



Part 2:

A better rice for the world

Tina Liu



Grain production increased 250% from 1950 to 1984!

People in developing countries eat 25% more calories today compared to before the Green Revolution.



Malnutrition is still widespread



1 in 7 people are
undernourished

Malnutrition is still widespread



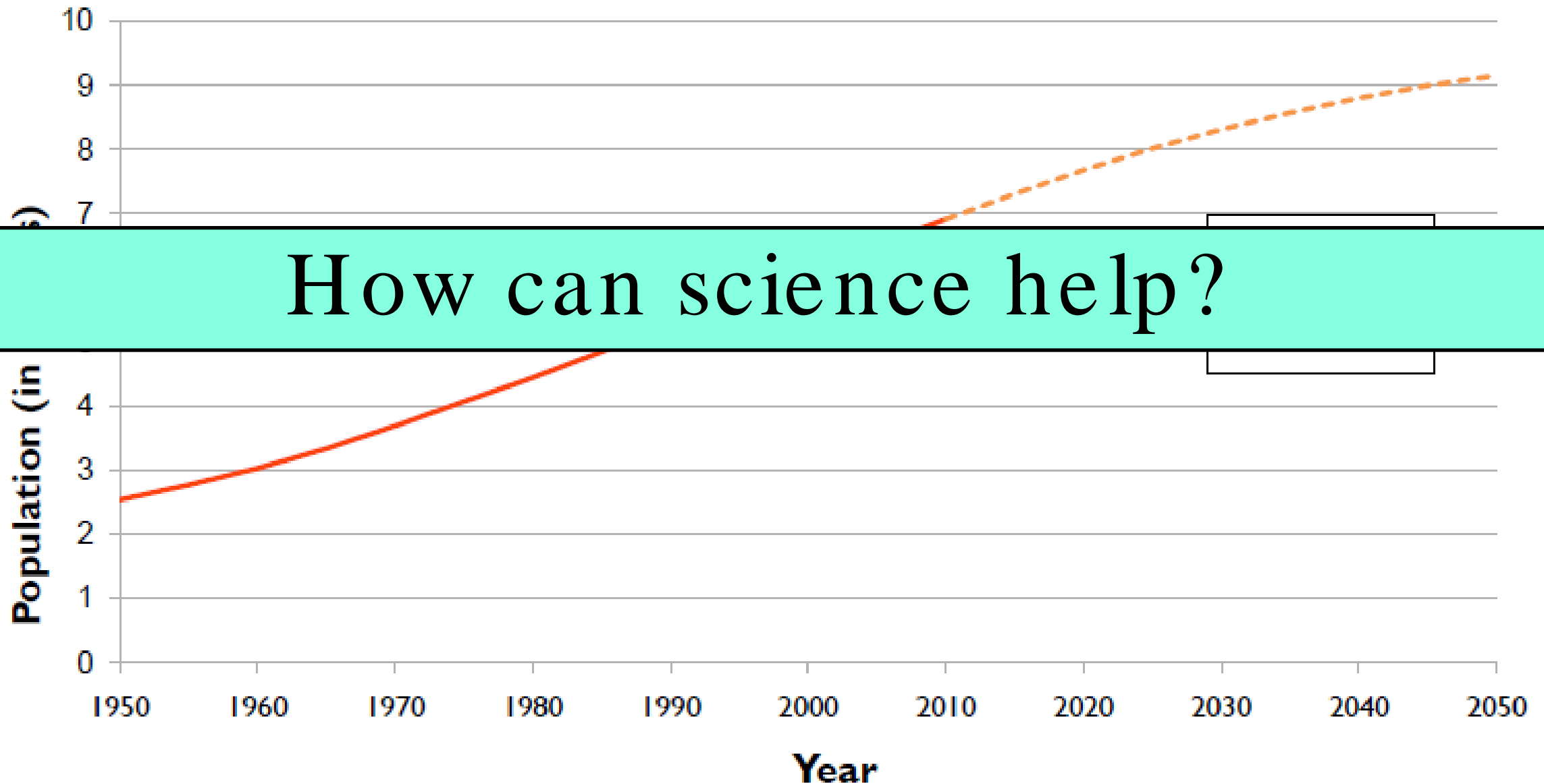
More suffer from
“micronutrient”
deficiency



1 in 7 people are
undernourished

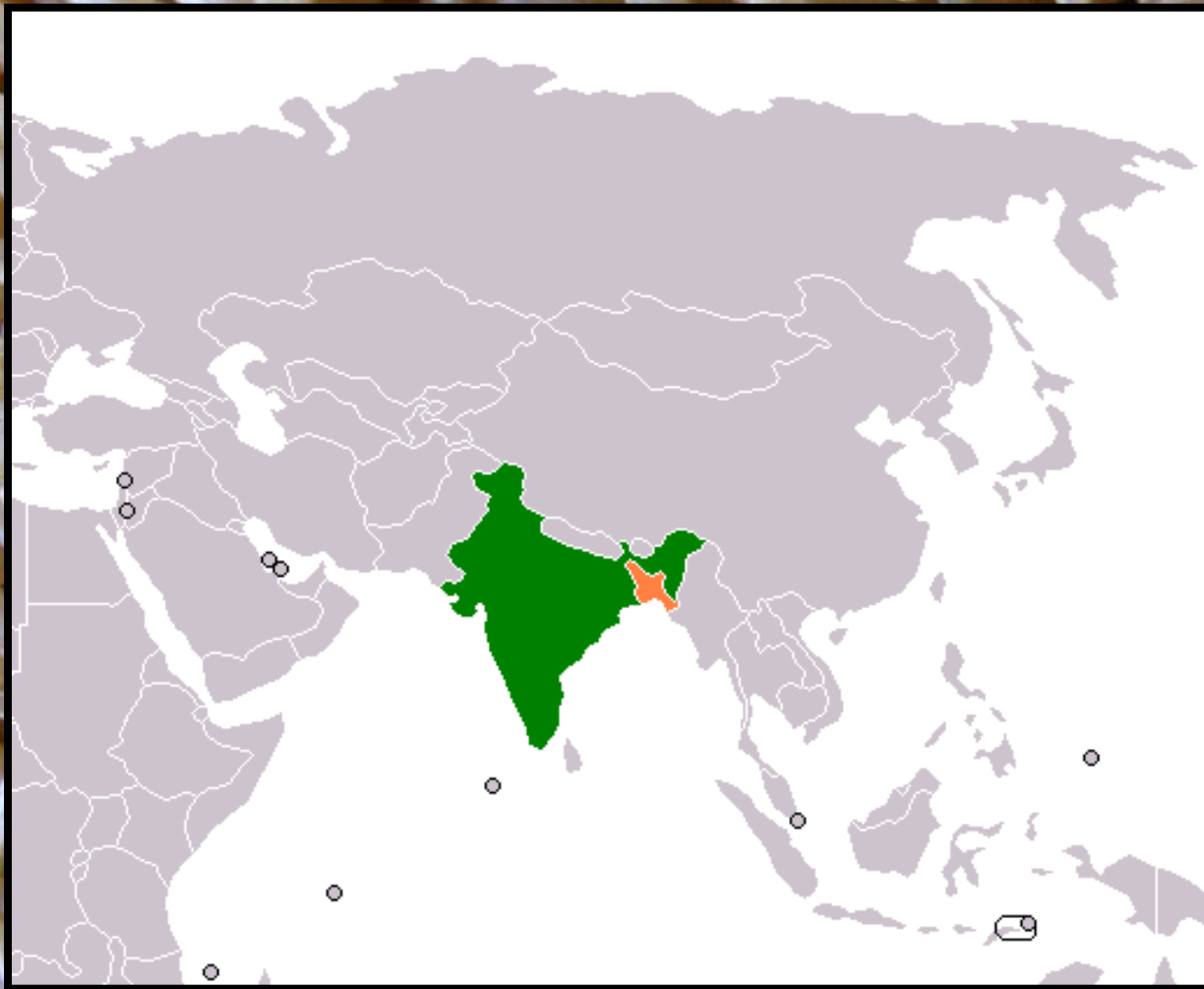


World Population Growth, 1950-2050



How can science help?

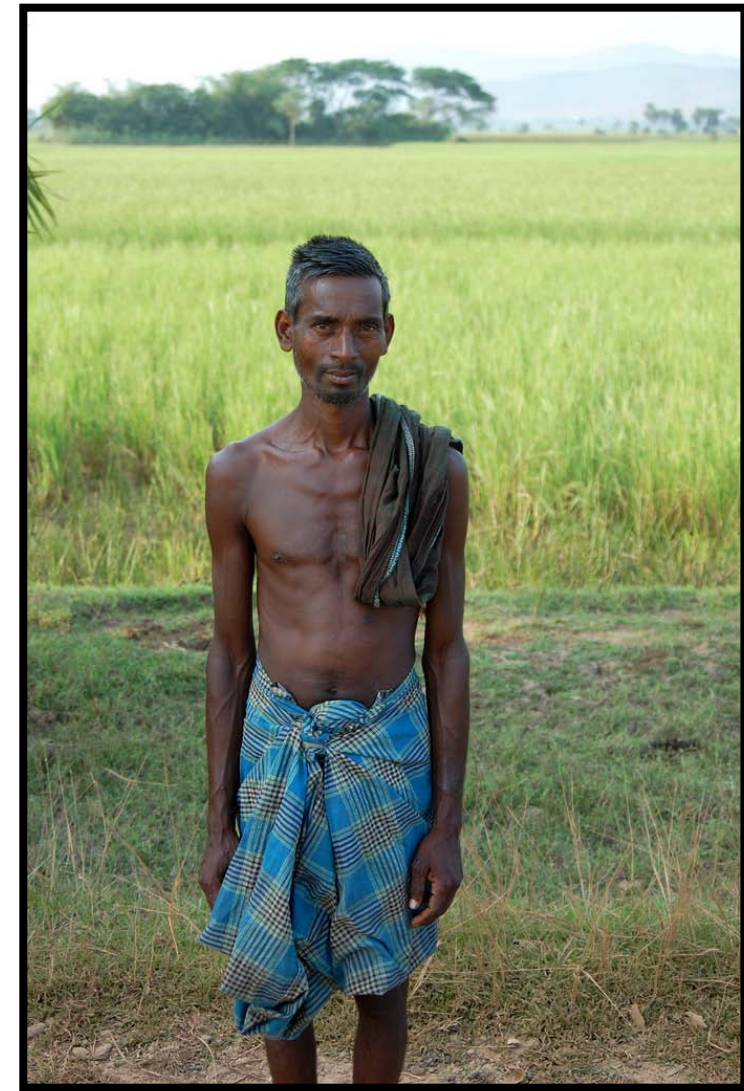
Our story starts in South Asia...



Monsoon rains can damage crops

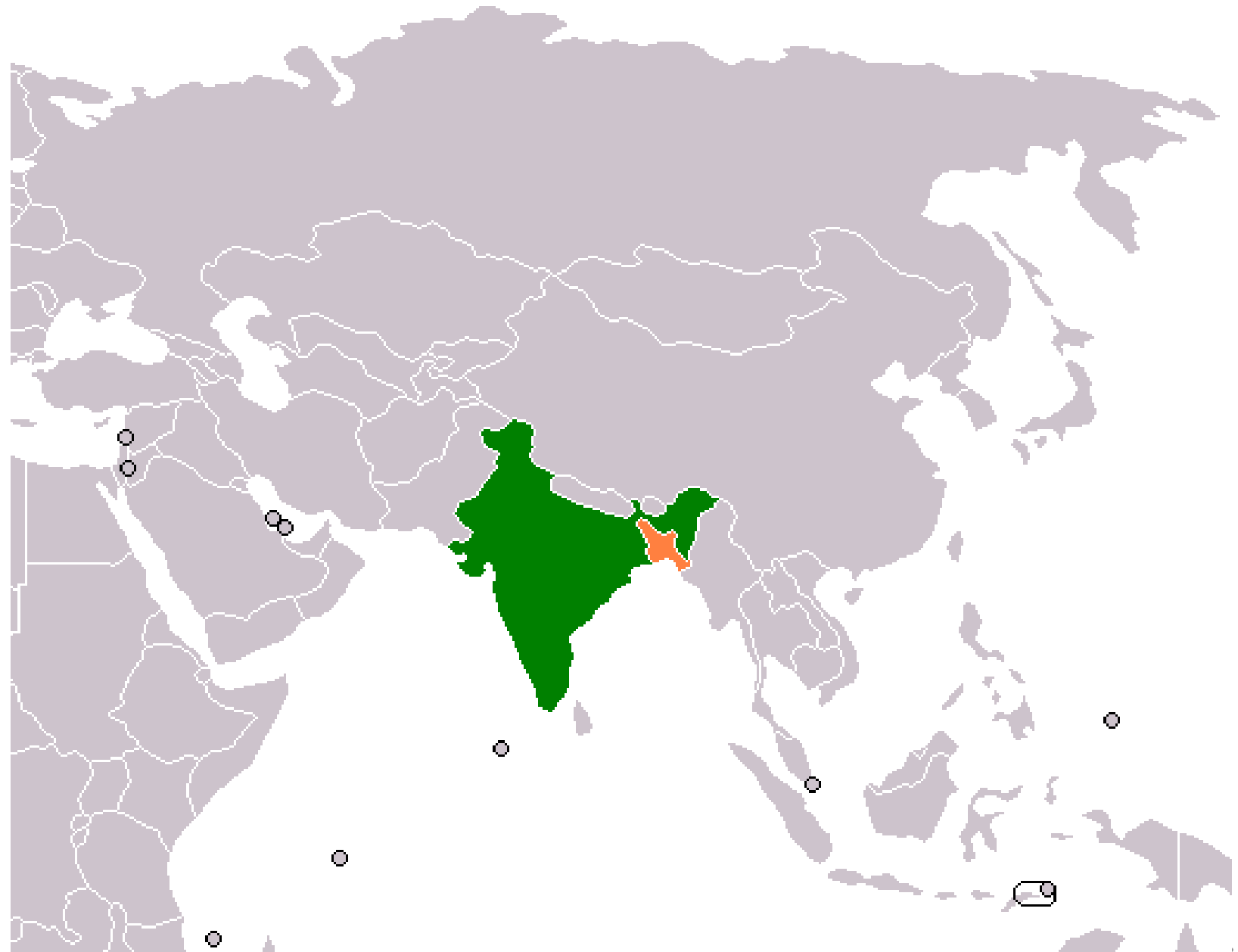


Loss of rice harvests has a big impact in India & Bangladesh



India & Bangladesh supply the world with rice

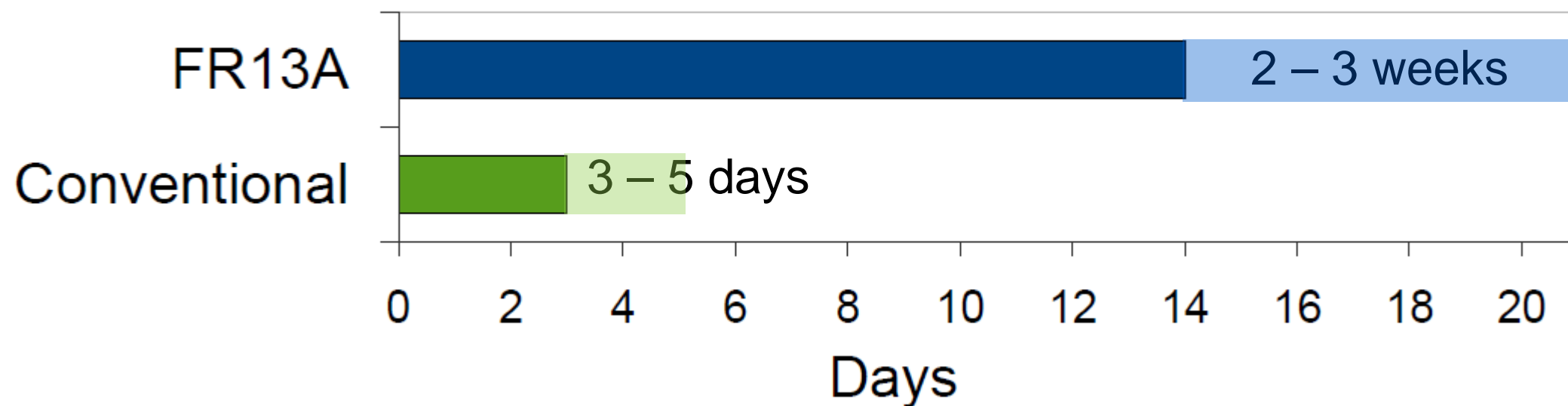
Basmati Rice



How can we prevent floods from destroying the
rice crop?

“FR13A” is a traditional Indian flood-resistant rice.

Maximum period of time underwater



...with caveats.

FR13A rice

Flood-resistant

X

Conventional rice

High-yield

The Ideal Rice Plant?

High-yield

Flood-resistant

~~The Ideal Rice Plant~~

High-yield

Flood-resistant

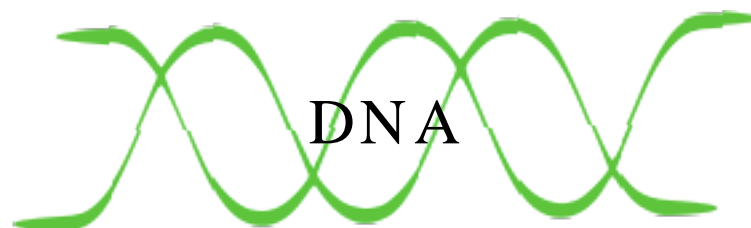
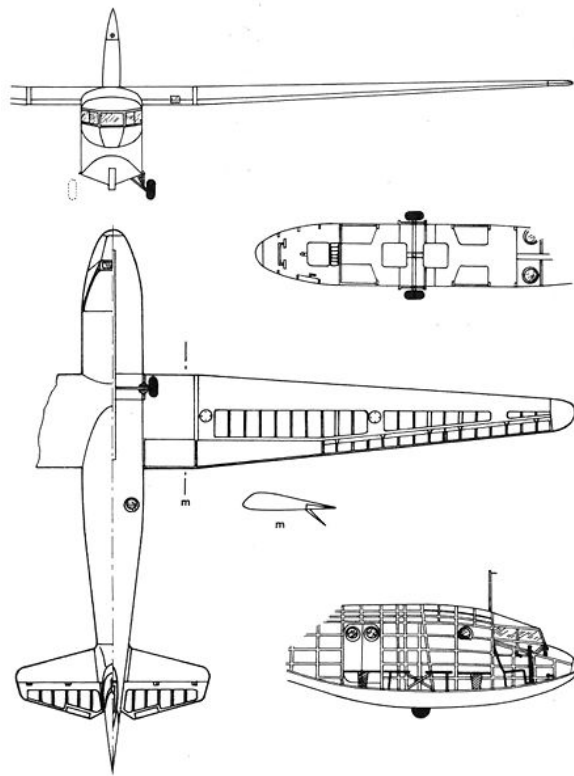
- Difficult to grow in local conditions
- Poor grain quality
- Poor taste

Difficult to separate traits you want from traits you don't want...

What can we do?

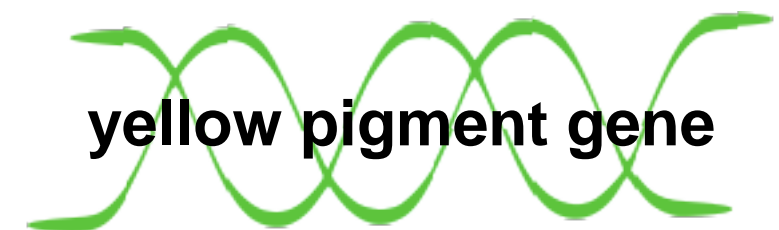
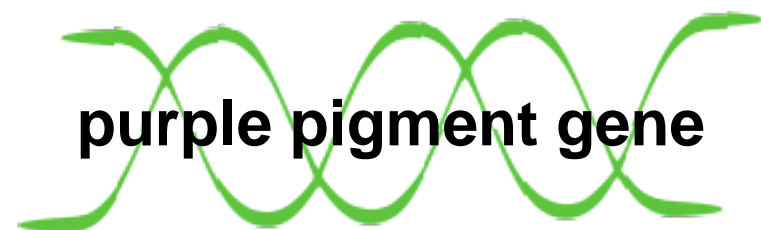
First, a review of the basics...

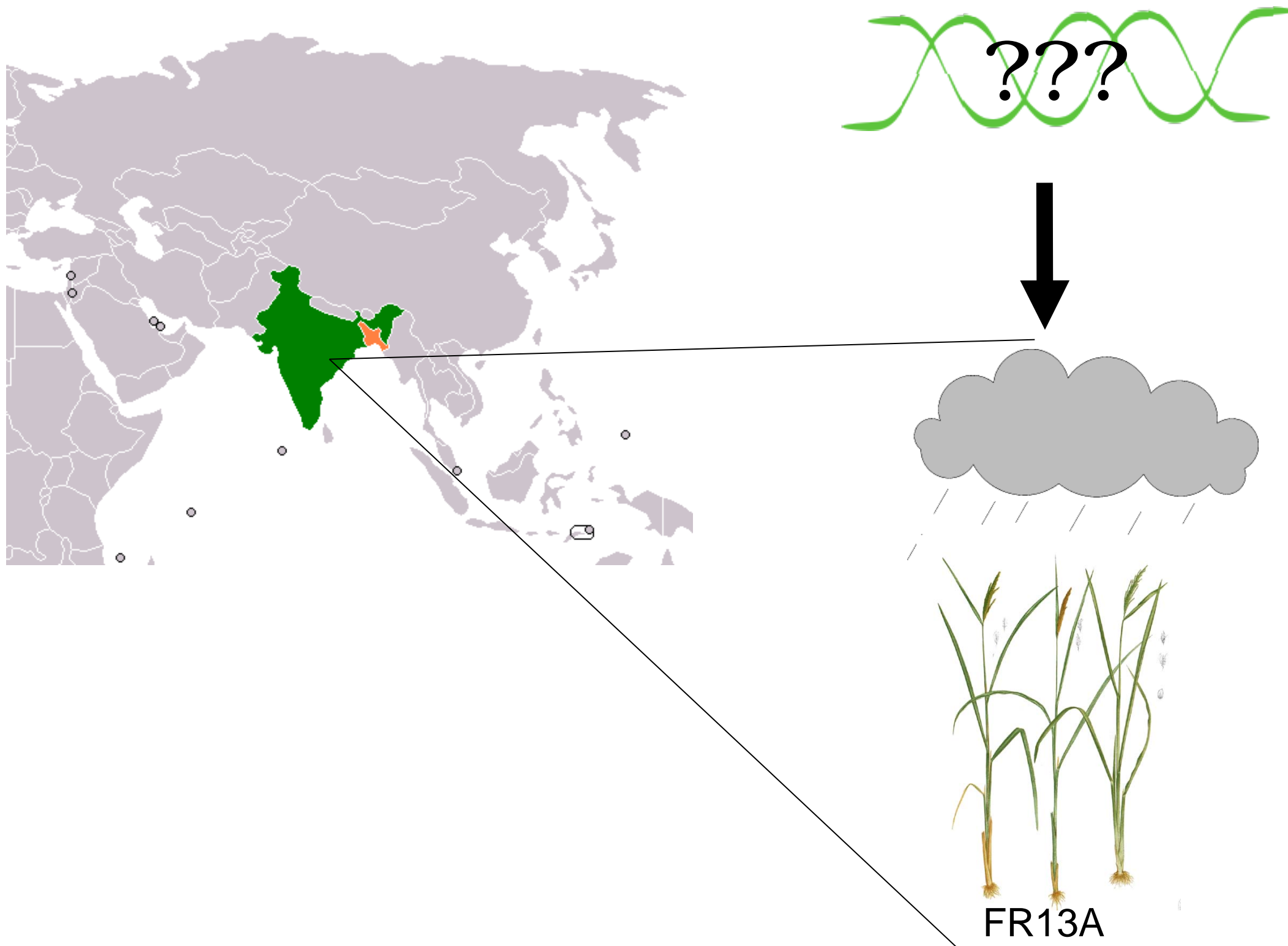
DNA is the “blueprint” for life

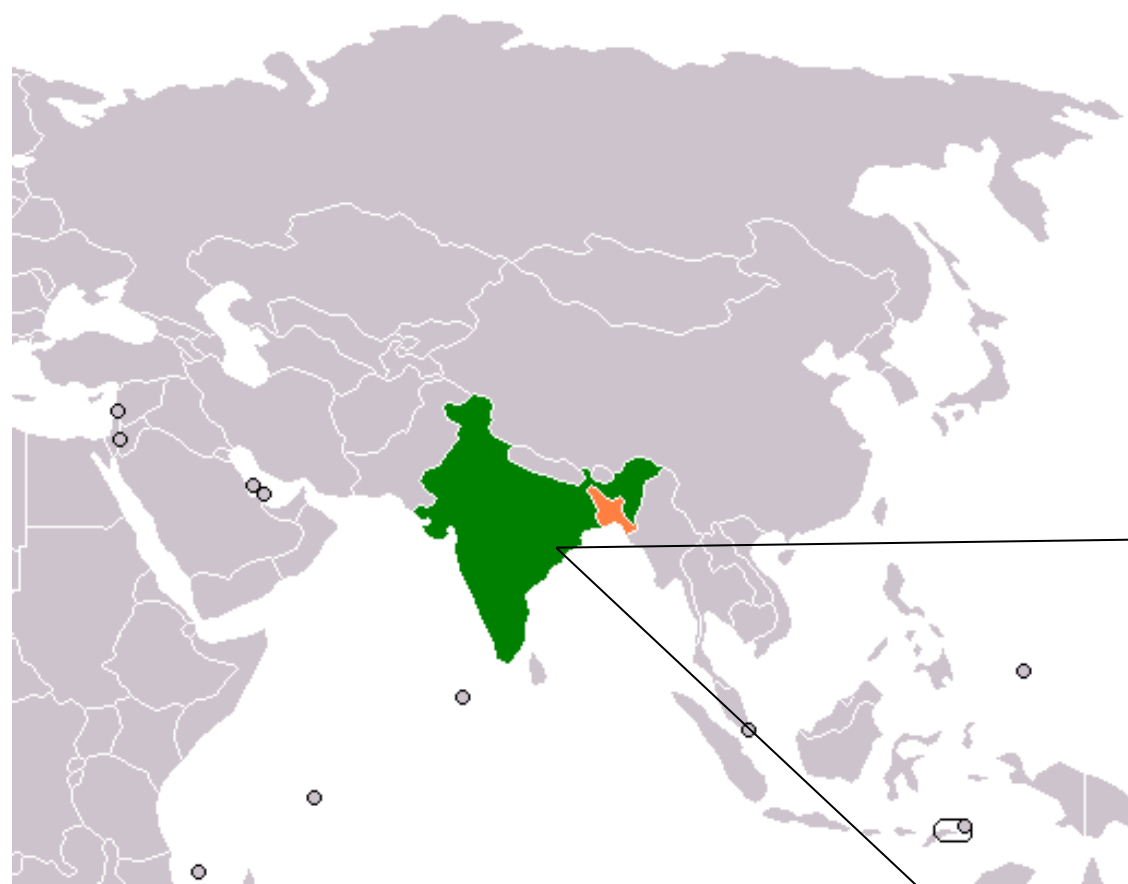


Genes are defined pieces of DNA

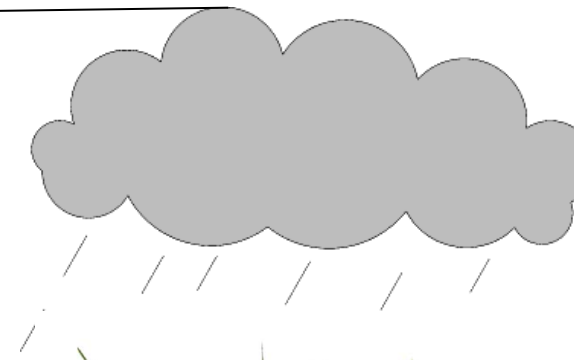
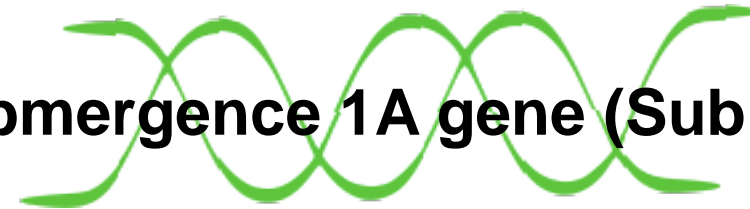
Different genes lead to different traits







Submergence 1A gene (Sub1A)



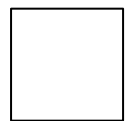
FR13A



David Mackill, IRRI

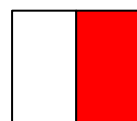
Precision Breeding

FR13A



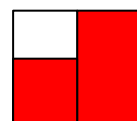
X

Conventional



X

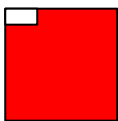
Conventional



X



What we want:



Identical to the conventional rice plant, except for Sub1A gene

Repeat



How do we select the offspring
plants that picked up only the
Sub I A gene?

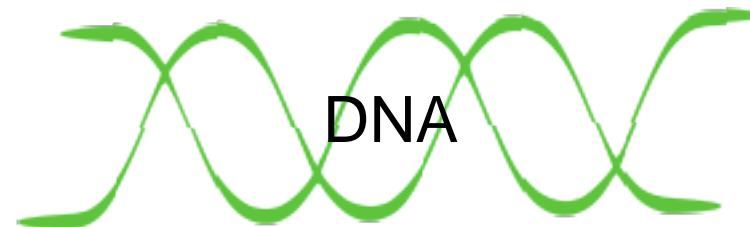
Offspring plants

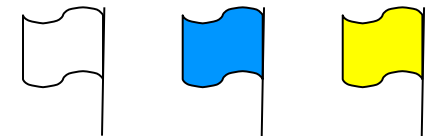
Extract their DNA

Identify patterns or
“markers” in the DNA

1.

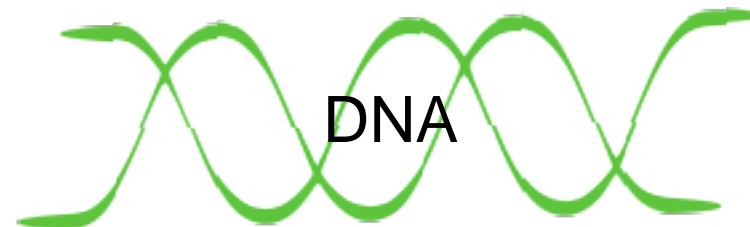






2.

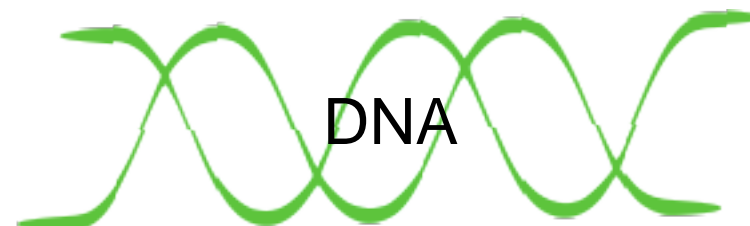


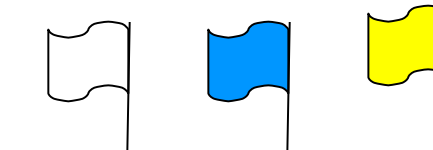




3.

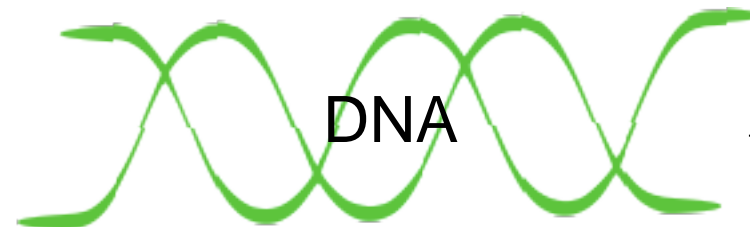


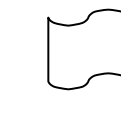




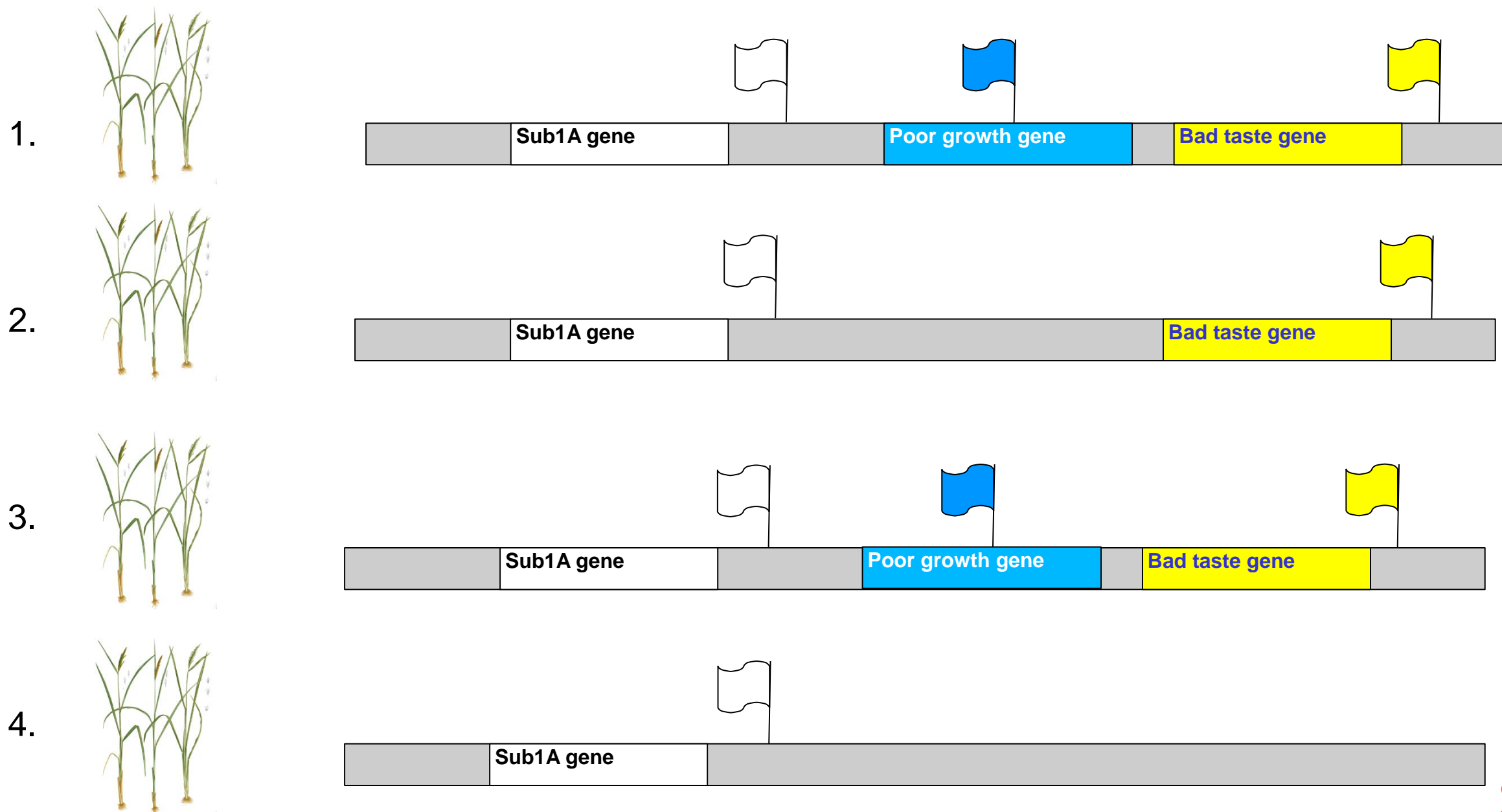
4.







What do these markers tell us?



Select the plant that has only the gene you want...

Voila!

4.



This type of selection process is called
“Marker-assisted selection.”



Precision Breeding

- Select traits with greater accuracy
- Select traits faster

All with the help of modern genetic technology!

So, did it work?



One year later (2007)...



“When I saw Mostafa’s field flooded, and then saw it recover, I was surprised—it was like magic,”





New flood-resistant rice putting farmers back in business in northeast India

Mar 2010, Reuters Alertnet



Flood resistance for the world?

GUYANA DEVELOPING FLOOD- RESISTANT RICE

JULY 2010, INTERNATIONAL RICE RESEARCH INSTITUTE



It doesn't stop there...



Drought resistance



“Perennial rice”



“Golden rice” supplies pro-Vitamin A



The importance of research...

Next up:

Genetically modified plants...

in your own backyard?

Questions?