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CAN *BAS-FOND* RICE PRODUCTION IMPROVE FOOD SECURITY IN MALI?

By

Georges Dimithè, J.M. Staatz, and A.O. Kergna

Food Security II Cooperative Agreement between U.S. Agency for International Development, Global Bureau, Economic Growth Center,
Office of Agriculture and Food Security, and Department of Agricultural Economics, Michigan State University

BACKGROUND AND OBJECTIVES:

Until the early 1970s, Mali was self-sufficient in cereals. However, after the 1974 drought, per capita food production failed to keep pace with the rapidly expanding demand for food. As the gap between national food production and demand widened in the late 1980s--largely because of recurrent droughts, rural-urban migration, and low agricultural productivity--Mali became increasingly dependent on commercial imports and food aid.

Although agricultural productivity has improved since the early 1990s and Mali has significantly reduced cereal input, the government is considering further cost-effective investments to boost domestic production and improve food security and exports. The government could continue to expand the input-intensive government-managed schemes that have been the focus of rice policy in Mali, but the cost of expanding and rehabilitating those irrigation systems is high. Alternatively, as a complement to rice production from the irrigated systems, the government could help increase rice production by improving the less intensive systems, especially those in the inland valley swamps (known as *bas-fonds*) for which there

has been a growing interest among agricultural policymakers and researchers. Unfortunately, very little is known about *bas-fond* rice production in Mali. To guide their decisions, scientists and government officials need answers to numerous questions. This synthesis focuses on four of these questions: (1) What is the current level of rice production in the *bas-fonds*? (2) What is the potential for expanding *bas-fond* production? (3) Would *bas-fond* farmers be willing to produce more rice? and (4) Would this additional production significantly improve household and national food security?

METHODS AND DATA: To address these questions, first, a *bas-fond* rice supply is compared with a rice supply from the *Office du Niger*, commercial imports, and food aid to Mali. Then, the ability of the *bas-fond* rice enterprise to generate rural household income is examined using standard enterprise budgets to estimate the financial profitability of alternative *bas-fond* rice production systems in comparison with major upland crops (i.e., maize, sorghum/millet, and cotton). Furthermore, this contribution is examined using domestic resource cost (DRC) ratios to estimate the social profitability of the *bas-fond*



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rice enterprise for farmer's home consumption or sale in the major consumption markets of Bamako, Bougouni, and Sikasso. *Bas-fond* financial profitability is analyzed by focusing on the dominant production systems. The financial enterprise budgets and DRCs are derived from survey data collected from a random sample of 221 rice farmers selected from a purposive sample of 12 *bas-fond* villages in Mali-Sud during the cropping season 1996-97.

FINDINGS: The data show that:

- **Numerous rice production systems exist in the *bas-fonds* surveyed, but four systems are most common:** (1) the *traditional* production system: farmers have no water control, plant "traditional" rice varieties, and apply no chemical fertilizer or herbicide; (2) the *macro-semi-intensive* production system: farmers have water control, use "traditional" rice varieties, and apply no chemical fertilizer or herbicide; (3) the *micro-semi-intensive* production system: farmers have no water control, use "traditional" rice varieties, apply no fertilizer, and apply some herbicide; and (4) the *intensive* production system: farmers have water control, use "improved" rice varieties, and apply both chemical fertilizer and herbicide.

- ***Bas-fond* rice production could contribute significantly to the Malian government's effort to boost domestic rice production.** Yield data analysis shows that in seven of the 10 villages surveyed, the level of per capita milled rice production is higher than or equal to the national average rice consumption per capita (34 kg/person/year). In other words, there is a real potential for

villages with surplus production of paddy to sell rice to deficit areas.

At the national level, the importance of this contribution is reflected by comparing the potential level of *bas-fond* rice production with the rice supply from the *Office du Niger*, as well as with commercial imports and food aid to Mali. Currently, only part of Mali-Sud's *bas-fond* area is planted to rice. However, if all Mali-Sud *bas-fonds* (48,657 ha) were brought into production at the average yield observed in this study, 59,167 mt of paddy could be produced. This represents 31% of the total paddy produced by the *Office du Niger* annually over the last five years, 26% of commercial rice imports, and 160% of food aid (rice) to Mali in 1991.

Similarly, only part of Mali-Sud's flooded plains are currently planted to rice. As *bas-fonds*, these plains are largely undeveloped that are irrigated by overflows from small rivers and seepage, and completely dry out during the off-season. However, they are much wider than the *bas-fonds*. If all of Mali-Sud's flooded plains (i.e., 173,000 ha) were brought into production at the average yield observed in the *bas-fonds*, 189,091 mt of paddy could be produced. This represents 111% of the total paddy produced by the *Office du Niger* annually over the last five years, 93% of commercial rice imports, and 569% of food aid.

- ***Bas-fond* rice production systems are profitable to farmers.** For all systems, the return per day of family labor in the rice field (ranging from 1,374 to 2,971 CFA.F/day) is higher than the opportunity cost of labor, estimated to be 500 CFA.F/day. Similarly, the cost of producing a kilogram of paddy



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(ranging from 43 to 78 CFA.F/kg) is lower than the output farm-gate producer price (115 CFA.F). These results indicate that these systems are financially profitable. Among the four systems studied, the most profitable is the *micro-semi-intensive* system, which also has the lowest production costs. This system is so profitable primarily because of significant herbicide substitution for hired labor in weeding. However, these results are based on a single year of data and therefore do not take into account the year-to-year production risks associated with the prevailing erratic rainfall and poor water control in these *bas-fonds*.

- ***Bas-fond* rice production is more profitable to farmers than upland crops.** All four *bas-fond* rice production systems yield higher returns to a day of family labor (1,374-2,971 CFA.F/day) than any of the three upland crop enterprises, whatever their level of mechanization. Thus, for farmers, *bas-fond* rice production would constitute an economically meaningful complement to the upland crops. Among the upland crops, maize is the most profitable (1,128-1,318 CFA.F/day), followed by sorghum/millet (823-1,072 CFA.F/day).

However, it is likely that farmers look at the profitability of the entire grain-cotton system, which includes the spillover benefits from cotton. For example, cotton ensures farmers access to inputs (some of which go to food crops) via the cotton development agency's *Compagnie Malienne de Développement des Textiles* (CMDT) credit system, and capitalizes the farming system as a whole. Because of guaranteed revenue from selling their cotton, these farmers have greater flexibility in deciding when to market their food crops. Furthermore, for the country as a

whole, cotton production offers important growth linkages with the livestock and processing sub-sectors, as well as demand and fiscal linkages.

Thus, given the importance of cotton in Mali's economy, a critical question for future research is to determine how greater intensification of the *bas-fond* rice production would affect the cotton enterprise. For example, would greater intensification of *bas-fond* rice production induce a significant number of farmers to abandon or reduce cotton cultivation, and thereby decrease its production?

- ***Bas-fond* rice production systems make a lower-cost contribution to supplying Mali's rice requirements for home consumption or for commercial purposes in Bamako, Sikasso, and Bougouni markets than importing rice of the same quality.** DRC analysis shows that, for home consumption, the four systems have DRC ratios that are less than 0.7, regardless of the distance between the production/consumption site and Bamako (Figure 1). In other words, under any of the production systems considered, producing rice for home consumption in any of the Mali-Sud *bas-fonds* is a better use of domestic resources than importing rice to feed farmers.

For commercial purposes, all but the *bas-fond macro-semi-intensive* rice production systems are competitive in Bamako (Figure 2), Bougouni or Sikasso markets, even if the distance between the point of production and the market is as far as 700 km. However, the further the production site is from the sale point, the less competitive these systems become. But the production site would have to be very far from the market for any of the *bas-*

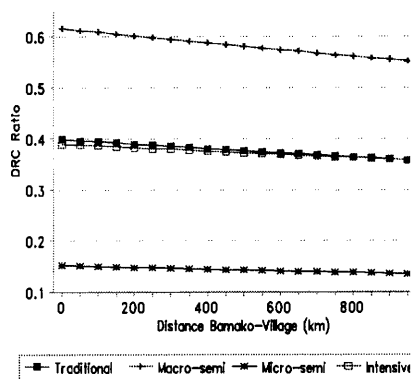


Figure 1. DRC Ratios for Subsistence *Bas-Fond* Rice Production Systems over Space, Mali, 1996.

fond systems to lose their competitiveness in those three output markets.

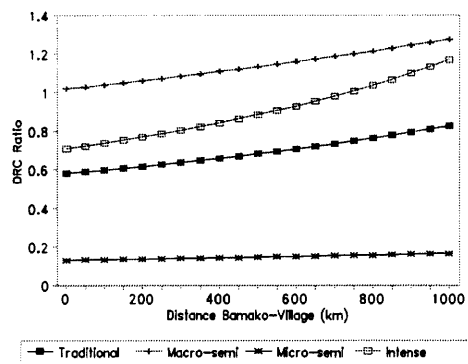


Figure 2. Bamako Output Market, DRC Ratios for Commercial *Bas-Fond* Rice Production Systems over Space, Mali, 1996.

● ***Bas-fond* rice production systems make a lower-cost contribution to supplying Mali's rice requirements in Bamako, Sikasso, and Bougouni markets than does the *Office du Niger*.** A comparison of DRC ratios from the *bas-fond* and *Office du Niger* rehabilitated (Niono) and non-rehabilitated (Macina) systems indicates that, within a distance ranging between 0 and 700 km, rice from the *bas-fond* production systems would be more competitive than rice of the same quality

harvested from any of the *Office du Niger* systems if sold either in Bougouni, Sikasso or Bamako.

CONCLUSIONS AND IMPLICATIONS: For three fundamental reasons, *bas-fond* rice production could be a major contribution to achieving household food security in Mali. First, if all Mali-Sud *bas-fonds* were brought into production, their production would represent 31% of the total paddy produced in the *Office du Niger* annually over the last five years, and 22% of commercial imports and food aid to Mali. If all Mali-Sud *bas-fonds* and flooded plains were brought into production, they could supply about 43% more paddy than the average quantity of paddy produced in the *Office du Niger* annually over the last five years, and roughly the same amount of grains as was imported annually through commercial imports and food aid.

Second, it makes sense for *bas-fond* farmers to produce rice because the *bas-fond* rice production systems are not only financially profitable, but also they yield higher returns to a day of family labor than the three upland crops competing with rice for farmers' labor. Therefore, by increasing rural incomes, *bas-fond* rice production raises rural households' access to food.

Finally, it also makes sense for the country because the DRCs establish that the contribution of *bas-fond* rice production systems to Mali's economy is great enough to justify using scarce resources required to develop these systems further, and two *bas-fond* rice production systems are more efficient in the use of domestic resources than the *Office du Niger* systems.



Given the positive financial and economic performance of *bas-fond* rice production systems, **there are two complementary (farm-level) ways to bring about the needed increase in its level of production.** One way is through an extensification strategy that will expand the current technology over a wider production area. The preceding analysis of the private and social profitability of *bas-fond* rice production is an analysis of this option.

Currently, only part of the *bas-fonds* is used because poor water control condition limits the command area. To expand the command area, improving the water control system and addressing other constraints farmers face would be necessary, especially labor constraints at tedious manual weeding. The existing quality and effectiveness of a water control infrastructure (i.e., dams across streams with no internal control of the water level) can be improved with complementary investments in plot-level water control (e.g., internal bunding) and a system of canals.

The high profitability of the *micro-semi-intensive* system (involving only use of herbicide) compared with the other systems indicates that given the current degree of water control in the *bas-fond*, insufficient labor for weeding is the most serious constraint on production. Labor cost's large share in the total production cost in each of the four most common *bas-fond* systems (44-86%) suggests that, in the short term, if scientists succeed in identifying relatively low-cost labor-saving technologies, the financial profitability of these systems could be much higher. Efforts to reduce labor costs should assess the potential of reducing labor input through the substitution of adapted and economically justifiable labor-saving

technologies such as herbicide, mechanical threshing, sickle harvesting, and better water control systems to reduce weed pressure.

The other complementary way to increase *bas-fond* rice production is through an intensification strategy including the use of yield-increasing modern inputs such as improved varieties, and herbicide and fertilizer applications, taking into account local resources and farmers' specific conditions. While the analysis of the rice enterprise profitability presented in this synthesis focuses on current technology, we have argued in other publications that **intensifying *bas-fond* production would require that a number of constraints be addressed.**

First, because the varieties farmers currently plant were developed for a much drier area, their yields tend to be lower, compared to those observed in the *Office du Niger*. For a greater intensification of *bas-fond* rice farming, scientists must develop appropriate high-yielding varieties. However, transferring the high experimental yields achieved on-station to the heterogenous *bas-fond* environment represents a challenge for Malian researchers because they must develop higher-yielding varieties that are appropriate for the *bas-fond* environment that is unstable due to poor water control. Short-term rapid yield increases may be achieved through traditional plant breeding strategies that rely on selecting appropriate genetic material from the world collection and screening the most promising selections under farmers' agro-environments. However, for this effort to succeed, scientists must adopt a participatory approach to combine the experimental knowledge of farmers and their formal scientific knowledge.



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Second, it is important to recognize that **currently the most pressing constraint to achieving higher rice yields is not the physiological potential of the varieties farmers plant. Rather, inadequate plot-level water control, soil infertility, pests, and diseases are the key factors that prevent farmers from fully exploiting the full potential of the varieties they currently plant.** In other words, the yield potential of varieties will not be realized in farmers' fields unless scientists develop appropriate complementary technologies to relax these constraints.

Third, *bas-fond* rice research in Mali has been limited in scope due to limited funding and human capital. Unless sufficient financial support is available, it will be difficult to carry out the research required to generate appropriate technologies suitable for intensifying *bas-fond* rice farming. Thus, for these efforts to succeed, the Malian researchers must mobilize a political constituency in support of agricultural research. However, as throughout West Africa, researchers have not been strong advocates for public investment in research. **As funding from the government and the donor community continues to dwindle, there is an increasing need for researchers to become pro active advocates of the value of agricultural research, especially given the limited political power of the farmers.**

Finally, although *bas-fond* farmers are **predominantly women (88%), existing institutional arrangements do not provide women direct access to new rice technologies and other resources such as credit.** Currently, the main source of "improved" technology is the CMDT, a

government agency that only provides credit to cotton farmers. Because all cotton farmers are men, many of whom are not willing to borrow for their wives, very few women farmers have access to modern inputs. As a result, women have limited access to household resources for investing in rice inputs.

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Dimithè is visiting assistant professor, and Staatz, professor, at Michigan State University; Kergna is with the Institut d'Economie Rurale/ECOFIL, Bamako, Mali.

This synthesis is a summary of a paper entitled: Can Agricultural Production in the Marginal Lands Improve Food Security in the Sahelian African Countries: An Evidence from *Bas-Fond* Rice Production in Mali. It can be obtained by writing to the authors:

Department of Agricultural Economics
Michigan State University
East Lansing, MI 48824-1039