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Status of Improved Forage Seed Production in Sudan

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Abstract: *This study attempt to investigate the current status of improved forage and/or seed production in Sudan. A farm survey was conducted during October 2010 using structured questionnaire. About 50 farmers from Gezira, Khartoum and River Nile states have been selected and directly interviewed. Both descriptive statistics and econometric model were used for data analysis. Cob-Douglass production function was used to estimate and determine the most important factors affecting area cultivated for forages production. The study showed that majority of the respondent farmers reported that, they have awareness to produce improved forage/fodder in their farms (78%). Results of regression analysis indicated that estimated coefficient of improved forage awareness of 0.61 indicated that the total factor area of forage was about 61% higher than that haven't awarded of improved forage on production of forage. A 10% increase in total area will result in 48% increase in forage area, while a 10% increase in other crop area would result in about 7% decrease in forage area. Farmers have more experience in cultivating crops, more area of forage seeds; years of experience increase by 10% area of forage would be increase by 25%. However, farmer educated more, have increased area of forage. A 10% increase in years of education would resulted in 38% increase in forage area.*

Key Words: *Improved forage, Gezira, Khartoum and River Nile states, Sudan, Cob-Douglass production function.*

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I. Introduction

Pastoral systems have a major contribution in the Sudan economy. In 2005, the animal wealth was responsible for 19.3% of the GDP (MFNE, 2005). Over 80% of the rural households in Sudan depend on a combination of pastoral and agricultural activities for their livelihoods. Livestock production is an important component in the Sudanese economy. Sudan is considered as the first country in terms of having great numbers of animals in the Arab region and second to Ethiopia among the African countries. Livestock population was estimated at about 103 million heads according to an official census conducted in the year 2010. These include about 39, 30, 29 and 4 million heads of sheep, goats, cattle and camels respectively (MARF (2011) and Eisa (2011).

In normal situations, the available forages for those livestock population in terms of dry matter per season are estimated to be about 86 million tons per year. The contribution of the natural ranges is about 62 million tons while agricultural byproducts are estimated at about 19 million tones. The contribution of the annual green forages is only 4 million tons in the irrigated areas (Ali *et al* , 1995).The total area of production of green forage is 120 thousand hectare (Khair, 2011) which include Northern, Central, Eastern and Khartoum states. The main green forages that are grown in Sudan are Medicago sativa (94%), *Sorghum bicolor* cv Abu Sabeen (5%) and *Lab lab purpureus*, *Clitoria ternatea* and *Vigna trilobata* (1%) (Khair, 1999). Added to that, about one million tons of concentrates are available around the large cities. The annual feed gap in Sudan is estimated at 28 million tons dry matter. Future expansion in the livestock enterprise in Sudan is therefore depends mainly on availing more feed, the quickest way to achieve such a goal on the other hand is only through the expansion in forage production. Among many constraints for such an activity, limited forage seed availability ranks the first. The objective of this study is to investigate the current status of improved forage and/or seed production in Sudan.

II. Material And Methods

Structure questionnaire has been designed for Primary data collection. The questionnaire included all needed variables to investigate the status of improved forage and/or seed production in selected sites. Random sampling technique was used for the collection of the primary data from farmers.

About 50 farmers were randomly selected and directly interviewed during August to October, 2010. The sample has been selected to cover the existing farming systems under irrigation. The survey was carried out in three states namely, Gezira (Central), Khartoum and River Nile (Northern) states which represent the most important production areas. The relative distribution of the samples in the three states was 58%, 26% and 16%, respectively. They were spread over various locations, sub-locations and villages. About 14 villages in Gezira, 7 in Khartoum and 3 in River Nile State have been chosen. The information was arranged and analyzed using statistical package for social science (SPSS) for the estimation of the parameters that reflect of improved forage and/or seed production. Those included frequencies, descriptive statistics, pared sample t test and Cob-Douglass technique.

The Ordinary Least Square method (OLS), particularly the Cob-Douglass technique (Cobb and Douglas, 1928), was also used to estimate and determine the most important factors affecting area cultivated for forages production.

The function was used to measure the impact of some factors on the area cultivated by forage. It employs area under forage at time t as a dependent variable; and total area of the farm at time t (A_1), area under crops at time t (A_2), years of experience of farmers in cultivating crops (E), years of education of farmers as independent variables. The factors were estimated by adding a dummy variables to the function which took the value of two for the respondents that have received any training in forage production, have awareness for improved forage and owned their farms, and one for the respondent that have not received any training in forage production, haven't awareness for improved forage and didn't owned their farms.

The method of Ordinary Least Squares (OLS) was used to estimate the population parameters from the transformed variables. The mathematical model used here is as follows:

$$A = b0\ A1^{b_1}\ A2^{b_2}\ E^{b_3}\ D^{b_4}\ M_1^{b_5}\ M_2^{b_6}\ M_3^{b_7}\ U_t \quad \text{……..1}$$

In order to estimate the coefficient of Cobb-Douglas function, the data were transformed by taking the natural log of each observation. The transformed data becomes linear in the logarithms of the variables. Thus, the equation (1) becomes:

$$\text{Log } A_t = b_0 + b_1 \text{ Log } A_{1t} + b_2 \log A_{2t} + b_3 \log E_t + b_4 \log D + b_5 \log DVARM_1 + b_6 \log DVARM_2 + b_7 \log DVAR\ M_3 + U_t \text{……2}$$

Where,

A_t = Current area under forage (at time t) (acres)
$A1_t$ = Current total area of the farm at time t (acres)
$A2_t$ = Current area under crops at time t (acres)
E = Experience of farmers in cultivating crops (years)
D = Years education of forage farmers (years)
M_1 = dummy variable for receive training in production of forage
M_2 = dummy variable for
M_3 = dummy variable for
b_0 = Intercept
$b_1 \ldots b_7$ = regression coefficients of the mentioned variables
U_t = error term.

III. Results And Discussion

Production characteristics of farmers

Background of improved forage production characteristics of interviewed farmers, were presented in tables 1 to 6.

Less than half farmers interviewed in the conducted survey owned their farms (60%) Table 1. Majority of the respondent farmers reported that they have awareness to produce improved forage/fodder in their farms (78%), while only 22% of farmers haven't awarded to produce improved forage/fodders in their farms (Table 2). Based on this awareness, most of them have established improved forage /fodders or rehabilitated old forage /fodders with improved ones (Table 3). However, half of the respondent farmers cited that they have received training on forage/fodder seeds production, while the other half hasn't received training (Table 4).

Considerable portion of interviewed farmers mentioned that 2010 is the year when established or rehabilitated improved forages/fodders (48.8%) Table 5. When more than half of them cited that there was current availability of improved fodders or forage in their farm (Table 6)

Table 1. Distribution of farmers according to farm ownership % (yes= owned, no = don't owned)

Item	Frequency	Valid Percent	Cumulative Percent
No	30	60.0	60.0
Yes	20	40.0	100.0
Total	50	100.0	

Source: Calculated from surveyed data collected during 2010

Table 2. Distribution of farmers according to improved forage awareness % (yes= aware, no = don't aware)

Item	Frequency	Valid Percent	Cumulative Percent
No	39	78.0	78.0
Yes	11	22.0	100.0
Total	50	100.0	

Source: Calculated from surveyed data collected during 2010

Table 3. Distribution of farmers according to establishing any improved forage/fodders or rehabilitating old forage/fodders with improved ones

Item	Frequency	Valid Percent	Cumulative Percent
yes	35	81.4	81.4
no	8	18.6	100.0
Total	43	100.0	

Source: Calculated from surveyed data collected during 2010

Table 4. Distribution of farmers according to receiving training on forage seeds production % (yes= received, no = don't received)

Item	Frequency	Valid Percent	Cumulative Percent
No	25	50.0	50.0
Yes	25	50.0	100.0
Total	50	100.0	

Source: Calculated from surveyed data collected during 2010

Table 5. Distribution of farmers according to the last year when farmer established or rehabilitated improved forages/fodders

Year	Frequency	Valid Percent	Cumulative Percent
2010	21	48.8	46.7
2001	5	11.6	56.7
2006 - 2008	17	39.6	100.0
Total	43	100.0	

Source: Calculated from surveyed data collected during 2010

Table 6. Distribution of farmers according to current availability of improved fodders or forage in their farm

Item	Frequency	Valid Percent	Cumulative Percent
yes	26	60.5	60.6
no	17	39.5	100.0
Total	43	100.0	

Source: Calculated from surveyed data collected during 2010

Results of descriptive analysis showed that improved forage have the least area among the farm area (4.61 acres) after total area (20.13 acres) of the farm and the area under other crops (13.35 acres) Table 7. on the other hand, the result of the paired sampled t test different areas of the farm showed that there was highly significant difference between mean of total farm area and the area under other crops, and there was non-significant difference between mean of area of improved forage and the area under other crops Table 8.

Table 7. Descriptive Statistics of area components in the three states

Item	Minimum	Maximum	Mean	Std. Deviation
Area of improved forage	0.00	60.00	4.61	8.86
Area under crop	0.00	300.00	13.35	43.34
Farm size	1.00	350.00	20.13	50.51
Years of education	0.00	16.00	5.40	4.18
Years of experience	2.00	49.00	18.61	12.88

Source: Calculated from surveyed data collected during 2010

Table 8. Paired Samples t Test between the areas of farm distribution

Farm areas	t	Sig. (two-tailed)
Total farm area – area of improved forage	2.196	0.033*
Total farm area – area under other crops	4.135	0.000***
Area under other crops - area of improved forage	1.426	0.160^{ns}

*,** and*** Significant levels at 5%, 1% and 0.1% respectively
Source: Calculated from surveyed data collected during 2010

The area of forage response Model:

Definition of the dependent and independent variables incorporated in the econometric analysis showed in table 9. The estimated coefficient of receiving training dummy of 0.21 indicated that, the total factor area of forage was about 21% higher than that haven't receiving training on production of forage. While the estimated coefficient of improved forage awareness of 0.61 indicated that the total factor area of forage was about 61% higher than that haven't awarded of improved forage on production of forage. On the other hand, the estimated coefficient of farm ownership of 0.10 indicated that the total factor area of forage was about 10% higher than that farmer haven't owned farm of improved forage on production of forage The total area cultivated to other crops also affected area of forage. A 10% increase in total area will result in 48% increase in forage area. Area under crop was found to be negatively affecting forage area; a 10% increase in other crop area would result in about 7% decrease in forage area. Farmers have more experience in cultivating crops, more area of forage seeds; results of regression analysis indicated that years of experience increase by 10% area of forage would be increase by 25%. However, farmer educated more, have increased area of forage. A 10% increase in years of education would resulted in 38% increase in forage area. (Table 10)

Table 9. Definition of the dependent and independent variables incorporated in the econometric analysis (Cob-Douglas model)

Variable	Description	Type
Independent variables	Current area of improved forage /fodder	Continuous
Independent variables		
Years of education	Farmers years of education (years)	Continuous
Farm size	Total farm size (acres)	Continuous
Area under crops	Current area under crops (acres)	Continuous
Farmer's experience	experience of farmers in cultivating crops (years)	Continuous
Farm ownership	Farmer own farm 1 = yes, 0 = no	Dummy
Improved forage awareness	Farmer aware to improved forage 1 = yes, 0 = no	Dummy
Receive training	Receive training in production of forage seeds (1 = yes, 0= no)	Dummy

Table 10. Estimated coefficients forage current area function

Independent variables	Regression coefficients	(Calculated t-test) Significant
Intercept	-0.51	0.006**
Years of education	0.37	0.010**
Farm size	0.47	0.080*
Area under crops	-0.06	0.781
Farmer's experience	0.25	0.041*
Farm ownership	0.05	0.631
Improved forage awareness	0.19	0.059*
Receive training	0.06	0.425
Adjusted R Square	0.69	
Durbin-Watson	1.73	
F test	12.51	0.000***
N	50	

*'**'*** Significant levels at 5%, 1% and 0.1% respectively

IV. Conclusion

The study concluded that, to fill the annual feed gap of forage and fodder in Sudan to front increasing in livestock numbers, these will be achieved by expansion in improved forage and fodders production through such activities of availability and accessibility improved forage seeds, and education and training services.

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