The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

Performance of Soybean's Farmer Field School-Integrated Crop Management in Central Java and West Nusa Tenggara Provinces, Indonesia

Istriningsih
The Indonesian Institute for Agricultural Technology Transfer (IIATT)
Indonesian Agency for Agricultural Research and Development (IAARD)
Jalan Salak No. 22 Bogor, West Java, Indonesia
istriningsih@litbang.pertanian.go.id

Yovita Anggita Dewi
Indonesian Center for Agricultural Technology Assessment and Development (ICATAD)
Indonesian Agency for Agricultural Research and Development (IAARD)
Jalan Tentara Pelajar No. 10 Bogor, West Java, Indonesia
yovita_anggita@yahoo.com

ABSTRACT

Indonesia is challenged by a shortage of soybean production to meet local demand. The Ministry of Agriculture has developed a strategy to increase soybean production through an integrated crop management (ICM) program, which was implemented through a farmer field school (FFS) approach in 2008. This paper aims to evaluate the performance of FFS-ICM implementation in two of the main areas for soybean production—Grobogan Regency in Central Java Province and West Lombok Regency in West Nusa Tenggara Province. Primary data was collected through in-depth interviews of 120 farmers. The before and after performance of the FFS-ICM program was evaluated using paired sample t-tests. The study found that FFS-ICM has increased soybean productivity significantly both in Grobogan Regency (1,854 kg/ha) and West Lombok Regency (1,492 kg/ha). However, this was less than the optimal productivity, which can reach 2,490 kg/ha in Grobogan Regency and 1,680 kg/ha in West Lombok Regency, therefore a soybean productivity gap remains. In order to improve the implementation of soybean FFS-ICM, four policy recommendations were suggested: improving the understanding of extension workers and participant farmers on the philosophy of FFS to dispel the perception that FFS-ICM is "an aid distribution" project; intensive assistance and monitoring by field extension workers during the FFS-ICM implementation; ensuring that inputs (especially seeds) are available on time by strengthening breeding institutions at the local level; and strengthening the research and dissemination of new high-yielding varieties that are suited to local agroecosystems and in accordance with market demand.

Keywords: soybean, FFS-ICM, productivity
JEL Classification: O33

INTRODUCTION

Indonesia is still challenged by a shortage of soybean production to meet local demand. Factors contributing to low production include low price of imported soybean, lack of import tariffs, a decline in harvested area, and low productivity at the farmer level (1.29 tons/ha) (IAARD 2007). Consequently, the quantity of imported soybean has increased, which decreased the local soybean price, thereby decreasing the incentive for soybean farming. On the other hand, Indonesia has natural resources, favorable climate, the availability of technology, and a large market. In terms of technology, the Indonesian Legumes and Tuber Crops Research Institute (ILETRI) has generated a number of high-yielding varieties, which could boost soybean production as the potential yield can reach 2.5–2.7 tons/ha (IAARD 2007). It becomes apparent that there is a potential solution to overcome the soybean shortage in Indonesia.

In response, the Ministry of Agriculture has developed an integrated crop management (ICM) program (MoA 2010b), which is a package of recommended technologies that suit local conditions. To scale up the program, the farmer field school (FFS) approach was implemented in 2008. FFS-ICM claimed to have increased soybean production by 27 percent in 2009 (MoA 2010a). In addition, Jumakir and Endrizal (2009) reported that the ICM approach implemented in semi-intensive rice fields in Tanjung Jabung Barat, Jambi Province, Indonesia, was able to increase farmers' soybean productivity by 37 percent. In comparison, a FFS-ICM on cotton in India has increased the cotton yields of FFS farmers by 26 percent higher than those of non-FFS farmers (Shabnam et al. 2012).

However, the sustainability of the soybean FFS-ICM program is a major concern. Dewi et al. (2011) reported that FFS-ICM implementation encountered several obstacles. For instance, farmers do not fully understand the concept of FFS-ICM, but perceive it as an aid program due to the provision of required inputs. As a result, this perception does not encourage farmers to adopt the technologies introduced in FFS-ICM into their farming system for a sustainable practice change. Therefore, this aspect needs to be evaluated in order to prevent creating dependency.

Nevertheless, aside from this obstacle, the IFS-ICM approach appears to be the best option to increase national soybean production. Therefore, the Ministry of Agriculture continues expanding the FFS-ICM implementation coverage area. This paper aims to provide information on the performance of FFS-ICM implementation in two main provinces of soybean production. It is expected that this paper could be used as reference for the improvement of FFS-ICM implementation in the future.

METHODOLOGY

Respondents and Data Collection

The study was carried out in 2011 in Grobogan Regency, Central Java Province, and West Lombok Regency, West Nusa Tenggara Province. The method for selecting the study sites was purposive sampling (Djarwanto 2011) due to both sites being representative of the main soybean production centers and having implemented soybean FFS-ICM. The respondents were 120 farmers who were selected by stratified random sampling (Singarimbun and Sofian 1995), so that the respondents could represent an actual picture of the research sites. The sampling frame of this study is comprised of the participants of the soybean FFS-ICM program in 2008, 2009, and 2010. The respondents from each cluster were randomly and proportionally determined.

Primary data was collected through in-depth interviews using a structured questionnaire. There were five types of information collected in the study: profile of respondents and their families, crop pattern, input usage, revenue of soybean farming before and after the program, and farmer's understanding of ICM components and their adoption of each component.

DATA ANALYSIS

One of the methods to evaluate the performance of FFS-ICM implementation in two soybean-producing provinces is through comparing the production and productivity before and after the implementation of FFS-ICM. Paired observation *t*-test can be applied in the case where an object of research is given two different treatments. Although using the same individual, the researcher still obtained two kinds of data samples, the first treatment and the second treatment. The first data sample can be either the control treatment or no treatment at all applied on the research object (Sudjana 1992). In this study, farmers before implementing FFS-ICM are considered as the control group. Therefore, the performance of the FFS-ICM implementation can be measured by comparing the condition of farmers as the research object before and after the implementation of FFS-ICM.

Paired observation *t*-tests were employed to test for those differences with the following formula (Walpole 1995):

$$t = \frac{\bar{d} - d_0}{\left({s_d}/{\sqrt{n}}\right)}, df = n - 1$$

where:

$\bar{d} - d_0$ = average of production/ productivity *after* implementation of FFS-ICM program minus *before* the implementation;
s_d = standard deviation of differences;
n = sample size;
df = degrees of freedom.

The hypothesis can be stated as follows:

H_o: There is no significant difference in the performance of soybean farming before and after the implementation of the FFS-ICM program.

H_a: There is a significant difference in the performance of soybean farming before and after the implementation of the FFS-ICM program.

With the conclusion that:

H_o is rejected if the *t*-test value > *t*-table value, α=.05

H_o is accepted if *t*-test value < *t*-table value, α=.05

In addition, to measure the profitability of soybean farming before and after FFS-ICM implementation, the benefit cost ratio (B/C) approach is employed. B/C of soybean farming could be approximated by the following equation (Soekartawi 1995):

$$B/C = \frac{(Q \times P) - (VC + FC)}{TVC}$$

where:

B/C = benefit-cost ratio;
Q = production (kg/ha/season);
P = selling price (IDR/kg);
VC = variable cost (IDR);
FC = fixed cost (IDR);
TVC = total cost (IDR/ha/season).

With the conclusion that:

B/C >1 soybean farming is profitable
B/C =1 soybean farming is at the break-even point;
B/C <1 soybean farming is not profitable

In order to measure the feasibility of the soybean FFS-ICM program, marginal benefit cost ratio approach (MBCR) is employed using the following equation (Soekartawi 1995):

$$MBCR = \frac{TR_a - TR_b}{TC_a - TC_b} \; is\ feasible\ if > i$$

where:

MBCR	=	marginal benefit cost ratio;
TRa	=	total revenue *after* implementing FFS-ICM (IDR);
TRb	=	total revenue *before* implementing FFS-ICM (IDR);
TCa	=	total farming cost *after* implementing FFS-ICM (IDR);
TCb	=	total farming cost *before* implementing FFS-ICM (IDR);
i	=	interest (%).

The MBCR calculation should include elements of risk premium up to 90 percent (Erwidodo 1994) in order to cover the costs of depreciation, transportation, and other costs. Therefore, to conclude whether the soybean FFS-ICM program is feasible, the value of MBCR should be greater than 1.9.

RESULTS AND DISCUSSION

Soybean Development in Indonesia

Soybean plays an important role in the economic development of Indonesia as the raw material of the soybean processing industry and as source of income for soybean farmers. Different types of product are made of soybean such as tofu, *tempe* (soybean cake), soy milk, and others. The government has set a target to achieve soybean self-sufficiency by 2014 for four main reasons: (1) most of Indonesia's population consumes it daily as a source of low-priced protein, (2) to support the soybean processing industry, (3) to save on foreign exchange, and (4) to reduce dependency on soybean imports (Budhi and Aminah 2010; Baharsjah 2004). Although soybean is cultivated in almost all provinces (excluding Jakarta), Indonesia still experiences a shortage of supply due to fast-growing demand and challenges in increasing national production. Table 1 shows the average contribution of soybean production in Central Java (19%) and West Nusa Tenggara (10%) provinces to national production in 2007–2012; the shares of area harvested were 16 percent and 12 percent, respectively. These provinces are very important in supporting the national soybean production system. If the potential and advantages of the regions can be harnessed, it can promote the government's policy to reduce dependency on imported soybean. Meanwhile, Table 2 shows that the national production during that period was only 0.8 million ton per year, while the average domestic demand was 2.39 million tons per year. As a consequence, an average of 1.64 million tons of soybean per year is imported to Indonesia to meet high local demand. High dependency on imported soybean has caused domestic price instability. For instance, domestic soybean price increased when the USA, a major exporter of soybean, experienced drought. The local market, which was dominated by a few players, held the stock and reduced the supply to the market since they predicted that there would be a decrease in world production (Nuhung 2013). In response, the Minister of Finance issued a regulation (PMK No. 133/PMK.011/2013), on 3 October 2013, which stipulated that the soybean import tariff be reduced to 0 percent. However, many analyses have stated that the 0 percent import tariff is not able to decrease local soybean price in the market. Nuryanti and Kustiari (2007) conclude that farmers will only receive a profit of around 18.85 percent if the government stipulated the rate of import tariff at 10 percent. Therefore, farmers' profit will be much lower if the import tariff is lowered to 0 percent. Furthermore, Nuryanti and Kustiari (2007) assert that optimal import tariff is 24.3 percent,

Table 1. Area harvested and soybean production in Central Java Province, West Nusa Tenggara Province, and at the national level (2007–2012)

Year	Central Java		West Nusa Tenggara		Indonesia	
	Area harvested (ha)	Production (ton)	Area harvested (ha)	Production (ton)	Area harvested (ha)	Production (ton)
2007	84,098	123,209	56,901	68,419	455,633	586,018
2008	111,653	167,345	76,154	95,106	590,956	775,710
2009	110,061	175,156	87,920	95,846	722,791	974,512
2010	114,070	187,992	86,649	93,122	660,823	907,031
2011	81,988	112,273	75,042	88,099	622,254	851,286
2012	97,112	152,416	62,888	74,156	567,624	843,153
Average	99,830	153,065	74,259	85,791	603,347	822,952
Share in national (%)	16.5	18.6	12.3	10.4		

Source: Statistics Indonesia (2014)

Table 2. Volume of soybean demand and import (2007–2012)

Year	Demand* (million tons)	Import (million tons)
2007	2.01	1.42
2008	1.96	1.18
2009	2.29	1.32
2010	2.65	1.74
2011	2.46	2.09
2012	2.95	2.11
Average	2.39	1.64

Source: Ministry of Agriculture (2012, 2013a)
Note: *demand for food, feed, seed, processing, and soybean losses

which may increase farmers' profit up to 25 percent. Therefore, if government does not address this issue, soybean farming will no longer be attractive to farmers, which may hamper efforts to increase national production.

Profile of Respondents

It is important to determine the characteristics of the respondents to know the potential factors that affect soybean farming development. These characteristics include age, soybean farming experience, formal education, and farm size. The study shows that the average farmer in Grobogan Regency, Central Java Province is 51 years old, with 6 years of formal education, and 18 years experience on soybean farming. The average farm size for soybean farming was 0.53 ha with half of the farmers being tenants. Farmers in West Lombok Regency, West Nusa Tenggara Province are similar to the farmers in Grobogan. They had an average age of 50, with 7 years of formal education, and 14 years soybean farming experience. The average size of land for soybean farming in West Lombok was 0.5 ha with the majority (98%) of the farmers owning the land (Table 3). The profile of farmers in both provinces shows that in general

Table 3. Characteristics of respondents

	Grobogan Regency	West Lombok Regency
Average age (years)	51	50
Average formal education (years)	6	7
Average soybean farming experience (years)	18	14
Average size of land (ha)	0.53	0.5
Tenurial status		
Leased (%)	48	98
Owned (%)	47	2
Both leased and owned (%)	5	-

Source: Primary data

they are in the productive age, which implies that there are many opportunities to improve soybean farming practices. The average length of farming experience further signifies that soybean farming is practiced from generation to generation in both sites.

Existing Soybean Farming

There are two types of land in the study sites in Central Java Province—rainfed and irrigated—which have different soybean cropping patterns. In the rainfed area, a paddy–maize/soybean–soybean cropping pattern (Figure 1) is observed, whereas a paddy-paddy-soybean pattern is common in the irrigated area (Figure 2). West Nusa Tenggara has a similar cropping pattern, where paddy is planted twice a year and followed by soybean (Figure 3).

The Soybean FFS-ICM Program

ICM is an approach that integrates land, water, crop, and pest management, as well as climate, resulting in increased productivity, farmer income, and environmental sustainability (IAARD 2009). This is consistent with van de Fliert and Braun's (1999) views, who argue that the approach emphasizes the balance between environment, social, and economic aspects to deliver the benefits of introduced technology sustainably. ICM includes compulsory technology (high-yielding varieties, high quality and labeled seeds, drainage channels, crop population management, and integrated pest management) and optional technology that suits local conditions (land preparation, fertilizing as needed, organic matter application, using ameliorant for acid-dry land, irrigating

Figure 1. Cropping pattern in rainfed area in Grobogan Regency, Central Java Province

Figure 2. Cropping pattern in irrigated area in Grobogan Regency, Central Java Province

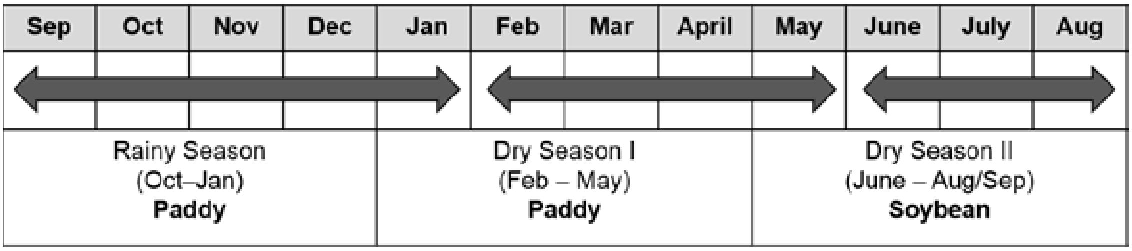
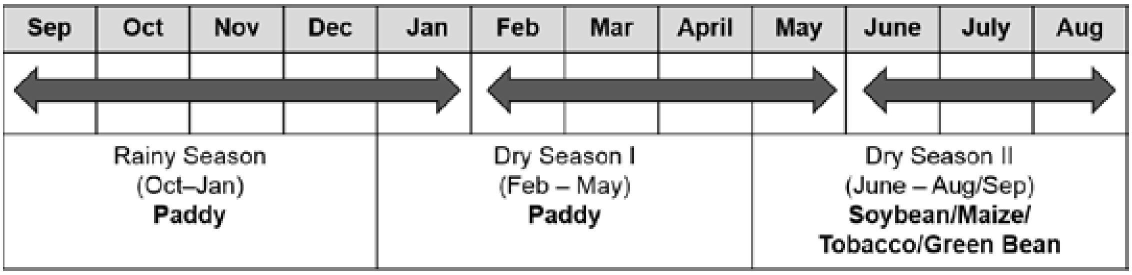


Figure 3. Cropping pattern in irrigated area in West Lombok Regency, West Nusa Tenggara Province



the fields during critical periods, and harvest and postharvest management) (IAARD 2009). Therefore, it seems reasonable that the ICM approach will help increase national soybean production.

FFS is considered an effective approach leading to sustainable development (van de Fliert 2010). FFS-ICM is implemented by employing participatory approaches in every stage, namely: (1) identifying issues and opportunities, (2) identifying ICM technology components, (3) developing collective business planning, (4) ICM implementation, and (5) introducing ICM to other farmers (IAARD 2009). In the FFS-ICM implementation, farmers in a group take part in the whole process of making decisions and taking action to solve their own problems. FFS approach provides room for farmers to select and test the technology and eventually decide on the best technology they will adopt (Asiabaka 2002). FFS concept is consistent with the opinion of Nair and White (1993, 12) in their book *Perspectives on Development Communication* that "it is the participatory communication approach that considers the local context, self-management and self-reliance, indigenous knowledge, and involvement of people in the message development and decision-making process." Therefore, the implementation of FFS-ICM that employs a participatory approach is expected to contribute to building a sense of ownership, empowering farmers, and promoting sustainable adoption of introduced technologies.

Adoption of ICM technologies

This study found that not all compulsory technology components introduced were fully adopted/implemented by farmers in both sites (Table 4). One of the reasons for limited implementation is that technology is

Table 4. Rate of adoption of soybean ICM technology components in Grobogan Regency, Central Java and West Lombok Regency, West Nusa Tenggara (%)

ICM Technology Components (%)	Grobogan Regency	West Lombok Regency
Compulsory		
High-yielding varieties	100	97
High-quality and labeled seeds	62	87
Drainage channels	87	82
Crop population management	92	72
Integrated pest management	97	63
Optional		
Land preparation	90	25
Fertilize as needed	82	35
Organic matter application	85	37
Ameliorant for acid-dry land	2	3
Irrigate the fields during critical period	47	75
Harvest and postharvest management	93	72

not available, specifically labeled seeds. To overcome this issue, farmers often select and use the best seeds from the previous season.

Compulsory technology implementation in both sites was relatively high, ranging from 62–100 percent. On the other hand, optional ICM component technologies showed different results in both sites, particularly for land preparation, fertilizing as needed, organic matter application, and irrigating the fields during critical periods. The rate of application of these technologies in both provinces was very different because of site-specific factors and local conditions. For instance, in West Lombok, because soybean is planted after paddy, soil nutrients remain quite high; therefore, farmers do not necessarily practice land preparation, apply fertilizer, or use organic matter. Conversely, Grobogan farmers used those technology components before FFS-ICM to improve soybean production, therefore, the rate of adoption is high. Irrigating the fields during critical periods in Grobogan is only applied by half of the farmers who have irrigated land, which are mostly located in the Toroh subdistrict where water supply from the Kedung Ombo dam is sufficient (Hanifah and Istriningsih 2012). The same reason is given by farmers in West Lombok whose soybean farms are mostly in irrigated land. In addition, the nature of the soil in both provinces is not acid-dry land; therefore, ameliorant application is not required or necessary.

Performance of FFS-ICM implementation

To evaluate the performance of FFS-ICM implementation in the two provinces, production and productivity were compared before and after implementation of the FFS-ICM program (Table 5). Productivity after FFS-ICM increased significantly in both sites, 27 percent in Grobogan ($p<.01$) and 55 percent in West Lombok ($p<.01$). The increased productivity in West Lombok (530.6 kg/ha) is higher than Grobogan (391.7 kg/ha) because even before FFS-ICM, the farmers in Grobogan already used higher inputs as well as the Grobogan soybean variety, which produced high yields. The potential yield in Grobogan is reported as 2,490 kg/ha (Agency of Crops and Horticulture of Grobogan Regency 2010). This explains why farmers in Grobogan have practiced better soybean farming than those in West Lombok. This increase is assumed to be due to higher NPK fertilizer and pesticide application and crop

Table 5. Difference in input usage, production, and productivity before and after the implementation of soybean FFS-ICM

	Before	After	Difference
Grobogan Regency, Central Java Province			
Seed (kg/ha)	75.3	66.5	−8.8***
Urea fertilizer (kg/ha)	100.8	82.6	−18.1**
SP36 fertilizer (kg/ha)	73.2	12.9	−60.3***
NPK fertilizer (kg/ha)	36.8	141.8	+104.9***
Cattle manure (kg/ha)	697.6	733.2	+35.6ns
Pesticide (IDR/ha)	304,784	407,770	+102,985.7***
Human labor (IDR/ha)	2,671,484	3,531,114	+859,659.4***
Productivity (kg/ha)	1,462	1,854	+391.7***
Production (kg)	763.6	1,003.2	+239.6***
West Lombok Regency, West Nusa Tenggara Province			
Seed (kg/ha)	57.4	51.5	-5.9 ns
Urea fertilizer (kg/ha)	80.6	84.3	+3.7 ns
SP36 fertilizer (kg/ha)	54.2	55.8	+1.6 ns
NPK fertilizer (kg/ha)	20.1	17.2	-2.8 ns
Cattle manure (kg/ha)	99.3	143.1	+43.7 ns
Pesticide (IDR/ha)	130,001	198,056	+68,055.6**
Human labor (IDR/ha)	1,964,135	2,260,668	+296,532.8 ***
Productivity (kg/ha)	961	1,492	+530.6***
Production (kg)	532.1	801.2	+269.2***

Note: ***, **, * = significant at 1%, 5%, and 10% probability levels, respectively; ns = not significant at 10% probability level

population management, which were reflected in the higher cost of human labor. Farmers used to spread or disperse the seeds, but in the crop population management practice, farmers required more labor to follow the recommended transplanting using the 20–40 centimeter (cm) planting space. Consequently, farmers must hire more labor and have higher costs as an outcome of applying this technology.

Since farmers in West Lombok believe that soil nutrients remain high after paddy farming, they did not apply NPK fertilizer and cattle manure as much as those in Grobogan. Table 5 shows that farmers in Grobogan applied higher quantity of inputs than those in West Lombok, which implies that farmers in West Lombok did not manage soybean as intensively as those in Grobogan. Nevertheless, FFS-ICM implementation in West Lombok increased soybean productivity. The factors contributing to this increase are assumed to be increased usage of pesticide and improved crop population management. Similar to the case of Grobogan, farmers in West Lombok also used to spread or disperse the seeds, but in FFS-ICM, the 10–15 cm × 40 cm planting distance was recommended to farmers, which required more labor. Seven out of 10 farmers (72%) applied it; the rest did not, due to the higher cost of hiring more labor. In addition, the potential yield in West Lombok is 1,680 kg/ha (AIAT of West Nusa Tenggara 2010), which is lower than in Grobogan. Therefore, even though FFS-ICM has proportionally improved soybean productivity more in West Lombok, productivity before and after FFS-ICM remains lower than in Grobogan.

Profitability and feasibility of soybean farming after the FFS-ICM program at the farmer level must be determined as a basis for consideration whether the FFS-ICM program should be scaled up and introduced to more farmers. The results show that farmers in West Lombok Regency benefited more from the program compared to those in Grobogan Regency, as reflected by the B/C values (Table 6). In West Lombok, farmer benefit increased to 63 percent with B/C values increasing from 0.82 to 1.34 after the soybean FFS-ICM implementation. On the other hand, in Grobogan, farmers only enjoyed slightly increased benefit after the program (16%) and BCR values increased from 1.04 to 1.21.

The results also show that the soybean FFS-ICM approach is feasible to farmers in both sites, as reflected by the MBCR values in Grobogan and West Lombok (3.73 and 4.55, respectively). This means that every additional cost of IDR 1,000 would give a revenue of IDR 3,730 for farmers in Grobogan Regency and IDR 4,550 for farmers in West Lombok Regency.

CONCLUSION

FFS-ICM has contributed to significantly increase soybean productivity both in Grobogan Regency, Central Java (1,854 kg/ha) and West Lombok Regency, West Nusa Tenggara (1,492 kg/ha). However, when compared to optimal productivity, which can reach 2,490 kg/ha in Grobogan and 1,680 kg/ha in West Lombok, a productivity gap remains for soybean. This gap needs to be addressed by continuous assistance and monitoring to improve farmers' knowledge and skills in order to ignite the need for change in practice. Sustainability of ICM implementation is very important and all relevant stakeholders need to work collaboratively to address this.

Four policy recommendations are suggested to improve the implementation of soybean FFS-ICM. First, improving the understanding of extension workers and farmers who are involved in FFS-ICM implementation about the philosophy of FFS. FFS-ICM is not a project. It is an approach, which is intended to change farmers' behavior through learning-by-doing in their own fields. In many cases, participants return to their previous behavior after the FFS-ICM is finished because they perceive FFS-ICM as an "aid distribution" project. Second, intensive assistance and monitoring by field extension workers during the FFS-

Table 6. BCR and MBCR of soybean farming before and after implementing soybean FFS-ICM

	Grobogan Regency, Central Java		West Lombok Regency, West Nusa Tenggara	
	Before	After	Before	After
B/C	1.04	1.21	0.82	1.34
MBCR		3.73		4.55

ICM implementation should be done. Third, production inputs, especially seeds, must be made available on time. In terms of improving the availability of certified seed at the local level, strengthening the existing breeding institutions such as local government agencies, the private sector, or local breeders is needed. In many FFS-ICM sites, farmers complain of poor-quality seed and late distribution. Consequently, farmers could not gain the expected high productivity because they had to use their own selected seeds from the previous harvest. Fourth, research and dissemination of new high-yielding varieties that suit local agroecosystems to provide more options for farmers must be strengthened. For instance, the Indonesian Agency for Agricultural Research and Development (IAARD) of the Ministry of Agriculture has generated several new high-yielding and drought-tolerant, varieties such as *Dering 1* and *Gema*, with potential productivity of up to 2.83 tons/ha and 3.06 tons/ha, respectively. The *Tanggamus* and *Seulawah* varieties have potential productivity of up to 2.5 tons/ha and are also tolerant to soil acidity (Ministry of Agriculture 2013b). Nevertheless, research on soybean breeding should not only focus on increasing productivity alone, but also consider market demand for soybean with large seed size and uniform white color preferred by the *tempe* and tofu industries.

REFERENCES

Agency of Crops and Horticulture of Grobogan Regency. 2010. *Agriculture Statistics of Grobogan Regency in 2009*. (unpublished).

AIAT of West Nusa Tenggara. 2010. *Final Report of the FFS-ICM Assistance in West Lombok Regency by AIAT of West Nusa Tenggara in the Year of 2010*. (unpublished).

Asiabaka, Chigozie. 2002. "Promoting Sustainable Extension Approaches: Farmer Field School (FFS) and Its Role in Sustainable Agricultural Development in Africa." *International Journal of Agriculture and Rural Development* 3 (1): 46–53.

Baharsjah, S. 2004. "The Orientation of Food Regulation Should be Directed to Self-Sufficiency." *Kompas*, January 14.

Budhi, G.S., and Mimin Aminah. 2010. "Self-Sufficiency in Soybean: The Hope and the Reality." *Forum Penelitian Agro Ekonomi* 28 (1): 55–68.

Dewi, Y.A., Vyta W. Hanifah, Istriningsih, Ume Humaedah, and Joko Mulyono. 2011. *Assessment of FFS-ICM Contribution toward Production Increasing to Support Self-Sufficiency 2014 (Research Report)*. Bogor: Indonesian Center for Agricultural Technology Assessment and Development.

Djarwanto, P.S. 2001. *Non-parametric Statistics (3rd ed)*. Yogyakarta: BPFE Gadjah Mada University.

Erwidodo. 1994. "Analysis of Fertilizer Application in Agriculture Sector. Paper presented at the Soil Test Training, Bogor, November 9−11.

Hanifah, V.W., and Istriningsih. 2012. "The Performance of Soybean FFS-ICM Technology Components in Central Java to Support the Achievement of Sustainable Self-Sufficiency." paper presented at the National Seminar on Site Specific Agricultural Innovation, Medan, June 5−7.

IAARD (Indonesian Agency for Agricultural Research and Development). 2007. *Prospects and Directions of Soybean Agribusiness Development (2nd ed.)*. Jakarta: Indonesian Agency for Agricultural Research and Development, Ministry of Agriculture.

———. 2009. *General Guidance of ICM Soybean.* Jakarta: Indonesian Agency for Agricultural Research and Development, Ministry of Agriculture.

Jumakir, and Endrizal. 2009. "Assessment on Cultivation Technology towards Soybean Productivity with Integrated Crop Management Approach in Semi Intensive Wetland." Accessed October 1, 2012. http://digilib.litbang.deptan.go.id/~jambi/view_detail.php? mfn=480&qtype=search&dbinfo=iptan&words=kedelai

Ministry of Agriculture. 2010a. *Guidelines for Implementing FFS-ICM of Rice, Maize, Soybean and Peanut 2010*. Jakarta: General Directorate of Food Crops, Ministry of Agriculture.

———. 2010b. *Guidelines for Implementing Development of Legumes and Tuber Crops 2010*. Jakarta: General Directorate of Food Crops, Ministry of Agriculture.

———. 2012. *Food Consumption Statistics 2012*. Jakarta: General Directorate of Food Crops, Ministry of Agriculture.

———. 2013a. *Food Consumption Bulletin* 4. Jakarta: General Directorate of Food Crops, Ministry of Agriculture.

———. 2013b. *400 Agricultural Innovative Technologies*. Jakarta: General Directorate of Food Crops, Ministry of Agriculture.

Nair, K.S., and Shirley A. White. (eds.) 1993. *Perspectives on Development Communication*. London: Thousand Oaks.

Nuhung, I.A. 2013. "Soybean and Food Politics." *Forum Penelitian Agro Ekonomi* 31 (2): 123–135.

Nuryanti, S., and R. Kustiari. 2007. "Increasing Soybean Farmer Welfare with Optimal Tariff Policy." Paper presented at the National Seminar on Dynamics of Agriculture and Rural Development: Seeking Alternative for Economic Development Direction, Bogor, December 4.

Shabnam, M.A., S.S. Dolli, S.L. Patil, R.K. Patil, and K.A. Jahagirdar. 2012. "Impact of Farmer's Field School (FFFS) on Cotton ICM Practice by Farmers in Dharwad District." *International Journal of Agricultural and Statistical Sciences* 8 (1): 119–125.

Singarimbun, M., and Sofian, E. 1995. *Research Survey Methods*. Jakarta: LP3ES.

Soekartawi. 1995. *Farming System Analysis*. Jakarta: Indonesia University (UI-Press).

"Statistics Indonesia." Accessed June 24, 2014. http://www.bps.go.id/eng/

Sudjana. 1992. *Statistical Methods (5th ed.)* Bandung: Tarsito.

Van de Fliert, Elske. 2010. "Communication and Sustainable Rural Development." In *An Introduction to Communication and Social Change* edited by P. Thomas and M. Bromley, 85−96. Queensland: Centre for Communication and Social Change, School of Journalism and Communication, The University of Queensland.

Van de Fliert, Elske, and Ann R. Braun. 1999. *Farmer Field School for Integrated Crop Management of Sweet Potato: Field Guides and Technical Manual*. Lima: International Potato Center.

Walpole, R.E. 1995. *Introduction to Statistics (3rd ed.)* Jakarta: Gramedia Pustaka Utama.