FEEDBACK
from the field

AVRDC
The World Vegetable Center

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This bulletin provides information about application of AVRDC's technologies in the field and other topics of interest regarding vegetable production and consumption constraints around the world. It is issued quarterly. We welcome everyone to share any interesting news about vegetables – please send a short article with photos to tech_dissemination@worldveg.org. Thank you!

Yellow vein mosaic disease inflicts severe damage on okra in Thailand

Yellow vein mosaic disease is widespread in okra fields in Kanchanaburi Province, Thailand.

Yellow vein mosaic disease (YVMD) caused by a begomovirus was first observed in 1995 and has become a serious problem affecting okra *(Abelmoschus esculentus)* production in Thailand since 1998.

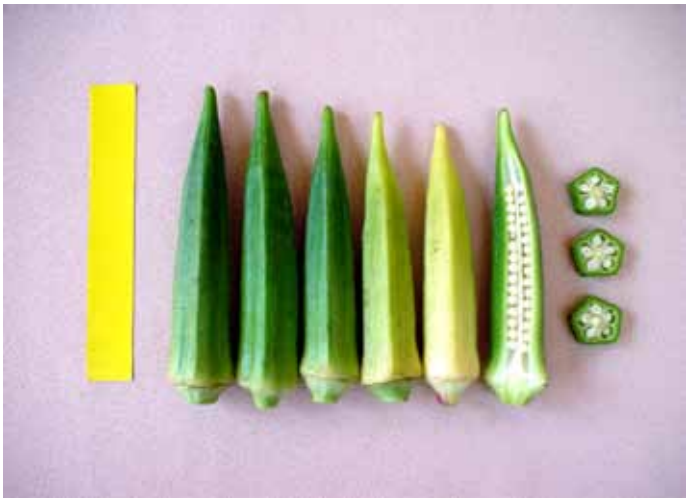
YVMD is transmitted by an insect vector, the whitefly *(Bemisia tabaci)*. The initial symptom on young leaves is a diffuse, mottled appearance. Older leaves have irregular yellow areas which are interveinal. Clearing of the small veins starts near the leaf margins about 15 to 20 days after infection. Thereafter, the vein clearing develops into a vein chlorosis. The newly developed leaves exhibit an interwoven network of yellow veins, which enclose the green patches of the leaf. Fruit developing on infected plants has irregular yellow areas that follow a longitudinal alignment. Fruit is also malformed, reduced in size, mostly yellow, small, tough and fibrous. Symptoms first show about 18 days after sowing in the seriously infected areas, and the most susceptible stage of the crop is from 35 to 50 days after sowing. There is no control for this disease if the plant is already infected. In areas not infected with YVMD, such as northeastern Thailand, some farmers still plant YVMD-susceptible varieties for their own consumption and supply for local markets.

Kanchanaburi Province is located in western Thailand and it is a major okra growing area where YVMD was widespread. In 1995 to 2000, the average annual exported production loss due to YVMD was about 498 tons. About 40-90% of total okra production is reduced during the virus-infected stage. Furthermore, 90-100% of the yield from infected plants is too low quality to export to Japan.

YVMD has intensively affected both okra exports and domestic consumption in Thailand. The yellow pods harvested from infected plants reduced the export levels to Japan from 1995 to 2000. A commercial variety with YVMD

resistance was first introduced from India to Thailand in 1999-2000. However, each resistant variety only has been able to ease the production problem for 2-3 years. The virus itself has continuously developed different strains and attacks the resistant variety so that eventually the resistant variety becomes susceptible.

The Department of Agriculture (DOA) continues to work on YVMD resistant variety development. Seed companies, such as East-West Seeds, Uniseeds, and Maejo University each have released 2-3 resistant varieties. Both the Horticulture Research Institute (HRI) and the Kanchanaburi Agricultural Research and Development Center (KARDC) are working on resistant selections; HRI is currently comparing lines and KARDC is evaluating yield. DOA plans to release low-cost open-pollinated varieties in the next 1-2 years. Farmers can then save their own seeds instead of paying more to buy the commercial resistant varieties.



Top left & right: *Diffuse, mottled, irregular yellow spots with vein clearing and chlorosis are the yellow vein mosaic disease (YVMD) symptoms in okra leaves.*

Bottom left: *Irregular yellow pods produced by YVMD infected plants.*

Bottom right: *Green pods harvested from healthy okra plants (left) and yellow pods harvested from YVMD infected plants (right).*

Source: *Amnuai Adthalungrong,* Horticulture Research Institute, *Kraising Choodee*, Kanchanaburi Agricultural Research and Development Center, Thailand; *Wen-shi Tsai*, Virology, AVRDC-The World Vegetable Center
Photos: *Amnuai Adthalungrong* and *Wen-shi Tsai*

Efficient Chinese yam production: A lesson from a Taiwanese grower

Mr. Chao-yung Yang builds iron arches across two slanted beds for growing Chinese yam.

Leaves of the Chinese yam variety 'Hualien no. 3'

Yam (*Dioscorea* spp.) is a deciduous perennial with creeping and climbing vines, mainly eaten for its starchy tuber in tropical and subtropical countries. It contains viscous polysaccharides, has a glutinous texture, and is a good source of dietary fiber, potassium, vitamin C, manganese and vitamin B6. There are more than 600 species of *Dioscorea*, about 60 have edible tubers and are cultivated as crops. Yams are easy to cultivate and have relatively few insect pests and diseases. In Taiwan, four *Dioscorea* species/varieties including *Dioscorea alata*, *D. alata var. purpurea, D. batatas (or D. opposite),* and *D. japonica* are grown in Taipei, I-lan, Hualien, Nantou, Chiayi and Pingtung areas.

Mr. Chao-yung Yang is a Chinese yam (*D. batatas*) grower in Hualien, Taiwan. He has cultivated Chinese yam for 20 years. 'Hualien no. 3' is the main variety planted on his 5 ha of land. This variety has long cylindrical tubers, brownish skin and white interior flesh. The underground tuber can reach more than 1 m long and 3.5 cm wide. Traditionally, tubers grown in sandy loam soil can curve and break apart easily during harvest. To produce good quality tubers that can be harvested without any damage, Mr. Yang developed a simple and effective method to grow Chinese yam.

Mr. Yang bought tens of thousands of PVC plastic pipes (about 125 cm long, 12 cm wide) and sliced them lengthwise into two halves. He then plowed and applied organic fertilizers at 1200 kg/ha to the field. Using thick iron wires, he set up an arch across two beds (150 cm wide each) and dug a trench 60 cm wide between the beds for irrigation. The beds were tilted a slight angle of 15-20 degrees toward the trench. Then, he placed the pipe halves side by side horizontally on the beds and covered them with 10 cm soil.

Top: *Mr. Yang uses 125 cm long and 12 cm wide PVC plastic pipe halves to grow Chinese yam.*

Left: *Small, potato-like structures called bulbils are formed after the plants have matured. Bulbils can be planted, but it takes 2-3 years for the tubers to reach commercial maturity.*

Right: *Stacks of halved PVC pipes can be reused for the next planting.*

*Eight months after planting, Mr. Yang uses his shovel to dig the pipe halves out **(left)**, and inverts them to reveal the yam tubers **(right)**.*

For preparing the Chinese yam cuttings (seed tubers), Mr. Yang chose nicely-shaped tubers with no pest infestation; cut them into several 6-10 cm (about 50-80 g) sections and applied plant ash to each transection. The cuttings were kept under the sun to heal for a few hours before being put into the wet sand and covered by plastic mulch to accelerate germination. When the bulgy buds emerge from the cuttings, it is time to plant.

For 'Hualien no. 3,' bulbils (small, potato-like structures) appear in the leaf axils of newly formed leaves after plants have achieved sufficient growth. These bulbils continue to appear until the end of the growing season. When the seed tubers are not available, bulbils can be planted. However, tubers grown from bulbils take 2-3 years to reach commercial maturity.

In February and March, Mr. Yang planted the budded seed tubers 6 cm from the top end of the pipe, and then covered them with 10 cm of soil. One seed tuber was planted per pipe. The intensive production system allows Mr. Yang to plant about 30,000 seed tubers per hectare. After 2-3 days, the beds were covered with black plastic mulch for weed control. When the yam vines reached 30 cm in height, he spread a supporting net on the sides and top of the arches. After eight months (around August to September), the tuber inside the pipe has grown more than 1 m long. During harvest, the dried vines, leaves and black plastic mulch were removed. A shovel was used to dig each pipe half out and invert it to reveal the yam tuber. The average yam yield is more than 20 t/ha.

With this method, harvesting yams has become easy for Mr. Yang. The yams produced in his farm are healthy and robust, straight and with no physical damage. The tubers of 'Hualien no. 3' can be stored in the cold room at 5°C for at least one year without quality degradation. Mr. Yang has multiple marketing channels. He sells his yams to the markets, farmer organizations, restaurants and shopping malls. Most of all, the half pipe growing method has increased his production yield and income many fold.

A newly harvested Chinese yam.

Source: *Jen Wen Luoh*, Nutrition; *Kun-lung Lee*, Legumes, AVRDC-The World Vegetable Center
Photos: *Susan Lin*, Pepper Breeding; *Jen Wen Luoh*, Nutrition; *Sophie Chou*, Genetic Resources and Seed; *Kun-lung Lee*, Legume, AVRDC-The World Vegetable Center

Innovative seedling cell production in Pare, East Java, Indonesia

Wooden frames are set on end, and polyethylene (PE) *tubes filled with soil mix are placed inside the frame. A saw is used to cut the tubes, creating the seedling cells* ***(left to right****).*

After cutting each layer, a thin wood sheet is inserted to keep the cells in place, and the frame of cells is laid flat. When moved to the seedling beds, the frame is set on the bed surface, and the wooden sheet and frame are removed ***(left & middle)****. Seedlings of chili pepper* ***(top right)*** *and tomato* ***(bottom right)*** *for sale.*

Mr. Supriyadi runs a simple and productive vegetable seedling nursery in a farming subvillage of Pelem village in Pare Subdistrict, Kediri District, East Java. Originally, he learned how to produce seedlings on a commercial scale while working for a private seed company. After that he worked with a farmers' group to modify the procedure using locally available materials. Net houses were constructed with bamboo poles for framing, and covered with clear plastic on the roof and netting on each side. Simple benches to hold the seedlings were built on the ground with a porous sand base and concrete block perimeters.

In his most innovative design to produce seedlings, he uses long cylindrical, polyethylene (PE) tubes which local people usually fill up with water and freeze to make refreshing ice.

Polyethylene (PE) tubes are filled with a mixture of sand, compost and soil for making seedling cells.

*Net houses for vegetable seedlings production were built with bamboo poles for framing, and covered with clear plastic on the roof and netting on each side **(top left)**. Simple benches to hold the seedlings were formed on the ground with porous sand base and concrete block perimeters **(bottom left & right)**.*

A mixture of sand, compost and soil is sterilized through solarization, and then placed in the PE tubes, and the ends tied. The tubes are stacked inside a wooden frame, four tubes wide and 14-15 tubes deep. The tubes are then cut with a saw to create seedling cells about 3 cm in diameter and 4 cm tall. After cutting each layer, a thin wood sheet is inserted to keep the cells in place, and the frame of cells is laid flat. When moved to the seedling beds, the cells are set on the bed surface, and the supporting frame and wooden sheet are removed. Finally, seeds are placed in a small indentation in each cell, and watered.

Mr. Supriyadi's nursery provides not only regular amounts of chili, eggplant, tomato and cabbage seedlings, but also accepts special orders from farmers. Farmers usually tell him the specific varieties they would like to grow, based on the popularity and demand in the market. About 23-30 days after sowing, the seedlings can be delivered to the farmers for transplanting in their fields. The seed source is from distributors, mostly hybrids.

Mr. Supriyadi sells about 9,000 seedlings every month and his net income averages about US$600. About 15 similar nurseries using the same technology have been established in the same subvillage, managed by other members of the farmers' group.

Source and photos: *Mandy Lin,* Global Technology Dissemination*; Paul Gniffke*, Pepper Breeding, AVRDC-The World Vegetable Center

AVRDC - The World Vegetable Center
Global Technology Dissemination
P.O. Box 42, Shanhua, Tainan 74199
Taiwan

T +886 6 5837801
F +886 6 5830009
E tech_dissemination@worldveg.org
I www.avrdc.org

Facebook: http://www.facebook.com/pages/Feedback-from-the-Field/169530259752510

Editors: *Mandy Lin* and *Greg Luther*, Global Technology Dissemination
Layout: *Vanna Liu,* Communications & Information