AVRDC-The World Vegetable Center Vegetable Breeding for ASEAN Countries

7th East Asia Plant Variety Protection Forum, Vientiane, Laos August 6-8 2014



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Presentation Outline

- Brief introduction of AVRDC- the World Vegetable Center
- Overview of AVRDC Vegetable Breeding and Approach
- AVRDC breeding strategies and products by crop
- IPR and distribution of AVRDC lines
- Outlook



AVRDC - The World Vegetable Center

- Founded in 1971 as the Asian Vegetable Research and Development Center
- 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





Our mission: AVRDC-The World Vegetable Center





"Alleviate poverty and malnutrition in the developing world through increased production and consumption of safe vegetables"



AVRDC - The World Vegetable Center in ASEAN countries





Theme Breeding: Goal

- Varieties that expand opportunities in tropical vegetable production
 - Increased productivity
 - Reduced farmer risk
 - Off-season production
 - Processing, value addition





AVRDC Global Vegetable Crops





Locations: AVRDC Vegetable Breeding





Improved Inbred Lines: Major Output of AVRDC Breeding



Tropical Adaptation:

- Heat tolerance
- Multiple disease resistances
- •High quality (firmness, color, taste
- •Improved nutrient content (vitamins A & C, iron, protein, phytonutrients)













Approaches: multidisciplinary teamwork

Plant pathology



Molecular breeding



Nutrition











Strategic Trait Development and Marker-Assisted Selection

- Trait development
- Design of marker protocols and marker-assisted selection



Screening for salinity tolerance

MAS to Pyramid Multiple Resistance Genes



MAS for disease resistance









Introduce Novel Genes from Wild Relatives





Theory of Change: Theme Breeding



Major AVRDC Tropical Tomato Product Profiles

Lowland Tropics

- Heat tolerance 32-34/ 23-25 °C
- Tomato yellow leaf curl virus disease (TYLCD) and bacterial wilt resistances
- Early blight, fusarium wilt, TMV
- Determinate, dual purpose fresh market/processing

Highland and mid-altitude tropics

- Semi-determinate, indeterminate plant habits
- Fresh market
- Late blight, bacterial wilt, early blight resistances
- Yield, fruit quality, and nutrient content important for all market types







Tomato Yellow Leaf Curl Disease (TYLCD)

- Major tomato problem in the tropics including ASEAN
- 100% yield loss from early infection
- Prompts farmer over-use of pesticides
- Resistant cultivars the foundation of sustainable control





AVRDC Tomato Lines Resistant to TYLCD



AVTO1130 Ty-2+Ty-3a





CHT2062 Ty-3, High β-carotene









- Adapted to tropics
- Pungent (hot)



- Not tropically-adapted
- Highlands



Strategic goals: AVRDC Pepper breeding

Chili: high & stable yield via multiple disease, insect resistance

- Viruses: Cucumber mosaic virus (CMV), Chili veinal mottle virus (ChiVMV), begomoviruses, others
- Fungi: Phytophthora wilt, anthracnose
- Bacteria: bacterial wilt, bacterial spot
- Insects: mites, thrips, aphids

Sweet Pepper

- Heat tolerance
- Multiple disease resistance

Special trait

Male sterility systems



22th International Chili Pepper Nursery (ICPN22)



Line	Disease Resistance*		Capsaicin**		
		Length (cm)	Width (cm)	Weight (g)	(mg)
C05573	PVY (R), CVMV (R)	8.1	1.1	3.3	140.0
AVPP1105	PVY (R), BW (MR), Anthr (GR)	14.2	1.4	12.0	15.3
AVPP1106	CVMV(R), PVY(R), BW(R), Anthr (FR)	13.6	1.5	11.7	17.5
AVPP9813	PVY (R), BW (R)	9.4	1.9	10.4	0.8
AVPP1107	CVMV(R), PVY(R), BW(R), Anthr (FR)	14.0	1.8	16.0	4.7
AVPP1108	CMV(MR), CVMV (R), PVY (R), BW (R), PC (R)	11.3	1.9	10.0	47.5
AVPP9905	PVY (R), CVMV (R)	15.5	2.6	29.3	16.6
AVPP1109	PVY (R), PC(R)	10.6	1.2	4.8	123.9
AVPP1110	CVMV (R), PVY (R), BW (R), Anthr(FR)	13.5	1.6	11.7	8.7
AVPP1111	CVMV (MR), PVY (R), BW (MR)	12.9	1.4	9.4	36.9

*CVMV=chili veinal mottle virus, PVY=potato virus Y, BW=bacterial wilt, CMV=cucumber mosaic virus, Anthr= Anthracnose (GR= green fruit resistance; FR= field tolerance), PC=Phytophthora blight race3; R=resistant, MR=moderately resistant ** 100g fresh weight edible portion.



11th International Sweet Pepper Nursery (ISPN11)							
			Fruit Traits				
Line	Resistance*	Shape	Color	Weight (g)	Length (cm)	Width (cm)	Wall thickness (mm)
AVPP1112	PVY (MR)	Bell	Lght green-red	160	8.7	8.5	4.8
AVPP1113	CVMV (R), PVY (R), BW (MS), PC1 (MR),BS (Hor.R)	Bell	Green-red	105	9.1	7.0	4.8
AVPP1114	PVY(R)	Bell	Green-yellow	191	7.8	9.2	5.9
C05483	PVY (MR), PC1 (MR), (check)	Bell	Green-red	98	9.9	7.0	5.0
AVPP1115		Bell	Green-yellow	148	7.1	8.7	5.9

*PVY=potato virus Y, PC1= Phytophthora race 1, CVMV=chili veinal mottle virus, BW=bacterial wilt, BS= bacterial spot (Hor.R=Horizontal resistant), R=resistant, MR=moderately resistant, MS=moderately susceptible,



AVPP1112





AVPP1114





C05483

AVPP1115

	Nutrient Contents (mg /100 g fresh weight edible portion)						
Line	Ascorbate	Capsanthin	Zeaxanthin	Lutein	β-Cryptoxanthin	β-Carotene	
AVPP1112	162	1.21	0.06	0.10	0.02	0.03	
AVPP1113	175	3.16	0.40	0.51	0.17	0.34	
AVPP1114	183	0.00	0.10	0.46	0.04	0.16	
C05483	200	3.02	0.14	0.57	0.11	0.17	
AVPP1115	132	0.00	0.05	0.27	0.02	0.12	



Crucifer Breeding

- Focus on leafy crucifers
 - East Asia secondary center of brassica diversity
 - Short duration, lower production costs
- Selection for high yield, vigor, earliness, nutrition



Pakchoi *B. rapa* cvg. *chinensis*



Choysum *B. rapa* cvg. *parachinensis*



Kailaan *B. oleracaeae* cvg. *alboglabra*



AVRDC Leafy Brassica OP's for Distribution





Cucurbit Improvement

- Research at regional station for AVRDC-East and SE Asia in Thailand and AVRDC-Taiwan
- Priority crops
 - Bitter gourd (*Momordica charantia*)
 - Pumpkin (C. moschata)



C. moschata





M. charantia



Cucurbit Breeding Objectives and Approach

Bittergourd

- Yield, earliness, gynoecy
- Fruit quality: shelf life and low fruit cracking
- Disease/ insect resistance
- Nutritional/medicinal components

Pumpkin

0

- Yield, earliness
- Fruit quality
- Disease resistance
- Carotenoids

Common approach and strategy

- Evaluate GRSU accessions, commercial hybrids
- Select superior inbreds from segregating hybrids, GRSU accessions
- Develop genetically diverse populations for targeted market segments for inbred development
- Hybrids from genetically superior inbreds



High yielding, high quality AVRDC bitter gourd lines



AVBG 1314 (41 t/ha)

AVBG 1310 (33 t/ha)

AVBG 1304 (36 t/ha*)



AVBG 1323 (33 t/ha)

AVBG 1325 (37 t/ha)

*Yields based on a 2013 May trial conducted in Kamphengsaen, Thailand







AVBG 1311 (39t/ha)

Promising Pumpkin Selections



TD-2-5-10

ED-8-8

LE-5-2-3



PKH251-3-3



12THCM33-09S-5



Nutrient Contents of Indigenous Vegetables Noted for Heat/ Flood Tolerance



Crop	Protein	Lutein	β-carotene	Vit. C	Са	Fe	Folate
0.00	g	mg	mg	mg	mg	mg	μg
Tropical violet	4.68	7.38	5.68	50	180	2.05	27
Malabar spinach	2.25	3.12	3.40	57	65	1.21	88
Jute mallow	5.17	7.02	5.10	124	300	5.74	92
Purslane	1.23		2.96	9	36	0.53	

100g edible portion on fresh weight

Courtesy: AVRDC Nutrition



AVRDC Breeding Line Distribution: http:¥www.avrdc.org

AVRDC The World Vegetable Center

AVRDC - The World Vegetable Center



ABOUTUS

- Who we are
- Where we are
- Our people
- Partnerships
- Contact Us

FOR YOU

- MEDIA
- DONORS
- TRAINEES

OUR WORK

- Managing germplasm
- Developing new varieties
 Improving production
- Enhancing consumption
- Projects
- Countries

WHAT WE OFFER

- Seeds
- Business opportunities
- Technologies
- Crops
 Dublicativ
- Publications
- Training
 Recipes

OUR LOCATIONS



Prosperity for the Poor Health for All

SEARCH

OUR MISSION

AVRDC - The World Vegetable Center is an international nonprofit research and development institution committed to alleviating poverty and malnutrition in the developing world through the increased production and consumption of nutritious and health-promoting vegetables.

NEWS





AVRDC The World Vegetable Center

AVRDC Seed Shop

Hot Pepper

Capsicum annuum Lines developed at AVRDC – The World Vegetable Center



Pedigree: Jin's Joy//Kulai*3/PBC932.

Tested as ICPN18-10, this line is a product of our anthracnose resistance breeding program. With moderate pungency and relatively high yield potential, the line carries resistance to four diseases (Cucumber Mosaic Virus, Potato Virus Y, Bacterial wilt, and Anthracnose). It has strong red color when mature, and good flavor. It has shown good combining ability in hybrid test crosses.

To order seed, please email:

seedrequest@worldveg.org

A handling fee will be charged. For seed distribution policies, please visit the AVRDC website: www.avrdc.org AVRDC – The World Vegetable Center Box 42 Shanhua, Tainan 74199 TAIWAN

Descriptor	Descriptor					
Maturity	Early					
Plant size	Medium					
Plant stature	Medium					
Days to flower	78.5					
Fruit type	Chili					
Fruit shape	Elongated					
Fruit shape at blossom end	Pointed					
Fruit length (cm)	10.65					
Fruit width (cm)	1.85					
Fruit fresh weight (g)	13					
Fruit position	Intermediate					
Fruit pungency	Medium					
Immature fruit color	Green					
Fruit color intensity at immaturity	Medium					
Mature fruit color	Red					
Fruit color intensity at maturity	Medium					
Plant habit	Compact					
Disease resista	nce *					
Cucumber Mosaic Virus (CMV)	MS					
Chili Veinal Mottle Virus (CVMV)	S					
Potato Virus Y (PVY)	R					
Tomato Mosaic Virus (ToMV)	S					
Bacterial spot (Xanthomonas)	-					
Bacterial wilt (Ralstonia)	R					
Phytophthora blight	MS					
Anthracnose (Colletotrichum)	FR					

* Laboratory evaluations conducted at AVRDC Taiwan, where R = resistant (80-100% symptom free), MR = moderately resistant (50-79% symptom free), MS = moderately susceptible (10-49% symptom free) and S = susceptible (<10% symptom free). Performance at other sites may vary.



AVRDC Breeding Lines: International Public Goods

- Available to public, private sectors for research, breeding
- No royalty charges
- Recipients asked to:
 - Inform AVRDC if a line is released as a variety, used as hybrid parent line
 - Provide trial performance data
 - Publicly acknowledge AVRDC



Acknowledgement of AVRDC in East-West seed catalog



AVRDC Varieties released worldwide



Seed Companies Critical for Vibrant Horticulture Sector

- Superior cultivars, high quality seed are essential for increased productivity
- Competitive seed company R&D produces a stream of improved cultivars
- Seed companies succeed by repeat sales and service to their farmer customers
- AVRDC assistance to seed companies, especially regional companies benefits farmers and consumers





AVRDC Seed Shipments* to ASEAN Countries (2004-2013)

Country	Tomato	Pepper	Legume (mungbean)
Brunei	1	1	0
Cambodia	30	17	5
Indonesia	11	19	0
Japan	48	20	0
Laos	4	5	3
Malaysia	1	4	1
Myanmar	10	5	5
Philippines	33	15	4
Singapore	3	0	0
Thailand	87	66	9
Vietnam	75	62	9

*Each shipment usually includes multiple crops and lines



Major Seed Company Recipients of AVRDC Tomato Lines (1993-2013)

Company	Countries	Shipments	No. Lines
East West + Hortigenetics	SE/S Asia	35 + 5	325 + 23
Limagrain/Marco Polo/Harris Moran	Thailand/USA/Italy	19	158 + 77 + 78
Southern Seed	Vietnam	17	147
Seminis (+Peto)	USA	16	113 + 122
Chia Tai	Thailand	16	156
Takii	Japan	15	97
Namdhari	India	15	126
Kagome	Japan/Taiwan	15	165
Bejo Zaden	India	15	118
Known You	Taiwan	14	144
Enza Zaden	Holland	11	81
BHN	USA	12	68

Outlook : AVRDC Breeding

- Expect rapid growth and sophistication of the horticultural and vegetable seed sectors in ASEAN
- Will continue to provide advanced breeding lines of global vegetable crops to ASEAN NARS and seed companies and build capacity in classical and new breeding approaches, especially molecular markers
- More indigenous vegetable research and improvement for crop diversification
- Greater AVRDC emphasis on strategic and complex traits such as heat and salinity tolerance, insect resistance, multiple disease resistance, and nutrient content



Thanks for your kind Attention



