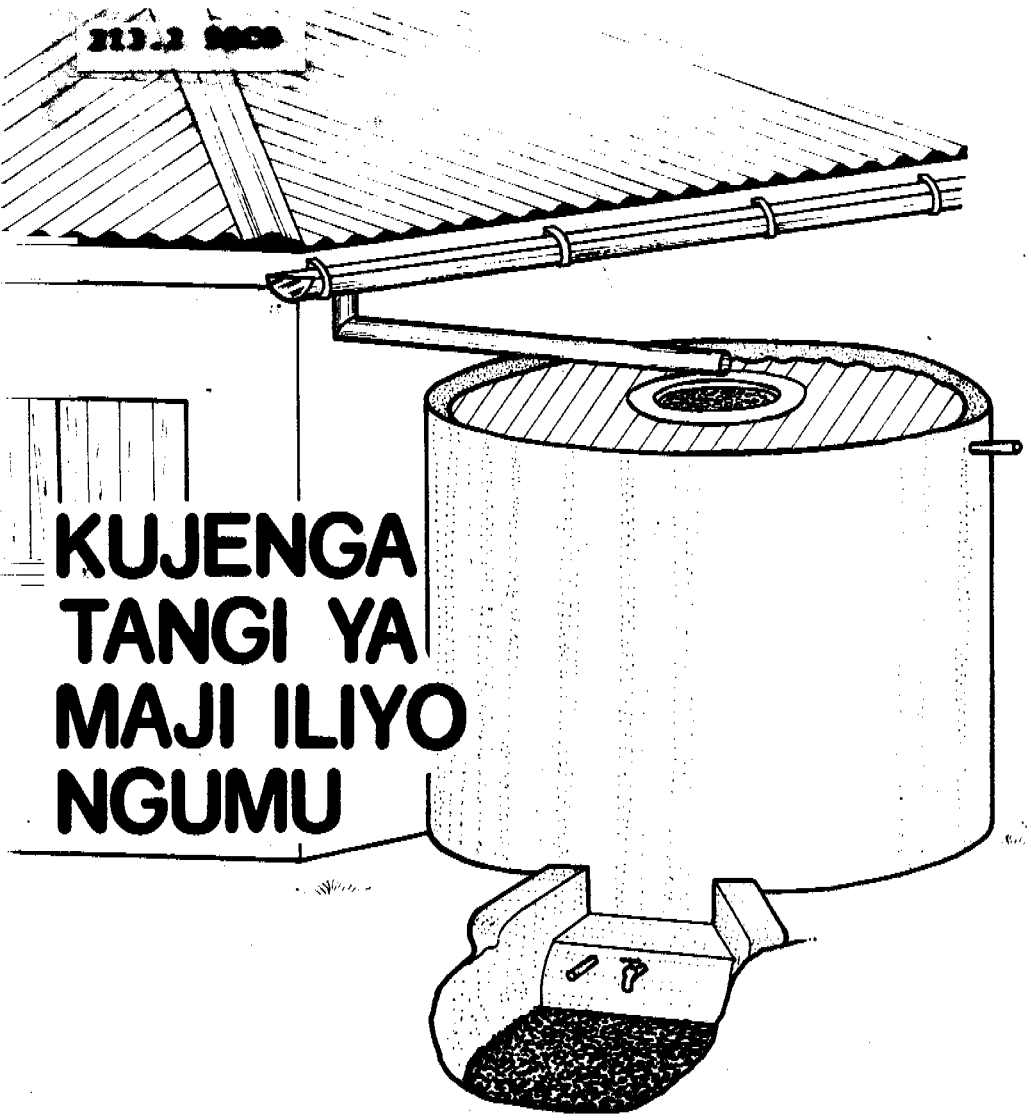
CONSTRUCTING THE REINFORCED WATER TANK



KUJENGA TANGI YA MAJI ILIYO NGUMU

INTRODUCTION

WATER

Hundreds of millions of people need safe drinking water. Much depends on efforts to better inform people on what they can do and how to make the best use of available water.

How community participation arises is debatable, but certainly if people and governments wait for each other to act, all may have to wait a long time.

A 1975 survey found women in rural areas spent more than 20 percent of their time in collecting water. Although the distance to water supplies has been nearly cut in half, some people still are several kilometres away form a water source. The key slogan for water projects, to cut down this distance, has become "we have made it ourselves!"

This booklet shows how communities can respond with building cheap and durable rain harvesting or water catchment tanks, thus providing clean water for drinking, cooking, irrigation etc.

UTANGULIZI

MAJI

Maelfu ya mamia ya watu wanahitaji maji safi ya kunywa. Mengi sana hutegemea juhudi ya kufahamisha watu vile wanaweza kufanya na kutumia vizuri maji yanayopatikana.

Jinsi jamii ushiriki yaweza kujadiliwa. Lakini, bila shaka, ikiwa watu na serikali watangojeana kufanya, yote yaweza kungojea kwa muda mrefu.

Ukaguzi wa 1975 ulionyesha wanawake vijijini wanatumia zaidi ya 20 kwa mia ya masaa yao kuchota maji. Hata ingawa umbali wa sehemu (pahali) maji yapatikana imepunguzwa kwa nusu, watu wengine bado wako mbali na chemchemi ya maji. Msemo muhimu wa miradi ya maji, kupunguza huu wrefu, imekuwa "Tumefanya sisi wenyewe".

Kijitabu hiki kinaonyesha vile jamii yaweza kuitikia kujenga matangi rahisi na ya kudumu ya kunasa maji ya mvua, ili kujipatia maji safi ya kunywa, kupika, kunyunyizia n.k.

Equipment, Materials and Aids you will need:

Quantity	Items/Description
15	Bundles of flexible sticks, approx. 7' x 0.5".
0.5 ton	of big rocks for the foundation.
1.5 ton	of small rocks (gravel) for the foundation.
4 ton	of sand.
15	Bags of cement
3 kg.	of waterproofing for cement.
5 kg.	Strap wire (or 8' x 4' x 2 mesh wire), for foundation reinforcement.
60 mtr.	Reinforcement wire, GI, gauge 8.
1	Timber, 16' x 2" x 4", to support the roof.
2	Iron sheets, 3 metres, gauge 30.
1	Drainage pipe, threaded, 1.5' x 2" Ø.
1	Cap for drainage pipe, threaded, 2" Ø.
1	Lockable tap, 0.5" Ø.
1	Socket for tap, 1" Ø.
1	Pipe, threaded, 1.5' x 1" Ø.
1	Plastic pipe, 1' x 2" Ø, for the overflow.
0.5 kg.	Roofing nails.
1	Hammer.
1	Woodsaw.
1	Hacksaw.
1	Tin snip.
1	Pruning shears.
2	Ladders, 8' long.
2	Wheelbarrows.
2	Shovels.
2	Forkjembes.
1	Wire cutting pliers.
1	Tape measure.
10 mtr.	Rope
2	Trowels.
4	Basins.
1	Sand sifter.
1	Water level.
1	Plumbline.
1	Panga

Zana (vyombo), vifaa na misaada utahitaji

Vifaa/maelezo	Kiasi
Vifurushi vya vijiti vya kupindika makisio (futi 7xØ inchi 0.5)	15
Miamba kwa msingi	nusu tani
Mawe ndogo kwa msingi	nusu tani
Changarawe (mchanga)	tani 4
Mifuko ya simiti	15
Simiti isiyopenyeza maji	kilo 3
Waya (au wire mesh mbili) kiasi futi 8xfuti 4, wa kuongeza msingi nguru	kilo 5
Waya wa kuongeza nguvu, (Gl geji 8)	mita 60
Mbao, futi 16xinchi 2xinchi 4, kusaidia paa	1
Mabati mita 3, geji 30	2
Mfereji kuondolea uchafu, uliotiwa nyuzi, futi 1.5xØ futi 2	1
Kifuniko cha mfereji wa ondoleo, kilichotiwa nyuzi Ø inchi 2	1
Mfereji unaoweza kufungwa Ø inchi 5	1
Soket ya mfereji Ø inchi 1	1
Mfereji unao nyuzi futi 1.5xØ inchi 1	1
Mfereji wa mpira futi 1xØ inchi 2	1
Misumali ya kuezeka	nusu kilo
Nyundo	1
Msumeno wa mbao	1
Msumeno wa chuma	1
'Tin snip'	1
'Pruning shears'	1
Ngazi, futi 8 urefu	2
'Wheelbarrow'	2
Miko	2
Uma (jembe)	2
Utepu wa kupimia	1
Plaisi ya kukata waya	1
Kamba	mita 10
Vijiko vya kujengea	2
Nungi ya changarawe	1
Karai	4
'Water level'	1
'Plumbline'	1
Panga	1

WORKSCHEDULE

DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
MATERIALS ON SITE	CEMENT FOUNDATION	PLASTER OUTSIDE	PLASTER INSIDE & OUTSIDE	PLASTER INSIDE & OUTSIDE WITH SMOOTH LAST LAYER	NIL LAYER INSIDE & FINISH BOTTOM	MAKE ROOF
BASKET FINISHED	PLACE STRAPS					
DIG FOUNDATION AND FILL WITH CORE	PLACE BASKET		MAKE WALLS STRAIGHT			
	PLASTER					

ORODHA YA KAZI

SIKU 1	2	3	4	5	6	7
VIFAA KWENYE PAHALI PA KUJENGEA	*MSINGI WA SIMITI*	*WEKA PLASTA UPANDE WA NJE WA UKUTA*	*KANDIKA NDANI NA NJE*	*WEKA PLASTA NDANI NA NJE KWA SIMITI LAINI YA MWISHO*	*PAKA 'NIL' (SIMITI MAALUM ISIVOPE-NYEZA MAJI) NDANI NA MALIZA CHINI*	*TENGE-NEZA PAA*
KIKAPU KUMALI-ZIKA	*WEKA GUZO*		*ZIFANYE KUTA KUWA WIMA*			
CHIMBA MSINGI, NA JAZA MAWE	*WEKA KIKAPU*					
	WEKA PLASTA					

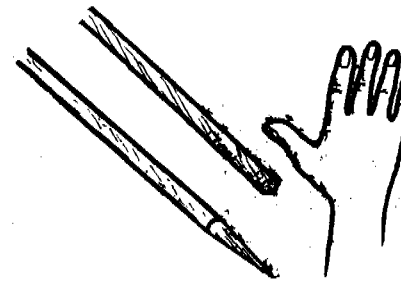
STEPS OF WORK

HATUA ZA KAZI

WEAVING THE BASKET

KUSHONA KIKAPU

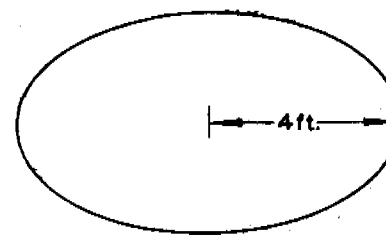
1. Select straight strong sticks as thick as your thumb for the vertical frame. Sharpen the end of each stick.



1. *Chagua vijiti nzito zilizonyoka, ukubwa kama gumba la mkono, za kusimama.*

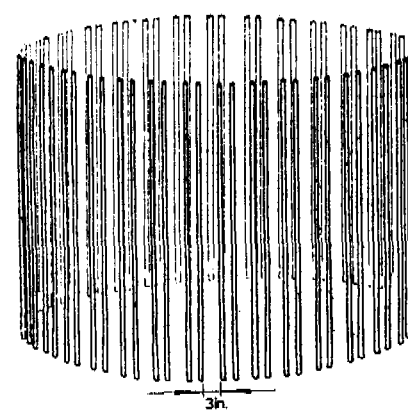
   Zitie ncha upande mmoja

2. Measure a circle of 4 feet radius on the ground, there where you will weave the basket.



2. *Pima duara ya futi 4 kutoka katikati pahali utashonea kikapu.*

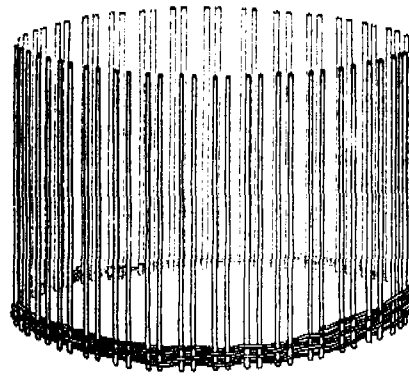
3. On the circumference of the circle, pin two sticks 4-6 feet long each 3 inches from the next pair.



3. *Kwenye duara hiyo, pigilia vijiti viwili futi 4-6 urefu kila moja umbali wa inchi 3 kutoka kwenye jozi lingine.*

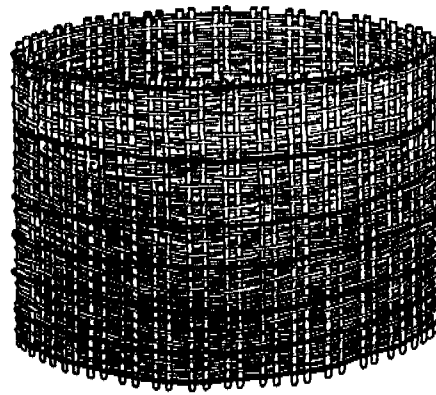
4. Start weaving at the bottom with thin flexible sticks. While weaving upwards tie a string around the basket every foot to prevent it from sagging.

4. *Anzia kushona kutoka chini na vijiti vyembamba zinazokunjika. Wakati unaendelea kushona juu, funga uzi kuzunguka kikapu kila futi ili kikapu kisipindike.*



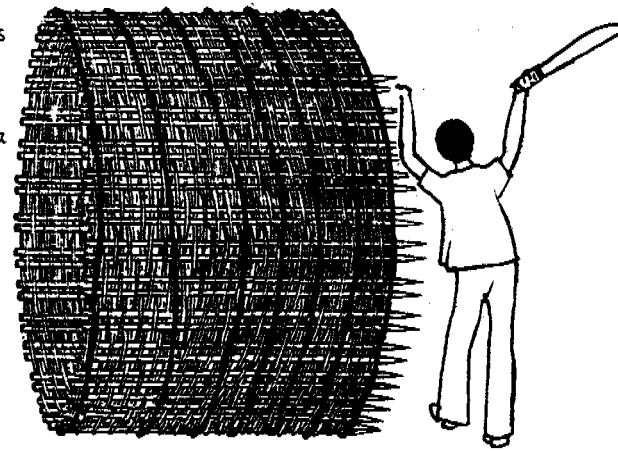
5. When the basket is 6 feet high, tie reinforcement wire around the bottom and the top of the tank. Then tie three more reinforcement wires around the lower half of the tank, and one reinforcement wire around the upper half of the tank.

5. *Wakati kikapu kiko futi 6 juu, funga waya wa kusaidia kuzunguka chini na juu ya tangi. Tena, funga waya tatu zingine katikati sehemu ya chini ya tangi na moja katikati ya sehemu ya juu ya tangi. (Angalia mchoro)*



6. Lift the basket from the ground and trim the sticks at the base.

6. *Inua kikapu kutoka chini na kata ncha za vijiti.*

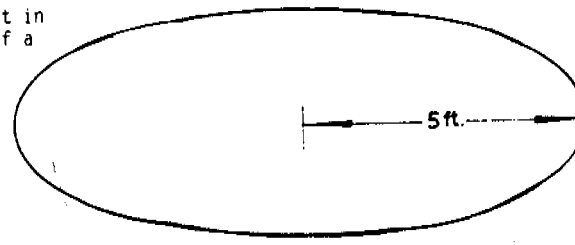


DIGGING THE FOUNDATION

KUCHIMBA MSINGI

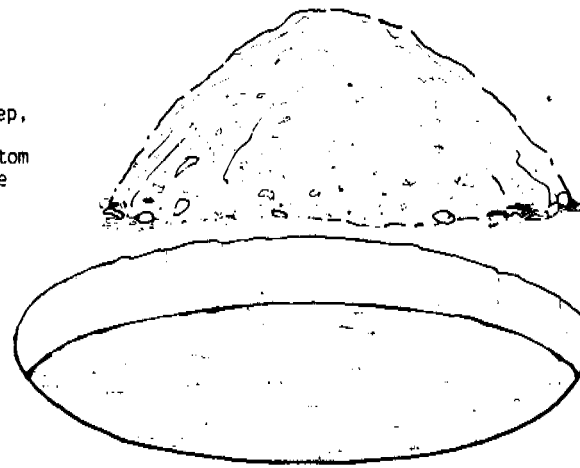
7. Measure a circle 5 feet in radius at the corner of a metal or tile roofed building.

7. *Pima duara ya futi 5 kutoka katikati kwenye kona ya mjengo wa paa ya mabati au tofali (tiles).*



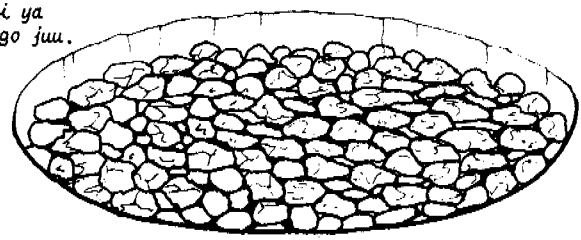
8. Dig at least 1.5 feet deep, but make sure that the distance between the bottom of the foundation and the roof is at least 9 feet.

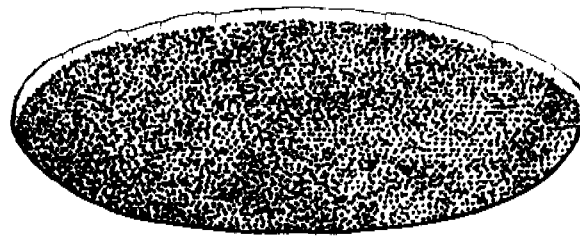
8. *Chimba futi moja na nusu chini, lakini hakikisha urefu kutoka chini ya msingi na paa isipungue futi tisa (9).*



9. Place big rocks in the foundation.
Add gravel on top.

9. *Weka miamba ya mawe ndani ya msingi. Ongeza mawe ndogo juu.*





10. Mix 9 wheelbarrows of small rocks,
6 wheelbarrows of sand,
2 bags of cement,
1 handful fo waterproofing.

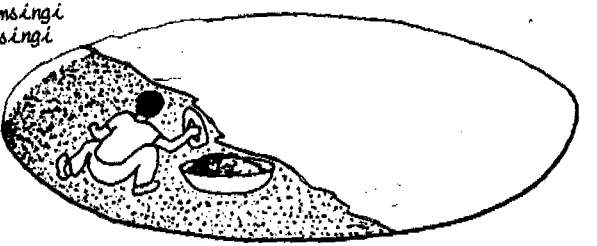
Mix without water until the mixture has a uniform colour. Then add just enough water to make the mixture workable. The mixture should not be shiny, this means that you added too much water.

10. *Changanya: 'wheelbarrow' tisa (9) za mawe ndogo,*
'wheelbarrow' sita (6) za changarawe,
mifuko 2 ya simiti
mkono 1 ya simiti maalum isiyopenyeza maji

Changanya bila maji mpaka mchanganyiko uwe sawa kwa rangi. Basi ongeza maji kiasi ili mchangangiko uwe unaweza fanya kazi. Mchanganyiko usiwe laini sana, hii ni kuonyesha umeongeza maji zaidi.

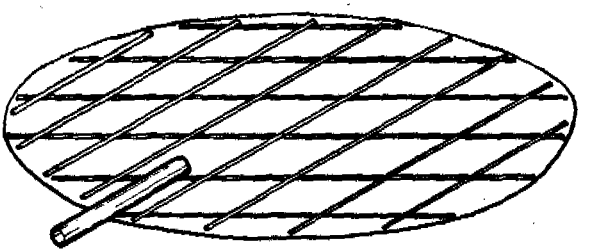
11. Put the concrete mixture in the foundation, and make sure the floor of the foundation is level.

11. *Weka mchanganyiko kwenye msingi na uhakikishe sakafu ya msingi ni 'level' (bila bonde).*



12. Spread the strap wires on the foundation in a rectangular pattern. Place the big drainage pipe on top of the foundation.

12. *Tandika waya wa kuongeza msingi nguvu (strap wires) juu ya msingi kama mchoro wa 'rectangle'. Uweke mfereji mkubwa wa kupitisha maji chafu juu ya msingi.*



13. Mix 3 wheelbarrows of small rocks,
3 wheelbarrows of sand,
1 bag of cement,
1 handful of waterproofing.

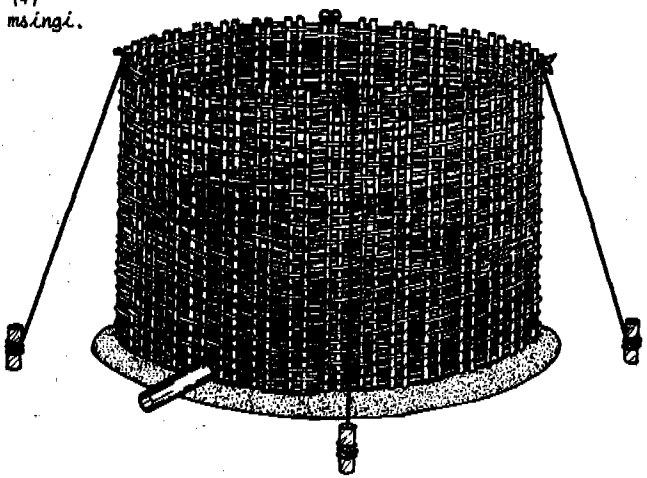
Mix thoroughly again (first mix dry) and add the cement on to the foundation.
Level the floor of the foundation again.

13. Changanya: 'wheelbarrow' tatu (3) za mawe ndogo,
'wheelbarrow' tatu (3) za changarawe,
mfuko moja wa simiti
mkono moja wa simiti maalum
isiyopenyeza maji

Changanya tena iwe sawa (kwanza bila maji) na uongeze mchanganyiko kwenye msingi. Tandaza kwenye msingi iwe lebo (level).

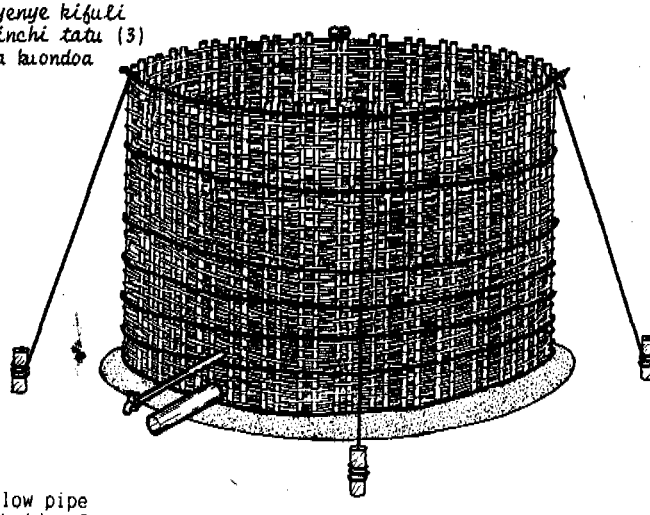
14. Install the basket, balance it and tie it with 4 ropes to install it firmly on the foundation.

14. Imia kikapu na uweke juu. Iweke isimame wima halafu ifunge na kamba nne (4) kuisimamisha kwenye msingi.



15. Stick the pipe with the tap on it through the basket, 3 inches above the drainage pipe.

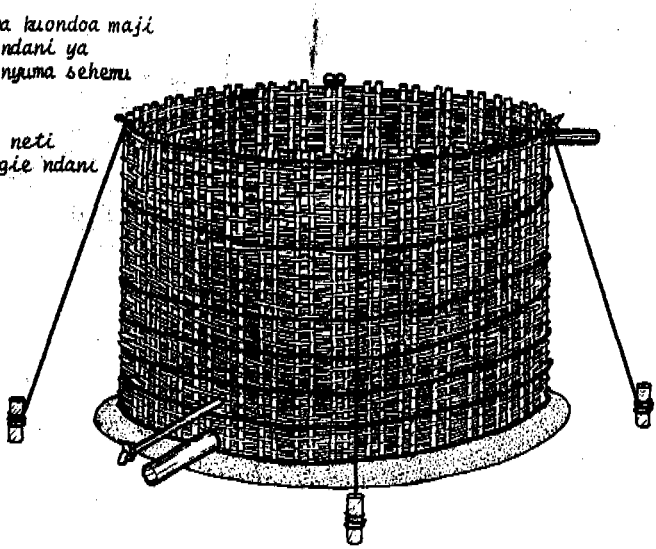
15. *Penyeza mfereji yenye kifuli ndani ya kikapu inchi tatu (3) juu ya mfereji wa kuondoa uchafu.*



16. Stick the overflow pipe through the backside of the basket at the highest point. Cover the overflow pipe with mosquito screen to prevent mosquitos from entering.

16. *Penyeza mfereji wa kuondoa maji yaliopita kiasi, ndani ya kikapu upande wa nyuma sehemu ya juu kabisa.*

Funika mfereji na neti kuzuia mbu yasiingie ndani ya tangi.

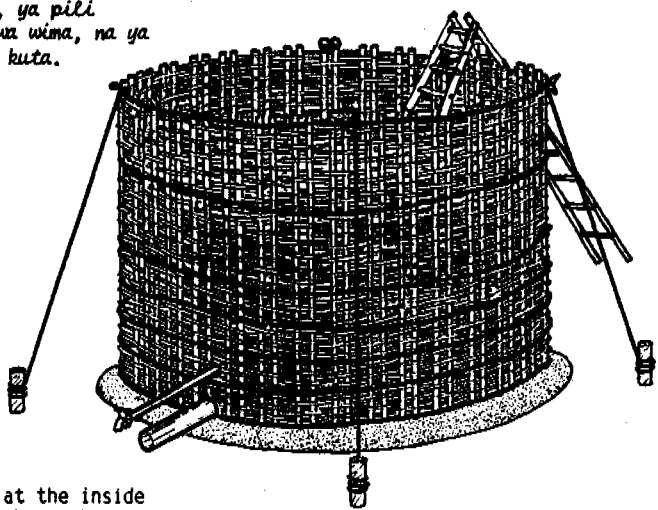


PLASTERING THE BASKET

KUKANDIKA KIKAPU

17. The tank will have three layers of cement on the inside, and three layers on the outside. The first layer to cover the basket, the second layer to make the walls straight, the third layer to make a smooth surface.

17. *Tangi itakuwa na safu tatu za simiti ndani, na safu tatu nje. Safu ya kwanza ni ya kufunika kikapu, ya pili kufanya kuta kuwa wima, na ya tatu kulainisha kuta.*

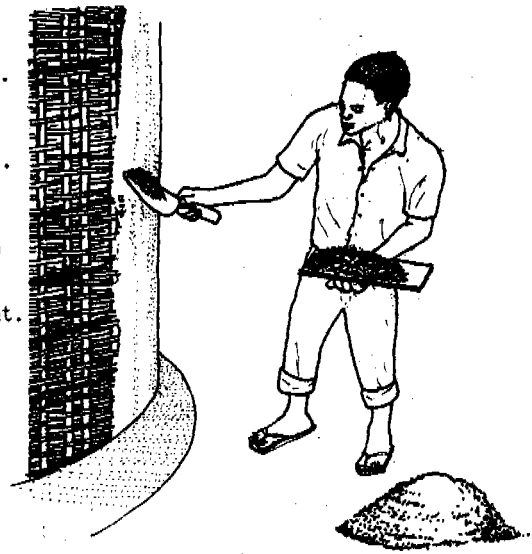


18. Place a ladder at the inside and outside of the tank, so the fundi can enter and exit the tank without touching the walls.

18. *Iweke ngazi ndani na nje ya tangi, ili fundi awe anaweza kuingia na kutoka bila kuuguza kuta za tangi.*

19. For each layer of cement,
mix 3 wheelbarrows of sand,
1 bag of cement,
1 handful of waterproofing.

Mix thoroughly, and make sure not to add too much water. Start plastering on the inside. After that, plaster the outside. Continue plastering inside and outside, until there are three layers on both sides.
Give the top of the tank a slant away from the water inlet.

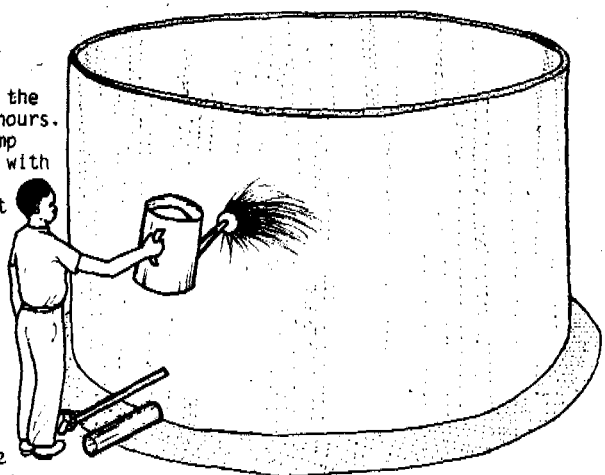


19. *Kwa kila safu ya simiti, changanya 'wheelbarrow' tatu za changarawe, mfuko moja wa simiti, mkono moja wa simiti maalum isiopenyeza maji.*

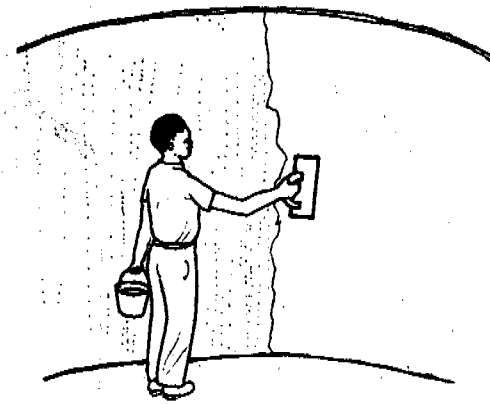
Changanya iwe sawa, usiongeze maji zaidi. Anza kukandika ndani. Baadaye kandika nje mpaka kiwe na safu tatu kila upande.

Inamisha sehemu ya juu ya tangi kitoka upande maji itaingilia.

20. After each layer, allow the cement to dry for four hours. Then keep the cement damp by gently sprinkling it with water. Never allow the cement to dry to a light grey colour to prevent cracks.

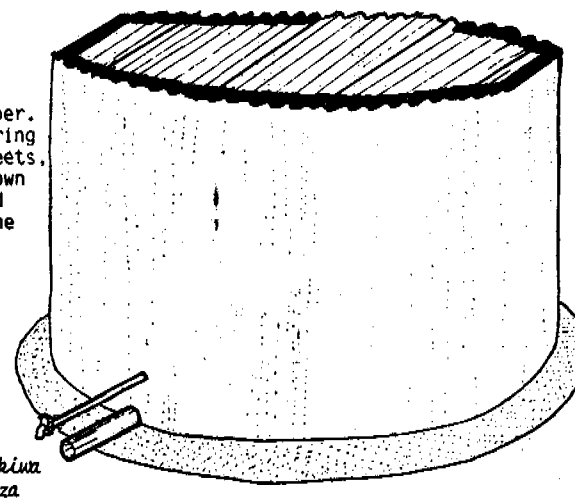


20. *Baada ya kila safu, iache simiti ikauke kwa masaa manne. Halafu fanya simiti kuwa majimaji kwa kunyunyizia maji. Usiache simiti kukauka kuwa rangi ya 'grey' ili isipasuke.*



21. After finishing all the layers, make a nil mixture. Mix half a bag of cement and half a kilo of waterproofing with an equal amount of water and coat the inside of the tank with this. Press this final coat on firmly with a steel trowel.

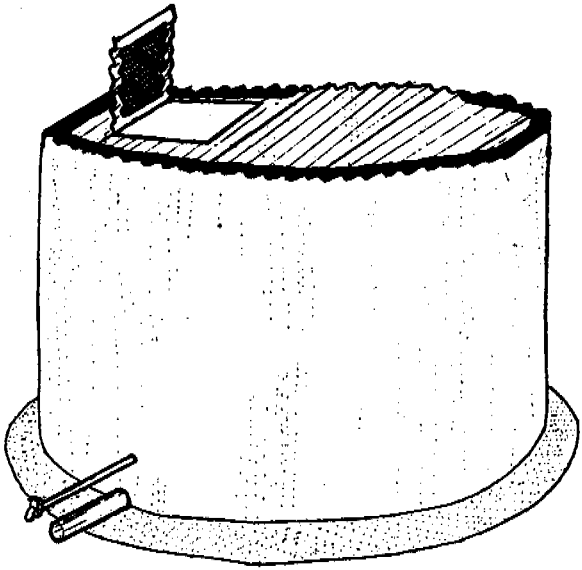
21. *Baada ya kumaliza safu zote, tengeneza simiti laini 'nil' changanya mfuko nusu wa simiti na nusu kilo ya simiti maalum isiopenyeza maji na ipake ndani ya tangi. Shindilia pako ya mwisho kwa nguvu ukitumia kijiko cha kujengea cha mabati (steel trowel).*



22. Put the iron sheets on the tank, supported by the timber. Construct a three quarter ring of cement on top of the sheets, so the roof will not be blown off the tank. The open end of the ring should be at the lowest side of the tank.

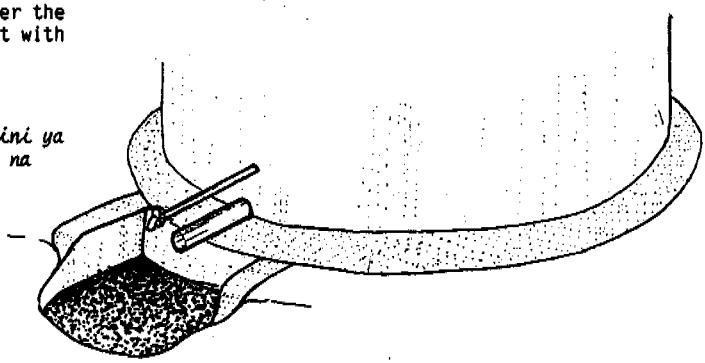
22. *Weka mabati juu ya tangi, ikiwa imelaliwa na mbao. Tengeneza robo tatu ya mviringo wa simiti juu ya mabati, paa isibebwe na upepo. Acha pengo wa huu mviringo sehemu ya chini ya paa ili maji ya mvua iteremke chini.*

23. Make a hole in the roof for the water to come in. The hole should be big enough so that a man can enter the tank to clean it. A simple filter will prevent mud, leaves and other contaminations from entering the tank.



23. *Tengeneza shimo ndani ya paa ili maji yaingie ndani. Ni lazima shimo iwe kubwa kiasi ili mtu aweze kuingia wakati wa kusafisha tangi. Kichungu rahisi itazuia matope, matawi na ambukizo nyingine kuingia ndani ya tangi.*

24. Dig a hole under the tap and fill it with gravel.



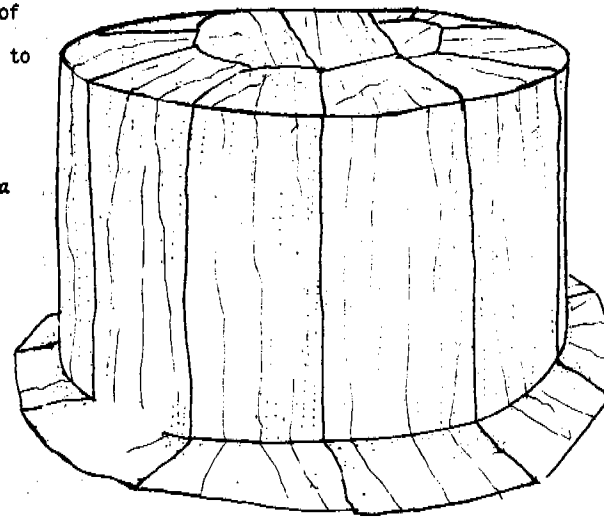
24. *Chimba shimo chini ya mfereji na jaza na mawe ndogo.*

25. After finishing keep the inside and the outside of the tank damp for at least four weeks, to prevent cracks.

25. *Ukimaliza, nyunyizie maji ndani na nje ya tangi ndani kwa muda wa wiki nne, kuzuia tangi kuwa na nyufa.*

26. Covering the outside of the tank with plastic sheets or cloth helps to prevent the tank from drying too fast.

26. *Kufunika nje ya tangi kwa karatasi ya plasti au kitambaa husaidia tangi kukauka haraka.*



REPAIR OF CRACKS

Structural cracks, when they occur, usually appear the first time the tank is full of water. They can be repaired as follows:

1. Chisel away all plaster within 15 cm. of the crack.

2. Coat the area with nil. (1 part cement, 1 part water).

3. Fill the area with plaster (1 part cement, 3 parts sand). The plaster should be well mixed and only have enough water added to be able to work it. It should not be shiny.

4. Coat the area with nil and press it on with a steel trowel.

5. Keep it damp for at least four weeks.

CARE FOR THE TANK.

1. Always clean the roof, guttering and tank well before the rains start.

2. When the rains start, divert the first water outside the tank, to ensure absolute cleanness.

3. If you notice any cracks, repair them immediately.

4. Use a simple filter (e.g. made from mosquito screen) to prevent dirt from entering the tank.

KUREKEBISHA NYUFA

Nyufa hutokea tangi ikiwa imejaa maji mara ya kwanza.
Nyufa hurekebishwa kwa njia ifuatayo:

1. *Ondoa plasta zote sehemu ya ufa kiasi ya sentimeta 15 ukitumia patasi.*

2. *Paka sehemu hiyo na simiti maalum isiyopenyeza maji (nil) (upande moja simiti, upande moja maji).*

3. *Weka plasta katika sehemu zote (upande moja simiti, pande 3 mchanga). Ni lazima plasta iwe imechanganywa vizuri na iwe na maji ya kutosha iwezeshe kutumiwa vizuri.*

4. *Paka sehemu hiyo na simiti maalum isiyopenyeza maji (nil) na gandamiza na kijiko cha kujengea cha mabati (steel trowel).*

5. *Nyunyizia maji kwa muda wa majuma manne.*

UTUNZAJI WA TANGI (KUWEKA TANGI VIZURI)

1. *Safisha paa ya tangi, 'guttering' na tangi yenyewe kila wakati kabla mvua kunyesha*

2. *Mvua ikianza kunyesha elekeza maji ya kwanza nje ya tangi ili kuhifadhi usafi.*

3. *Ukigundua ufa rekebishe haraka.*

4. *Tumia kichungi kwa kuzuia uchafu usiingie kwa tangi.*

APPENDIX

HOW TO PREVENT THE TANK FROM CRACKING

1. Store the cement on a platform, covered in a shed, protected from moisture.
2. Make sure there are no lumps in any of the cement you use. If lumpy cement is used it's amount should be increased by half.
3. Sift the sand before you use it, to ensure it is clean.
4. Mix cement and sand thoroughly, until the mixture is all one colour, before adding water.
5. Use clean water for the plaster.
6. Make the plaster fairly dry, add just enough water to make it stick together.
7. Do not mix more plaster than can be used in one hour.
8. Trowel the final coat of plaster on smooth.
9. Press the final coat of nil on firmly with steel.
10. Make sure there are no parts of the reinforcement wire protruding through the plaster.
11. Splash the tank with water four hours after each coat of plaster or nil, cover the tank with plastic sheeting, and keep it moist, never allow the cement to dry to a light grey colour until after at least four weeks.

JINZI YA KUZUIA TANGI ISIWE NA NYUFA

1. *Weka simiti kwenye jukwa ikiyo ndani ya nyumba, ili kuzuia maji kuharibu simiti.*
2. *Hakikisha ya kuwa simiti haijashikana. Simiti/ikishikana kiasi chake lazima iongezwe kwa nusu.*
3. *Chunga mchanga kabla kutumia kuhakikisha ni safi.*
4. *Changanya simiti na mchanga uone iko sawa kabla kutia maji.*
5. *Tumia maji safi kwa plasta*
6. *Plasta isiwe maji maji ili ishikamane vizuri*
7. *Usichanganye plasta nyingi ambayo yaweza kutumiwa kwa muda wa zaidi ya saa moja.*
8. *Weka pako ya mwisho ya plasta ukitumia troweli.*
9. *Gandamiza pako ya wisho ya 'nil' ukitumia troweli.*
10. *Hakikisha waya haitoki kwa plasta.*
11. *Nyunyizie tangi maji masaa manee baada ya kila pako ya plasta au 'nil'. Funika tangi na karatasi ya plastik na unyunyizie maji. Usiache tangi ikauke iwe 'grey' mpaka baada ya wiki nne.*

THE REPLICATION PROJECT

MARAGUA RIDGE MIKIGI ROOF-CATCHMENT (RAIN HARVESTING) WATER PROJECT

In 1981, 35 women of the Maragua Ridge Women's Group, Nginda Location, Murang'a District, visited the Kandara Self-help Project to see which projects they were doing. They found the women of this area focusing their attention on a water project building tanks with local materials and were intrigued into doing likewise. So far they have built 27 tanks.

The 35 families each contribute 10 shillings every week to the collective fund. The family who will have the tank is decided by the regularity of contributions and the drawing of names. They appointed an Administration Officer and a committee for finances. Every three months a name is drawn and that person receives the tank money but are helped by all to build the tank. The tank is built over three days of group labour with one fundi employed to help with plastering. This method of collective effort is sometimes called Merry-go-round or Mabati Groups. In Murang'a the people use the local Migigi tree, which is thin and flexible, for the tank frame.

UENEZI WA PROJECT

MARAGUA RIDGE MIKIGI ROOF-CATCHMENT (RAIN HARVESTING) WATER PROJECT

Mnamo mwaka wa 1981, wakina mama 35 wa kikundi cha Maragua Ridge katika sehemu ya Nginda (wilaya ya Murang'a), walitembelea kikundi cha kujisaidia ya Kandara, kujionea ni kazi gani hicho kikundi kilikuwa kinafanya.

Waligundua wakina mama wa eneo hilo walikuwa wanaelekeza nia zao juu ya mpango wa maji kwa kujenga matangi kwa kutumia vifaa za urahisi na kwa hivyo waliamua kufanya hivyo hivyo.

Kila wiki jamii 35 huchanga shillingi 10 kila moja. Jamii hupata tangi kulingana na vile wanatoa mchango. Wanachagua afisa wa kusimamia kazi na kamiti ya pesa. Baada ya miezi tatu mtu hupata pesa za ujenzi wa tangi na husaidiwa na wenye kikundi kujenga tangi. Tangi huchukuwa siku tatu kujengwa na wenye kikundi wakisaidiwa na fundi moja wa kuweka plasta. Mtindo huu wa kufanya kazi pamoja huitwa "Merry-go-round" au "Mabati Groups". Katika Murang'a watu hutumia miti aina ya migigi ambayo ni nyembamba na ni rahisi kwa kutengeneza fremu ya tangi.

THIS MANUAL IS THE RESULT OF A CO-OPERATIVE PROJECT OF THE

INTERNATIONAL LABOUR ORGANIZATION
(SKILL DEVELOPMENT FOR SELF RELIANCE PROJECT)

AND THE

INSTITUTE OF CULTURAL AFFAIRS (ICA)
P. O. Box 21679, NAIROBI, KENYA

Printed by Afropress Ltd., Lusaka Close, P.O. Box 30502, Nairobi.