*International Proceedings of Chemical, Biological and Environmental Engineering, Vol. 92 (2016)*
*DOI: 10.7763/IPCBEE. 2016. V92. 5*

# Farmers' Responses to Vegetable Production Technology in East Java, Indonesia

Amanatuz Zuhriyah [1 +], Noor Rizkiyah [2], Nugrahini S. Wisnujati [3], Putu B. Daroini [4] and Joko Mariyono [5]

[1] University of Trunojoyo Madura/Agribusiness, Bangkalan, East Java, Indonesia
[2] Antakusuma University/Agriculture, Pangkalan Bun, Central Kalimantan, Indonesia
[3] Wijaya Kusuma University/Agribusiness, Surabaya, East Java, Indonesia
[4] Assessment Institute for Agricultural Technology, East Java, Indonesia
[5] University of Pancasakti/Economics, Tegal, Central Java, Indonesia

**Abstract.** This study assesses farmers' perception on technology production on chili and tomato in East Java. Chilli and tomato were the main vegetable commodity in East Java. The assessment was done by survey at across 12 different project sites during September - December 2014. The survey uses structured questionnaires on 250 farmers. For this purpose, the study uses "before and after" assessment framework. The results indicate that technology has very favourably increased vegetable farming capability and knowledgebase of the farmers. Farmers reported that they could increase yield with reduced uses of chemicals and other inputs. They reported very positive impacts of technology on all of the farmers' association. Farmers' knowledge on plant protection and soil fertility improvement increased significantly. In conclusion, technology has been successfully delivered to improve knowledge and skill on chilli and tomato farming, and vegetable production in general. Besides, the process of technology transfer has strengthened the group formation and social capitals related to vegetable farming in the remotely located communities.

**Keywords:** Farmers' response, production technology, chilli and tomato, East Java – Indonesia.

## 1. Introduction

Chilli and tomato are the main vegetable commodities in Indonesia. Since 2001, Indonesian vegetable production has grown by an average of 8% per year from 6.9 million tons to reach more than 9 million tons in 2005, from almost one million hectares of land with an average yield of 9.6 tons per hectare[1]. Chili production uses 20% of the vegetable land but only produces 12% of the total vegetable output due to low average yields. Whereas, both cabbage and potato use only 6.3% and 6.8% respectively of the vegetable land and have much higher yields resulting in large volumes of produce.

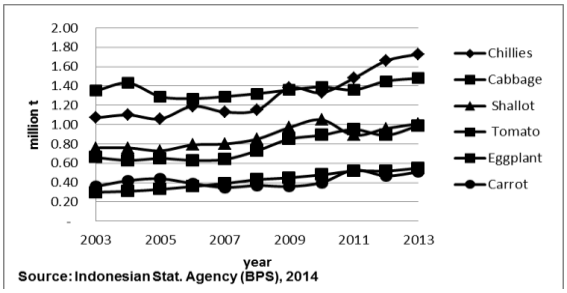


Fig. 1. Indonesian vegetable production

+ Corresponding author.
*E-mail address*: amanatuz.zuhriyah@gmail.com
[1] This exclude almost 31 million tons of mushrooms

The main vegetables grown in Indonesia (besides mushrooms) and their average yields (tons per hectare) are as follows: cabbages (22.4 t/ha), chili (4.7 to 6.4t/ha), potato (16.4t/ha), shallot & onions (8.8t/ha) and tomato (12.6t/ha) [1]. Among the vegetables grown in Indonesia, chili is the highest in terms of acreage and production.

As shown in Fig. 1, the production of vegetables increases during the last decade. Chili is the highest growth rate. Production of chili increased dramatically from 1.2 million ton in 2003 to almost 1.9 million ton in 2013. This is due mainly to substantial improvements in irrigation infrastructure and better cultivars. Other vegetables also increased steadily because of the same efforts as chili.

The major vegetables are produced year-round, but there are two main production seasons: one starting from mid-February with a harvest running from late April to early June, and then starting in late July with a harvest running from September to as late as early November. Consequently, Indonesian vegetable production does not exhibit a very strong seasonal pattern. For instance, monthly production of chili nation-wide, averaged by month over the period from 2000 to 2013, ranges from 60,000 to 150,000 t with a peak in April and a lower peak in September. It means that variations in weather, planting and other factors can overwhelm seasonal output effects [2]. Year-round pattern of the productivity in Java reveals a sigmoid shape, meaning that supply fluctuates [3]. East Java is one of the potential productions of chilli and tomato. However, the productivity is relatively low compared to other regions [4]. To improve the productivity, a package of technology has been transferred to farmers via farmers' field school (FFS). The process of FFS was documented during its implementation, and the impact of FFS was conducted one year after completion of FFS thus the impact documented here was only of the immediate impacts of FFS. This paper assesses the farmers' responses to production technology on chili and tomato in East Java transferred through farmers' field school.

## 2. Literature Review

FFS has been a popular method to disseminate new agricultural technologies for over 20 years, and it is practiced with various annual and perennial crops. Many FFS in Indonesia have focused on IPM. FFS evolved and became popular after the Government of Indonesia revolutionized its policy on plant protection by implementing the national IPM program initiated in 1986 under Presidential Decree No. 3. The program was motivated by the fact that pesticides were not wisely used. The unwise use of pesticides led to economic losses associated with pest outbreaks in the 1960s [5] and in the 1980s [6]. In addition, there were other adverse impacts of unwise use of pesticides such as environmental and health problems [7], [8]. The program was then conducted in 1989 [9], with the objectives of IPM training being: higher productivity, increased farmers' income, monitored pest populations (i.e. to keep pests below economic threshold levels), limited use of chemical pesticides, and an improved environment and better public health [10].

There exists a strong claim that Indonesian IPM programme has been able to reduce the use of pesticides significantly. In the field trials, the training has been able to cut down pesticide use by 50% without sacrificing the level of production [7]. Farmers have adopted the IPM principles [11]-[15], and there is an indication of strong diffusion of IPM knowledge among farmers [16]. Using a participatory approach shows "that the deeper understanding of the occupational hazard of handling pesticides indeed induced a change in the FFS participants' attitudes towards pesticides" [17]. Underpinning the rise of participatory research has been a realization that the poor in general, and poor marginal farmers in particular, are far from being a homogeneous group. Thus, technologies have to be selected and adapted for particular systems. Based on an empirical study of successful adaptation and spread of pro-poor technologies, it is found that farmers who are members of FFS groups are significantly better off than non-member farmers [18]. In summary, FFS is an effective method to disseminate improved technologies to farmers. Many studies have shown this approach to be effective. Modified and adapted FFSs on other crops and topics are expected to have positive impacts on farming practices and improve understanding of farmers on such topics.

## 3. Methodology

Total number of farmers trained in FFS is about 1600. The assessment was done at individual across 12 different project sites during September - December 2014.

The survey used structured questionnaires; an intensive interview was done with 250 FFS-graduate farmers. For this purpose, "before and after" method of impact assessment framework was used to evaluate FFS participants on the technology of vegetable production.

# 4. Results and Discussion

## 4.1. Characteristics of FFS

Description of FFS in both tomato and chili is presented as follow. Composition of participants of Tomato Field School based on gender and status of land owner Status in Bali and East Java provinces as shown in Table 1.

Table 1: Participant composition

| Crops | Number of participants | | Land owner | |
|---|---|---|---|---|
| | Man (%) | Woman (%) | Owner (%) | Worker (%) |
| Tomato | 56.3 | 53.7 | 61.3 | 39.7 |
| Chili | 76.4 | 23.6 | 72.0 | 28.0 |
| Note : Data from 5 FFS on Chili in Bali 9 FFS in East Java; Data from 10 FFS on Tomato in Bali and 5 FFS in Weast Java | | | | |

## 4.2. FFS Process

The process of FFS in transferring technology is as follow.

- Time Implementation of Field School. Implementation of field school from January to December 2014, in general it has implemented within their proper time and season, starting in March to August, 2014.
- The presence of participants. based on the monitoring results show that level of attendance is a good, in Bali attendance rate reaches 95%, because when in the field school period, a lot of ceremonial activities. In East Java attendance rate of more than 95%
- Provision of seeds. in general, providing seed for Tomato field school is done by grafting seed. In Bali, grafting seed growth reached 97.5% and in East Java, grafting seed growth of 90%. 85% achievement of the growing power is carried by field school participants, for example field school in District Kayen Kidul in Kediri district did own practice, with the growth is very good
- Tools and Training Materials, in general, it can be provided well and timely, availability can thus support the activities of the Field School.
- Land Study of field school participants. Tomato field school activities for land use practices, in general they use SST treatment, grafting, an integrated technical control, compost and add with bio-agents such as *Trichoderma*, organic liquid fertilizer, and for basic fertilizer, they use of NPK fertilizer, and in the farmers, in general they use NPK fertilizer and pesticide use by mixing a variety of pesticides and spraying are not using the economic threshold, the practice of land used by the participants as reference material in the management of a healthy crop cultivation and low cost.

## 4.3. Subject of FFS

The field school subjects presented by the facilitator for implementing Field School are:

- FFS on Tomato: general agroecosystems, agroecosystems element management in pest control, tomato technical cultivation, tomato crop seeding, soil ecology, technical grafting, SST technical, biological agents, organic liquid fertilizer, integrated pest management techniques on pests and diseases of tomato plants, analysis of farming
- FFS on Chili: general agroecosystems, agroecosystems element management in pest control, technical aquaculture chillies, chilli crop seeding, soil ecology, SST technical, biological agents, organic liquid fertilizer, integrated pest management techniques on pests and diseases of tomato plants, the analysis of farming

## 4.4. Descriptive Impact of FFS Perceived by Farmers

Experience following the AVRDC Field School, members of the group receive excellent benefits include increased insight and skills in vegetable production is greatly increased among other technical SST and Grafting gives hope that such knowledge can improve the quality of farmed vegetables and increase farmers'

income, cost efficiency study of farming and product quality control and technical increasing cultivated wear controllers organic material so as not to damage the environment and the resulting product safe for consuming, healthy crops and reduce pesticide.

Joys and sorrows, in the process for the field school need patience because it's rather difficult to change farmer mind-set; nevertheless field school has been providing technical mutual learning together and joint problem solving. Experience attempts to solve the problem in field school for fertilizer efficiency with SST technology and the use of non-chemical fertilizers and pesticides to control pests and plant diseases.

The advantage of this program is that a package of technology such as SST and grafting technology for tomatoes and knowledge of pest control can be obtained from this field school program.

## 4.5. Farmers' Response to Technological Package

Farmers perceived that technologies delivered via FFS are useful. Results shows that 84% sampled farmers intended to apply the technologies in their own vegetable farming. While, 16% said "no" because of several reasons. The main reason is that such technologies were incompatible to local conditions (see Fig. 2). With respect to adequacy of technologies, results shows that 67% farmers perceived that the technologies were adequate. Those who perceived that such technologies were inadequate were because of insufficiency of meeting number and materials; and unsuitability of technology with local agro-ecosystem (see Fig. 3).

## 4.6. Benefit of FFS to Farmers

One important finding from the qualitative study was related to respondents' perceptions of impact of the program. The study found that the program, which is FFS has given several benefits to farmers, especially the knowledge given in the FFS. Farmers felt that FFS has given some valuable knowledge. Through these knowledge farmer can cultivate more crops than before. Farmers mentioned several training materials or knowledge given in the FFS. In general the knowledge that is received by farmer from FFS can be grouped as follows: plant observation, pest handling, seed selection, fertilizer management and grafting technique.

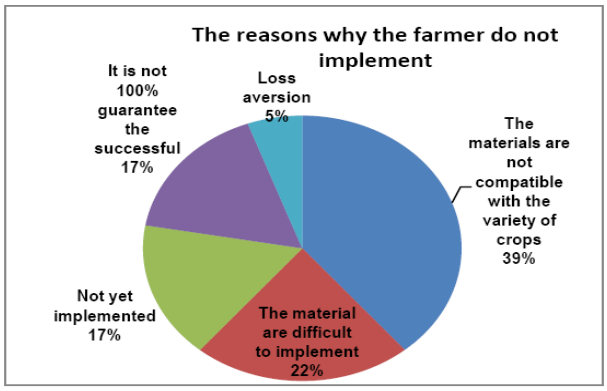


Fig. 2. Farmers' reasons on Not applying the technology

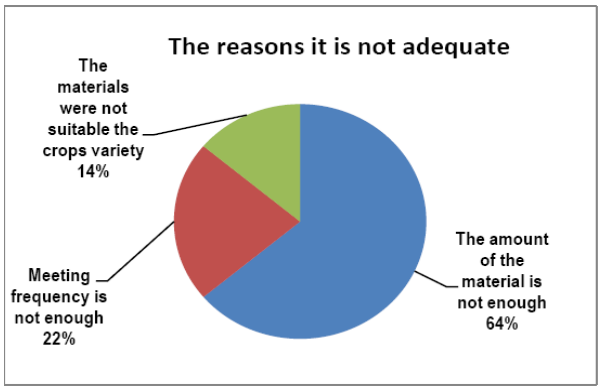


Fig. 3. Farmers' reason on inadequacy of technology

Table 2: The most useful knowledge for farmer

| Knowledge provided in the FFS | Respondent's Answer (%) | |
|---|---|---|
| | Most useful knowledge | Second Most useful knowledge |
| Plant observation | 24.29 | 26.94 |
| Pest controlling | 48.99 | 24.49 |
| Pest traps | 2.02 | 12.24 |
| Seed selection | 4.45 | 11.84 |
| SST (or "kocoran") | 6.88 | 16.33 |
| Fertilizer test | 1.62 | 4.08 |
| Grafting technology | 3.24 | 3.27 |
| Other techniques | 8.50 | 0.82 |

The importance of knowledge provided by FFS for farmer is also shown by one finding from the field survey using the structured questionnaire. The majority respondent admitted that they would still continue implementing the knowledge from FFS. There are some factors that could explain the low value of the specific technique perceived by farmers. Firstly, farmers still uncertain that implementing new technique will automatically lead to higher income. Some farmers in Kediri think that new technique, in this case grafting just increase the cost of farming. (Table 2)

Income has become an important issue for farmers. They will try new technique if only this technique is able to increase their income. Unfortunately, income of farmers is heavily determined by the price of commodity, which in most of cases unstable. Therefore, famers suggested that future FFS should provide post harvesting material (Table 3). They believe those knowledge will help them to get a better price for their product.

Table 3: The material needed in future FFS

| Materials needed | Respondent's Answer (%) |
|---|---|
| Product processing | 24.8 |
| Product marketing strategy | 31.9 |
| Other farming technique for different crop | 34.1 |
| Other subjects | 9.3 |

The second reason that explains farmers' reluctance to implement new knowledge is the difficulty to implement the technique. Some farmers still think that several techniques taught in FFS is not really practical. This finding is confirmed by quantitative study result, which identified that around 37 percent of respondents who do not implement some FFS materials because they think some techniques in FFS are too complicated.

Not only benefit from the knowledge, FFS also gives other benefits to farmers, which is better network among them. Through regular FFS meetings farmers can strengthen their relationship. This finding is quite similar with the condition in other developing countries. FFS in Kenya has able to make the relationship among farmers became strong [19].

## 5. Conclusion and Recommendation

The results indicate that FFS has very favourably increased vegetable farming capability and knowledgebase of the FFS participants. Farmers were able to distinguish between insect pests and beneficial insects, as well as kinds of pesticides for targeted pests. Farmers reported that they could increase yield with reduced uses of chemical pesticides and other inputs. From participatory survey with group of FFS participants, we analysed FFS impacts on dynamics of farmers association. They reported very positive impacts of FFS on all of the farmers' association. After attending a crop season long FFS, farmers' knowledge on plant protection and soil fertility improvement increased significantly.

On an average, farmers perceived chilli and tomato yield increased by over 10% and level of pesticide uses on crops reduced by at least 25% than what they were using before attending the FFS. In conclusion, FFS has successfully delivered the improved knowledge and skill on chilli and tomato farming, and vegetable production in general, to the farming communities. Besides, the FFS has strengthened the group formation and social capitals related to vegetable farming in the remotely located communities.

## 6. Acknowledgment

This study was a part of "Vegetables for Indonesia" Project, funded by USAID Indonesia and executed by AVRDC-The World Vegetable Center in collaboration with AIAT East Java. The authors are responsible for interpretation and errors.

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