TEMPERATURE AND LIGHT REQUIREMENTS FOR PALMER AMARANTH SEED GERMINATION WITH AFTER-RIPENING

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Abstract

Experiments were conducted on seeds collected in 2004 and 2006 from a natural population of Palmer amaranth near Pendleton, SC, to determine the temperature and light requirements for germination of seeds on the soil surface or buried over a 12-month period in the field. Germination of seeds in response to temperature and light varied over the 12-month period. Freshly matured seeds collected in November required constant and fluctuating temperature regimes of 25 to 40 C and 17.5/32.5 to 27.5/42.5 C, respectively, and natural or red (R) light for increased germination. Following after-ripening in the winter, seeds experienced a reduction in dormancy in February and displayed an average of 30% higher germination at mean temperatures ranging from 25 to 35 C. With after-ripening for an additional 3 months, seeds had the ability to germinate to a similar percentage across all evaluated constant and fluctuating temperatures; however, germination in natural light or R light was more than twice that in the absence of light and far-red (FR) light inhibited germination. Fluctuating temperatures improved germination during the after-ripening period, except in summer and fall (9- and 12-mo after maturation). Germination by fall was at least 50% higher in seeds retrieved from the soil surface when compared to those exhumed from a 10-cm depth, implying that burial for 3 to 6 mo induced dormancy in seeds. In addition, exposure of seeds to high after-ripening temperatures during the summer caused secondary dormancy induction. Averaged across temperature amplitudes, seeds had higher germination at 25 to 40 C. After-ripened seeds required exposure to R or natural light for higher germination in fall, whereas, exposures to FR light or darkness inhibited germination. The effect of R and FR light was reversible, indicating Palmer amaranth germination was at least partially a phytochrome-mediated response. It is concluded that Palmer amaranth seeds undergo changes in temperature and light requirements for germination with after-ripening.