

# Test Report

on

## Evaluation of Humiforte 20 on crop promotion in mature clonal tea

*sponsored by*

**Inagrosa Industries Agro biologicals**  
Deha 28001, Madrid

**PGR (HUMIFORTE)** Humiforte 20  
MS: Inagrosa, Madrid 28001

**CONDUCTORS** Placido Basadre, Director  
EPASI TRF

**TRIAL SITE** EPASI Experimental Farm, Valparai  
MSL: 1050 m,  
10° 30' N 77° 0' E

**PERIOD** January - December 2007

*at*

**UPASI Tea Research Foundation**  
**Tea Research Institute**  
**Nirar Dam BPO, Valparai 642 127**  
**Coimbatore District, Tamil Nadu**

**January 2008**

**CONFIDENTIAL**

**UPASI Tea Research Foundation  
Nirar Dam BPO, Valparai 642 127**

**TEST REPORT**

**STUDY TITLE**

**Evaluation of Humiforte 20 on crop promotion in mature clonal tea**

**TEST ITEM**

**Humiforte 20**

**STUDY NO.: PHY/156 (PGR)/07-AN**

**SPONSOR**

**Inagarosa Industries Agro Biologicals  
S.A., C/Velazques, 31 4 deha, 28001, Madrid, Spain**

**TEST FACILITY**

**UPASI Tea Research Foundation  
Tea Research Institute  
Nirar Dam BPO  
Valparai 642 127, Coimbatore District**

**January 2008**

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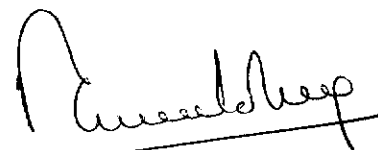
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UPASI Tea Research Foundation  
Nirar Dam BPO, Valparai 642 127

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### DECLARATION

The work presented in this report is a true and authentic record of the experiment entitled "Evaluation of Humiforte 20 on crop promotion in mature clonal tea" based on the research conducted at Valparai by the UPASI Tea Research Foundation, Tea Research Institute in accordance with the standard protocol. The report furnished herein is based on the original record of the results obtained.



Director

**UPASI Tea Research Foundation,**  
Nirar Dam BPO,  
Valparai-642 127,  
Coimbatore District, India

Date: 31.01.08  
UPASI TRF, Valparai

## TEST REPORT

### 1. General information

#### 1.1. Study title

Testing the bioefficacy of PGR, Humiforte 20 on crop promotion in mature clonal tea

#### 1.2. Sponsor

Inagrosa Industries Agro Biologicals  
S.A., C/Velazques  
31 4, deha, 28001  
Madrid, Spain

Tel: +91 435 90 80 435 91 49

Fax: +91 575 54 67

e-mail: [inagrosa@inagrosa.es](mailto:inagrosa@inagrosa.es)

Web: [www.inagrosa.es](http://www.inagrosa.es)

#### 1.3. Test facility & project staff

##### 1.3.1 Test facility

Plant Physiology Division  
UPASI Tea Research Foundation  
Tea Research Institute, Nirar Dam BPO  
Valparai 642 127  
Coimbatore District, Tamil Nadu

Tel: 91-4253 – 235301/235303

Fax: 91-4253 - 235302

e-mail: [physiolupasitearesearch@rediffmail.com](mailto:physiolupasitearesearch@rediffmail.com)

Web: [upasitearesearch.org](http://upasitearesearch.org)

##### 1.3.2. Field/trial locations

UPASI Tea Research Foundation, Experimental Farm of Tea Research Institute, Valparai 642 127

##### 1.3.3. Project officials

Dr.A.K.A. Mandal, Sr. Scientist & HOD  
Dr.R. Raj Kumar, Sr. Plant Physiologist  
Mr. Jibu Thomas, Assistant Botanist  
Plant Physiology Division  
UPASI Tea Research Foundation

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Tea Research Institute, Nirar Dam BPO, Valparai 642 127

#### 1.4. Study schedule

|  |  |
|--|--|
| Date of start of the trial                     | January 2007   |
| Pre-treat yield record                         | January to March 2007                                    |
| Scheduled date of spray                        | April, May, September and October 2007                   |
| Physiological observation                      | June and November 2007                                   |
| Period of sampling<br>for green leaf analysis  | June and November 2007                                   |
| Period of sampling for<br>made tea preparation | June and November 2007                                   |
| Harvesting                                     | As and when crop is ready throughout the<br>study period |
| Date of completion                             | December 2007  |
| Compilation of data<br>and dispatch of report  | January 2008   |

#### 1.5. Study compliance

Conduct of field trials to determine the physiological attributes, harvesting of tea shoots at specific intervals and preparation of tea samples for green leaf/made tea analyses were followed as per standard protocol. Physiological and biochemical analysis at the test facility were performed as per standard protocol. Organoleptic evaluation was done by professional tasters'.

## 2. OBJECTIVE

Determination of the bioefficacy of Humiforte 20 in mature clonal tea for crop promotion by conducting the study as per the standard protocol.

## 3. DETAILS OF THE TRIAL

### 3.1. Test item information

|                        |                               |
|------------------------|-------------------------------|
| Test item              | Humiforte 20                  |
| Trade name/common name | Humiforte 20                  |
| Active ingredient      | Amino acids and oligopeptides |

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|                     |  |
|---------------------|--|
| Formulation type    | Liquid - Bio complex providing NPK       |
| Batch number        | 35.090                                   |
| Batch produced by   | Inagrosa Industrias Agro Biologicas      |
| Date of manufacture | October 2006                             |
| Date of expiry      | Not mentioned                            |
| Purity (%)          | Not mentioned                            |
| Physical appearance | Liquid formulation light brown in colour |
| Storage condition   | Normal room temperature                  |

### 3.2. Selection of the field

Third year (after pruning) field having uniform plucking table was selected for this trial. Details of field and crop variety are presented in Annexure 1. The pretreatment history of the field prior to the start of the trial are given in Annexure 2.

### 3.3. Lay out of experimental field

Detailed outline of the field layout is presented in Annexure 3. A photograph of the experimental field is enclosed with Annexure 3.

### 3.4. Experimental details

|                           |  |
|---------------------------|--|
| Location                  | Valparai   |
| Experimental design       | RBD  |
| Total number of trial(s)  | One  |
| Treatment                 | 1. Humiforte 20 150 ml/ha<br>2. Humiforte 20 200 ml/ha<br>3. Humiforte 20 300 ml/ha<br>4. Standard I<br>5. Standard II<br>6. Untreated control |
| Number of bushes per plot | 20 bushes  |
| Number of plots           | Six replicates/Treatment   |
| Number of sprays          | Four (two each in high cropping season, i.e. April, May<br>September and October)  |
| Spray volume              | 200 l/ha   |
| Trial duration            | One year (January - December '07)  |
| Type of samples           | Fresh green leaf and black tea (CTC manufactured)  |
| Sample weight             | 50 g of fresh leaf for biochemical analysis of green leaf<br>2.0 kg of fresh leaf for made tea preparation                                     |



Sampling intervals

Date of sampling for green leaf analyses was second plucking after second and fourth spray while it was first plucking after second and fourth spray for made tea preparation

### 3.5. Time of spraying

Foliar application of the test item was carried out only after plucking the harvestable shoots so that the targetted maintenance leaves are exposed to perceive the foliar applied spray fluid and enough quantity of shoots are assured for the successive preparation of tea samples at specific interval of time for analysis. Foliar application was carried out under favourable weather conditions (Annexure 4).

### 3.6. Mode of spraying

Spraying was done with hand operated knapsack sprayer. Entire spraying operations were monitored by the study personnel. Date of spraying and spraying work sheets are Annexed (Annexure 5).

### 3.7. Frequency of spraying

For this study four sprays were executed at the prescribed seasons as detailed in the details of the trial (3.4). Details of dilution of spray fluid are furnished in Annexure 5.

### 3.8. Weather conditions

Weather parameters were collected from the meteorological observatory situated at UPASI TRF, Tea Research Institute, Valparai. Meteorological data recorded on the day of foliar application are provided in the Annexure 4.

### 3.9. Sampling of tea shoots

Green leaf yield for one year study period was recorded. Determination of yield attribute, banji per cent in the harvest, was also monitored during each plucking round. Physiological parameters during second plucking after second spray in each high cropping seasons were studied. Sampling for biochemical analyses of green tea shoots were done randomly from each



plot with replications during second plucking after second spray. All biochemical analyses were carried out immediately following the standard procedures.

Sampling for made tea manufacture was made at the time of harvest during first plucking after second and fourth spray. Harvested samples of all replications in a treatment were pooled together and about 2.0 kg of mixed sample was drawn and brought to CTC mini manufacturing unit for made tea preparation. Prepared made tea samples were subjected to quality constituent analyses, immediately. A batch of tea samples were sent to M/s. Paramount Tea Marketing Pvt. Limited, Coonoor and M/s. Contemporary Tea Auctioneers Pvt. Limited, Coonoor for organoleptic evaluation.

All obtained data were subjected to statistical analysis, ANOVA. Tables are presented with the critical difference (C.D.) and co-efficient of variation (C.V.).

## **4. RESULTS**

### **4.1. Yield and yield attributes**

Significant improvement of yield was evident in response to foliar application of Humiforte 20 at 150, 200 and 300 ml per ha with a concentration dependent decrease in the banji formation in the harvest (Table 1). Highest significant reduction in banji content with crop yield was noticed due to the application of Humiforte 20 at 300 ml/ha when compared to untreated control. In general all the treatments significantly enhanced the yield and reduced the yield attributes.

### **4.2. Physiological components and green leaf constituents (biochemicals)**

Foliar application enhanced the physiological attributes of tea bushes such as stomatal conductance and chlorophyll significantly (Table 2). Significant reduction in the the diffusion resistance was noticed with application of Humiforte 20. Both 200 and 300 ml/ha registered significant differences for all the physiological parameters studied.

Biochemical analysis revealed a significant increase in the content of total polyphenols in all the treatments (Table 3). However, catechins and amino acids did not exhibit significant improvement in any of the treatments of Humiforte 20.

### **4.3. Quality attributes and organoleptic evaluation**

Quality parameters such as theaflavins, thearubigins, total liquor colour, colour index, and briskness index of made tea samples had a significant improvement in response to the foliar application of Humiforte 20 at 300 ml/ha (Table 4). But there was variations existed among the different treatments. Humiforte 20 application at 150 ml/ha enhanced the values for TF, TR, CI and BI whereas improvement was evident only in CI and BI at 200 ml/ha treatment.

Organoleptic evaluation of made tea samples done by the professional tasters' showed an improvement in the scores on infusion, colour, strength and briskness (Table 5) and total score

in the samples applied with Humiforte 20 at 300 ml/ha. Improvement in the values of infusion, briskness and total score was noticed in 150 and 200 ml/ha treatments as well.

#### 4.4. Comptability test

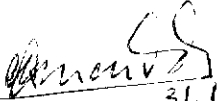
Laboratory experiments revealed that Humiforte 20 was compatible with commonly used agrochemicals as per UPASI recommendation with slight alterations in pH except for micronutrients and di ammonium phosphate (DAP). **However, it is not recommended to combine Humiforte 20 with any other agro chemicals to retain its bioefficacy.**

#### 4.5. Conclusion

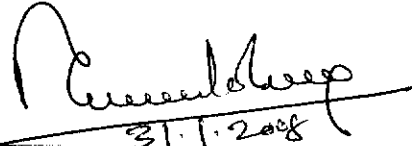
Among the different concentrartions tested, foliar application of Humiforte 20 at 300 ml/ha was found to significantly increase the yield to about thirty seven percent when compared to untreated control with significant improvement in physiological attributes, quality constituents and liquour characteristics. Overall improvement was also evident in Humiforte 20 application at 150 and 200 ml/ha.

The work presented in this report is a true and authentic record of the experiment entitled "*Evaluation of Humiforte 20 on crop promotion in mature tea*", based on the research conducted by the Tea Research Institute, Valparai 642 127, in accordance with the standard protocol.

Signature with date

  
(AKA Mandal) 31.1.08  
HOD, Plant Physiology Division



  
31.1.2008  
(N. Muraleedharan)  
Director

**Table 1. Bioefficacy of Humiforte 20 on yield of mature clonal tea**

| Treatments               | Yield, kg made tea/ha*<br>April -<br>December 2007 | Banji content<br>(per cent) |
|--------------------------|--|-----------------------------|
| Untreated control        | 2847   | 75                          |
| Standard I               | 4507   | 69                          |
| Standard II              | 2817   | 70                          |
| Humiforte 20 (150 ml/ha) | 3115   | 56                          |
| Humiforte 20 (200 ml/ha) | 3173   | 55                          |
| Humiforte 20 (300 ml/ha) | 3921   | 53                          |
| C.D. at P = 0.05:        | 177  | 3.42                        |
| C.V. (%)                 | 15.17  | 7.32                        |

\*Calculated for 13,000 bushes per hectare at an out turn of 22.5%

**Table 2. Influence of Humiforte 20 on certain physiological parameters of mature clonal tea**

| Treatment                | Stomatal conductance<br>(cm/s) | Difusion resistance<br>(s/cm) | Chlorophyll<br>SPAD |
|--------------------------|--------------------------------|-------------------------------|---------------------|
| Untreated control        | 0.29                           | 3.51                          | 73.88               |
| Standard I               | 0.32                           | 3.16                          | 75.12               |
| Standard II              | 0.29                           | 3.45                          | 77.63               |
| Humiforte 20 (150 ml/ha) | 0.36                           | 2.78                          | 74.87               |
| Humiforte 20 (200 ml/ha) | 0.43                           | 2.36                          | 76.73               |
| Humiforte 20 (300 ml/ha) | 0.38                           | 2.66                          | 77.47               |
| C.D. at P = 0.05:        | 0.05                           | 0.16                          | 1.91                |
| C.V. (%)                 | 9.25                           | 8.43                          | 3.38                |

**Table 3. Effect of Humiforte 20 on certain green leaf constituents of mature clonal tea**

| Treatment                | Polyphenols<br>(Per cent) | Catechins<br>(Per cent) | Amino acids<br>(Per cent) |
|--------------------------|---------------------------|-------------------------|---------------------------|
| Untreated control        | 21.79                     | 16.59                   | 3.84                      |
| Standard I               | 22.88                     | 16.25                   | 3.54                      |
| Standard II              | 23.19                     | 16.16                   | 3.71                      |
| Humiforte 20 (150 ml/ha) | 22.37                     | 15.99                   | 3.62                      |
| Humiforte 20 (200 ml/ha) | 23.17                     | 15.93                   | 3.41                      |
| Humiforte 20 (300 ml/ha) | 22.72                     | 16.68                   | 3.92                      |
| C.D. at P = 0.05:        | 0.44                      | 1.19                    | 0.19                      |
| C.V. (%)                 | 2.63                      | 9.85                    | 6.83                      |

**Table 4. Bioefficacy of Humiforte 20 on quality attributes of made tea**

| Treatment                | TF   | TR    | TR:TF | HPS   | TLC  | CI   | BI    | Caffeine |
|--------------------------|------|-------|-------|-------|------|------|-------|----------|
| Untreated control        | 1.13 | 11.10 | 10.40 | 10.70 | 4.13 | 5.04 | 26.67 | 3.44     |
| Standard I               | 1.20 | 11.38 | 9.48  | 11.85 | 4.69 | 5.20 | 28.52 | 3.57     |
| Standard II              | 1.13 | 11.08 | 9.85  | 11.51 | 4.69 | 4.99 | 28.43 | 3.46     |
| Humiforte 20 (150 ml/ha) | 1.22 | 11.49 | 9.57  | 10.43 | 4.05 | 5.55 | 37.87 | 2.67     |
| Humiforte 20 (200 ml/ha) | 1.16 | 10.91 | 9.45  | 10.17 | 4.19 | 5.49 | 32.11 | 3.03     |
| Humiforte 20 (300 ml/ha) | 1.26 | 11.38 | 9.03  | 10.72 | 4.59 | 5.72 | 31.91 | 3.32     |
| C.D. at P = 0.05:        | 0.06 | 0.19  | 0.20  | 0.16  | 0.14 | 0.19 | 1.17  | 0.19     |
| C.V. (%)                 | 6.46 | 4.67  | 2.75  | 2.02  | 4.42 | 4.82 | 5.08  | 7.73     |

TF: theaflavins (%); TR: thearubigins (%); TR:TF: ratio of thearubigins and theaflavins; HPS: high polymerised substances (%); TLC: total liquor colour; CI: colour index; BI: briskness index and Caffeine in per cent.

Table 5. Bioefficacy of Humiforte 20 on organoleptic evaluation of made tea

| Treatment                | Infusion | Liquor characteristics |          |           | Total score |
|--------------------------|----------|------------------------|----------|-----------|-------------|
|                          |          | Colour                 | Strength | Briskness |             |
| Untreated control        | 4.00     | 5.00                   | 4.50     | 4.00      | 17.50       |
| Standard I               | 5.50     | 5.00                   | 5.50     | 4.50      | 20.50       |
| Standard II              | 4.50     | 5.00                   | 4.50     | 4.00      | 18.00       |
| Humiforte 20 (150 ml/ha) | 4.75     | 4.50                   | 4.75     | 4.25      | 18.25       |
| Humiforte 20 (200 ml/ha) | 5.00     | 4.75                   | 4.50     | 4.25      | 18.50       |
| Humiforte 20 (300 ml/ha) | 5.50     | 5.25                   | 5.00     | 4.25      | 20.00       |
| C.D. at P = 0.05:        | 0.44     | 0.15                   | 0.29     | 0.22      | 0.98        |
| C.V. (%):                | 12.03    | 4.22                   | 8.15     | 6.94      | 7.07        |

**Annexure 1**  
**Selection of field and crop/variety**

Study No.: PHY/156 (PGR)/07-AN

Location: Valparai

Trial No.: PHY/156 (PGR)/07-AN

Season: Wet & dry periods

Details of location

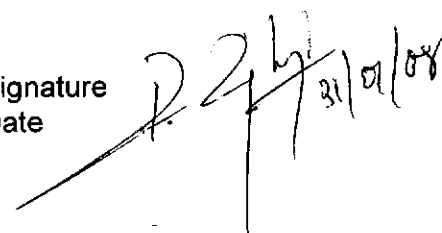
|             |                               |
|-------------|-------------------------------|
| Farm/Estate | : UPASI Tea Experimental Farm |
| Field No.   | : Tea Board Area              |
| Altitude    | : 1050 m (above MSL)          |
| Topography  | : Hilly terrain               |
| Soil Type   | : Latosol                     |

Crop/Variety:

|                        |   |
|------------------------|---|
| Jat/clone              | : UPASI-9, "China" jat                    |
| Year of planting       | : 1992                                    |
| Spacing                | : 75 x 75 x 90 cm                         |
| Last pruning           | : May 2004                                |
| Height of pruning      | : 26" (65 cm)                             |
| Shade                  | : Yes, tea plants provided with the shade |
| Name of shade tree     | : <i>Grevillia</i> sp.                    |
| Spacing of shade trees | : 40 x 40 ft                              |

Compiled by: Name R. Raj Kumar

Signature  
Date

  
31/01/08

**Annexure 2**  
**Pre-treatment history of experimental plot**


Study No. PHY/156 (PGR)/07-AN  
Location Valparai  
Last pruning May 2004  
Trial No. PHY/156 (PGR)/07-AN  
Season Wet & dry periods

| Month/year | Fertilizer | Pesticide | Weedicide | Fungicide | PGRs | Foliar nutrients |
|------------|------------|-----------|-----------|-----------|------|------------------|
| Oct. '06   | Yes        | Yes       | -         | Yes       | -    | Yes              |
| Nov.       | -          | -         | Yes       | Yes       | -    | -                |
| Dec.       | Yes        | Yes       | -         | -         | -    | -                |
| Jan. '07   | -          | -         | -         | -         | -    | Yes              |
| Feb.       | -          | Yes       | -         | -         | -    | Yes              |
| Mar.       | -          | Yes       | -         | -         | -    | Yes              |

Application of fertilizers and micro nutrients were applied in accordance with UPASI recommendations while pesticides, weedicides and fungicides were applied when ever warranted following the recent recommendations. Since the field is selected for bioefficacy test of Humiforte 20, application of plant growth regulator (PGR) is not done prior to the start of the experiment.

Prepared in consultation with Mr.A. Robert Gunasekaran, Field Officer, UPASI Tea Research Experimental Farm, Valparai.

Compiled by: Name Jibu Thomas

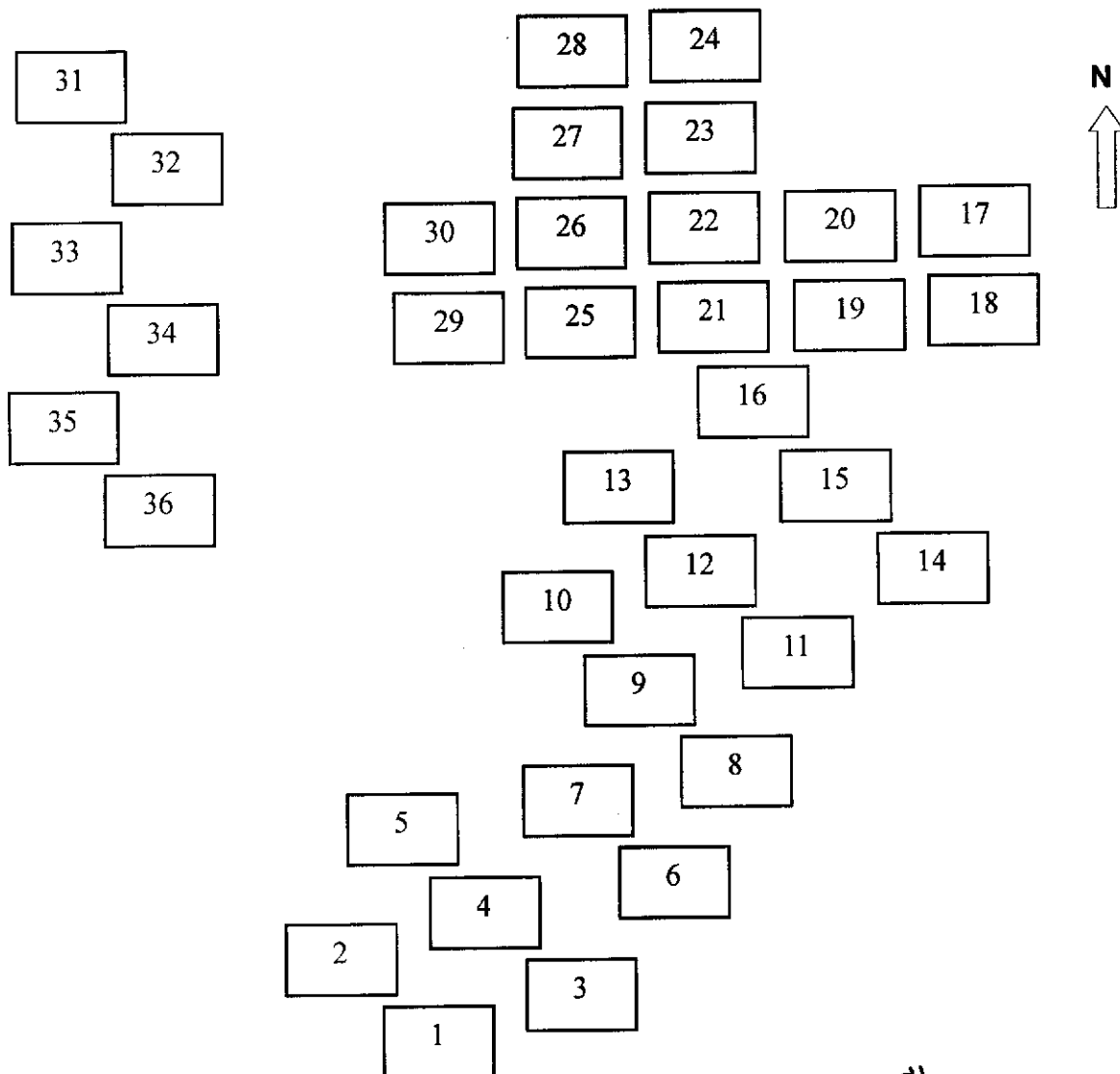
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Date



**Annexure 3**  
**Design and layout of the experimental plots/area**

Study No. PHY/156 (PGR)/07-AN  
Location Valparai  
Design RBD  
No. of Treatments Six  
No. of replications Six  
Actual plot size 20 bushes/plot; 15-20 m<sup>2</sup>  
Dimension of the plot 2 row x 10 bushes  
Guard rows Nil  
Season Wet & dry periods

Layout of the plots. Sketch (map) of the experimental area: (North facing up); Photograph of the experimental field is enclosed herewith.



Recorded by: Name Jibu Thomas

Signature *Jibu Thomas*  
Date

**Annexure 4**  
**Information on spraying**

Study No. PHY/156 (PGR)/07-AN  
Location Valparai  
Spraying details

| Trial No.           | Crop season         | Date of starting/spray |
|---------------------|---------------------|------------------------|
| PHY/156 (PGR)/06-AN | 1st crop, 1st spray | 24.04.07               |
|                     | 1st crop, 2nd spray | 17.05.07               |
|                     | 2nd crop, 1st spray | 26.09.07               |
|                     | 2nd crop, 2nd spray | 22.10.07               |

The following details obtained and compiled from the records of Meteorological Station/Centre/ Department of UPASI Tea Research Foundation, Tea Research Institute, Valparai.

| Spraying date | Temperature (°C) |      | Relative humidity (%) |          | Rainfall (mm/day) | Sunshine (h/day) |
|---------------|------------------|------|-----------------------|----------|-------------------|------------------|
|               | Max              | Min  | 8.30 am               | 02.30 pm |                   |                  |
| 24.04.07      | 28.4             | 17.1 | 90                    | 64       | 18.8              | 6.20             |
| 17.05.07      | 28.4             | 15.5 | 77                    | 48       | 00.0              | 6.10             |
| 26.09.07      | 21.0             | 16.8 | 80                    | 72       | 19.6              | 7.10             |
| 22.10.07      | 24.8             | 17.5 | 93                    | 89       | 37.6              | 1.25             |

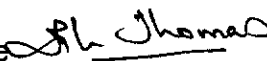
Remarks: About 2.0 cm rainfall (evening showers) was recorded on April 24, 2007 four hours after foliar application of Humiforte 20. Two to three hours period is adequate for foliar absorption of applied formulation/nutrient. Hence foliar application was not repeated. Similarly, on third and fourth application on September 26 and October 22, 2007, respectively, the experimental field experienced <2.0 and <4.0 cm rainfall that too recorded in the evening/night. In the present study, no rainfall interrupted the foliar application.

Recorded by

Name Jibu Thomas

Signature

Date



Annexure 5

Worksheet for spraying

Study No PHY/156 (PGR)/07-AN  
Location Valparai  
Season Wet & dry periods  
Date of last plucking 23.04.07; 15.05.07; 25.09.07; 19.10.07  
Date of spraying 24.04.07; 17.05.07; 26.09.07; 22.10.07  
Actual plot size 20 bushes/plot approximately 15-20 m<sup>2</sup>  
Spray fluid volume 200L/ha

Details of formulation used

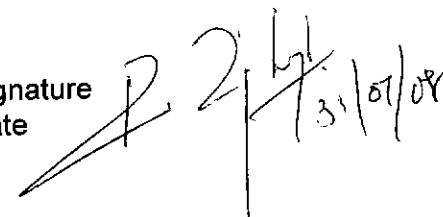
Formulation supplied by Inagarosa Industries Agro Biologicals, Madrid  
Formulation Humiforte 20  
Lot No. 35.090  
Date of manufacture October 2006  
Expiry date Not mentioned  
Date of receipt at field trial location December 2006  
Packing size One litre

| Treatment (T)             | Volume of test item | Volume of water added | Plot number       |
|---------------------------|---------------------|-----------------------|-------------------|
| T1 Control                | —                   | —                     | 31-32-33-34-35-36 |
| T2 Standard I 200 ml/ha   | 6.0 ml              | 6 L                   | 4-10-12-17-19-25  |
| T3 Standard II 80 ml/ha   | 2.4 ml              | 6 L                   | 2-3-7-13-18-28    |
| T4 Humiforte 20 150 ml/ha | 4.5 ml              | 6 L                   | 5-9-14-23-27-30   |
| T5 Humiforte 20 200 ml/ha | 6.0 ml              | 6 L                   | 1-8-15-16-20-21   |
| T6 Humiforte 20 300 ml/ha | 9.0 ml              | 6 L                   | 6-11-22-24-26-29  |

Recorded by

Name R. Raj Kumar

Signature  
Date

  
31/07/08

**PGR (HUMIFORTE 20) FIELD TRIAL**

M/8. Inagrosa, Madrid, SPAIN

CONDUCTED BY: Plant Physiology Division  
UPASITRF

TRIAL SITE: UPASI Experimental Farm, Valparaiso  
MSL - 1050 m,  
10° 30' N 27° 0' S

PERIOD: January - December 2007

