Objectives of Agriculture (USDA), 2016). Stream probe sampling (United States Department of Agriculture (USDA) are stream sampling and by the United States Department of Current sampling techniques recommended across the state.

Feed sampling is important because animals consume the ingredients present in the feed. Inspectors are currently using a sampling cup that is too heavy to gather a representative feed sample. They are also not able to accurately obtain a representative sample due to climbing restrictions. It is important for an inspector to gather a representative sample of the entire batch of feed that is being transported to farms across the state.

Objectives

The objectives of this project include:

- Identify all Occupational Safety and Health Administration (OSHA) safety standards that need to be met.
- Determine AAFCO sampling protocols and standards.
- Collect survey data from at least four inspectors on safety concerns.
- Observe and summarize safety issues from each site visit.
- Supply a final tool design for inspectors to take a sample from the ground.
- Pinpoint safety implementations for sampling protocols.
- Obtain a representative feed sample using the proposed method.

Constraints

The constraints of the design are as follows:

- Safety of inspectors
- Standards and Regulations
- Sampling Sight
- Type of sample
- Material used

Design Alternatives

There were 3 main design considerations:

- Safety standards
- Sampling procedural standards
- MDARD inspectors' personal opinions

The main component of the design was the sampling cup, which will hold the sample. The materials considered for the cup were aluminum, galvanized steel, carbon fiber, and HDPE plastic. HDPE plastic was ultimately chosen because of its strong durability and lightweight. The team kept the original dimensions of the MDARD current sampling cup since it is calibrated to hold a 2.5 lb sample, see Figure 1 for the 3D model of the sampling cup.

The surveys collected from the MDARD inspectors highlight difficulties:

- Gathering samples from designated areas
- Obtaining representative samples

The answers were ranked on a scale of 1-5 where 1 was disagree and 5 was agree.

Design Parameters

Design parameters include the length of each of the rods, the weight of the design, the cost, and possible safety implementations.

Both the horizontal and the vertical rod are telescoping. The horizontal rod ranges from 3’ to 6’. The inspector can control the length of the horizontal rod depending on their distance away from the middle of the loadout shoot. A length of 6’ would likely be used during the sampling process but can be changed if sampling from a closer distance to the truck. The vertical rod ranges from 3’ to 12’. Depending on the truck that is being loaded the inspector will be able to change the height of the pole to accommodate the size of the truck. The 3’ length is perfect for transportation for the inspectors for both poles.

The cost and weight of the tool is dependent on the materials used for the rods and sampling cup. The team recommends MDARD use steel for the rods and HDPE plastic for the sampling cup. However, if the tool is too heavy for the inspectors with the implemented safety equipment, then aluminum or carbon fiber could be used for the rod which would increase the price. Using steel for the sampling cup is a cheaper option, but the team recommends using HDPE plastic because it is much lighter than steel and can easily be repaired.

Safety Application

The team suggests the implementation of a harness to use while gathering a sample from the ground. The team recommends a fishing harness that will allow for the inspector to have a better grip on the sampling tool during the sampling process, see Figure 5.

Economics

Table 1 shows the total price estimation of the proposed design for one tool for an MDARD feed inspector.

<table>
<thead>
<tr>
<th>Component</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical Rod</td>
<td>$34</td>
</tr>
<tr>
<td>Horizontal Rod</td>
<td>$34</td>
</tr>
<tr>
<td>Sample Cup</td>
<td>$14.59</td>
</tr>
<tr>
<td>Angle Adapter</td>
<td>$31</td>
</tr>
<tr>
<td>Leveling Mechanism (Inner Ring)</td>
<td>$68</td>
</tr>
<tr>
<td>Leveling Mechanism (Outer Ring)</td>
<td>$61</td>
</tr>
<tr>
<td>Harness</td>
<td>$45</td>
</tr>
<tr>
<td>Back brace</td>
<td>$66</td>
</tr>
<tr>
<td>Total</td>
<td>$405</td>
</tr>
</tbody>
</table>

The total for all 6 sampling tools is just under $2,500. These prices do not include manufacturing costs and is solely material costs. This brings the total price for one sampling tool to be $405 including the recommended safety implementations. Without the recommended safety implementations, the price per sampling tool is $300 or $1,800 for 6 sampling tools.

While implementing the proposed design will be more costly than the current design used by MDARD, the proposed design is one-time expensive for each feed inspector. The design is easily weldable if necessary and can withstand the worst-case scenario of 240 psi exerting on the design.

Select References


