

# UBC Farm Egg Washer

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**Abstract:** The UBC Farm requested a new egg washing device to reduce the time needed to effectively clean, sanitize, and dry eggs. The designed prototyped uses a cleaning and an auger brush to clean, and translate eggs through the device. A sanitizing solution is sprayed during cleaning, and pressurized air enhances drying upon the eggs exit. Various tests were done to optimize both brush designs to promote fast, complete cleaning and reduce egg breakage. A process to ensure that the brushes remain clean and sanitized after the devices operation is needed.

**Introduction:** During peak season the UBC Farm can produce up to 150 eggs daily that require cleaning before sale at their weekly market. Their previous egg cleaning process was inadequate because every egg required hand washing and drying, also the time required to heat the water to an appropriate temperature was an issue. Therefore, the UBC Farm requested a device that would make the process of washing, sanitizing, and drying eggs quicker and simpler. The critical function of the device is that eggs exit completely clean, defined by passing a visual inspection insuring there are no foreign contaminants on the shell. Client specified design limits were imposed on the number of eggs needed to be reprocessed, cleaning time, and egg breakage.

**Design Overview:** Based on the needs of the UBC Farm and the developed requirements, the device in figure 1 was designed.

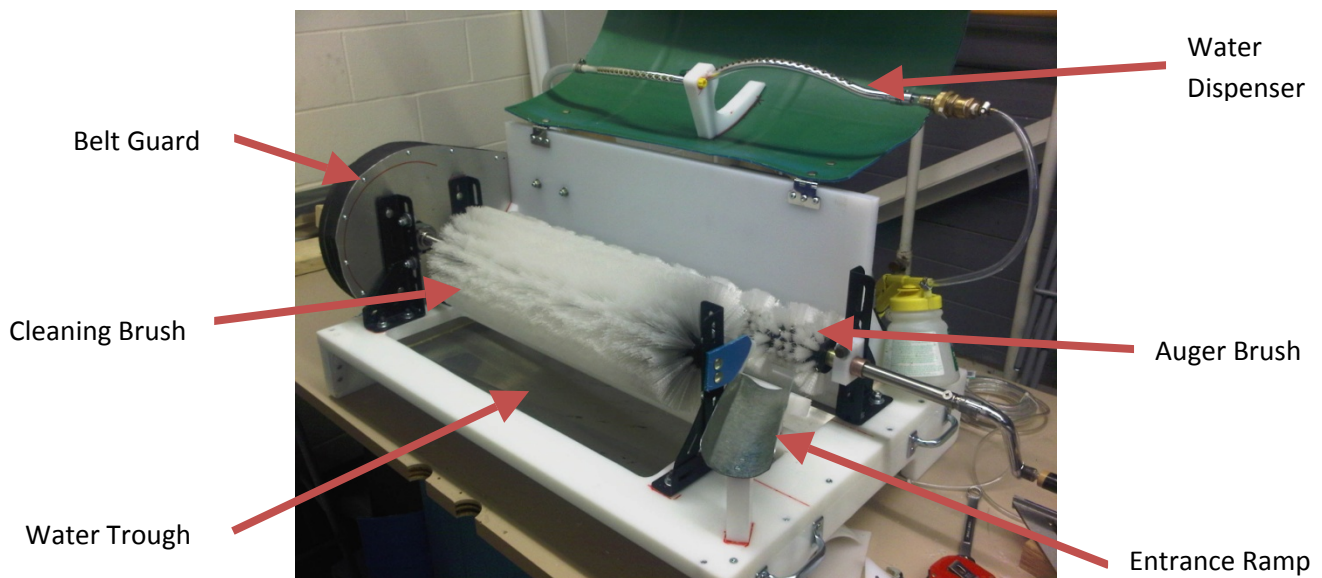


Figure 1: Egg Washing Device

The device's main feature is a pair of brushes used to clean the eggs, as well as translate the eggs through the system while rotating them around their axis to ensure cleaning of the full surface. Eggs are hand fed onto the entrance ramp where they roll into contact with the auger brush. Hand cranking the auger brush translates the eggs along their guide and into the motor driven cleaning brush. A sanitizing solution is sprayed during the first half of cleaning while water is used during the second half as a rinse. Upon exiting the cleaning brush, the eggs are directed by the auger onto the exit ramp where they roll onto the drying rack and are sprayed with pressurized air (not pictured above). Water is drained out the bottom from the water trough and will be disposed of by hose.

**Technical Analysis and Testing:** As the brushes are the main components of the device and have a direct influence on the top level function, the major design decisions were made in relation to the auger and cleaning brush. Research was done to find which brush parameters would influence the cleaning effectiveness. It was found that the rotation speed of the brush, the bristle diameter, and the bristle length had the greatest effect on a brush's cleaning ability. Experiments were done to verify how these results translated to washing eggs. Various combinations of different rotational speeds, bristle lengths, and bristle thicknesses were tested to determine which would best clean eggs. We observed that the changes provided little difference in cleaning ability. The decision to go with thinner bristles was made due to the higher bristle density, while the shortened length added some stiffness lost with the thinner bristles. The rotation speed was decided to be 260 rpm, the slowest tested, because it provided sufficient cleaning and minimized egg breakage. Various auger designs were also tested where different thread directions, pitch lengths, flight thicknesses, and auger materials were examined. The brush auger was chosen because it: was easily fabricated, sufficiently translated the eggs through the device, rotated the eggs around their long axis to expose all sides to the cleaning brush, and also provided some cleaning to the egg ends, a spot we determined was very difficult to clean. The interaction between the cleaning brush, auger brush, and egg guide was another important factor and required testing to verify the optimal position to meet our device requirements.

**Discussion and Conclusions:** The cleaning and auger brush design is very effective at quickly cleaning eggs. The client specified requirements were that 100 eggs could be cleaned in 45 minutes, without breaking more than 3 healthy eggs, and reprocessing 10 eggs. Our verification testing proved that our time requirements could easily be reached, even when a higher number of eggs needed reprocessing due to extremely dirty eggs. The drying function was not tested at that time, however the cleaning time was so greatly reduced that we feel confident the drying time will not jeopardize the overall time requirement. Based on our testing, 100 eggs are able to be cleaned in 10 minutes, leaving 35 minutes for device setup, egg drying and packaging.

**Recommendations:** Upon completion of the egg washing device, the most important recommendation is to have a procedure to insure the brushes remain clean and sterile after washing. The remnants of eggs that break in the machine could remain in the brushes and promote bacteria growth. Washing the device down with sanitizing solution, turning on the motor to remove excess water, and rinsing and scrubbing the auger brush are possible methods to ensure clean brushes.