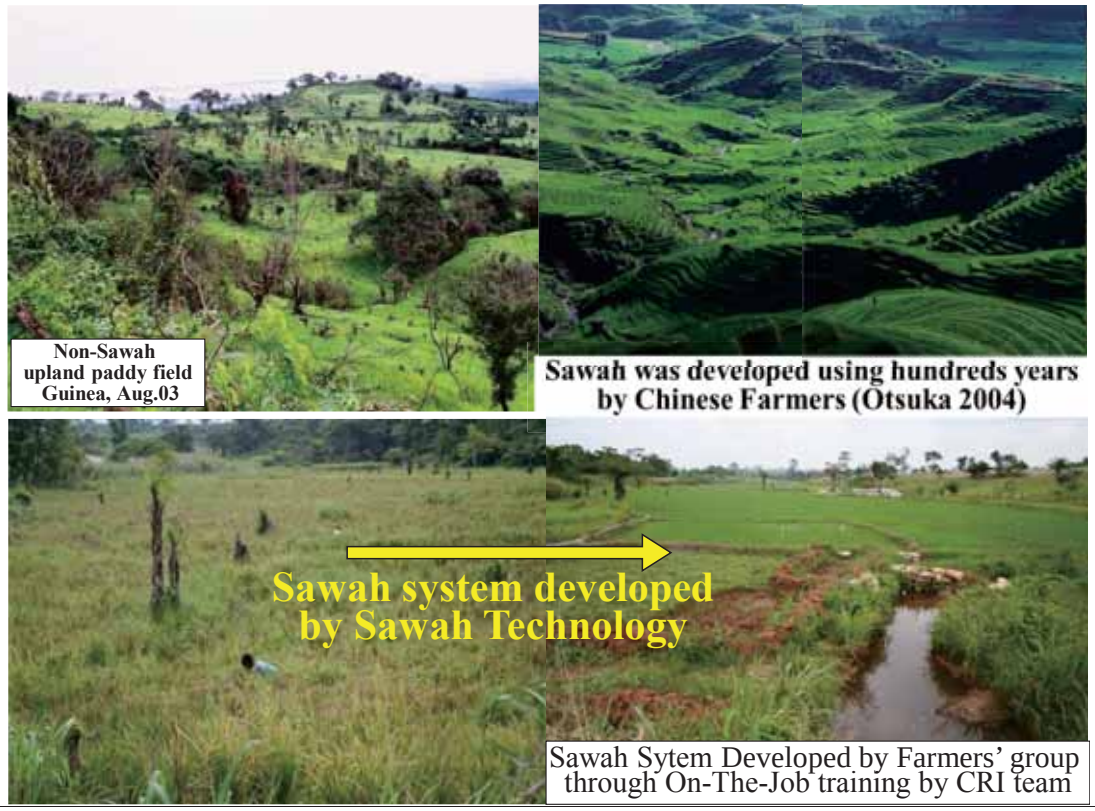
5September 2016

What is Sawah?, Sawah Technology? and Sawah Technology Strategy?
Why CSIR's sawah technology could not transfer to MOFA,, Ghana?

T. Wakatsuki (Shimane University, Japan), Sawah network homepage: www.kinki-ecotech.jp/



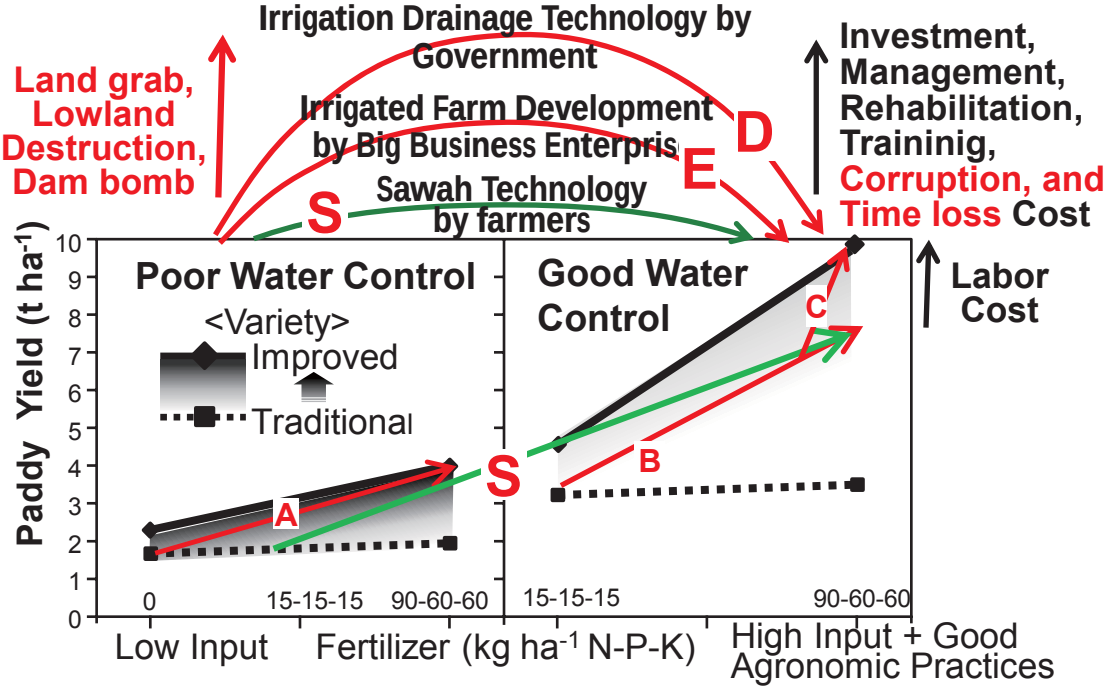


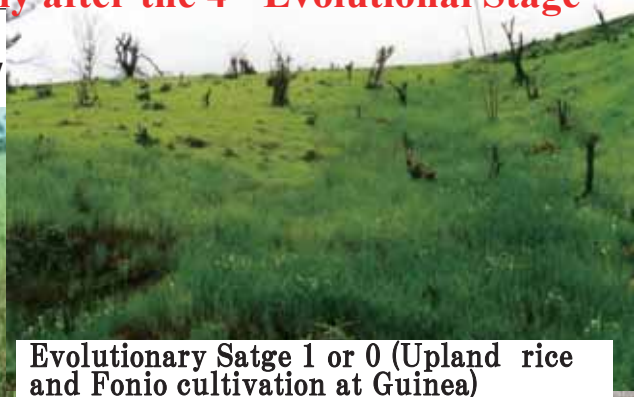
Figure. Six Strategies to Increase Paddy Yield and Production in SSA

A type strategy: Upland **NERICA** technology
B type strategy: **Asian Green Revolution technology**
C type strategy: **System Rice Intensification**
D type strategy: **Contractor based ODA** irrigation/drainage development
E type strategy: Irrigation by **private big business enterprises**
S type strategy: Sawah technology with sustainable mechanization

6 Stages of Sawah System Evolution (I)

Green Revolution is possible only after the 4th Evolutional Stage

1st (L) stage : Lowland non sawah rice cultivation, Inland Valley, Sierra Leone, 1987



Evolutionary Satge 1 or 0 (Upland rice and Fonio cultivation at Guinea)

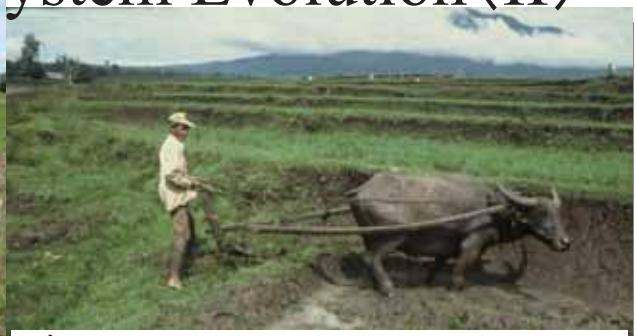
2nd stage: Irrigated micro rudimentary sawah and ridge planted rice in Inland valley, Nupe, Nigeria

Micro sawah plots (Evolutionary Stage 2) at Archaelogical site of 2400-2500 years ago).(Photo by T. Komori, 2011, http://tsu-com.515.my.coocan.jp/H23.11.12.Nakanish

Irrigated but micro rudimentary sawah plots at Northern Nigeria
Because of difficulty of water control, paddy yield is less than 3t/ha

6 Stages of Sawah System Evolution (II)

Stage 3, Irrigated sawah plots with ridge rice planting, Kaduna river flood plain, 2005



4th Stage: Standard sawah plots with leveling quality of ±5cm using animal plowing, Indonesia.

5th stage : Standard sawah plots with leveling quality of±5cm. Bush inland valley was developed by farmer using powertiller

6th stage sawah of >1ha. Leveling quality ±2.5cm.using laser leveler tractor. Direct sawing is also possible

Fig. Sawah development and evolution by Alh Bello Baidu farm at Bagudo are in progress on Niger flood plain

Table 3. Four Skills of Sawah Technology for Farmers Personnel Irrigated Sawah Systems Development and Rice Farming to Realize Green Revolution in SSA

(1) Site & Right Season Selection & *Sawah* system design

(a)Rice cultivation >15ha
Farmers strong will to improve technology
(b)Hydrology & quality
Gravitational water use:
>30 L/s, >5 months/year.
To control Flood:
Maximum flow <10ton/s
Note: Good community cooperation, if >50ha
Shallow Groundwater
Shallower <10-20m, small pumps make possible double cropping
(c)Topography and soil
Slope <1-3%
Sand+Silt <90-95%
(d)Privately own the land
or at least Secured rent longer than 5-10 years
(e) *Sawah* system design
Sawah layout
Leveling quality
Bunding quality & Mgt.
Drought and Flood control measures
(f) Powertiller and trailer traffic road
(g) Water intake, storage, distribution, & drainage
Simple sand bag & wooden dam/Weir dam, barrage
Canal system
Interceptor canal
Pond and fish pond
Small pump & shallow tubewell
Central drainage

On-the-job training on site-specific *sawah* development & management

Collaboration between farmers & scientists, engineers, and extension office is very important

Farmers know site specific hydrological conditions which are the most important for site election

The successful example of *Sawah* ecotechnology innovations:
(1) Oasis type pump irrigation in floodplain (Sudan savanna zone, Kebbi state)
(2) Spring based irrigation system (all climatic zones)
(3) Overflow dykes on small rivers (Guinea savanna zone, forest transition zone, forest zone)

(2) Efficient & Low cost Sawah Development: Skill & Technology

(a)Skills for bush clearing, de-stumping & support smooth powertiller operation
(b)Skills for bunding, canal construction and levelling ±5cm in a sawah plot
©Cost for hired labors, tools, pump and powertiller
>10ha of development/3 years using one powertiller
Purchasing $3000-4000/10ha
Running $2000-3000/10ha
Pump&Tubewell $1500/10ha
Tools & materials $1000/10ha
(d)On-the-job training cost
Scientist & engineers $1000/ha, Extension officer $500/ha, Leading Farmer $250/ha

Sawah development: at least 10ha by one Power-tiller

Target cost: $1000-3000 /ha

Target speed of development: >3-5ha/year /powertiller

(3) Socio-Economic Skills for Rice farmers empowerment

(a) Group organization & leading farmers training
(b)Training of powertillers assisted sawah development & sawah based rice farming
(c)Post harvest technology using small harvesters of $10,000 per set if sawah area >25ha & paddy production >100ton per year
(d)Loan system to buy agric. Machines and sawah lands
(e)Land tenure arrangement for secured rent >10 years

(4) Sawah based rice farming

(a)Management of water intake, storage, distribution, & drainage systems
(b)Management of bunding & leveling
(c)Water Managt. of sawah depth of water irrigation timing
(d)Puddling skills
(e)Skills of Nursery & trans-planting
(f)Weed, pests, and birds Managt.
(g)Managnt. of Fertilizers, nutrient & organic matters
(h) Variety selection & Managnt
(i)Achievement of targeted yield

(1)Immediate target: Paddy yield >4t/ha, >20ton paddy /powertiller

(2)>50t paddy /year /power tiller will accelerate *sawah* Development

(3) Basic research on sustainable paddy yield >10t/ha is important

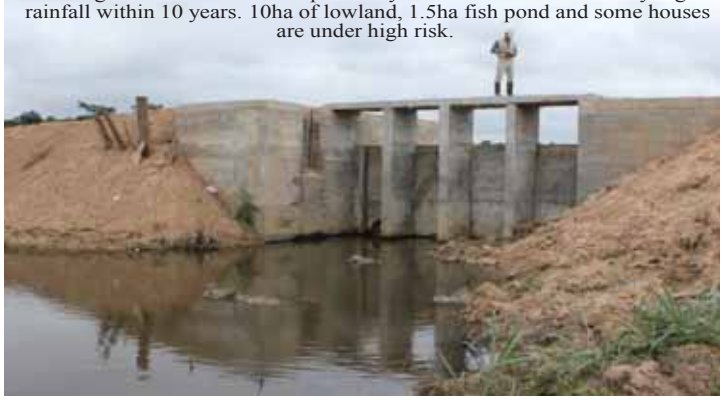
(1) To train qualified sawah farmers and or groups who could develop sawah >5ha and get annual paddy production >20ton using one powertiller within three years after the initiation of sawah development.
(2) To train the leading *Sawah* farmers is the key for sustainable and endogenous sawah development. The leading farmers can train farmers and farmers groups to achieve the target as qualified *Sawah farmers*.
(3) If site selection is suitable, sawah can be developed in Africa easier than Asia.

Sawah technology can reform ODA and contractor based development :
Endogenous development will be, farmers to farmers > > extension officers > researchers >> ODA style technology transfer

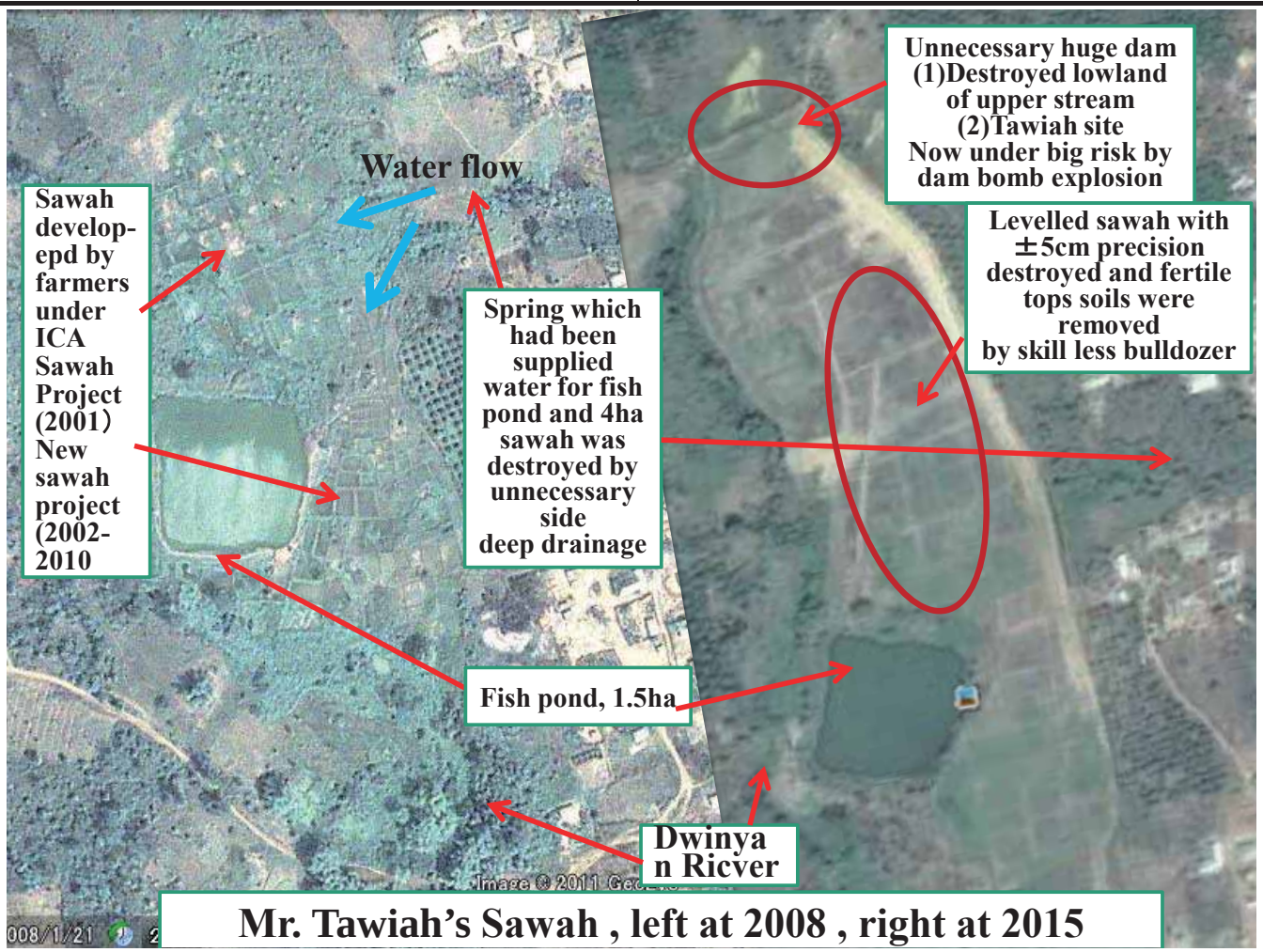
Mr. Tawaih (Lead farmer) site, old JICA research project (1996-2001) and New Sawah research project(2003-2011), Aug.2010. The site has goo water control system for both rice and fish pond.
Just before MOFA IVRDP destruction start. The sign board steals the site

Mr. Tawiah developed about 4ha sawah by Sep. 07 surrounding his 1.5ha of fish pond. Total paddy production was more than 20ton annually, which gave gross revenue about $10,000. Power tiller loan is $1500 per year for four years

Adugyama Dam, Aug.2011. Flood security has only one meter, no proper emergent gate and spillway except for very small bottom hole. Soil dyke of will degrade and bomb will explode anytime at the occasion in very high rainfall within 10 years. 10ha of lowland, 1.5ha fish pond and some houses are under high risk.



IVRDP destroyed sustainable spring and seepage water source for fish pond and sawah rice by unnecessary deep side drainage. Mr. Tawaih site 2011. Maybe confused the sawah system protection and road protectio



Mr. Tawiah's Sawah , left at 2008 , right at 2015

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Mr. Tawiah and his rice growing in sawah of abour 4ha developemd by himself with CRI/SRI and JIRCAS scientists, August 2009. This is the site of JICA/CRI sawah project in 1997-1999. In 2011 the site will expand about 10ha

Unnecessary huge dam destroyed lowlands and already developed 6ha of sawahs upper stream. Sawahs were developed by farmers under new sawah project 2001-2011

About 8ha of levelled sawah with ±5cm precision destroyed and fertile tops soils were removed by skill less bulldozer,

JICA/CRI sawah project, 1998-2001, New sawah project, 2001-2011

Sawah farmers sawah survived, which is irrigating by spring water

This area was destroyed by fake constructions operations, such as no water source irrigation canals, bunding and deep drainage

Unnecessary huge dam destroyed lowlands and already developed 6ha of sawahs upper stream,

This site is also now under big risk by dam bomb explosion

Biemso No.1, Zongo site,New Sawah project, Sep.2007

Biemso No.1, Zongo site,New Sawah project, Aug.2010,
just before MOFA IVRDP destruction started

Biemso No1 Sawah, the lowest end Aug. 2000

Biemso No1 Sawah, the lowest end 2Sep2016, Destruction of Sawah system. Farmers have to construct sawah system again to control water for rice production

African leaders asked to support production of local rice

November 23, 2011 | Filed under: Business,Latest news | Posted by: VibeGhana

Madam Sherry Ayittey, Minister of Environment, Science and Technology, tasked Africa leaders to initiate policies and strategies to promote the production and consumption of local rice.

He noted that African countries had the capacity to produce more rice to feed the people, and said: "What is needed is the commitment and political will from leaders to take bold decisions to motivate farmers to produce on high scale and to encourage the people to consume locally produced rice".

Madam Ayittey was opening the first international workshop on "Sawah", eco-technological and rice farming concept in Sub-Saharan Africa, on the theme: "Improving and Sustaining Rice Production under Changing Climatic Conditions", in Kumasi on Tuesday.

The concept that was developed by Professor Toshiyuki Wakatsuki of the Kinki University, Japan, sought to improve soil and water conditions management in Africa lowlands, irrigation and fertilizer efficiency to increase rice production per hectare.

Nigeria had successfully utilized the technology to increase rice production.

The workshop, which was organised under the auspices of the Council for Scientific and Industrial research (CSIR) with technical and financial support from the Kinki University in Japan, Japan International Research Centre for Agricultural Sciences, and AfricaRice, based in Cotonou, Benin, brought together participants from Japan, Indonesia, Nigeria, Ghana and Senegal.

It aimed at showcasing the principles and practices of the eco-technology, sharing ideas and knowledge on its

Fake irrigation canals, which is developed on upland higher than 2m from Biem river. It is impossible to introduce water to the canal. Biemso No.1. Upper area of the dam completed, 2nd of September 2016

Why long continued collaborative successful research and development on sawah system and sawah technology under CSIR institutes and Shimane/Kinki university supported by JICA and MEXT Japan could not disseminate in Ghana (only)?

- JICA/CRI/SRI,WRI,FORiG/Shimane University: sawah research project 1995-2001, $2million research budget
- SRI/CRI/Kinki University New sawah project, 2002-2011, $1.5million research budget

Even though ongoing two dissemination projects were direct influence of sawah project, the technology transfer was failed (by political reason?)

(1)JICA rainfed rice project: They has understanding of sawah system, but they refused to use our sawah technology properly, especially refused to use powertiller, which failed to make impact because of no mechanization can only possible to make small area development

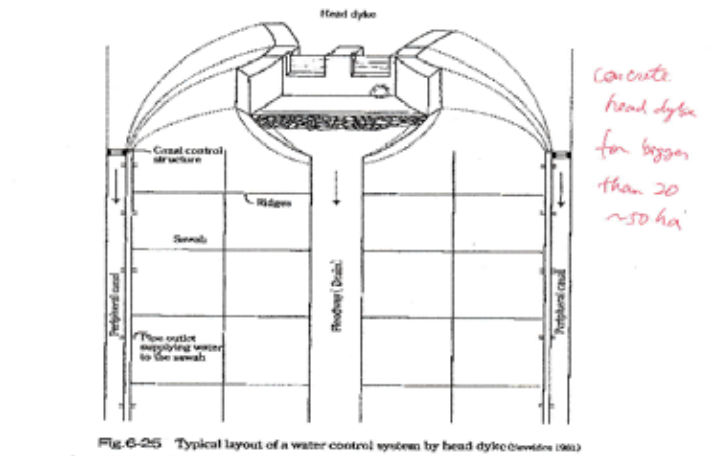
(2)IVRDP and MOFA: They have no under standing of Sawah system and sawah technology: High cost and environemnta destruction

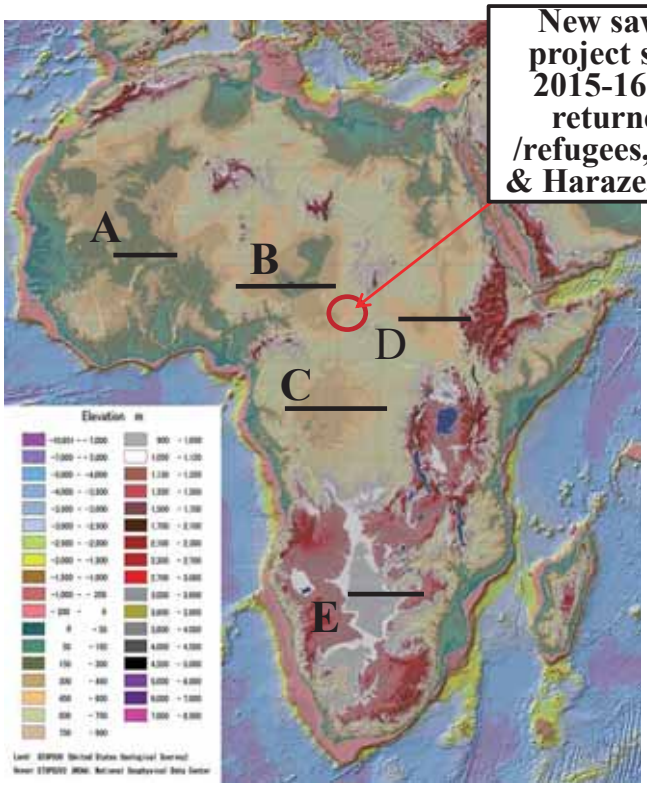
(3)Major reason seems Ghana specific: CSIR under Ministry of Sicence, technology and environemnt, which is separetd from MOFA

Restoration measure to connect spring water and sawah by irrigation canal and syphon pipes at Adugyama, Mr. Tawiah's site, August 2011

Once Sawah system was developed, yield can reach at least 4t/ha. If improved rice agronomy can practice, such as System Rice Intensification, yield reach to 10t/ha (CRI sawah team, Ghana)

Sand bag weir by farmers and SRI Sawah team, Aug.2009, Nsutem, Ghana





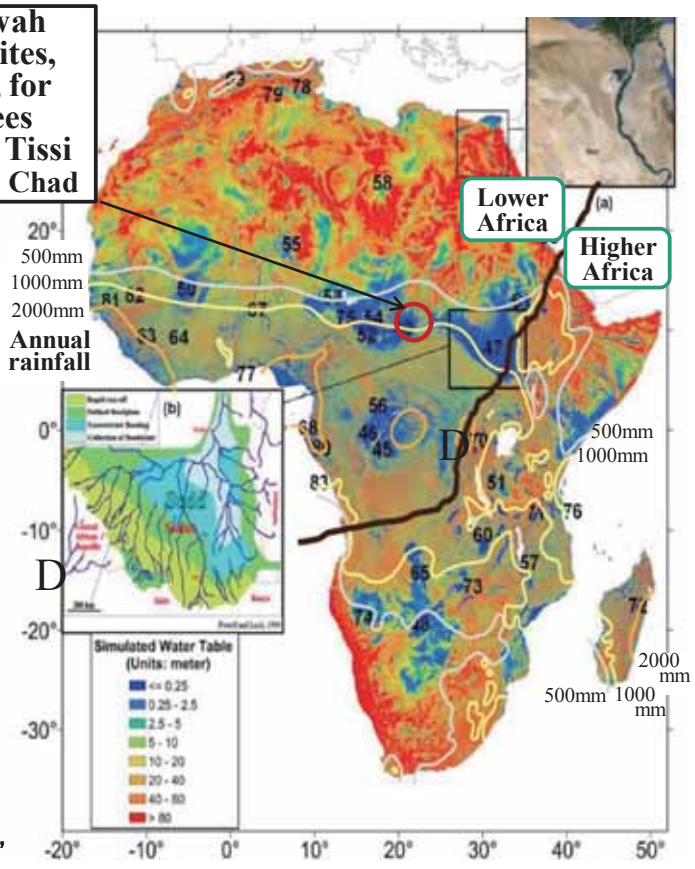


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Fig.14. Distribution of inland basins in various altitudes with shallow groundwater for possible future application of sawah technology in Sub Saharan Africa

Table 4. Extension of Sawah Rice Production Technology in Kebbi State during March 2011 to April 2014

1. Kinki University/NCAM Demonstration and Training, March 2011–April 2012

Local Government	Farmers	No.of powertiller supplied/ bought	Total sawah developed(ha)	Total No. of 100kg bag	Paddy yield in ton/ha
Arugungu*	shared	2 shared	6.5	487.5	7.5
Birinin Kebbi*	shared	2 shared	3.5	227.5	6.5
Jega*	shared	2 shared	8	560	7
	Total	shared	18	1275	7.1(mean)

* Demonstration and dissemination sites are shownin Google erath maps of Fig. 6

2. Sawah Technology extension, April 2012-October 2013

Local Government	Farmers	No.of powertiller supplied/ bought	Total sawah developed (ha)	Total No. of 100kg bag	Paddy yield in ton/ha
Arugungu*	MGD farm*	2	15	975	6.5
	JUM farm	1	10	650	6.5
	ABK farm	1	4	260	6.5
	AK farm	1	3	180	6
	AMB farm	1	4	240	6
	Dr YA farm	1	4	240	6
	ANL farm	1	3	180	6
	AMI farm	1	6	390	6
	ASD farm	1	5	300	6
Birnin Kebbi	ABA farm	1	4	260	6.5
	BB farm	1	3	180	6
	AS farm	1	3	180	6
Bagudo	ABB farm	5	35	2450	7
Jega	HHJ farm	1	7	455	6.5
	AUA farm	1	20	1200	6
Suru	Dr.UD farm	1	5	300	6
	Total	22	131	8440	6.4(mean)

3. 2014 Dry season rice in November 2013 to May 2014

Local Government	Farmers	No.of powertiller supplied/ bought	Total sawah developed (ha)	Total No. of 100kg bag	Paddy yield in ton/ha
Arugungu*	MGD farm*	2	20	1400	7
	JUM farm	1	10	650	6.5
	ABK farm	1	8	480	6
	AK farm	1	6	360	6
	AMB farm	1	5	300	6
	Dr YA farm	1	5	300	6
	ANL farm	1	5	325	6.5
	AMI farm	1	10	650	6.5
	ASD farm	1	5	300	6
Birnin Kebbi	AAA farm	1	4	no data	no data
	BB farm	1	6	360	6
	AS farm	1	6	360	6
Bagudo	ABB farm	5	50	3500	7
Jega	HHJ farm	1	14	910	6.5
	AUA farm	1	40	2400	6
Suru	Dr.UD farm	1	5	300	6
	Total	22	199	12595	6.3(mean)

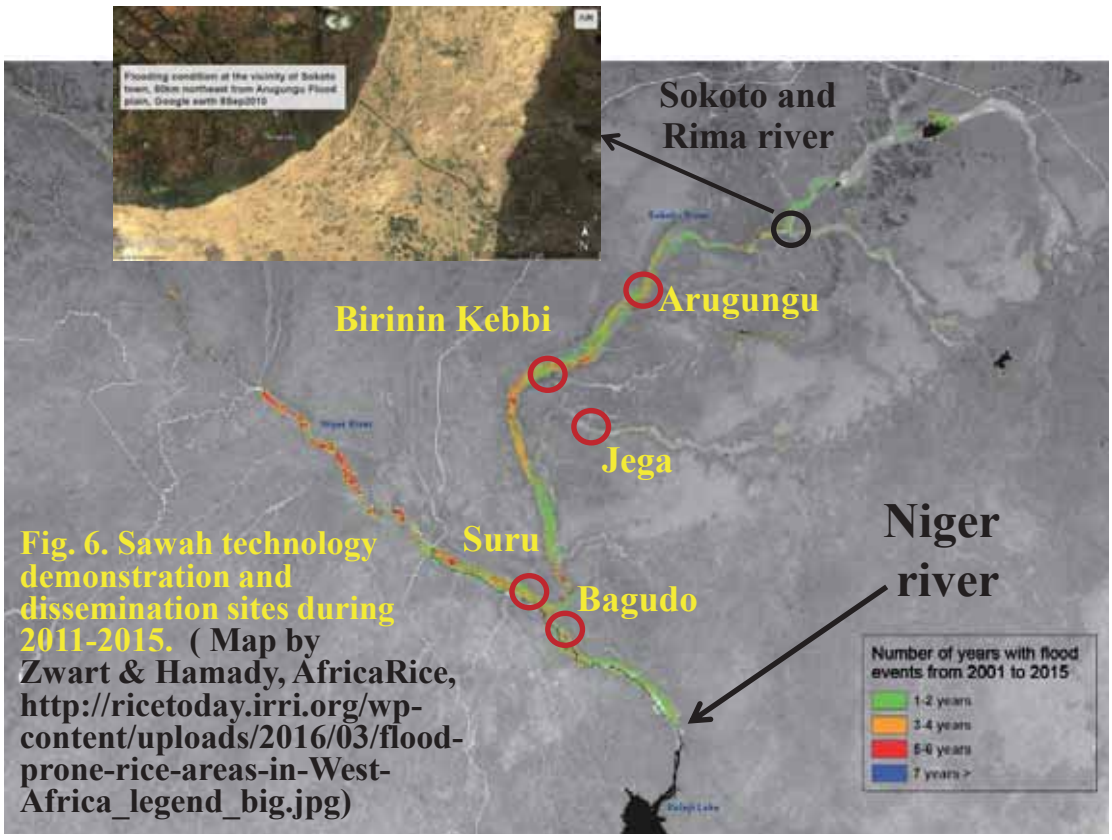


Fig. 6. Sawah technology demonstration and dissemination sites during 2011-2015. (Map by Zwart & Hamady, AfricaRice, http://ricetoday.irri.org/wp-content/uploads/2016/03/flood-prone-rice-areas-in-West-Africa_legend_big.jpg)

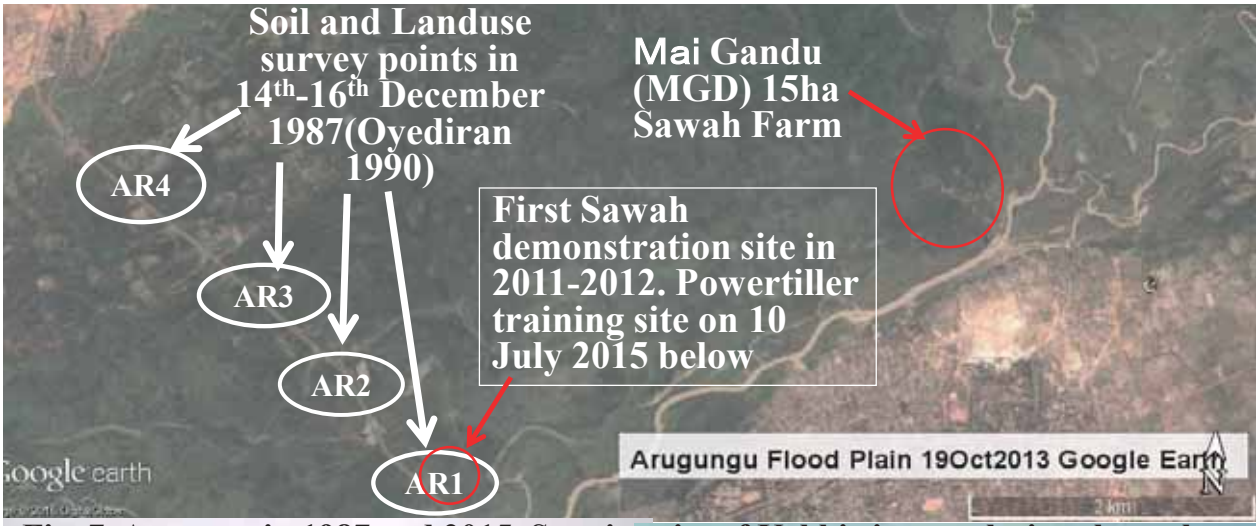


Fig. 7. Arugung in 1987 and 2015. Starting site of Kebbi rice revolution through sawah system evolution through sawah technology

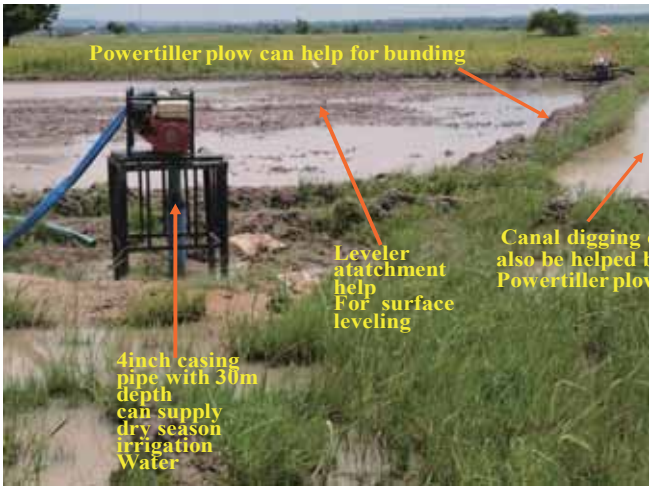
Kebbi Powertiller and sawah technology training on 10th of July 2015 at AR1 site

Fig. 10. Demonstration & training of sawah technology(upper two are Jega on April, 2011, lower left is AR1 in Fig. 7 at Arugungu, right is at Birinin Kebbi, on Sep 2011)

Indonesian G1000 Boxwer's puddler, leveler and plow. Plow can help bunding (10th Jul 2015), Kebbi and Niger State, Nigeria

Indonesian G1000 Boxer can move soil 25m for leveling(10th Dec 2015)

Canal construction by power tiller plow



20-30 m depth Tube well digger Cost

(1) $300 for Tube well digging & 4 inch pipe installation
(2) $250 for pump, 3inch, 600liter/min and $180 for 12m suction & 70m extension horse in case groundwater depth is shallower than 8m.
(3) $400 for submerged pump with 2.2inch pipes lifting water 500liter/mine from 20m depth of groundwater using generator of $1000, which can drive two to three submerged pumps
(4) 1ha sawah needs 100ton of water per day
(5) Tubewell digger machine cost $2500-5000

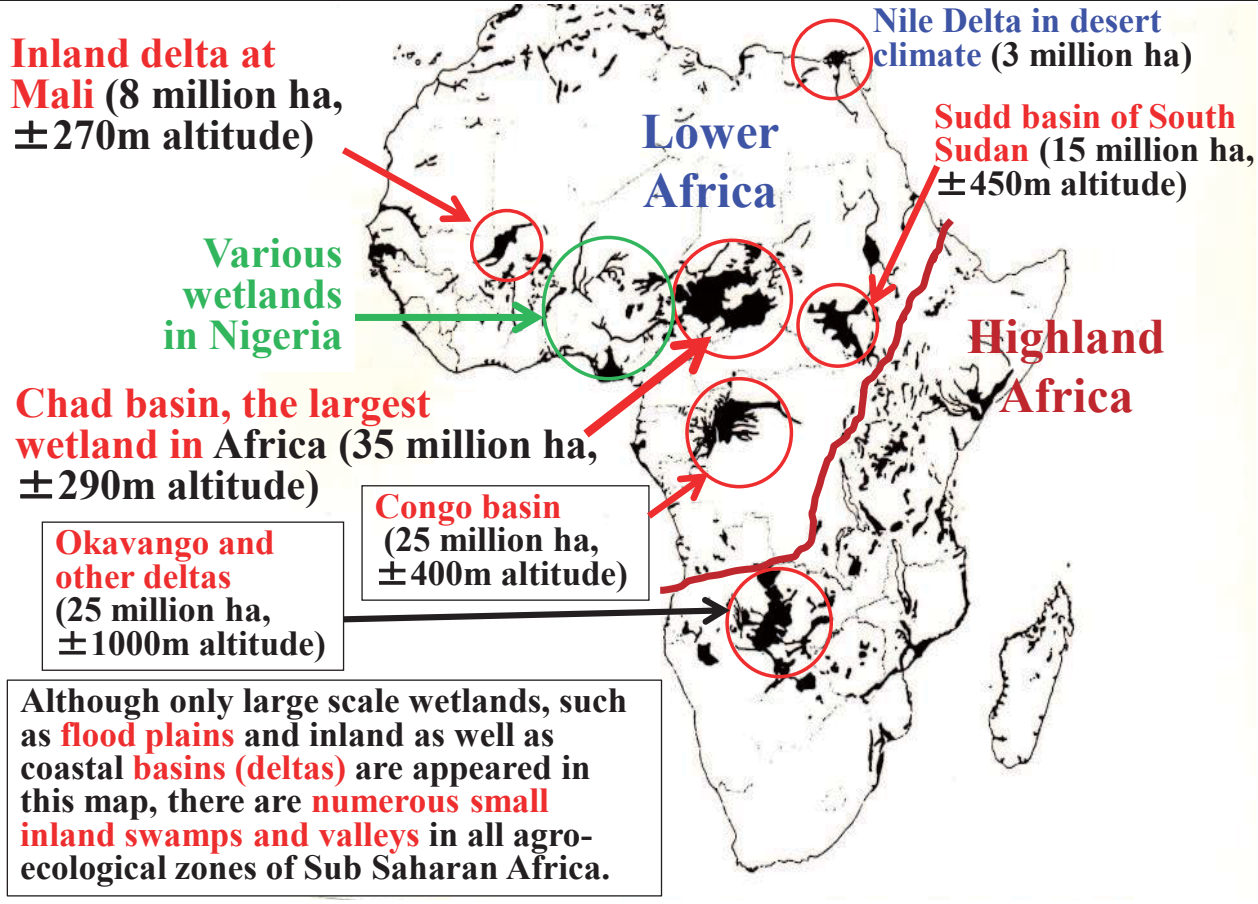


Fig. 2. Distribution of flat wetland soils in Africa (Van Dam and Van Diepen 1982)