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The World Vegetable Center

Prosperity for the poor & health for all!

International Vegetable Training Course
Module 1 – Seed to Harvest
14th September 2015

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Research to promote development

- Founded in 1971 as the **Asian Vegetable Research and Development Center** with a regional research focus on Asia
- Our research and development is **nonprofit**
- Our research outputs are **global public goods**
- **The World Vegetable Center** has an expanding global role with a growing network of regional offices

Alleviate poverty and malnutrition in the developing world through the increased **production** *and* **consumption** *of health-promoting* **vegetables.**

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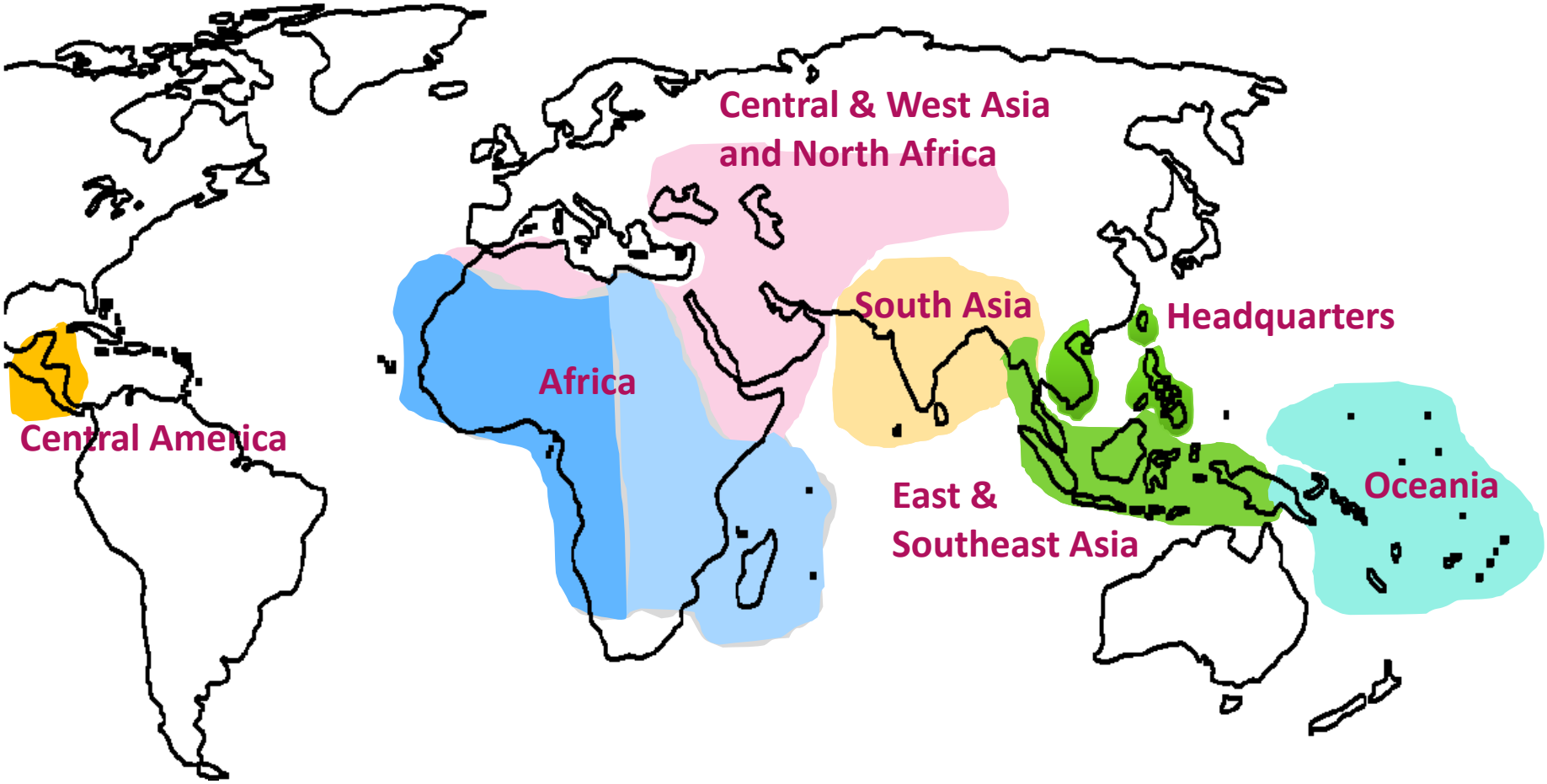

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vegetables = nutrition

deficiency in calories and proteins		= HUNGER	≥ 870 million underweight
deficiency in vitamins and minerals		= MICRONUTRIENT DEFICIENCY	2 billion malnourished
excess calories		= IMBALANCED CONSUMPTION	≥ 1.4 billion overweight

Source: FAO; IFAD; WFP, 2012

75% of diabetics will soon be in developing countries

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“Hidden hunger” micronutrient deficiencies

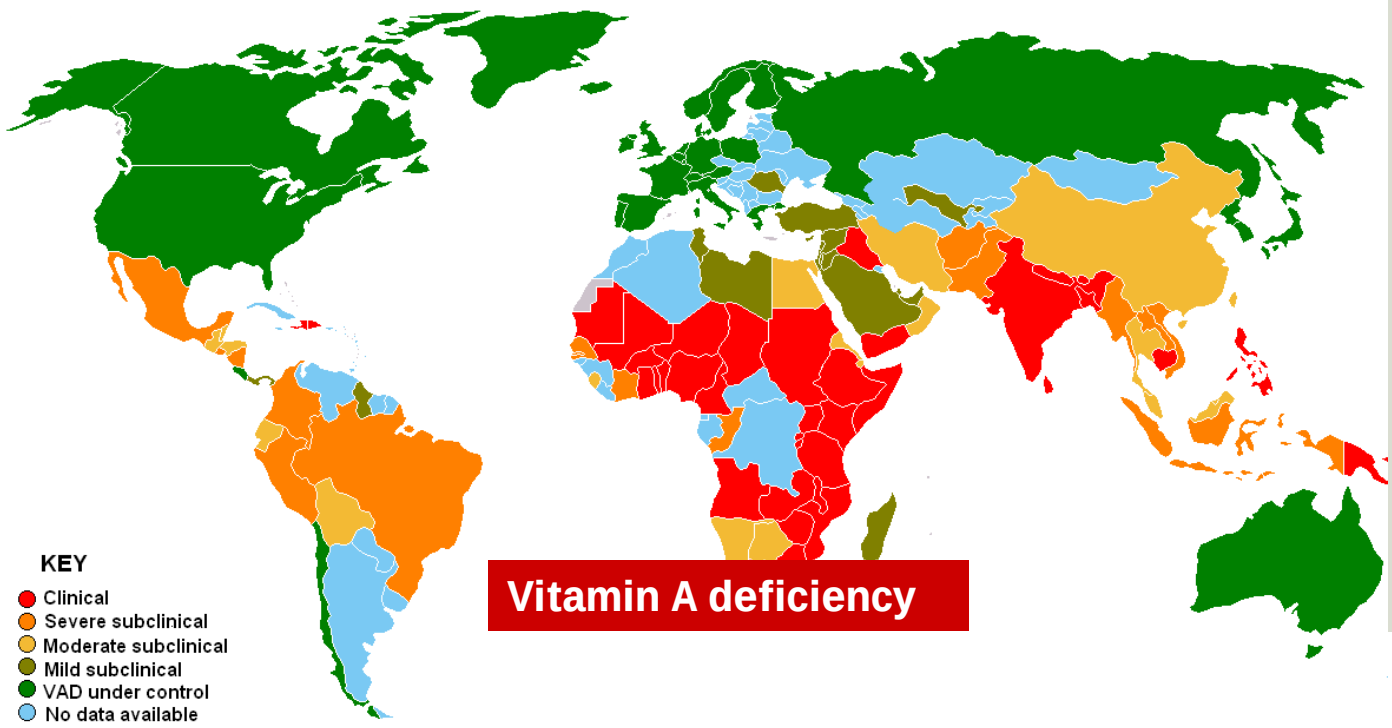
Each Year:

2.7 million deaths due to insufficient intake of micronutrients

Each Day:

300 mothers die in childbirth due to iron deficiency

4,000 children die from effects of vitamin A deficiency



Recommended nutrient intakes (RNI) and % RNI contributed per 100 g of:

	Protein	Vitamin A	Iron	Folate	Zinc	Calcium	Vitamin E
RNI for pregnant women (1st trimester)	g 60	µg RE 800	mg 30	µg 600	mg 11	mg 1000	mg α-TE 7.5
percentage of RNI	- % -						
rice	0	0	1	2	4	0	0
cassava (root)	2	0	1	5	3	2	0
millet	6	0	2	14	8	0	0
meat (chicken)	**37**	0	3	1	**14**	1	3
mungbean	**40**	**2**	**22**	**104**	**24**	**13**	**7**
vegetable soybean	**18**	2	**13**	**28**	**13**	4	**78**
cabbage	3	1	1	10	2	4	2
tomato	2	18	1	3	2	1	7
slippery cabbage	**6**	**106**	**5**	**30-177**	11	**18**	**58**
moringa leaves	7	**146**	**11**	**49**	5	10	**65**
amaranth	9	**160**	6	**31**	6	**32**	17
jute mallow	10	**198**	**12**	**21**	0	**36**	36
nightshade	**8**	**101**	**13**	**10**	**9**	**21**	**28**
vegetable cowpea leaves`	8	**193**	6	**27**	3	**54**	**101**

RNI source: FAO/WHO 2004; RNI for iron with low bioavailability; RNI for zinc with medium bioavailability
Nutrient data source: USDA nutrient database, AVRDC IV nutrient data, and literature

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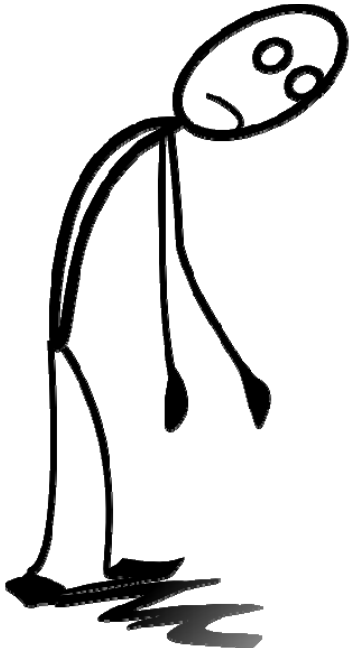
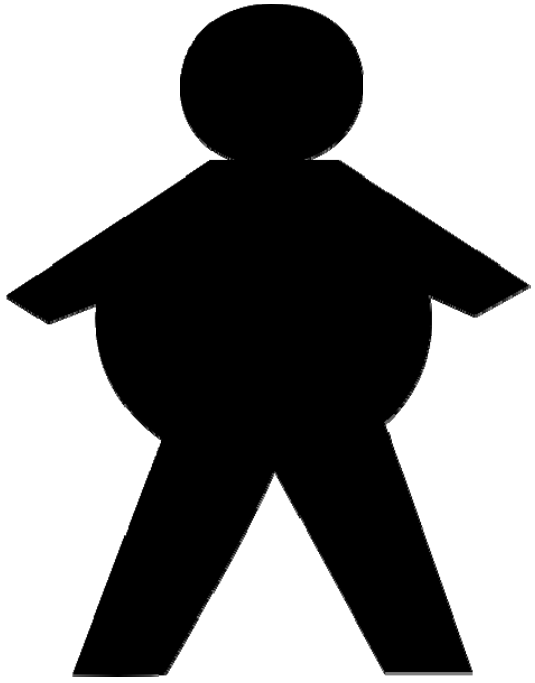
East and Southeast Asia and Oceania

Malnutrition in both developing and developed countries





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(bio)fortification….

iron and zinc biofortification ?

Iodization ?

vitamin supplements ?

… or more diverse diets?

Vegetables WIN (women, income, nutrition)

1. empowerment of women to manage small rural and urban plots
2. high value inputs and outputs (fresh and processed)
3. short cultivation cycle and huge diversity
4. increased nutrition provided to family and consumers

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4 themes: from farm to fork, from seed to table

jhup soolvp	germplasm conservation and evaluation, gene discovery
euhhglqj	genetic enhancement, varietal development, selection of indigenous lines, seed production
surgxfwlrq	safe and sustainable vegetable production systems
frqvxp swlrq	postharvest management and market opportunities, nutritional security, diet diversification and human health

whfkqrorj|#glvvhp lqdwlrq	p rqlwrulqj#dqg#hydoxdwlrq

theme germplasm

the world’s largest vegetable collection (61,494 accessions)
Africa’s largest vegetable collection (2,351 accessions)
439 species from 155 countries

Global vegetables

Traditional vegetables

Wild relatives, diverse with unique traits

avrdc.org

Hibiscus sabdariffa **(roselle): Source of vitamin C**

theme breeding

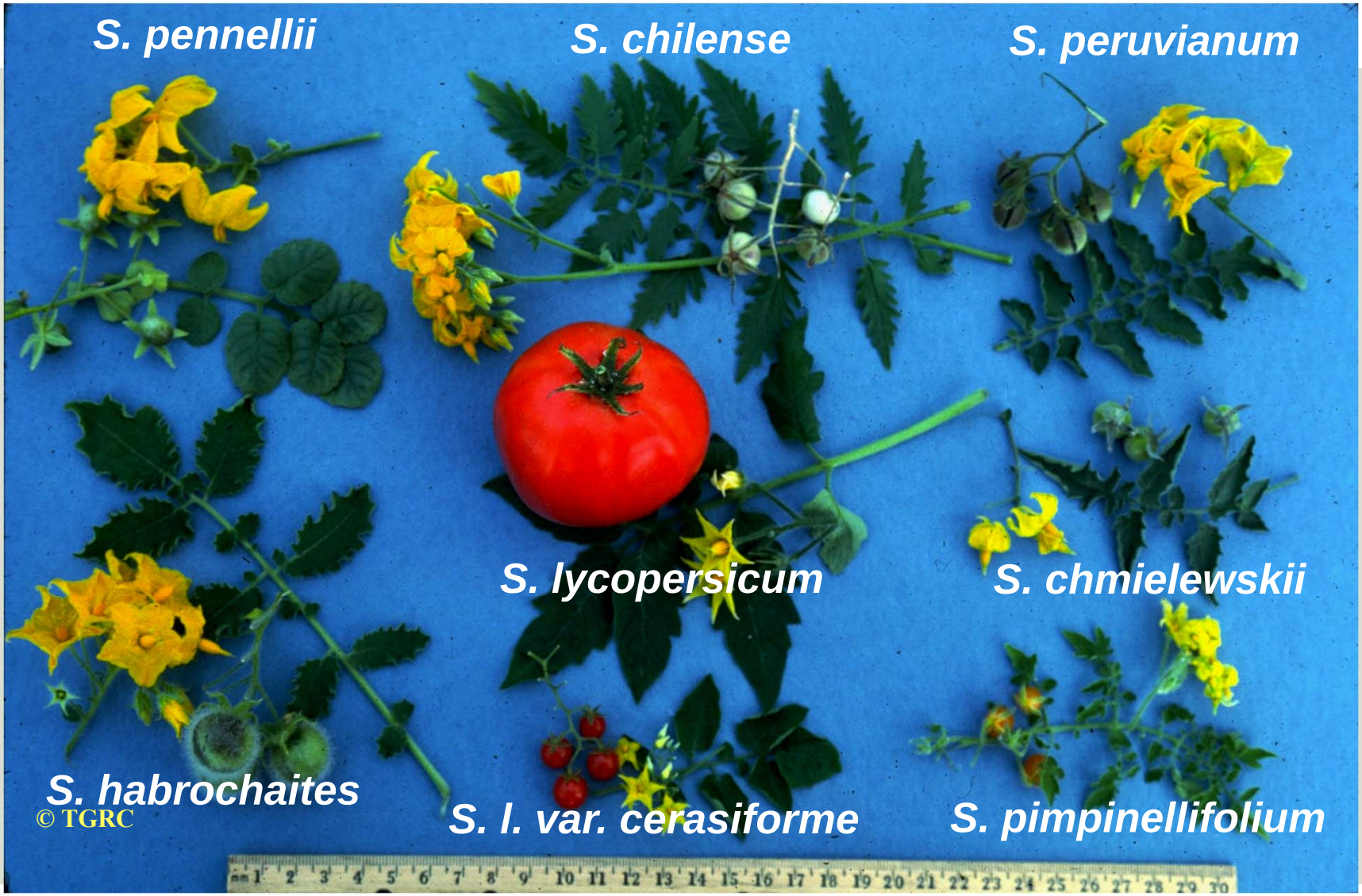
screening protocol (identification of sources of biotic and abiotic tolerance)

plant pathogen screening laboratories

molecular laboratory

nutrition laboratory

Wild relative genetic resources



Bitter gourd

Momordica charantia can help millions in the developing world who suffer from metabolic disorders such as type-2 diabetes.

VI047688 VI047830 VI055378 VI050842 VI048038 VI047983 VI047819

VI047674 VI047875 VI048061 VI047145 VI054790 VI055014 VI049939 VI049940

VI049949 VI043046 VI043053 VI047216

Phenotyping and photo documentation

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VI056799

VI056800

VI056801

VI056804

VI056807

VI056816

VI056824

VI056825

VI056829

VI056833

VI056834-A

VI056834-B

Phenotyping and photo documentation

AVGRIS

AVRDC Vegetable Genetic Resources Information System

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WELCOME TO AVGRIS

The AVRDC Vegetable Genetic Resources Information System (AVGRIS) is an information system that manages the data of all vegetable germplasm conserved at GRSU, AVRDC. It is designed to manage the GRSU operations more efficiently. It links all operations associated with germplasm conservation and management from registration, characterization, evaluation, seed inventory and seed distribution to end-users.

This web version of AVGRIS has been developed by GRSU staff. It provides the user direct access to germplasm data through the internet.

Use of the system is FREE but please first read the TERMS OF USE

The system aims to:

- Assist the GRSU staff in day-to-day activities.
- Facilitate recording, storage and maintenance of germplasm data.
- Provide direct access to information pertaining to accessions in the genebank
- Allows requests for the desired seeds

The data that are accessible are:

- Passport
- Characterization, and
- Evaluation

Germplasm information and access

Global distribution - 500 improved vegetable lines

180 tomato lines

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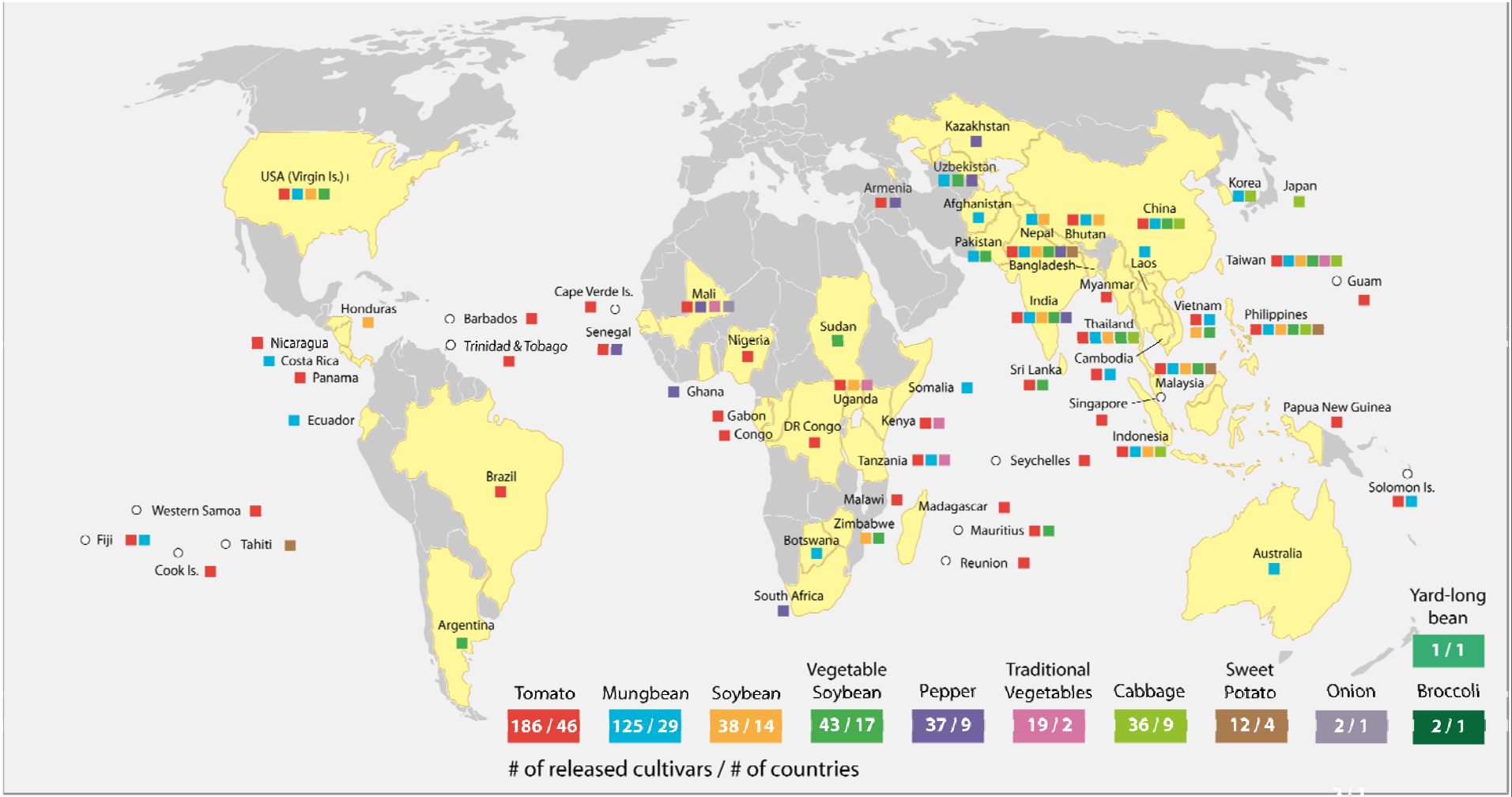
AVRDC-derived varieties released since 1978



501 improved vegetable cultivars

benefit farmers around the world

September 2013

Seasonality of Bangladesh Vegetables

May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
SUMMER Cucurbits, vegetable cowpea, hyacinth bean, stem amaranth, several aroids and Indian spinach						**WINTER** Tomato, cabbage, Chinese cabbage, cauliflower, eggplant, carrot, spinach, bottle gourd, bush bean and radish						
YEAR ROUND Okra, heat tolerant tomato, eggplant, carrot, spinach, many leafy vegetables, small onion, etc.											

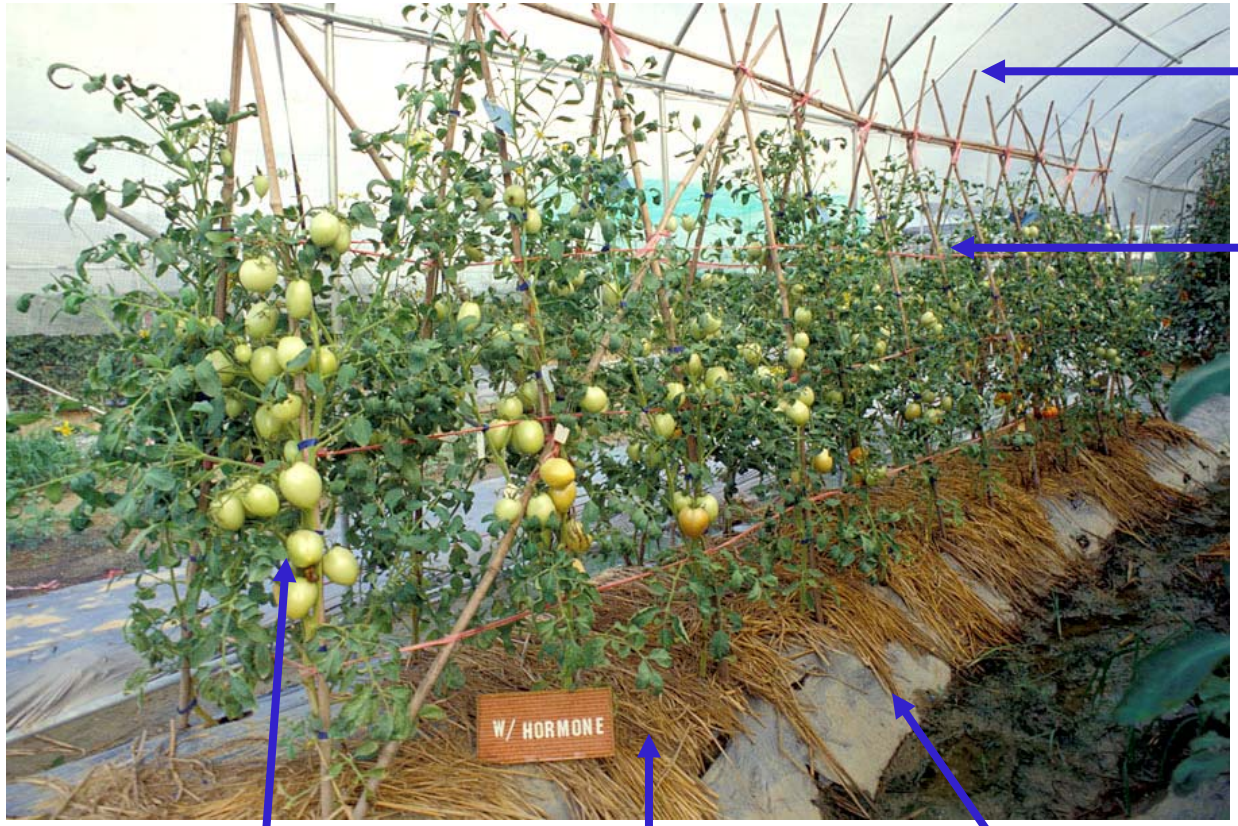
theme production

IPM against fruit and shoot borer

grafting

Parameter	Lam Dong province
Adoption rate	100%
Average yield (t/ha)	73.3
Yield advantage of using grafting (%)	30%
Change in total revenues associated with grafting (%)	171%
Change in total cost associated with grafting (%)	78%
Increase in annual profit from using tomato grafting (million US$)	**36.7**

Improved tomato lines and technologies: summer tomato production



simple structure

staking

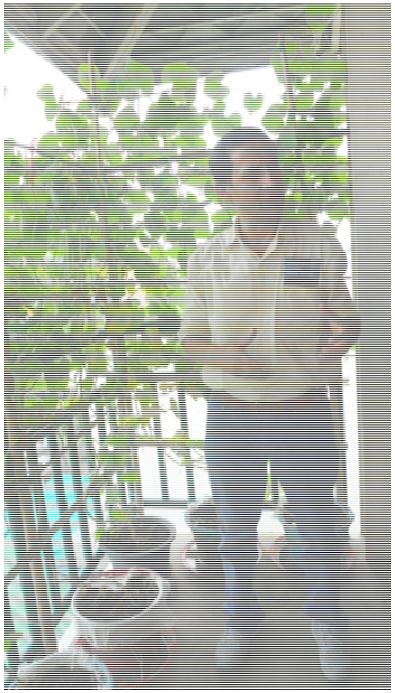
Tomatotone (fruit-set)

Heat tolerant variety

mulch

raised bed

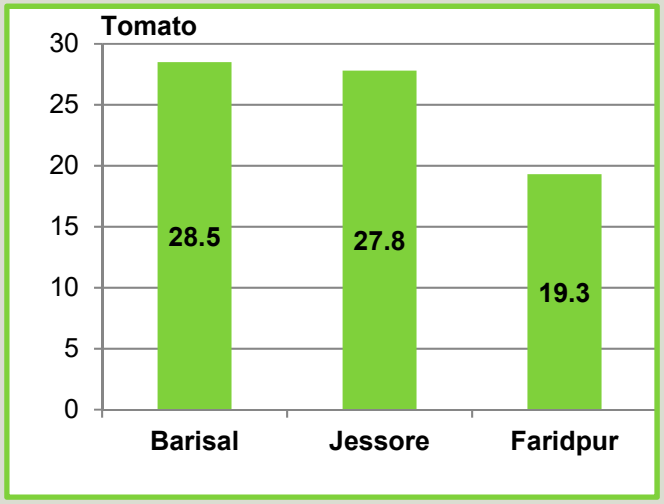
theme consumption: postharvest

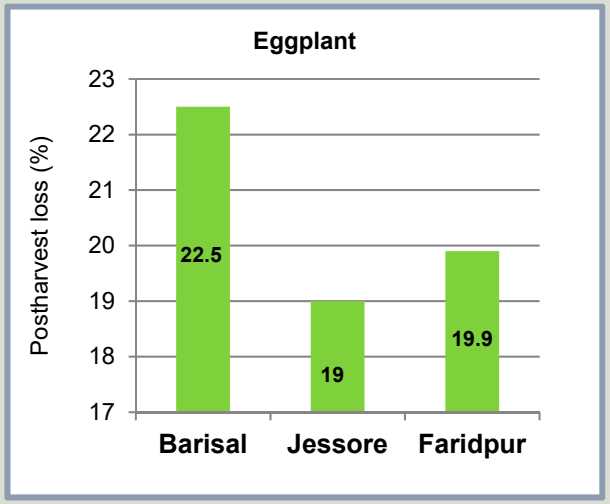


one-stop shop for equipment, advice, services

Monitoring and evaluation

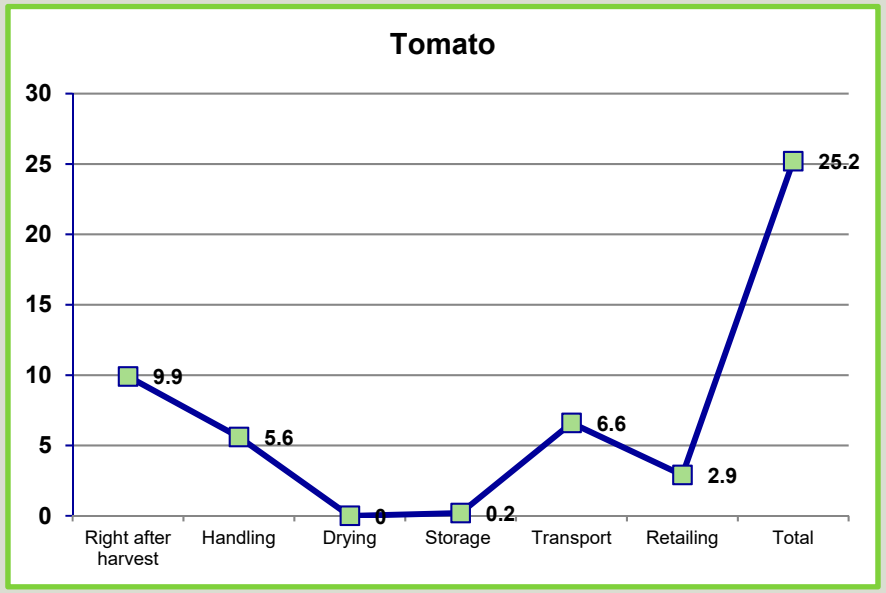
Postharvest losses of vegetables (%) in Bangladesh

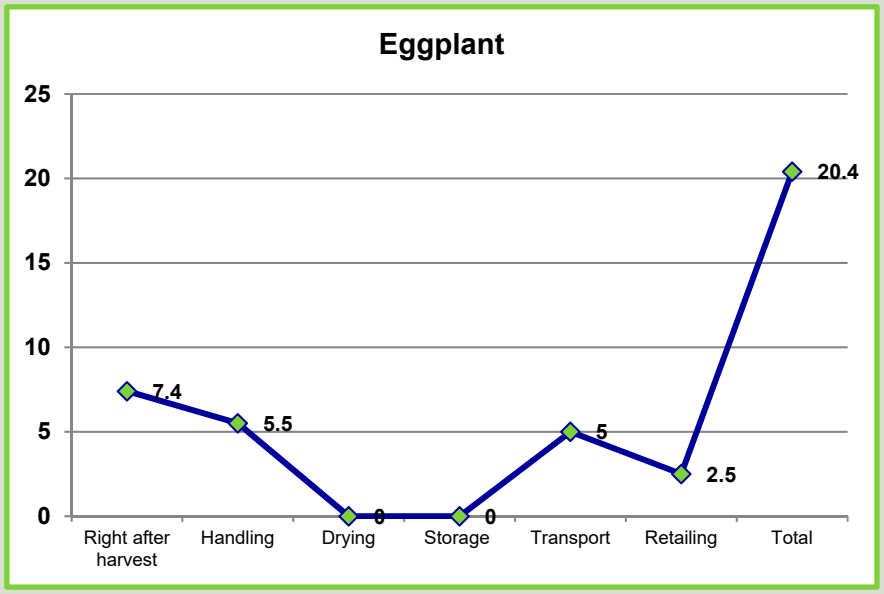




Md. Saleh Ahmed
Post Harvest & Quality Assurance Expert
SCDC, NATP, Hortex Foundation

Postharvest losses of vegetables in each stage of postharvest system





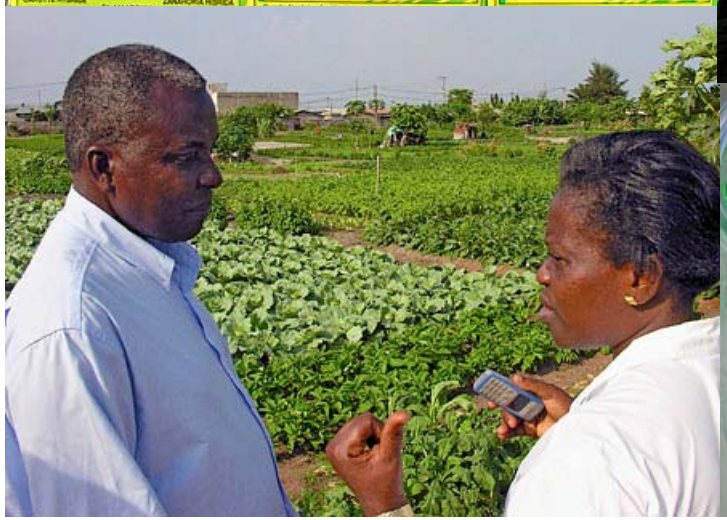
theme consumption: marketing

recipes and nutrition education

‘vegetables go to school’

home garden seed kits

linking private and public sectors



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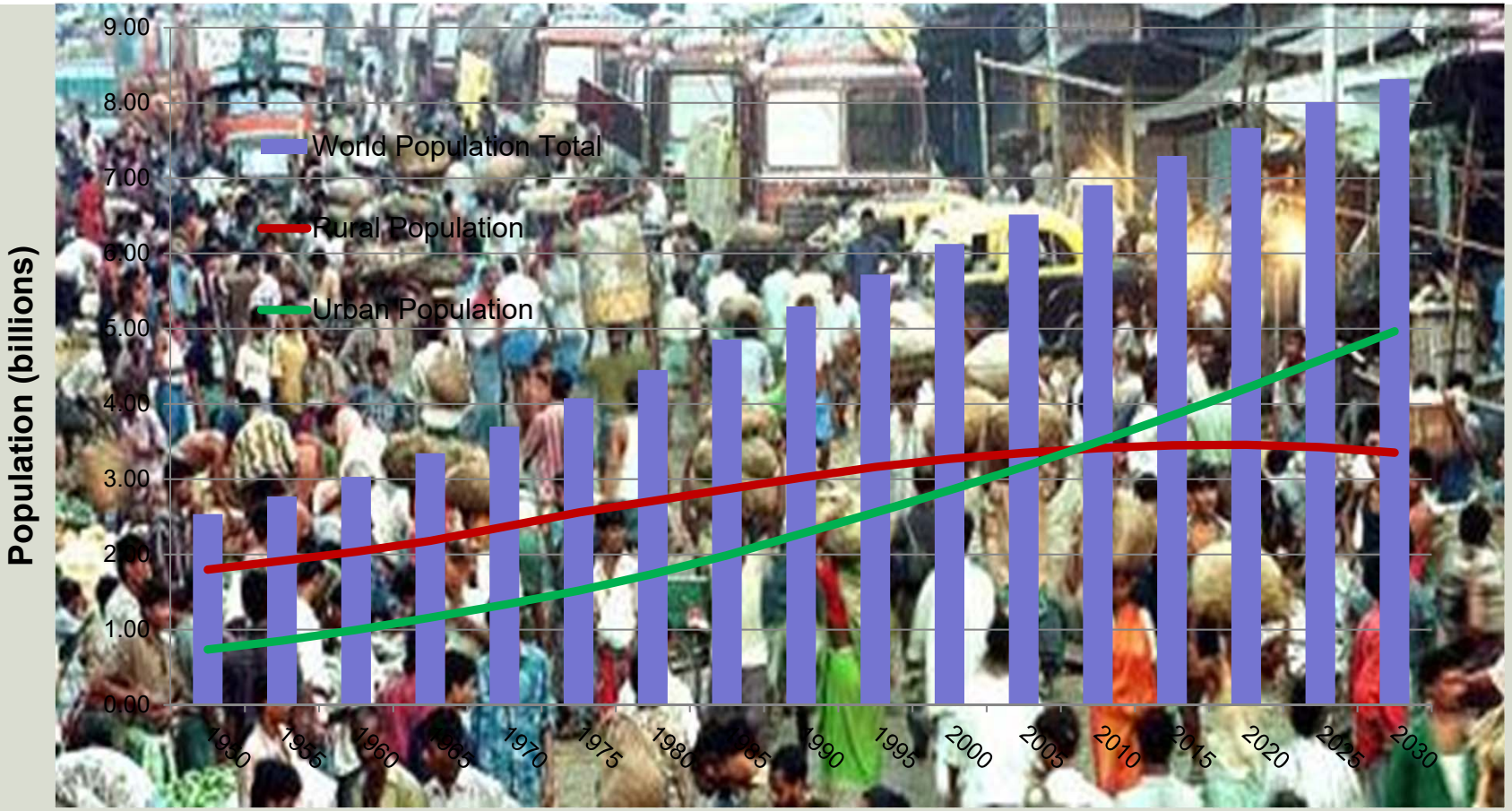
Global Urbanization Trends



The Urban and Rural Population of the World (1950 to 2030)*

**Source: United Nations, Department of Economic and Social Affairs, Population Division (2006). World Urbanization Prospects*

Allotment gardens Philippines

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Container and community gardening

Urban agriculture can take place in small spaces and can be productive.

Ingenuity is the key!

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Community Gardens

Copying with climate uncertainties

Wild tomato - source of drought tolerance

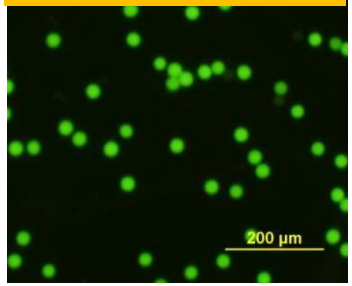
High yielding
tomato variety

Heat tolerance

Normal flower

Damaged flowers of CA4

Pollen Viability



No fruit set in CA4

Heat tolerance in pepper

Orange Bell
0537-7032

X

SW-HP
9848-4840

F1 COA 779

Resilient production systems to adapt to climate change

New varieties
Cropping systems
Grafting
Irrigation
Drainage
Rain shelters

Protected cultivation – nursery and production
Hydroponics and fertigation
Post-harvest

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Enhancing Climate Resilience

Nutritious vegetables must be safe!

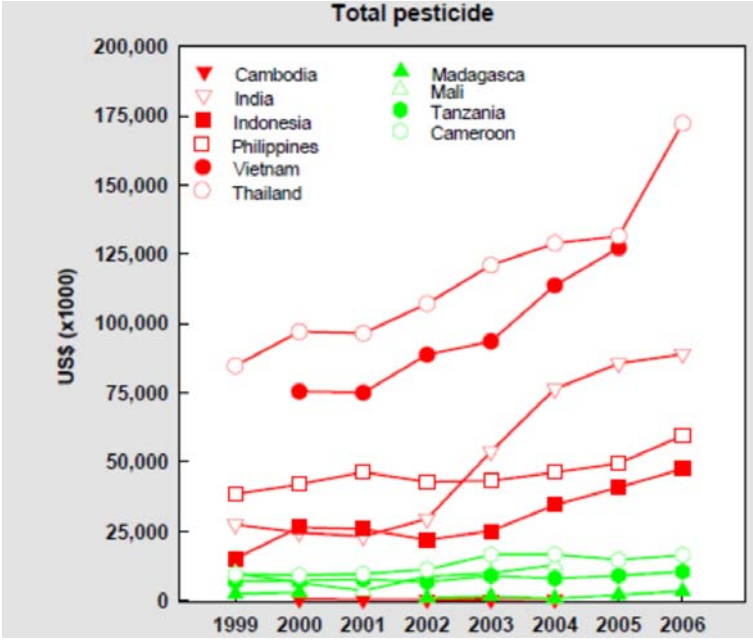
The Association of Southeast Asian Nations

"UNIDO Regional Trade Standards Compliance Report, 2013"

"ASEAN potential to gain from macro trends of increasing population and purchasing powers not met in all countries by increased vegetable production"

- Food safety and quality issues cause import rejections:
  - Maximum Residue Limits (MRLs) exceeded of pesticides (approved and prohibited) and mycotoxins
  - presence of quarantine plant pathogens and pests
  - inadequate hygiene standards

Inappropriate pesticide use accepted practice



Precise data not available!

Loss of producer profit

Loss of trade and value chains

Loss of country and retailer credibility

Loss of biodiversity

Loss of yield

Increased pest resistance

Health hazard to growers

Health hazard to consumers

Solutions to inappropriate pesticide use

Precise pest and disease diagnostics and IPM

- **Agronomic practices**
- **Judicious pesticide use**
- **Biological control**

Agronomic practices

Tomato bacterial wilt caused by *Ralstonia solanacearum* (soil-borne, vascular bacterial disease)		
Control principle	Specific measures	Efficacy
Pathogen exclusion	Use a plot without disease history Use clean seedlings No contact with contaminated water	***
Pathogen reduction	Practice rotation Remove diseased plants Apply chemical or organic amendments	**
Host resistance	Use locally effective resistant cultivars	***
Direct protection	Use sterilized pruning tools	*

Agronomic practices

Tomato leaf curl virus caused by begomoviruses (insect-transmitted viral disease)		
Control principle	Specific measures	Efficacy
Pathogen exclusion	Raise healthy seedlings by protection with 60-mesh net	***
Pathogen reduction	Control whitefly, with pesticide, trap crops, pheromone traps Remove and destroy infected plants	*
Host resistance	Use locally effective resistant cultivars	***
Direct protection	Apply summer oil on leaves	*

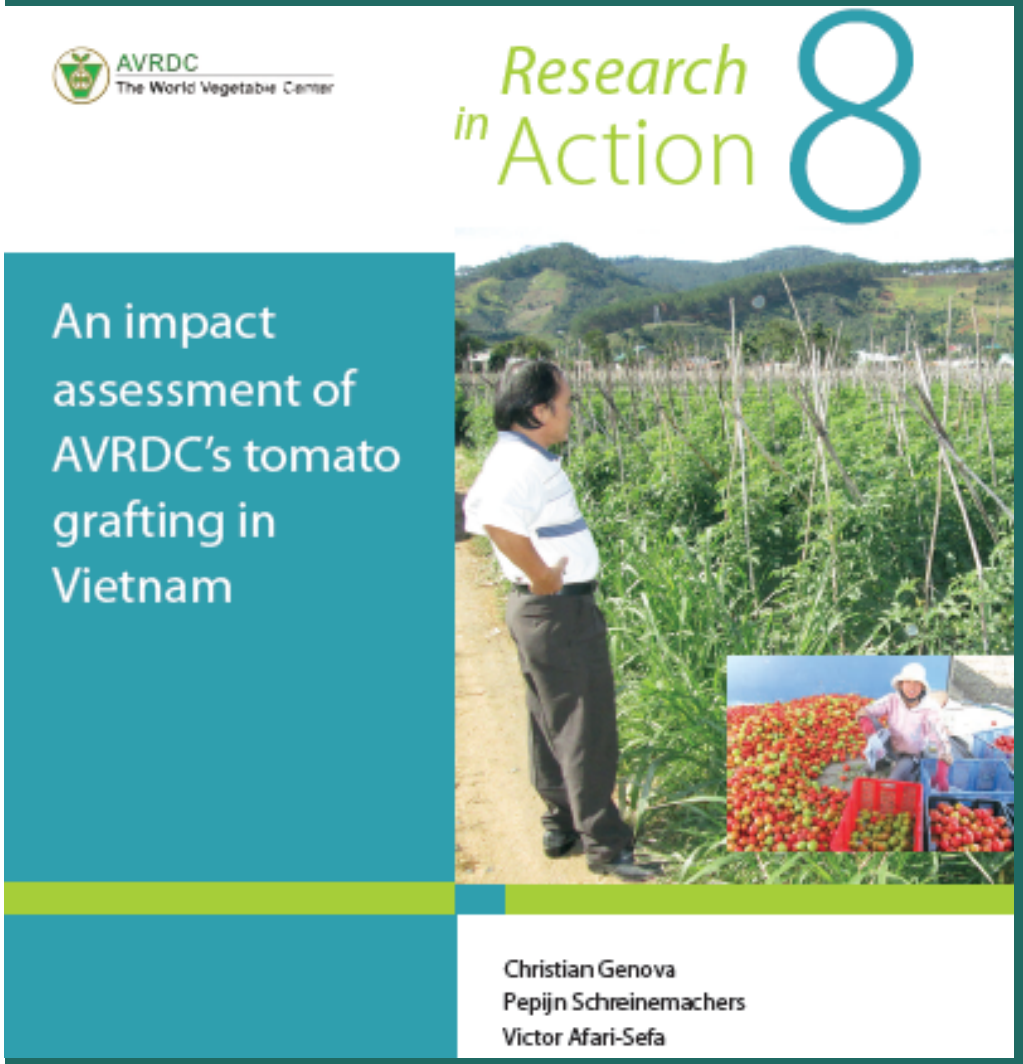




Agronomic practices

Graft preferred vegetable variety onto rootstock with resistance to prevalent diseases (or flooding)

Grafting



Quang Vinh, IVTC trainee

2007 Lam Dong Province 4000 ha cultivated with grafted seedlings

2012:
Full adoption in Lam Dong and increasing in Red River Delta

Yield increased by 18 t ha^{-1}

Increased profit in Lam Dong of US$7.7 million

AVRDC recommended rootstocks for tomato grafting

TS03 🔴🔵

EG190 🔴🟡🟢🔵

EG195 🔴🔵

Resistant to:

- 🔴 Bacterial wilt
- 🟡 Fusarium wilt
- 🟢 Root-knot nematode
- 🔵 Flooding

EG203 🔴🟡🟢🔵

EG219 🔴🟡🟢🔵

HW7996 🔴🟡

CropLife ASIA

Judicious Pesticide Use

Crop Protection Stewardship

Enforce GAP

Increase awareness:

MRLs and health impacts
Appropriate use of approved products at correct dose for specific crops
Appropriate timings of applications (respecting Pre-Harvest Interval)
Use of correct safety and application equipment
Store and dispose responsibly

Biological control

Metarhizium anisopliae* var. *acridum

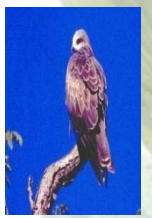
Green muscle™ Africa
Green guard ™ Australia

Senegalese grasshopper

(*Oedaleus senegalensis*)

Millet (*Pennisetum glaucum*)

Biocontrol – ecological equilibrium



Nosema

Metarhizium

Gold Sparrow

Bombyliidae

Gr. buzzard

Meloidae

Cattle egret

Abdims stork

Scelionidae

Sparrowlark

Acrotylus blondeli

Senegalese Grasshopper

Pyrgomorpha cognata

Sahelian grass

Millet

Sorghum

IPM can combine chemical and biological control

Combining bio-pesticides with chemical pesticides to manage legume pod borer (Maruca vitrata) on yard-long bean in Thailand

S. Yule[a] & R. Srinivasan[b]

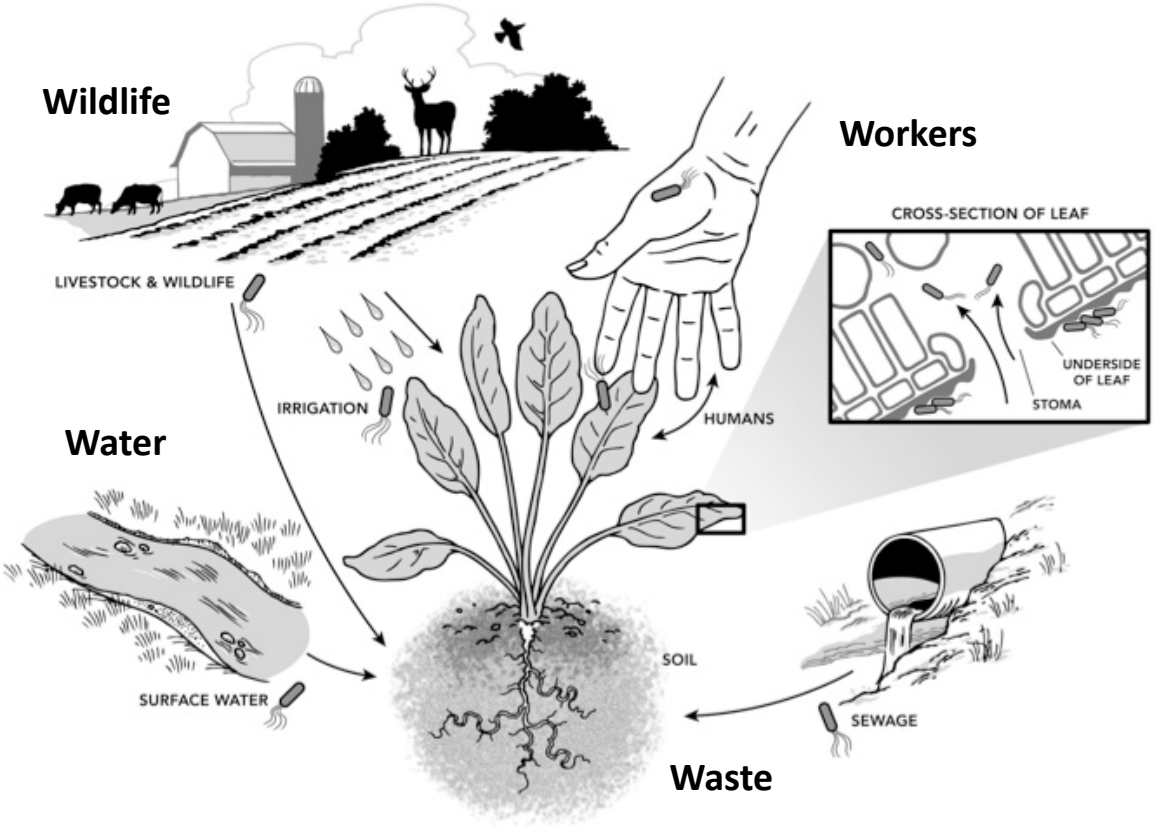
[a] AVRDC - The World Vegetable Center, East and Southeast Asia, Research and Training Station, Kasetsart University, Kamphaeng Saen Campus, Kamphaeng Saen, Nakhon Pathom 73140, Thailand

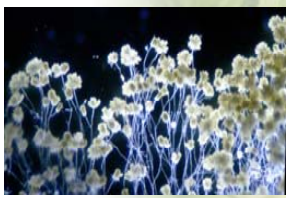
[b] AVRDC - The World Vegetable Center, Shanhua, Tainan 74151, Taiwan

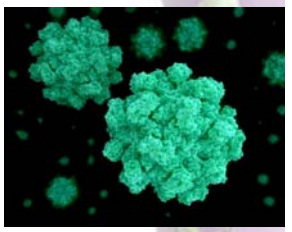
Published online: 25 Apr 2014.

International Journal of Pest Management

Risk Factors - Foodborne Pathogens







Harvest → Post Harvest → Consumption

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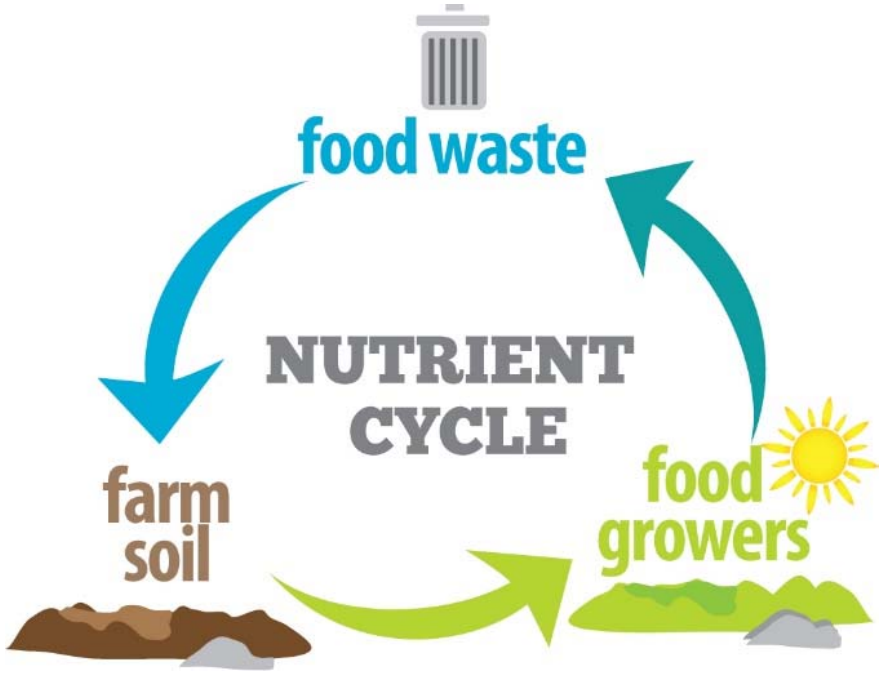
Summary - nutrition is the core

Exploit strategic niche of vegetables – in focused approach

Evidence of links between agriculture / nutrition / health / gender

Evidence of quality nutrient supply (varieties / agronomy / postharvest)

Evidence of resilient vegetable - cropping systems



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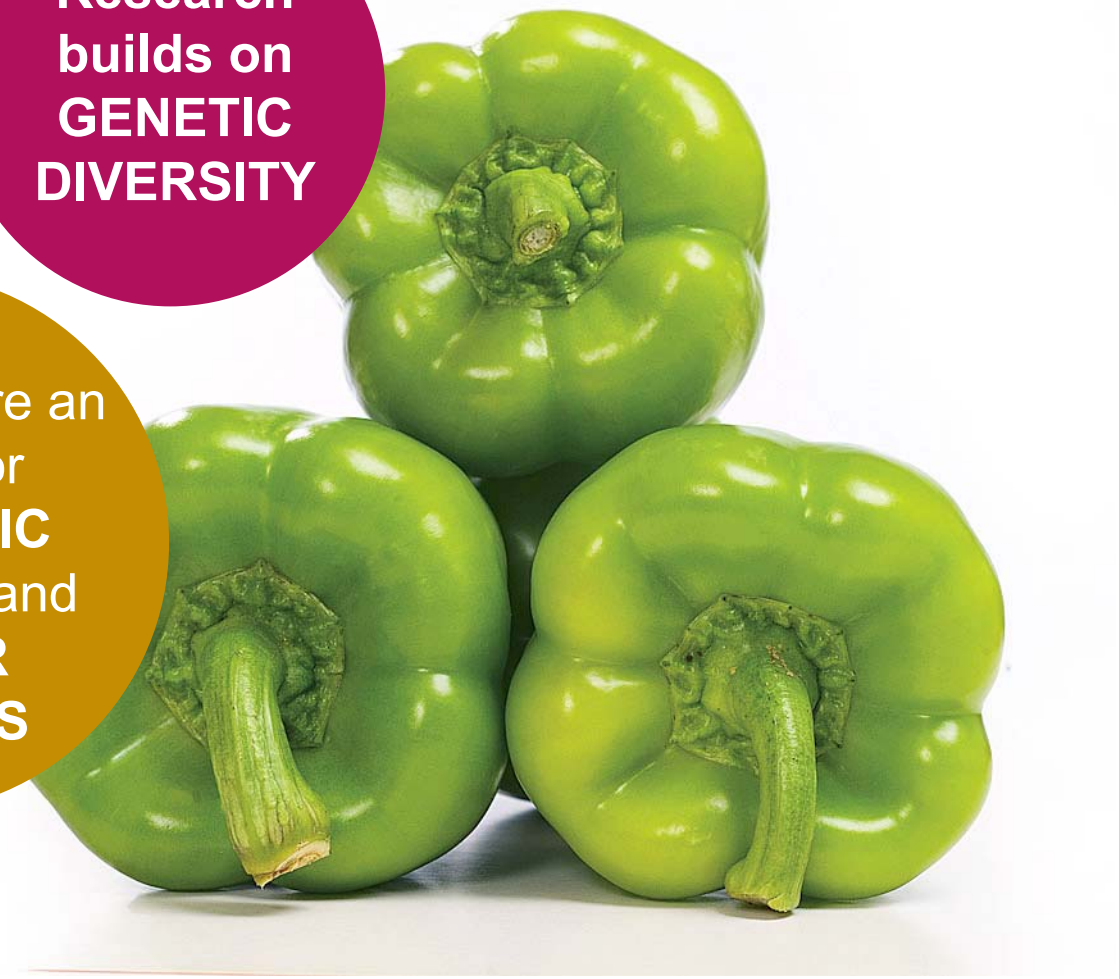
Summary

Vegetables are essential for HEALTH

Research builds on GENETIC DIVERSITY

Vegetable are an engine for **ECONOMIC GROWTH** and **HIGHER INCOMES**



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Prosperity for the poor & health for all!

Thanks and questions?

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