

The Impact of Own-crop prices on its Yield: an Empirical study on sorghum crop in White Nile State– Sudan (1970-2019)

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Abstract:

The study aimed to Analyze and measure the own-price impact of sorghum crop on its yield in the state of White Nile-Sudan (1970-2019) ,collected the study data for study variables were as follows: yield, price and costs, from the annual reports of the Federal and state Ministries of Agriculture, the State Ministry of Finance and the Agricultural Bank for the three sectors on sorghum crop cultivation; irrigated, mechanized rain-fed and traditional rain-fed. Data were analyzed using multiple regression analysis, one-way variance analysis, and correlation analysis. The study concluded that yield was affected by both the price and costs in the three sectors. The study also recommended for increasing efforts of the state government to set incentive focus prices for crop production in order to increase yield and activate the policy or supporting input prices so that producers and consumers are not harmed.

Key words: price of production, cost of production, sorghum crop, yield, agricultural sector

المستخلص:

هدفت الدراسة إلى تحليل وقياس اثر السعر الخاص لمحصول الذرة الرفيعة على معدل إنتاجيته في ولاية النيل الأبيض –السودان (1970-2019) تم جمع بيانات الدراسة عن متغيرات الدراسة وهي: الإنتاجية، السعر والتكاليف من التقارير السنوية لوزارة الزراعة الاتحادية والولائية، وزارة المالية الولائية والبنك الزراعي لقطاعات زراعة الذرة الثلاث المروي، المطري الآلي والمطري التقليدي. تم تحليل البيانات باستخدام تحليل الانحدار المتعدد، تحليل التباين الأحادي في اتجاه

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واحد وتحليل الارتباط. توصلت الدراسة الى ان الانتاجية تآثرت بكل من السعر والتكاليف في القطاعات الثلاثة. كما اوصت الدراسة بزيادة جهود حكومة الولاية في تقدير اسعار تركيز تشجيعية لانتاج المحصول بغرض زيادة الانتاجية وتفعيل سياسة دعم اسعار مدخلات الانتاج حتى لا يتضرر المنتجون والمستهلكون.

Introduction

Sorghum occupied the first position in the list of Sudanese crops in terms of area and production as it occupies half the cultivated area and make 75% of total grain production, It is considered as an important food for humans and animals, as it is used in the manufacture of dry fodder (70%) , The rest is stored for years as strategic storage. In times of the surplus, varying amounts are exported to earn hard currency, and is found both in irrigated and rain-fed agriculture. The sorghum area, is around 90% in rainfall cultivation both traditional and mechanized,as the average annual production of mechanized rain-fedsorghum crop in Sudan is estimated at (20. 38) million tons and yield of (187) kg / feddan. The average annual sorghum production in the Traditional rain-fed sector is estimated at (1. 872) million tons and yield of (234) kg / feddan (Musa 2005, Kambal2015, FAO2019). The area of sorghum in the White Nile State is estimated at approximately (1. 5) million feddan. The average annual production in the irrigated sector is estimated at (86. 9) thousand tons and yield of (252. 6) kg/feddan and an average annual production for the mechanized rain-fed sector is about (182. 2) thousand tons and yield of (266. 8) kg / feddan ,as for the traditional rain-fed sector its an average production is estimated at (52. 9) thousand tons and yield (154) kg/ feddan. (State Ministry of Agriculture 2015,2017)

The yield of sorghum crop in the White Nile State continued to fluctuate due to the large increases in the prices of energy

products and other inputs to production and prices of sorghum production, which negatively affected the lives of citizens, as well as the escalation of local inflation rates in other food prices and the trade balance deficit. (Arab organization for agricultural development 2009, World bank 2011, State ministry of finance and economy 2018) therefore, the yield of sorghum crop in White Nile State is directly affected by production prices and costs, This is in line with the findings of Mudhi and others (2009) that the failure of the sorghum crop in Iraq at the global level is caused by high production costs and the lack of government support to prevent its impact (Mudhi and others, 2009) , It also agreed with the findings of Abdullah and Awad Allah (2015) that the failure to follow a price policy in the inputs of sorghum crop production in Qadarif affected the prices and abundance of production (Abdullah, 2015) , also, it agreed with Shadia and other (2016) findings that the most important problems facing sorghum crop farmers in Assiut Governorate are the high prices of production requirements and their lack of availability in agricultural associations, which negatively affected the productivity level (Shadia,Basim and Hina,2016). Accordingly, this study aims to find out the effect of change in the production price and costs on the yield of sorghum crop in White Nile State - Sudan .

2. The Econometric Model, **Data** and Methodology

White Nile State Located between the 33:33 and 33:15 longitudinal lines and the 15:12 and 15 ° latitudes, it lies between Sinnar and Gezira States in the east, It is bordered to the north by Khartoum State, the west by North of kordofan State and to the south by Southern Sudan Republic. It has an area of 39. 701 km², with a population about 1,140,694million. (wikipedia. org/wiki/White Nile state,2018) .

Two types of data from secondary sources were used in this study. The average of prices (inSDG) , during autumn season

was obtained from the State Ministry of Finance and Economy time series data of sorghum yield (in kg) was obtained from Ministry of Agriculture and Forestry, Statistics department, Khartoum, Sudan, and White Nile of Agriculture, Information Centre, Kosti, Sudan .

Secondary data was analyzed econometrically for multiple regression analysis, which is a model for measuring the relationship between one dependent variable (Y) and more than one independent variable (Xs) and is calculated by the following formula:

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + \dots + B_kX_k$$

Where: (K): represents the number of independent variables .

One-way analysis of variance, it is denoted by ANOVA is a test used to compare averages, calculated by the following formula:

$$\sigma^2 = \sum_{i=1}^k \frac{S_i^2}{K}$$

Where: σ^2 = variance, S_i^2 variance level in groups, K = number of averages

Correlation, the value of (r) range from -1 to + 1. The value of (r) near zero indicated a correlation between variables, while a value near +1 and -1 indicates a high positive or negative level of correlation. (Sulayman2008, *wikipedia.org/wiki2019*)

3. Results and Discussion

3-1- Evaluating the effect of price and costs on sorghum yield in the irrigated sector in White Nile State

Table (1) shows that there is an effect of the price and costs on yield by percentage (89%) , (20%) respectively, we notice from the table that yield is less affected by costs than the price, due to the importance of the sorghum crop for the food farmers .

Table (1) Relationship of both price (in SDG) and costs (in SDG) with yield (kg / feddan) of sorghum crop in the irrigated sector in White Nile State (1970 - 2019)

Variable	Coefficient	t-statistic	Significant
Price	12. 1067	55. 91586	0. 885
Costs	1. 94097	8. 966044	0. 203

Source:author computation,From federal and state ministries of agriculture (1970-2019)

3-2- Evaluating the effect of price and costs on sorghum yield in the mechanized rain-fed sector in White Nile State

Table (2) shows that there is an effect of the price and costs on yield by percentage (88%) , (97%) respectively, we notice from the table that yield is less affected by price than the costs, due to the large size of holdings in this sector, which increases the volume of costs .

Table (2) Relationship both of price (in SDG) and costs (in SDG) with yield (kg / feddan) of sorghum crop in the mechanized rain-fed sector in White Nile State (1970/2019)

Variable	Coefficient	t-statistic	Significant
Price	13. 3333	74. 36880	0. 884
Costs	17. 6367	98. 37176	0. 972

Source:author computation,From federal and state ministries of agriculture (1970-2019)

3-3- Evaluating the effect of price and costs on sorghum yield in the traditional rain-fed sector in White Nile State

Table (3) shows that there is an effect of the price and costs on yield by percentage (55%) , (20%) respectively ,we notice from the table that productivity is less affected by costs than the price, due to the reliance of farmers in this sector on traditional methods of agriculture and municipal seeds and the small size of holdings. We also find the large impact of price on yield that due to the dependence of farmers in this sector on selling



surplus production after deducting the amount of family consumption to bring in the rest of their household necessities.

Table (3) Relationship of price (in SDG) and costs (in SDG) with yield (kg / feddan) of sorghum crop in the traditional rain-fed sector in White Nile State (1970/2019)

Variable	Coefficient	t-statistic	Significant
Price	54	12. 17209	0. 546
Costs	16. 70954		0. 202

Source:author computation,From federal and state ministries of agriculture (1970–2019)

3-4-Evaluating the effect of costs on sorghum yield in the irrigated, mechanized rain-fed and traditional rain-fed sectors in White Nile State

Table (4) explains that there is an effect of the costs on yield in the irrigated, mechanized rain-fed and traditional rain-fed sectors by percentage (94%) .

Table (4) Relationship of costs (in SDG) with yield (kg / feddan) of sorghum crop in the irrigated, mechanized rain-fed and traditional rain-fed sectors in White Nile State (1970/2019) .

Variable	Coefficient	Significant
Costs	1. 082625	0. 942

Source:author computation,From federal and state ministries of agriculture (1970–2019)

3-5-Evaluating the effect of price on sorghum yield in the irrigated, mechanized rain-fed and traditional rain-fed sectors in White Nile State



Table (5) explains that there is an effect of the costs on yield in the irrigated, mechanized rain-fed and traditional rain-fed sectors by percentage (68%) .

Table (5) Relationship of price (in SDG) with yield (kg / feddan) of sorghum crop in the irrigated, mechanized rain-fed and traditional rain-fed sectors in White Nile State (1970/2019)

Variable	Coefficient	Significant
Price	26.48	0.683

Source:author computation,From federal and state ministries of agriculture (1970-2019)

3-6-Evaluating the differences in yield averages (kg/feddan) between the cultivated sorghum, irrigated, mechanized rain-fed and traditional rain-fed sectors in White Nile State

From Table (6) It is clear that there are significant differences between the yield averages in the irrigated, mechanized rain-fed and traditional rain-fed sectors for the cultivation of this sorghum crop, due to the zero yield value which is less than (5%) , this means that yield averages are affected by each other through the final outcome For state production .

Table (6) the differences in yield averages (kg/feddan) between the cultivated sorghum, irrigated,and mechanized rain-fed and traditional rain-fed sectors in White Nile State

Variable	Mean Square	F-value	Significant
Between Groups	1.404E+13	18.964	0.000
Within Groups	7.404E+11		

Source:author computation,From federal and state ministries of agriculture (1970-2019)

3-7-Average differences in costs (in SDG) between the cultivated sorghum, irrigated, mechanized rain-fed and traditional rain-fed sectors in White Nile State

From Table (7) it is clear that there are no significant differences between the average costs in the irrigated, mechanized rain-fed and traditional rain-fed sectors for the



cultivation of this sorghum crop, as reflected by the probability value (0. 265) which is greater than (5%). This means that the production costs in the three sorghum cultivation sectors some of them are not affected by the difference in the pattern of cultivation in each of them .

Table (7) the differences in costs averages (in SDG) between the cultivated sorghum, irrigated, mechanized rain-fed and traditional rain-fed sectors in White Nile State

Variable	Mean Square	F-value	Significant
Between Groups	12626. 978	1. 528	0. 256
Within Groups	8263. 724		

Source:author computation,From federal and state ministries of agriculture (1970-2019)

3-8-Analysis of the correlation between levels of price (in SDG) , costs (in SDG) , and yield (kg/Fadden) of sorghum yield in the irrigated,mechanized rain-fed and traditional rain-fed sectors in the White Nile State

From Table (8) we note the high rate of correlation between the price of sorghum and yield in the irrigated sector (84%) , in proportion to the encouragement focus prices announced by the state government early in order to maintain sufficient quantities to meet the nutritional needs of the population and provide feed for livestock in the state, noting a weak relationship The correlation in the mechanized rain-fed sector between the price and yield (32%) , due to the fact that farmers in this sector are focusing on cultivating large areas more than their focus on means of increasing yield, in the traditional rain-fed sector, we note the strong correlation between the price and yield (69%) , due to the fact that farmers in this sector are totally dependent on the sorghum crop for their livelihood, where they store enough of their strength and sell the surplus to provide their other living requirements. As for the relationship between the costs and yield in the irrigated

sorghum sector, we note that they are weak, as we find that the costs affected yield by (13%) only the importance of the sorghum crop to farmers in the irrigated sector in terms of food for humans and animals, as for the mechanized rain-fed sector, we also note that the correlation is weak, as costs affected yield by about (65%) , this is the ratio due to large size of holdings, In the traditional rain-fed, too, we note that the correlation between production costs and productivity is very weak at about (10%) Percentage of the sector's reliance on traditional methods in agriculture, municipal seed and family employment, and the small size of holdings .

Table (8) Correlation coefficient between levels of prices, costs and sorghum crop productivity in the irrigated, mechanized rain-fed and traditional rain-fed sectors in the White Nile State in the period (1970-2019)

Variable	Impact of price%	Impact of costs%
Irrigated subsector	84	13
Mechanized rain-fed subsector	32	65
Traditional rain-fed subsector	69	10

Source: author computation, From federal and state ministries of agriculture (1970-2019)

4. Main Findings:

- 1- Yield was affected by the price in the three sectors of the sorghum crop cultivation irrigated, mechanized rain-fed and traditional rain-fed sectors by percentage (89%) , (88%) , (55%) respectively .
2. Yield was affected by the costs in the three sectors of the sorghum crop cultivation irrigated, mechanized rain-fed and traditional rain-fed sectors by percentage (20%) , (97%) , (20%) respectively .
3. The effect of price on yield was greater than effect of costs in the irrigated and traditional rain-fed sectors that farmers in

→ this sectors due to dependence on selling surplus production after deducting the amount of family consumption to bring in the rest of their household necessities. But in the mechanized rain-fed the effect of costs on yield was greater than effect of price because, the farmers in this sector cultivate large size of holdings.

4- There are significant differences in the mean yield of the sorghum crops .

5. Main Recommendations:

1- More efforts are to be exerted by the White Nile State government to encourage concentration of prices of sorghum production in order to motivate farmers to increase yield .

2- It is anti-resent in Sudan that press for removing any subsidies and supports in process to liberalize Sudan economy.

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