

Sensitivity of Radicchio to External Ethylene and Decay Pathogens

Ana Maria Hernandez, M. Cantwell, and T. Suslow, Department of Vegetable Crops, UCD

Radicchio (*Cichorium intybus* var. *foliosum*) is an increasingly popular salad vegetable in the United States. The red-leafed, head-forming variety of Italian chicory, Radicchio di Chioggia, has become a common component of bulk and bagged salad mix products. It is valued for its bright, reddish-purple leaves with contrasting white ribs, and mildly bitter flavor. Recently, two storage and distribution disorders have been a reoccurring problem for suppliers and shippers of radicchio. It has been observed that mixed cold storage of radicchio with ethylene producing commodities, such as apples, increases decay of radicchio to an unacceptable level. Extensive trimming of affected outer leaves can be so serious as to render the stored product a complete loss, even at holding temperatures of 2°C (35.6°F). A second observation has been a sporadic, high incidence of severe decay of radicchio heads on or shortly after arrival at receiver's docks. Holding temperatures were as high as 10°C (50°F).

No publicly available information regarding ethylene-induced susceptibility to disease for radicchio could be located. In addition, information on respiration rates and ethylene production rates for red head radicchio did not appear to be publicly available. Therefore, we undertook a preliminary evaluation of the handling issues for radicchio.

Methods

Briefly, two radicchio heads were placed in replicated, 6L glass containers with a humidified airflow with and without 10ppm ethylene in the airstream. We had previously measured background ambient ethylene concentrations of 8-12ppm in a commercial, mixed apple, short-term cold storage facility. The radicchio were held at either 7.5°C (45°F) or 20°C (68°F) to accelerate ethylene and decay interactions. Respiration rate was measured, every 24hr for eight days, as production of CO₂ from a flowing system. Ethylene evolution was measured daily for three days. Overall Visual Quality and Decay Incidence and Severity were evaluated at 4 and 10 days.

Results

Measured respiration rates under these conditions were approximately 25 ml/kg-hr at 20°C (68°F) and

12 ml/kg-hr at 7.5°C (45°F). Storage with 10ppm ethylene did not significantly affect respiration rate under these conditions. Ethylene production was 0.6 to 1.0 µl/kg-hr at 20°C (68°F).

Fungal decay incidence and severity did increase slightly in an airflow containing 10 ppm ethylene at both temperatures. The impact of temperature on disease onset and severity completely overshadowed the minor effects of exogenous ethylene, within the timeframe of the preliminary experiment. Within five days of storage at 20°C (68°F), all radicchio heads were severely decayed externally and internally. The predominant pathogen recovered from early leaf margin decay was *Botrytis cinerea* and to a lesser extent *Cladosporium* spp. and *Alternaria* spp. Isolations from commercial shipments of radicchio with high frequency of decay on arrival were predominated by recovery of *B. cinerea* and pectolytic (soft-rotting) *Pseudomonas* bacteria. At lower temperatures, 1 to 3°C (34 to 37°F), the progress of *B. cinerea* is slower and outer leaves may be removed prior to immediate use, under many circumstances.

It was readily apparent that some commercial shipments had a high frequency of bacterial decay, even at low storage temperatures, due to the extensive damage during harvest operations. Many radicchio heads were undercut across the leaf base creating severe wounding and multiple infection sites.

Inoculation of radicchio tissue with pure cultures of pectolytic bacteria, obtained from this tissue, in combination with 10ppm ethylene in an airstream did not result in increased decay severity or increased susceptibility to the pathogen compared to air alone.

One significant effect of exogenous ethylene on radicchio quality was the clear stimulation of pigment development in the white ribbing of the leaves. At both temperatures a deep purple-pink pigmentation develop in those radicchio heads exposed to 10ppm ethylene.

Recommendations

- Harvest radicchio by careful undercutting with a small amount of root-stub tissue attached to reduce decay promoting tissue damage.
- Store radicchio at optimal temperatures and humidity.

- Avoid storage of radicchio with ethylene generating commodities or environments.
-