

Submergence Tolerant Rice

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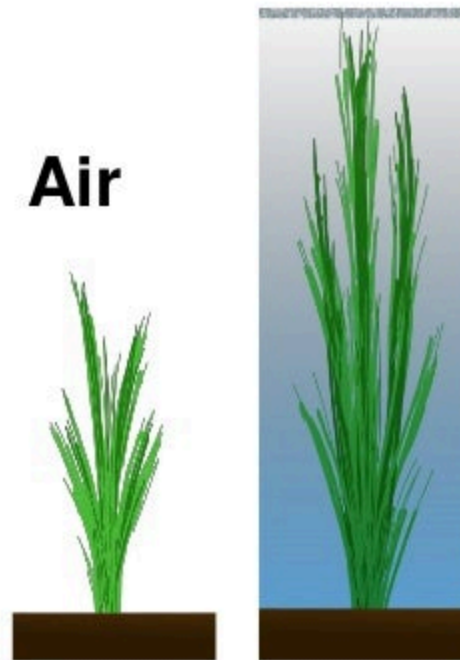
Flooding effects on rice

- ◆ Rice is the staple food for over half of humanity, 2/3 of the world's poor
- ◆ Floods annually reduce productivity in over 22 million ha of rice in Asia and large area in Africa
- ◆ Incidences set farmers deeper into debt and poverty
- ◆ Floods are worsening with climate change
- ◆ Scientific discoveries provided opportunities to develop varieties that cope with floods



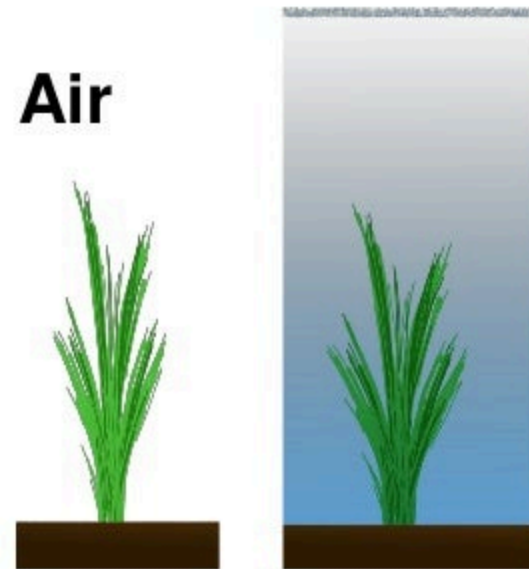
Transient complete submergence during vegetative stage (1-2 wks)

Short-term complete flooding
(attempted escape)



Lowland rice

Short-term complete flooding
(quiescence)



+*SUB1A*



SUB1 confers tolerance of complete submergence in rice

- 1970s: tolerant types identified
- 1990: Breeding lines, mapping
- 2006: *SUB1* cloned, MABC
- 2009 – varieties released

***SUB1*: Major QTL on Chr. 9, provides protection for 3 -18 d of complete flooding**



FR13A
“Donor”

Sensitive Variety

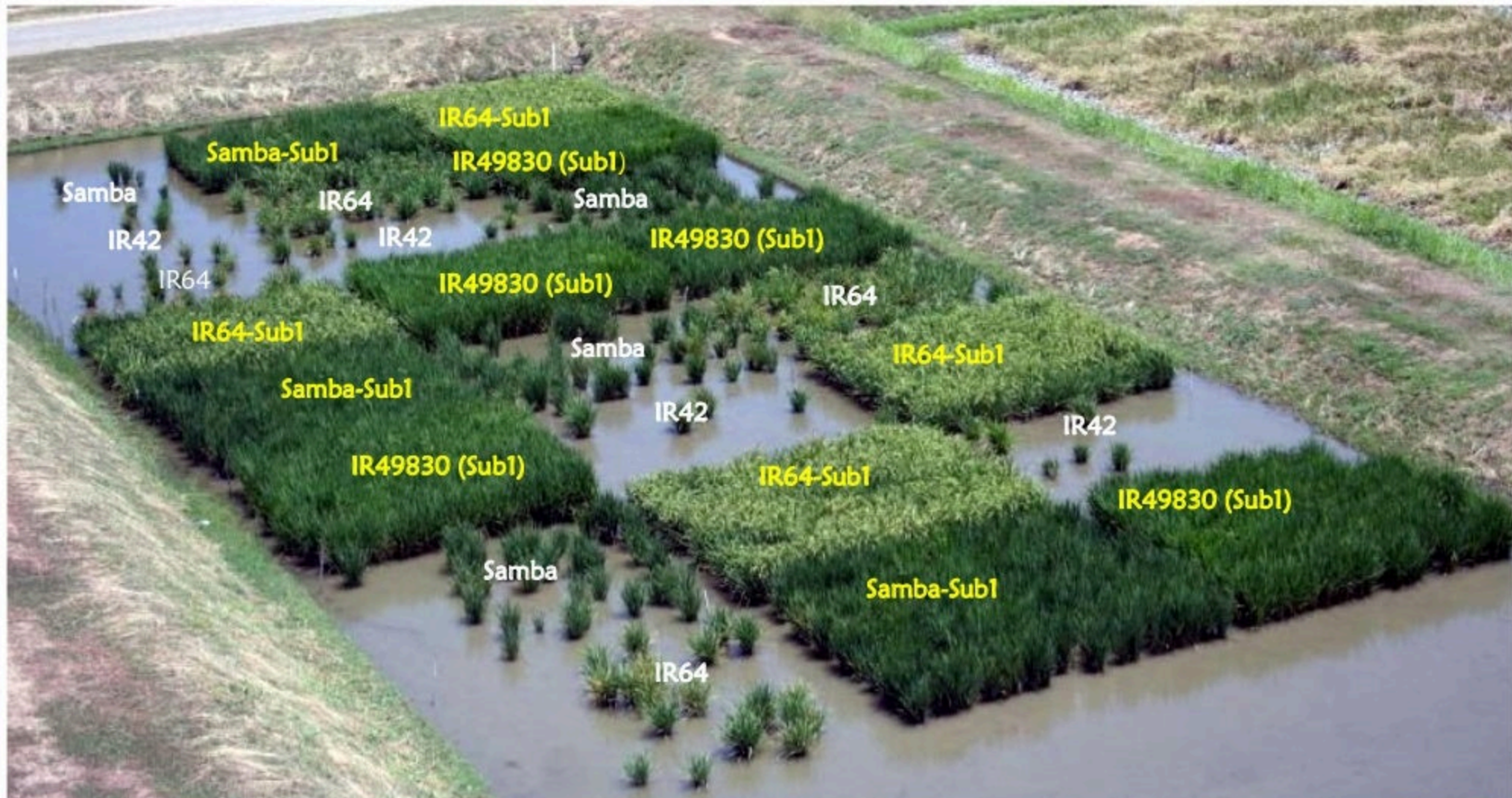


-Sub1

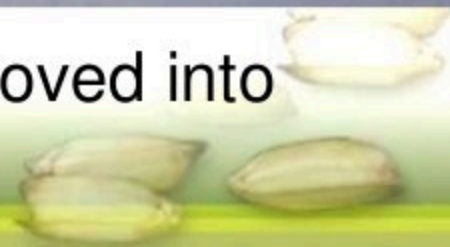
+Sub1

Swarna

Sub1 varieties after 17 days of submergence in the field at IRRI



Genes for submergence tolerance moved into popular “mega-varieties”



Sub1 varieties: help poor farmers to cope with perennial flooding



Mr. Asha Ram Pal
Village Palia Goa,
District Faizabad,
Uttar Pradesh

Released in Bangladesh,
India and Philippines 2009...
Nepal in February 2011

Major support from BMZ, Japan
USAID; B&MGF, IFAD enables us
to reach > 3,000,000 farmers in
2012; millions over next few ears



Pooja

Swarna-Sub1 (DS)

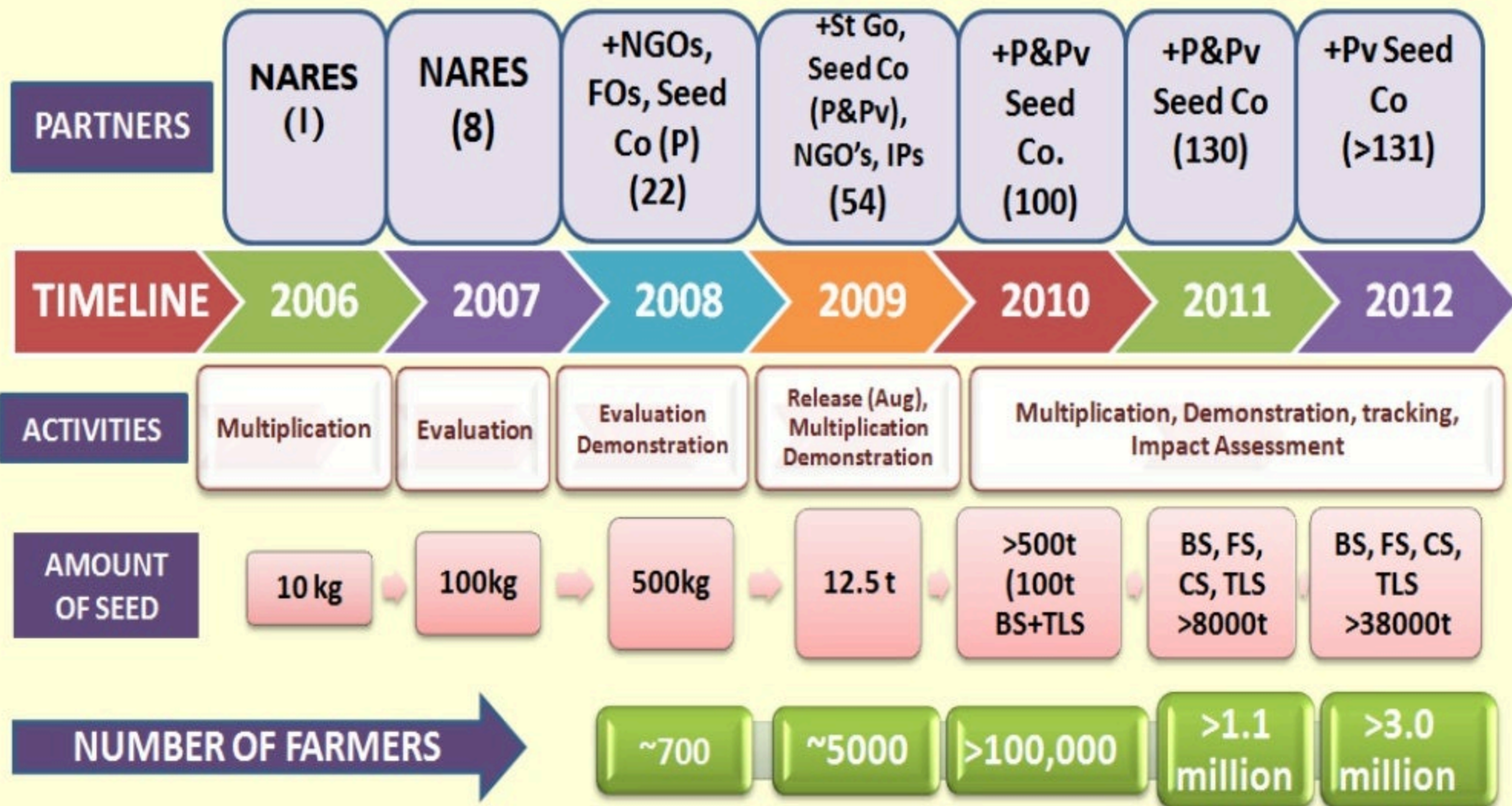
Pooja

Pooja

Older seedlings
for
Retransplanting

Puri distt., Orissa; Sept 29, 2011

Fast adoption by farmers



◆ **2013: Sub1 Varieties reached ~ 4 m farmers on ~1.7 m ha**

SUB1 in farmers' fields

- ◆ Enhances survival and recovery and shorten delay in maturity caused by submergence
- ◆ Provide yield advantage of 1 to 3.5 t ha⁻¹ in farmers' fields following submergence
- ◆ No effects on yield or quality in absence of stress
- ◆ Works in all genetic backgrounds and environments
- ◆ Effective from seedling to early reproductive stage

Nursery



Vegetative



Reproductive



Several Sub1 varieties released in Asia

Breeding line	Year	designation	Country
IR05F102 (Swarna)	2009	Improved Suwarna	India
	2009	INPARA-5	Indonesia
	2010	BRRI dhan-51	Bangladesh
	2011	Swarna-Sub1	Nepal
	2011	Yemyoke Khan	Myanmar
IR07F102 (IR64)	2009	NSIC Rc194	Philippines
	2009	INPARA-4	Indonesia
IR07F290 (BR11)	2010	BRRI dhan-52	Bangladesh
IR09F436 (Ciherang)	2011	INPARA-5	Indonesia
	2013	BINA dhan11	Bangladesh
IR07F101 (S. Mahsuri)	2012	S. Mahsuri-Sub1	India
	2011	S. Mahsuri-Sub1	Nepal
	2013	BINA dhan12	Bangladesh
IR49830-7-1-2-1-3	1999	Popoul	Cambodia
IRRI 119	1997	PSB Rc 68	Philippines

Opportunities for greater impact

- ◆ More resilient varieties with tolerance of multiple stresses – drought, salinity, pests and diseases
- ◆ Shorter maturing varieties with Sub1 provided opportunities for multiple crops in one year
- ◆ Tolerant varieties provide assurance for farmers to invest in inputs and good management, hence higher yields
- ◆ Having sufficient food and stable income help farmers to move out of poverty



Elements of success of SUB1 deployment

- ◆ Submergence tolerant versions of popular varieties
“Marketable product”
- ◆ Effective networks of partners => over 450 partners
in South Asia
- ◆ Strong awareness program to generate interest of
seed producers and demand from farmers
- ◆ Strong policy support to:
 - Stimulate investments in seed systems &
infrastructures
 - Enabling environments through changes in varietal
release guidelines and seed policies
- ◆ Additional investments through parallel programs
from national and international sources



Thank you



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R&D Partners

NARES
NGOs
Private Co.
Farmers &
organizations

BILL & MELINDA
GATES *foundation*

