

Socio-economic analysis of rice production in Ghana: Agenda for policy study

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ABSTRACT

This paper analyses some factors that adversely affect rice production in Ghana as a whole and at some irrigation projects in particular, and measures put in place to address them. The paper is based mainly on a field survey conducted at the Dawhenya Irrigation Project (DIP) between 2004 and 2007 as part of a policy study on irrigation agriculture in Ghana. The methodology used involved administering questionnaires to farmers and officials at the DIP, group discussions, and a feedback workshop with the farmers. The findings showed that the local rice industry had suffered from, among others, high cost of inputs and production constraints at the pump-type irrigation projects (PTIPs); particularly the high electricity tariffs that had resulted in closure of some irrigation schemes, including those at Dawhenya and Weija, difficulties in accessing credit, use of poor-yielding seed varieties, inappropriate agronomic practices, limited mechanisation, poor processing methods, and poor marketing strategies. Policy interventions should address these challenges to enable the local rice industry produce enough food to feed the country and for export.

RÉSUMÉ

OBIRIH-OPAREH, N.: *Analyse socio-économique de production du riz au Ghana : Programme d'étude de la politique*. Partout dans le monde, le riz (*Oryza sativa*) est la deuxième récolte après blé. Au Ghana, la culture de riz n'a pas suivi la demande la plus en plus élevée. Au lieu de cela, le pays importe de grandes quantités de riz pour compléter la production locale. L'ironie est que le Ghana a des conditions agro-climatiques requises pour la culture de riz. Pourquoi le Ghana ne produit pas assez du riz pour faire face à la demande intérieure énorme et pour l'exporte? Est-il dû aux priorités mal placées ou aux politiques méjugées par le gouvernement? Utilisant Dawhenya comme étude de cas, cet article analyse certains des facteurs qui compromettent la production du riz dans certains des projets d'irrigation en particulier et au Ghana dans son ensemble et les mesures mettez en place pour les adresser. L'article est basé principalement sur une enquête de champ menée au Projet d'Irrigation de Dawhenya (PID) entre 2004 et 2007 en tant que une étude de politique d'agriculture irriguée au Ghana. La méthodologie employé était l'administration impliquée des questionnaires structurés et semi structurés aux fermiers et aux fonctionnaires à PID, aux discussions de groupes et un atelier de retombe avec les fermiers. Les résultats ont prouvé que l'industrie locale du riz souffre de notamment, un coût élevé d'entrées et les contraintes de production aux projets d'irrigation du type pompe en particulier les tarifs élevés de l'électricité qu'avaient résultées à la fermeture de certains des schèmes d'irrigation comprenant ceux chez Dawhenya et Weija, difficultés en crédit de accès, utilisation des variétés de graine qui donne de rendement bas, des pratiques agronomiques inadéquates, la mécanisation limitée, des méthodes de transformation inefficace et des stratégies de commercialisation de bas niveau. Les interventions politiques devraient viser et rectifier ces problèmes qui militent contre le développement accéléré de l'industrie locale de riz pour produire assez de nourriture pour alimenter le pays et pour l'exportation.

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Introduction

Rice (*Oryza sativa*) is the second most important cash crop in the world after wheat. To grow better, it requires an agro-ecosystem in which water is present on the land throughout most of the crop's growing season. Small and medium-scale farmers grow about four-fifth of the world's rice in low-income developing countries (UN, 2004). Asian farmers produce about 90 per cent of the world's total rice, with two countries, China and India, producing over half of the total crop (Workman, 2008). These rice-based productive systems are essential for economic development and for improved quality of life for most of the world's population (FAO, 2000).

In Ghana, rice is cultivated in most agricultural regions. It is grown mainly in the valley bottoms, using traditional farming practices. Various governments in Ghana have offered rice farmers series of economic incentives including constructing irrigation dams, providing high-yielding rice seeds for cultivation, and extension services. The measure aimed at developing a vibrant local rice industry that can meet increasing domestic demand and for export. Although all the country's post-independent governments (1957-2006) have supported rice production, one government that stands out of the pack is the military government of 1972-1978. Mobilising students from all the country's universities and some youth groups to desilt dams, dig trenches for canals and suchlike at the Dawhenya Irrigation Project (DIP) and elsewhere, which led to large increases in rice production in the mid-1970s, showed the seriousness that government attached to the local rice industry, under its *Operation Feed Yourself* (OFY) policy. Similar results were realised in other parts of the country. The Northern Region was the main centre of rice production in the country, and Tamale was dubbed the rice city.

However, the withdrawal of government's subsidy on agricultural inputs as part of implementing the Structural Adjustment Programme (SAP) and the unfettered trade liberalisation since the early 1980s have led to

the Ghanaian market being flooded with cheap rice, and the near collapse of the local rice industry. It has also contributed to severe unemployment problems in the rice-producing areas, particularly in the three northern regions of Ghana, the main rice basket of the country. Since then, the local rice industry has neither had any significant support from government nor seen any appreciable increase in rice production. Ghana was only 35 per cent self-sufficient in rice production in 2006 (MOFA, 2007). This contrasts sharply with what pertained in the mid-1970s when the country was almost self-sufficient in rice production. It is in this context that rice production in Ghana is analysed within a globalised world.

The main objective of the study was to analyse factors that adversely affect rice production in Ghana, particularly at irrigation projects (using Dawhenya as a case study), and to recommend policy interventions to address the challenges.

Materials and methods

The study area is the Dawhenya Irrigation Project (DIP) near Dawhenya, a town in the Dangbe East District of the Greater Accra Region (Fig. 1). The dam was completed in the 1960s, but the irrigation system was not constructed until the 1970s. As at June 2004, only 190 ha (i.e. 42%) out of the available 450 ha had been cultivated, because the Project was unable to pump water to all the canals. Farming at the DIP was organised through the Dawhenya Rice Farmers Cooperative Society. The irrigated area consisted of lateral plots of about 1 or 2 ha, allocated to farmers according to their capacities and experience in rice farming. In June 2004, the society had a membership of 234 farmers and a cooperative development officer farming on 190 ha of land. The farmers dried and milled their rice on platforms and millers provided by the Ghana Irrigation Development Authority.

Besides reviewing secondary sources, including official documents on rice, the study used quantitative and qualitative methods to generate primary data. It administered questionnaire to a sample size of 236 comprising

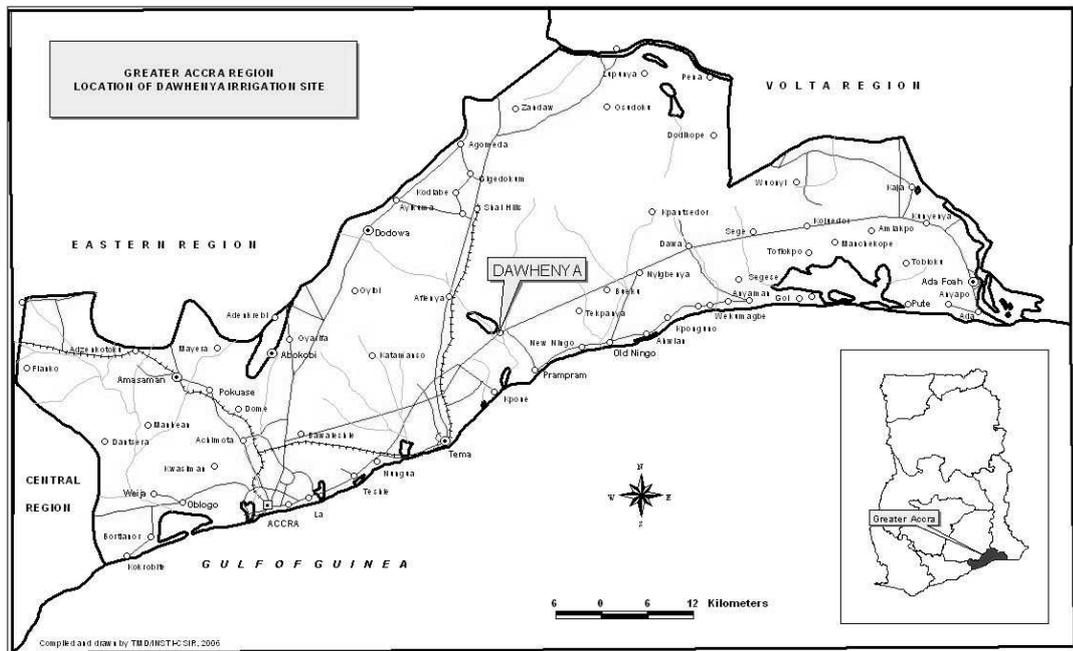


Fig. 1. Location map of Dawhenya.

234 farmers and two officials at the Project. It held in-depth oral interviews with some farmers and officials. It also organised participatory rapid approaches (PRAs), including group discussion and a feedback workshop, with some rice farmers at the DIP on various aspects of rice cultivation at the individual and cooperative society levels. Thirteen farmers, besides the irrigation and cooperative society officers, took part in the group discussion, whilst the feedback workshop involved 53 farmers. Furthermore, separate interviews were organised for the irrigation and cooperative development officers. Checklists were used for the group discussion, interviews with the two officials, and for the feedback workshop to capture their opinions on the major problems facing rice farming at Dawhenya, and suggestions for addressing them. The questions centred on (i) agronomic issues, (ii) reasons for cultivating certain rice varieties, (iii) quality and marketing of rice, (iv) major constraints facing the local rice industry in Ghana (particularly rice cultivation at

Dawhenya), and (v) measures for addressing challenges. In addition, the author undertook field observation of the rice farms and transect walk with two farmers and the two officials. Two key informants were also interviewed to draw out further information, especially at the cooperative society level. The quantitative data were processed and analysed using Microsoft Excel. The study used simple random sampling technique, whilst inferential statistical analysis of ordinary sample averages and proportions were used to estimate the characteristics of interests.

Results

The results were presented in two parts: (i) rice production in Ghana from the secondary data analysis, and (ii) rice production at Dawhenya and other irrigation projects from the primary data analysis.

Rice production in Ghana

In Ghana, like in many sub-Saharan African

countries, the technology for rice cultivation is basic, and the use of improved seeds and machinery is limited (MoFA, 2007). The area under rice cultivation in 2006 was 125,000 ha involving 800,000 farm households (MoFA, 2007). Ghana's paddy rice production levels for the periods 1995-1997, 1998-2000, 2001-2003, and 2004-2006 have averaged 211,400, 2235,200, 257,400, and 242,800 MT a⁻¹, respectively (Table 1), compared with an average of 62,000 MT a⁻¹ in the 1970s and 105,000 MT a⁻¹ in the 1980s. The country's average milled rice production of 150,000 MT a⁻¹ since 2001 have been supplemented by a yearly import of between 150,000 and 500,000 MT of rice (Table 1) (MoFA, 2007).

The average rice yield of 2 MT ha⁻¹ (MoFA, 2007) now is very small compared to countries such as China, India, USA, Thailand, Vietnam, and Indonesia (Fig. 2). The Ghana Living Standard Survey (GLSS, 2000) shows that the per capita consumption of rice stood at 18.7 kg a⁻¹ for 1998-2000 and increased at 4.7 per cent annually (GLSS, 2000). Thus, the per capita rice consumption (PCRC) per annum increased by 4.7 per cent from 18.7 kg in 2000 to 25 kg in 2007. In 2006 and 2007, with an estimated population of 22.410 and 22.931 million, respectively (World Fact Book, 2007), an estimated 550,000 and 590,000 MT of rice, respectively, might have been consumed. However, in 2006, the production of the commodity in Ghana, estimated to be 250,000 MT of paddy rice or 150,000 MT of milled rice (MoFA, 2007),

fell far short of its demand. Ghana imported large volumes of rice, particularly from the USA and Thailand, to augment the huge shortage in production (USDA, 2000). Between 1998 and 2003, and on an average, the percentage of the composition of Ghana's total rice import comprised the United States (33%), Thailand (30%), Vietnam (17%), China (12%), and Japan (8%).

Ghana's rice self-sufficiency ratio fluctuates between 25 and 65 per cent. The irony is that Ghana has the requisite agro-climatic conditions, human resources, and potential for rice cultivation. The successful control of the black flies, which cause onchocerciasis (river blindness) particularly in the White Volta basin, has opened up for development, the vast lands of the fertile Fumbussie Valley in the Interior Savannah zone. This has been the main factor allowing for an increase in rice production area from 88,300 ha in 1990 to 105,300 ha in 1996 and 125,000 ha in 2006 (MoFA, 2007). Ghana has great potential to expand its present average rice production area particularly in the Interior Savannah zone, which covers almost the whole of the northern half of the country, extending over nearly 9.32 million ha, the Afram Plains, and the coastal savannah.

Rice production at Dawhenya and other irrigation projects

About 90 per cent of the rice farmers at the Dawhenya Irrigation Project (DIP) were men. All the farmers were above 40 years of age, with most

TABLE 1
Rice Cultivation, Production and Importation, 1997-2006

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Areas planted ('000 ha)	118	130	105	115	135	123	118	119	120	125
Paddy rice ('000 MT)	197	281	210	215	253	280	239	242	237	250
Milled rice ('000 MT)	118	169	126	129	152	168	143	145	142	150
Rice imports ('000 MT)	76,074	182,8	241.6	187.3	311.5	297	797.7*	253.9 ^a	484.5 ^a	389.7 ^a

Source: Statistics, Research and Information Directorate (SRID), MoFA, Ghana, 2007

Source: Ministry of Trade and Industry, Accra

- Part of this amount may have been trans-shipment to neighbouring countries. However, this could not be verified from the MOTI & PSI. ^a Figures from GSS.

above 50 years. The oldest was 67 years. The casual labourers were in their twenties and thirties. The DIP showed (i) the distinctive role of small-scale rice farmers on irrigated plots (with about 1-2 ha, (ii) inadequate credit for farmers from financial institutions, (iii) the role of women in providing credit to rice farmers and marketing of the rice, (iv) consumers' preference for particular types of rice and the inability or ability of farmers to meet the quantity demanded, (v) high electricity tariffs and its effect on rice production, (vi) the tendency to push public health and environmental concerns to the background at the planning and design stage of irrigation projects, and (vii) lack of popular participation in decision-making by the community concerning the irrigation project. The major findings were organised under the following sub-headings: (a) most important problems, (b) rice varieties cultivated, (c) high yielding versus customer preference, (d) quality and marketing of rice produce, (e) credit or loans and repayment, (f) cost of inputs and revenue, and

(g) electricity tariffs.

a. Most important problems

About 93 and 4.3 per cent of the farmers identified high electricity tariff and lack of water for irrigation (due to disconnection of power supply to pump the water to the rice fields for irrigation) as their first and second most important problems, respectively. Thus, the two problems that accounted for 97.3 per cent were one and the same looked at from different dimensions. The high cost of agricultural inputs emerged as the farmers' third most important problem with 0.9 per cent. This was followed by inadequate credit (0.7%), high cost of tilling the land (0.6%), inadequate tilling machines (0.3%), and high cost of mechanised services (0.1%).

Other problems such as health hazards, including malaria, invasion of red ants and spread of waterborne diseases, accounted for the remaining 0.1 per cent (Table 2). About 95 per cent of the respondents cited abundance of mosquitoes

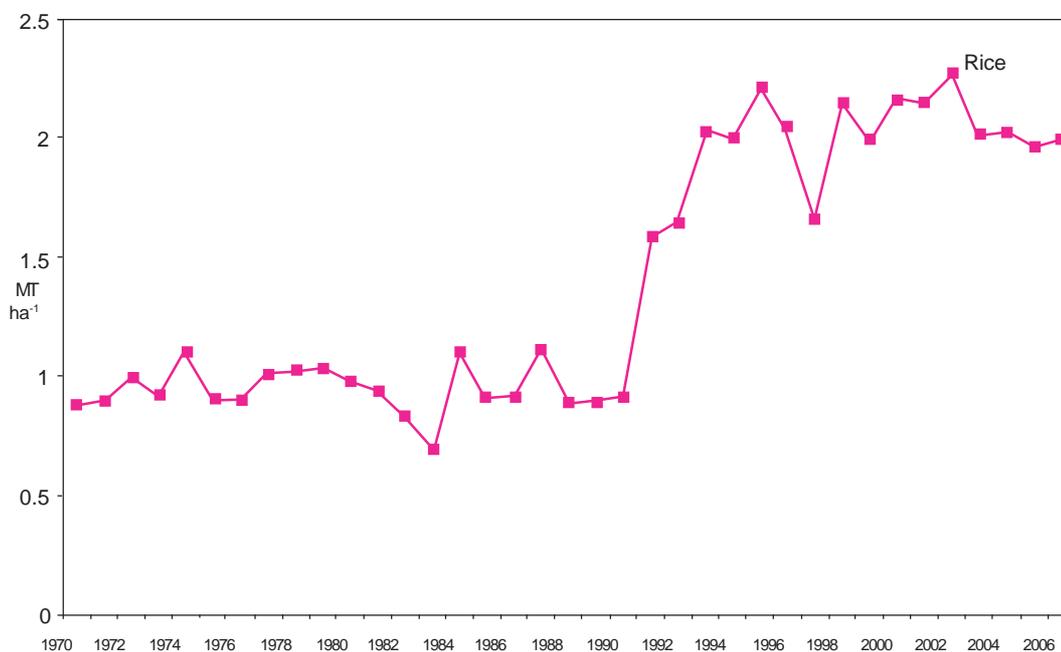


Fig. 2. Average rice yield in Ghana.

and high incidence of malaria as the main problems. Though there were numerous health problems associated with irrigation agriculture, such as schistosomiasis, 91 per cent of the respondents said the dam and canals had no effect on spread of waterborne diseases. Virtually all the farmers did not use protective gears (including Wellington boots) when working in the rice fields. According to the farmers, the type of boots available on the market gets stuck in the muddy ricefields, impeding free movement.

b. Rice varieties cultivated

The rice varieties cultivated at Dawhenya include Tox₃₁₀₇, Tox₃₁₀₈, Boake, Jasmine₈₅, GK₈₈, ITA₂₂₂, ITA₃₀₄, ITA₄₀₆, Grug₇, and WITTA₉. In 2003, the farmers cultivated four main rice varieties: Tox₃₁₀₈, Boake, Jasmine₈₅, and GK₈₈. All the rice varieties were cultivated on irrigated plots. They took 4 to 5 months (i.e. 110-130 days) to mature, depending on the variety; Tox₃₁₀₈ took 130 days to mature, whilst Boake and GK₈₈ took 120 days, and Jasmine₈₅ 110 days.

c. High yielding versus customer preference

The highest paddy rice yields ever recorded at the Dawhenya irrigation farm was 9.7 tons ha⁻¹ and lowest 3.0 tons ha⁻¹. Factors such as high-yielding seed, adequate inputs, and good

agronomic practices accounted for these yields. The average yield capacities for Tox₃₁₀₈, Boake, GK₈₈ and Jasmine₈₅ were 5.9, 5.7, 5.7, and 5.4 tons ha⁻¹, respectively. Tox₃₁₀₈ emerged as the highest yielding rice variety cultivated at the Project. The average yield of the rice at Dawhenya between 2000 and 2003 fell drastically owing to, among others, the high cost of inputs: electricity for water supply, compounded by intermittent disconnection of power supply during farming season; fertilizer, and labour. These forced the resource-poor farmers to make substitutes that adversely affected the yields.

According to the farmers, Boake and Tox₃₁₀₈ were consumers' most preferred rice varieties, each with 40 per cent of the total share. Tox₃₁₀₈ was farmers' most preferred rice variety for cultivation with 60 per cent of the total share, followed by Boake with 26.7 per cent (Table 3). Quality and taste were the two most important influencing factors for consumers' preference, followed by price and ease of cooking; whilst farmers cultivated more of a variety in response to specific market demand and profitability.

d. Quality and marketing of rice produce

The farmers indicated that patronage of their rice was high on the local market without many consumers knowing the source, because the market women and other traders re-bagged and sold some locally produced rice under foreign brand names. Sometimes re-bagging and re-labelling of the rice with similar foreign brands that were popular took place right in front of the farmers at the farm-gate. Though the quality of most locally grown rice varieties is not in doubt, poor post-harvest handling and marketing strategies account for the inability of their dealers to sell as expected; thus, the huge pile at the warehouses.

e. Credit or loans and repayment

The Dawhenya Cooperative Farmers

TABLE 2

Most Important Problems Facing Dawhenya Rice Farmers

<i>Order of ranking</i>	<i>Most important problem facing farmers</i>	
	<i>Item</i>	<i>%</i>
1	Electricity	93.0
2	Water	4.3
3	High cost of agricultural inputs	0.9
4	Inadequate credit	0.7
5	High cost of tilling the farm	0.6
6	Inadequate tilling machines	0.3
7	High cost of mechanised services	0.1

Source: Author's interview with Dawhenya rice farmers, June 2004

TABLE 3
Consumers' and Producers' Rice Preference

Rice variety	Producer preference (n = 234)	Consumer preference (n = 234)
	%	%
Boake	26.7	40.0
GK ₈₈	6.7	6.7
Jasmine	6.7	13.3
Tox ₃₁₀₈	60.0	40.0
Total	100.0	100.0

Source: Construction based on farmers' response to questionnaire in June 2004

Society did not give cash credit to the rice farmers, but inputs in the form of fertilizer, other agro-chemicals, Wellington boots, and cutlasses. The farmers also got trade credit from Continental Commodity Trading Company (CCTC) and the women traders. Loan recovery rate of the Cooperative Society for the period 1997-2000 was 90 per cent. However, it fell to 86 per cent in 2001 and 68 per cent in 2002.

f. Cost of inputs and revenue

The cost of inputs increased very fast between 1995 and 2003. The farmers cited lack of subsidy on agricultural inputs, including electricity supply, as responsible for high cost of production. Normally, the rice farmers cultivated two crops per year. The total cost of rice production for two crop seasons per hectare per year at Dawhenya was about $\text{¢}12.0$ million, including administrative and service charges, cost of production, and marketing cost. A farmer's revenue depended on the number of crop seasons and the number of bags of rice produced per season. In 2003, the Dawhenya rice farmers did two crop seasons and produced an average of between 60 and 70 bags per hectare per season. The farm-gate price for a 50-kg bag of rice at Dawhenya was then $\text{¢}150,000.00$. The field data of two rice farmers at DIP, Mr Asomani and Ms Charway, who produced 70 and 60 bags, respectively, for each of the two

crop seasons, were used to illustrate the point. Mr Asomani's revenue was $\text{¢}150,000 \times 70 \times 2 = \text{¢}21.0$ million. If his cost of production was $\text{¢}12.0$ million, then his net income was $\text{¢}9.0$ million per ha per annum. Similarly, Ms Charway's revenue was $\text{¢}150,000 \times 60 \times 2 = \text{¢}18.0$ million. If her cost of production was also $\text{¢}12.0$ million, then her net income was $\text{¢}6.0$ million per ha per annum.

g. Electricity tariffs

Table 4 shows that in 1997, rice farmers paid $\text{¢}0.188$ m per year. The tariffs increased to $\text{¢}0.337$ m, $\text{¢}0.500$ m, and $\text{¢}0.857$ m in 1998, 1999, and 2000. At 1997 nominal prices, the increases were 79.6, 166.7, and 357.1 per cent, respectively, over the same period. These charges continued to increase, but more rapidly from 2001 onwards. The electricity charges per hectare increased to $\text{¢}1.160$ m in 2001 and $\text{¢}1.734$ m in 2002, and to $\text{¢}5.172$ m in 2003. For 1997 nominal prices, the increase was 518 per cent for 2001, 825 per cent for 2002, and 2658.6 per cent for 2003. This shows that in 6 years, the percentage change in electricity charges of 2003 over that of 1997 was 2658.6 per cent. For 1997 constant prices (i.e. deflating for inflation), the charges per hectare were $\text{¢}0.290$ m, $\text{¢}0.379$ m, $\text{¢}0.462$ m, $\text{¢}0.516$ m, $\text{¢}0.669$ m, and $\text{¢}1.615$ m for 1998, 1999, 2000, 2001, 2002 and 2003, respectively. For percentages, these were 54.4, 101.5, 145.8, 174.3, 255.9, and 758.9 per cent, respectively. The differences in the changes in electricity charges of 2003 over those of 1997, for 1997 nominal and constant prices, were $\text{¢}4.985$ m and $\text{¢}1.427$ m, respectively. According to the Cooperative Society, by the end of 2003, it owed the Electricity Company of Ghana (ECG) $\text{¢}450$ million. The ECG disconnected the power supply after the farmers' inability to pay the bills.

Discussion

Ghana experienced a rapid dietary shift to rice,

TABLE 4
Electricity Charges Incurred on Rice Farming at the DIP, 1997-2003

Year	Rate of inflation	Area cultivated (ha)	Electricity cost (nominal prices)		Electricity cost ha ⁻¹ (1997 constant prices)				
			Total	Per ha	Total	Per ha			
			Changes over previous rate ha ⁻¹	%	Changes over 1997 rate ha ⁻¹	%	Changes over 1997 rate ha ⁻¹	%	
1997	21.0	80	15.00	0.188	-	15.000	0.188	-	-
1998	16.0	155	52.20	0.337	0.149	45.000	0.290	0.102	54.4
1999	13.8	160	80.00	0.500	0.163	60.602	0.379	0.088	30.5
2000	40.5	140	120.00	0.857	0.357	64.700	0.462	0.083	22.0
2001	21.3	150	174.00	1.160	0.303	77.341	0.516	0.053	11.6
2002	15.2	143	248.00	1.734	0.574	95.689	0.669	0.154	29.8
2003	23.6	87	450.00	5.172	3.438	140.48	1.615	0.946	141.3

Source: Constructed from data provided by Dawhenya Cooperative Society, June 2004. Data on inflation for 1997-2003 is based on information collected from Ghana Statistical Service.

particularly in the urban centres, during the early post-independence period. The increase in demand for rice in Ghana is attributed largely to increased income, favourable government's commodity pricing policies, good storability of rice, ease of cooking, and rapid urbanisation. The discussion covered credit, farming methods, rice varieties, marketing difficulties, and electricity tariffs.

Credit

Like most countries in sub-Saharan Africa, often the size of credit farmers in Ghana receive is inadequate to buy the requisite inputs such as sprinklers, tractors and combined harvesters as well as fertilizer and agrochemicals in the right quantities for their farming activities. This severely affected yield, farmers' income, and contribution to food security and poverty reduction.

Farming methods

The use of modern machines was limited to land preparation and milling of rice. All other activities such as planting of seed, weeding, harvesting, and threshing were manual. The limited use of machines in the production chain was partly responsible for the foreign objects, such as stones, and the higher percentage of broken parts. These affected rice quality and marketability. Farmers should be assisted to adopt modern methods for harvesting, drying, and processing of rice to get rid of foreign objects and enhance its quality, marketability and competitiveness in a globalised world.

Rice varieties

Farmers cultivated many rice varieties at any given farming period

instead of concentrating on a few market-driven, high-yielding varieties. Considering the highly competitive nature of the rice business as a result of trade liberalisation, it became incumbent on the resource-poor rice farmers in sub-Saharan Africa (including Ghana) to be selective concerning rice varieties to cultivate. Cultivating few high-yielding varieties, such as the New Rice for Africa (NERICA), could enable research and development institutions to focus more on them to improve on their yield, and to ensure standardisation, quality, and marketability. However, if few varieties (including NERICA) should be promoted, then more attention must also be paid to their marketability and consumer acceptability.

Marketing difficulties

Marketing was a major problem facing the local rice industry. The traditional milling method in use now, which most farmers use for locally grown rice, does not only result in loss of yield, but also poor quality of produce, which seriously affect marketability. Large quantities of local rice were locked up in warehouses and homes, unable to sell, whilst farmers faced the problems of debt servicing for loans from banks, moneylenders, and market women. Dealers in imported rice have, through better marketing strategies, succeeded in creating the perception that foreign rice is superior to local rice. To mitigate the problem, local rice farmers should grow high-yielding rice varieties with high marketability and consumer acceptability. They should use modern agronomic practices and machines to harvest, thresh, mill, dry, and bag the rice to get rid of foreign objects in the rice, and to minimise the percentage of broken parts to acceptable standards. Also, rice should be properly stored and packaged in attractive bags with brand names. Dealers or traders in locally grown rice should emulate or outdo their counterparts with better marketing strategies. The rice industry is one of standards and competition, and local rice operators must function as such.

Electricity tariffs

In Ghana, rice farmers involved in pump-type irrigation projects (PTIPs) all over the country pay the same rates as those charged to industries. The high electricity tariff was partly responsible for high production cost and the fallen trend of loan recovery rate at DIP. The PTIPs in Dawhenya, Weija, and Amate in Ghana and elsewhere in Africa require large quantities of electricity to pump water to the farms. Comparatively, farmers in the gravity-type irrigation projects (GTIPs) such as Aveyime, Afife, Botanga, Golinga, Ligba, Tono, and Vea, and elsewhere all over the world save tremendously on production cost and have competitive edge over their counterparts in the PTIPs. Addressing the high electricity tariff in PTIPs would remove a huge burden off the neck of farmers. It would also enable farmers to invest in other inputs such as high-yielding disease-resistant seed varieties, agro-chemicals, better agronomic practices, better harvesting and processing practices, increased mechanisation in the production process, and effective marketing strategies.

Recommendations

Ghana should construct more irrigation dams to ensure that water is accessible at affordable prices for rice irrigation. The existing PTIPs might require concessionary electricity tariffs to perform better, though; many developing countries such as Ghana may be unable to raise the necessary resources to provide adequate subsidy for this purpose because of limitations in budget allocations. The PTIPs must also explore alternative sources of power such as wind and solar energy to pump water to their rice fields. The government should not construct additional PTIPs because they are too expensive to operate. The government should make rice production a key strategy for food security and poverty reduction programmes, and for employment creation. Rice production should be linked to marketability and consumers' acceptability. Policy measures should target factors such as research,

production, and marketing constraints of rice production in Ghana.

Conclusion

Rice production in Africa faces many problems, particularly in irrigated ecologies. Though various governments in Ghana had recognised irrigation as the cornerstone of the country's drive toward agricultural modernisation and food security, there had been enough lip service toward its realisation. The few irrigation projects have broken down, not been effectively and efficiently managed, or have closed down because of high electricity tariffs (e.g. Dawhenya and Weija Irrigation projects). Irrigation projects are very expensive and should, therefore, be used effectively and efficiently to benefit the country.

The inability of the government to formulate and implement a coherent national agricultural development policy to meet the country's increasing rice demand has caused the food security problem. Ghana's huge rice import suggests policy failure in the agricultural sector, in view of Ghana having the requisite agro-climatic conditions and human resources for rice cultivation. Ghana's rice industry requires structural transformation that enables policy-makers and farmers to respond efficiently and effectively to growing consumer demand for quality rice. Ghana needs to do more to improve her competitiveness in rice production, post-harvest handling, and marketing. Ghana can

increase her rice production if the government, in partnership with the private sector, commits more resources to provide soft loans to rice farmers, provides inputs including machines and high-yielding seeds at affordable prices, deepens support for research-extension-farmer linkage, streamlines commodity pricing and marketing policies for rice, and makes rice production attractive and lucrative.

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