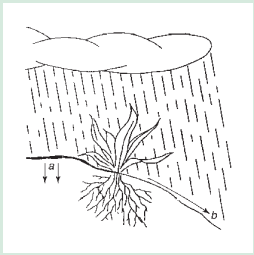
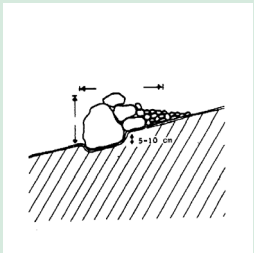
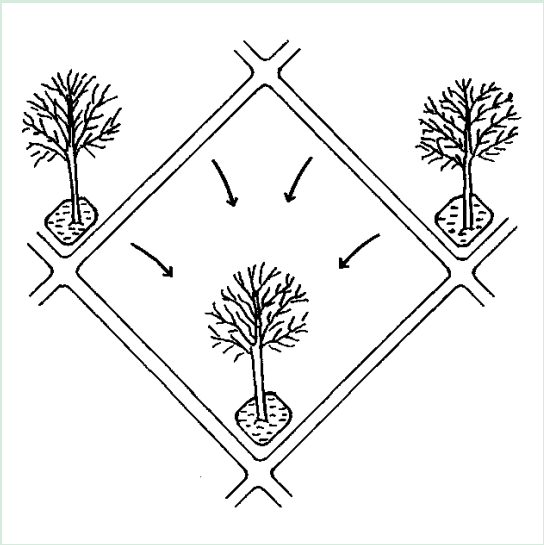
Agrodok-series No. 13

Water harvesting and soil moisture retention







CTA

partageons les connaissances au profit des communautés rurales

sharing knowledge, improving rural livelihoods

Agrodok 13

Water harvesting and soil moisture retention

Justine Anschütz
Antoinette Kome
Marc Nederlof
Rob de Neef
Ton van de Ven

First English edition: 1997
Second edition: 2003

Authors: Justine Anschütz, Antoinette Kome, Marc Nederlof, Rob de Neef, Ton van de Ven
Editors: Justine Anschütz, Marc Nederlof
Illustrator: Barbera Oranje
Translation: Sara van Otterloo
Printed by: Stoas Digigrafi, Wageningen, the Netherlands.

ISBN Agromisa: 90 77073 40 X

Foreword

The Agrodok series has lacked a booklet describing how water available from rainfall and run-off, i.e. from smaller sources than rivers and ground water, can be better utilised in agriculture. Antoinette Kome, Rob de Neef and Ton van de Ven have filled the gap by writing this Agrodok: 'Water harvesting and soil moisture retention'. The contents have also been supplemented by the undersigned. The water harvesting techniques described are particularly useful in arid and semi-arid areas, but the techniques described for soil moisture conservation are also of use in sub-humid regions.

Theo Meijer, Max Donkor and Marc Nederlof have contributed technical advice to this Agrodok. Agromisa is also grateful to Anne Gobin of the Institute for Land and Water Management in Leuven, Belgium, and to Pierre Chevallier of the Hydrology Department of ORSTOM in Montpellier, France, for their comments on an earlier version of this Agrodok. Finally, without Barbera Oranje this Agrodok would not have been complete, for she has drawn and adapted a large number of the illustrations.

Justine Anschütz & Marc Nederlof, editors
Wageningen, April 1997

Contents

1 Introduction: why water harvesting and soil moisture retention

Water is one of the main requirements for healthy plant growth. Most arid and semi-arid regions, however, suffer from insufficient and unreliable rainfall. In these areas a high rate of evaporation in the growing season is also common. When it rains in (semi-)arid areas, the rainstorms are usually heavy. The prevailing soils generally cannot absorb the amount of water which falls in such a short time. As a result rainfall in (semi-)arid areas is often accompanied by a large amount of surface runoff.

These climatic characteristics of (semi-)arid regions mean that it is important to use the limited amount of rainfall available as efficiently as possible. One way to do this is to use surface runoff (*water harvesting*). Another is to encourage infiltration and storage of rainwater (*soil moisture retention or conservation*). The advantages of water harvesting and moisture retention techniques in (semi-)arid areas may be summarized as follows. A higher amount of water available for crops may lead to a greater reliability and a higher level of yields. In addition, it can tide a crop over an otherwise damaging dry spell and it can make crop production possible where none is viable under existing conditions.

Most techniques for water collection make use of large water sources such as rivers and ground water (eg. wells and irrigation systems), and require large-scale investments. But in many countries in the world small-scale, simple methods have been developed to collect surface runoff for productive purposes. Instead of runoff being left to cause erosion, it is harvested and utilized. A wide variety of water harvesting techniques with many different applications is available. This Agrodok **'Water harvesting and soil moisture retention'** presents a number of these techniques. Whereas water harvesting makes use of and even induces surface runoff (Figure 1), soil moisture retention aims at preventing runoff and keeping rainwater in the place where it falls as

much as possible. However, the distinction between the two types of techniques is not always clear, especially when the (runoff producing) catchment area is very small. In addition, soil moisture retention techniques can be applied in the cultivated area of water harvesting systems.

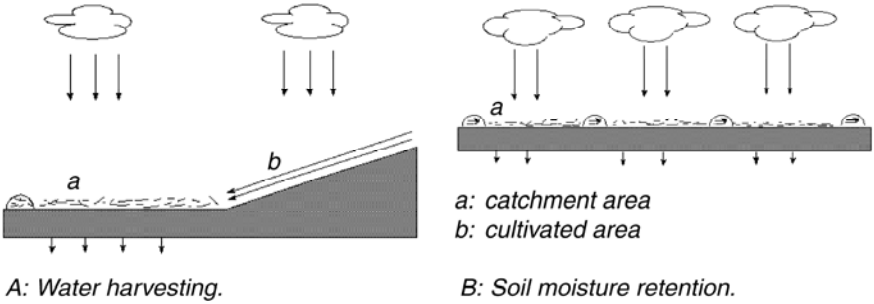


Figure 1: Water harvesting and soil moisture retention.

This Agrodok is written for agricultural extension workers who work with farmers faced with water shortages, eroded soils and low yields in (semi)-arid areas. Two warnings are necessary here. Firstly, the techniques described in this booklet cannot increase the total amount of rainfall available in an area. They can only increase the availability of water to plants, by collecting water that would otherwise be lost. Secondly, all water harvesting techniques concentrate runoff water in a limited (cultivated) area which increases the potential risk of erosion.

The structure of this Agrodok is as follows:
Part I is dedicated to water harvesting. After an introduction in Chapter 2, Chapter 3 explains the theory for designing a water harvesting system. Chapter 4 helps to select an appropriate water harvesting system and chapters 5 and 6 give examples of small-scale systems.
Part II covers the subject of soil moisture retention (conservation). Chapter 7 and 8 describe a number of measures to increase infiltration of water into the soil. Part II ends with Chapter 9 describing ways to reduce evaporation of water from the soil and measures to optimize the use of soil moisture.

The glossary provides a list of technical terms and their explanations. The two appendices cover respectively a description of ridging equipment for draught animals to decrease hand labour and an extensive explanation of the use of the water tube level in measuring height, staking out contour lines and defining the slope gradient.