

Participatory Breeding on Organic Vegetables

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Key words: organic, participatory breeding, vegetables, variety development, seed production, on-farm

Abstract

To impede diversity loss and encourage organic farmer seed independence, the development of varieties suitable for organic farming was done in Regions 4A, 4B, 8 and 12, in the Philippines using participatory breeding protocols. Segregating lines and populations were given to cooperators for continuous evaluation and selection, breeding for desirable traits, and seed production. Aloague Farm has been planting their selections of cherry tomato and lettuce for several seasons; selections from both crops are grown in commercial scale. In OISCA Farm, selections on pepper and tomato were commercially produced and sold in weekend organic market. Cooperators in Region 8 are producing their selections in bitter melon, sitao, squash and eggplant for market while potential varieties were developed in pepper, eggplant, tomato, and sitao from on-station trials. In Region 12, several organic farmers are already selling their produce from selected lines. Seeds of these lines were shared with other farmers around the area.

Introduction

In the Philippines, there had been increasing interest to go into organic farming since the approval of the Organic Agriculture Act but several constraints such as lack of training, information, and organic farm inputs have been experienced by stakeholders. The problem on seed availability forced organic farmers to use conventional varieties; however, researches show that good performance in conventional systems does not indicate the same performance in organic conditions (Murphy et al. 2007). Thus, organic growers need crop varieties well-adapted to the low-input conditions of organic systems (Zystro 2012). One way of solving the problem is through participatory breeding where farmers develop and adapt crop varieties to the specific conditions and farm practices in their areas (Halewood et al. 2007). This study was undertaken to train selected organic growers on organic variety development and seed production, to develop organic varieties of selected vegetables through participatory breeding, and to produce seeds of the organic varieties developed.

Materials and Methods

Germplasm Collection, Orientation, Training and Seed Distribution

The germplasm includes materials from the study group which were mainly entries from other organic breeding projects and potential organic varieties developed by the group, as well as farmers' varieties and landraces. The cooperators were allowed to contribute germplasm that they want to improve. Commercial varieties were used as check varieties for the trials.

In each region, orientation and initial training was first conducted to familiarize the farmers with the objectives, mechanics, expected output and terms of reference of the study and to identify priority crops per region. Topics discussed during the trainings include breeding, pest and cultural management, production of organic farm inputs, and seed production. After the orientation, initial seeds of crops preferred by the farmers were distributed. For Regions 8 and 12, seeds given to the cooperators include pole sitao (7 entries), squash (3), tomato (4), and eggplant (6). The entries were mainly lines that can further be improved with selection and one check variety per crop. In Region 4A, two sets of seeds were given to each farm cooperator; one set includes potential organic varieties while the other set was mainly segregating lines of the cooperators' preferred crops.

There were also seeds allotted for on-station trials in each region (PAMANA, UPLB in Region 4A, Abuyog Experimental Station in Region 8, and DA-CEMIARC Tupi, South Cotabato in Region 12). Crops planted on-station include pole sitao, squash, cucumber, watermelon, melon, tomato, pepper and eggplant – each crop having five F₅-F₆ lines. In the on-station trials, selection of potential organic varieties and initial organic seed production was accomplished; afterwards, the harvested seeds were distributed to the cooperators in the respective regions. In addition, on-station trials served as laboratories of the cooperators during training days and as back-up for on-farm trials.

On-station and On-farm Evaluation of Germplasm

The lines given to the cooperators were evaluated under low input condition in their respective farms. Cultural management depends on the farmers' option, as long as they comply with the Philippine National Standard for Organic Agriculture. Line and individual plants were selected depending on the market and farmers' preferences. Other factors considered were plant vigor, reaction to pests and diseases, fruit characteristics, yield, and over-all acceptability. When selected plants started to flower, selfing, sibbing and hybridization were done by the cooperators. Seeds from selfed or sibbed fruits were obtained for purification and use for succeeding trials.

For on-station trials, entries were planted on raised beds covered with plastic mulch. Standard plot sizes were used, namely 5 meters long and 1 meter wide with 0.5 meter spacing between plots. There were two planting rows per plot with holes spaced at 50 cm along the row and 75 cm apart. Minimal fertilizer application, weeding, and pest control measures were observed. Vermicompost was the main organic fertilizer used which was applied at the rate of 1 kg/m². Fermented plant and fruit juices were also applied during the vegetative and reproductive stages of the plants. Pest management interventions include planting of insect-repellent aromatic plants and spraying of hot pepper solution (25 g/L) whenever necessary. Barrier plants and attractants were also planted within and around the area. Weeds were allowed to grow between plots.

Monitoring of Trials and Data Gathering

Visitation of on-farm trials in the target regions was done once or twice every month. For every visit, hands-on training on selection, pollination, hybridization and seed production was carried out (whichever is applicable during a particular visit). Observations on co-operators' selected lines, crosses formed, and seed-produced entries were noted, along with their basis on selection. For on-station trials, data obtained include days to flowering and harvesting, plant vigor, reaction to pests and diseases, and horticultural characters. Plants having the desired characteristics based on these factors were selected, seed produced, and subjected to further evaluation and purification.

Results

Aloague Farm has its own selections in table tomato, cherry tomato, lettuce, pepper, cucumber, squash, and eggplant. Selections in cherry tomato and lettuce, the farm's two priority crops, have already been planted for several seasons. Selections on these crops differ based on the preferences of the consumer eg. small cherry, large cherry, fine curls, etc (see Table 1). They were also able to make their own crosses in pepper. In Kai Farms, also in Cavite, the selections in tomato and eggplant were seed produced for the next round of production.

In OISCA in Quezon, the co-operators were able to select and seed produce selections in eggplant, pepper, sitao, cucumber and squash. They market their produce from the selected lines in the weekend organic market in Lucena, Quezon. For on-station trials in Region 4, crosses in pole sitao, cucumber, eggplant, and pepper have been evaluated for 2 generations. Continuous evaluation and selection are being conducted for these lines.

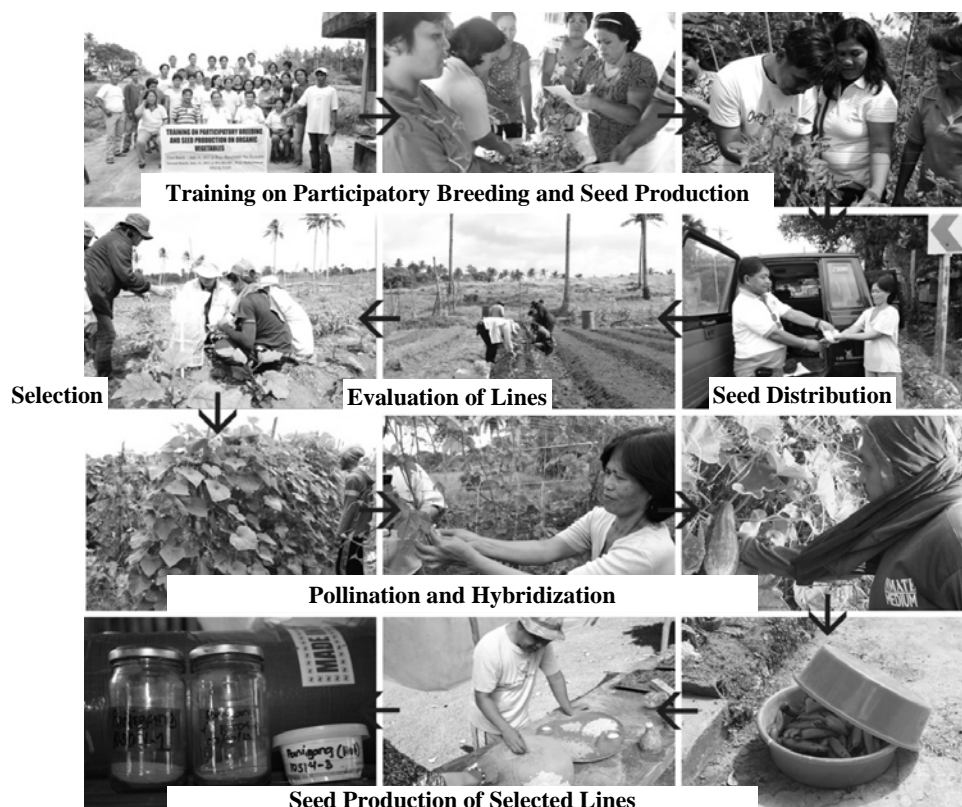


Figure 1. The participatory plant breeding process conducted at the cooperators' farms.

Table 1: Characteristics of some selections of cooperators in their respective priority crops

Cooperator/Selection	Characteristics
Aloague Farm	
Cherry tomato -1	Small cherry, round, red fruit skin color
Cherry tomato -2	Large cherry, round, red fruit skin color
Cherry tomato -3	Large cherry, round, sweet, pink fruit skin color
Pepper 10514-1	Light green, non-pungent, wrinkled fruit with blunt end
Pepper 10514-2	Light green, mildly pungent fruit with pointed end, horn-type
Pepper 10514-3	Green, slim, very pungent fruit with pointed end
OISCA Farm	
Pepper 10449-1	Dark green, medium-sized fruits with pointed end
Pepper 10506-1	Green, medium-sized fruits
Pepper 10506-2	Light green fruits with pointed end, horn-type
Pepper 10506-3	Light green, slender, medium-sized fruits
Pepper 10509-1-1	Green, thin/slim, medium-sized fruits
Pepper 10510-1	Dark green, straight and slender fruits

In Region 8, several cooperators are already producing in commercial scale selections in bitter melon, sitao, squash and eggplant. Potential varieties were also selected on pepper, eggplant, tomato, and sitao from the on-station trials. Some cooperators were also able to make their own crosses which will be undergoing evaluation.

Cooperators from Region 12 also have their own selections which they continuously evaluate, purify, and seed produce. Many cooperators from this region were able to seed increase their selections in different vegetable crops which they used for planting for commercial scale. They were also able to sell organic produce and share their organic seeds with other farmers in their areas. As a matter of fact, one cooperator is already doing negotiations for the marketing of his organic seeds. The same cooperator has also started keeping records of his sales, selections, and seeds produced and distributed.

For this study, the main problem encountered is that many farmers were interested with the training but only a few are willing to participate in the breeding aspect and actually continue the selection and seed production of the crops. And, if ever they do seed produce their selections, problems in terms of labelling and seed storage arise. Also, active cooperators' enthusiasm in breeding has a tendency to decline due to the tedious nature of breeding activities. Thus, focus was given to those cooperators with promising selections and who show interest and initiative in sustaining the project. Other problems met include the failure of farmers to save seeds of their selections (they either give seeds to fellow farmers or sell them to buyers) and the difficulty in monitoring of the on-farm trials since the farms are far from each other.

Discussion

In the course of the study, promising results from active farmer co-operators were accomplished including selections on their priority crops, seeds produced from those selections, and potential varieties which are continuously undergoing purification and trials. But more than these, more significant accomplishments in terms of the cooperators' experiences were achieved. Some farmers learned how to keep records of their produce, sales and selections, as well as the seeds that they were able to produce, sell and distribute to other farmers. Others also get to put into practice the things that they were taught during the trainings, especially in the breeding aspect. Although most of them were discouraged to participate in the breeding works due to the tedious process, there are still cooperators who show eagerness to learn and to continue the breeding works that they have started.

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