

Goji Berry Production 2009

Submitted by Norma Wilson

Growing the goji berry to supply the U.S. health food market has the potential to improve the economic sustainability of small farms while providing a safe food product to the public. The vast majority of goji berries are produced in China where pesticide use and food safety are far less regulated than in the United States. Growers in the U.S. could supply the health food market with nutrient packed, high quality, and locally grown goji berries. These fruit are a high value horticulture crop that can be produced on small acreage farms. As a new unproven crop, very little information is available concerning production, post harvest care, marketing and the financial costs required to get started. Finding sources of plant material has been one the biggest challenges in establishing goji berry production in the United States. Goji berry plants are available for sale in a few specialty plant nursery catalogs but the retail price for a few plants is not practical for commercial establishment. Evaluating the best propagation practices to get a small farmer started in goji berry production is the primary goal of the first year of this project. More data on how to successfully root cuttings and establish these plants in the field will help growers around the country get started on a path to economic and environmental sustainability. We hope to determine how the plants establish in the field as well as how hardy they are in our local growing conditions.

2009 Growing Season – Getting Started with Gojis

Overall, I would characterize this past growing season as a success. A good deal of this process has been learning how much we actually don't know and what we need to learn about these plants. When is the optimal rooting period of this plant? Indications are that semi-soft wood roots the best and that targeting the early part of the growing season will yield the best results.

Securing sufficient quantity of cuttings was a challenge this year. Communication and logistic issues complicated the transfer of cuttings from Virginia Tech in Blacksburg, VA to Lovettsville, VA. Due to this problem, cuttings were taken June 17th, August 1st, and September 8th. Even though the number of cuttings was less than what was originally planned, there were still a lot of interesting data collected and observations made during the 2009 growing season.

25 cuttings of *Lycium chinense* were delivered on June 17th from Dr. Welbaum at Virginia Tech. An additional 15 cuttings were taken from *L. chinense* plants rooted at my farm in 2008. These tip cuttings were taken from current season growth. The average cutting length was 14.2 cm. There were mechanical issues with the large aeroponics chamber and so the smaller, bench top (professional model) was used. This aeroponics chamber was more than adequate for the 40 cuttings to fit in the allotted rooting spaces. Aeroponics is a form of hydroponics which uses a nutrient and water mist to root cuttings.

Aeroponic Bench Top Unit Professional Model

These cuttings were evaluated July 21st, 2009. Cutting length was measured and the number of roots that formed was counted. Adequate roots definitely formed within 27 days. Rooting was fairly successful with 60% of the cuttings rooting. 27.5% of the cuttings taken in June died. 12.5% of the cuttings did not form roots, but were still alive. The cuttings that had rooted as well as the cuttings that were still alive without roots were then transplanted into 4" plastic pots containing my media mix (worm castings, woodchips, and soil mixture) and placed in the greenhouse. These transplants were observed on August 28th, 2009. Data was collected on transplant mortality. Overall the June transplants leafed out well, and some even bloomed and fruited within a month of rooting. Data on all cuttings and transplants is compiled in Table 1 and Table 2.

Successfully transplanted cuttings taken 06-17-09

Table 1: Comparison of cutting length (cm), rooting success, mortality and root number between cuttings taken in June, August and September of 2009.

Cuttings taken	Total #	Mean Cutting Length (cm)	% rooted	% alive/no roots	% dead	Mean root #
June 17	40	14.2	60.0%	12.5%	27.5%	7.9
August 1	40	6.3	55.0%	22.5%	22.5%	3.7
September 8	150	9.5	36.0%	10.0%	54.0%	3.4

There were no cuttings available in July. 40 cuttings from my 2008 stock plants were taken on August 1st and placed in the bench top aeroponics chamber. These cuttings were tip cuttings taken from growth initiated earlier in the same growing season. The growth was more mature compared to the June cuttings. The cutting length was shorter with an average of 6.3 cm. Successful rooting was slightly lower at 55% of cuttings forming roots. 22.5% of cuttings died, while 22.5% were still alive but failed to form roots. 31 cuttings were transplanted to the greenhouse on August 28th, 2009. These transplants by October 13th were mostly dead. Only 22.6% or 7 total transplants were still alive. This was perhaps one of the biggest surprises during the growing season. The low survival rate of the transplants may indicate that cuttings taken earlier in the growing season perform better.

Table 2: Evaluation of mortality of transplants derived from cuttings taken in June and August of 2009.

Cuttings Taken	Total # of transplants 7/21/09	% Alive 8/28/09	% Dead 8/28/09	Total # of Transplants 8/28/09	% Alive 10/13/09	% Dead 10/13/09	Total # of Transplants 10/13/09
June 17	29	75.9%	24.1%	29	69.0%	31.0%	
August 1				31	22.6%	77.4%	
September 8							69

To the Left: Cuttings taken in August did not fare well when transplanted to the greenhouse.

To the Right: Goji flower and berry. Bloom is typical of the *Solanaceae*.

On September 8th, 150 cuttings were taken from my 2008 stock plants. I decided to vastly increase the number of cuttings to ensure that I had adequate plant material to work with in the future. These cuttings were definitely from more mature growth including some from hard wood. They were also taken from multiple positions on the stems, some were tips and some were from farther down the shoot. During the rooting process, there was some question that location within the chamber may affect rooting. Data was collected on cutting position. Chamber position as well as cutting length and root number was evaluated. There does not appear to be a connection between the position of the cutting in the aeroponics chamber and the rooting ability or mortality of the cuttings.

Figure 1 is chart comparing cutting position in the rooting chamber with the percent of rooted cuttings, cuttings that did not root but were still alive and dead cuttings. On October 13th, cuttings were evaluated and transplanted to the greenhouse. The mortality of the September cuttings was higher, with 54.0% dead. Only 36% rooted successfully. 10% of the cuttings were still alive but did not form roots. In total, 69 cuttings were transplanted to the greenhouse. These transplants were not able to be evaluated for survival this growing season. There was not much time after they were transplanted before they went dormant, not allowing for a good determination on growth. October cuttings were not attempted because the greenhouse is unheated and transplants would not have time to adapt before cold weather began.

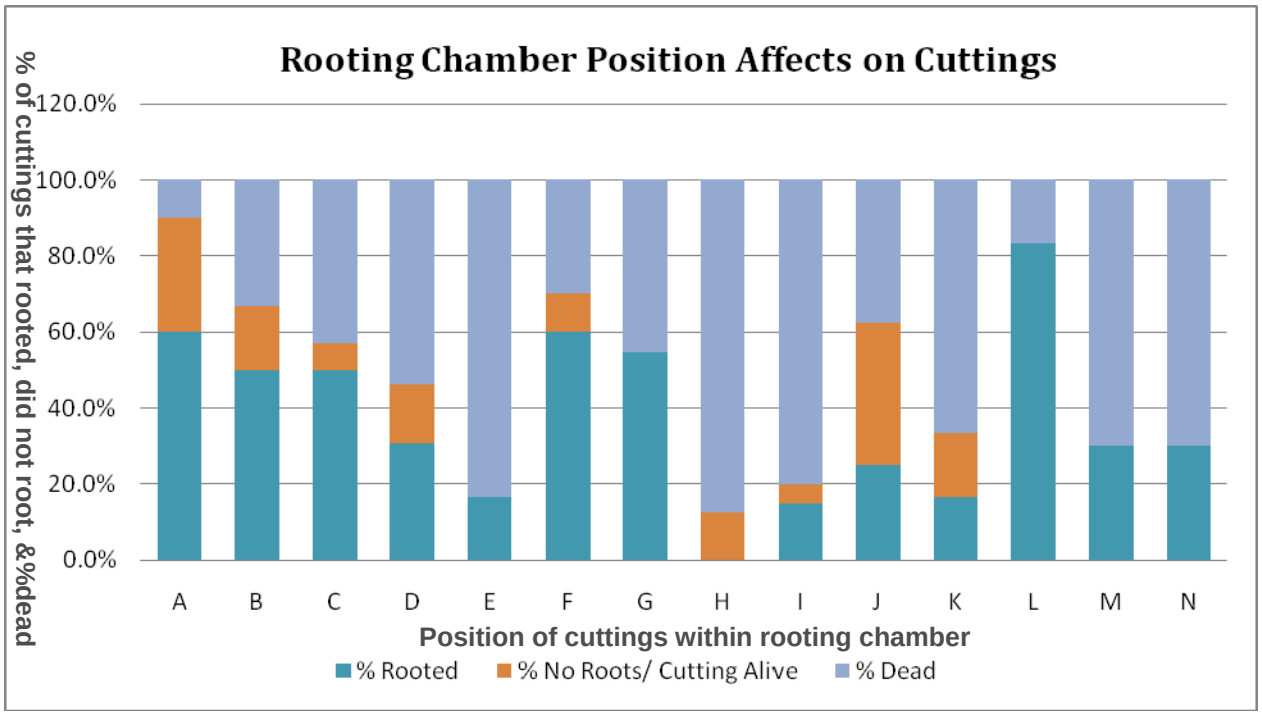

Figure 1: Comparison of cutting position within aeroponic rooting chamber and rooting ability of cuttings taken in September. No significant relationship between position and rooted, dead or non-rooted cuttings was determined.

Table 3: Comparison of the impacts of mean cutting length (cm) and mean root number on the mortality of greenhouse transplants of cuttings derived in June and August. Letters denote significant differences (at α =.10) between the mean cutting length and mean root # of successful and failed transplants.

Cutting Characteristics	Transplant Status	JUNE Cuttings	AUGUST Cuttings
Mean Cutting Length (cm)	ALIVE	14.9[a]	6.8[a]
Mean Cutting Length (cm)	DEAD	12.5[a]	6.1[a]
Mean Root #	ALIVE	7.2[b]	4.4[b]
Mean Root #	DEAD	9.7[b]	3.6[c]

(F-test, α= 0.10)

In Table 3, the mortality of transplanted cuttings from June and August are compared by examining the impacts of cutting length and root number. The mean cutting length of cuttings made in June that were still alive was 14.9 cm while the mean cutting length of transplants that died was 12.5 cm. Using an F-test, these values were not found to be significantly different (p = 0.13). The mean number of roots on successful transplants was 7.2 while the mean number of roots on the June cuttings that died when transplanted was 9.7. These values were also found to not be significantly different (p=0.91). August cuttings which had a higher mortality rate than the June cuttings showed somewhat different results. Mean cutting length of cuttings that died once transplanted was 6.1 cm while successful transplants had a mean cutting length of 6.8cm. These values were also not significantly different (p=0.26). Mean root number of dead transplants was 4.4 while successful transplants had a mean root number of 3.6. This was found to be significant at α = 0.10 level (p=0.07). These findings are really basic. Continuing this data set to encompass the overwintering ability of the transplants is necessary to determine optimal propagation. Gathering more data this growing season on seedlings will also help to improve the analysis process.

Fruit hanging on a cutting rooted the previous growing season (spring 2008)

Rooted cutting from June 2009. Extra vigorous transplant with a newly produced basal shoot.

My plan for this upcoming growing season is to repeat part of the rooting and transplanting aspects of this project. In addition to moving the 2009 transplants to the field, I have plans to take cuttings the first of May (early spring, as soon as new growth is adequate). I will have sufficient plant material from my own stock plants to supply my cutting requirement. I think that cutting length does have some impact on the rooting ability of a cutting. There is an optimal cutting length, likely between 8-14cm (3-5.5 inches). The minimum cutting length should be 8cm. I think these are numbers to work with due to the observations I have made this past summer. Hopefully with more data, I will be able to support this hypothesis.

I look forward to the field day planned for this summer. I have tentatively scheduled this for the beginning of August. Before the growing season kicks off, I am working on the marketing sheets to share the nutritional benefits of the goji berries with consumers (to help farmers market their own berries). I have found a couple of new goji berry growers on the internet and would like to interview them on their own production systems. Networking with other producers is essential to improving your own production.

Galls on the leaves of a greenhouse transplant.

Flea Beetle damage (holes in leaves)

I did have two pest issues on my greenhouse goji plants that I plan on investigating and managing this upcoming season. Flea beetles were a real pain and ate holes in the leaves. The threshold for these pests on goji appears to be fairly high. Another problem was galls on the new leaves of the transplants. I am not sure what the cause of this was, but plan on sending samples to the Virginia Tech Plant Disease Clinic to get an analysis done this year (assuming it happens again). I was glad to not have any aphid issues on the plants.

Evaluating the survival of the transplants after a cold winter will be done as soon as spring finally arrives (March hopefully?). Stayed tuned for the 2010 Goji Adventure!