

STORAGE OF CUTTING WOOD PRIOR TO STICKING

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This topic has been reported in many of our *Proceedings* as well as *The Plant Propagator*. In addition, many published papers allude to cutting storage, relative humidity, temperature, and duration. I will discuss Zelenka Nursery's experience regarding the storage of *Juniperus*, *Taxus*, and *Thuja* cutting wood. I will also comment on some of the published data that enabled our nursery to warrant R&D testing and eventually establish an accepted production practice.

The phrase "carbohydrate-reserves" was capably explained by Sid Waxman (12) at our 1962 meeting in Cincinnati. He was discussing the taking of *Taxus* wood prior to the rest (dormancy) in the buds being completely broken. At this same meeting, Ray Halward (6) advised us to store dormant scionwood at 2 to 5 °C (35 to 40 °F) with high humidity. He commented that without sufficient humidity this technique will not be successful. At our Newport, Rhode Island meeting in 1966, Jim Law read Darrell Holmes' (7) paper discussing storing *Juniperus* wood for "several days", and dormant deciduous wood from October to April. The following year in Mobile, Alabama, during a question period, Vince Bailey (1) discussed refrigeration of conifer cutting wood over-winter, and sticking the cuttings in April. This fine nursery has been using this practice since the mid-1950s.

The one paper that I can so vividly recall was the one presented by Dick Cross from Minnesota (4) in 1971 at Norfolk. I can still hear his words stating that never again will he go to the field with brooms to sweep the snow away from stock plants. He would collect about 30 bushels of cutting/scion wood and place them in his root cellar. He cautioned all of us to have the wood dry to avoid mold. This was a great paper and those of us who have waded in snow up to our knees were very sympathetic to this great propagator's words.

A dynamic paper relative to this topic was presented in 1977 by D. H. Simons (10) from the Australian Region. He stressed that the major function of storage is to avoid change or to slow down cell deterioration. Since cutting wood has no root system, it is extremely susceptible to water loss. This paper helped me to understand, somewhat, the conversion of starch to sugar at low storage temperatures as in the case of Irish potato and the complete reverse of this phenomenon with sweet potato. When I asked him how

much time is required for the conversion, he surmised, “slowly over prolonged storage periods”. I want to believe that this conversion contributes to higher rooting percentages when we stick properly stored cutting wood.

When we met for the second time in Toronto in 1978, the Graduate Student Award paper presented by Barry Eisenberg (5) covered this topic. Granted, he discussed the merits of LP (low pressure) and RF (refrigerated storage), but I am certain that Sid Waxman would agree that the physiology is comparable. The following year, in St. Louis (1979), my good friend Dave Bakker (2) discussed freezing bareroot liners, cautioning all of us to maintain high humidity or we would have serious storage problems. This comment was repeated in 1980 by my mentor, Hugh Steavenson (11), who commented how important the Bahnson humidifier was in his storage facility. This humidity factor was mentioned by Shugert (9) in 1982 and by Richey (8) in 1986.

A 1984 paper presented by Volker Behrens (3) from West Germany, discussed the storing of ten coniferous species/cultivars at four temperature regimes and, at 2°C (34°F), had a high reduction of sugars. Strangely this paper did not reference humidity.

I would be remiss not mentioning jacketed storage often used by our G.B. & I. members. Many of us saw this for the first time in August, 1973, when we followed Jim Wells on our pilgrimage to the United Kingdom. Some of us in the room this morning also saw the jacketed cold store at Nick Dunn's nursery in August of this year on the G.B. & I. tour. This storage tool holds the temperature at a constant 0 to 1°C, and is used for cutting wood and understocks. I suspect a few people in the room this morning have had jacketed cold store experience.

I shall now explain the Zelenka Nursery practice for the storage of unrooted cuttings of *Juniperus*, *Taxus*, and *Thuja*.

As I earlier commented, at our nursery we mandate that an R&D project must proceed for three years before we can change an accepted Zelenka Nursery practice. I serve as the R&D Department, and some of my projects were such dismal failures they didn't require the second and third year test. Happily, R&D No. 86-2—“Storage of *Taxus* cutting wood” was successful.

The large quantity of wood needed is predicated on our nursery's production plan. Wood is required for our contract grower for sales, and for “insurance cuttings”. Due to the above cutting wood requirements, in 1989 we collected wood for one million *Juniperus*, 1-1/2 million *Thuja*, and 5 million *Taxus*. Of the above total, half will be stuck by our contract grower and half by Zelenka's head propagator.

Timing of taking the cuttings is not a major concern of mine. I was taught, over two score years ago, that coniferous evergreens must have several hard frosts prior to taking cuttings. This is wrong! In 1955, Hugh Steavenson and I, in Elsberry, Missouri, took *Taxus* cuttings in September, stuck them in ground beds and transplanted the following September. I am glad that Hugh and I did not read the book! A charter member of our Society, Dick Filmore, guided us on this procedure since none of us had any asexual propagation experience. Therefore, frost “hardening-off”, etc. is not a primary concern. We start with *Juniperus* in late September, with a completion date of mid-October. This cutting wood comes entirely from container-grown plants, so there is close communication between the Propagator, the Container Cultural Manager, and the Quality Inventory Control Department. These folks exchange pleasantries often during this three-week period. The *Taxus* and *Thuja* wood is harvested from field-grown plants and *Thuja* windbreaks, beginning in mid-October and is completed by mid-November. We were about a week late this year (1989), due to an unseasonable winter blizzard bringing snow, ice, and high winds.

We handle all wood from the three genera the same. Harvest is with hand shears, and on occasion some *Taxus* are harvested with a modified combine. The cutting wood is loosely placed in slotted pallet boxes to allow air circulation, and the pallets go into refrigerated storage (34 to 36 °F) with 90% humidity provided by the Bahnson humidifier. In my opinion, humidity is the key to this storage technique. I say this since several years we rented storage space from a perennial grower neighbor who carries his humidity about 40%, and we had desiccated cutting wood. Another fascinating feature of this storage, which possibly goes back to starch/sugar conversion, is that if you take *Taxus* ‘Hunnewelliana’ cutting wood, showing some brown winter needle color, after about three weeks the foliage is green again! The humidity factor also enters the picture when we recall earlier research, Simons (10), reminding us that cutting wood is susceptible to water loss since the root system is absent.

I have been asked how long wood can be held under these conditions—we have stored for seven months. The earlier mention of “insurance cutting wood” enters into the picture at this point. Assume, heaven forbid, that a catastrophe occurred such as a thermostat malfunctioning and a bench of cuttings burns up in February. With wood in the humidified refrigeration, you would have time to restick that bench and not lose one year of production time. Any “insurance” *Taxus* wood remaining is utilized by sticking one ground bed polyhouse in mid-March, and the balance in mid-to late- April. This technique has been used for many years by

propagators in Lake County, Ohio. You will hear the phrase “twelve month” *Taxus* used with this practice.

In review, and contrary to propagation textbooks of another decade, *Juniperus*, *Taxus* and *Thuja* wood CAN be harvested prior to hard frosts, CAN be stuck without stripping basal foliage, and CAN be stored for a considerable amount of time. Obviously, any wood under stress, water related/nutritional problems/disease, is going to present problems. I firmly believe that the key is humidity, and if you try this practice at your nursery try to maintain humidity levels of 90%.

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CHARLES HILDEBRANT: Have you done any work with an anti-desiccant in your storage?

RALPH SHUGERT: No. I have had many years of anti-desiccant use in field studies and none of them have been satisfactory.

WAYNE LOVELACE: My question is in reference to your stated lack of a cold period on taxus. At Forrest Kealing Nursery we use basically the same technique, except we feel we are getting the cold period in the cold house. Do you feel that you are getting that cold treatment in storage?

RALPH SHUGERT: I think the key for the grower is that it eliminates the need to collect frozen wood. I do not know the answer to your question but there may be a starch-sugar conversion at the cold temperature. I think there is a need for a cold period but there may also be a different effect.

GARY RITCHIE: We root a lot of Douglas fir cuttings out west. When we experimented with different temperatures we found that -1 °C extended our storage life dramatically. Mold colonization is also prevented. Cold storage may be satisfying the chilling requirement for bud dormancy and therefore satisfying the need for a cold requirement present before taking the cutting. We have found that with early winter cuttings the longer the storage the better they root, up to a point.

RALPH SHUGERT: Did you have the same humidity at the various temperatures?

GARY RITCHIE: Yes, it was probably close to 100% because we placed the cuttings into clear plastic bags and each contained a large block of saturated Oasis material.