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Indigenous variety development in food crops strategies on Timor: their relevance for in situ biodiversity conservation and food security

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This article describes how farmers have developed varieties through selection processes which are embedded in local belief systems. These strategies have allowed farmers to adjust crops and crops varieties to widely differing local environments. This has been of significant importance. The ability to adjust genetic material and develop different varieties through selection is important to maintaining food security in traditional farming systems.

The farmers of Timor have their own unique varieties of major staple crops such as maize, sorghum, foxtail millet, dryland rice and cassava. These varieties have been developed and maintained over time, in order to cope with a climate that is characterized by erratic rainfall.

The farmers have developed a set of strategies to select the seeds, maintain a seed stock and anticipate climate changes. These strategies, which are holistic in nature and include both physical and spiritual indicators, are widely practiced and are of significant relevance to agricultural development. They are used not only for indigenous various land races, but also for new hybrid varieties. These varieties have become an integral part of the farming system and are maintained and developed in the same way as indigenous varieties. Of course, this implies that through selection and - unintended - cross-breeding these introduced varieties change over time, and after 5-7 year have different characteristics than they had when they were introduced.

It is argued that these strategies are important and that they are part of local culture. In this respect the cosmology of farmers, which is strongly linked to gender roles, plays a crucial role in the process. And finally, a number of possible strategies to develop improved local varieties are proposed. These strategies must be based on indigenous development strategies, so that farmers feel that these improved varieties are actually theirs.

INCREASING SKILLS

It is known that farmers have developed very specific skills to select and develop varieties (Winarto 1997: 3; Bandyopadhyay & Saha 1998: 4). Often these varieties have changed over time due to changing preferences and environments. It is also known that the selection process and the choice of varieties differs from one farmer to the next (Winarto 1997: 4; Setyawati 1996: 12). Programmes aimed at developing participatory technology must be based on the farmers' own indigenous knowledge, skills and practices. This article describes the results of a primary assessment of a programme set up by NGOs to strengthen household food security on Timor.

One of the characteristics of agriculture on Timor is its diversity. Faced with highly erratic rainfall, and soils that are basically limestone on top of soft scaly clays which are extraordinarily hygroscopic, local farmers have developed various farming systems of their own. Fox (1995: 4) states that although farmers plant maize as a major staple, a wide variety of other crops must also be relied upon to maintain food security, in view of the fact that every five years the harvest may be expected to fail, due to erratic rainfall.

For most farmers their major aim is to ensure that there is enough food available for the next year, as most people rely on swidden agriculture as their major source of food and income. In recent years, integration into the market economy has significantly increased the need for cash. Farmers are trying to fulfill those needs by looking for cash-generating activities alongside the cultivation of field crops. Traditionally, the major such activity is the sale of livestock, but cash crops (including candlenut, coffee, citrus fruits and betel nut), vegetable-growing, petty trade (dried fish and salt), as well as off-farm work in the construction field are becoming increasingly more important. In spite of the changes that have taken place, farmers still devote most of their time to growing staple crops. These are still perceived as the most important activity by which farmers can secure basic household needs such as food, cloth (cotton) and petty cash.

Most crops were introduced into Timor from elsewhere, and throughout its history the region has been open to the dissemination of a variety of genetic materials (Fox 1995). The earliest food crops include rice, millet (both foxtail and common), job's tears, mung bean, pigeon pea, sesame, cucumber, ginger, yam, taro and sugarcane. These crops were either there or were brought by the early Austronesians. Later, sorghum arrived through Malay contacts from Persia or India.

The arrival of the Europeans opened the way for a whole new set of food crops that transformed

agriculture in the region. These included maize, squash, beans, chilies, peanuts, onions, garlic, eggplants, sweet potato and cassava. It is noteworthy that the introduction of maize in 1672 by the Dutch East India Company was the first articulation of agricultural policy in the region.

The following is a description of indigenous processes that farmers on Timor are using to adapt indigenous crops (such as finger millet and tubers) and non-indigenous crops (such as maize) to their environment. It explains how these crops and their varieties have been adapted and improved. The data used in this study are based on Focus Group Discussions (FGD) with both male and female farmers collected in late 1998 and early 1999. During these discussions, PRA tools (Participatory Rural Appraisal) were applied, to enhance the farmers' understanding of crop development processes and help them to visualize their ideas. The interviews were held in three different villages in two districts: North Central Timor and South Central Timor.

FOOD SECURITY AND FARMERS' VARIETIES

During history farmers have developed skills to select and maintain crop varieties needed to mitigate crop failures and deal with periods of food insecurity. Two villages will be discussed in detail, one in the mountains and one on the coast. The mountain areas receive significantly more rain than the coast, 1500 mm and higher, but tend to be more vulnerable to heavy winds and excessive rainfall in La Nina years. Villages located on the coast receive less than 800 mm annually, falling in less than 3 months, and drought is a major problem during El Nino years.

The mountain village is Teakas, located 800 m above sea level, which has an oral history that goes back to the 14th century. [Table 1](#) shows the crops and the specific varieties grown in Teakas, as well as what the farmers see as the main factors affecting yields. Farmers identify cyclonic winds (Timor is the only Island in Indonesia where cyclones occur) and heavy rains as major yield-influencing factors. In addition, farmers stressed the importance of the time of planting. All cereals are planted at the same time, after the first rains have started. Cassava is planted after the cereal crops have been weeded for the first time, about one month after the planting of the cereals. The timing is important because crops planted at the right time get the most benefit from the increased rate at which organic matter is decomposed just after the rains start (Birch effect, see Piggin 1995: 6).

Cyclonic winds	Factor					Importance for consumption (1 = important, 5 = of limited importance)
	Cyclonic winds	Heavy rains	Snails	Weevils	Rice bug	
Maize (pena)						
■ Pena nais	1	5	5	1	0	1
■ Pena mollo	5	3	5	2	0	1
■ Pena putih	5	5	5	5	0	1
Upland Rice (Ane)						
■ Ane mollo	5	0	1	0	5	2
■ Ane putih	5	0	1	0	5	2
■ Ane meal	5	0	1	0	5	2
Foxtail millet (sain)						
■ Suisio	2	0	1	0	0	4
■ Suisuso	2	0	1	0	0	4
Sorghum (Buka)						
■ Tekal	4	0	5	2	0	5
■ Noa	4	0	5	2	0	5
Cassava						
■ mollo	0	0	5	0	0	3
■ putih	0	0	5	0	0	3
Ranking yield of factor (5 = important, 1 = not important)						
	5	1	3	4	2	

Table 1: Different varieties and yield-determining factors for the Teakas hamlet (800 m asl) (The figures shown are the farmers indicators, 0 = resistant, 5 = very susceptible).

Farmers have succeeded in developing 2 or 3 different varieties of every major crop (Fox, 1995). One of the main differences between varieties is the rate at which they mature. This is very important, as early maturing varieties escape cyclone damage during the peak of the rainy season (February), while many varieties that mature late have potentially higher yields and are resistant to weevils during storage (see the example of *Pena mollo* (Yellow Maize, [table 1](#)). Instead of maize, dry-land rice is used in rituals, both agricultural and social (rites of passage). A specific rice variety, *Ane meal*, is used for ritual purposes during ceremonies, because it is linked to nobility and purity.

Under no circumstances is it permitted to use rice purchased from unknown sources, because this significantly reduces the efficacy of the rituals. Among the Antoin Pah Meto (name for the Dawan, major ethnic group in West Timor) it is thought that this will have repercussions in the form of human sickness and disease, and crop failure.

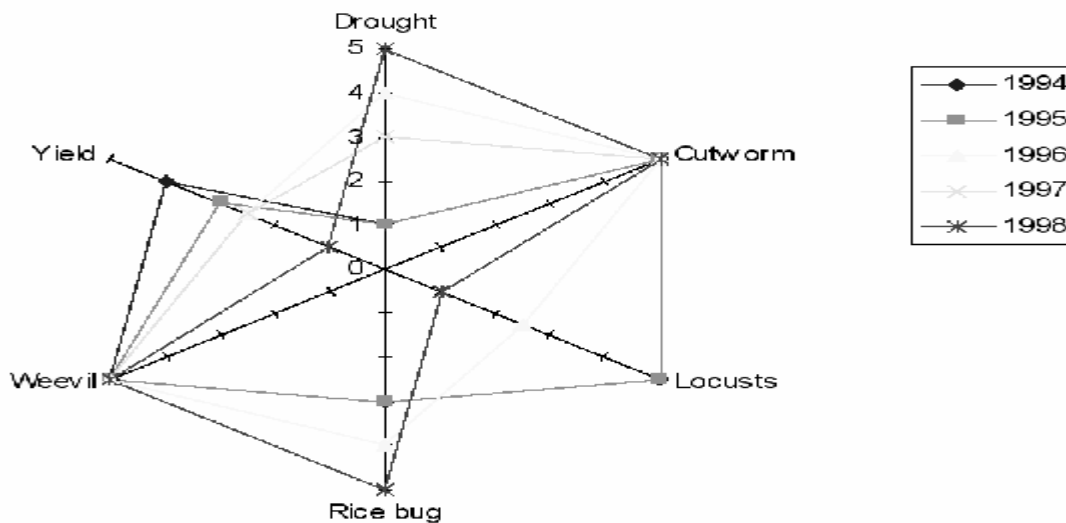
Farmers identified cyclonic winds and weevils as the most significant factors affecting yields in the Teakas hamlet. Farmers mentioned that in the process of selection, the main indicators are

resistance to cyclonic winds (via an escape mechanism such as early maturing) and weevil resistance.

In the coastal areas conditions are reversed. The yield tends to be good during wet years, while often failing during dry years. Before the so-called pacification in the 1910s coastal areas were uninhabited because of their vulnerability to raids by slave traders and head-hunters. At this time most people lived in the mountains.

Wini is an example of a village which was founded fairly recently. The ancestors of the current inhabitants came from an area similar to Teakas and cultivated the same genetic strains. When the hamlet was established around 1924/25 they brought these with them to Teakas. Since then, farmers have adapted their varieties to a coastal environment.

[Figure 1](#) shows the major yield-influencing factors identified by farmers, and the yield for



different cropping seasons on a relative scale. Scores on the indicators (1= low, 5=high) are linked by lines and show how these indicators are linked to the relative yields of maize over the years (1= relative low yield, 5 = relative high yield) .

Figure 1: The most important yield indicators and their relation to yield

Drought is the major yield determinant in the Wini hamlet. Dry years like 1998 result in low yields, and wet years in above average yields. Here, unlike Teakas, cyclones were of most

importance. But crops are not only influenced by factors that vary because they are directly influenced by climate, such as drought and - indirectly - locusts, but also by factors that constantly affect yields, such as weevil and to a lesser extent the rice bug and cut worm. Rice bug and cut worm were seldom mentioned in the mountains, tending to occur more frequently in drier and warmer areas.

Decision process

Both cases show that selection and decision making is based primarily on climate. Farmers, especially women, have developed their own ways of coping with climatic problems, combining different varieties on the basis of forecasts for the next rainy seasons. These forecasts are produced by elderly men (often Shamans) and are based not only on physical indicators, such as the fruiting of the Mango trees, or a certain bird species spotted, but also on spiritual indicators. The Antoin pah Meto use astrology (the positions of the moon and the stars) and spiritual indicators such as dreams to make decisions on which crop mixture to plant. In a year when rain forecasts are good, women tend to prepare more rice seeds and maize varieties that are short. In dry years they prepare more drought-resistant plants, such as fo-stalked foxtail millet and sorghum, and certain maize varieties. The later include the nine-leaf (no siu) corn, a very early maturing variety that needs only 3 good falls of rain to produce.

If the Shamans forecast cyclones, then woman select more seeds of varieties with a shorter stem, which mature earlier (90-110 days), in preference to seeds of varieties with a higher yield but a longer growing period (150-170 days).

To further spread the risks, farmers usually plant different varieties in different gardens. Most farmers grow crops on 2-4 different sites: homeyards (poan) and 2-4 gardens (Lele), preferably located on different soil types.

Selecting seed and developing new varieties

Farmers select the cobs that will be used as seed after the harvest. There is no on-field selection of promising plant types. [Table 2](#) shows the different steps in the process of seed selection.

During the process only healthy seeds which form big cobs are selected and planted. It is important to note that most of the decisions concerning selection of seeds are taken by women.

Antoin Pah Meto believe that femininity is related to the earth and to fertility, women's hands are best suited for selecting seed. Femininity is perceived as being cool (mold), and this is necessary to guarantee a fertile crop. By nature men are related to heaven and to power; they are seen as less capable of selecting seed, because heaven (the Spirit's Maputo=hot). Hot hands are not suitable for selecting seeds, since they are involved in activities related to the clearing of the field. The importance of hot and cold is underlined in the Sifo Nopo ceremony where the garden is cooled down. Forest and fallow are perceived as places where there are spirits that disturb crop growth and must be banished.

Stage of selection	Who does it?	Indicators	When
Selection of cobs	Men; but they are corrected by women if a woman sees	Cob size, cob filling and weight (by intuition)	Before the cobs are tied (Maiga cobs are tied and

Table 2: Ranking of maize varieties by farmers (both men and women).

[Table 2](#) also shows the link between the cosmology embedded in indigenous belief systems and decisions related to agriculture, with special reference to rituals and the use of crop failure. In some 80% of all village in central Timor farmers still perform these rituals which they regard as an integral part of agriculture (Kieft & Duan, 1998), and necessary to guarantee good yields and

prosperity. Although today most people are Christians, this has not significantly undermined the belief in the need for rituals.

Farmers' attitudes towards introduced varieties

Most villages on Timor have taken part in programmes where new varieties were introduced. After the assumed successes of the green revolution in the high-potential areas in Java, Sumatra and to a lesser extent Sulawesi, the government started to introduce (High Yielding Varieties) into the marginal upland areas in the late 70s and early 80s. R development planners were striving to boost staple food production and to help farmers to become self-sufficient, not only in rice but also in maize and other upland crops.

In the Supel, South Central Timor, farmers were exposed to most of the newly introduced varieties from the 70s on, partly because the village is located on the main road between Kupang and Attambua. It is interesting to look at what happened to these varieties. [Table 3](#) shows all the maize varieties grown in the Supul, introduced as well as indigenous, and the indicators used by farmers to assess varieties.

Table 3: Ranking of maize varieties by farmers (both men and women).

Of all these varieties on Metro is no longer grown. Farmers indicated during FGD that these varieties have changed over time and that they use specific varieties in specific locations.

Contrary to previous indications, taste is of secondary importance. When questioned, farmers (both men and women) all replied that taste did not influence their decision on whether to retain a certain variety. They explained that introduced varieties are evergreen (kase). These varieties have to go through a period of adjustment, after which they are adapted to Timorese circumstances (so that they become Atoin). If they do not adapt (kero) then they are no longer used. A good example of this process is the introduction of the single hybrid

Arjuna. Initially it produced an extremely high yield, but it was extremely vulnerable to weevil. As most farmers grow maize for subsistence, many of them lost over 75% of their harvest in storage. Understandably many farmers no longer plant Arjuna (Fox 1995: 7). And yet, the Arjuna planted in Supul shows a reasonable resistance to weevil (Table 3) and yields are still high compared to other varieties. For farmers this is obvious proof that the Kaseb has an Atoin. A possible explanation is that this adjustment process is the result of cross-breeding and selection on the basis of weevil resistance and cob size existing that because it is an F1 hybrid, it normally splits genetically; this means by the means of selection farmers have been able to develop their Arjuna, which is somewhat different (grain colour, and longer stalk).

Basically, the selection process consists of saving a certain quantity of this is stored for a time, during which weevil resistance is observed. During the next planting the healthiest cobs are selected. This process gradually transforms a variety, making it suitable for Timorese conditions.

It is clear from Table 3 that farmers are successful in developing varieties suited to their environment. Farmers have increased their yields by adapting high-yielding (HYV), mainly hybrids, to their farming system, and retaining certain other varieties with specific favourable characteristics.

Conclusions and implications for programme development

Farmers on Timor have the skills and the capacity to develop and conserve different varieties of staples. This allows them to grow a variety of crops which can cope with a harsh and poor soils. These skills are needed to ensure that they can grow the basic food for their household. These skills are a potential for development. However, until now they have been neglected or, even worse, labeled as backward. It should be stressed that it is who possess these skills and do most of the selection. Until now the role of gender in seed selection and the creation of new varieties has received little attention from others (Wianto 1997; Bandyopadhyay & Saha 1998). It would appear that gender roles in seed selection are embedded in the cosmology of the Antoin. As Antoin cosmology is closely related to femininity a

fertility (Schulte-Nordholt 1971: 90), it gives women access to, and control over, seeds and the development of new varieties.

Experiences in Tanzania and the Philippines have shown that farmers are able to develop their own varieties by interacting with scientists (De Waal 1997: Briones 1996). This is an option for the future development and improvement of landraces in Timor. It provides the opportunity to manage gene flows between different varieties, and to conserve genes that may be needed for future crop improvement. The potential for in-situ conservation needs to be explored, and this is in fact what is happening at the moment. Improving indigenous varieties by empowering indigenous mechanisms for developing new varieties will enhance food security in the future. It will add new options to a repertoire of coping mechanisms that can help prevent crop failures. This is of great importance in an area where most households face food insecurity. At present most of them still rely on their own homegrown food, and this situation will probably change only gradually, in the direction of more cash crops and other activities. This will, however, continue to be limited by climate, soil quality and socioeconomic circumstances on the island.

In these efforts, the role of gender has to be taken into account. A possible first step is to empower women who have scientific insight into breeding and single crosses. A study of why these specific gender roles exist is needed in order to determine how gender diversity can be developed and conserved. Gender roles are strongly linked to people's cosmology and should be understood from that point of view.

It is widely acknowledged that the conservation of indigenous landraces at farms will be of crucial importance in the more efficient management of plant resources in the future (Phan et al. 1995: 54). This case shows that the potential is indeed considerable. In situ conservation is a dynamic and capable of fulfilling the immediate needs of farmers, such as food and income security. The improvement of management skills through PTD activities (Participatory Technology Development) is one way of empowering farmers, especially women, to increase their capacity for developing and maintaining genetic variety, in the knowledge that they are making their own contribution to biodiversity.

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References

- Bandyopadhyay A.K. and G.S. Saha (1998) 'Indigenous methods of seed selection and preservation on the Andaman Islands in [Indigenous Knowledge and Development Monitor 6 \(1\)](#): 3-6.
- Briones A., P. Vincente and J. Gibe (1996) 'Alternative research: A challenge to addeme in a poverty stricken country', pp. 140-143 in N.H. Kristenesen and H. Hogh-Jensen (eds) [New research in Organic agriculture. Proceedings vol \(2\) of the 11th Scientific IFOAM Conference August 11-15, 1996 Copenhagen](#). Tholey-Theley: IFOAM.
- De Waal, D. (1997) 'Village based cassava breeding in Tanzania', pp. 83-88, in L. Van Veldhuizen, A. Waters-Bayer, R. Ramirez, D.A. Johnson and J. Thornton (eds) [Farmers' research in practice: lessons from the field](#). London: IT Publications
- Fox J.J. (1995) [Social history and government policy of agricultural development in Eastern Indonesia](#) Paper presented at the International Conference on Agricultural Development in semi-arid Areas of East Nusa Tenggara, Kupang: 10-16 December 1995.
- Pham J.L., M.R. Bellon and M.T. Jackson (1995) 'What is on farm conservation research on Rice genetic resources', pp. 54-65 in J.T. Williams, C.H. Lamoureux and S.D. Sasiraja (eds) [South East Asian plant genetic resources: Proceedings of the third South East Asian regional Symposium on genetic resources](#). Jakarta: Kehati.
- Piggin C. (1995) [Agronomic aspects for agricultural development in semi arid region](#) Paper presented at the International Conference on Agricultural Development in semi-arid Areas of East Nusa Tenggara, Kupang: 10-16 December 1995.
- Kieft J. and M.L. Duan (1998) [Antoin cosmovision in agriculture](#) (in press).

Setyawati I. (1996) 'Environmental variability, IK and the use of rice varieties' [Indigenous Knowledge and Development Monitor](#) **4**(2): 11-13.

Schulte-Nordholt H.G. (1971) 'The political system of the Atoni of Timor' *Verhandelingen van het Koninklijk instituut voor Taal- land- en volkenkunde* 60. The Hague: Marinus Nijhof.

Winarto Y.T. (1997) 'Maintaining seed diversity during the green revolution' [Indigenous Knowledge and Development Monitor](#) **5**(3): 3-6.