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Impact of Adoption of Improved Groundnut Varieties on Factor Demand and Productivity in Uganda

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Abstract

The study analyzed the impact of adoption of improved groundnut varieties on farm inputs demand and productivity using instrumental variables approach. The data was collected from a simple random sample of 161 groundnut farmers in Eastern Uganda. Econometric results show significant increase in expenditure on improved seed and labor among adopters relative to the non-adopters. Adoption of improved varieties significantly increased groundnuts yield, by about 1688kg per hectare. Thus, more effort is needed to increase farmers' access to improved varieties. The Government and partners should facilitate the development of local seed multiplication systems to reduce the cost of improved seed..

Introduction

Agrarian economies including Uganda have embraced green revolution for increased agricultural productivity. In Uganda, groundnut is one of the most important staple crops targeted by research interventions. The crop accounts for 20% of the national oil crops production (FAO, 2011), and is a principal source of inexpensive protein, vitamins and income to many households (Okello *et al.*, 2010). Several improved varieties of groundnuts such as the Serenut series (I, II, III and IV) have been developed (Okello *et al.*, 2010). Adoption rates in most parts of the country have increased from 4.1% in 2001 to 40% in 2007 (UNHS, 1999/00; 2005/06) and is projected to reach 50% by 2014 (Moyo *et al.*, 2004). An average farmer allocates about 86% of land area under groundnuts to improved varieties (UNHS, 2010). Despite the observed technological progress, the economic impact of adoption of modern varieties not yet been fully studied in Uganda.

Objective of the Study

The study attempts to examine the impact of adoption of improved groundnut varieties on farmers' input allocation decisions and productivity in Eastern Uganda.

Research Questions

How do farmers' input allocation decisions change with technological progress? Are there yield advantages gained from adopting improved groundnut varieties?

Methodology

Study Area: The study was conducted in Tororo and Kumi districts in Eastern Uganda. The districts are, receptively, the leading groundnut producing areas in the country.

Data Collection and Analysis: The study used cross sectional data collected from 161 randomly selected groundnut farmers in 2004. The impact of adoption was examined by estimating a yield function and a system demand functions for the major variable inputs used in the crop production including: human labor, animal draft power and planting seed. Potential endogeneity of adoption decision was corrected using instrumental variables approach. The price of seed and distance to markets are instruments used. The elasticities of substitution and factor demand are also estimated from the coefficients of the cost share equations.

Preliminary Findings

Descriptive results:

About 57% of the farmers planted improved varieties. Low levels of input usage were found among farmers in both adopters and non adopter. None of the farmers used fertilizers in groundnut production. Average yield of adopters was 19% higher than that for non adopters.

Econometric results:

The coefficient on adoption variable in the share functions for labor and seed is positive and significant suggesting increased expenditure on the inputs by the adopters compared to the non-adopters (Table 1). The results are expected because improved seed is expensive in Uganda and is one of the major constraints to adoption. Higher expenditure share of labor among adopters can be explained by the higher demand for labor due to increased crop care by the adopting households-e.g. pesticides application, row planting. Elasticities of substitution and cross price elasticities of factor demand are positive and negative for substitutes and complements, respectively (Table 2). The dummy variable for improved varieties in the yield function is positive and significant suggesting that adoption of improved seed generates economic gains (Table 3). The estimated coefficient for improved varieties implies that adoption of improved seed increases groundnut yield by 1668kg per hectare.

Preliminary Findings..

Table 1. Estimates of the input demand system

Variable	Labor demand	Draft power	Seed demand
Constant	1.204*** (0.161)	0.041 (0.101)	-0.013*** (0.003)
Adoption of improved variety (1=yes; 0 otherwise) x10 ⁻²	18.20** (7.10)	-5.3 0 (4.40)	0.011*** (0.11)
Log of extension (no. of visits)x10 ⁻²	-3.0* (144.0)	5.16 (0.99)	0.20*** (0.078)
Log of years of farming experience x10 ⁻²	2.23 (1.26)	1.53 (0.79)	-0.025 (0.07)
Dependency ratio x10 ⁻²	-2.80*** (1.10)	0.78 (0.68)	0.087 (0.059)
Log of education of headx10 ⁻³	-4.74** (2.40)	0.53 (1.51)	0.28*** (0.131)
Logpriceseedx10 ⁻²	-5.7*** (0.1.0)	-0.99 (0.64)	0.08 (0.05)
Loghumanwge ⁻³	-4.63 (20.9)	3.55 (13.76)	0.18 (0.56)
logAnimwagex10 ⁻²	-3.6 (0.4)	2.88*** (0.29)	0.06 (0.11)
Logchempricx10 ⁻³	-4.21*** (2.08)	-1.78 (1.31)	0.73*** (0.25)
R-square	0.40	0.38	0.07
Chi-square	108***	102***	17***

Significance: 1% (***), 5% (**), 10% (*); standard errors in parenthesis

Table 2. Derived elasticity estimates

Allen elasticities of substitution				
Share function/price	Wage	Price of draft power	Price of seed	Price of pesticide
Labor	-0.694	3.34x10 ⁻³	-0.26 x10 ⁻⁴	6.9x10 ⁻⁶
Draft power	4.5x10 ⁻⁴	-4.64	-4.3 x10 ⁻⁴	-1.5 x10 ⁻⁴
Seed	-3.2 x10 ⁻⁴	0.18x10 ⁻⁴	-75.74	2.1 x10 ⁻⁴
Pesticides	-	-	-	-79.32
Derived elasticities of input demand				
Share function/price	Wage	Price of draft power	Price of seed	Price of pesticide
Labor	-0.41	4.77x10 ⁻⁴	-3.4x10 ⁻⁷	8.8x10 ⁻⁸
Draft power	2.1 x10 ⁻²	-0.66	-5.6x ⁻⁶	-2.0x10 ⁻⁶
Seed	-1.49 x10 ⁻²	2.36x10 ⁻⁷	-0.97	2.7x10 ⁻⁶
Pesticides	-	-	-	-1.01

Preliminary Findings ..

Table 3. Estimates of the Groundnut yield function

Variable	Coefficient	Std. Error
Constant	-2278.0***	855.5
Adoption of improved variety(1=yes; 0 otherwise)	1668.1*	951.9
Farming experience (years)	28.2	44.2
Square of experience	-0.6	1.2
Seed planted (kg/ha)	720.7***	259.4
Square of seed planted	-47.9*	27.0
Land size (ha)	-236.5	282.1
Sex of household head (1=male; 0=female)	130.8	251.8
Amount of labor (persondays)	3.1	3.1
Square of labor x10 ⁻³	-5.4	3.6
Draft power (hours)	5.9	10.9
Education of head (years of formal education)	29.4	38.9
Extension (visits received per season)	275.9**	117.9
Number of observations	161	
Wald chi square value	39.96***	

Significance: 1% (***), 5% (**), 10% (*)

Conclusion

Adoption of improved varieties leads to a positive shift in groundnut productivity. The productivity gains are however, associated with increased expenditure on labor and seed input. These findings underscore the need to identify and implement appropriate strategies to increase dissemination of improved agricultural technologies, increase optimal input allocation and yields. Interventions to develop multiplication and distribution of improved seed are needed to reduce expenditure on the input.

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