Fish Feed Production Systems
Fish Feed Types

• We classified feed types in two groups:

• 1. Moisture Feeds

• 2. Dry Feeds (Pellet and Extruder Feeds)
Moisture Feeds

• Made by non economic fish species
Moisture Feeds

• The main principle is grind and mix and then feed the fish
Moisture Feeds

• Most important advantage of the feed is to be cheaper than the other feed types,
• It does not require any mechanization.
Moisture Feeds

• **Disadvantages:**

• 1. It is hard to find in all seasons,

• 2. The nutritional content of the feed varies according to season,

• 3. It is difficult to keep it fresh and ready to use.
Dry Feeds

- **Advantages:**

  1. Nutritional content of the feed is guaranteed (you can exactly know the nutritional level of the feed),

  2. there is no change according to the season of the year,

  3. You can buy it whenever you want from fish feed plants,

  4. It is easy to store the feed.
Dry Feeds

- Disadvantages;

  1. Requires mechanization and automation,

  2. It is more expensive than moisture feeds,
Introduction to Dry Feeds

• Pellet Feeds

• Extruder Feeds
Introduction to Dry Feeds – Production Steps

• 1. Intake ingredients,
• 2. Grinding,
• 3. Mixing
• 4. Conditioning,
• 5. Pelleting
• 6. Sieving, drying and cooling
• 7. Packing
**Grinding:** Variety of raw ingredients requires size reduction. Particle size is critical to mechanical and chemical activity

A major step in raw material preparation

**Benefits of grinding:**

“Large surface area for reaction

“Efficient & fast pre-conditioning

“Prevents from die plugging

“Visual appearance
Introduction to Production Steps of Aquatic Feeds (Grinding)

- **Grinding provides**;

- Reduced particle size results in conditioner better water penetration and improved gelatinization
- Improved product appearance
- Reduced incidence of die orifices plugging
- Ease of cooking
- Reduced product breakage and fines
- Increased water stability
- Improved retention of liquid coatings due to small cell structure
- Particle size is critical to mechanical and chemical activity
- Finally: increased digestibility
Introduction to Production Steps of Aquatic Feeds (Grinding)

- **Grinding equipments; Hammer Mills:**
  - Low investment costs
  - 85% grinding success (especially good down to 150-250 microns)
  - High capacity (10 mt/hour)
  - Low energy costs (1.85-2.25 USD/mt)
  - Easy maintenance (0.20-0.25 USD/mt)
  - Total grinding cost: 1.20-1.55 USD/mt
Introduction to Production Steps of Aquatic Feeds (Grinding)

- **Grinding equipments; Roller Mills:**
  - High investment cost
  - 90% grinding success (especially down to 500 microns)
  - High capacity (5-7 mt/h)
  - Low noise
  - Low maintenance costs (0.1-0.15 USD/mt)
  - Total grinding cost: 2.05-2.50 USD/mt
Introduction to Production Steps of Aquatic Feeds (Mixing)

- **Mixing**: The process is as important as grinding. If you grind ingredients but then you should mix them homogenously. So mixing is;
  - To assist in obtaining a more homogenous grind,
  - To increase the efficiency of the grinding process: e.g. high oil content ingredient such as fish meal, full fat soybean meal,
  - would, easily clog the hammer mill screens if ground separately. Grinding a complete ration would lower mixture oil content thus improving grinding performance.
  - Mixing time 3-5 minutes, mixer speed 25-30 rpm (rpm: rotation per minute)
- **Please remember**, every formulation has its mixing time. If you get over the mixing time ingredients start to be decomposed
- **Please remember**, to put very small amount of ingredients like additives at the middle of filling the mixer.
• **Mixing equipments:** are evaluated in two groups;

• 1. Continuous mixing

• 2. Partial mixing
  
  a. Vertical mixers
  b. Horizontal mixers (Welt mixers and pallet mixers)
Introduction to Production Steps of Aquatic Feeds (Mixing)

- **Vertical mixers:** Grinded ingredients are sent to vertical mixers, the spiral container transport the ingredients above of the mixer. Spiral material helps to mix them while transporting.
- Vertical mixers provide fish feed plants to save place.
Introduction to Production Steps of Aquatic Feeds (Mixing)

- **Horizontal mixers, welt mixers** provide;
  - uniform mix in low speed,
  - homogenous distribution of grinded ingredients,
  - great partial capacity.
Introduction to Production Steps of Aquatic Feeds (Mixing)

- **Horizontal mixers, batch mixers** provide;
- mixing of partial ingredients completely,
- mixing ingredients in different densities,
- to add liquid in to the mixing ingredients.
Introduction to Production Steps of Aquatic Feeds (Conditioning)

- **Conditioning**: is the last important process point before extrusion, provides;
  - To mix water, steam and oils in the dry material (mixed ingredients),
  - To moisturizing the feed particles,
  - To transfer the steam’s heat in to the particles.
- Water, steam and oils are added respectively.
- Conditioning gets some advantages in the system because;
  - Lengthens the life of extruder,
  - Increase the speed of production,
  - Increase the product quality.
• Important points effect the conditioning are:
  • Time: 2 – 3 min.
  • Temperature: minimum 95 C
  • Moisture: 20 – 24 %