Introduction to World Vegetable Center (WorldVeg)

Fenton Beed Regional Director, East and Southeast Asia / Oceania

VEGETABLES: FROM HARVEST TO TABLE

Module 2, International Vegetable Training Course 6th November – 1st December, 2017





worldveg.org

Vegetables for health and prosperity!



- Founded in 1971 as **AVRDC**
- Research to promote development nonprofit
- Research outputs global public goods
- Profitable value webs affordable year round

Alleviate poverty and malnutrition through increased **production** and **consumption** of health-promoting **vegetables**





WorldVeg







World Vegetable Center STRATEGY 2017-2025

Healthier lives, more resilient livelihoods





FAO; IFAD; WFP, 2012; Bereuter and Glickman, 2015: Healthy Food for a Healthy V

Fo	Food and <u>nutritional</u> security through vegetables								
deficiency calories ar proteins	 Every year > 3M children die due to mal-nutrition Every day 400 mothers die in childbirth due to iron 								
deficiency vitamins and minerals	deficiency • Every day 1400 children go blind due to Vitamin A								
excess calories	 deficiency First 1000 days affects physical and mental development Asia and Africa loss 11% of CNR each year due to poor 								
	 Asia and Africa lose 11% of GNP each year due to poor nutrition Rates of diabetes increasing fastest in developing countries 								

... or more diverse diets?

(bio)fortification....



iron and zinc biofortification ?



vitamin supplements ?





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
- increased nutrition provided to family and consumers (micronutrients, vitamins, dietary fiber, phytochemicals and protein)



Global growth and urbanization

- 2015 7.3 billion people (60% in Asia 16% in Africa)
- 2030 8.5 billion people (58% in Asia 20% in Africa)
- 2050 9.7 billion people (54% in Asia 25% in Africa)
- 2100 11.2 billion people (44% in Asia 39% in Africa)



United Nations, Department of Economic and Social Affairs, Population Division (2015). *World Population Prospects: The* 2015 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP.241.





Germplasm: to prepare for the storm

Collect remaining diversity from the wild and field
Conserve it – securely and permanently
Characterize novel traits
Develop improved and adapted varieties
Public Private Partnerships for seed supply

Copying with climate and market uncertainties



The world's largest public sector collection of vegetable germplasm

Global vegetables

Traditional vegetables





Wild relatives, diverse and unique traits





Hibiscus sabdariffa: Source of vitamin C

our crop portfolio

Solanaceae (tomato, pepper, eggplant,...)

bulb alliums (onion, garlic, shallot,...)

legumes (mungbean, vegetable soybean,...) crucifers (pak choi, broccoli,...) cucurbits (cucumber, pumpkin,...)

traditional vegetables

more nutritious more 'sturdy' easier and faster to grow growing demand





the revolution

tomato: Tengeru 97, Tanya, Kiboko, Meru

African eggplant: DB 3



impact in Tanzania:

production: 50% of tomato 98% of eggplant

investments: USD 6.9 million in research, extension, and promotion

economic gains: USD 254 million for tomato USD 5 million for eggplant

High quality, nutritious: 'Golden' tomatoes

Golden tomatoes"

- High quality
- Nutritious
- Good marketability
- Resistance to multiple diseases

One single improved tomato can provide a person's full daily vitamin A requirements Contain 3 to 6 times more vitamin A

Cucurbit breeding at the World Vegetable Center



J. AMER. Soc. HORT. Sci. 141(5):475-484. 2016. doi: 10.21273/JASHS03748-16

Diversity Among a Wide Asian Collection of Bitter Gourd Landraces and their Genetic Relationships with Commercial Hybrid Cultivars

Narinder P.S. Dhillon¹ and Supannika Sanguansil

World Vegetable Center, East and Southeast Asia/Oceania, Kasetsart University, Kamphaeng Saen, Nakhon Pathom 73140, Thailand

Roland Schafleitner and Yen-Wei Wang Biotechnology, World Vegetable Center, P.O. Box 42, Shanhua, Tainan 741, Taiwan

James D. McCreight

U.S. Department of Agriculture, Agricultural Research Service, U.S. Agricultural Research Station, 1636 E. Alisal Street, Salinas, CA 93905

The lines developed by WorldVeg represent a broader genepool due to their development from the global collection of bitter gourd maintained at the WorldVeg genebank.



Traditional treasures: diet diversity











Cowpea



Blue pea



Moringa



Nightshade



African eggplant







Watercress



Jute mallow



Ethiopian kale

Recommended nutrient intakes and % per 100 g of:

	Protein	Vitamin A	Iron	Folate	Zinc	Calcium	Vitamin E	
RNI for pregnant women	g	µg RE	mg	μg	mg	mg	mg α -TE	1
(1 st trimester)	60	800	30	600	11	1000	7.5	
percentage of RNI	rcentage 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





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 ISSUES CAUSE IMPORT REJECTIONS:



- MRLs exceeded of pesticides (approved and prohibited) and mycotoxins
- presence of quarantine plant pathogens and pests
- inadequate hygiene standards



Inappropriate pesticide use - accepted practice





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
- ▼ Host resistance
- **×** Agronomic practices
- × Judicious pesticide use
- ▼ Biological control







Diagnostics; monitoring known, emerging and new viruses



Crop	Total	BV	СМV	ToMV	CVMV	PMMV	TSWV
Tomato	36	32	1	0	0	0	7
Pepper	38	33	7	7	23	3	0
Eggplant	16	15	0	0	0	0	0

Сгор	Total	BV	CMV	ΤοΜV	CVMV	PMMV	TSWV
Tomato	10	9	0	0	0	0	0
Pepper	46	24	7	0	17	0	0
Eggplant	4	1	0	0	0	0	0

Chili infected with PepYLCVs



¹⁰⁰ ⊢ BYDV-PAV

BLVR SbDV

BYDV MAV

TBSV

BYDV-PAS

100

Aphid-borne Poleroviruses
(Luteoviridae)

New	Virus	Countries
	<i>Cucurbit aphid-borne yellows virus</i> [Common] (CABYV-C)	PHL, TWN, UZB
*	Cucurbit aphid-borne yellows virus [Recombinant] (CABYV-R)	IND, PHL, THA, TWN
*	Luffa aphid-borne yellows virus (LABYV)	ТНА
	Melon aphid-borne yellows virus (MABYV)	TWN
*	Pepo aphid-borne yellows virus (PABYV)	MLI, CIV
	<i>Pepper vein yellows virus</i> (PeVYV)	IND, IDN, MLI, PHL, THA, TWN
*	Sauropus yellowing virus (SaYV)	ТНА
	Suakwa aphid-borne yellows virus (SABYV)	IND, PHL, THA, TWN





Diagnostics for anthracnose of chili fruit

- Multigene phylogenetics to identify causal spp. of *Colletotrichum* in field (Fiji, Indonesia, Korea, Lao PDR, Solomon Isles, Taiwan and Thailand)
- Validate to pathotype level and map regionally
- Development of qPCR diagnostic tests
- Pathogen taxonomy and population genetics





The world's largest public sector collection of vegetable germplasm

Screening for new resistance (Squash leaf curl Philippines virus)

Pyramiding genes (Tomato yellow leaf curl viruses)



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

		Table	of Character	ristics of	AVRDC-S	elected Ro	otstock Li	ies					
			Resistance/tolerance to flooding, pathogens and soil-borne diseases ¹										
Crop name & Vegetable	Othersee		Bacterial wilt						— Fusarium wilt ³		Root-knot Phytophthol nomotodo ⁴ blight ⁵	Dhutanhthara	
introduction no.	Other name	Scientific name	Flooding	Ralstonia solanacearum strain ²								Phytophthora	
				Pss4	Pss97	Pss190	Pss1587	Pss71	race 1	race 2	nematoue	blight	
Tomato rootstock for tomat	o grafting												
VI043614	Hawaii 7996	Solanum lycopersicum	S	R	-	S	-	-	R	MR	S	-	
Eggplant rootstocks for ton	nato and eggplant	grafting											
VI045276	EG203	Solanum melongena	R	R	MR	MR	S	-	R	R	MR-R	-	
VI046103	EG195	Solanum melongena	R	R	-	S	-	-	-	-	R	-	
VI034845	TS03	Solanum melongena	R	MR	-	S	-	-	-	-	R	-	
VI046104	EG219	Solanum melongena	R	R	MR	MR	S	-	R	R	MR-R	-	
VI046101	EG190	Solanum melongena	R	R	S	S	S	-	R	R	MR-R	-	
Hot pepper rootstocks for s	sweet pepper and l	not pepper grafting											
AVPP0205	PP0237-7502	Capsicum annuum	R	-	-	-	-	R	-	-	R	S	
VI037556	PBC535	Capsicum annuum	MR	-	-	-	-	R	-	-	R	S	
VI014995	PI201232	Capsicum annuum	MR	-	-	-	-	R	-	-	R	R	

¹R=resistant, MR=moderate resistant, S=susceptible, '-' = data not available

² Ralstonia solanacearum strain Pss4 (Phylotype I, race 1, biovar 3); Ralstonia solanacearum strain Pss97 (Phylotype I, race 1, biovar 3); Ralstonia solanacearum strain Pss190 (Phylotype I, race 1, biovar 4);

Ralstonia solanacearum strain Pss1587 (Phylotype II, race 3, biovar 2); Ralstonia solanacearum strain Pss71 (Phylotype I, race 1, biovar 3)

⁹ Fusarium oxysporum f. sp. lycopersici isolate Fol 11A (race 1); Fusarium oxysporum f. sp. lycopersici isolate Fol-34-1 (race 2)

Meloidogyne incognita

⁵ Phytophthora capsici isolate PC134

Grafting





An impact assessment of AVRDC's tomato grafting in Vietnam



Christian Genova Pepijn Schreinemachers Victor Afari-Sefa

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\$ 9million p.a.



Increase awareness:

Enforce GAP!

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

Grain legume pod borer - Maruca vitrata



^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.







Food quality and safety - Aflatoxin

- Highly toxic metabolite produced by ubiquitous *Aspergillus flavus*
- Fungus infects crops and produces toxin in field and store
- Contamination possible without visible signs of the fungus





- In nature, some strains produce aflatoxin (toxigenic) and others do not (atoxigenic)
- Increase frequency of atoxigenic strains that cannot mate with toxic relatives but that are ecologically competitive against them
- Aflatoxin reduced in field and stores
- Native strains selected and marketed as AflasafeTM







The Association of Southeast Asian Nations "UNIDO Regional Trade Standards Compliance Report, 2013"

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Capacity building and networking





IVTC is endorsed by the International Society for Horticultural Science (ISHS) and Horticulture Innovation Lab Regional Center at Kasetsart University.



Dr. Somsiri Sangchote leading the participants in the seed health sessions.



Learning how to graft vegetable seedlings.



Evaluating lettuce plants at the Agri-Technology Complex.



Accomplished grafters show their handiwork.

IVTC – International Vegetable Training Course



- Began in 1982 as Regional Training Course
- Kamphaeng Saen campus of Kasetsart University (KU)
- Annual
- Initially 5 months and then revised to 3 months and now 2 months
- Blends theory, practice and value chain visits
- Resource persons from WorldVeg, KU, Universities and research and development partners
- Endorsed by ISHS and USAID Horticulture Innovation Lab
- Certificates signed by WorldVeg and KU
- Internationally renowned with lasting legacy

Number of participants (887) per country (52) (1982 – 2016)



South East Asia		Central / South	Central / South Asia			Oceania / Central Pacific	
Brunei	5	Afghanistan	12	Burkina Faso	4	Kiribati	1
Cambodia	78	Bangladesh	44	Cameroon	1	Marshall Islands	2
Indonesia	59	Bhutan	18	Egypt	3	Nauru	1
Lao PDR	66	India	14	Gambia	1	Palau	1
Malaysia	13	Kazakhstan	20	Kenya	1	Papua New Guinea	4
Myanmar	70	Nepal	9	Malawi	1	Solomon Islands	1
Philippines	23	Pakistan	8	Mauritius	4	Timor Leste	3
Singapore	6	Sri Lanka	43	Nigeria	3	Tuvalu	2
Thailand	68	Tajikistan	1	Sao Tome	1	Others	
Vietnam	105	East Asia		South Africa	1	Netherlands	1
Middle Ea	st	China	142	Sudan	2	United Kingdom	1
Iraq	1	Hong Kong	7	Swaziland	4	Venezuela	1
Jordan	3	Korea	9	Zambia	1		
Lebanon	2	North Korea	10				
Oman	1	Taiwan	5				

Interactive web portal





9 October – 3 November 2017

- Biodiversity, Breeding, Seed systems, Integrated Pest Management (IPM)
- Grafting, Protected Cultivation, Integrated Disease Management (IDM)
- Seed Health, Seedling Management, IDM
- Sustainable Production, Good Agricultural Practices (GAP)

MODULE II: From Harvest to Table

6 November - 1 December 2017

- Postharvest Care
- Food Safety, Nutrition, Good Manufacturing Practices (GMP)
- Nutrition, Value Chain and Market Analysis
- Extension, Scaling, Monitoring and Evaluation

SCENES FROM MODULE III OF THE 34TH IVTC!



DOWNLOAD BROCHURE FOR 36TH IVTC



https://ivtc.avrdc.org/

worldveg.org

Networking





AARNET: Origins, Vision & Mission

VISION: To be the premier platform for spearheading vegetable research and development and information exchange in ASEAN

MISSION: To coordinate and facilitate development and implementation of R&D projects on vegetables in ASEAN member countries, in collaboration with AVRDC – The World Vegetable Center and its regional office in East and Southeast Asia, and other organizations, as well as facilitate information exchange, technology transfer and training on vegetable production related fields.



NEWS

ASEAN members experience agriculture in Taiwan

Representatives from nine member countries of the Association of Southeast Asian Nations (ASEAN) got a closer look at the horticultural practices and policies of Taiwan during the 12th Steering Committee Meeting of the **ASEAN-AVRDC Regional Network for Vegetable Research and Development (AARNET)**, held 23-25 May 2017 at World Vegetable Center headquarters.

ASEAN-AVRDC Regional Network for Vegetable Research and Development

(AARNET)





Expert Consultation on

Climate Change Mitigation and Adaptation Strategies for Vegetables in Southeast Asia

> 26 March 2015 Champasak, Lao PDR





ASEAN-AVRDC Regional Network for Vegetable Research and Development (AARNET)



Expert Consultation on Vegetables for Health:

The essential role of vegetables in supplying micro-nutrients

> 24 March 2016 Palace of the Golden Horses MINES, Kuala Lumpur, Malaysia



Vegetables for improved nutrition and livelihoods



SEAVEG 2012



High Value Vegetables in Southeast Asia: Production, Supply and Demand

24-26 January 2012 Chiang Mai, Thailand





http://avrdc.org/aarnet/publications/seaveg-1. /

www.avrdc.org





Kaset Fair 2016

The World Vegetable Center's East and Southeast Asia regional team set up a colorful and informative exhibit to guide fair visitors through the wonderful world of vegetables.

VEG VIEW:

http://avrdc.org/category/video/vegview/







51 of x









Vegetables are essential for **HEALTH** Research builds on GENETIC DIVERSITY Vegetable sector is an engine for ECONOMIC GROWTH and PROFIT



Thanks!



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