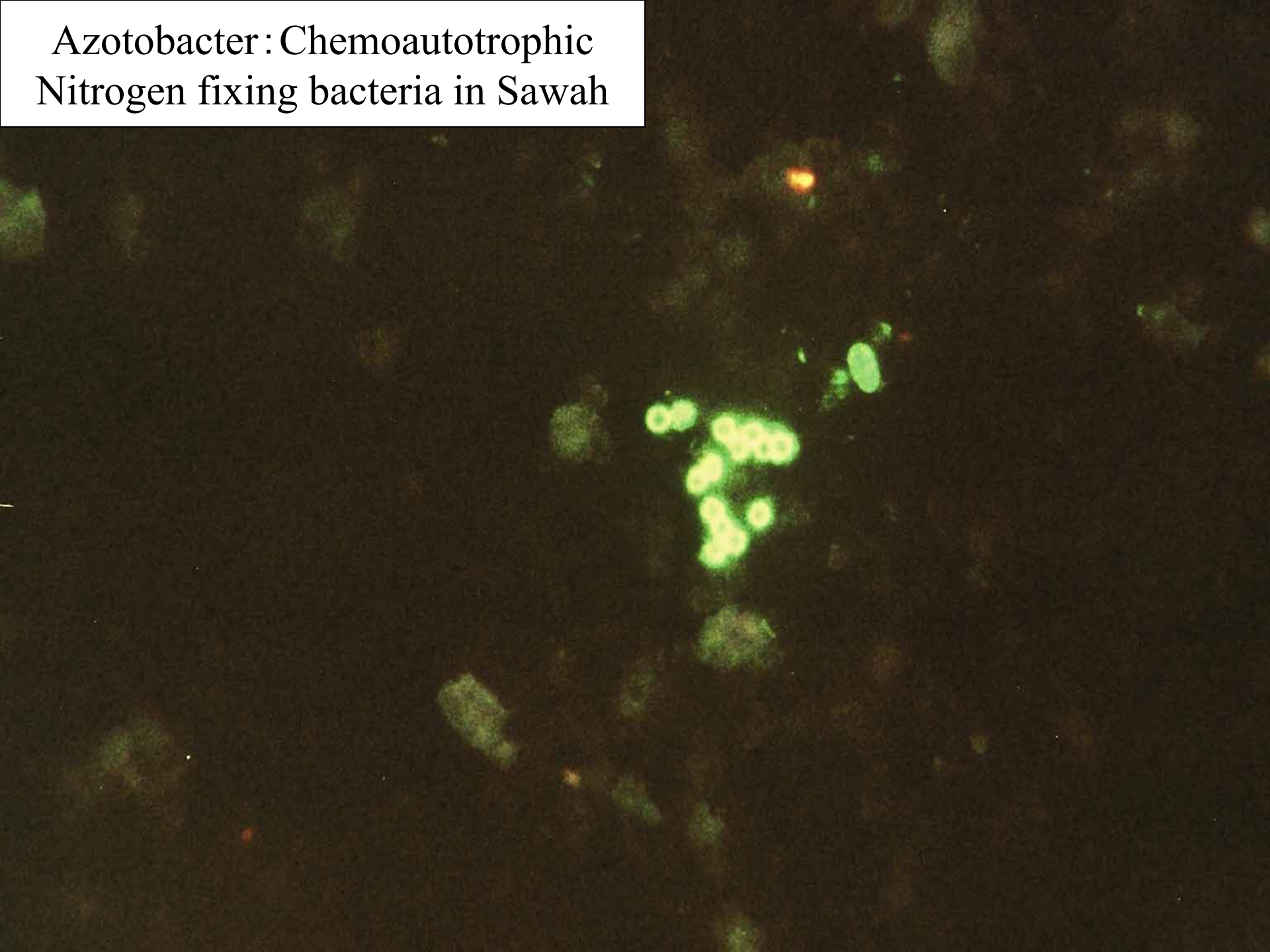
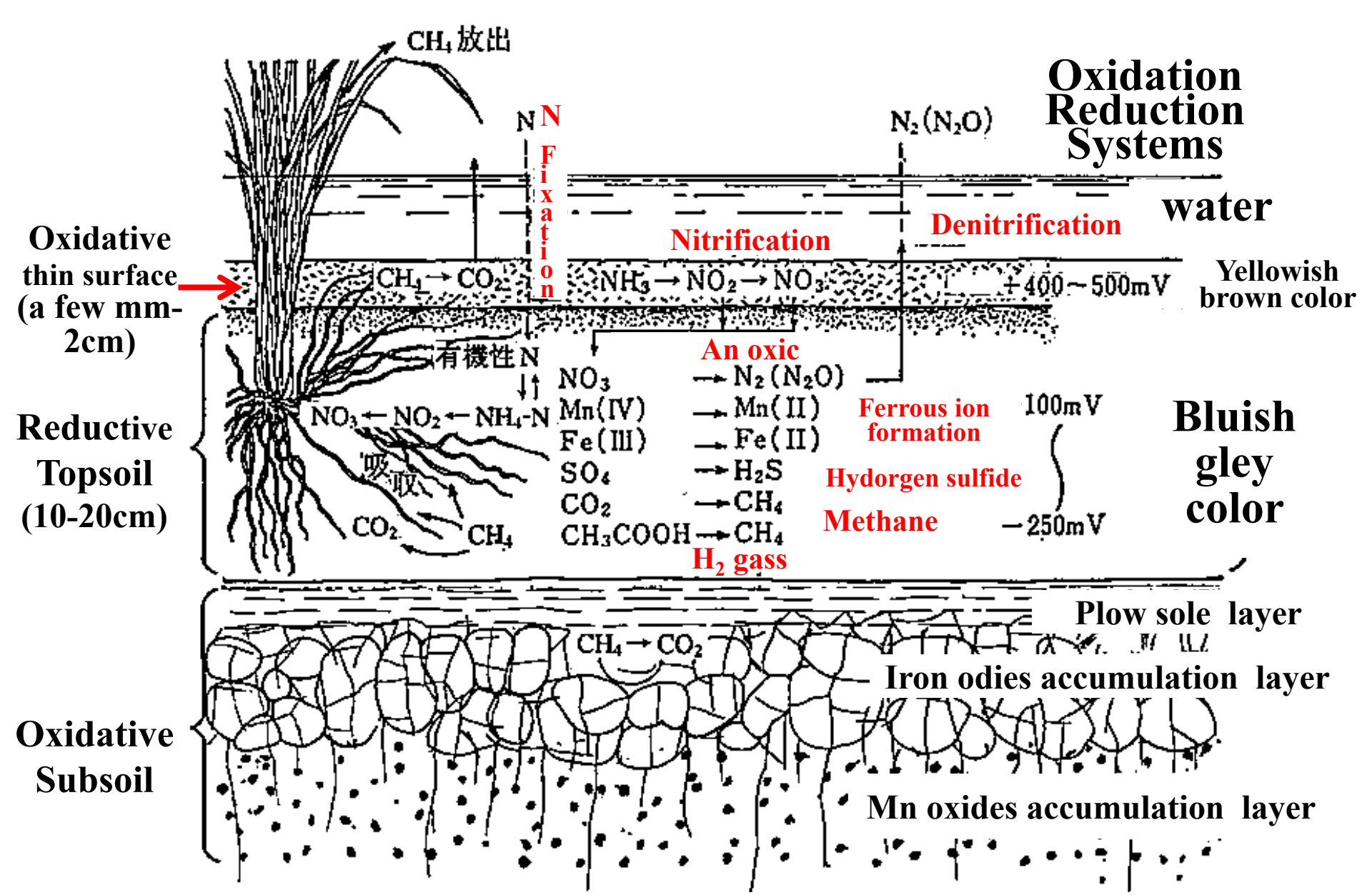

Sawah and traditional non sawah rice ,
Pampaida, UN millennium village, Zaria
Poor tillering and aggressive
weed in non sawah field

Submerged sawah: Multi functional ecosystems of various interaction between Rice, Algae, Fish, Goose, microbes, and others

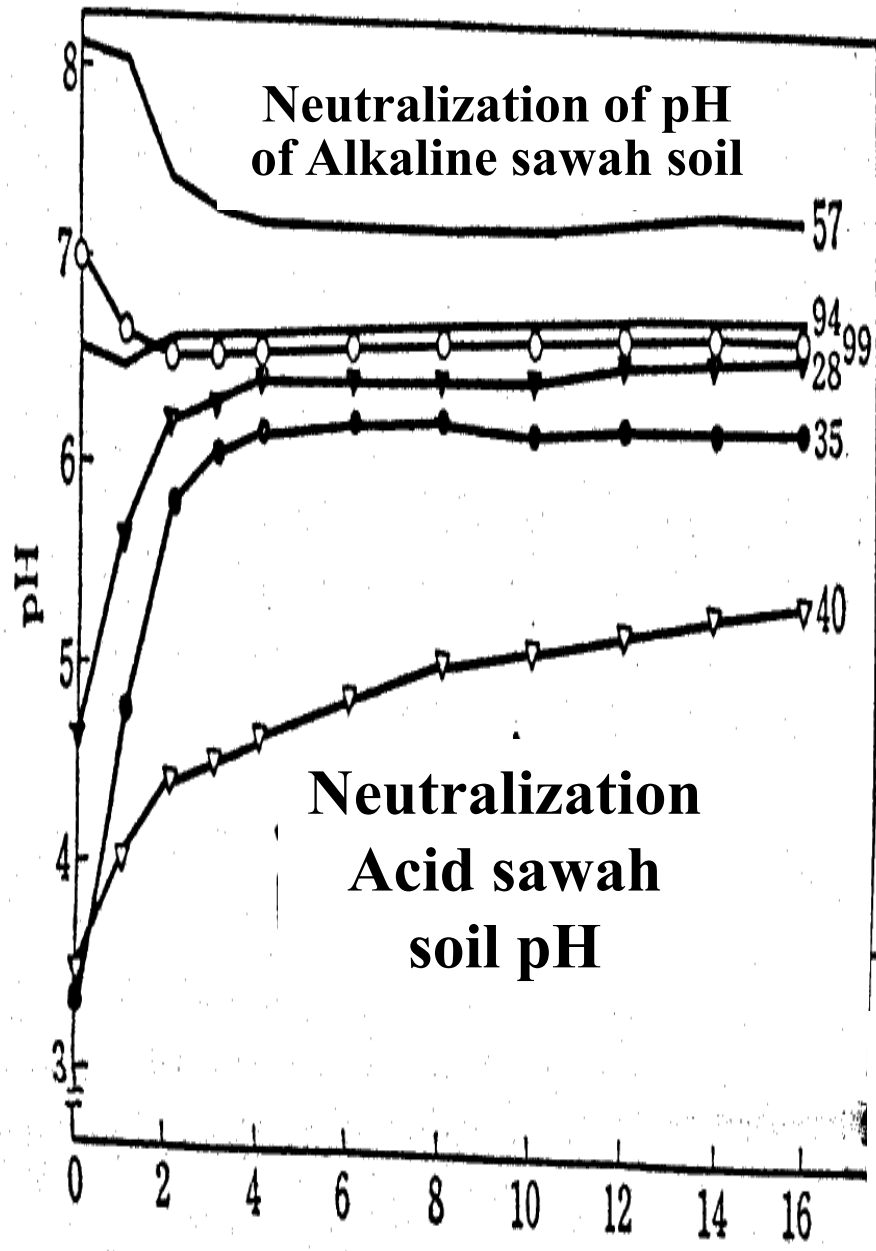
Left :nitrogen fixing Azola

Azotobacter : Chemoautotrophic
Nitrogen fixing bacteria in Sawah





Typical Sawah soil profile development under submerged condition

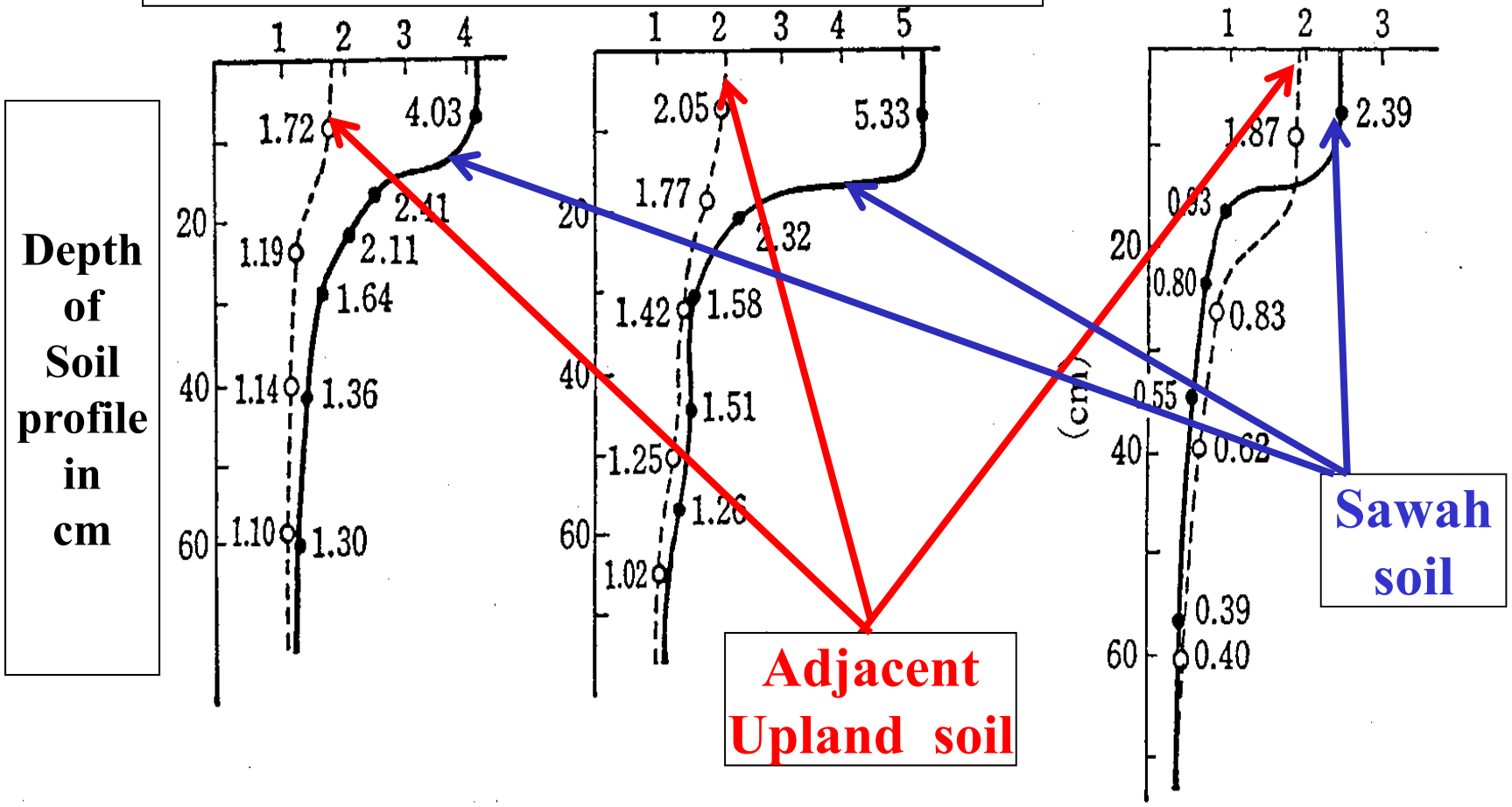


soil No.	Soil texture	pH	Content(%)		
			OM (%)	Fe(%)	Mn(%)
28	埴 土	4.9	2.9	4.70	0.08
35	埴 土	3.4	6.6	2.60	0.01
40	埴 土	3.8	7.2	1.50	0.00
57	埴壌土	8.7	2.2	0.63	0.07
94	埴 土	6.7	2.6	0.96	0.09
99	埴壌土	7.7	4.8	1.55	0.08

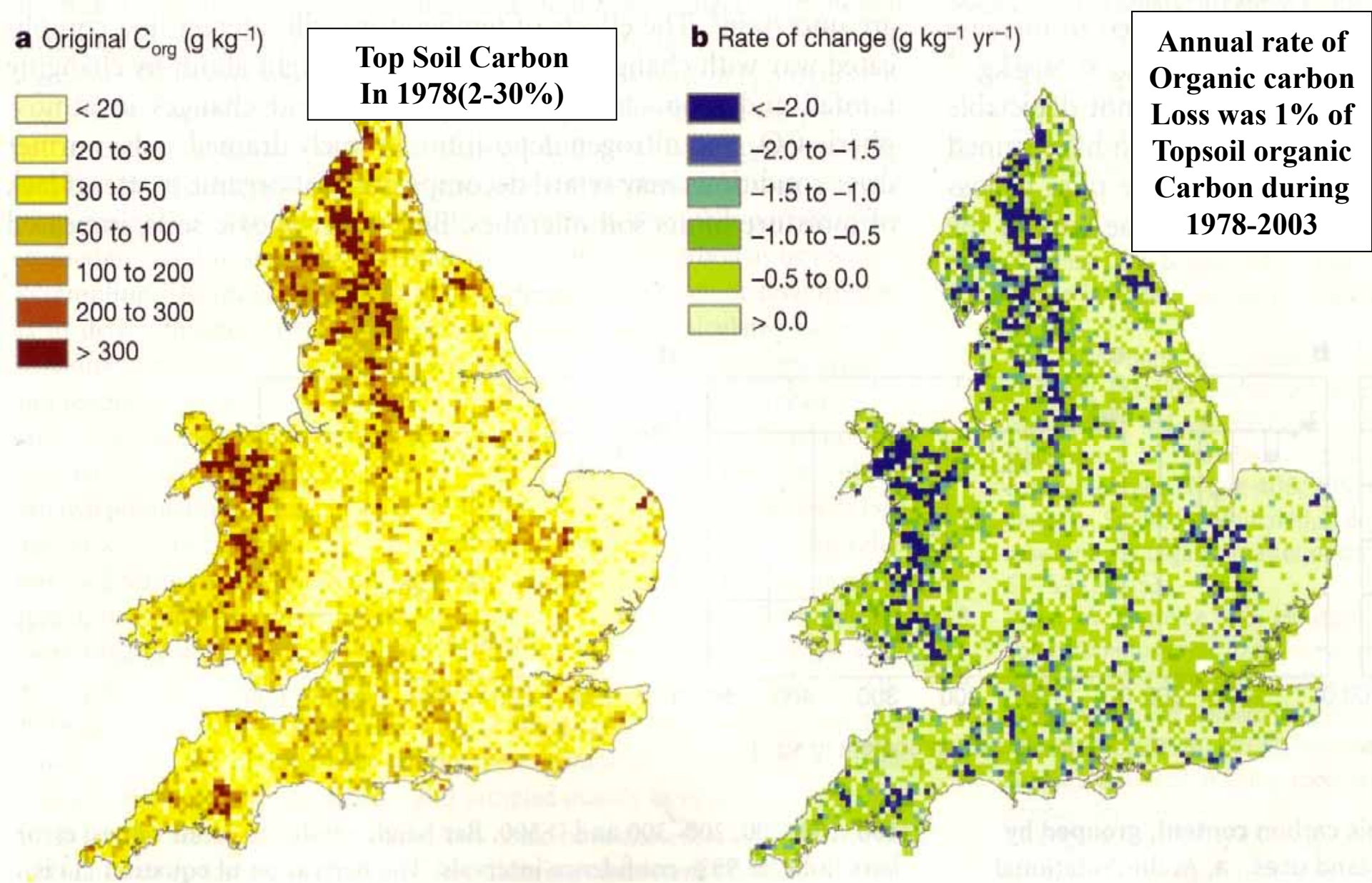
Sawah soil neutralization through submergence(Ponnamperuma 1976)

Organic matter % in Lowland Sawah soils in comparison with soils in upland management condition

Upland terraced sawah and upland Non-sawah

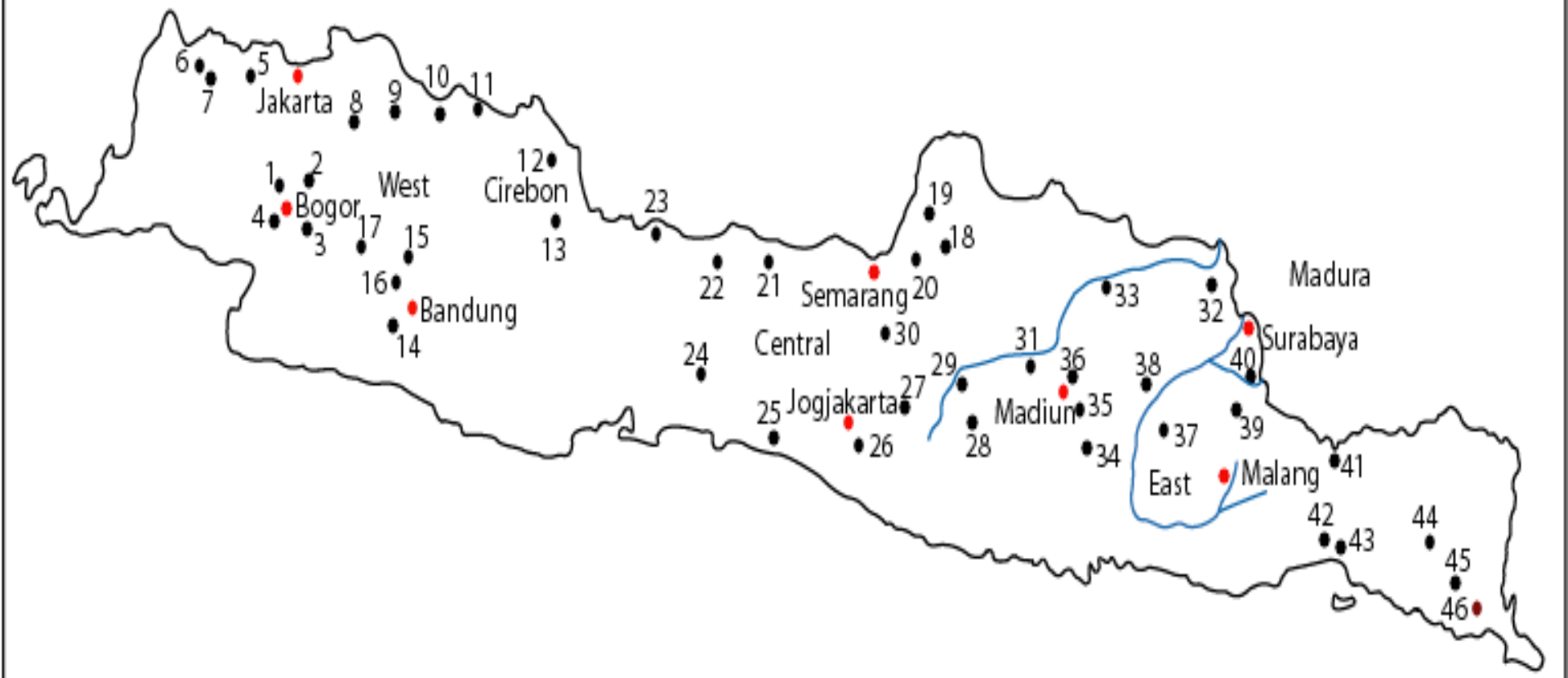


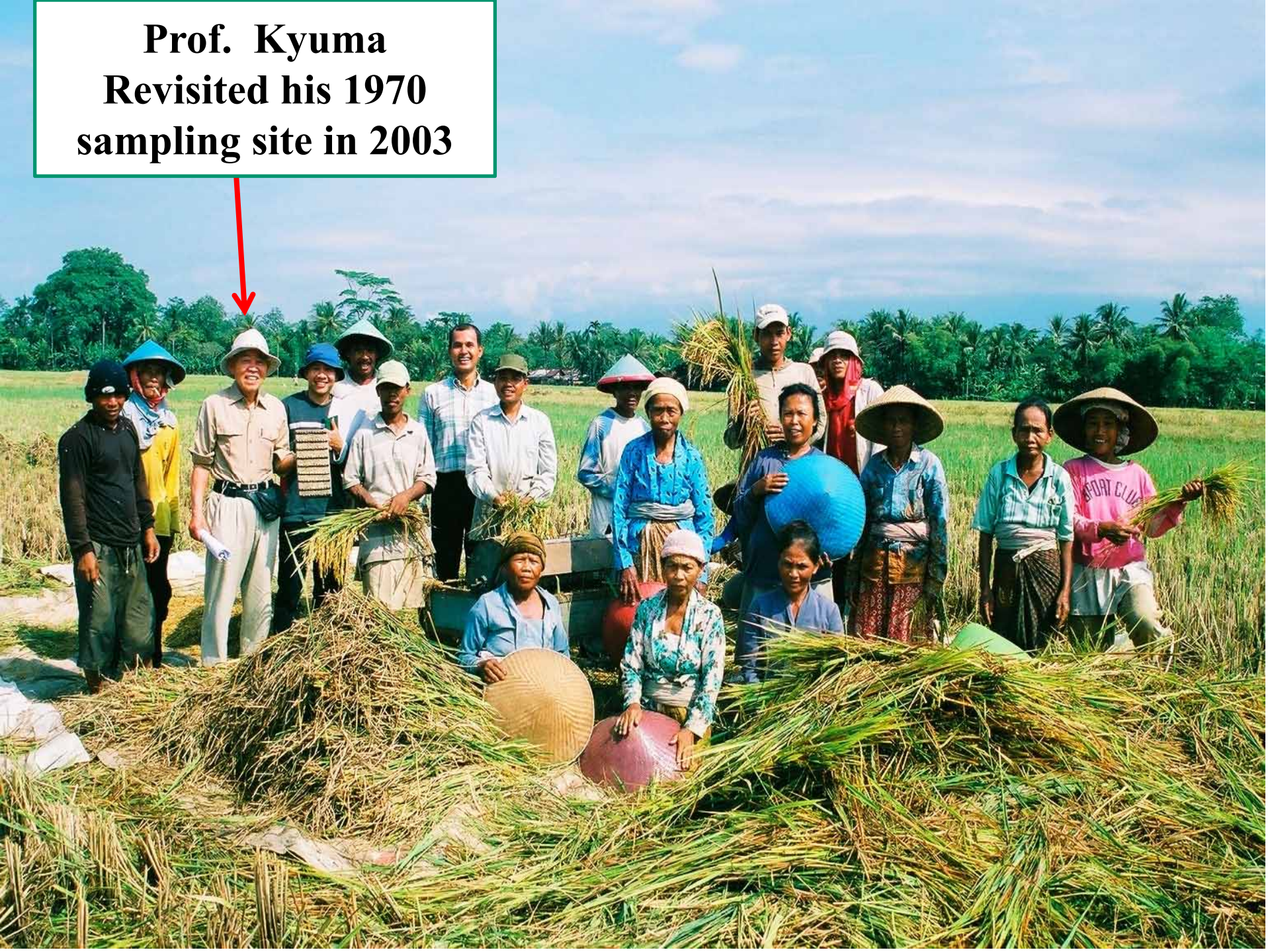
Organic matter % in Sawah soils in comparison with soils in upland management (Mitsuchi 1970, 1974)



Soil Carbon Change: **Carbon losses from all soils across England and Wales 1978-2003** (Nature Vol.437/ 8, September, 2005 p.245)

Sawah soil carbon change of Java, Indonesia, during 1970-2003, the Green revolution period (Darmawan et al 2006)




Prof. Kyuma
Revisited his 1970
sampling site in 2003


In 2003, Dr. Darmawan collected sawah soils from the same sites where Prof Kyuma surveyed in 1970

Table 3 Changes in total carbon and total nitrogen (Mg ha^{-1}) content in the 0–20 cm and 0–100 cm soil layers in seedfarms and non-seedfarms from 1970 to 2003 in Java, Indonesia

	Seedfarm				Non-Seedfarm			
	0–20 cm		0–100 cm		0–20 cm		0–100 cm	
	1970	2003	1970	2003	1970	2003	1970	2003
Total carbon (Mg ha^{-1})								
n	18	18	18	18	22	22	22	22
Mean	34.50	39.24	92.68	112.83	29.77	41.37	79.60	114.86
Standard deviation	9.95	9.70	39.47	40.91	10.88	15.12	28.07	40.50
Mean change		4.74		20.15		11.60		35.26
% change		13.7		21.7		39.0		44.3
t-test		*		***		***		***
Total nitrogen (Mg ha^{-1})								
n	18	18	18	18	22	22	22	22
Mean	3.16	3.95	9.34	12.03	2.94	3.98	8.93	11.44
Standard deviation	1.07	0.89	4.01	4.10	1.15	1.24	3.16	3.30
Mean change		0.79		2.69		1.04		2.51
% change		25.0		28.8		35.4		28.1
t-test		**		***		***		***

n, number of sampling sites. *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$

Both C & N increased 30% per30 years during Green Revolution

Macro-scale watershed eco-technological mechanisms to support Sawah hypothesis II: Geological Fertilization of eroded top-soils and accumulation of nutrient rich water in lowland Sawah

Sustainable green revolution by sawah and SATOYAMA systems for combating Global warming: (1) efficient use of water cycling and conservation of soil fertility, (2) Ecological safe carbon sequestration by CDM, Bio-char and humus accumulation in sawah Soil layers, which will eventually transfer to sea floor, and (3) increase soil productivity by bio-char and humus accumulation

Micro-scale eco-technological mechanisms to support Sawah hypothesis II: Enhancement of the availability of N, P, K, Si, Ca, Mg, and micronutrients and quality carbon accumulation

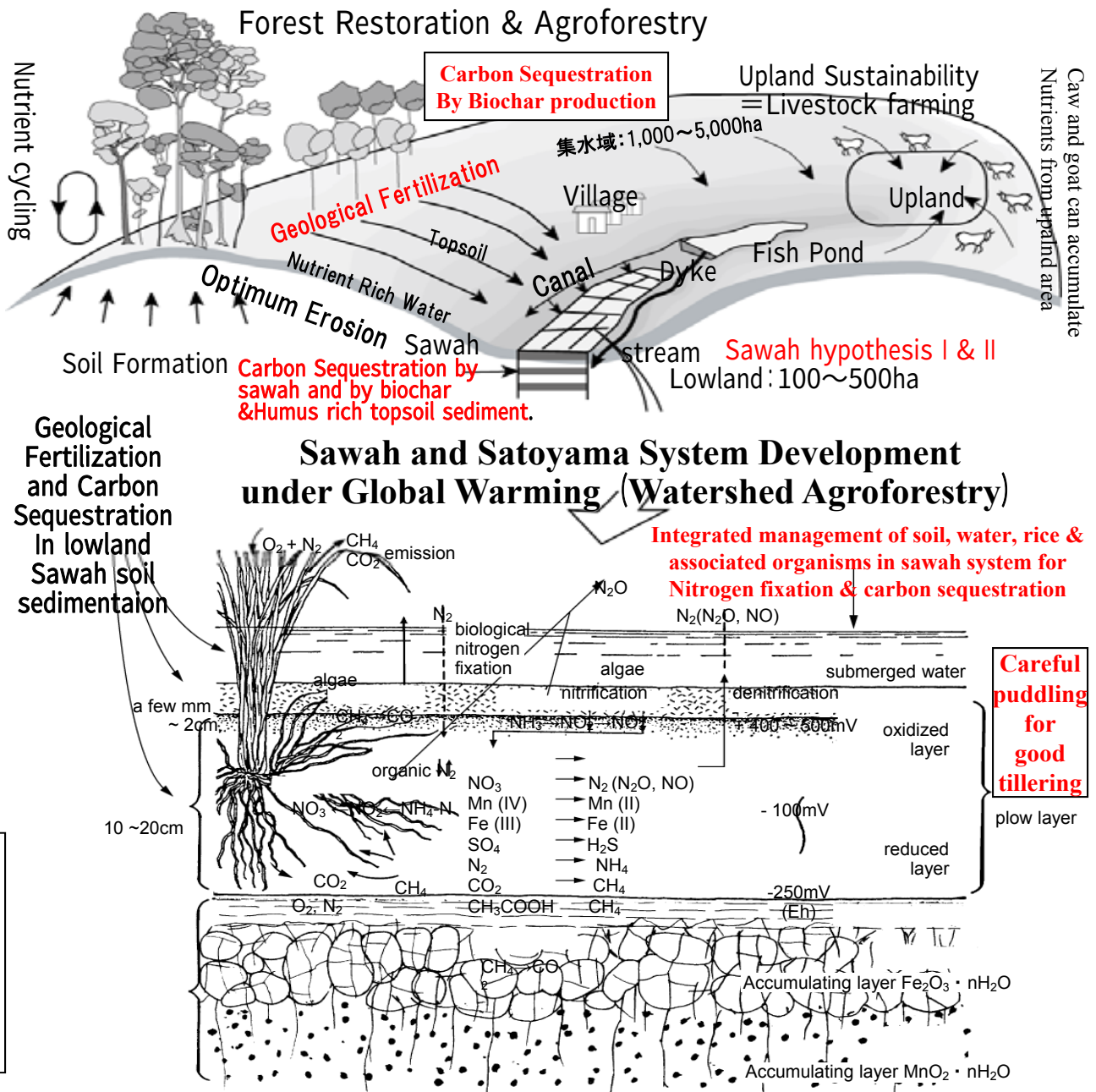
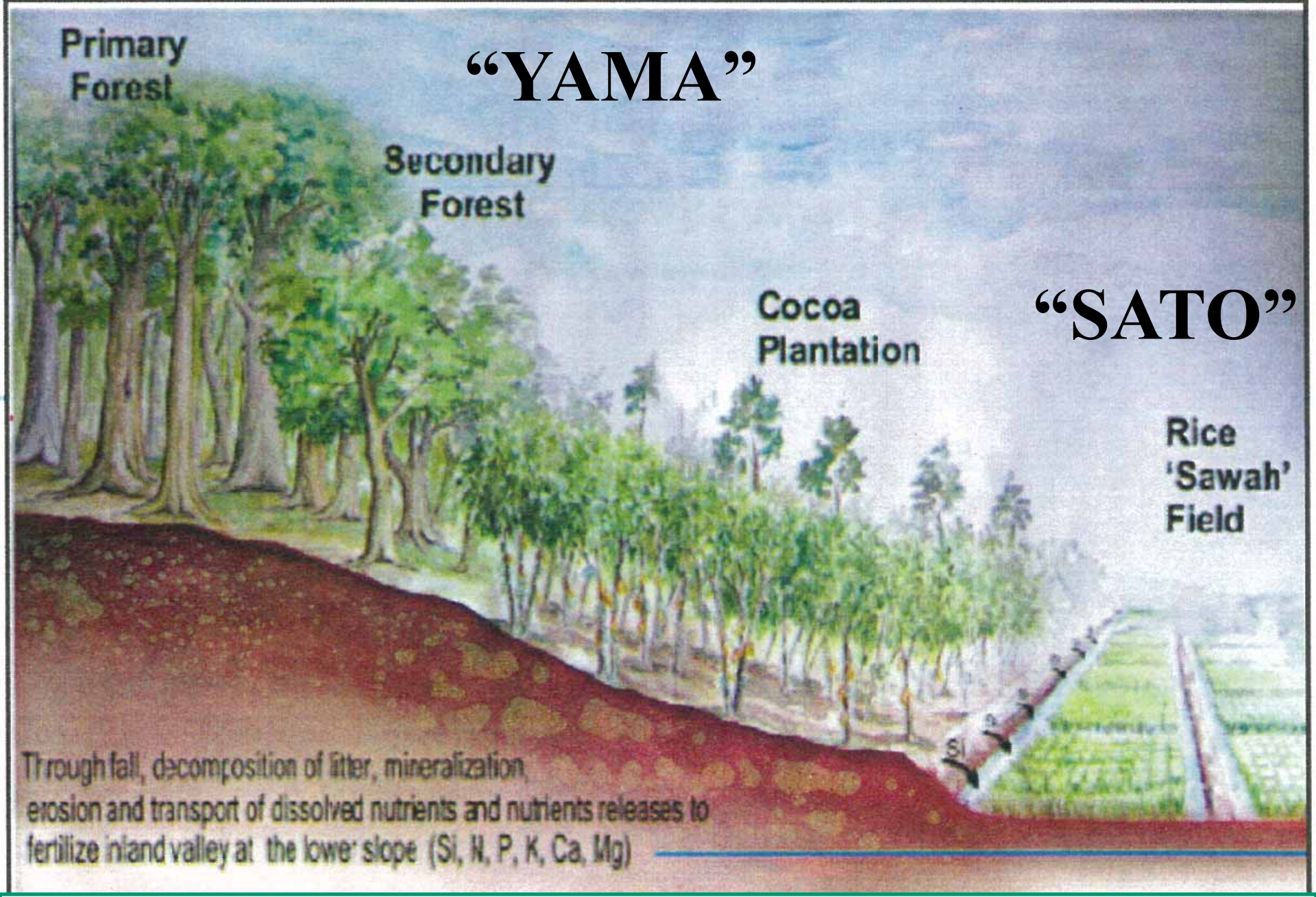
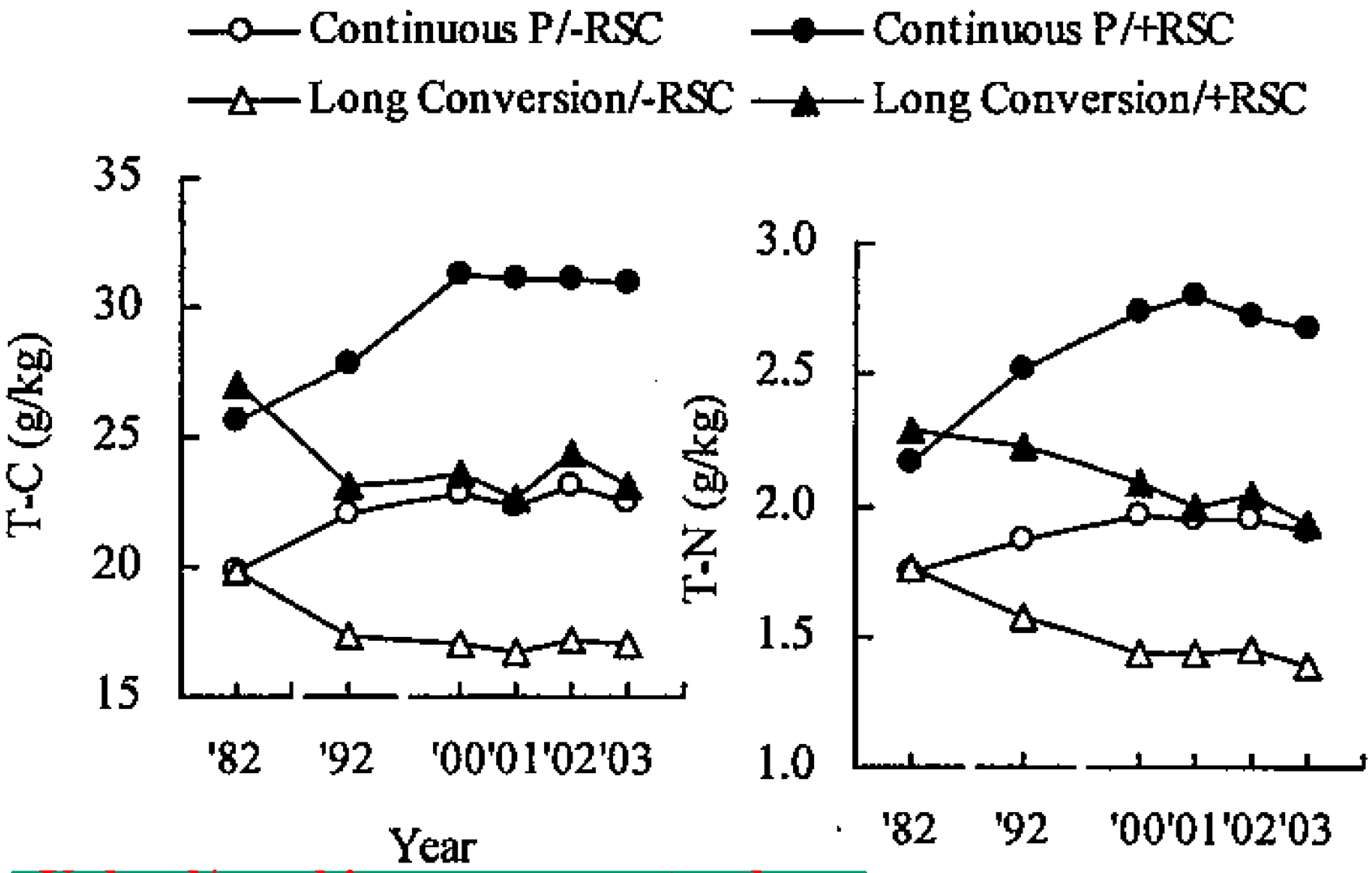


Fig. Sawah hypthesis (II) and creation of African SATOYAMA watershed systems to combat food crisis and global warming



One Example of Africa SATO-YAMA Concept Map by Dr. Owusu, FoRIG, Ghana, which is a watershed agro-forestry applicable to Cocoa belt region in West Africa.

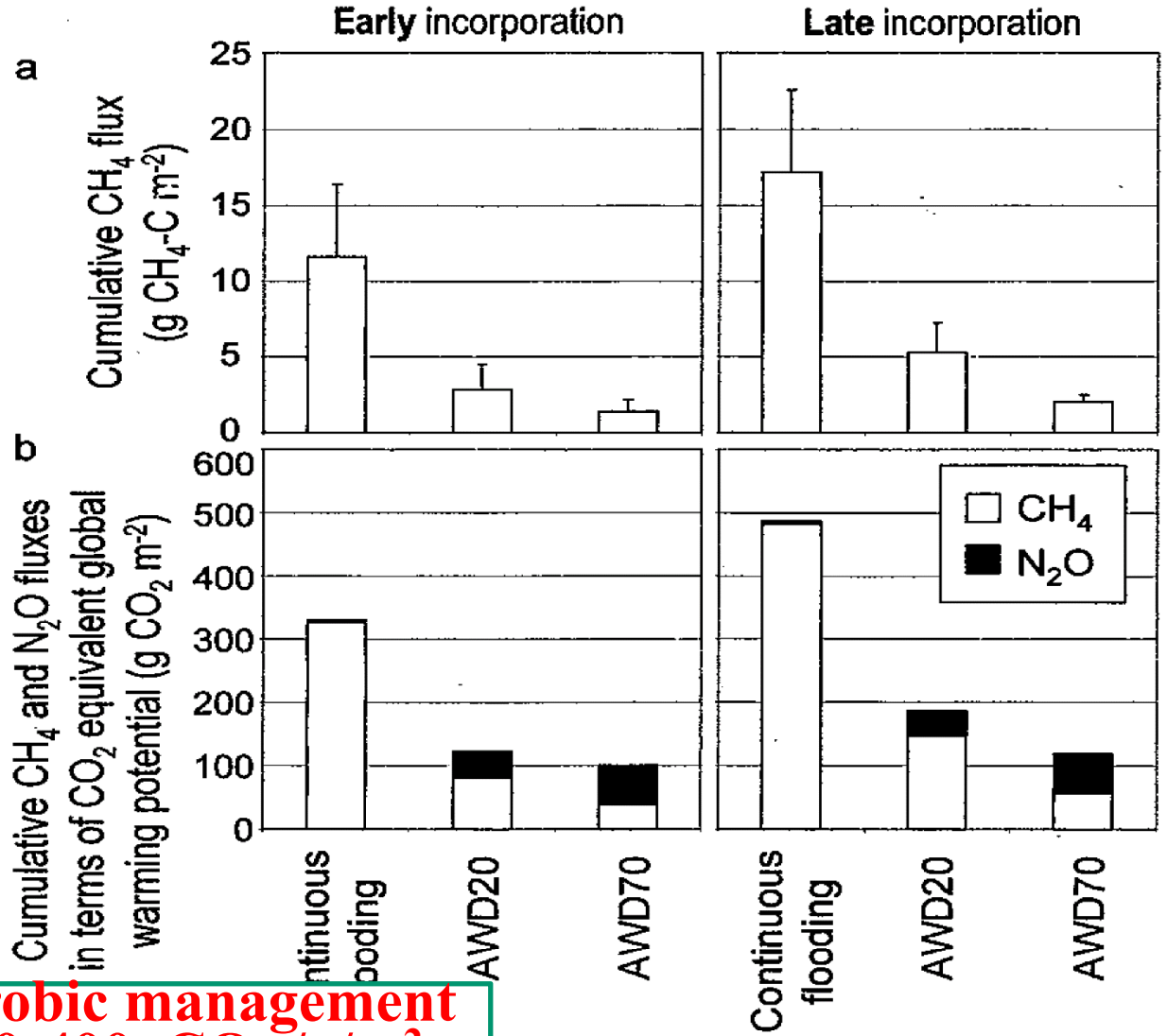

Nigeria Nupe's rudimentary Sawah system
THANK YOU FOR LISTENING



Upland/aerobic management reduce 50-100gC or 200-400gCO_2 /y/m^2

Fig. 5 Changes in total C and N contents of the soil in long-term upland conversion system. P, paddy; RSC, rice straw compost.

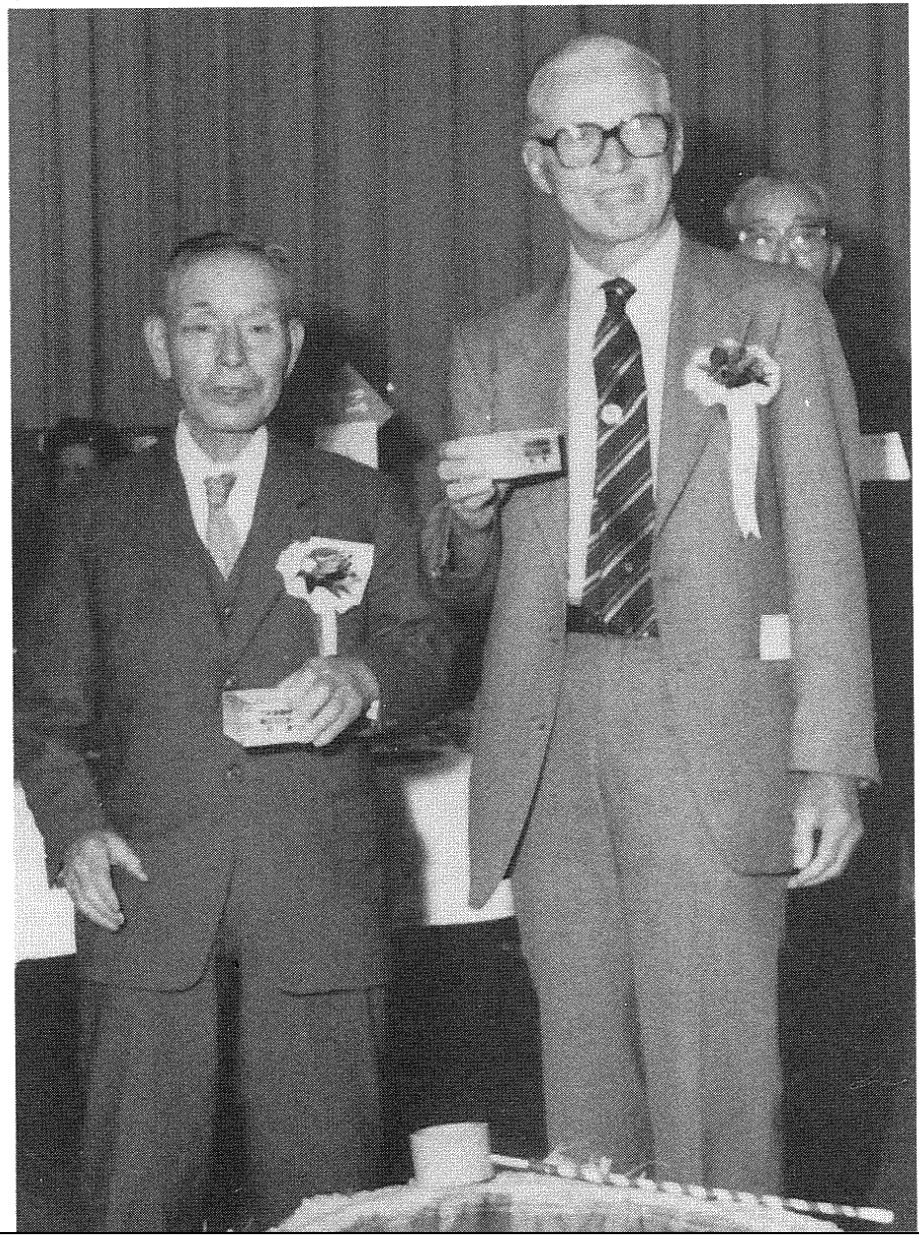
100gCO_2/m_2 is equivalent to 0.27ton C/ha
200g of CO_2 is equivalent to 0.54 g of C



Upland/aerobic management reduce 200-400gCO_2 /y/m^2

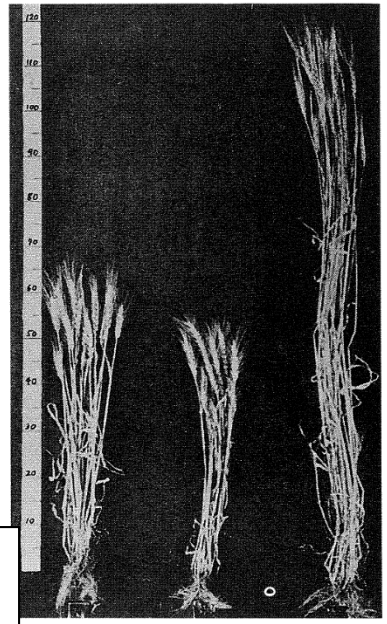
Figure 1. Cumulative CH_4 flux (a) and cumulative CH_4 and N_2O fluxes in terms of CO_2 equivalent global warming potential (b) during rice cropping period (January 29, 2007 (transplanting) – May 8, 2007 (harvest around this date); the conventional cropping period in dry season in the region). Bars indicate S. E. (only for **a**) (n = 3).

AWD20: irrigation under water potential-20kP(=2-3 days after water saturation)
AWD70:intermittent irrigation under water potential at-70kP(close to upland)

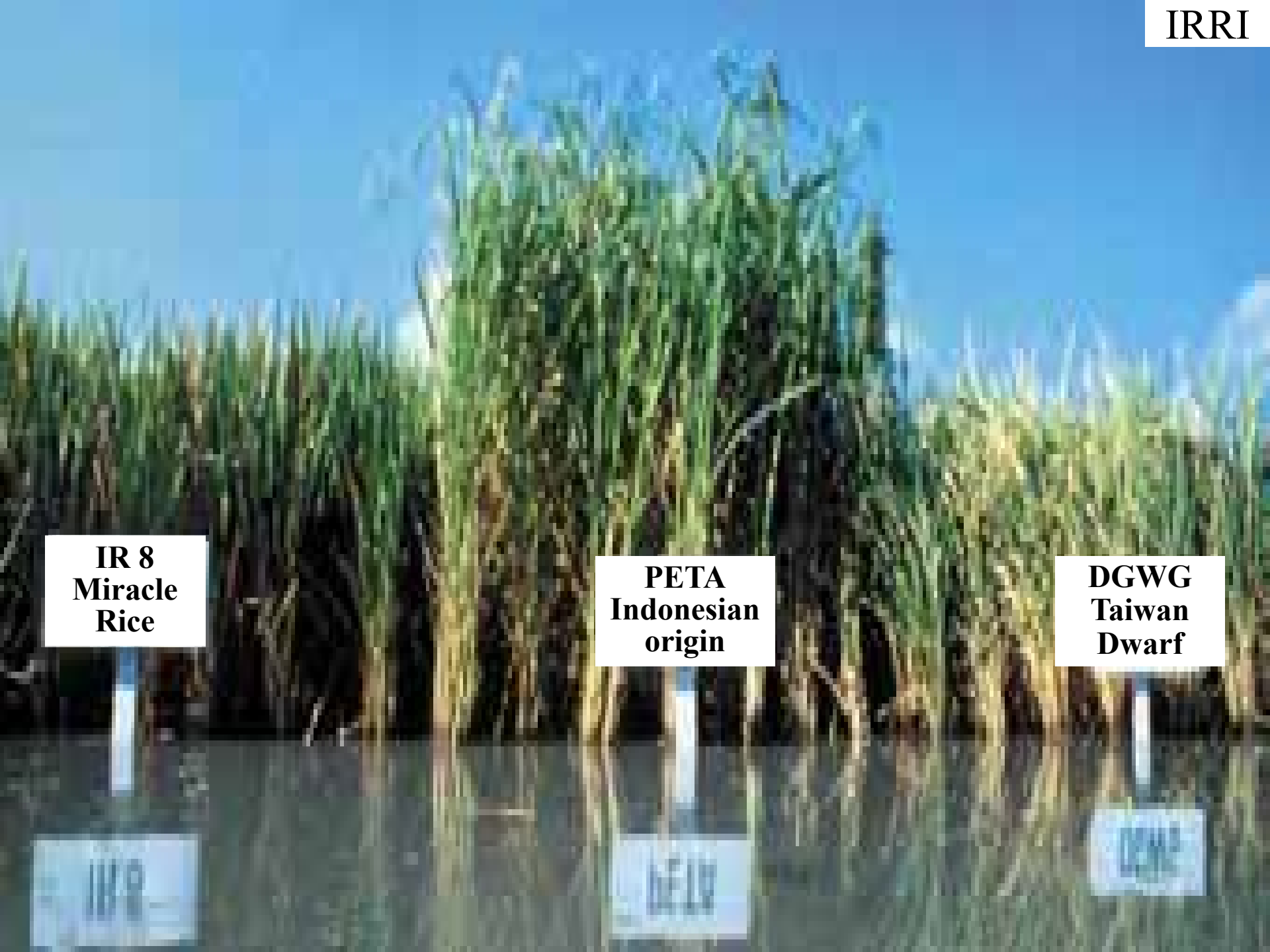


上／新品種を生み出すため、岩手県立農事試験場では地道な小麦の栽培が続けられた

Right:Turkey Red
Center:
Fruit DARUMA
Left: NORIN 10
in 1935

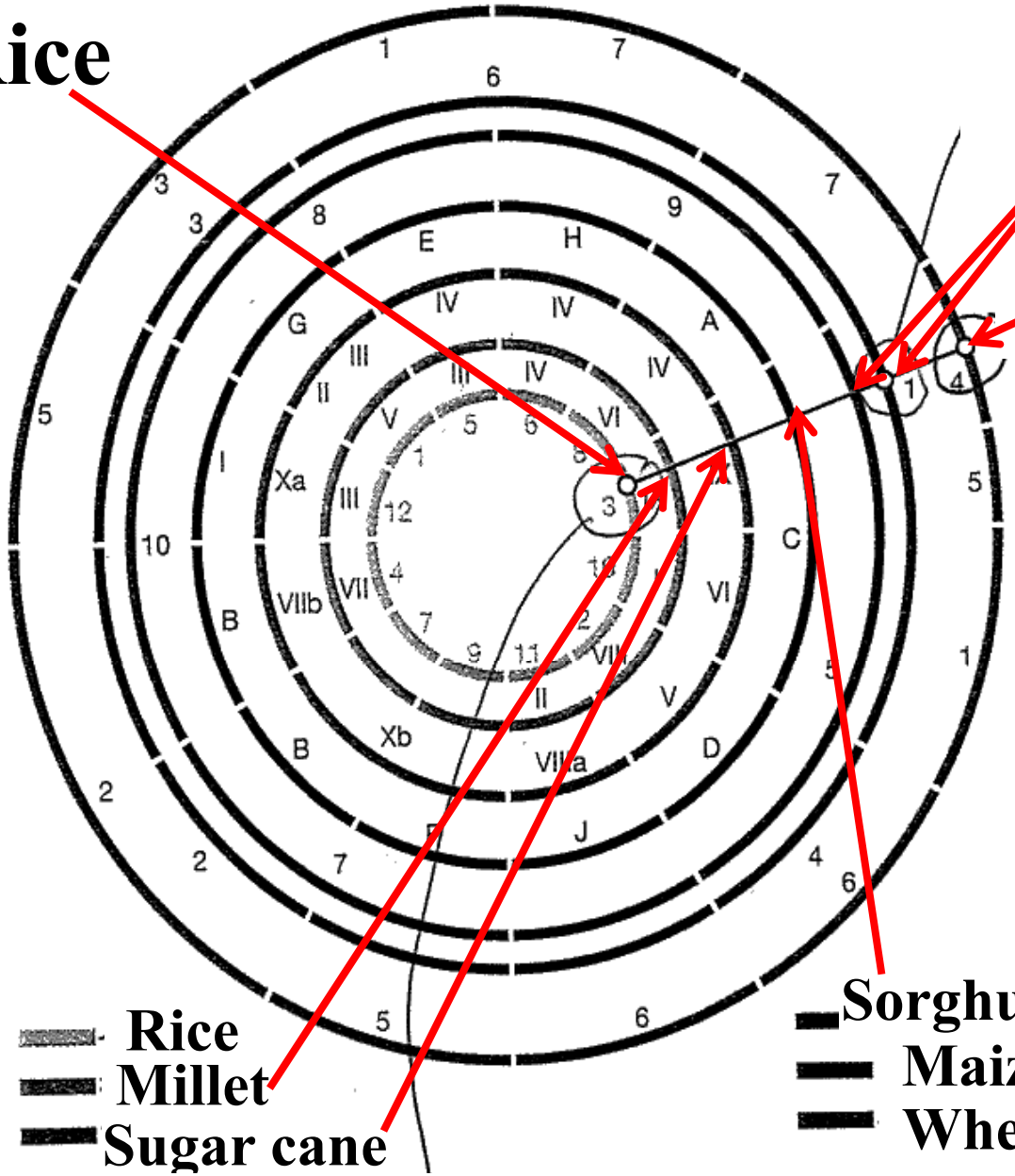


Dr.G. INAZUKA bred Norin 10 of wheat in 1935. The Norin 10 was collected by US occupied force in 1951. Dr. N. Borlaug bred, released 14 HYVs using Norin 10 in 1957. The start of CG center


IRRI
IR 8
Miracle
Rice
PETA
Indonesian
origin
DGWG
Taiwan
Dwarf

Left: traditional old variety

Right: Semi-dwarf high yielding variety (Sd1)



High Yielding Varieties for Green Revolution in Asia and Latin America have the same Gene, Sd 1. The Norin 10 was the first variety that expressed the Sd 1 character.

(Matsuoka 2004) **Sd1=Semi-dwarf 1**