C.I.L.S.S.
SAHEL INSTITUTE
RESADOC PROGRAMME

AGRICULTURAL MINISTRY OF MALI
RURAL ECONOMY INSTITUTE
AGRONOMIC RESEARCH DIVISION
FRUIT AND GARDEN CROPS RESEARCH SECTION

HOW TO PLANT MANGO-TREES IN AN ORCHARD

A TECHNICAL GUIDE

BAMAKO, december 1987

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The RESADOC Programme benefits assistance from the Canadian International Development Agency (CIDA) and the International Development Research Center (IDRC)

Published by : RESADOC Sahel Institute
P.o Box 1530 Bamako (Mali)
☎ 22.21.78

ABSTRACTS

Mango-trees grow in countries with a warm climate. In the sahelian zone, mango-plantations represent important investments.

Before making one's orchard, it would be convenient to consult a specialist. In order to obtain a long-lasting production of quality, there is need to implement appropriate techniques, observe a regular maintenance and carry out an effective insect and disease control.

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PREFACE

Research results available in Mali as well as in Sahel countries in general, have been unsufficiently valorized. In fact, Scientific and Technical Information remain confined in research reports which are, unfortunately, unpublished and written in a language not understandable by non-specialists.

Like the other national research structures, the Fruit and Garden Crops Research Section is experiencing difficulties in transmitting its findings. However, it has been already elaborating a series of technical data sheets on current themes for supervisory staff and producers.

The present guide has been made in the framework of a fruitfull collaboration between the Fruit and Garden Crops Research Section and the RESADOC Programme of the Sahel Institute. Being a simplified version of a technical data sheet, the merit of this guide is the fact that it is clear, accurate, sufficiently illustrated, easy and pleasant to read. Consequently, it is assuredly the type of information and techniques extension document for non-specialists.

It is desirable that such an initiative becomes a constant component of the policy being carried out by the RESADOC Programme for the dissemination of Scientific and Technical Information.

This new orientation will enable national research structures to disseminate and extend the results of their research work. It will also enable the supervisory staff and producers to have adapted information which meet their needs.

S. SIDIBE
Head of the Fruit and Garden Crops
Research Section

FOREWORD

In the framework of the dynamisation of its policy for the dissemination of Scientific and Technical Information, the RESADOC Programme has undertaken to produce technique extension documents.

In order to carry this policy through to a successful conclusion, RESADOC intends to test on national research structures for exploiting and valorizing the results already existing confined in technical reports.

This other type of documentary products aims at a large public of non-specialists who are daily faced with a very particular need of information. This public includes supervisory staff, producers, students, etc.

The present guide has been worked out in that context. It is a simplified but true version of a technical data sheet elaborated by the Fruit and Garden Crops Research Section.

The Sahel Institute wishes to thank the Research Section for its exemplar and unreserved collaboration.

The Sahel Institute would also like to thank UNESCO and Mr Pierre BARROT, consultant for their valuable support in the production of this guide.

Director General of
Sahel Institute, p.i.

M. Madi KONATE
Administrative and Financier Director

Areas most favourable for growing mango-trees are the ones where rainfalls are ranging from 900 to 1,300 mm annually. In Mali, mango-trees are grown in the regions of Sikasso, Kayes (southern part), Segou and Koulikoro (mid and south).

MOST APPROPRIATE SOILS

Mango-trees adapt themselves to various soils. Excessively acid soils are to be avoided (PH is advised when ranging between 5.5 and 6.5). Lands with sandy loam are the most favourable ones.

MIND THE PRESENCE OF A SLAB !

Before planting mango-trees, check first if a slab does not exist at less than two meters underground. Such a slab blocks the roots of trees and causes the heating of soil in dry season. In rainy season, the soil risks to be soaked through with water because of the water-proof layer constitued by the slab (see diagram nº 1, on page 4).

BEWARE OF THE RAISING OF THE GROUND WATER SHEET !

Mango-trees perform poorly in lands where the groundwater-sheet raises up too close to the land-surface during the rainy season. For verifying that this problem does not prevail and for controlling the absence of flagstones, the most simple method consists in digging, during the rainy season, trenches, of 2 meters deep. If the ground water-sheet raises up to less than 1m 50 from the soil-surface, such a land is not suitable for planting an orchard of mango-trees. (See diagrams 2 and 3 on page 4).

DIAGRAM 1 : There exists a slab at less than two meters underground

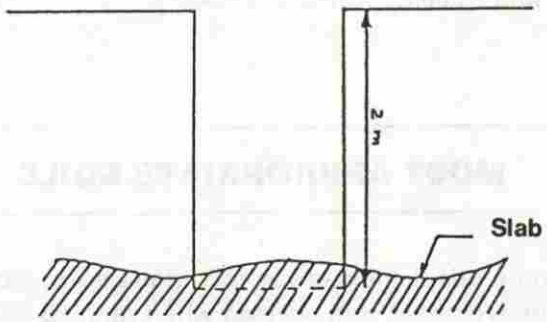


DIAGRAM 2 : The water of the sheet is kept too high

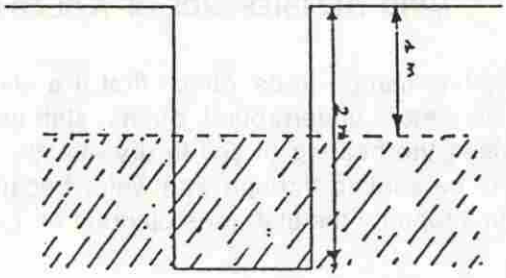
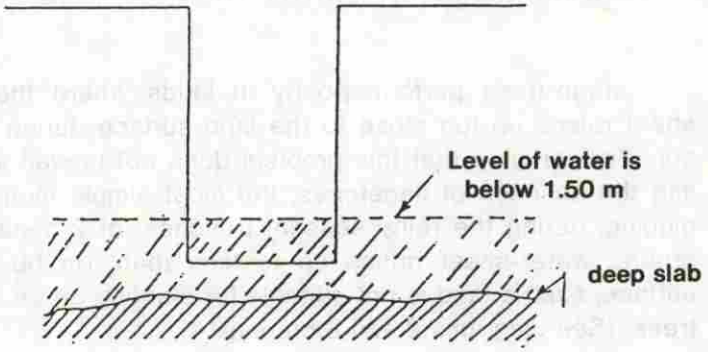
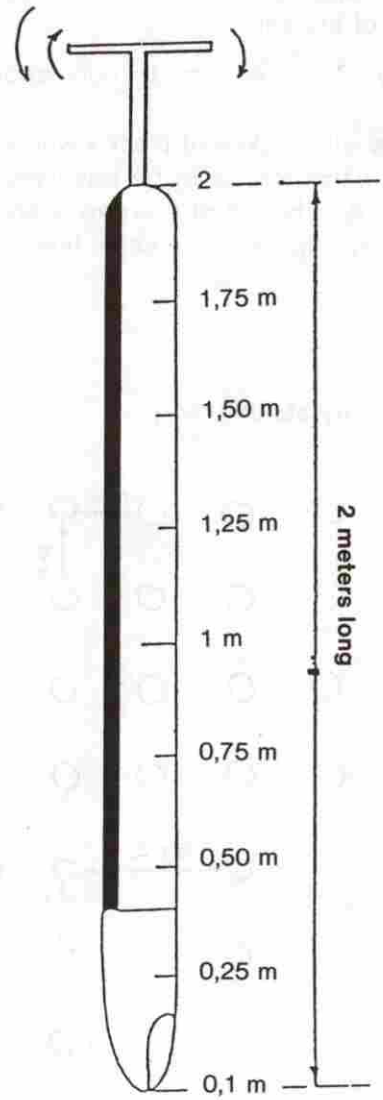


DIAGRAM 3 : Suitable soil



The depth of soil and the raising of water sheet can be also checked by using an auger.

DIAGRAM 4 : Auger

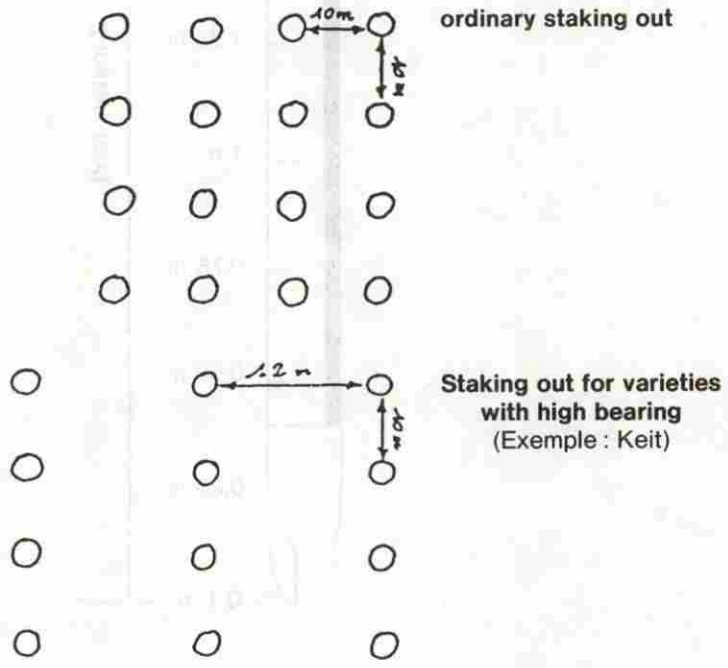


HOW TO PREPARE THE PLOT

Clear the land and uproot stumps while blocking up the big holes. Do not burn lopped-branches on the plot so as to avoid destroying the humus of the soil.

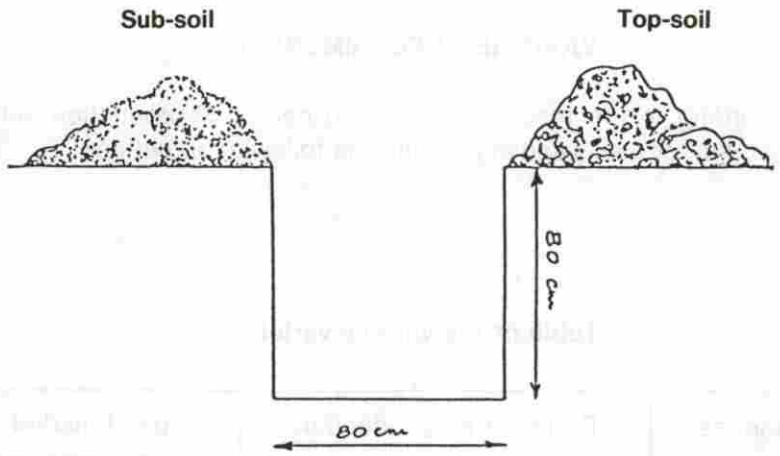
Plough deeply (30 to 40 cm) to bury spontaneous vegetation ; then break clods.
Mark planting lines with stakes at places where trees are to be planted. A spacing of 10 meters is to be observed between each stake and any other one. For the « Keit » variety a spacing of 10 m is to be observed between two trees in the same line but two lines should be spaced by 12 m.

DIAGRAM 5 : Ordinary staking out



As soon as the rainy season begins, dig holes of 80 cm wide and 80 cm deep. When digging, put separately the greyish top-soil and the sub-soil which is clearer. When turning back the whole into the hole to block it up, avoid to put the top-soil at the bottom of the hole since that one is richer. That one is more fertile.

DIAGRAM 6 : digging of the hole.



Leave the holes open for a week to have them well-aerated. Then, prepare for each hole 20 kg of manure, 1 kg of Tilemsi phosphate and 100 g of lindane or of HCH, or any other termite-control product.

Put back the sub-soil mixed with 500 g of Tilemsi phosphate. Then, add up the whole top-soil mixed with the 20 kg of manure, the remaining 500 g of phosphate and the 100 g of insecticide.

HOW TO SELECT YOUR SEEDLINGS

PRECAUTIONS FOR OBTAINING VIGOROUS SEEDLINGS

Purchage from a nurseryman grafted seedlings of 1 m high and whose graft measures 50 or 60 cm. Trim each seedling in such a way to suppress two thirds of its leaves. This operation which is called « pruning » allows for a quicker growth of the seedling. If the plantation is near the nursery, transport seedlings with clod, smear the roots with clay before wrapping them up in straw which will conserve moisture.

VARIETIES RECOMMENDED

According to the type of market and period of production being aimed at, select your seedling among the following varieties :

Table of the various varieties

Varieties	Period of full production	Type of market
Zill	March-April	Export and local
IRWIN	April-May	" "
SMITH	May-June	" "
Amelie	May-June	" "
Palmer	June	" "
Dixon	May-June	" "
Bldon	May-June	" "
Kent	June	" "
Keitt	July-August	" "
Sabot	May-June	Local only
Bewerly	May-June	Export and local

The Kent and Keitt varieties produce too many fruit which are too big to meet the current requirements of European markets.

" SABOT " VARIETY : A MANGO-TREE FOR YOUR YARD

The " SABOT " variety as well as the " Julie " variety, tastes like " Muscat " which is very appreciated by local consumers but its yield is too low for a commercial plantation. It is mainly recommended for yards with purpose of concession because it gives trees of average height and with thick foliage.

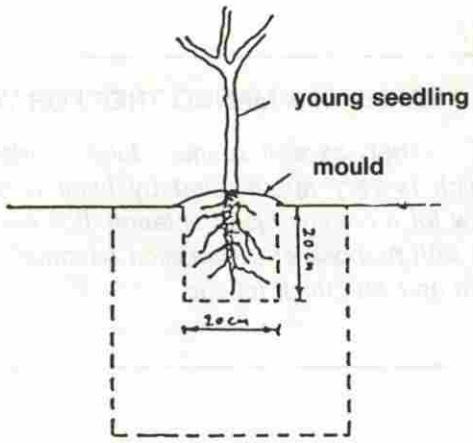
WHEN TO PLANT

Plant seedlings during the first half of the rainy season and one month after having blocked up the holes. If you have used compost in the place of non-decomposite manure, it is possible to plant seedlings as soon as the holes have been blocked-up.

HOW TO PLANT

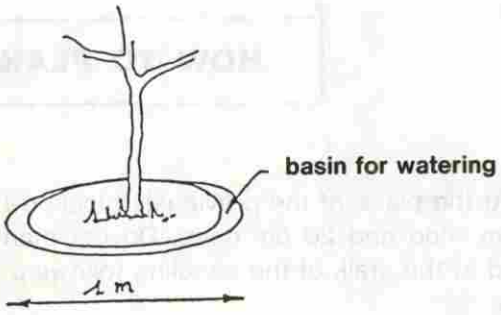
At the place of the previously blocked-up hole, dig a new hole of 20 cm wide and 20 cm deep. Do not plant too deeply and make a mould at the stalk of the seedling following the indications in the diagram.

DIAGRAM 7



Around each seedling, make a circular basin with a radius of 50 cm. Just after planting, pour there 15 to 20 litres of water.

DIAGRAM 8 : basin for watering

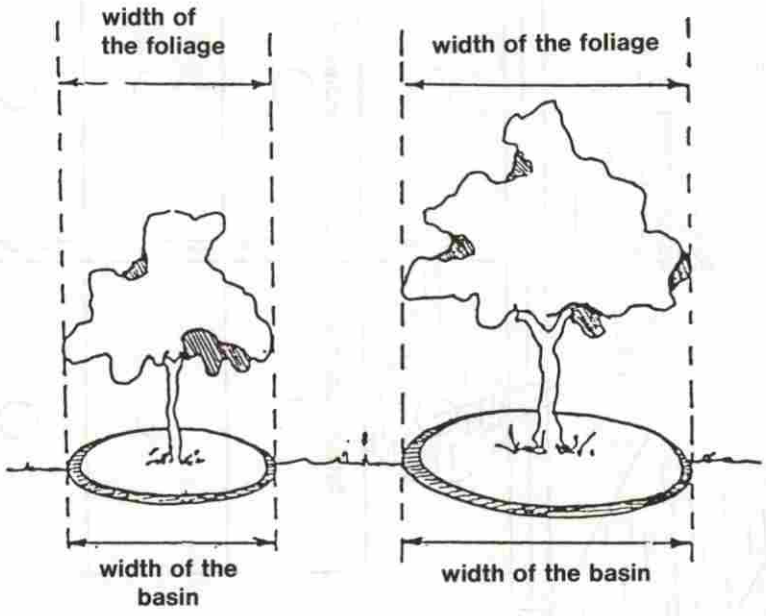


MAINTENANCE OF THE ORCHARD

WATER

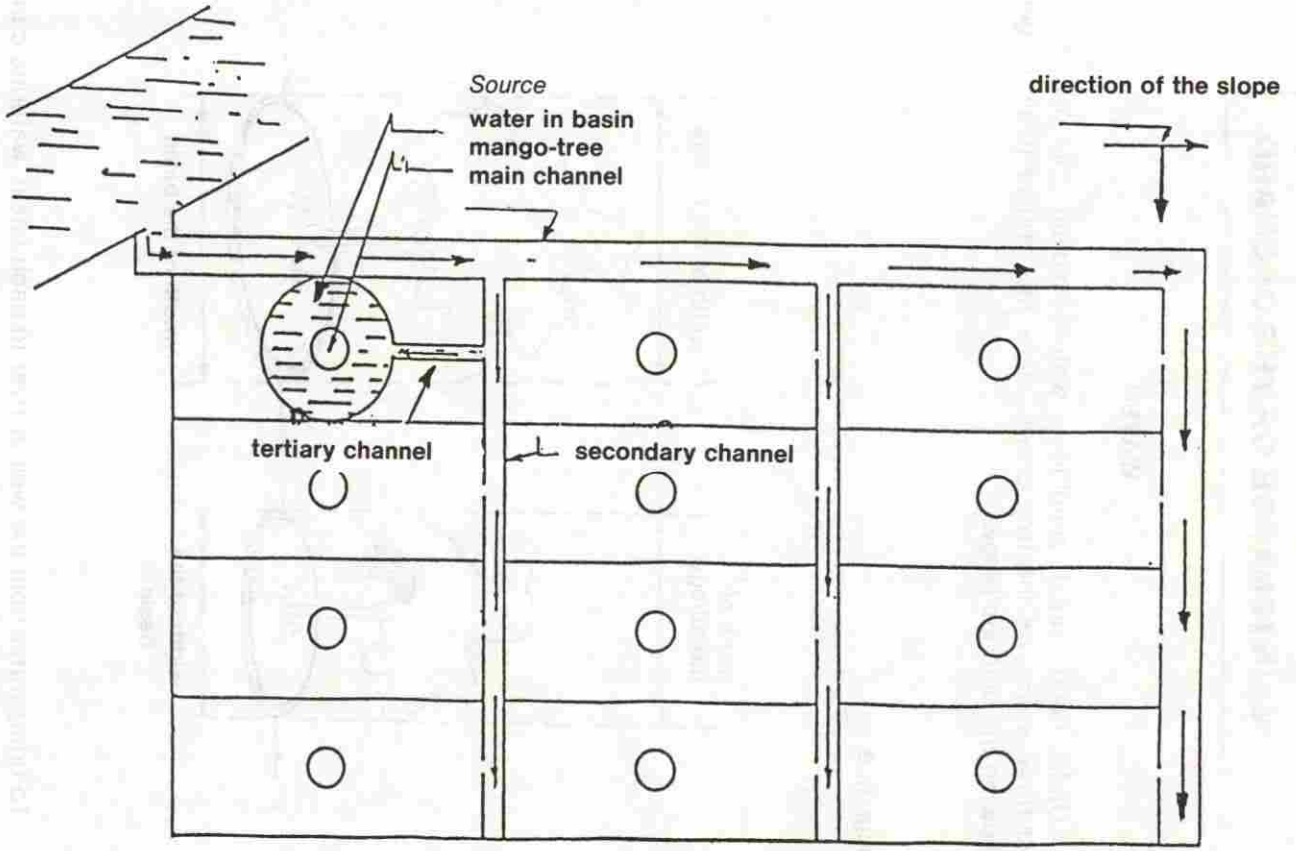
Under good rainfall conditions, water seedling only during the first three years. As the tree grows, make the circular basin bigger, following the diagram below :

Diagram 9



To bring water from the well or river to each basin, watering cans can be used for small plantations. For large plantations, use an irrigation-pipe or set up a network of channels following the diagram :

DIAGRAM 10 : Diagram of the irrigation system by channels



QUANTITY AND FREQUENCY OF WATERING

Pour water in each basin until the water level reaches 5 to 9 cm : twice a week during the first year and once a year later on.

CAUTION !

In all cases, avoid to water trees by sprinkling them with water. This would risk to make blossoms fall and cause some diseases.

MULCHING THE BASINS

At the beginning of the dry season, cover the basins with a layer of 20 to 25 cm of very coarse grasses. This mulching reduces the evaporation of the irrigation water and chokes weeds.

FERTILIZERS

A maintenance manure is desirable during all the lifetime of the tree. The first application of fertilizer takes place one year after planting, at the beginning of the rainy season. To the stalk of each tree should be applied :

- 217 g of phosphate of ammonium
- 300 g of sulfate of potassium
- 33 g of urea.

Toward the end of the rainy season, add 100 g of urea. Those quantities should be increased as trees grow, according to the following table :

Period of spraying and kinds of fertilizers / Years	Beginning of rainy season			End of rainy season
	Phosphate ammonium	**Sulfate of potassium**	**UREA**	**UREA**
1st year	217 g	300 g	33 g	100 g
2nd year	434 g	600 g	66 g	200 g
3nd year	651 g	900 g	99 g	300 g
4th year	862 g	1.200 g	132 g	400 g
5th year	1.085 g	1.500 g	165 g	500 g
6th year	1.302 g	1.800 g	198 g	600 g
7th year	1.519 g	2.100 g	231 g	700 g
8th year	1.736 g	2.400 g	264 g	800 g
9th year	1.953 g	2.700 g	297 g	900 g
10th year	2.170 g	3.000 g	330 g	1.000 g

Starting from the tenth year, the annual quantity of fertilizer remains unchanged.

How to apply fertilizer ?

Bury away the fertilizer in the basin all around the stalk.

DIAGRAM 11 : how to apply fertilizer ?

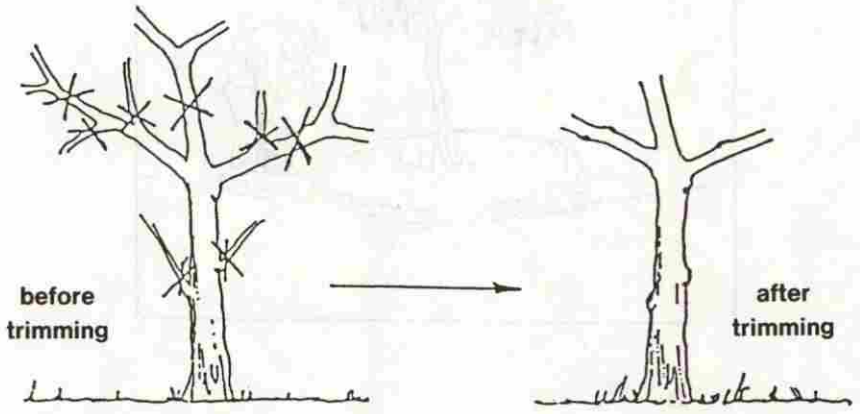
TRIMMING TREES

It is necessary to trim trees in order to obtain strong branches which can bear many fruit.

The first trimming should occur during the rainy season following the planting of trees.

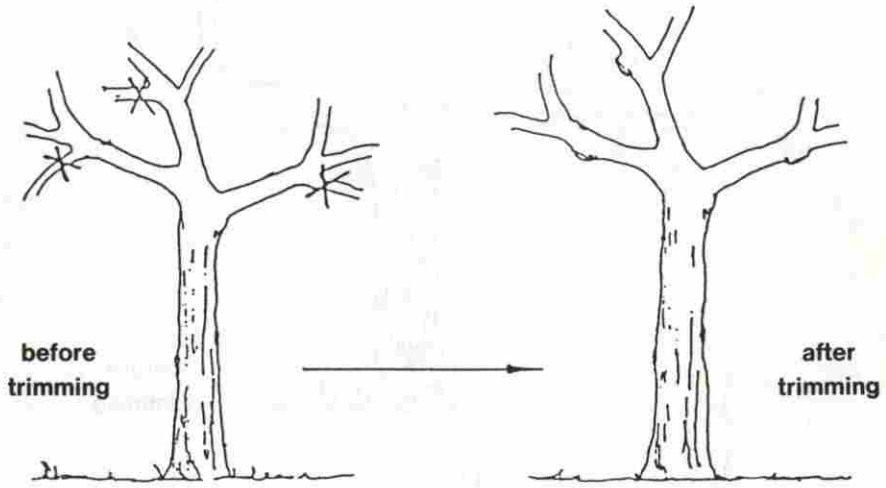
1. Cut off the three branches deriving from the trunk at one third of their length. Suppress all the other shoots (suckers).

DIAGRAM 12 : 1st year after planting.



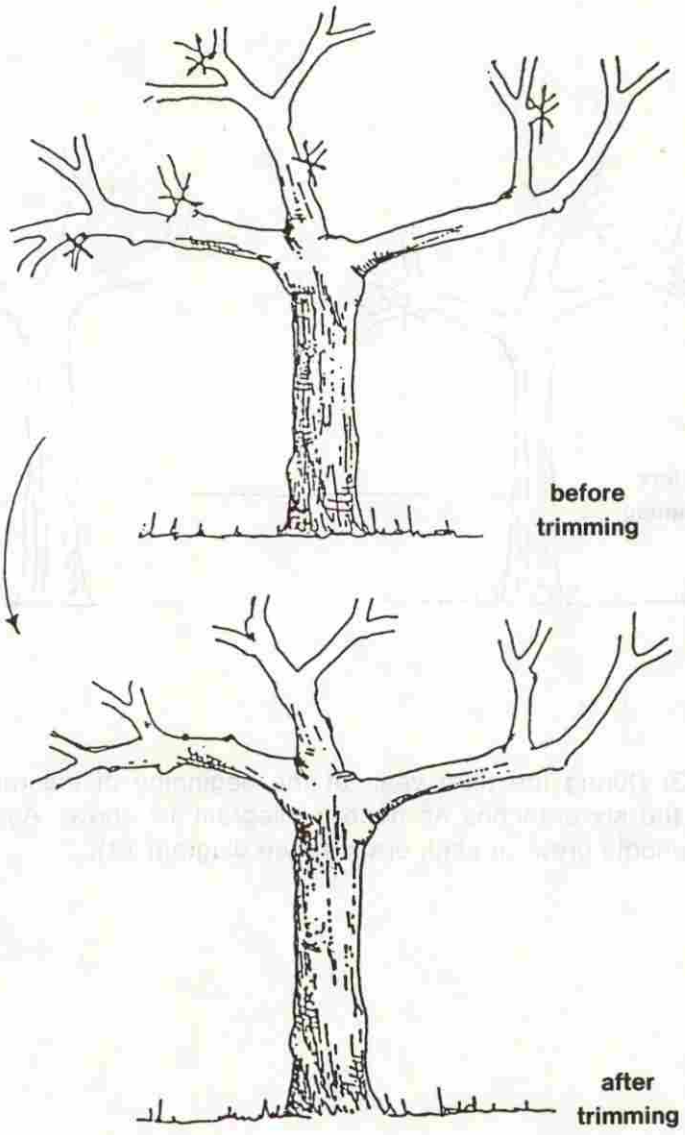
2) Later on, leave only two well spaced shoots on each branch.

DIAGRAM 13 : 2nd year after planting.



3) During the third year, at the beginning of the rainy season, trim the six branches as done in diagram 12 above. Again, let only two shoots grow on each branch (see diagram 14).

DIAGRAM 14 : 3nd year after planting

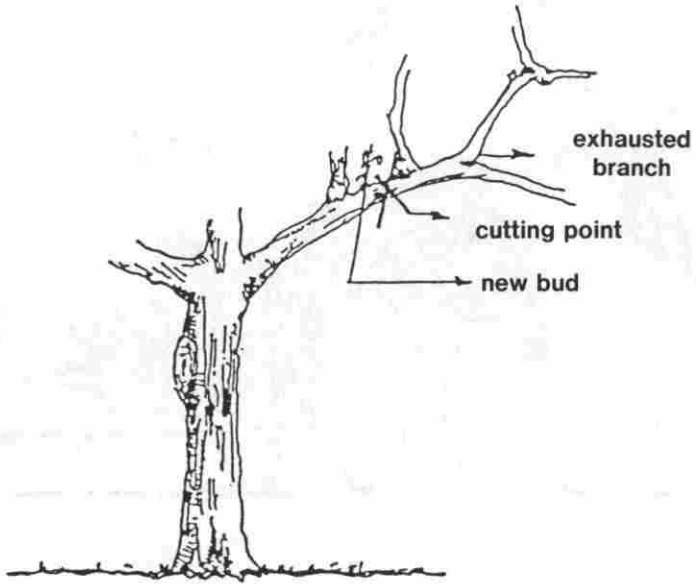


TRIMMING FOR THE MAINTENANCE OF YIELDING TREES

This trimming allows for having trees with less dense foliage and more productive. Always cut small branches down to big ones from which they derive, in order to avoid the formation of stumps (remaining part of withered ramifications) which may cause trees pot. Following the diagram below, cut off all branches not producing fruit.

Cut off or saw off branches just above any shoot or bud which is near their emerging point. When the height of trees becomes an impedment to harvesting, their upper branches should be cutt off.

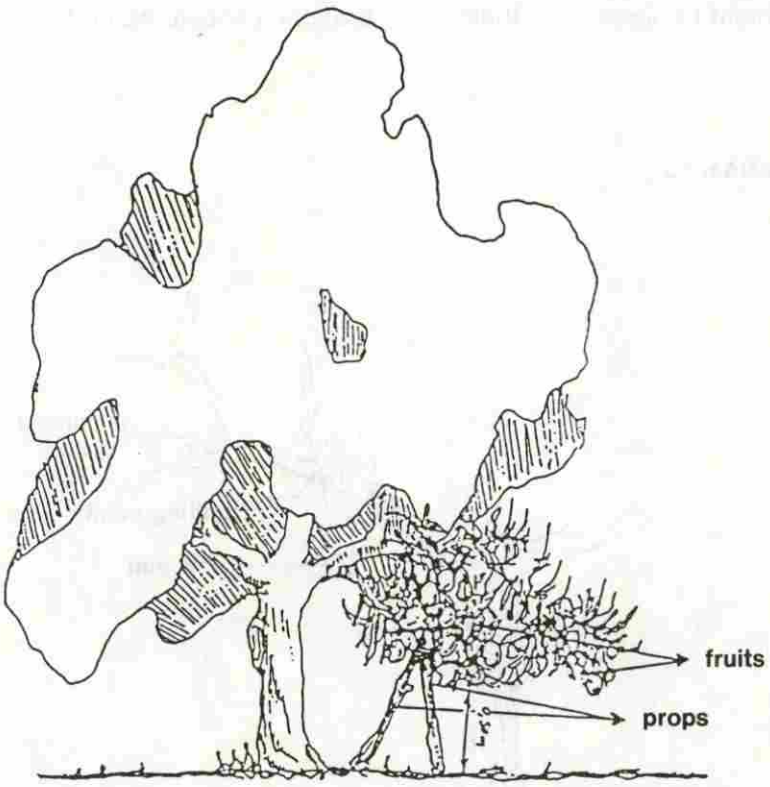
DIAGRAM 15



Prop branches with too many fruit.

When a branch risks to be broken under the weight of fruit, place a prop to support it.

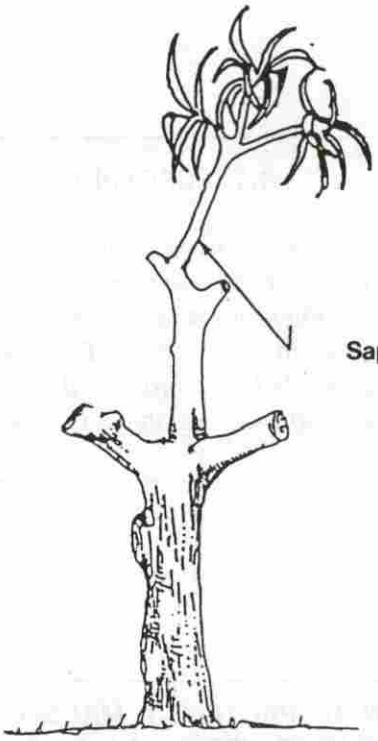
DIAGRAM 16



TRIMMING FOR REGENERATION

When the yield of the orchard decreases due to the ageing of trees, big branches should be cut off at 20 or 30 cm. Only one branch should be left : the sap conducting branch.

DIAGRAM 17 :



PRECAUTIONS AFTER TRIMMING

For each branch of more than three centimetres of diameter that has been trimmed, cover the wound with a healing ointment (FLIN-KOT, KB, plant tar or copper-ointment). Cut off branches should be taken away from the plot to avoid diseases.

KEEP THE GROUND CLEAN

- Each month, the space around trees and between lines of trees should be weeded.
- At the end of the rainy season, plough the space between rows of trees.

INTERCROPPING

During the first three years following planting, one can grow peanuts between trees in the rainy season, and garden-crops or banana-trees and papaya-trees in the dry season. Be careful to leave enough space between crops and trees in order to avoid impeding the development of roots.

HOW TO PROTECT A MANGO TREES AGAINST PESTS AND DISEASES

PESTS

Termites : to protect seedlings against pest-attaks, spread HCH- or lindane, or spray Dieldrine around trunks.

Fruits flies : when mangoes are almost ripe, fruit flies begin to attack them and lay eggs there. Some varieties of mango-trees are more sensitive to flies than others. In the case of varieties less sensitive to fly attacks, treatment is not always necessary. Among the varieties mentioned on page 8, « Keit » variety is the most sensitive to flies.

As a precaution, all fruit attacked and fallen on ground should be collected and buried at 50 cm deep. Worms can be observed inside those fruit.

One month before harvesting begins, attach traps on mango-trees bordering the orchard (yellow or orange plates containing the hydrolisat of proteins to attract files, and an insecticide, malathion).

Locusts and flower-eating beetles : They attack flowers, leaves and small branches. To destroy them, spray Dieldrine (dose : 30 cubic centimetres (30 ml) for 15 litres of water).

Red ants " weavers " : they curl up in leaves of mango-trees and can bite so severely workers that the latter may not be able to carry out the maintenance and harvesting work. To get rid of them, spray an insecticide such as Decis (dose : 30 cubic centimetres (30 ml) for 10 litres of water).

DISEASES CAUSED BY FUNGI

Anthrachnosis and cercosporiosis cause black or resh-grey spots on leaves and fruit, Treat by spraying Zinebe or Manabe.

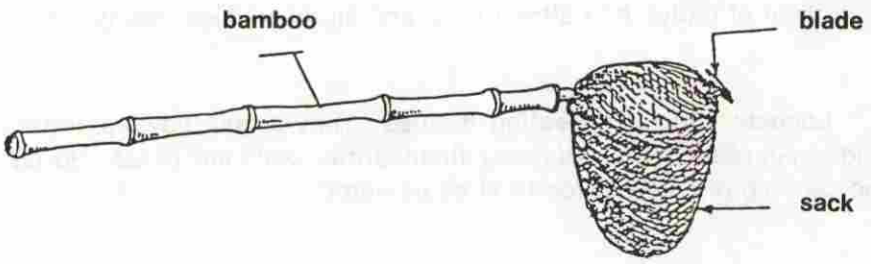
The presence of Oidium is shown by a whitish down on leaves and young shoots. Young leaves get warped and some fruit turn black and get withered.

When trees are blossoming, treat them with a mixture of wettable sulphur, copper and wetting agent.

HARVESTING

Harvest when fruit are mature. For mangoes out of reach, use a pluck.

DIAGRAM 18



If you harvest fruit with the purpose of exporting them, put them in a single layer in boxes. Avoid to transport them in bulk in vehicles ; which may damage them.

THE YIELD OF A MANGO PLANTATION

Under good conditions, 15 to 25 tons can be obtained per hectare. A mango plantation can produce fruit over 40 years.

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Achevé d'imprimer
sur les presses de l'Imprimerie Saint-Paul – Dakar
Juin 1991

WHAT IS RESADOC ?

The Programme on the Sahelian Scientific and Technical Documentation and Information Network (RESADOC) is an information and documentation system based on regional cooperation. It covers nine sahelian countries : Burkina Faso, Cape Verde, Gambia, Guinea-Bissau, Mali, Mauritania, Niger, Senegal, and Chad.

1. **Objectives :**

The main objectives assigned to RESADOC are the collection, processing, storage and dissemination of scientific and technical information.

2. **Areas covered :**

RESADOC is a developing Network. It is working in the sectors of activities of CILSS. These sectors are relating to food self-sufficiency, the restoration of sahelian space, water-control and the knowledge of human environments.

3. **Structures :**

3.1. **National level :** In each and every member State there exists a national network composed of several documentation centres and librairies. The activities of the national network are coordinated by a national correspondent centre.

3.2. **Regional level :** It exists documentation centres or specialized librairies of regional institutions.

3.3. **Regional Centre of Coordination :** Based in Bamako (Mali) at the SAHEL INSTITUTE, it ensures the Coordination of the Network.

4. **Publications :**

RESADOC publishes :

- RESINDEX a bibliography on the SAHEL, produced from the data base, is published half-yearly.
- The series of thematic bibliography on agricultural research in the Sahel
- Synthesis and bibliographical review series
- Technical guide series
- " Profile " in the series : " Millet-Sorghum-Maize-Cowpeas ", " Demography-Socio-Economy ", " Ecology-Environment ", and " Crop Protection ".

SERVICES OFFERED

For its users, RESADOC

- initiates bibliographical researches ;
- communicates its documentary resources (loan, on-spot consultation) ;
- answers to written questions ;
- elaborates thematic bibliographies when requested or according to standard or personalized profiles (DSI) ;
- provides photocopies and microfiches ;
- orientates towards other information sources.

In the field of training, RESADOC ensures four types :

- Initiation to documentary techniques,
- Initiation to the Methodology,
- Initiation to Documentation Date Processing, specially to the CDS/ISIS 2.3 software developed by UNESCO,
- Initiation to microfilming techniques.

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For any information on fruit-tree planting, garden-croptechniques and methods for fruit and vegetables conservation

Write to :

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