

## CASSAVA AND SWEETPOTATO YIELD ASSESSMENT IN MALAWI

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### ABSTRACT

Cassava (*Manihot esculenta* Crantz) and sweetpotato (*Ipomoea batatas* Lam) are important food and cash crops in Malawi. However, key information regarding varieties grown, sources of planting materials, post-harvest handling, utilisation and tuber yields is lacking. A study was, therefore, conducted to source this information. Farmers grow mostly local varieties of cassava with own gardens as the main source of planting materials. Several varieties of sweetpotato are grown with Kenya (SPN/O, bred in Tanzania) as the most popular. Sprouts from previous season's gardens are the main source of planting materials. Cassava and sweetpotato are grown for food and cash. However, in some area cassava stems are used for fuel wood. Most farmers do not store fresh cassava roots but process them into *makaka*, *kanyakaska* and *kadonoska*, or sell them fresh. Processing for sweetpotato is limited to boiling and roasting. Most farmers store sweetpotato, but this is constrained by the sweetpotato weevil damage and rotting. Root yield ranged from 13.1 to 31.4 t ha<sup>-1</sup> for cassava, and 10.2 to 14.0 t ha<sup>-1</sup> for sweetpotato. Except for Nkhata Bay, the yields of both crops were much lower than from research stations. Unavailability of acceptable improved varieties, high incidence of pests and diseases, and poor cultural practices are the main causes of low yields in the targeted areas.

**Key Words:** *Ipomoea batatas*, *Manihot esculenta*, planting materials, weevil

### RÉSUMÉ

Le manioc (*Manihot esculenta* Crantz) et la patate douce (*Ipomoea batatas* Lam) sont des importants aliments et plantes génératrices de ressources en Malawi. Cependant, l'information clé concernant les variétés plantées, les sources de matériels de plantation, les manœuvres post-récoltes, l'utilisation et les rendements de tubercules manque. Une étude était alors conduite pour approvisionner cette information. Les fermiers cultivent souvent les variétés locales de manioc avec comme source principale de matériels de plantation leurs propres champs. Plusieurs variétés de patate douce sont cultivées au Kenya (SPN/O, conditionnée en Tanzanie) comme la plus populaire. Les germes des champs de saison précédente sont la source principale de matériels de plantation. Le manioc et patate douce sont cultivés pour la nourriture et l'argent. Cependant, dans certaines aires les tiges de manioc sont utilisées pour le bois de chauffe. La plus part des fermiers n'entreposent pas les racines de manioc frais mais transforment les en *makaka*, *kanyakaska* et *kadonoska*, ou les vendent frais. La transformation de la patate douce est limitée à l'ébullition et au rôtissage. La plus part des fermiers entreposent la patate douce, mais ceci est gêné par les dégâts et les avaries des charançons. Les rendements des racines ont variés de 13.1 à 13.4 t ha<sup>-1</sup> pour la patate douce. A l'exception de l'aire Nkhata, les rendements des toutes les deux cultures étaient plus bas que ceux des stations de recherche. La non disponibilité des variétés améliorées acceptables, l'incidence élevée des pestes et maladies, et les pauvres pratiques culturales sont les causes principales de faibles rendements dans les aires visées.

**Mots Cles:** *Ipomoea batatas*, *Manihot esculenta*, matériels de plantation, charançon

## INTRODUCTION

In Malawi, maize is the main food crop and occupies 70% of the cultivated land. However, of late cassava (*Manihot esculenta* Crantz) and sweetpotato (*Ipomoea batatas* [L.] Lam) have gained importance as food crops following the drought years of the early and mid- 1990s when maize production was reduced by almost half of the normal production (MoALD, 1994). It is estimated that in 1998 the two crops accounted for 35%, in maize equivalents, of the total food production.

Because of the importance of these crops, Malawi in 1983 joined a regional network on root and tuber crops, the Eastern and Southern Africa Root Crops Research Network (ESARRN) and in 1994 the Southern Africa Root Crops Research Network (SARRNET). The objective of the study was, therefore, to fill gaps in the existing baseline information, particularly on the varieties grown and their sources of planting material, the status of processing and household utilization and the actual farm level yields.

## METHODOLOGY

The study was conducted in Nkhata Bay (Chintheche Extension Planning Area [EPA]), Lilongwe East (Chitsime EPA) and Mulanje (Milonde EPA) Rural Development Projects (RDPs) for cassava; Mzimba (Zombwe EPA), Lilongwe West (Mitundu EPA) and Mulanje (Msikawanjala EPA) RDPs for sweetpotato. The main features of these areas are given in Table 1.

Nkhata Bay and Mulanje were selected to represent areas where cassava is grown for staple, while Lilongwe East represented areas where cassava is grown for snack and the fresh market. Mzimba, Lilongwe West and Mulanje represent major sweetpotato growing areas.

Farmer interviews were conducted and involved about 90 small holder farmers for each crop, 30 from each area. A structured questionnaire was used for the interview. Direct field observations were also made to collect additional information. The information included varieties grown and their uses, cropping systems, sources of planting material, pests and diseases, storage, processing, utilisation, marketing and farm level yields.

TABLE 1. Major features of the areas in which cassava and sweetpotato baseline surveys were carried out

Feature	Mzimba	Nkhata Bay	Lilongwe East	Lilongwe West	Mulanje
Mean annual temp. (°C)	18-21	21-27	18-22	18-21	23
Mean annual rainfall (mm)	600-900	1700-2000	750-900	750-900	1600-2000
Altitude (m.a.s.l.)	1000-1500	450-610	750-1300	1150-1250	500-1000
Soils	Ferruginous, sandy ferrallitic	Ferrallitic, ferrisols; Lithosols	Ferruginous; Lithosols	Ferruginous; Interfluvies	Latosols; lithosols
Main crops	Maize, groundnut, tobacco	Rice, cassava, tea, rubber	Maize, pigeon pea, groundnut,		
Tobacco, cowpea	Maize, groundnut, tobacco, cow pea	Tea, tobacco, rice, maize, groundnut			

Farm level yield assessment was done on crops of at least 9 months old for cassava and 4 months old for sweetpotato. For each crop, 14-16 fields in each target area were randomly selected. Yield was determined by weighing roots from an area of at least 14.6 m<sup>2</sup> for cassava and 8.1 m<sup>2</sup> for sweetpotato.

Data were analysed using the statistical package for social scientists (SPSS).

## RESULTS AND DISCUSSION

**Demography.** Sixty percent of cassava farmers in Nkhata Bay and Mulanje, and 77% in Lilongwe are 26- and 55 years old, and 80-90% of these farmers have at least primary school level education. In Nkhata Bay, women (67% respondents) play a big role in cassava production, while in Lilongwe, men (93% respondents) dominate production of cassava. This could be explained by the fact that in the latter area, cassava is grown mainly for the fresh market.

Sixty percent of sweetpotato farmers in Lilongwe, 90% in Mulanje and 76% in Mzimba are 25 and 55 years old, and 77-97 % of them have primary school level education. About half of these farmers in Lilongwe and Mulanje, and 60 % in Mzimba are men.

### Number and size of fields and varieties grown.

Eighty seven percent of farmers had one to three cassava fields, while 13% had three or more fields. The fields varied in size from 0.57 ha in Mulanje to 1.37 ha in Nkhata Bay.

Most farmers had one to two sweetpotato fields. However, in Mulanje 34% of the farmers had more than two fields. The size of the fields ranged from 0.1 to 0.6 ha.

Farmers grow several varieties of cassavas (Table 2). Most of these are local except for Mkondezi (MK91/478), Maunjili (TMS91934) and Silira (TMS60142A), released in 1999. The varieties grown depend on use.

TABLE 2. Cassava varieties grown by farmers in Nkhata Bay, Lilongwe East and Mulanje RDPs, 2001

Nkhata Bay	Lilongwe East	Mulanje
1. Gomani (87)	1. Manyokola <sup>†</sup> (100)	1. Chithekere (67)
2. Depwete (43)	2. Maunjili <sup>*</sup> (7)	2. Mbundumali <sup>†</sup> (57)
3. Nyankhata (27)	3. Silira (3)	3. Research (30)
4. Nyamalonje (27)	4. Kaligonje (3)	4. Kaligonje (27)
5. Chakuwawa (26)		5. Pangani (23)
6. Mbundumali <sup>†</sup> (23)		6. Mwandirawa (23)
7. Mpuma (17)		7. Ngarangwa (20)
8. Chitala (17)		8. Matuvi (13)
9. Nyaharawa (13)		9. Masangwi (13)
10. Ngw'enyani (10)		10. Balaka (13)
11. Nyamakozo (10)		11. Muyaya (7)
12. Mkondezi <sup>*</sup> (7)		12. Romani (7)
13. Kalumo (7)		13. Makhwekwere (3)
14. Nyachikundi (7)		14. Admarc (3)
15. Masoghabazungu (7)		15. Kalienda (3)
16. Nyasungwi (7)		16. Phirigondo (3)
18. 20-20 (3)		17. Zalamaenje (3)
19. Nyauzumala (3)		18. Kalithekere (3)
20. Nyavisomba (3)		19. Chitedze (3)
21. Nyamwakayuni (3)		
22. Sansi (3)		
23. Chikwinda (3)		
24. Kachamba (3)		

Figures in brackets are the number (%) of respondents growing the variety

\* Improved cassava varieties

<sup>†</sup> Clean planting material from the MoAI/NGOs/SAEENET

In Nkhata Bay where cassava is grown for staple and processed through submerged fermentation, farmers prefer bitter varieties such as Gomani, Depwete, Nyankhata, Nyamalonje and Chakuwawa to guard against theft and monkeys in the field. In Mulanje, where cassava is also grown for staple but processed into *makaka* (non-fermented dried chips) farmers prefer sweet and semi-sweet varieties such as Mbundumali (Manyokola), Chithekere, Kaligonje and Pangani. In Lilongwe, where cassava is grown for snack and the fresh market, sweet varieties such as Mbundumali are preferred.

Farmers look for varieties that have the following characteristics: high yields, acceptable taste (depending on use), high in dry matter content, low in fibre content, good cooking qualities, tolerance to pests and diseases and early maturing. These attributes are important for incorporation into new varieties if such varieties are to be accepted by farmers.

Likewise, farmers grow several varieties of sweetpotato (Table 3). Most of these are local except for Kenya (SPN/0), Semusa (Sensa 74-228) and promising clones, 440131, 420240 and 440077. Farmers prefer varieties that are high yielding, produce big roots, have good taste, and

have high dry matter and low fibre content. Such varieties have high domestic and market demand. Kenya is one such variety. Other varieties are Semusa, Tainoni (Tainon 57) and Mugamba released in 1999. Kenya is an improved variety introduced from Tanzania and released in Malawi in 1988. It is high yielding (25-30 t ha<sup>-1</sup>), early maturing (4-5 months after planting) and high in dry matter content. It is grown by over 60% of farmers in the target areas and is the most popular variety in the country.

Despite the availability of these varieties some farmers are still growing local varieties. Reasons for this include good sprouting, good storability and good taste (Table 4). The ability to sprout is an important factor to farmers for provision of vines.

**Sources of planting material.** Cassava is planted from stem cuttings. The main sources are farmers' own fields. Farmers growing cassava for the first time obtain cuttings from relatives (38% respondents), friends (35% respondents) and neighbours (34% respondents), but thereafter from own gardens (84% respondents). The problem with these sources is that virus-infected plants are used as planting material.

TABLE 3. Sweetpotato varieties grown by farmers in Mzimba, Lilongwe West and Mulanje RDPs, 2001

Mzimba	Lilongwe West	Mulanje
1. Kenya* (49)	1. Kenya* (57)	1. Kenya* (76)
2. Local (8)	2. Kamchiputu (18)	2. Local (5)
3. Joni (8)	3. Yoyela (10)	3. Lingoni (5)
4. Zituwa (6)	4. Local (8)	4. Hybrid (5)
5. Bwatanyina (3)	5. Joni (2)	5. Kamchiputu (3)
6. Semusa* (3)	6. Dankeni (2)	6. Babache (3)
7. Zondenj (3)		7. Kajoni (3)
8. 420240* (3)		
9. Kamteka (3)		
10. Kamphunobi (2)		
11. ChiLilongwe (2)		
12. 440131* (2)		
13. 440077* (2)		
14. Sundwe (2)		
15. Nyabwata (2)		
16. Kamonga (2)		
17. Chilale (2)		
18. Nyavisomba (2)		
19. Chalale (2)		

Figures in brackets are the number (%) of respondents growing the variety

\* Improved sweetpotato varieties

In Lilongwe, cassava is a relatively new crop. As such, planting materials are scarce, especially among new growers. Farmers, in some cases, rely on buying (60% respondents) from each other. The prices range from MK2 to 3.50 (US \$1.00 = MK80.00) per stem.

Early harvesting coupled with few farmer seed multiplication nurseries aggravates the scarcity of planting materials. To take advantage of the high prices during the dry season, farmers sometimes harvest cassava very early (August or September), and leave the stems to dry in the field. In Nkhata Bay and Mulanje, on the other hand, almost every farmer grows cassava and planting material is readily available. The problem is that unhealthy plants are included as planting material.

Sweetpotato is planted from vine cuttings. Farmers obtain the cuttings from neighbours (29% respondents), friends (22% respondents) and relatives (18% respondents) if growing the crop for the first time and from previous season's gardens (86% respondents) if have been growing the crop in the past. These sources are important because in most areas planting materials are given free of charge or sold at very low prices. However, these sources cause delays in planting as farmers rely on sprouts for planting as they rarely multiply the vines themselves in readiness for planting. This is, despite the sensitisation and training in the past 10 years on sweetpotato seed multiplication. As a result, shortage of vines continues to be a constraint at planting.

Apart from own gardens (and nurseries, in few cases), farmers sell to each other vines. This is

more common in Lilongwe (67% respondents) than in Mzimba (47%) and Mulanje (43%). The vines sell at MK40.00 - MK150.00 (US \$1.00 = MK80.00) per 50 kg sack in Lilongwe and MK30.00 - MK50.00 per 50-kg sack in Mzimba and Mulanje. However, farmers lack cash (45%) to buy the vines.

**Utilisation.** Cassava and sweetpotato, apart from being a source of food (raw, roasted, boiled, *nsima*, vegetable) and cash (roots, stems), dry cassava stems are used for fuel wood and are processed into soda ash for preparing vegetable while sweetpotato is also increasingly becoming an important livestock feed.

**Storage of roots and processing.** Once harvested, cassava roots do not keep well for more than two days. As such, most farmers (86% respondents) do not store fresh roots. After harvesting, the roots are immediately sold or processed into products that can easily and safely be consumed or stored such as *kanyakaska* and *kadonoska* in Nkhata Bay and *makaka* in Mulanje (Table 5). In Lilongwe, there is little processing other than roasting, boiling and flour making for brewing sweet beer. Details of the processing procedures are the same as those given earlier on (Moyo *et al.*, 1998; Sauti, 1988).

The main problems in processing include cloudy/rainy weather, peeling and pounding. Cloudy/rainy weather delays drying of roots, which sometimes leads to mould growth while, peeling and pounding are both laborious.

In areas where cassava is processed, almost all farmers (93-97% respondents) store cassava. Reasons for this include excess production (73% respondents), low demand during peak harvesting period (85% respondents), and saving for the rainy season when it is difficult to process the roots (71% respondents). However, long storage of products is hampered by insect pest damage and mould growth.

Generally, many farmers store sweetpotato. The practice is more common in Lilongwe (55%) than in Mulanje (37% respondents) and Mzimba (43% respondents). However, the amount stored is very little for fear of high storage losses due to the sweetpotato weevil (92% respondents), rotting (8% respondents) and sprouting (8% respondents).

TABLE 4. Reasons for growing improved or local sweetpotato variety in Mzimba, Lilongwe West and Mulanje RDPs, 2001

Reason	Respondents (%)	
	Improved	Local
Early maturity	84	0
Big roots	83	0
High yields content	76	0
High dry matter	73	9
Pest/disease tolerance	57	14
Good taste	52	41
Good storability	5	42
Good sprouting	0	67

Sample size = .....

Most of the sweetpotato is consumed or utilised in fresh form with little processing, and this is limited to boiling or roasting.

**Marketing.** Cassava is an important cash crop for farmers, especially in Lilongwe (97% respondents) where over 75% of the cassava produced is sold. Here people depend on maize for staple. In contrast, in Nkhata Bay (44% respondents) and Mulanje (55% respondents), not as much cassava is sold since people depend on cassava as the staple. The money realised from the sale is used for domestic needs (59% respondents) such as buying clothes

and food; farming (29% respondents); buying livestock (25% respondents) and opening up businesses (24% respondents).

Cassava is sold in unprocessed and processed forms. In Lilongwe, it is usually sold fresh, while in Nkhata Bay and Mulanje it is usually sold in processed form. Local people and middlemen are the main buyers (Table 6). Local people buy cassava in small quantities for home use, while the middlemen buy in bulk, usually from the farm, to sell in towns.

At the farm, cassava is sold in 50 kg sacks (Table 7), but in Lilongwe it is also sold per plant

TABLE 5. Main cassava products in Nkhata Bay, Lilongwe East and Mulanje

Product	Respondents (%)			
	Nkhata Bay (n=28)	Lilongwe East (n=14)	Mulanje (n=28)	Mean (n=70)
<i>Makaka</i>	7	14	100	46
<i>Nsima</i>	68	0	29	39
Flour ( <i>kondowole</i> )	36	79	0	30
<i>Kanyakaska</i>	64	0	0	26
Porridge	21	0	4	10
Sweet beer	0	0	28	7
<i>Kadonoka</i>	11	0	0	4
Fermented chips	0	7	4	3

TABLE 6. Main cassava buyers in Nkhata Bay, Lilongwe East and Mulanje

Location	Respondents (%)		
	Local people	Middlemen	Fishermen
Nkhata Bay (n=12)	67	17	17
Lilongwe East (n=29)	76	86	0
Mulanje (n=16)	56	44	0
Total (n=57)	68	60	4

TABLE 7. Unit of charge (MK) for selling cassava in Nkhata Bay, Lilongwe East and Mulanje RDPs

Unit of charge	Respondents (%)					
	50 kg <sup>-1</sup>	Heap <sup>-1</sup>	Kilogramme <sup>-1</sup>	Plant <sup>-1</sup>	Per unit area	Per root
Nkhata Bay (n=15)	80	0	13	0	7	0
Lilongwe East (n=29)	36	18	4	21	7	14
Mulanje (n=22)	64	24	12	0	0	0
Total (n=66)	57	14	13	7	5	4

MK = Malawian Kwacha

or per unit area. In small quantities, cassava is sold per heap, per unit weight or per root.

The prices charged vary with area and season (Table 8). Cassava is more expensive in Lilongwe than in the other areas. It is also more expensive during the slack harvesting than at the peak harvesting period. However, in Nkhata Bay where cassava is harvested throughout the year, there is little price variation with time as supply is almost constant in the year.

Sweetpotato is an important cash crop in Lilongwe (100% respondents), Mulanje (93% respondents) and Mzimba (77%). Farmers sell varying quantities of sweetpotato, with more sold in Lilongwe and Mulanje than in Mzimba. This is also reflected in the revenue realised from sweetpotato sales, with Mulanje having the highest revenue (MK4,150.00 per farmer) followed by Lilongwe (MK2,450.00 per farmer) and Mzimba (MK1,170.00 per farmer). The money realised is used for domestic needs (86% respondents) such as clothes and food; fertilisers (17% respondents); opening up groceries (10% respondents); banking (4% respondents) and paying back loans (2% respondents).

Sweetpotato is mostly sold in fresh, unprocessed form. Middlemen are the main buyers (83% respondents). These buy in bulk from the farm for

sell in towns. The rest of the sweetpotato is sold locally for home consumption. At the farm, sweetpotato is sold using pails (Mzimba) or 50 kg sacks (Lilongwe and Mulanje) but at markets it is usually sold per heap. The prices charged vary with area and season (Table 9).

Sweetpotato is more expensive in Mzimba and Lilongwe than in Mulanje. Zombwe in Mzimba and Mitundu in Lilongwe, the study sites, are within easy reach of the city markets, where demand for sweetpotato is high. This is unlike Msikawanjala in Mulanje which is far from a similar market in Blantyre. Businessmen prefer to buy at a cheaper price from areas, which are far from the markets to cover transport costs. The prices are also lower during peak harvesting periods than at other times of the year.

**Farm-level root yields.** Table 10 presents the farm level cassava yields. The yields were highest in Nkhata Bay (31.4 t ha<sup>-1</sup>) followed by Mulanje (17.6 t ha<sup>-1</sup>) and Lilongwe (13.1 ha<sup>-1</sup>). Shrestha and Mahungu (1993) found similar trends, with Nkhata Bay (19.6 t ha<sup>-1</sup>) having much higher yields than Mulanje (3.7 t ha<sup>-1</sup>) and most other areas. The variability in yield was attributed to differences in varieties, agro-ecologies and management. Except for Nkhata Bay, the yields

TABLE 8. Cassava prices (Kwacha) during the peak and slack harvesting periods in Nkhata Bay, Lilongwe East and Mulanje

Product	Nkhata Bay		Lilongwe East		Mulanje	
	Peak	Slack	Peak	Slack	Peak	Slack
Fresh, unprocessed root	2.00	2.55	4.80	8.20	0.85	1.75
<i>Makaka</i>	1.75	1.75	-	-	1.75	4.20
Flour	3.30	3.30	-	-	-	-

TABLE 9. Sweetpotato prices in Mzimba, Lilongwe West and Mulanje RDPs

Location	Peak harvesting period		Slack period	
Mzimba (n=18)	MK96 /pail	MK4.80 /kg	M163 /pail	MK8.15 /kg
Lilongwe (n=26)	205 /bag*	5.13 / "	315 /bag	8.78 / "
Mulanje (n=25)	79 /bag	1.98 / "	197 / bag	4.93 / "
Total (n=69)		3.97 / "		7.29 / "

\* 50 kg bags by volume

TABLE 10. Variety, age at harvest, cropping system, seedbed type, plant density and fresh cassava root yield in Nkhata Bay, Lilongwe East and Mulanje RDPs

Variety	Nkhata Bay (n=15)	Lilongwe East (n=14)	Mulanje (n=16)
	Various <sup>a</sup>	Mbundumali	Various <sup>b</sup>
Age at harvest (MAP)	14.4	10.8	11.3
Cropping system (% sole)	100	100	56
Seedbed type (%)	87 (13)	100	100
Plant density (plants ha <sup>-1</sup> )	24,665	13,228	12,294
Root yield (t ha <sup>-1</sup> )	31.4	13.4	17.6

MAP = Months after planting; values in brackets represent % mounds and outside brackets represent %ridges

<sup>a</sup>Kachamba, Ngwenyani, Kalomo, Mpuma, Nyamakozo, Nyauzumala, Gomani, Depwete, Chakuwawa, Mbundumali and Korobeka

<sup>b</sup>Chithekere, Manyokola, Makhwekhwere, Kherekhere, Sikisimansi, Mwandilawa, CH92/082, CH92/108, Masangwi and Pangani

TABLE 11. Variety, age at harvest, cropping system, seedbed type, plant density and fresh sweetpotato root yield in Mzimba, Lilongwe West and Mulanje RDPs

Variety	Mzimba (n=16)	Lilongwe West (n=14)	Mulanje (n=16)
	Kenya (63 %); Local (37 %)	Kenya (71 %); Local (29 %)	Kenya (94 %); Local (6 %)
Age at harvest (MAP)	4-5	4-5	4-5
Cropping system	100 % sole	100 % sole	100 % sole
Seedbed type	100 % ridges	100 % ridges	100 % ridges
Plant density (plants ha <sup>-1</sup> )	28,127	33,737	37,911
Root yield (t ha <sup>-1</sup> )	10.2	14.0	12.2

MAP = Months after planting

were much lower than those reported at research stations (25-30 t ha<sup>-1</sup>) (MOA, 1993).

Table 11 presents farm level sweetpotato yields. Kenya was the dominant variety in the fields, with 63% in Mzimba, 71% in Lilongwe West and 94% in Mulanje. Despite its dominance, the yields were very low (6.2 t to 18.3 t ha<sup>-1</sup>) in Mzimba, intermediate (6.9 t to 20.6 t ha<sup>-1</sup>) in Lilongwe West and 6.2 t to 27.9 t ha<sup>-1</sup> in Mulanje. These yields are much lower than those obtained at research stations (MOA, 1993). With good management, Kenya can yield 25-30 t ha<sup>-1</sup> (Makato, 1997). Similar low yields (13.4 t ha<sup>-1</sup>) have been reported by the Ministry of Agriculture and Irrigation (MoAI, 2001).

The low cassava and sweetpotato yields on farmers' fields are attributed to several factors, among which are inadequate extension services, farmer's attitude and poor cultural practices.

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