APPENDIX-V

INFORMATION, EDUCATION AND COMMUNICATION (IEC)

V.1 INTRODUCTION

This Study prepared a set of dissemination materials. The materials consist of “comprehensive guideline” and “technical manual”, which together composes of one volume, and incorporates leaflets and posters as follows.

1) Technical Manual (Part I: Comprehensive Guideline, Part II: Process Description Manuals)
2) Leaflets (2 kinds of total 6 pages each, English)
3) Posters (6 sheets of A-3 size, utilized as picture stories as well)

The comprehensive guideline is mainly for provincial and district TSB officers as the primary users and for BEOs and CEOs as the secondary users. Technical manual is meant for district TSB officers and also the frontline extension officers, BEOs and CEOs. Since the comprehensive guideline constitutes of the entry part to the technical manual, these two were merged into one volume, called ‘Technical Manual’.

To widely disseminate smallholder irrigation development, especially simple irrigation schemes, the other two materials were prepared; 1) leaflets and 2) posters which can also work as picture stories. These are designed to be used by the frontline extension officers, BEOs and CEOs, as the primary users and also district TSB officers as secondary users.

Since Technical Manual is presented as a separate volume of report, only contents are shown below, while the Leaflets and Posters are attached hereto from the next page (posters are reduced in A-4 size). Readers may photocopy the leaflets and posters for their own use.

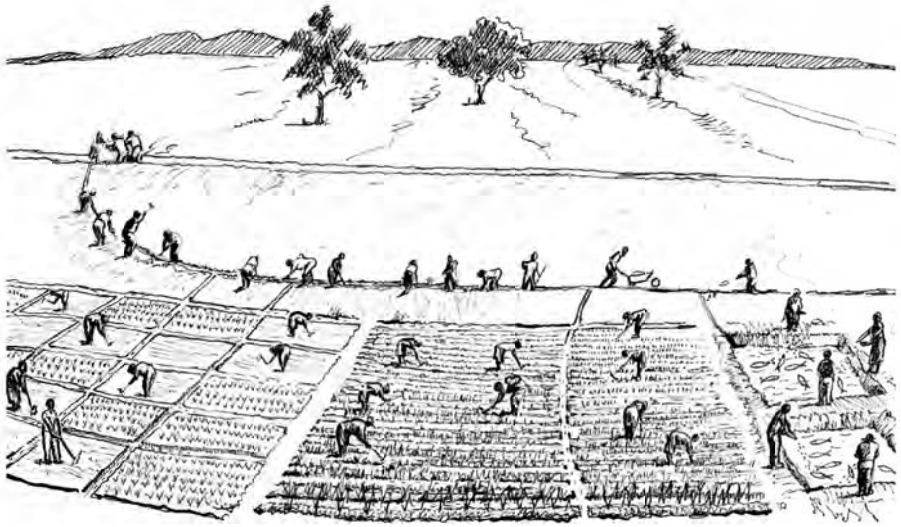
CONTENTS OF PART I: COMPREHENSIVE GUIDELINE

CONTENTS OF PART I: PROCESS DESCRIPTION MANUALS

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
MINISTRY OF AGRICULTURE AND COOPERATIVES (MACO),
REPUBLIC OF ZAMBIA

IRRIGATED AGRICULURE TODAY FOR BETTER LIFE TOMORROW

Using a Simple Irrigation Technique,
Let's Start Improved Irrigated Agriculture Now!



APRIL 2011

SANYU CONSULTANTS INC., TOKYO, JAPAN

1. Initiation of Irrigation Development

There is a set of quite simple technologies that can well fetch water from small stream with no outsourced materials like cement or iron bars; called Community-based Smallholder Irrigation (COBSI). With this simple technology and community members' participation, you can enjoy irrigated agriculture TODAY. To be an owner of irrigation system, you can get necessary information and technical assistance from nearby MACO officers; they are ready with technical manual, leaflet, process-description posters and leaflet for you. This leaflet encourages you to start an improved irrigated agriculture using your COBSI scheme. For the detail of irrigation development itself, please refer to a leaflet "Starting Irrigation in Our Local Context."

2. BOKASHI COMPOST (A Quick-Compost)

As you may know, soil in this agro-ecological zone is quite depleted and thus fertility is generally low. With the low fertile soil, you may not always enjoy abundant harvest notwithstanding plenty of water flowing in front of you. Thus, first thing recommended is to cope with unfertile soil in your farm. Fortunately, irrigation water can provide you with a great potential in improving soil condition; here is a technique of making compost in a short period of time using irrigated water.

BOKASHI compost is a type of quality compost that can be made with local materials in 2-3 weeks. As compared to conventional compost that takes 2-3 months, required time is significantly short. Because of this quickness, you can prepare this compost for this dry season even after constructing canal.

The principle of making BOKASHI compost is simple: 1) to facilitate the decomposition of the materials, incorporate virgin soil which contains a lot of active microorganisms, 2) Through periodical turn-up, keep the temperature of the materials less than 60 degree Celsius in order not to kill the microorganisms, and 3) by watering time by time, keep the moisture content of the materials appropriate for microorganisms. With the aerobic condition in the material heap, aerobic microorganism's activities will be highly accelerated and the compost will be ready in a short period of time.

Process of BOKASHI Making

Materials required for one heap of Bokashi are as follows. Although it can be adjusted depending on availability of each material, soil should not be more than 30% of all materials.

- Water: Provided by Canal
- Animal manure: 3 buckets (+ urine absorbed in grasses)
- Virgin soil: 3 buckets (from dambo, and/or natural forest)
- Plant residue: 4 buckets (legume, maize bran, etc.)
- Ash: A half bucket (pH control, K supplement)
- Broken charcoal: A half bucket (as microbes' house)
- Yeast materials: a half bucket of local beer residue, one bucket of Bokashi previously made, a 1/2-1 bucket of banana peal, rotten fruits, all soaked in water.

Cut the plant residues into small pieces to mix thoroughly with other materials. It also helps facilitate the decomposition process. Plant residues are cobs of maize, pod of beans, maize bran, sugarcane residues, and other plant bodies. Fresh materials are recommended, as the fertility has not yet evaporated.

Mix the material a little by little. After regulating moisture, pile it as a heap and cover it by banana leaves. Temperature of the materials usually rises up in 1-2 days. As too high temperature kills the effective microorganism, if temperature reached 60 degree Celsius or more, break down the heap and re-make it. To know the temperature, stick a panga or alike into the heap for ten seconds and touch it; you will feel the temperature.

As you check the temperature, also check the moisture. If it is too dry, add water. Take care of the temperature and moisture once or twice a day during the first week. After 2-3 weeks, the color of Bokashi gets dark; ready for the use. Spread all the materials and dry it under shade.

Bokashi can be used both as basal- and as additional-fertilizer. When applying it as additional-fertilizer, a handful of Bokashi is generally suitable to each plant: make a hole, put it in the hole and cover it up with soil.

3. INTERCROPPING

Advantages of Intercropping

One of recommended cropping systems under irrigation is intercropping. Intercropping is a way of diversifying the farming system by which crop production can be more stabilized at lower risks. Specifically, there are several advantageous aspects in this system:

- Increased land productivity by producing multiple crops
- Reduced risk of pest and disease by diversification
- Efficient use of water, nutrient, and sunlight
- Minimized weed population with cover crop
- Improved soil fertility when legume is incorporated

By mixing two or more types of crops, it can dramatically increase the production per land area. Then, by enriching the diversity in the farming system, stability generally increase with reduced risk of pest and disease. In addition, with the use of crops with that have different root systems, shape of plants, and growing characteristics, it can use water, nutrient and sunlight more efficiently. It leads to higher production level comparing to aggregated production of individual crops. Furthermore, increased leaf cover in intercropping helps reduce weed populations once the crops are established.

Recommended Combination

Typical crops combinations for intercropping are summarized in Table 1. Concerning the generally depleted and thus low fertile soil in this area, it is recommendable to mix legume crops with other crops. By incorporating legume crops in the system, nitrogen fixation can be facilitated, whereby soil fertility is to be improved and maintained. Furthermore, legume crops are generally rich in protein and can be a good source for nutrition management of the rural household.

Another good aspect of intercropping is that when incorporating deep rooting crops, such as pigeon pea, physical characteristics of surface soil can be improved deeper.

Table 1: Examples of Recommended Intercropping

Crop	Description
Maize-climbing bean (Relay-cropping)	After at least 4 weeks of sowing maize, but before the harvest, plant climbing bean so that the bean can use maize stalks as stakes. Climbing beans can produce 3-4 times more yield than bush beans.
Maize-Legume (2 by 2 system)	Establish two rows of maize and another two rows of legume crops to alternate each other. Common bean, Soybean, green gram, and groundnuts can be used in this system. By creating a wide space in between maize rows, legume crops can receive more sunlight and thus a total production can be increased.
Maize-Sweet potato (Leaves) (mixed cropping)	Maize is sown in row and after the first weeding, and fertilization, sweet potatoes are planted in between the maize. Sweet potato plants cover the surface of the soil by which damage of weeds can be reduced.
Cabbage-Tomato	Tomato acts as a physical barrier against insects like Diamondback moth and has repellent odor. Cabbage is planted two weeks after Tomato is transplanted.
Cabbage-onion	Onion has repellant effect against common insects including aphids and is a useful intercrop for many crops. One of good combinations is with cabbage and carrot. But, combination with pea is not recommended.

4. Cropping Calendar

Sample models of cropping calendar are shown in Table 2. As smallholder farmers maintain 0.25 limas for irrigated agriculture, expected profit of each system computed based on actual farmers' practice are also indicated. Note that, however, the profit may differ depend on the characteristics of each site and each farmer.

There listed are 5 types of cropping systems. 1) relay-cropping of green maize and climbing beans: climbing bean can use maize stand as sticks; 2) gradual planting of tomato: risk and

labor can be dispersed; 3) rotation of groundnuts and cabbage: legume crop improve soil fertility and highly profitable crop can be introduced later; and 4) intercropping of Tomato/onion and cabbage: by introducing crops that have repelling effect, damage from insects can be reduced.

Table 2: Examples of Recommended Cropping Calendar

Area	Apr	May	Jun	Jul	Aug	Sep	Oct	Expected Profit
Pattern 1 G-maize & beans (0.25 lima)		Green Maize		**Relay planting**	Climbing Beans			457,000ZMK
Pattern 2 Tomato (0.25 lima)		Tomato		Tomato		Tomato		400,000ZMK
Pattern 3 Groundnuts & Year 1 (0.25 lima)		Groundnuts						807,000ZMK (1st year)
Cabbage Year 2 (0.25 lima)		Cabbage						1,030,000ZMK (2nd year)
Pattern 4 Tomato/onion and Cabbage Intercropping (0.25 lima)		Tomato/Onion		Cabbage				With Tomato 715,000ZMK With Onion 828,000ZMK

Source: Harvest survey to 282 sample farmers in six districts in Northern and Luapula provinces.
Note: Expected profit may vary significantly depending on the amount of agricultural inputs, level of farming techniques, and marketing potential.

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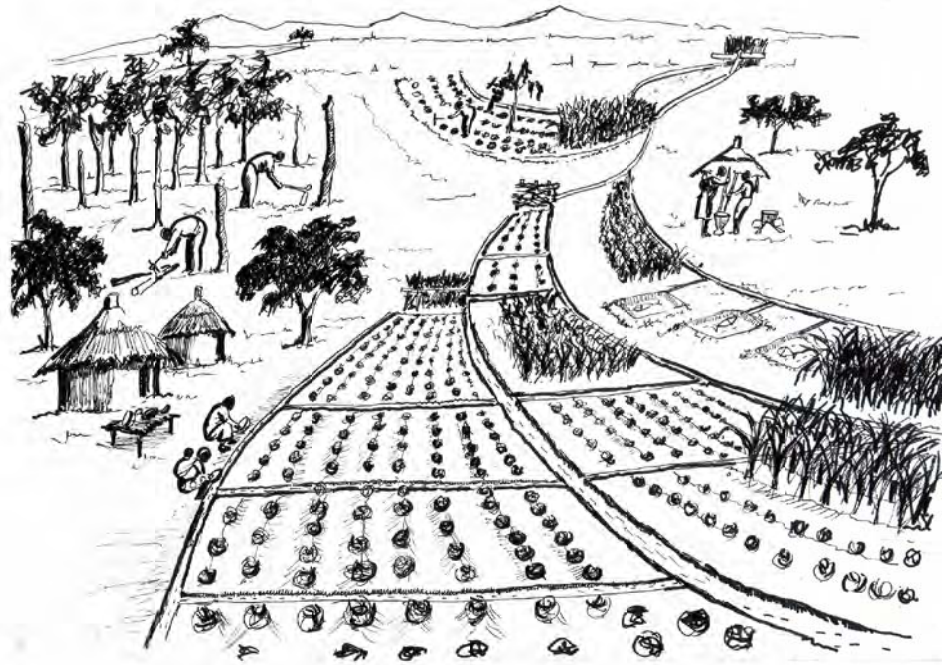
This leaflet was prepared under:

THE STUDY ON THE CAPACITY BUILDING AND DEVELOPMENT FOR COMMUNITY BASED SMALLHOLDER IRRIGATION SCHEMES IN NORTHERN AND LUAPULA PROVINCES, IN THE REPUBLIC OF ZAMBIA

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
MINISTRY OF AGRICULTURE AND COOPERATIVES (MACO),
REPUBLIC OF ZAMBIA

STARTING IRRIGATION IN OUR LOCAL CONTEXT:

Rather than waiting for someone else's support, why don't we try something we can do first?



APRIL 2011

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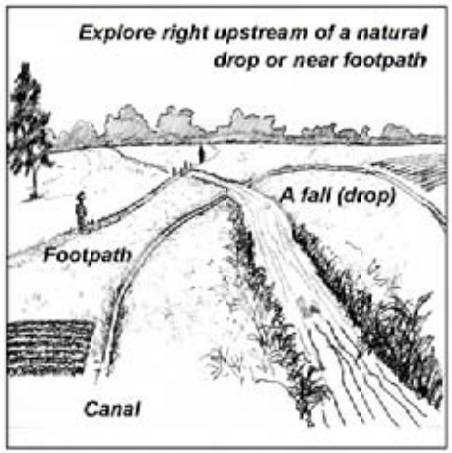
1. ATTITUDE TO PROMOTE IRRIGATION CULTURE

Given a perennial stream, we can start up irrigation on our own. In this context, the facilities should be such that they are constructed, operated and maintained by the farmers themselves. To bring such irrigation system into being in the farmers' locality, CEOs should be a technical advisor and also PARTICIPANT while the farmers are the committed implementers and the OWNER of the irrigation system.

2. IDENTIFY POTENTIAL DIVERSION SITE

Potential diversion sites should maintain perennial flow, and the depth should not be very deep: preferably limited to 2 m. Good sites can very often be found at JUST UPSTREAM OF NATURAL DROPS (small falls) and near villagers' FOOTPATHS which cross a perennial stream.

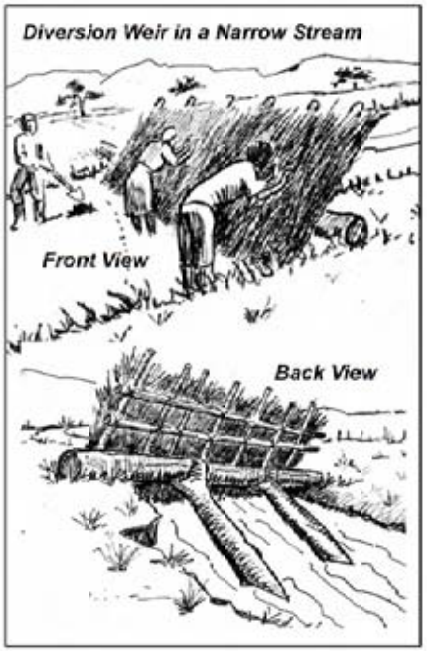


Right upstream of natural drops (small falls) could easily lead the water into canal by gravity thanks to the elevation difference. Footpaths usually traverse streams at a shallow place, forming a topographic condition, which is easier in diverting and getting water onto the farms.

3. CONSTRUCT DIVERSION STRUCTURE

First step is to believe that weirs can be constructed by using locally available materials such as wooden log, bamboo,

grasses, soils, etc., and can raise the water level across even over a 20 meter width stream and as high as 1.5 meter depth.

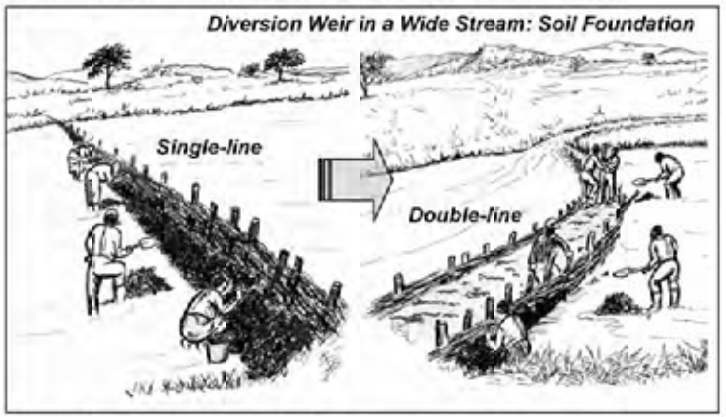


In case of narrow stream, constructing diversion weir is very easy: 1) put a horizontal member (wooden log) astride the both banks preferably supported by a wooden prop, 2) place vertical members, on the horizontal member, of bamboo, twig, and reed inclined to downstream, 3) put grasses on the vertical members and then clay soil thereon.

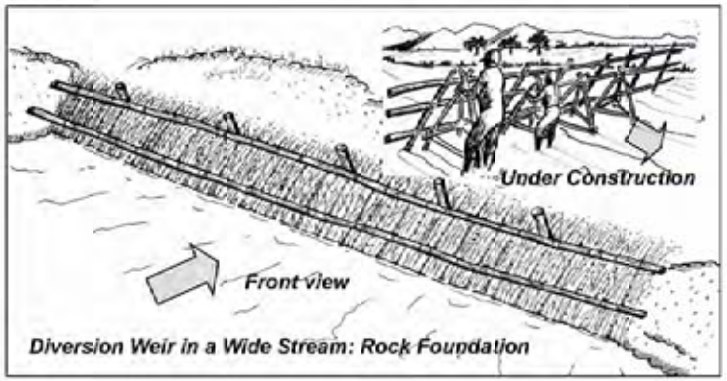
In case of wide stream, there are mainly two ways of constructing a diversion weir depending on the foundation condition: i.e. soil or rock.

At soil foundation, 1) drive wooden logs into the foundation across the stream preferably 30 – 50 cm interval, 2) put grasses alternately through the logs like weaving the logs, and then 3) patch clay soils upstream on the woven wall. This single-line weir is very simple and can fit in dambo areas. If leakage needs to be minimized, 4) make another line of the wooden-log woven with grasses about 70 cm to 150 cm downstream from the first line, 5) put clay soil in between the

two lines and compact the soil by footing/treadling. This double-line weir can also work as footpath for villagers.



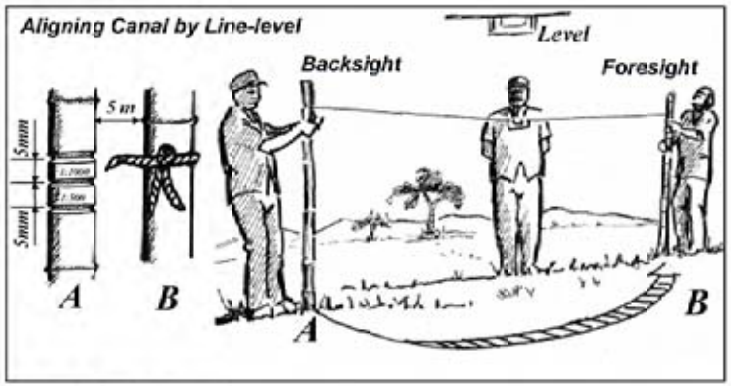
At rock foundation, 1) first prepare trigonal prop stand structures which support the weir body from behind across the stream, 2) put horizontal members of twig or bamboo in front of the props preferably every 30 – 50 cm interval in vertical, 3) put vertical members of twig, bamboo and reed on the horizontal members, 4) put grasses and then clay soils thereon.



4. ALIGN CANAL AND START DIGGING

The simplest way of aligning canal is to follow the water flow by gravity; namely, 1) dig the canal from the diversion point for example a 10 meter distance, 2) let the water flow in the dug canal, 3) deepen the canal and/or shift the canal alignment toward lower side (stream side) if the water does not run well, and 4) repeat the process until the end point.

Better way of canal alignment is to use sprit line level. Interval of the two poles should preferably be 5 meter, and one side of the tied points should be 0.5 – 1 CM HIGHER THAN THE OTHER. Pole with higher tied point should always be placed foreside, not like conventional alternate placing. 0.5 cm difference in 5 meter gives 1:1000 gradient suitable for gentle topography like dambo, and 1 cm gives 1:500 gradient adaptable for sloped topography. Note that in a very gentle plain like dambo where you can hardly find the B point in 5 m radius area, try 10 - 15m interval instead of the standard 5 m with 1 – 1.5 cm difference, whereby giving 1:1000 gradient.

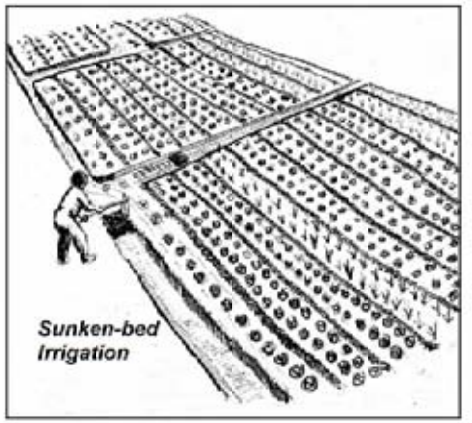


5. LAYOUT THE PLOT AND DO THE IRRIGATION

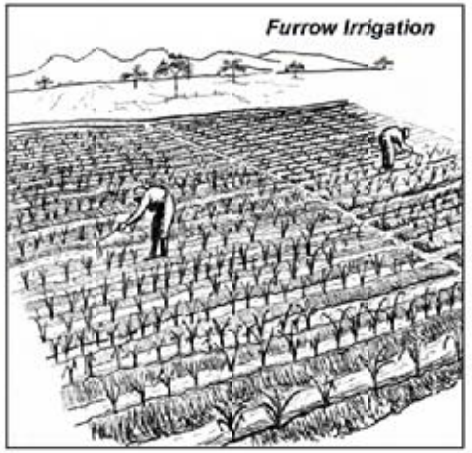
There are two irrigation methods adaptable for smallholders;

SUNKEN-BED and FURROW. Sunken-bed is a horizontal area of land, which is surrounded by earthen bands and is suited for any kinds of crops. Furrow irrigation system looks like commonly used ridged rain-fed agriculture since it consists of furrows and ridges. The furrow irrigation is suited to row crops such as maize.

At flat lands, sunken bed irrigation can be best suited as long as water logging does not last more than 48 hours. Smallest size of sunken bed can be 0.9m x 2m, and be enlarged to 1.2m x 5m depending on the soil, leveling and the size of the plot.



On sloped lands, say more than 4% slope, furrow irrigation may be preferred by the farmers and indeed adaptable. The spacing of the furrow can follow the rainy season's ridge spacing or a little narrower; say 60 cm – 80 cm. Length can be 3m to 10m depending on the soil, and size of the plot.



The irrigation interval is determined based on moisture holding capacity of the soil and the crop type. Though the maximum irrigation interval depends on the soil characteristics, it can be said that the interval SHOULD NOT BE OVER 8 DAYS in most cases, or crops may start wilting.

6. ISSUES AND CONCERNS

6.1 Possible Service Area on the Water Available

It can be roughly said that a crop area of 1 hectare needs 1.0 to 1.4 l/s of irrigation water under continuous application. This means 10 l/s could serve 10 hectares at maximum. However, as most farmers do daytime irrigation only, possible irrigable area could be less than half of that. Therefore, possible service area could be said to be equal acreage to the water amount in litre per second; say 10 acreages on 10 l/s, 30 acreages on 30 l/s, etc (1 acreage equals to 0.4 hector).

6.2 Equity between Haves and Not-haves

Irrigation obviously cannot serve all the villagers simply because of certain land location being outside the service area. This may create jealousy to the Haves. A mitigation measure is to divide the service area into blocks and lend out to the Not-haves either free or with a minimal rental fee. The rented land will be returned to the owner for rainy season agriculture.

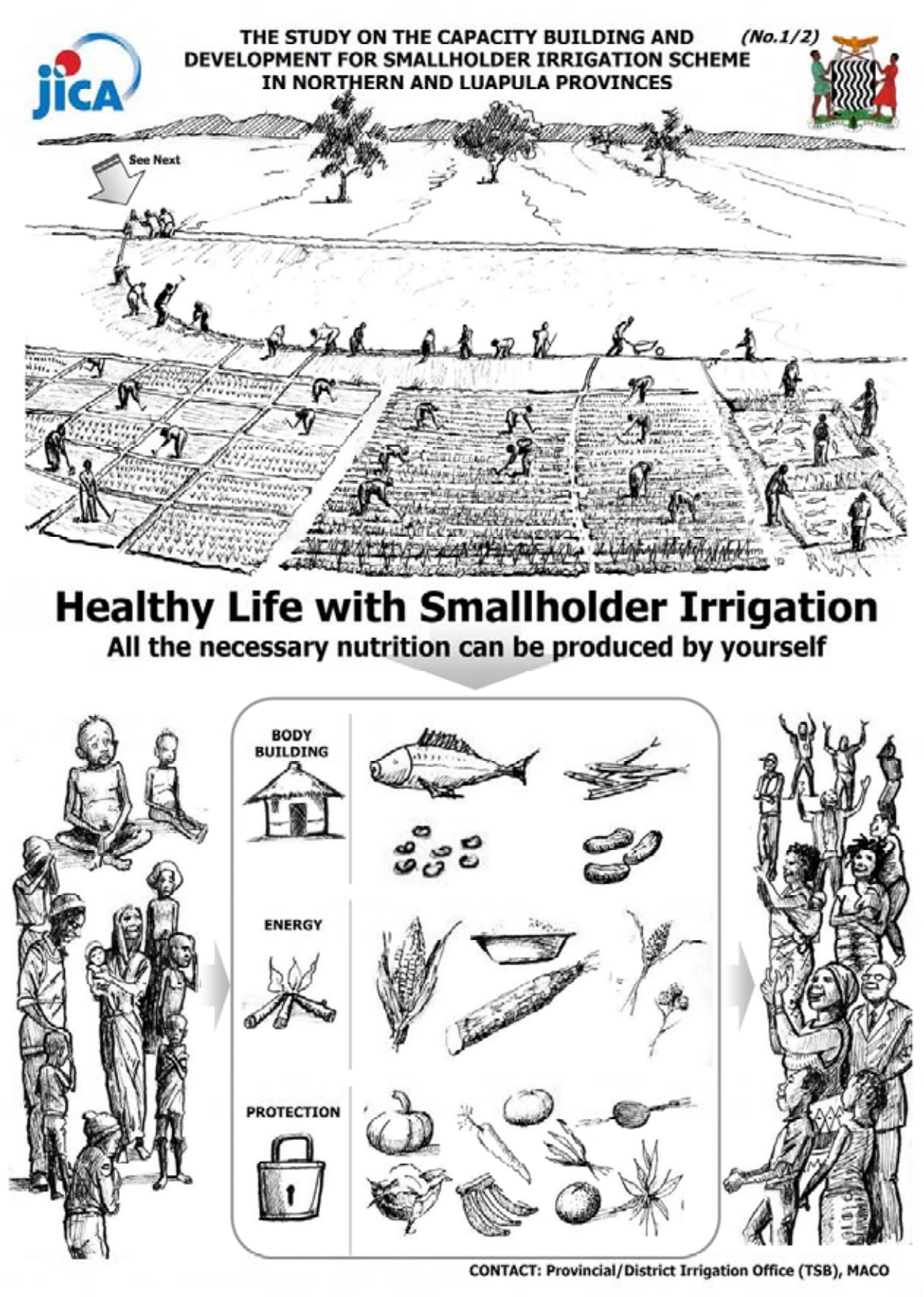
6.3 Physical Improvement of the Soil

It can be seen in Zambia that chemical fertilizer having long been applied without measure of physical improvement has already fatigued/exhausted the soils here and there. Irrigation agriculture results in two times usage of the same land, exploiting the soil fertility further. COMPOST MANURE should therefore be strongly recommended to the irrigators not only for supplementing fertility but also improving the physical soil characteristics.

This leaflet was prepared under:

THE STUDY ON THE CAPACITY BUILDING AND DEVELOPMENT FOR COMMUNITY BASED SMALLHOLDER IRRIGATION SCHEMES IN NORTHERN AND LUAPULA PROVINCES, IN THE REPUBLIC OF ZAMBIA

V.3 POSTERS

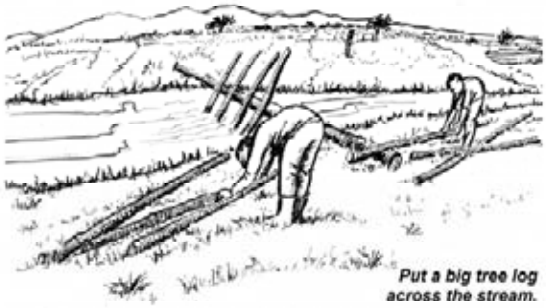

THE STUDY ON THE CAPACITY BUILDING AND DEVELOPMENT FOR SMALLHOLDER IRRIGATION SCHEME IN NORTHERN AND LUAPULA PROVINCES
(No.1/2)
JICA
See Next
Healthy Life with Smallholder Irrigation
All the necessary nutrition can be produced by yourself
BODY BUILDING
ENERGY
PROTECTION
CONTACT: Provincial/District Irrigation Office (TSB), MACO

TRY SIMPLE TECHNOLOGIES TO MAKE IT HAPPEN ! (No.2/2)

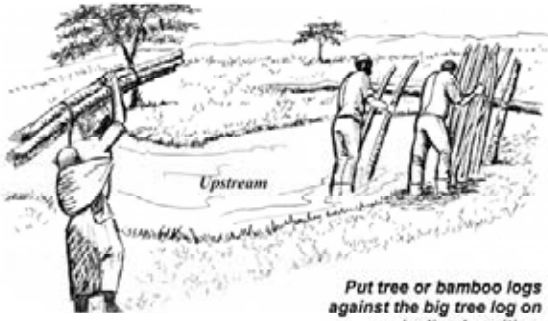
HOW TO TAP THE STREAM WATER FOR YOUR IRRIGATION !

CONTACT: Provincial/District Irrigation Office (TSB), MACO

Where the Stream is Narrow:



Put a big tree log across the stream.

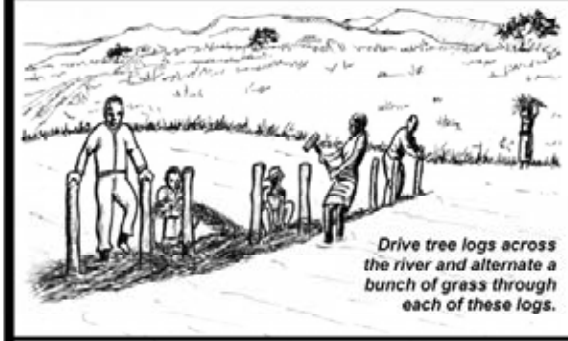


Put tree or bamboo logs against the big tree log on an inclined position.

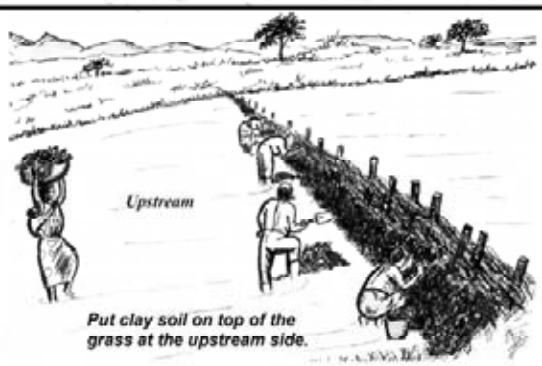
Put grass on top of the tree logs.

Put clay soil on top and compact if firmly.

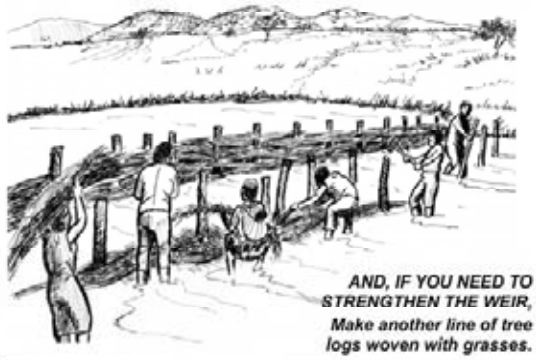
Where the Stream is Wide:



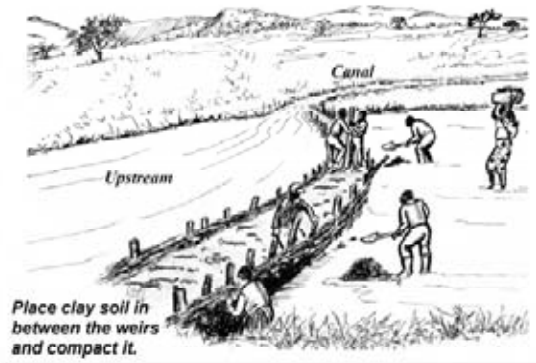
Drive tree logs across the river and alternate a bunch of grass through each of these logs.



Put clay soil on top of the grass at the upstream side.



AND, IF YOU NEED TO STRENGTHEN THE WEIR,
Make another line of tree logs woven with grasses.

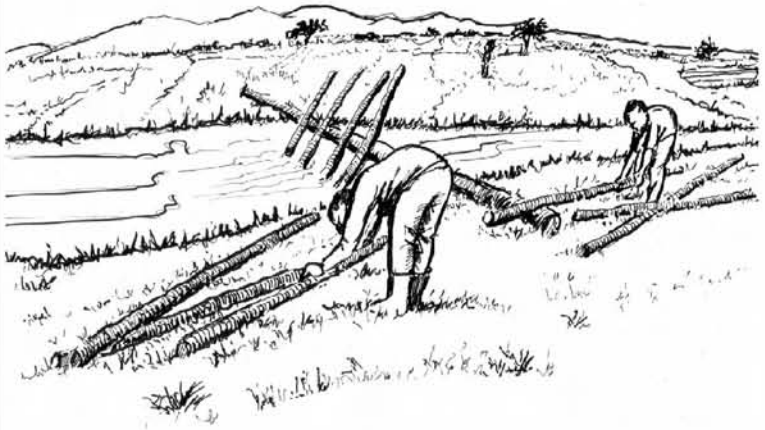


Place clay soil in between the weirs and compact it.

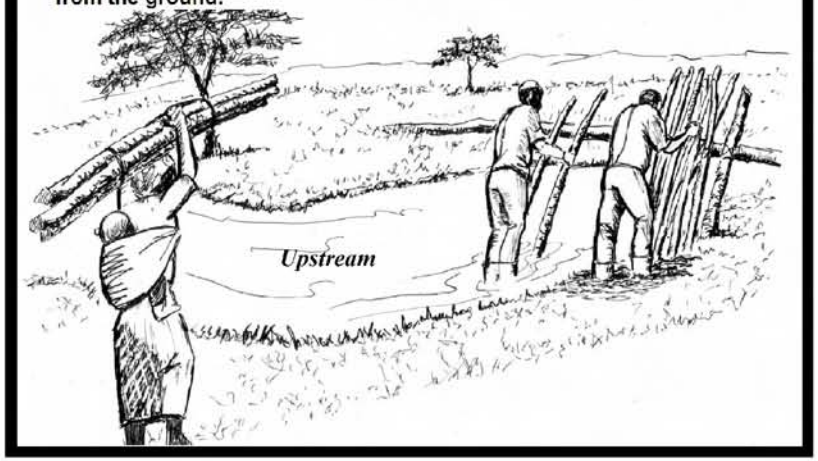
COMMUNITY-BASED SMALLHOLDER IRRIGATION SCHEME No.1/4

Promote Irrigation as a Part of the People's Culture !!! Inclined Type where Stream is Narrow

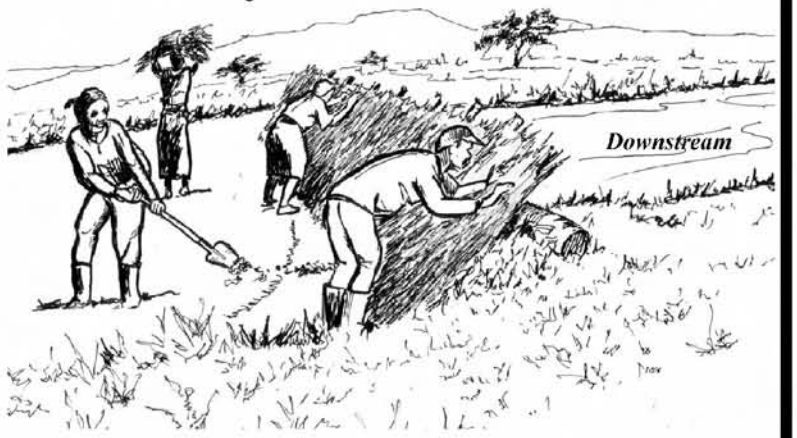
1. Put a big tree log traversing the whole stream width. The diameter of the tree is preferably more than 20 cm depending on the site condition.



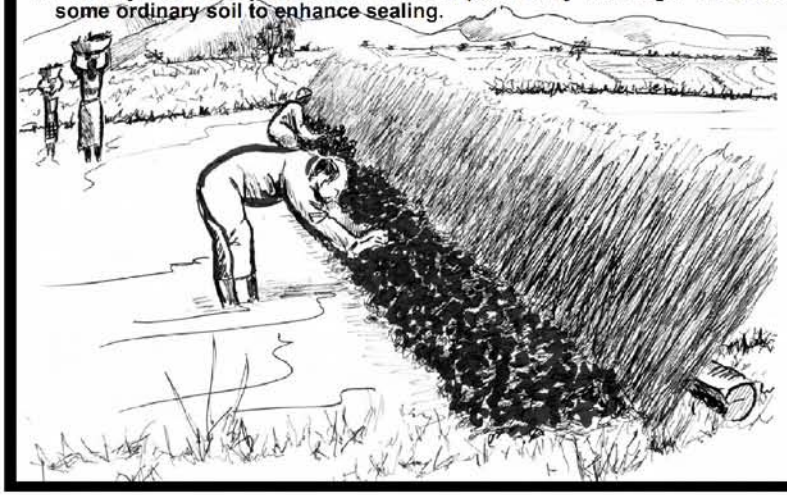
2. Put sizable tree or bamboo logs across the big tree log on an inclined position to the upstream. The inclination should be about 60-70 degrees from the ground.



3. After completing the tree logs or the bamboo logs as in the second illustration, put grass cover on top, and throw clay soil underneath to minimize water leakage.



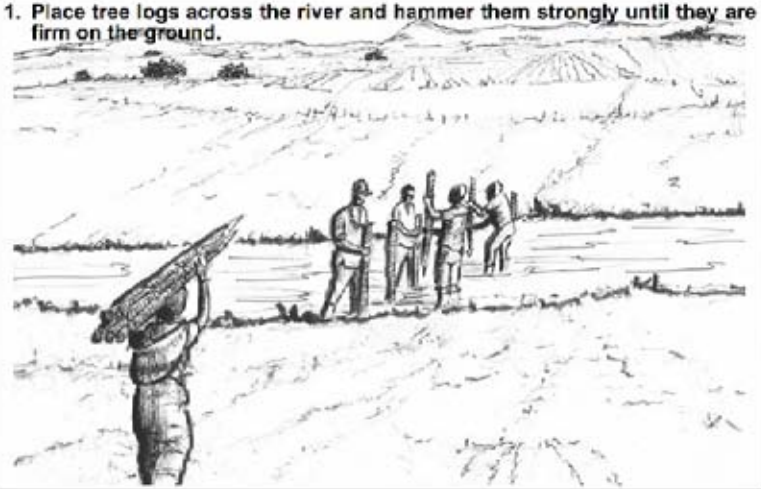
4. Put clay soil on top thereafter and compact firmly with legs. Then add some ordinary soil to enhance sealing.



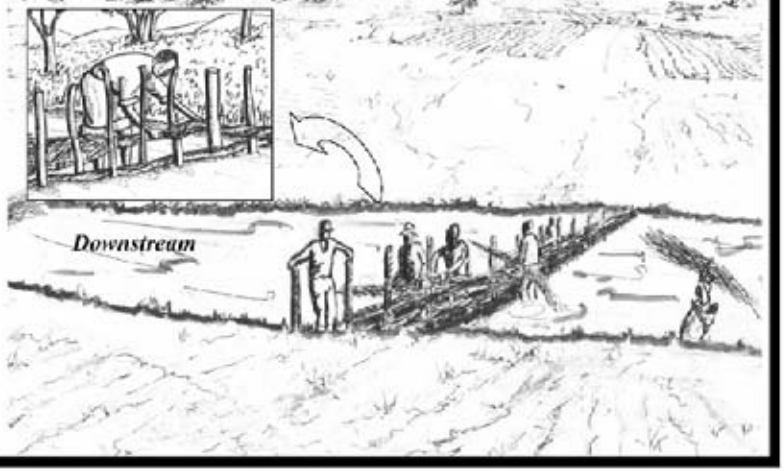
COMMUNITY-BASED SMALLHOLDER IRRIGATION SCHEME No.2/4

Promote Irrigation as a Part of the People's Culture !!! Single-Line Type Where Stream is Wide

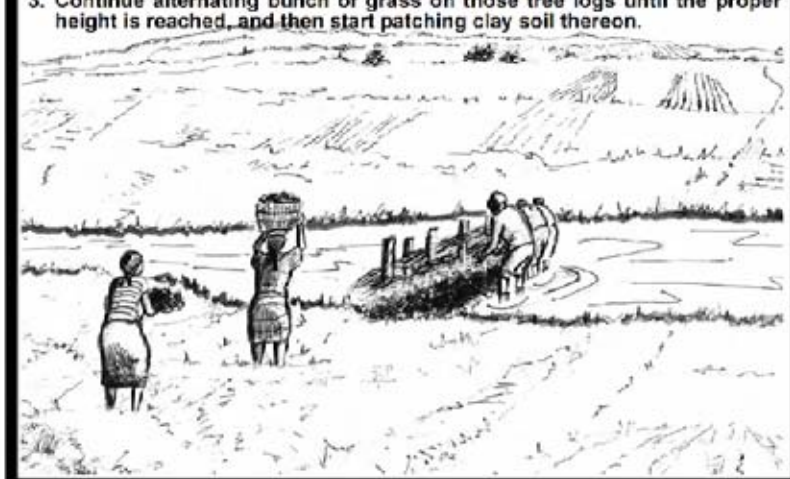
1. Place tree logs across the river and hammer them strongly until they are firm on the ground.



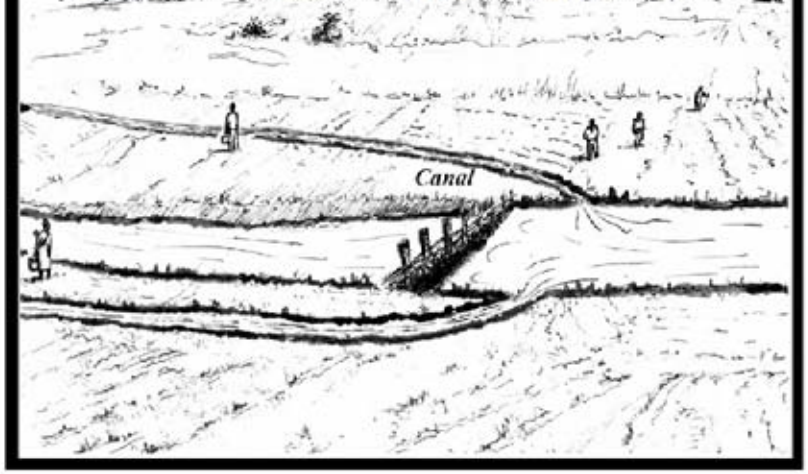
2. Alternate a bunch of grass on the tree logs: this is just to weave the grasses through the tree logs driven into the river foundation.



3. Continue alternating bunch of grass on those tree logs until the proper height is reached, and then start patching clay soil thereon.



4. Patch clay soil on the grass woven wall, starting from the foundation, going upwards, and then place soils thereon to minimize the leakage.

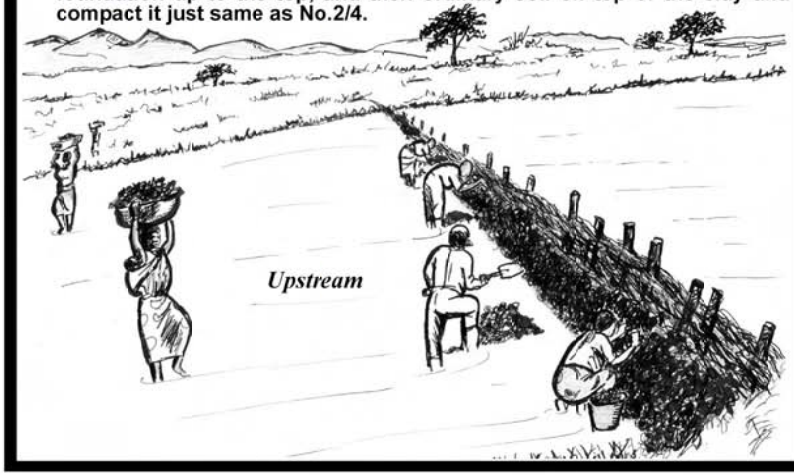


COMMUNITY-BASED SMALLHOLDER IRRIGATION SCHEME No.3/4

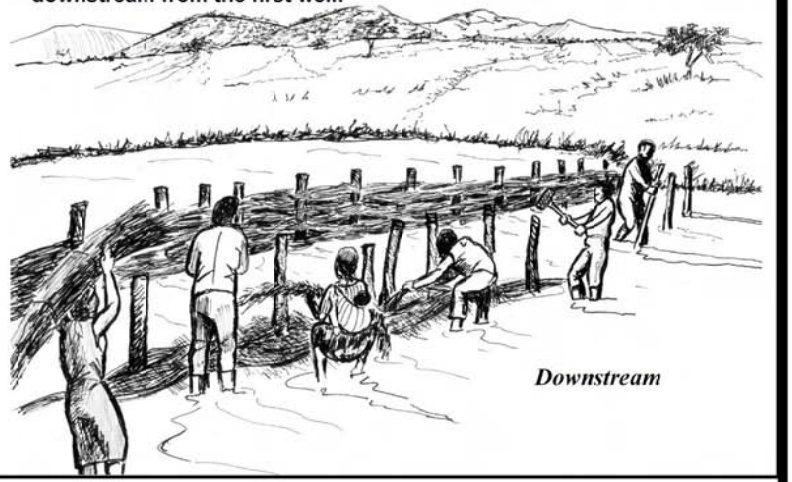
Promote Irrigation as a Part of the People's Culture !!! Double-Line Type to Minimize Leakage

1. Place and drive tree logs across the river and alternate a bunch of grass within these trees, just as shown in No.2/4.

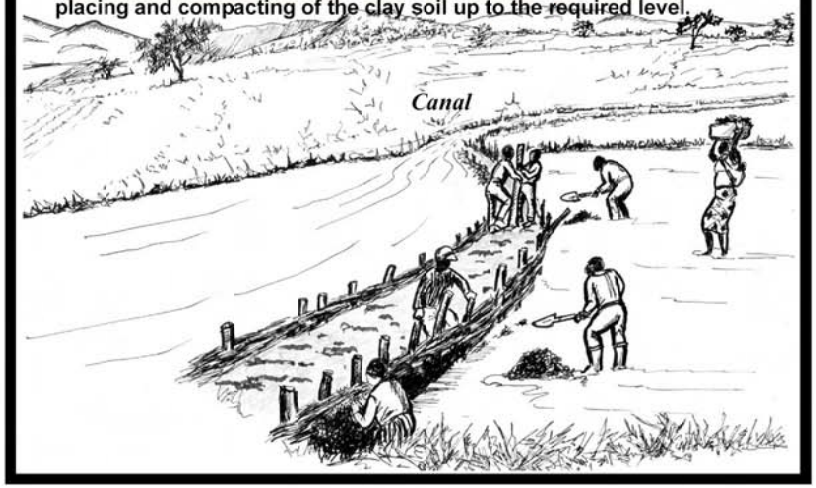
2. After completing putting grass alternately, put clay soil starting from foundation up to the top, and then ordinary soil on top of the clay and compact it just same as No.2/4.



3. Make another line of tree logs woven with grasses about 70 - 150 cm downstream from the first weir.



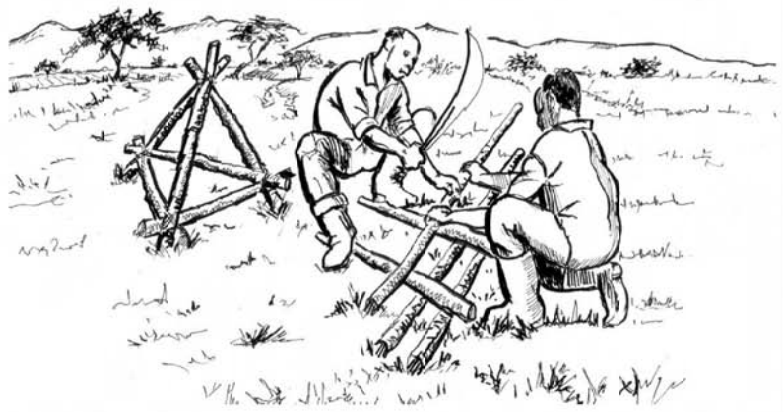
4. Place clay soil between the weirs and compact it, and continue the placing and compacting of the clay soil up to the required level.



COMMUNITY-BASED SMALLHOLDER IRRIGATION SCHEME No.4/4

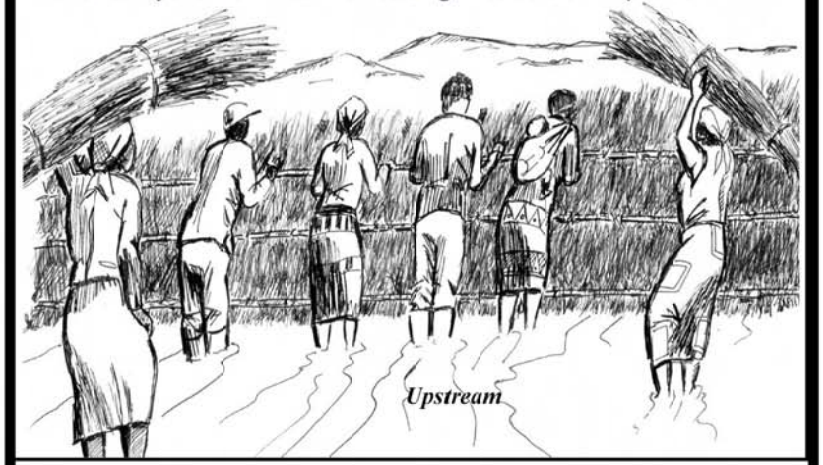
Promote Irrigation as a Part of the People's Culture !!! Trigonal Type on Rock Foundation

1. Cut tree or bamboo logs to a required size, depending on the height, which we want to tap water. Then construct number of trigonal stand structures depending on the width of the river.



2. Place these trigonal stands across the river, and connect them by using horizontal members and tying them firmly. Then start putting grasses on the horizontal members.

3. Continue putting the grass on top of the horizontal members and put another layer of horizontal members again to tie them in position.



4. Place clay soil on top of the grass firmly starting from the bottom up to the required level.