



SOCIO-ECONOMIC ROLE OF *Acacia senegal* GARDENS TO SMALL-SCALE OF GUM ARABIC PRODUCERS IN ENNUHUD LOCALITY, WEST KORDOFAN, SUDAN

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study was carried out during 2017 – 2018 in Ennuhud Locality, West Kordofan Sudan to assess socio-economic profile and silvicultural practices of small-scale gum Arabic producers. Questionnaires were distributed randomly to 186 respondents in 10 villages (out of 100 villages) and associated with personal interviews and key informant methods. The data was analyzed using descriptive statistics and correlation analysis using Statistical Package for Social Science (SPSS). The results revealed that the majority of the respondents (68.3%) were farmers and gum producers who applied traditional silvicultural practices. The yield of gum Arabic was estimated by 37% and 43.9% of respondents as 1.3 - 1.7 kg/tree and 2.2 kg/tree, respectively. The study revealed that production of gum contributed to the producers' income by less than 5,000SDG and 5,000 – 10,000SDG as 47.3% and 46.2%, respectively as mentioned by responds more (62.9%) of them mentioned that the expenses of gum tapping were 3,500 SDG/8.03ha. Pests was mentioned as main factor (42.5%) affecting gum Arabic production. A significant positive correlation ($R = 0.532$) between gum production area and total garden area was observed, while a negative correlation ($R = - 0.011$) was found between costs of collection and average gum production ($P = 0.01$). In addition, majority (96.8%) of the respondents used their financial returns for the rehabilitation. With regard to the registration of Gum Arabic Producers Association, about 60.2% of the respondents completed the registration process. The study recommended the practice of private plantation rehabilitation process using high-yielding varieties, high advanced tapping tools and capacity building, which is considered as most developed opportunity to local communities in semi-arid areas.

Keywords: Gum Arabic; silvicultural practices; socio-economic characteristics; small-scale producers.

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1. INTRODUCTION

Gum Arabic belt is considered as the most essential forest type in Sudan, which lies within the low-rain savanna zone in central Sudan roughly between latitudes 10° and 14° N, with two areas outside these borders found in the northeast (FAW- Gedaref-Kassala) and in the southeast alongside the Blue Nile/Upper Nile border. It spans the regular rain-fed agricultural areas of Western and Central Sudan that consist of Great Kordofan (49.3%) [1,2].

The *Acacia senegal* tree (*Hashab*) is a multipurpose tree that has a vital function in generating income, supplying family wood energy and fodder demands, except enriching the soil fertility, maybe also through biological nitrogen fixation [3]. Gum Arabic exudes from *Hashab* timber in the structure of giant (5 cm diameter) nodules or “tears”. The mature trees with 4.5 - 6 m height and 5 - 25 years old, are tapped with the aid of making incisions in the branches and stripping away the bark to accelerate exudation [3,4].

The gum income contribution varied greatly between regions and districts in Africa. In dry-lands of eastern Africa for example, gum and resin income contributes to 14 - 23% of the small-scale producers' household income [5]. While in Sheikan locality in Sudan, the contribution of gum Arabic to the average household's income was found to be 38% [6].

The main factors rendering gum production includes fluctuation of prices in the local markets, poor supply of drinking water in the production areas, social and institutional factors, lack of livelihood services; young

generations turned to other occupations; mismanagement of natural resources. In addition to, inefficient marketing chain, policies and programs resulting in unstable supplies of food and cash crops, livestock and gum Arabic to the domestic and world market; decline of traditional systems tenure and reciprocity systems for managing pastoralism and agriculture [7,8,1,4]. This paper aimed to assess socio-economic profile and silvicultural practices of small-scale gum Arabic producers in West Kordofan, Sudan using structured questionnaire and key informant.

2. MATERIALS AND METHODS

The study was conducted in Ennuhud Locality, West Kordofan State, Sudan. The State is located between longitudes 27.30° to 32.00° E, and latitudes 09.20° to 14.50° N, While the Locality is located between latitude 12° to 14° N and longitudes 27° - 30° E in the northern part of West Kordofan State (Fig. 1), in low rain fall savannah zone (300 – 400 mm/annum). The temperature is ranging between 24 - 39° C. The Nubian sandy stone soils deposited are dominated the land in the study area. Population is about 277,107 inhabitants according to 2009 census. Ennuhud Locality is known for production of various agricultural and forestry crops. The Locality is characterized by international exports such as gum Arabic (one-third of Sudan' annual export) and seeds oils. The vegetation cover in the area consists of trees, shrubs and wild plants. The most important tree species in the area from economical point of view is the *Acacia senegal var senegal* (*Hashab*), which owned by local communities, [9,10].

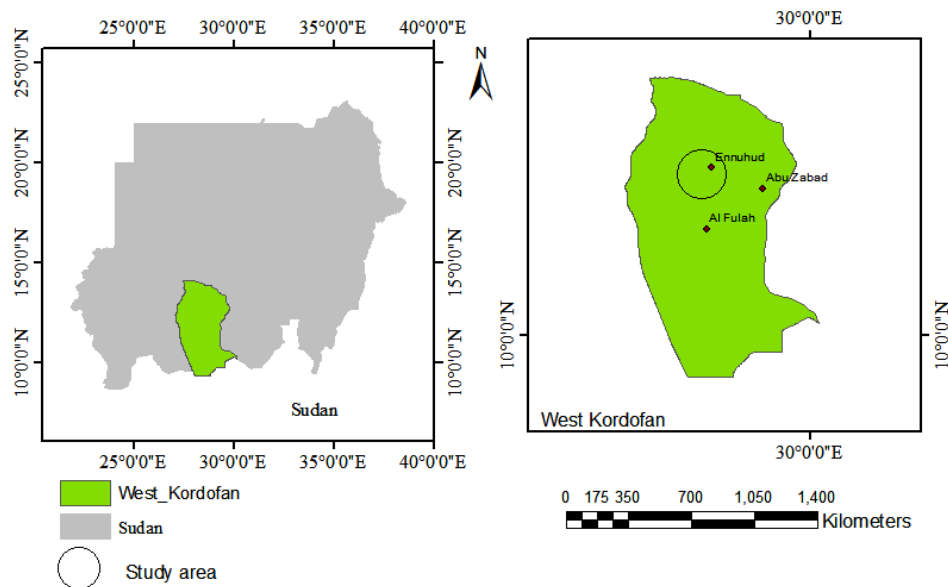


Fig. 1. Location of the study area

The data collection was depended on field survey, questionnaire, key informants and personnel observations. The structured questionnaire was distributed randomly among 186 respondents, in 10 out of 100 villages with sampling percentage of 10%. Moreover, personal interviews were done with Forest National Corporation (FNC) officers, Gum Arabic Producers Association (GAPA) leaders as key informant. In the field survey. A total number of ten sites were randomly selected and Global Positioning System (GPS) was used for the layout of sample plots. In each site, three circular sample plots (0.1 ha) were allocated, diameter (cm), height (m) and number of all trees were measured and recorded in each plot. (re words should be deleted because was not presented in the results!!!!) The data was analyzed by use of descriptive statistics, and correlation analysis using Statistical Package for Social Science (SPSS).

3. RESULTS

The gum Arabic production in Ennuhud Locality was fluctuated during the period (2012 - 2016), from maximum 646,392 Quntar (2012) to minimum 152,408 Quntar/year (2015) and to 273,169

Qunter/year (2016), but the prices of gum Arabic were varied differently from maximum 1,050 SDG/Qunter in 2016 and minimum 460 SDG/Qunter in 2012 (Table 1).

The majority of interviewed households (88%) were male and quarter of them (24%) were in age between 46 – 55 years old. Whereas most (87%) of the respondents were married and almost more than half (67%) of them were read and write compared to (30%) illiterate. The result showed that 68% of the main occupation of the respondents is farming (Table 2).

Also respondents indicated of the private gardens of *Acacia senegal* was inherited land tenure (57%), followed by owned (25%), Gift (8%), registered (5%) and rented (5%) types (Fig. 2).

About a quarter (36.6%) of respondents showed that tapping and collection of gum Arabic was the most silvicultural practices that were applied in *Hashab* orchards, followed by weeding (21%), old tree cutting (20.5%). While replanting and singling showed only 17.2% and 4.8% as least practiced activity, respectively (Table 3).

Table 1. Gum Arabic production and prices in Ennuhud Locality, West Kordofan (2012 – 2016)

Years	Production/Quntar	Unit price (SDG/Quntar)	Total production	
			Kg	Tones
2012	646,392	460	161,598,000	161,598
2013	324,920	613	81,230,000	81,230
2014	195,021	850	48,755,250	48,755.25
2015	152,408	925	38,102,000	38,102
2016	273,169	1050	68,292,250	68,292.25
Total	1,591,910		397,977,500	397,977.5

1 Quntar = 100 Lb

* Source: Ennuhud Crop Markets, Annual report (2016)

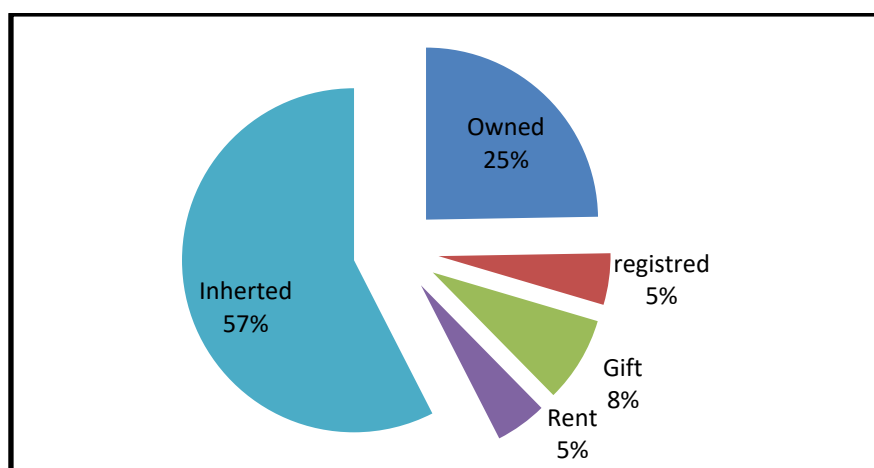


Fig. 2. Types of land tenure of *Acacia senegal* private gardens in Ennuhud Locality

Table 2. Demographic features of the respondents' in private gardens in Ennuhud Locality

Demographic factor	Variable	Frequency	%
Gender	Male	164	88
	Female	22	12
	Total	186	100
Age (years)	Less than 25	24	13
	26 – 35	40	22
	36 – 45	39	21
	46 – 55	45	24
	More than 56	38	20
	Total	186	100
Education level	Illiterate	55	30
	Read and write	124	67
	Graduate	7	3
	Total	186	100
Marital status	Unmarried	19	10
	Married	158	85
	Divorced	3	2
	Widowed	6	3
	Total	186	100
Main occupation	Gum producers	17	9
	Farmers	127	68
	Herders	2	1
	Employee	5	3
	Trader	35	19
	Total	186	100

Table 3. Silvicultural practices applied by respondents in Hashab gardens

Silvicultural practice	Frequency	%
Weeding	39	21.0
Replanting	32	17.2
Singling	9	4.8
Cutting old trees	38	20.4
Tapping and collection	68	36.6

According to labour used in tapping activity, 29.6% of the respondents showed that gum producers depends on rent labour followed by 26.3% and 23.1% depending on family members and themselves, respectively (Table 4).

The average annual yield of gum Arabic from Hashab in Ennuhud Locality was mentioned by 37.1% of respondents as 1.3 - 1.7 kg/tree, followed by 34.9% as 2.2 – 4 kg/tree, while 16.1% of them mentioned that it can reach more than 4.4 kg/tree (Table 5).

Local communities practice tapping of Hashab in the off season time to increase their incomes from the gums' returns. The study revealed that production of gum contributed to the producers' income by less than 5,000SDG and 5,000 – 10,000SDG as 47.3% and 46.2%, respectively as reported by the respondents,

while a few of them (6.5%) achieved more than 10,000SDG (Table 6).

Considerable amount (42.5%) of the respondents mentioned that pests are the main factor affecting gum Arabic production in the Ennuhud locality, followed by a quarter grazing (31.7%) (Table 7). While a few of them indicated that rainfall fluctuation (7.0%), no credit (6.5%), lack of labour (4.3%) and scarcity of drinking water (1.1%) are also influencing the production.

In season 2016, the study indicated a considerable significant positive correlation ($R = 0.485$), ($R = 0.265$), ($R = 0.319$) between area and production/garden, tapping costs and gum retruns/SDG ($P = 0.00$), respectively in Ennuhud Locality (Table 7).

Table 4. Types of labour for tree tapping process in the Ennhud Locality

Labour	Frequency	%
Family	49	26.3
Rent	55	29.6
<i>Nafir</i>	13	7.0
Share	26	14.0
Themselves	43	23.1

Table 5. Average annual yield (kg/tree) of Gum Arabic according to the respondents in Ennhud Locality

Gum yield (g/tree)	Frequency	%
Less than 0.9 kg	21	11.3
1.3 – 1.7 kg	69	37.1
2.2 – 4 kg	65	34.9
More than 4.4 kg	31	16.7
Total	186	100

Table 6. Average returns (SDG) of gum Arabic according to the view the respondents

Returned (SDG)	Frequency	%
Less than 5,000	88	47.3
5,000 – 10,000	86	46.2
More than 11,000	12	6.5
Total	186	100

Table 7. Factors affecting gum Arabic production in the study area

Factor	Frequency	%
Pests	79	42.5
Rainfall fluctuation	13	7.0
No credit	12	6.5
lack of labour	8	4.3
Scarcity of drinking water	2	1.1
Grazing	59	31.7
No problems	13	7.0

Table 8. Correlations between production area, tapping and collection costs, gum production and returned of *Acacia senegal* gardens season 2016

		Production area	Costs of tapping	Costs of collection	Production/orchard	Orchard Returned/SDG
Area of production	Pearson Correlation	1	.265**	.056	.485**	.319**
	Sig. (2-tailed)		.000	.445	.000	.000
Tapping costs	Pearson Correlation	.265**	1	.399**	.201**	.188*
	Sig. (2-tailed)	.000		.000	.006	.010
Collection costs	Pearson Correlation	.056	.399**	1	-.011	.184*
	Sig. (2-tailed)	.445	.000		.880	.012
Production/orchard	Pearson Correlation	.485**	.201**	-.011	1	.302**
	Sig. (2-tailed)	.000	.006	.880		.000
Orchard Returns/SDG	Pearson Correlation	.319**	.188*	.184*	.302**	1
	Sig. (2-tailed)	.000	.010	.012	.000	
	N	186	186	186	186	186

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

4. DISCUSSION

Gum Arabic production and prices in Ennuhud locality were fluctuated in the market during the period 2012 - 2016. Historically, the price mechanism of Gum Arabic commodity at the auction markets was fully dependent on the minimum floor price (5, Elskehkh 2016). Elskehkh et al. (2016) stated that fluctuations are attributed to some factors among which are the disfavoring gum Arabic prices offered at the auction market, lack of credit facilities, high taxes and fees and fluctuation in gum Arabic supplied to the market. Furthermore, the study identified the demographic, socioeconomic features of gum producers which agreed with previous studies that gum Arabic production practices is a male dominated occupation [11,12,13]. Generally, most of the producers' age were in the old age group suggesting the future of gum production in the study area is not sustained. The garden size distribution of the *Acacia senegal* plantation is small holders growing Hashab were the most dominant in Ennuhud area. This observation is lined with previous reports of Mohamed [14] Balla et al., [15] and Taha and Pretzsch [16]. The study also confirmed that rent and family labour were dominated in Ennuhud locality. Pest are considered as main factor affecting the gum production in Ennuhud locality. Wekesaa, et al. [17] reported that improving of gum production through tapping for the economic, social and environmental benefits of local communities in the dry-lands reveals that natural regeneration and population structure of *Acacia senegal* were affected majorly by pests and browsing. This observation agreed with previous report of Abu Baker [4] who stated that gum Arabic production and marketing in Sudan is witnessing many constraints including expansion of mechanized rain-fed agricultural schemes on natural forests, commercial fuel wood and charcoal making activities, late tapping, infestation of pests. More than half (62.9%) of the respondents showed that their average costs of tapping for 8.03 ha was 3500SDG. Almost half (47.3%) of them gained return was less than 5000SDG. It is worth to mention that gum Arabic production requires little investment apart from the trees, which can regenerate naturally [1]. In addition, most (96.8%) of the respondents used their financial returns to rehabilitation of their areas. With regard to the registration of the gum Arabic Producers Association, 60.2% of the respondents accomplished the process and 39.8% are not [18] This observation is the lined with of Gaafar, [19] who stated that gum production is a pillar of family economy and considered as an income-generating source that requires only a low input of work after the rainy season [20-24].

5. CONCLUSION

The study concluded that gum producers secure their land tenure through inherited types and implement many silviculture activities to manage their gum gardens. Also rent and family labour are the most labour form for tree tapping and gum collection activities. Gum yield per tree, prices and returned are fluctuated. Finally, the study recommended the rehabilitation of Hashab trees in the bare lands within the plantations of GAPAs gardens using high yielding varieties, impressing the capacity building of the GAPAs to use more advanced tapping and harvesting tools.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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