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Estimating Water Use Efficiency in Agricultural Production: A Case Study of Dry Season Vegetable Production by Resource-poor Farmers in Benin

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Abstract

In many sub-saharan countries, the dry season is a period characterised by food shortage and low income among resource-poor farmers. To address these problems and reduce poverty in rural areas of Benin, vegetable production in the dry season has been recently promoted by both government and NGO. Vegetable production is an important opportunity of income because fresh vegetables are sold at higher prices during the dry season. Furthermore, vegetable can play a vital role in supply of balance diet. However, due to increasing scarcity of water, the limited factor of vegetable production remains water resource. Therefore, improving water use efficiency is a plausible means of increasing productivity of vegetable in the dry season when water is at its scarcest level. Accordingly, the aim of this study was to quantify the efficiency of water use to produce vegetable in the dry season and analyse factors explaining the difference of water use efficiency among resource-poor farmers in Benin. The study used an input-specific Data Envelopment Analysis and a bootstrapped Tobit. Bootstrapped Tobit allows taking care of the dependency problem between efficiency estimates which has been until recently ignored in the literature. Additionally, to avoid bias due to omitted variables, the study considered not only socio-economic characteristics but also environmental variables as determinants of water use efficiency. Data are collected from 105 households in Benin.

Water use efficiencies were estimated to be on average 0.38 and 0.50 under constant and variable returns to scale specification, respectively. This implies that significant amounts of water could be saved if farmers become more efficient. In addition, many farmers operated at an increasing return to scale, revealing that most farms should be larger to produce efficiently. Based on robust standard errors, the important determinants of water use efficiency were: market access, land fragmentation, contact with extension service and water expenditure. Water use efficiency was also affected by environmental conditions such as rainfall. We conclude that policy programs should focus on raising farmers' access to training and market in order to increase water use efficiency and thereby reduce the food security problem and poverty among resource-poor farmers.

Keywords: Benin, resource-poor farmer, vegetable production, water use efficiency