

Medicinal Herb Seed and Seedling Rootlet Production
FNE07-599
Sustainable Agriculture Research & Education Program (SARE)
Final Report

David C. Carman
215 Haw Pond Farm Rd.
Princeton, WV 24740 - 6741
(304) 384-9147

Goals

The primary objective of this research was to determine whether Virginia snakeroot (*Aristolochia serpentaria* L.) and fairywand [*Chamaelirium luteum* (L.) Gray] would respond favorably to the incorporation of different rates of humus (0, 1, 2 lb/ft² = 0, 22, 44 tons/acre) and bonemeal (0, 2, 4, oz/ft² = 0, 2.7, 5.4 tons/acre) in order to maximize plant development and root and seed yield. Secondary objectives were to: 1) develop propagation methods, 2) establish a planting stock and seed source for growers, and 4) compile and disseminate growing techniques, planting and care instructions.

Farm Profile

My farm property (about 35 acres) is typical West Virginia woodland composed of steep wooded hills and poor dry soils. This project is an extension of several years of growing ginseng and goldenseal for seed and planting stock production.

Participants

Technical Advisor: Dr. Mario R. Morales, Director, Medicinal Botanicals Program, Mountain State University, Beckley, WV. Dr. Morales was active and advisory in my decision to apply for the grant and was instrumental with the grant application process. His technical advice and assistance has been invaluable throughout the period of performance of this grant agreement. He provided technical expertise necessary to establish the experimental planting replication plan for soil amendment evaluations, and established the plan to monitor, record, and evaluate the results of these efforts. His willingness and expertise in using the university publication "The Herbal Dispatch" to disseminate information, reports, advertising, gift seed offer, photography, and using the online process for grant application, experimental results, and reporting is sincerely appreciated. His capacity and dedicated assistance has made my participation possible. The entire process has been a very rewarding and enjoyable experience for me. Cooperator: Dean Myles, Coordinator, Medicinal Botanicals Program, Mountain State University, Beckley, WV. Dean was active providing assistance throughout the grant period by being a point of contact with cooperating entities such as West Virginia Herb Association, prospective future growers of Virginia Snakeroot and fairywand, seminars, coordination and scheduling of presentations, promoting interest with online inquiries concerning Virginia snakeroot and fairywand, and active assistance with my annual humus production efforts. His assistance is greatly appreciated.

Project Activities

After signing the grant contract, I purchased materials and built a deer proof fence around the experimental and production areas. The soil in these wooded areas is full of tree roots and rocks and it took many hours of intensive labor to clean it out and get it ready for planting. Experimental planting beds were prepared and planted with three replications of each plant species using three rates of organic

amendments of hardwood leaf humus (0, 1, 2 lb per ft² = 0, 22, 44 tons/acre) and bonemeal (0, 2, 4, oz per ft² = 0, 2.7, 5.4 tons/acre). Beds are in rows, each five feet long, two feet wide, with two feet between beds, six beds per row, and three rows per replication. Virginia snakeroot and fairywand are in separate alternate beds. Growth rate comparisons were recorded at the peak of the growing season in 2009 and 2010. At the end of the last growing season in 2010, all plants were dug and weighed for root weight comparison. Virginia snakeroot seeds were collected each year for quantitative evaluation and reporting. They were collected using a modified one-inch diameter tin box with a transparent lid. Each seed capsule was placed inside a box to prevent seed from falling to the ground and being taken away by ants that eat the attached elaiosome. Seed development of fairywand proved insignificant for evaluation due to the species dioecious nature and poor blooming performance of female plants. Blooming is required for gender determination. In spite of poor rainfall throughout much of the grant period, fairywand survival rate was 100%, whereas Virginia snakeroot suffered 15% loss of plants. Of the fairywand plants, 32% were identified as male and 5% as female; 63% have not bloomed yet. One research sub-award agreement amendment was made on 4/1/10 for the purpose of extending the research effort one additional growing season. I considered this to be necessary to achieve a more meaningful research data.

Results

Virginia snakeroot

Virginia snakeroot responded positively to the application of humus and bonemeal (Table 1). The humus rates (0, 22 and 44 tons/acre) produced seed yields of 6.20, 8.12 and 8.85 lb/acre, increasing yields by 31% (second rate over the first) and 43% (third rate over the first). The same rates produced dry root yields of 59, 62 and 67 lb/acre, for increases of 4% and 12% of the second and third rate over the control, respectively. The yield increases from 0% to 4% to 12% in response to the 0, 22 and 44 tons/acre rates indicate that Virginia snakeroot will respond positively to even higher rates. This is something that would need further investigation. Response of Virginia snakeroot to bonemeal was impressive. The 0, 2.7 and 5.4 tons/acre rates yielded 5.49, 8.13 and 9.68 lb/acre of seed, generating increases of 48% (second rate over the first) and 76% (third rate over the first). The same rates produced root yields of 45, 73 and 68 lb/acre, increasing yields 62% and 51%. Using the price of \$50.00 per pound that some root dealers paid growers for Virginia snakeroot in 2010 (Duncan's Botanical Products, Inc.), we estimate that the application of 44 tons/acre of humus can bring a grower increases in income of 12% (from \$2,968 to \$3,334 per acre) while an application of 2.7 tons/acre of bonemeal can bring increases in income of 62% (from \$2,254 to \$3,411 per acre).

Table 1. Seed and dry root yield of Virginia snakeroot at three rates of humus and bonemeal.

Humus	Bonemeal	Seed yield	Seed yield increase	Dry root yield	Gross income ¹	Dry root and gross income Increase ²
----- tons/Acre -----		Lb/Acre	%	Lb/Acre	\$/Acre	%
0		6.20	0	59.4	2,968	0
22		8.12	31	62.0	3,100	4
44		8.85	43	66.7	3,334	12
	0.0	5.49	0	45.1	2,254	0
	2.7	8.13	48	73.3	3,663	62
	5.4	9.68	76	68.2	3,411	51

¹: Based on a value of \$50 per pound.

²: Increase over the 0 rate of each amendment.

Fairywand

Fairywand did not respond to humus treatments but did to bonemeal (Table 2). Humus rates (0, 22 and 44 tons/acre) produced 217, 208 and 219 lb/acre, respectively, with no apparent effect on root yield. Bonemeal was a different story. Plots treated with 0, 2.7 and 5.4 tons/acre yielded 186, 280 and 178 lb/acre of dry root, for an increase of 51% of the second rate over the first (control). Root yields actually decreased (-4%) with the 5.4 tons/acre rate. Using the price of \$40.00 per pound that some root dealers paid growers for fairywand in 2010 (Duncan's Botanical Products, Inc.), we estimate that the application of 2.7 tons/acre of bonemeal can bring growers increases in income of 51% (from \$5,579 to \$8,405 per acre).

Table 2. Root yield of fairywand at three rates of humus and bonemeal.

Humus	Bonemeal	Dry root yield	Gross income ¹	Dry root and gross income change ²
----- tons/acre -----		Lb/acre	\$/acre	%
0		162.9	6,517	0
22		156.0	6,241	-4
44		164.2	6,569	1
	0.0	139.5	5,579	0
	2.7	210.1	8,405	51
	5.4	133.6	5,343	-4

¹: Based on a value of \$40 per pound.

²: Change over the 0 rate of each amendment.

Conclusions

1. This project has demonstrated that using humus and bonemeal as soil amendments to produce medicinal botanicals in woodland lots in Appalachia could be of substantial benefit. Virginia snakeroot treated with humus at a rate of 44 tons/acre would increase seed yield by 43% and root yield by 12% over the control, while bonemeal at rates of 2.7 and 5.4 tons/acre would increase root yield by 62% and seed yield by 76%, respectively, over the control. Fairywand amended with bonemeal at a rate of 2.7 tons/acre would increase root yield by 51%.
2. Root dealers paid growers \$50.00/lb for Virginia snakeroot and \$40/lb for fairywand in 2010. Estimates indicate that using the best bonemeal rates reported here, growers could increase income from Virginia snakeroot sales by 62% (from \$2,254 to \$3,411 per acre) and fairywand by 51% (from \$5,579 to \$8,405 per acre).
3. Overall, results of this research indicate both species, Virginia snakeroot and fairywand, can be profitably and sustainably grown by farmers and wood lot owners who are seriously interested in supplementing their income by growing these plants for the medicinal herb market.
4. Through experimentation, I discovered both species can be propagated via rhizome cuttings and, additionally, Virginia snakeroot can be rooted from above ground stem cuttings.

Economics

Cost of planting stock for experimental beds was not planned or budgeted, but stock purchase was necessary due to insufficient size and quantity of existing on-hand stock to support the project, thus increasing project cost. Additionally, labor requirements were underestimated.

Assessment

As I progressed in the study, I discovered that both plants, but specially Virginia snakeroot, required additional soil moisture to produce optimum growth. Normal rainfall was not sufficient. These species require additional moisture during dry summer periods, or they require woodland planting sites enhanced by surface moisture. I suspect they will grow beyond expectations when continuous moisture is present throughout the growing season. This could be the subject for a future project.

Adoption

I plan to incorporate the findings of this study into my present and future plantings of Virginia snakeroot and fairywand and other practices I have investigated. I plan to continue providing seeds and planting stock, on a small scale, for those interested in growing these plants for profit on their land. I also plan to provide supplemental watering so that my production capacity can be improved and enhanced, and to further experiment with methods of propagating fairywand.

Outreach

Through my outreach program I

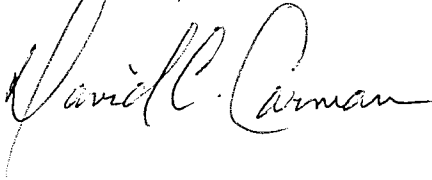
1. Provided free seeds and seedling plants to interested prospective growers who requested them.
2. Disseminated research results via
 - a. Presentations at West Virginia Herb Association conferences, Mountain State University Medicinal Botanicals Program symposia, BIBEE Nature Club meetings, and Master Gardener's meetings. Additionally, pertinent information in this final report will be presented at the Mountain State University Medicinal Botanicals Program annual symposium in the spring of 2011.
 - b. Publications, which include:
 - i. A book chapter in 'Medicinal Botanicals I, Utilization, Cultivation, Value-Adding, Marketing'; Mario R. Morales, editor; Proceedings Appalachian Opportunities Symposium, Beckley, WV, 2008; InstantPublisher.com, 2009; Sponsors: USDA Agricultural Research Service, Appalachian Farming Systems Research Center, Beaver, WV; and Collaborative for the 21st Century Appalachia, Charleston, WV 25302.
 - ii. Several articles in "The Herbal Dispatch", the newsletter of the Medicinal Botanicals Program of Mountain State University, Beckley, WV.
 - iii. Handouts for distribution at presentations, and SARE grant interim reports for posting on the internet.
 - iv. The forthcoming book 'Plants Native to Appalachia', By David C. Carman and Mario R. Morales. The book will include aspects of this research and be printed in 2011.

Summary

The purpose of the project was to learn how to grow Virginia snakeroot and fairywand profitably by determining the rates of humus and bonemeal that would maximize yields and to produce seeds and stock for distribution to growers interested in growing them for profit. The experiment had three rates of

humus (0, 22 and 44 tons/acre) and three of bonemeal (0, 2.7 and 5.4 tons/acre) combined in all possible ways for a total of nine combinations. Each combination was incorporated into a separate 2' x 5' bed. Each set of nine beds was replicated three times. The experiment ran for four years (2007 to 2010), with data on plant characteristics and seed yield collected in 2009 and 2010 and root yield in 2010. Virginia snakeroot treated with humus at a rate of 44 tons/acre increased seed yield by 43% and root yield by 12% over the control, while bonemeal at rates of 2.7 and 5.4 tons/acre increased root yield by 62% and seed yield by 76%, respectively, over the control. Fairywand amended with bonemeal at a rate of 2.7 tons/acre increased root yield by 51%. The best bonemeal rate will increase income from Virginia snakeroot production 62% (from \$2,254 to \$3,411 per acre) and fairywand production 51% (from \$5,579 to \$8,405 per acre). Through experimentation, seed germination of Virginia snakeroot was improved and a technique for seed collection of fairywand developed, which facilitated the establishment of a production area for seeds and planting stock. The project results prove these species can be profitable and sustainably grown by farmers and woodlot owners for supplemental income. Establishment of plantings from seed alone is not practical, however, and profitable growing should be accomplished with planting stock primarily, allowing natural reproduction to occur for future replacement after harvest.

David C. Carman
December 22, 2010

A handwritten signature in black ink that reads "David C. Carman". The signature is written in a cursive style with a large, sweeping initial "D".