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Efficacy of Cork Granulates as a Top Coat Substrate Component for Seed Germination as Compared to Vermiculite

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Summary. A top coat is a lightweight substrate component used in seed germination. The seeds are typically placed on a substrate such as peat and then the seeds are covered with a layer of the top coating substrate. The top coat serves to maintain adequate moisture around the seeds and to exclude light. Vermiculite and cork granulates (1 mm) were used as top coat substrates for seed germination to determine if cork granulates could be successfully used as an alternative to vermiculite. The cork granulates had a bulk density of 0.16 g·cm^{-3}, which was higher than that of vermiculite that had a bulk density of 0.12 g·cm^{-3}. Cork granulates had an air-filled pore space of 22.7% (v/v), which was higher than vermiculite which was 13.2%. The water-holding capacity of vermiculite was 63.4% (v/v), which was higher than that of cork granulates that was 35.1%. Seeds of 'Rutgers Select' tomato (*Solanum lycopersicum*), 'Dazzler Lilac Splash' impatiens (*Impatiens walleriana*), 'Orbital Cardinal Red' geranium (*Pelargonium ×hortorum*), 'Better Belle' pepper (*Capsicum annuum*), and 'Cooler Grape' vinca (*Catharanthus roseus*) were placed on top of peat and covered with a 4-mm top coating of either vermiculite or cork granulates. For tomato, impatiens, and vinca, days to germination were similar between seeds germinated using vermiculite and granulated cork as a top coat. Days to germination of geranium and pepper were significantly different with geranium and pepper seeds coated with cork granulates germinating 0.7 and 1.5 days earlier than those coated with vermiculite. For tomato, impatiens, and geranium, the number of seeds germinating per plug tray was similar between the top coats. Number of seeds germinating per tray for pepper and vinca were significantly different. Pepper had an average of 2.8 more seeds germinating per tray, and vinca had an average of 2.4 more seeds germinating per tray if seeds were germinated using granulated cork vs. vermiculite. For all species, dry shoot and dry root weights were similar for seedlings germinated using cork and vermiculite top coats.

Vermiculite is a naturally occurring sheet silicate mineral, formed by hydrothermal alteration of minerals such as biotite and phlogopite (Brindley and Brown, 1980). Flakes of unprocessed vermiculite are mica-like and contain interlayer water within their structure. When the flakes are heated rapidly, above 870 °C, the water flashes into steam and the flakes expand into accordion-like particles. This process is called exfoliation, and the resulting material is lightweight, fire resistant with excellent insulating and absorption properties (Potter, 2000). Vermiculite has been widely used as a horticulture substrate component because of its lightweight and its capacity to hold water and mineral nutrients (Nelson, 1998). Most commonly, vermiculite has been blended with peat as a component to increase substrate water-holding capacity (Boodley and Sheldrake, 1977; Stamps and Evans, 1999). Additionally, vermiculite has been commonly used as a top coating material because it is sterile, holds significant water in its layers, and seedlings can easily emerge through it upon germination (Dana and Lerner, 2001). Walker et al. (1984) reported that watering was less frequent when a top coating was used in seed germination. A vermiculite top coat was also shown to prevent surface packing of the substrate, reduce the incidence of tipping over of seedlings, and increase the seedling rating as compared with no top coating (Walker, 1984).

Cork oak (*Quercus suber*), native to southwestern Europe and northwestern Africa, is a forest tree species grown in the Mediterranean basin countries, where it is exploited for cork production (Manzanera et al., 1993). Cork is produced by the cork cambium in the outer bark of the cork oak, and it is considered a natural and renewable raw product (Silva et al., 2005). Cork consists essentially of suberin, lignin, and cellulose (Kolattukudy, 1978) and also contains a small amount of fatty acids, terpenes, long chain aliphatic compounds, and saccharides (Pereira, 1988). These compounds give cork unique properties such as high elasticity and low permeability to liquids. Because of these physical properties, cork has a wide range of traditional applications, such as in green buildings and handicrafts, but cork stoppers for wine bottles remains the primary use and the highest value market (Silva et al., 2005). Waste cork from the cork-based products industry, low-quality cork, and virgin cork (rough and irregular cork bark coming from the cork tree the first time it is harvested) are all used to produce cork granulates (Gil, 2009). This granulated cork material, discarded and unsuitable for cork products production, can be used in a variety of applications and different task such as in industrial components, various fillers, insulators, or as compounds to be mixed with other materials.

Limited research has been reported regarding granulated cork in substrates. Bazzocchi and Giorgioni (1987) reported that nephthytis (*Syngonium*

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Units

To convert U.S. to SI, multiply by	U.S. unit	SI unit	To convert SI to U.S., multiply by
29.5735	fl oz	mL	0.0338
2.54	inch(es)	cm	0.3937
25.4	inch(es)	mm	0.0394
28,350	oz	mg	3.5274×10^{-5}
1.7300	oz/inch^3	g·cm^{-3}	0.5780
1	ppm	mg·L^{-1}	1
(°F – 32) ÷ 1.8	°F	°C	(°C × 1.8) + 32