Evaluation of Tomato Varieties for Resistance to Bacterial Wilt

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Abstract

Tomato, the most important vegetable crop in Uganda, is produced mainly in peri-urban areas for fresh-market consumption. One of the major disease constraints on tomatoes is Bacterial wilt (*Ralstonia solanacearum*), a soil-borne disease for which there are no control options available in Uganda. To identify and test alternative control options for this disease, the IPM CRSP tomato program carried out an on-station trial to test 13 new tomato lines versus four currently available ones for resistance to bacterial wilt. In 2001a the introductions from AVRDC Taiwan have shown high resistance to Bacterial wilt for one season, though most of them are susceptible to Late Blight. In the two seasons, the older varieties were slightly more susceptible.

Research Objectives

To evaluate and select tomato varieties with resistance to bacterial wilt, which will eventually be availed to farmers in tomato growing areas infested by the disease.

IPM Constraints

Bacterial wilt, Late Blight, occurrence and levels of infestation of tomato pests.

Research Methods

In season 2000b, the tomato varieties requested from AVRDC Taiwan did not arrive on time. Only one, Tengeru, from AVRDC Arusha was available for comparison with three other varieties already available at KARI. The trial was laid out in a RCBD with four replicates each with four plots. Recommended pest control was carried out with fungicides and insecticides. Data was taken on incidence and severity of bacterial wilt, late blight, and insect pests (presented elsewhere). Yield was also recorded.

In 2001a, 13 new tomato lines from AVRDC Taiwan were received. However, seed quantities were too small for replicated plots, while poor germination further reduced the seedling numbers. The seedlings were therefore planted in single plots for seed multiplication, observation, and data collection. The trial carried out with the four available varieties from the previous season was also repeated.

Research Results and Discussion

Plant stand count was recorded to assess resistance to bacterial wilt. In 2000b Tengeru was the most susceptible to Bacterial wilt, while MT55 did not wilt at all (Table 1a). In 2001a wilting in all the three varieties was less than 20%. It is possible that the field used in 2000b had a different and more virulent strain of the pathogen. In 2001a only three of the new introductions succumbed to wilt (Table 1b), each with less than 10% of the plants wilting, providing a possible large germplasm base for bacterial wilt resistance.

Table 1. Plant Stand Count At (a) End Of 2000b And 2001a For Old Varieties, And (b) End Of 2001a For AVRDC Introductions

(a)

Variety	2000b	2001a
Tengeru	9 (50%)	17 (94%)
MT56	14 (78%)	16 (89%)
MT55	18 (100%)	15 (83%)
Redlander	12 (67%)	16 (89%)

(b)

Variety	Plants Surviving	Number Wilted
CLN2123A	71 (93%)	5
CLN2020B	44	0
PT4719A	5	0
PT4664B	14	0
CLN1462A	5	0
CH154	28	0
CLN1466P	48 (96%)	2
CLN1314G	66	0
D5915-206	38	0
CLN2026D	60	0
CLN2116B	25	0
CLN2037B	43	0
CLN1555A	46 (98%)	1

Table 2. Late Blight Scores (%) for Old Tomato Varieties in 2000b

Variety	15/11/00	18/12/00
Tengeru	36	83
MT56	29	70
MT55	31	77
Redlander	28	68

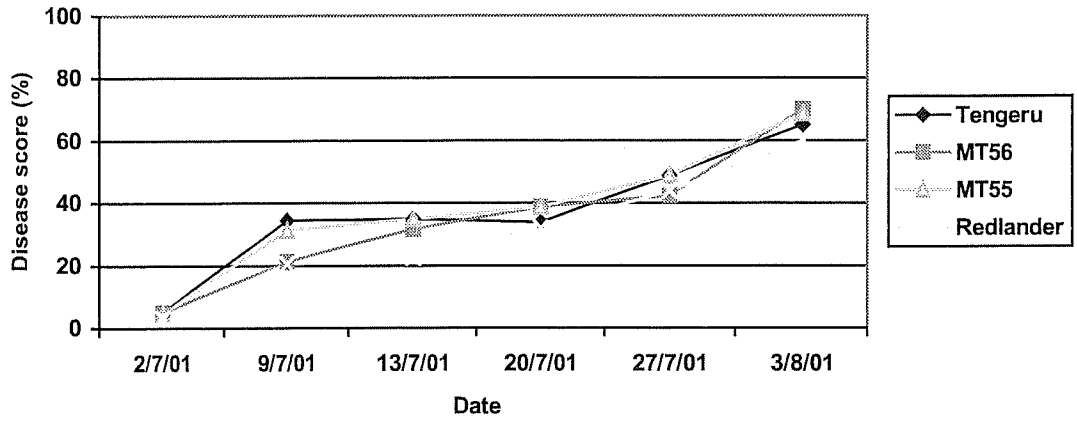
Scores on Late Blight resistance were also taken from the trials during both seasons. Since Late Blight is another major constraint and it would be advantageous for final selections to have some resistance or tolerance to this disease. In both seasons (Table 2 and Fig. 1a), Redlander was the most resistant to Late Blight, followed by MT56 and Mt 55, and Tengeru was the most severely infected. Among the introductions (Fig. 1b) at the beginning of the season, CLN2037, bred with Late Blight resistance, was least susceptible to Late Blight and remained that way for the whole season. It was followed by CH154, CLN2116B, and PT719A. Most affected were CLN1314G and CLN1466P. At the end of the season, the most severely infected by Late

Blight were CLN2123A, CLN2116B, and PT719A. The last two may be eliminated on the basis of their susceptibility to Late Blight if they react the same during the next two seasons.

In both seasons among the old varieties, MT55 significantly yielded highest, followed by MT56, Redlander, and lastly Tengeru (Table 3a.). This was the case even when the marketable fruits were sorted out in 2001a. The largest unmarketable yield was a result of boll worm damage, though there was no significant difference between varieties. Redlander had the highest percentage of fruit yield infected by Late Blight, followed by MT55. With its relative susceptibility to wilt, high susceptibility to Late Blight, and low yields, Tengeru, the introduction from AVRDC Arusha, is likely to be eliminated. It is not performing as well as it does in Arusha where it was developed.

Yields of the introductions from AVRDC Taiwan are shown in Table 3b. Though there were no replications, yields obtained in the plot area for each variety were extrapolated to 1 Ha for ease of comparison. CH154, a cherry tomato, followed by CLN1555A and PT4664B had significantly highest total and marketable yields, while CLN1466P and CLN2026D had the lowest. CH154, CLN1555A, and CLN2037B had the highest % marketable yield, while D5915-206 and CLN1466P had the least marketable yield. Though D5915-206 had moderate Late Blight infection on the leaves (Fig. 1b), much of its unmarketable fruit yield (39%) was due to Late Blight infection.

(a)



(b)

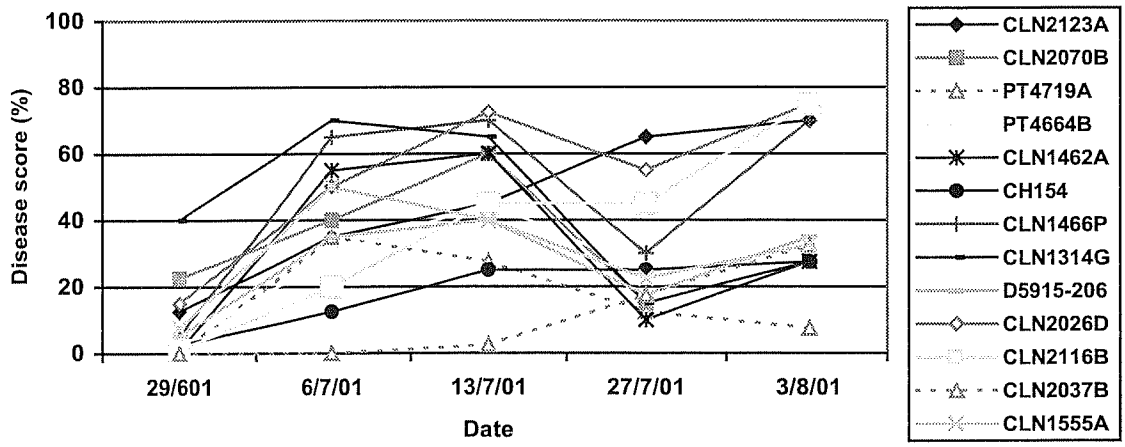


Fig. 1. ***Phytophthora infestans*** **scores (%) in 2001a on (a) old tomato varieties, and (b) introductions from AVRDC**

Impacts

Identification of new bacterial wilt resistant tomato varieties will increase production in affected areas in Uganda and the East African region as a whole and reduce fungicide spray applications.

Networking Activities

Workshops participated in: IPM CRSP Ugandan site annual report preparation meeting in September 2000; IPM CRSP Ugandan site Annual planning workshop, April 2001; ICIPE-NARES IPM Vegetable Workshop, Arusha, June 2001.
Visit by and discussions with Dr. Greg Luther.

Publications and Presentations

Developing IPM technologies for tomato production in namulonge sub-county, Mpigi District. Poster presented at the IPM CRSP Uganda site planning workshop in Jinja, April 2001, and at the Annual meeting of the IPM CRSP Blacksburg, Virginia, May 2001.

Training Output

Eric Kagezi is presently studying for his M.S. in Entomology.

Project Highlights

- All 13 tomato introductions from AVRDC have shown 90 - 100% resistance to bacterial wilt.

Table 3. Yield (T/Ha) of Different Bacterial Wilt Resistant Tomato Varieties (Numbers in Brackets Are % of Total Yield)

(a)

	2000b	2001a			
Variety	**Total Yield**	**Total Yield**	**Marketable Y**	**Boll-worm Y**	**Late Blight Y**
Tengeru	5.4 c	10 c	6.6 d (66)	3 (30)	0.5 c (5)
MT56	17.1 ab	20.2 ab	13.4 b (66)	6 (30)	0.7 bc (4)
MT55	26.2 a	24 a	18.3 a (76)	3.6 (15)	2.1 a (9)
Redlander	16.1 b	16 b	10.4 c (65)	4.2 (26)	1.6 ab (10)
	$Lsd_{0.05}$= 9.8	$Lsd_{0.05}$= 5.5	$Lsd_{0.05}$=2.9		$Lsd_{0.05}$= 1.0

(b)

Variety	**Plants/ Plot**	**Total Y**	**Marketable Y**	**Bollworm Y**	**Late Blight Y**
CLN2123A	71	13.7	9.2 (67)	4.1 (30)	0.4 (3)
CLN2020B	44	8.5	6.7 (79)	1.6 (19)	0.2 (2)
PT4719A	5	14.6	10.4 (71)	3.9 (27)	0.4 (2)
PT4664B	14	20.5	12.7 (62)	7.3 (36)	0.5 (2)
CLN1462A	5	15.1	8.9 (59)	5.8 (38)	0.4 (3)
CH154	28	30.1	28.9 (96)	1.2 (4)	0.01 (0)
CLN1466P	48	5.5	2.9 (53)	2.1 (38)	0.4 (7)
CLN1314G	66	10.3	7.1 (69)	2.4 (23)	0.8 (8)
D5915-206	38	19.6	9.1 (46)	2.8 (14)	7.7 (39)
CLN2026D	60	7.2	5.1 (71)	1.8 (25)	0.3 (4)
CLN2116B	25	11.7	7.5 (64)	4.2 (36)	0
CLN2037B	43	8.5	7.3 (86)	0.7 (8)	0.5 (6)
CLN1555A	46	29.2	26.5 (91)	2.3 (8)	0.4 (1)