Strategy for Maize Farming Systems Development of Subsistence/Semicommercial Farmers in Indonesia

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Abstract. Subsistence/semicommercial farmers have been slow to adopt new technologies of maize cultivation in East Nusa Tenggara (ENT) province of Indonesia although they were potentially profitable and compatible with local sociocultural conditions. Uptake was hampered by the predominantly food security orientation of subsistence/semicommercial agriculture and the high inputs required by the new technologies (ie, superior maize seed, fertilizer and pesticides). Farmers are constrained by the lack of cash to buy inputs or the nonavailability of inputs at the subdistrict/village level. As a consequence, new technologies could not be extended, and trained farmers tended to revert back to traditional practices. In our study, three participating farmer groups planted 15 ha of maize in South Timor Tengah district in ENT province in 2007-2008. Problems were overcome by close guidance of the groups and establishment of a technology clinic at the village level. The clinic is managed by extension workers and the farmer group (Gapoktan). The clinic provides farmers with agricultural information and ensures input supply (fertilizer and pesticides) by buying them from agricultural shops at the district/province level. Farmers can take inputs on credit from the technology clinic and repay them in kind with maize grain after harvest. The technology clinic also processes maize, sells produce during the early rainy season and helps build maize seed units at the village level. This strategy shows promise in ensuring the continuity of maize farming and has the potential to be extended to other villages.

Key words: Maize, adopt, subsistence/semicommercial farmers, technology clinic

Introduction

Maize is the staple food in East Nusa Tenggara (ENT) province of Indonesia, particularly in the rural areas where 70% of the people of the province live (BPS NTT 2004). However, maize production is very limited although attempts have been made to improve cultivation technology. Productivity at the farm level remains at 1.5-2.0 t ha^{-1}. It could be increased to 2.3-4.8 t ha^{-1} (Bobihoe *et al*. 1999), and a productivity level of 3.4-6.7 t ha^{-1} has been reported under research conditions in ENT (Subandi 1999).

External interventions to increase productivity have been attempted, but adoption of maize cultivation technology by farmers in this province has been very slow, mainly because maize cultivation is primarily oriented toward food security (Yusuf and de Rosari 2001). The Indonesian government has taken up many social and economic initiatives as part of PELITA III (a development plan, phase III) to address this problem, but change in farmers' attitude has been difficult to achieve. Farmers have tended to return to old technologies after the completion of such projects (Lidjang 1995).

Farming in this mainly dryland province remains at a subsistence or semicommercial level (Subandi *et al*. 1997) with a predominant orientation toward food security (Sumarno and Bamualim 1999). So technology information and innovation initiatives must be accordingly designed. There is need for institution building to strive for sustainable technology doption.

The maize technologies used by farmers in this province are very simple; use of production inputs such as fertilizer and pesticides is limited. As a result, land fertility continues to diminish (Murdolelono and Beding 2006).

Subsistence/semicommercial farmers are mainly constrained by low natural resources, uncertain weather during the rainy season, use of inadequate technology and limited capital ownership. They need technology and capital access. Their concerns could be addressed by strengthening farmer groups.

The purpose of our research was to identify a suitable agribusiness model for subsistence/semicommercial maize farmers in ENT.

Materials and Methods

Our study was conducted on three farmer groups in Tobu village in Mollo Utara subdistrict of South Timor Tengah district in ENT during2007-2008.

The innovations sought to be introduced were both technological and institutional. The new technologies included improved varieties, recommendations on plant spacing and fertilizer application and seed production techniques. The institutional initiatives included strengthening of farmer group capital, management of input supply and seed production (Table 1)

The initiative involved operation of technology clinics by extension workers and farmer groups (Gapoktan). The functions of the clinics were to take technological information and input access to farmers. The clinics lend inputs to farmers who then repay them in kind in the form of a part of their maize production. The clinics buy inputs (fertilizer and pesticides) from shops in the subdistrict or district and maize seed from seed production units operated by farmer groups.

Data analysis

Maize production data were collected by measurement. Other data were collected by observation and Rapid Rural Appraisal (Table 2)

Table 1. Existing and improved cultivation techniques and institutional arrangements used by farmers in study villages in ENT province.

Innovation	Existing technology	Technology improvement
A. Maize cultivation Technology		
· Varieties	Local OPVs	White Srikandi OPVs
· Plant spacing	Not uniform; 80-125 × 80-125 cm; 4-5 seeds per hole	100 × 40 cm; 2-3 seeds per hole
· Fertilizer	Not used	N 90 kg ha^{-1} + K_2O_5 36 kg ha^{-1}
· Seed production	Selection from farmers' own maize production	Maize seed production procedure
B. Farmers' institutions		
· Strengthening farmers' group capital	None	Farmers get out maize product equal than inputs price
· Management of input supply	None	Supply of inputs by technology clinics and loaned to farmers againt postharvest repayment in grain
· Management of seed production	None	Farmers produce seed of excellent quality

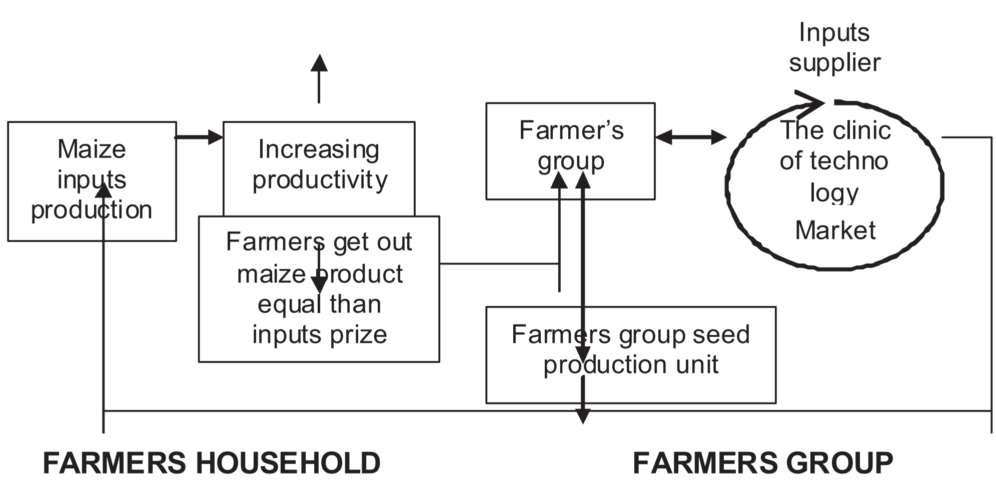

Figure 1. Design for improving farmers' institutions for energy cycle.

Table 2. Data collection and data analysis method.

Innovation	Data collection	Analysis technique
Maize cultivation		
Maize production	In the same year: 9 samples of existing maize cultivation and 9 samples of improved maize cultivation	T-test
	Previous year: measurement of maize production storage before introduction of innovation (exiting technology) and after introduction on the same land	Wilcoxon signed test
Farmers' response	Farmers' response to technology introduction	Descriptive
Institutional innovation		
Strengthening of farmers' group capital	Farmers' response to revolving system	Descriptive
Management of input supply	Farmers' response to input supply system	Descriptive
Management of seed production	Farmers' response to maize seed supply system	Descriptive Observation

Results and Discussion

Maize cultivation

Our research showed that plant height and diameter of the local open-pollinated variety (OPV) and the OPV Srikandi were not significant in the T-test for equality of means at 5%. However, there was significance in respect of amount of plant and productivity. Amount of plant under farmers' conventional practices was 13.25 holes per 10 m^2 and 17.56 holes per 10 m^2 under the newly introduced technology package. Other results showed that the new package of technologies could increase maize productivity from 1753 kg ha^{-1} to 3438 kg ha^{-1} (Table 3).

Srikandi is 105-day and the local varieties are of 120-day duration. The shorter of Srikandi holds an advantage for Timorese farmers because the rainfall period there lasts only 3-4 months. The other advantages of Srikandi are the high protein content ie, lysine 0.410% and tryptophan 0.087% (Azrai 2004).

The study's technological interventions increased farmers' maize storage by 173.2% per household. The average maize storage before our intervention was 80.2 kg per household. This rose to 219.1 kg per household after new practices were introduced (Table 4). These production figures do not include the maize grain deducted by farmers to pay for the inputs borrowed from the technology clinics. Improved production was a surprise for the participating farmers and increased their motivation to adopt maize cultivation.

Farmers' human resources in this area were very low with years of education averaging 4.2 years. This factor does influence acceptance of technology.

Table 3. Comparison of maize plant height, diameter, amount of plant per 10 m^2 and productivity under farmers' existing practices and under newly introduced technology.

Variable	Existing practices	Introduction practices	Notation
Plant height (cm)	149.62	149.78	ns[1]
Tree diameter (cm)	2.42	2.41	ns
Amount of plant (holes per $10m^2$)	13.25	17.56	**
Productivity (kg ha^{-1})	1.753	3.438	**

[1.] ns: not significant under t-test for equality of means at 5%.
** very significant under t-test for equality of means at 1%.

Table 4. Farm households' maize production before and after technological intervention.

Item	Sample size	Household production (kg)**)
Before intervention	10	80.2
After intervention	10	219.1

** Very significant under 2-tailed Wilcoxon signed ranks test.

Seed production

Maize seed production initiatives were taken up in partnership with farmer groups as part of this study. Seed production was conducted on 0.15 ha plots using Srikandi as the foundation seed. Seed production added up to 315 kg (productivity of 2100 kg ha^{-1}). These seed were sold at low prices to farmers in the farmer group as well as to others. Before this seed production initiative, farmers used to useown seed of local maize cultivars, generally selecting bigger maize grain as prospective seed.

To promote adoption of new varieties, improved seed units must be within reach of farmers. However, this was not the case in the study area. Maize seed had to be brought from the capital city of the province, which is about 150 km away. The distance adds to the cost of maize seed. The purpose of setting up seed production units at the farmer level was to ensure easy supplies to farmers and also to ensure that proper procedures of seed production were followed. The main problem affecting seed production in the study area was availability of irrigation. Seed production must be done during the dry season, which requires adequate irrigation. As a consequence, seed production needs much labor, mainly for providing irrigation to the seed plots.

Institutional innovation

Generally, subsistence/semicommercial farmers live far from the city. Their mobility and communication access is hampered by poor road infrastructure. Since government and church organizations are relatively more accessible to farmers, their help has been sought for dissemination of agricultural information in the study area. The weekly traditional market held every Saturday provides another opportunity to disseminate technology information as farmers tend to congregate there. It is therefore ideal to set up technology clinics near traditional markets.

Subsistence/semicommercial farmers are constrained by (a) low natural resources and unsuitable agricultural cultivation practices which lead to low productivity; (b) uncertain weather, mainly during the rainy season, causing uncertainties in agricultural production; (c) limited access to capital and credit; and (d) lack of agricultural knowledge. Lack of access to capital weakens farmers' bargaining position and forces them to sell their produce unprofitably.

Organizing subsistence/semicommercial farmers into farmer groups is difficult. The groups are often not based on a firm foundation and therefore break down easily. Generally, farmer groups are built by extension workers as part of a government project and not at the farmers' own initiative. For effective functioning, farmer groups need to be strengthened with capital and by building production units which can make use of the farmers' own labor.

Farmers' maize production can be increased by introducing new cultivation technologies. Farmers need technology inputs (improved varieties, fertilizer, pesticides, etc), and to buy them they need capital and credit assistance. As part of our study, loan assistance was extended to farmers through farmer groups. Direct loan assistance by government to farmers has often led to repayment defaults. Extending such assistance indirectly through farmer groups was felt to be the better option because farmers are discouraged from defaulting on repayment by the likelihood of social sanctions.

Strengthening farmer's group capital strategies can be done in two ways. The first is to increase maize production for consumption, and the second is to increase maize production for consumption as well as home industry purposes.

In the first strategy, the service provider gives production inputs as as loan assistance to the farmer group. Members of the farmer group pay for these inputs in the form of maize grain after the harvest. The farmer's group sells the maize grain and buys inputs for the members' use in the next season. This model guarantees supply of inputs for production. It needs a partnership with input suppliers, say, an input distributor or shop. Maize seed is supplied to farmers from the farmer group's seed production unit at the village level.

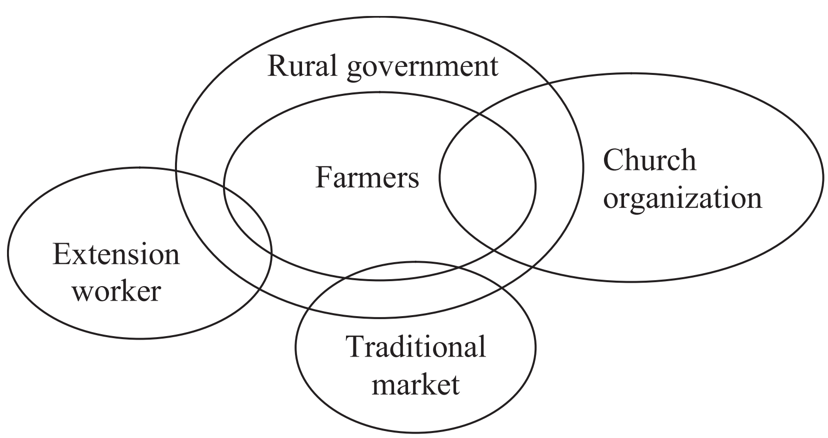

Figure 2. Venn diagram showing the relationships betwen institutions in the rural areas of Indonesia.

In the second strategy, the service provider gives production inputs as loan assistance to the farmer group. Besides, the service provider also gives loan assistance to the group to process maize production. The objective of this strategy is to strengthen farmer group capital and give wage payment to the farmer group members for the work done by them.

Management of input supply

There are no agricultural inputs shops in the study area. The nearest shops were one located in the district capital about 50 km away and another in the provincial capital about 200 km away. Such distances add to the cost of inputs for subsistence farmers.

The combination of high cost of inputs, limited knowledge agricultural technology and low capital constrain farmers from adopting improved technology. Setting up of an agricultural technology clinic was envisaged to help solve this problem, particularly that of input supply to farmers.

The clinic is not profit-oriented. Farmers are invited to visit the clinic and interact with extension workers and read agricultural information of use to them. The clinic's policy is to allow farmers to visit the clinic of their own volition. Extension workers are at hand to supply any information required by the farmers

The clinic has three divisions: the input supply division provides a linkage between farmers and input suppliers; the marketing division provides a linkage with commodity buyers; and the technology content division provides the required information to farmer.

Conclusions

The technology clinic has proven to be a useful institutional innovation. Extension workers and the farmers group manage the clinic which provides agricultural information to farmers and facilitates input supply by buying them from shops and supplying them to farmers. Farmers can take the inputs on credit from the clinic and repay it in in kind after the harvest. The technology clinic also processes maize grain and sells it in the early rainy season. It also helped build a maize seed unit at the village level. This strategy shows promise in ensuring the continuity of maize farming and has potential to be extended to other villages.

Acknowledgement

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