

## Marula Fruit Yield Survey – Methodology

### Background

A study with the aim of quantifying marula fruit yields in North-central Namibia, and to find correlations between tree size (trunk, canopy and height) and fruit yields was done in 2002<sup>1</sup>.

The fruits of 104 marula trees were weighed by community members, but in the final analysis only 56 of the data sets seemed reliable, and the rest of the data was discarded. It was furthermore said that the results of the study were not statistically valid because of the small size of the sample, the not random selection of the trees, and the late start of the survey, which excluded many of the trees that had already started to drop their fruits earlier in the season. Moreover, of the data that was used in the final analysis it was said that reliability of the yield measurements was affected by a number of factors:

- The quantity of usable and unusable fruits was unknown, bad or damaged fruits were included in some measurements and excluded in others
- It was likely that unmeasured fruit fell onto piles of measured fruits, meaning the actual number of fruits was higher than recorded
- Fruit flies added strongly to the quantity of fruits which perished. Especially towards the end of the season these unusable fruits were most likely ignored by harvesters

In addition to the problems with the reliability and validity of the data of this survey, it is known that there are strong annual variations in fruit production, and it was mentioned that in 2002, when the measurements were done, the trees generally had fewer and drier fruits than the year before.

The results of the study showed a wide variety in fruit production per tree, ranging from a few kilograms to 2860 kg. The average amount of fruit production per tree was 596 kg (standard deviation 465kg). In the conclusions and recommendations the authors however stressed the problems with the validity and reliability of the data, and suggested that more research needs to be done, collecting data on the number and characteristics of marula trees and fruit yields.

This marula fruit yield survey aims to complement the existing data.

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<sup>1</sup> Botelle, A, P. du Plessis, K. Pate, R Laamanen (2002) – *A survey of marula fruit yields in North-central Namibia*. CRIAA SA-DC for DFID/FRP Winners and Losers in Forest Product Commercialisation (ZF0140/R7795)

## Survey method

Annex 1 shows the survey that has to be filled in by the DoF extension officers. It indicates the general characteristics of the tree and its positioning:

- Name of owner of the tree (if applicable)
- Village/Region
- GPS position of tree
- Is it a Forestry Research mother tree?
- Estimated age of tree
- Circumference of trunk
- Canopy width
- Canopy height
- Estimated fruit yield of tree
- Fruits commonly used (& reason)

In addition to this general information, the Forestry extension officers are to fill in the marula fruit yield data. At the beginning of the 2011 season, all Forestry offices in the Northcentral regions were visited by the project coordinator and a researcher of the National Forestry Research Station. One or more representatives of all DoF extension offices was informed about the research, trained on the tree selection and data collection, and given a scale, a file and data collection forms. They were particularly told to:

- Select trees close to their offices in order to not be dependent on transport for the duration of the survey.
- Select trees that are fenced in or otherwise protected from animals grazing on the fruits or people picking up the fruits.
- Establish cooperation with the owners of the trees, making sure that fruits are not used until they have been weighed, in case the tree is owned.
- Go to the tree once the tree starts to drop fruit, and continue with intervals of 3-4 days until the tree has stopped dropping fruits.
- Put all the fruits that have fallen in bags, which are then weighed and recorded (date and kg). Once this has been done, the fruits should be put to a side, making sure that they are not weighed again next time they come.
- The owner of the tree can use the fruits once they have been weighed

Since there is a strong annual variation in fruit yields, it was decided to conduct the survey over a period of 5 years. On the double-sided survey form there is space to record the data of the same tree from 2011 up to 2015.

## Sampling method

The sampling method was determined by the location of Forestry extension offices and research units in the marula growing areas, since the marula fruit yield survey was to be conducted by and institutionalised in the Department of Forestry.

Below is a table of all forestry extension offices and research units consulted, detailing their contacts and level of participation:

Region	Forestry office	Contact	Participation
Oshana region	Ongwediwa District Forestry Office	Kebby Mutanekelwa, 0813441540 / 065 230295, <a href="mailto:mutanekelwa@yahoo.com">mutanekelwa@yahoo.com</a>	Agreed to participate, but did not collect data in 2011
Oshana region	Eheke Forestry substation	Through Kebby Mutanekelwa 0813441540 / 065 230295, <a href="mailto:mutanekelwa@yahoo.com">mutanekelwa@yahoo.com</a>	Not participating, as there are no marula trees in the vicinity of the office, and no transport is available.
Oshana region	Ombogo Forestry substation	Through Kebby Mutanekelwa 0813441540 / 065 230295, <a href="mailto:mutanekelwa@yahoo.com">mutanekelwa@yahoo.com</a>	Not participating, as there are no marula trees in the vicinity of the office, and no transport is available.
Ohangwena Region	Eenhana District Forestry Office		Not participating, no trees in vicinity of the office
Ohangwena Region	Omafo Forestry sub-station	Ugenia Shinohamba 0812617417 / Mr. Mutota 0813275289 / 065 266631	Agreed to participate, but no data was collected in 2011. Informed us that they will collect data from 2012.
Ohangwena Region	Ongha Forestry sub-station	through Kebby Mutanekelwa, 0813441540 / 065 230295	Agreed to participate, and some data was provided in 2011, but not valid
Ohangwena Region	Ongenga Forestry sub-station	Hapheni Mtuleni 081 4385753	Agreed to participate and data from 4 trees was provided in 2011
Ohangwena region	Okongo Forestry sub-station		Not participating, no trees in vicinity
Omusati Region	Outapi District Forestry Office	Wilhelmina N Kautiwa 065 251064 (tel), 065 251092 (fax), <a href="mailto:kautiwana@yahoo.com">kautiwana@yahoo.com</a> .	Agreed to participate but no data was collected in 2011 due to shortage of staff.
Omusati Region	Tsandi Forestry sub-station	Kreckensia Kamati 0814909133 / 065 258147	Agreed to participate but no data was collected in 2011.
Omusati Region	Okahao Forestry sub-station		Not participating, as there are no marula trees in the vicinity of the office, and no transport is available.
Omusati Region	Onesi Forestry sub-station	Lasarus Gregorius, 0813130254 / 065 258999, <a href="mailto:lasarus@web.com.na">lasarus@web.com.na</a>	Agreed to participate, but in 2011 only collected limited data from a tree that was not fully grown yet.

Oshikoto Region	Onankali Forestry office		Not participating, no marula trees in the area
Oshikoto Region	Onayena Forestry sub-station	Contact: Magdalena Andreas 0812350859 / 065 248850.	Agreed to participate, but did not collect data in 2011
Oshikoto Region	Mannheim Forestry Research station	Rosemary Hukununa, through mr. Charles Francis tel: 067-242128, fax: 067-242129	Agreed to participate, but only incomplete data from 1 tree was collected in 2011
Kavango region	Rundu District Forestry Office	Mr Haifene 066 – 255943	Agreed to participate, but no data collected in 2011 due to time limitations
Kavango region	Hamoye Forestry Research Station	Ms Selma Elago 066 - 686028	Data from 6 trees collected in 2011, but not all valid (some trees in public space)
Kavango region	Nkurenkuru Forestry substation	Ms Josina 066-258014	Data from 2 trees collected in 2011, but not 100% valid (trees in public space)
Caprivi Region	Ngoma forestry substation	Mr Silumbu 0816632460	Data from 4 trees collected in 2011, but not valid (short period of measurement)
Otjozondjupa Region	Grootfontein forestry office	Charles Francis tel: 067-242128, fax: 067-242129	Data collected of 2 trees, of which one was in a public space

Since transport constitutes a problem for many of the Forestry extension offices, the selected trees are likely to be in the immediate surroundings of the offices. Most trees sampled will be from people of nearby farms, and some may be from grafting trials on Forestry plots. Important is that the trees are fenced in or otherwise protected from goats or other animals, and that cooperation is established with the owners of the trees. Within these limitations, the DoF extension officers were told to randomly select marula trees for the survey.

In 2011 the Forestry offices in the North-central regions were informed and trained in the first week of February. Although most marula trees in the North central regions only start fruiting from February/March, the marula fruit yield survey in 2011 excludes the few “early fruiterers” that have started dropping fruit early in January. Is it advised that early fruiterers will be included when the survey continues in 2012. In the Caprivi, Kavango and Otjozondjupa Regions marula fruits later and all offices were informed and trained well before the start of the fruiting season.

Extreme flooding in 2011 made some of the trees and fruits inaccessible, and were therefore excluded from the 2011 sample.

## **Sampling size**

From the onset it was extremely unlikely that the sample size would be statistically valid. Even using a very conservative estimate of 500'000 fruiting marula trees in Namibia, surveying the fruit yield of 500 trees would constitute as little as 0.1% of the resource. Nevertheless, getting more marula fruit yield data would be useful and add to the existing information

Since the fruit yield survey is to be conducted by and institutionalised in forestry offices, sample size was limited to what they could take on. We were hoping all the forestry offices contacted could gather data of 5-10 trees, but in practice we came to nowhere near this number in 2011, due to a number of reasons:

- The marula fruit yield survey was not enforced by the Ministry of Agriculture, Water and Forestry. Although several influential government officials were informed about the survey and asked to assist, the request to collect the data to the forestry staff on the ground remained a request from the project coordinator and a forestry research staff member, which did not motivate most of the field staff to conduct the survey.
- No staff time and transport were allocated to the surveys, and the short notice given made it hard for most forestry offices to participate
- The extreme flooding situation in the North-central regions resulted in areas being inaccessible, as well as shifting priorities of all Government departments.

In total only 25 trees were surveyed in 2011, with not all data proving valid. It is hoped that with the proper government motivation at least 100 trees will be surveyed in the next season.

## **Data analysis**

An excel spreadsheet was developed, which allows for data up to the year 2015 (5 years). All the data gathered in 2011 was entered in the spreadsheet, but due to the lack of valid data, no proper analysis could be made. In total 8 Forestry offices (extension offices and research stations) collected data of 25 marula trees. However, only 7 data sets were assessed as valid. In the other cases:

- Only 1-3 days per tree were measured, not capturing the full season (9 trees)
- Trees were growing in public spaces, with no control over fruit usage (7 trees)
- Huge amounts were recorded in 1 go (2720-5100 kg), unlikely to be measured by surveyor (3 trees)
- Tree was only 7 years old and not yet in full production, it produced less than 5kg (1 tree)

In some cases the other data recorded on the survey forms was also incomplete, i.e. GPS position of tree, circumference of trunk, canopy width, canopy height, estimated fruit yield and fruit usage.

Although no analysis of the data could be conducted, the database has been explained and handed over to the National Forestry Research Centre in Okahandja. It is also attached to this methodology report as annex 2.

### **Conclusions and recommendations**

Although the methodology for the marula fruit yield seems feasible, the 2011 season has gathered little useful results. The main reason for this seems the lack of motivation of most field officers to carry out the survey, which in turn is the result of the lack of enforcement of the Department of Forestry (DoF). The main recommendation would therefore be for DoF to prioritise the marula fruit yield survey, conveying its importance to the field staff and allocating enough time for this activity in the working schedules of the forestry extension offices and research units.

Other reasons for the lack of valid data included:

- The extreme flooding in the 2011 season, resulting in areas being inaccessible, as well as shifting priorities of all Government departments. This was beyond our control. Data showing that fruits are inaccessible during some years is valid as well, but inaccessible trees were not recorded in 2011.
- The gathering of data from “public” trees. It is therefore recommended to go through the methodology with all the participating offices again before the start of the next fruiting season.

It is furthermore recommended that a researcher from the National Forestry Research Centre in Okahandja is mandated to coordinate the marula fruit yield survey in the next few years.