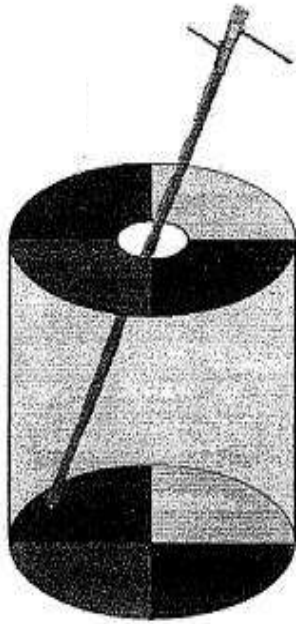
Taking samples from bulk bags (≥ 1mT)



1 bag >>
12 samples



2 bags >>
6 samples per bag



3 bags or more >>
4 samples per bag

Methods to Analyze Samples

1. **Chemical analysis:** done in a laboratory

2. **Physical methods** using equipment as jars, sieves, etc.

Physical method – Bulk Density

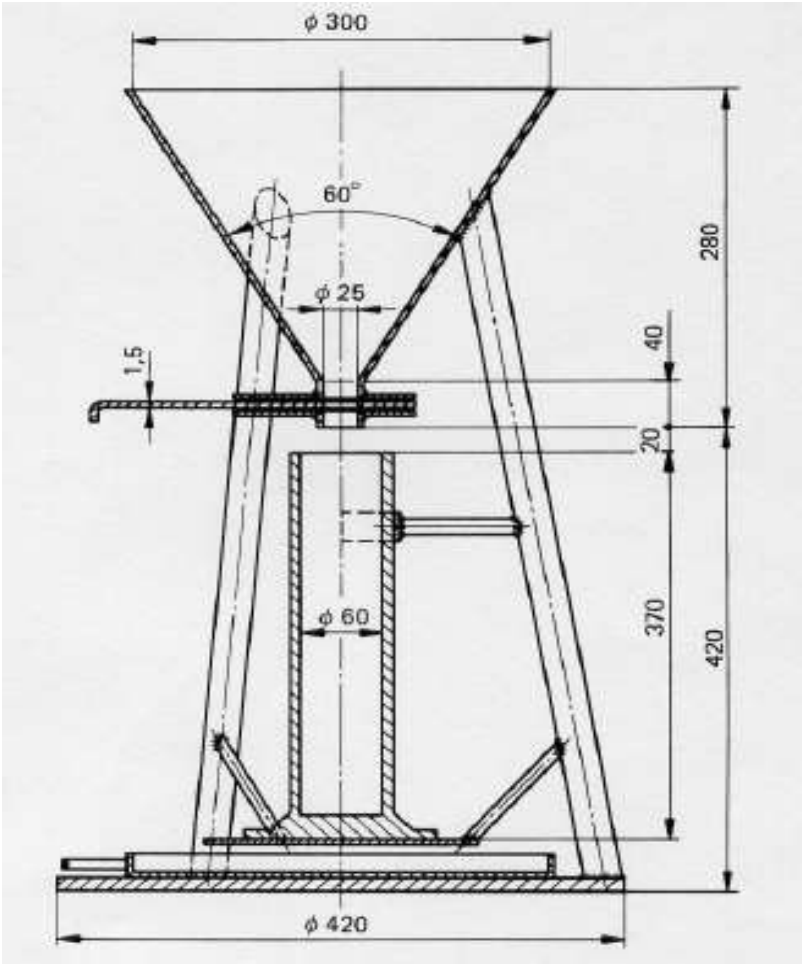
Bulk density

- Represents the mass to volume ratio of a bulk sample, including the space between individual particles.
- Each blending plant is **calibrated** based on the density of the raw materials. In case the bulk density changes, it will affect the weight of the raw material used per blend and will results in different blends.

Physical method – Bulk Density

Checking the bulk density

1. Release samples into the funnel.
2. Weigh the content of the barrel.
3. Calculate the Volume.
4. Calculate the bulk density by dividing the mass by the volume.



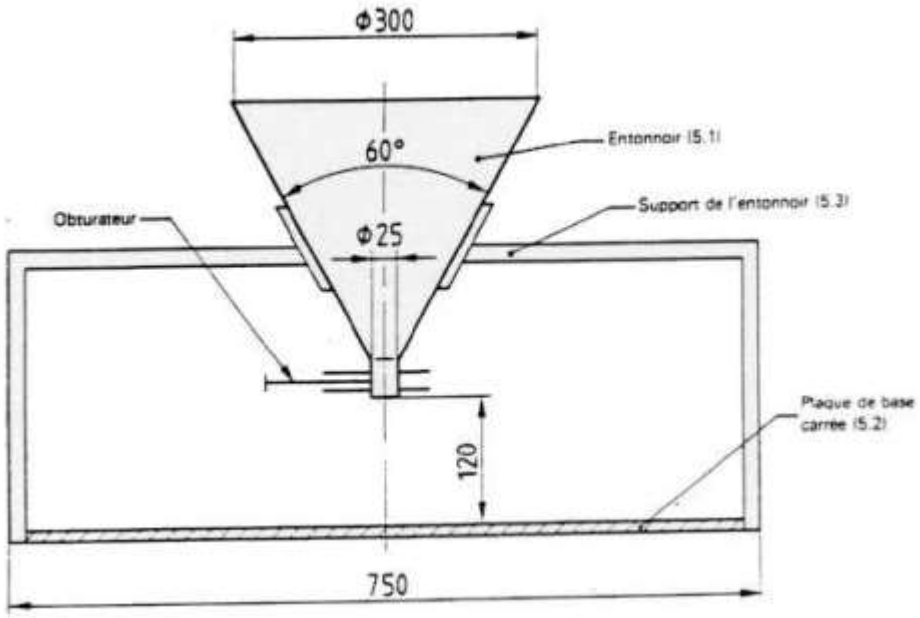
Physical method – Angle of repose

- **Angle of repose** is the steepest angle at which a sloping surface formed of loose material is stable.
- It is important to know the angle of repose **to avoid segregation** because bigger particles will fall to the outer sides of the pile, while inside smaller particles and dust will remain.

Physical method – Angle of repose

Checking the angle of repose

1. Release samples into the funnel.
2. Make four different piles by shifting the base plate.
3. Calculate the average diameter of each pile
4. Calculate the value of the angle of repose



Example of some results

	Fertilizer		
	A	B	C
d16	3.11mm	2.85mm	2.34mm
d50	3.42mm	3.27mm	3.04mm
d84	3.86mm	3.79mm	3.83mm
GSI	10.96	14.42	24.55
Loose Bulk Density (ρ)	1,000 kg/m^3	750 kg/m^3	950 kg/m^3
Angle of Repose (α)	32.6°	32.6°	38.7°

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

Storing samples

- You need to store at least one sample
  - Blend samples can be stored for up to three years
  - Raw material samples can be stored for up to two years
- Samples can be put back into new blending processes
- Store collect samples in airtight, moisture free and transparent containers to preserve the integrity of the samples

USAID
FROM THE AMERICAN PEOPLE

IFDC

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

IFDC

Part 3: Operating a Blending Facility

Session 3.7 Sampling

USAID
FROM THE AMERICAN PEOPLE