



# Banana diversity in the Middle East (Jordan, Egypt, Oman)

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INIBAP is a programme of the International Plant Genetic Resources Institute (IPGRI), a center of

**FUTURE HARVEST**<sup>SM</sup>

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## Preface

The survey reported herewith was achieved under excellent conditions. The interested authorities of the three countries were most collaborative during the preparation of the mission and the following persons are especially thanked for their support and for facilitating the operation:

- \* Dr Abdul Nabi Fardous, Director General and Dr Amer Al Nsour, Director of Socio-Economic Studies, NCARTT, Jordan;
- \* Dr Fawzi N. Mahrous, President of the Agricultural Research Center and
- \* Dr Abdelmenim Abou Zeid, Director NPGRP, Egypt;
- \* Mr Ali Bin Hussein Al Lawati, National Coordinator for PGR and  
Ing. Abdulaziz Salim AlHarthy, Directorate of Research, Al Roumis Agricultural Research Centre, Oman;
- \* Mr Habib Abdullah Al-Hasni, Director of International Relations, Ministry of Agriculture & Fisheries, Oman.

Actual participation in the survey was assured by Dr Salam Ayoub, specialist in Olive Research, in Jordan, Dr Abou Zeid, Director of the National Plant Genetic Resources Programme (NPGRP) and Dr Reda Rizk, National Coordinator of PGR in Egypt, and Mr. Alhosni, Agricultural Researcher in Oman. They found the time to prepare a suitable programme, to guide the visiting specialist to the villages, to draw attention to many significant details and to exhaustively discuss the results in order to make this mission a success within a relatively short time. They are herewith warmly thanked for their efforts.

Every farmer visited was most eager to offer technical details and to exchange viewpoints regarding banana varieties and management. The skill and inventiveness in farming practices under sometimes difficult circumstances was impressive. The readiness of scientists to provide all relevant information should particularly be acknowledged. Contact with farmers and researchers was therefore most instructive and helpful.

Suzanne Sharrock, Germplasm Conservation Scientist at INIBAP has been monitoring the entire undertaking with great attention and care. Florence Malafosse should be thanked for her help in the final layout and printing of this report.

Finally, I am grateful to the Director of INIBAP, Dr Emile Frison for having offered this unique opportunity to learn more about banana diversity in the Middle East. It is hoped that the present report meets expectations and will be of help in making decisions regarding the future of banana cultivation in the countries visited.

Edmond De Langhe

## Introduction

The International Network for the Improvement of Banana and Plantain (INIBAP) organized a survey of banana diversity in the Middle East in collaboration with the Food and Agriculture Organization (FAO).

The idea of the survey was first proposed by Dr Mahmud Duwayri, Director of Agricultural Production and Protection Division at FAO, member of the Board of Trustees of the International Plant Genetic Institutes Resources (IPGRI) and took place from the 26<sup>th</sup> February to the 20<sup>th</sup> March 2002.

Three countries were visited in the following order: Jordan, Egypt, Oman (The full programme is provided in Annex 1). The mission Team changed according to the country visited and consisted of the present report's main author, Dr Edmond De Langhe, with the respective principal collaborators:

- \* Dr Salam Ayoub, specialist in Olive Research, for Jordan,
- \* Dr Abou Zeid, head of the National Plant Genetic Resources Programme (NPGRP) and
- \* Dr Reda Rizk, National Coordinator on PGRs for Egypt,
- \* Mr Alhosni, Agricultural Researcher, for Oman.

The survey was the first effort at the international level to systematically explore banana cultivar diversity in the Middle East region. A consistent literature on the subject does not seem to exist. Indeed the few indications of diversity, found in incidental reports, papers, or references to the latter, are either not dealing with taxonomic aspects, or have not been confirmed afterwards<sup>1</sup>.

Pieces of documentation acquired, together with personal communications to the main author and some study of the history in the region, left the impression that banana diversity is a fact but that its importance was uncertain. If the diversity in banana cultivars is important, and considering that the ongoing modernization of agriculture in the Middle East may severely affect it, the survey was felt to be a timely operation. On the other hand, if the diversity in traditional cultivars is quite a narrow one, then the question arises if the input of new *Musa* germplasm would not be beneficial to banana cultivation in the region.

The survey clarified the situation at least for the three countries visited. The diversity in traditional bananas is a small to moderate one, depending on the country. With the practical consequence that the introduction of other cultivars or of new hybrids is a matter that deserves serious attention, especially in order to meet the perceived difficulties experienced by small-to-moderate income farmers.

This reality brought the survey team to spend some time on the agronomical and economical aspects of banana cultivation in each country. This effort is reflected in the recommendations formulated for each visited country, based as they are on the observations and discussions that could be carried out within the rather limited time dedicated to the survey. The majority of the findings and respective recommendations however, deal with the taxonomical clarification of the observed banana cultivar diversity in the visited countries, thus conforming to the main objective of the survey.

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<sup>1</sup> As is the case for example with the existence of 'French Plantains' in Egypt, in a paper of Tackholm and Drar, 1954, to which N.W. Simmonds refers in his book 'Bananas'.

# Chapter 1: Historical and economical background, general considerations and conclusions<sup>2</sup>

## A. Rationale

The present chapter aims to show why a better knowledge on traditional banana cultivars in this region is of economic importance. Since the existence of traditional cultivars in the region would point to their capacity to survive in difficult conditions, their genetic potential would be a fact. Breeding/selection programmes could make use of that potential, in order to provide varieties/hybrids with market-value that would not require sophisticated growing techniques, and would thus become accessible for small/moderate-scale farming.

The region of the Middle East and Northern Africa is rather peripheral to the banana cultivation zone in the Old World, since the crop thrives best in the humid tropics. Traditional banana cultivation<sup>3</sup> thus faces two sorts of difficulties. The Southern belt of the region is characterized by long periods of drought, while the winter-cold on the northern side is an even harder condition for the crop, which generally dies after a few successive nights with temperature below 10°C.

However, some banana cultivars apparently have been grown in this region since many centuries. This raises at least the following questions, with the consequent research subjects:

### ***(1) How did the farmers manage to make these cultivars reasonably productive?***

Are these bananas found only on restricted sites with a favourable microclimate, or are they grown under various traditional irrigation conditions? A closer look at the adapted growing techniques is required;

### ***(2) How important is the genetic diversity of these bananas?***

In a given region, the diversity in banana cultivars can be generated: (a) by regular and successful introduction of new cultivars; (b) by secondary diversification (somatic mutation) of an originally modest number of cultivars; (c) by a combination of these two processes.

Both possibilities (a) and (b) call for sufficient historical/botanical insight in order to evaluate the current reality and to plan any efficient survey.

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<sup>2</sup> The text of this chapter served as a background reference document for the *Musa* diversity survey, with visits to banana growing areas in the countries: Egypt, Jordan, Oman and Yemen. Most unfortunately, Yemen could not be visited. The document was an attempt at constructing a very tentative picture of this diversity, based on rare and fractional sources of information. Its weakness, i.e. the lack of precise information and the possibility of some misleading, reflected the urgent need for such investigation.

The text has been adapted on the base of the findings of the survey mission, especially under the item 'Fact finding and conclusion'.

<sup>3</sup> Meaning: simple planting of the suckers, minimal crop maintenance techniques, heavy reliance on favourable weather for getting the crop to produce decent bunches.

## Historical indications and speculations<sup>4</sup>

### *On the Arabic term 'mauz' for 'banana'*

Literature will almost invariably explain that the Arabic term for the banana, i.e. *mauz*, comes from the Sanskrit *moc(h)a*, and that the plant was therefore somehow introduced from India in the Middle East and further West and South, by Arab traders during pre-Islamic times. This scheme became the implicit base for the commonly held assumption that all the banana cultivars in Africa (and later on in America) must have come from India.

Recent investigations, however, point to the strong possibility that most traditional cultivars in humid tropical Africa have their origin much farther in the East, in Eastern Indonesia and around (De Langhe and de Maret 1999). India was nevertheless at the origin of the rather drought resistant ABB cultivars in the Middle East and Northern Africa, whereby Arab and/or Persian traders would have played a key role in the past.

It should be noticed that the Sanskrit term *moc(h)a* is applied in the ancient Indian texts (the Mahabharata for example) for the banana flower, or at the most the whole female/male bud, but neither for the fruit nor the plant, for which the name *kadali* (and in some texts *rambha*) was used.

According to Dr Reda Rizk, the collaborator to this mission in Egypt, the derivation 'mocaamos or muz' is unlikely because the latter terms are phonetically very different. He recalls the possibility that these names may be linked to that of the prophet *Musa* (Ca. 1200 B.C.) who was born in Egypt and joined the exodus with Israeli people to the land of Palestine. He also refers to the option that the name may have a Roman origin. Indeed, the name '*Musa*' adopted by Linnaeus for the entire genus may have been derived from Antonius Musa (63-14 B.C.) who was physician to the first Roman Emperor, Octavius Augustus.

Consequently, the origin of the names '*mauz/mos/muz*' and of '*musa*' still seems to be a subject for further investigation by linguists.<sup>5</sup>

It is equally intriguing that the term *mosa* designates the pseudostem of *Ensete ventricosum*<sup>6</sup> in Omotic, a language group in S.W. Ethiopia (Shigeta 1990). The farmers there still keep a very long tradition of cultivating Ensete for many purposes, a tradition which was probably common to many Southern Cushitic speaking people all over East Africa (from the Ethiopian highlands down to the south) before Christian era (BCE). Contacts between this area and the Arab world thus may have been instrumental for the shift "*mosa* ==> *mauz*" in designating a banana-like plant, even before the advent of the edible banana. Linguists could thus elaborate on the supposed connection in a very different perspective<sup>7</sup>.

In the context of the present report, it can be concluded that the Arabic term "*mauz*" does not necessarily point to an Indian origin of the banana cultivars as a whole to the West of that subcontinent. And that it became applied only to those cultivars that were 'at some time' introduced in the Middle East by Arab traders.

<sup>4</sup> 'Historical' in a large sense, including a period before written sources appeared.

<sup>5</sup> Dr Rizk recalls also that even the name 'Banana' may have originated from the Arabic language, with the meaning 'finger of man'. It is mentioned as such in the Holy Quran at part number 29, "Souret El Quamma" Number 75:4. The word "Banan" is present in Arabic dictionary in plural form, meaning fingertips.

<sup>6</sup> Frequently surnamed 'the false banana' in Africa.

<sup>7</sup> *Ensete* spp. does exist all over India, up to the Himalayan region. *Ensete superbum* is of special significance in Buddhist culture, regularly grown close to the monasteries.

### ***A 'pre-Sabean' possibility?***

Speculations on how the banana was introduced in the African continent do include a theory (popular in the early 20<sup>th</sup> century) of its move along the southern coasts of the Arab subcontinent, and then across the Red Sea into Africa. This could be called 'the pre-Sabean route'.

Because of the very dry conditions in that zone, more humid periods in the past would have been required for this 'operation' to have been feasible. But current knowledge of paleo-humid phases seriously precludes such a possibility. By 5000 before present (BP - or 3000 BCE) Southern Arabia was covered by a savannah at the most, and bananas cannot subsist in such an environment in non-irrigated conditions. Only if the ingenious irrigation practices in Mesopotamia and around at that time had existed in this region, could the hypothesis have a chance. There exists evident vestiges of elaborate irrigation systems in the zone (e.g. in present-day Yemen) but they are of more recent times (3000 BP). And any period after 5000 BP apparently witnessed increasingly drier conditions.<sup>8</sup>

The 'pre-Sabean route' should therefore be considered as a very remote/minimal possibility, and alternatives should be looked for, when it comes to explaining the existence of the traditional banana cultivars in humid tropical Africa.

### ***The Sabean route***

Between 3000 and 1500 BP, the southwest of Arabia and the African region on the opposite side of the Red Sea were witness of the Sabean civilization. Agriculture was very important and organized and included extensive irrigation.

The classic theory of the 'Sabean route' would have it that the Sabeans (*sensu largo*), by their contacts over the sea with India and beyond, played the key role in the introduction of banana and other Asian crops (Asian yam and taro for example) to the African continent.

For ecological reasons however, the theory can not hold in the case of the Plantain cultivars which dominate in the rainforest zone: they cannot survive a long dry season, and certainly not a series of cold nights (less than 10°C). If traders found an interest in shipping the suckers, transporting them over the Indian Ocean, and delivering these 'goods' on the ports of the East African coast, the ecological problem persists. The hinterland of these coasts is dry (along Somaliland and Kenya) and the more humid mountain slopes far away.

The case of the East African Highland AAA bananas, so popular in the Great Lakes Region, is more intriguing. These cultivars thrive at altitudes of 1000-1700 masl, provided they benefit from regular humidity. The existence of such cultivars in Ethiopia has been regularly reported orally to the author of the present report. They would even be growing in Yemen, in association with the coffee trees, according to the same sort of reports. It can of course be argued that these cultivars may as well have been introduced in more recent times from the South, the Great Lakes region<sup>9</sup>. Perhaps a study of whether or not they have some sort of cultural significance in these areas could solve the question.

The remaining hybrid cultivar-groups, i.e. the ABB, and the 'AAB-other-than-Plantains' are of particular interest in the present context. They are more resistant to physical strain and

<sup>8</sup> There is also the question of what crops would have been grown by priority in such expensive 'settlements'.

Cereals and vegetables would most probably have the advantage, by far. And palms would have played the buffer-role around.

<sup>9</sup> These cultivars provide an excellent shade to the Arabica tree, and the association became widespread in recent centuries, even in Middle-America.

some of these cultivars can grow in various ecologies, from lowland to high up in the hills. The chances that they were introduced with success in the Middle East and Northern Africa during the Sabeian period and later, are real.

### ***The Madagascan route***

Murdock (1959) brought forward the hypothesis that banana, taro and Asian yam were introduced from Indonesia by ancestors of the Malagasy, who would have visited the African east coast as well. The first archaeological traces of settlement in Madagascar date from around 500 *Anno Domini* (after Christ) and bananas would thus have reached the African continent at about the same period. The hypothesis was supported by Simmonds (1962) who suggested that the bananas reached the continent after a first settlement in Madagascar. It still is the most widely accepted theory. The very low diversity in AAB Plantain as well as in AAA East African Highland bananas in Madagascar is a major difficulty for this theory (De Langhe *et al.* 1994).

### ***An earlier alternative***

The unique diversity of the Plantains in rainforest Africa seems to have been generated *ad hoc* and should therefore have needed a considerable time there, probably more than two millennia. The new hypothesis that Plantains may have been introduced from eastern Indonesia by 3000 B.C. is based on botanical deductions from linguistic schemes that explain the development of the Malayo-Polynesian languages in South-East Asia/Pacific (De Langhe and de Maret 1999).

### ***The possible extent of the Arabic influence on banana diversity***

The point of an Arabic influence on banana diversity in the Middle East and in Africa seems to become clear from the above review of theories, which appear to be complementary rather than conflicting.

While it progressively becomes evident from archaeological research that Arabian navigators operated in the Indian Ocean much more than two millennia ago, they may not have been in close contact with the Austronesian ancestors who would have introduced the Plantains and the East African Highland bananas to Africa.

But the Arabian tradesmen, moving on the northern side of the ocean, could certainly have been instrumental in the diffusion of the cultivars that originated in India and still are important there. These are mostly AAB-and ABB hybrids.

The survey mission was therefore not only interested in the identification of cultivars, but tried to find an answer to the two following questions:

- \* From what period on could the hybrids have been diffused over the Middle East and northern Africa?
- \* Could the Arabian tradesmen, during their contacts with farmers in Africa, have been sufficiently interested in the already existing Plantains and East African Highland bananas to introduce these to the Middle East and Egypt?

### ***Fact finding and conclusion***

The results of the survey led to the following conclusions:

1. No botanical trace could be found of banana cultivation since remote times. Such cultivation would have generated at least a moderate amount of somaclonal variation among the once introduced cultivars from India, but this is not the case. The survey team got the impression that introduction of AAB and ABB cultivars relied on temporal opportunities and individual initiatives, and that some cultivars may at places even



have disappeared for some time and been re-introduced later. The situation of the commercial AAA Cavendish cultivars is clear: these have been introduced during the last century and received by farmers with rapidly growing success.

2. No members could be found of the banana subgroups AAB Plantain and AAA East African Highland banana. This is not surprising, considering the rather narrow ecological conditions under which they can be maintained for a long period in traditional farming conditions. If some of these cultivars ever have been introduced 'from the South', they must have disappeared without leaving any (historical) trace.<sup>10</sup>

This situation prompts the survey team to come to the practical conclusion that a scope for introduction and selection of banana germplasm definitely exists in the visited countries.

## Economic potential

### *An ambiguous first impression*

On the one hand, farmers appear to grow some banana cultivars in relatively non-sophisticated conditions.

On the other hand, the commercial bananas, such as those belonging to the 'Cavendish-group', have found their place in the region during the 20<sup>th</sup> century. But this undertaking, backed by strong and appropriate agricultural research, calls for an important input in sophisticated techniques, and the risk of unproductive harvests is real in most cases. This system is not readily accessible to the small/moderate scale farmers.

This initial glance at the reality leaves the observer with an ambiguous impression regarding the future economic status of banana production. The two components of the impression are:

- Commercial bananas do have a future in the region, but their cultivation is confined to very sophisticated agriculture (commercial plantations on selected sites; sprinkler irrigation and fertigation; programmed timing of interventions and treatments supported by crop-growing/micro-environment simulation models; etc.)
- Traditional bananas have no future because they do not fit into the increasingly popular/accessible intensive agricultural/horticultural systems.

There is a risk that this impression could lead to the conclusion that traditional banana cultivars in this region do not deserve any further attention. Collection and conservation of local germplasm would not be of regional interest and would thus rather have to rely on opportunities and facilities offered by international involvement. And yet:

### *Some considerations*

- 1 Banana gardens and banana fields have a very beneficial impact on micro-environment. They not only have a local buffering effect on climatic changes, but also play a basic role in soil conservation (in both physical and chemical terms). The fact is well-known and needs no substantiation in the present report.
- 2 Less well appreciated is the fact these garden and groves do not require much care (a) if the plants belong to locally adapted varieties and (b) once the gardens/groves have

<sup>10</sup>It should be stressed that Yemen has not been visited by the mission, and that the field for the two conclusions is restricted to Jordan, Egypt and Oman.

<sup>11</sup>Meaning that beyond a critical number of plants in the garden, a turnover of nutrients keeps the production of new biomass going, with minimal human intervention. The bunches are a considerable sink in carbohydrates but mobilize a minimum only of mineral nutrients: their harvest does not decrease the biomass production potential over a long time.

reached a stage of 'self-sufficiency', realized through mass-effect<sup>11</sup>. Replacing the cultivars by 'more productive' varieties, but which are not adapted to the local environment is disastrous. And the same banana population, but dispersed over separate small gardens, is another disaster, simply because many more plants get exposed to the macro-environment.

- 3 Productivity of banana gardens/fields/groves can be significantly improved, if the cultivars are replaced by more productive ones, provided that the new varieties are equally well adapted to the environment.

For the region under consideration, the traditional bananas belong, for the most part, to the AB/ABB group (cfr *in fine* of above item on 'Niches'). Very productive ABB/ABBB cultivars and newly created hybrids are available, but each of them has its own 'ecological niche'. Massive introduction of this new germplasm, followed by selection for the most adapted ones is a cumbersome and expensive operation. Instead, the introduction should be restricted to germplasm with comparable morphology and consequent physiology. This would offer the best chance to detect in an economical way the most appropriate new accessions. Consequently, a good knowledge of the traditional germplasm is a prerequisite to any such improvement.

Genetic improvement of bananas has reached a stage whereby synthetic material can be introgressed into local germplasm, at the national level. A range of synthetic diploids with various genetic backgrounds are available, and single crossing onto local cultivars produces in many cases a spectrum of tetraploid/triploid 'candidate-hybrids'<sup>12</sup>, in which the selection for the most productive plants does not require sophisticated facilities.

### ***Fact finding and conclusions***

The survey confirmed the existence of two broad categories of farmers with respect to banana cultivation: those who can afford investment for high performance, and those who are faring less well and who consequently cannot rely on banana for a regular income.

The major constraints to commercial banana crop growth differ from country to country: water shortage in Jordan, salt-loaded water in Oman, labour requirements in Egypt – where the presence of the bunchy top virus calls for regular observation of each plant, in addition to the usual management.

The attractive commercial Cavendish cultivar 'Williams' is quite demanding regarding these constraints and is thus not so accessible to the second farmer category. The other major commercial Cavendish, the 'Grande naine', produces less perfect bunches but is also more adaptable to less intensive management.

It is in such configuration that the future of banana cultivation may depend on what these farmers really can afford in terms of adapted cultivars and hybrids and consequent management load.

Some of the recommendations formulated per country in this report are addressing this problem. In more general terms, and in the light of what was already argued regarding the better prospects for banana breeding at the national level, it should be of interest for economists to investigate and to evaluate the potential of improved traditional bananas for small-to-moderate income farming systems in the region.

<sup>12</sup>The following should be noted in particular. The group of ABB cultivars is more seed-fertile than any other group as a whole, and artificial pollination of the female flowers regularly leads to several-to-many seeds per bunch. Meiotic segregation during macro-sporogenesis proved to be common in many natural AxB hybrids, so that a single cross (cultivar x synthetic diploid) produces a segregation among the obtained hybrids.

## Chapter 2: Diversity in Jordan

### Introduction

A brief review of banana cultivation in Jordan was prepared for the mission by Dr Salam Ayoub, specialist in research on the olive tree, and is reproduced in Annex 2. The review stresses the current difficulties in irrigation which discourages farmers from cultivating bananas at the levels they used to manage. The rare exceptions are mostly the farms relying on artesian wells. Highlighted is also the need for small scale farmers to grow cultivars which are less demanding in terms of water demand.

### Cultivars in rural area

Farms were visited in the two representative villages of Al Kafrin and Al Rama. The team (Salam Ayoub and Edmond De Langhe) was joined by Mr Tariq Al Idwan, an horticulturist at the South Shouna station who is in close contact with the farmers and familiar with many aspects of banana cultivation in Jordan.

In both villages no other cultivars than those belonging to the AAA Cavendish subgroup could be detected. If AAB's and ABB's were ever cultivated, they have disappeared. It should be noted that the system of home gardens (or backyards), where traditional bananas are generally seen in many tropical and subtropical areas, does not exist, at least in these two villages.

Three Cavendish cultivars were observed:

- 'Balady', the Dwarf Cavendish which was said to have existed since long in Jordan. The name covers that concept, just as it is in Egypt and perhaps elsewhere in Arabic speaking countries. The cultivar is progressively being replaced by the following two, but is frequently used as a border row, protecting the field from weeds and wind (photo 1). The latter effect can be questioned since the plant is so short. The much taller but still vigorous AAB 'Mysore', with its regular bunches, attractive fruits and resistance/tolerance to many diseases, looks a serious replacement candidate here, but its resistance to winter conditions should be tested;
- 'Paz', a taller sport not unlike 'Grand nain', and of which the origin could not be traced. The name could mean "a kind of eagle" but the present reporter remembers having noticed the same name for a Cavendish in western Mediterranean, where 'paz' could be Spanish ('peace');
- 'Grande naine', pronounced 'Grandnain' as in many American countries, is the well known commercial cultivar (photo 2). It was rather recently introduced (from Israël among others) and is rapidly becoming important through *in vitro* propagation and with the help of private nurseries. Somaclonal variation was observed in at least one case: a slightly taller plant resembling the 'Williams' (photo 3).

### Constraints and prospects

The banana plants are generally well managed and average production is estimated at about 25 t/ha. One case was noticed where grasses – instead of dicotyledons- were invading the soil and where efficient clean weeding was not being practised: stolons were not eliminated and even more aggressive invasion could be predicted.

A multispan greenhouse was visited, where originally *in vitro* propagated 'Grande naine' plants formed an impressive and homogenous population (photos 4, 5). Such a sophisticated system has the advantage of producing good bunches over a longer period of the year.

The climate in the South Jordan Valley is subject to a sometimes quite pronounced winter-time for several months, thus seriously compromising the formation of bunches with market value. For open field cultivation, farmers therefore have adapted the planting time and method in a judicious way for getting a maximum of good bunches at rather restricted periods, with fluctuations in prices as a result. In spring time, they plant large maiden suckers with peepers attached, and the latter will assure the production (photo 6). Indeed, the large biomass protects the meristems from cold night effects at this time of the year. In a second period, around September, small suckers are planted, which can rapidly grow out before the coming winter. Irrigation is practised from March to September. The winter conditions are the main reason why banana cannot be productive in the north of the Valley, where blackening is caused by frost.

One can conclude that commercial banana cultivation in Jordan, if it relies on the current Cavendish varieties, cannot have a great future, even with the skilled farmers met by the team. Introduction of the variety 'Williams' is unlikely to improve prospects, since this cultivar is even more demanding.

Production will remain mostly oriented to the supply for the capital. But since bunch quality is not optimal, at least for much of the year, the question arises if alternative germplasm could better meet the climatic stress. Some AAB- and ABB cultivars produce reasonable bunches with local market value elsewhere in the tropics, and they have the advantage of being far less demanding for management in open field cultivation. Moreover, several recently produced hybrids seem to become even more convenient alternatives, because producing good quality fruit.

It is recommended that agricultural research in Jordan should give the necessary attention to the introduction, selection and assessment of hybrids and AAB/ABB cultivars that should be able to produce attractive bunches and fruits over a longer period of the year. Some of these may well require much less water and thus assure a more regular supply to the markets with a significantly improved 'cost/benefit' ratio.

For a national banana field collection. Recommendation

The need for a special effort to stop any further deterioration of the general situation is very clear. One of the measures could be the introduction of alternative banana cultivars which would be more resistant or tolerant to the said stresses.

Participatory research on banana is conducted in the Jordan Valley by the Agricultural Research Station of South Shouna, located in the southern part of the valley near the King Talal Dam (photo 7). It could be argued that the few existing local cultivars in Jordan do not require a field collection at the station. However, the absence of such a collection seriously hampers any efforts by farmers and scientists to improve banana cultivation by introducing suitable cultivars from abroad. It is almost impossible for a research station to access internationally available germplasm if it is not able to refer exactly to the local cultivars and thus introduce similar cultivars with higher performance or better adaptation to physical and biological stresses.

Uncontrolled introduction of germplasm is harmful *per se*, and direct introduction of any so-called promising cultivars at the farmer's level is too much the subject of speculation as to its performance.

Moreover the present survey was faced with the difficulty of exactly identifying cultivars in the rural areas because grown under various ecological and management conditions. The same cultivars can only be adequately identified when grown in the same field and under the same management conditions.

Facilities for *in vitro* maintenance and conservation for *Musa* do exist at the Genetic Resources Unit of the NCARTT. A National Committee on Plant Genetic Resources was established as an outcome of the National Seminar on Plant Genetic Resources of Jordan held in 1994 under the auspices of the NCARTT and the IPGRI-WANA Regional Office. Private nurseries for bananas are active and the team visited one of them, which is run in excellent conditions (photo 8). Consequently, the safe introduction and distribution of banana germplasm should present no major problem.

It is therefore recommended that a national field collection for bananas be established with the following three objectives:

1. Field conservation and planned trials of any cultivar grown by farmers in the country;
2. Access to the INIBAP Transit Centre (ITC) for the introduction of suitable cultivars and hybrids;
3. Operational interaction via INIBAP with the international banana research community.

## Chapter 3: Diversity in Egypt

### Identification of cultivars

#### ***The national field collection. Tasks of the survey mission***

Banana cultivars had been the subject of a systematic taxonomical study several decades ago (Tackholm 1954). The identified specimen were planted in a field collection at the El Kanater Agricultural Research Station, in the Delta region. The collection was maintained over the years and still provides reliable reference material. Relative shortage of funds for work on *Musa* at the station has inevitably caused some recent deterioration and Services were considering a transplantation to ARC at Cairo, under the supervision of the National Plant Genetic Resources Programme (NPGRP). In effect, and almost immediately after the present survey took place, the accessions have been transplanted in a field collection genebank at El Qaliobia.

It was agreed that the survey would start with a systematic observation of this collection, and use the results as reference for all further taxonomic work in the rural areas.

The composition of this collection is as follows<sup>13</sup>

Table 1

<b><i>Plantain</i></b>	<b><i>Cavendish</i></b>
1. Sindhi	<b><i>I) Giant Cavendish</i></b>
<b><i>Sapientum</i></b>	9. Poyo
2. Baradika	10. Maghrabi
3. Mohammed Ali	11. Williams
4. Ambel	12. Valery
5. Sapdavalsh	13. Chiketa
6. Lalavalsh	14. Grandnain
7. Red Banana	<b><i>II) Dwarf Cavendish</i></b>
8. Senari	15. Hindi
	16. Basrai

The classification had been developed before the now widely applied classification system in AAA, AAB, etc. (Simmonds and Shepherd 1955). In the current classification, all of the Cavendish varieties belong to the AAA group, the Plantain is a special AAB subgroup, while the 'Sapientum' falls into the groups AAB, ABB and even some AAA.

It was made clear that several accessions are not – or are no longer- cultivated by farmers.

The survey mission thus had the tasks:

1. To identify the accessions at El Konater according to the current classification;
2. To assess their actual presence in the farms over the country.

#### ***Identification at the El Kanater collection***

Since the accessions were represented by lines with several stools, or even blocks for some 'Cavendish', most of them could be identified. The process went in two steps: assessment of the genomic group (AAA, AAB, etc.) by using the Shepherd-Simmonds list of critical characteristics (Simmonds and Shepherd 1955) followed by the tentative cultivar identification.

<sup>13</sup> Data provided by Dr Rizk in his Introduction to the survey.

### **1. Sindhi**

Turned out rapidly to be an ABB with the typical plump male buds, bract colours (rich pink all over the inside), the closed petiole canals and the closely clasping petiole bases on a pseudostem without the 'acuminata'-blotches (photos 9, 10). Further study of the flowers and the fruits enabled its classification as a ABB Ney Mannan (see Annex 4). 'Sindhi' was later on found in many farms, especially in the south, under various local names. Its origin is obscure but indications are provided further on in the text sub 'The cultivars in rural areas. 'Sindhi'<sup>14</sup>.

### **2. Baradika**

The plants were clearly ABB's but no bunches were observable at the time. Many 'Baradika' at the nearby Mansour Amer farm allowed for the cultivar to be identified as a ABB Pisang Awak (photos 11, 12). Baradika (also 'balalaika') has been introduced around the early 20<sup>th</sup> century as a wind-breaker for the Cavendish plantations (Tackholm 1954), and examples of this function were noticed afterwards on many farms.

### **3. Mohammed Ali**

This is the AAB Mysore (photos 13, 14, 15). The plant is said to have been introduced during the reign of King Mohammed Ali, hence the name. But this name was not noticed on the many farms where the cultivar is grown. Nomenclature for the plant at farm level was erratic or non-existent. Adoption of the name 'Mohammed Ali' as the representative of Mysore in Egypt is therefore recommended.

### **4. Ambel**

The accession is in a poor state at the collection<sup>15</sup>. Only one stool with a reasonably developed bunch led to the tentative identification of the accession being the AAB Silk. The plant was not found elsewhere on the farms.

### **5/6. Sapdavalsh and Lalavalsh**

Both are clearly AAB Mysore with the densely packed oblique-to-pendulous bunch and the characteristic pink dorsal side of the midrib on younger leaves. These names were not noticed on any farm. The plants are supposed to have been introduced from India 'at some time'. Both names contain the phoneme '*valsh*' which is strikingly reminiscent of the Tamil-Dravidian generic name '*vazhai*' for bananas.

### **7. Red banana**

This is the AAA 'Red banana'. The plant did not exist on the farms visited and no farmer seems to be aware of it.

### **8. Senari**

The collection has no accession of this cultivar, or it may have been lost. What was called 'Senari' at the Mansour Amer farm turned out to be again the AAB Mysore (photo 16).

### **9-14. Giant Cavendish**

The station must at one time have tried to sort out the synonyms among these accessions; witness the large blocks per accession. The results of that assessment are no longer available<sup>16</sup>.

<sup>14</sup> Relevant here is the existence of Ney Mannan in Oman, under different local names.

<sup>15</sup> But no trace of diseases was found on it.

<sup>16</sup> The station has no reports, neither of the registering of introduced cultivars, nor of the results of observations.

Cursory observation led the mission team to suggest that Poyo = Maghrabi while the Williams looks somewhat sturdier. 'Valery' and 'Grandnain' had recently been transplanted and no study was possible. 'Chiketa' was not present. 'Maghrabi' was said to have been introduced from Morocco in the early 20<sup>th</sup> century. The supposed difference between these cultivars is the subject of a rather worldwide confusion. The regular appearance of mutants in size makes the problem worse.

It is recommended that a comparative study for morphology and agronomical performance be effected at least on the group 'Maghrabi-Williams-Grandnain'. Such assessment would be of great help in clarifying the situation at the farmer's level. It would also allow for a standardization of Cavendish cultivars at the national level<sup>17</sup>.

Regarding the nomenclature, it is suggested that the collective name 'Giant Cavendish' should be dropped, since most of these accessions are taller than the classical 'Giant'.

### 15-16. Dwarf Cavendish

Hindi is the typical Dwarf Cavendish. It is the most widespread banana cultivar since a long time in Egypt, together with its name 'Hindi'. 'Basrai' is a problem. At the station collection, 'Basrai' is in all evidence the extra Dwarf Cavendish. But, while the cultivar was not observed in rural area, many farmers would apply the name of 'Basrai' for what clearly was the Dwarf (and not the extra Dwarf). Since the extra Dwarf is of no economic importance, the name 'Basrai' should be avoided<sup>18</sup>.

**Table 2 : The resulting classification at the El Konater field collection**

<b>AAA</b>	<b>AAB</b>
<b>Red banana</b>	<b>Mohammed Ali = Mysore</b>
<b>Cavendish:</b> dwarf range	Including: M. Ali; Sapdavalsh;
Hindi	Lalavalsh; Senari.
Basrai: extra dwarf	<b>Ambel = Silk</b>
<b>Cavendish:</b> semi-dwarf range	<b>ABB</b>
Maghrabi = Poyo ?	<b>Baradika = Pisang awak</b>
Williams	<b>Sindhi = Ney mannan</b>
Grandnain	
Valery	

### Additional comments

1. The mission team tried in vain to reconcile the AAB and ABB accessions with the cultivar descriptions by Tackholm (1954). As explained in the next comment, the 'Plantain' could not be observed. As for the AAB 'Mysore' and the two ABB's, the rather confused descriptions of the '*M. sapientum*' make any identification hazardous<sup>19</sup>. It is recommended to consider the classification by Tackholm as of historical value only<sup>20</sup>.

<sup>17</sup>These cultivars are well represented in the north of Egypt, especially 'Williams' and 'Grandnain'. Nurseries are providing plantlets from *in vitro* propagated plants. Some farmers, when thus introducing so-called 'Williams' are faced with a mixture of different sizes. The unavoidable consequence of all this confusion is that about every farmer has his own opinion on the discriminate characteristics.

<sup>18</sup>The accidental appearance of extra Dwarf mutants among Hindi cannot be avoided, however. But the farmers are very keen on what is productive or not, and would rule out these off-springs.

<sup>19</sup>In effect, the Tackholm description is open to several interpretations. Regarding the '*M. paradisiaca* Plantain' some characteristics such as "stem 4-10 m; leaves bright green; red or violet bracts; calyx white; thick yellow (fruit) skin" are rather pointing to an ABB. The "persistent lanceolate bracts" and "angled fruits" are indeed characteristic of the AAB Plantain. But ABB fruits can be considered as 'angled' as well. About the bract persistence, there is the strange statement for the next described cultivar (*M. sapientum*), that it is "very close to the preceding but male flowers and bracts deciduous". Yet that variety is said by Tackholm to have three races, one of which manifestly being the AAB 'Mysore' (reddish midrib, and reference to the Indian name 'champa') and another one being the AAA 'Red Banana'.

<sup>20</sup>However, the paper offers a wealth of information on bananas in Egypt in the past. Its chapter on the presumed presence of *Ensete* in Egypt in remote times looks quite convincing.



2. The AAB 'Plantain' was not observed, neither in the collection nor at any of the many farms visited afterwards. The Tackholm suggestion that 'Senari' was a 'Plantain' may have been caused by the great confusion around the name 'Plantain' at the time. In many regions over the world, 'Plantain' stood for the loose concept of "starchy bananas, to be cooked". Most ABB cultivars are indeed starchy, and 'Senari' was the name used at one farm for the ABB cultivar 'Sindi'. It could also be the reason why Sindhi (ABB Ney Mannan) was classified as a 'Plantain' in the collection. Since, Simmonds (1959) has clarified this situation and the name 'Plantain' is applied nowadays only for the restricted AAB Plantain subgroup, dominating in the African rainforest and also frequent in Kerala State (India).
3. The following cultivars of the collection were not observed elsewhere: AAA 'Red Banana'; 'Ambel'; 'Valery'; 'Chiketa'.

### ***A determination key for common Egyptian cultivars***

The observations at the El Konater collection and in rural area led to the conclusion that the following cultivars are rather common and traditional<sup>21</sup>:

AAA Cavendish 'Hindi',

AAB 'Mohammed Ali',

ABB's 'Baradika' and 'Sindh'.

The AAA 'Williams' and 'Grandnain(e)' are more recent, but are replacing the 'Hindi' wherever economically feasible.

The following adapted determination key is suggested for use in Egypt:

<b>A.</b> petiole margins large/extrors (bending outwards), leaving the petiole canal wide-open	
<b>B.</b> all bracts on male axis persistent	
<b>C.</b> pseudostem extra-dwarf <sup>22</sup>	<b>Basrai</b>
<b>CC.</b> pseudostem dwarf	<b>Hindi</b>
<b>BB.</b> bracts dehiscent; pseudostem semi-dwarf	<b>Grandnain(e)</b>
	<b>Williams<sup>23</sup></b>
	<b>Maghrabi=Poyo ?</b>
<b>AA.</b> petiole margins narrow/intrors (bending inwards) but still leaving the petiole canal open; dorsal face of midrib pink on younger leaves	<b>Mohammed Ali<sup>24</sup></b>
<b>AAA.</b> petiole margins narrow/intrors and touching each other, thus closing the petiole canal over most of the petiole length; petiole bases closely clasping the pseudostem; no pink on pseudostem <sup>25</sup>	
<b>B.</b> free tepal of the male flower translucent white with variable pink touch; fruit short; <sup>26</sup>	<b>Baradika</b>
<b>BB.</b> free tepal rich-pink with rich-yellow margins; fruit pedicel long <sup>27</sup>	<b>Sindhi<sup>28</sup></b>

<sup>21</sup> Traditional in the sense that they have been cultivated in Egypt at farmer's level for about a century. 'Hindi' and perhaps 'Sindhi' may have a longer history.

<sup>22</sup> Male bud touching the soil at advanced fruiting stage

<sup>23</sup> In theory, the 'Williams' should be slightly taller than 'Grandnain(e)' but standardized delivery of the correct cultivars is necessary for the distinction to become practical. The actual 'Grande naine' should have a number of persistent bracts at the proximal end of the male bud.

<sup>24</sup> I.e. the AAB Mysore in the international nomenclature;

<sup>25</sup> But the dorsal face of midribs can show a faint bronze tinge.

<sup>26</sup> The pedicel bases on each hand are more or less merging, thus producing a more or less large 'cushion'.

<sup>27</sup> Pedicel bases remain distinct

<sup>28</sup> For a determination in broader ABB diversity context, see Annex 5.

## The cultivars in rural areas

Some general facts can be found in Annex 3 prepared by Dr Reda Rizk.

The team visited the farms along the entire Nile Valley and in the western part of the Delta region. Afterwards, Dr Rizk completed the observations with visits to the rest of the Delta and north Sinai. On the map of Egypt (page 21) which figures at the end of this report, Dr Rizk has plotted the places where the ABB ('Baradika'; 'Sindhi') and AAB ('Mohammed Ali') were found. The Cavendish cultivars are ubiquitous.

### ***Cavendish***

The Dwarf Cavendish 'Hindi' seems to have been cultivated since a long time in Egypt, at least for much more than one century. This is probably the reason why it is sometimes called 'Baladi', meaning "original/native" or "of the country". But Baladi was also used for a non-Cavendish AAB or ABB cultivar, as appears from reading the Tackholm (1954, p. 553) paper. The name was indeed noticed by the team for 'Sindhi' (ABB 'Ney Mannan') between Luxor and Assiut. It is recommended that the term 'Baladi' be avoided for any banana cultivar.<sup>29</sup>

During the 20<sup>th</sup> century, 'Hindi' has been progressively, but not completely replaced by 'Williams' and 'Grandnain' in northern Egypt (especially the Delta region). The latter two cultivars were introduced to Egypt respectively in 1980 and 1982. They rapidly spread through the country because of their excellent performance, the large bunch with longer fingers, the excellent taste and high tolerance to transportation. 'Williams' and 'Grande naine' are planted on a wide scale, for example at a large farm placed at the west of the Delta at al-khattaba (Mahmoud Salem farm). This farm has its own nursery.

'Hindi' still represents about 70% of the total banana cultivation in Egypt and remains most popular in the south (along the Nile valley and on islands) because of its better resistance to cold nights.<sup>30</sup>

As for 'Maghrabi', this cultivar was introduced from Cameroon in 1922 by a farmer and its diffusion is rather scattered through the country, from Essna to the north, with some concentration at Al Qaluobia and Al Monefia.

The Cavendish is the commercial banana *par excellence*. The farmers interested in its cultivation demonstrate great skill in selecting the proper soils, and in planting/maintaining the fields. Control of banana bunchy top virus is optimal, and symptoms are very rare<sup>31</sup>. However, their cautious attempts at replacing the robust 'Hindi' by the more productive, but also more demanding 'Williams' are handicapped by the failure of private nurseries to provide reliable planting material. This 'Williams' plant material comes from *in vitro* propagated plantlets and is therefore highly priced. But the mission team noticed more than once on the resulting Williams fields, a notable proportion of other Cavendish sports – perhaps somaclonal variants generated *in vitro* – thus depreciating the intended upgrading effort.

<sup>29</sup>The term is rightly used with several crops for the truly local varieties and landraces of old tradition, with their specific 'niches' and local names (Dr Zeid, pers. comm.). The name has not very much sense in the case of the banana cultivars. It is also applied in Jordan for the Dwarf Cavendish.

<sup>30</sup>Temperature gradient is higher in the south, while it is buffered in the Mediterranean climate of the north.

<sup>31</sup>The mission was of some help here, by showing the emergence of the disease at the ultimate stage of a fruiting plant, when no new leaves are formed. The male bud in such case will develop bracts with green tips that tend to curl outwards.

In the mean time, the AAB and ABB cultivars discussed hereunder proved to be more resistant or tolerant to drought and diseases than the Cavendish ones.

### ***Baradika (ABB 'Pisang awak')***

Also called 'Balalaika' or 'Balika'. 'Baradika' has no origin in the Arabic language. It could be derived from the words such as "paradise" or "paradisiaca". Taekholm and Drar (1954) mentioned "Paradise banana" in their taxonomic treatment of banana in Egypt. The robust plant is said to have been introduced in the north as a windbreak for the Cavendish plantations and striking examples were indeed noticed there by the team.

After the survey, Dr Rizk observed the cultivar over the whole Delta area and in North Sinai<sup>32</sup>. The fruits are sold on the market at about half the price of a Cavendish banana. Important stocks for sale were found by Dr Rizk on the markets of Damietta (North), El Gharbia (middle of Delta), and Giza (Cairo) which seems indeed to indicate that the cultivar has a longer history in the northern Egypt. The fruit is consumed raw by lower income people. The pulp is mixed with other fruits and milk and/or sugar, to make a compound of high nutrient value especially for the children. A similar compound is available as a juice in coffee shops.

The plant is known to be remarkably resistant to many physical and biotic stresses, and needs but minimal care<sup>33</sup>. This, together with the windbreak advantage, constitute the potential for this cultivar to become competitive with Cavendish in marginal growth conditions. In effect, the team found a monoculture of 'Baradika' on a farm south of Luxor (photo 17). The farmer explained that the limited labour necessary for maintenance made the banana income competitive with 'Williams'. On another farm, the cultivar was hardly present, and said "to be there for the view and the shade".

Somaclonal variation could be observed on a farm in the village Dar-es-Salam, to the west of Qena. At least one plant showed shorter fingers with some wax on the pericarp, but still the merged pedicel bases, forming the "cushion" (photo 18). Judging from the exploration results, the cultivar 'Baradika' is rare, if not absent, further to the south.

### ***Sindhi (ABB 'Ney Mannan')***

In contrast with 'Baradika', this cultivar was not observed in the north<sup>34</sup>, while its presence increases along the Nile Valley from north to south, and certainly from Essna on. The name 'Sindhi' was not recorded by the team beyond the El-Kanater station. No other specific name was noticed either, except for 'Balady' in one case, in a village along a primary irrigation canal north of Luxor, where it was said to have been planted after the construction of the Aswan Dam. Most farmers, when asked from where they had the plant, pointed to "family or friends in the south".

The Head of the agricultural station of El-Kanater, Dr Ahamed El-Kader, reported his impression, gained from several conversations with farmers on this matter, that 'Sindhi' may well have been introduced from Sudan at a more or less remote time. The name 'Soudani' is indeed applied by scientists in Egypt for this cultivar.

It is interesting to note hereby that AAB 'Ney Mannan' has been reported in tropical East Africa, at least in Tanzania, among several ABB cultivars<sup>35</sup> (Evers 1991). All these ABB's would be able to grow well in the area of Sindhi. Moreover, both the 'Ney Mannan' and the 'P. awak', and perhaps 'Bluggoe' have been observed in Oman during this mission.

<sup>32</sup> In home gardens but also in a zone corresponding with a leakage in the water pipe across North Sinai, more exactly at Al Arish, Al Shikh Zewied and Beer El Abd.

<sup>33</sup> Hence its widespread popularity in S.E. Asia and elsewhere in the tropical world.

<sup>34</sup> After the survey, Dr Rizk observed the plant "here and there" in the Delta area and around Alexandria.

<sup>35</sup> Such as 'Bluggoe' and 'Monthan', which are absent in Egypt; and 'P. awak', i.e. the 'Baradika', equally absent at least in the far south of Egypt.

Perhaps the cultivars in Yemen could provide the key to this intriguing configuration, which seems to be confined to Arabic influence since many centuries.

The cultivar is grown for various purposes such as: local consumption, shade, protection of the residence (photo 19). It is the only banana found in some villages (photo 20).

### ***Mohammed Ali (AAB ‘Mysore’)***

The cultivar was observed on widely separated spots along the Nile Valley, and according to Dr Rizk, is also present in the Delta region (at El Daqahlia). It is more frequent around Luxor, where it seems to have been introduced “from farm to farm”, perhaps starting with the Island of Armand<sup>36</sup>. It is the ubiquitous cultivar on the famous “Banana Island” on the Nile, where its biomass is most impressive (photos 21, 22). At this spot, the names ‘Mos kawi’ and ‘Mos cati’ (lemon) are used for the cultivar, and these names are also applied at Al-Qaloubia farms.

In the absence of a consistent nomenclature, the survey team recommends the adoption at national scale of the name ‘Mohammed Ali’, with the representative accession under that name at the El-Kanater collection.

The plants are huge on the very fertile alluvial soils of the Delta region and of the islands of the Nile River. The fruits are much more attractive than those of ‘Baradika’ (= ‘P. awak’)<sup>37</sup>. The plant is quite resistant to diseases, and its compact, cylindrical bunches are ideal for transport on trucks. This cultivar deserves considerably more popularity. It is recommended that ‘Mohammed Ali’ be tested, at least as a wind-break instead of ‘Baradika’, and perhaps even as an alternative to the Cavendish wherever felt appropriate. Its more intensive cultivation on reasonably fertile soils could indeed mean a better income (compared to the Baradika) for the farmer on the local markets.

## Research on diversity in the future. Recommendations

The review of the results of the mission during the debriefing session with Dr Zeid, led to the following general conclusions on desirable research in the future.

### ***1. Regarding the AAA Cavendish subgroup:***

Standardization of the nomenclature in the ‘Williams-Grandnain-Maghrabi’ complex, through a comparative morphological study of the involved accessions on the El-Kanater field collection plus representative accessions with the same name from INIBAP. The study should produce the reference cultivars for further propagation via governmental and private nurseries.

### ***2. Regarding the ABB cultivars***

Broadening the spectrum so as to assess the possibility of upgrading the quality of the existing cultivars. Several “sports” of the ABB ‘Pisang awak’ are of better organoleptic quality (e.g. some accessions at the ITC from Thailand). In a first phase, the new accessions could be propagated and delivered at moderate scale to interested farmers. In a second phase, farmers could select the economically feasible accessions, which would then enter the intensive delivery stage via the nurseries.

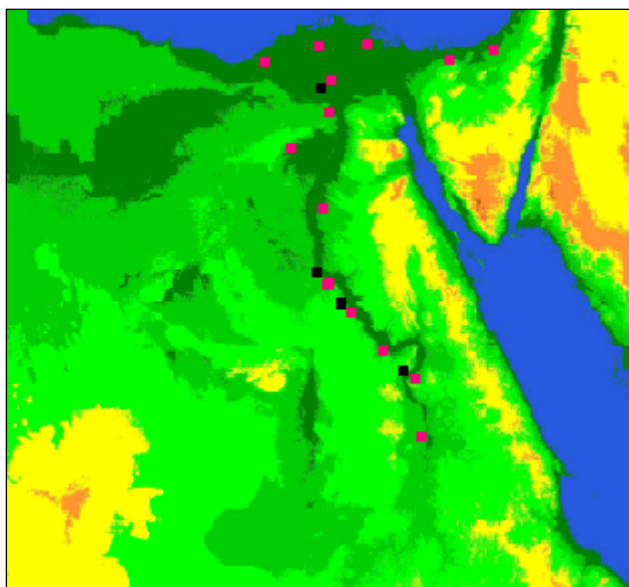
<sup>36</sup> Where a (Belgian?) farmer with this name would have cultivated it quite intensively on the fertile soil, more than a century ago.

<sup>37</sup> ‘Mysore’ is the popular dessert banana, not only in several parts of India, but all over Sri Lanka as well, where it has the name ‘Honderawala’.

These initiatives involve a close collaboration between the NPGRP in Egypt and INIBAP, whereby the most convenient cultivar candidates would be identified, and the follow up be agreed upon.

Beyond these suggestions the recommendations regarding specific issues, as they figure on the present text, are hereby recapitulated:

- 1 To consider the classification of Egyptian bananas by Tackholm as of historical value only, and to adopt the identification and classification established in the present report (cf. 'Identification at the El Kanater collection', under 'Additional comments').
- 2 To adopt the name 'Mohammed Ali' as a standard name in Egypt for the cultivar AAB 'Mysore' (cf. 'Identification at the El Kanater collection').
- 3 To carry out a comparative study with the Cavendish cultivars 'Maghrabi', 'Williams', 'Grandnain' for a better quality control in the delivery of plantlets to the farmers, from *in vitro* propagation (cf. 'Identification at the El Kanater collection', under '9-14. Giant Cavendish').
- 4 To avoid the confusing name 'Baladi' for any cultivar name (cf. 'The cultivars in rural areas', sub 'Cavendish')
- 5 To set up trials with farmer's participation for assessing the value of the cultivar 'Mohammed Ali' as a wind break (cf. 'The cultivars in rural areas', sub 'Mohammed Ali')



Location of AAB and ABB in Egypt (black boxes are AAB's ; red boxes are ABB's)

## Chapter 4: Diversity in Oman

### Identification of cultivars

#### ***Introduction***

The survey had been prepared down to the last detail by Mr Abdul-Aziz Al-Harthy and Ing. Abdullah Alhosni, the latter being the guide and collaborator for the entire visit programme. Banana diversity in Oman has been explored in its essence with this survey, effected in a very short time. However, the survey team has the impression that a number of remote villages deserve a special visit in the future in order to cover the entire spectrum of diversity.

#### ***Field collections in the Dhofar region***

An important collection with 31 accessions was planted in 1997-1998 and has been maintained since, at the Agriculture research station of Salalah (see Table 4 of Annex 4). A second collection exists at the Royal Diwan Farms (the Al-Rubat Farm) north of Salalah, of which most of the accessions have been duplicated at Salalah.

The collections reflect the great interest in banana culture, especially in the Dhofar region. Relevant research has been carried out, focusing on the main production problems, which relate to irrigation and soil/plant management. Most farmers are observing the methods which were recommended on the basis of that research.

The most striking feature of these collections is that they include a large number of introductions from the Comoro Islands, Zanzibar and India (the latter at the station at least). They are probably unique for collections at the national scale. It is recommended that INIBAP enters into an exchange of accessions of international versus national interest<sup>38</sup>.

With the exception of 'Red banana' the Salalah collection does not include the cultivars discussed in a short publication on the performance of bananas in Oman (Viswanath *et al.*, 1997): 'Malindi', 'Bashri', 'Somali', 'Fard', 'Red banana', 'Naggal'. The first three belong to the AAA Cavendish subgroup. 'Malindi' could be the Dwarf Cavendish 'Hindi' in Egypt, but 'Bashri' is certainly not the Dwarf Cavendish 'Basrai' in India because it is very tall. 'Somali' would be a Giant Cavendish probably introduced from that country<sup>39</sup>. 'Fard' and 'Naggal' are discussed further on in the present report.

#### ***Identification at the field collections***

Both the collections consist of rows with at least 10 plants per accession. The collection at the station was observed in detail (photo 23), while the Royal Diwan collection was rather rapidly visited, due to shortage of time. Consequently, the hereunder reported identification is principally based on the observation results at the station, and completed for a limited number of accessions with the additional checking at the second collection.

During the visit to the collections, the team was guided by Ing. Anwar Ahmed Bait Hadhil, Fruit Researcher at the station, and strengthened by the most valuable presence of

<sup>38</sup> Several cultivars in the Comoro Islands have never been reported elsewhere. During the 80s, and on the initiative of the french institute CIRAD-FLHOR, a number of these cultivars was duplicated at the *Musa* field collection in Guadeloupe. Some of these have since then entered the INIBAP-ITC and it seems worth the effort to complete the ITC in exchange with cultivars that may be of interest in Oman, as this report explains in this chapter.

<sup>39</sup> The mission did not find the opportunity to visit these cultivars on the farms.

Dr Gamaleldin, Senior Fruit Engineer at the Royal Diwan, who had initiated the field collection efforts.

Review of the accessions (list on Annex 4, Table 4)<sup>40</sup>.

- 1-3. Cavendish cultivars. They looked to conform to the international standard classification.
4. 'Mbo' (Zanzibar). The accession is a typical AAB 'Horn Plantain'.
5. 'Moongil' (India). Is the same AAB 'Horn Plantain', the only of the sort reported in India (photo 24).
6. 'Sawara' (India). AAA 'Red Banana'.
7. 'Poovan' (India). The fruiting plants were not sufficiently developed for reliable identification, but both the name and the faint red midribs point to AAB 'Mysore'.
8. 'Ney Poovan' (India). Is not the typical AB 'Ney Poovan': plant stature looks triploid; the bunch resembles that of a AAB 'Mysore'. A 'Mysore' with green/yellow midribs has been reported in Tanzania, with the names 'Kipukucha' and/or 'Kipakapaka' applied there to the AB 'Ney Poovan' as well (Evers 1991)<sup>41</sup>.
9. 'Nendran' (India). ABB 'Ney Mannan', which is also grown by farmers in Oman. It is not the AAB 'French Plantain' as the name suggests<sup>42</sup>.
10. 'Kunnan' (India). A semi-dwarf ABB and perhaps the ABB 'Kunnan' (photo 25).
11. 'Abu Bakar' (from local farm, Salalah). ABB 'Ney Mannan'
12. 'Bombay Green' (from same local farm, Salalah). AAB 'Mysore' without doubt. The adjective "green" may point to the transient mutant with green midribs at the time of its introduction.
13. 'Borabayi'. Tentatively AA diploid, but no bunch available. The accession 'Barabay' at the Guadeloupe collection was also introduced from the Comoros, but is an ABB 'Bluggoe'<sup>43</sup>. The accession No. 13 does not show any of the typical ABB characteristics.
14. 'Sugar Banana'. ABB 'Pisang awak' sport. The adjective "sugar" could point to a sport with dessert quality of the fruit, as with several 'P. awak' sports in Thailand. No ripe fruits were available. The possibility should be checked because of the great potential of this vigorous plant<sup>44</sup>.
15. 'Red Banana'. AAA 'Red Banana'.
16. 'Kalckito'. AAB 'Silk', judging from the splitting pericarp on ripening fingers on one plant, as well as from the name ('Kolikutta' is the 'Silk' in Sri Lanka)<sup>45</sup>.
17. 'Mdzodji'. AAB 'Pome'. A hardy plant, common as a dessert cultivar in southern India, in Brazil, where it is called 'Prata', and in Australia, with the confusing name 'Lady's Finger'<sup>46</sup>.

<sup>40</sup>The accessions 13 to 31 are duplicates of the accessions at the Royal Diwan Farm which were originally introduced from the Comoros and Zanzibar.

<sup>41</sup>The AB 'Ney Poovan' in South India is in fact a complex cluster of perhaps more than ten cultivars. Some of these may well be AAB triploids and thus come close to the 'Mysore' (which is called 'Poovan' in some parts of South India). Only when this cluster is duly studied and classified will it be possible to clarify the confused situation of 'Poovan'/'Ney Poovan' in India, East Africa and elsewhere. The accession in this collection is therefore of importance.

<sup>42</sup>The name 'Nendran' is a generic name in Kerala State for the AAB 'French Plantain'

<sup>43</sup>Called 'Barabara' in Madagascar.

<sup>44</sup>Cf. the 'Baradika' in Egypt, with the less "pleasant" pulp.

<sup>45</sup>A glance in the Diwan collection gave the impression that the accession with the same name could be an AAB 'Mysore', and caution is of the order not to merge the two for propagation.

<sup>46</sup>The name is confusing anyhow, because the Mkojosi in Tanzania and around is the ABB 'Bluggoe'.

18. 'Isaukari'. Presumably an AAB, judging from the vegetative aspects. It could be a sport of AAB 'Silk' but no bunch was sufficiently developed. The fruits do have a sweet and pleasant taste according to Dr Gamaleldin<sup>47</sup>. Needs further study (photo 26)
19. 'Kerala'. AAB 'Pome'.
20. 'Paka'. AAB 'Pome'. A 'Paka' accession exists in the Guadeloupe collection, as an introduction from the Comoros and is also a AAB 'Pome'. It is not the AA 'Paka' of Zanzibar<sup>48</sup>.
21. 'Ntsounouh'. Could be the 'Nshonowa' in Tanzania, which has a AA-diploid morphology and of which a variant with yellow bracts exists. The frank green petioles are characteristic of the AA Mchare-subgroup, to which 'Nshonowa' belongs (De Langhe *et al.* 2001). The one available bunch was very young and reliable identification was not possible (photo 27)
22. 'Padje'. ABB 'Ney Mannan'. May be a "sport" because of its "flatter" taste according to Dr Gamaleldin. Definitely not the AA/AAA 'Paji' with yellow bracts<sup>49</sup>.
23. 'Samba'. No plant has survived. Said to be a very fragile cultivar. Could have been a AA diploid, since the Guadeloupe collection has a confirmed AA diploid also called 'Samba', also introduced from the Comoros.
24. 'Menaloki'. AAB 'Pome'<sup>50</sup>.
25. 'Ikame'. Not in a good state. Probably an AA. An accession with the name 'Chicame' exists at the Guadeloupe collection. It was introduced from the Comoros and confirmed as an AA diploid. 'Ikame' is thus most probably the same cultivar<sup>51</sup>.
26. 'Contiriki'. AAB 'Pome'<sup>52</sup>.
27. 'Mtsahbu'. AAB 'Pome'
28. 'Al-Qutoof'. AAA reminiscent of Dwarf Cavendish<sup>53</sup>.
29. 'Shahita'. AAA reminiscent of Dwarf Cavendish
30. 'Grand naine'. Probably true to the type.
31. 'Zanzebar'. AAB 'Horn Plantain'<sup>54</sup>.

<sup>47</sup> Both the AAB 'Silk' and 'Mysore' are called 'Kisukari' in East-Africa, but this accession does not seem to resemble either one.

<sup>48</sup> But the corresponding accession at Diwan collection could not be verified.

<sup>49</sup> The 'Padji' from Comoros at the Guadeloupe collection is an AAA 'Cavendish'.

<sup>50</sup> A 'Mnalouki' from the Comoros is in the Guadeloupe collection, but it is apparently an AAB 'Plantain' there.

<sup>51</sup> De Langhe, on a visit to the Guadeloupe collection, could observe the 'Chicame' and found that it had many features characteristic for the AAA East African Highland bananas.

<sup>52</sup> The 'Kontriki' from the Comoros, is an AAA 'Cavendish' at the Guadeloupe collection ...

<sup>53</sup> The four last accessions were not well developed. They were briefly visited at the Diwan collection, where a few plants were reasonably developed, but bunches were very rare.

<sup>54</sup> Could be a small type, but the state of the few plants was confusing.



Table 3. Revised classification<sup>55</sup>

<i>Genomic group</i>	<i>Cultivar</i>	<i>Accessions</i>
AA	<i>Borabayi? ?</i>	13
	Ntsounouh?	21
	Samba? ?	23
	Ikame?	25
AAA	Cavendish-Dwarf	1; 28?; 29?
	<i>Cavendish semi-Dwarf</i>	2; 3; 30
	<i>Red Banana</i>	6, 15
AB	<i>Ney Poovan?</i>	8
AAB	<i>Pome</i>	17; 19; 20; 24; 26; 27
	<i>Mysore</i>	12; 8?
	<i>Silk</i>	7?; 16
	Horn Plantain	4; 5; 31
	"not determined"	18
ABB	<i>Ney Mannan</i>	9; 11; 22 (a 'sweet' sport)
	Pisang Awak	14 (a 'tasty' sport?)
	<i>Kunnan?</i>	10

**Comments:**

- 1 The collection at the Agricultural research station of Salalah, in conjunction with the Diwan collection, is quite representative of the bananas grown in the Indian Ocean area, i.e. the countries around- and the islands in the ocean. It is the only collection of these types of bananas<sup>56</sup>. It is highly recommended to consider the possibility of the collection getting a regional status, and to take the proper measures for such effort in close collaboration with INIBAP.
- 2 The collection is beginning to suffer from insufficient maintenance: soil fertility is not well restored and soil protection (with mulch for example) is lacking. Some demanding accessions are poorly growing and at least one of them has disappeared altogether ('Samba'). Shortage in funds at the station was said to be the main reason.
- 3 In view of the recommendation in comment No.1, a further deterioration of this collection would be disastrous for the international banana research community.
- 4 The presumed three AA diploids are of potential importance in banana breeding in general. Edible diploids are currently used as parents in the construction of desirable triploids, as in the breeding programmes in Guadeloupe and at the International Institute of Tropical Agriculture (IITA) in Nigeria.
- 5 Seven of the 31 accessions (including four presumed AA's) could not be identified with certainty by the mission. They call for replanting under optimal conditions, and comparison with the available accessions with the same name, from the Guadeloupe collection<sup>57</sup>. Considering the potential importance at the international level of the non-Cavendish accessions in this uncertain group, it is recommended that the comparative study takes place under the guidance of INIBAP.

<sup>55</sup> The '?' and '??' indicate the degree in uncertainty.

<sup>56</sup> The important field collection at Kerala Agr. University (India) does not include the cvs of Zanzibar and Comoros.

<sup>57</sup> Preferably via the INIBAP ITC, if available there.

## Cultivars in rural area

### **General**

The Batinah region, i.e. the coastal zone to the N.W. of Muscat, is dry during most of the year and faces a water-supply problem. Drip irrigation has been progressively introduced since a decade. Large farms dominate, but banana cultivation is relatively rare<sup>58</sup>.

A clear overview of the banana culture in the Dhofar was prepared for the mission by Ing. Anwar Ahmed Amur Bait Fadhil, Fruit Researcher at the station and is reproduced in Annex 4. The region benefits from the monsoon, due to its geographical configuration, and is humid during a major part of the year. The spectrum in farm-size is broad, and banana cultivation is widespread. The banana plantations are very well managed and look healthy. The banana bunchy top virus has so far not been detected. Problems with nematodes (*Radopholus*) were reported.

As is explained in the Annex, water salinity is the main problem. The soils do have a pH of around 8.5 and research for adapted application of chemical fertilizers has been carried out with some success. Still, and during the conversations with the mission team, it was made clear that manure is very helpful. An alternative practised by the farmers is to add a massive dose of fertile soil from the wadi's (photo 28).

All these measures, together with the regular maintenance of the field, mean an important input for the farmer. But the results obtained so far were and still are very promising.

The future of banana cultivation in the Dhofar is not assured, however, as it heavily relies on interventions at the governmental level. Prospects are not evident in that respect, and farmers do not feel encouraged for expansion/intensification. Import from abroad forms the major part of the banana consumption in urban sectors. The price of these imported bananas turns out to be surprisingly low, and thus highly competitive with the local production. A banana ripening-packing factory, which was established during recent years, had to be abandoned due to lack of sufficient governmental support. Yet, the will at the local level to develop the cultivation is clear, and is expressed among others by the recent development of a marketing board, with participation of farmers and various shareholders. A more protective policy by the Government seems to be of the essence in this matter.

Research on bananas at the agricultural station of Salalah had been developed quite successfully in recent years, but is presently facing some funding problems. Close collaboration with research work on the Royal Diwan farms is partly alleviating the burden. Communication with the international banana research community needs serious improvement. The mission recommends the development of a regular contact with the INIBAP, starting with the reception of *INFOMUSA* and other newsletters and reports produced by this network.

Regarding the diversity, and with the exception of the Cavendish 'Williams', the cultivars in the rural areas are the result of random introductions over the centuries. Previous introductions may even have disappeared since. Given the main problems: salinity, water shortage (in Batinah) and nematodes, the systematic introduction of candidate-cultivars and hybrids that are more resistant/tolerant to these stresses is recommended.

### **Cavendish cultivars**

The Dwarf Cavendish dominates by far the plantations. Efforts are presently produced via participatory research to replace the cultivar by the semi-dwarf 'Williams'. The higher productivity and the cylindrical bunches of 'Williams' would certainly make the production in the Dhofar more competitive. The cultivar is however more demanding to

<sup>58</sup> Banana production is estimated to be up to three times more expensive in Batinah, compared to the Dhofar.

the farmer and needs some encouragement (*vide* above paragraph 'General').

### ***AAB Mysore***

The cultivar has different local/Indian names, but the most common seems to be 'Fard' (meaning "duty"?) in the Dhofar. It has been noticed by the survey team as a windbreak on several farms. The cultivar is quite popular, which is explained by the presence of many labourers and entrepreneurs of Indian origin since a long time. The fruits are therefore in some cases higher priced than the (Dwarf-) Cavendish ones. Although less yielding, the 'Mysore' plantations need less care (limited to no fertilisation and almost no pruning). This matter calls for a statistical study regarding supply/demand and resulting income predictions.

### ***ABB Ney Mannan***

The cultivar is rare compared to the previous one. In the Batinah area, the name 'Negal' (a common name in India, cf. 'the Negal god') was noticed on the Galeb farm (village Birkha). The said farm had a consistent plantation with this cultivar (photo 29). Even drip irrigation has been applied since several years. The fruit is considered as a dessert banana on the local markets. The name in the Dhofar is 'Green Omani' and the fruit is cooked.

### ***ABB Monthan?***

At the same Galeb farm in Batinah, a single stool was shown on a garbage corner. The pseudostems were impressive and the pendulous bunch with large fingers (distinct broad apex) led to the tentative identification that this is a ABB 'Bluggoe' rather than the 'Ney Mannan' (photo 30). The cultivar was observed nowhere else, and is apparently not known in the country. It is suggested to introduce it in the Salalah field collection in order to verify its taxonomical status by comparing it to other ABB's.

## Conclusions

Judging from the general impression gained by the mission during its visit to the collection and the farms, it can be stated that:

- \* The existing cultivars in rural areas are reasonably well adapted to the local ecological and market conditions: Dwarf Cavendish and 'Williams' for major commercialization, 'Fard' (AAB 'Mysore') for additional (local) commercialisation and 'Negal' for local consumption and/or limited commercialisation;
- \* The cultivars are very well managed and the plants in general, healthy looking;
- \* the stress caused by dry periods and by nematodes, although not noticed during the visits, calls for broadening the diversity spectrum with resistant cultivars or hybrids that produce similar bananas. While nematode resistance has been for many years a target in banana improvement programmes, resistance to drought or to salty water is hardly on the agenda. Leaving the research stations and farmer with the only alternative to introduce and to test cultivars with comparable morphology and fruit quality. This could be a solution for AAB and ABB bananas, of which it is known that some of them are grown under rather severe conditions.

## Recommendations

During the debriefing session with the scientists at the Agricultural research station of Salalah under the chairmanship of Ing. Mussam Ahmed Tabook, Assistant Director General of Agricultural Development in Dhofar (Ministry of Agriculture), the following recommendations were submitted:

1. To upgrade the status of the field collection at Salalah to that of a regional collection in consultation with INIBAP<sup>59</sup>;
2. To augment the currently narrow spectrum of Cavendish-, AAB and ABB cultivars by introducing comparable accessions from INIBAP that are resistant/tolerant to water salinity, to water stress, to nematodes, or to any combination of these qualities;
3. To prepare and to implement, in collaboration with INIBAP, the provision to the ITC of a number cultivars which originally came from the Comoro Islands, and which are of potential interest to banana breeding in general;
4. To definitely identify the taxonomy of cultivars which could not be determined with certainty by the mission (they are designated with a question mark on Table 3)
5. To complete the collection with the local cultivars under the names as they figure in the present report, in order to verify their presumed identity;
6. To develop a further regular contact of the Salalah agricultural station with INIBAP, starting with the reception of **INFOMUSA** and other newsletters and reports produced by this network.

The survey team hereby puts forward the general recommendation that programmes for selection and genetic improvement of the banana should from now on devote much more attention to drought/salt water resistance/tolerance than in the past. Banana cultivation in irrigated conditions in a large number of countries throughout the zone stretching from North-and Sahel Africa in the West, to N.W. India in the East would amply benefit from such an effort.

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<sup>59</sup> *In vitro* exchange of accessions is a necessity, and the facilities at the central laboratory in Muscat could be convenient.

## Bibliography

- Champion J. 1967. Notes et Documents sur les bananiers et leur culture. Tome 1: Botanique et génétique des bananiers. I.F.A.C. Editions SETCO, Paris.
- De Langhe E.A., R. Swennen & D. Vuylsteke, 1994-5. Plantain in the early Bantu world. *Azania* 29-30: 147-60.
- De Langhe E.A. & P. de Maret. 1999. Tracking the banana: its significance in early agriculture. In 'The Prehistory of Food' (Chris Gosden and John Hather, eds). Routledge, London and New York.
- De Langhe E.A., D. Karamura & A. Mbwana, 2001. Tanzania *Musa* Expedition 2001. A Report to INIBAP. 106 pp.
- Evers G. 1991. Banana cultivar diversity in Morogoro area. Paper presented at the Crop Coordinating Committee (Banana). Moshi, February 1991.
- Evers G. 1992. Banana cultivar diversity in the area of Morogoro, Tanzania. *Fruits* 47(3): 77-391.
- Jacob K.C. 1952. Madras bananas, a monograph. Madras.
- Madhava Rao V.N. & K.M.P. Nambisan. 1959. Descriptive studies on bananas. The 'monthan' and 'peyan' groups. *Indian J. Agric. Sci.* 29(2-3): 164-171.
- Murdock G.P. 1959. Africa, its peoples and their culture history. McGraw-Hill, New York.
- Shigeta M. 1990. Folk *in situ* conservation of *Ensete* (*Ensete ventricosum* (Welw E. Cheesman): towards the interpretation of indigenous agricultural science of the Ari, Southwestern Ethiopia. *African Study Monographs* 10(3): 93-107.
- Simmonds N.W. 1959. Bananas. Longman, London.
- Simmonds N.W. 1962. The Evolution of the Bananas. Longmans, London, United Kingdom.
- Simmonds N.W. 1966. Bananas (2<sup>nd</sup> ed.). Longman, London, United Kingdom. 512 pp.
- Simmonds N.W. & K. Shepherd. 1955. The taxonomy and origins of the cultivated bananas. *J. Linn. Soc. (Bot.)* 55: 302-12.
- Stover R.H. & N.W. Simmonds. 1987. Bananas. Longman, London, United Kingdom. 467 pp.
- Tackholm V. & M. Drar. 1954. Flora of Egypt. Vol. III, Cairo.
- Valmayor R.V., F.N. Rivera & F.M. Lomuljo. 1981. Philippine banana cultivar names and synonyms. National Plant Genetic Resource Laboratory. Institute of Plant Breeding, University of the Philippines at Los Banõs.
- Venkaratamani K.S. 1946. Studies of Indian bananas. I. A descriptive study of 24 varieties. *Proc. Indian Acad. Sci.* 23: 123-128.
- Viswanath P., A.N. Al-Bakry & S.K.Nadaaf. 1997. Performance of banana (*Musa* spp.) cultivars in Sultanate of Oman. *InfoMusa* 6(2): 21-22.

Annexes

## Annex 1: Programme

### *Jordan*

**Tuesday 26/02** Brussels-Amman Jordan. Welcomed by Dr Salam Ayoub, Fruit Tree researcher at NCARTT.

**Wednesday 27/02** Field visit to the Southern Jordan Valley with Dr Salam Ayoub. Visit South Shouna Agr. Research Station and met with and Mr Tariq Al-Idwan, Fruit tree technician, who joined during the visit to Jordan valley. Visit Al-Kafrin village: typical banana farms, banana grown under multispans greenhouse; meeting with Mr. Ahmad Al-Idwan and Mr. Mousa Shalashn banana farmers. Visit Al-Rama village: banana farms and meeting with Mr. Basel Al-Idwan, banana farmer. Visit to banana seedling nursery at South Shouna.

### *Egypt*

**Thursday 28/02** Visit NCARTT and met with Dr Sameer Satti, Deputy Director of NCARTT  
Visit Genetic Resources Unit with Dr Siouf.  
Amman- Cairo Egypt. Welcomed by Dr Reda Rizk.

**Friday<sup>60</sup> 01/03** Briefing Session at Agr. Research Center Cairo:  
- Introduction to the NPGRP by the Director General Dr Abou Zeid  
- Introduction to the survey by Dr Rizk, National Coordinator, discussion  
- Planning the survey: critical issues; schedule  
- Lunch with Dr Zeid

**Saturday 02/03** - Study with Dr Rizk, Dr Loutfy El Khouly and Ing. Awad Abou El-Ela of the field collection at El Konater research station  
- Visit large banana farm with nursery nearby

**Sunday 03/03** Cairo-Luxor by air

**(03/03 afternoon to 07/03 morning)** Private time (Cruise), reaching Aswan. (overnight on the Cruise)

**Thursday 07/03** Banana farm on Island Eldoon (Aswan)<sup>61</sup>  
(overnight on the Cruise)

**Friday 08/03** Farms/villages along the East-side road Aswan-Luxor with Dr Zeid and Dr Rizk<sup>62</sup>

<sup>60</sup> Islam Holiday

<sup>61</sup> With Dr Zeid and Dr Rizk for most of the trajectory along the Nile. With Dr Rizk for the remaining part.

<sup>62</sup> Most of these farms had been selected by Dr Rizk on his previous exploratory tour along the Nile Valley.

- Saturday 09/03** «Banana island» at Luxor; farms around Luxor (mainly 20km south of-)
- Sunday 10/03** Farms/villages along the road Luxor-Assiut (partly the W-side road near Qeena). Overnight at the University.
- Monday 11/03** Farms/villages South of Assiut (esp. El Namasa, at 10km) Down to El Minya along W. side road. Welcomed by Dr A. Alam and Dr Kassen Zaki of the University and overnight there.
- Tuesday 12/03** Provided a lecture on banana diversity in Egypt at the University. El Minya- Cairo along the desert road.
- Wednesday 13/03** Revisiting El Konater station and the farm (checking the findings; briefing on INIBAP Descriptor List)
- Thursday 14/03** Debriefing Session at NPGRP with Dr Zeid, Dr Rizk and Mr Taha Hussein & Ing. Mohamed Fawzi: evaluation of the results; outlooks for further cooperation.
- Oman**
- Friday 15/03** Rest. Wrap-up of findings.
- Saturday 16/03** Cairo-Muscat Oman. Welcomed by Mr Ali Sjuwin Al-Habsi, PR at the Ministry of Agriculture and Fisheries.
- Sunday 17/03** Farms in the Batinah zone, West to Muscat (esp. at Birkha) with Ing. Abdullah Al-Hosni<sup>63</sup>  
Muscat-Salalah by air.
- Monday 18/03** Briefing Session at the Agr. Research Center of Salalah, with Ing. Mussam Ahmed Tabook, Ass. DG of Agricultural Development in Dhofar (Ministry of Agriculture).  
Farms around Salalah
- Tuesday 19/03** Field collection of the Center under the guidance of Dr Anwar A.A. Bait Fadhil, Fruit Researcher  
DIWAN Royal Court farm: trials and collection with Dr Qureshi and Dr Gamaleldin
- Wednesday 20/03** Debriefing at Center. Discussion of prospects.  
Salalah-Muscat by air  
Muscat-Brussels

<sup>63</sup> Who assisted/guided the entire survey in Oman.



## Annex 2: Banana cultivation in Jordan

### ***Prepared by Dr Salam Ayoub***

Fruit tree researcher at the National Center for Agricultural Research and Technology Transfer (NCARTT).

The kingdom of Jordan is placed to the east of the Mediterranean between the two parallels 29 and 33 north and Meridians 34 and 39 east of Greenwich. The total area of the country is 8.92 million hectares. The total cultivated area in 2000 was 235,405.36 hectares. The irrigated area constituted about 32.7% of the total cultivated area (Department of Statistics, 2000).

Jordan is divided into 4 main topographic areas: the continental region comprising Jordan valley, Wadi Araba and the Dead Sea; the highlands; the plains; the desert. The country is characterized by a long, hot and dry summer; the rain falls mainly in winter, its annual average varying between 40 and 500 mm.

All the area planted with banana is found in the Jordan valley. The total area planted with banana in 2000 was 2,082.43 hectares and the total production was 20,832 tons (Department of Statistics, 2000). Banana plantations hold second place after citrus orchards in the Jordan valley.

During the last 3 years, Jordan has faced sever drought conditions, which has resulted in a shortage of irrigation water.

The northern portion of the Jordan Valley (from north Shouna to south Shouna) is irrigated with surface water derived from the Yarmouk River and from the King Talal dam, conveyed respectively through the King Abdalla Canal and a pressurized pipe system. In this area, irrigation restrictions have been imposed since 1999 by the Ministry of Water and Irrigation. On average, less than 70% of the normal water discharge is provided to the system. Accordingly farmers depending on that source of water are starting to decrease the areas of banana plantations. On the other hand, farmers that own artesian wells are not affected by the shortage of water. On the contrary, these farmers improved their plantations, introduced intensive farming systems and new more productive banana cultivars. In addition, a number of water distillation units have be established to solve the problem of water salinity for banana irrigation. Consequently, a gradual replacement of the traditional banana plantations by new commercial banana cultivars (specially cultivars propagated by tissue culture) has been seen. This has had a negative impact on traditional banana cultivation, and small-scale farmers cannot compete with them.

At present, traditional banana plantations are restricted to some villages in the Jordan Valley such as Al-Kafrin and Al-Rama. The most common traditional banana cultivars grown in the Jordan Valley are Balady and Paz. In addition, there are several commercial cultivars such as Cavendish, Grand Naine, Williams and others, also grown in the Jordan valley.

## Annex 3: The production and area of banana in Egypt

	<b>1982</b>	<b>1992</b>	<b>1994</b>
* Total area (Fadden)	17027	33839	32795
* Production per Fadden	10.39	12.28	12.98
* Total production	165390	396497	405237

\* Source: Reports of agriculture statistical, II , Central unit of agro economic, Ministry of agriculture and land reclamation

The areas planted with banana are distributed over Egypt especially in the Delta and Nile valley. The new reclaimed land in the Sinai and the western desert were planted also with banana.

Many farms have their own artesian wells that are used for banana irrigation, and the technology is presently applied in the new reclaimed lands.

Dr Reda Rizk

## Annex 4: Banana in Dhofar region, Sultanate of Oman

### Banana In Dhofar Region Sultanate of Oman

#### **Introduction:**

Banana is one of the most important fruit crop in the world. World wide annual production of banana is 50 million tones and the Arab countries produce about 824000 tones (table 1 ).

About 11 million tones of banana are exported yearly and about 2% of it ( 218000 tones ) is the local consumption in Arab countries. The Gulf state consume about 92% of the amount consumed by Arab countries ( table 2).

#### **The present situation of the Banana Production**

##### **Area and Production :**

The most important areas of banana production in Sultanate of Oman are Dhofar and Batinah regions. A study made by Ministry of Agriculture and Fisheries in 1994, showed that about 990 hectares are cultivated by banana and they produce about 14000 tones per year (table3).

Dhofar region is more famous for banana production in Oman and it has more than 40% of the total area of banana in the Sultanate. The main area of banana in Dhofar is Salalah plain which constitutes 98% of a cultivated area.

Water salinity is the most important factor which affect the increase of banana cultivation in Dhofar. For optimal production, soil salinity should not exceed 5000  $\mu\text{s}/\text{cm}$ .

**The Varieties:**

There are more than 300 varieties of banana around the world. In the Agriculture Research Station farm in Salalah plain, there are 31 varieties of banana collected from Salalah farms, Royal Diwan and overseas ( table 4 ).

Dwarf Cavendish is the most common variety in Oman which was given the name local banana. The research findings from Agriculture Research Station in Salalah plain, show that Williams variety is the best substitute for a local variety, Dwarf Cavendish banana.

**Agronomic Practices:**

Banana is cultivated in a fertile soil with spacing of 3x3 m. and it is irrigated 2-3 times a week with a water salinity less than 5000  $\mu\text{s}/\text{cm}$  . Banana is fertilized on a first year by 150 gm. N.P.K. fertilizer (20:10:10) and 75gm. potassium sulphate 4 times and 20 kg. of organic manure 2 times per plant hole. From the second year, we applied 300 gm. N.P.K. fertilizer (20:10:10) and 150gm. potassium sulphate 4 times and 30 kg. of organic manure 2 times per plant hole / year.

**Irrigation:**

Banana is irrigated 2-3 times a week under a different irrigation systems. Salalah farmers use the traditional system of irrigation by flooding. In the Agriculture Research station in Salalah plain bubbler system is common. In Royal Diwan farms, they use a bubbler and drib irrigation system.

There is an idea to use a drib irrigation system on a new block of banana in Agriculture Research station farm in Salalah plain to evaluate some banana varieties under this irrigation system.

### **Research in Salalah Research Station:**

There are many research was done in banana yield. Research carried out in 1983/84 indicated that maximum production was obtained from 3 suckers/ plant hole and that the optimum levels of N.P.K. fertilizers are 750 gm. Of ammonium sulphate, 100 gm. Of super phosphate and 150 gm. Potassium sulphate per plant hole applied 5 times a year.

An evaluation of banana cultivars was carried out during 1996-1999. Research finding revealed that cultivar Williams outyielded all cultivars (62.3 tones / ha.). Dwarf and Giant Cavendish cultivars gave 33.6 and 39.7 tones / ha. Respectively.

Foliar fertilizers experiment, showed that addition Maxi Crop foliar fertilizer at the rate 10 ml. per hole 4 times a year gave an increase of 47% in yield.

### **Crops Pests:**

- 1) Sigatoga.
- 2) Burrowing nematode.
- 3) Leaf spot.
- 4) Banana aphid: Vector of Banana bunchy top virus ( Luckily disease was not recorded in the Sultanate).
- 5) Mealy bug.

*Anwar Ahmed Amur Bait Fadhil  
Fruit Researcher  
Salalah Agriculture Research station  
Dhofar region - Sultanate of Oman*

**Table 1 : The production of Fruits in Arab Countries.**

Yield	Production		Total
	( Thousand Tones )		Production
	1992	1993	%
Date palm	2667.11	2918.04	14.6
Grape	2944.20	2836.10	14.2
Mango	340.30	357.80	1.8
Citrus	5932.70	5841.10	29.2
Banana	763.60	824.04	4.1
Total	20300.50	19969.80	

Source: Arab Organization for Agricultural Development ( AOAD ).  
1995.

**Table 2 : Imports of Arab Countries from Banana.**

Years	*		**
	1993		1996
Country	Quantity (Thousand Tones)	Price (Million Dollar)	Quantity
UAE	49.60	26.05	60.00
Bahrain	5.80	2.54	
Tunis	5.27	2.66	16.00
Algeria	-	-	
Djibouti	0.52	0.19	
KSA	118.83	35.88	156.00
Iraq	0.07	0.31	
Oman	0.93	0.44	
Qatar	5.91	3.70	
Kuwait	19.12	8.68	24.00
Lebanon	6.26	2.53	
Libya	5.37	2.37	2.00
Mauritania	0.50	0.50	
<b>Total</b>	<b>218.18</b>	<b>85.85</b>	
<b>Gulf Country</b>	<b>200.19</b>	<b>77.300</b>	

Source:

\* Year Book of Arab Agricultural Statistics. 1994.

\*\* FAO. 1998.

**Table 3 : Total Area & Production of Fruit Crops in Sultanate of Oman.**

Yield	Area (Hectare)	Area %	Production (Thousand Tonse)	Production (tones/ha.)	% of Self Safficiency	Production Area
Date Palm	35508	85.6	172.9	4.87	104	Batina,Dakhlia,Dahera,Musandum,Sharqia
Lime	2901	6.8	31.9	11.00	104	Batina,Dahera,Musandum,Sharqia
Mango	1952	4.5	4.9	2.51	86	Batina
Banana	990	2.3	14.1	14.24	103	Dhofar,Batina
Coconut	214	0.5	3.7	17.29	138	Dhofar
Papaya	186	0.4	1.6	8.60	104	Dhofar
Others	1225	2.9	5.5	4.49	100	
<b>Total</b>	<b>42976</b>	<b>100</b>	<b>234.6</b>			

Source: Ministry of Agriculture and Fisheries – Oman. 1994.



**Table 4 : The varieties of Banana in Gene bank block.**

No.	Variety	Source	Date of Planting
1	Dwarf Cavendish	Agriculture Research Station farm	6/7/1997
2	Giant Cavendish	“ “ “ “	6/7/1997
3	Williams	“ “ “ “	20/9/1997
4	Mbo	“ “ “ “	20/9/1997
5	Moongil	“ “ “ “	20/9/1997
6	Sawara	“ “ “ “	20/9/1997
7	Poovan	“ “ “ “	20/9/1997
8	Ney Poovan	“ “ “ “	20/9/1997
9	Nendran	“ “ “ “	20/9/1997
10	Kunnan	“ “ “ “	20/9/1997
11	Abu Bakar	Mohd Al-Shaykh Farm - Salalah	18/10/1997
12	Bombay Green	“ “ “ “	18/10/1997
13	Borabayi	Al-Rubat Farm – Royal Diwan	18/1/1998
14	Sugar Banana	“ “ “ “	18/1/1998
15	Red Banana	“ “ “ “	18/1/1998
16	Kalckito	“ “ “ “	18/1/1998
17	Mdzodji	“ “ “ “	18/1/1998
18	Isaukari	“ “ “ “	18/1/1998
19	Kerala	“ “ “ “	18/1/1998
20	Paka	“ “ “ “	18/1/1998
21	Ntsounouh	“ “ “ “	18/1/1998
22	Padje	“ “ “ “	18/1/1998
23	Samba	“ “ “ “	18/1/1998
24	Menaloki	“ “ “ “	18/1/1998
25	Ikame	“ “ “ “	18/1/1998
26	Contiriki	“ “ “ “	18/1/1998
27	Mtsahbu	“ “ “ “	18/1/1998
28	AL-Qutoof	“ “ “ “	20/7/1999
29	Shahita	“ “ “ “	20/7/1999
30	Grand nain	“ “ “ “	20/7/1999
31	Zanzebar	“ “ “ “	20/7/1999

Sources: Indicated are Local sources and not from origin.

## Annex 5: ABB cultivars

### A Tentative determination key

#### **Introduction**

No internationally recognised system exists for determining the many cultivars among the ABB bananas. The handbook 'Bananas' does not describe the many Indian ABB cultivars beyond the worldwide-spread 'Bluggoe' and 'Monthan' (Simmonds 1959 and 1966). The majority of ABB varieties have been described in India (Venkaratamani 1946; Jacob 1952), followed by a major attempt at systematic classification of the Indian cultivars (Madhava Rao and Nambisan 1959).

Champion's remarkable and comprehensive effort to elaborate on that classification and to extend it to non-Indian accessions has not been followed-up since (Champion 1967). Various other non-Indian ABB varieties have been duly reported and described for the Philippines and mainland South-East Asia (e.g. Valmayor *et al.* 1981; Stover and Simmonds 1987), but these have only amplified a confusion in the classification which persists today. The excellent INIBAP *Musalogue* 'Diversity in the genus *Musa*' is also limited in the description of the whole ABB complex.

The present report shows that the ABB's in Middle East countries such as Egypt and Oman. have also been reported for tropical Africa, and especially East-Africa (Evers 1991)<sup>64</sup>.

Only the existence of a large field collection, with all the representative ABB cultivars reported over the world, would allow for their reliable classification at the international level. Such an achievement may well never come to reality.

The alternative is to construct a tentative determination key, which can be completed/corrected/improved over the coming years.

The present determination key is an attempt with that purpose. It is based on the above recorded literature as well as on the most valuable advice of Dr Aravindakshan and Dr Rena Menon, both of the Kerala Agricultural University.

Once the cultivar under observation has been determined as a ABB triploid, the following key could be applied:

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<sup>64</sup>The same author published his findings under a revised form (Evers, 1992). Of some cultivars (e.g. AAB 'Mysore') it is stated that they in fact do not exist in Tanzania, while others are ranged as sports of AAB 'Silk'. The ABB 'Ney Mannan' is classified as a sport of the ABB 'Monthan'. No critical characteristics are advanced for this re-classification. Moreover, the Ney Mannan appears with the present report to be widely represented in Egypt and Oman, whereas Monthan was not observed, with one rather unclear exception in Oman. Given the poor state in classification of many AAB's and certainly the ABB's, the assembly in subgroups is somewhat premature and could cause additional confusion. The present report prefers to maintain the distinct cultivars.

<b>A.</b> Bract tip obtuse <sup>65</sup>	
<b>B.</b> Bract tip split; bract scars very prominent; compound tepal lobes orange; fruit apex bottle-necked	<b><i>Pelipi(t)a</i></b>
<b>BB.</b> Bract tip not split; bract scars not prominent; compound tepal lobes yellow; fruit apex blunt	<b><i>Saba</i></b>
<b>AA.</b> Bract tip (more or less broadly-) pointed	
<b>B.</b> Male bud conical-to-subcylindrical <sup>66</sup> ; bracts brick red-pink; petiole bases without blotching; free tepal translucent white with more or less pronounced pink-to-purple tinge; mature pericarp pale-yellow	
<b>C.</b> free tepal tip fan-shaped, with triangular filament	<b><i>Sakar</i></b> <sup>67</sup>
<b>CC.</b> free tepal tip truncate, with thin filament	<b><i>Peyan</i></b> <sup>68</sup>
<b>CCC.</b> free tepal tip rounded, with more or less narrow filament; pedicel bases of the fruits merging as a large 'cushion'	
<b>D.</b> pseudostem tall and robust; bunch pendulous	<b><i>Pisang Awak</i></b> <sup>69</sup>
<b>DD.</b> pseudostem medium-sized; bunch oblique	<b><i>(Pey) Kunnan</i></b> <sup>70</sup>
<b>BB.</b> Male bud ovoid or ellipsoid; bracts purple-violet; petiole bases with brown blotching; free tepal purple-pink; mature pericarp dark-yellow	
<b>C.</b> male bud ovoid, remaining plump at advanced fruiting stage; bunch oblique; fruit apex nearly blunt	<b><i>Ney Mannan</i></b>
<b>CC.</b> male bud ellipsoid, becoming more slender at advanced fruiting stage; bunch pendulous; fruit apex distinct and broadly pointed	
<b>D.</b> free tepal filament broad-triangular; fruit apex distinct in colour	<b><i>Monthan</i></b>
<b>DD.</b> free tepal filament thin, threadlike; fruit apex same colour as fruit-body	<b><i>Bluggoe</i></b>

The more popular names (*Saba*, *P. awak*, *Peyan*, *Bluggoe*, *Monthan*) actually represent a cluster of closely related cultivars, generated by somatic variation in pseudostem and fruit waxiness, bunch configuration, finger-size, pericarp features, pulp colour and/or quality. Each variant has its local name in Asia which makes the nomenclature of the whole group all the more complicated.

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<sup>65</sup> I.e. the typical form in the wild *Musa balbisiana*.

<sup>66</sup> The accession should always be observed at a rather advanced fruiting stage, which roughly corresponds to two-to-three months after emergence of the inflorescence. Young male buds of ABB's are generally plump and thus misleading in their form.

<sup>67</sup> A rather rare cultivar in South India.

<sup>68</sup> The base of the petiole is dark-green. The fruits are small and arched without any straight section.

<sup>69</sup> Very rare in India and sometimes confounded with 'Peyan'. Ubiquitous in Southeast Asia. Variation exists in fruit form, pulp colour and taste, and presence of wax on the pericarp.

<sup>70</sup> 'Kunnan' can also be distinguished from 'P. awak' by its persistent styles and non-drooping leaves. It may in fact be a semi-dwarf mutant of 'P. awak'.

Illustration

## Jordan

**Photo No. 001** 'Balady', AAA Dwarf Cavendish. The dicotyledonous weed is not a menace because its rooting system is less shallow than that of the bananas. Cold nights damaged many banana leaves on the border lines.



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**Photo No. 002** Dr Salam Ayoub and Mr Tariq Al Idwan examining a bunch of the Cavendish 'Paz' cultivar.



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**Photo No. 003** A slightly taller, 'Williams'-looking mutation in a 'Grande naine' field from *in vitro* propagated plants.



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**Photo No. 004** Multispan greenhouse with one year old 'Grande naine'.



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**Photo No. 005** Multispan greenhouse with one year old 'Grande naine'.



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**Photo No. 007** The South Shouna Agricultural Research station at the King Talal Lake.

**Photo No. 008** One of the greenhouses of a private banana nursery. *In vitro* plantlets are in pods filled with a precise mixture of peat and volcanic scores. Plants can be delivered after three weeks.



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**Photo No. 006** Planting the variety 'Balady' in March.



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# Egypt



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**Photo No. 009** Dr Rizk showing a 'Sindhi', ABB 'Ney Mannan'. Note the inclined bunch.



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**Photo No. 010** The long pedicels of 'Sindhi' fingers, not merging at their base in a 'cushion'.



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**Photo No. 011** 'Baradika', ABB 'Pisang awak'.



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**Photo No. 012** A huge 'Baradika' bunch (20 hands). Plants grown on the rich alluvial soils of the Delta area are impressive.



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**Photo No. 013** 'Mohammed Ali', AAB 'Mysore' at the field collection of El Kanater Agricultural Research Station.



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**Photo No. 014** The 'Mohammed Ali' plants could serve as windbreaks in Cavendish fields.



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**Photo No. 015** Male buds of the 'Mysore' are surprisingly large and wide on the alluvial soils.



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**Photo No. 016** AAB 'Mysore' called 'Senari' at a farm near El Kanater.





**Photo No. 017** Monoculture of 'Baradika', ABB 'Pisang awak'.



**Photo No. 018** A somaclonal variant of ABB 'Pisang awak' near Qena.



**Photo No. 019** 'Sindhi', ABB 'Ney Mannan' protecting the residence of a farmer (bottom-right).



**Photo No. 020** 'Sindhi' as the only variety in a village of the South, along a primary irrigation canal.



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**Photo No. 021** The shiny and massive pseudostems of 'Mohammed Ali', AAB 'Mysore' at Banana Island on the Nile.



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**Photo No. 022** The pink outer nerve on young leaves of AAB 'Mysore', 'Mohammed Ali' in Egypt.

## Oman



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**Photo No. 023** The Banana Field Collection at Salalah Agricultural Research Station.



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**Photo No. 024** The famous 'Moongil' at the collection, about the only AAB 'Horn Plantain' cultivar in India.



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**Photo No. 025** 'Kunnan' introduced from India in the collection and probably the correct semi-dwarf ABB 'Kunnan'.



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**Photo No. 026** Mr Alhosni, the main collaborator on the survey, with the enigmatic 'Isaukari', an AAB which could belong to the AAB 'Silk' cluster.



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**Photo No. 027** 'Ntsounouh', presumably the Nshonowa in Eastern Tanzania, an edible AA belonging to the AA 'Mchare' cluster. Note the dark green petiole and the yellowish bud.



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**Photo No. 028** A farmer (and an interested grandson) with soil from the wadi's which will be ploughed-in for fertilization, near Salalah.



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**Photo No. 029** Indian manager of a farm in Batinah region, in front of a monoculture of 'Negal', ABB 'Ney Mannan'. Bunches (and buds) are rather small, due to moderate pruning, but are numerous and marketable at Muscat.



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**Photo No. 030** ABB 'Bluggoe'-looking fingers on a unique banana stool at the same farm. The bunch is too dense for a classical 'Bluggoe'. No similar plants could be detected for further identification during the survey.