

GHANA

Strategy Support Program



Green Revolution in Ghana: Looking for The Key Under The Lamp Post

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DISCUSSION NOTE # 006

INTRODUCTION

With renewed interest in technical change and productivity growth in the African agricultural sector, interest is growing in the lessons of Asia's Green Revolution and in the implementation of input promotion and subsidies to promote agricultural growth. While there are several valid reasons for seeking a model for African agricultural productivity growth from the Asian Green Revolution, the abundance of natural resources in Africa compared to Asia means that the Asian lessons might have limited application across Africa.

We take an empirical approach to the question of relative factor abundance and factor constraints in Ghana's agriculture by analyzing profits of agricultural producers to see how the use of Green Revolution technology, labor use and agroecological conditions affect economic results and efficiency of the household. The methodology used allows the decomposition of profit efficiency into price and technical efficiency (Badunenko et al. 2008). Technical efficiency is further decomposed into scale efficiency and pure technical efficiency. A firm is technically efficient if it uses the minimal possible combination of inputs for producing a certain output; or equivalently, if it produces the maximum possible output given a certain combination of inputs. Price efficiency refers to the ability of a firm to choose the optimal combination of inputs and outputs given input and output prices. Scale efficiency results from the distance between the scale size of a production unit and the most productive scale size.

The data used were obtained by the fifth round of the Ghana Living Standards Survey (GLSS 5) undertaken in 2008. Information on 5,069 rural households are included. Further, these data classify households into the Forest, North Savannah, and South Savannah zones of Ghana. These three zones are representative of the major agro-ecological regions in the country in terms of rainfall, climate, vegetation, soil, and growing seasons.

We found that agriculture in Ghana is labor-constrained and highly inefficient, and that the limited increase in the production and productivity of staple crops is related to labor and land constraints in the forest region and to labor constraints in the sa-

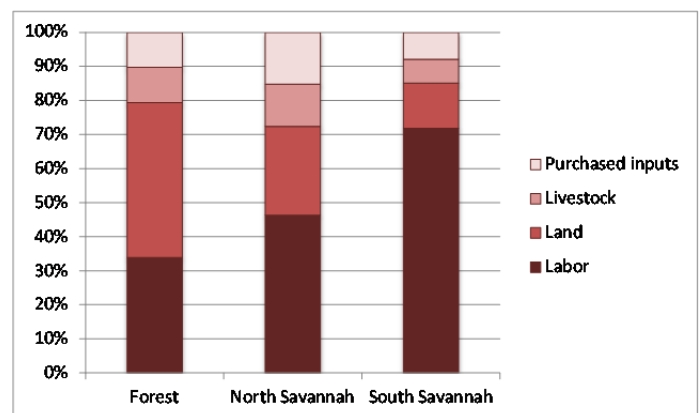
vannah region. Most of the identified inefficiency results from inadequate scale of production, with a significant number of smallholder producers relying on off-farm income and lacking incentives to increase productivity. Main findings of the study follow.

GHANA IS NOT ASIA: LABOR IN AGRICULTURE IS SCARCE AND HAS HIGH OPPORTUNITY COST

The relative scarcity of resources employed in agricultural production is reflected in the opportunity cost or "shadow prices" of these resources. For instance, the opportunity cost of labor reflects how much producers are willing to pay for an extra unit of labor: if labor is scarce they are willing to pay more for an extra unit of labor as they expect a high return from that extra unit.

Figure 1 shows the contribution of inputs to total cost for each of the major agroecological zones in Ghana when using input shadow prices instead of market prices. We conclude from the figure that labor in Ghana is a major constraint for agricultural production, particularly in the Savannah, where labor explains 70 percent of costs in South Savannah and almost 50 percent in North Savannah. In the Forest region, labor share is 35 percent, a lower share than that of land (45 percent).

FIGURE 1—INPUT SHARES FROM SHADOW PRICES

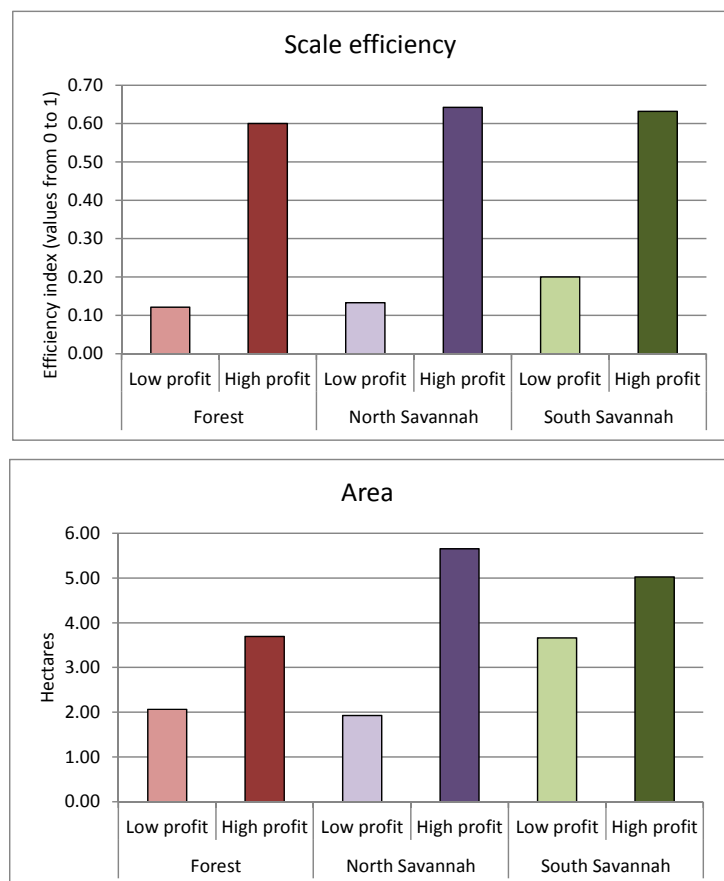


Source: Authors' estimates.

SCALE MATTERS AND AGRICULTURE IN GHANA IS HIGHLY SCALE-INEFFICIENT

Agriculture in Ghana shows low technical efficiency primarily due to low scale production. As shown in Figure 2, the group of highly inefficient households includes 40 percent of households in the Forest region with areas below 2.5 hectares and with less than half of their income coming from agricultural production; 40 percent of producers in North Savannah with less than 2.3 hectares and only 30 percent of their income coming from agricultural production; and 20 percent of households in South Savannah with less than 2.5 hectares and half of their income obtained from off-farm sources. Notice that land area affects scale but is not the only factor determining scale efficiency. For instance, as shown by Figure 2, land area is determinant of scale efficiency in North Savannah, where cereals are most important and have less substitution possibilities with other crops. On the other hand, the importance of cassava in South Savannah and cocoa and cassava in the Forest region determines that the scale of operation can be increased by substituting cassava for other crops using the same area.

FIGURE 2—SCALE EFFICIENCY, AREA AND LAND USE BY PROFITABILITY



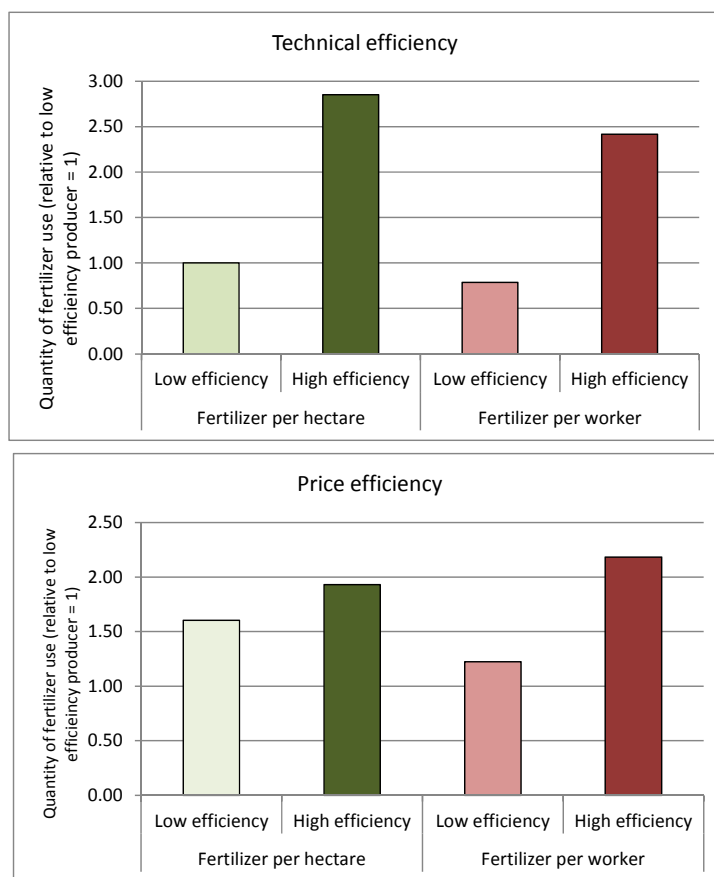
Note: Low and high profit producers are those in first and last two quintiles of the distribution of profit efficiency.

Source: Authors' estimates.

FERTILIZER: MORE OR LESS?

Higher fertilizer use per hectare is positively related to technical efficiency but not necessarily to price efficiency (Figure 3). On the other hand, greater use of fertilizer per worker appears to be associated with higher technical and price efficiency. In other words, increasing cultivated land per worker allows increased fertilizer use per worker, keeping fertilizer per hectare at profitable levels.

FIGURE 3—LEVEL OF FERTILIZER PER HECTARE AND WORKER USED BY TECHNICALLY AND PRICE-EFFICIENT PRODUCERS, NORTH SAVANNAH



Note: Low and high profit producers are those in first and last two quintiles of the distribution of technical and price efficiency.

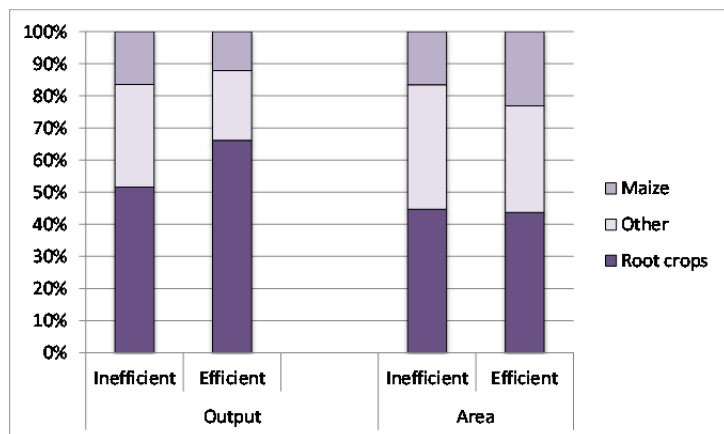
Source: Authors' estimates.

As in the case of North Savannah, there are few incentives to increase the use of fertilizer per hectare in South Savannah, although there could be different policy implications due to the importance of root crops in the production systems of that region. Profit efficiency in South Savannah is related to the share of root crops in total output.

Figure 4 shows that the difference between producers obtaining high or low profits is higher yield of root crops, as the area allocated to these crops is similar in efficient and inefficient producers. However, our results show that efficient producers use 20

percent less fertilizer per hectare and higher fertilizer per worker than inefficient producers.

FIGURE 4—LAND USE AND OUTPUT COMPOSITION FOR PROFIT EFFICIENT AND INEFFICIENT PRODUCERS IN SOUTH SAVANNAH REGION



Note: Low and high profit producers are those in first and last two quintiles of the distribution of profit efficiency.

Source: Authors' estimates.

LAND CONSTRAINTS IN THE FOREST AND SOUTH SAVANNAH

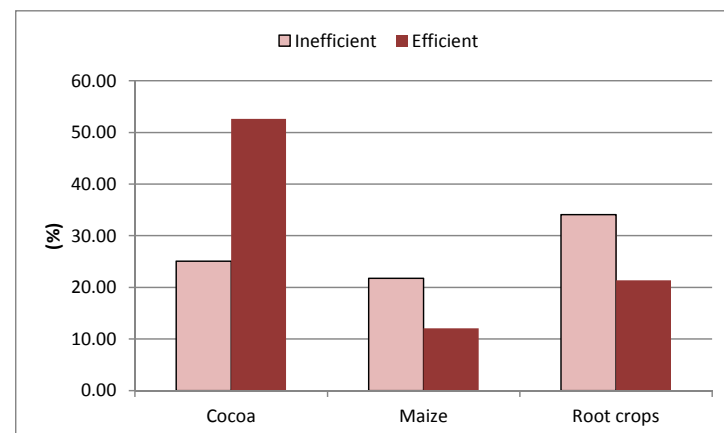
Profitability of production systems in the Forest region depends directly on the share of total area allocated to cocoa and on the scale of production: the larger the level of operation of the farm and the share of cocoa in total area, the larger the price efficiency, and the overall economic efficiency (Figure 5). The implications for root crops and cereals are clear: there is no incentive to increase production of staple crops by area expansion.

Conversely, land scarcity generated by higher population densities and the high demand of land by cocoa production could create incentives to increase land productivity and higher use of fertilizer per hectare. However, our results show no evidence of higher use of fertilizer per hectare in the Forest region (Table 1). In fact, fertilizer relative to land and labor use in the Forest region is the lowest among all regions.

Even if we assume that land availability is a major constraint to production in the Forest region, profit efficiency is achieved not by increased use of inputs per hectare but by increased output of cocoa, cassava, and yam, crops that rely less on the use of inputs and fertilizer than cereals. Second, our results show evidence that labor might still be a major constraint to production in the Forest region, which could explain the fact that efficient producers tend to use more fertilizer per worker than inefficient producers. This could be indicating that even in the Forest region, the most land-constrained region in Ghana, labor scarcity still affects economic results with producers achieving better economic re-

sults by increasing labor productivity rather than land productivity.

FIGURE 5—LAND USE BY PROFIT EFFICIENT AND INEFFICIENT PRODUCERS IN THE FOREST REGION



Note: Low and high profit producers are those in first and last two quintiles of the distribution of profit efficiency.

Source: Authors' estimates.

TABLE 1—LEVEL OF FERTILIZER USE PER HECTARE AND WORKER BY PROFIT-EFFICIENT AND -INEFFICIENT PRODUCERS (RELATIVE TO LEVELS OF FERTILIZER USED BY NORTH SAVANNAH PROFIT EFFICIENT PRODUCERS)

	Fertilizer per hectare		Fertilizer per worker	
	Inefficient	Efficient	Inefficient	Efficient
North Savannah	0.33	1.00	0.27	1.00
South Savannah	0.41	0.36	0.42	0.48
Forest	0.22	0.27	0.23	0.39

CONCLUSIONS

The Asian Green Revolution strategy to increase production and accelerate agricultural growth in Ghana has limited possibilities of success. In the case of the North Savannah, this is because higher fertilizer use per hectare increases technical efficiency but has a negative effect on profitability. Greater use of fertilizer per worker appears to be associated with higher technical efficiency and also shows a positive relation with economic efficiency.

The possibility of increasing cereal production in the Forest and South Savannah through a higher use of fertilizer per hectare is also limited for two reasons. First, there is little incentive to increase the use of inputs per hectare as profit efficiency is achieved by increased output of cocoa, cassava, and yam, crops that rely less on the use of inputs and fertilizer than cereals. Second, labor might still be a major constraint to production in the Forest region, which could explain the fact that efficient producers tend to use higher fertilizer per worker than inefficient producers.

We conclude that technical change and the increased use of chemical inputs would be more likely to occur in the North Savannah if they are channeled as part of a labor saving technology package and if conditions are created for the adoption of this

package. In the South, the dynamism of agriculture seems to be related to the development of technical solutions to increase productivity in cocoa and root crops, which will require market opportunities for crops like cassava.

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