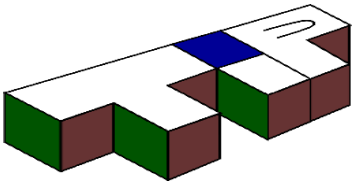


TRADITIONAL IRRIGATION & ENVIRONMENTAL DEVELOPMENT ORGANIZATION

TERRACES

- BENCH TERRACES
- FANYA JUU
- STONE TERACES

MATUTA

- MATUTA YA NGAZI
- FANYA JUU
- MATUTA YA MAWE

BENCH TERRACES

Bench terraces are level or nearly level steps constructed on the contour and separated by embankment known as risers. They can be formed by excavation or developed from a fanya juu.

Terrace.

Main function of the bench terraces are:

- Control of erosion by reducing the slope of the cultivated land.
- Increasing the infiltration of rain water
- Eases farm operation like weeding, spraying etc.
- Keeps soil fertility (no erosion)
- Allows improved water management (basin irrigation)

Disadvantages of bench terraces as compared to the fanya juu is more labour intensive.

Labour requirement

slope	Riser heigth	Bench width	Length bench/acre	Labour required man days per acre	Area of riser as % of total area
%	meter	meter	meter	Man Day/acre	%
20	1	4.5	800	150	
30	1	2.8	1200	140	15
40	1	2.0	1600	133	20
20	2	10.0	400	300	10
30	2	6.7	600	2290	15
40	2	5.0	800	265	20
50	2	4.0	1000	250	25

Source: SWC Manual for Kenya

Bench terraces can be used in areas with:

- Slopes up 55 percent (30^{o})
- Deep soils (minimum soil depth 1.5 meter)
- Stable siols (clay loam, slity clay)

Risk:

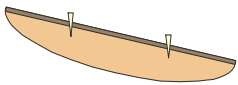
Construction of bench terraces on steeper slopes than 55 percent and in areas with shallow soil can lead to landslides due to the water pressure of infiltrated rainwater.

CONSTRUCTION OF BENCH TERRACES

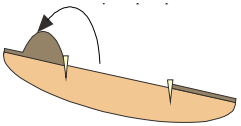
For the design and construction of bench terraces, skilled labour is required. In the areas where TIP is operating, Village technicians are trained in the constructing of bench terraces. Please contact the Village technician or the district technician for assistance.

Construction of bench terraces include the following steps:

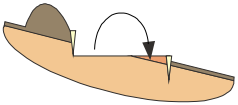
After the construction, the embankment have to be stabilized with



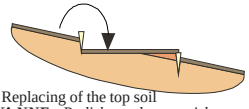
STEP 1 - Put pegs on the contour lines
HATUA YA KWANZA *- Weka/pigilia mambo kufuata kontua*



STEP 2 - Throw the fertile top soil up hill
HATUA YA PILI *- Rusha udongo wa juu wenye rutuba upande wa juu wa kontua*

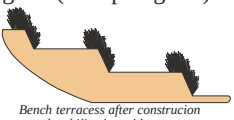


STEP 3 - Leveling of terrace
HATUA YA TATU *- Sawazisha tuta*



STEP 4 - Replacing of the top soil
HATUA YA NNE *- Rudisha na kusawazisha udongo wa juu wenye rutuba kwenye tuta*

grass. In humid or sub-humid areas elephant grass (or napier grass) is often preferred farmers since it produces lots of fodder. In semi arid areas Guatamala grass is often used.



Bench terracess after construcion and stabilization with grasses
Tuta la ngazi baada ya kuchimbwa na Kuimarishwa kwa majani

FANYA JUU

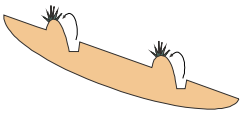
A Fanya juu terraces is made by digging a trench and throwing the soil uphill to form an embankment. After some years the Fanya juu develops into outward sloping bench terraces.
The trench can be used for rainwater harvesting. Farmers do plant banana trees or other useful trees in the trench.

Advantages in comparison to bench terraces

- Labour requirement is less
- Applicable in areas where the soil depth is too shallow for leveled bench terraces

CONSTRUCTION OF A FANYA JUU

1. Laying out pegs the contour
2. Digging trench on the contour and throwing the soil uphill
3. Stabilizing of the embankment by grasses



Fanya juu just after construction
Fanya juu mara tu baada ya uchimbaji

MAINTANANCE

- After heavy rain, the embankment have to be checked for breakage and any damage should be repaired immediately
- Cutting grasses on embankment (the grass can be used as fodder) If grasses become too long it may harbour pests or compete with crops.
- Desalting of the trench to maintain the water storage capacity. The silt can thrown onto the embankment.

LABOUR REQUIREMENT

STONE TERRACES

Land slope	Dimension trench to excavate		Labour requirement	
%	Width meter	Depth meter	Days per 100 meter	Days per acre
5	0.50	0.50	8	17
10	0.50	0.55	10	26
20	0.60	0.60	12	53

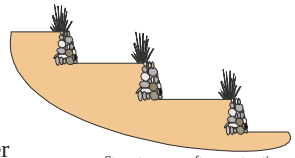
Stone terraces are level or nearly level steps constructed on the contour and separated by embankments known as risers. Actually they are the same as bench terraces except that the riser is constructed by using stones.

Main function of the stone terrace are the same as for bench terrace:
- Control of erosion by reducing the slope of the cultivated land.
- Increasing the infiltration of rainwater

Main advantages as compared to the normal bench terrace are
- It can be used on steeper slopes
- It can be used in areas with a more shallow soil
- It is a more permanent structure if well maintained
- It is self - stabilizing

Disadvantages as compared to bench terraces are:
- Highly labour intensive
- Only applicable in areas where stones are available

Labour requirement
The labour requirement is like the construction of bench terraces plus additional labour for:
- Collecting breaking the stones
- Constructing of the stone wall riser



Stone terracess after construction
Matuta ya mawe baada ya ujenzi

For technical advise on the construction of stone terraces please contact the district TIP's Manager.

MATUTA YA NGAZI

Haya ni matuta yanayochimbwa katika mteremko kwa mtindo wa ngazi ngazi zilizo katika usawa au karibu sawa ambazo hutenganishwa na kingo za ujazo wa udongo. Matuta haya hutengenezwa kwa kuchimba moja kwa moja au kutokana na matuta ya fanya juu.

Kazi ya matuta;
- *Huzuia mmomonyoko kwa njia ya kupunguza / kubadili hali ya mteremko kuwa katika hali ya usawa (tambarare)*
- *Husaidia mvua kunywea kwa urahisi mashambani (ongezeko la unyevu).*

Faida nyingine
- *Hurahisisha kazi shambani (mfano Palizi, kupiga dawa n.k)*
- *Hutunza rutuba (Hakuna mmomonyoko).*
- *Husaidia katika kuimarisha matumizi bora ya maji (mfano Matuta ya sahani)*

Hasara ya matuta ya ngazi ukilinganisha na fanya juu ni kwamba huhitaji nguvu kazi kubwa zaidi.

Nguvu kazi

Mteremko	Urefu wa kingo	Upana wa tuta	Urefu wa tuta kwa eka	Nguvu kazi kwa siku / eka	Eneo la kingo kwa asilimia ya eneo lote
%	Mita	Mita	Mita	Idadi ya siku kwa eka / mtu	%
20	1	4.5	800	150	
30	1	2.8	1200	140	15
40	1	2.0	1600	133	20
20	2	10.0	400	300	10
30	2	6.7	600	2290	15
40	2	5.0	800	265	20
50	2	4.0	1000	250	25

Kutoka: Mwongozo wa hifadhi ya udongo na maji Kenya

Matuta ya ngazi yanaweza kutumika katika maeneo yenye

- *Mteremko hadi asilimia 55 - 30º*
- *Udongo wenye kina kirefu (wastani 15m) udongo mgumu (mfinyanzi na wenye mchanganyiko na tifutifu)*

Mapungufu:
Uchimbaji wa matuta ya ngazi kwenye maeneo yenye mteremko zaidi ya asilimia 55 na yale yenye kina kifupi cha udongo yanaweza kuporomoka (kumomonyoka), kutokana na kupungua kwa nguvu ya mvutano inayosababishwa na msukumo wa maji ya mvua yanayonywea.

Uchimbaji wa matuta ya ngazi:
Kwa usanifu na uchimbaji wa matuta ya ngazi utaalam unahitajika. Kwa maeneo yale ambayo TIP inafanya kazi, wapo wataalam (wakulima) waliofundishwa na TIP jinsi ya kuyatengeneza.
Kwa mafanikio - Ndugu wasiliana na wataalam wa Kijiji au wataalamu kutoka wilayani kwa ushauri

Uchimbaji wa matuta ya ngazi kufuata hatua kama ilivyoonyeshwa kwenye michoro Hatua ya 1 - 4.

Baada ya kuchimba matuta ni lazima kuimarisha kingo kwa kupanda majani stahili. Kwa maeneo ya ukanda wa juu majani tembo au siteria hutumiwa na wakulima kwa vile huzalisha malisho kwa mifugo. Kwa maeneo ya ukanda wa kati na ule wa chini, sehemu kama hii hupandwa majani aina ya makarikari.(angalia mchoro matuta ya ngazi baada ya ujenzi).

FANYA JUU

Matuta ya fanya juu hutengenezwa kwa kuchimba mtaro upande wa chini wa kontua na hurusha udongo upande wa juu wa kontua ili kutengeneza kingo.Baada ya miaka kadhaa, fanya juu hujijenga na hutengeneza tuta la ngazi.Mtaro uliochimbwa hutumika kwa kuvuna maji ya mvua na wakati mwingine wakulima hupanda migomba au miti muhimu (kilimo mseto) ndani ya mtaro.

Hatua ya utengenezaji wa matuta ya fanya juu

1. *Weka mambo kwenye kontua (upimaji)*
2. *Funga kamba kufuata mambo na chimba mtaro kufuata kontua na kurusha/kuweka udongo upande wa juu wa*

kontua.

3. *Imarisha kingo kwa kupanda miti stahili na majani.*

Ukarabati

- *Baada ya mvua kubwa kunyesha, kingo za fanya juu ni lazima zikaguliwe na kufanyiwa ukarabati kila pale palipo haribika mara moja.*
- *Ukataji wa majani ya kuimarisha kingo mara kwa mara. (Kama majani yataachiwa yakue zaidi yanaweza kukaribisha magonjwa na wanyama na wadudu waaribifu wa mazao.*
- *Usafishaji wa mitaro/mifereji mara kwa mara ili kewezesha uvunaji wa maji kwa kiwango kilicho kusudiwa. Udungo unatolewa kwenye mfereji /mtaro uwekwe/urudishwe kwenye kingo za fanya juu.*

(angalia mchoro wa fanya juu baada ya kuienawa)

Mteremko wa shamba	Vipimo vya mtaro		Nguvu kazi inayohitajika (watu)	
	Upana mita	Kina mita	Siku kwa mita 100	Siku kwa eka
5	**0.50**	**0.50**	**8**	**17**
10	**0.50**	**0.55**	**10**	**26**
20	**0.60**	**0.60**	**12**	**53**

Mahitaji ya nguvu kazi

MATUTA YA MAWE

Haya ni matuta ambayo hujengwa katika usawa au ngazi ngani zinazokaribia usawa (tambarare) ambazo hutenganishwa na ukuta/ukingo wa mawe unao jengwa kitaalamu.Ni matuta ya ngazi ya kawaida isipokuwa tu haya ukuta wake hujengwa na huimarishwa kwa mawe.

Kazi ya matuta ya mawe hufanana sana na zile za matuta ngazi ya kawaida.

- *Huziua mmomonyoko kwa njia ya kupunguza/kubadili hali ya mteremko kuwa katika usawa (tambarare)*
- *Husaidia mvua kunyea kwa urahisi mashambani (ongezeko la unyevu)*

Faida muhimu ikilinganishwa na matuta ya kawaida ya ngazi.

- *Hutumika katika miteremko mikali*
- *Huweza kutumika katika maeneo yenye kina kifupi cha udongo*
- *Ni ya kudumu kwa muda mrefu kutokana na utunzaji*
- *Hujiimarisha lenyewe (mawe)*

Hasara ukilinganisha na matuta ya ngazi ya kawaida

- *Huhitaji nguvu kazi kubwa zaidi*
- *Hutengenezwa na hushauriwa katika maeneo ambayo mawe hupatikana kirahisi*

Mahitaji ya nguvu kazi:

Mahitaji ya nguvu kazi ni kama vile matuta ya ngazi ya kawaida pamoja na;

- *Ukusanyaji na uvunaji wa mawe*
- *Ujenzi (kuta za matuta)*

TRADITIONAL IRRIGATION AND ENVIRONMENTAL DEVELOPMENT ORGANIZATION

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