Training on Compost Fertilizer Preparation

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Venue: Nec-CPS, Balkhu

The analysis of the household questionnaire survey and discussions with farmers and key-informants in Lubhu brought forward the declining availability of water and increasing soil degradation as a result of increasing dependency on chemical fertilizer as major cause of increasing pest attacks in crops and consistent decline in crop productivity. The farmers in Lubhu were therefore increasingly getting attracted towards compost fertilizers and though in minor number the practice of making compost at household level had already been started at the farmers own initiatives. However lack of proper knowledge on the process of preparation of compost and its application techniques was hindering the farmers in expansion of its use. Thus as per the need and interest of the farmers in Lubhu, Peri-urban Water Security Project at Nepal Engineering College provided a two days long capacity building training on Preparation, Use and Application of Compost and Vermicompost. Under the facilitation of Dr. Janardhan Khadka, the Senior Soil Scientist from Bagbani Kirtipur, a total of 28 farmers from various Farmer's Committee in Lubhu were trained along with a participatory demonstration on the compost preparation process.

Day 1:

Session 1:

The first day of the training began with a brief review of the peri-urban project and the activities conducted in Lubhu as the pilot intervention site. Following this was the theory classes on the compost fertilizer which commenced with the presentation on the soil and soil management techniques wherein the role of soil in plant development was stressed in simple terms so as to make the training effective for the participant farmers. The intensive cropping technique involving increasing use of chemical fertilizers and decline in nutrient-rich humus need to fuel plant growth was stressed as major cause of soil degradation. The mutual interactions among the participants and the facilitator facilitated to bring forward the problems being faced by the farmers, the causes and the knowledge gaps. The interaction also helped to identify possible solutions to the existing and emerging problems of soil degradation through sharing of the field based experiences, understanding and experiences from research and practices in different parts of the country and the world. In doing so the facilitator highlighted on the need of identification of soil type and state of soil such as its pH prior to the soil treatment process and how compost restores vitality to depleted soil. Additionally the farmers could also understand the proper

technique and appropriate time for the application of Calcium carbonate (*Chun*) commonly used by farmers to neutralize acidic soil

Session 2:
The second session began with short note on the types of solid wastes and need of proper management of soil waste where in the 4R principle was introduced (Reduce, Reuse, Recycle and Replace). Farmers were introduced about different techniques of compost preparation on a domestic scale such as bin compost, pile compost, pit compost, chamber compost and vermin-compost. The need of segregation of bio-degradable and non-biodegradable solid waste as primary need of compost preparation and how increasing solid waste with increasing urbanization can be a source of fertilizer through proper composting techniques was elaborated.
Similarly the aerobic and an-aerobic composting techniques were also discussed while a detailed explanation was made on thing to be noted for composting.

1. Size of waste
2. C:N ratio
3. Air
4. Moisture
5. Temperature
6. Micro-organisms
7. pH range

During the session the problems commonly faced by farmer during composting were explained along with the causes and simple and practical solutions to them. Among them unpleasant odors from compost pile and cow shed was a concern for the farmer. To which the facilitator suggested that the odors could be reduced, or eliminated, by following two practices: first, by not putting bones or meat scraps into the compost; second, covering new additions to the compost pile with dry grass clippings or similar mulch. Adding lime or calcium will also neutralize odors. If the compost smells like ammonia, adding carbon-rich elements such as straw, saw dust or dried leaves.

The other commonly faced challenge for small-scale backyard composting was finding enough carbon-rich materials to balance the regular input of nitrogen-rich materials to maintain C: N ratio in compost. Farmers were explained about the common sources of Nitrogen to be green material such as kitchen scraps, fruit and vegetable peelings, grass clippings and other fresh materials. Carbon-rich matter were brown material such as like straw, branches, stems, dried leaves, peels, bits of wood, bark dust or sawdust etc.

The farmers were explained about the role of carbon in providing energy and the fluffy nature of compost while nitrogen in providing protein needed for making enzymes. Thus the need of of making a balance between carbon and nitrogen rich material was

reemphasized. A healthy compost pile should have much more carbon than nitrogen. A simple rule of thumb is to use one-third green and two-thirds brown materials. This allows oxygen to penetrate and nourish the organisms that reside there. Too much nitrogen makes for a heavy, smelly, slowly decomposing mass. Good composting hygiene means covering fresh nitrogen-rich material, which can release odors if exposed to open air, with carbon-rich material, which often exudes a fresh, wonderful smell and were suggested to add more carbon rich material in case of any doubt.

The training focused on aerated composting and explained about the significance of turning over the pile to provide aeration. Similarly the new techniques of no-turn composting techniques through management of aeration mechanisms were also introduced. The aeration could maintain the appropriate temperature for the proliferation of microbes responsible for the decay of organic wastes. The farmers were advised to cover the compost pits to reduce the loss of moisture and the nutrients at the same time protect from rain to maintain the moisture content in the compost as the excess of water could result into decay of compost.

The training focused on use of locally available material for the successful and sustainable use of compost as alternative to chemical fertilizers. The role of ash in regulating moisture was mentioned however the implication of excess use of ash could result into increased pH due to its alkaline nature thus deactivating the microbial activity in compost. Similarly the farmers were provided three simple tips to improve the cow-shed quality and the quality of compost from animal dung by managing the base for the animal bed , a canal for urine discharge and collection and a roof for protection of cow-shed from direct sunlight and rain was cowshed. Some of the participating farmers with some practical experiences on composting techniques had some idea of Effective Micro-organisms (EM) while for the rest it was a new topic. During the session, the farmers were explained about the role of EM in proliferation of micro-organisms responsible for composting. Further they were explained about the need of checking the manufacture and expiry date prior to the purchase of EM and advised to collect fresh EM for its effective action. Towards the end of the session, the farmers were explained about the proper technique of application of compost including complete information on the application time, distance from the plant, techniques to apply different types of plants and season and timing for reapplication. In addition the participants were also explained about the technique of application of human urine after disinfection as being used in the Bagbani Kirtipur which was also explained to be prescribed by WHO guidelines.

Session 3:
The session started with introduction of vermincompost. Vermicompost is the product or process of composting using various earthworms to create a heterogeneous mixture of decomposing vegetable or food waste, bedding materials, and vermicast. Vermicast, also called worm castings, worm humus or worm manure, is the end-product of the breakdown of organic matter by an earthworm. These castings have been shown to

contain reduced levels of contaminants and a higher saturation of nutrients than organic materials contain before vermicomposting. Containing water-soluble nutrients, vermicompost is an excellent, nutrient-rich organic fertilizer and soil conditioner. This process of producing vermicompost is called vermicomposting.
The facilitator further classified two major types of earthworms. Epigeic types live on the surface in freshly decayed plants and animal residues. Endogeic types live underground and eat soil to extract nutrient from decayed organic residues. Earthworm in epigeic category are commonly used in vermicomposting and *Eisenia foetida* is the species most commonly used. It is a voracious eater, each worm eating 1-7 gram/day and cast 0.8- 6gram/day.

Following the introduction of vermicomposting was the presentation on the process of vermicomposting beginning with the process of preparing bed for the vermicompost. Bedding is the living medium and also a food source for the worms. It is a material high in carbon and made to mimic decaying dried leaves the forest floor, the worms' natural habitat. The bedding should be moist (similar to the consistency of a wrung-out sponge) and loose to enable the worms to breath and to facilitate aerobic decomposition of the food that is buried in it. He further explained the possibility of vermicomposting in both indoors and outdoors with proper care and management of the appropriate environment keeping away from the direct sunlight and rain. The environment management involved the management of bedding material, organic materials needed to supply necessary nutrients, need of management of moisture and temperature range for the survival of earthworm and the microbial activities in vermicomposting. *Eisenia foetida*, the most common worms used in composting systems, feed most rapidly at temperatures of 10–32 °C and the temperatures above the range may harm them.

During the training the facilitator explained the possibility of vermicomposting in small scale for domestic purpose and on commercial scale and explained about it increasing popularity at both national and international scale. He suggested adding the fresh organic material based on how rapidly those were being consumed by earthworm and best would be to let the material to decompose outside the bed for about two weeks so that the leachate drain out thus maintain moisture content in vericompost. Further he pointed the need to not to leave the vermicompost unattended too long as there can be excess or deficiency of moisture or any other imbalances in layering of bedding materials.

Vermicompost is ready for harvest when it contains few to no scraps of uneaten food or bedding and can be harvested when contents look like dark black soil and most worms have migrated up to the second and third working lower layers. It takes 3-4 months after startup before first harvest can happen. While harvesting, considering the value of vermicomposting earthworm species, he recommended picking out as many worms, eggs and cocoons as possible and returning them to the compost bin. The training also included a session on troubleshooting to help the participants

with possible problems and instructing the points to be considered in selecting the bedding materials, composting material and the possible risks and pests were explained along with the ways to avoid them.

He explained vermicompost to be richer in many nutrients than compost produced by other composting methods. The value of vermicompost as soil conditioner and plant growth stimulant was due to the concentrated nutrient in worm cast. Unlike other compost, worm castings also contain worm mucus which helps prevent nutrients from washing away with the first watering and holds moisture better than plain soil from the decomposition of organic material. Further, it is rich in microbial life which converts nutrients already present in the soil into plant-available forms. Its recognition with a wide range of applications in homes and commercial gardens was growing.

The farmers were also shared about the ongoing research on the process of application of collection and application of human urine as fertilizer and other hormones such as Rotex and *Trichoderma* fungus to upgrade the quality of compost. Upon the discussion about the about the perceived cause of declining application of organic manure, the participating farmers felt the growing deviation from the indigenous farming practice and lack of knowledge transfer from the expert to the farming communities as the major cause of growing imbalance in application of chemical fertilizers. Too this the facilitator as soil scientist suggested to continue using compost despite use of chemical fertilizer was essential for the sustainability of soil quality and crop productivity.

Day 2

The second day was an exhibition and demonstration visit to *Bagbani*, Horticulture Research Station at Kirtipur. It involved observation of ongoing vermicomposting research section and a participatory demonstration on the preparation of compost and vermicompost. It was intended to provide the participants an exposure to the activities involved in composting and vermicomposting and upgrading their capacity through self-help for replicating the process independently. The farmers were provided a short visit in the *Bagbani* premise exposing them to the arrangement of collection of human urine and its application after disinfection along with the fruit varieties under research and promotion by *Bagbani*. Further they were also briefed about the waste water treatment plant being constructed to supplement the irrigational water need for the horticulture and various other researches undertaken in the centre.

During the practical session for the prepation of compost and vermicompost, the total participants were divided into two groups each with a team leader. Along with the participation

of team leader the two groups were guided by the facilitator in the overall activities in composting and vermicomposting in the first session based on the theory lesson and handouts provided in the first day of training. Post lunch, the farmers were trained on the use of bone powder and *Trichoderma* for upgrading the prepared vermicompost. Following this the farmers were also trained on the process of application of the disinfected human urine for irrigating.

The training ended with a evaluation of the training from the participants perspectives and a short note from the research team and the facilitator encouraging participants to take advantage of the capacity building activities and to consult experts in case of any problem.

Figure: Evaluation of Overall Training by the Participants