Nataima-31, A cassava (*Manihot esculenta*) Variety Resistant to the Whitefly, *Aleurotrachelus socialis*

*Arias, B.V., Bellotti, A.C. **Vargas, H.L.B.
*Centro Internacional de Agricultura Tropical (CIAT), AA 6713, Cali, Colombia
**CORPOICA, Regional 6, Espinal-Tolima, Colombia

INTRODUCTION

In recent years, the whitefly *Aleurotrachelus socialis* has been a major pest of cassava, causing over 30% yield losses in different regions of Colombia. Due to its short life cycle (30-35 days), *A. socialis* populations increase rapidly and its ability to develop resistance to pesticides makes chemical control uneconomical. Host plant resistance is sustainable alternative for managing this pest.

Fig. 1. Population and Damage of *A. socialis*

The moderate to high levels of whitefly resistance found in cassava is somewhat unique in cultivated food crops. The CIAT research program to identify whitefly resistance was initiated about 20 years ago and resistance has now been identified in numerous cassava genotypes. Nataima-31 is a resistant commercial hybrid developed in a joint effort between CIAT and CORPOICA/MADR in Colombia.

ORIGIN OF Nataima-31

Evaluation of the CIAT cassava germplasm bank for whitefly (*A. socialis*) resistance was initiated in 1978. A 1 to 6 whitefly damage and population scale was employed, where 1 indicates the absence of whitefly damage and population and 6 indicates the severest damage and highest population (Table 1 and 2).

Table 1. Population scale for evaluating cassava germplasm for resistance to whiteflies

1 =	no whitefly stages present
2 =	1-200 individuals per cassava leaf
3 =	201-500 per leaf
4 =	501-2000 per leaf
5 =	2001-4000 per leaf
6 =	> 4000 per leaf

More than 6000 cassava genotypes have been evaluated using these scales and different sources of resistance have been detected in several genotypes. Clone MEcu 72 has consistently express high levels of resistance. The variety Nataima-31 is the progeny of a cross between MEcu 72 and MBra 12. MBra 12 was selected as the male parent because of its high yield and desirable agronomic and culinary qualities.

Table 2. Damage scale for evaluating cassava germplasm for resistance to whiteflies

1 = no leaf damage
2 = young leaves still green but slightly flaccid
3 = some twisting of young leaves, slight leaf curling
4 = apical leaves curled and twisted; yellow-green mottled appearance
5 = same as 4, but with sooty mold and yellowing of leaves
6 = considerable leaf necrosis and defoliation, sooty mold on mid and lower leaves and young stems

The original cross resulted in 128 progeny and these were evaluated for whitefly resistance, yield and cooking quality at the CORPOICA Research Station in Espinal, Tolima, Colombia. Of the 128 progeny, four (CG 489-34, CG 489-31, CG 489-23 and CG 489-4) were selected for low whitefly populations and no damage as well as the agronomic qualities described above. Nataima-31 is the 31st progeny of the 128 that were evaluated (Bellotti, 2003).

Fig. 2 Nataima-31 plant type

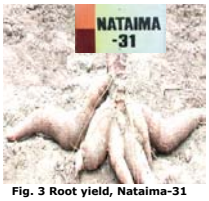

Fig. 3 Root yield, Nataima-31

VARIETAL REACTION TO WHITEFLY ATTACK

Field evaluations on Nataima-31 reveal that whitefly (*A. socialis*) populations are absent or very low. Whitefly populations and damage were considerably higher on the regional farmers variety, Aroma, and the susceptible control, CMC-40 (Fig. 4 and 5).

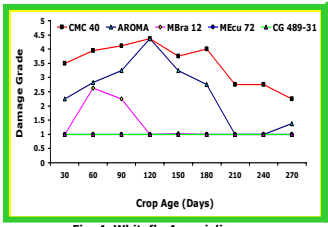

Fig. 4. Whitefly *A. socialis* populations on five cassava genotypes

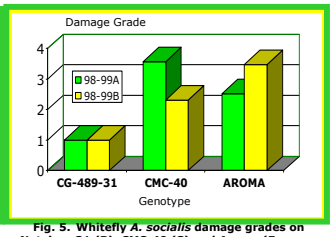

Fig. 5. Whitefly *A. socialis* damage grades on Nataima-31 (R), CMC-40 (S) and Aroma (Farmers Variety)

Additional studies have shown that Nataima-31, as well as its resistant female parent, MEcu 72, have antibiotic effects on *A. socialis* development. The development cycle is longer and there is a higher nymphal mortality ranging from 42.5 to 75.2% (Arias, 1995). Nataima-31 also displays antixenosis with lower ovipositional levels (Table 3).

Table 3. Average per leaf oviposition of *A. socialis* on several cassava genotypes

Genotype	No. Leaves	Eggs/Leaf[1] Average		C.V
MBra 12	92	82.1	A	291
CMC 40	57	75.2	A	104
CG489-23	54	69.7	AB	119
MCol 1505	70	59.3	B	148
MEcu 72	75	40.4	B	141
CG 489-34	102	20.5	C	134
CG 489-31	77	19.0	C	149

[1] Values followed by the same letter are not significantly different (Duncan alfa = 0.005).

It is therefore estimated that Nataima-31 will not require chemical pesticide applications for effective whitefly control in area such as Tolima, where *A. socialis* is endemic and, farmers are presently applying up to 6 insecticide applications per crop cycle. These pesticide applications increase production costs and adversely effect the environment. The ideal range of adaptation for Nataima-31 is between 400 to 1000 m.a.s.l., and yields more than the regional variety Aroma (23.0 T/ha vs. 16.2 T/ha).

In addition, roots contain low HCN levels and posses good cooking quality. Roots have a dark brown outer bark and a pink colored inner peel surface. Dry matter is above 30% and adapted to both the fresh and industrial market for starches and animal feed.

THE RELEASE OF Nataima-31

On March 28, 2003, Nataima-31 was officially released by the CORPOICA Research Station in Espinal, Tolima, with ICA (Instituto Colombiano Agropecuario) register number 008, July 10, 2002.

Several presentations were made describing the research process for developing Nataima-31 and explaining its agronomic characteristics and recommended crop management practices.

Newspaper Coverage of the Release of Nataima-31

During the field day, participants visited several field plantings of Nataima-31 where plants were harvested and root quality evaluated. Nataima-31 planting material (stem cuttings) was distributed to field day participants, the initial distribution of this variety.

ECONOMIC, PRODUCTION AND SOCIAL IMPORTANCE OF Nataima-31

It is estimated that the Colombian aviculture industry will require 290,000 tons of cassava for poultry feed. It is planned that the Departments of Tolima, Huila and Cundinamarca will plant 14,500 hectares of cassava toward this goal and by 2007; approximately 3,000 hectares may be planted to Nataima-31 in the high, warm Rio Magdalena valley. This could have the following effects on the region:

- An increase of 3,000 hectares with Nataima-31 above the already 8,900 hectares presently being grown using regional varieties.
- A generation of about 177,000 new jobs in the production phase, 48,000 jobs in the post harvest phase and 24,000 indirect jobs.
- A 25% yield increase from the present average of 10 T/ha to 20 T/ha with Nataima-31 for a regional average production of 12.5 T/ha.
- The 3,000 ha sown to Nataima-31 will produce 60,000 tons, and overall production will increase from 89,000 tons annually to 149,000 tons in 2007, an increase of 67.4%.
- A production cost reduction of 6.7% per hectare due to the reduced pesticide applications (a minimum of 3) presently being applied for whitefly control.
- At present between 3,600 to 7,200 kg of active ingredient of pesticides is being applied. This represents an expenditure of 324 to 628 million pesos. Planting Nataima-31 will reduce this cost.
- Nataima 31 maintains the high dry matter and quality of the regional cultivars and is superior in being less susceptible to physiological deterioration; this is an advantage in time of transport to markets.
- Nataima-31 will bring direct benefits to approximately 1,500 rural families and an indirect benefic to 4,500 families in the Rio Magdalena Valley region.

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