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Evaluating improvements in understanding and skills for chili nursery practices through practice-based training

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ABSTRACT

Chili (*Capsicum annuum* L.), locally known as lombok, is an important horticultural commodity for household consumption, but successful cultivation is strongly determined by nursery quality. This evaluative study aimed to analyze changes in participants' understanding and skills after participating in a practice-based chili nursery training program conducted by the Agrotechnology Student Association of Universitas Borneo Tarakan. The study was carried out at STP Universitas Borneo Tarakan and involved students and members of the general public as respondents. An unpaired descriptive pre-post design was applied because unique respondent identifiers were not available. Data were collected using a 1-5 scale questionnaire, open-ended responses, and training documentation. There were 25 pre-training responses and 17 post-training responses. The results showed an increase in mean nursery understanding from 3.04 to 3.53, independent nursery ability from 2.92 to 4.00, and perceived usefulness from 4.40 to 4.53. Participants also rated material clarity at 4.29 and the usefulness of hands-on practice for understanding at 4.12. The main constraints included selecting quality seeds, pests and diseases, limited land, growing-media availability, and maintenance time. The findings indicate a positive tendency toward improving participants' readiness, but follow-up assistance across the complete cultivation cycle and objective skill assessment are needed.

INTRODUCTION

Chili or lombok (*Capsicum annuum* L.) is a horticultural commodity with high economic and social value because it is widely used in household consumption, culinary enterprises, and the food industry. At the household level, the ability to cultivate chili in home yards can reduce dependence on market purchases, especially during periods of price fluctuation. Strengthening household horticultural cultivation skills is also relevant to the use of home-yard space as a source of food, nutrition, and family income.

The success of chili cultivation is not determined only during the maintenance phase of mature plants; it begins at the nursery stage. Healthy, uniform, and vigorous seedlings are more adaptive when transplanted into polybags or open fields. Agronomic studies indicate that seedling quality is influenced by seed quality, seedling age, growing media, nutrition, moisture, and transplanting method [2], [4], [5]. Therefore, nursery management is a fundamental skill that should be mastered by community members before they proceed to more advanced cultivation practices.

A common field problem is the uneven distribution of technical knowledge related to selecting source fruit for seed, seed selection, seed treatment, nursery-media composition, watering, and the proper timing of transplanting. The initial mapping in this study showed that the participants' mean understanding was 3.04 on a 1-5 scale, while the mean ability to conduct nursery practices independently was 2.92. These values indicate that the participants had interest in the training but still required procedural strengthening through direct practice.

Technical capacity development is important because chili productivity is influenced not only by input intensification but also by input-use efficiency and the quality of technology implementation. Previous studies on chili production efficiency have shown that knowledge, farming experience, technology, seed quality, farmer-group participation, and the implementation of Good Agricultural Practices (GAP) are associated with farm performance [1], [3], [6], [7], [8]. In a community-training context, simple technology transfer through nursery practice can serve as an entry point for improving cultivation practices at household and community scales.

Several studies and horticultural-training reports show that chili-cultivation capacity can be strengthened through technical extension, demonstration, field practice, assistance, and the use of polybags or home yards. In training research, pre- and post-intervention measurements are needed so that changes in understanding, skill, and participant readiness can be analyzed more measurably. However, training studies that specifically assess indicator changes before and after chili nursery intervention still need further development.

Based on these conditions, this study was designed as an evaluative study of a practice-based chili nursery training program using descriptive quantitative and simple qualitative approaches. The novelty of this study lies in the presentation of an aggregate pre-post evaluation that combines indicators of understanding, independent ability, perceived usefulness, material clarity, usefulness of practice, constraints, and participant suggestions. This article aims to describe the implementation of the training intervention, analyze changes in

participant-indicator means, and formulate implications for developing a more applicable and sustainable chili nursery training model.

MATERIALS AND METHODS

Research Site and Time

This study used an unpaired descriptive pre-post evaluative design to assess a practice-based chili nursery training intervention. The study was conducted at STP Universitas Borneo Tarakan, Tarakan, Indonesia. The study subjects were students and members of the general public who were interested in learning chili nursery techniques. The training quota announced by the committee was 40 participants. The resource person was Dr. Amarullah, SP., MP., who delivered the main material on chili cultivation and nursery techniques. An unpaired design was used because the pre- and post-training questionnaires did not contain unique identifiers that could link individual responses.

Table 1. Study design and data sources

Component	Description
Type of activity	Evaluative research based on a practice-training intervention
Theme	Chili Nursery Training
Organizer	Agrotechnology Student Association of Universitas Borneo Tarakan
location	STP Universitas Borneo Tarakan
Target participants	Students and members of the general public as respondents
Training quota	40 participants
Pre-training dataset	25 responses; 8 columns; response time 09:33:07-14:37:12
Post-training dataset	17 responses; 12 columns; response time 10:45:40-19:33:13
Documentation	Questionnaires, poster, certificate, presentation materials, and evaluation graphs

Materials, Tools, and Research Design

The training was organized by the Agrotechnology Student Association of Universitas Borneo Tarakan. The main materials included source fruit for seed, chili seeds, seed-treatment materials, organic fertilizer, soil, sand, nursery containers, watering equipment, training posters, certificates, presentation materials, and evaluation questionnaires. The evaluation instruments consisted of a 1-5 scale questionnaire and open-ended questions. A score of 1 represented the lowest category, while a score of 5 represented the highest category according to the measured indicator. Training documentation, including the poster, certificate, presentation material, and evaluation graphs, was used to strengthen the interpretation of the questionnaire results.

Table 2. Evaluation variables and instruments

Stage	Main variables	Data type
Pre-training	Age, occupation, farming experience, initial understanding, initial ability, perceived usefulness, planned application	Numeric, categorical, and 1-5 scale
Post-training	Final understanding, material clarity, usefulness of practice, independent ability, perceived usefulness, planned application	1-5 scale and categorical
Post-training	Participant constraints and suggestions	Open-ended text
Documentation	Poster, certificate, presentation materials, and graphs	Visual documents and technical materials

Research Procedures

The activity consisted of preparation, core implementation, and evaluation stages. The preparation stage included developing the training material, publishing the activity, registering participants, and preparing materials for practice. The core implementation stage included completion of the initial questionnaire, delivery of technical material, hands-on nursery practice, discussion, and completion of the final questionnaire. The technical material covered the selection of source fruit, seed selection, seed treatment, nursery-media composition, sowing technique, watering, seedling transfer to polybags, and seedling readiness for field transplanting. The overall flow of activities is presented in Figure 1.



Figure 1. Flow of the chili nursery training and evaluation process.

Observed Parameters and Data Analysis

Quantitative data were analyzed by calculating the number of responses, percentages, minimum values, maximum values, means, and mean differences for comparable indicators. Qualitative data from open-ended responses were analyzed by grouping themes of constraints and participant suggestions. Content validity was strengthened by aligning the evaluation indicators with the training objectives, while triangulation was performed by comparing questionnaires, training materials, posters, certificates, and

evaluation graphs. Ethical considerations were addressed by presenting data in aggregate form without displaying participants' personal identities.

RESULTS

The intervention was implemented as an open learning space for students and the general public. The training emphasized that good chili seeds should come from physiologically mature, healthy, and undamaged fruit produced by parent plants free from pests and diseases. Participants were introduced to technical stages, beginning with collecting seeds from the middle part of the fruit, selecting seeds through soaking, drying, treating the seeds, preparing growing media, sowing in rows, watering regularly, and transplanting seedlings. The study design and evaluation variables are summarized in Tables 1 and 2, while the key technical content from the nursery material is presented in Table 3.

Table 3. Key technical information from the chili/lombok nursery material

Technical component	Size/requirement	Description
Fruit used as seed source	4th to 6th harvest	Recommended harvest period to obtain optimal seeds
Seed treatment	Soak in insecticide/fungicide for 15 minutes	Use half of the recommended dose
Nursery media	Organic fertilizer: soil: sand = 1:1:1	Media should be prepared in sterile condition
Media preparation	1 week before sowing	Allows the media to become ready for use
Warm-water soaking	12 hours	Helps accelerate germination
Seedbed	1-1.25 m width	Length adjusted to need
Row spacing	3-6 cm	Seeds are covered with a thin soil layer and watered regularly
Transfer to polybags	2-3 fully developed leaves	Seedlings are transferred after becoming sufficiently strong
Field transplanting	20-25 days or 5 leaves	Indicator of seedling readiness for open-field planting

The number of pre-training responses was 25, while the number of post-training responses was 17. In the pre-training stage, most participants were students, totaling 17 people or 68.0%. In the post-training stage, students remained the largest group, totaling 9 people or 52.9%. Participants' farming experience varied. Before training, 12 participants had farming experience and 11 did not, while after training, 7 participants reported farming experience and 10 reported no farming experience. This variation indicates that the training was attended by participants with heterogeneous initial backgrounds. Respondent characteristics are shown in Table 4.

Table 4. Characteristics of respondents before and after training

Indicator	Pre-training	Post-training
Number of responses	25 responses	17 responses
Age data available	25; range 18-59; mean 27.28 years	16; range 18-59; mean 30.81 years
Students	17 people (68.0%)	9 people (52.9%)
Entrepreneurs/self-employed	1 person (4.0%)	3 people (17.6%)
Lecturer	1 person (4.0%)	1 person (5.9%)
Retired participants	2 people (8.0%)	2 people (11.8%)
Other/not filled	4 people (16.0%)	2 people (11.8%)
Farming experience: yes	12 people (48.0%)	7 people (41.2%)
Farming experience: no	11 people (44.0%)	10 people (58.8%)
Farming experience: not filled	2 people (8.0%)	-

The evaluation results showed increases in all comparable indicators between the pre- and post-training stages. The mean understanding of nursery practices increased from 3.04 to 3.53, or by 0.49 points. The mean ability to conduct nursery practices independently increased from 2.92 to 4.00, or by 1.08 points. Perceived usefulness also increased from 4.40 to 4.53, or by 0.13 points. The largest increase occurred in independent ability, indicating that hands-on practice more strongly influenced participants' procedural readiness than it influenced perceived usefulness. The mean comparison is presented in Table 5 and Figure 2.

Table 5. Comparison of mean indicators before and after training

Indicator	Pre-training mean	Post-training mean	Difference	Direction
Nursery understanding	3.04	3.53	+0.49	Increased
Independent nursery ability	2.92	4.00	+1.08	Increased
Perceived training usefulness	4.40	4.53	+0.13	Increased

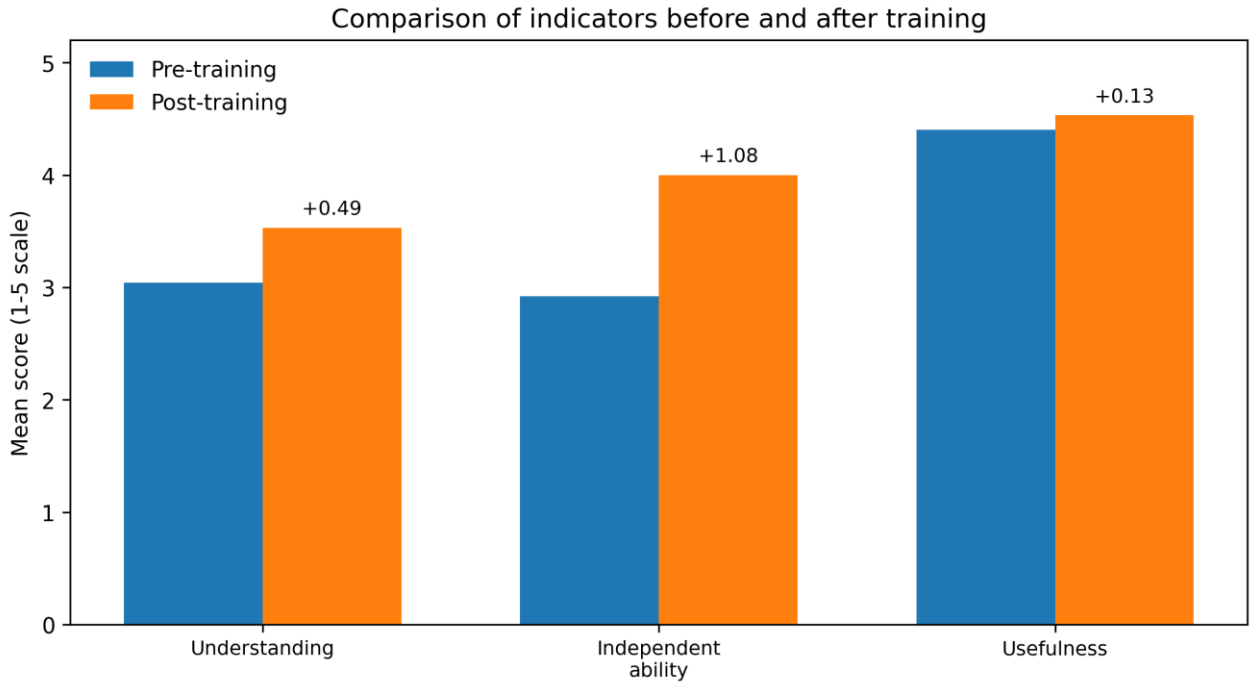


Figure 2. Mean comparison of comparable indicators before and after training.

The score distribution showed that post-training scores were no longer located at values of 1 or 2 for the indicators of understanding and independent ability. For understanding after training, most participants were located at scores of 3 and 4. For independent ability after training, 12 of 17 participants were located at scores of 4 and 5. In addition, material clarity obtained a mean score of 4.29, and the usefulness of practice for understanding obtained a mean score of 4.12. These findings indicate that the training material and practice were considered accessible to participants with different levels of farming experience. The score distribution is shown in Table 6 and the summary of post-training indicators is shown in Figure 3.

Table 6. Distribution of participant evaluation scores

Indicator	n	Mean	Min	Max	Dominant score
Understanding before training	24	3.04	1	5	Scores 2 and 3, each with 7 responses
Independent ability before training	25	2.92	1	5	Score 2 with 9 responses
Usefulness before training	25	4.40	3	5	Score 5 with 12 responses
Understanding after training	17	3.53	3	5	Score 3 with 9 responses
Material clarity after training	17	4.29	3	5	Score 4 with 8 responses
Practice helped understanding	17	4.12	2	5	Score 4 with 8 responses
Independent ability after training	17	4.00	3	5	Score 4 with 7 responses
Usefulness for productivity and food security	17	4.53	3	5	Score 5 with 10 responses

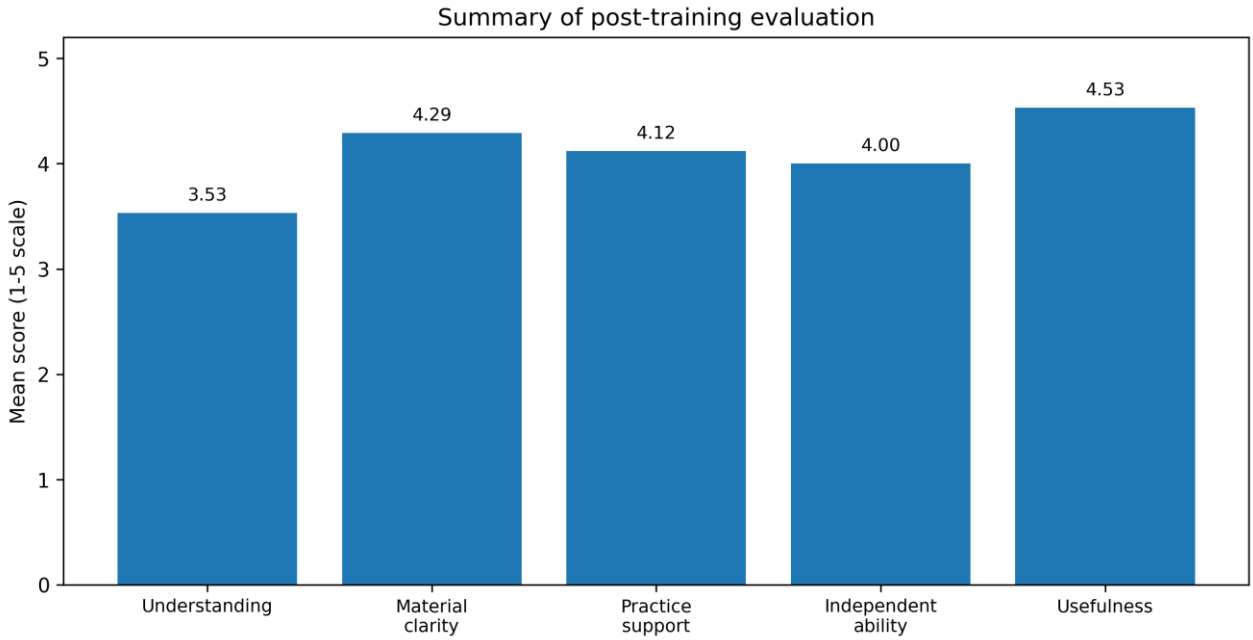


Figure 3. Summary of post-training evaluation indicators on a 1-5 scale.

Open-ended responses showed that some participants did not encounter constraints, while others still required further technical support. Reported constraints included selecting quality seeds, pests and diseases, limited land, availability of growing-media materials,

and maintenance time. Participants also suggested that training should be held more frequently, implemented continuously, cover practice from seed selection to transplanting, and be expanded to other horticultural commodities. A summary of participant constraints and suggestions is presented in Table 7.

Table 7. Summary of participant constraints and suggestions after training

Aspect	Main theme	Description
Constraint	Seed selection	Participants still had difficulty selecting quality chili seeds
Constraint	Pests and diseases	Participants mentioned leaf curl, dwarf plants, and the need for pest control
Constraint	Land	Some participants had limited home-yard space or gardens located far from home
Constraint	Growing media	Availability of media materials, such as chicken manure, was a concern
Constraint	Time	Some participants considered maintenance time relatively limited
Suggestion	Follow-up training	Complete cultivation training is needed, from nursery, soil preparation, maintenance, to harvest
Suggestion	Field practice	Participants suggested direct practice from the beginning until transplanting
Suggestion	Continuity	Training should be more frequent, routine, and not limited to chili commodities

DISCUSSION

The greater increase in independent nursery ability compared with understanding indicates that practice-based training is relevant for procedural material. Nursery practice is not merely an activity of knowing the definitions of seed and nursery media; rather, it is a sequence of actions that must be performed in a proper order. Stages such as seed soaking, preparing the 1:1:1 media composition, sowing in rows, watering, and transferring seedlings are easier to understand when participants can observe and practice them directly.

The post-training mean understanding score of 3.53 still indicates room for improvement. Some participants felt that they understood the material, but not all reached the very high category. This condition is reasonable because 58.8% of post-training respondents had no farming experience. Material related to seedling quality, seedling age, and transplanting time should be repeated through continuous practice because these aspects have been reported to influence seedling quality and productivity in Capsicum cultivation [4], [5].

Constraints related to seed selection, leaf curl, dwarf plants, and pest control show that nursery training needs to be connected with seedling maintenance and plant-disorder diagnosis. In chili cultivation, pests and diseases are limiting factors that can reduce yield potential [2]. The implementation of GAP principles is also important to help participants understand cultivation practices that are safer, more efficient, and more sustainable [6].

From the perspective of agricultural education research, these results show that simple technical training can improve participant readiness to apply cultivation skills at home. Land limitation, as reported by participants, can be addressed through material on polybag cultivation, simple vertical gardening, nursery racks, or the use of narrow household spaces. Variation in growing media should also be introduced because growing media influence chili growth and yield [9].

The study further indicates that training evaluation should not stop at participant satisfaction. This article presents pre-post data, score distributions, constraints, and suggestions so that training outcomes can be interpreted more measurably. Nevertheless, interpretation should remain proportional because the pre- and post-training data were unpaired, the number of post-training responses was smaller, and the indicators were still based on self-perception. Future evaluations should include observation of practice, germination rate, seedling quality, number of surviving seedlings, and monitoring of technique adoption at participants' homes or gardens.

The practical implication of this study is the need for a sequential training model. The first session can focus on seed selection and nursery preparation; the second on seedling maintenance, media, and nutrition; the third on transplanting and pest-disease control; and the fourth on harvest and outcome evaluation. Such a model is important so that changes in understanding and skill do not stop at self-perception but can be traced to nursery success, seedling quality, and actual application by participants.

CONCLUSION

The evaluative study of the Chili Nursery Training conducted by the Agrotechnology Student Association of Universitas Borneo Tarakan showed a positive tendency in participants' understanding and skills. Mean understanding increased from 3.04 to 3.53, independent nursery ability increased from 2.92 to 4.00, and perceived usefulness increased from 4.40 to 4.53. The material was rated clear with a mean of 4.29, and hands-on practice was rated helpful for understanding with a mean of 4.12. These findings indicate that the combination of material delivery and direct practice is suitable for improving participants' basic readiness to conduct chili nursery activities. However, the findings should be interpreted as aggregate mean changes because the pre- and post-training data were unpaired and objective skills were not yet measured. Future studies should include skill observation, germination rate, seedling quality, seedling maintenance, pest and disease control, transplanting, and monitoring of technique adoption at participants' homes or gardens.

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