Field evaluations of cassava cultivars for resistance to tetranychid mites

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Abstract

The results are given of two field trials evaluating resistance of cassava cultivars to tetranychid mites. The cultivars were selected at CIAT (Colombia) and planted at the experimental farm of CENIAP (Venezuela). Using an injury scale of 0 to 5 for terminal buds and leaves, av damage and standard deviations were determined. A list is given of 19 cultivars with different degrees of resistance.

Introduction

At present cassava is widely grown and there is great interest in developing commercial operations on a large scale. From the standpoint of plant protection, damage caused by tetranychid mites is probably one of the most important limiting factors. The crop completes its cycle in about twelve months, during which time it needs to withstand a long dry period in the majority of the areas where it is cultivated. These environmental conditions favor the development of high populations of different Tetranychidae, which can cause total defoliation of plants, affecting root yields (2-3).

One of the more efficient and economic approaches to solve this problem is the use of resistant varieties. The Centro International de Agricultura Tropical (CIAT) began research along these lines in Colombia (1). Since selections were made under laboratory or greenhouse conditions, it was decided to conduct evaluations in the experimental fields at CENIAP in Maracay, state of Aragua, Venezuela. This paper reports the results obtained during the 1975-76 and 1976-77 trials.

Methods

Planting material was selected by A. Bellotti from the CIAT collections and mailed to Venezuela, where C. Arias from CENIAP was in charge of planting and cultural practices. E. Doreste from the School of Agronomy at the Universidad Central de Venezuela was responsible for the sampling and all observations on mite populations.

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Experiment 1

A total of 102 cultivars were planted in two plots, using a random block design at a distance of 1.20 m between rows and 1 m between plants. Each plot was formed by 4 plants of the same cultivar. Planting was done on June 18, 1975 and harvesting was done 12 months later.

Experiment 2

Planting was done on August 16, 1976 and harvesting was done on June 9, 1977. The same experimental design was used but only 51 cultivars were evaluated.

Sampling method

The sampling method was based on observations of two plants selected at random from the four in each plot; level of damage to terminal buds and mature leaves was determined separately, using the scale below:

For the analysis and statistical interpretation of data, different degrees of susceptibility were established, using the average of all damage levels determined on terminal buds and leaves, which gives the damage level by cultivar and the standard deviation. Those cultivars with values below the mean ($\bar{x}$) minus two standard deviations were considered as highly resistant and those below the mean minus one SD, as slightly resistant. Those over the mean plus two SD were considered as highly susceptible; all those with values equal to the mean with one SD more or less were considered as normal.

Comments

In the first trial, a few mites were observed at the end of October, when the plants had reached about 1 m in height. By December 10, a level of damage 1 was observed on the terminal buds of Col 485, 544, 873 and 1867 and on the leaves of Ecu 44. Level 2 damage was registered on Mex 22 and Col 452-B. The mite infestation became general in January. On January 29 and February 12 plants were well irrigated. On the 4th of February infestation was high, but by the end of the month the plants had recovered and there was new foliage as a result of the irrigation. On March 18 it rained heavily, and by the end of the month infestation was general. Final observations were made on June 3 when a great recovery of the plants was noted, many having new terminal buds and healthy leaves. Mite populations were not abundant, and many dead and some apparently diseased mites were found. The mites may have been attacked by a fungus; abundant colonies of a Phtyoseiidae were observed on the terminal buds.

Level of damage	Terminal buds	Leaves
0	No damage, no spots	No mites or damage
1	Mites present, a few spots	A few mites on some leaves, some whitish spots
2	Many mites, terminal leaves with spots	Whitish spots, few mites on many leaves
3	Buds affected, nearby leaves with many spots	Fairly extensive damage, many mites on some leaves
4	Deformed buds, nearby leaves with many mites	Extensive damage, many mites on several leaves
5	Dead buds, defoliation, many mites	Severe damage, defoliation, many mites on all leaves

During the second experiment it was necessary to irrigate lightly four times during the dry season (Jan.-Mar.). On January 21 there were no plants available for evaluation in two blocks containing cultivars Col 804, 525*, 292*, 320, 612, 230 and 15 as a result of poor germination and growth. The other plots had plants with healthy foliage; only cultivars Col 425, 526, 560, 586, 1058 and 131 had damage levels of 1 and 2. By February 16 infestation was generalized, and some terminal buds had been attacked heavily, showing deformation. Nevertheless, damage was not too heavy on the whole, which means the mite populations was young and in a developing stage. One month later damage was general and quite heavy, and some old stems and other debris were infested with termites. There was abundant rainfall at this time and from the middle of May onward, it rained regularly. No more counts were made after May 21 because of plant recovery; nevertheless, some cultivars (Col 526, 395, 81, 323, 551, 247, 198, 320 and 266, Ven 15) showed no signs of recovering.

Results

Experiment 1

Based on the results of seven field counts, the cultivars were grouped into three categories: a large group with normal to high susceptibility and two small groups, one showing resistance and the other great susceptibility. Calculated statistical values were as follows:

$\bar{x} = 1.95$ $\quad \bar{S} = 0.04$
$S = 0.41$ $\quad C.V. = 21.03$

From these values we consider the standard error low and the coefficient of variation acceptable for this type of biological population, which means uniformity of population distribution under field conditions. The cultivars were grouped in the following categories on the basis of mean damage levels and SD:

High resistance (X-2S), values under 1.13: Ecu 133 and Mex 20.

Low resistance (X-S), values between 1.13 and 1.54: Mex 28, 29, 31 and 1005; Col 890, 1325, 282, 10, 480, 65, 85 and 1010-B.

Susceptible, values between 1.55 and 2.35: Col 710, 808, 1138, 654, 348, 1142, 395, 1657, 673-A, 949, 867, 1805, 961, 982, 485, 900, 1807, 420, 76, 22, 971, 1157, 929, 601, 873, 1073, 660, 647, 659, 1710, 658, 1025, 1605, 1802, 1651, 966, 494 and 73; CMC 39; Mex 27, 5, 59, 41, 56, 22, 53, 66 and 52; Pan 31 and 48; Extranjera; Ecu 160 and 155.

Highly susceptible (X + S) values between 2.36 and 2.76: Llanera; Col 248, 544, 1813, 399, 706, 463, 544, 452-B, 642, 667 and 110; Mex 44.

Extremely susceptible (X + 2S), values over 2.77: Col 5.

Cultivars not analyzed: Mex 24 and 23; Col 607, 1062, 717, 1766, 1540, 272, 820, 9 and 144; Ecu 137, 144, 83, 142, 125 and 177; CMC 84.

Experiment 2

A total of four field counts were made during the first four months of 1977; final observations were made in May for those cultivars that had not shown any recovery symptoms to that date (Ven 15; Col 256, 395, 81, 323, 1551, 247, 198, 320 and 266). Evaluations were made according to the scale described in Experiment 1. The general mean for the cultivars and the standard deviation were determined, giving the following values:

$\bar{X} = 2.28$ $\quad \bar{S} = 0.05$
$S = 0.38$ $\quad C.V. = 16.67$

Standard error and the coefficient of variation also showed conditions of uniformity in the field. Based on these analyses, the cultivars in this experiment were grouped as follows:

High resistance (X-2S), values under 1.53: none.

Low resistance (X-S), values between 1.52 and 1.90: Col 323, 520 and 414; Ven 157 and 45-C.

Susceptible, values between 1.91 and 2.66: Col 247, 551, 156, 379, 81, 191, 593, 725, 1333, 568, 336, 282, 1828-A, 1050, 256, 283, 395, 1833, 1055 and 1856; Ven 15, 133, 11, 35 and 10.

* Both plots

Highly susceptible (X + S), values between 2.66 and 3.04: Col 425, 131, 647, 1058, 198 and 34.

Extremely susceptible (X + 2S): None.

Cultivars not analyzed: Col 914, 1097, 15, 576-A, 560, 693, 804, 525, 266, 292, 751, 320, 612, 320 and 586.

Conclusions

Based on the results obtained in these two field trials, the following conclusions were reached:

1. Resistance to tetranychid mites in cassava apparently exists.
2. Highly promising sources of resistance are cultivars Ecu 133 and Mex 20. Promising ones are Mex 28, 29, 31 and 1005; Col 890, 1325, 282, 10, 480, 65, 85, 1010-B, 323, 520 and 414; Ven 157 and 45-C.
3. Additional field experiments should be conducted with these cultivars and other promising ones obtained from greenhouse screening, as well as some of the commercial varieties.

Literature cited

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