PROMOTING INDIGENOUS FRUIT IN NAMIBIA (PIF)

Phase One Final Report

Submitted to the
Indigenous Plant Task Team
by
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CRIAA SA-DC

Funded by the
Ministry of Agriculture, Water and Rural Development
GOVERNMENT OF THE REPUBLIC OF NAMIBIA

October 2002
Promoting Indigenous Fruit in Namibia: Phase One Final Report

Commissioned and published by the
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Funded by the
Ministry of Agriculture, Water and Rural Development
REPUBLIC OF NAMIBIA

October 2002

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<tbody>
<tr>
<td>AEO</td>
<td>Agricultural Extension Officer</td>
</tr>
<tr>
<td>CBD</td>
<td>Convention on Biological Diversity</td>
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<tr>
<td>CBO</td>
<td>Community Based Organisation</td>
</tr>
<tr>
<td>CBNRM</td>
<td>Community Based Natural Resource Management</td>
</tr>
<tr>
<td>CITRAD</td>
<td>International Research Centre in Agronomy for Development (France)</td>
</tr>
<tr>
<td>COSDEC</td>
<td>Community Skills Development Centre</td>
</tr>
<tr>
<td>CRIAA SA-DC</td>
<td>Centre for Research-Information-Action in Africa – Southern Africa Development and Consulting</td>
</tr>
<tr>
<td>DFID</td>
<td>Department for International Development (UK)</td>
</tr>
<tr>
<td>DFID-FRP</td>
<td>DFID Forestry Research Programme</td>
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<td>DFID-EDF</td>
<td>DFID Enterprise Development Fund</td>
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<td>DFST</td>
<td>Department of Food Science and Technology (UNAM)</td>
</tr>
<tr>
<td>Dia. / ø</td>
<td>Diameter</td>
</tr>
<tr>
<td>DoF</td>
<td>Directorate of Forestry</td>
</tr>
<tr>
<td>DRFN</td>
<td>Desert Research Foundation of Namibia</td>
</tr>
<tr>
<td>EVD</td>
<td>Eokka Activation Drive (Project)</td>
</tr>
<tr>
<td>EWC</td>
<td>Eudafano Women Co-operative Ltd</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agricultural Organisation (United Nations)</td>
</tr>
<tr>
<td>GEF</td>
<td>Global Environment Facility</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information Systems</td>
</tr>
<tr>
<td>GRN</td>
<td>Government of the Republic of Namibia</td>
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<tr>
<td>IFTT</td>
<td>Indigenous Fruit Task Team</td>
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<tr>
<td>ITC</td>
<td>International Trade Centre</td>
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<tr>
<td>KAP</td>
<td>Katutura Artisans’ Project</td>
</tr>
<tr>
<td>KMS</td>
<td>Kalahari Melon Seed (<em>Citrullus lanatus</em>)</td>
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<tr>
<td>MADI</td>
<td>Mashare Agricultural Development Institute</td>
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<tr>
<td>MAWRD</td>
<td>Ministry of Agriculture, Water and Rural Development</td>
</tr>
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<td>MHETEC</td>
<td>Ministry of Higher Education, Training and Employment Creation</td>
</tr>
<tr>
<td>MOV</td>
<td>Means of Verification</td>
</tr>
<tr>
<td>NAB</td>
<td>Namibian Agronomic Board</td>
</tr>
<tr>
<td>NCRs</td>
<td>North Central Regions</td>
</tr>
<tr>
<td>NFRC</td>
<td>Northern Namibia Forestry Committee</td>
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<tr>
<td>NNF</td>
<td>The Namibia Nature Foundation</td>
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<td>NTFP</td>
<td>Non-Timber Forest Product</td>
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<tr>
<td>PIF</td>
<td>Promotion of Indigenous Fruits</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>RDC</td>
<td>Rural Development Centre</td>
</tr>
<tr>
<td>SAFIRE</td>
<td>Southern Alliance for Indigenous Resources (Zimbabwe)</td>
</tr>
<tr>
<td>SANProTA</td>
<td>Southern African Natural Products Trade Association</td>
</tr>
<tr>
<td>S&amp;AP</td>
<td>Strategy and Action Plan</td>
</tr>
<tr>
<td>SIDA</td>
<td>Swedish International Development Agency</td>
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<tr>
<td>SME</td>
<td>Small and Medium Enterprise</td>
</tr>
<tr>
<td>UNCED</td>
<td>United Nations Conference on Environment and Development</td>
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<tr>
<td>UNCTAD</td>
<td>United Nations Conference on Trade and Development</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
</tr>
<tr>
<td>UDPD</td>
<td>Useful Plant Development Project</td>
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<tr>
<td>VTC</td>
<td>Vocational Training College</td>
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</table>
EXECUTIVE SUMMARY

The *Strategy and Action Plan for Promoting Indigenous Fruit in Namibia* was based on the deliberations of the 1st PIF workshop held in April 2000. The Indigenous Fruit Task Team (IFTT) formed after this workshop contracted CRIA SA-DC (through NAB) to implement PIF Phase 1 (budget of N$714 495 provided by MAWRD) to start implementation of the action plan. Phase 1 started in March 2001 and the draft final report was circulated in November 2002.

PROMOTION STRATEGY: “PRODUCT DEVELOPMENT PIPELINE”
(see table below)

- ID resources with potential (literature, market developments)
- Assess supply (ecological and socio-economic)
- Trial purchases (costs, availability, logistics)
- Trial processing (samples)
- Market assessment (potential, “right-sized”)
- Product development partnerships
- Scale up if and when successful (as appropriate for each resource)

This work is:
- on-going (clients cannot wait for project budgets to become available)
- dynamic process (priorities change, require flexibility)
- slow (at least 5 years to bring new cosmetic ingredient to market)

PIF Phase 1 had 3 main components:
- trial purchases
- trial processing
- trial marketing

PIF Phase 1 priority spp.:
- marula
- manketti
- melon seed
- makalani
- llnara

Second team:
- *Berchemia discolor* (eembe, bird plum)
- *Ximenia* spp. (sour plum, eembeke)
- *Diospyros mespiliformis* (jackal berry, eenyandi)
- *Adansonia digitata* (baobab, omakwa)

“Light and wide” initial assessment of other resources
MAIN ACHIEVEMENTS

Kalahari Melon Seed (KMS) exports to UK for use by The Body Shop

- procurement, cleaning (which included designing and building a mechanical cleaner), packaging and export of KMS from the NCRs to the UK
- more than 44 tons in 2001 (turning over N$352 000 of which N$95 000 (27.25%) was paid out in cash to primary producers
- around 50 tons in 2002 (despite the drought)
- further orders for 2003
- processing and refining by a specialist oil processor in UK
- formulated into a skin lotion and launched in international markets (48 countries) as Melon Seed Body Butter
- additional products launched by The Body Shop
- serious commercial interest from other buyers
- private-sector processor in Ondangwa (Yetu Cosmetics/Oontanga Oil Factory) landed an order for a few tons of KMS oil on the back of these Community Trade exports
- there is now a formal market for about 150 tons of KMS a year (at N$2/kg worth N$300 000 to farmers) which is expected to grow rapidly over the next few years

Small marula presses (juice and oil)

- 10 small hydraulic presses (designed and manufactured at KAP) disseminated in NCRs (cost about N$4 000 each, plus N$1 200 for optional oil pressing equipment)
- presses far exceeded expectations under field conditions (up to 200 litres a day)
- only minor technical problems, rectified in improved design (2003)
- inspired RDC (Ongwediva) to develop an alternative design for such a press
- provided access to enough fruit, press is a viable SME technology
- further growth depends on extent of local and national informal markets for marula cider (omaongo)
- 12 such presses used for larger processing trial in March/April 2003
- solar batch pasteuriser (developed for PIF by Rolf Behringer of the Solar Stove Project at Valombola VTC) used to prove the principle of solar pasteurisation of marula juice
- combined with the small juice press theoretically capable of producing around 50 litres of pasteurised marula juice a day, so producers can sell omaongo in local or national markets at any time of the year

Ximenia oil production

- production of Ximenia oil in Namibia was systematically studied for the first time (initially under the Sida/NNF-funded X-otic project, continued under PIF)
- samples of this unusual oil were made available to research and commercial partners for evaluation
- no formal export market yet, but serious interest
- Ximenia oil extraction is technically difficult
- using a rotary seed roaster designed at KAP oil yield was increased from less than 10% to around 25%
- improving the technology depends on feedback not yet provided by the research partner
- need better understanding of the distribution and potential production of Ximenia in Namibia
Manketti oil promotion continued

- CRIAA SA-DC started promoting manketti oil in 1997
- PIF 1 provided funding to continue
- fresh oil samples were produced and supplied to research partners
- active R&D interest in manketti oil
- not yet translated into substantial market demand
- also SANProTA focal species
- eventually large high-value market niches

!Nara oil production

- cold-pressed !nara oil was produced for the first time (by KAP) and packaged for local marketing
- remains unclear whether the !nara resource is big enough to interest export markets
- local oil processing could add significant additional value for harvesters
- community-owned oil pressing enterprise will face considerable management challenges and might not attain the necessary economies of scale
- advisable to out-source processing services at least until a bigger market has been secured

Active participation in SANProTA

- 1st workshop stressed need for regional cooperation
- participation in SANProTA initially supported from PIF funds
- has opened additional opportunities and sources of funding
- CRIAA SA-DC has secured an R&D grant of US$12 000 to further investigate processing of melon seed and manketti, and DoF NFRC has been granted US$2 000 to collect samples
- cooperation with other SANProTA members can potentially open up market channels through which to commercialise Namibia’s limited baobab and Kigelia resources

Marula oil product launch by The Body Shop

- not part of the PIF project as such, but major result from earlier national efforts to promote indigenous fruit commercialisation
- first consumer products containing Namibian marula oil (produced by Eudafrano Women’s Cooperative)
- took six years to bring this new natural product to formal markets

INCONCLUSIVE ADVANCES

Formulating liqueurs based on indigenous fruits

- using marula, *Strychnos* (omauni) and *Berchemia* (eembe)
- system needed to deal with seasonal and regional variations in fruit quality
- initial results suggest it would be worthwhile spending additional money on product development and packaging design
- private sector partnerships need to be investigated more systematically
Formal markets for marula juice/pulp

- serious formal-market interest in marula pulp (from European cosmetics sector and South African juice manufacturers)
- practicalities of larger-scale marula processing investigated in 2003 (MJP³, continuation of PIF)
- enough information to design practical production system, but fruit supply might be problematic
- further cooperative research being planned with CIRAD of France and other Namibian partners

Jams, chutneys etc. from various fruits

- processing trial results have been inconclusive
- some of the products are good enough to find acceptance in formal markets, BUT not clear that any such enterprise beyond SME scale would be economically viable under Namibian market conditions
- hard for such products to break into regional markets, and almost impossible to penetrate developed-country markets
- major constraint on development of SMEs of this type is difficulty in obtaining suitable bottles and labels
- KAP has started stocking and selling on a cost-recovery basis two different types of jam jars (complete with lids and already packed into cardboard boxes of 24 to ease transportation and marketing) – this needs promotion and expansion

Manketti nut processing

- demonstrated on very small scale that manketti nuts can be manually removed from their hard pericarps in an economically viable manner
- has to be done under supervision (for quality control and health reasons) at a central location
- samples produced so far have been too small to allow market testing
- whole nuts as snacks can create many additional employment opportunities and diversify manketti product range
- further work on this – which should include trials of improved manual technologies – should be designed into an integrated manketti processing pilot project
- two models of an improved spring steel blade for manketti decortication were designed and field-tested (under the Ekoka Activation Drive (EAD) project funded by the Sida/NNF Swedish Local Environment Small Grants programme)
- 30 copies of the preferred model have been manufactured for dissemination in manketti-producing areas

Mopane seed essential oil

- small sample has been produced through laboratory-scale steam distillation
- additional analyses needed to determine if it is sufficiently unique to warrant further production efforts
- a large and unutilised resource
- further work justified to establish whether large-scale collection and processing would be an economic proposition
Strengthening CBOs

- trial and commercial-scale purchases strengthen community interest in indigenous natural resources
- income opportunities have contributed significantly to strengthening CBOs
- need for much more support to such emerging groups, especially in the form of organisational and business training

Truffle preservation

- preservation trials with Kalahari truffles have yielded promising results
- highly seasonal (rainfall-dependent) resource
- CRIAA SA-DC collaborating with Israeli researchers to study co-cultivation of truffles with melons

OTHER ISSUES AND ACTIVITIES

- PIF project has contributed to the national debate around access and benefit-sharing related to genetic resources – this is a matter that must be carried forward by a national institutional (GRN) stakeholder as a matter of urgency
- PIF project excluded all non-fruiting plants and non-fruit products from indigenous plants, which made it hard to respond to market enquiries for these products (and alternative natural products from non-indigenous plants that can be marketed through the same channels)

CONSTRAINTS AND PROBLEMS

- failure to secure more active, enthusiastic and effective participation by Unam
- distillation trials have yielded – with a few exceptions – rather disappointing results – further work recommended in this regard
- very limited opportunities for detailed resource surveys not regarded as a serious short-term obstacle, but should be addressed in future, preferably by involving DoF/MAWRD field-workers in the compilation of a more detailed national description of the distribution and density of various species of commercial interest

SUMMARY OF RECOMMENDATIONS

In addition to recommendations in the text (highlighted in bold italic), the following activities are recommended (in order of priority):

1. Pilot-scale marula juice and pulp processing
2. Pilot-scale manketti spirits, nuts and oil processing
3. Continued support to KMS market development, extension messages, cultivation guidance and quality control
4. Continuation of the “pipeline approach” for other promising species
5. More systematic assessment of Ximenia raw material supply and oil processing
6. Feasibility study and business plan for a privatised, for-profit natural product incubation business that can leverage public funding, mobilise private and venture capital, secure equity ownership for primary producers and take commercial risks
<table>
<thead>
<tr>
<th>PIPELINE - SUMMARY TABLE (JULY 2003)</th>
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<tbody>
<tr>
<td><strong>CURRENT TRADE</strong></td>
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<tr>
<td>-------------------</td>
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<tr>
<td>EWC exports (Local sales) Informal sector</td>
</tr>
<tr>
<td>None</td>
</tr>
<tr>
<td>Limited local</td>
</tr>
<tr>
<td>Samples (Informal sector)</td>
</tr>
<tr>
<td>Informal sector</td>
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<tr>
<td>Informal sector</td>
</tr>
<tr>
<td>EWC/CRIAA SA-DC sees exports to UK Contango Oil Factory Oil exports to UK</td>
</tr>
<tr>
<td>TCF Informal sector Various exporters</td>
</tr>
<tr>
<td>KAP for TCF, but very limited</td>
</tr>
<tr>
<td>None</td>
</tr>
<tr>
<td>Informal sector</td>
</tr>
<tr>
<td>Whole fruit only, informal markets</td>
</tr>
<tr>
<td>Zimbabwe, Tanzania, West Africa None in Namibia</td>
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<tr>
<td>Limited informal market for traditional oil Mayb Oontango Oil Factory (rumours not confirmed)</td>
</tr>
<tr>
<td>None known</td>
</tr>
<tr>
<td>None in Namibia Limited in Zim, W. Africa to EU</td>
</tr>
<tr>
<td>None known</td>
</tr>
<tr>
<td>SPECIES/PRODUCT</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Eembie - fruit</td>
</tr>
<tr>
<td>Eembie - oil</td>
</tr>
<tr>
<td>Styphnasia spp. - fruit</td>
</tr>
<tr>
<td>Styphnasia spp. - oil</td>
</tr>
<tr>
<td>Disopyros nigrafoliosa - fruit</td>
</tr>
<tr>
<td>Vangueria infausta - fruit</td>
</tr>
<tr>
<td>Kalahari fruits</td>
</tr>
<tr>
<td>Grewia spp. - fruit</td>
</tr>
<tr>
<td>Ziziphus mucronata - fruit</td>
</tr>
<tr>
<td>Tyloosia esculenta - nuts</td>
</tr>
<tr>
<td>Cuscuta medullosa - fruit</td>
</tr>
<tr>
<td>Diospyros engleriana - fruit</td>
</tr>
<tr>
<td>Gelsemium cedaneoefolia - seeds and roots</td>
</tr>
<tr>
<td>Ocimum pulla - oil</td>
</tr>
<tr>
<td>Creston gratissimus - leaves for essential oil</td>
</tr>
<tr>
<td>Bitihornia - leaves for essential oil</td>
</tr>
<tr>
<td>Ternandia serrata - moth plant</td>
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</table>

Dried fruits are popular and fetch high prices - not clear that value-added products would be affordable, fresh fruits too soft for central processing.

Around 15% oil content, but seeds not available in sufficient quantities; no records of oil production or use.

Very suitable for fresh trade, good flavour, problematic texture.

Few references in literature, but no known commercial production ever.

Fairs if seed as hy-products.

Trally abundant and popular fresh and dried; no soft for fresh processing.

Popular fresh and dried; improved varieties for agro-forestry.

Hung potential if co-cultivation with melons is successful.

Important famine feed, fairly widespread, low value overall.

Easy to grow; good live fence, include in agro-forestry trials.

Cultivation trials in RSA and USA (mainly as root vegetables); increasing oil potential cop.

Cultivated in New Zealand; probably more suitable for domestication as a crop than for wild harvesting.

Unreasonable harvesting practices; further commercialisation not viable.

Important subsistence food; oil production reported in literature but potential unclear at this stage.

Appears to be quite rare; oil produced by traditional methods in Kavango, Botswana, Zambia.

Might not be able to compete with real lavender.

A vast resource, if commercially viable use can be found.

Large resource; sales of bark could help offset cost of field clearing; rooibark harvesting needs careful control to avoid unsustainable use.
MAIN REPORT

1 Background

The first Promotion of Indigenous Fruit workshop held in April 2000 was requested by the Minister of Agriculture, Water and Rural Development, Hon. Helmut Angula MP, "to develop a coordinated approach and strategy for the implementation of an economically sustainable promotion of indigenous fruits in Namibia". The workshop was called by the Directorate of Agricultural Research and Training (with the Namibian Agronomic Board as management agents and CRIAA SA-DC as facilitators) and was attended by about 40 participants from Government, academic institutions, NGOs and donor organisations. A major output of the workshop was the creation of the Indigenous Fruit Task Team (IFTT), which coordinated the compilation and publication of a Strategy and Action Plan for Promoting Indigenous Fruits in Namibia based on the workshop deliberations, and acts as the steering committee for the PIF project.

The original Project Proposal for PIF Phase One (based on an earlier Concept Note and the Strategy and Action Plan approved by the IFTT) was designed to run for 16 months (until May 2002) at a cost of N$1 136 259. At the request of key IFTT members this was later reduced to a budget of N$998 074, mainly by contracting it to run over 8 months (Feb 01 to Sep 01). Both these budgets were based on a misunderstanding about the available funding (the IFTT was only informed later that 50% of the MAWRD budget administered by NAB was earmarked for mahangu work). The revised proposal was considered and approved by the IFTT in stages, as Phase 1a (N$476 157,50) and Phase 1b (N$238 337,50).

Implementation of Phase 1 started in March 2001. In light of the uncertainties about funding, a conservative approach to spending the budgets was taken throughout (e.g. by saving days and kilometres on fieldtrips, holding back on analyses until they could be better targeted, and – in some cases where the work was of dubious value to emerging priorities – by not spending certain budget lines at all). By mid-August 2001 (13th IFTT meeting) it became clear that the IFTT would not be in a position to allocate further significant funding before March 2002 – right in the middle of the next marula season.

CRIAA SA-DC therefore proposed (and the IFTT accepted at its 14th meeting on 28 September 2001) that the PIF 1a and 1b projects should be combined into one and re-budgeted to run until March 2002. At its 15th meeting the IFTT further agreed that this no-cost extension could incorporate elements included in the original project proposal but not approved under PIF 1a & b.

In January 2002 the IFTT approved this no-cost amendment of the project, which consolidated Phases 1a and 1b, removed some of the planned activities, added some other activities from the original project proposal and extended the implementation period. This final report is based on the amended and consolidated project document (see Appendix 1).

The report is not intended as a blow-by-blow account of every activity under PIF over 18 months of implementation (such details can be gleaned from the various written and verbal interim reports provided to the IFTT, as well as from the appendices and financial report attached). Instead it summarises the main achievements, elucidates the main constraints, draws out the significant lessons learnt and describes the current commercialisation stage and status of targeted resource, so as to provide guidance for planning Phase 2 of PIF.
2 Budget and expenditure

The IFTT approved a budget of N$714 495 for PIF Phase 1 (from funds provided by MAWRD and administered by NAB) – see financial report attached as Appendix 2.

In addition to the funding provided by MAWRD/IFTT, CRIAA SA-DC supported the implementation of PIF by:

- contributing around N$200 000 in cash flow to the first round of Kalahari melon seeds (KMS)\(^1\) exports (which was recovered from sales income)
- contributing around N$165 000 (at a consultancy rate of N$1 725/day) in unpaid person-days, as well as N$25 000 in additional vehicle expenses, to the first round of KMS exports (which were not recovered)
- deferring payment of more than N$60 000 in heavily discounted coordination, market liaison and administration charges on KMS exports to the second year of operations
- realising significant savings by exploiting synergies (e.g. shared transport costs, additional time in the field) from the funding (around N$300 000) provided by DFID-FRP to the “Winners and Losers in Forest Product Commercialisation” project
- using additional synergies from work done under the DFID-EDF funded Southern African Marula Oil Producers Network to contribute to marketing work around the KMS exports
- pre-financing development of a small marula juice/oil press to the tune of N$12 750
- raising N$57 500 from the SIDA Swedish Local Environment Small Grants Fund (administered by NNF) for *Ximenia* (embeke/oombeke) oil production trials under the X-otic project
- raising a further N$32 500 from the Sida/NNF Swedish Local Environment Small Grant programme for the Ekoka Activation Drive (EAD) project.

CRIAA SA-DC (UK) contributed at least another N$120 000 in unpaid market liaison time despite repeated requests to the IFTT to find additional funding for this indispensible work. There were no charges for the last 12 months’ use of processing and storage space at KAP, or the last six months of “unofficial” project coordination (April to September 2002) or for the production of this final report (which required more than three weeks of intensive work).

*It is recommended that future phases of PIF include contingency funding to accommodate the process nature of promoting the commercialisation of indigenous resources.*

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\(^1\) *Citrus lanatus*
3 Main achievements

During the implementation of PIF Phase 1 Namibia took some significant steps forward in promoting the commercial use of indigenous fruits and fruit products:

a) Procurement, cleaning (which included designing and building a mechanical cleaner), packaging and export of more than 44 tons of KMS from the NCRs to the UK, turning over N$352 000 of which N$95 000 (27.25%) was paid out in cash to primary producers (see *KMS Special Report* attached as Appendix 3, and see also Appendix 11). After processing and refining by a specialist oil processor the KMS oil was formulated into a skin lotion and launched in international markets (48 countries) as *Melon Seed Body Butter* by The Body Shop. A second export order for 105 tons of KMS has been received and is being collated. A private-sector processor in Ondangwa (Yetu Cosmetics/Oontanga Oil Factory) landed an order for 6 tons of KMS oil on the back of these Community Trade exports (after years of failing to break into the international market and despite consistent refusal to cooperate with the IFTT). Between the 2002/03 KMS exports and Yetu’s projected seed requirements there is now a formal market for about 150 tons of KMS a year (at N$2/kg worth N$300 000 to farmers) which is expected to grow rapidly over the next few years (barring major set-backs caused by the current drought in the region).

b) For the first time ever in Namibia, marula juice (for omaongo production) was extracted mechanically using small hydraulic presses designed by KAP and disseminated by CRIAA SA-DC under PIF (see Appendix 4 for a report on the press by the designer, Roger Gamond). The presses far exceeded expectations under field conditions (some operators achieved up to 200 litres a day – more than 300% the predicted daily production) with only minor technical problems (all of which could be rectified in the field, or with assistance from the Rural Development Centre in Ongwediva, which was approached by Eudefano Women’s Cooperative to assist press owners with repairs). Repairing the KAP presses inspired RDC to develop an alternative design for such a press (it would be interesting and useful to do some systematic comparative performance trials with the two press designs). Most of the KAP presses have now also been adapted for small-scale production of marula oil for local markets (see Appendix 5 for a report on marula oil pressing with this technology). Many enquiries about and several tentative orders for such presses have been received from prospective entrepreneurs and community groups, and there have even been enquiries from other Southern African countries.

c) A prototype of a solar batch pasteuriser was developed for PIF by Rolf Behringer of the Solar Stove Project at Valombola VTC and used to prove the principle of solar pasteurisation of marula juice (building on earlier pasteurisation trials by Roger Gamond – see Appendix 6). Once the prototype is scaled up (see Appendix 7 for a report on the calculations used to determine the size of a full-scale model) it can be combined with the small juice press into a technology package theoretically capable of producing around 50 litres of pasteurised marula juice a day, which will enable producers to sell omaongo in local or national markets at any time of the year (the fermentation of marula juice after it has been pasteurised – and the natural yeasts killed – needs to be studied more closely). The use of solar power will result in significantly lower energy costs during production (compared to electricity or gas), allow the package to be used in areas where such energy sources are hard to come by, and limit deforestation from fuelwood harvesting. Outside the marula season the pasteuriser can also be used as a solar oven for cooking and baking.
d) The production of *Ximenia* oil in Namibia was systematically studied for the first time (initially under the Sida/NNF-funded X-otic project, continued under PIF) and samples of this unusual oil (produced at KAP and by traditional methods – see Appendix 8) were made available to research and commercial partners for evaluation.

e) After several years of inconclusive market exploration a serious and well-resourced development partner (in the form of a major multinational and its specialist oils and fats subsidiary) has finally taken an active R&D interest in manketti oil (and *Ximenia* oil). While this has not yet translated into substantial market demand (and is unlikely to do so for at least another year or two) it does hold out the promise of eventually developing large high-value market niches for these oils, based on their special properties. Because these resources also occur in significant quantities in other countries Namibia has only limited competitive advantages (being first; higher manketti distribution density; tradition of *Ximenia* oil production and use) and must do everything it can to secure its position as a preferred supplier to industry by demonstrating that it can reliably supply superior products.

f) Cold-pressed !nara oil was produced for the first time (by KAP) and packaged for local marketing. It remains unclear whether the !nara resource is big enough to interest export markets (initial interest from a few potential buyers has not yielded conclusive results) but local oil processing could add significant additional value for harvesters – at least to part of their production (see Appendix 9 for a report on !nara seed oil pressing by Roger Gamond). The Topnaar Community Foundation has reported interest in the oil from retail and tourist outlets at the coast. A community-owned oil pressing enterprise will face considerable management challenges and may not attain the necessary economies of scale, making it advisable to continue out-sourcing processing services at least until a bigger market has been secured.

g) Namibia’s active participation in SANProTA (which participation was initially partly supported from PIF funds) has opened additional opportunities and sources of funding. CRIAA SA-DC has secured an R&D grant of US$12 000 to further investigate processing of melon seed and manketti, and DoF NFRC has been granted US$2 000 to collect samples of manketti, baobab, *Kigelia* and melon seed from Namibia for a regional assessment of quality variation. Cooperation with other SANProTA members can potentially open up market channels through which to commercialise Namibia’s limited baobab and *Kigelia* resources. Cyril Lombard of CRIAA SA-DC has been designing SANProTA’s R&D strategy on a consultancy basis and has recently agreed to act as the association’s interim agent in Europe (provided the donors approve the necessary changes to the budget).

h) Indigenous fruit trees and their relationship with traditional knowledge about land units has been selected as the topic of the 11th Summer Desertification Programme to be run by DRFN at the end of 2002. This work is expected to result in an improved understanding of the cultivation potential of various fruiting species, and to raise awareness at various levels of society about the sustainable development potential of Namibia’s indigenous resources. In the longer term the data from SDP11 will also contribute to the design of improved agro-forestry systems in northern Namibia.

While it was not part of the PIF project as such, it is worth mentioning that the first range of consumer products containing Namibian marula oil from the Eudafano Women’s Cooperative – The Body Shop’s new make-up range – has finally been launched in international markets. The fact that it took six years to bring this new natural product to formal markets indicates the time-scales that are realistic in this type of work (at least for cosmetic ingredients – food products are subject to stricter regulations and may take even longer to reach international markets, while prescription pharmaceuticals may take up to 20 years – if the huge R&D budgets needed are available.)
4 Inconclusive advances

As could be expected, not all the work done so far under PIF has yielded unambiguously positive results. Project areas where there has been significant progress but no conclusive successes are as follows:

a) Although no market-ready products have been developed yet, there has been some solid initial work on formulating liqueurs based on indigenous fruits, specifically with marula and *Strychnos* (omauni), and to a lesser extent with *Berchemia* (eembe). A reliable and cost-effective source of full-strength neutral alcohol for formulation has been identified. It has become clear that a system needs to be devised to deal with seasonal and regional variations in fruit quality (the most likely solutions are scaling up volumes to facilitate blending, maturation in wooden vats, and mixing the production of two or more years). Initial results suggest it would be worthwhile spending additional money on product development and packaging design. The possibilities for private sector partnerships need to be investigated more systematically.

b) The existence of serious formal-market interest in marula pulp (from the European cosmetics sector and South African juice manufacturers) has been established beyond doubt, but a lack of knowledge about the practicalities of larger-scale marula processing, and the absence of a technology package or collation system capable of producing the required quantities at the right quality, have prevented a more active engagement with these potential buyers at this stage. In a related vein (successful pasteurisation trials notwithstanding) there is still no practical, reliable and affordable way to preserve large quantities of marula pulp for transport over long distances, short of a major investment in refrigeration technology (which might not be justified by the scale of the available opportunities). Reports from South Africa indicate that the IFTT was right not to acquire the Indian/Brener pulping package promoted by Infruitec (see further discussion under 7a) Marula below).

c) Two lots of marula fruit were sent to CIRAD in France for processing trials. Unfortunately the delay in starting this work, and the unusually dry 2002 rainy season, meant that the fruits that could be supplied (first batch in mid-April and second in early May) were not of very good quality (they were unusually dry and heavily infested with fruit-fly). Thought should be given to doing follow-up work during the 2003 marula season.

d) Processing trials designed to develop jams, chutneys etc. from various fruits have been inconclusive – some of the products that were developed (including the marula jam formulated by Dr Keya) are good enough to find acceptance in formal markets, but it is not clear that any such enterprise beyond SME scale would be economically viable under Namibian market conditions (it will be hard for such products to break into regional markets, and almost impossible to penetrate developed-country markets). A major constraint on the development of SMEs of this type is difficulty in obtaining suitable bottles and labels for packaging their products; in an attempt to overcome this problem KAP has started stocking and selling on a cost-recovery basis two different types of jam jars (complete with lids and already packed into cardboard boxes of 24 to ease transportation and marketing). This service needs promotion and expansion. Trial results for individual species are discussed in more detail below.

e) It has been demonstrated on a very small scale that manketti nuts can be manually removed from their hard pericarps in an economically viable manner, provided this is done under supervision (for quality control and health reasons) at a central location. However, the samples
produced so far have been too small to allow for market testing. Since whole nuts for use as snacks can create many additional employment opportunities and diversify the manketti product range, further work on this – which should include trials of improved manual technologies – should be designed into an integrated manketti processing pilot project (see 7b) Manketti below). Two models of an improved spring steel blade for manketti decortication were designed and field-tested under the Ekoka Activation Drive (EAD) project funded by the Sida/NNF Swedish Local Environment Small Grants programme – 20 copies of the preferred model (which has the blade running parallel to the base) have been manufactured for distribution under EAD, and a further 10 have been acquired by PIF for dissemination in other manketti-producing areas.

f) *Ximenia* oil extraction is technically difficult (at least with the 30 ton Kapmond hydraulic press – with the Mini 50 expeller at KAP it is impossible, although it might be feasible with a different type of screw expeller using the correct settings, shaft speed and pre-treatment). Using a rotary seed roaster designed at KAP oil yield was increased from less than 10% to around 25% but the oil is very sticky and hard to process (see Appendix 8 for a report by Roger Gamond on *Ximenia* oil processing). Further improving the technology depends on a large extent on feedback that has not yet been provided by the research partner (the lecithin/phospholipids responsible for the stickiness could be desirable in some industrial applications). It might be worthwhile to investigate other alternatives (e.g. solvent extraction) as a way to supply local markets for “traditional” eemheke oil (for which there is a proven but unquantified demand). There is a need for a better understanding of the distribution and potential production of *Ximenia* in Namibia, and for a carefully differentiated collection of the various (sub-)species for use in comparative analyses.

g) A very small sample of mopane seed essential oil has been produced through laboratory-scale steam distillation, indicating a w/w yield of around 500:1 (which is reasonable for an essential oil). The oil has a very good smell, but so far no dedicated analyses have been done to determine if it is sufficiently unique to warrant further production efforts (it won’t be if it has to compete with either pine or eucalyptus). This is a large and unutilised resource and further work is justified to establish whether the oil can be marketed at prices that would make large-scale collection and processing an economic proposition.

h) Trial and commercial-scale purchases under PIF (and X-otic and KMS) have done much to strengthen community interest in indigenous natural resources; in some cases the income opportunities have also contributed significantly to strengthening existing or new community-based organisations. There is however a need for much more support to such emerging groups, especially in the form of organisational and business training, which is probably best delivered through more active collaboration with existing service providers such as JCC and MTIs various SME support mechanisms and initiatives.

i) Initial preservation trials with Kalahari truffles have yielded promising results, but the highly seasonal (rainfall-dependent) nature of this resource presents significant obstacles. CRIAA SA-DC was approached by the Israeli researchers who plan to study the cultivation of truffles (co-cultivation with melons) and asked to replace Oxfam as the local partner, but nothing definite has been agreed yet; the IFTT will be kept informed of relevant developments.

j) The PIF project has contributed to the national debate around access and benefit-sharing related to genetic resources, but so far nothing concrete has emerged from this rather frustrating process. This is a matter that must be carried forward by a national institutional (GRN)
stakeholder as a matter of urgency (we have already lost out on at least one golden opportunity to secure major gratis scientific analyses of marula pulp because we do not have clear mechanisms in place to deal with requests from *bona fide* researchers, let alone bio-prospectors).

k) The PIF project excluded all non-fruiting plants and non-fruit products from indigenous plants, which made it hard to respond to market enquiries for these products (e.g. a serious interest in *Terminalia* rootbark). Hopefully this will change if and when the UPDP project is funded and the mandate of the IFTT is extended to include all useful plants (which should also include alternative natural products from non-indigenous plants that can be marketed through the same channels – e.g. we can sell dried prickly pear (*Opuntia ficus-indica*) flowers for US$20/kg if we had a supply chain going, and there are numerous potential income streams – of uncertain profitability – to be derived from *Prosopis*).

l) Two extremely promising elite genotypes of marula (one producing fruit three times bigger than the national average; the other a small tree with huge fruits of excellent quality), and one of embe, have been identified, but due to the delay in starting the FAO/DoF project nothing further has been done in this regard.

There is growing interest from various UN bodies (CBD, UNCCD, UNFCCC, UNCTAD, ITC, GEF and others) and other international donors in the potential sustainable development and conservation benefits of commercialising indigenous plants; a concerted effort is needed to translate this interest into actual project funding for income-producing activities that contribute to poverty alleviation, sustainable resource-management practices and diversification of livelihood options (e.g. through processing jobs, natural produce trade, or agro-forestry systems based on useful indigenous species).
5 Constraints and problems

Like any other large and complex collective human endeavour PIF has had its share of disappointments and setbacks:

a) It is a pity that PIF and the IFTT failed to secure more active, enthusiastic and effective participation by Unam in the project. To summarise:

i) Dr E. Keya made (under a separate arrangement with the IFTT, but using fruit supplied through PIF) a jam and a white wine from marula. The jam is good – it tastes more like marula than any other attempt – but complicated to replicate at SME scale, the wine is unlikely to be produced successfully at SME level; neither production process was documented in a way that will allow easy replication without further experimentation.

ii) Unam DFST could not do routine analyses (e.g. fatty acid profiles) for which it has the necessary equipment (but not human resources), forcing the PIF project to source such analyses from Namibian, South African and British laboratories (which produced the required results but failed to build Namibian scientific capacity).

iii) It took a year for Unam to nominate a Namibian researcher to go to CIRAD for the marula work, but then she went straight from France for further studies in the Netherlands without reporting back to her sponsors.

iv) Samples of manketti oil pressed from boiled and raw nuts were supplied (for free) to the Chemistry department for use by final year students in their laboratory practicals, on the understanding that they would report on possible differences between the oils; to date no report (or even verbal feedback) has been received, despite repeated requests to various members of the department.

b) The distillation trials at KAP have so far yielded – with a few exceptions – rather disappointing results, partly because the two stills (copper and stainless steel) require further fine-tuning, and partly because conditions at KAP are less than perfect for controlled fermentation (which plays a key role in determining the quality of the resulting distillate). On the upside none of the spirits analysed had significant methanol content (i.e. all were safe for human consumption), there is now a much better understanding of the modifications required to make the stills more efficient, and the last few batches of spirits distilled were significantly better than the first. Further work on distillation is recommended.

c) The multitude of topics covered during fieldwork and the wide geographic coverage of the project resulted in very limited opportunities for detailed resource surveys – while this is not regarded as a serious short-term obstacle to the continuation of the project it is a lack that should be addressed in future, preferably by involving DoF/MAWRD fieldworkers in the compilation of a more detailed national description of the distribution and density of various species of commercial interest. To maximise the benefits of this work it should be designed in such a way that it is compatible with on-going GIS work being done by the National Remote Sensing Centre, as well as other relevant national initiatives (Tree Atlas project etc.).
6 Key lessons learnt

a) Making market linkages is the heart of natural products commercialisation. Effective, persist-ent, pro-active and convincing market liaison work is indispensable for success. A major part of this work is negotiating mutually acceptable quality standards, production schedules and prices with commercial partners (once their initial interest has been secured). It is time-consuming work that requires specialised skills, a thorough understanding of the natural products sector, substantial research and reading to keep up with market developments, and frequent communications with colleagues and partners at community level (to keep up with production developments). This work must be adequately resourced and supported (financially and institutionally). It was a mistake to under-resource international marketing work during PIF Phase One, to include local and regional market liaison in the project coordination work, and to delay funding for local marketing.

b) Unless and until the issue of enterprise ownership is clearly agreed by all stakeholders it is not advisable to put information about processing technology, markets, potential buyers/partners and prices in the public domain – doing so might result in confusing messages to the market and jeopardise opportunities for all stakeholders. It is recommended that the IFTT promote a model in which primary producers can leverage their resource ownership to acquire equity in viable, profitable and sustainable businesses (along the lines of Kalahari Wild Silk (Pty) Ltd, as recently approved by the wild silk workshop). Should the IFTT prefer a model that prioritises private ownership of enterprises it should provide clear guidance about how, when and on what terms information should be provided to such enterprises, and on how such enterprises can collaborate to minimise downwards pressures on primary producer prices resulting from competition for international markets.

c) Rural producers are (understandably) reluctant to go to extra trouble or expense (e.g. post-harvest processing; transport to buying point) until they are convinced that the opportunity to sell their indigenous fruits and fruit products at fair prices is real. Nothing convinces people of this reality like cash, and the word-of-mouth that cash generates. Purchases under PIF and KMS typically drew a much larger and more enthusiastic response the second time round, especially when organised through established community groups with some credibility. It can be assumed that this effect will gather momentum and that managing supply (pending the growth of markets) will pose an increasing challenge. On the other hand, establishing a reliable supply chain cannot be done through one or two purchases, or in one season. It is recommended that this problem be dealt with by using established CBOs as market intermediaries in the initial stages, on a case-by-case basis.

d) While trial purchases can elucidate the procurement logistics pertaining to particular resources and prove that certain minimum quantities are in fact available, they cannot (within limited budgets) provide very much information about the total availability of a resource (e.g. it is still not clear that the second round of KMS intakes will in fact yield the required 105 tons). At some stage in the commercialisation of a new resource it might be necessary to "waste" a large intake simply to prove to prospective buyers that sufficient quantities are available, and to accurately quantify the intake logistics.

e) "Middlemen" are very quick to take advantage of new opportunities if given half a chance. These "collators" are people who have a competitive edge, e.g. a vehicle or a steady income. They buy up small quantities of desired resources from neighbours for less than the project
pays and sell at a profit (if they can). Logistically, this can be a highly functional and cost-effective mechanism for transporting dispersed resources to central locations. In some cases, however, people have reportedly been paid only about 25% of the “market” price. To avoid exploitation, information about prices should be broadcast regularly on regional vernacular radio so that even the most remote primary producers can make informed decisions about the price they will accept in their particular situation.

f) Producers are especially vulnerable to exploitation when the only formal market is one that is controlled by a single private-sector enterprise, and doubly so when this enterprise is an emerging one without access to high-value markets. As an example of this tendency it is worth noting that Yetu Cosmetics reportedly paid only N$0.70/kg for melon seed before the KMS purchases set a price of N$2/kg (there is some uncertainty about the extent to which Yetu matched the higher price after it had received – as a result of the KMS exports – a larger order for oil, but it definitely did so in some of the areas where it had to compete directly with the KMS purchases). It will also be interesting to find out how much the Strychnor liqueur business is paying for fruit. Private sector processors should be convinced of the benefits of fair trade, and encouraged and helped to negotiate real benefit-sharing with primary producers. In general individually owned enterprises should compete on the basis of their reputed ability to operate more cost-effectively, and not by forcing primary producer prices as low as they can go (which can be extremely low in a depressed rural economy characterised by desperate poverty) – to do so would negate all the desired improvements to natural resource management practices and might also provide incentives for unsustainable use. This provides another reason for generic market development – a rising tide float all boats and private businesses will be able to pay better producer prices if and when they have access to better and bigger markets (or will at the very least be forced to do so by producer-owned enterprises that have access to such markets).

g) There is a tendency among rural people to misunderstand (and sometimes actively resent) the concept of wholesale prices. In quite a few instances, people who live a hundred kilometres or more from the nearest market and who don’t have reliable access to transport nevertheless expected to be paid the retail urban market price for their products. Another example of this is the observed practice of selling produce on behalf of a neighbour without taking any profit – some informants reported that marketing for a commission would be regarded as “cheating” in their communities. This tendency towards price inflexibility is most notable in local markets, where “everyone knows the price” – in national markets outside the NCRs prices are sometimes more than 500% higher than in communal areas. Primary producers should be educated about the functional roles of collators and agents, and about the fair mark-ups that such people could expect to earn.

h) There is evidence of increased, and increased interest in, traditional processing of “semi-commercialised” resources for local informal markets – an obvious functional step in raising the perceived value of indigenous fruits and their products, and consequently in stimulating entrepreneurial demand for, and investment in, processing technologies. It remains highly desirable from a development viewpoint (but not essential from a business angle) to have financing mechanism that make available such business opportunities to people with no collateral or other form of security – if not the investment opportunities will accrue (as has largely happened with mahangu service mills) to those who have already escaped poverty (through formal employment or owning an established business) and can therefore access Agribank or other loans.
i) It might take five years or more to bring a new natural product to international markets (as has happened with marula oil). However, under favourable circumstances demand-driven commercialisation can very rapidly create enormous “deliver or lose the opportunity” pressures (as suddenly happened with the KMS exports after four years). There is currently no “fast-track” for dealing with such eventualities in an expedited manner, despite the existence of various potentially relevant and applicable financial facilities.

j) When the market demands fairly traded, community-supplied resources it will not do to simply “privatise the opportunity” (e.g. Yetu Cosmetics can only supply a part of the total KMS oil required by The Body Shop, since it is a Community Trade product; without the Community Trade element Yetu would most likely not have access to this particular buyer at all). One solution (which can also help to limit the price-cutting tendencies of middlemen) is to organise producers into a marketing cooperative (such as EWC is for marula kernel), or to set up private trading companies in which primary producers can acquire equity (against cash or in-kind payments, as was recently agreed should be done for Kalahari wild silk). Both models require organisation-building and management/training support, as well as working capital, which are available from Government and donor supported schemes and/or commercial lenders. In developing such producer-owned enterprises it is doubly important to adhere to sound business principles, ensure that the business model is sustainable, avoid hidden development aid subsidies to recurrent costs (such aid should be used to build capacity) and keep good management accounts (for reasons both of financial transparency to members, and of sound pricing and planning). In short, because such producer-owned enterprises typically have more democratic – and thus more cumbersome – decision-making structures than private enterprises they must be enabled to compete by being even more cost-effective. A major advantage of producer-owned businesses is that they “reserve” for primary producers some of the profit nodes higher in the value chain. (See also 8) Ownership below.)

k) From a technology perspective the KMS opportunity has made improving melon seed extraction methods a priority for R&D spending. The IFTT authorised a limited verificantion of funds to this work near the end of PIF Phase 1, but more work is required before a significant breakthrough can be expected (see Appendix 11 for an interim report on the work done so far). Traditional extraction methods (see Appendix 3) vary and are not equally efficient (especially as far as they affect quality) – the best of these methods should be documented and/or adapted and their wider adoption facilitated through appropriate extension messages.

l) One of the objectives of PIF Phase 1 was to rationalise and prioritise the initial list of species to focus on in Phase 2. Specifically (as outlined in the PIF Strategy and Action Plan) it was the intention to spin off pilot-scale projects focussing on those resources and/or products that would justify such an approach. In a way this has already happened with KMS (although further work is needed on technology development and genetic selection, and the details of technology transfer for local oil processing have to be negotiated). It is recommended (see below) that pilot-scale projects be established for marula juice/pulp, and for manketti (kashipembe, nuts and oil). Further trials with liqueurs and spirits from indigenous fruits can either be spun off as a stand-alone project (but not at pilot-scale yet) or retained as part of PIF 2. Makalani should be removed from the priority list (for now) but retained on the overall list of interesting species (distillation trials). Berchemia, Ximenia and Kigelia should be on the priority list (and if the extension of the IFTT’s mandate to all useful plants is approved at least Hoodia, Acacia gum and Terminalia should also be added).
m) Climatic variables such as rainfall, temperature and strong winds (especially during flowering) have major effects on the production of indigenous fruits (and apparently also on the prevalence of pests like fungi and fruit flies). This needs to be studied and documented more systematically over a number of years, and measures should be devised to bridge abnormal seasons (through stockpiling, limited irrigation, natural pest control or collaboration with other suppliers in the region).
7 Discussion of individual resources

a) *Sclerocarya birrea* (marula)

Although it might be outstripped in the medium-term by KMS as a cash crop, marula remains one of the biggest potential sources of income for primary producers, especially in the NCRs (the situation in Kavango and Caprivi should be assessed more closely, especially insofar as it can help to extend the processing season). The strategy advocated for marula in the PIF S&AP is to minimise initial disruptions to kernel production (hence oil exports) by first targeting local or traditional markets for fruit products (using the small KAP juice presses). It is further assumed that potential juice/pulp production (if processing constraints are overcome) far outstrips local demand, and that there will eventually also be a need for higher-capacity processing equipment to supply larger quantities to formal or industrial markets (there is known market interest but actual deals – especially details of a production system that will assure delivery of mutually agreed quantities at the right quality – must still be negotiated).

During the 2001 and 2002 marula seasons, which by common consensus were not good ones, and before most of the small KAP presses were working smoothly, temporary surpluses of omaongo were occasionally observed in informal markets in the NCRs (too many sellers, too few customers), even though most sellers said they always sold everything they took to market. The substantial interest in the marula press would suggest that many potential processors still see an opportunity in local (or national) markets. The possibility of buying a press only to find that the market is fully supplied was mentioned to a number of producers who had expressed an interest, and they were unanimously of the opinion that this would not be a problem (interestingly enough, quite a few of the prospective buyers were men who seemed more interested in the social cache of having very large quantities of omaongo to share with friends than in the commercial opportunity). The IFTT was therefore probably correct to recommend that CRIAA SA-DC disseminate as many copies of the presses as people were prepared to buy, and let the market sort out performers from non-performers. The names of prospective buyers are being collected (also from other SADC countries) so as to estimate the production run required (it is more cost-effective to produce a larger number of presses in one go).

The technical and business performance of the small juice presses (disseminated on easy payment terms to the producer association members of EWC) was also monitored as part of PIF Phase 1. In short:

- The availability of easy credit played a big role in uptake – EWC helped its member association to pay the deposit, and CRIAA SA-DC required no collateral (because of its established and ongoing relationship with the buyers); without such credit only one association ordered a second press, but many people expressed a need for more presses to be made available on credit; nevertheless some private investors were interested (often after renting and using a press) in buying presses outright for their own use, and were even willing to pay a deposit to cover material costs and then to wait for delivery.
- Technical problems were almost exclusively due to the hydraulic jacks rather than the press itself. The recommended solution is to keep a spare jack ready at all times for a quick field exchange (6 ton jacks cost less than N$200 a piece in Oshakati – when they are available, that is) and to repair or replace broken jacks as soon as possible. Another option – using more expensive jacks of higher quality – is being investigated, but could end up more expensive
than changing cheap jacks more frequently. Having said that, some presses got through the entire season without technical problems. The harder a press worked, the more likely it was to break down – but at least some of these problems (e.g. oil leakages) were due to the press being transported more frequently, rather than to the workload itself.

- The presses employed in central locations as service-presses were under-utilised. This is directly related to the problem of transporting fruit to the press, and juice and pips back to the homestead. Stationary service pressing of marula is apparently not a viable business model. A well-run mobile pressing service might be viable, especially if it took payment in the traditional coin (i.e. a percentage of the juice produced) instead of cash, and could market its “payment” successfully. Controlling transport costs would be crucial to the profitability of such a service business.

- The busiest presses were those that were rented out. It is unclear how chances to rent were distributed, but some associations rented only to members while others also rented to outsiders. Daily rentals were N$40 to N$50/press/day. Some associations charged on a per-use basis (N$3 to N$5 per 20 litres of juice produced) but had no monitoring and control measures in place – it is not clear how well this “honour” system actually worked. Renting a press was only an option if transport could be organised. It is also unclear how effectively rentals were collected, especially when presses were retained longer than arranged, or broke down during use.

- Although it is perfectly possible (but not easy work) for two or four people to carry the press quite some distance, this only happened to a very limited extent, and mainly between nearby trees belonging to whoever had access to the press that day. Most producers took the press to the tree, where it was operated by one person with one or two helpers (often children) to collect, sort out and pile up fruits ready for pressing. As in traditional processing fruit were usually not washed before pressing. Only one producer (a relatively wealthy household with many members) set up a “production line” system, in which children brought fruits from the trees to a central processing area, where they were washed and allowed to drip dry before being pressed.

- None of the press users bothered to press fruit twice, as was done with the limited quantities of fruit available during initial trials at KAP – in a situation where fruit is much more abundant than press-time, a single pressing is probably the correct option. As a result, real production yields were usually higher than the benchmark (10-12 litres/hour) set at KAP. The highest production actually measured was 15 litres per hour, although at least one user was observed to be on his way to exceeding this, having produced around 50 litres in what he estimated was less than two hours (time unfortunately did not allow accurate measurements). The highest daily production reported was more than 200 litres (on a long day). Juice yields vary considerably (25% to 42% w/w) between different types of fruit at different stages of ripeness, and average figures are therefore potentially misleading.

- Assuming a press owner can maintain 200 litres/day for a 50-day season, and sell the entire production for a wholesale ongaango price of N$1.50/litre, the potential gross income is N$15 000/season. To do so will require access to 33.33 tons of fruit – some, but not many, people probably have that much fruit on their own farms. If an entrepreneur has to buy fruit the price that is negotiated will be crucial (there is not yet a set price for marula fruit in the NCRs). The other obvious factors in determining how profitable such a venture will be are the costs of transport and labour. An enterprise that is located close to an urban market, owns many marula trees, has paid-off capital in the form of a press and bakkie, and uses family labour, could easily earn an income in the region of N$5 000 or more a season. If the enterprise additionally used family labour to retail its production (for N$3/litre in urban markets) the potential profit could be several times higher.
After EWC members had taken some of the KAP presses to the RDC in Ongwediva for the jacks to be fixed, the RDC designed and built a press of similar size. It is based on a completely different design (the RDC press has a fixed tray-table, is bolted together instead of welded, has the jack – which is operated by hand – above the cage on a little tray fixed to the frame by two tension springs, and its aluminium fruit cage is closed at the bottom). The RDC prototype was finished near the end of the 2002 marula season and no systematic comparison of performance has been done yet. A possible advantage of the RDC press is that the springs automatically return the jack to the “ready” position when the valve on the jack is opened; on the other hand the jack has to be pumped by hand (as opposed to the pedal-operated KAP press), which might be more tiring. It is definitely better to use a stainless steel fruit cage (as the KAP press does) since aluminium reacts with acids and excessive aluminium intake is associated with several long-term health problems.

During initial discussions with the RDC they indicated that the press was mainly intended as a prototype, since they did not have the capacity – and did not see it as their role – to manufacture many copies for dissemination. However, RDC has since been reported to be selling their presses for N$1 870 – about a third of the price of a complete KAP press with juice and oil pressing fittings and cages. This is believed to be a subsidised price based on the cost of raw materials only. At such a low price it is extremely unlikely that small manufacturers could successfully take up the opportunity (at least without being forced to cut corners and compromise on quality). This competition from a parastatal institution has also forced KAP to review its options and the manufacture of further presses is on hold until more orders have been confirmed.

Various marula juice preservation techniques were tried (Appendices 6 and 7), but as yet none (apart from pasteurisation at a small scale) appears suitable for introduction at rural producer level. One idea currently under investigation is to use a solar oven to pasteurise KAP-press produced juice in 750 ml beer bottles closed with star caps – such a technology package could produce around 50 litres of pasteurised juice a day for later fermentation and marketing outside the main season, when prices might be higher (and an additional 150 litres a day for immediate marketing). The major technical challenge with marula puree/pulp/juice is to stabilise these products in a way that retains the positive flavour and fragrance characteristics of good marula fruit.

Distillation trials with marula were very disappointing. Alcohol yields were very low and none of the products were drinkable. Marula probably has too little sugar to make a good basis for distillation (without adding sugar) – this might be why it is traditionally not used for omkibke production. Another possible cause is the presence of wild yeasts. Further trials, during which cane sugar was added to the fermentation, also delivered disappointing results, but this was probably due to problems with the still. More work is required before marula distillation can be attempted at larger scale. Some interesting comparative experiments have been done at the University of Stellenbosch on the effects of different yeasts on marula distillates. It is unclear whether Namibia has the scientific capacity to do similar work locally.

Various preservation techniques were tried with omaongo in an effort to produce a stabilised and standardised product that can be marketed throughout the year. In most cases anaerobic fermentation in the bottles resulted in a sulphurous off-flavour (which disappeared after while if the bottles were left open at room temperature – hydrogen sulphide?). Some encouraging results were obtained during trials designed to produce “marula champagne” but these require further work. In all cases the product threw a heavy sediment in the bottle, resulting in a visually unattractive product. Access to a good industrial filter is probably essential for real progress in this regard (a cloudy juice is acceptable to some formal-market segments, but not a cloudy wine).
A few omaongo producers have expressed interest in a technology that would allow them to sell bottled omaongo – options in this regard need further investigation (brown 2-litre plastic bottles might be a solution, but are expensive to transport). These producers were confident that their own omaongo was good enough to attract a wider clientele if it could be sold in local formal markets. They also thought that local people were more likely to make good omaongo than a central processor, because people knew the quality of their fruits very well and could process the best fruits when they were at exactly the right stage of ripeness. *Such a “boutique winery” model is worth investigating further.*

Liqueur trials with marula focussed on the simplest possible method, which is to mix alcohol with fresh juice into a “dessert wine”. The first lot of “marula jerepigo” was very good after it had matured for about six months (it was a bit rough and acidic before that) but a second batch (from mediocre 2002 fruit) was too acidic. *These trials need to be continued,* and improved aging techniques (in wooden vats) should be considered. It might be necessary to even out seasonal quality variations by over-producing and then mixing the production from two or more years to assure a relatively even quality to the final product.

The existing production and marketing of marula products in the NCRs was studied in more detail under the DFID-FRP sponsored “NTFP Commercialisation Winners and Losers” project, in which CRIAA SA-DC was the Namibian partner. This study included a household survey, a resource survey and a commercial chain analysis (reports will be available by mid-November). Some key findings included:

- Sales of omaongo and ondjove in informal markets are relatively recent (many people only started selling after hearing about the commercialisation of marula oil) and this development is not (yet) accepted or supported by everyone (especially older men with more traditional views)
- There are no clear trends in the factors that determine which households sell omaongo, and which don’t (i.e. it is not related to wealth, household income, distance from markets or even ownership of marula trees)
- There is a clear correlation between marula distribution and certain landforms – the main factor seems to be soil depth (marula does not grow in the very shallow saline soils, and is not common on the deeper Kalahari-type sandy soils)
- The relationship between human settlement and marula distribution (at least in the NCRs) appears to be symbiotic in that people see marula (in addition to its many other uses) as an indicator of soils suitable for crop production and – when the option is available – preferably settle on sites where marula trees already grow; there are however other soils that are also suitable (and under certain rainfall conditions might be better) for cropping – when people settle on these sites they often introduce marula (sometimes deliberately, more often accidentally, by bringing in pips for decortication and losing some of them in the sand)
- There are hardly any “communal” marula trees in the NCRs – even the few trees that grow outside farms usually belong to specific people – and there is an intricate systems of transferred ownership (apparently linked to family and other social connections) that results in some people “owning” (or having usufruct of) trees in various dispersed locations
- The traditional practice of occasionally moving the homestead to a new location on the farm has been a key element in establishing “groves” of marula and other indigenous fruit trees (several sapling of about the same age that germinated inside the homestead and were big enough to survive when it was moved), but this “recruitment system” is in decline because more people are now building permanent structures and not moving their homesteads
• Many farmers actively control the establishment of marula trees on their farms — those who already have many productive trees hoe out many seedling each year to limit competition with annual crops, while those who do not have enough trees often plant and/or protect young trees against livestock (though protection of volunteers is still much more common than planting).

• While the production of omaango is traditionally a social activity, the extraction of kernels (omahuku) is much more typically a household-level activity — the most common production system involves an older member of the household (or sometimes an experienced, paid neighbour) chopping open the seeds in the morning and children helping to extract the kernels after school (some snacking is allowed!)

• People who have many marula trees and the means to buy or hire a juice press (and pay someone to operate it) are increasingly using more of their marula fruit for commercial-scale omaango production, and sharing less of their fruit with neighbours — this is especially significant in so far as it affects access to seeds for decortication (since neighbours without their own trees are traditionally allowed to keep the seeds from the fruit they squeeze during omaango production sessions).

• Even the limited commercialisation that has taken place so far has created a perception that there might well be a shortage of marula in the near future and many people are now interested in (and practising) propagation of marula trees.

• Most of the presses are operated by young men (despite being owned by women's associations) and many men have expressed an interest in acquiring presses — the technology might be contributing to a change in gender-related traditional ownership and use patterns.

• Given the relatively recent advent of commercialisation, informal marketing chains for marula products (in local markets and in urban markets outside the NCRs) are surprisingly well-developed and profitable, but significantly higher levels of benefits to primary producers (in terms of overall opportunity, not necessarily profitability) are possible in more formal market chains.

• Marula producers are very knowledgeable and discerning about the quality of fruit produced by different trees — the fruits of some trees are highly rated for omaango and omahuku production, other are not considered worth processing for juice but are collected later (when they have dried out) for omahuku production; most producers were of the opinion that people would keep the best fruits for their own use, and sell only poorer fruits to a central processing project or facility; many were also unhappy with the idea of being given (on an exchange basis) just any old seeds to decorticate, stating that they knew and preferred working with their own fruit.

There are several reasons why a larger-scale marula juice/pulp production system (and technology) should be established as a pilot project during PIF Phase 2:

• A confirmed interest from South African juice formulators in high-quality juice/pulp (around 100 tons initially, prices to be negotiated but must be competitive with South African producers)

• Strong interest from European cosmetics markets in a stabilised and standardised pulp product (further market and product R&D required)

• A need to assess the practicalities of larger-scale processing

• Enabling larger-scale preservation trials

• Enabling larger-scale processing trials with jams, jellies etc.

• Incubating a commercial opportunity in which primary producers can acquire ownership.
There are however major obstacles to the establishment of such a pilot project, which would additionally require a substantial capital investment, and is not 100% assured of early success (i.e. might need continued support for at least another year or two):

- The major problem that must be solved is the geographically dispersed nature of the marula resource. To put it simply: How do we reliably get large quantities of marula fruit to a central processing facility (and preferably return the seeds to rural areas where they can be decorticated)? How much will this cost? Would mobile processing be a viable alternative to a central facility?
- How do we deal with the inevitable problem of people keeping their best marula fruit for own use, and selling only poorer or sub-standard fruits to the processing facility? Would the aggregated quality of these fruits still deliver a product acceptable to the target markets?
- How do we conserve large quantities of pulp for transport to distant markets (for cosmetic use some preservatives might be acceptable, for the juice market they are not and freezing is the preferred option – can we organise reliable frozen transport to South Africa at the necessary scale)?
- How do we give primary producers equity in the business and/or involve the Namibian private sector in such a project (if and when it is economically viable)?
- Where do we locate such a facility to assure that it has access to the widest possible marula-producing area, and to other essential services (quality control, technological back-up, transport)?
- How do we “right-size” the production technology if we don’t know the real size of the market?
- Can we pay the prices expected by Namibian producers (most of whom thought 50c/kg was too low) and compete with South African processors (who pay 25c/kg)? Alternatively, can we secure enough quality fruit if we only pay 25c/kg?

To put the fruit price in context: the lowest omaongo price encountered (in a rural area) was N$1.50/litre, the predominant price in urban markets in the NCRs was N$3/litre, and prices in Windhoek were reported as varying between N$5 and N$8/litre.

Working on the rural price (so as to factor out the real and opportunity costs of marketing), and assuming a juice yield of only 20% with traditional manual extraction (this varies considerably with fruit quality), we arrive at an equivalent fruit price of 30c/kg (since the fruit is free, this is actually income to labour). Using good fruits an experienced woman can manually extract up to 5 litres of juice from 25 kg of fruit in an hour, but she would spend an additional half an hour sorting the fruits and piling them into a heap – at N$1.50/litre she therefore earns an effective “wage” of around N$5/hour. If the same woman sold 25 kg of fruit at 25c/kg she would earn N$6.25 for half an hour of collecting. In either case additional time is spent getting the omaongo or fruits to a purchase point, waiting for a buyer, concluding the sale and going home.

Looked at from this angle, a woman can spend a day (2.5 hours collecting and 5 hours processing) and produce 25 litres of omaongo, which she can carry to the nearest sales point or road, and for which she can expect to get at least N$37.50, and possibly as much as N$75. If we assume that she spends an additional day and N$20 travelling to and from the market, and that she sells all her omaongo at N$3/litre on that day, she can earn N$55 in two day – N$27.50 a day. The same woman can probably only carry 40 kg of fruit, for which – at 25c/kg – she gets N$10; if she does one trip a day she’ll earn N$20 in two days. However, she does not have to spend the whole day on this, especially if several people take turns to wait for the collection vehicle and conclude the
sale(s), or if an agency system was in place. The imponderables in this equation are how far the seller has to walk (e.g. can she take three bags to the collection point if she gets up really early, or if her children help to carry?) and how badly she wants that extra N$7.50 (i.e. whether the time saved is worth the earnings – and social interaction at the market – foregone).

From these rough calculations we cannot answer the question about how much fruit of good quality could be bought at 25c/kg, but we can fairly confidently predict that people will retain their best fruit to process at home for selling in local omaongo markets. The most likely outcome is that people will juggle the two options according to their individual needs. In any event 25c/kg appears to be a fair price.

To answer the questions posed above, it is proposed that the pilot project be implemented at a smaller scale in the first year (to solve practical problems, provide better information for setting prices and make large samples available to prospective buyers) and then scaled up in the second year, subject to confirmed commercial orders. To allow this flexibility it is further proposed that the project (at least initially) uses the small KAP presses (which are quickly available and very cost-effective, compared to the Indian brush-pulper offered by Infruitec/Brebner) – it would be interesting to also use the RDC press for comparative purposes. This will also provide an opportunity to negotiate mutually acceptable quality standards with prospective buyers, which can then be used in designing a larger-scale pulping technology (possibly with additional inputs from CIRAD). In calculating the costs and requirements of such a pilot project the following calculations and considerations have been used:

i) Scale of production and equipment

- Set a target of 25 tons of juice/pulp in the first year (to supply larger samples to interested parties, and for larger-scale preservation and processing trials)
- Assume the peak marula season (when surplus fruits of good quality are most likely to be available) lasts only 50 days (from early February to late March)
- This gives a production target of 0.5 tons/day
- Assume a juice yield of 30%
- The quantity of fruit to process daily is 1.67 tons (83.5 tons over 50 days)
- Assume the processing facility will work only 7 hours a day (one shift with an hour downtime) in the first year, but probably around the clock in the second year
- The quantity of fruit that must be processed per hour is 239 kg – round up to 250 kg
- Assume each KAP press can process three batches of 12 kg each per hour, i.e. 36kg/press/hour
- Seven presses are needed – say 8 to allow for breakdowns and repairs
- Provide two buckets, one washing trough and one draining rack per press
- Pack the juice into 10 litre food-grade plastic bags, heat-seal and freeze

**ESTIMATED COSTS – YEAR ONE**

**Equipment**

8 x KAP marula presses (without oil-pressing adapters) @ N$5 000 ea 40 000
Maintenance and spares 8 000
8 x sets of buckets etc. @ N$250 ea 2 000
Heat-sealer 4 000
3 000 x 10 litre plastic bags (food-grade) @ N$2.50 ea 7 500
**Sub-total** 61 500
Raw materials
83.5 tons of marula fruit @ N$250/ton 20 875
20% wastage (rotten fruits) 4 175
Sub-total 25 050

ii) Facilities and human resources
- Locate the operation at COSDEC in Ondangwa, where a suitable building is available (about equally accessible from the main marula areas, with a slight bias towards western Ohangwena, which has the highest density of marula trees)
- Ask MHETEC to provide this space for free in the first year (they will in principle consider this), but account for it – and for water and electricity – at full commercial rates to prevent price distortion and provide realistic figures for further planning
- Rent a freezer container for three months
- Recruit and train 12 press operators (1/press and 4 alternates to allow for illness, absence and days off)
- Contract management, supervision, project coordination and equipment maintenance services from consultants (10 days preparation, 50 days processing, 10 days analysis and reporting)
- Employ casual labour for handling fruit etc. – assume 4 workers are needed per processing day
- Employ one driver/buyer for 50 days

Facilities and human resources
Rent, water and electricity (COSDEC/MHETEC) gratis
Freezer container (6m) – 3 months rental @ N$5 000/month 15 000
12 x operators @ N$50/day x 35 days ea 21 000
Management etc. – 70 days @ N$1725/day (VAT incl.) 120 750
Casual labour – 200 person-days @ N$33.50/day 6 700
Driver/buyer – 50 days @ N$150/day 7 500
Sub-total 170 950

Transport and miscellaneous
Transport to Ondangwa (av. 300 km/day x 50 days x N$2.50/km) 37 500
Transport to prospective buyers (25 tons @ N$3 000/ton) 75 000
Consumables (cleaning and preservation trials) 5 000
Sub-total 117 500

Contingencies (10% on items above) 37 500
Sub-total of all items above 412 500
Administration (15%) 61 875
Total 474 375

With this cost structure – and assuming the presses and other equipment are paid off in one year – 25 tons of juice will cost N$19.20/litre – about double the price that can realistically be expected. However, if we strip out the management and administration charges (which are occasioned by the exercise being a pilot project that needs establishment and documentation inputs, and will eventually be counted as profits to the enterprise owners) and reduce the contingencies to 5% we arrive at an overall “real” cost of N$271 477.50, giving a break-even juice price of N$10.86/litre (for 25 000 litre in the first year). A 20% mark-up on this gives a target price of around N$13/litre (delivered)
– if this price is acceptable to (segments of) the market the enterprise will have some scope to increase its profitability by e.g. rationalising transport costs, increasing production to three shifts a day to achieve better economies of scale and/or procuring larger-scale technology.

To put the target price in context, the Amarula pulping factory in Phalaborwa reportedly sells to Distell, who part-owns the facility, for R2 500/ton, while exotic tropical fruit pulps sell in the South African industrial market for R4 000 to R8 500/tons. Marula pulp is not yet commercially available in large quantities and a reliable producer might therefore – provided it had a pro-active approach to negotiating market-development deals – secure such a premium price. It is recommended that the IFTT budgets for at least 25 days of marketing (N$50 000 @ N$2 000/day), in addition to the N$474 375 calculated above.

Using the small presses during the initial phases of the pilot project has the major advantage of leaving eventual arrangements flexible (e.g. processing at regional satellite centres, or with mobile units). It also allows production to be scaled up gradually, if needed, without major additional investments (e.g. producing 100 tons/season would require only 2 additional presses and three 7.5 hour shift a day). However, in the longer term the small presses have one main drawback: they require a large labour force (at least 46 operators under a 10-press three-shift scenario, plus additional casual labour), which is desirable from a job-creation viewpoint but can be an expensive nightmare to manage and administrate.

Furthermore, there is no market ceiling at 100 tons, and a successful marula juice retail product can easily create demand for several times this quantity annually. It is therefore highly desirable to have a larger-scale juice processing technology in the wings, if and when it is needed. In this regard the following observations:

- Different processing technologies produce qualitatively different products. The KAP presses produce a juice with very little fruit pulp in; the Amarula factory at Phalaborwa produces a liquidised pulp which includes virtually all the flesh and skin with the juice (using technology that resembles scaled-up kitchen blenders).

- If the KAP cage presses are used to produce commercial samples then the larger technology should be able to deliver a product with very similar qualities – the simplest and surest way to do this is to build a much larger hydraulic press (which can probably be done in a relatively short time and at reasonable cost in Namibia), or to buy such a press from a European manufacturer (but without any assurance that it is suitable for marula). From what we know of other marula processing in the region it would appear that brush or impact pulping of whole marula fruit is technologically problematic, relatively expensive and hard to maintain – another reason to prefer cage technology at this stage. A larger cage press also keeps open the option of integrating the production from many smaller decentralised operations into the main marketing channel, should this prove necessary or desirable (and provided effective quality control is possible).

- Much more likely than simple “straight-run” juice, the product that will appeal to the cosmetics market will be a stabilised pulp that includes a high proportion of skin (marula skins contain a large number of chemical compounds, many of which are desirable in cosmetics but problematic in juices). Producing a skin-pulp separately, as a “by-product” of juice extraction, is technologically feasible (the fruits are opened during juice pressing, allowing the pips to be extracted manually and the skin to be pulped separately, without the problems the pips pose to pulping technology). Standardised blends of juice and pulp might also find separate niche markets, and it will be very useful for downstream processing
(jams, chutneys etc.) to be able to blend juice and pulp in different proportions for different products.

- In view of the above it is recommended that the IFTT funds the pilot project outlined above, as well as smaller-scale pulping trials to provide samples, but delays developing a larger technology for either product until market responses have been better evaluated, and mutually acceptable quality standards have been negotiated. Pulping trials have not yet been costed out fully, but are estimated to add around N$50 000 to the overall cost of the project.

On the assumption that an order for 100 tons of juice can be secured for the second year, an estimated budget for this level of production is presented below. It is assumed that 10 KAP presses will work three 7.5-hour shifts a day (if a bigger press is preferred the capital and labour costs will be different) and that the additional equipment will be paid off completely in the year of acquisition.

**ESTIMATED COSTS – YEAR TWO**

**Equipment**
2 x KAP marula presses (without oil-pressing adapters) @ N$5 000 ea  10 000
- Maintenance and spares (10 presses)  10 000
- 2 x sets of buckets etc. @ N$250 ea  500
- 12 000 x 10 litre plastic bags (food-grade) @ N$2.50 ea  30 000
  **Sub-total**  50 500

**Raw materials**
- 334 tons of marula fruit @ N$250/ton  83 500
- 20% wastage (rotten fruits)  16 700
  **Sub-total**  100 200

**Facilities and human resources**
- Rent, water and electricity (2 months @ N$5 000/month)  10 000
- Freezer container (1 x 12m) – 3 months rental @ N$8 000/month  24 000
- 46 x operators @ N$50/day x 35 days ea  80 500
- Casual labour – 800 person-days @ N$30/day  24 000
- Driver/buyer (4 x 50 days) – 200 days @ N$150/day  30 000
  **Sub-total**  168 500

**Transport and miscellaneous**
- Transport to Ondangwa (av. 1 200 km/day x 50 days x N$2.50/km)  150 000
- Transport to prospective buyers (100 tons @ N$3 000/ton)  300 000
- Consumables (cleaning and preservation trials)  20 000
  **Sub-total**  470 000

**Sub-total of all items above**  789 200
- Contingencies (5%)  39 460
- **Total costs**  828 660

Management and administration mark-up (25%)  207 165
**Total income target**  1 035 825
At 100 tons production and sales the break-even price required is N$8.29/litre; with 25% profit added the minimum price is N$10.36/litre. Since the first year’s production is fully sponsored, and income will be low (but will of course accrue to the IFTT), this is the minimum price to be negotiated (on 100 tons), but (as calculated above) negotiations should start at N$13/litre (on 100 tons). The practicalities of paying for management and administration will have to be negotiated between the IFTT and its selected service provider or other management partner. If the preferred option is to privatise the business (to whatever enterprise ownership model), further negotiations about capital investments and goodwill are also required.

To conclude the section on marula, a cautionary note: some individuals have reported stomach troubles after drinking fresh, full-strength marula juice, or a concentrated marula juice product (cordial diluted with water). In view of the fact that traditional cultures in southern Africa almost never drink marula juice without first fermenting it (and some people have taken issue with efforts to develop such a drink, claiming that it is not healthy to drink unfermented juice) further investigation into this topic is highly advisable – such work should be undertaken as part of the collaborative research programme on marula pulp production being planned with CIRAD.

b) *Schinziophyton rautanenii* (manketti)

After marula oil and KMS, manketti is probably the next resource that will be commercialised at larger scale, for the following reasons:

- The pioneering work that CRIAA SA-DC has done since the NTFP project in 1998 has had time to “incubate” serious market interest (from a subsidiary of a major multi-national chemical company, among others) and further market liaison work is being done through SANProTA
- It is one of the four resources targeted for technical and market R&D funding from SANProTA (including US$6 000 to CRIAA SA-DC to investigate oil processing technologies and systems)
- It is known to be available in commercially significant quantities in a number of countries and is therefore the subject of substantial commercial interest at a variety of levels (community, NGO, private enterprise, larger private-sector operators…) – this interest is expected to reach critical mass soon
- In Namibia there is already a substantial collation network in the form of kashipembe/ombike distillers, widespread traditional knowledge of decortication methods, and basic information about collation and processing systems
- There are multiple potential markets (fruit for distillation, edible nuts, oil with several potential niche uses)

At this stage the major unknown is the price at which manketti oil can find an export market niche, and the size of this niche. This should be clarified by the SANProTA work. Namibia has a substantial lead over other manketti producers, on which it should capitalise as soon as possible (since the SANProTA work will put an updated version of what is currently known in Namibia within reach of all members). In particular Namibia should re-activate and expand networks of decorticators, do further trial purchases, and possibly stockpile nuts for processing at short notice.

It is likely that Namibia’s main competitors to supply manketti products will be from Zambia and Botswana (although nothing is known about Angola’s potential production) – operational costs in these countries are comparable to those of Namibia and transport chains are longer, which seems to imply that Namibia has a competitive footing in the emerging manketti industry. Malawi and
Zimbabwe have some manketti, although apparently not in the same quantities – these countries have very different cost structures and might be highly price-competitive with the manketti that they can produce.

Considering the above it is recommended that the IFTT support the establishment of an integrated manketti processing pilot project at Mashare Agricultural Development Institute (MADI) in Kavango region. Exploratory talks with LuxDev (MAWRD’s development partner at MADI) has revealed interest in such a project, and the idea is supported in principle by the MAWRD staff member in charge (also because it might strengthen MADI’s plan to do more around appropriate technology R&D). The PIF project coordinator has been requested to explain in more detail how such a pilot project might work (but has not yet, because he has been working on this report). LuxDev might help to co-finance such a project, provided it likes the details.

The manketti pilot project would investigate the economics and practicalities of producing three formal-market products from manketti fruit:

- Manually decorticated and de-pericarped whole nuts, roasted and salted/flavoured, packed in small plastic bags for sale in national and regional tourist and retail outlets
- Manketti oil of a consistent quality and character for large-scale exports to Europe (and possibly some oil packaged for national and regional markets)
- A twice-distilled and standardised version of kashipembe packed in attractive bottles for marketing in national tourist and retail outlets

Compiling a full costed proposal for such a pilot project will require a substantial effort that is beyond the scope of PIF Phase I. The project will be complicated to manage, but will have a very high potential to spin of various viable enterprises. It will also help Namibia to keep and even extend its lead in manketti commercialisation. If the IFTT and the second PIF stakeholder workshop endorse the “incubation” model of natural product enterprise development, and agree that such a pilot project is desirable, and if the partners at MADI also agree, a full proposal can be commissioned.

In brief, it is envisaged that an integrated manketti processing facility will work as follows:

- Whole manketti fruit would be bought in, boiled, fermented and distilled to raw kashipembe. The nuts from this process will go to the decortication line. If a specific market demands oil from unboiled nuts the fruits will be decorticated and the nuts removed before the pulp is boiled off (but this is not a preferred option).
- Additional raw kashipembe will be bought from informal-sector distillers, combined with the project’s own spirits, and re-distilled to a superior product.
- Boiled nuts from the project’s own kashipembe production will be decorticated by casual labour paid on a piece-job basis – a premium will be paid for whole nuts.
- Decorticated nuts will also (and preferably) be bought from decentralised processors, at a slightly higher price than the piece-job rate, with a similar premium price for whole nuts.
- Broken decorticated nuts will be pressed for oil.
- Whole decorticated nuts will go to a de-pericarping production line where the pericarps will be manually removed by supervised casual labourers wearing gloves and masks and working for a piece-job rate, with payment for whole nuts only. Any nuts broken in the process will go to oil production.

Whole de-pericarped nuts will be roasted, salted/flavoured and packaged for sale.
c) **Ximenia** spp.

It is unlikely (but not impossible) that *Ximenia* (eemheke/oombeke or nokakukuru/ nompeke) oil will proceed to significant commercialisation within the next year. The oil is currently under investigation by a well-resourced research partner (after efforts to promote its use to cosmetic formulators and other industrial users foundered on a lack of essential technical information). It is important to keep fairly large samples of *Ximenia* seeds on hand in case they are required at short notice (KAP currently holds 800 kg of seeds, which must be processed and replaced in the forthcoming season).

*Ximenia* oil extraction is technically difficult (at least with the 30 ton Kapmond hydraulic press – with a worm-screw expeller it is impossible). Using a rotary seed roaster designed at KAP the yield was increased from less than 10% to around 25% but the oil is very sticky and hard to process (see Appendix 8 for a report on *Ximenia* oil processing). Further improving the technology depends to a large extent on feedback that has not yet been provided by the research partner (the lechitin/phospholipids responsible for the stickiness might in fact be desirable in some industrial applications). It might be worthwhile to investigate other alternatives (e.g. solvent extraction) as a way to supply local markets for “traditional” eemheke oil (for which there is a proven but unquantified demand).

*There is a need for a better understanding of the distribution and potential production of *Ximenia* in Namibia,* and for a carefully differentiated collection of the various (sub)species for use in comparative analyses. Such an exercise will have to be undertaken early in the year and if the IFTTT agrees that it is worthwhile it should approve funding for this as early as possible (since this involves basic biological research it might possibly interest one of the IFTTT’s academic partners). To keep up the momentum with *Ximenia* more trial purchases (over a wider area) should be done in 2003, processing and oil refining should be improved and local marketing should be pursued more actively.

*Ximenia* fruits are very soft and could not be purchased in a condition fit for processing trials. They might be suitable for home processing at a very small scale, but are unlikely to be an economic proposition even at SME scale. Some fruits (large yellow ones with a strong bitter almond taste) are clearly not suitable for eating – according to one informant “if you eat them you will vomit blood and die” – consequently the seeds from this type are available in larger quantities. The smaller red fruits that are eaten are usually picked by children as soon as they ripen, and are therefore unlikely to ever be available in commercial quantities, unless the trees were more widely planted.

*Ximenia* is one species for which a positive impact of commercialisation on conservation (with an interesting gender twist) has already been reported. According to a DoF official at Eenhana the communities from which most of the *Ximenia* trial purchases in 2001 were sourced are now interested in planting the species as live fencing. This came about after women complained to their men that they were chopping out a valuable resource to use in brush fences (for which *Ximenia* is a preferred species because it is tough and spiny).

d) **Acanthosycios horridus** (Inara)

Cold-pressed Inara oil was produced for the first time (by KAP) and packaged for local marketing. Samples of the oil were also sent to potential product R&D partners. No seeds were packaged for local marketing (but this is still on the cards, pending improved quality control during extraction).
A liqueur and a fruit sauce made from !nara fruit were not widely appreciated. Fruit processing attempts were hindered by problems in reliably securing ripe fruits (and dried fruit pulp).

It remains unclear whether the !nara resource is big enough to interest export markets (initial interest from a few potential buyers has not yielded conclusive results) but local oil processing could add significant additional value for harvesters – at least to part of their production (see Appendix 9 for a report on !nara seed oil pressing). The Topnaar Community Foundation has reported interest in the oil from retail and tourist outlets at the coast. A community-owned oil pressing enterprise will face significant management challenges and might not attain the necessary economies of scale, making it advisable to continue out-sourcing processing services at least until a bigger market has been secured.

The biggest immediate opportunity for !nara harvesters remains collective marketing of their seed to the traditional markets in Cape Town. The cooperative seed buying and trading system (at community level) is not yet – as far as can be established – working really well, mainly because of other demands on the time of the Topnaar Community Foundation organiser, and due to transport problems. There is still hope that the system could work, but it would require greater unity of purpose from harvesters.

Further work is needed on the (seed) quality requirements of different markets, finding a simple way of sorting the seeds for size, and possibly a mechanical decortication method. A systematic assessment of the storage characteristics of seeds and oil is desirable, but could not make the priority cut under available budgets. Whole seeds store well for at least two years, decorticated seeds go rancid within a few weeks, and oil goes rancid after a few months, depending on storage conditions.

An effort was made to compare the oil of the gemsbok cucumber (*Acanthosicyos naudiniana*, okatangakamuififi) with that of its cousin, but the seeds that were bought were empty (probably because they are not traditionally used and people have no traditional knowledge about harvesting them). This is still a topic of interest – *A. naudiniana* has a much wider distribution and is potentially available in much higher quantities than !nara. It has even been suggested that the two species can be hybridised.

e) *Adansonia digitata* (baobab) and *Kigelia africana* (sausage tree)

It is likely that bigger markets will be created for baobab (and maybe *Kigelia*, which was not included in PIF Phase One except for literature searches and a rough resource assessment that was not meaningful as it excluded Caprivi – the region of Namibia where *Kigelia* is most common) because these are the other two priorities species for SANProTA R&D funding. Namibia’s populations of these species need to be assessed more closely for their sustainable yield potential.

There are now at least four small enterprises in neighbouring countries producing baobab oil. Their current and potential levels of production are not known. The Body Shop sells Baobab Bath Oil as part of its African Spa range – this oil is believed to be sourced from Tanzania (possibly West Africa). SAFIRE in Zimbabwe has received a SANProTA R&D grant to investigate baobab pulp and oil processing (oil yields are currently very low).

In Namibia baobab (omakwa) is only common in parts of western Omusati region (and reportedly in north-eastern Otjozondjupa and parts of Caprivi, which were not covered by PIF 1). Limited trial purchases of whole baobab fruits were done at Onesí, but the prices asked (N$50/bag) seemed to
restrict the opportunity quite severely. This might be because of the value people attach to the fruit pulp, suggesting that a trial purchase of clean seeds might yield more promising results.

In any event the seeds (with or without adhering pulp) should be purchased at least removed from the hard shells, to facilitate more rational transport logistics. Pulp can easily be removed from the seeds with a grain dehuller (suggesting that a local enterprise could possibly dehull baobab along with mahangu). There is as yet no formal market for the pulp or its products, except the small juice-production facility in Malawi (which produces large quantities of seed as a by-product and will be a low-cost competitor when it branches out into oil production, as it plans to do). Limited baobab pulp processing trials under PIF Phase One resulted in the formulation of a spicy sauce and a jam, neither of which seemed like it could be the next Coca Cola. SANProTA has also commissioned further work on baobab pulp.

The potential supply of Kigelia (also from other parts of Africa) is much larger than the current demand (although a French company holds a patent on a breast-firming cream containing Kigelia extract). Kigelia is easy to grow (it is now widely planted in the NCRs) and starts fruiting after 7 years. Namibia’s head start in collaboration networks might lower marketing costs and make production from cultivated trees competitive. Researchers at the University of Zimbabwe have received a SANProTA R&D grant to investigate the production of Kigelia extract, and SANProTA might commission more specialised research into the species. It is suggested the Namibia waits for the results of these investigations and then re-evaluate its options with these two species.

f) **Hyphaene petersiana** (makalani palm, omulunga)

*Hyphaene petersiana* was included in the PIF priority list because it is very common in some parts of the NCRs, and is widely used for ombike distillation (the vegetable ivory and leaves are also important craft materials). However, surpluses of eendunga (makalani fruits) were very rarely encountered, and people quoted prices as high as 50c each for fruits. Further work on this species under PIF is probably best limited to the purchase and re-distillation of ombike produced from it.

g) **Berchemia discolor** (eembe, bird plum)

For all that marula might be more valued as a resource, this is the NCRs favourite fruit, eaten by everyone in season, used for ombike distillation and/or dried when available in surplus, in dried form often given away as a gift or sold in informal markets for N$2/cup (an astonishing N$10/kg). It is hard to imagine how such a resource can still be promoted further, but efforts under PIF have included liqueur formulation trials, ombike purchases for re-distillation, and jam/jelly production. To summarise the results:

- Fresh eembe goes soft rapidly, with the result that it cannot be transported very far, or kept very long – the fruits are crushed by their own weight, the juice is lost and the strong flavour attracts fruit flies – and for these reasons no processing trials were done with fresh eembe
- Jam made from dried eembe is “gritty” unless it is strained through a very fine cloth (or otherwise filtered)
- Boiled, eembe has an incredibly rich deep red colour, which makes very attractive products, including jelly
- A problem that has been identified is that boiled eembe products are too sweet and not acidic enough, but adding acid affects the beautiful colour (it turns muddy brown or goes an unpleasant pinkish orange)
- Eembe makes good strong ombike with a characteristic flavour (some batches)
So far the most promising products from eembe have been a liqueur and a jelly (Unam also made – before PIP – a white wine). Both products require relatively small quantities of fruits. It is not certain that processing large quantities of eembe will be profitable, because the raw material costs are high. The recommended course of action regarding this resource is to tackle the acidity/colour problem and to continue liqueur formulation. When the whole range of liqueurs is almost ready for marketing, much larger purchases of eembe from informal markets can be done to assess the depth of the resource (and further product development can be done if there is in fact a larger surplus than currently appears to be the case).

Oil production from eembe is theoretically possible, but has not been tried (and will only be feasible once larger quantities are processed and seeds are available as a by-product).

**h) Strychnos spp. (omauni, maguni)**

The main species in Namibia appear to be *S. cocculoides* and *S. pungens*, although *S. spinosa* is reportedly more popular with some people. This is another fruit that is already substantially commercialised – large quantities are sold in urban markets in season, and sellers reported no shortage of customers. Prices ranged from 50c (for fruits <7 cm dia.) to NS2 (fruits >12 cm). Maybe because there is already an informal trade, this was one of the fruits for which the idea of wholesale prices seems to have taken hold. People recognised that transporting omauni is a problem, and were sometimes prepared to negotiate lower rates on whole bags of fruit in remote areas. In Kavango, where the fruit is most common and most commercialised, a 25 kg bag of medium-sized fruits costs NS30, and large fruits NS40.

Certainly one of the strongest points going for *Strychnos* is its hard shell, which makes it easy to transport (although care should be taken to minimise bruising of fruits intended to be sold whole, as it can result in unsightly blemishes). The fruits also ripen slowly after being harvested and have the best flavour when they are over-ripe, which eases the organisation of product flow in processing.

Even when very ripe fruits have been boiled the pulp adheres strongly to the pips and is hard to remove (at least without a suitable brush pulper). The pulp is fibrous, the very fine fibres take a long time to settle out and are hard to filter out (without a specialised filter). When the fruits are very ripe a good liqueur can be made by simply mixing the pulp with the required proportion of neutral alcohol. Doing so commercially appears to be a very simple operation, but substantial quantities of fruits cannot be processed without appropriate pulping or filtering technology, and it might be necessary in a larger production system to standardise the quality by blending various batches of liqueur.

A very small quantity of *Strychnos* jam was made and had a good taste, but a truly revolting dirty brown colour.

On outside appearances, and in fragrance, fresh *Strychnos* fruit is very acceptable to Western tastes. The brain-like brown appearances of the pulp, and the frustrating mouthfeel experience of unsuccessfully trying to loosen the pulp from the pip, are not so acceptable. *It would be a good idea to subject fresh fruits to evaluation by a professional European tasting panel* (e.g. through CIRAD) and – depending on their response – organising a trial export of whole fruit.

The commercial *Maguni* liqueur is a little too sweet to be quaffed in large quantities, and the formulators appear to have also had a filtration/clarification problem (the product is slightly
cloudy). At more than N$90 for a 375 ml bottle the market for Maguni will be limited, especially in the absence of visible promotion, but there might be a large enough niche in the tourist market to absorb current levels of production at that price. Once the proposed factory is established in Rundu it will be interesting so see if the price is reduced, and to assess the impact of the business on rural incomes.

i) *Diospyros mespiliformis* (eenyandi, jackal berry)

The fresh and dried fruits are very popular as snacks. Fresh fruits do not transport well. Dried fruits are sometimes available in large quantities (this appears to be seasonal, but the exact factors that contribute to a bumper crop are unclear) and store very well if protected against pests (a small moth similar to the one that infests mahangu in storage).

The dried fruits have a high sugar content and made one of the better spirits distilled under PIF. Boiling resulted in a very sweet pulp with a gritty texture that could not be made into anything interesting. Apart from ombike production this fruit currently appears to have limited commercial potential.

j) Other species

"Minor" species evaluated under PIF Phase One included:

- *Vangueria infausta* (wild medlar, eembu) is popular fresh, not often available in large quantities (even dried it is quite rare) and of limited commercial interest; it is however a species on which VPR&D in Botswana has done quite extensive domestication and selection work and is certainly worth including in such work in Namibia, and in agroforestry systems.

- *Terfezia* spp. (Kalahari truffles) are highly dependent on late rainfall and are therefore only available sporadically. Preservation trials were generally successful (blanching and freezing yielded the best product, but slices pickled in brine were also good and will be easier to market). Processing and trade will plerforce have to be opportunistic until cultivation methods are developed (in cooperation with Israeli researchers).

- *Grewia* spp. (eeshe) are important survival foods. They are also extensively used for ombike production in some areas, and are sometimes sold in informal markets for this purpose. Apart from that they seem to have little commercial potential.

- *Ziziphus mucronata* (omukekete, buffalo thorn) is also used for ombike production. It appears to have limited other commercial potential, but it is widely available and might justify some further work.

- *Tylosoema esculenta* (morama bean) also appears to produce well in some season, and hardly at all in others. A smallish quantity of beans from Omaheke was purchased for processing trials. Roasted morama beans have been marketed as formal-market snacks in Botswana, with limited success. Evenly roasting the seeds is problematic and some individual beans are extremely bitter. The young roots are a popular vegetable and this use needs further research (or at least collaboration of the considerable existing research). In consultation with Unam Chemistry Department oil analyses were delayed to allow a Masters student to finish and publish her thesis on this species. In the NCRs Tylosoema was observed to grow but according to local people not used by humans; it is unclear whether this was *T. esculenta* or the very similar *T. fassoglense*. 
• *Cucumis metuliferus* (African horned cucumber, eenoshwa) is popular fresh. Selected strains cultivated in New Zealand are marketed internationally under the Kiwano brand name. VPR&D in Botswana has made an interesting fruit cheese/leather from this fruit, but not marketed it successfully. Wild fruits are not available in huge quantities and sell for around N$1 each in informal markets – some are bitter. This species requires selection and cultivation work more urgently than processing.

• *Dialium engleranum* (nonsimba, thimba, Kalahari pod-berry) is a popular snack in Kavango and is often sold in small quantities (for about 20c/small lid). Unsustainable harvesting practices are used (cutting down big branches) and *further commercialisation is not advisable,*

• *Colophospermum mopane* (mopane, omusati) seeds were bought and evaluated for essential oil production. A small sample was steam distilled and yielded 1:500 essential oil. *Further evaluation of the commercial potential is proposed,* since this is an unutilised resource that it available in very large quantities.

• *Guibourtia coleosperma* (nonsivi, copalwood, false mopane) seeds were purchased in small quantities. The oily arils were very good cooked with cabbage – a traditional recipe – but went rancid before they could be processed. They might be made into an interesting relish. Seeds are reportedly eaten and some further work would be a good idea.

• *Ochna pulchra* (makopa) yields a potentially interesting oil and is reported to be locally common in parts of Kavango (and possibly Caprivi), as well as in Omaheke. The oil is extracted by traditional methods in Kavango, and also in Botswana and Zambia. This could be a resource that is interesting when a regional supply can be mobilised (e.g. through SANProTA).

• *Croton gratissimus* (lavender croton, two sub species) is very common in some parts of the NCRs (and fairly widespread in the country) and *should be investigated further as a potential source of essential oil.*

• *Pechuel-Loeschea leubnitziae* (bitterbush) is extremely common in many places and *should also be targeted for essential oil production.*

• *Terminalia* was not included in PIF, but market enquiries about the rootbark coincided with an opportunity to obtain samples from a bush-clearing pilot project in Ohangwena region. Since *T. sericea* is a prominent invasive species in some areas, and since a market for the rootbark could possibly contribute to the cost of bush-clearing in these areas, a sample of 200 kg of dried rootbark was ordered through the MAWRD AEO at Okongo (but has not yet been delivered).
8 Ownership

The IFTT has so far failed to resolve, or even seriously address, the issue of enterprise ownership (in most cases resource ownership is less problematic, since it is largely governed by traditional law). To put it bluntly: Who is/are supposed to own the commercial opportunities (“bankable business plans” to quote the S&AP) created by PIF? How and under what conditions will this ownership be conferred? What are the implications of this for who gets access to which commercial information, when? To what extent should PIF support private sector initiatives around indigenous fruits? Should PIF compete with newly established ventures (such as the Strychnos liqueur) and bid up the price of fruit (if it can) in order to maximise benefits to primary producers? Such questions are best answered in an open forum with maximum stakeholder participation – a national workshop.

In general it is proposed that the IFTT expresses itself strongly in favour of a development model that uses public funds to incubate viable businesses in which primary producers can own equity and consequently a share of the benefits. It is envisaged that cooperative ownership will feature prominently, but that mixed enterprise ownership will evolve in accordance with Namibia’s mixed economy. Without a fair ownership arrangement it is not possible to access fair trade markets, which are in most cases more lucrative than “ordinary” markets (and in some cases the only markets, at least initially). The ideal solution would be a privatised, for-profit natural product incubation business that can leverage public and donor funding to secure additional private sector investment and venture capital, as well as equity participation for primary producers, and that can take calculated commercial risks. It is recommended that the IFTT supports the compilation of a feasibility study and business plan for such an incubation enterprise.

Enterprises that operate from an unfair and inequitable footing are inherently unsustainable and could moreover result in social conflict and division. They are therefore unlikely to contribute much to the ultimate aim, which is to alleviate rural poverty, enhance the perceived value of natural resources and provide added incentives for improved management of natural resources through sustainable use. While it is probably idealistic to expect that commercialisation could result in perfect socio-economic equity in all cases, it is recommended that equality of opportunity be retained as a policy objective.
9 Conclusions

Phase One of PIF delivered more and less than planned.

Significant steps were taken towards achieving the overall goal:

Stable and sustainable long-term markets have been established for a range of sustainably harvested indigenous fruits and/or indigenous fruit products on terms advantageous to the livelihoods and food security of rural harvesters and producers in Namibia.

The broad aim of Phase One was met:

To gather, by way of applied research and through the application of multi-disciplinary development skills, environmental, socio-economic and commercial information required for planning further phases in the promotion of sustainable indigenous fruit utilisation in Namibia. Specifically, to do so by:

- purchasing, collecting, processing, marketing and otherwise commercialising at various scales, on a trial basis but aimed at economic sustainability, the fruits of available indigenous species; and by
- co-operating with and supporting various stakeholders in commercialisation initiatives around indigenous fruits.

PIF Phase One objectives were met to various extents for various species at different stages of their "commercialisation lifecycle":

a) To start building up and recording a more detailed picture of which fruits are available where and when, in what quantities, from whom, at what prices, quality and effort, and with which likely effects on environmental and socio-economic sustainability. Coincidentally, to start identifying and recording elite genotypes for use in domestication, breeding and cultivation programmes.

b) To investigate the technical and/or economic parameters of various types of processing with various types of fruit, at a bench scale for all fruit purchased or collected, and at a small to medium scale for priority resources. Coincidentally to make information available for use in developing technology for processing.

c) To start building up a more detailed picture of various markets for indigenous fruits and/or products, by quantifying the existing trade, testing market responses to various products and developing markets for novel products. Coincidentally to facilitate Namibia's participation in regional marketing initiatives, provide marketing support to IF products already at various stages of commercialisation, and make available information for planning marketing strategies at later stages.

d) To keep Namibian stakeholders informed, through the IFTT, of local, regional and international developments affecting indigenous fruits, including the outputs of the Objectives above, and to report on these to key stakeholders on a regular basis.

e) To make relevant data available for planning the next phase(s) of the PIF project.
Overall it can be concluded that PIF Phase One:

- Significantly improved Namibian stakeholders’ understanding of the complexities of natural product commercialisation
- Re-affirmed the need for a holistic and integrated approach stretching from the resource management level all the way through to final markets
- Underscored the need to provide adequate resources for market liaison
- Highlighted the constraints around local and national processing and marketing, and the need to seek external markets for Namibian natural products
- Affirmed the value of cooperation with other regional producers of natural products
- Provided a sound basis for planning Phase Two of the project Promoting Indigenous Fruits in Namibia.

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Acknowledgments

The invaluable personal and professional support of the following people is highly appreciated: Everyone at CRIA SA-DC for everything, the IFTT for it support and guidance, Herta Kolberg and Ben Bennett for reviewing the first draft, all EWC members, the members of the King Nehale Resource Committee, Andy Botelle, Silke Rugheimer, Betrand and Nora Kahuure-Dayot, Arne Larson, Mike O’Brian, Alex Verlinden, Agnes Akwenye, Marion Hyde, Sigried Mwaala, Lilja Itenge, Miriam Kafula, Pricilla Nashandi, Colin Nott, Jericho Mulofwa, Rolf Behringer, Charlie Mwaetako, Sarah Haawi, Lotto Kishona, Jaco Wakudumo, Mado Samuel, Simeon Hengari, Mr. Hausiku, Tony Cunningham, Mr Ndauendapo, and hundreds of others whose names I did not record, including the producers who provided the resources used in this project.
Appendix 1: Amended project proposal

1 PIF VISION STATEMENT

Stable and sustainable long-term markets have been established for a range of sustainably harvested indigenous fruits and/or indigenous fruit products on terms advantageous to the livelihoods and food security of rural harvesters and producers in Namibia.

2 BROAD AIM OF PHASE ONE

To gather, by way of applied research and through the application of multi-disciplinary development skills, environmental, socio-economic and commercial information required for planning further phases in the promotion of sustainable indigenous fruit utilisation in Namibia. Specifically, to do so by:

- purchasing, collecting, processing, marketing and otherwise commercialising at various scales, on a trial basis but aimed at economic sustainability, the fruits of available indigenous species; and

- co-operating with and supporting various stakeholders in commercialisation initiatives around indigenous fruits.

3 PHASE ONE OBJECTIVES

a) To start building up and recording a more detailed picture of which fruits are available where and when, in what quantities, from whom, at what prices, quality and effort, and with which likely effects on environmental and socio-economic sustainability. Coincidentally, to start identifying and recording elite genotypes for use in domestication, breeding and cultivation programmes.

b) To investigate the technical and/or economic parameters of various types of processing with various types of fruit, at a bench scale for all fruit purchased or collected, and at a small to medium scale for priority resources. Coincidentally to make information available for use in developing technology for processing.

c) To start building up a more detailed picture of various markets for indigenous fruits and/or products, by quantifying the existing trade, testing market responses to various products and developing markets for novel products. Coincidently to facilitate Namibia’s participation in regional marketing initiatives, provide marketing support to IF products already at various stages of commercialisation, and make available information for planning marketing strategies at later stages.

d) To keep Namibian stakeholders informed, through the IFTT, of local, regional and international developments affecting indigenous fruits, including the outputs of the Objectives above, and to report on these to key stakeholders on a regular basis.

e) To make relevant data available for planning the next phase(s) of the PIF project.
4 PHASE ONE BROAD ACTIVITY OUTLINE

a) Liaise and co-ordinate with project and business partners, as well as local, regional and international initiatives, and report to the IFTT on a monthly basis.

b) Purchase or collect, store and transport on a trial basis the widest possible range of indigenous fruits so as to investigate:
   - the harvesting, collating, purchasing, storage and transport logistics of trading significant quantities of fresh indigenous fruit in various parts of rural Namibia;
   - the seasonal availability of various fruits in different areas;
   - the willing-seller-willing-buyer prices of fruits in various seasons in various markets; and
   - the storage potential of selected species under different conditions.

Coincidentally, record the position and features of elite genotypes.

c) Analyse, process and/or market on a trial basis a selected range of indigenous fruits so as to investigate:
   - the processing characteristics of selected species;
   - potential urban markets for fresh or processed fruits;
   - market acceptance of selected fruits and some products made from them;
   - specific technology and/or R&D required to make processing viable;
   - potential for co-operation with larger private sector companies;
   - likely marketing costs from point of collection to point of processing;
   - likely processing costs;
   - likely prices for potential processed products;
   - market characteristics (e.g. segmentation); and
   - possible market placement and promotional strategies for individual products and indigenous fruit products as a whole.

Coincidentally, support the marketing of existing indigenous products, especially in such a way as to put more money in the hands of primary producers, and by collaborating in regional (SADC) and international marketing initiatives.

5 PHASE ONE SPECIFIC ACTIVITIES

The following project activities are proposed in order to meet the specific objectives:

5.1 Project partners and co-ordination

a) The IFTT will act as the Project Steering Committee.

b) The NAB will administer project funds on behalf of MAWRD.

c) CRIAA SA-DC will be contracted to implement and co-ordinate the project, with technical services provided by the KAP workshop. Pierre du Plessis will be Project Co-ordinator, with assistance and inputs from Michel Mallet (economic and business development planning), Roger Gamond (technology and processing R&D), Cyril Lombard (research, marketing and international liaison), Dave Cole (socio-economic and CBNRM aspects). Frederika Amutse,
Nico Shikongo and Mbazo Mothlaping will help with community liaison. Jenniphar Gatsi and Saskia den Adel will assist with marketing.

d) The other partners in the project:
- NBRI, as secretary to the IFTT, will collect and store such reports as are produced.
- CIRAD will do systematic evaluations of the processing characteristics of marula.
- DRFN and the Topnaar Community Foundation will facilitate access to Inara harvesters.
- Eudafano Women’s Co-operative, X-otic project/Ohangwena Forest Trust, King Nehale Resource Committee and other CBOs as appropriate will facilitate community and resource access in NCRs

Many other institutions have indicated a willingness to take part, or have good reasons to take part, but their participation has not been confirmed.

e) In addition to the specific items budgeted below, CRIAA SA-DC will be paid a co-ordinator’s fee of N$10,350 per month. This will cover six days of Pierre du Plessis’s time, for liaising with various project partners and markets, keeping updated on project developments and reporting to the IFTT (short monthly reports, more detailed and analytical reports end-May and end-August).

| Cost:       | 8 months x 6 days x 1 500 | 72 000 |
|            | VAT @ 15%                  | 10 800 |
|            | 5 months x 2 days x 1 500 | 15 000 |
|            | VAT @ 15%                  | 2 250  |
| Total      |                           | N$100 050 |

Duration: Feb 01 to Mar 02 (13 months)

Outputs: Various project components proceed in co-ordinated manner
Contacts are kept up with partners
IFTT is kept informed of results and developments

MOV: Short monthly reports; more detailed reports in May 01 (on purchases and progress) and March 2002 (end of Phase One report)

[NOTE: In the S&AP most of the activities included in Phase One are scheduled to take place over 16 months, from Feb 01 to May 02, so as to encompass two “main” fruiting seasons and one “minor” season. To lower the cost of the first contract until more clarity on the available budget is available, and to allow the IFTT and stakeholders to guide the planning of Phase Two from a more informed position, only the first part of this work is included here. Subject to alternative guidance from stakeholders, it is envisaged that Phase Two will complete the purchase, processing and marketing trials contained in the S&AP, and start the pilot project phase.]

5.2 Fieldwork

a) It will be necessary to do regular field trips to the project areas to liaise with harvesters and other partners, and to survey markets, resource use and socio-economic effects. The trips will obviously double as purchasing opportunities, and will themselves provide information on transporting and storage. At the same time, feedback and support will be provided to project partners and new products will be introduced to markets in the production areas on a trial
basis. An effort will be made to facilitate and foster inter-regional trade, e.g. between Kavango/ Caprivi and the NCRs.

b) Since the trips have multiple purposes, it is not possible to assign them strictly to specific project components. However, it can roughly be considered that 10 trips are required to the NCRs [not including two trips paid for by X-otic project, or trips paid from KMS, or future trips that will be paid from the FRP marula “winners and losers” project], 5 trips to Kavango (mostly for marketetti), and 3 trips to Erongo (while these last can be assigned to Inara processing they are included here for consistency).

Cost: N$215 750
Duration: Feb 01 to Mar 02
Outputs: Trial purchases conducted as detailed below
Resource, market and socio-economic monitoring conducted
Marula press dissemination followed as detailed below
Rural stakeholders and partners kept in contact with IFTT
Raw materials available for trials as detailed below
MOV: Project Co-ordinator’s monthly reports; other project components make progress

[NOTE: Details of field trips done are contained in Appendix 2.]

5.3 Trial purchases

Since the availability and prices of indigenous fruits are not known, it is impossible to budget accurately for expenditure on trial purchases. Moreover, some of these purchases will result in sales, producing at least some income. For these reasons it is proposed that a float of N$50 000,00 be budgeted for “general fruit and product trading” and that all purchases and sales not directly budgeted elsewhere be accounted for against this float.

Cost: N$50 000
Duration: Feb 01 to Mar 02
Outputs: Fresh fruits and traditional products available for marketing trials
Raw materials for processing trials provided to CIRAD, Unam FSTD and KAP
Information on prices
MOV: Marketing reports; processing reports; detailed trading account

[NOTE: After all PIF purchases and sales are accounted for the balance left on this float is N$25 082.41 – see Appendix 2 PIF1a.4.]

5.4 Monitoring marula juice presses,

a) Marula processing is an absolute top priority, (resource, some market, technology, institutions are in place; need for urgent action to stay ahead of other producing countries). While more information is required to plan medium-scale or industrial processing trials, there is an immediate opportunity for many small enterprises to press marula juice and sell it fresh or fermented. Local markets in the NCRs are at this stage the most profitable and likely to remain so for some time (partly due to low marketing costs) – for this reason the S&AP recommended keeping traditional markets fully supplied and investigating alternative uses (at unknown prices) for surplus production.
b) The demonstration of a small French-made press by CRIAA SA-DC on behalf of MAWRD at the WIB-SADC Trade Fair at Ongwediva in 2000 has resulted in considerable interest in the technology. KAP has therefore decided to pre-finance a Namibia-adapted prototype of such a press (to the tune of N$12 750) and, after testing, to market copies of the press at cost (N$4 370 each) in the NCRs during the 2001 marula season. The dissemination of this technology needs to be supported by monitoring and benchmark tests, so as to assess:

- the degree of spontaneous uptake and the extent of private or group investment in an unsubsidised technology investment opportunity;
- the extent of local markets for fresh or fermented marula juice, and the marula surplus available once these markets are more fully supplied;
- the feasibility of storing juice at homestead level for supplying traditional markets out of season;
- the feasibility of buying juice rather than whole fruit for processing and marketing;
- the extent of urban markets in other parts of Namibia for fresh or fermented marula juice, and the associated marketing costs;
- the effects on the economics of marula kernel production of concentrating, through increased juice processing capacity, more marula pips in centralised locations;
- the ability of small groups and individuals to operate a micro-fruit processing and marketing enterprise, the opportunities and constraints associated with these enterprises, the actual productivity of enterprises against best-practice benchmarks, and the economics of production; and
- the effects of increased marula fruit commercialisation on socio-economic (and especially gender) relations.

c) Transport and general fieldwork costs have been included above. Additional costs for this component are:

<table>
<thead>
<tr>
<th>Cost</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchmark trials 3 days</td>
<td></td>
</tr>
<tr>
<td>Preservation trials 4 days</td>
<td></td>
</tr>
<tr>
<td>Data analysis and reporting 3 days</td>
<td></td>
</tr>
<tr>
<td><strong>Total 10 days @ 1 500</strong></td>
<td>15 000</td>
</tr>
<tr>
<td>VAT on fees @15%</td>
<td>2 250</td>
</tr>
<tr>
<td>Per diems 7 x 400</td>
<td>2 800</td>
</tr>
<tr>
<td>Consumables</td>
<td>1 000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>N$21 050</td>
</tr>
</tbody>
</table>

Duration: Feb 01 to Mar 02  
Outputs: Productivity benchmarks known  
Press dissemination followed up and monitored as detailed above  
Marula juice preservation guidelines available  
MOV: Reports to IFTT; info pamphlet for press owners

NOTE: Balance on this budget line is N$7 268.23 – still needed for technical follow-up and servicing]

5.5 Literature searches

By May 01 information should be available to start short-listing promising species in a more systematic manner. At this stage it will be advisable, and possible, to conduct literature surveys on a
few top-priority resources. Because it is not clear how many days would be required, the time allocated (to Cyril Lombard for information searches in the British Library) is budgeted in tranches of two days (one to search, one to report) so as to keep the IFTT updated on progress.

Cost:  
5 x 2 days @ 2 500  
No VAT  
Total  
N$25 000

Duration: As approved by IFTT  
Outputs: Information as requested  
MOV: Reports to IFTT

[NOTE: A full set of photocopies obtained will be made available to NBRI.]

5.6 Processing trials at KAP

The range of processing trials envisaged is detailed in the PIF S&AP. Due to the uncertainty of fruit availability, the processing trials at KAP will necessarily have to be conducted in a somewhat ad hoc manner at first. It will soon become clear which resources warrant further work, which can then be planned and considered by the IFTT.

Cost:  
Equipment purchase/manufacture

Still for distillation trials  
Solar drier  
VAT @ 15%  
Sub-total  
[NOTE: Equipment remains property of MAWRD. IFTT approved using solar drier funds for solar pasteuriser instead – only prototype manufactured. Two presses – one copper and one stainless steel – and one still stand with a gas burner have been manufactured. Balance on analytic account is N$15 743.15]

Rentals

Cold storage 8 mths x 1 500  
Processing space 8 mths x 1000  
Electricity and water 8 mths x 750  
Sub-total  
[Extended to 18 months – from April 01 to Sep 02 – at no extra charge.]

Consumables

Yeasts, alcohol, sugar, cream, cleaning etc.  
Sub-total  
[NOTE: This budget line was also used – with the authorisation of the IFTT – to pay for the reprint of the Strategy and Action Plan, and an additional 5 days for melon seed extraction trials – see Appendix 2, PIF1b.3. Balance on analytic account is N$132.32.]
Analyses

Basic analyses 15 000
VAT @ 15% 2 250
More detailed analyses 25 000

Sub-total 42 250

[NOTE: The analytic balance on this budget line is N$20 606.80. Expenditures totalled N$21 643.20, which included shipping larger processing samples to partners in Europe (through an oversight no other provision for this essential activity was made in the budget). The IFTT had agreed to pay the cost of shipping marula fruit to CIRAD – N$14 017.50 – separately and if this payment is refunded by NAB the analytic balance will be correspondingly higher.]

Time

5 days/mth x 6 x 1 500 45 000
VAT on fees @ 15% 6 750

Sub-total 51 750

Total N$178 500

Duration: Feb 01 to Mar 02
Outputs: Products, recipes, information
MOV: Reports to IFTT

5.7 Marketing trials

At this stage of the commercialisation process the main marketing activities are liaison with potential buyers and consumers, introducing fruits/products to potential markets, monitoring seasonal supplies and price movements in traditional markets, and attempting to profile various kinds of markets as to prices, volumes, quality requirements etc., with the aim of evolving simple marketing plans. Since much of this work is on-going and hard to schedule, it is included in the monthly Project Co-ordination fee.

The PIF S&AP contains two specific allocations for marketing work, with N$30 950 for marketing trials allocated as follows:

Cost: Packaging and labels 3 100
Market liaison in Europe 7 days x 2 500 17 500
(No VAT)
Local, national and regional marketing
6 days x 1 500 9 000
VAT on fees @ 15% 1 350

Sub-total 10 350

Total N$30 950

Duration: Mar 01 to Mar 02
Outputs: Marketing information, possibly markets for definite products
MOV: Products in markets, reports to IFTT
5.8 Further planning

An independent evaluation and major replanning are budgeted for January 2003 in the S&AP. Depending on the progress made, the IFTT may wish to move this work ahead, which would be better for using the 2003 fruiting season to the full, but present a problem in that the evaluation will take place outside the main fruiting season. It is considered that the regular reports to the IFTT, the final Phase One summary report to the workshop, and the workshop proceedings, will provide enough information to facilitate informed planning for Phase Two. Thus no specific provision is made in this proposal for further planning.

6 SUMMARISED BUDGET

The re-budgeted costs of the combined PIF Phase One are summarised below:

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project co-ordination</td>
<td>100 050</td>
</tr>
<tr>
<td>Fieldwork</td>
<td>215 750</td>
</tr>
<tr>
<td>Trial purchases</td>
<td>50 000</td>
</tr>
<tr>
<td>Samples to CIRAD (at cost – not included here)</td>
<td></td>
</tr>
<tr>
<td>Monitoring marula press</td>
<td>21 050</td>
</tr>
<tr>
<td>Literature searches</td>
<td>25 000</td>
</tr>
<tr>
<td>Processing trials at KAP</td>
<td>178 500</td>
</tr>
<tr>
<td>Marketing trials</td>
<td>30 950</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td><strong>621 300</strong></td>
</tr>
<tr>
<td>15% administration (including 15% VAT)</td>
<td>93 195</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>N$714 495</strong></td>
</tr>
</tbody>
</table>

[NOTE: For a detailed budget see Appendix 2.]

7 SCHEDULE OF PAYMENTS

Received to date:  
PIF 1a 1st payment (40%)  190 463,00  
PIF 1a 2nd payment (30%)  142 847,25  
Additional 10% of PIF 1a  47 615,75  
Sub-total PIF 1a  380 926,00  
PIF 1b 1st payment (40%)  95 335,00  
PIF 1b 2nd payment (30%)  71 501,25  
Sub-total PIF 1b  166 836,25  
Total received  N$547 762,25

Still outstanding:  N$166 732,75 (23.34% of N$714 495)  
To be paid by end March 02 on submission of Final Report.
### Appendix 2: Financial report
(Period: March 2001 to October 2002)

#### PIF-1A

<table>
<thead>
<tr>
<th>DATE</th>
<th>FUNDS RECEIVED</th>
<th>FOLIO NO.</th>
<th>NS</th>
<th>BUDGET</th>
<th>BALANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/03/01</td>
<td>NAB cheque # 9832 (part), 1st payment (40%)</td>
<td>211</td>
<td>190 463,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/07/01</td>
<td>NAB cheque # 9024, 2nd payment (30%)</td>
<td>797</td>
<td>142 847,25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12/12/01</td>
<td>NAB cheque # 100004 (part), 3rd payment (10%)</td>
<td>1488</td>
<td>47 615,75</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Funds Received</strong></td>
<td></td>
<td></td>
<td><strong>380 926,00</strong></td>
<td><strong>473 957,50</strong></td>
<td><strong>-93 031,50</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE</th>
<th>FUNDS RECEIVED</th>
<th>FOLIO NO.</th>
<th>NS</th>
<th>BUDGET</th>
<th>VARIANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>26/02/01</td>
<td>P. du Plessis, fees 6 days (Feb. 01)</td>
<td>156</td>
<td>10 350,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30/03/01</td>
<td>P. du Plessis, fees 6 days (Mar. 01)</td>
<td>339</td>
<td>10 350,00</td>
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</tr>
<tr>
<td>02/05/01</td>
<td>P. du Plessis, fees 6 days (Apr. 01)</td>
<td>453</td>
<td>10 350,00</td>
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<td></td>
</tr>
<tr>
<td>31/05/01</td>
<td>P. du Plessis, fees 6 days (May 01)</td>
<td>555</td>
<td>10 350,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22/06/01</td>
<td>P. du Plessis, fees 6 days (June 01)</td>
<td>711</td>
<td>10 350,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19/07/01</td>
<td>P. du Plessis, fees 6 days (July 01)</td>
<td>843</td>
<td>10 350,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27/08/01</td>
<td>P. du Plessis, fees 6 days (Aug. 01)</td>
<td>957</td>
<td>10 350,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25/09/01</td>
<td>P. du Plessis, fees 6 days (Sep. 01)</td>
<td>1094</td>
<td>10 350,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15/10/02</td>
<td>P. du Plessis, fees 6 days (Oct.-Nov. 01 &amp; Dec. 01Jan. 02)</td>
<td>44</td>
<td>10 350,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28/02/02</td>
<td>P. du Plessis, fees 2 days (Feb. 02)</td>
<td>272</td>
<td>3 450,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>05/04/02</td>
<td>P. du Plessis, fees 2 days (Mar. 02)</td>
<td>510</td>
<td>3 450,00</td>
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<td></td>
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<tr>
<td><strong>Total project co-ordination</strong></td>
<td></td>
<td></td>
<td><strong>100 050,00</strong></td>
<td><strong>100 050,00</strong></td>
<td><strong>0,00</strong></td>
</tr>
</tbody>
</table>

### 3. FIELDWORK

#### 3.1 NCRs trips

<table>
<thead>
<tr>
<th>DATE</th>
<th>FUNDS RECEIVED</th>
<th>FOLIO NO.</th>
<th>NS</th>
<th>NCRs trip</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/03/01</td>
<td>P. du Plessis, per diem 6 days (5-11/03/01), 1st NCRs trip</td>
<td>235</td>
<td>2 400,00</td>
<td></td>
</tr>
<tr>
<td>12/03/01</td>
<td>P. du Plessis, fees 6 days, 1st NCRs trip (5-11/03/01)</td>
<td>243</td>
<td>10 350,00</td>
<td></td>
</tr>
<tr>
<td>12/03/01</td>
<td>Vehicle charge N43747W, 2524 km (5-11/03/01), 1st NCRs trip</td>
<td>246</td>
<td>5 310,00</td>
<td></td>
</tr>
<tr>
<td>03/04/01</td>
<td>P. du Plessis, per diem 4 days (3-7/04/01), 2nd NCRs trip</td>
<td>349</td>
<td>1 600,00</td>
<td></td>
</tr>
<tr>
<td>08/04/01</td>
<td>Ford N43747W, 2 309 km, 2nd trip NCRs (3-8/04/01)</td>
<td>365</td>
<td>5 772,50</td>
<td></td>
</tr>
<tr>
<td>12/04/01</td>
<td>P. du Plessis, fees 6 days 2nd trip to NCRs (3-8/04/01)</td>
<td>375</td>
<td>10 350,00</td>
<td></td>
</tr>
<tr>
<td>07/05/01</td>
<td>NNP/NRSC no. 07/041, printing 40 A2 tree spec. density maps</td>
<td>487</td>
<td>850,00</td>
<td></td>
</tr>
<tr>
<td>22/05/01</td>
<td>P. du Plessis, per diem 9 days (7-18/05/01), 3rd NCRs trip</td>
<td>541</td>
<td>3 600,00</td>
<td></td>
</tr>
<tr>
<td>22/05/01</td>
<td>Toyota Hilux N16415W, part charge 1551km, 3rd NCRs trip (7-20/05/01)</td>
<td>545</td>
<td>3 877,50</td>
<td></td>
</tr>
<tr>
<td>23/05/01</td>
<td>P. du Plessis, fees 10 days, 3rd NCRs trip (May 01) less NS800</td>
<td>559</td>
<td>16 450,00</td>
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</tr>
<tr>
<td>05/06/01</td>
<td>P. du Plessis, per diem 4 days (5-10/06/01), 4th NCRs trip</td>
<td>634</td>
<td>1 600,00</td>
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<tr>
<td>12/06/01</td>
<td>Toyota N16415W, 1896 km (6-10/06/01), 4th NCRs trip</td>
<td>664</td>
<td>4 740,00</td>
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</tr>
<tr>
<td>12/06/01</td>
<td>P. du Plessis, fees 4 days, 4th NCRs trip (6-10/06/01)</td>
<td>666</td>
<td>6 900,00</td>
<td></td>
</tr>
<tr>
<td>13/07/01</td>
<td>Ford N55180W, 2467 km (9-13/07/01), 5th NCRs trip &amp; Kavango</td>
<td>822</td>
<td>6 167,50</td>
<td></td>
</tr>
<tr>
<td>13/07/01</td>
<td>P. du Plessis, per diem 3 days (part), 6th NCRs trip (2 days)</td>
<td>824</td>
<td>800,00</td>
<td></td>
</tr>
<tr>
<td>13/07/01</td>
<td>P. du Plessis, fees 2 days 5th NCRs trips (9-11/07/01)</td>
<td>825</td>
<td>3 450,00</td>
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<tr>
<td>27/08/01</td>
<td>P. du Plessis, per diem 5 days (27/08-1/09/01), 6th NCRs trip</td>
<td>964</td>
<td>2 000,00</td>
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<tr>
<td>01/09/01</td>
<td>Ford N43747W 1866km (27/08-1/09/01), 6th NCRs trip</td>
<td>1003</td>
<td>4 715,00</td>
<td></td>
</tr>
<tr>
<td>03/09/01</td>
<td>P. du Plessis, fees 5 days (27/08-1/09/01), 6th NCRs trip</td>
<td>1008</td>
<td>8 625,00</td>
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<tr>
<td>22/11/01</td>
<td>Toyota N16425W, 854km, part trip NCRs (15-21/11/ 01)</td>
<td>1360</td>
<td>2 135,00</td>
<td></td>
</tr>
<tr>
<td>22/11/01</td>
<td>P. du Plessis, gross fees 1 day, 7th NCRs trip (15-21/ 11/01)</td>
<td>1357</td>
<td>1 725,00</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Description</td>
<td>Cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-----------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31/12/01</td>
<td>CRIAA SA-Dc, additional 899km charge, credited from X-OTIC project</td>
<td>1600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19/02/02</td>
<td>P. du Plessis, per diem 5 days (19-24/02/02), 8th NCRs trip</td>
<td>216</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25/02/02</td>
<td>P. du Plessis, fees 5 days (19-24/02/02), 8th NCRs trip</td>
<td>250</td>
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<tr>
<td>25/02/02</td>
<td>Toyota N16415W 2025km (19-24/02/02), 8th NCRs trip</td>
<td>253</td>
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</tr>
<tr>
<td>15/03/02</td>
<td>P. du Plessis, per diem 10 days (17-30/03/02), 9th NCRs trip</td>
<td>350</td>
<td></td>
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</tr>
<tr>
<td>05/04/02</td>
<td>N16415W 2617km (18/03-30/04/02), 9th NCRs trip</td>
<td>493</td>
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<tr>
<td>05/04/02</td>
<td>P. du Plessis, fees 10 days (17/03-30/04/02), 9th NCRs trip</td>
<td>504</td>
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<tr>
<td>16/04/02</td>
<td>P. du Plessis, per diem 4 days (17-21/04/02), trip</td>
<td>558</td>
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</tr>
<tr>
<td>22/04/02</td>
<td>P. du Plessis, fees 5 days (17-21/04/02), 10th NCRs trip</td>
<td>592</td>
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<td></td>
</tr>
<tr>
<td>16/05/02</td>
<td>Rennes Travel nc02604 (part), airfare P. du Plessis (Etosha)</td>
<td>748</td>
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<tr>
<td></td>
<td>Sub-total NCRS trips</td>
<td>156370,00</td>
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<tr>
<td></td>
<td></td>
<td>148237,50</td>
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<tr>
<td></td>
<td></td>
<td>-10132,50</td>
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<tr>
<td>3.2</td>
<td>Omahohe trips</td>
<td>0</td>
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<tr>
<td>3.3</td>
<td>Erongo trips</td>
<td>0</td>
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<td></td>
</tr>
<tr>
<td>09/07/01</td>
<td>P. du Plessis, per diem 2 days (8-6/07/01), 1st Erongo trip</td>
<td>782</td>
<td></td>
<td></td>
</tr>
<tr>
<td>09/07/01</td>
<td>P. du Plessis, fees 2 days (5-6/07/01), 1st Erongo trip</td>
<td>783</td>
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<td></td>
</tr>
<tr>
<td>09/07/01</td>
<td>Toyota N16415W, 1000km, 1st Erongo trip (8-6/07/01)</td>
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<tr>
<td>27/08/01</td>
<td>Toyota N16415W, 837km 2nd Erongo trip (21-22/08/01)</td>
<td>953</td>
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<tr>
<td>27/08/01</td>
<td>P. du Plessis, per diem 1 day (21-22/08/01), 2nd Erongo trip</td>
<td>954</td>
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<td></td>
</tr>
<tr>
<td>27/08/01</td>
<td>P. du Plessis, fees 1,5 days (21-22/08/01), 2nd Erongo trip</td>
<td>955</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Sub-total Erongo trips</td>
<td>11830,00</td>
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<tr>
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<td>Kavango trips</td>
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<td>01/06/01</td>
<td>P. du Plessis, per diem 3 days (1-3/06/01), 1st trip to Kavango</td>
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<td>Toyota N16413W, 1855 km, 1st trip to Kavango</td>
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<td>P. du Plessis, fees 4 days, 1st Kavango trip (1-4/06/01)</td>
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<td>13/07/01</td>
<td>P. du Plessis, per diem 3 days (part), 2nd Kavango trip (1/7/01)</td>
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<td>P. du Plessis, fees 2 days, 2nd Kavango trip (9-11/07/01)</td>
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<td>25/04/02</td>
<td>P. du Plessis, per diem 3days (30/04-11/05/02), 3rd Kavango (8 NCRs) trip</td>
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<td>CRIAA SA-Dc, 3803km (30/04-11/05/02), 3rd Kavango (8 NCRs) trip</td>
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<td>P. du Plessis, fees 4days (30/04-11/05/02), 3rd Kavango trip</td>
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<td>P. du Plessis, fees 4 days (3-8/09/01), SANProTA launch Botswana</td>
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<td>P. du Plessis, per diem 5 days (3-8/09/01), SANProTA launch Botswana</td>
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<td>P. du Plessis, Mazda N34711W 2000km (4-8/09/01), trip to Gaborone</td>
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<td>TRIAL PURCHASES</td>
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<td>12/03/01</td>
<td>P. du Plessis, trial purchases NCRs (Tunetu #2, Manketti #1, Merula jenny no. 99)</td>
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<td>07/04/01</td>
<td>CYMOT (Gahakali), purchase of 3x 25-L cans for Ombike</td>
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<td>P. du Plessis, trial purchases of Ximenia &amp; Manketti nuts</td>
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<td>P. du Plessis, trial purchases from Epandula Assoc. (part payment)</td>
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<td>26/04/01</td>
<td>Epandula Asa, (Endola) #9, payment balance (ref. no. 365 of 30/04/01)</td>
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<td>22/05/01</td>
<td>P. du Plessis #11-12-13-14, purchases of fruits and Ombike</td>
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<td>Amount 2</td>
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<td>05/06/01</td>
<td>P. du Plessis #15-46, purchase of Manketti nuts &amp; Kashipembe, Kayango</td>
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<td>678,60</td>
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<td>06/06/01</td>
<td>P. du Plessis #47, purchase of Marula jam &amp; fruits, Kayango</td>
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<td>175,00</td>
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<td>P. du Plessis, purchase of Ximenia seeds (#48) &amp; oil (#72) at Eenhana</td>
<td>662</td>
<td>3,784,00</td>
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<td>28/05/01</td>
<td>EWC Dikina Assoc. (Ongena), 3 latas melonseed samples (34,54kg@N52,00)</td>
<td>745</td>
<td>70,00</td>
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<td>02/07/01</td>
<td>Nampost Courier no. 827336, 1 bag melonseed samples from Ongena</td>
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<td>80,96</td>
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<td>Topnaar Community Foundation (#49), 170kg Naran seeds @ N510/kg</td>
<td>778</td>
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<td>13/07/01</td>
<td>P. du Plessis, trial purchases (PIF #57, #50-53, #54, #55-55)</td>
<td>823</td>
<td>3,219,00</td>
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<td>24/07/01</td>
<td>Marta Imene (#19), 126,38kg melonseeds at Omatala (Oshakati)</td>
<td>858</td>
<td>227,50</td>
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<td>30/07/01</td>
<td>A. Nuule, melonseed transport (26/07/01) from Oshakati (565,53kg)</td>
<td>864</td>
<td>441,76</td>
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<td>30/07/01</td>
<td>A. Nuule, Ximenia seed transport (26/07/01) from Oshakati (602,77kg)</td>
<td>865</td>
<td>300,38</td>
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<td>31/07/01</td>
<td>P. Nashandi (Ondangwa), melonseed to Whk (513,06kg@N51,50+0,10+0,50)</td>
<td>873</td>
<td>1,231,39</td>
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<td>31/07/01</td>
<td>EWC, melonseed purchase at Oshakati (103,71kg@N51,90)</td>
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<td>2,055,38</td>
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<td>01/09/01</td>
<td>P. du Plessis (#58-77), trial purchase Vanguiera &amp; 303kg melonseeds* in Onesi</td>
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<td>1,571,00</td>
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<td>30/09/01</td>
<td>28/09/01, Eenhana, purchase of 336.38kg melonseeds</td>
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<td>30/09/01</td>
<td>28/09/01, Okongo, purchase of 564.26kg melonseeds from Ongola</td>
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<td>1,006,00</td>
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<td>30/09/01</td>
<td>29/09/01, Ondombe, purchase of 159.50kg melonseeds</td>
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<td>316,00</td>
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<td>30/09/01</td>
<td>28/09/01 #2, transport melonseeds from Okongo to Eenhana</td>
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<td>Mr Kalola, transport of 414 kg melonseeds from Oshakati to Whk</td>
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<td>207,00</td>
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<tr>
<td>11/10/01</td>
<td>A. Nuule, transport Osh.-Whk 562,26kg melonseeds (Eenhana/Okongo)</td>
<td>1161</td>
<td>261,15</td>
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<tr>
<td>11/10/01</td>
<td>J. Kalola, transport Osh.-Whk 239,42 kg melonseeds (Eenhana)</td>
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<td>119,80</td>
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<td>22/11/01</td>
<td>P. du Plessis #79, purchase 6 bags strychnos at Kankolomwe (15/11/01)</td>
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<td>220,00</td>
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<td>22/11/01</td>
<td>P. du Plessis #80, purchase 90kg melonseeds at Okongo (17/11/01)</td>
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<td>180,00</td>
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<td>22/11/01</td>
<td>P. du Plessis #81, 152,5kg m/seeds* &amp; other fruits/ seeds at Onesi (19/11/01)</td>
<td>1363</td>
<td>732,00</td>
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<td>14/12/01</td>
<td>P. du Plessis PIF/#2 (20/11/01), 10 small bags of Mopane seeds</td>
<td>1511</td>
<td>200,00</td>
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<td>04/02/02</td>
<td>P. du Plessis #84, purchase 4 bags Mopane seeds in Onesi</td>
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<td>180,00</td>
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<td>15/02/02</td>
<td>R. Dausab (Topnaar Comm. Fund) #86, 17kg Naran seeds @ N510,00</td>
<td>199</td>
<td>170,00</td>
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<td>25/02/02</td>
<td>P. du Plessis, purchase 6 bags marula fruits, 8th NCRs trip</td>
<td>255</td>
<td>60,00</td>
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<td>13/03/02</td>
<td>A. Etele #87/89, purchase Marula fruits &amp; Eembe, NCRs field trip (7/03/02)</td>
<td>360</td>
<td>40,00</td>
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<td>03/04/02</td>
<td>R. Dausab #62, purchase 80kg Naran seeds</td>
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<td>05/04/02</td>
<td>P. du Plessis, purchase 4 bags Marula fruits from N. Kakonda</td>
<td>495</td>
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<td>22/04/02</td>
<td>P. du Plessis #90&amp;81, purchase 6 bags Marula fruits (CIRAD)</td>
<td>564</td>
<td>300,00</td>
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<td>14/05/02</td>
<td>Oxfam Ben-Hur no. 348, Marama beans purchased from community members</td>
<td>717</td>
<td>213,70</td>
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<td>15/05/02</td>
<td>P. du Plessis, purchase 100 eembe cups (Oshakati) &amp; 4 marula bags (Rundu)</td>
<td>731</td>
<td>360,00</td>
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<td>23/05/02</td>
<td>KAP, reimbursement to PIF-1A for 120,38kg Naran seeds used</td>
<td>771</td>
<td>-1,203,80</td>
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<td>29/05/02</td>
<td>Okongo Community Forestry Project no. 16, 10x bags Manketti fruits</td>
<td>805</td>
<td>100,00</td>
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<td>17/06/02</td>
<td>Reallocation expenses from PIF-1A/4, to melonseed purchase (5347,18kg)</td>
<td>898</td>
<td>-6,769,77</td>
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<td>17/06/02</td>
<td>Reallocation expenses from PIF-1A/4, to melonseed transport</td>
<td>899</td>
<td>-1,399,71</td>
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### 6. MONITORING MARULA JUICE PRESS

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<td>20/03/01</td>
<td>Pupkewitz no. 02350346, 3 blue square Jerrycans (2 SL) for Marula juice</td>
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<td>18/12/01</td>
<td>R. Gamond, fees 3 days, juice press benchmark trials</td>
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<td>13/03/02</td>
<td>A. Botelle, small eqt Marula fruit presses, NCRs field trip (11/02-7/03/02)</td>
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<td>15/03/02</td>
<td>A. Botelle, fee 1 day (11/02-7/03/02), fruit press monitoring</td>
<td>383</td>
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<td>31/08/02</td>
<td>R. Gamond, fees 4 days (Jul.-Aug. 02), marula fruit presses</td>
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<td>14/10/02</td>
<td>KAP no. 1000030, 9x EWC marula fruit presses service &amp; repairs</td>
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**Total monitoring marula juice press**

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<td>16 329.43</td>
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<td>5 175.57</td>
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### 7. LITERATURE SEARCHES

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<td>17/04/01</td>
<td>C. Lombard (UK), fees 3 days</td>
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<td>22/08/01</td>
<td>C. Lombard (UK), fees 3 days</td>
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<td>25/10/01</td>
<td>C. Lombard (UK), fees 4 days</td>
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**Total literature searches**

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### 8. ADMINISTRATION

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<td>10/07/01</td>
<td>CRIAA SA-OC, admin. fee on 1st payment (40%)</td>
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<td>31/10/01</td>
<td>CRIAA SA-OC, admin. fee on 2nd payment (30%)</td>
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<td>CRIAA SA-OC, admin. fee on 3rd payment (10%)</td>
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**Total administration**

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### TOTAL EXPENSES

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### BALANCE FUNDS RECEIVED: EXPENSES

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### PIF-1B

#### DATE

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<td>23/05/01</td>
<td>NAB cheque #8953, 1st payment (40%)</td>
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<td>12/12/01</td>
<td>NAB cheque # 100004 (part), 2nd payment (30%)</td>
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**Total funds received**

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<th>NS</th>
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<td>1. EQUIPMENT PURCHASE AND MANUFACTURE</td>
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<td>KAP no. C/35, copper distillation still</td>
<td>337</td>
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<td>Solar Stove Project Valombola, solar stove for pasteurisation</td>
<td>476</td>
<td>1 210.00</td>
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<td>Solar Stove Project Valombola (solar stove), reimbt VAT charged (ref. folio 475)</td>
<td>583</td>
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<td>KAP no. C/65, 1x stainless distillation still</td>
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#### 2. KAP WORKSHOP RENTALS (8 MONTHS)

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<td>KAP no. A/54, workshop rental 4 months (Mar.-June 01)</td>
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<td>KAP no. B/54, workshop rental 4 months (Jul.-Oct. 01)</td>
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#### 3. CONSUMABLES FOR TRIALS

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<td>KAP no. 35, 10 empty plastic bottles (500 ml) and lids</td>
<td>571</td>
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<td>Namprint no. 12862, re-print x300 PIF Strategy &amp; Action Plan</td>
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<td>10/07/02</td>
<td>NDCG, report pre-feasibility study tree planting project in NDCs</td>
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<td>KAP no. 1000021, 10x Manetti nut deicorticating blades</td>
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<td>R. Gamond, fees 5 days (Jul-Aug, 02), melonseed extraction trials</td>
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<td><strong>23 867,68</strong></td>
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<td></td>
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<td></td>
<td><strong>24 000,00</strong></td>
<td><strong>132,32</strong></td>
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### 4. ANALYSES

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<tr>
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<td>Analytical Lab. Services no. M010805, melonseed &amp; oil analysis</td>
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<td>Analytical Lab. Services no. M011205, oil contents 10x melonseed samples</td>
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<td>V. Ndjamba, casual work 2 days (28-27/01/02), trad. Ximelia oil processing</td>
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<td>04/03/02</td>
<td>Analytical Lab. Services no. M020215, Mopane leaves steam distillation</td>
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<td>Kuehne &amp; Nagel no. 1004381, freight fresh manula fruits to CIRAD Montpellier</td>
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<td>Analytical Lab. Serv. no. M020716, melonseed oil fatty acid composition</td>
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### 5. PROCESSING TRIALS CONSULTANTS’ FEES

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<td>18/12/01</td>
<td>R. Gamond, fees 7 days, processing trials</td>
<td>1543</td>
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<td>18/12/01</td>
<td>P. du Plessis, fees 4 days, processing trials</td>
<td>1547</td>
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<td>28/02/02</td>
<td>P. du Plessis, fees 5 days (Feb. 02), processing trials</td>
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<td>27/03/02</td>
<td>P. du Plessis, fees 6 days (Mar. 02), processing trials</td>
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<td>10/04/02</td>
<td>P. du Plessis, fee day, processing trials</td>
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<td>26/04/02</td>
<td>P. du Plessis, fee 1 day (Apr. 02), Jackal berry distillation</td>
<td>623</td>
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<td>30/08/02</td>
<td>P. du Plessis, fees 6 days (Aug. 02), distillation trials at KAP</td>
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### 6. ADMINISTRATION FEE

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<td><strong>31 087,50</strong></td>
<td><strong>9 326,28</strong></td>
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### 7. MARKETING TRIALS (NEW ITEM OF 2002)

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<td>22/04/02</td>
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<tr>
<td>23/05/02</td>
<td>KAP no. C/87, design labels 1Nara seed oil</td>
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<td>30/05/02</td>
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</table>

**Total marketing trials**

|                  | 29 632,50 | 30 950,00 | 1 317,50 |

**TOTAL EXPENSES**

|                  | 193 411,47 | 240 537,50 | 47 126,03 |

**BALANCE FUNDS RECEIVED: EXPENSES**

|                  | -26 575,22 |           |           |

Prepared by
MICHEL MALLET
Executive Director, CRIA SA-DC (Namibia)
15 November 2002
Appendix 3: Promoting Indigenous Fruit in Namibia:
Special report on Kalahari melon seed exports

submitted to the
Indigenous Fruit Task Team
by
CRIAA SA-DC
September 2002

Purpose

The purpose of this Special Report is to inform the IFTT and other stakeholders about Kalahari Melon Seed exports to the UK. The report deals mainly with the first round of KMS exports, which were conducted in the period between July 2001 and February 2002, although some subsequent information has been included.

Acknowledgements

The Kalahari Melon Seed (KMS) exports reported on below are the result of the collaborations and contributions of many dedicated people, including the hundreds of farmers who produced the seeds, the community activators and activists who spread the word and organised the producers, the scores of workers who loaded, off-loaded, cleaned, re-bagged and loaded again, the drivers who provided transport and the many others who assisted with paperwork and logistics. A special word of thanks is due to the members of the Eudafano Women’s Cooperative (EWC), who started developing this opportunity with CRIAA SA-DC three years ago by supplying 15 tons of seed for processing trials, and to Sigried Mwaala from the Office of the President, who played a key role in organising the purchases. All CRIAA SA-DC and KAP staff members contributed in one way or another, especially Cyril Lombard (who made it all possible with his market liaison in the UK), Saskia den Adel (who worked like a Trojan wherever she was needed), Michel Mallet (who meticulously managed the process and recorded the money involved) and Frederika Amutse (who did sterling liaison work and made invaluable contributions on traditional practices). Last but not least, a special word of appreciation is due to the King Nehale Resource Committee and the communities around Omuthiya/Okashana, who provided more than half of the seed required for the first year’s exports and thus saved the opportunity for the whole country.

Much of the information in this paper is adapted from the draft paper EWC Kalahari Melon Seed of Namibia: Production and Quality Control Stages prepared by Frederika Amutse and Michel Mallet in June 2001. Pierre du Plessis compiled this report.
Background

The use of melon seed as a source of oil is well known and documented in many parts of the world. In West Africa the production of melon seed for eating and oil extraction has long been an important part of local agricultural systems, and tens of thousands of tons of such seeds are used for oil extraction annually. In India melon seed production and processing similarly forms the basis of a substantial rural industry.

In Southern Africa the use of wild melon seed as a source of oil can be traced to the San people, but has also been incorporated into the traditional practices of other groups in the region. Traditional production of melon seed oil (through boiling the crushed seeds in water and skimming off the oil that floats to the top) is especially common among the Oshiwambo-speaking people of northern Namibia.

Because melon seed can fairly easily be produced in commercially significant quantities it is an obvious resource to include in development interventions aimed at increasing rural incomes through the commercialisation of indigenous plants. In the mid-1990s Cyril Lombard of CRIAA SA-DC therefore started researching high-value niche markets for melon seed oil in the cosmetics industry. Having established that such markets could indeed be created if sufficient quantities were available, attention turned to the practicalities and implications of establishing a melon seed oil production system in Namibia. In order to differentiate the Namibian (or Southern African) product in the international market it was decided to call it Kalahari Melon Seed oil – an appellation of origin that will protect local producers against competition from other parts of the world.

Some preliminary work on Kalahari Melon Seed (*Citrullus lanatus*) oil production was done by CRIAA SA-DC in 1997 with support from the Ministry of Trade and Industry, and later also under the Non-Timber Forest Products project funded by the Government of Austria through CARE Austria. In 1999 the Eudafano Women’s Cooperative, CRIAA SA-DC and KAP collaborated to further investigate the production of KMS oil as an alternative income stream for EWC members (who were then already supplying kernels for marula oil production). Samples of cold-pressed KMS oil were produced and sent to potential clients in the UK, some oil was packaged for the local market and melon seed oil soap was made and marketed.

The initial market reaction to the oil itself was positive (especially the fact that it was light, non-greasy and easily absorbed by the skin). Further information on quantities and prices was requested, so as to plan product development strategies.

At that stage the oil extraction rate with local processing equipment was around 7.5% w/w (improved processing methods developed through trials at KAP have since raised this to 10.5%). At such a low extraction rate, the relatively low production capacity and high labour/management costs of the locally manufactured 30 ton Kapmond hydraulic cage and plate press meant that locally processed oil would be so expensive (and/or result in such low prices for seed producers) that the commercial opportunity would be severely limited. Nevertheless, efforts to overcome these obstacles continued.

In early 2001 a specialist oil processor who is a major supplier to the cosmetics industry, Statfold Seed Oils Ltd. (SSO), indicated that KMS oil could potentially be used in very large quantities if it could be put on the market at a price comparable to that of hemp seed oil. After protracted tripartite discussions between Cyril Lombard of CRIAA SA-DC, the oilseed processor and the final buyer – The Body Shop International (BSI) – it was agreed that product development with KMS oil from Namibia would proceed as follows:
• SSO will do small trials in the UK to assess the viability of the opportunity and make available at least 200 kg of refined KMS oil for product formulation trials.
• If these trials are successful, Namibia (specifically EWC) will supply, and SSO will process, enough KMS to have 6 tons of oil in stock by November 2001 (this was done late – by March 2002), an additional 6 tons by early 2002 (this could not be done in time, resulting in an order for 6 tons of KMS oil being placed with Yetu Cosmetics/Oointanga Oil Factory) and a constant reserve of 10 tons at all times as soon as possible after that (in case the product is very successful)
• Processing will be done in the UK (where better and larger equipment can extract just under 15% oil, and do so more cost-effectively) until a large enough market is developed to justify transferring the technology to Namibia (the export of unprocessed KMS for this purpose was approved by the IFTT and – at the request of EWC – at higher political level) (see also “Local Processing” below)
• A producer price of N$2/kg will be paid for KMS at decentralised rural assembly points in the NCRs, CRIAA SA-DC and SSO will monitor other export, processing and marketing costs and negotiate a benefit-sharing agreement once more information is available (the General Manager and the majority shareholder of SSO are planning a trip to Namibia in February 2003 to discuss this issue, and technology transfer options)
• The first products (initially a body butter, and possibly later a wider range) will be fast-tracked for release in early 2002 – this was done on schedule
• Small-scale Namibian producers will be strongly associated with the product image (i.e. it will clearly be branded as a Community Trade product benefitting primary producers) – although this link is not very apparent from the packaging of the Body Butter it has been highlighted in The Body Shop’s promotional materials (and EWC has been assured that The Body Shop will at most source 40% of its oil requirements from other sources, such as Yetu Cosmetics/Oointanga Oil Factory)

Strategic importance of KMS

Melons can and do grow almost anywhere in Namibia. From a sustainable resource use perspective a sufficiently large market for melon seed will provide a most drought-resilient alternative (or inter-) crop for virtually all parts of the country, thus contributing to agricultural diversification and alleviating pressure on other (especially wild-gathered or communal, open-access) resources. It has been shown many times that desperately poor people will knowingly (and often regretfully) over-exploit natural resources for mere survival. Any additional slack that can be introduced into the local economic system therefore makes it more likely that people will adopt and adhere to sustainable practices.

Moreover, the potential market for the oil is substantial. Estimates range between 50 and 500 tons of oil a year, which translates to between 350 and 3500 tons of seed annually. At N$2/kg this could bring in between N$700 000 and N$7 million additional cash income for Namibian farmers every year (without profit-sharing). Such income could go a long way towards providing the economies of scale that are required to collate and commercialise other, smaller, resources (i.e. other resources can be bought from the same sellers at the same time, resulting in lower logistical costs).

Because melons are an annual crop, production can – climatic conditions permitting – be scaled up rapidly as and when the market grows – as long as appropriate measures are in place to ensure that small-scale farmers have first access to this market so as to prevent a few large commercial farmers
from over-supplying and depressing prices. KMS therefore offers a much larger short-term opportunity for processing and further value-adding than most other indigenous oil-bearing crops. As such it can serve as an “anchor” for a larger value-adding enterprise targeting a wider range of resources – it can provide the scale that is needed to attract an investment in hi-tech processing to Namibia.

**Melon production**

In many parts of Namibia the melons that grow wild in the veld are more often than not eaten by animals before they can be harvested. As far as can be ascertained the melon seeds purchased for the KMS exports have all been harvested from cultivated (or volunteer) melon crops growing in fenced fields. According to Amutse and Mallet (*op cit*) four main types of melons are traditionally cultivated:

- Sweet watermelons (seeds not eaten or used for oil production, but kept for planting next season) [However, at Onesl largeish quantities of these seeds were available from farmers, possibly as a by-product of making a fermented watermelon drink, and people reported producing oil from them; oil content slightly lower than “proper” KMS, oil quality not systematically compared yet]
- Big whitish melons producing softer white seeds that are roasted and eaten
- Cooking melons (seeds are not removed before cooking and are eaten with the melons, not used as oilseeds)
- Oilseed melons (*oontanga dhomukokotwa* in Oshiwambo, sometimes called *tsammnas*), smaller in fruit size than the other types, with many colour patterns, edible but often not eaten (it is frequently bitter), traditionally only used to extract seeds (*eenkonkotwa*) for oil production, as animal fodder and (in some places) as an emergency source of water

Watermelons and selected strains of cooking melons are important food crops in northern Namibia (as in most traditional farming systems in southern Africa) and are commonly inter-planted (along with legumes) with the main mahangu (pearl millet) crop, but not with sorghum (because that is specifically planted in the wetter/clayish soils unsuitable for melons). It is not clear whether oilseed melons were ever planted deliberately before the creation of a formal KMS market, or whether they were volunteers growing from spilled seed, or seed contained in manure. The traditional cultivation system is completely organic – no pesticides or mineral fertilisers are used.

There is anecdotal evidence that melons will fruit even when the mahangu harvest fails due to drought, but the current and potential productivity of melons as a crop, and especially as a seed crop, under various climatic conditions is not known. Undoubtedly there are bad drought years when even the hardiest melon strains will not produce normally (as appears to have been the case in 2002). Keeping Namibia’s market share in such years might require building up a strategic stockpile of seeds (or oil).

KMS exports are expected to result in increased cultivation of oilseed melons and there is an urgent need for cultivation guidelines, extension advice and selected seed to boost production. MAWRD (DEES/DART/FSRE) should consider what could be done to deliver the required support to growers (also outside the NCRs).

**Selection and breeding of oilseed melons**

It is not clear to what extent the melons used for oilseed production have been selected by humans for desirable characteristics. Since the Kalahari (including Namibia) is the centre of genetic diversity
for *Citrullus lanatus*, however, it seems reasonable to assume that indigenous strains can be selected for higher oil yields. The recent proposal by Herta Kolberg of the NBRI to select melons for oil-seed production is an excellent start, and 12 strains were planted under irrigation at Mahenene in September 2002 for evaluation and to bulk up seed supplies for further trials.

The oil yield of a melon crop is determined by the combination of oil content per seed, mass of seeds per melon and melons produced per unit area cultivated. At this early stage the main traits that can be selected relatively quickly are seeds/melon and melons/area. Though the data are inconclusive, it is interesting to note that, of the melons strains analysed so far, the one that had by far the highest oil content (a traditional Tswana landrace from the Omaheke region that contained 52.1% oil, compared with an average of 23.12% for all other strains) also had the lowest percentage of seeds (1% compared to an average of 4% of the total fruit weight in a sample2 of *contanga dhomukokotwa* from the NCRs2).

Once melon strains that yield a large number of fruit with a high seed content have been identified it will be possible to select those with the highest oil content per seed and/or crossbreed them with strains that have an unusually high oil content (cucurbitas have separate male and female flowers and are therefore relatively easy to crossbreed through manual pollination).

Table 1: OIL CONTENT (W/W) OF SELECTED NAMIBIAN MELON SEED SAMPLES

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<th>SAMPLE</th>
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<td>Watermelon type; lowest</td>
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<tr>
<td>Okongo KMS-7</td>
<td>September 02</td>
<td></td>
<td>23.5</td>
</tr>
<tr>
<td>Omuthiya KMS-7</td>
<td>September 02</td>
<td></td>
<td>22.8</td>
</tr>
<tr>
<td>KMS-6 mixed</td>
<td>August 02</td>
<td>Mainly Omuthiya</td>
<td>22.6</td>
</tr>
<tr>
<td>Sample E</td>
<td>December 01</td>
<td>Reference seeds to SSO</td>
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</tr>
<tr>
<td>Sample A</td>
<td>December 01</td>
<td>Small black “right” seeds</td>
<td>22.5</td>
</tr>
<tr>
<td>Sample V</td>
<td>December 01</td>
<td>Reddish big seeds</td>
<td>22.9</td>
</tr>
<tr>
<td>Sample C</td>
<td>December 01</td>
<td>Sweet melon, black/white</td>
<td>23.9</td>
</tr>
<tr>
<td>Omuthiya 42</td>
<td>December 01</td>
<td>KMS</td>
<td>22.5</td>
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<td>Omaheke</td>
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<td>Sesoswane landrace; highest</td>
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<td>Large seeds KMS-4</td>
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<td></td>
<td>22.2</td>
</tr>
<tr>
<td>Omuthiya</td>
<td>December 01</td>
<td></td>
<td>23.4</td>
</tr>
<tr>
<td>Large seeds KMS-3</td>
<td>October 01</td>
<td>Mixed &amp; old seeds</td>
<td>22.2</td>
</tr>
<tr>
<td>Okongo</td>
<td>October 01</td>
<td></td>
<td>22.6</td>
</tr>
<tr>
<td>Mangundu (Okahao)</td>
<td>October 01</td>
<td>KMS-3</td>
<td>22.6</td>
</tr>
<tr>
<td>Endila</td>
<td>October 01</td>
<td>KMS-3</td>
<td>24.8</td>
</tr>
<tr>
<td>Ondrobe</td>
<td>October 01</td>
<td>KMS-3</td>
<td>25.8</td>
</tr>
<tr>
<td>Tumelus (Tsandi)</td>
<td>October 01</td>
<td>KMS-3</td>
<td>21.6</td>
</tr>
<tr>
<td>Average all samples</td>
<td></td>
<td></td>
<td>23.26</td>
</tr>
<tr>
<td>Average excluding high &amp; low</td>
<td></td>
<td></td>
<td>23.12</td>
</tr>
</tbody>
</table>

(Analyses by Silke Rüghimer of Analytical Laboratory Services, Windhoek)

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2 The Omaheke seeds were supplied by Jeremy Muller of Oxfam, who reported that 4 tons of melons yielded 40 kg of seed; NCR data is from seed extraction trials conducted by Roger Gamond of CRIAA SA-DC under the PIF project.
Socio-economic considerations

In the traditional agricultural calendar of the NCRs some melon seed for oil production is processed at any time when labour and ripe melons are both available and the household needs oil. The main melon seed harvest is processed after the mahangu harvest has been threshed and stored (as early as May, as late as August, depending on the rains of the season) not only because mahangu is vulnerable to bird and insect damage and, as a staple food, has higher priority, but also because it allows the melons to ripen completely, resulting in well-filled seed and a higher oil yield. Melon seed stores well for at least a year and most households keep a small stock for processing as needed.

Melon seed extraction is labour intensive and many farm families do not harvest all the melons they grow (and do not grow all the melons they could), especially since local markets for seed or oil are extremely limited (because most households produce and process their own). The unwanted melons (usually those on the edges of fields, where they are more difficult to harvest and transport) are a valuable stock feed in the winter, and leaving them too long is wasteful. The observed practice is therefore to harvest the number of ripe melons that can/will be processed, store them inside the homestead (they store well) and then open the fields so that livestock can graze the mahangu stover and leftover melons. Some families harvest only their watermelons and eating melons and hardly bother with the volunteer “oil melons” at all. It will be interesting to see if, and how, these traditional farming practices will change in response to the newly created market for KMS.

The final decision to go ahead with the first KMS export of 40 tons was only taken in early August 2001, and word took a while to get round, so that many farmers lost out on the opportunity because they had allowed their cattle into the fields too early.

Seed extraction

Traditional seed extraction involves variations on the following basic steps:

- The fruits are crushed on a clean piece of ground with the handle of a pounding pestle
- The seeds are separated by hand, sometimes aided by putting the pulp in a bucket of water (the seeds sink and are also cleaned)
- The pulp and skins are fed to animals or discarded
- Extracted seeds are thoroughly dried in the sun and then winnowed before storing

Observed variations include:

- Melons are cracked with a short stick, the “seedy” part of the pulp is scooped out by hand, then put in a shallow depression in the ground, where the juice drains away, aided by occasional agitation. Further separation of this concentrated seed/pulp is done by hand and the seeds are rinsed before drying.
- Melons are sliced in half with a knife and the pulp extracted by hand.
- Melons are sliced and dried; the dry slices are pounded in a mortar and the seeds winnowed out.
- Skins are dried on the fence of the homestead for use as animal feed at a later stage.

At Onesi “watermelon” seeds are produced in fairly large quantities, most likely as a by-product of a traditional fermented melon drink, but the exact process used has not yet been documented. Since these seeds are currently not included in the KMS exports, the matter will be reported on in more detail later.
It is very likely (depending on how fast the market grows) that the labour-intensive nature of traditional seed extraction practices will soon constitute a significant bottleneck to increased KMS production. This will be made worse by the labour demands of other opportunities (such a conflict with marula kernel extraction seems especially probable). It is therefore highly desirable (and urgent) to develop an improved seed extraction technology, preferably at household level, and preferably one that also addresses the quality concerns raised by processing seeds on the ground. Ideally such an extraction technology should allow a single person to process at least 250 kg of melons a day (on the basis that one ton of melons at 4% seed weight will yield about 40 kg of seed, i.e. an income of around N$80, and 250 kg therefore an income of N$20 a day, which is a fair approximation of the opportunity cost of labour in the NCRs).

Geographic location

KMS purchases were confined to the NCRs in the first year, for various reasons:

a) While melons do grow wild in other parts of Namibia they are very often grazed before they can ripen – in the NCRs they are grown and/or voluntarily grow in fenced fields and are protected along with the main crops.

b) Since extracting large quantities of seed for oil production is a well-known traditional farming activity in the NCRs\(^3\) there was no need to organise labour or teach people how to do the job (as Oxfam staff at Tjaka-Ben Hur in Omaheke had to do with melons from their trial plantings). In Kavango melons are widely grown, but oil production from melon seed seems largely unknown (possibly because mangetti nuts are readily available). The same melons also grow in Caprivi but the seed-extraction situation is still unclear.\(^4\)

c) In the sandy Kalahari of Omaheke and Otjozondjupa, wild melons are a crucial source of water for many wildlife species during the dry part of the year. Since the supply of wild melons in these areas is already under pressure from grazing it seemed unwise to encourage wild harvesting before a closer assessment has been done. There are also currently not many fenced fields used for crop production in these areas.

d) Eudafano Women’s Cooperative (which currently has member associations only in the NCRs) and CRIAA SA-DC started developing this opportunity (an obvious business diversification strategy for EWC) in 1999. Given its historical involvement in the project, and the obvious synergies with the marula oil project, EWC was expected and encouraged to become the biggest supplier of KMS.

Within the NCRs there appears to be a regional differentiation in the extent to which oilseed melons are processed (but this aspect needs further research). Specifically, there appears to be a correlation between soil type and melon seed production, with melon seed extraction much more common in the sandy areas outside the Cuvelai floodplain (e.g. Omuthiya, Omuntele, Onesì, Eenhana, Okongo etc.). This could be due to the fact that melons are susceptible to water-logging and therefore grow better in these soils than in the shallower, more clayey soils of the Cuvelai, but it might also be ascribed to the fact that these areas have fewer alternative sources of edible oil (because they have

\(^3\) At least for small quantities of seeds, and not in all areas – some NCR farmers were observed to use less than optimal methods, suggesting a need for further work and/or extension messages

\(^4\) According to the thesis of G. Maggs-Kölling oil seed melons are known in Caprivi, where the variety called "runovi" in Silozi is specifically used for oil production.
fewer manula trees). Table 2 below shows the quantities of KMS purchased from various sources in 2001/02.

Table 2: SOURCE AND QUANTITY OF 2001/02 KMS PURCHASES

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>QUANTITY (KG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Omuthiya (KNRC)</td>
<td>22 385.51</td>
</tr>
<tr>
<td>EWC (member associations across NCRs)</td>
<td>10 832.63</td>
</tr>
<tr>
<td>Omunzale</td>
<td>5 220.52</td>
</tr>
<tr>
<td>PIF (various places in NCRs)</td>
<td>3 347.18</td>
</tr>
<tr>
<td>Oshakati (Omaheke, open intake)</td>
<td>1 832.47</td>
</tr>
<tr>
<td>Eenhana and CKongo (MAWRD/OFT)</td>
<td>1 711.80</td>
</tr>
<tr>
<td>Ondangwa (open intake at COSDEC)</td>
<td>1 123.34</td>
</tr>
<tr>
<td>Various others</td>
<td>652.08</td>
</tr>
<tr>
<td>Total</td>
<td>47 206.53</td>
</tr>
</tbody>
</table>

Note: Quantities purchased do not correspond to quantities exported due to losses incurred during cleaning and transport.

Mobilisation

In addition to EWC member associations, other community groups were also given an opportunity to contribute so as to ensure that sufficient quantities would be mobilised to fill the order. The King Nehale Resource Committee (KNRC) at Omuthiya played an especially important role in organising purchases in this key production area.

Later, when it seemed doubtful that enough seed would be procured, open purchases were announced on NBC radio (at quite short notice, to prevent an overwhelming response). At Eenhana the purchases were also advertised by hand-drawn posters (though unfortunately the price was incorrectly conveyed as NS35/lata, which caused some unhappiness later since a typical lata of melon seeds weighs somewhere between 11 and 13.5 kg).

Once the decision was taken to go ahead with the full KMS export, a major effort was launched to achieve sufficient volumes without drawing an overwhelming response (which the budget could not handle – this would have had major repercussions for the future).

The mobilisation expenses and logistical efforts contained in Table 3 below should be seen against this do-or-die approach, and the extra efforts required in the initial phases of any undertaking. Once a KMS export system has been established, these costs can be rationalised and substantial savings should be possible. The figures here do not include additional support to KMS provided on trips paid for by PIF – without this support, and the additional transport costs paid from other budgets, the mobilisation costs would have been around NS25 000 higher.

Table 3: KMS MOBILISATION EFFORTS –FIELD TRIPS

<table>
<thead>
<tr>
<th>DATE</th>
<th>PERSON DAYS</th>
<th>KM TRAVELLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-24 July 2001</td>
<td>2 pax x 8 days = 16</td>
<td>3 332</td>
</tr>
<tr>
<td>13-17 August 2001</td>
<td>2 pax x 5 days = 10</td>
<td>2 712</td>
</tr>
<tr>
<td>27 August to 3 September 2001</td>
<td>1 pax x 8 days (50%) = 4</td>
<td>other budget</td>
</tr>
<tr>
<td>2-6 September 2001</td>
<td>1 pax x 5 days = 5</td>
<td>1 722</td>
</tr>
<tr>
<td>2-8 September</td>
<td>2 pax x 7 days = 14</td>
<td>2 850</td>
</tr>
<tr>
<td>23-30 September 2001</td>
<td>2 pax x 8 days = 16</td>
<td>2 484</td>
</tr>
<tr>
<td>8-14 October</td>
<td>1 pax x 7 days = 7</td>
<td>other budget</td>
</tr>
<tr>
<td>29 October to 3 November 2001</td>
<td>2 pax x 6 days = 12</td>
<td>2 648</td>
</tr>
<tr>
<td>29 November to 12 December 2001</td>
<td>2 pax x 5 days = 10</td>
<td>3 777</td>
</tr>
<tr>
<td>Total (first 9 trips only)</td>
<td>94</td>
<td>19 505</td>
</tr>
</tbody>
</table>
The person days were not charged to the project account on a consultancy basis (some were done by salaried CRIAA SA-DC staff members, or for free, or were paid by other sources). However, per diems were paid and kilometres charged at the usual rates. Including casual labour and miscellaneous expenses, total mobilisation expenses paid were N$46 233.99 (13.28%); true costs were nearer N$70 000 (excluding person days, which at N$1 725/day VAT included would have added another N$162 150).

Other expenses

Transport from the NCRs to Windhoek cost N$20 567.05 (direct payments to transporters, in addition to seeds transported at the end of fieldtrips).

Off-loading, cleaning, re-bagging and loading into containers were done at KAP at a cost of 57.5c/kg including VAT. Adding the cost of new 25 kg woven polypropylene bags brought the total to N$27 978.82 (8.04%).

Shipping and other export expenses came to N$101 786.54 (29.23%). This included a once-off expense of N$27 066.76 for airfreighting the first 1500 kg consignment that was needed urgently to produce 200 kg oil for trial formulations. A 6 m container can hold about 15 tons of KMS in bags, or 12-13 tons if the bags are packed on pallets (as the client requires), and costs around N$29 000 (varies with exchange rate – more than N$30 000 on first two containers of second round) to send from Windhoek via Walvis Bay to the UK – costs were contained by shipping marula oil with the KMS and sharing costs pro-rata. If the system was more evolved and the time constraints less pressing it would have been possible to ship the whole lot in four containers, which would have entailed a small overall saving.

Additional charges on the budget were for project coordination by Michel Mallet (8 days – severely underpaid) and market liaison by Cyril Lombard (8 days – even more severely underpaid), plus a 10% management charge (low, considering the hassles and dangers of handling large sums of cash in the NCRs). These charges – N$ 56 744.45 (16.3%) – were carried over to the 2002 budget so as to make available some cash flow for the first 2002 purchases.

Income from sales

The first five exports of KMS yielded an income of GBP23 123.00 – at an average exchange rate of N$15.2146 this equalled N$351 807.24. The gross surplus of income over expenses (including the charges deferred to the 2002 budget, but not including additional costs detailed above) was N$ 3 618.26.

Profitability

The summary income and expenditure figures are derived from the analytic account of the KMS project for the period July 2001 to June 2002 (the detailed analytic account of the KMS project is available on request).

The unusual expenses incurred as a result of time pressure (and because this was the first KMS intake at this scale), as well as the unstable exchange rate, make it difficult to predict how profitable
such an undertaking would be on an on-going basis. The following figures are presented as an indication only, and should not be regarded as conclusive:

<table>
<thead>
<tr>
<th>Income (44310 kg KMS)</th>
<th>351 807.24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflexible costs</td>
<td></td>
</tr>
<tr>
<td>Purchases @ N$2/kg</td>
<td>94 888.13</td>
</tr>
<tr>
<td>Transport to Windhoek</td>
<td>20 567.05</td>
</tr>
<tr>
<td>Export costs</td>
<td>101 786.54 (incl. around N$25 000 extra airfreight)</td>
</tr>
<tr>
<td>Sub-total</td>
<td>217 241.72</td>
</tr>
<tr>
<td>Sub-total (excluding airfreight)</td>
<td>192 241.72</td>
</tr>
</tbody>
</table>

Income minus inflexible expenses (excluding once-off airfreight) | 159 565.52 |

Flexible costs

| Procurement costs | 46 223.99 (not full cost, but larger intakes cheaper) |
| Handling, cleaning, bagging etc. | 27 978.82 (could possibly be lowered) |
| Admin, management, marketing | 56 744.45 (undercharged, but marketing lower later) |
| Sub-total | 130 947.26 |

Potential margin | 28 618.26 |

In interpreting these figures the following should be considered:

- Procurement was directly subsidised by CRIAA SA-DC to the tune of about N$25 000 (excluding support provided from PIF, and an additional N$165 000 in person days not charged), but could eventually be lower in an established system.
- A larger quantity of KMS (e.g. 105 tons ordered for 2002/03) could lower procurement costs through economies of scale.
- Marketing liaison charges were severely underpaid; these might be lower in the second and subsequent years provided the existing buyer can continue to absorb increases in production and there is no need to engage alternative partners for the time being.
- There will be additional expenses associated with negotiating benefit-sharing and technology transfer agreements – these negotiations have reached a sensitive stage where careful negotiation is crucial to determining the eventual levels of benefit accruing to Namibian primary producers.
- Administration and management costs are unlikely to be much lower for, but may be regarded as enterprise income by, a private sector operator.
- At one stage CRIAA SA-DC had negative cash flow to the tune of N$200 000 on the KMS budget, but no finance charges were included in the costs – such charges could be significant considering the long delays in payment experienced during the first round of exports (KMS1 airfreighted 28/8/01 and paid 19/10/01; KMS2 shipped 27/9/01 and paid 23/11/01; KMS3 shipped 6/11/01 and paid 18/12/01; KMS4 shipped 29/11/01 and paid 50% on 18/12/01 – to help cash flow – and 50% on 14/02/02; KMS5 shipped 8/02/02 and paid 11/06/02).
- Very limited capital investments were required in the first year, because the existing facilities at KAP could be used; a private-sector or community-owned business trying to set up a similar operation from scratch would need at least under-roof cleaning, packaging and storage facilities (because the KMS will be spoiled if exposed to rain).
- Quality-control analyses were paid from the PIF budget.
Local processing and technology transfer

Government policy in Namibia is to add as much value as possible to raw materials before they are exported, in order to stimulate local industrial development and job creation. It was for this reason that permission was sought and obtained from the IFTT and higher political authority before exports of unprocessed KMS to the UK started. From the outset this was done on the understanding that processing and further value-adding would be moved to Namibia when the sales of KMS oil reached levels that would justify the substantial capital investment required.

In evaluating the feasibility of local processing, the following should be considered:

a) To survive in a harsh environment, KMS – like many other desert plants – has evolved extremely hard seed coats so that seeds do not germinate until they have been wet for a long time (i.e. when there is a good chance the soil is wet enough so seedling will survive until the next rainy spell). These hard seed coats make KMS technically difficult to process by causing abnormal wear and tear of processing equipment – when SSO first started processing KMS oil they broke several expeller screws on their Komet presses and later, after they had adjusted the press settings to accommodate KMS, they found that the standard screws wore out very quickly. (The majority shareholder of SSO also owns a large heavy-engineering business. When the Komet manufacturer was unable to supply hard-faced screws for its presses, this business custom-made them for SSO – and now sells them to Komet!)

b) The locally made Kapmond 30 ton hydraulic cage-and-plate press was designed to process marula kernel and other soft materials (which cannot successfully be processed in a worm-screw expeller) but is not very efficient at processing harder materials such as KMS (which has to be hammermilled first, and even then yields only about 67% of the oil – after two pressings – that can be obtained with an expeller – 10.5% vs 15% w/w). Moreover, the Kapmond press is much slower than a worm-screw press, resulting in higher labour and management costs (but additional employment opportunities).

c) KMS is bulky and containerised shipping is therefore relatively cost-inefficient – local processing could potentially reduce freight charges by shipping the oil, which has a much higher value/volume ratio. However, the market demand for KMS is currently only around 150 tons of seed (assuming we can meet this requirement in 2002/03), which should yield (at maximum efficiency) around 21.5 tons of oil, or slightly less than 2 tons a month over 11 months of processing. At this level of production it is no longer cheaper to ship in dedicated containers (since the unrefined oil deteriorates in storage and cannot be accumulated in sufficient volumes). The alternative option is shared-load shipping – which can only be done through Cape Town at present and is significantly more expensive by weight (at 2 tons/month it costs about the same as sending containers through Walvis Bay). Turning the potential savings on freight charges into a reality will therefore require either a market for about double the current production (which is expected to materialise sooner or later), and/or a substantial investment to establish a local refining facility (which will enable longer storage of the oil and allow larger volumes to be shipped at one time).

d) The above notwithstanding, it would probably be (marginally) viable – now that a fairly secure niche market for the oil has been created – to establish a factory in the NCRs to process KMS with mechanised expellers at current levels of production/demand. Doing so will however result in a KMS oil price so high that it significantly curtails the future growth of markets
for the oil, thereby severely restricting the scope and scale of the income opportunity for rural producers. Furthermore, while the potential profits from such a venture could possibly be interesting to Namibian investors, they are not substantial enough (in absolute terms) to attract a foreign investor to the country (at current levels of production). This implies that the minimum additional value-adding steps required after oil extraction (refining, deodorising, bleaching, packing under nitrogen, warehousing, selling on to formulators) will remain outside the country, which leaves the local enterprise to operate as a price-taker with an inflexible cost structure and a limited market. Under such circumstances any downward pressure on prices (e.g., through a significant decrease in the world price of hempseed oil) would inevitably be translated into lower producer prices for KMS (which are – at 4% KMS content w/w for fresh melons – only N$80/ton, or 8c/kg, for melons). At even lower prices it is extremely doubtful that Namibian farmers would take up the opportunity in a significant way, which would in turn restrict primary production, prevent market growth and generally undo the potential rural development benefits of the whole exercise. While local oil extraction might therefore at first glance seem like a good idea, it is probably not in the best long-term interest of Namibian growers to pursue it as the primary strategy for developing the whole KMS opportunity/industry.

e) KMS oil should be seen in the context of a much larger opportunity around indigenous cosmetic oils from Africa. To maximise for primary producers the potential benefits contained in this opportunity will require investment and technical expertise beyond the capacity of local entrepreneurs and service providers. It is therefore advisable to keep an eye on the larger prize and to continue negotiations with appropriately resourced foreign partners (such as SSO) about a suitable technology transfer and benefit-sharing arrangement. Such negotiations will not be easy, but to forego an opportunity of this scale in exchange for medium-term gains of questionable sustainability would be shortsighted.

f) To negotiate from a position of strength one must have alternative options available in case the negotiations fail. For this reason several other potential buyers with a strong interest in KMS oil (including its community-traded aspects) have been identified, as have several alternative processing and value-adding partners. For the time being SSO remains the preferred partner (partly because it is BSI’s preferred supplier, partly because it has already solved the technical issues around refining KMS oil, and mainly because it has demonstrated good faith by being prepared to take the risk with Namibian suppliers). SSO is currently building a super-critical CO₂ extraction facility, which should be commissioned by December 2002 – this is cutting-edge extraction technology that could potentially open up several other high-value opportunities for Namibian resources and producers.

g) Alternative sources of equipment and expert advice are available for establishing oil extraction and refining operations in Namibia, should forthcoming assessments identify this as the most appropriate strategy.

Yetu Cosmetics/Oontanga Oil Factory

From before the first PIF workshop CRIAA SA-DC has made a concerted effort to get cooperation from Ms Salmi Kaulinge of Yetu Cosmetics/Oontanga Oil Factory. The possible effects of KMS exports on this enterprise were also raised and discussed at the IPTT, and the IPTT made repeated efforts to engage Ms Kaulinge in an exchange of views on this topic. However (as is the prerogative of any private enterprise regarding its confidential commercial information, and limited time) Ms
Kaulinge has chosen not to engage in such a dialogue with the IFTT, CRIAA SA-DC or EWC, and has been very secretive about her operations. Consequently very little is known about the economic viability of this local oil processing business, or the extent to which it is supported by shareholder capital and/or soft financing (the information that is available, e.g. from a recent pamphlet by the Investment Centre, is clearly boosterish and should be treated with caution).

Nevertheless, the discussion about local processing (above) raises an obvious question: How come Yetu/Oontanga can process KMS in Namibia, and apparently do so profitably? Without attempting a comprehensive answer, the following points should be considered:

- Before the KMS purchases started Yetu Cosmetics paid producers 70c/kg for melon seed — an indication that it either could not market its oil profitably, or that it did not care much about producer incomes.
- As a result of the low price Yetu/Oontanga only bought relatively small quantities of melon seed, from a restricted area.
- A&E Connock Perfumes and Cosmetics Ltd (a large re-seller of semi-processed raw materials to the trade) has been trying to promote oontanga oil for some time with limited success.
- As far as can be established, Yetu/Oontanga never managed to secure a substantial market for its oil before it received a 6 ton order from BSI via SSO — this order was placed to secure an ongoing supply of oil for formulators in the period between the first and second rounds of KMS exports, and also because BSI (like any business) is nervous about basing a product on a single source of supply.
- On the strength of this order Yetu/Oontanga increased its producer price to N$2/kg and expanded its supply network, in direct competition with the EWC/CRIAA SA-DC KMS purchases — which does not help much to extend the opportunity or increase the overall market for the seeds.
- On a recent visit to Namibia, BSI representatives assured the leadership of EWC (as its designated Community Trade partner) that it would source at most 40% of its KMS oil requirements from Yetu, and only when EWC could not deliver sufficient quantities.
- In light of the above it seems unlikely (but this is speculation) that BSI or SSO has entered into a long-term agreement with Yetu/Oontanga.
- Unless Yetu/Oontanga has another large and secure market for KMS oil unknown to CRIAA SA-DC (which is unlikely but not impossible), or can secure such a market before EWC manages to supply all the KMS oil BSI requires, its long-term financial viability remains uncertain.

EWC has turned down a suggestion to contract Yetu/Oontanga to toll-process its KMS, preferring instead to pursue its longer-term vision of an own processing facility that can handle its production of marula, KMS and other oils. Although it is cooperatively owned, EWC is as much part of the private sector as Yetu/Oontanga, and should be allowed (and helped where possible) to pursue its own commercial objectives.

Conclusions

In the period since July 2001, when it was decided to go ahead with the KMS exports:

- A large supply chain that delivers good levels of benefits for primary producers has been established (and competitors have been forced to match the price paid).
- Sufficient raw material has been collated, cleaned and shipped to make the launch of a formal-market product a reality (resulting additionally in a substantial order being placed with a Namibian private-sector processor).
- The product has been very successful and is now sold in 48 countries.
- The development of other products incorporating KMS oil is under active consideration.
- A good relationship has been established with a potential foreign investment partner that has the necessary capital and know-how to open up a much larger oil-processing opportunity for Namibian producers.
- Additional buyers and potential alternative processing partners have been identified and are being engaged in on-going discussions.
Appendix 4: **KAP marula fruit press**

by

Roger Gamond

October 2001

1. **BRIEF OVERVIEW**

Traditional marula fruit processing has been done the same way for centuries. It consists of punching the fruit skin with a sharp object (horn) and then squeezing the juice out by hand. The juice is then left fermenting and the brew is then consumed.

As long as the juice is extracted this way, it does not make sense to promote preservation because of the low productivity of hand processing, which allows the juice to start fermenting rapidly; on the other hand, the production of omongo does not meet the demand. Preservation will probably be positively considered by juice producers the day there will be overproduction.

For the same reason (slow process) it is difficult to promote jelly making. An additional constraint, in this case, is the capacity of marula juice to start fermenting within the hour of its extraction, destroying pectin in the juice and preventing jelly to set.

It is also well known that, due to juice extraction slowness, large quantities of fruits go rotten under the trees.

At village/community level, the development/promotion of new products made from marula juice requires the availability of much larger quantities of juice in a short time (with fruit presses), which make further processing possible before fermentation takes place.

2. **A STEP TOWARDS JUICE PRODUCTION INCREASE**

Research, design and development of a small fruit press appropriate to marula fruits has been conducted at KAP (Katutura Artisans’ Project) following the successful exhibition/demonstration of an imported small grape press at the WIB-SADC Trade Fair in Ongwediva in May 2000.

Depending on fruit condition, an extraction rate of 30% to more than 40% by weight has been achieved. The press cage has a capacity of about 12kg of whole fruits meaning that the expected quantity of juice may vary from 3.6 kg to 4.8 kg (or more) per batch. Generally the best yields are achieved with a double pressing.

On a single pressing basis, taking 20 to 30 minutes for a 12 kg batch with an extraction rate of 30%, one can easily produce 7 to 8 kg of juice per hour, meaning 55 to 65 kg per day (to be compared to 5kg per day, figure given – but not checked – for one person performing the traditional method).

If the fruit presses are disseminated in marula growing areas, juice preservation would become a request from producers.

Nine presses were built and sold to EWC associations at the end of March 2000; but it was already late (marula fruits season was close to finish).
3. LESSONS LEARNED FROM TRIALS

3.1 Press performance

Many trials have been made at KAP with the imported grape press, the KAP bridge screw press and the KAP bridge hydraulic press. These trials were more targeting successful press design, construction and operation easiness than establishing the best of fruit processing characteristics.

It is difficult to rate presses according to their efficiency as long as the three presses have not been simultaneously tried on same batches of fruits or as long as there are no general features allowing to precisely characterize fruits. Fresh fruits at the optimum ripeness condition and quickly processed will give an excellent juice yield and quality; the same press, processing the same way green, overripe or partly dried fruits, will give a low juice yield and quality.

If we want to rate these presses according to operation easiness, there is no doubt that the hydraulic one will be awarded the 1st prize: one person can easily operate it without the physical strength required for a screw press. Luckily, the hydraulic one is also the cheapest one to manufacture.

3.2 Fruit condition

From our trials, we can state as follows:

- Cold fruits, coming from the cold room (between 0 and 5°C) give a much clearer juice than the same fruits processed when at room temperature (less pectin?).
- Pectin decreases as fruits are ripening.
- Fresh ripe fruits are squeezed open during the pressing stage, allowing to easily separate skin and pits.
- Most of the green/unripe fruits are not squeezed open, even with a second pressing (difficulty to take out the pits) Shall we consider increasing the jack force (e.g. from 6 to 8 tons)?
- Overripe fruits, when pressed, give a puree difficult to use (heavy foots difficult to decant).
- Warming up (steaming) fruits before pressing increases yield and marula aroma. Depending on the temperature, wild yeasts, enzymes and even bacteria could be destroyed (but very easy re-contamination).
- Fruits collected at the right stage can be kept in clean bags in a cool, dry and dark place for one to two weeks without much losses (it is much easier to store fruits than juice).

3.3. Juice processing at village level (using a fruit press)

As reported above, jam, jelly, syrup making or juice pasteurization at village/homestead level is possible provided that small batches of juice are processed (fruit press required) as soon as the juice is extracted (to prevent fermentation). Organization is then the key to success.

The main standard processing steps are:

- fruit selection and collection;
- washing with clear water (eventually additive to kill wild yeasts and bacteria);
- warming/steaming (optional);
- first pressing (not forgetting to place a fine stainless steel strainer on the bucket collecting the juice); then immediately
- second pressing (following which, the juice must be quickly used).
4. CONCLUSION AND RECOMMENDATIONS

- Fruit features and characteristics must be clearly established (colour, size and weight, firmness, juice content ...) in collaboration with juice producers, leading to work out fruit standards for juice extraction purpose (best juice extraction rate and quality).
- The 9 fruit presses in rural areas must be closely followed in order to make sure that they are reliable and appropriate to marula fruits (hydraulic jack force, lifespan).
- If so, a lot of presses should be spread in marula growing areas.
- An economic study, based on field records, should be carried out to determine the conditions of viability (service press) and the results should be disseminated.

MARULA FRUIT PRESSES: RESULTS OF TRIALS

<table>
<thead>
<tr>
<th>Type of press</th>
<th>Kg of fruits</th>
<th>Fruit condition</th>
<th>1st press kg of juice</th>
<th>2nd press kg of juice</th>
<th>Total juice (kg)</th>
<th>% juice by weight</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>grape press</td>
<td>11.00</td>
<td>partly dried</td>
<td>2.20</td>
<td>No</td>
<td>2.20</td>
<td>20.00</td>
<td>May 2000</td>
</tr>
<tr>
<td>grape press</td>
<td>9.64</td>
<td>partly dried</td>
<td>2.04</td>
<td>No</td>
<td>2.04</td>
<td>21.10</td>
<td>May 2000</td>
</tr>
<tr>
<td>30T press</td>
<td>20.00</td>
<td>old fruits &gt;30days in cold room</td>
<td>2.20 (screw only)</td>
<td>0.83 (under 10 tons)</td>
<td>3.03</td>
<td>15.10</td>
<td>20/04/00</td>
</tr>
<tr>
<td>30T press</td>
<td>20.00</td>
<td>old fruits &gt;30days in cold room</td>
<td>2.40 (screw only)</td>
<td>1.13 (under 10 tons)</td>
<td>3.53</td>
<td>17.66</td>
<td>20/04/00</td>
</tr>
<tr>
<td>KAP screw press</td>
<td>12.90</td>
<td>yellow, good condition</td>
<td>3.82</td>
<td>0.82</td>
<td>4.64</td>
<td>35.97</td>
<td>24/02/01</td>
</tr>
<tr>
<td>6T hydraulic press</td>
<td>11.99</td>
<td>yellow fruits from cold room ± 5°C</td>
<td>3.84</td>
<td>No</td>
<td>3.84</td>
<td>32.00</td>
<td>6/03/01</td>
</tr>
<tr>
<td>6T hydraulic press</td>
<td>12.00</td>
<td>yellow/green from cold room ± 5°C</td>
<td>3.83</td>
<td>0.82</td>
<td>4.65</td>
<td>38.75</td>
<td>17/03/01</td>
</tr>
<tr>
<td>6T hydraulic press</td>
<td>12.00</td>
<td>yellow fruits from cold room ± 5°C</td>
<td>4.07</td>
<td>0.76</td>
<td>4.83</td>
<td>40.25</td>
<td>19/03/01</td>
</tr>
<tr>
<td>6T hydraulic press</td>
<td>12.00</td>
<td>yellow fruits from cold room ± 5°C</td>
<td>3.85</td>
<td>0.95</td>
<td>4.70</td>
<td>39.16</td>
<td>19/03/01</td>
</tr>
<tr>
<td>6T hydraulic press</td>
<td>13.16</td>
<td>yellow fruits from cold room ± 5°C</td>
<td>3.63</td>
<td>1.15</td>
<td>4.78</td>
<td>36.32</td>
<td>21/03/01</td>
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<tr>
<td>6T hydraulic press</td>
<td>12.00</td>
<td>yellow fruits from cold room ± 5°C</td>
<td>3.38</td>
<td>0.95</td>
<td>4.33</td>
<td>36.08</td>
<td>21/03/01</td>
</tr>
<tr>
<td>6T hydraulic press</td>
<td>12.50</td>
<td>green fruits from cold room ± 5°C</td>
<td>3.28</td>
<td>No</td>
<td>3.28</td>
<td>26.24</td>
<td>23/03/01</td>
</tr>
<tr>
<td>6T hydraulic press</td>
<td>12.15</td>
<td>overripe fruits from cold room ± 5°C</td>
<td>2.60</td>
<td>No</td>
<td>2.60</td>
<td>21.40</td>
<td>25/03/01</td>
</tr>
</tbody>
</table>

Note: As previously stated, it is clear that fruit condition is the major factor of (high/low) yield.
Appendix 5: Marula oil processing trials with KAP hydraulic fruit press

by

Roger Gamond

Trial conditions

Kernels from the 2000 intake stored in the cold room, taken out 24 hours before processing and left in the sun for 1 to 2 hours.

Press: KAP hydraulic fruit press prototype, force 6 tons
Cage: \( \varnothing \) 100 x 370 mm

Comments

Firstly, It must be highlighted that the pressure (kg/cm\(^2\)) achieved with the fruit press on the \( \varnothing \)100 cage is not so different from the pressure achieved with the 30 ton press on a standard cage: 76.5 kg/cm\(^2\) for the fruit press versus 86.70 kg/cm\(^2\) for the 30 ton press. These figures lead us to assume that the small fruit press is also suitable for marula oil extraction. Marula oil processing trials conducted with the fruit press confirm the versatility of this equipment.

Systematic trials with other indigenous fruits/oilseeds should be planned to inform communities about the press performance.

On the other hand, the press versatility reinforces the communities capacity to reach financial sustainability. Processing marula oil at community/household level for the export market is at this time out of question; however as a lot of pips are usually left unused, it could bring an increase in marula oil consumption leading to the development of a local market and the creation of job opportunities and cash income in rural areas.

However, simple technical alterations must be carried out to make presses easily versatile and systematic testings will have to be conducted to assess the lifespan and reliability of the presses.

Trials and results

<table>
<thead>
<tr>
<th>Kernels kg</th>
<th>1st press kg of oil*</th>
<th>2nd press kg of oil*</th>
<th>Total oil yield kg*</th>
<th>% oil* by weight</th>
<th>Pressing time (min)</th>
<th>Trial date</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.45</td>
<td>0.45</td>
<td>No</td>
<td>0.45</td>
<td>18.35</td>
<td>not recorded</td>
<td>5/03/01</td>
</tr>
<tr>
<td>2.52</td>
<td>0.38</td>
<td>0.20</td>
<td>0.58</td>
<td>23.01</td>
<td>35 (total)</td>
<td>16/08/01</td>
</tr>
<tr>
<td>2.56</td>
<td>0.40</td>
<td>No</td>
<td>0.40</td>
<td>15.62</td>
<td>not recorded</td>
<td>20/08/01</td>
</tr>
<tr>
<td>2.62</td>
<td>0.43</td>
<td>No</td>
<td>0.43</td>
<td>16.41</td>
<td>not recorded</td>
<td>20/08/01</td>
</tr>
<tr>
<td>2.26</td>
<td>0.38</td>
<td>No</td>
<td>0.38</td>
<td>16.81</td>
<td>not recorded</td>
<td>20/08/01</td>
</tr>
<tr>
<td>2.77</td>
<td>0.40</td>
<td>0.22</td>
<td>0.62</td>
<td>22.38</td>
<td>not recorded</td>
<td>20/08/01</td>
</tr>
</tbody>
</table>

* crude oil

Comments

More extensive trials should be done with a different number of plates, different kernel temperature and yield should be measured according to pressing time.
Appendix 6: **Marula fruit processing**

by

Roger Gamond

October 2001

1. **BRIEF OVERVIEW**

Traditional marula fruit processing consists of punching the fruit skin with a sharp object (horn) and then squeezing the juice out by hand. The juice is then left fermenting on its own and the brew (omaongo) consumed.

As long as the juice is extracted this way, it does not make sense to promote preservation because of the low productivity of hand processing allowing the juice to start fermenting; on the other hand, the production of omaongo does not meet the demand. Preservation will probably be positively considered by juice producers the day there will be overproduction.

For the same reason (slow process) it is difficult to promote jelly making. An additional constraint, in this case, is the capacity of marula juice to start fermenting within the hour of its extraction, destroying pectin in the juice and preventing jelly to set.

It is also well known that, due to juice extraction slowness, large quantities of fruits go rotten under the trees.

At village/community level, the development/promotion of new products made from marula juice requires the availability of much larger quantities of juice in a short time (fruit presses), allowing to start a further processing before fermentation takes place. The small presses made by KAP make this a possibility.

2. **JUICE PRESERVATION**

There are different ways to preserve marula juice; some are very easy, others are more sophisticated and a few require specific knowledge and background. We won’t consider in this document, wine processing and alcohol distillation as preservation methods because these processes are too sophisticated to be introduced at an early stage to rural communities.

Using cold:
- **Refrigeration**: to keep fresh juice for a few days even a few weeks, depending on the temperature inside the fridge. However, fermentation does start developing.
- **Deep freezing**: it is also an easy way to preserve the juice and its taste for weeks or months. However, fridge and deep freezers are not widely spread at homestead or village level and they are a very expensive way of preservation.

Using sugar and heat: Jam, jelly and syrup production: the preservative agent is sugar that must be mixed and cooked with fresh juice in a proportion of around 50% by weight (the longer the cooking, the lesser the fruit taste). After cooking, syrup, jelly or jam must be quickly poured in airtight bottles or jars and stored in a cool, dry and dark place. The shelf life of these products, if well prepared and stored, can easily exceed one year.
Using alcohol: Mixing 43% alcohol – vodka or cane – (and most often sugar) with fresh fruit juice is also a way to preserve the juice, provided that the mix titrates between 15 and 20% alcohol. Syrup can also be mixed with alcohol to make liquors. However, alcohol addition remains also an expensive way of preservation.

Using heat and low oxygen: Pasteurization is a preservation process using the heat to kill (and then prevent any development) of yeasts, enzymes and most of bacteria. No other additive is required. The simplest way is to fill clean bottles with fresh juice, then to seal them and heat the juice in the bottles by means of a bain-marie between 70 and 80°C for a few minutes. The bottles are then cooled down and stored in a dry, cool and dark place. This way of preservation can allow to keep the juice and its taste for several months. It is also a cheap and simple way of preservation provided that second hand bottles are collected and cleaned (empty beer bottles, for instance) and that a non-expensive heating method is used (gas). The only condition is to provide producers with new crown caps and a simple hand capper. If pasteurization is not properly carried out, two risks can occur: either fermentation develops in the bottle (insufficient heating) or the juice gets a burnt taste (over-heating). To be highlighted that a pasteurized juice can still be processed further (syrup, wine ...).

Chemical preservation:
Several chemical preservatives are commonly used in industrial juice production; however, disseminating their use in rural areas where, most of the time, people have not the required knowledge/background and equipment is really risky, even hazardous. One of the major constraints is the very tiny required amount of these chemicals:

- **Potassium metabisulphite**: preventing oxidation, killing wild yeasts and stopping fermentation. The required quantity to stop the juice fermentation at room temperature is 1ml/litre of a 5% SO2 solution, meaning 2.5ml for a 25 litres jerrycan.
- **Potassium sorbate**: stabiliser, preventing re-fermentation; required quantity 100mg/litre.
- **Sodium benzoate**: same effects than potassium sorbate; 200mg/litre.
- **Ascorbic acid**: prevents juice oxidation; 50mg/litre.

3. **LESSONS LEARNED FROM TRIALS**

3.1 **Fruit condition**

From our trials, we drew the following conclusions:

- Cold fruits, coming from the cold room (between 0 and 5°C) give a much clearer juice than the same fruits processed when at room temperature (less pectin?).
- Pectin decreases as fruits are ripening.
- Fresh ripe fruits are squeezed open during the pressing stage, allowing an easy separation of skins and pips.
- Most of the green/unripe fruits are not squeezed open, even with a second pressing (difficulty to take out the pits) Shall we consider increasing the jack force (e.g. from 6 to 8 tons)?
- Overripe fruits, when pressed, give a puree difficult to use (heavy foots difficult to settle).
- Warming up (steaming) fruits before pressing increases yield and manula aroma. Depending on the temperature, wild yeasts, enzymes and even bacteria could be destroyed (but very easy re-contamination).
- Fruits collected at the right stage can be kept in clean bags in a cool, dry and dark place for one to two weeks without much losses (it is much easier to store fruits than juice).
3.2 Juice processing at village level (using a fruit press)

As already stated, jam, jelly, syrup making or juice pasteurization at village/homestead level is possible provided that small batches of juice are processed (fruit press required) as soon as the juice is extracted (to prevent fermentation). Organization is then the key to success.

The main standard processing steps are:
- fruit selection and collection;
- washing with clear water (eventually additive to kill wild yeasts, enzymes and bacteria);
- warming/steaming (optional);
- first pressing (not to forget to place a fine stainless steel strainer on the bucket collecting the juice); then immediately
- second pressing (at which stage the juice must be quickly used).

To be reminded that Marula juice contains a lot of pectin (needed for jelly to set but a constraint to make syrup because in this case syrup can become jelly) and fermentation destroys pectin. On the other hand, cooking must be as quick as possible to avoid the loss of specific flavour (jelly – 4-5 minutes cooking, syrup – don’t exceed 85°C to keep the full flavour).

If juice preservation is the target at home level, the best way is pasteurization:
- Fill quickly clean bottles or jars – 0.5 litre is a good size – (allow 2cm of vacuum for juice dilatation).
- Seal them with new crown or twist off caps.
- Put them in a big pot that will be filled afterwards with warm (40-50°C) water (one bottle in the middle filled with the same water is not capped to allow to put a thermometer and follow the temperature evolution). The bottom of the bottles must not be in direct contact with the metal of the pot.
- Warm up as quickly as possible to reach 75-80°C; keep this temperature for 4-5 minutes.
- Take carefully out the bottles to cool them down.
- Put labels and store the bottles in a dry, cool and dark place.

3.3 Juice processing at small scale enterprise level

Note: Small-scale processing for commercial purpose requires more specific knowledge and sophisticated processing/equipment.

The standard process is as follows:
- Fruit selection and collection according to standards
- Washing with clear water (eventually additive to kill wild yeasts, enzymes and bacteria).
- Warming/steaming (optional)
- Crushing the fruits and soaking all the components together for 6-12 hours with immediate addition of potassium metabisulfite to stop fermentation
- Single pressing or double pressing
  - The juice is ready to cook with sugar to make jelly
- 6 hours after crushing and metabisulfite addition, pectin removal (pectinase)
- Clarification
  - The juice is ready to cook with sugar to make syrup
- Acidity measurement
- Sugar content
• Acidity and sugar adjustment – nectar – (ratio to be worked out and tested)
  - The juice/nectar is ready for pasteurization
• Pasteurization (efficient heating system)
• Labelling and storage
  - The juice/nectar can be stored at room temperature for a few weeks/months

Note: If wine is the final target, acidity and sugar adjustment must be done in accordance with selected wine characteristics: dry or sweet wine, expected alcohol % ... and an appropriate yeast must then be added.

4. CONCLUSION AND RECOMMENDATIONS

• Fruit features and characteristics must be clearly established (colour, size and weight, firmness, juice content ...) in collaboration with juice producers, leading to work out fruit standards for juice extraction purpose (best juice extraction rate and quality).
• Further preservation experimentations should be carried out to allow to establish clear and accurate rules for simple juice processing into jelly, syrup and pasteurized juice.
• Demonstrations showing these simple processing opportunities should be scheduled at community level. Specific equipment and supplies (bottle brushes, crown caps, hand cappers, jars and caps, pots, gas burners ...) should be made available – KAP-EWC Associations?
• Competitions should be organized to select the best products and prizes awarded to the best producers; products should then be promoted (trade fairs, marketing, publicity ...) and producers supported both technically and financially to develop their businesses.

5. MARULA JUICE PRESERVATION AND RESULTS

• The late availability of PIF budget did not make easy preservation trials, particularly with regard to chemical preservation or wine yeasts, pectinase ... only found in Europe (UK and Belgium). A lot of time was spent looking for the right ingredients, their properties and dosage. Another constraint was the lack of appropriate equipment, especially a precision scale able to accurately measure a few mg.
• The only chemical preservation trials were done with ingredients found in Namibia: sodium metabisulfite and ascorbic acid. However, the results were disappointing (quality of these ingredients, approximative dosage?) and do not allow to make any comment.
• Jelly making: if soft green fresh fruits are selected for this purpose, there is no need to add extra pectin. Cooking juice and sugar (same weight) for 4-5 minutes can make a nice jelly.
• Mixing dried baobab fruit flesh with juice makes easier the jelly to set.
• Syrup: the main problem is to get a clear juice (requires the use of pectinase; syrup made from such a juice was of good quality, keeping most of the marula fruit taste. (see samples)
• Mixing marula syrup with alcohol in different proportions (see samples) makes a good liquor. However a panel test should determine what proportion gives the best result.
• Juice pasteurization: it is probably the simplest way of preservation. Several trials were done successfully (see samples and labelling). We just regret that at the time of the trials we did not have the simple equipment allowing to measure the juice sugar content and its acidity (different from pH). This equipment would have allowed us to make different adjustments (sugar to acid ratio) for panel testing and best ratio establishment.
• Another advantage of pasteurization is that the juice can still be processed further after a few weeks or months (fermentation to wine for example).
# Appendix 7: Heating marula juice with solar power

by  
**Rolf Behringer**  
**Solar Stove Project**  
**Valombola VTC**

**Energy Requirement for Marula Juice (Temperature Range 20°C - 80°C)**

<table>
<thead>
<tr>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.18 kJ/kg x C</td>
<td>4.18 kJ/kg x C</td>
<td>4.18 kJ/kg x C</td>
</tr>
<tr>
<td>4.5 kg</td>
<td>7.5 kg</td>
<td>12 kg</td>
</tr>
<tr>
<td>56 C</td>
<td>56 C</td>
<td>56 C</td>
</tr>
<tr>
<td>1053.36 kJ =kWs</td>
<td>1755.6 kJ =kWs</td>
<td>2808.96 kJ =kWs</td>
</tr>
<tr>
<td><strong>0.2926 kWh</strong></td>
<td><strong>0.487667 kWh</strong></td>
<td><strong>0.780287 kWh</strong></td>
</tr>
</tbody>
</table>

**Energy Requirement for Marula Juice (Temperature Range 20°C - 80°C)**

<table>
<thead>
<tr>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.18 kJ/kg x C</td>
<td>4.18 kJ/kg x C</td>
<td>4.18 kJ/kg x C</td>
</tr>
<tr>
<td>4.5 kg</td>
<td>7.5 kg</td>
<td>12 kg</td>
</tr>
<tr>
<td>60 C</td>
<td>60 C</td>
<td>60 C</td>
</tr>
<tr>
<td>1128.6 kJ =kWs</td>
<td>1881 kJ =kWs</td>
<td>3009.6 kJ =kWs</td>
</tr>
<tr>
<td><strong>0.3135 kWh</strong></td>
<td><strong>0.5225 kWh</strong></td>
<td><strong>0.836 kWh</strong></td>
</tr>
</tbody>
</table>

**Energy Requirement for Marula Juice (Temperature Range 30°C - 80°C)**

<table>
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<tr>
<th>Q1</th>
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<th>Q3</th>
</tr>
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<tbody>
<tr>
<td>4.18 kJ/kg x C</td>
<td>4.18 kJ/kg x C</td>
<td>4.18 kJ/kg x C</td>
</tr>
<tr>
<td>4.5 kg</td>
<td>7.5 kg</td>
<td>12 kg</td>
</tr>
<tr>
<td>50 C</td>
<td>50 C</td>
<td>50 C</td>
</tr>
<tr>
<td>940.5 kJ =kWs</td>
<td>1567.5 kJ =kWs</td>
<td>2508 kJ =kWs</td>
</tr>
<tr>
<td><strong>0.26125 kWh</strong></td>
<td><strong>0.435417 kWh</strong></td>
<td><strong>0.698667 kWh</strong></td>
</tr>
</tbody>
</table>

**Energy Conversion of Marula Solar Stove (1st model)**

- **Solar Stove Surface:** 0.5 sqm  
- **Solar Radiation:** 800 W/sqm  
- **Receiving Solar Energy:** 
  - 0.5 sqm  
  - 900 W/sqm  
  - **450 W**

**Efficiency:** 0.7 (including reflectors)

- 450kW  
- 0.7  
- **315W**

- 0.45kW  
- 0.7  
- **0.315kW**

**Energy Requirement for Glass Bottles**

<table>
<thead>
<tr>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.83 kJ/kg x C</td>
<td>0.83 kJ/kg x C</td>
<td>0.83 kJ/kg x C</td>
</tr>
<tr>
<td>3.15 kg</td>
<td>5.25 kg</td>
<td>8.4 kg</td>
</tr>
<tr>
<td>56 C</td>
<td>56 C</td>
<td>56 C</td>
</tr>
<tr>
<td>146.412 kJ =kWs</td>
<td>244.02 kJ =kWs</td>
<td>390.432 kJ =kWs</td>
</tr>
<tr>
<td><strong>0.04067 kWh</strong></td>
<td><strong>0.067783 kWh</strong></td>
<td><strong>0.108453 kWh</strong></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.83 kJ/kg x C</td>
<td>0.83 kJ/kg x C</td>
<td>0.83 kJ/kg x C</td>
</tr>
<tr>
<td>3.15 kg</td>
<td>5.25 kg</td>
<td>8.4 kg</td>
</tr>
<tr>
<td>60 C</td>
<td>60 C</td>
<td>60 C</td>
</tr>
<tr>
<td>156.87 kJ =kWs</td>
<td>261.45 kJ =kWs</td>
<td>418.32 kJ =kWs</td>
</tr>
<tr>
<td><strong>0.043575 kWh</strong></td>
<td><strong>0.072625 kWh</strong></td>
<td><strong>0.1162 kWh</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.83 kJ/kg x C</td>
<td>0.83 kJ/kg x C</td>
<td>0.83 kJ/kg x C</td>
</tr>
<tr>
<td>3.15 kg</td>
<td>5.25 kg</td>
<td>8.4 kg</td>
</tr>
<tr>
<td>50 C</td>
<td>50 C</td>
<td>50 C</td>
</tr>
<tr>
<td>130.725 kJ =kWs</td>
<td>217.875 kJ =kWs</td>
<td>348.6 kJ =kWs</td>
</tr>
<tr>
<td><strong>0.036313 kWh</strong></td>
<td><strong>0.060521 kWh</strong></td>
<td><strong>0.096833 kWh</strong></td>
</tr>
<tr>
<td>Bottles</td>
<td>Temperature</td>
<td>Energy (kWh)</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
<td>--------------</td>
</tr>
<tr>
<td>6 Bottles</td>
<td>56°C</td>
<td>0.33327</td>
</tr>
<tr>
<td>6 Bottles</td>
<td>60°C</td>
<td>0.357075</td>
</tr>
<tr>
<td>6 Bottles</td>
<td>56°C</td>
<td>0.297563</td>
</tr>
<tr>
<td>10 Bottles</td>
<td>56°C</td>
<td>0.55545</td>
</tr>
<tr>
<td>10 Bottles</td>
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</tr>
<tr>
<td>16 Bottles</td>
<td>56°C</td>
<td>0.88872</td>
</tr>
<tr>
<td>16 Bottles</td>
<td>60°C</td>
<td>0.9522</td>
</tr>
<tr>
<td>16 Bottles</td>
<td>50°C</td>
<td>0.7935</td>
</tr>
</tbody>
</table>

**Required Surface for 16 bottles and one hour (1 h) heat-up time**

\[
\text{(900 W/sqm; delta t: 56°C)}
\]

0.9 kWh / 0.9 kW = 1 h  
\[\text{radiation} = 0.9 \text{ kW/sqm}\]

\[
0.9 / 0.7 = 1.29 \text{ kWh}
\]

\[
0.9 \text{ kW x 1 h} = 0.9 \text{ kWh}
\]

\[
0.7 \text{ sqm}
\]

**Required Surface = 1.43 sqm**

The surface of our first model is 0.55 sqm, which is insufficient to meet the required heat up time of one hour (1 h) for 16 bottles. Therefore the number of bottles should be reduced to 6 bottles or we construct a new oven with the appropriate surface.
Appendix 8: Ximenia oil processing trials

by
Roger Gamond
October 2001

Seeds: big seeds, recently decorticated
Press: KAP 30 ton press
Cage: standard, Ø 210 x 370

Trial method and results: As this oilseed was almost unknown to us (a quick trial had been made several months ago) several conditioning methods were tried to identify the one giving the best results. They are summarized below.

1. No conditioning
   - Filling the cage with 5.59 kg of whole seeds
   - Packing the seeds in the cage with the screw and the jack up to 10 tons (oil just starts to come out)
   - Lowering the table and topping up the cage with seeds (new total weight 7.81 kg)
   - Pressing the seeds: lots of worms coming out through the cage’s holes, and only traces of oil.

2. Warming up the seeds in the sun
   - 7 kg of seeds left in the sun for 1 to 2 hours
   - Filling the cage and packing the seeds
   - 1st pressing: crude oil 0.37 kg
   - Removing and crumbling the seeds/cake, then re-filling/packing the cage
   - 2nd pressing; crude oil 0.26 kg
   - Total yield 0.63 kg
     = 9%

3. Seed steaming
   - 7 kg of seeds in a big pot with ±1 litre of water, placed on a gas burner for 10 to 15 mn (70-80°C)
   - Filling and packing immediately the cage
   - Pressing: worms come out immediately. It is assumed that steaming soften the seeds.
   - Again only trace of oil

4. Roasting dry seeds
   - 7 kg of whole seeds in the same pot, but without water, placed on the same gas burner
   - Stirring as much as possible for 15 to 20 mn (some seeds burning, other still cool)
   - Immediately filling and packing the cage
• Pressing slowly (increasing the pressure too quickly leads to the formation of worms)
• 1st pressing (30 tons); crude oil 0.79 kg
• Removing and crumbling manually the cake, then re-filling and packing the cage
• 2nd pressing; crude oil 0.25 kg

Total yield 1.04 kg

= 14.86%

5. Roasting the seeds on a fire

A small drum made of wire mesh \( \varnothing \) 210 x 600 mm has been made to fit on a small charcoal stove of the same length. A 20 mm shaft equipped with a hand crank at one end passes through the drum and enables it to be rotated.

The drum was filled with 7.24 kg of Ximenia seeds and put on the stove at 09h10. It was slowly rotated by hand for 40 minutes.

Then the warm seeds (temp. not measured but likely around 60°C) were put straight in the cage on the 30 ton press; packing on the press, filling again, then pressing:
• 1st pressing starting at 10h00 finished at 10h35; very thick and sticky oil, but anyway better yield than before: 1.18 kg of crude oil, meaning 16.66%.
• Unloading the cage, disintegrating manually the still warm seeds and refilling the cage.
• 2nd pressing starting at 10h45, finishing at 11h15: still the same type of oil; yield of 0.43 kg, bringing the total yield 1.61 kg and the extraction rate to 22.24%.
• Again unloading the cage, disintegrating manually the cake, filling the cage and pressing.
• 3rd pressing started at 11h30 and finished at 12h00 yielded 0.24 kg, giving a total yield of 1.85 kg of crude oil and a total 25.53% extraction rate (a recent measurement of the oil content of these seeds by Anticor laboratory was 28%).

Comments

• The oil content of Ximenia seeds is about 28% in weight.
• The main constraint with these seeds is their trend to extrude “worms” through the holes of the press cage.
• Steaming is not a good idea because increasing the difficulty of processing.
• The best conditioning, so far, is dry warming/roasting of the seeds.
• However, no matter the conditioning method, oil is gummy, thick and sticky and takes a lot of time to settle.
• Different seed/cake crushing trials at different stages with different hammermill sieve sizes have failed (blockage of the sieves).

Further useful trials

• To find an easy way of oil degumming; boiling a mix of oil and water?
• To try pressing seeds before decortication to increase the fibre content.
• To try to improve the traditional extraction way.
Appendix 9: Inara oil processing trials

by
Roger Gamond
October 2001

Trial conditions

Relatively clean seeds, a bit sandy, not decorticated
No conditioning

Press: KAP 30ton press
Cage: standard, mild steel, ID 210 x 370 mm
Hammermill: Drotsky S1, 3000 rpm

Trial method and results

30/07/2001
- Filling the cage with 6.59 kg of whole Nara seeds
- 1st pressing; oil starts flowing around 18 tons; crude oil: 0.67 kg
- Seeds removal from the cage, loosened
- Filling again the cage with the same seeds
- Second pressing; oil starts flowing at 27 tons; crude oil: 0.19 kg
- Seeds removal from the cage
- Crushing the seeds already pressed twice in the hammermill (5.38 kg left), sieve of 3.5 mm
- Adding and mixing water to the crushed seeds (± 10% by weight)
- Pressing again; oil comes out at about 6 tons; crude oil: 0.67 kg
- Crushing again the cake with the same sieve (5.27 kg left)
- Adding and mixing water to crushed seeds (± 6% by weight)
- Pressing again; oil comes out at about 6 tons, but huge trend to make worms if pressure is increased too quickly; crude oil: 0.67 kg

Total yield 2.20 kg
= 33%

13/08/2001
- 19.88 kg of seeds
- 1st pressing in 3 batches; crude oil: 1.42 kg
- No 2nd pressing of the whole seeds
- 18.07 kg left after crushing the pressed seeds in the hammermill
- Pressed in 2 batches of 9 kg, after adding and mixing ± 10% of water
- 1st batch; crude oil: 1.23 kg
- 2nd batch; crude oil: 1.15 kg
- No second pressing of the cake

Total yield 3.80 kg
= 19.1%
Comments

- The 2nd trial's crude oil yield (1st pressing) is lower than in the 1st trial one (7.1 instead of almost 10%), probably due to pressing time.
- The second pressing of the whole seeds has not been done, because giving a very low yield.
- On the other hand, the first pressing after crushing's yield is better (12% instead of 10%).
- A second and last crushing and pressing would theoretically (if the same % than in the 1st trial) have brought the total yield to ± 31%.
- The results are quite consistent.
Appendix 10: Melon seed oil processing trials

by
Roger Gamond
October 2001

Seeds: small grey seeds from last year harvest
Press: KAP 30ton press
Cage: standard, Ø 210 x 370 mm
Hammermill: drosky S1, 3000rpm

Trial method and results

27/06/2001 (oil sample for Holland)
• Cleaning/grading the seeds with the mahangu pre-cleaner
• Crushing the clean seeds in the hammermill, 3.5 mm sieve
• Filling and packing the cage with 7 kg of crushed seeds
• 1st pressing: no trace of oil under 30 tons
• Unloading the cage and crumbling the crushed seeds
• Adding and mixing water (10%) with the crushed seeds
• Re-packing the cage with this mix
• Pressing: oil comes out at 7 to 8 tons; crude oil: 0.54 kg
• Unloading the cage and re-crumbling the cake in the hammermill
• Re-filling and packing the cage without any further addition
• Pressing again; trace of oil only at 30 tons
• Re-crumbling the cake through the hammer-mill
• Adding and mixing water (5%)
• Re-filling and packing
• Pressing again; oil comes out at 16 to 17 tons; crude oil: 0.20 kg

Total yield 0.74 kg
 = 10.57%

27/07/2001 (oil sample of the whole intake for Peroxide Value)
• 3.32 kg of seed-crushed in the hammermill (3.5 mm sieve)
• Adding 10% water and mixing well
• Filling and packing the cage
• 1st pressing; crude oil: 0.18 kg
• Unloading the cage and crumbling the cake (3.57 kg) in the hammermill
• Adding 5% water and mixing well
• 2nd pressing; crude oil: 0.17 kg

Total yield 0.35 kg
 = 10.54%
Comments

- The second trial method is probably the simplest and best one for this type of melon seeds, according to our equipment.
- The yield (very little settling) is far better than the previous one when a lot of melon seeds were processed (about double).
- Results of the two trials are more than consistent.
Appendix 11: Seed extraction from *Citrullus lanatus*

by
Roger Gamond
August 2002

Ripe *Citrullus Lanatus*

Preamble

Melon seed freshness and cleanness are the utmost quality requirements for oil processing, especially when this one is done through an expeller or any rotative screw press.

- Freshness ensures that seeds are not contaminated by pests or empty.
- Cleanness ensures that there is either no sand mixed with the seeds or foreign matters including small stones, feathers, mice droppings, other seeds...

Cleaning of the seeds done through the seed cleaner and grader does remove sand particles as well as most of the foreign matters; however, the very fine sand dust stuck on the seed envelope is difficult to fully remove.

The rotative screw presses or expellers are appropriate for melon seed oil extraction, but also particularly sensitive to sand because of their mode of operation: a large screw rotates in a barrel,
carrying and compressing very strongly the seeds; at the end of the barrel, an adjustable choke allows to adjust pressure on the seeds. The screw is heavily strained and if there is any sand mixed with the seeds, friction becomes abrasion wearing out very quickly the screw, leading to its replacement. Press screws are very expensive items, as they require specific steel, heating treatment and engineering equipment.

Machine and part replacement affects strongly oil costing and then, justifies the strong cleanliness requirement.

In order to avoid sand mixed with seeds, early precautions have to be taken. The method of extraction widely determines further seed cleanliness.

**Seed extraction methods**

As manual seed extraction brings extra cash income to rural populations, particularly women, mechanised extraction has not been considered, even if possible.

Manual extraction can be done two ways:

- **Dry process**: Melons are either crushed by pounding with a heavy pestle or cut in relatively big pieces and dried in the sun. After about one week, dry pieces are again pounded, then winnowed to separate the seeds from the dry pulp and skin.

If all operations – pounding/cutting, drying and re-pounding – are done on a clean surface and if seeds do not have any further contact with sand afterwards, they may be clean and sand-free.

![Melons cut into cubes for drying](image-url)
Same cubes when dry

Dried cubes after pounding
Winnowing after pounding

Seeds collected after winnowing (mixed with skin pieces)
- **Wet process:** Melons are cut into pieces (slices preferred) and seeds are manually separated from flesh above or into water. Fresh seeds sink at the bottom while flesh and empty seeds float at the surface, making quick and easy the separation. Advantage of this method: perfect cleanness of the seeds, provided that they are kept away from sand afterwards.
What seems the best way?

- Looking only at seed quality, the wet process is probably the best because separation of good seeds, empty seeds, pulp is very easy and there should not be any sand mixed with seeds. The quantity of required water is not much because it can be continuously recycled: top water is poured in another bucket through a sieve of 3.5 to 4mm that retains pulp and empty seeds; these ones are thrown away. Then the rest of water is poured through the same sieve that this time retains the right seeds. If this handling is done carefully, there is quite no loss of water.

- Looking at easiness, may be the way of roughly cutting, pounding, winnowing is somehow more usual to rural population. This way can be a right alternative as long as all operations are made on a clean surface, away from sand. But everybody also knows that in these areas, sand is omnipresent and very difficult to leave aside. Another difficulty is the complete separation of seeds and skin pieces that has to be done manually after winnowing unless it is agreed that a small quantity of dry skin in the seeds may be tolerated. Lastly, it is not proved that winnowing eliminates all empty seeds.
Recycling water: 1. getting rid of pulp and empty seeds

Recycling water: 2. all pulp and empty seeds are in the sieve and will be discarded. Notice good seeds left over in the bucket
Water recycling: 3. the rest of water as well as seeds are poured into the sieve. Seeds are extremely clean

Seed location in fruits

In order to find the best way of cutting, it is important first to determine the location of the seeds inside the fruit.

If a melon is cut in slices the way that orange segments are naturally split in the fruit, no high-density seed areas can be noticed. On the other hand, if the fruit is cut in slices perpendicular to the fruit axis (round slices), generally 6 high-density seed areas are clearly noticed.

Both ways of slicing have been tried, confirming that seeds are much easier to find, and then to pick up, when fruits are sliced perpendicular to the fruit axis and when slices are thin (10 to 20mm according to the size of the fruit is the right thickness).
Seed extraction helping devices

To increase manual seed extraction production, the first reflection led to design a prototype device able to slice the whole melon in one operation.

As the skin of the fruits is generally a bit hard, pieces of stainless steel band saw blade were used. The initial device was a bit oversized (20 blades every 12mm) making difficult to saw/cut the fruit. Another problem was how to hold the fruit while sawing. This was solved in fixing three long nails in a piece of timber, the fruit being impaled on them.

![Multi-blade device](image1)

In order to make easier the slicing operation, the multi blade device was given up and a single bladed device was designed, made of one saw blade fastened on a wood board in such a way that the space between the board and the blade determines the thickness of the slice. This device is working well for small melons up to 80-90mm of diameter because they are easy to hold in a single hand; it is a bit more difficult with bigger melons.

![Single-blade slicing device](image2)
Still looking at increasing slicing speed and regularity (and lesser tiredness), we are now looking towards a knife-saw equipped with a rigid blade but with small and aggressive teeth. This would probably be much more accepted as people are used to handle knives.

Another small prototype device looking as a small comb but with thin blades instead of teeth has been designed and constructed. It speeds-up seed collection from flesh provided that melon slices were not too thick; this device has still to be improved (handle to make holding easier) but has already proven its efficiency.

Conclusion from trials already done

Melon slicing (12 to 15 mm thick slices perpendicularly cut to fruit axis), immediately followed by seed extraction above water, with a small comb-extractor, seems at the moment the best alternative able to provide high quality seeds. However, trials at homestead level should be conducted in order to identify possible constraints and required improvements.

If women accept the process described above, a range of prices must be established for poor, medium and high quality seeds giving a clear advantage to the top quality.

A short technical leaflet with clear sketches could be designed and translated to help rural women to follow the right process.

A few figures

On large and ripe melons from 1.3 to 2.0 kg, dry seeds range between 3.5 and 5.5 % by weight (56 to 74 g). Average: 65 g of dry seeds for a 1.65 kg melon or 4%.

At an oil extraction rate of 10%, 254 kg of melon are needed to get 1 kg of oil, and 1 ton of melon roughly gives 4 kg of oil.