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Determinants and Impact of Adopting Climate-smart Brachiaria Grass among Dairy Farmers in Kenya

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Abstract

Evolving changes such as population growth, urbanization and a growing middle-income class in Africa are redefining the agro-food systems. Population growth is expected to double the demand for milk and meat products in Africa by 2050. This raises concerns on the capability of African countries to meet the projected demand. It is imperative that farmers seize the opportunities for earning higher and stable income by responding to the new trends and overcoming the constraints tightened by climate change. Access to quality fodder has continued to be the single most important challenge in livestock production systems. The objective of this article is to evaluate the impact of climate-smart Brachiaria on milk productivity in dairy production in Kenya. A random sample of 237 farmers, 111 adopters and 126 non-adopters of Brachiaria were selected in Makueni and Siaya using multi-stage sampling. Data was collected through face-to-face interviews and Propensity score-matching approach was then employed to evaluate the impact of Brachiaria grass on milk productivity. In this study, non-adopters of Brachiaria were farmers who were using Napier grass as their source of fodder.

The findings reveal that adoption of Brachiaria increases milk production by about 27.6%. This translates to an average increase of about 3 litres daily per animal. The surplus milk implies more income for the household, improved nutrition from milk consumption and improved wealth status of household. The study concludes that policies and efforts aimed at increasing widespread adoption should address factors that influence adoption. We recommend increasing extension and training on climate-smart fodder and strengthening collective institutions such as farmer groups for sustainable livestock production.

Keywords: Brachiaria grass, milk productivity, propensity score matching

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Introduction

Growth in population, increased affluence and concomitant changes in food preferences are increasing demand on livestock (White, Peters, & Horne, 2013). Bosire et al., (2016) notes that continued economic growth has contributed to the dietary changes leaning more towards animal proteins from eggs, milk and meat. The global urban population is projected to reach the 6.3 billion mark by year 2050 (United Nations General Assembly, 2015). In particular, 90% of the projection will come from Asia and Africa. It is expected that the continued growth in population will double the demand for livestock and its products over the same period (Holechek, Cibils, Bengaly, & Kinyamario, 2016). This brings to question on the ability of Africa to sustain the growth in population. There is therefore need to intensify livestock production in order to achieve the sustainable development goal one of ending poverty in all its forms everywhere and two of achieving improved nutrition and food security. Specifically strategies aimed at increasing the productivity of the dairy sector will go a long way in achieving this. Dairy sector in Kenya contributes to over 14% to the country's GDP but is often constrained by feed scarcity in dry seasons (Njarui, Gichangi, Ghimire, & Muinga, 2016). Effects of climate variation exacerbates the situation further leading to a decline in productivity (Gachuiri et al., 2017). Therefore, sustainable and efficient dairy production requires regular supply of adequate quality fodder (Nangole et al., 2011). Climate-smart planted forages such as Brachiaria grass offers a solution in the era of climate change. Therefore, this research was aimed at evaluating the determinants and impacts of adopting grass among dairy farmers using cases from Kenya.

Material and Methods

The study sampled dairy farmers drawn from drier medium potential agro-ecological zones in Kenya. The zones included Siaya and Makueni Counties where the government of Kenya has been promoting commercialized dairy farming and production of improved fodder (Brachiaria). The survey was carried out in June 2018 where 237 farmers with lactating cows were randomly selected. This included farmers that had adopted Brachiaria and a control group of farmers that had planted Napier grass. Data was collected using computer aided personal interview application CS Pro on socio-economic and demographic characteristics. Data was then analysed using Propensity-Score matching to get the impact of adopting Brachiaria grass.

Results and Discussion

Determinants of adoption of Brachiaria grass

Findings showed that age of household head influences the decision to adopt Brachiaria grass. This implies that older farmers in Makueni and Siaya Counties tend to adopt new forage technologies compared to the younger counterpart. Consequently, farmers that are endowed with larger herd sizes measured by tropical livestock unit (TLU) are more likely to adopt Brachiaria. Moreover, farmers that have more of crossbreeds and exotic breeds are likely to adopt Brachiaria compared to farmers with local breeds of cattle (table 1). The study further reveals that farmer's perception on the incremental effect of Brachiaria on milk production contributes to the adoption of the grass. Farmers prefer technologies that result in increased productivity (Kassie et al., 2015). Membership to a social group contributes to the adoption of Brachiaria grass whereby farmers that belong to a social group are more likely to adopt. Consequently, farmers with access to extension services increases the likelihood to adopt. Therefore, Social capital and access to social services play a vital role access to information that is associate with new technologies.

Table 1: Determinants of adoption of Brachiaria grass in Siaya and Makueni Counties

Variables	Coef.	Std err	Marginal Effects
Socioeconomic			
Sex of household head (1= male 0 = female)	-0.0082	0.254	-0.0032
Age of household head (years)	0.0211**	0.0092	0.0083
Years of schooling of household head (Years Completed)	-0.0242	0.0173	-0.0096
Farming experience (Years)	-0.0111	0.0097	-0.0044
Household size (Count)	-0.0046	0.0419	-0.0018
Main Source of household income (1= OffFarm 0 = Farm)	-0.0406	0.2339	-0.0161
Farm Characteristics			
Farm size (acres)	-0.021	0.0419	-0.0083
Tropical Livestock Unit (TLU)	0.0633***	0.0238	0.025
Breed Type (1= exotic breed 0 = otherwise)	0.7051***	0.1889	0.2782
Farmer perception			
Perception on milk productivity	1.0204***	0.1653	0.4026
Institutional			
Group membership (1= yes 0 = no)	0.5440**	0.2715	0.2067
Access to credit (1= yes 0 = no)	0.133	0.2174	0.0526
Access to extension (1= yes 0 = no)	0.5049**	0.2431	0.1948
Number of observations	237		
LR $Chi^2(13)$ =	131.2		
Prob. > Chi^2 =	0.000		
Log pseudo likelihood =	-98.19943		
Pseudo R^2 =	0.4005		

Source: Survey Data 2018
***, ** and * represent levels of significance at 1%, 5% and 10%, respectively.

Impact of adopting Brachiaria on milk productivity

After matching and testing for sensitivity to hidden bias, table 2 indicates the impact of adopting Brachiaria grass on milk production measured by annual milk yield. The computation of the yield by estimating the area under the lactation curve of a cow is able to account to breed type and the lactation cycle. On average, adopters of Brachiaria produce 3302.47 litres annually compared to 1872.32 for non-adopters. This translates to a daily average of 7.9 litres for adopters and 4.55 litres for non-adopters. After controlling for unobserved factors using propensity score matching, adoption of Brachiaria grass results in a 27% increase in milk yield. This implies that on average it results in an increase of 3 litres daily. Therefore, Brachiaria grass result in an increase in milk productivity of dairy in drier medium potential agro-ecological zones.

Table 2: Impact of Brachiaria on milk production among dairy farmers

Outcome Variable	Sample	Treated	Control	ATT	S.E.	t-value	Sensitivity Analysis (Γ)
Total Milk Yield Per year (litres)	Unmatched	3444.82	1728.46	1716.36	350.53	4.90***	1 - 1.3
	Matched	3302.47	1872.32	1430.14	456.86	3.11***	
Average Milk Production (per day per Cow)	Unmatched	8.25	4.81	3.44	0.67	5.15***	1 - 1.3
	Matched	7.91	4.55	3.35	0.82	4.07***	

Conclusions and Outlook

This study showed that adoption of Brachiaria is determined by age of the household head, tropical livestock unit, breed type, farmer's perceptions, membership to a group and access to extension services. Moreover, estimation of the impacts of adopting this grass indicate that it results in a 27% increase in milk production when incorporated as fodder. As such, adoption therefore will result in productivity gains. The positive effects will result in an improvement in welfare of farmers. Understanding the drivers of adoption would therefore inform on the dissemination pathways for forage technology. Consequently, given the relatively low adoption rate by farmers; future research can focus on access to inputs such as forage seeds.

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