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Reduced Indexing Time for Cachexia and Exocortis Diseases in Citrus

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ABSTRACT. The influence of three vigorous rootstocks (Cuban shaddock, rough lemon, and Volkamer lemon), gibberellic acid, and foliar urea sprays on the expression of exocortis and cachexia symptoms on indicator plants were evaluated. Cuban Shaddock proved to be the best rootstock for symptom expression on Clemeline 11-20 and Arizona 861 S-1 citron indicator plants for cachexia and exocortis, respectively. Application of 0.5% foliar urea sprays, alone or combined with 20 ppm gibberellic acid promoted better symptom expression for cachexia than the unsprayed control.

Exocortis and cachexia are viroid diseases found throughout the citrus regions of the world including Cuba. Although different indexing methods are known for these two pathogens, the one most commonly used method is the bioassay method which is time-consuming (1, 3). It may be possible to reduce indexing time by selection of hosts which allow greater pathogen multiplication. This report describes our results of several trials done with the objective of shortening the biological indexing period and, thus, decrease the indexing costs under Cuban conditions.

The influence of three vigorous rootstocks, gibberellic acid (GA3), and foliar urea sprays on symptom expression of cachexia and exocortis on Clemeline 11-20 and Arizona 861 S-1 citron indicator plants were evaluated. The viroid detection method

described by Pérez et al. (2) was used for verification.

Cuban Shaddock was a better rootstock than rough lemon or Volkamer lemon for indexing cachexia and exocortis (Table 1). This rootstock results in a very erect growth of Clemeline 11-20 and Arizona 861 S-1 citron and induced stronger expression of cachexia symptoms. It was also easier to handle in nursery situations.

The severe cachexia source induced pitting and gum impregnation symptoms in all of the indicator plants, but expression was more intense in Clemeline 11-20 propagated on Cuban Shaddock and Volkamer lemon (Table 1). For the mild source, two indicator plants on Rough lemon remained symptomless; while more intense symptoms were detected in the indicator plants

TABLE 1
CACHEXIA SYMPTOMS IN CLEMELINE 11-20 INDICATOR PLANTS ON DIFFERENT ROOT STOCKS 6.5 MO POST-INOCULATION

Rootstock	Cachexia source	Intensity of cachexia symptoms in indicator plant ^a				
		(-)	(+)	(++)	(+++)	(++++)
Rough lemon	mild	2		1	1	
Volkamer lemon	mild		2	2		
Cuban Shaddock	mild		1	1	2	
Rough lemon	Severe			1	2	1
Volkamer lemon	Severe					4
Cuban Shaddock	Severe					4

^a(-) = No symptoms; (+) = very mild symptoms; (++) = mild symptoms; (+++) = moderate symptoms, and (++++) = severe symptoms. Each rootstock was replicated four times.

TABLE 2
INFLUENCE OF FOLIAR SPRAYS ON THE EXPRESSION AND INTENSITY OF CACHEXIA SYMPTOMS IN CLEMELIN 11-20 INDICATOR PLANTS

Treatment	Indicator plants with symptoms according to intensity ^a					
	(-)	(+)	(++)	(+++)	(++++)	(+++++)
0.5% Urea		2	4	1	1	1
20 ppm GA3	2	1	3	3		
0.5% Urea + 20 ppm GA3		3	2	3		1
Unsprayed control	2	2	2	2	1	

^a(-) No symptoms; (+) very mild; (++) mild; (+++) moderate; (++++) severe and (+++++) very severe. Each treatment had nine replications.

propagated on Cuban Shaddock. It may be that Cuban Shaddock, being a natural hybrid of *Citrus medica*, allows for greater multiplication of the inoculated viroids and results in stronger symptoms.

Application of 0.5% foliar urea sprays alone or mixed with 20 ppm gibberellic acid produced more intense expression of cachexia symptoms in the indicator Clemeline 11-20 (Table 2). All plants developed cachexia symptoms 6.5 mo after the inoculation in treatments where urea was used; whereas, in the unsprayed con-

trol, two plants remained symptomless. The effect of GA3 did not markedly increase symptom intensity. These results suggest that urea, but not gibberellic acid, had a positive effect on symptom expression in the exocortis and cachexia biological indexing.

In all of the cases, exocortis was detected on citron by 60 d post-inoculation. By the use Cuban shaddock rootstock and the urea spray, we determined that biological indexing for exocortis and cachexia can be completed in 6.5 mo.

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