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Short Paper

Extension Training on Bokashi Fertilizer Production

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Abstract

The increasing cost of chemical fertilizer in the market urges the local farmers to formulate and develop an alternative source of nutrients for their crops. One of which is the use of organic fertilizer, however, the conventional production of organic fertilizer is tedious and time-consuming. Thus, the extension unit of one of the campuses of a university in the Bicol introduced the concept of Bokashi fertilizer through an Extension Training program. Bokashi is a fermented organic fertilizer that is rich in nutrients that are essential for plant growth and development. Studies have also shown that it can be used as a feed additive to tilapia and swine. The training aimed at capacitating farmers on bokashi fertilizer production. It was divided into theoretical and practical activities where the farmer-participants performed the production process. A pretest and post were given, and the result from the pre-test (M=4.46; SD= 2.25) and post-test (M=6.33; SD=2.31) showed that there is a significant difference in the level of knowledge attained by the participants $t(14) = -2.88$; $p=0.01$. This suggests that there is an increase in knowledge among the participants. To date, the farmer-participants are preparing to adopt the said technology and a Memorandum of Agreement (MOA) has been inked and an application to DOLE as a farmers' organization has been approved. Finally, using the BUEMD evaluation tool, both the resource speakers (4.75) and the training evaluation (4.73)

received an outstanding remark. Development and formulation of Bokashi using locally available materials, a record of ROI and IRR, and impact assessment is recommended. This paper presents the result of the training, its implementation process, and its output.

Keywords – Bokashi, Extension, farmer-participants, organic fertilizer, training

INTRODUCTION

The extension program is one of the mandates of all Higher Education Institutions (HEIs) (RA 8292). Extension refers to a transfer of technology, innovation, or information systematically, that is generated by HEIs and its partners to seek solutions to 'specific development concerns' based on the actual needs and problems (https://bicol-u.edu.ph/extension/extension+function). To date, one of the concerns identified is the increasing cost of production of agricultural commodities such as the increasing price of fertilizers and agrochemicals.

In the early 1900s, the introduction of commercial inorganic agrochemicals radically altered agricultural productivity and agroecosystems (Cabrera, 2003). However, it has been shown that the continual use and application of agrochemicals, such as fertilizers, insecticides, and herbicides, for agricultural production harm soil quality, microbial population, and even human health (Lirag & Bordado, 2016; Srivastava et al., 2020). Despite these evident harmful effects, farmers continue to rely largely on it because of its ease of application and preparation. In addition, empirical observation suggests that farmers in the Municipality of Gubat, Sorsogon have little understanding of other sources of fertilizer or soil additives, like Bokashi fertilizer.

Bokashi is a Japanese term that means "*fermented organic matter*." It is the product of either an anaerobic or aerobic process using organic matter (food/kitchen wastes, farm waste, etc.), effective microorganisms (EM), molasses, and water (Boechat et al., 2013; Lew et al., 2021). Fermentation and composting are included in the production. This fermented and composted organic fertilizer contains the essential nutrients, amino acids, and microbes for optimal plant growth and development (Dou et al., 2012; Lasmini et al., 2018; Maki et al., 2021).

Application of bokashi as a soil amendment has shown efficacy in boosting soil properties, preventing salinization, promoting plant development, and increasing lettuce, peanut, potato, spinach, Bok choy, and wheat yields (Christel, 2017; Hata et al., 2020; Hu & Qi, 2013; Li et al., 2021; Maki et al., 2021; Merta & Raksun, 2021; Pei-Sheng & Hui-Lian, 2002). The application of Bokashi to rice has increased the overall morphological characteristics in terms of yield, panicle height, and ripened yield percentage (Kakar et al., 2019). Bokashi fertilizer can also be used to improve the organic properties, Potassium and

Phosphorus content likewise uptake of Iron and Manganese in a coal mine (Hindersah et al., 2018).

Additionally, research indicates that effective microorganisms in bokashi may be utilized as a feed additive for tilapia and swine (Jarosz et al., 2021; Lim et al., 2021). Moreover, one of its practical benefits is that it requires less preparation time (2-4 weeks) than the conventional method of composting (6 months). In a study by Nisyawati and Wardhana (2020), bokashi fertilizers can be ready to use in 21 days, but horse-dung-based bokashi can be produced in 30 days (Gashua et al., 2022). Further, it is also inexpensive to produce, since any locally available materials, such as cow dung, farm wastes, or food/kitchen wastes may be utilized. In addition, it is recommended to use bokashi as a transitional supplement from chemical fertilizer-dependent farms to organic agriculture (Jensen et al., 2006). However, the use of bokashi as a soil additive or an organic fertilizer is not popular among the local farmers of Gubat, Sorsogon.

Despite the capacity buildings being made by municipal and provincial agriculture, composting is still a challenge to farmers due to a lack of interest in doing the operation since they considered it labor-intensive, and it took a long process. Besides, the rampant and indiscriminate use of synthetic fertilizer can adversely affect the soil microbial properties and the environment (Gyawali, 2018). However, there are still alternatives to composts that are less explored in our agricultural system that can easily be produced.

Thus, the Extension unit of a campus of a state university in Bicol conducted extensive training to capacitate farmers by introducing and adopting this technology to selected farmers of Gubat, to help them attain sustainable agriculture through an eco-friendly, economically viable, and socially acceptable approach.

OBJECTIVE

The two-day training on bokashi fertilizer production generally aims to capacitate the selected farmers of Gubat, Sorsogon. To introduce and demonstrate the process of how to produce bokashi organic fertilizer as an alternative to an expensive commercial fertilizer. The paper presents the result of the training, its implementation process, and its output.

METHODOLOGY

This two-day training was conducted through a lecture and discussion with practical application. On the first day of the training (morning session), theories and methodologies, and benefits of bokashi were discussed, and in the afternoon, a practical and actual demonstration was conducted. The second day of the training shall be after 14 days for harvesting and packing. The training was conducted by observing strictly the health protocol as per Inter-Agency Task Force (IATF) for COVID-19 guidelines such as wearing a face mask and washing hands with soap.

Moreover, the training was divided into three phases, the *Pre-training phase*, *the Training proper phase*, and *the post-training phase*. The *Pre-training phase* includes the selection of participants from Gubat Sorsogon. The participants invited were from the organized farmer's organization on campus. Invitation to resource person with confirmation, program, training evaluation, and other required documents had been prepared. Lastly, procurement of materials needed for the training.

The *Training proper phase*. During the training, the observance of the IATF health protocol for the entire duration of training was emphasized as the first agendum in the overview of the activity. The training includes lectures with practicals, wherein the participants will be able to practice the theories discussed. A pre-test and post-test were given to assess the participants if they have increased their knowledge of bokashi fertilizer production. A t-test-Paired Two Samples for Means using MS Excel was employed in the study.

Finally, the *Post-training phase*, training evaluation, feedback to the resource persons and testimonials developed by the Bicol University Extension Management Division (BUEMD) were given. Evaluation of the training took place after the session and a narrative accomplishment report was submitted to BUEMD.

FRAMEWORK OF THE TRAINING

The Input-Process-Output or IPO Model was employed in the conduct of this Extension Training program. The IPO model is a functional graph that illustrates the three stages, the input, process, and output of the activity. Figure 1 shows the IPO framework of the training. The Inputs include a copy of the learning materials or a copy of the presentation and internal funding from the Bicol University Gubat Campus amounting to Php 53,600.00. The training process involves an interactive lecture and discussion where all are expected to participate in the lecture, distribution of learning materials, and a practical demonstration on how to produce bokashi fertilizer. It is then followed by the evaluation of the speakers and the training. Testimonials from the farmer participants were sought. Finally, the expected outputs of the training are the number of participants trained, the number of participants who can demonstrate how to produce bokashi, a memorandum of Agreement between Bicol University and the participants (i.e., farmers); and that the trained participants be organized and be registered at the Department of Labor and Employment (DOLE) as a farmers' organization.

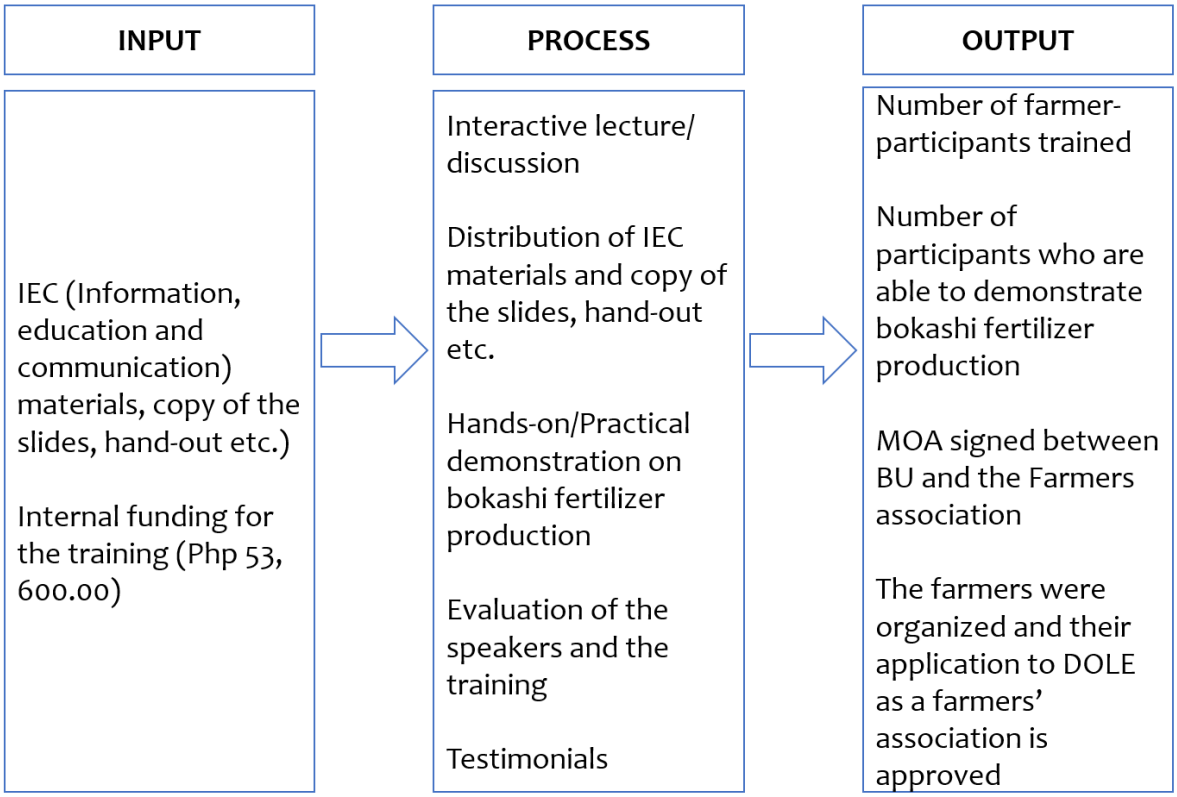

Figure 1. IPO framework of the training.

RESULTS AND DISCUSSION

After a thorough evaluation of the extension proposal, the training was approved by the BUEMD. Then, procurement of the materials for the training followed. Invitation to both the speaker and farmer-participant was sent. Invitation for the farmer-participant was first forwarded to the Barangay Captain of the target beneficiaries. The two-day training was conducted at the Shekinah building of BUGC and a total of 16 cassava farmers from Cabiguhan, Gubat, Sorsogon participated in the training**.**

Moreover, the participants of the training were members of the newly established farmers' association known as "Cabiguhan Kaunlaran Farmers Association" which was organized by the Bicol University Gubat Campus early this year. Their application for registration to the Department of Labor and Employment (DOLE) had been submitted for them to become a legitimate farmers' organization. Similarly, a Memorandum of Agreement (MOA) between the group and the BUGC has been crafted and inked. To date, the farmer participants are slowly adopting the technology and according to them, they are now preparing to procure materials needed for production. On the other hand, a demonstration farm for the technology will be established on the site. The group has now

constructed a meeting center wherein they will be gathering every last Sunday of the month (Figure 2).

Figure 2. Farmer-participants from Cabiguhan Gubat Sorsogon posing in front of their newly constructed meeting center or learning site (a); farmers with their harvested and packed bokashi (b); newly mixed bokashi ready for fermenting (c); and packed bokashi (d).

On the other hand, after the training, the participants gave their testimonials verbally and in writing; and generally according to them, they are grateful for the training and the opportunity to learn new technology in agriculture. Moreover, based on the evaluation scaling of the BUEMD (Table 1). The resource speakers got an average 4.75 rating; the quality of the service is 4.71; and the timeliness of service delivery is 4.75 with an overall mean rating of 4.73. In addition, the result from the pre-test (M=4.46; SD= 2.25) and post-test (M=6.33; SD=2.31) showed that there is a significant difference in the level of knowledge attained by the participants $t(14) = -2.88$; $p=0.01$. Further, the t-computed value of 2.88 is beyond the t-critical value of 1.76 at a 0.05 level of significance with 14 degrees of freedom, thus, the null hypothesis is rejected. This means that the posttest result is higher than the pretest result. This result suggests that the training was delivered to its' clientele efficiently and effectively.

Table 1. Evaluation scores developed by BUEMD.

Evaluation scores	Verbal description
1	Poor
2	Fair
3	Good
4	Very good
5	Excellent

Production and utilization of Bokashi fertilizer

To do this, prepare all the materials (dried animal manure/chicken dung, carbonized rice hull, garden soil, rice bran, molasses/sugar, coco vinegar, and indigenous microorganisms (IMO)) needed and mix all solid-to-solid ingredients using a shovel. Liquid materials such as molasses and vinegar must also be mixed separately and thoroughly. While mixing and piling the garden soil, carbonized rice hull, and rice bran, slowly sprinkle the liquid ingredients. Repeat mixing at least three times and form a mounded pile. Cover the pile with laminated sacks. On the following day, mix the pile in the morning and afternoon. From 10-14 days, mix the pile once a day either in the morning or afternoon until it cools off. Pack the produced bokashi in a plastic sheet at 1kg/pack (**Figure 2**) and store it in a dry place and away from direct sunlight.

Table 2. Guidelines for using bokashi as an organic fertilizer on various plants (Adapted from Jensen et al., 2006).

Crops	Type of application	Rate of application	Methods
vegetable and rice	Basal application	20-30 sacks/ha	Apply bokashi by spreading it onto the topsoil before plowing.
Corn, millet, and upland rice	Basal application	30 sacks/ha	Apply in between furrows before seed sowing.
Lowland rice	top dress	1kg/m2	Drain the rice field and apply the bokashi thoroughly.
Cucurbits	Top dress	2kg/plant	Apply bokashi by digging a trench 5-10cm from the base of the plant and covering the topsoil.
Solanaceous	Top dress	1kg/plant	

Using Bokashi as a fertilizer for crops and vegetables is very simple. It can be applied by either basal application or top dress. For basal application, bokashi is broadcasted into the field before transplanting of crops or seed sowing, whilst for top dress, crops were already planted. It is done by digging a drench 5-10cm from the base of

the plant and covering the topsoil (Jensen et al., 2006). However, some suggest that the bokashi be applied 10-14 days before planting with a planting distance of 10-15cm away from the roots (Ncube, 2008; Olle & Williams, 2013). Technically, in terms of the rate of application, there is no such overdose because bokashi has no adverse effect on crops, humans, and the environment. However, Jensen et al (2006) suggested a certain rate of application to common crops (Table 2). It is recommended to use organic fertilizer in converting farms from chemically and commercially dependent into organic farms in a gradual shift. However, the use of bokashi and days of production may differ from the types of raw materials used and the country of origin.

CONCLUSIONS AND RECOMMENDATIONS

The two-day training on the production and utilization of bokashi provided theoretical and technical knowledge to selected farmers of the municipality of Gubat, Sorsogon. It provided them with new knowledge on the use of an alternative to synthetic and expensive fertilizers. Organized farmers have initiated the production and utilization of bokashi. Application to the Department of Labor and Employment (DOLE) as a farmers' organization has been approved and a Memorandum of Agreement (MOA) between Bicol University Gubat Campus and Cabiguhan Kaunlaran Farmers Association has been inked. Overall, the training has satisfactorily achieved its objectives. Moreover, it is recommended to research the development and formulation of bokashi using available local materials, and the record of the Return on investment (ROI) and Internal Rate of Revenue (IRR) shall be properly documented. Finally, an impact assessment shall be conducted after a few years to assess the impact of the training.

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DECLARATIONS

Conflict of Interests

All authors declared no conflict of interest.

Informed Consent

Informed consent was obtained before the conduct of extension training including the use of photographs and images used in this paper. Moreover, participation in this study is voluntary and they can withdraw anytime with no penalty.

Ethical Approval

No ethical approval is needed in this training.

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Author's Biography

Demetrio E. Castillo is a faculty in the Agricultural Technology Department of the Bicol University Gubat since 2018. He finished his Bachelor's degree at Bicol University with a degree in Agricultural Technology *cum laude*. He was a recipient of the Transnational Education program of the Commission on Higher Education (CHED) in partnership with the British Council in 2018-2020. Through the grant, he earned his Master's degree in Master of Science in Sustainable Food Systems (MScSFS) and Master of Science in Advanced Biological Sciences (MScABS) passed with merit, at Bicol University and the University of Liverpool in the United Kingdom, respectively. He was awarded as best paper on extension during the Research, Development and Extension (RD&E) Awards 2022; 'Outstanding Extension Practitioner in 2022;' and an 'Outstanding Individual in the Field of Agriculture in 2023 by the Instabright Excellence Awards.

Gerald H. Estiller graduated with the master's degree, MS in Agriculture at Bicol University College of Agriculture and Forestry, Gionobatan, Albay in 2018. Currently working as Assistant Professor at Bicol University Gubat. Been actively involved in community development projects since 2015 when he started to be employed at the Provincial Local Government of Sorsogon. When he returned to the university, he then performed tasks related to extension activities and serving clients near his profession. This was successfully made through various training implemented in marginal communities he worked with.

Rosemarie R. Jadie is a Licensed Teacher, with a bachelor's degree in Arts with a major in Economics, a master's degree in Business Administration in Business Economics, and Ph.D. in Development Management. The author is employed as Professor VI from Bicol University, Legazpi City. A committed public servant engaged in research and community extension.