A Comparative Study Between tapping *Acacia senegal* by *Sunki* and *Axe* in West Kordofan, Sudan

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Abstract

The broad objective of this research was to compare between *Sunki* and traditional *Axe* (as tapping tool for *Acacia senegal* trees) in term of gum Arabic production, number of trees tapped per day, hazard facing the producers in tapping process and the influence of each tapping tool in the productive age of trees in the gum gardens of En Nahud Locality- West Kordofan State, Sudan. The primary data was collected through face-to-face interview with local farmers, group discussions with key informants, and observations. A random sample of 102 respondents was selected from six villages representing the locality. Secondary data was obtained from thesis, journals, books, reports, web, and other relevant sources. Data was analyzed using descriptive statistics and Chi-square, t-test and binary logistic regression analysis using Statistical Package for Social Sciences (SPSS). The main findings of the research are; there were significant differences at (p=0.05) between *Sunki* and traditional tapping tool (axe) with regards to gum production, number of trees tapped per day, hazard facing the producers when dealing with tree and the influence of each tool in the productive age of trees in the gum garden of En Nahud Locality. The result of binary logistic regression showed that extension and training service are the main determinants factor for adoption of *Sunki*. Drawing from the present empirical findings the *Sunki* was preferred tapping in the gum gardens of En-Nahud Locality.

Keywords

Agricultural Technology, Tapping Tools, Gum Arabic, Acacia senegl, Sudan

1. Introduction

Gum Arabic is one of the main crops produced in the traditional rain-fed agricultural sub-sector in Sudan. It is a non-timber forest product of the genus Acacia; namely *Acacia Senegal* [8] and [12]. Gum Arabic plays an important role as a cash crop produced in the traditional rain-fed areas of North Kordofan in Western Sudan [4]. En Nahud locality contributes significantly to the national economy through the

production of cash exportable crops; Gum Arabic from *Acacia senegal* is a highly valuable cash export crop [11]. Among the main constraints of the gum Arabic production are Tapping tools, particularly the (Axe). The Gum Research Division (GRD) was involved for several years in widespread extension campaigns aimed at improving gum gardens, their protection against fire and the use of the new tapping tool (*Sunki*). Gum tappers use small axes for tapping *Acacia Senegal* trees. Tapping is usually done on younger branches and rarely on the main trunks because the latter produces

gum of rather poor quality. The use of the axes frequently damages the wood making them be more susceptible to attack by borers which might eventually kill the branch or even the whole tree (Gum Arabic Belt Rehabilitation [7]. Because of this several tapping tools were tested to find a suitable alternative to the axe. An alternative tool (*Sunki*) was finally evolved by the Gum Research Division (GRD) with the help of a local blacksmith.

Different local tools are used by gum tappers in Sudan for tapping A. senegal trees for gum production. For example, axes are traditionally used for tapping the stems and/or branches of A. senegal. Another tool that is used is called a Makmak, which is also used for tapping A. senegal trees. Makmak, weighing 0.50-0.75kg with a 15cm blade and a 7-10cm sharp edge, is designed for tapping gum trees, for example A. senegal, by pushing the blade upward into the bark, the two tools are mentioned are not recommended, as it is difficult to control the depth of the incisions made in the stem and/or branch of the tree, The tapping tool "Sunki" or "Bayonet" 20cm in length and weighing 0. 25-0.50 Kg is used for tapping A. senegal (Ballal et al., 2005). Sunki is advanced tapping tool, which was developed by the gum research program for tapping Acacia senegal (Hashab tree), while the axe is the traditional tool for tapping the gum Arabic trees [6] Saied that the researchers of Gum department have developed a new hand tool called the '*Sunki*' which is easier and faster in use as well as being less injurious to the tree.

The (*Sunki*) is a spear-like blade and has many advantages over the axes: it does not damage the tree; it regulates the width of the bark removed; it enables tapping of branches and from any direction, and more trees can be tapped by one person in a shorter time, obtaining of pure gum free from impurities, reaching the higher branches that could not be tapped by using an axe, saving time and reducing labor, *Sunki* could be used in gum collection, increasing the productive age for the tree [2].

2. Methodology

2.1. Study Area Description

West Kordofan State lies between latitudes 9° 30" and 13° N; longitudes 27° 31" and 31° 31" E. It is surrounded by four states, namely south Kordofan, North Kordofan, Upper Nile and North Darfur states. It is located within the dry land savannah zone. En Nahud locality is located in the Northern part of West Kordofan State. It has an area of 111,373Km² (43,001 miles²). En Nahud locality lies between latitudes 12° 27"- 13° 15" N and longitudes 28° 12"- 29° 55" E (Figure 1).



Figure 1. Location of the study area in West Kordofan.

Population of the state is about 1,327,500 inhabitants (National Census 1993).

The state contributes significantly to the national economy through the production of cash exportable crops; Gum Arabic from *Acacia senegal* is a highly valuable cash export crop [11]. The annual rainfall ranges between 400mill meters in the North to over 750mill meters in the southern parts of the state [5]. The area of the state is 11361000ha for farming

land. The state is characterized by sand dunes in the northern parts and eastern parts, while southern and western parts are diversified by many small steep sided hills as an extent for the known Nuba Mountains. Loamy and alluvial soils are confined to the seasonal streams and valleys in the different parts of the state. Dark cracking clays are limited to the mechanized farming schemes [1].

The vegetation cover of the state are Acacia senegal Acacia seyal (Talh), Acacia mellifera, Dalbergia melanoxylon, Albizia amara, Guiera senegalesis, Combretum hartimanianum, Combretum glotinosum, Tamarindus indica, Adansonia digitata, Acacia polycantha, Pilostigma reticulatum [1].

2.2. Research Design and Data Collection

Data for this study was mainly collected from primary and secondary sources through a combination of qualitative and quantitative data collection tools. Primary data were collected from 102 randomly selected households in six villages in the study area. Structured questionnaire with closed ended questions that lasts for 30 minutes were used for the household survey. Diverse issues such as the households' socioeconomic and demographic characteristics, adoption of Sunki and comparing between Sunki and axe in term of in term of gum Arabic production, number of trees tapped per day, hazard facing the producers when dealing with trees and the influence of each tool in the productive age of trees. Prior to the actual survey the questionnaire was pre-tested and modified accordingly. The survey data was complemented with key informant interviews, focus group discussions and direct observation.

2.3. Data Analysis

Data was analyzed using descriptive statistics and Chisquare t-test and binary logistic analysis using Statistical Package for Social Sciences (SPSS).

3. Results and Discussion

3.1. Quantity of Gum Arabic Produced in Kantar Last Season from Trees Tapped by (*Sunki* and Traditional Axe) in the Study Area

The results showed that there was a significant difference between produced quantities of gum Arabic last season from trees tapped by *Sunki* and quantities of gum Arabic produced last season from trees tapped by Axe, table 1.

Table 1. Chi-Square test for comparing between Sunki and axe with respect to production of Gum Arabic in kantar last season.

Tool used in tapping		Number	Numbers of kantar			
		(1-10)	(11-21)	(22-31)	(32-41)	- KI
Combri	0	10	5	2	2	19
SUNKI	Е	(10)	(6)	(2)	(1)	
4.110	0	44	2	10	3	8
AXC	Е	(44)	(25)	(10)	(4)	
CT		54	31	12	5	102

Calculated Value = 1.457 df = 3

Tabulated Value = 0.352 L.S. = 0.05

Chi- Square Equation Calculated manually by:

 $E = (CT) \times (RT) \div GT$

Where: E Expected Value calculated by the equation above RT Row Total, GT Grand Total, CT Column Total Chi- Square = $\sum (O-E)^2 \times E$

Where is: O Observed Value (from questionnaire).

3.2. Comparison Between *Sunki* and Traditional Axe in Term of Number of Trees Tapped per Day and Productive Age of the Trees in the Study Area

The results of the study showed that there are significant difference between *Sunki* and traditional axe at p=(0.005) in term of number of trees tapped per day and productive age of trees, table 2.

Table 2. Comparison between Sunki and Traditional Axe in term of number of trees tapped per day and productive age of trees.

Item	Mean	Std. Deviation	Т	d.f	Sig
Number of trees tapped by Sunki per day in comparing with Number of trees tapped by axe per day	-0.353	1.279	2.786	101	0.006
Productive age of trees tapped by Sunki in comparing with Productive age of trees tapped by Sunki	0.373	0.770	4.888	101	0.000

This result was confirmed with [2], who cited that the *Sunki* is saving time and labor. He concluded that the effective labor could be able to tap up to 300 trees per day when using *Sunki* and (30-50) trees per day in the case of traditional axe. Also, this result was in line with [3], who announced that the average life of the tree is significantly decreased as a result of the injury caused by the axe. For example the gum tree was found to die at the age of 7 to 14 years in the areas using the traditional axe and it can survive more when using *Sunki*.

3.3. Comparison Between *Sunki* and Traditional Axe in Term of Damage Caused to Gum and Injury Caused to the Producers in the Study Area

The results funded out that there are significant difference between *Sunki* and traditional axe at p=(0.005) in term of damage caused to gum and injury affected the producers, table 3.

Table 3. Comparison Between Sunki and Traditional Axe in Term of Damage Caused to Gum and Injury Caused to the Producers.

Item	Mean	Std. Deviation	t	d.f	Sig
Damage caused to gum and trees in case of tapping by <i>Sunki</i> in comparing with Damage caused to gum and trees in case of tapping by Axe	0.147	1.206	1.232	101	0.221
Injury caused the producers in case of tapping by <i>Sunki</i> in comparing with Injury caused the producers in case of tapping by Axe	0.578	1.360	4.295	101	0.000

The respondent explained that when they are used the traditional axe they comes closed to the tree and they affected by the spine of tree and other injury cause by the branches of the trees, and they can avoid all these kinds of injury when using the *Sunki* because they deal with the trees remotely. Also, the damage to the trees and gum is lower in case of using *Sunki*.

3.4. Factors Determining the Adoption of *Sunki* in the Study Area

The results of binary logistic regression showed the determinant factors affected the adoption of *Sunki*, table 4.

Table 4 Determinant	Factors Affa	ected the Ar	lontion d	of Sunki
<i>nume</i> 4. Determinum	Tuciors Alle	cieu ine Au	opnon	ij Sunki.

Factors	В	S.E.	df	Sig.	Exp (B)
Education	0.502	0.408	1	.219	1.651
Age	0.003	0.266	1	.990	1.003
Availability of Sunki	205	0.679	1	0.763	0.815
Extension	0.241	0.670	1	0.719	1.273
Training	1.318	0.685	1	0.054	3.736
Constant	-1.689	1.896	1	0.373	0.185

*Significant at a=0.05; n=102

The findings of the table 4, reveal that adoption of *Sunki* is affected by the Training and. This finding emphasizes the role of extension messages, if scientifically formulated, in changing the attitudes and perceptions of farmers and enhance the adoption of new innovations as reported by [10].

4. Conclusion

Drawing from the present empirical findings the *Sunki* was preferred tapping tool in term of gum Arabic production, number of trees tapped per day, hazard facing the producers in tapping process and the influence of each tapping tool in the productive age of trees in the gum gardens of En Nahud Locality- West Kordofan State, Sudan.

Socio-demographic characteristics of respondent as well as extension and training services constitute the main factors determining the adoption of new innovations.

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