



Using Specific Gravity to Measure Eggshell Strength

Why measure eggshell strength?

Regular monitoring of eggshell strength can be a helpful tool to determine how changes in management impact shell strength. Improved shell strength helps reduce undergrades, improving both food safety and your profitability.

An eggshell quality problem can often be identified and corrected before it becomes serious if routine measurements are conducted. By measuring eggshell strength regularly you:

- Can identify when eggshell problems begin (and can relate this to flock information such as the age of the flock, feed ingredient changes, temperature changes, vaccinations, etc.)
- Can monitor whether management decisions help in correcting the problem
- Can help in determining where eggshell problems are occurring

A number of techniques have been developed to measure eggshell strength. A method you can use on farm that does not damage eggs is called specific gravity. Determining an egg's specific gravity is accomplished by floating eggs in various salt solutions.

What is specific gravity?

Specific gravity is the ratio of the weight of an object to the weight of an equal volume of water. Specific gravity of an egg indicates the quantity of shell relative to other components of the egg.

Specific gravity is highly correlated to eggshell thickness. As specific gravity goes down the number of cracks generally increase. Specific gravity can give you an idea of the probability of the eggs being cracked during handling.

Egg specific gravity usually declines as the hen ages. This is partly due to the size of the egg increasing more rapidly than shell weight. Therefore, differences in specific gravity among eggs of similar weights are mainly due to variations in the amount of shell.

What is needed to determine egg specific gravity?

To measure specific gravity on the farm you will need:

- 3 plastic garbage cans or buckets with covers (10 to 20 gallon / 40 to 80L capacity)
- 1 smaller bucket (approximately 1 gallon/4L)
- salt (granulated-iodized livestock salt is OK)
- water (tap water is OK)
- 1 hydrometer (can be purchased at Acklands or similar store for approximately \$45.00+)
- 1 glass or plastic cylinder that can hold water and is about twice the length of your hydrometer
- scale for weighing the salt
- large stick or plastic boat paddle to stir solutions
- plastic basket (with holes) capable of holding about 20 eggs and 3-5 plastic egg trays



Making the Salt Solutions:

No more than five solutions will be needed (three will usually be sufficient). These solutions should have specific gravities of 1.070, 1.075, 1.080, 1.085, and 1.090.

Specific Gravity of Solution	Amount of Salt per Gallon (4 liters) of Water		
1.070	0.8 lbs	or	363 g
1.080	1.0 lbs	or	454 g
1.090	1.05 lbs	or	476 g



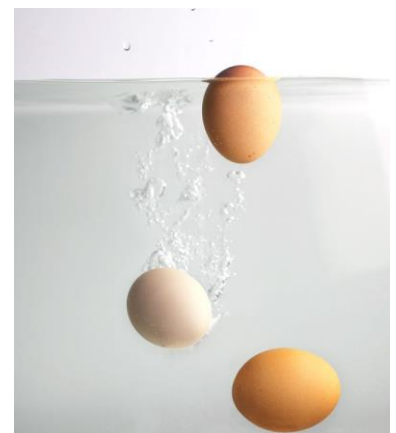
1. Fill garbage can or large bucket with 10 gallons of water.
2. Measure the appropriate amount of salt for the solution you are making. For example if you are making the solution with a specific gravity of 1.070 and you have 10 gallons (40L) of water in your container, add 8 lbs of salt to 1 gallon of warm water:
10 gallons of water x 0.8 lbs of salt = 8 lbs of salt needed
(40L/4L) of water x 363g of salt = 3,630 g of salt needed
3. Pour the salt into the water and stir until completely dissolved. The salt will dissolve more easily if the water is room temperature.
4. Fill the cylinder with the mixed solution and carefully place the hydrometer in the cylinder. Determine the specific gravity by reading the hydrometer.
 - If the reading is too high, remove the hydrometer and pour the solution back into the bucket. Add a small amount of water to the bucket, restir and then recheck the specific gravity.
 - If the reading is too low, just add a small amount of highly concentrated salt solution or salt to the bucket,
5. Stir and recheck the specific gravity. Repeat step 4 until the desired specific gravity is reached.
6. Repeat with 3 batches of solutions at different specific densities (as per the chart above).
7. Place the solutions in a cooler overnight (your egg cooler is the perfect place!) and place lids on the cans to reduce contamination and evaporation.

Measuring the Specific Gravity of Your Eggs

The number of eggs to sample each time you measure specific gravity can vary depending on your goals. Typically a sample size of 100 eggs provides you with good data. If you are testing regularly (once a week is recommended) a sample size of 50 eggs should be sufficient)

When selecting your eggs to measure:

- Choose eggs that are laid at the same time of day, preferably in the morning. *Eggs laid in the afternoon tend to have higher specific gravity (thicker shells) than eggs laid in the morning.*
- Select freshly laid eggs. *It is best to measure specific gravity within 24 hours of egg collection.*
- Store eggs in the cooler until they are the same temperature as the salt solutions stored in the cooler.
- If you have more than one flock, ensure the eggs you are testing are from the same flock.
- Start measuring specific gravity when your undergrades typically start to increase.



To measure the specific gravity of your eggs:

1. Re-stir the salt solution and recheck their specific gravity before you conduct your measurements.
2. Carefully place 15-20 eggs into the plastic basket and lower them into a bucket containing only water (no salt). This solution is a pre-dip solution. Lift the basket out of the water and let it drip for 10-15 seconds.
3. Carefully lower the eggs into the first (lowest) specific gravity solution for about 15-20 seconds. Remove any eggs that float (break the surface and remain there) and place them in a plastic egg tray with the particular specific gravity marked on the tray.
4. Carefully raise the basket with the remaining eggs out of the bucket and let them drip for 10-15 seconds. Then place them in the next higher specific gravity solution (never skip solutions or go from a higher to a lower solution). Continue this procedure until all the eggs have been placed in their appropriate egg flats.
5. Reload the basket and continue until all the eggs have been tested.
6. Calculate and record the percentage of eggs in each specific gravity category. A simple chart can be used to record your measurements. Graph your data to help you understand trends.

Specific Gravity	1.070	1.080	1.090
# of Eggs			
% of Eggs			

7. Cover water solutions for use next time.

What Specific Gravity Can Tell You:

If you have high undergrades, you can measure your specific gravity and eggshell strength to determine if the problem is most likely occurring due to weak shells, or due to handling issues. A specific gravity of higher than 1.080 indicates that your eggshell strength is good, so cracks are likely taking place during handling or transport. Specific gravity of less than 1.080 indicates you may have an eggshell strength problem originating from your hens. You can speak to your veterinarian or nutritionist to get guidance on how to address these issues



Undergrades may be due to a nutrition problem.

Undergrades are more likely due to handling or transportation issues.

By regularly monitoring eggshell strength in addition to changes you make to your management, you can learn how different factors impact shell strength and manage accordingly. Factors that can impact egg shell quality:

- Ventilation
- Temperature
- Egg size
- Feed recipes
- Feeding times
- Bird health

Sources: <http://edis.ifas.ufl.edu/vm044>



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