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Natural Farming: Water-Soluble Calcium

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Calcium plays a very important role as a nutrient in regulating plant growth and development and must be available for uptake from the soil or other growing media. Several soil characteristics affect the availability of calcium to plants: soils with higher pH have higher levels of available calcium than acidic (lower-pH) soils; soils with a higher capacity to absorb or hold calcium will have more available calcium; the presence of excessive amounts of sodium, potassium, or magnesium in the soil interferes with calcium availability. Calcium can also react with other soil nutrients, such as phosphorus, to form insoluble compounds that cannot be used by plants. Calcium is commonly applied as a soil amendment in the form of ground limestone (calcium carbonate) or gypsum (calcium sulfate) (Hodges 2010). Water-soluble calcium (WCA) is an alternative to these commercial sources of calcium. This fact sheet addresses frequently asked questions about making WCA and its use in Natural Farming.

What Is WCA?

Water-soluble calcium is a source of available calcium that can be made from commonly used household items, eggshells and vinegar. When applied as a foliar spray, WCA provides available calcium to plants for normal cell processes, root growth, and fruiting (Hasenstein and Evans 1988, Marschner 1995, Hodges 2010).

Crushed eggshells, applied alone as a soil amendment, contain calcium in an insoluble form, calcium carbonate, which is not available for plant uptake unless it is ground very finely (Mitchell 2005). When eggshells are mixed with a weak acid, such as vinegar (3% acetic acid), the chemical reaction converts the calcium into an available form, also creating the byproducts carbon dioxide, which escapes as gas, and water.

In Natural Farming, WCA is applied as a foliar spray during the reproductive stage of a plant's growth cycle when setting fruit and vegetables are most vulnerable to blossom-end rot (Hodges 2010).

Table 1: Preparation of 1:1000 WCA Solution

Water volume	Amount of WCA (select ONE column only)		
	Kitchen utensils	Fluid ounces (fl oz)	Milliliters (ml)
½ gallon	⅓ tsp	0.06	2
1 gallon	¾ tsp	0.13	4
5 gallons	1¼ Tbsp	0.64	19
10 gallons	2½ Tbsp	1.28	38
25 gallons	little less than ½ c	3.2	95

How Is WCA Used?

WCA is commonly diluted with water (1:1,000 ratio) and applied as a foliar spray (see Table 1) to flowering and fruiting plants (including vegetables). The best times to spray are just after sundown or very early in the morning, to prevent leaf burn and to allow sufficient time for absorption before evaporation from the leaf surface. Use a light mist; do not spray so heavily that the solution drips from the foliage (run-off). Plants require adequate levels of calcium to support fruit yield and quality and to prevent blossom-end rot (Hao and Papadopoulos 2003, Taylor and Locascio 2004, Hodges 2010).

Seeds that are deficient in calcium generally have poor germination rates and produce abnormal, weak seedlings (Adams et al. 1993, Keiser and Mullen 1993). WCA is used in combination with other Natural Farming inputs including oriental herbal nutrient (OHN), fermented plant juice (FPJ), brown rice vinegar, and fish amino acid (FAA) as a seed-soaking solution prior to planting to improve seed germination and seedling vigor.

How to Make WCA

Collect eggshells (oyster or clam shells may also be used); remove the tough internal membrane from the inside of the shells.

1. Break the shells into small pieces (1/4").
2. Lightly roast or grill the shells in a frying pan or foil container over low heat for approximately 45 minutes to remove any organic substances that will rot and contaminate the WCA.
3. Shells should be dry and lightly burnt to a light tan color but not charred.
4. Slowly add roasted eggshells to a glass jar filled 2/3 full with brown rice vinegar at a 1:10 ratio by weight.

   The eggshell fragments will float up and down within the vinegar, emitting carbon dioxide bubbles, while the calcium is being dissolved into the solution.
5. Cover the mouth of the jar with breathable cloth, such as muslin, or paper (not plastic) and secure with rubber bands or ties to keep out pests. Place the jar in a cool, dark location for 7 to 10 days.
6. After this time, check if bubbles are present in the solution. If bubbles are not present, the WCA is "saturated" – proceed to step 8. If bubbles are present, add more roasted eggshells and let stand for 1 to 2 more days. Repeat until the solution stops producing bubbles.
7. Strain the vinegar-and-eggshell solution through a colander into a clean glass jar to remove eggshells. Label the WCA solution and store at room temperature out of direct sunlight.

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Figure 1. Collect any poultry eggshells (oyster and clam shells may also be used).

Figure 2. Remove inner egg membrane from the shell prior to roasting.

Figure 3. Roast crushed eggshells over low heat for 45 minutes until lightly browned but not charred to remove organic matter.

Figure 4. After roasted eggshells are added to brown rice vinegar (1:10 ratio by weight) in a glass jar, cover to keep pests out and store in a cool, dry spot out of direct sunlight for 7 to 10 days.