PRODUCTION, SUPPLY, AND MARKETING OF SESAME IN ERITREA

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SESAME OR [SIMSIM(LOCAL NAME) (SESAMUM INDICUM)]

1. Introduction

Sesame (Sesamum Indicum), also locally known as simsim is an important oilseed crop. Its seeds have an oil content of 45-55%. It is widely grown in the western lowlands of Eritrea, especially in the valley of River Gash, Tukumbia, Gulug, Omhager, and Tesseney areas. It is also important in the province of Senhit and lowland areas of south-western parts of Seraye province. At present there is no large scale production of sesame; hence, most sesame is consumed locally.

2. Plant Characteristics

Sesame (sesamum indicum) belongs to the plant family pedaliaceal, characterized by bell-shaped flowers and opposite leaves. It is an erect annual herb that reaches a height of 3 to 6 feet (0.9-1.8m.). It has a taproot and a dense surface mat of feeding roots. The stem is branched or unbranched, depending on the variety. The lower leaves are opposite, broad and palmately lobed whilst the upper leaves are alternately arranged, narrow and lanceolate.

There are 1-3 flowers in each axil, the number depending largely on the variety, and these are white, pink or purple. The tabular, two-lipped flower is about 3/4 inch long, with a pink or yellow corolla. The lower flowers begin blooming two or three months after seedling, but blooming continues for some time until the upper pods open.

The fruits are erect capsules about 1 in. (2.5 cm) long. The upright pods split open at the top at maturity which gave rise to the expression "open sesame". Each capsule contains a large number of very small seeds of which there are about 9,000 to the ounce (320 to the gram)[1].

The seeds drop out when the plant is inverted, except with varieties with indehiscent pods. All the local varieties are dehiscent, i.e, the capsules split from the top downwards for about two-thirds of their length when mature; this process is encouraged when the plants are moved about by the wind and unless precautions are taken much seed is shed.

The seeds of different varieties are creamy white, dark red, brown, tan or black. The seeds some-what resemble flax-seed in size, shape, and sometimes also in colour. The yields usually are below those of the shattering varieties.

Although sesame is predominantly self-pollinated there is up to 5% cross-pollination. In most varieties the period from sowing to maturity is about 3 to 4 1/2 months[2].

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[1]John H.martin and others, principles of crop production. (3rd edition, New York: Macmillah publishing Co.Inc. 1976), pp. 974-75.

[2]Ibid pp. 975-77.

3. Ecology (Climatic Requirements)

Sesame requires a warm climate with a frost free period of 150 days or more. The crop is moderately drought resistant; this is especially true of branching varieties because these have a more prolific root system. Sesamum indicum is basically considered a crop of the tropics and sub-tropics. Its main distribution is between 25°S and 25°N. Although some varieties are grown up to 1500 meters above sea level, the crop is normally widely grown in areas below 1,250 meters above sea level.

Sesame normally requires fairly hot conditions during growth to produce maximum yields. A temperature of 25-27°C encourages rapid germination. Should the temperature fall below 20°C for any length of time, germination and seedling growth will be developed, and below 10°C inhibited. A hard frost at maturity will not only kill plants but will also reduce seed and oil quality. It can also adversely affect minor seed-oil constituents.

Sesame's drought resistant qualities are among its chief advantages, since it can be planted in relatively arid zones and still produce a high quality oilseed. Selection of a variety with the ability to give high average yield over a fairly wide rainfall range is a major factor in ensuring a profitable return from annual sesame. The crop is important in many low rainfall areas because of its resistance to water stress and its adaptability, but if the conditions under which a local crop is grown are changed, it is most probable that the local variety will no longer be the most suitable. This is frequently the case when irrigation water is made available, with resulting high crop yield expectation, increased use of fertilizers and more advanced agricultural techniques. However, it is unfortunate that indehiscent varieties require more water than shattering types, and this appears to be due to an inherently greater transpiration rate.

Sesame will produce an excellent crop with a rainfall of 500-650 mm, but down to 300mm and up to 1000mm will also produce a crop under certain conditions. For maximum yields precipitation should be distributed over the period of plant growth in approximately the following proportions:

- germination to first bud formation 35%
- to main flowering 45%
- to maturity not more than 20%

and falling as seeds are filling, and ceasing as first pods begin to ripe. Heavy rain at flowering will drastically reduce yield, and if cloudy weather persists for any period at this time yield can be exiguous. Rainfall when plants are ready for harvest also reduce yield by increasing susceptibility to disease and prolonging the period required for capsules to dry out. Sesame is extremely susceptible to waterlogging, and heavy continuous rains at any time during growth will greatly increase the incidence of fungal disease. It is possible that breeding or selection could produce varieties less susceptible to high levels of soil moisture.

Localities suitable for sorghum, maize, Bultug (millet), and cotton in Eritrea are considered suitable for the production of sesame. In Eritrea, sesame is grown mainly in the 300-600 mm rainfall areas, especially in the province of Gash-Setit. At the lower range the seedling stage is susceptible to a local dry period, but at 500mm excellent crops are produced in the Guluge, Omhager, Tesseney, Tukumbia, and Setit areas. At the higher range soils must be well drained, and in the South Western regions where this is so rainfall up to 650 mm will be tolerated. As you come from South - West and West to East and central Eritrea sesame

is generally grown in those areas too dry for ground nuts, i.e in the rainfall range of 300-400 mm, or where there are likely to be local dry periods. Good rainfall distribution during the period of most active growth in July-August-September improves yields.

Sesame is susceptible to wind damage after the main stem has elongated, and tall-stemmed combinable types are not recommended for areas where high winds at harvest time are common. More sturdy but dehiscent types are also unsuitable for windy localities, as a high proportion of the seed can be lost through shattering in the field. Very cold winds also, during early growth and flowering cause severe injury to plants. sesame is very susceptible to hail damage at all stages of growth. Prior to flowering, stems can be badly bruised, sometimes broken, and terminal shoots so damaged that distorted growth occurs. At flowering, both buds and flowers may be stripped from plants , or damaged buds produce aborted flowers. Heavy storms can virtually strip plants of all leaves, and recovery is slow.

Sesame grows well on a variety of soil types, but thrives best on those which are moderately fertile and free-draining. Composition and structure appear to be of secondary importance compared to water-holding capacity, as the plant is extremely susceptible to even short periods of water logging at any stage of growth. Shallow soils with an impervious subsoil or those which are saline are not suitable. Sesame is extremely susceptible to salinity, and salt concentrations that have little effect on cotton are fatal to the crop.

Soils with a neutral reaction are preferred, and although good results have been obtained on slightly acid and slightly alkaline soils, sesame does not thrive on acid soils. It will grow in soils of PH 5.5 - 8.0, but at the higher figure soil structure becomes of increasing importance. Within these rather broad limits sesame can be successfully grown on a very wide range of soils, but this is done more to the diversity of types well adapted to local conditions than to the basic adaptability of any one variety[3].

4. Field Operations

Sesame is usually sown early in the arable break because it requires fertile soils. It is often sown as an opening crop although grasses must be thoroughly eradicated because it is intolerant of weed competition.

A rough seedbed is usually preferred for sesame despite the small size of the seeds. The reason for this is that a fine seed-bed is more likely to form a cap if heavy rain falls, thus hindering emergence of the seedlings.

Sesame must be sown as early in the rains as possible. Late sowing definitely leads to yield reductions. In the Western lowlands of Eritrea it is sown in the first rains, usually as a pure stand, or alternatively it may be inter-sown with maiz, sorghum, or pearl millet[4]

Sesame seed is usually broadcast at the rate of 5 to 9 kg/ha. It is often mixed with soil before sowing in order to achieve an even spread.

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[3]E.A.Weiss, Oilseed Crops, (London: Longman, Group Ltd., 1983), pp. 295 302.
[4]A.G. Hill, Oilplants in East Africa, (London: Longmans Ltd., 1989) pp 172-73.

Sesame seedlings make slow initial growth, and are poor competitors to many quick-growing tropical weeds. A weed-free seed-bed is most important, since cultivation of sesame seedlings is difficult as the fine. fibrous roots are easily damaged. All types of weeds must be removed prior to planting. Efficient weed control is therefore important.

Highest sesame yields are obtained when grown under irrigation in arid regions where the sunny, dry climate is very suitable, and the low humidity reduces the incidence of fungal diseases. Flood irrigation is normall for small-holder crops, and row or furrow irrigation practiced only when it is grown more extensively or as a mechanized crop. However, the high cost of water in many arid areas often precludes the planting of sesame on irrigated lands, or alternatively the cost of production when rain-grown is so low that irrigated crops can not complete on local markets. A common method is to impound rain-water in fields, allow it to percolate, then sow sesame in the dry surface soil. The crop then grows on residual soil moisture. This can be a most effective method of production, and on fertile soils good yields are obtained. This system also utilizes flash floods that occur in river valleys of many arid regions, and water which would otherwise be wasted is retained in the soil[5].

The total water required to produce an irrigated sesame crop varies from 1200 to 2500 mm/ha, the very wide range due mainly to the maturation period of the variety sown, soil conditions, climate, and whether fully or partially irrigated. Sesame is susceptible to root rots and other fungal diseases caused by water logging or excessive humidity, especially when small. Fairly substantial pre-planting irrigations are to be preferred to immediate post-emergence watering, but the difficulty of mechanically planting wet fields may require that the seed is dry planted, and then irrigated.

5. Harvesting

Sesame is normally ready for harvesting 80-150 days after sowing, most commonly 100-110 days, but some cultivars also mature 70-75 days after sowing.At maturity, leaves and stems tend to change from green to a yellowish then redish tint. Dehiscent types are usually stooked to allow the plants to dry off, then threshed by hand.

At harvesting sesame presents two problems: the capsules split and shed their seeds when they are mature and they ripen unevenly from the bottom upwards. If harvesting is delayed until the top capsule is ripe, the lower ones split and the wind blows the plants about so much that most of seed is shed. It is therefore essential to harvest the plants as soon as the lowest capsules ripen; at this stage flowering has usually stopped at the top of the plant and most of the leaves have been shed. The plants are uprooted and the parts of the stems below the lowest capsule are removed; this is best done by holding the stems against and chopping them with a pod, this avoids shaking the pods and encouraging then to split or to shed their seeds. The plants are then stooked or tied to a fence which has been previously constructed in the field or homestead. The fences are often as high as 3 meters and are usually built parallel to the prevailing with to prevent them being blown over. The bundles of sesame plants are tied on to each side facing upwards; in this position the seed is not lost because the plants can not be shaken.

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[5]E.A. Weiss, pp. 309-316

After three or four weeks all the capsules should have matured. The seeds are removed beating the plants on a mat.

Yields are usually between 220-330 Kg/ha. Good husbandry produce 450-550 Kg/ha[6].

6. Pests And Diseases

Pests

Sesame Seed Bug

The Sesame Seed Bug mainly attacks the seeds of sesame. The sesame is usually attacked in the field after the plants have been cut and put together in stacks for drying. The Sesame Seed Bug was a serious pest between 1970-1974 in Geref, Omhager, and Gulug in Eritrea. Sesame Seed Bug can be controlled with Carbaryl, BHC Dust.

Sesame Webworm

The larvae of the pest spin a silkin web around the terminal leaves and eat the foliage and the pods. In Eritrea it occurs in Tesseney, Gulug, and Omhager areas. Sesame Webworm is normally controlled by natural enemies, but a heavy infestation can be controlled by light spray of DDT, Dimercon, Dipterex or Thiodah.

Flea Beetle

Flea Beetles are dangerous pests which cause most serious damage to young seedlings. They eat the foliage during the early stages of growth. In Eritrea Flea Beetle has been recorded along the Gash River and in Tesseney in rain-fed sesame and cotton. It can be controlled by using dieldrin as a seed dressing or in the seed-bed. It can also be controlled with Endosulfan, Hostation, and DDT.

Gall Midge (Asphondylia sesami)

These minute insects lay their eggs in the ovaries of the flowers. When the larvae hatch they devour the inside of the ovaries and in place of capsules round barren galls are produced. Dimethoate sprays are effective but are probably uneconomic.

Disease

Diseases include bacterial leaf spot, caused by pseudomonas sesami; a leaf spot, caused by the fungus cercospora sesami, and alternaria spp. They seldom do serious damage[7].

7. Utilization

Sesame seeds are exported to Europe for use in edible oil and pharmaceutical products. In Eritrea, at present, owing to the absence of market, most sesame produced is consumed locally. In the Western lowlands of Eritrea, sesame oil is produced using wood and stone-made, camel driven local sesame-oil crushing machine known as Ashera. At least 40 litres of oil is produced from one quintal of sesame. The residue is used as animal feed.

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[6]E.A.Weiss, pp. 309-316

[7]Andemeskel Woldchaimanot, HandBook of Insect Pests of Major Grops In Eritrea, (Asmara University, 1987), pp.40-43.

Alternatively, it is usually prepared for eating by pounding until it becomes an oily paste. This can be eaten as it is or can be used for frying vegetables or meat. Moreover, sesame seeds can be eaten raw, can be eaten fried, or can be included in various types of confectionery.

8. Sesame Production And Supply

In Eritrea sesame is grown only on the lowlands, mostly the Western Lowlands of the Gash-Setit areas. Eritrea's sesame is considered a high quality oil seed and most of it has been for export. Owing to the persistent drought and war sesame production and export has been practically nill.

The Western province of Gash-Setit and Barka are major sesame producing areas. Those provinces are major areas of private commercial farming with a total area of about 4.6 million hectares bordering the Sudan to the West, and Ethiopia to the South.

Today, the Western lowlands of Eritrea, especially the Gash-Setit area has become one of rapid, settlement, and planned economic expansion areas. Recently about 100,000 refugees have returned to the area, and the Government of Eritrea is conducting a comprehensive development project in the area to resettle and reintegrate returnees, and to enhance food production.

At present, experienced and inexperienced farmers are coming into the area, and are able to obtain land in the form of concession. Concession land is being assigned by the Provincial Administration Office of the Ministry of Agriculture. So far, after the total liberation of Eritrea, until the end of the year 1993, 11,548 hectares of land has been developed primarily by 348 private concessionaries with the assistance of modern engine powered equipment. Side by side with these, also exist a large number of local and returning camel and/or ox-farmers with small farms of two to four hectares of land.

The whole areas is of considerable interest to the government and development agencies because of its high economic potential. Definitely, mechanization will play an essential role in the agricultural system. Economic expansion in the area would become much more enhanced with organized planning and the rapid development of infrastructure, especially in the areas of administration, health and communications. A clear cut policy formulation, designing of efficient, effective and implementable strategy is required to attract the movement of all resources to the area in order to overcome the existing shortage of labour, credit, market, storage facscilities, and agricultural services.

Hence, the Government of Eritrea in collaboration with international financing agencies, donors, Nago's and others is conducting a concerted effort to enhance the overall economic development of the area. An EC funded project, aimed at settling and integrating 400 families of returning refugees is already under operation. The Government of Eritrea in collaboration with the German Technical Unit for Co-operation is conducting an Integrated Food Security project aimed at boosting agricultural production in the area. The Ministry of Agriculture has stationed its best staff to promote agricultural extension activities.

Moreover. the Ministry has established a Zonal Agricultural Machinery Service Unit with a well-equipped garage to render tractor and other machinery hiring and maintenance services[8].

Sesame Production

The average farmer in the area cultivates 2 to 4 hectares of land and operates with two pairs of oxen and grows mainly sorghum, maize, millet, and sesame. Despite the existing of the seasonal rivers os Setit and anseba and the availability of rich underground water, irrigation practice is almost nill. The agriculture of the area depends entirely on the rainfall which is the major limiting factor. All crops are rainfed and the area receives 400-600 mm. of rainfall a year, almost all of which falls in three months and soaks into the soil. Rains before June and after October are agriculturally insignificant.

Currently, major concentration of crop production is on the staple food-crop of the area, sorghum. If there is an economic incentive, farmers will definitely shift to the cultivation of other cash crops like sesame. The average crop distribution is 60 percent sorghum, 5 percent sesame, and 35 percent others (millet, maize, cotton). The crop operation for sesame, seedling rate, estimated yield and mean monthly rainfall is shown on the table below (Table 1).

Sesame: CROP OPERATION SEED RATE, ESTIMATED YIELD AND MEAN MONTHLY RAINFALL **Table 1**

crop	cultivation period		planting period		harvesting		Seedling Rate kg/hu.	Seed Cost Birr/Qt	Yield Q/ha.
Sesame	Early mid June		June-July		Sept-Nov		5-9	300	3-8
Mean monthly Rainfall	Apr	May	June	July	Aug	Sep	Oct	Nov	Total
	6.6.7	15	87.75	148.92	210.83	70.83	50.83	0.50	591.33

SOURCE: MOA, Planning and Programming Dept.

Usually each farmer grows sorghum, millet, maize, and sesame each year. Tillage practices are traditional using camel or ox driven wooden ploughs. Tillage is done as soon as the soil is moist and the weeds are sprouting (early mid June). This operation is repeated after one or two weeks to ensure the disappearance of more weeds.

Sesame seed is broadcast by hand. It is sown as soon as possible after the rains, usually early in june. This assures ripening during a relatively mild time before extremes of high temperature and low humidity can cause sudden shattering of the pods. Also the early harvest provides ready cash to meet indebtedness.

[8]MOA, Western Lowlands Development Project, 1993, mimeographed

After hand-sowing, all weeding is done with a hand-hoe and harvesting with a sickle. The main problem of harvesting sesame is shattering, so harvesting is done very carefully entirely by hand. Sesame is harvested into small sheaves stooked together forming several piles which are the basis of payment to harvesters. Harvesters are well aware of he critical time factor and press for high rates of payment to harvest sesame.

No rigid pattern of rotation is followed; when an area becomes weedy, sorghum is planted in the following season. In some areas (in the inter-riverine flat and much more fertile areas with alluvial soils) fallow cultivation is not practiced; and in some areas is practiced. Weeds are considered by farmers in the area to be the major problems of cultivation. The current build-up of insect pests is becoming a more serious problem necessitating all forms of prevention, protection, and controlling measures. Local concern has been expressed that unless an efficient spray service can be obtained, not only sesame but also the production of all other types of crops will come under a serious threat. In addition to insect damage of the field, storage of sesame is hazardous because of the sesame seed bug

9. Cost of Production

A genuine farm management study should be conducted to make accurate estimates of farm costs and incomes of an average farmer in the area. For the purposes of this work only rough approximations are made as shown on the table below (Table 2).

ESTIMATED COST OF PRODUCTION FOR SESAME FOR AN AVERAGE FARM OF ONE HECTARE

Table 2.

Clearing ..... 5 MD/Ha/Birr 20/MD		100.00
1st to 3rd ploughing ..... Birr 180/Ha		540.00
oxen hire = Birr 80/Ha		
one MD = Birr 20		
Cost of seed ..... 9 kg/Ha/Birr 3/kg		27.00
1st and 2nd weeding ..... 5 MD Ha/Birr 20/MD		200.00
Harvesting ..... 5 MD/Ha/Birr 20 MD		100.00
Bagging, loading and unloading ..... 0.16 MD/Ha/Birr 20/MD		3.20
Total Production Cost per Hectare.....		Birr 970.20
Estimated Yield per Hectare		5 Q/Ha.
Cost of production per quintal		Birr 194.04
Transport and Handling Charges		Birr 51.00
- 5 sacks at Birr 5/sack ..... Birr 25.00		
- loading and unloading 0.15 MD/Ha..... " 3.00		
- Transport cost to Asmara market at Birr 0.05/q/km .... " 23.00		
Total Transport and Handling charges 51.00		
Total Cost to Asmara markets.....		245.04
Estimated seasonal (average price at Asmara).....	Birr	350.00
Margin/quintal on average price		104.96
Average farmer's area of sesame....		2 Hectares
Average farmer's total production		10 quintal
Net total income		1049.60
Net income per hectare		524.80

Major sesame market is in Asmara; about 2 percent is sold locally for home use. Since there is no local marketing organization, most farmers are obliged to sell their crops through merchants in Tesseney, Aligider, Omhajer, Barentu, Agordet, and Keren; although few bigger farmers (concessionaries) associated with merchants are able to sell in Asmara.

Under the present conditions of production it is clear that transportation and handling charges are high in relation to other costs. Poor and/or total non-existence of feeder roads in the farming areas necessitate haulage by pack animals to the collecting points where trucks are loaded to the Asmara markets. The road from the port of Massawa leading to sesame producing areas of the Western lowlands is still under maintenance. Such a situation is a disincentive for owners and operators of cost saving transport devices. Those who volunteer to go and transport back sesame demand high service charge usually more than the tariff (Birr 0.05/qn/km) set by the government. Thus, the above mentioned and other diseconomies of scale cause transportation and handling charges to be high.

10. Potentials

Documented facts show that in 1964 in Eritrea, a total of 16,000 hectares of land had been under sesame and a total of 12,250 tons had been produced and exported. According to Aradom Tedla, in 1963 a total of 8431 tons of sesame were exported through the port of Massawa to European and middle East countries. The plan of the recently rehabilitated Aligider cotton plantation project is to put 4000 hectares of land under sesame as a rotation crop with cotton and other crops. Taking into consideration all the present rehabilitation and integration schemes, it is estimated that by the end of the year 1996 about 10,000 hectares of land will be under sesame production[8].

For the sake of simplicity, assuming that 1000 ha. of land is under sesame cultivation, an estimate of the approximate current level of production is made based on present simple farmer cultivation practices in the area. The estimate made is shown on the table below Table 3).

[9]Aradom Tedla, Facts about Eritrea, (Asmara: Printing and Stationery Dept., 1964), P.91

ESTIMATED TOTAL EX-FARM INCOME AND PRODUCTION COST FOR SESAME

Table3

TOTAL AREA	ESTIMATED YIELD	TOTAL PRODUCTION	ESTIMATED SEASONAL PRICE AT ASMARA	ESTIMATED TRANSPORT AND HANDLING COSTS TO ASMARA	ESTIMATED EX-FARM PRICE	TOTAL VALUE PRODUCT EX-FARM	ESTIMATED PRODUCTION COST	TOTAL PRODUCTION COST	ESTIMATED NET INCOME
HA	Q/HA	Q/HA	BIRR/Q	BIRR/Q	BIRR/Q	BIRR/Q	BIRR/Q	BIRR/Q	BIRR/Q
(1)	(2)	(3)=(2X1)	(4)	(5)	6=(4-5)	(7)=(3X6)	(8)	(9)=(3X8)	(10)=(7-9)
2	5	10	350	51	299	2990	194.04	1940.40	1049.60

The present obvious economic deficiencies in the area contribute substantially to inadequate economics of scale. It is understood that any future development of the Western lowlands and other sesame and cash-crop producing areas, must depend on the establishment of adequate infrastructure so that individual entrepreneurs can use their skills to exploit the potential economics of large scale mechanized farming.

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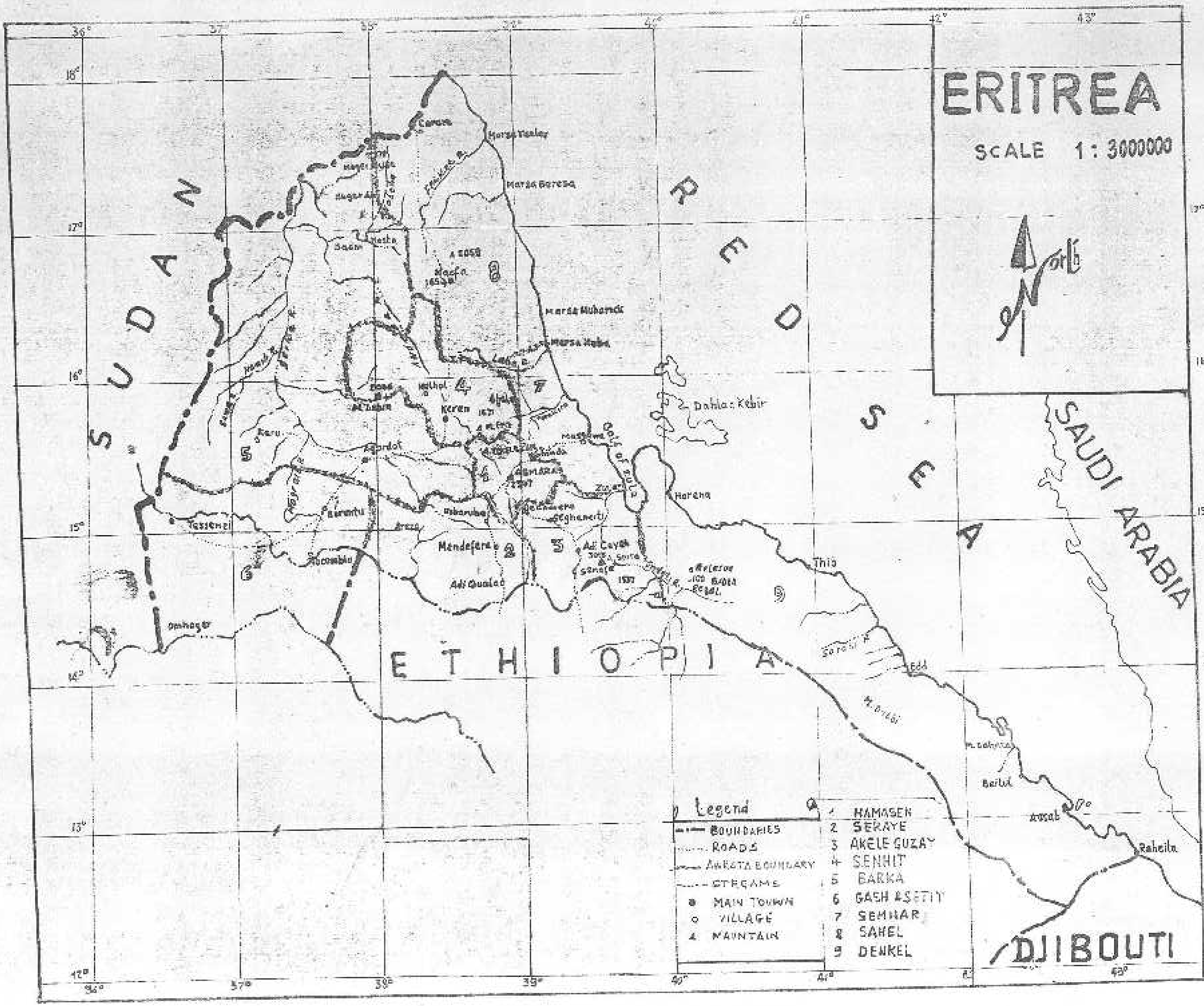
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