



Small-Scale Egg Handling

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Many small-scale egg producers sell specialty eggs, such as free-range or organic eggs, to the public at farmers' markets and other venues and need to wash the eggs or prepare the eggs for market. Immersing or soaking the eggs in water is not recommended, but small- and medium-scale egg washers that use brushes and sprayers are very expensive. Small producers often use low-tech methods to clean eggs, including dry cleaning, dipping and spraying or pouring. Small producers should also candle and grade eggs to ensure high quality.

Contents

Introduction.....	1
Keeping eggs clean.....	1
Egg collection.....	2
Cleaning	2
Candling	4
Grading	5
Methods for washing, candling, and grading	5
Storage and distribution.....	9
Site facility	10
Egg products	10
Government regulations and grading.....	10
Organic egg handling	11
Conclusion.....	11
References	11
Further resources	12



Introduction

While information on large-scale egg washing and handling is readily available, there is less information available on handling eggs on a small or medium scale. This publication covers proactive methods to keep free-range eggs clean through egg collection, egg cleaning, candling and grading. You should be aware of your state's regulations on the sale of eggs so you will know what practices are required. Information on substances approved for use in organic production and equipment suppliers is listed in the **Further resources** section at the end of this publication.

For information on producing eggs in alternative and free-range poultry production

systems, see ATTRA's *Alternative Poultry Production Systems and Outdoor Access*.

Keeping eggs clean

Egg washing is an important issue in alternative poultry production systems because eggs often become dirtier in free-range systems than in cages. Dust, mud, feces, feathers and contents from broken eggs may soil as many as 30 percent of eggs in free-range systems (Parkhurst and Mountney, 1988). Free-range systems should minimize mud on pastures and make provisions such as pallets, straw or gravel at the entrance of the bird doorways to clean the feet of hens entering the poultry house. It is also important to maintain clean nesting material. If eggs are broken



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in the nest the other eggs will get dirty. Methods to prevent broken eggs include collecting eggs often, using a nest with a sloping floor (roll away nest) so that eggs roll to a separate collection area and allowing access to the nests only during the morning when most birds lay. Hens should not sleep in nest boxes because the hens will defecate. That dirties the eggs and prevents them from rolling out, increasing the potential for breakage. Some nest boxes have a grill or door to keep birds out during the night, and sufficient perch space will allow birds to roost at night rather than sleep in nest boxes. Provide a sufficient nest area to prevent hens from laying eggs on the floor where the eggs are easily soiled. If individual nest boxes are used, allow no more than 5 hens per nest box. If communal nest boxes are used, follow the manufacturer's recommendations. The Freedom Food program in the UK allows 1 square meter for 120 hens in communal nest boxes. This can be calculated as 11 hens for a square foot. Nests should be designed or oriented to allow birds to avoid brightly lit areas during lay; some nests use curtains for darkening.

Egg collection

In laying operations, most of the eggs are generally laid within five hours of the first light in the morning. Collect eggs often — twice in the morning and once in the afternoon — to help decrease the number of dirty and broken eggs and start cooling eggs (Bigbee and Froning, 1997). Collection should be more frequent in very hot or cold weather. Eggs should be held at 60 degrees Fahrenheit and 70 percent relative humidity before cleaning. Eggs stored at room temperature, about 75 degrees, can drop as much as one grade per day. Embryos can start to develop in fertile eggs held at a temperature above 85 degrees for more than a few hours (Parkhurst and Mountney, 1988). Keep egg temperature relatively constant until the eggs

are washed to avoid sweating. Sweating occurs when eggs are moved from cold storage to a warm environment. Condensation on the surface of the egg facilitates the movement of microbes inside the shell due to moisture. In the past, eggs were held in plastic-coated wire baskets so that the air could circulate freely among the eggs and cool them. Now, eggs are also held in fiberboard flats that hold 30 eggs per flat. Misshapen, cracked, broken or extremely dirty eggs should be separated from clean eggs.

Manual egg gathering is labor intensive. An egg cart, filler flats and a nearby storage site will help reduce labor. In mechanized egg collection, a moving belt brings the eggs to a section of the house where the eggs can be packed into flats. Eggs are positioned in the flat with the small end down, the same position they should be in the carton as well. Roll-away nests simplify egg collection because the eggs can roll from the sloped floor of the nest to a collection area or belt.

Eggs are ideally packed within 24 hours after they are laid. U.S. Department of Agriculture (USDA) rules require that eggs be packed within 30 days of lay. In programs that assure high quality, eggs are usually packed within 3 to 7 days of lay. It is important to remember not to store eggs in coolers with items that give off odors, such as onions and citrus, because the eggs can pick up the odor through the shell's pores.

Cleaning

Eggs are cleaned to remove debris and stains and reduce the microbial load. Excessively dirty eggs should not be cleaned, but rather discarded.

Dry cleaning

A slightly dirty egg can be brushed with an egg brush or rubbed with a sanding sponge and sandpaper.

Wet cleaning

Naturally, the egg has good defenses to help protect the embryo during incubation. The shell is covered by a waxy layer (the cuticle) that helps prevent microbes from entering the pores that allow the passage of gases. The cuticle is not impenetrable and water on the surface of the egg shell can undermine these defenses because water helps bacteria pass through the shell pores into the egg. If the period of contact between egg and water is short, there will be little microbial penetration into the egg (Zeidler, 2002). Therefore it is important to limit the amount of time that the shell is wet. Soaking eggs in water for as little as 1 to 3 minutes can allow microbes to penetrate the shell (Zeidler, 2002).

Although the USDA does not allow immersion washing (allowing eggs to stand or soak in water), most small producers are not operating under USDA requirements. Most operate under exemptions to state egg laws and washing methods are usually not specified. Small-scale egg washing should take place with a continuous flow of water, such as dipping, spraying or pouring, that allows the water to drain away from the eggs.

Only potable water should be used for cleaning. According to the USDA, iron levels in the water must not be higher than 2 parts per million (ppm). Egg white does not contain iron and this helps prevent microbial growth, but if iron is introduced it may induce spoilage of the egg contents (Zeidler, 2002).

Interestingly, in Europe Grade A eggs are not washed. This practice is a result of research done in the early 1900s that indicated washing eggs before storage resulted in unpredictable and sometimes deleterious results. However, the length of wash time, cleanliness and temperature of the water and the proper use of sanitizers varied widely in these studies (Hutchison et al., 2003).

Note that washing eggs can damage the cuticle or bloom, the waxy layer that seals the pores and helps keep out bacteria. Older egg production books do not recommend washing eggs at all. In the past, it was important to protect the cuticle because refrigeration was not always possible.

Prewetting

Wetting or lightly spraying the eggs with warm water, about 104 degrees, prior to washing will help loosen debris on the shell (Hutchison et al., 2003).

Washing

Eggs should be washed in water that is at least 20 degrees warmer than the warmest eggs, and the water should be at least 90 degrees. This is to prevent water that is cooler than the egg from forcing the egg contents to contract and pull water and microbes through the shell into the egg and cause contamination. However, the wash water should not be more than 40 degrees above the temperature of the eggs or the eggs may experience thermal cracking.

Cleaners can be helpful in the washing process. According to the Food and Drug Administration (FDA) the ingredients in the material used to clean eggs must be Generally Recognized as Safe (GRAS). The ingredients must also be a substance that is regulated as a food additive (USDA FSIS, 2008). Ingredients in compliance with FDA guidelines can be found in the Code of Federal Regulations. Detergents help remove dirt and kill microbes during wet cleaning. Detergents generally raise water pH to 11 and the alkaline environment helps kill microbes, including salmonella (Zeidler, 2002). There are many detergents or egg soaps on the market. For example, Egg Wash Powder is an alkaline chlorinated foam controlled powder available through Incredible Egg Washer Co., Nasco and other suppliers.

Note that washing eggs can damage the cuticle or bloom, the waxy layer that seals the pores and helps keep out bacteria.

Be conscious of where your wash water goes, an ongoing and excessive use of detergent could be harmful to your septic system.

In certified organic processing under the National Organic Program, §205.605 of the National List lists nonagricultural (nonorganic) substances that may be used in processed products labeled as organic or made with organic ingredients. The list includes natural materials such as citric and lactic acids and synthetic materials including chlorine, hydrogen peroxide, ozone potassium hydroxide, and peracetic acid. The Organic Materials Review Institute (OMRI) lists brand name products that are allowed under this National List. The name brand list includes AFCO 5242 Egg Wash Org, whose main ingredient is potassium hydroxide. Keep in mind not all possible options are listed because there is a cost for OMRI listing.

Be conscious of where your wash water goes, as ongoing and excessive use of detergent could be harmful to your septic system. If you dispose of wash water on farm, a gentler soap or other material should be used. IPS-CareFree Enzymes, Inc. has an egg wash product called Egg Washer Pro that breaks down contaminants with a blend of enzymes that make up the wash. Some small producers use a solution of distilled white vinegar diluted in half with water to wipe their eggs. Vinegar can aid in removing stains from the shell and is known to have antibacterial properties due to its acidity (Entani et al., 1998).

The USDA requires that wash water be changed every four hours in commercial production. Replacement water is added continuously.

Defoamers are used with egg-washing machines to help reduce foaming. Excessive foaming causes water to spill over sides of tank and this affects water temperature and pH.

Rinsing

Eggs are rinsed to remove adhering dirt, detergents, and foam (Zeidler, 2002). Rinse water should be a few degrees higher than the wash water to prevent drawing the water into the egg.

Sanitizing

After washing, eggs are sanitized to reduce microbial load.

Chlorine-based sanitizers should be from 50 to 200 ppm (Zeidler, 2002). However, using less than 100 ppm chlorine may help protect the cuticle (Hutchison et al., 2003). One tablespoon of household chlorine bleach, usually 5.25 percent sodium hypochlorite, per gallon of water will result in a solution of 200 ppm chlorine (McGlynn, 2009). Free chlorine level must be frequently checked because chlorine is inactivated by organic material such as dirt. Chlorine test strips are available in restaurant supply stores.

Organic requirements permit a final rinse with a chlorine level less than 4 ppm, the limit under the Safe Drinking Water Act. See the OMRI product list for approved sanitizers and check with the individual company to ensure the product can be used on shell eggs.

Interestingly, in a test comparing the effectiveness of sanitizers including chlorine, electrolyzed water and peracetic acid, none of the sanitizers were more effective than rinsing with water (Musgrove et al., 2008).

Drying

Eggs should be dried after washing and before packing and storing to prevent fungal and microbial growth. Eggs can be dried by evaporation, with fan assistance or by wiping.

Candling

In some states, small-scale producers may be required to candle eggs to ensure interior quality of the eggs in terms of blood spots, cracks and more. Even if you are exempt, candling is still important to ensure your customers do not receive fertile eggs with developing embryos, eggs with blood spots or cracked eggs. If you gather frequently and use cold storage, embryos will not have the chance to develop in fertile eggs.

Brown eggs are more difficult to candle than white eggs due to the darker shell which can generally lead to a higher percentage of blood and meat spots.

Grading

Grading involves sorting eggs based on quality, size and weight standards. Quality is based on shell quality, the air cell, the white and the yolk. For example, the highest quality Grade AA has a clean, unbroken, unstained shell; the air cell is 1/8 inch or less in depth; the white is clear and firm; and the outline of the yolk is only slightly defined and free from defects such as blood spots. The USDA Egg Grading Manual, available at www.ams.usda.gov/Poultry/pdfs/EggGrading%20manual.pdf, describes how grading is done under the USDA (USDA, 1990).

Grading also involves sorting eggs into weight classes or sizes including peewee, small, medium, large, extra large and jumbo. The USDA Egg Grading Manual explains the required individual egg weight and how much a dozen eggs need to weigh for each weight class. Consumers notice size variation within a carton but not as much from carton to carton. Most states do not require small-scale egg producers to grade eggs and cartons usually must be marked as ungraded.

Methods for washing, candling and grading

The capacity of washing methods is often described in terms of cases. A case is 30 dozen or 360 eggs and a half case is 15 dozen.

Manual methods

Washing

Methods that use spraying, pouring or dipping reduce the time of contact between water and egg. As mentioned earlier, soaking eggs is generally not

recommended because it may allow microbes to enter the shell.

If you have just a few eggs, use a brush and wash them in a sink with hot running water and then dip them in a sanitizer (Bigbee and Froning, 1997). The water should be warmer than the egg. Prewetting and using a detergent will help. Brushes that can be sanitized are helpful. For example, surgical brushes, which are small nylon brushes packed with micro bristles, are made to clean hands and under nails and are useful in egg cleaning because they can easily be sanitized in the dishwasher or bleach water.

Dip washing

To wash several dozen eggs, make up separate basins of detergent, rinse water and sanitizer solutions. Wash each egg separately and do not soak. Dip the egg in rinse water, and then dip it in sanitizer. Using an egg basket or colander to rinse and sanitize many eggs at once will save time. Set eggs aside to dry. It is important to remember to change the detergent and rinse water after every 3 to 4 dozen eggs. Use gloves to protect hands from hot water, detergent and sanitizer (Bigbee and Froning, 1997). Sinks with three basins are ideal for this method and can usually be found through bar and restaurant equipment suppliers. Also available through similar sources are brushes atop a suction base that will attach to the bottom of the sink and can be used under wash water, freeing up a hand in the scrubbing process. Be cautious of disposing wash water on the farm because the detergents and sanitizers may be highly caustic or chlorinated and your septic will suffer if fed the mix (Davis, 2005).

Spray or pour washing

Robert Plamondon, a small-scale producer in Oregon, provides the following recommendation:

While the eggs are in wire baskets or plastic egg crates, shower them generously with the use of a watering can with 100 degrees water that contains detergent and enough chlorine to bring the level to 100-200 ppm. Allow the wash water to run away from the eggs by sitting the basket atop a drain. After standing a few minutes the eggs may need to be watered again. Then wipe the eggs individually with a paper towel. Replace the paper towel often during the process. A cloth towel should not be used because it may continue to be used long after it has become dirty. Clean eggs should then be placed in a clean wire basket or plastic flat. Clean eggs are then sanitized by generously showering them with 100 degree water that is 100-200 ppm chlorine. You can dry the eggs manually or let them air dry. Drying racks can be made with half-inch hardware cloth on a wooden frame. The eggs will also dry if put into the refrigerator while still in the basket or crates. Wet eggs should not be placed in cartons because they will stick (Plamondon,2001).

Candling

For hand candling, there are many different setups.

According to Colorado State Extension, “a suitable light can be handmade by cutting a 1.25-inch diameter hole in the end of a coffee can. Insert a light bulb fixture through the lid, using a 40-watt bulb. View the interior of the egg by holding the large end up to the hole cut in the bottom of the can. As the light passes through the egg, twirl the egg several times. If blood spots are present, you will see them” (Geiger, 1995). Another low-tech way to candle is by taping a 3-inch length of empty bath tissue paper tube to a flashlight. Suppliers such as Nasco, Kuhl and Rochester Hatchery offer hand candlers.



Candlers help ensure the interior quality of eggs. Photo courtesy Maine Organic Farmers and Gardeners.

Grading

For small-scale grading, gravity operated scales can be found for less than \$70. They are available through Kuhl, Nasco, Rochester Hatchery and other suppliers.



The Jiffy Egg Scale is an inexpensive gravity-operated egg scale. Photo courtesy of Meyer Hatchery.

The small egg scales that most catalogues sell are not very accurate and are not for legal trade. If you do a lot of wholesaling, you need to get a commercial scale that will be inspected regularly for accuracy. A diet or kitchen scale is usually enough for people who sell small numbers directly to the consumer.

Mechanical egg washing and grading

Machinery may be needed if the amount of eggs being processed is too much to do by hand. Although immersion washing is not recommended, there are some machines on the market. Check with your state egg laws to see if immersion washing is allowed. Oregon egg producer Robert Plamondon recommends only cleaning 3 dozen eggs per gallon of water in the machine before replacing the water and using the proper amount of chlorine or sanitizer. Prewetting is also helpful.

Immersion washers

The Incredible Egg Washer is a plastic bucket that handles 8 dozen eggs at a time. It includes a 10-inch egg basket and is small enough to use in a kitchen. An air compressor bubbles water around the eggs. It costs about \$100 but the air compressor is sold separately and costs about \$140. It is



The Incredible Egg Washer uses air bubbles and water to clean shell eggs. Photo courtesy of The Incredible Egg Washer Co.

offered by The Incredible Egg Washer Co., Nasco, and other suppliers.

Producer Mike Geubert described how to make a similar system on the farm. This can save on costs, especially if one already owns an air compressor. The bubbler system can be made with PVC piping with holes drilled throughout the base and an air coupler to connect to the compressor. The regulator on the compressor can be used to adjust the pressure to 10 to 5 pounds per

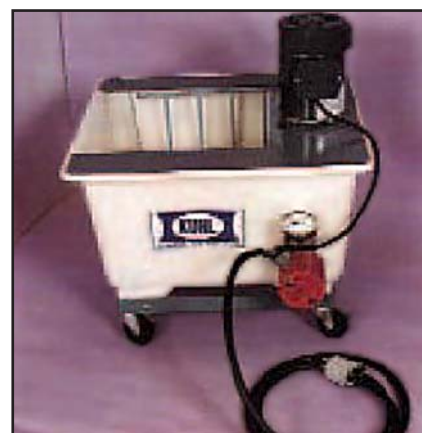


This is a homemade unit to clean eggs with water and bubbles. The unit is made with three-quarter-inch PVC pipe and drilled with a 3/32-inch bit. Photo by Mike Geubert.

square inch. The system is made to fit in a 5-gallon bucket, which also holds an 8-dozen-size egg basket. Eggs are given a 5-7 minute bubbling warm water, about 100 degrees, bath before a rinse in warm water. Eggs that are still dirty may need a quick wipe and another rinse before being set to dry (Guebert, 2007).

The Kleen Egg Turbo Air-Wash, available through Rochester Hatchery, is a 7-gallon galvanized bucket with a heating element and egg basket. It washes from 10 to 15 dozen eggs in 3 to 5 minutes and has an adjustable thermostat to maintain water temperature. It costs about \$400 but also requires an air compressor to blow air bubbles through the water. According to producer Robert Plamondon, “with a suitably small compressor, this would work fine in the kitchen”(Plamondon, 2000). The heating element is a 115-volt, 1,500-watt element. You can fill it with hot water from the kitchen sink and it is small enough to pick up and dump used water. In fact, for kitchen use Plamondon does not recommend plugging in the heating element because “by the time the water’s cold, it’s probably also dirty”(Plamondon, 2000). In this case it would probably only be necessary in a situation where one did not have access to hot water.

Kuhl Corp. offers a large fiberglass immersion egg washer that cleans from one to eight cases, or 360 to 2,880 eggs, in an hour and operates with an egg crate or egg basket. It is large enough that it cannot be lifted to dump water out and requires a floor drain. These KF Models are offered for 110-volt or 220-volt electricity and both cost more than \$1,200.



The KF Model is a low capacity immersion egg washer. Photo courtesy of Kuhl Corporation.

Dishwasher

Dishwashers are used experimentally for washing eggs by some small egg producers. Dishwashers are used with a detergent suitable for egg washing and not dishwasher

soap because it is too harsh. Dishwashers may be able to clean eggs with the sheer force of the water. Only the top rack should be used, as the bottom rack is too close to the jets and will cause the eggs to bounce around and break. The main things that should be considered are achieving proper water temperature and drainage.

Dishwashers usually heat the water hot enough to potentially cook the eggs. This could be resolved by setting the water heater to from 110 to 120 degrees and turning off the dishwasher's heat dry or temperature sensor feature so that it doesn't heat the water and the eggs more than what is necessary.

Drainage issues result from the soil and feathers that are washed off the eggs building up in pipes and eventually creating clogs. The filter on the dishwasher is usually large enough to let debris pass. Even though clogs may not be a problem in the beginning, some producers discover a clogged line after several months, especially if there is a large percentage of very dirty eggs. A separate water outlet pipe for an egg-washing dishwasher may be appropriate.

Chlorine can be added to the water during the rinse cycle to sanitize the eggs, but it may be time-consuming to wait for the change in cycles. If the eggs are not extremely dirty just using the rinse cycle may be sufficient.

Brush and spray washers

Brushing and spraying is an ideal way to clean eggs. However, there are only a few small brush and spray washing machines currently on the market and most egg-washing equipment is very large and runs hundreds of cases each hour for large-scale production. Large-scale egg washers use water sprays and brushes to clean eggs and can process 500 cases an hour. Brushes are usually oriented perpendicular to egg flow. The spinning of eggs around their vertical axis facilitates cleaning. Wash water is re-circulated in large machines and new replacement

water is added to maintain a continuous overflow.

Kuhl Corp. offers the EBEW 1-5, which processes from one to five cases an hour, or from 360 to 1,800 eggs. A recycled spray is used to clean eggs. Eggs are rotated on rubber rollers during cleaning and then pass through a sanitizing spray. A grader or farm packer can be attached.



The EBEW 1-5 cleans eggs through a pressure spray wash and sanitizer spray. Photo courtesy of Kuhl Corporation.

The National Poultry Equipment Company offers the Sani-Touch line of machines, which come in models 5, 10 and 20, referring to the number of cases that can be processed in an hour. These machines are washer and sanitizer units with driers that have optional candling and grading attachments. The machines require water and drain hookups but come with their own water heater. The Sani-Touch models do not recycle the water. The Model 10 is more than 13 feet long and 2 feet wide, and the Model 5 is more than 10 feet long without candler or grader additions.

An additional attachment is a spool-spinner candler that rolls the eggs around for viewing and even has a mirror on the back so you can see both ends of the eggs. It can be combined with a vacuum-operated egg

lifter to load six eggs at a time on the candler section. The grader bolts onto the far end of the unit and separates the eggs into six grades, peewee through jumbo.

In the past Sani-Touch units were sold under the AquaMagic name and have been made for decades. It may be possible to find used equipment and parts are still available that work with the old machines.

Producer Robert Plamondon describes his used Aquamagic:

“The AquaMagic candles, washes (with a water spray and brushes), dries (with fans and more brushes). The washer section works MUCH better than immersion washers, and the drier section means you don't have to leave eggs sitting around to dry. The washer comes with a little pump that pumps detergent/sanitizer solution out of a bucket and mixes it with the warm wash water. It comes with a chute loader, which is a ramp that you fill up with a row of eggs. They roll slowly down the ramp as the washer picks the eggs up one at a time. The washed/sanitized/dried eggs come out the far end onto a table, where you pick them up and put them into flats or cartons. For a little extra, you can have a candling light added onto the chute loader, where a bright light shines up through a slot in the chute, allowing you to candle the eggs as they pass by.”(Plamondon, 2000)

The smaller Model 5 sanitizer unit with candler costs from \$10,500 to \$11,000 (or slightly less without the candler) and \$26,500 with the candler and grader. Two people can run it at 75 percent of its top speed. The larger Model 10 S costs about \$14,000 with a candler (slightly less without the candler) and \$29,000 with the spool-spinner candler and grader. It requires four people — a loader, candler and two packers — to run it at top speed.

The water heater that comes with the Sani-Touch models is very intricate. It may be possible to connect it up to an existing source of hot water for some savings. The machines are sturdy and can process over 2,000 dozen eggs a day (Plamondon, 2003).

Candlers and graders

National Poultry Equipment sells a free-standing grader, the Sani-Touch Model CG.

The Egomatic was a candler and grader that was sold in the past in the United States and is sometimes sold as used equipment.

Oiling

Eggs can be oiled with a food-grade mineral oil after washing to help reduce moisture or CO₂ loss, maintain the internal quality of the egg and prevent the introduction of microbes. In the United States eggs are generally distributed quickly and oiling is not necessary. Oiling is more important in warmer areas where there is a risk of inadequate refrigeration (Hutchison et al., 2003).

Storage and distribution

After processing, eggs should be stored at 45 degrees to prevent microbial growth. Humidity should be kept at 70 to 85 percent. Clean eggs stored at these conditions will keep for three months (Damerow, 1995). In a standard refrigerator, where the humidity is lower, washed eggs only keep for five weeks.

In large-scale commercial production, eggs usually reach the packing plant only a few days after hens lay them (USDA FSIS, 2007). Eggs packed under federal regulations require the pack date to be displayed on the carton. It is a three-digit Julian date that represents the consecutive day of the year. The carton is also dated with the sell-by or expiration date (Exp.), depending on the state. Eggs with a federal grade must be sold within 30 days from day of pack (USDAD FSIS, 2007a). The USDA recommends that consumers buy eggs before the expiration date and use them within 3 to 5 weeks. In June 2006, a USDA Agricultural Marketing Service (USDA AMS) rule prohibited the repackaging of eggs previously shipped for retail sale that were packed under its grading program.

Small specialty producers should sell their eggs within seven days of lay so that the eggs are as fresh or fresher than conventional eggs.

Site facility

The handling area should generally be clean and free of insects, vermin and other possible contaminants. Some states may require screened windows; rodent-proof doors; washable walls and floors with all joints caulked; potable water; sanitary drainage; and no pets in the building (Plamondon, 2000).

Oregon egg producer Robert Plamondon describes his egg washing area:

Our egg-washing is done in our garage (which we don't use for vehicles). Just about any garage that already has a concrete floor, water, a drain going to the septic system, and adequate electrical power could be converted pretty cheaply. Basically, the food-safety inspectors want to see an installation that appears to be built to code and is appropriate for proper food-handling, which mostly revolves around keeping bugs and rodents out, being easy to clean, having enough sinks, and having potable water so you're taking bacteria away when you wash, not adding them (Plamondon, 2000).

Egg products

Small-scale producers usually sell only shell eggs, not processed eggs. However, in the United States about 30 percent of eggs are consumed in the form of egg products such as broken whole eggs, yolks and whites. After breaking, egg products are sold as liquid, dried and frozen products. Yolks are salted or sugared if frozen to prevent forming a rubbery gel upon thawing. In large-scale processing, egg products are pasteurized after breaking to kill microbes. The USDA Food Safety and Inspection Service (USDA FSIS) inspects these operations. Egg products are used in food manufacturing. For more information, see the USDA FSIS Egg Products and Food Safety Fact Sheets, available at www.fsis.usda.gov/PDF/Egg_Products_and_Food_Safety.pdf.

Government regulations and grading

A producer with a flock of fewer than 3,000 hens is exempt from complying with the Egg Products Inspection Act. The Egg Products Inspection Act was passed in 1970 to insure egg products are safe for human consumption. In 1972, quarterly on-site inspections of all shell egg processors became required. This Shell Egg Surveillance program ensures that shell eggs are as good or better than grade B. For more information, see 7 CFR, Part 57 of the Regulations Governing the Inspection of Eggs at www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELDEV3004691.

The USDA AMS has a voluntary egg grading service for shell eggs that is paid for by plants. The Regulations Governing the Inspection of Eggs 7 CFR, Part 56 describes how eggs should be processed under the voluntary grading program. See www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELDEV3004690 for more information. Under this service, USDA graders continuously monitor the grading and packing of eggs to ensure that the eggs meet quality and size standards. In addition, plant processing equipment, facilities, sanitation and operating procedures are verified according to regulation requirements. By meeting these requirements, eggs packed at official plants are eligible to carry the USDA grade shield. The Egg Grading Manual is an excellent resource and is available online at www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELDEV3004502.

With more emphasis on Hazard Analysis and Critical Control Points (HACCP) and high quality, the Plant Sanitation and Good Manufacturing Practices Program (PSGMP) is also available under voluntary grading.

Although small-scale egg producers do not have to comply with federal programs, they need to follow state egg laws. Although states have exemptions for small producers, some states are quite rigorous

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in terms of washing, candling and temperature requirements during storage and sale. Many eggs are sold ungraded at farmers' markets.

Organic egg handling

In order to be certified organic, the eggs must be handled or processed under requirements of the National Organic Program (NOP) and the processing facility must be certified organic. Organic handling requirements are covered in CFR § 205.270 to 205.272 of the NOP.

In general, organic processing requires:

- The use of organic ingredients or ingredients allowed by the National List.
- Management that prevents contamination with prohibited substances.

- Facility pest management that prevents contamination.
- Management that prevents commingling with nonorganic products. (Kuepper et al., 2009)
- Proper recordkeeping and audit control procedures that ensure traceability of the product and proper use of the organic seal.

Conclusion

Proper handling is a critical part of any egg business despite the size of the operation. Proper handling ensures quality and safety for consumers and compliance with state and federal regulations. The information given in this publication provides viable options for small and medium sized egg producers in executing proper handling within their own production system.

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Further resources

Approved Substances

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Lists substances which comply with major FDA guidelines for shell egg cleaners and sanitizers; those which are approved as Generally Recognized as Safe (GRAS) for use in food, and regulated as food additives. List is updated annually.

Organic Materials Review Institute (OMRI)
Box 11558

Eugene, OR 97440
541-343-7600
541-343-8971 FAX
info@omri.org
www.omri.org

Voluntary review and listing service for products used in organic production and processing as certified under the USDA National Organic Program. Approved products are listed annually in the directory, OMRI Products List. Hard copy of the OMRI Product List is available through paid subscription, and the online version can be viewed at no cost.

Equipment Suppliers

IPS-CareFree Enzymes, Inc.
PO Box 190
Kansasville, WI 53139
262-878-0995
262-878-0997 FAX
carefree@execpc.com
www.carefreeenzymes.com

Offers enzymatic products for a variety of areas including poultry. Their natural poultry product line includes Poultry Protector, Waterer Protector, Odor Digester, and egg washing products Egg Washer Pro and Foam Blocker. A list of retailers carrying IPS-CareFree Enzymes, Inc. products can be found on their Web site or by contacting them through email or by phone.

Incredible Egg Washer Co.
P.O. Box 302
Manchaug, MA 01526-0302
508-476-0084
888-852-5340 (toll-free)
877-455-4647 FAX
www.theincredibleeggwasher.com

Offers the Incredible Egg Washer, replacement parts, and Egg Wash Powder. The washer safely uses air to gently clean the eggs.

Kuhl Corporation
P.O. Box 26
Flemington, NJ 08822-0026
908-782-5696
908-782-2751 FAX
www.kuhlcorp.com

Offers egg washing equipment and a variety of poultry production equipment. Egg washer options include low capacity immersion washers KF-200, KF-400 (max. capacity: 8 cases/hr) and spray/

sanitizer washer EBEW 1-5 (max. capacity: 5 cases/hr). Detergents, sanitizers, preserving oils, and nest boxes are also available. Offer product catalogs upon request.

Lee Valley Tools, Ltd.
P.O. Box 1780
Ogdensburg, NY 13669-6780
800-267-8735 (toll-free)
800-513-7885 FAX
customerservice@leevalley.com
www.leevalley.com

Offers a variety of woodworking and gardening tools. They offer the World's Kindest Nail Brush which some small egg producers find helpful in their manual egg washing system.

NASCO
P.O. Box 901
Fort Atkinson, WI 53538-0901
800- 558-9595 (toll-free)
920-563-8296 FAX
custserv@enasco.com
www.enasco.com

Large supplier of farm and ranch equipment with a large line of poultry equipment. Egg supplies include nest boxes, baskets, cartons, flats, cases, candler,

scale, washer, wash powder, brushes. Product catalogs are available upon request.

National Poultry Equipment Co.
3290 Lancer Ave.
Osage, Iowa 50461
641-732-1460
641-732-1470 FAX
info@nationalpoultryequipment.com
www.nationalpoultryequipment.com

Manufacturer of egg processing equipment for small to medium sized egg producers. Web site shows their Sani-Touch washers, has a forum for those who may be looking to buy or sell used equipment, features videos about how to use the equipment and more.

Rochester Hatchery
9420 109 Street
Westlock, Alberta T7P 2R4, Canada
780-307-3622
sales@rochesterhatchery.com
www.rochesterhatchery.com

Offers many varieties of poultry chicks and poultry equipment. Egg supplies include nest boxes, detergent, brushes, candler, scales, cartons, boxes. Catalogs can be requested through email or can be downloaded from their Web site.

Notes
