Disinfecting seeds with hydrogen peroxide

Back in the July 1994 issue of FNN, we talked about using household laundry bleach as a nursery disinfectant. The practical benefits of bleach are that it is inexpensive, safe to use, and available around the world. Also, since it is not considered to be a pesticide, bleach has fewer restrictions on its use than other products. Hydrogen peroxide (H202) is another common household product that can be used to control pathogens around the nursery. Since it shares the same practical benefits as bleach, H202 is an ideal candidate for your IPM program. Actually, H202 is superior to bleach in that it breaks down into oxygen and water and so leaves no toxic residue. Because of its strong oxidizing properties, however, H20z can be used to disinfect tools or surfaces around the nursery, but has most widely been used to surface sterilize seeds. (Table 9) H20z is commercially available in 30% and 3% solutions and both have been used in forest and conservation nurseries. A 40-minute soak in 30% HZOZ virtually eliminated all seedborne organisms on Douglas-fir seeds, and also was effective on southern pines with

Table 9. A 4-hour soak in 3% hydrogen peroxide (H202) cleansed seed coats of Fusarium spp. without adversely affecting germination of these Douglas-fir seeds

	Greenhouse Germination (%)	
Douglas-fir Seedlot Number	Control	3% H_2O_2 for 4 h
424	80.0	78.3
479	78.3	81.7
501	87.2	96.1
510	90.6	94.4
1262	79.4	78.9
1270	80.0	85.0
1292	70.6	68.9
4532	63.3	58.3
4605	71.7	64.4
31902	96.1	92.8
Average	79.7	79.9

treatment times ranging from 15 minutes to 1 hour. In particular, longleaf pine seeds are infested with pathogenic fungi. So, the North Carolina Claridge State Nursery operationally soaks their longleaf pine seeds in 30% H_2O_2 to reduce fungal contamination. The procedure is as follows: seed lots of 9 to 11 kg (20 to 25 lbs) are placed in porous nylon mesh bags and soaked for 55 minutes in the H_2O_2 solution at 24 °C (75 °F). Then, the bags are drained and triple rinsed in clean water before being allowed to surface dry.

The more common antiseptic grade of 3% H_2O_2 **(Fig. 7)** is less caustic than the laboratory grade chemical and therefore safer to use. Recent operational trials in British Columbia found that a 4-hour treatment with 3% H_2O_2 was quite effective in reducing seedborne pathogens on seeds of three commercial conifers. For example, seeds from ten coastal Douglas-fir seedlots that were known to be infested with Fusarium spp. were selected for a test. Following normal cold-moist stratification, the lots were soaked in one of four different H_2O_2 solutions (0, 1 and 3%) for one of three treatment intervals (1, 4 and 16 hours). Then, the treated seeds were rinsed in running water, surface-dried and cultured on selective media. After 10 to 14 days, the culture plates were rated for growth of *Fusarium*. All of the 16-hour treatments were too caustic and resulted in seedcoat damage with decreased germination. However, the 4-hour soak in 3% H_2O_2 was consistently effective in removing Fusarium from the seed coats **(Fig. 8)** without

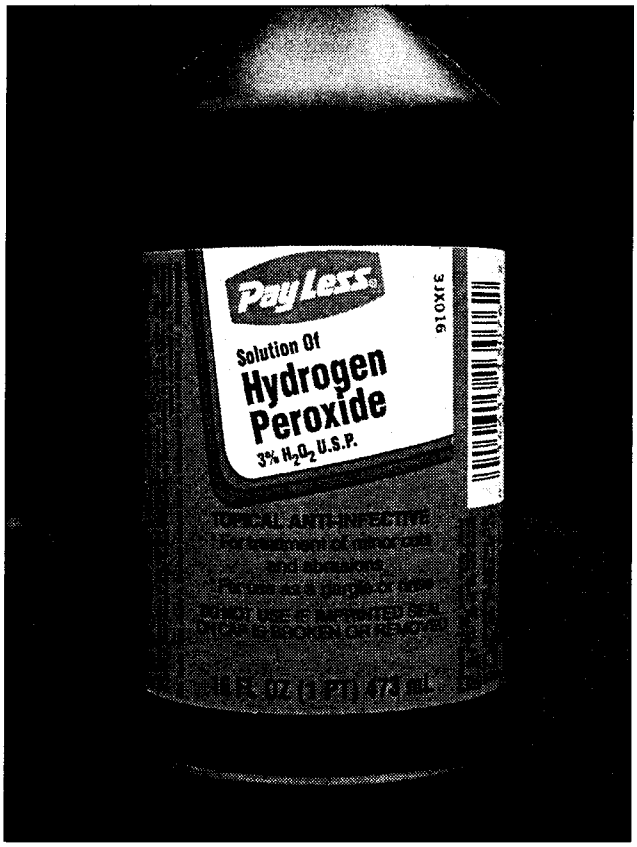

Figure 7. The common medicinal disinfectant hydrogen peroxide is a 3% solution

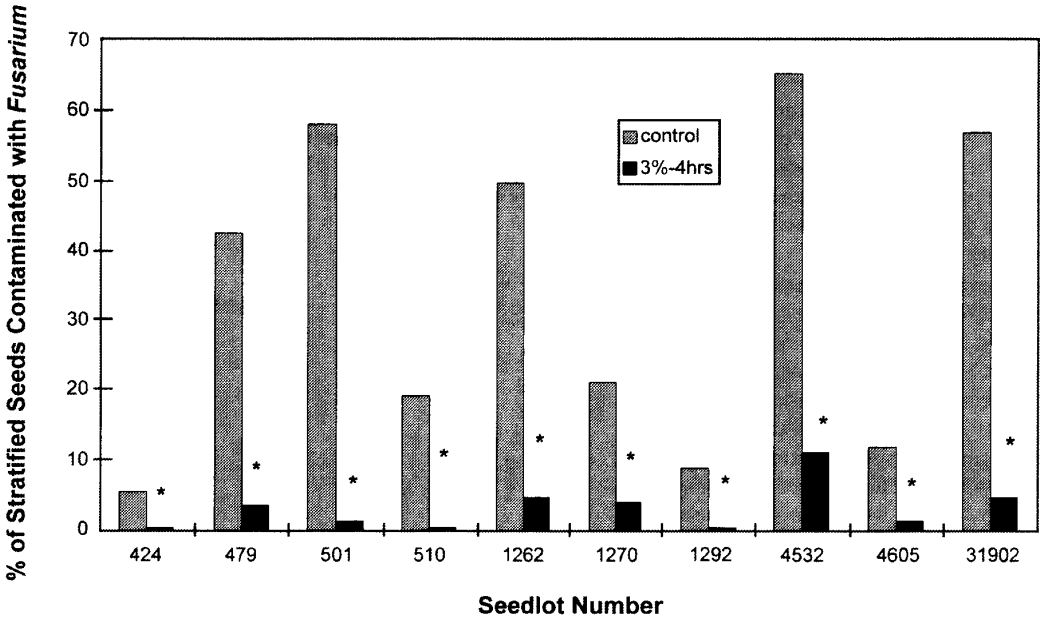

Figure 8. A soak in 3% hydrogen peroxide solution for 4 hours significantly reduced the incidence of the pathogenic fungi, *Fusarium* spp., on these Douglas-fir seeds (from Neumann and others 1997)

reducing germination in the greenhouse (Table 9). Results were just as good for western larch seeds but those of subalpine fir were more sensitive as greenhouse germination was significantly reduced after the 4-hour/ 3% H_2O_2 treatment. This would be expected because seeds of Abies spp. have thinner seed coats than most other commercial conifers. However, the 1-hour/3% H_2O_2 treatment gave reasonably good control without significantly reducing germination.

In addition to effectively sterilizing seed coats, H_2O_2 has been found to increase germination of some pine seeds because it softens their seedcoats and increases permeability to water and oxygen. This was found to be the case in the North Carolina nursery where better seed germination increased longleaf pine seedling density by about 10% after the 30% H_2O_2 treatment. I'm not aware of any test results with 3% H_2O_2 but the beneficial germination effect should be the same once the proper treatment time has been worked out.

Hydrogen peroxide seed treatments should be evaluated for other forest and conservation seeds, not only as a seed disinfectant but also for the potential increase in germination. However, because of variation in seed coat thickness, the choice of 3% or 30% H_2O_2 and the best treatment time will have to be determined on a species by species basis. Nevertheless, H_2O_2 has tremendous potential as a relatively safe chemical to add to your IPM arsenal.

Sources:

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