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Archives nationales d'Aix-en Provence, FR ANOM 30Fi87/17, cliché G. Ramiandrisoa, sous réserve des droits réservés à l'auteur ou à ses ayant-droits¹.

¹ Nous remercions Marie-Hélène Degroise et Frédéric Gilly, des Archives Nationales, Aix-en-Provence, pour leur aide et les renseignements aimablement fournis.

Le titre du cliché de la couverture aux Archives nationales d'Aix-en-Provence est « Tananarive. Marché du "Zoma" ; l'herboristerie en plein air. 1940 ». Il s'agit d'un cliché - consultable en ligne sur la base Ulysse - de G. Ramiandrisoa qui s'inscrit dans une série d'une quarantaine de photographies données au Ministère de la France d'Outre-Mer en 1946. Pourquoi les auteurs de ce numéro se sont-ils arrêtés à ce tableau si tananarivien ? N'auraient-ils pas pu s'accommoder d'autres clichés plus anciens ? Celui-ci a en effet quelque chose de contemporain, voire d'actuel, quand on sait la fascination qu'exercent médecine traditionnelle ou phytopraticiens. Cette « herboristerie » est à la croisée de deux mondes, ceux que P. Boiteau évoque en 1942, lors d'une exposition consacrée aux plantes médicinales, à Tsimbazaza. C'est tout l'art de Ramiandrisoa que de le montrer d'un bloc.

Ramiandrisoa fixe les attitudes de quelques inconnus en ce haut lieu, où, il n'y a pas si longtemps, avant l'explosion du Zoma en de multiples marchés excentrés, se vendaient encore les simples (rues Andrianampoinimerina, Escande, Ranavalona I^{ère}).

Propret, un marchand dûment chapeauté vend des graines au tas. Graines de *fano*, *Entada chrysostachys* (Benth.) Drake, qui servent à dresser la table de divination géomantique, ou graines de *katra*, *Guilandina bonduc* L., qu'on emploie pour le jeu qui porte le même nom, et qui ont aussi des vertus médicinales ? On conjecture puisque l'ethnopharmacopée n'est jamais loin à Madagascar, chez les allogènes d'entre les deux guerres y compris. Le client au feutre noir, alter ego quasi-comparse est là pour assurer la transition avec le second plan, fondamental. Ramiandrisoa ne truque pas, il trouve.

C'est sans doute là une trouvaille de composition. Qui plus est, le jeu de (non) regards vaut sa part de politesse malgache. La vendeuse, de statut social peu considéré, est attentive au choix de l'homme jeune, bien mis, bien né sans doute... Tout n'est qu'ordre et beauté, pauvreté, calme et volupté d'être vendredi, jour béni. L'arrière-plan renvoie à ces valeurs. Nœud papillon, pantalon de toile écru, couvre-chefs divers. Autre monde à décoder avec lequel nous ne frayons plus guère.

La lumière aidant, on devine que l'hiver austral n'est pas loin ; de même pour la Seconde guerre mondiale, bien cachée ici, qui fait de ce monde malgache, trois ans plus tard, un peuple de gens en loques, en rabane, en vêtement unisexe. Quel Tananarivien achète alors des médicaments en cas de maladie, les intrants n'arrivant qu'au compte-goutte ?

La photo est donc bonne puisque Ramiandrisoa fait vivre ce qu'il voit. On peut la croire apprêtée, compassée. L'opérateur va beaucoup plus loin. Comme ses pairs, dont il faudra bien un jour faire la recension, Ramiandrisoa, à sa façon, organise le passé de Tana. Ce n'est pas à la portée de chacun.

Claude Bavoux

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Vary Gasy: Folk Models of Rice and Implications for Agricultural Development in Eastern Madagascar

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Summary. This paper examines folk models of Malagasy rice (*vary gasy*) and their implications for agricultural development in eastern Madagascar. Data on rice models were collected during two field seasons, in 2003 with rice merchants and agricultural scientists in Toamasina and in 2004 with rural farmers in Andasibe. Rural subsistence farmers and rice merchants in eastern Madagascar ascribe meanings to rice types, which include beliefs that certain types are healthier to consume and produce higher yields than other types. Rice merchants define rice types by characteristics of the rice kernel while farmers define rice types by characteristics of the rice plants. Agricultural scientists define rice types primarily by the grain yield per hectare as well as by farming method (dry and wet), growing season and length of time to harvest. Agricultural scientists disregard rice preferences of merchants and farmers as being inconsequential to rice yields, which are believed to be the primary metric of farming success. Agricultural development in Madagascar cannot rely upon one set of authoritative knowledge of rice types, but must take into account all the participants' beliefs.

Résumé. Cet article examine les modèles culturels du riz malgache (*vary gasy*) et leurs implications dans le développement agricole dans l'est de Madagascar. Les données ont été collectées durant deux saisons, en 2003 avec les marchands de riz et les agronomes à Toamasina, et en 2004 avec les agriculteurs à Andasibe. La subsistance rurale des agriculteurs et marchands de riz de l'est de Madagascar assigne aux types de riz des significations qui incluent des croyances selon lesquelles certaines variétés sont meilleures pour la santé et produisent de meilleurs rendements que d'autres. Les marchands définissent les types de riz principalement par le rendement en grains à l'hectare ainsi que par le mode de culture (sec ou humide), la saison de croissance et la durée de la période de récolte. Les agronomes ignorent les préférences des marchands et des agriculteurs, les considérant comme sans réel lien avec les rendements, qui sont, selon eux, le seul critère pour évaluer le succès agricole. Le développement agricole à Madagascar ne peut se fonder sur un seul ensemble de connaissances faisant autorité sur les types de riz, mais doit tenir compte des points de vue de tous les participants.

Introduction

This paper examines the cultural meanings of rice in Madagascar and their implications for agricultural development in Madagascar by presenting an analysis of the different folk models of rice held by rural farmers and agricultural scientists. Eastern Madagascar is in the midst of an agricultural crisis due to a high and growing human population that is making greater demands on increasingly limited available fertile farmland. Due to these pressures and the degradation of the local environment which has led to decreased soil fertility and arability, the local population is facing increasing

difficulty in producing sufficient food to support itself. To solve, or at least mitigate this crisis, the Malagasy government is implementing multidisciplinary policies designed to promote agricultural sustainability by transitioning from *tavy* (swidden farming) to *tanimbary* (irrigated agriculture). Since rice is the staple of the Malagasy diet and is consumed in greater quantities per capita than any other nation¹ (IRRI 2009), increasing rice crop yields is an important development goal for the country as a whole. The current plan is to distribute genetically engineered types of rice along with teaching and promoting the methods of irrigated rice agriculture to increase crop yield. With the new technology and continuing attempts to limit burning of forests and prevent the current topsoil from eroding due to overuse and poor land management, it is hoped that agricultural development will assist biodiversity conservation by reducing deforestation and encroachment on protected lands.

There are several Malagasy and international organizations that are involved in the development of rice agriculture in Madagascar. The Ministère de la Recherche Scientifique, Direction Inter Régionale Centre, Régionale de Recherche Est, Toamasina (FOFIFA), has had a cooperative relationship with the International Rice Research Institute (IRRI) since 1982 with funding from USAID and other NGOs to develop new types of rice (IRRI 2009). The Ministère des Eaux et Forêts (MEF) manages the agricultural use of existing forests, but is limited by having few employees that are able to cover field sites in eastern Madagascar. The Ministère de l'Agriculture et de l'Élevage which teaches farmers new agricultural techniques is also limited in its ability to succeed by being understaffed in eastern Madagascar. L'Association Nationale pour la Gestion des Aires Protégées (ANGAP) manages protected areas and attempts to prevent encroachments by farmers, hunters and plant gatherers. Finally, the Ecole d'Application des Sciences et Techniques Agricoles (EASTA) trains agricultural technicians in new methods of agriculture with the genetically engineered types of rice. The resultant policy and agricultural development has two key aspects that must be addressed. A technical fix must be created to increase the crop yields and this fix must be done in an economically, environmentally and culturally sustainable way. The farmers, rice merchants and rice consumers must all find the result acceptable and suitable to their own personal needs. In their plans for agricultural change, the Malagasy government and non-governmental organizations have neglected one key element, and that is the integration of folk models of rice of the Malagasy

¹ Consumption has decreased from 150 kg/year in 1977 to 118 kg/year in 1995.

people (Hume 2006). It is through an analysis of the folk models of rice for rice merchants, rural farmers and agricultural scientists that policy recommendations may be made, which find commonalities among the models and mitigate the differences.

Methods

In 2003, market rice merchants in *Bazary Kely* (one of the largest bazaars in Toamasina) were interviewed. Each rice merchant in *Bazary Kely* had an opportunity to take part in interviews and of the fifty-two merchants approached only five declined to participate. These merchants discussed the changes of rice prices and their understanding of what types of rice customers prefer. The merchants participated in card sorting tasks as part of these interviews as a tool for the interviewer to discover how they differentiated between rice types.

In addition to speaking with rice merchants, officials from FOFIFA in Toamasina were interviewed. It was during these interviews that it became apparent that the rice merchants and scientists at FOFIFA had two distinctly separate ways of thinking about and categorizing rice types. The director of FOFIFA in Toamasina supplied documentation (Rasambomanana 2001, Rakotonirainy and Raharinirina 1987) regarding the experimental rice types in which FOFIFA and IRRI were collaborating together for use in eastern Madagascar. It is from this documentation and the interviews of the director and his assistant that the folk model of scientist knowledge was constructed.

In 2004, approximately thirty rural farmers in the Ampangalatsary district of Andasibe were interviewed in groups and individually. In addition to questions regarding their own personal swidden farming techniques (Hume 2005), the farmers were asked which rice types they planted and how they differentiated between those types. Farmers indicated that they used plant characteristics to differentiate between rice types. Card sorting was not part of the interview process with the farmers, as they did not have any difficulty deciding what characteristics determined the differences between rice types.

Bazary Kely Rice Merchants

Bazary Kely (small market) is one of two large open markets in Toamasina, the eastern provincial capital. The folk model of rice held by the rice merchants reflects the specific knowledge that they must have to sell rice to customers. Upon arriving at the merchant's store, the customer will first examine which rice types are available (noted by cardboard or paper signs

written with the rice name and price affixed or placed within each basket holding rice). Picking up a handful of rice and examining its quality is a way for a customer to express further interest in a particular type. The customer may also smell the rice. Additional factors that influence decision-making beyond those already discussed are the percent of broken rice grains, the location of cultivation and the amount of rice husk still in the rice. None of these qualities is dependent upon the rice type, but the processing method (e.g., machine and/or by hand).

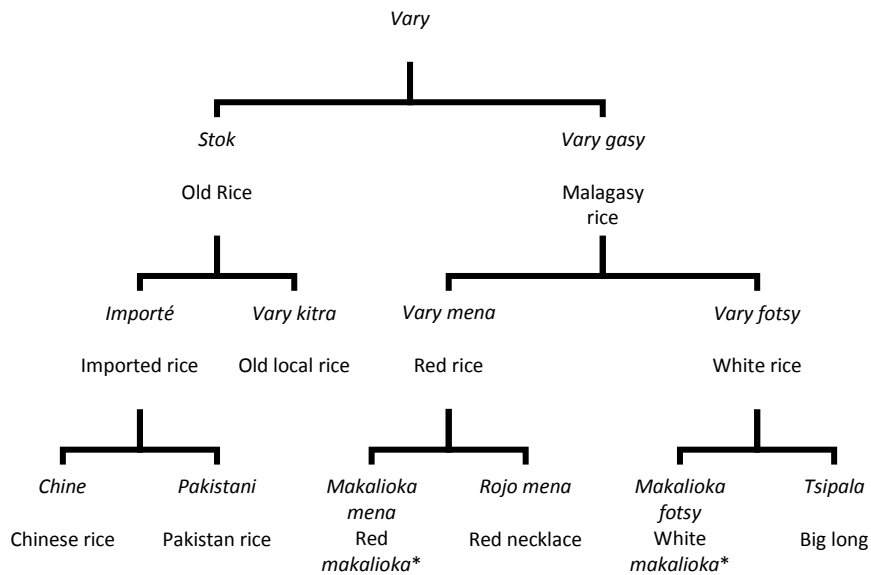


Figure 1. *Bazary Kely* merchant taxonomy of commonly known rice types.

**Makalioka* is a proper name without translation

The merchant’s knowledge of rice types is dependent upon whether the merchant has ever farmed rice. Those with farming experience are aware of a greater variety of specific rice types (e.g., *betahavana*, *vary betanety*, *bary bodofotsy*, *bary mamoriaka*, and *vary tsimaory*). The rice merchant’s knowledge of rice includes characteristics that customers’ use to decide whether to purchase a particular type of rice. The following discussion of rice types only

reports those types of rice that are commonly known to all of the rice sellers in Bazary Kely.

There are seven rice types commonly known as rice types by the rice merchants in *Bazary Kely* (*Chine, makalioka fotsy, makalioka mena, Pakistan, rojo mena, tsipala* and *vary kitra*; see Figure 1 and Table 1). The first dimension of contrast between rice types is *stok* and *vary gasy*. *Stok* is a category of old rice that is dehydrated and so when it is cooked the volume increases more than fresh local rice (*vary gasy*). *Stok* is less expensive (440 Malagasy Ariary [MGA; 0.35 USD²] per kilo average) than *vary gasy* (500 MGA [0.40 USD] per kilo average). The preferred type of rice, for those customers that can afford it, is *vary gasy*. The rice merchants and buyers believe that *vary gasy* tastes better and is better for one's health, because it contains more vitamins. The merchants stated that the poor usually buy half *stok* and half *vary gasy* and mix the two types when cooking meals. Only the poorest of their customers buy only *stok*, as the strength of this preference for local rice results in all other customers buying some type of *vary gasy*.

2 The conversions from Malagasy Francs to United States Dollars is based on the average currency conversion rates for May 2003 (1250 MGA to 1 USD), which was the period when average retail prices for local types of rice were collected in Toamasina markets.

Name	Red	Transparent	Short-thick	Smell	Fresh	Stones	Taste	Chemicals	Location (s)
<i>Pakistan</i>	-	-	-	-	-	-	-	+	11
<i>Chine</i>	-	-	+	-	-	-	-	+	11
<i>Makalioka fotsy</i>	-	-	+	+	+	±	+	-	1, 4, and 6
<i>Tsipala</i>	-	+	-	+	+	-	+	-	1
<i>Makalioka mena</i>	+	-	-	+	+	+	+	-	4
<i>Rojo mena</i>	+	-	+	+	+	+	+	-	4
<i>Vary kitra</i>	±	-	±	±	-	±	+	-	1 to 10

Table 1. *Bazary Kely* Merchant's Folk Model of Rice

(Locations: 1 Ambatondrazaka, 2 Ambositra, 3 Antsirabe, 4 Antananarivo, 5 Ambatolampy, 6 Tsiraomandidy, 7 Maroantsetra, 8 Fenoarivo-Est, 9 Toamasina II, 10 Vavatenina and 11 Imported).

The three types of *stok* are *vary kitra*, *Chine*, and *Pakistan*. *Vary kitra* is local rice that has dried due to the length of time that it has remained in the store. This type of rice is the least in demand by customers. The other two types of *stok* are *Chine* and *Pakistan*, both of which are imported. Merchants believe that *vary importé* (imported rice) contains chemicals, which prevent rats and other pests from eating the rice while in transit to Madagascar. It is a common belief that these chemicals are unhealthy for consumption, especially for children. This belief, that *vary importé* is not healthy, was also

echoed by other Malagasy who were not rice merchants. Several of the merchants reported that *vary importé* had a distasteful flavor of chemicals.

The four types of *vary gasy* are *makalioka fotsy*, *tsipala*, *makalioka mena* and *rojo mena*. The differentiation of these four types is by the color of the rice kernel (white – *makalioka fotsy* and *tsipala*; red – *makalioka mena* and *rojo mena*). Merchants report that both *makalioka* types are the same kind of rice, the only difference being the color of the rice kernel. The main differences between *makalioka fotsy* and *tsipala* are that the *makalioka fotsy* kernel is thick and cloudy white, while the *tsipala* kernel is thin and transparent. With the red types of *vary gasy*, *makalioka mena* and *rojo mena*, the difference lies in that *makalioka mena* is long grain rice and *rojo mena* is short grain rice. The location where the rice is grown and the method of processing is a determinant for the presence or absences of stones. The method of removing rice from the husk in both Antananarivo and Ambatondrazaka is by winnowing the rice over bare soil, which allows stones to intermix with the rice, whereas in other areas farmers winnow rice over baskets, thus keeping the rice free of stones. *Tsipala*, *makalioka fotsy* and *vary kitra* are the only rice types sold from Ambatondrazaka. The merchants reported that customers prefer rice free of stones, as the stones are detrimental to one's dentition, but customers seeking to economize will purchase the rice with stones. Among all types of rice sold by the merchants in *Bazary Kely*, customers prefer the local red rice, which is the most expensive (560MGA [0.45 USD] per kilo average).

Andasibe Rural Farmers

Farmers in Andasibe practice both *tavy* (swidden) and *tanimbary* (irrigated) rice agriculture. Farmers were only interviewed about *tavy* rice types, as *tavy* is the primary agricultural method and *tanimbary* is only practiced sporadically and often without success. One of the farmer's explanations for crop failure with *tanimbary* is that they are unable to make the soil hot enough (in a physical sense by burning or fertilizer) for the rice plants to flourish.

The farmers only know the type of rice being grown if they use seed grain from last season's crop. More often than not, farmers are forced to buy seed rice from the market and will not be able to determine from the seed characteristics alone precisely which type of rice will be grown. In addition, the purchased seed might come from several different types of rice plants, which will make growing the crop difficult as each rice type has unique growing periods, heights, nutrient requirements and other environmental factors for optimal growth.

The knowledge of *tavy* rice types of Andasibe's rural farmers follows a model that is quite different from that of the rice merchants in *Bazary Kely*. The first difference between the two models is the number of rice types known. The rice merchants have common knowledge of six types of rice and the farmers have shared knowledge of nearly three times as many. Of the merchants that claimed to know additional types of rice other than the commonly known types, only those that had farming experience could identify more than two additional types. In contrast, the Andasibe farmers who knew more types than the merchants' commonly known types, claimed to have additional knowledge of four to twenty-one rice types some of which were not grown in the Andasibe region due to environmental constraints. Only the rice types that were grown in Andasibe are included in the farmers' folk model of rice.

The second difference between the folk models of rice by the merchants and farmers is the characteristics that are used for identification. Merchants base their model of rice upon the rice kernels, whereas the farmers base theirs on the plant's characteristics. The model of *tavy* rice types allows farmers to know what types of rice are growing in their fields so that the time of harvest may be determined. In addition, the different types of rice plants appear to require different times of planting, but the farmers interviewed could not agree which types should be planted at what time. From interviews, it also appears that the rice kernel used for seed is not always enough information to determine the rice type. The farmers claimed that a round grained rice kernel will likely result in a round grained product, but other than shape, the farmers could not be sure of the exact rice type that was sown prior to germination and the plant characteristics became evident.

Farmers claimed that the most important attribute of rice for determining its identity was the color of the stalk's base. Rice plant types vary in stalk base color from dark reddish brown to light whitish green. However, there are only three different color variations and sixteen types of rice. Therefore, base color, by itself, does not allow a farmer to determine the exact type of rice plant.

The second most important identifying characteristic of rice plants is the color of the kernel's skin. The possible variations are white, red and black. The color of the kernel's skin is especially important as the color can influence the amount of time that the farmer must spend protecting the rice plants from pests, such as the indigenous sparrow, *fody* (Madagascar Fody, *Foudia madagascariensis*). The black type (*salazana*) is of interest as the farmers claim that the black color of the kernel skin protects the kernels from being

consumed by the *fody*. The farmers spend countless hours guarding their rice fields from the *fody* with stones thrown with slings. The farmers stated that it is believed that the *fody* does not recognize the black skins as containing rice kernels and so does not consume them.

The next most important cluster of characteristics used in distinguishing rice types is the kernel shape, kernel color and plant height. The length and width of a kernel determined the basic shapes of rice, which may or may not include a "beard," a string of fiber of varying length attached to the rice kernel. Most of the rice types produce white kernels (9 variations), others produce bicolor (6 variations) and one produces exclusively red rice kernels. The height of rice plants varies from 25 centimeters to 175 centimeters. This aspect is important as the only difference between *loambitro botsa* and *loambitro malady* is the plant height. These names encode the key difference between the two types: the shorter type of *loambitro* is termed *malady*, which translates as "quick." In general, the *malady* plants have a shorter growth period before harvest and also are physically shorter. The farmers did not express a preference for fast-growing types, but instead were concerned with the quality and quantity of the yield of kernels the plants produced.

The folk model of *tavy* rice types described above is important for rice farmers as the knowledge of which types of rice are being grown determine the time of the harvest and give the farmer the ability to estimate yield and amount of energy needed to protect crops from pests. If a farmer does not harvest rice at the optimal time, the *fody*, rats or other pests will consume the rice in the field and thereby lower the crop yield. The landscape of Andasibe is dotted by farms that have failed. The farmers reported that these families have left the area, as they did not have any success in farming due to poor land, failed to attend to the spirits who inhabit the land and/or lacked the knowledge of rice types that grow well in the Andasibe area. Being that most, if not all, of the farmers in the Andasibe region are living perilously close to starvation, a single failed crop is disastrous for the farmer and his family.

Name	Red kernel	Red skin color	Growth period (months)	Stalk base color	Kernel shape	Plant height in cm
<i>Belohalitra</i>	-	-	6	Dark reddish brown	Short grain	100 to 175
<i>Bodoravina</i>	-	-	6	Dark reddish brown	Short grain	100 to 125
<i>Botrafotsy</i>	-	-	6	Light whitish green	Round	75 to 100
<i>Botramitso</i>	±	-	6	Green	Round	100 to 125
<i>Kely randro</i>	-	-	5	Light whitish green	Short grain	100 to 125
<i>Langaka fotsy</i>	-	-	6	Light whitish green	Short grain	100
<i>Langaka mena</i>	+	+	6	Dark reddish brown	Short grain	100 to 175
<i>Loambitro botsa</i>	±	-	6	Light whitish green	Short grain	50 to 75
<i>Loambitro malady</i>	±	-	5	Light whitish green	Short grain	25 to 50
<i>Mananelatra</i>	-	-	5	Light whitish green	Short grain	50 to 75
<i>Menalava</i>	-	-	6	Dark reddish green	Short grain	100 to 175
<i>Salazana</i>	-	-*	6	Dark reddish brown	Short grain	100 to 175
<i>Sihanika</i>	-	-	5	Light whitish green	Short beard/round	75 to 100
<i>Soamitso</i>	±	-	4	Dark reddish brown	Short grain	50 to 75
<i>Sombotra</i>	±	-	5	Light whitish green	Long beard/short Short-fat grain	100 to 125
<i>Vonjy (Brazil)</i>	±	-	4	Green	Short-fat grain	25 to 50

Table 2. Rural Farmer's Folk Model of Rice (* Black). Translations of farmer's rice types was not collected.

FOFIFA Agricultural Scientists

The agricultural scientists interviewed at FOFIFA dismissed the knowledge of rice merchants and farmers as unimportant to the development of rice agriculture in Madagascar. Instead, they maintained that rice yield was the single most important measurable variable in the agricultural development of rice. The director provided a list (Rakotonirainy and Raharinirina 1987) of types that were currently being grown successfully in eastern Madagascar. While there were several rice types in development, he was very impressed by the yield of a new type that was being tested (B22) due to it producing higher yields than any of the current types in use.

Name	Kg/ha	Cycle (days)	Two season	Wet	Dry	Origin	Other
<i>Balaulé</i>	5,523	170	-	+	-	South Africa	Rustic, long grain
<i>Bengala morima</i>	4,380	120	+	+	-	Madagascar	Rustic
<i>Boina 1329</i>	4,665	140	-	+	-	Madagascar	Rustic, long grain
<i>Chianan 8</i>	4,650	140	+	+	-	Taiwan	-
<i>Chinsei asahi</i>	5,670	110	+	+	-	Japan	Quality grain (round)
<i>Ci Ca 4</i>	5,285	120	-	+	+	Colombia	Quality grain
<i>Daniela</i>	4,000	120	-	-	+	Brazil	Rustic
<i>I.R. 20</i>	5,400	130	-	+	+	Philippines	Rustic, quality grain
<i>I.R. 8</i>	5,660	135	+	+	+	Philippines	Rustic
<i>Java</i>	3,556	165	-	+	-	-	-
<i>Kagoshima hakamuri</i>	4,500	150	-	-	+	Japan	Quality grain (round)
<i>Madirat 27</i>	6,912	150	-	+	-	Madagascar	-
<i>Madirat 36</i>	5,582	150	+	+	+	Madagascar	Rustic, quality grain (round)
<i>Makalioka 34</i>	5,800	180	-	+	-	Madagascar	Rustic
<i>Rakaraka</i>	4,845	145	-	+	-	Madagascar	Rustic
<i>RS-25-T</i>	3,000	130	-	-	+	Madagascar	Rustic
<i>Taichung 178</i>	5,750	130	+	+	-	Japan	Quality grain
<i>Vato</i>	5,432	150	-	+	-	Madagascar	Rustic

Table 3. Scientist's Folk Model of Rice (Rakotonirainy and Raharinirina 1987)

The agricultural scientists' cultural modal of rice types is primarily ordered by yield (kilograms per hectare) followed by the cycle (in days from

planting to harvest) of the rice plant. Another consideration to the quality of the type is whether it can be grown during both early and late in the growing seasons or only during the main season. The types with the highest yields are grown in wet (irrigated agriculture) versus dry (swidden farming) methods.

Discussion and Conclusion

The analyses of folk models of rice illustrate how the participants in Madagascar's agricultural development think about and use rice. There is a shared goal of increasing the ability of farmers to grow enough food for the merchants to sell and the general populace of Madagascar to consume. This main goal is not the problem with the current policies of the agencies and organizations developing rice agriculture in Madagascar. The conflict exists, rather, in the folk models of which rice type is preferred and impacts which type should be produced. The merchants selling rice to consumers have a very different folk model of rice than the farmers and scientists (see Table 4).

	Rice age	Yield increase	Kernel color	Kernel shape	Wet/dry farming	Growing period	Kernel skin color
Rural farmer	-	+	+	-	+	+	+
Rice merchant	+	-	+	+	-	-	-
Agricultural scientist	-	+	-	-	+	+	-

Table 4. Comparison of rural farmer, rice merchant and agricultural scientist folk models of rice.

The solution to the current agricultural and conservation problems in Madagascar must be a joint effort by all of the stakeholders involved, not just the organizations holding power (e.g., MEF, ANGAP, and FOFIFA). For example, it is by knowing and understanding the folk model of rice types, that a rice merchant can be successful in presenting the rice for customers' needs and/or wants. The merchants must have a variety of rice types in their shop so that they can cater to each socio-economic class, for example, the

'upper class' seeking *makalioka mena* and *rojo mena* and the 'lower class' requiring inexpensive *stok*. However, if the prices were equal between the rice types, the merchants reported that *makalioka mena* and *rojo mena* would be preferred as they are both red, fresh, chemical and stone free, as well as having a pleasant taste and odor. The importance of this choice is that FOFIFA, in its pursuit of increasing rice yields, states openly that it does not consider the physical appearance of rice to be of importance; as long as the crop yields increase, the farmers, merchants and consumers will be pleased. At least in the short term, this assumption by FOFIFA is clearly misguided. To increase the likelihood that the Malagasy accept a genetically engineered rice type, it should fall within the characteristics of *vary mena* (red with long and thin grain), which is the preferred type by the Malagasy in Toamasina.

The different folk models of rice held by *Bazary Kely* merchants and by Andasibe farmers show that there are at least two ways that the Malagasy think about rice. The consumer preference for either *makalioka mena* or *rojo mena* types illuminates the need for red types of genetically engineered rice, rather than the white types, which are currently in development by FOFIFA. If creating a more productive red type is not feasible, at minimum, an education program should be developed to influence public perception of the new white rice type to enhance the acceptability of the rice to the consumer. The merchants must know the qualities of the rice grains that satisfy the customers and the farmers must know the different types of rice plants so they know when the rice is ready to harvest. The only common trait of rice that is present in both the merchant and farmer's rice models is rice kernel color. In the case of the farmers, *salazana*, which has a black skin color that, it is believed, *fody* do not recognize, may also lead to the development of a rice type that could have pest resistant qualities and therefore increase crop yields without the use of pesticides if the farmer's belief is shown empirically to be correct. In both of these instances, the local Malagasy knowledge regarding rice from sowing to consumption could and should be used by organizations attempting to increase crop yields to increase the likelihood of success and acceptance by the Malagasy people.

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