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Teaching Educators Basic Fruit Tree Grafting Methods

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Abstract. Hands-on education has proven to be successful in teaching basic grafting methods. MSU Extension developed and conducted eleven statewide workshops teaching Extension Agents and Master Gardeners preferred fruit tree grafting methods. The hands-on workshops provided specialists, agents, and Master Gardeners training on teaching fruit tree grafting classes for clientele. Each workshop consisted of a pre-test, a PowerPoint presentation, a post-test, and a grafting demonstration. Post-test scores showed a significant gain in knowledge over pre-test scores. This training can be replicated/adapted by other organizations to conduct educational outreach.

INTRODUCTION

Grafting is a reoccurring theme for county agricultural agents during their annual evaluation; the method of teaching, however, need assessment. Extension's clients want to know how to graft plants: some want to graft fruit trees (heritage trees) from the old family home place that have withstood the difficult growing conditions of the Deep South (Berle & Westerfield, 2013; Roulston et.al., 2009). Others may want to grow grandmother's favorite rose but have chosen a difficult spot and need a special rootstock, while still others simply want to be creative.

Teaching people to graft plants requires a lot of work and preparation. Extension representatives in Mississippi realized that it would be time consuming for horticulture specialists to travel across the state teaching grafting techniques to everyone interested, so they developed a train-the-trainer model in which Mississippi Extension Agents and Master Gardeners would act as educators. A grant was awarded by the USDA Mississippi Department of Agriculture and Commerce (MDAC) Specialty Crop Block grant program to support this endeavor. A series of workshops were set up around the state.

Hands-on demonstrations can help teach the skill of grafting (Gomez, 2004). Grafting, a method of asexual propagation, joins the scion and rootstock from different plants in such a way that the two parts eventually heal and grow as one. Scion is the desired plant portion that is removed and grafted onto the rootstock (Wilson et al., 2019). Train-the-trainer workshops developed and delivered through the MDAC grant focused on the benefits of knowing which grafting method was most successful with the hopes of increasing the use of heritage fruit trees in Mississippi. Growing educators' grafting knowledge could possibly help promote a cottage industry that produces heritage trees, as has been done through Extension in other states (Brown, 2000). The techniques learned could also be applied to other plants.

The primary objectives of the program were to train Mississippi Extension Agents and Master Gardeners on various fruit tree grafting methods, to determine the most successful grafting method for teaching beginning grafters, and to promote heritage fruit tree propagation and use. Three straightforward grafting methods were selected for their high success rates and relative safety for everyone involved. This work outlines one possible educational method for demonstrating various fruit tree grafting methods.

WORKSHOP DESCRIPTION

Malling-Merton (MM111) ¼-inch rootstocks were ordered from Willamette Nursery in Oregon along with necessary grafting supplies from various sources. Dormant scion wood was collected form heritage apple trees

throughout Mississippi. Promotional brochures were mailed to all Mississippi Extension offices and emailed to an Extension horticulture list of 1,200 individuals. Printed copies were also displayed in Extension offices and community sites.

Researchers gave a five-question open-ended pretest followed by a presentation and concluded with the same five-question posttest. The two-hour indoor presentation included a PowerPoint that explained why individuals may choose to graft, how to collect scion wood, the tools needed for grafting, proper timing, common grafting methods, reasons for graft failure, and post-grafting care.

Following the indoor activities, researchers demonstrated numerous grafting methods. Participants selected two of the heritage apple varieties available and grafted them onto the provided rootstock using any of the three grafting methods: cleft, whip and tongue, or omega. The omega graft was performed with a hand-held grafting tool (A.M. Leonard brand) designed for easier use. The newly grafted trees were potted in 3-gallon containers in a mixture of pine bark, sand, and a slow-release fertilizer for the participants to take home. Participants also completed a Likert scale standard Extension evaluation after the four-hour workshop.

Data collected included the apple variety chosen, the grafting method used, and the grafting success rate. Success was defined as a living graft at the time of the follow-up email survey six weeks after the class. Two weeks later, we followed up with non-respondents to request the same data. The workshops were repeated eleven times over two years throughout Mississippi.

WORKSHOP RESULTS

EVALUATION

Workshop participants answered evaluation questions on a Likert scale of 1 to 5, with 1 as "no," 3 as "possibly," and 5 as "yes." The evaluation results are in Table 1.

The workshops were free, but participants indicated they would pay an average of $20.25 for similar workshops. This amount provides an estimate of what participants might pay for this type of educational program. This fee would help cover material and supply costs for an Extension employee or Master Gardener group providing the training.

PRETEST AND POSTTEST

Scores increased for all five questions from pretest to posttest. Combined overall scores increased from 41% correct on pretests to 86% correct on posttests, showing an overall gain in knowledge (Table 2).

GRAFTING

Table 3 displays the number of grafts performed and the success rates by methods used. Since participants used numerous apple varieties, they were all pooled together by grafting technique. Successful grafts using cleft and whip/tongue (W&T) methods were similar at 82.9% and 80.8%, respectively The omega grafts resulted in a 73.9% success, which was lower than expected. This lower rate could be due to different qualities of scion material or participants' limited familiarity with the device used in this method. The overall success rate for all methods was 80.1%.

CONCLUSION

The successful workshops trained 271 people, including 54 Extension Agents and 151 Master Gardeners. Participants increased plant grafting knowledge in every category of questions, and pretest and posttest scores increased overall, from an average of 41% to 86% correct. Participants demonstrated knowledge gained by performing the hands-on grafting methods and succeeded in post-grafting care by keeping plants alive for at least 6 weeks after the initial class.

Ratings of the workshops were overwhelmingly positive, with participants indicating that they were helpful, presented clearly, well organized, and worth an average cost of $20.25. This amount, if charged as a workshop fee, would help cover grafting supply costs.

Whip and tongue, omega, and cleft grafts were each performed successfully. This study recommends that Extension Agents and Master Gardeners use the cleft or whip/tongue methods for teaching beginner fruit tree

Table 1. Workshop Evaluation Questions

Questions Asked	Means
Was this program helpful?	4.8
Was the material presented clearly?	4.9
Were the presenters considered knowledgeable of the subject matter?	4.8
Was the material related to real-life situations?	4.8
Was the content relevant to your needs?	4.7
Was the workshop well organized?	4.8
Was the information based on credible, up-to-date information?	4.8
Would you attend future Extension educational programs?	4.9

Table 2. Percent Correct Scores for Pretest and Posttest

Questions Asked	Pretest Score %	Posttest Score %	% Increase
What is a graft?	43	87	44
Name one reason to graft a tree.	57	89	32
Name the wood grafted onto a rootstock.	54	95	41
What is the most common type of graft used?	29	88	59
What is the most important key to success?	23	72	49
Combined overall scores	41	86	45

Table 3. Success Rates of Apples as Influenced by the Grafting Method

	Cleft - Yes	Cleft - No	W&T - Yes	W&T - No	Omega - Yes	Omega - No	Overall Success Rate
# of Respondents	136	28	139	33	68	24	
% Success	82.9		80.8		73.9		80.1%

Note. W&T = 'whip and tongue'; Omega = 'Ω-shaped tool'; Yes = successful graft; No = failed graft.

grafting. The omega graft method is another option, but it requires an additional purchase and takes more practice for gardeners to become proficient.

Mississippi Extension Agents and Master Gardeners have a PowerPoint presentation, a supply list, and an Extension publication available to train clientele in basic fruit tree grafting methods (Wilson et al., 2019). Both groups have used the knowledge and skills gained through these workshops to teach six beginner grafting classes to more than 90 participants, fulfilling the mission of Extension. These participants learned grafting methods through hands-on experience and increased knowledge and confidence in grafting heritage fruit trees (and possibly other plants). This was the most important indicator of success for this program. Agents and Master Gardeners in other states could follow this format to teach educators beginner-level fruit tree grafting. These agents would also then be better prepared to assist their clientele with fruit grafting issues.

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