Temperature/Relative Humidity Trials on Harvested Nuts: Field collected, undried walnuts were placed in moist chambers with 15 different combinations of relative humidity and temperature. The nuts were observed at regular intervals up to three weeks for mold development. Temperatures used were 15°C, 21°C and 27°C and relative humidities were 100, 95, 90, 85 and 80%. By the second day of incubation, a low percentage of nuts (6%, 7%, 12%) appeared moldy at the high RH-high temperature regimes (100% RH at 21°C and 27°C, and 95% RH at 27°C). By the fourth day at 27°C-100% RH, 100% of these nuts were moldy. Mold formed on some nuts at all temperature-RH combinations except at the 80% RH and 27°C and 21°C combinations. It also did not occur at the low temperature (15°C)-low RH combinations (80, 85, 90% RH).

These results indicate that there is a two day safety period before nuts begin to mold at most temperature-RH regimes. In short, high temperatures of around 27°C favor mold development regardless of RH in the 80-100% range. However, mold development is much less at 15 and 21°C at this humidity range.

Variety Trials: Four varieties were tested to determine the amount of kernel colonization in nuts that mature at different times. Ashley (early harvest), Serr (early harvest), Tehema (mid harvest) and Hartley (mid to late harvest) varieties were collected from the same orchard at three times near harvest. On September 5, 0% of the Serrs and 20% of the Ashleys were colonized. No Tehemas or Hartleys were collected at this date. On September 24, the Serrs, Ashleys and Tehemas were all around 60% colonized, while the Hartleys were 40%. On October 7, the Serrs and Ashleys had reached 100% colonization, while the Tehemas were 88% and the Hartleys were 73%. Thus, the longer the nuts remain on the trees, the greater percentage will become infected. There was no apparent difference in the susceptibility of the varieties to mold infection.

Fungal Colonization of Growing and Maturing Nuts: Further work was performed in 1980 to pinpoint the infection pathway of mold-causing fungi. Specific areas of the hull were inoculated separately. The blossom end, the pedicel end, and the side were inoculated with sport suspensions of Aspergillus, Penicillium, Alternaria and Cladosporium with a paint brush. Plots were made in July, August and September. Five samples were taken during the growing season and at harvest. Key findings were:

1) Overall colonization of the kernel and/or vascular tissue increased in untreated nuts from 0% (Aug 19) to 48% (Sept 16) to 87% (Oct 7). Penicillium accounted for 0%, 20% and 70% of the moldy nuts, respectively.

2) Overall hull colonization of untreated nuts were as follows: the stem end increased from 30% (Aug 19) to 40% (Sept 16) to 100% (Oct 7). Colonization of the blossom end went from 40% to 30% to 90%. Fungi colonized the hull sections at 3% to 30% to 75% in the same time period. Penicillium accounted for 0% to 20% to 46% of total fungi in the stem end. Counts of Penicillium from the blossom end increased from 0% to 13% to 53%. The hull section increased from 0% to 8% to 31%.

3) The % kernel or vascular tissue colonized by Penicillium with Penicillium-inoculated nuts rose from 2% (Aug 19) to 21% (Sept 16) to 87% (Oct 7).