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THE IMPACT OF MILLET, SORGHUM, AND COWPEA RESEARCH AND TECHNOLOGY TRANSFER IN NIGER

By

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BACKGROUND: Since 1970 Niger has experienced 13 years of deficit cereal production.¹ In half of those years, the country was forced to import one-third of its food requirements. To counter these problems, the Government of Niger and donor agencies have sought to increase agricultural productivity by improving research and extension capacity for three of Niger's most important crops, millet, sorghum, and cowpea. Millet and sorghum together account for 85% of total production and 80% of national calorie intake. Cowpea is the leading cash crop, produced mainly for export to Nigeria. Intercropped millet, sorghum and cowpea is the most common agricultural production system in Niger. During 1986-1990, 68% of Niger's public outlays for agricultural research and 58% of its researchers were devoted to these three crops. Since 1976, USAID has invested more than \$22 million in research projects for these three crops, through the Institut National de Recherche Agronomique du Niger (INRAN).

OBJECTIVE: In spite of increased investments in research and extension, cowpea yields increased only 0.2% annually between 1961 and 1990, and sorghum and millet yields decreased by 0.7% and 2.7% per annum, respectively. The two objectives of this study were (1) to evaluate the economic returns to investments in sorghum, millet and cowpea research and

extension, and (2) to analyze the principal institutional and organizational factors that influence the development and adoption of agricultural technologies.

For objective (1), a benefit-cost analysis of investments in Niger's variety development and technology transfer system for sorghum, millet and cowpea between 1975 and 2011 was undertaken. A rate of return (ROR) was calculated, which measures the net benefits to society from investments made in research and technology transfer activities. The ROR must be equal to or greater than the target rate of return (the opportunity cost of capital, typically assumed to be about 10% in West Africa) if the investment is to be considered "profitable." The improved varieties evaluated were P3KOLLO, HKP, and CIVT for millet, TN5-78 for cowpea, and three sorghum varieties released to farmers in the early 1990s: NAD1, SEPON82, and SRN39. Other data used to estimate benefit and cost streams for each year included area under cultivation, adoption rates by farmers, output prices, production costs, and costs of research, extension, and seed multiplication. For objective (2), a qualitative analysis was conducted of the research, extension and seed multiplication systems.

FINDINGS: In on-farm trials, the improved millet varieties yielded 22% more than traditional varieties. Yield increases for the improved cowpea varieties

¹This summary presents information as of the date of the original study (1991).



ranged from 27 to 46%. The internal rates of return (RORs) estimated for the package of sorghum, millet and cowpea investments, incorporating projected returns to 2011, ranged from 2% to 21% depending on the assumptions used regarding yield differentials, prices, adoption rates, and production and extension costs. These positive returns indicate that sorghum, millet and cowpea research and technology transfer have contributed to increased productivity in Niger's agricultural sector. The returns are comparable to those found for research on cowpea (15%) and sorghum (1%) in Cameroon, but are low compared to RORs calculated for other commodities elsewhere, e.g., 135% for maize research in Mali. Sensitivity analysis showed that the adoption rate had the largest effect on the rate of return, and that inclusion of seed multiplication costs greatly decreased the rate of return.

CONSTRAINTS TO TECHNOLOGY ADOPTION AND DISSEMINATION: Several factors contribute to the positive but limited impact of research and extension in Niger. First, Niger's arid climate and soils are poorly suited to agriculture. Marginal and risky production conditions exist throughout the country. The risks that climate creates for agricultural cultivation mean that the scope for major increases in productivity from crop production research is also limited. High-input varietal technology is unlikely to be adopted on a large scale, because of the difficulty of obtaining yield increases substantial enough to make inputs profitable in the extremely dry climate.

The negative effects of climate on technology adoption and crop intensification are compounded by other factors such as the low market price for cereals, weak transport and market infrastructure, poor seed multiplication system, and the unavailability of seeds, fertilizer, and credit.

ISSUES: In Niger, research has been primarily focused on genetic breeding, which is highly resource intensive. While this study shows positive returns to investment in this research program, it raises questions about whether the investment should be maintained. Productivity gains based on varietal

improvements have been hard won in the difficult production environment of Niger. This is particularly so for millet and sorghum, where thousands of years of natural selection have given rise to a number of good local landraces. With multidonor funding several times that of INRAN, ICRISAT at Sadoré has yet to develop a variety that can outperform Niger's landraces. Despite the difficulties, however, breeding work receives an increasing share of INRAN's financial and human resources, averaging 68% of total expenditures and 58% of total human resources from 1986-90.

A structured comparison of estimated future returns from alternative research programs could assist INRAN in deciding whether it would be economically more beneficial to continue the emphasis on breeding, or allocate more resources to research on, e.g., soil, water, or livestock-related topics. In addition, improving INRAN's linkages with regional and international research institutions and networks that have a comparative advantage in breeding, such as ICRISAT, would free scarce domestic resources for adaptive research problems particular to Niger.

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This paper is also forthcoming as a SD Publication Series technical paper. It can be obtained through USAID's development information system (CDIE). CDIE Reference No. PN-ABT-283 or PN-ABS-728.