

Research Note

YIELD AND TOLERANCE OF BELL PEPPER (*CAPSICUM ANNUUM L.*) CULTIVARS TO POTATO VIRUS Y ISOLATE FROM PUERTO RICO¹

The Agricultural Experiment Station is actively engaged in a research program geared to increase commercial production of important vegetable crops. Pepper, a crop of major importance in tropical and subtropical regions, is a popular food item. It is low in calories and an excellent source of vitamins A and C.² Peppers rank third among the most important vegetable food crops in Puerto Rico. The farm value of this crop in 1984 was estimated at \$4.38 million.³ Results of field trials indicate that at least 30,000 pounds of pepper per acre can be produced in the southern coastal belt, with drip irrigation and other improved technologies.

In Puerto Rico Roque et al.⁴ and Pérez et al.⁵ have reported moderate to heavy losses of pepper crops because of virus diseases affecting yield and fruit quality. The most common virus infecting peppers in Puerto Rico is potato virus Y (PVY), although tobacco etch virus (TEV) and tobacco mosaic virus (TMV) have been also informed.⁵

An evaluation experiment on bell pepper cultivars Shamrock, Skipper, Annabelle, Yolo Wonder, Four Corners, Pip, Keystone Resistant Giant #3, Hybelle, and Crispy was conducted at the Fortuna Research and Development Center in Juana Díaz, Puerto Rico, from February to June 1986. The nine cultivars were planted in four replicated

plots and harvested from the 3rd to the 5th month. Yields were recorded and plants evaluated for uniformity, vigor, size, and virus symptoms.

For each cultivar, samples of pepper leaves showing mosaic symptoms were collected at random from the four replicated plots and placed in separate plastic bags. The specimens were numbered and stored in a refrigerator for a period not exceeding 1 week.

Affected pepper leaves from each cultivar were ground in mortar and pestle with 0.01 M K_2PO_4 buffer (1:3 w/v, pH 7.0) and the sap squeezed through four layers of cheesecloth. The sap was rubbed in carborundum (400 mesh) dusted leaves of virus-free *Capsicum annuum* cv Blanco del País, *Datura stramonium*, and *Chenopodium quinoa*. Plants thus inoculated as well as healthy controls were kept in a greenhouse (presumably insectproof) at an average temperature of 28° C and observed for 21 days.

Leaves were homogenized in 0.01 M K_2PO_4 buffer (1:3 w/v, pH 7.0) and squeezed through four layers of cheesecloth. The crude extract was tested against antisera of cucumber mosaic virus CMV, PVY, TEV and TMV from Florida. The immunodiffusion medium containing sodium dodecyl sulfate (SDS) was prepared according to methods

¹ Manuscript submitted to Editorial Board 5 November 1986.

² Villalón, B., 1981. Breeding peppers to resist virus diseases. *Plant Dis.* 65 (7): 557-62.

³ Anonymous, 1984. "Ingreso Agrícola." Cifras revisadas para 1982-83 y preliminares para 1983-84. Puerto Rico Department of Agriculture, Santurce, Puerto Rico.

⁴ Roque, A. and J. Adsuar, 1941. Studies on the mosaic of peppers (*Capsicum frutescens*) in Puerto Rico. *J. Agric. Univ. P. R.* 25 (4): 1-11.

⁵ Pérez, J. E., H. Irizarry and A. Cortés-Monllor, 1974. Present status of virus infections of peppers in Puerto Rico. *J. Agric. Univ. P. R.* 58 (1): 137-39.

TABLE 1.—Marketable yield and average fruit weight of 9 bell pepper (*Capsicum annuum* L.) cultivars

Cultivar	Marketable yield	Mean fruit weight
	kg/plot ¹	g
Yolo Wonder L	19.03 c ²	109.06 b
Four Corners	17.63 c	96.48 c
Pip	18.13 c	111.82 b
Shamrock	28.29 a	108.25 b
Skipper	24.89 b	111.93 b
Keystone Resistant Giant #3	18.08 c	95.11 c
Hybelle	17.58 c	98.36 c
Crispy	17.60 c	92.72 c
Annabelle	22.66 b	122.11 a

¹ Mean of 4 plots, with 28 plants and 7.8 m² each.

² Means followed by one or more letters in common do not differ significantly at P=.05, according to Duncan's Multiple range test.

previously reported by Purefull and Batchelor.⁶

Epidermal strips dyed with calcomine orange/"Luxol" brilliant green and Azure A were studied to detect virus induced inclusions.⁷

Results indicated that cultivars Skipper, Annabelle, and Shamrock produced the highest fruit yield among the nine cultivars (table 1). On the basis of symptomatology, host range, serology and viral inclusions, the virus isolated was identified as potato virus Y (PVY). Extremely high incidence of infection (100%) caused by the PVY isolated was observed in all cultivars (table 2). Tolerance to PVY was observed in cultivars Skipper and Annabelle (table 2).

The isolated virus was mechanically transmitted to *Capsicum annuum*, and *Chenopodium quinoa*. Leaf mottling was observed on infected *Capsicum annuum* plants. Affected *Chenopodium quinoa* developed local lesions on the inoculated leaves. No symptoms were observed on virus assayed plants of *Datura stramonium*.

Positive reaction was obtained in gel double diffusion test against antisera of PVY and TEV from Florida. Precipitation zones in agar formed by the reaction of PVY homologous and the Fortuna isolates against PVY antisera coalesced and no spur was noted. A spur formation was observed only with the reaction of TEV homologous and the Fortuna antigens against TEV antiserum. This formation may indicate a difference between the TEV and the Fortuna antigens. No reaction was obtained with the other antisera tested and when crude sap from healthy pepper was used.

Light microscopy of stained epidermal strips from all the infected bell pepper cultivars revealed cylindrical inclusions in the cytoplasm, adjacent to the nuclei. Cylindrical inclusions observed in the cytoplasm were similar to the inclusions associated with PVY and other members of the potyvirus group.⁸ No inclusions were observed in epidermal strips dyed with Azure A.

⁶ Purefull, D. E. and D. L. Batchelor, 1977. Immunodiffusion test with sodium dodecyl sulfate (SDS) treated plant viruses and plant viral inclusions. IFAS, Agric. Exp. Stn., Fla. Univ. No. 788, 39 pp.

⁷ Christie, R. G. and J. R. Edwardson, 1977. Light and electron microscopy of plant virus inclusions. IFAS, Agric. Exp. Stn., Fla. Univ., Monograph Series No. 9, 155 pp.

⁸ Edwardson, J. R. and R. G. Christie, 1979. Light microscopy of inclusions induced by virus infecting peppers (*Capsicum annuum* L.) *Fitopatologia Brasileira* 4: 341-73.

TABLE 2.—*Plant evaluation and virus leaf symptoms of 9 bell pepper (Capsicum annuum L.) cultivars*

Cultivar	Plant Evaluation			Virus leaf symptoms mainly due to PVY ¹
	Uniformity	Vigor	Size	
Yolo Wonder L	Med. high	Medium	Medium	Mosaic
Four Corners	Medium	Medium	Medium	Mosaic
Pip	High	Medium	Med. large	Mosaic
Shamrock	High	High	Medium	Mosaic, some blisters
Skipper	High	High	Med. large	Mild mosaic
Keystone Resistant Giant #3	Medium	Medium	Med. large	Mosaic, some blisters
Hybelle	Medium	Medium	Medium	Mosaic
Crispy	Medium	Medium	Medium	Mosaic, some blisters
Annabelle	High	High	Med. large	Mild mosaic

¹ Determined in laboratory.

High incidence of PVY and other viral diseases decrease pepper yield in Puerto Rico. Recently, in a survey of virus affecting peppers at three private southern farms, the author⁹ observed incidence of diseases caused by the PVY ranging from 30 to 80 percent.

While surveying for virus diseases of bell peppers the aphid *Myzus persicae* was observed in constant association with infected peppers as well as with the weed *Trianthema portulacastrum* growing near the plantation. *Myzus persicae* has been identified as the vector of PVY and other viral diseases of peppers.¹⁰ Efforts should be directed toward controlling the vectors of PVY (aphids) as well as the weeds harboring these pathogens and vectors to prevent the spread of this malady. Also the search for pepper cultivars with a high de-

gree of tolerance to this and other viruses affecting peppers in Puerto Rico should be continued.

The use of mineral oil spray (this product is not registered in Puerto Rico for this purpose) such as JMS Stylet Oil (developed by Jack Simons, Florida) has been reported by Galon¹¹ and Zittler¹² as effective in controlling the spread of vegetable viruses (stylet born in pepper and summer squash). Costs are relatively low (about \$30/acre), when compared to other expensive methods, such as the use of reflective aluminum mulch (about \$170/acre), that interfere with the transmission of aphids diseases.

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⁹ Escudero, J., 1986. Virus diseases affecting peppers (*Capsicum annuum* L.) in Southern commercial fields of Puerto Rico. (In preparation).

¹⁰ Delgado-Sánchez, S. and R. G. Grogan, 1970. Potato Virus Y. C.M.I. A.A.B. Description of Plant Viruses, No. 37.

¹¹ Galon, A., 1986. Personal Communication, ISPRAC, Vegetable Corporation, Santa Isabel, Puerto Rico.

¹² Zitter, T. A., 1986. New virus threatens cucurbits. American Vegetable Growers, May: 13-17.