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Training and Visit (T&V) Extension vs. Farmer Field School: The Indonesian Experience

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Abstract

For several decades the effective and efficient dissemination of new agricultural knowledge among farmers in developing countries has been problematic. Two major programs were implemented in Indonesia, namely The Training and Visit (T&V) Extension Program or The Massive Guidance (BIMAS) Program, from the mid 1960s until the end of the1980s, and the Farmer Field School (FFS) Program, during the 1990s. The main difference between these two programs is that, while farmers were instructed what to do under the T&V program, the FFS program encouraged and stimulated farmers to make their own decisions. This paper aims to discuss and compare the effectiveness of these two programs with reference to rice production in Indonesia. The findings suggest that, for regions where the level of development is still very low, implementing a T&V program instructing farmers what to do is probably more appropriate than an FFS. As for regions where agriculture is relatively developed, an effective FFS program seems more appropriate

Key words: Food policy, agricultural economics and policy, development policy, public policy.

JEL: Q16, Q18, O11, O33

Training and Visit (T&V) Extension vs. Farmer Field School: The Indonesian Experience

1. Introduction

One of today's major challenges remains how to feed the world population, particularly in developing countries (FAO, 2004; Sachs, 2005; Thirtle and Lin, 2003; World Bank 2007). Being able to boost food production in countries where famine and undernourishment exist is an important strategy towards meeting this challenge. Numerous genetically altered plants are continually being invented, even for difficult regions such as Sub-Saharan Africa, with these new varieties being expected to increase food production significantly (Hoisington et al., 1999; Khush, 1999; Pinstrup-Andersen et al., 1999; Karshenas, 2001; Thirtle and Lin, 2003). The most important issue, then, is how these new plants and technologies should be disseminated in regions where undernourishment and poverty are the main problems. Several scientists have discussed this dissemination issue and consider that East Asia's successful Green Revolution during the 1970s, 1980s and 1990s should be the model to follow (Otsuka and Kalirajan, 2006; Otsuka, 2006). Of particular interest is the case of rice production in Indonesia, where dissemination of agricultural intensification methods led to annual average growth rates of more than 4 percent during the 1960s, 1970s and the beginning of the 1980s.

Two major programs in particular were implemented in Indonesia to disseminate new rice production knowledge among farmers, namely The Training and Visit (T&V) Extension Program—in Indonesia this is called the Massive Guidance (*Bimbingan Masal* or BIMAS) Program—and the Farmer Field School (FFS) Program. The main difference between these two programs is that, where the T&V program was concerned, farmers were instructed on what to do and were given incentives through the provision of cheap credit to follow these instructions (Mosher, 1976; Feder and Slade, 1986; Birkhaeuser et al., 1991), while the FFS

program encouraged and stimulated farmers to make their own decisions (Oka, 1991; Pincus, 1991; Kenmore, 1992). The performance of these programs has been well discussed in a number of previous studies for various regions.[1] However, there has been less discussion of the extent to which these programs are different in terms of their implementation processes and outcomes. Hence, this paper aims to discuss and compare these two programs and their performance along those lines.

There are at least five difficulties in achieving the goal of this paper. First, Indonesia no longer actively conducts any of the T&V or FFS programs. Second, Indonesia never actively conducted these two programs simultaneously: the T&V or BIMAS program was conducted from the mid 1960s until the end of the 1980s, the FFS program during the 1990s. Third, the Indonesian T&V program mostly, though not only, dealt with introducing farmers to new high-yielding varieties, namely IR8, IR5 and their derivatives, while the FFS program was mostly concerned with appropriate ways to control pests, namely the integrated pest management approach. Fourth, consistent and comparable data reporting the performance of these two programs is relatively limited. Hence, it is difficult to compare the two programs quantitatively. Lastly, how to precisely measure the performance of these programs is itself a controversial and complicated issue, still the focus of on-going debate (Feder et al., 2004a; Van den Berg and Jiggins, 2007).

This paper will conduct a narrative-descriptive analysis, describing chronologically the implementation of these programs and their outcomes, including the unintentional ones, and explaining why it was possible to implement each program and why the outputs were as such. To compare the performance of these programs, this paper will particularly focus on seven indicators: 1) impact on yield, 2) impact on chemical use, 3) risk of crop failure, 4)

[1] For example, the T&V extension program worldwide has been reviewed by Birkhaeuser et al. (1991) and Anderson et al. (2007). Van den Berg and Jiggins (2007) provided a comprehensive review of the FFS program. Röling and Van den Fliert (1994) discussed in more detail the institutional settings of the FFS program. Both the T&V and FFS programs were discussed by Van den Fliert et al. (1996) and Eicher (2007), but not in great detail.

ability to sustain the technology disseminated, 5) cost, 6) up-scaling issues, and 7) corruption issues. Our conclusions will be drawn based on these indicators.

The outline of this paper is as follows. In the next section, we present the overall performance of rice production in Indonesia. Then the implementation of T&V or BIMAS and its performance is described, followed by a section on the FFS program. Finally, we compare these two programs and draw conclusions.

2. Overview of Rice Production in Indonesia[2]

Rice has been the most important food crop in Indonesia for decades. Nevertheless, maize, cassava, and sweet potatoes have also been important. We compare the performance of rice production with that of cassava, maize and sweet potatoes in Indonesia since the mid 1960s. Figure 1 shows that, in the mid 1960s, the level of rice production was more or less the same as that of cassava, and that of maize and sweet potatoes was around one fifth that of rice. Until 2006, rice and maize production grew relatively steadily and reached around 3–4 times their 1966 levels. Cassava production grew moderately, while that of sweet potatoes declined.

<<Insert Figure 1>>

Figure 1 also shows the average annual growth in production for cassava, maize, rice, and sweet potatoes for 4 different periods. The first period is from 1966 until 1983. This is the period when BIMAS (including its credit program) was actively being implemented. The second period is from 1984 until 1989. BIMAS's credit program was abolished around 1984, and the whole BIMAS program had been put aside by 1989. The third period comprises

[2] From now on, we will use the term BIMAS program for the Indonesian T&V program.

when implementation of the FFS began (1990) until the economic crisis (1997). The fourth period is from 1998 until 2006, a post-crisis period. This periodisation is expected to give us some insight into how the production of food crops has changed over time in Indonesia under different regimes.

During the first period, the rice production growth rate was well above 5 percent annually — the highest growth rate of the periods covered. The growth rate of maize production was close to 2 percent annually, while cassava and sweet potatoes experienced almost no growth. To understand the reasons behind the dynamics of production of these crops, it is necessary to observe their yield per ha performance (Figure 2). Although it is true that the area under rice production has continued to expand along with the production level since the early 1960s, as can be seen in Figure 2, the yield per ha performance of rice also significantly improved during this period. This situation has typically been associated with the success of the BIMAS program. Around the end of this period, Indonesia became self-sufficient in rice (Simatupang and Timmer, 2008). The slow growth of cassava and maize production were mostly due to the slow expansion of plantation areas for these crops. The negative growth of sweet potatoes was due to a reduction of areas under sweet potato production.

<<Insert Figure 2>>

During the second period, the average annual growth rate of rice production declined to slightly above 3 percent. Cassava's performance significantly improved; together with maize, they grew at annual rates of close to 4 percent and slightly above 3 percent, respectively (Figure 1). From the perspective of yield per ha, average annual growth of yield per ha for cassava, maize and sweet potatoes had improved compared to the first period, but

not for rice, which dropped by more than half its average annual growth rate for the first period. This indicated that Indonesia was no longer self-sufficient in rice. The BIMAS program was typically criticised for this situation, and during this period alternative programs were being seriously debated.

During the third period, the growth rate of rice production continued to decline to well below 2 percent, while the production of cassava and sweet potatoes grew negatively. Only maize performed rather well, relatively speaking (Figure 1). Average annual growth rates of cassava, rice and sweet potatoes were very low (Figure 2). Although the FFS introduced during this period was considered ineffectual in improving the annual growth rate of rice production, it was credited with preventing an even worse situation from occurring. These issues are still being debated (Yamazaki and Resosudarmo, 2008). Whatever verdict may be reached on that score, it is generally agreed that the first seven years of the 1990s were a gloomy period for Indonesia's food crop production (Simatupang and Timmer, 2008).

During the fourth period, after the economic crisis, rice production did not improve. Its growth was relatively the same as during the previous period. Cassava production performed well, but not maize and sweet potatoes (Figure 1). The numbers for average annual growth rate of yield per ha do, nonetheless, show improvements for cassava, maize, rice and sweet potatoes. For rice, however, the average annual growth rate of yield per ha was still far below that of the first period.

Let us now compare Indonesia's performance in food crop production, namely rice, with some other developing countries in Asia. Figure 3 shows that Indonesia's rice yield per ha in 1966 was similar to that of other developing countries in Asia, except for China. But from the mid 1960s to the mid 1980s, Indonesia's productivity grew faster than that of most other countries in Asia. Hence Indonesia's rice yield per ha was relatively higher than most other developing countries in Asia, but still not as high as that of China. As mentioned

above, many associated this achievement with the implementation of the BIMAS program. Since then, however, Vietnam's rice yield per ha has increased faster than Indonesia's, so by the mid 2000s the former's rice yield per ha outperformed that of the latter.

<<Insert Figure 3>>

The conclusions that can be drawn from the discussion in this section are the following. First, rice production in Indonesia performed well during the 1960s, 1970s and early 1980s. It has been suggested that the improvement in yield per ha during this period was due to the implementation of the BIMAS program. Second, since the mid 1980s, Indonesia has not been able to maintain the performance of high growth in rice production, due to its inability to improve the yield per ha significantly. Critics typically claimed that the BIMAS program had become ineffective. It might be true that the alternative program, the FFS, was able to stop the declining growth of yield per ha, but it did not seem able to improve it significantly. The next two sections will discuss in more detail and give some explanations for the differences in performance of the two rice technology dissemination programs implemented since the mid 1960s, namely the BIMAS and FFS programs.

3. BIMAS: The Indonesian T&V Program

3.1. Historical Perspective

During the Japanese occupation, throughout its early independent years, and until the beginning of the 1960s, Indonesia faced serious food shortages. The first serious Indonesian effort to improve rice production was the establishment of the *Padi Sentra* program in 1959, which would run for 5 years. Learning from international experience, various padi centers were established to supply farmers with inputs they needed on credit. From the beginning of

the program, logistics were the main problem; when it ended, there had been almost no improvement in rice production, and the farmer rate of repayment was low (Roekasah and Penny, 1967; Birowo, 1975).

The main reason for the failure of the *Padi Sentra* program was not because local agricultural scientists were unable to develop techniques to improve rice production. Education and research systems in the field of agriculture in Indonesia were relatively developed; many Dutch researchers were still in the country, and links existed with international communities. The most likely reason for its failure was lack of experience in engaging in a large-scale program, particularly the lack of adequately trained and experienced personnel to handle various management activities (Birowo, 1975; Mears and Moeljono, 1981).

A glimmer of hope came from the two consecutive projects, Action Research and Mass Demonstration (*Demonstrasi Masal* or DEMAS) — the embryos of BIMAS — conducted by the Bogor Institute of Agriculture in West Java in 1963–64 and 1964–65, respectively. Around 440 students were sent to about 220 villages, covering approximately 10 thousand hectares of rice fields, to guide (read "instruct") farmers in implementing the Five Farming Efforts system (*Panca Usaha Tani*) and acquire credits for the farmers' cooperative (*Koperta*). The Five Farming Efforts system was concerned with (1) intensive use of high yielding varieties (HYVs) which had recently been developed, such as Arimbi, Dara and Shinta (Fox, 1993); (2) appropriate and timely use of fertilisers; (3) pest and disease management; (4) improvement in cultivation methods; and (5) improvement in irrigation and drainage systems. Farmers received loans, mostly in kind, in the form of slips or release orders which were presented to the PN Pertani kiosk for the delivery of farm supplies such as seeds, fertilisers and insecticides. After the harvest, farmers were also to return their loans in kind (Roekasah and Penny, 1967; Rieffel, 1969; Birowo, 1975; FAO, 2001). This was also

the early period of T&V development worldwide (Birkhaeuser et al., 1991). Indonesian researchers were certainly in communication with international experts in developing this DEMAS program.

Despite several cases where fertilisers did not arrive in time or repayments were problematic, overall the programs were considered successful. Increased rice yields among farmers involved in the program were recorded at around 50 percent more than previous harvests. In 1965 these activities were adopted as a nationwide program, called BIMAS, and were organised by the Department of Agriculture (DOA). That year around 1,200 students were sent to an area covering around 140 thousand hectares of rice fields. In the following year the BIMAS area coverage increased to around 480 thousand hectares and continued to increase after that. Gradually the students were replaced by agricultural extension staff of the Department of Agriculture. The Indonesian People's Bank (BRI or *Bank Rakyat Indonesia*, then called *Bank Koperasi Tani dan Nelayan*) was the main source of loans, which were mostly extended through farmer cooperatives or village heads (*lurah*). KOLOGNAS (*Komando Logistik National*), formed in 1966 to maintain domestic distribution of food crops, was also asked to provide credit to BIMAS farmers (Roekasah and Penny, 1967; Rieffel, 1969).

As the program expanded significantly, it became more apparent that the logistics of timely and appropriate provision of fertilisers and pesticides were problematic, and intensive supervision was often not available. Hence, two modifications took place in 1967. First, the loans BIMAS farmers received also included cost of living and transportation, and they were required to pay back their loans in cash. The second was the establishment of another massive supervision program called INMAS (*Intensifikasi Masal* or mass intensification). With INMAS, farmers still received supervision, though less than with BIMAS, and no credit facility was provided. Farmers were expected to find their own source of financial support.

INMAS planners would merely arrange for fertilisers, insecticides and sprays to be available for cash purchase close to the farm. Initially, INMAS was meant to be a follow-up program for successful BIMAS farmers who no longer needed financial support or were able to find their own sources. Later on, it turned out that being ex-BIMAS was not in fact a criterion for joining INMAS (Mears and Afiff, 1968; Birowo, 1975). It is also important to mention that during this period BIMAS started to introduce the IR8 and IR5 varieties of rice to farmers, the HYVs that had just been developed by the International Rice Research Institute (IRRI) and which started the Green Revolution in South and Southeast Asia (Fox, 1991 and 1993).

While there is no clear report on the performance of farmers who joined INMAS, there were optimistic reports relating to the performance of BIMAS farmers. Data in 1966–67 showed that the average yield increase among BIMAS farmers was around 1–2 tons of rice per hectare, and the average yield of BIMAS farmers was around 50 percent higher than that of non-BIMAS farmers (Mears and Afiff, 1968). This was most likely due to the introduction of new HYVs.

When Soeharto resumed the presidency in 1967/68, he and his economic team, recognising the large amount of foreign exchange needed to import rice, made BIMAS one of the top national priorities. In 1968, Soeharto and his cabinet modified BIMAS into BIMAS *Gotong Royong* (Cooperative BIMAS). In this program, the government contracted seven foreign companies to supply fertilisers, pesticides and some equipment at subsidised prices on a one-year deferred payment basis to BIMAS farmers (Pearson et al., 1991). These companies were paid a fixed price for every hectare they supplied with production inputs. BULOG, formed in 1967 to replace KOLOGNAS, organised the payments to these companies and repayments from farmers. The main reason for contracting foreign companies is that the government was running out of foreign exchange for the importation of necessary production inputs. In distributing these inputs to farmers, foreign contractors were assisted

by agricultural extension people. By the wet season of 1970, the program covered approximately 780 thousand hectares or around 10–20 percent of the total rice field area in Indonesia (Birowo, 1975).

BIMAS *Gotong Royong* was considered a failure. Reported yields during its implementation were below expectation and the average rate of repayment was as low as around 20 percent. One main argument commonly mentioned for this lack of success was that the guidelines for farmers were too strict. Instead of suggesting that farmers adopt the BIMAS formula with some flexibility, they were instructed to follow it strictly, whereas, in reality, technical changes cannot be made mandatory for farmers. The entire system was also open to abuse: from mark-up pricing of material inputs and cheating over the quantity/quality distributed to black-market sale of supplies obtained from the program (Birowo, 1975; Piggott et al., 1993).

Despite the failure of BIMAS *Gotong Royong*, abandoning the program was impossible. Although rice importing began in the early 1970s, so that Indonesia became the world's largest rice importer — around 20 percent of the world rice trade — food shortages were still a problem. Hence a new rice intensification program was established, called Improved BIMAS (BIMAS *yang Disempurnakan*), in which BRI played a much more significant role. The state bank set up (1) village and mobile units to overcome problems of lending to small farmers, (2) village retailers of fertilisers and insecticides to reduce problems of late delivery, and (3) village warehouses to store rice awaiting sale, so as to use the stored rice as a warranty for further credits. The program increased the number of extension workers to replace the BIMAS students fully and distributed HYVs widely (IR8, IR5 and C4 of IRRI and Indonesian Pelita I-1 and Pelita I-2) and, later on, pest-resistant varieties (IR26 and IR30 in 1975, IR24, IR28, IR32 and IR34 in 1976) to farmers. Any private sector company, in general, was allowed to sell fertilisers and pesticides to the BIMAS market.

However, the government heavily subsidised the prices of these inputs. BULOG, later on supported by BUUD (*Badan Usaha Unit Desa* or rural semi-cooperatives) and KUD (*Koperasi Unit Desa* or rural cooperatives), was asked to actively purchase and sell rice to establish floor and ceiling prices (Mears and Moeljono, 1981; Manning, 1987; Pearson et al., 1991; Fox, 1993; Timmer, 1996).

It was thanks to bonanza oil revenues received during the 1970s that necessary funding was available to allow for expansion of the program. During this period, significant rehabilitation and expansion of irrigation systems was also conducted throughout Indonesia, vital to the implementation of HYVs through the BIMAS program. International agencies such as USAID and World Bank were also involved in supporting the implementation of BIMAS and rehabilitation of irrigation systems (Pearson et al., 1991; Booth, 1977a and 1977b).

Throughout the 1970s, the BIMAS program was considered to be successful. The area coverage of BIMAS by the mid 1970s was around 4 million hectares or around 70–80 percent of the rice growing area (Mears and Moeljono, 1981). The program continued throughout the 1980s, though the achievements were not as impressive as in the 1960s and 1970s.

Another program, similar to BIMAS, was also developed in 1979, namely INSUS (*Intensifikasi Khusus* or Special Intensification). This program was geared more toward developing extension activities, including farmer (discussion) groups and cooperatives rather than incorporating the BIMAS credit component. INSUS was modified into OPSUS (*Operasi Khusus* or Special Effort Program) in the early 1980s and finally into SUPRA INSUS in 1987, typically to form better farmer discussion groups and cooperatives. There was some argument to the effect that the performance of INSUS farmers was better than that of BIMAS farmers, but not significantly so (Sawit and Manwan, 1991; FAO, 2004).

3.2. Accomplishments of BIMAS

Firstly, rice production increased substantially during BIMAS, and it contributed to ensuring secure food supplies. BIMAS farmers were also reported to have received higher income than non-intensified farmers. Hence, the intensification program was argued to have contributed to poverty reduction in rural areas (Tabor, 1992). Secondly, when the financial situation of farmers was very poor, BIMAS provided a relatively easy channel for necessary capital. Thirdly, BIMAS was able to disseminate new cultivation knowledge widely, especially by making farmers adopt important new inputs, such as HYVs, fertilisers and pesticides. Fourthly, up-scaling the program to encompass rice fields nationwide was not too difficult and could be achieved in a relatively short period.

Ten years after the BIMAS program was begun, around 45 percent of rice areas in the country were under some sort of intensification program; after 20 years, around 75 percent; and after 25 years, more than 80 percent. The various intensification programs employed were BIMAS, INMAS, INSUS or SUPRA INSUS (Figure 4), which resulted in a significant, relatively steadily increasing yield of rice production in the 1960s, 1970s and 1980s (Figure 2). In 1979, Indonesia was still the largest rice-importing country in the world, with annual imports of 2.9 million metric tons, costing about USD 600 million. However, by 1983, Indonesia became a rice self-sufficiency country for the first time in its history (Sawit and Manwan, 1991; Pearson et al., 1991; Tabor, 1992; Piggott et al., 1993; Hill, 2000).

<<Insert Figure 4>>

3.3. Issues with BIMAS

The first concern regarding BIMAS was its high cost, as argued by Mears and Moeljono (1981), Barbier (1989), Tabor (1992) and Panayotou (1993). There are several reasons to support this argument. First of all, while the market nominal monthly interest rates in the 1970s were around 5 percent, those of BIMAS were around 1 percent.[3] Second, as has been mentioned before, BIMAS operations were prone to abuse, such as selling BIMAS supplies on the black market, corrupting the quantity/quality of BIMAS supplies and stealing farmer repayments. Third, in several cases, rates of credit repayment were low. For example, in the 1973/74 budget year alone, the amount of unreturned credits was about USD 4 billion (DOF, 1977). Fourth, BIMAS encouraged the increased use of pesticides and fertilisers up to an unnecessary level. From the outset, the government subsidised these inputs so as to maintain the farmer profit margin and to keep the price of rice relatively low. In the mid 1980s, the rates of subsidy for fertilisers and pesticides reached around 50 and 80 percent of their market prices, respectively. Hence, the total fertiliser and pesticide subsidy in 1986/87 was around USD 725 billion, that is, around 66 percent of the total agricultural sector development budget for that fiscal year (Barbier, 1989; Tabor, 1992).

The second concern regarding BIMAS, still related to the first issue, was collusion between agricultural chemical companies and high-ranking officers in the Department of Agriculture. BIMAS encouraged the use of fertilisers—typically non-organic fertilisers—and pesticides which benefited suppliers of these chemical products, in this case chemical companies. In a way, BIMAS provided a guaranteed amount of sale each year for these companies (Tabor, 1992). To protect this lucrative income and to smooth the processes for obtaining necessary permits, most of these chemical companies put high-ranking officers from the Department of Agriculture and retired generals on their payrolls. Furthermore,

[3] In real terms, interest rates of BIMAS' credits were probably negative.

through these high-ranking officers, chemical companies influenced the BIMAS program (including INSUS) to instruct farmers to use increasing amounts of fertilisers and pesticides.

The third concern regarding BIMAS was pest resistance as a result of this overuse of pesticides. The first major pest outbreak was when brown planthoppers damaged more than 450 thousand hectares of rice fields in 1976/1977. The estimated yield loss was 364,500 tons of milled rice, which could have fed three million people for an entire year. In 1980, the outbreak of green leafhoppers damaged at least 12 thousand hectares of rice fields in Bali alone. The reaction to these pest outbreaks, instead of reducing the use of pesticides, was to instruct farmers to use even more. Hence, in 1986 there was another brown planthopper outbreak, destroying approximately 200 thousand hectares of rice (Useem et al., 1992; Oka, 1997).

The fourth concern regarding BIMAS was the human health impact caused by the use of pesticides. In 1988, it was recorded that there were around 1,300 cases of acute pesticide poisoning in 182 general hospitals throughout the islands of Java and Bali. An observation on the health of farmers in that same year indicated that approximately 20 to 50 percent of the farmers who utilised pesticides contracted chronic pesticide-related illnesses. These illnesses included headaches, weakness, insomnia, and difficulty with concentrating (Achmadi, 1991).

The above-mentioned concerns regarding the BIMAS approach became apparent by the mid 1980s. In 1984, consistent with the on-going economic reforms due to declining oil revenues, the BIMAS credit package was abolished and the KUPEDES market-oriented program was introduced. In 1989, the pesticide subsidy was eliminated, though the fertiliser subsidy continued. By the early 1990s, the glory of BIMAS was over. The Department of Agriculture (DOA) decided it would no longer implement BIMAS and its derivatives actively.

4. Farmer Field School: The IPM Program

4.1. Historical Perspective

In response to alarm concerning the negative side effects of the overuse of pesticides, by the end of the 1970s Indonesian scientists had learned from their research and various worldwide reports of many more problems relating to the use of pesticides in agriculture (Oka, 1978, 1979; Soekarna, 1979; Pimentel et al. 1992; Antle and Pingali 1994). Based on these findings and information from international agricultural communities, Indonesian scientists concluded that Indonesia had to stop relying solely on pesticides and needed to employ several control tactics, including synchronised planting, crop rotation, natural predators, as well as pesticides, but only as a last resort, that is, to adopt the strategy commonly known as integrated pest management (IPM). But the tactic need not be applied uniformly, as farmers themselves, either individually or sometimes collectively, needed to make their own decisions as to the best strategy. It was also concluded that conducting a Farmer Field School (FFS) in which farmers could 'learn by doing' was the appropriate method of learning IPM skills.

Resistance to moving from a BIMAS to an FFS approach was very strong in the DOA. First, many officials in the DOA still believed chemical pesticides to be the easiest, most reliable and effective method of pest control. Second, several high officials in the DOA were closely associated with pesticide companies that still wanted to promote the intensive use of their products (Oka 1997). Third, the supporters of intensive use of pesticides were politically strong: particularly chemical companies that received the most benefit from their intensive use and subsidisation. Several retired generals with strong political influence had vested interests in these companies.

The second national brown planthopper outbreak in 1986 aroused the concern of the Indonesian National Planning Agency (BAPPENAS), at that time the most powerful

government agency, which quickly sought advice from scientists in the DOA, leading universities and international organisations, who recommended implementation of the IPM program at a grassroots level. This led to the establishment of the "IPM by Farmers" program (Oka 1997).

BAPPENAS consulted intensively with President Soeharto concerning the need to implement the IPM program, and this resulted in the launching of Presidential Decree (*Keppres*) No. 3/1986, supporting the implementation of the IPM and providing national political support to establish the IPM program as a national policy requiring the support of all government agencies, including the military. It was also a signal from the president to all retired generals to retract their political support of pesticide companies.

The main activity of the IPM by Farmers program was conducting field schools to train farmers in IPM practice. To achieve this goal nationwide, three steps were taken: training for trainers, training for farmers by these trainers, and training for farmers by farmers. The last two types of training were undertaken at the FFS, whose graduate farmers were expected to change their beliefs and practices from exclusive use of pesticides more towards management of the ecosystem, growing healthy crops, and preserving beneficial natural enemies, as well as being capable of making their own decisions as to the best way to grow their plants and to control pests in their fields, rather than rote compliance with instructions to spray pesticides regularly. Farmers were also expected to develop a habit of regularly conducting observations in their fields and skills to identify pests and their natural predators (Dilts 1985; Kenmore 1992; Useem et al. 1992).

In the FFS, participants were asked to observe and discover, by themselves, pests and their natural enemies. Participants discussed their findings with one another. Then they were encouraged to derive practical conclusions and implement them. In this training there was no clear-cut distinction between trainers and trainees. Trainers only acted as facilitators. Most of

these activities were conducted in the field, where half of the field was planted using techniques that farmers had normally practiced and the other half was planted following the IPM practices being learned.

Realising that it was still very hard to expect the DOA actively to implement IPM training to extension workers and farmers, BAPPENAS undertook this role from mid 1989 to mid 1994. This was unusual, since BAPPENAS is supposed to be concerned only with planning, not with implementation.

By the end of 1991, 2,000 extension workers and 1,000 field pest observers had trained approximately 100,000 farmers. By 1992, approximately 200,000 farmers, most of them rice farmers, were trained in IPM practice. Approximately ten percent of these 200,000 farmers were chosen to receive further training to become trainers. Funding for the first two years of this activity, 1989–1991, was mainly from USAID, which extended funding until mid 1992. From mid 1992 till mid 1994, the program also received some support through a World Bank loan for other existing agricultural training projects not particularly designated for IPM training (SEARCA 1999). Reports on the success of this IPM by Farmers program were available, and typically they mentioned that the program had been able to empower farmers in making their own decisions and that there was evidence of yield increases among farmer graduates of the program.

In mid 1994, the program was transferred to the DOA, reflecting a declining interest in this program by BAPPENAS and a growing interest among officers in the DOA, as well as a desire to make the program truly a national one. For the next five years, until mid 1999, the program was mostly (approximately 75 percent) funded through a loan from the World Bank that was specifically targeted to support the IPM Program. The Indonesian government provided the other 25 percent, as the matching fund for the World Bank loan. The total cost of the second stage of the program was approximately Rp. 112 billion (around USD 35

thousand), reflecting the intention to up-scale the previous program (DOA, 1999). By 1999, around 1 million farmers had been trained in the FFS. The number was still relatively small, however, since there were around 20 million rice farmers in the country.

Despite a growing number of farmers attending the program and its larger coverage, a negative view of the second stage (1994–1999) of the IPM emerged. It never received the strong political support accorded to the first stage of the program (1989–1994) and had to face problems, such as funding delays and other bureaucratic obstacles that would have been overcome had top leadership been strongly supportive of the policy. It was suspected that training quality declined during the 1994–1999 period of the program. Hence, there were some doubts that up-scaling and sustaining the efforts of the IPM program would ever be successful (Pincus, 2002).

In 1997, the economic crisis hit Indonesia, resulting in a huge drop in the country's GDP in 1998. During this period, the number one priority of the government, including foreign donors, was to restructure the financial sector to prevent it from bringing down the national economy even further and to soften the impact of this crisis on poor people. Suddenly, the IPM Program was no longer a national priority, losing all of its by then only moderate political support, and was terminated at the end of 1999.

4.2. Accomplishments of FFS

First, various case studies find evidence of an increase in rice yield, at least in the short-run (SEARCA 1999; Van den Berg 2004; and Van den Berg and Jiggins 2007). Second, the FFS was able to disseminate new and better cultivation knowledge to farmers, in particular changing their attitudes toward insects, pesticides and pest control. The FFS was able to encourage farmers to reduce pesticide use and convince them to use it properly when needed (Oka, 1991; Pincus, 1991; Useem et al., 1992; Darmawan et al. 1993; and Deybe et al.,

1998). Also, the FFS increased farmers' confidence in making their own decisions as to how to best cultivate their plants without instructions from agricultural extension workers. Furthermore, farmers understood the need to activate farmer groups, since collective actions in controlling pests are much more effective than individual ones. As a result, there was an increase in the quantity and quality of discussions in farmer groups concerning pest control and growing healthy crops (Oka and Dilts 1993; and Pontius et al., 2002).

Before enrolling in the FFS, almost all farmers thought of most insects as pests that therefore should be killed. After the FFS, farmers realised that there are harmless insects and, most importantly, there are natural predators for most pests in their fields. Furthermore, farmers now understood that there is an economic threshold of pest population, below which the pests will not have any significant impact on the amount to be harvested. Regarding pesticide use, farmers also understood that inappropriate and excessive use of pesticides is dangerous and harmful, because they not only kill pests, but also their natural enemies and other living creatures in the fields; overuse of pesticides leads to pest resistance to pesticides and then increased risk of pest outbreaks; and pesticides are poisons that are also very harmful to humans. Hence, to control pests below their economic threshold, farmers preferred to implement synchronised planting and crop protection, field sanitation, and the use of resistant plants as their first measure. Further action involved conducting physical control measures and preserving natural enemies, before, if circumstances necessitated, as a last resort using the least dangerous pesticides. Lastly, appropriate control of pesticides also meant there were fewer opportunities for officials and chemical companies to abuse the program.

4.3. Issues with FFS

The major concern regarding the FFS program is related to up-scaling and maintaining the quality of the program. The rate of expansion of the program had been slow. In the 10 years of implementation, only 5 percent of rice farmers had the opportunity to join the FFS and learn the IPM method. It is also suspected that the training quality declined during the 1994–1999 period of the program. Availability of funding seems not to have been the main reason, however, as it has been reported that the DOA was not able to spend all funding available for the FFS program during that period (DOA, 1999).

The second concern relates to keeping farmers consistent in implementing the IPM method. There is evidence that FFS graduate farmers returned after a while to the old method of routinely spraying pesticides and conducted field observations less often than they should have. There are reasons for this. First, routine pesticide spraying seems much easier than conducting observations and making a decision to develop a strategy to control pests without using pesticides. Second, pesticide companies kept finding ways to influence farmers to use more pesticides. One of their strategies was to develop a program named "IPM Plus", which involved routinely spraying pesticides. Third, many field extension workers had not mastered the IPM method and, when a 'crisis' came about, they quickly encouraged farmers to resort to spraying pesticides. Lastly, due to changes in labour organisation over time, the opportunity cost of learning and implementing the IPM strategy could have become too high, inducing farmers to return to calendar-based spraying (Beckmann and Wesseler, 2003).

The third concern is related to an expectation that FFS graduate farmers would share their knowledge of the IPM with their neighbours. Given the complexity of the information and farmers' limited ability to convey complex decision-making skills effectively to other farmers through informal communication, the diffusion process was possibly limited and curtailed (Feder et al., 2004b).

The fourth concern is that the cost of implementing an FFS program is high (Quizon et al., 2001; Anderson and Feder, 2004; Eicher, 2007; Van den Berg and Jiggins, 2007). The estimated start-up and recurrent costs per graduate amounted to between USD 21 and USD 62. The average total cost per school was around USD 532 for a trainer-to-farmer school and around USD 586 for a farmer-to-farmer school, with the latter being slightly more expensive since two experienced farmers were needed to lead the school, whereas the trainer-to-farmer school only needed one official trainer (Braun et al., 2000). It is important to note that there are about 20 million rice farmers in Indonesia. This high cost slowed down the program's expansion, and made it hard to maintain program quality.

The fifth concern involves farmers' willingness to enroll in a FFS, which required farmers attending the school to spend some time in joint discussions. Poor farmers tend to use their off-farm time for other jobs. Hence, while there were strong incentives for many farmers to enroll in and graduate from the program (Oka 1997), attending an FFS was not attractive to some farmers; if they enrolled, they could not finish the program (SEARCA 1999).

Finally, there is no evidence yet whether FFS graduate farmers have experienced higher yields than those who did not attend the FFS, especially in the medium- to long-run. Various case studies in Sumatra, Java, Bali and Lombok reported that IPM farmers were able to increase yields by approximately 10 percent and to reduce the use of pesticides by approximately 50 percent, resulting in a reduction of costs by approximately 11 percent (MET 1993; Oka, 1997; Kuswara, 1998a and 1998b; Paiman, 1998a and 1998b, Susianto, et al. 1998; SEARCA, 1999; and Van den Berg, 2004). However, a study by Feder et al. (2004a), using a panel data system, argued that there is no evidence that the FFS induced an increase in yields and a reduction in the use of pesticides.

It is important to note that most case studies observed farmers who had relatively recently graduated from the FFS, typically observing a small group of FFS graduates and comparing their performance with a small adjacent group of non-FFS farmers. Conversely, Feder et al. (2004a) observed a larger sample of farmers (around 320 observations) and their performance throughout a medium period of time by comparing their performances in 1991 and in 1999. Hence, one possibility is that the case studies actually report the short-run impact of the FFS, while the panel data studies observe its medium-run impact. It appears that immediately after graduating from the FFS or being exposed to its influence, farmers did significantly improve their performance, but they were not able to maintain this standard over time, with their performance declining in the medium-term (Yamazaki and Resosudarmo, 2008).

5. Discussion

Let us compare the performance of BIMAS and FFS programs based on the seven indicators mentioned above: 1) impact on yield, 2) impact on chemical use, 3) risk of crop failure, 4) ability to sustain the technology disseminated, 5) cost, 6) up-scaling issues, and 7) corruption issues.

In terms of the impact on yield, many seem to agree that the BIMAS program implemented from the mid 1960s till around 1983 was able to significantly improve the yield per ha of BIMAS farmers, so that the average annual growth of yield per ha was more than 4 percent during these years (Mears and Moeljono, 1981). This annual growth rate was high by world standards. After 1984, many started to doubt that the BIMAS program was still effective in improving farmers' yields. Where the FFS program is concerned, the debate over whether or not the program actually improved farmers' yields per ha is still ongoing. In the immediate period after farmers graduated from the school, it seems there was evidence that

their yields improved. However, there was less or even no evidence of this in the medium- and long-term after farmers had graduated from the school.

In terms of chemical use, there was a tendency for BIMAS farmers to overuse both fertilisers and pesticides, leading to instances of acute and chronic human poisoning. The FFS program educated farmers to minimise the use of chemical inputs, particularly pesticides, while maintaining/improving yields. Nevertheless, whether or not farmers who graduated from the FFS were actually able to reduce their use of chemical inputs significantly is still debatable.

The overuse of pesticides under the BIMAS regime was also seen to cause pest resistance and so induce pest outbreaks in various BIMAS areas in the mid 1970s and 1980s. Hence, the BIMAS program was blamed for imposing a higher risk of crop failure. The FFS program, on the other hand, introduced an integrated pest management (IPM) technique aiming, among other things, to avoid the problems of pest resistance. Experience in the early 1990s shows that this technique effectively overcame this issue and thus reduced the risk of crop failure due to pest outbreaks (Oka, 1997).

In the end, both the BIMAS and FFS programs, for different reasons, seemed to fail to sustain the technology they introduced. Implementation of HYVs with regular use of chemical inputs introduced by the BIMAS program was not sustained, since the overuse of chemicals induced a higher risk of crop failure and human health problems. Neither was the IPM technique introduced through the FFS program carried out fully, since there is evidence that FFS graduate farmers returned after a while to the old method of routinely spraying pesticides and conducting field observations less often than they should have.

Both programs are costly, at least by a developing country's standard. Typically, implementation of these programs is only feasible when there is a windfall revenue or significant external donors. As has been mentioned before, the cost of the chemical input

subsidy under the BIMAS program reached about USD 725 billion in the 1986/87 budget year. BIMAS was heavily financed by Indonesia's bonanza oil revenues in the 1970s, which turned out to be unsustainable, and some support from external agencies such as USAID and World Bank. As the revenues of oil declined in 1980s, so did the BIMAS activities.

The FFS program cost per farmer was also high. The Indonesian FFS program was supported mainly by USAID during the first phase (1989–1991) and by the World Bank in the second phase (1992–1999) of its implementation. When the economic crisis hit Indonesia in 1997/98, priorities of external agencies changed mainly to the issues of banking and industrial restructuring. Without available external funding, the FFS program had to be terminated.

The Indonesian experience showed that, when funding was available, it was rapidly possible to scale-up the BIMAS program to reach about 80 percent of targeted areas or farmers. This was not the case for the FFS program. Extension workers' limited knowledge and ability to transfer relatively complex knowledge and decision-making processes to farmers, as well as farmers' limited ability to transfer this complex knowledge through informal communication to other farmers were the main challenges to scaling-up the FFS program, which Indonesia failed to do, and the program never reached the majority of targeted farmers.

Lastly, and importantly, BIMAS was prone to abuse, such as where officials marked-up prices of inputs, reduced the quantity or quality of supplies distributed to farmers, or sold supplies on the black market. There were fewer opportunities for abuse in the FFS program. BIMAS also created an opportunity for collusion between chemical companies and officials. Chemical companies were willing to provide kickbacks to officials as long as more of their chemicals were used in the program. This kind of opportunity did not exist in the FFS program.

6. Conclusion

This paper has reviewed Indonesia's experience in conducting the Training and Visit (T&V) Extension Program—in Indonesia this is called the Massive Guidance (*Bimbingan Masal* or BIMAS) Program—and the Farmer Field School (FFS) Program to accelerate dissemination of new knowledge to and among farmers. Although these two national programs were different, there are key similarities underlying their degrees of success.

First, there was strong local research, supported by strong links with international research communities, before the implementation of the programs. This contributed significantly to their design and made the initial implementation of the programs possible. Several modifications of the programs reflected this strong local knowledge.

Second, there was strong national political will to implement the programs. Both Soekarno, the president before Soeharto, and Soeharto himself placed rice intensification as a top priority. Explicit support from these leaders signaled for every agency in the country to support the programs, which made their smooth implementation possible. Without this strong political will, the budget would most likely have been more restricted, and the programs could hardly have succeeded.

Third, there were administrative breakthroughs to start the programs. In the case of BIMAS, the program was initiated by the two projects organised by the Bogor Institute of Agriculture. At that time, the Indonesian economy was in a very bad state and the political situation was not stable, so government departments were not functioning properly. Conditions at the university were much better, and urging students to contribute to the program was easier, as they were mostly idealistic young people who wanted to do some good for their country and they were also eager to obtain field experience. In the case of the FFS, the administrative breakthrough was the BAPPENAS decision to start the program, as

there was much resistance to it in the Department of Agriculture, including from the Minister of Agriculture.

Fourth, farmers could quickly observe the positive impact of the program in terms of a significant increase in yields in the case of BIMAS and an improvement of their cultivation knowledge, a feeling of confidence in making decisions and better health in the case of the FFS.

In the previous section, we have discussed the benefits and costs of these two programs in terms of their impacts on yield, chemical use and risk of crop failure, their ability to sustain the technology disseminated, their costs, as well as issues related to scaling-up the programs and corruption. Based on this discussion, the main overall conclusion is the following. For regions where the level of development is still very low, such as in off-Java islands and some of the Sub-Saharan regions, implementing a T&V program instructing farmers what to do is probably more appropriate than an FFS. Within a relatively short period of time spent employing the former, large numbers of farmers will do as they are told. But because of this it is also important to protect the program from officials who might abuse it and from collusive behaviours between chemical companies and officials. After the program is significantly developed, it is necessary to switch to a program such as the FFS, allowing farmers to make their own decisions as to what is best to do in their fields.

As for regions where agriculture is relatively developed, such as in Java and other regions in Asia, there is no need to go back to implementing programs such as BIMAS. A more effective FFS program followed by a new program to maintain farmers' knowledge is more appropriate. Whatever the choice, strong local research with links to international communities, a national political will and administrative breakthroughs are most likely needed.

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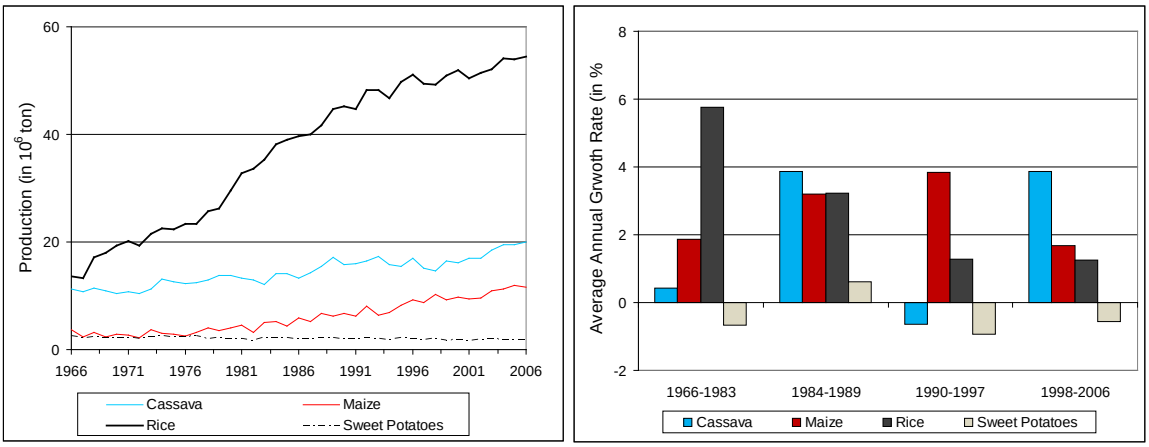
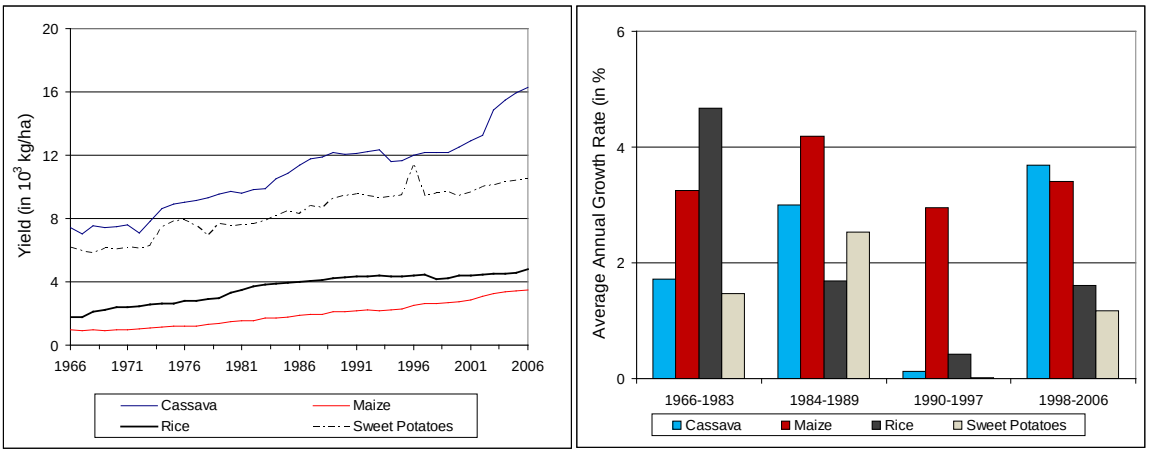


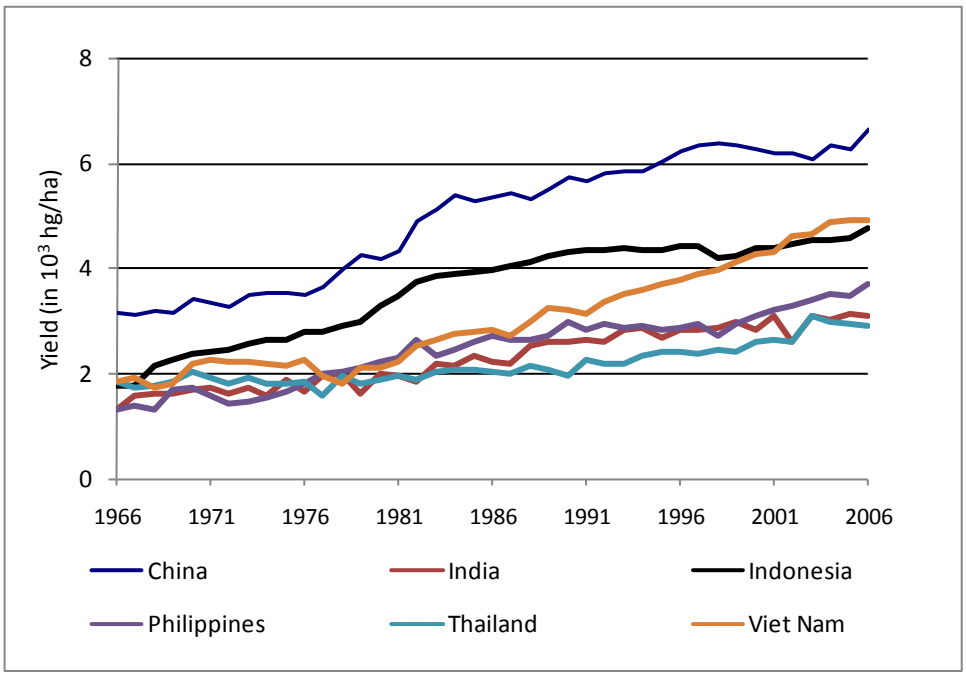
Source: FAOSTAT [http://faostat.fao.org/default.aspx]

Figure 1. Production (in 10^6 metric tons) and Average Annual Growth Rates (in %) of Several Indonesian Food Crops



Source: FAOSTAT [http://faostat.fao.org/default.aspx]

Figure 2. Yield (in 10^3 hg/ha) and Average Annual Growth Rate (in %) of Several Indonesian Food Crops



Source: FAOSTAT [http://faostat.fao.org/default.aspx]

Figure 3. Yield (in 10^3 hg/ha) of Rice in Several Developing Asian Countries

Source: Hill (2000)

Figure 4. Rice Intensification Area and Fertiliser Use

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