

# **TRIAL PRODUCTION OF FRESH !NARA SEED OIL**

## **FINAL REPORT**



**SUBMITTED TO THE INDIGENOUS PLANT TASK TEAM (IPTT)**

**Under a Consultancy Contract with the Namibian Agronomic Board**

**Prepared by CRIAA SA-DC**

**Windhoek, December 2008**

## 1- INTRODUCTION

The project proposal “Trial Production of Fresh !Nara Seed Oil” (see *Annex 1*) was submitted to the 46<sup>th</sup> Meeting of IPTT held on 7 February 2007 and approved. A contract was signed with NAB for IPTT (MAWF Funds) on 13 March 2007.

The aim of the project is to test-market cold-pressed, virgin !Nara seed oil as a gourmet exotic and rare quality vegetable oil to assess the potential of this niche market, where rarity and quality are most probably more important than the price. To this end, CRIAA SA-DC was contracted to carry out the following tasks:

1. Produce cold-pressed oil from a 100kg of freshly harvested !Nara seeds (*Acanthosicyos horridis*) procured from the main endemic growing area in the Khuseb delta
2. Organise laboratory analysis of oil samples (oil content, acid and peroxide values, microbiological profile) locally
3. Obtain the fatty acid profiles of oil (sampled from 6 bags) from Aldivia in France (analysis by gas chromatography - GC)
4. Package the !Nara oil in small bottles as samples for further market testing
5. Test-market the oil in Namibia with the samples produced by obtaining feedback from oil gourmets about its culinary potential
6. Review results and plan the way forward.

The !Nara seeds (freshly extracted from fruits) were procured by Pierre du Plessis in January 2007. Weighing of the bags at KAP in Windhoek on 1 March 2007 gave a total weight of 89.2 kg, 10.8 kg short from the targeted 100kg (which can be explained by approximate filling of bags and probably drying of seeds).

Oil processing was conducted at Katutura Artisans’ Project (KAP) at the end of March by Thomas Ambinga, David Ipinge and Julien Gallardo (who summarised the results and took pictures presented below). The oil re-packaging was handled by Letitia Nafuka and Monica Ntinda at CRIAA SA-DC. A progress report submitted to the IPTT in November 2007 was reviewed and edited by Michel Mallet. This final report was produced by Pierre du Plessis.

## 2- PROCESSING METHODOLOGY

Two processing trials with 35kg of seeds were planned, one with conditioning (water addition) and one without.

### 2.1- TRIAL 1 (without conditioning)

#### Equipment:

Press: Kapmond-30 press (30t hydraulic bridge press)

Cage: standard, mild steel, ID 210 x 370 mm

Hammermill: Drotsky S1, 3000 rpm

#### Method:

Processing 35kg of !Nara seeds with the Kapmond-30 press with 4 pressings without water conditioning:

- Filling the cage of the press with whole !Nara seeds
- First pressing
- Removing seeds from the cage
- Crumbling the seed cake
- Filling the cage with the first cake
- Second pressing
- Removing the cake from the cage
- First crushing of the cake with the Hammermill (sieve 3.5mm)
- Filling the cage of the press with the crushed cake
- Third pressing
- Second crushing of the cake with the Hammermill (sieve 3.5mm)
- Filling the cage with the crushed cake
- Fourth pressing
- Removing the cake from the cage

## **2.2- TRIAL 2 (with water conditioning)**

### Equipment:

- same as Trial 1-

### Method:

Processing 35kg of !Nara seeds with the Kapmond-30 press with 4 pressings with water conditioning:

- Filling the cage of the press with whole !Nara seeds
- First pressing
- Removing seeds from the cage
- Crumbling the cake
- Filling the cage of the press with the first cake
- Second pressing
- Removing the cake from the cage
- First crushing of the cake with the Hammermill (sieve 3.5mm)
- Adding and mixing water to the crushed cake ( $\pm 10\%$  by weight)
- Filling the cage of the press with the crushed cake
- Third pressing
- Second crushing of the cake with the Hammermill (sieve 3.5mm)
- Adding and mixing water to the crushed cake ( $\pm 10\%$  by weight)
- Filling the cage of the press with the crushed cake
- Fourth pressing
- Removing the cake from the cage



*!Nara seed processing with Kapmond-30 press*



*!Nara seed cake hammermilling (clean hand hygiene rules were followed)*



*!Nara seed cake conditioning with clean water*

### **2.3- SAMPLING**

The following samples were taken for laboratory analysis:

- one representative sample of seeds among the six bags for oil content,
- two samples of oil (from trial 1 and trial 2) for acid value and peroxide value analysis, and microbiological profile,
- six samples of oil (one oil sample per bag delivered) for fatty acid profile.

### 3- RESULTS

#### 3.1- OIL EXTRACTION YIELDS

3.1.1- Trial 1 (without conditioning) conducted on 26/03/2007

TRIAL 1: WITHOUT CONDITIONING				
!Nara		Batch (kg)	Oil (kg)	Yield (%)
SEEDS		7	0.580	
		7	0.728	
		7	0.592	
		7	0.620	
		7	0.630	
<i>Total</i>		<i>35.0</i>	<i>3.150</i>	<i>9.0</i>
CAKE I		7	0.190	
		7	0.250	
		7	0.200	
		7	0.200	
		3.6	0.140	
<i>Total</i>		<i>31.6</i>	<i>0.980</i>	<i>3.1</i>
CAKE II		7	0.140	
		10	0.070	
		10	0.000	
		3.6	0.000	
<i>Total</i>		<i>30.6</i>	<i>0.21</i>	<i>0.6</i>
<b>TOTAL</b>			<b>4.34</b>	<b>12.4%</b>

Because of a very low oil extraction yield obtained with Cake II, it was decided not to press Cake III.

3.1.2- Trial 2 (with conditioning) conducted on 27/03/2007

TRIAL 2: WITH CONDITIONING				
!Nara		Batch (kg)	Oil (kg)	Yield (%)
SEEDS		7.0	0.60	
		7.0	0.60	
		7.0	0.31	
		7.0	0.31	
		7.0	0.92	
<i>Total</i>		<i>35.00</i>	<i>2.74</i>	<i>7.8</i>
CAKE I		7.0	0.54	
		7.0	0.21	
		7.0	0.20	
		7.0	0.22	
		3.6	0.18	
<i>Total</i>		<i>31.60</i>	<i>1.35</i>	<i>3.9</i>
CAKE II		7.0	0.83	
		7.0	0.79	
		7.0	0.82	
		7.0	0.74	
		5.12	0.58	
<i>Total</i>		<i>33.12</i>	<i>3.76</i>	<i>10.7</i>
CAKE III		7.0	0.15	
		7.0	0.21	
		7.0	0.21	
		7.0	0.17	
		3.7	0.08	
<i>Total</i>		<i>31.7</i>	<i>0.82</i>	<i>2.3</i>
<b>TOTAL</b>			<b>8.67</b>	<b>24.8%</b>

3.1.3- Oil extraction yield comparison

TRIAL		OIL (kg)	YIELD (%)
TRIAL 1		4.34	12.7
TRIAL 2		8.67	24.8

The trial with conditioning gives a better extraction yield than without conditioning almost twice higher.

YIELD (%)	TRIAL 1	TRIAL 2
1st & 2nd pressing	12.1	11.7
3rd & 4th pressing	0.6	13.1

The first and second pressings show nearly the same results between the two trials (12.7% and 11.7% respectively). However, the third and fourth pressings show a completely different extraction yield: 0.6% for trial 1 without conditioning and 13.7% with conditioning.

### 3.2- OIL QUALITY ANALYSIS

#### 3.2.1- Oil content

The analysis of the sample of whole seeds (representative of the six !Nara seed bags) revealed an oil content of only 32.7% (see *Annex 3*). This is much lower than anticipated (around 50%) and explain the relatively low oil extraction yield obtained during the trials.

#### 3.2.2- Acid and peroxide values

TRIAL	A.V.	P.V
TRIAL 1	0.30	2.7
TRIAL 2	0.30	2.7

The acid and peroxide value analysis results of both Trial 1 (“A” in ALS results shown in *Annex 3*) and Trial 2 (“B”) show a very good quality of the oil processed, with no significant difference between the two trials.



*Final production of !Nara seed oil after first decanting and bottling*

#### 3.2.3- Microbiological profile



TRIAL	Total plate count (cfu/ml)	Mould and yeast count (cfu/ml)	Coliform count (cfu/ml)	E. coli count (cfu/ml)
TRIAL 1	5000 estimated	2 mould	300	<10 estimated
TRIAL 2	1000 estimated	2 mould	<100 estimated	<10 estimated

The microbiological profiles of the two samples were performed by Analytical Laboratory Services (ALS) in Windhoek (see *Annex 4*).

According to ALS, the results are acceptable for food oil, though not perfect. It compares with Wilson's Foods (a South African Company) for their refined Canola and sunflower oils: total microbiological (plate) count <1000, Coliforms <10, E. coli: nil, Yeast <50 and Moulds <50.

### 3.2.4- Fatty Acid (FA) profiles

The FA profiles of six oil samples were analysed by gas chromatography (GC) at Aldivia in France. The results (see *Annex 5*) showed that the main fatty acids in !Nara oil are linoleic acid (55.5%), oleic acid (25.5%), palmitic acid (10.8%) and stearic acid (6.9%), with other minor fatty making up the remaining 1.4%.

This FA profile would suggest that !Nara oil is suitable for both food and cosmetic use, but has no particularly interesting properties for either.

## 3.3- OIL PRODUCED AND FURTHER TRIALS

### 3.3.1- !Nara oil further processing trial

Because of the low oil extraction yield obtained, it was decided to process more seeds from the remaining stock to get a sufficient quantity of oil.

A further trial was carried out with warming up the seeds for 5 minutes in an electrical oven until the temperature reaches 45-50°C.

Two 7kg batches were processed separately by two different operators. In Trial 3 the seeds were not warmed up but the cake was, in Trial 4 seeds and cakes were warmed up.



### **3.4- MARKET TESTING**

The work foreseen included re-contacting interested partners, and getting feedback about culinary potential forward. This was done within the context of a partnership around indigenous lipids between PhytoTrade Africa and Aldivia.

#### 3.4.1- Re-contacting previously interested parties

The Swiss natural products company that had approached DRFN about !nara did not respond to repeated messages offering fresh samples.

The South African cosmetics company was still interested but would only move ahead of the oil had a registered INCI name and quality control could be guaranteed.

#### 3.4.2- Consumer feedback on culinary potential

Oil samples were informally offered to various people to gauge their response to the characteristic taste. Tasting samples were also made available at two Open Days at the Gobabeb Training and Research Centre and feedback recorded.

A majority of potential consumers who tasted the oil liked or strongly liked it and indicated that they would be prepared to pay a premium price of up to N\$250/l.

#### 3.4.3- Feedback from Aldivia

In addition to the GC analyses reported above Aldivia has been considering whether it should get further involved with !nara oil (which does not meet the “three producer countries” criterion to become a PTA focal species. The latest (Feb09) report in this regard is that Aldivia feel very passionately that they can do a good job with this specialist oil without compromising the other African oil portfolio, and indeed that it will add general momentum with key customers.

Outstanding questions for a full commercialisation plan include:

- Historical, current and potential production volumes
- Price range / kg
- Seasonal production issues (when harvested, when oil extracted)
- What are the main risks to sustainable and reliable production, including raw material supply and enterprise operations
- Who are the producers of the raw material, how are they organised
- Who would the manufacturer / supplier be, and will they be members of PhytoTrade Africa
- What are (or will be) the key production process steps from harvesting through to oil production, including pre-heating and pressing technology
- Are there likely to be any changes in the process between samples already received and future production
- Are there any known production hazards or problems
- Will there be any seasonal or other major influencers on variation of quality
- Are there any reports on the project and its current status

It is recommended that this list of questions be reviewed and answered as best as possible.

## 3.5- THE WAY FORWARD

### 3.5.1- Seed production and coordinated marketing

Three fundamental problems have bedeviled the commercial production of !nara oil to date:

- it is a small and geographically restricted resource
- it is perceived as a resource in decline
- its harvesters and traditional knowledge owners are disorganized and fragmented

This has led to a situation where two small private-sector operators and at least one “community” project (funded by the GEF SGP) are competing for seed supplies, without any of them approaching commercial viability. ***Unless and until the Topnaar traditional authority and/or MET act to control and regulate !nara seed harvesting, and to organise harvesters into a cooperative, it is unlikely that a sustainable !nara oil industry can or will be developed.***

### 3.5.2- Regulatory compliance

Before !nara oil can be marketed internationally it must at the very least be registered with INCI (for cosmetic markets) or approved under various regulations pertaining to exotic food (e.g. EU Novel Foods regulations). Once this has been achieved, long-term quality assurance measures are still required. ***It is therefore recommended that further work on !nara oil commercialisation be done with a commercial partner like Aldivia, which can take care of these technical aspects.***

### 3.5.3 “We want our own factory”

With all due respect to community aspirations regarding local processing and value addition, it will be a long time before a dedicated !nara oil processing facility in the production area becomes an economically viable proposition, if it ever does. If and when the raw material supply chain issues mentioned in 3.5.1 above are resolved it is recommended that primary producers initially use toll-processing services to build up market volumes.

**Proposal**  
regarding  
**Trial production of fresh !nara seed oil**  
made to  
**Indigenous Plant Task Team**  
by  
**Pierre du Plessis and Julien Gallardo**  
**CRIAA SA-DC**  
**February 2007**

## 1. BACKGROUND

The near-endemic !nara melon (*Acanthosicyos horridus*) of the Khuseb delta is a “Namibian special” that was included in the top-five “first team” of focal species selected for Phase One of the Promoting Indigenous Fruit (PIF) project. Among other product development trials, samples of !nara seed oil were produced, packaged into small bottles and supplied to the Topnaar Community Foundation for trial marketing at the coast.

It soon became obvious that commercialisation of !nara seed oil would be constrained by several factors, most significantly:

- The inherently low availability of the raw material (!nara seed – at most 12 tons/a, not all of which could or should initially be used for oil production so as not to disrupt century-old markets in Cape Town) makes the product an unattractive R&D target for larger commercial partners, because the economic opportunity can never grow very large
- A lack of coherence and collaboration between harvesters leads to a fragmented market, resulting in high transaction costs for raw material procurement
- Insufficient economies of scale make local oil processing sub-economic.

Further work on !nara oil was not prioritised by the Second National Workshop. The IPTT consequently budgeted only N\$20000 for producing fresh oil samples if and when required.

## 2. RECENT DEVELOPMENTS

In 2005 and in 2006 two separate market enquiries were received about !nara oil from what appeared to be suitable (i.e. serious and professional but not very big) commercial partners (one from Switzerland and the other from South Africa). The Ubuntu partnership between PhytoTrade Africa and Aldivia also opened potential new avenues to markets. Finally, plans to transfer to Namibia the technical capacity required to assure food-grade quality in vegetable oils suggested that it might be possible to target the very top end of the gourmet market for exotic oils, where price is no object and inherent rarity probably a marketing asset rather than a drawback.

Initial attempts by the IPTT ad-hoc coordinator to get 100kg of fresh !nara seed for oil production were unsuccessful. In early January 2007 the purchase of 100kg of seed for N\$1500 was organised with help from Dr Joh Henschel at Gobabeb Research and Training Centre, Mr Joel Kootjie of MAWF in Walvis Bay, Mr Swartbooi, chairman of the Topnaar

Community Foundation, and Ms Alexandra Speiser (who fronted the cash and transported the bags to Windhoek).

### 3. WORK PROPOSED

- Step 1: Procure 100kg fresh !nara seed (done, N\$1500 to be refunded to PdP)
- Step 2: Process 70kg fresh seed as per KAP quotation (see Annex A) and budget (N\$6420.25, see Annex B); store remaining 30kg for later processing to determine influence of seed storage on oil quality.
- Step 3: Analyse for oil content, acid value and peroxide value as per KAP proposal
- Step 4: Send 6 samples (from 6 bags) to Aldivia for FA profiles (6 x Euro90 x 9.5 = N\$5130, plus N\$1150 (VAT incl.) handling and shipping = N\$6280)
- Step 5: Test for microbial contamination (N\$1500)
- Step 6: Re-contact interested partners with offer of samples and analyses
- Step 7: Get feedback from oil gourmets about culinary potential
- Step 8: Review results and plan way forward

Some of the oil produced will be test-marketed in Namibia and the rest kept in cold storage pending market feedback.

### 4. SUMMARISED BUDGET

100kg fresh seed	1500
FA profiles	6280
Microbial tests	1500
Coordination and market liaison (2 days x 2300)	4600
<i>Sub-total</i>	<i>13880</i>
Overheads, Management, Admin (15%)	2082
<i>Sub-total</i>	<i>15'962</i>
KAP processing etc. (Annex B)	6'420.45
<b>Total</b>	<b>22'382.45</b>
(Terms: 65% at contracting, 35% after final report)	

### 5. TIMEFRAME

- January 2007: Seed procured
- February 2007: Contract signed
- March 2007: Oil produced and sent for analysis
- April 2007: Market liaison
- May 2007: Final report to IPTT

## **!NARA OIL PROCESSING TRIALS QUOTATION FOR IPTT**

*By: JGa*

*Date: 31/01/07*

100kg !Nara seeds will be provided by the PIF project (P. du Plessis) for new processing trials at KAP. Two processing trials with 35kg of seeds each will be conducted, one with water addition (conditioning) and one without. The balance of 30kg of seeds will be cold stored for three months maximum for further use but not budgeted.

### **TRIAL 1:**

Quantity: 35kg of !Nara seeds

Estimated extraction yield: ±24% (unconfirmed)

#### Equipment:

Press: KAP 30ton press

Cage: standard, mild steel, ID 210 x 370 mm

Hammermill: Drotsky S1, 3000 rpm

#### Method:

Processing 35kg of !Nara seeds with a KAP 30ton press by four pressings and by two cake crushing without adding water to it.

- Filling the cage of the press of whole !Nara seeds
- First pressing
- Removing seeds from the cage
- Crumbling the cake
- Filling the cage of the press with the first cake
- Second pressing
- Removing the cake from the cage
- First crushing of the cake with the Hammermill (sieve 3.5mm)
- Filling the cage of the press with the crushed cake
- Third pressing
- Second crushing of the cake with the Hammermill (sieve 3.5mm)
- Filling the cage of the press with the crushed cake
- Fourth pressing
- Removing the cake from the cage

#### Time needed:

Preparation, hammermilling, recording and cleaning: 0.5 day

Processing: 7kg/cage x 4 pressings = ±0.5 day. Total for 35kg: ±2.5 days

## **TRIAL 2:**

Quantity: 35kg of !Nara seeds

Estimated extraction yield:  $\pm 30\%$

### Equipment:

Press: KAP 30ton press

Cage: standard, mild steel, ID 210 x 370 mm

Hammermill: Drotsky S1, 3000 rpm

### Method:

Processing 35kg of !Nara seeds with a KAP 30ton press by four pressings and by two cake crushing adding water to it.

- Filling the cage of the press of whole !Nara seeds
- First pressing
- Removing seeds from the cage
- Crumbling the cake
- Filling the cage of the press with the first cake
- Second pressing
- Removing the cake from the cage
- First crushing of the cake with the Hammermill (sieve 3.5mm)
- Adding and mixing water to the crushed cake ( $\pm 10\%$  by weight)
- Filling the cage of the press with the crushed cake
- Third pressing
- Second crushing of the cake with the Hammermill (sieve 3.5mm)
- Adding and mixing water to the crushed cake ( $\pm 10\%$  by weight)
- Filling the cage of the press with the crushed cake
- Fourth pressing
- Removing the cake from the cage

### Time needed:

Preparation, hammermilling, recording and cleaning: 0.5 day

Processing: 7kg/cage x 4 pressings =  $\pm 0.5$  day. Total for 35kg:  $\pm 2.5$  days



## Annex B

**KATUTURA ARTISANS' PROJECT (KAP)**

Corner Andrew Mogalie & Attie Potgieter Streets - Katutura, PO Box 23778 Windhoek - Tel. (061) 216308  
 Management: CRIAA SA-DC - Tel. (061) 220117 - Fax: (061) 232293 - criaawhk@iafrica.com.na

To:	<b>IPTT, Att. Pierre du Plessis</b> <b>PIF Phase-1 !Nara Oil Processing Trial</b>
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<b>QUOTATION No</b> <b>IPTT/2007/01</b> VAT reg. No: 2682020-01-05
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Ref:	<b>KAP processing services:</b>  <b>Cold-pressed !Nara seed oil production (2x 35kg seeds), packaging &amp; storage, oil analysis &amp; brief reporting 70kg + 30kg = 100kg of !Nara seeds to be supplied</b>
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<b>Date:</b> <b>01-Feb-07</b> <b>KAP</b> <b>ref.:</b>
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Quotation valid for 1 month

No	Breakdown of costs	Unit	Cost/unit	Nb of units	Total N\$
<b>1</b>	<b>Processing and storage service :</b> 2 trials (with & without seed conditioning): 3 days each (4 pressings per batch)				
1.1	Kapmong-30 processing costs: 2 x 35kg !Nara seeds	day	264.00	6	1,584.00
1.2	Hammermilling seed cake (before 3rd & 4th pressing): 2x 2x 35kg	Kg	1.00	140	140.00
1.3	Cold-storage of seeds and oil (estimated at 3 months max.)	month	90.00	3	270.00
	<b>Sub-total :</b>				<b>1,994.00</b>
<b>2</b>	<b>!Nara oil samples packaging (bottles, labels, labour) :</b> Trial-1 without conditioning: unconfirmed extraction yield +/-24% x35kg = +/-8.5kg crude oil				
2.1	Bottling in 1 litre plastic bottle	bottle	3.50	6	21.00
	Bottling in 100ml plastic bottle with printed label	bottle	3.00	25	75.00
2.2	Trial-2 with conditioning: expected extraction yield +/-30% x35kg = +/-10.5kg crude oil				
	Bottling in 1 litre plastic bottle	bottle	3.50	8	28.00
	Bottling in 100ml plastic bottle with printed label	bottle	3.00	25	75.00
	<b>Sub-total :</b>				<b>199.00</b>
<b>3</b>	<b>Laboratory analysis (ALS Windhoek):</b>				
3.1	!Nara seeds oil content (1 representative sample)	sample	150.00	1	150.00
3.2	!Nara seed oil acid & peroxide values (1 sample per trial)	sample	150.00	2	300.00
	<b>Sub-total :</b>				<b>450.00</b>
<b>4</b>	<b>Technical supervision, recording and brief report :</b>				
4.1	Time (JGa), VAT included	day	345.00	8	2,760.00
4.2	Local travel in Whk (to & from KAP & Lab.): 10km/day @3.00	day	30.00	6	180.00
	<b>Sub-total :</b>				<b>2,940.00</b>
	<b>SUB-TOTAL :</b>				<b>5,583.00</b>
<b>5</b>	<b>Overheads, management &amp; administration</b>	<b>15%</b>			<b>837.45</b>
<b>TOTAL N\$ (including VAT) :</b>					<b>6,420.45</b>

VAT  
included: 813.97

NB. *!Nara seed oil content unconfirmed*  
*Oil extraction yields to be confirmed from trials*  
*!Nara seed oil production estimated*  
*Further use of 30kg of !Nara seeds not quoted*

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**For  
KAP**

DELIVERY.XLS printed: 16/06/2006

RECORD OF DELIVERY TO KAP (please use different sheets for different products)			
Product:	! NARA SEEDS	From:	P. DU PLESSIS
Delivery date & time:	1/3/2007	Delivered by:	J GALLARDO
Record prepared by:	J. GALLARDO	Reference:	! NARA FOR IPTT
Identification of delivery		Weighing	Comments on quality:
Bag No	From	Kg	product & bagging problems (if any)
1	P. DU PLESSIS	10,1	∅
2	"	6,8	"
3	"	5,0	"
4	"	23,4	"
5	"	23,0	"
6	"	20,9	"
6	TOTAL OF THE PAGE :	89,2	Page No: —
6	GRAND TOTAL :	89,2	When more than 1 page used, add up page totals here

**ANALYTICAL LABORATORY SERVICES**

P.O. Box 2108, Windhoek, Namibia  
 Tel (061) 210132 Fax (061) 217102 email analab@mweb.com.na

**TEST REPORT**

To: CRIAA SA-DC  
 P.O. Box 23778  
 Windhoek  
 criaawhk@iafrica.com.na

Date received: 28-Mar-07  
 Date required:  
 Date completed: 03-April-07

Attention: Michel / Julien

**Your Reference: !Nara**  
**Lab. Reference: I070332**

**Type of Sample(s)**

!Nara seeds and oil

**Samples Received**

One and two samples respectively received on the 28/03/2007

**Test(s) Required**

Oil content, acid and peroxide value

**Test Method(s) used**

Deutsche Einheitsmethoden zur Untersuchung von Fetten, Fettprodukten, Tensiden und verwandten Stoffen, 1994

DGF B-I 5 (87) oil content, extraction: petroleum ether bp. 40-60°C for 4h

Sample preparation: crushing with mortar and pestle

Deutsche Einheitsmethoden zur Untersuchung von Fetten, Fettprodukten, Tensiden und verwandten Stoffen, 1994

DGF C-V 2 (81), acid value, titration, indicator: phenolphthalein

Deutsche Einheitsmethoden zur Untersuchung von Fetten, Fettprodukten, Tensiden und verwandten Stoffen, 1994

DGF C-VI 6a (77) peroxide value, Wheeler

**Result**

Sample I.D.	Test	Oil content g/100g ('as is' basis)
1. !Nara seeds A/2007 (with husk)		32.7

Sample I.D.	Test	Acid value mg KOH/g	Peroxide value mEq O <sub>2</sub> /Kg
1. !Nara oil A/2007		0.3	2.7
2. !Nara oil B/2007		0.3	2.7

**Remark:**

\_\_\_\_\_  
 S. Rügheimer  
 Section Head: Microbiology and Food Chemistry

**ANALYTICAL LABORATORY SERVICES**

P.O. Box 2108, Windhoek, Namibia  
 Tel (061) 210132 Fax (061) 210058 email analab@mweb.com.na

**TEST REPORT**

To: CRIAA SA DC  
 P.O. Box 23778  
 Windhoek  
 Fax 232293

Date received: 28-Mar-07  
 Date required:  
 Date completed: 03-April-07

Attention: Julien

**Your Reference: !Nara**  
**Lab. Reference: I070332**

**Type of Sample(s)**

!Nara oil

**Samples Received**

Two samples received on the 28/03/2007 and tested on the 29/03/2007  
 Samples were collected by the client in own sample bottles.

**Test(s) Required**

Total plate count  
 Mould and yeast count  
 Coliform and E. coli count

**Test Method(s) used**

Methods for the microbiological examination of foods (American Public Health Association)  
 Enumeration of aerobic mesophilic organisms in foods  
 CFU/ml  
 Spread plate method  
 Plate count agar, 35°C/48h

Methods for the microbiological examination of foods (American Public Health Association)  
 Enumeration of mould and yeast in foods  
 CFU/ml  
 Spread plate method  
 Dichloran rose bengal chloramphenicol agar, room temperature/5 days

Enumeration of coliform and E. coli organisms simultaneously in foodstuffs  
 CFU/ml  
 Pour plate method  
 Selective E. coli / coliform chromogenic medium, 35°C/48h

**Duration of Test(s)**

29/03/2007-03/04/2007

**Result**

Test	Total plate count cfu/ml	Mould and yeast count, cfu/ml	Coliform count, cfu/ml	E. coli count cfu/ml
Sample I.D.				
1. !Nara oil A/2007	5000 estimated	2 mould	300	<10 estimated
2. !Nara oil B/2007	1000 estimated	2 mould	<100 estimated	<10 estimated

cfu/ml = Colony forming units per ml

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FATTY ACID COMPOSITION OF !NARA OIL (IPTT/CRIAA SA-DC !Nara Oil Trial Processing Project)												
Fatty acid		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Average	Range		Sample A	Sample B
Palmitic acid	C16:0	11.18%	11.15%	10.41%	10.55%	10.73%	10.67%	<b>10.8%</b>	+/-0.4%		10.96%	10.80%
Stearic acid	C18:0	6.62%	6.59%	6.45%	7.32%	7.35%	7.18%	<b>6.9%</b>	+/-0.5%		7.06%	7.15%
Oleic acid	C18:1	27.67%	27.77%	24.02%	23.07%	25.45%	24.74%	<b>25.5%</b>	+/-2.4%		25.29%	25.39%
Linoleic	C18:2	52.96%	52.96%	57.66%	58.39%	54.85%	55.96%	<b>55.5%</b>	+/-2.9%		55.27%	55.16%
Other fatty acids (> C18:3) *		1.57%	1.53%	1.46%	0.67%	1.62%	1.45%	<b>1.4%</b>	+/-0.7%		1.42%	1.50%
Total :		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.0%			100.00%	100.00%

\* Other fatty acids including Linolenic acid (C18:03) around 0.7% (+/-0.1%)

All oil samples produced at KAP in April 2007 as part of the IPTT !Nara Oil Trial Processing Project commissioned to CRIAA SA-DC:

a) Oil samples No 1 to 6: cold-pressed oil extracted from seeds from 6 different bags procured in January 2007

b) Oil sample A: cold-pressed oil from seeds without water conditioning; sample B: cold-pressed oil from conditioned seeds

All oil samples analysed by Aldivia S.A. in Lyon, France:

Method of analysis: Gas Chromatography (GC) Standard Method: NF EN ISO 5508/95 & NF EN ISO 5509/00

a) Oil samples No 1 to 6: Aldivia certificates of analysis dated 20 July 2007 (Ref. batch No EC111/07 to EC116/07), analyses repeated

b) Oil samples A & B: courtesy of Aldivia, certificates of analysis dated 15 May 2007 (Ref. batch No EC109/07 to EC110/07), analyses not repeated