Effect of a Static Uniform Magnetic Field on Lettuce Seed Germination Rate Monitored by Near Real-Time Imaging

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All living organisms, including plants, have evolved under the influence of the naturally occurring geomagnetic field (GMF). Numerous studies have described the biological effects of magnetic fields (MFs) on plant life (Pittman, 1972; Rochalska, 2005; Vashisth, 2008). However, surveys of publications on MF effects on plant seeds reveal a number of contradictory reports, with few successful independent replication studies (Maffei, 2014). The objectives of this study were to (1) experimentally assess the effects of a strong, static, uniform magnetic field on the germination speed of Lactuca sativa (lettuce) seeds and (2) establish and validate a high-resolution, near real-time image-capture setup for detecting seed germination time and monitoring early growth. The hypothesis was that lettuce seeds treated with a static uniform magnetic field (stronger than the GMF) would germinate faster than untreated seeds. In total, 1008 lettuce seeds were observed over 1152 hours using 9216 images. An image-processing algorithm for detecting seed germination time was successfully developed. The algorithm enabled detection of newly germinated seeds with radicles as small as 0.01 mm in length, a significant improvement over the 1–2 mm threshold reported in the literature (Maffei, 2014). A detection time accuracy of 15 minutes was demonstrated. Experimental results showed that seeds treated with a static uniform magnetic field germinate faster than untreated (control) seeds. On average, treated seeds germinated 1.21 hours earlier (13.13%) than untreated seeds in trial 1 (83 Gauss) and 0.75 hours earlier (8.65%) in trial 2 (55 Gauss).

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