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EFFECTS OF AGRICULTURAL COMMERCIALIZATION ON FOOD CROP INPUT USE AND PRODUCTIVITY IN KENYA

By

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BACKGROUND: It is commonly argued that productivity growth in African agriculture will require a transformation out of the semi-subsistence, low-input, low-productivity agriculture that characterizes most of rural Africa. Given population growth and the limits of area expansion as a means to increase crop production, productivity growth will increasingly entail yield growth and/or shifts to higher-return activities, involving more intensive use of productivity enhancing inputs and more market oriented patterns of crop production.

High-valued cash crops represent one potential avenue of crop intensification. The promotion of cash crop commercialization and its effects on smallholder welfare have been debated for decades. **Commercialization schemes featuring non-food cash crops have frequently been criticized in African contexts as having a negative effect on food production and food security.** Without reliable and efficient food markets, commercialized cropping patterns may expose smallholder households to major risks of food insecurity.

However, studies from a range of African countries also demonstrate potential synergies between cash crop investment and food crop production. These studies found that the presence of commercially viable cash crops such as cotton and

groundnuts had positive spillover benefits for smallholder food production in selected regions. These spillover benefits included increased adoption of fertilizer on food crops made possible by cash crop input delivery channels, and increased availability of farm credit through cash crop schemes with which to hire additional labor and finance investments in productive assets such as draft oxen and traction equipment. These studies raise the possibility that the promotion of cash crop production may, if suitably implemented, have important positive spillover effects on food crop intensification and productivity.

OBJECTIVES AND METHODS: The objective of this report is to analyze the effects of smallholder commercialization on food crop input use and productivity in rural Kenya.

The main research objectives are:

1. To examine the determinants of smallholder fertilizer use on food crops, with a focus on the effects of household and regional agricultural commercialization;
2. To examine the determinants of food crop productivity, again with a focus on the effects of commercialization; and

3. To discuss the implications of the findings for policy and additional research necessary to improve the contribution of cash cropping to rural food productivity growth and food security.

For purposes of measuring the effects of crop commercialization, we defined the *household commercialization index* (HCI) as:

$$\text{HCI} = \left[\frac{\text{gross value of all crop sales}_{hh\ i, \text{year}\ j}}{\text{gross value of all crop production}_{hh\ i, \text{year}\ j}} \right] * 100$$

This index measures the extent to which household crop production is oriented toward the market. A value of zero would signify a totally subsistence oriented household; the closer the index is to 100, the higher the degree of commercialization.

Analysis is based on a national rural household survey of 1,540 rural households implemented under the Kenya Agricultural Monitoring and Policy Analysis Project (KAMPAP), a joint collaboration between Tegemeo Institute/Egerton University, Michigan State University, and Kenya Agricultural Research Institute.

Results are derived from two econometric models that determine the effects of commercialization at both the household and district levels on food crop fertilizer use and productivity. With respect to the fertilizer model, because 44 percent of sampled households applied no fertilizer to food crops, the distribution of this variable is censored and we therefore use a Tobit estimation technique. With respect to the productivity model, we find that both key purchased input variables -- fertilizer and hybrid maize seed -- are endogenous to the determination of productivity. As such, an instrumental variables approach is used for this model.

A main premise of the paper is that the effects of commercialization are not uniform and cannot be generalized. The effects are hypothesized to differ according to differences in the institutional/contractual arrangements between firms and smallholders, management decisions, and the

level of credit and extension support provided to smallholders by the various private and parastatal firms involved in promoting smallholder cash crops.

FINDINGS: The principle findings of the study are:

1. The degree of smallholder commercialization differs widely across zones in Kenya. Even within a particular zone, households differ significantly in the degree of crop commercialization (see Table 1);
2. Crop commercialization is not uniformly correlated with landholding or area cultivated among the households surveyed;
3. Household agricultural commercialization, *ceteris paribus*, generally has a significant and positive effect on food crop fertilizer use and productivity. The results indicate that a 10 percent increase in HCI from the mean level of 39 percent would, on average, result in an additional 8 kgs/acre of fertilizer used on food crops, and an additional 670 Ksh/acre boost in food crop productivity (a 7 percent increase in the mean), *ceteris paribus*;
4. While the general effect of commercialization on food crop input use and productivity was positive, the magnitude and direction of the effects differed by region and by crop. This finding indicated there are certain variable features of commercialization schemes that influence performance outcomes. Hence the impact of agricultural commercialization cannot be generalized;
5. As expected, smallholder adoption of hybrid maize seed, frequently in combination with fertilizer, was shown to have significant positive effects on productivity per unit of land; and

Table 1. Selected Farm Statistics by Zone and Quartile of Gross Value of Food Production Per Acre, 1996/97

Agro-Regional Zone		Gross Value of Food Production per Acre	Food Crop Area	Land Owned	Fertilizer Nutrients Applied to Food Crops	Household Commercialization Index
	Quartile	Ksh/acre	acres / person		kgs / acre	percent
Coastal	1	1102	0.29	0.59	0.01	17
Lowlands	2	2310	0.25	0.43	0.61	28
	3	3897	0.37	0.63	0	27
	4	8933	0.23	0.76	0.06	32
Eastern	1	795	0.59	1.1	0.28	10
Lowlands	2	2031	0.52	1	0.86	25
	3	3815	0.28	0.69	1.71	30
	4	10490	0.25	0.79	2.29	42
Western	1	1309	0.4	0.76	0	27
Lowlands	2	3074	0.47	0.97	0.01	22
	3	4806	0.33	0.73	0.06	22
	4	10839	0.28	0.62	1.35	27
Central	1	8392	1.1	1.37	1.55	58
Lowlands	2	12520	0.87	2.71	0	68
	3	16227	1.2	2.85	3.97	81
	4	21881	1.06	2.28	1.52	78
Western	1	3403	0.32	0.78	7.05	35
Transitional	2	6733	0.37	0.95	11.75	32
	3	10524	0.41	0.81	23.01	43
	4	19039	0.42	0.77	21.29	53
Western	1	2987	0.24	0.33	7.249	27
Highlands	2	5968	0.23	0.4	11.94	41
	3	9853	0.2	0.47	12.58	35
	4	19216	0.15	0.33	20.1	37
Central	1	2295	0.34	0.85	9.076	40
Highlands	2	7542	0.28	0.56	16.75	54
	3	12394	0.22	0.5	22.12	53
	4	27126	0.18	0.56	33.3	59
High	1	5581	0.56	1.37	20.67	38
Potential	2	10010	0.82	1.6	27.23	56
	3	13744	0.7	1.51	30.44	56
	4	21720	0.81	1.17	38.54	62

Source: KAMPAP Household Survey, 1996/97 season.

6. There is a meaningful payoff to formal education in terms of food crop productivity; fertilizer use was also found to be positively associated with education.

POLICY AND FUTURE RESEARCH IMPLICATIONS: In general, the results indicate that discussions of agricultural commercialization and its effects were positive in most cases. The strength of these findings is consistent with empirical findings from Mali, Senegal and

Mozambique where robust complementary relationships were found between household-level cash cropping and food crop performance. But this conclusion should not be overgeneralized. What matters is what kind of commercialization, how particular schemes are organized, and their effects on smallholder access to inputs, management advice, market outlets, price levels and price risks, etc.

The most important pathways by which crop commercialization may improve food crop productivity are hypothesized to be:

1. Crop commercialization provides a source of cash that allows the household to overcome credit-related constraints on the purchase of fertilizer and other cash inputs;
2. Participation in a cash crop (e.g., coffee in some areas) improves the household's access to inputs distributed through the cash crop marketing firm (e.g., coffee cooperatives), which may result in the household using some of that input on food crop production; and
3. Cash income from commercialized production patterns also facilitates the ability to purchase draft oxen and traction equipment that may promote food crop productivity.

The emerging picture indicates the benefits of attempting to address the risks and market failure aspects necessary to make increased agricultural commercialization viable rather than accept these risks and market failures as inherent, unalterable features of the African context that require a "food first" production orientation. Increased access to food depends on income growth, and for the majority of African smallholders dependent on agriculture, income growth is tied to productivity growth in agriculture, i.e., increasing the value of production generated from available household resources.

Governments in Africa are seeking policies designed to increase rural incomes through productivity-

enhancing technology packages. Cash crop promoters such as sugarcane mill owners or coffee processors can be important investors and partners in this process, but their performance is critical to determining whether the welfare outcomes for smallholders are positive or negative. A major task for future research is to understand better how successful commercialization arrangements linking smallholders and marketing/processing firms have been structured so that their successful ingredients can be replicated and incorporated more broadly into commercialization strategies in other regions. This is likely to yield high payoffs in terms of increasing agricultural productivity and food security.

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