Soy Excellence Center
SEC Feed Manufacturing Track – Basic Level

SOY EXCELLENCE CENTER
A USSOY program

Finish Feed Loadout - Bagging, Bulk Transportation, and Quality Control

Patrick Clark, PhD

Load Out

- Once animal feed or pet food has been manufactured, it must leave the facility
  - Bags
  - Bulk on delivery trucks

Bagged Feeds

- Bagged products are typically fifty-pound bags
  - Shipped to a retail location or warehouse
  - There are also multiple types of bagging systems:
  - Manual operation to completely automated
    - Concerns related to the packaging process are similar

Bagging Equipment

- Should be properly sized and maintained
- Standard maintenance considerations
  - Oiling, greasing
  - Tensioning of belts
  - Inspection of compressed air lines

- Lot numbers
  - Product traceability

Bagging

- Has an impact on quality during storage and shipment related to items such as product stability, logistics, and the prevention of spills
- Bag closure options:
  - String sealed
  - Heat sealed
  - Glued
- Bag materials
  - Multi-wall paper bags with or without a polypropylene layer and
  - Woven polypropylene
- The choices will impact the likelihood of a bag leaking material, how resistant the bag is to tearing, and how the product or even the bag itself reacts to environmental conditions during storage

Bagging

- Automated systems improve efficiencies and allow the facility to place workers in other areas,
  - System must be monitored to ensure that bags are properly closed and palletized
  - Improper closing can lead to spills during shipment or during storage in a warehouse
  - Improper or inconsistent palletizing can lead to stacks of bags being too tall or too wide, which makes them more likely to get ripped as they are moved around
- Potential exposure to environmental hazards could be considered a food safety issue.

Warehousing

- First-in, first-out order will keep the product fresh
- The higher volume products should be closest to the packaging and loading processes to minimize movement and time in the warehouse
- Product should be stored at least one feet from the wall
- Lighting should be protected

Labeling

- Proper labeling is important to comply with regulations
- Products must be identified with all the information required by country regulations such as:
  - Product name
  - Feeding directions
  - Ingredient statements
  - Guaranteed analyses
  - Medication statements if applicable
  - Net weight
  - Distributor information

Labeling

- Labeling options:
  - Single bag type and design with printed tags affixed during sealing
    - Good option for smaller facilities and/or those who do a lot of custom feed manufacture.
  - Pre-printed bags for each product
    - This is an excellent choice for branding and even helps with warehousing as products can be much more quickly identified

Inventory Control

- Recently, the usage of QR and bar codes in bagged feeds, has made inventory management more efficient
- These tools have improved product traceability during feed transportation from warehouse to the customers.

Bulk Load Out Systems

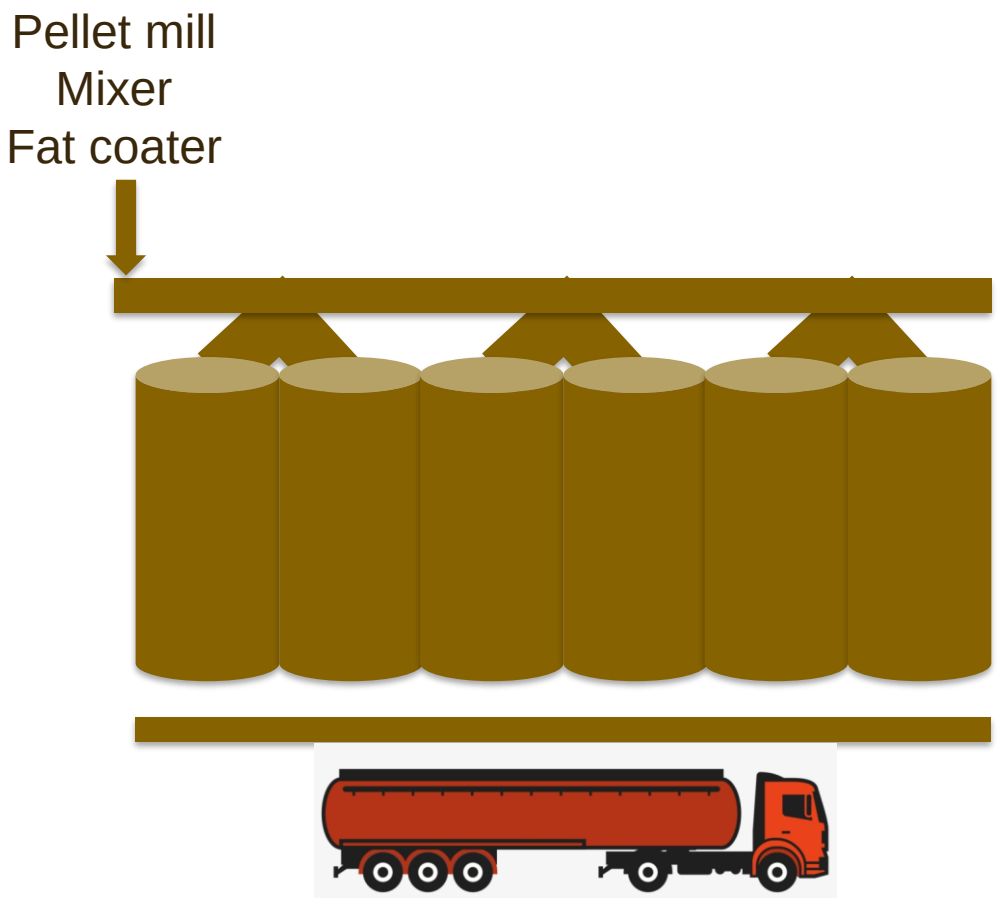
- Reduce transportation costs and improve feed delivery
- Advantages
- No additional costs associated with buying new bags, pallets, and packing materials
- More cost-efficient for loading and unloading
- For example $0.50 x 40 bags per ton of feed = $20/ton
- Bags are susceptible to physical damage during transportation and storage, require warehouse space to store the new bags, and are not typically reused, which can generate additional waste.

Bulk Load Out Systems

- Commercial feed mills usually manufacture bulk feed only when requested by customers and store it for a short period of time
  - More bins
  - Smaller sizes
- Integrated operations produce fewer feed types and have a bulk storage capacity of 1 to 2 days for each feed type depending on animal feed consumption and delivery schedule

Components

- Bulk loadout system can be divided into filling, storing, unloading, and feed delivery
- **Filling**: Consist of distributors and spouting for short loadout driveways or screw or drag conveyors, gates and spouting for longer loadout bays

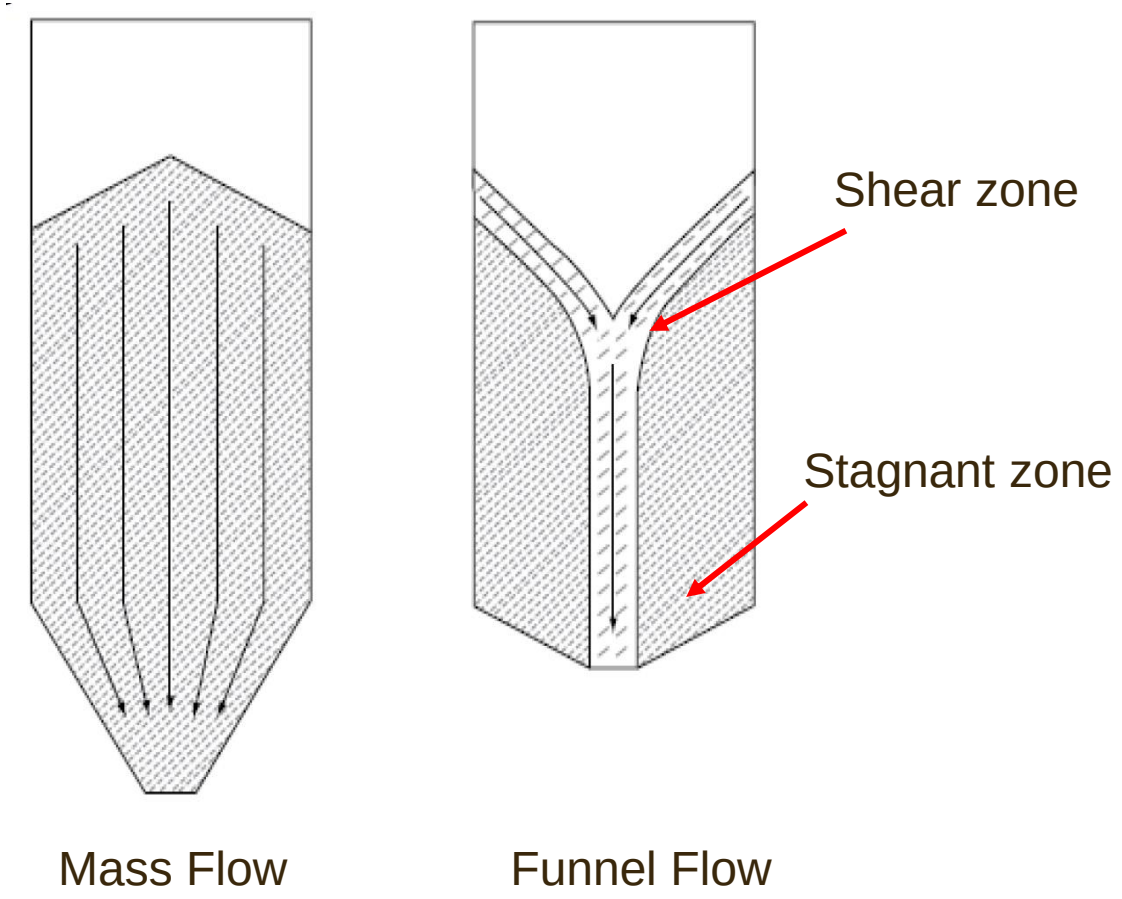


Components

- **Storing:** Bins are made of steel or concrete and can be fabricated with several hopper configurations such as square, rectangle or semi round
- The shape of the hopper influences feed's flow (e.g. funnel flow or mass flow)
  - Mass flow:
    - Obtained with smooth and steeply walled hoppers
    - Reduce friction and allow particle movement along the wall
  - Funnel flow:
    - Caused in hoppers with a shallow cone angle
    - Create a stagnant region along the walls of the hopper

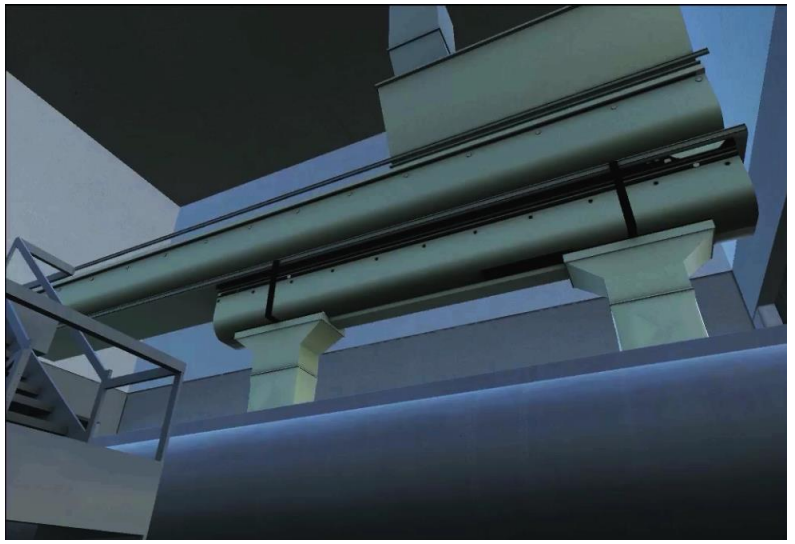
Components

- Hoppers with mass flow configuration are more expensive and might require a taller loadout bays, but achieve a first in-first out principle
  - Produce less physical and nutritional segregation
  - Funnels with funnel flow reduce pellet damage due to lower frictional forces between pellets



Load Out Systems

- Truck is filled from the overhead finished feed bin either by a loadout operator or a truck driver
- Can be controlled manually (push bottom control panels) or automatically using programable logic controller (PLC) computer systems.
  - Some PLC systems can capture load weights for each truck compartment and print them on the delivery ticket
- A sock or flexible boot is used to reduce the distance from the discharge to the truck
  - Reduces dust and feed spillage

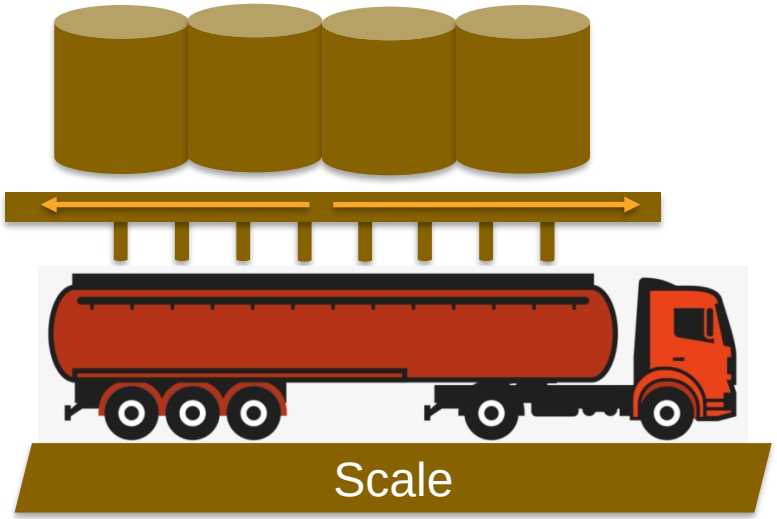


Load Out Systems

- Some loadout systems weigh the feed using a weigh lorry prior to discharging it into one of the truck's compartments
  - Reduce or eliminate cross contamination between finished feeds, but require longer loading times
  - Truck remains stationary with the lorry riding on rails to move between the feed bin and the desired truck compartment
  - The weigh lorry hangs on load cells, allowing the operator or truck driver to weigh the desired amount of feed for each compartment

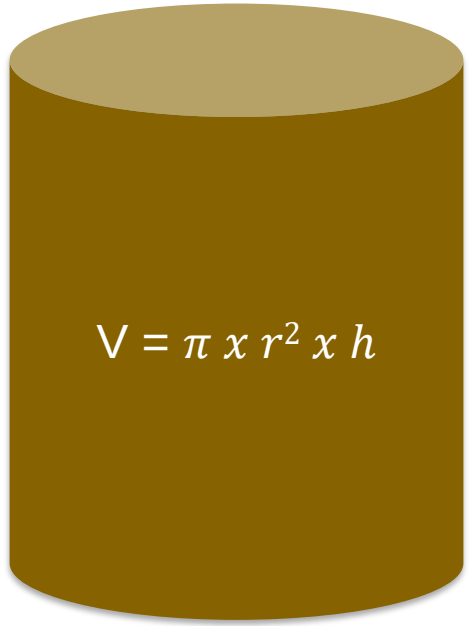
Shuttle Conveyor Systems

- Speed up the loadout process
- Feed discharges into a centralized collection conveyor, which transports the feed to the shuttle conveyor, which rides on rails and has a discharge in each end allowing it to discharge in the desired truck compartment
- The truck sitting over a scale is used as the weighing vessel



Inventory Control

- Important to evaluate if daily production goals are achieved
  - Actual inventory = initial inventory – shipped feed + feed produced
- Less complex than bagged feeds
- Finished feed inventory can be taken by dropping a line into each finished feed bin to calculate the empty space or by using inventory management software
- During loadout, the feed in each truck compartment must be identified with all the information required by country's regulations such as:
  - Product name
  - Feeding directions
  - Medication statements
  - Net weight
  - Customer or farm name
  - Other relevant information.



$\pi = 3.1416$
R = radius
H = height

Bulk Feed Trailers

- Typically constructed of aluminum due to its light weight, durability, and easy to clean
- Prior to loading, drivers must inspect the condition of the truck and bulk trailer and make sure compartments are clean and empty
- Prior to leaving the feed mill, drivers must close all the lids and be aware of the delivery address, feed bin location and any information related to farm/customer bio-security policies

Pre-Loading

- Inspect the transportation vehicle
  - Gates and lids
- Inspect compartments
  - Are they clean and empty?
  - Regularly clean compartments thoroughly (use dry cleaning, but if water is used, make sure the surfaces are dried prior to the next use)
  - If possible, use designated trucks for each feed produced (broilers, layers, breeders, etc.)
- Reject/re-clean vehicles that can contribute to cross contamination and notify the trucking company or the person responsible
- Know the flushing, sequencing, and physical clean-out procedure prior to leaving the feed mill
  - Medicated feeds
  - Feeds that contain prohibited mammalian protein – BSE rule

Loading

- Check feed labels and tags
- Check delivery ticket
  - Customer name or ID
  - Feed type and compartment #
  - Weight per compartment
  - Customer Bin # and quantity
  - Delivery date
- Close all lids prior to leaving the feed mill

Feed Delivery

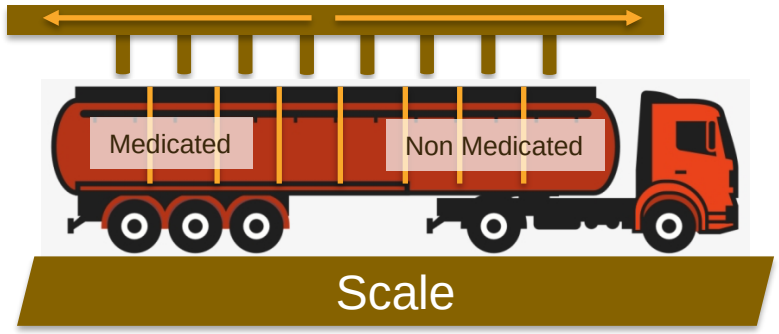
- **Prior to leaving the feed mill**
  - Make sure you have the proper PPE and Bio-security clothing
  - Make sure you know the exact delivery location
  - Understand customers requirements
    - Can they receive the feed at anytime or just during the daily hours?
- **Unloading**
  - Unload from the back compartment first, and open one compartment at a time
  - Flush or sequence between feeds if required
  - Confirm the compartments are empty
  - Report all feed spill and note on ticket
    - Ask the customer to sign the ticket
  - Before you leave the farm, make sure the bulk bin lid is closed

Feed Delivery

- Once you return to the feed mill or warehouse
- Report any property damage or irregularities
- Check for any mechanical problems
- Make sure the compartments are closed

Flushing Procedures

- Unload from the back compartment first
- Open one compartment at a time
- Document the unloading sequence if other than back to front
- Confirm the compartments are empty



Flushing Procedures

- Leave the trailer gates or doors open on the return trip to the feed mill, which will allow material in the compartments to fall into the bottom conveyor
- Run the bottom conveyor after returning to the feed mill to remove any residual feed in the bottom conveyor
- Place flush material in the front compartment of the truck and flush the bottom conveyor, transitions, and lift auger
- Physically clean the transition areas (feed box and lift auger)
- Close the gates prior to loading the truck

Stark, 2011

Clean Out Points

Top of the trailer

Compartments

Lift Auger

Floor Auger

Truck Inspections

- Companies should inspect each feed trailer and access the risk of cross contamination.
- Potential cross contamination points include:
  - Bottom of the vertical lift auger
  - Space between the bottom sidewall and pan and drag chain and paddles
  - Auger connection and hanger bearings
  - Space between the flights and trough
  - Transition box between the horizontal bottom conveyor (auger or drag) and vertical lift auger

Stark, 2011

Conclusions

- It is important to define the frequency of equipment inspection, loading and unloading protocols, information needed in shipping documents as well as sequencing, flushing, and physical clean out procedures to prevent cross contamination between feeds
- The adequate functioning of scales becomes crucial when using bags for the feed, therefore, all the used scales should have calibration records and lot number identification and comply with labeling requirements, inventory rotation and warehouse managements
- Recently, the usage of QR and bar codes in bagged feeds, has made inventory management more efficient
  - These tools have improved product traceability during feed transportation from warehouse to the customers.

Thank You!

Wilmer Javier Pacheco, MSc., PhD.
Extension Specialist and Assistant Professor
Auburn University
wjp0010@auburn.edu