The Discovery of the Mango Flower Induction Technology and the Research Process

Dr. Ramon C. Barba

National Scientist

National Academy of Science and Technology (NAST)

Department of Science and Technology (DOST)

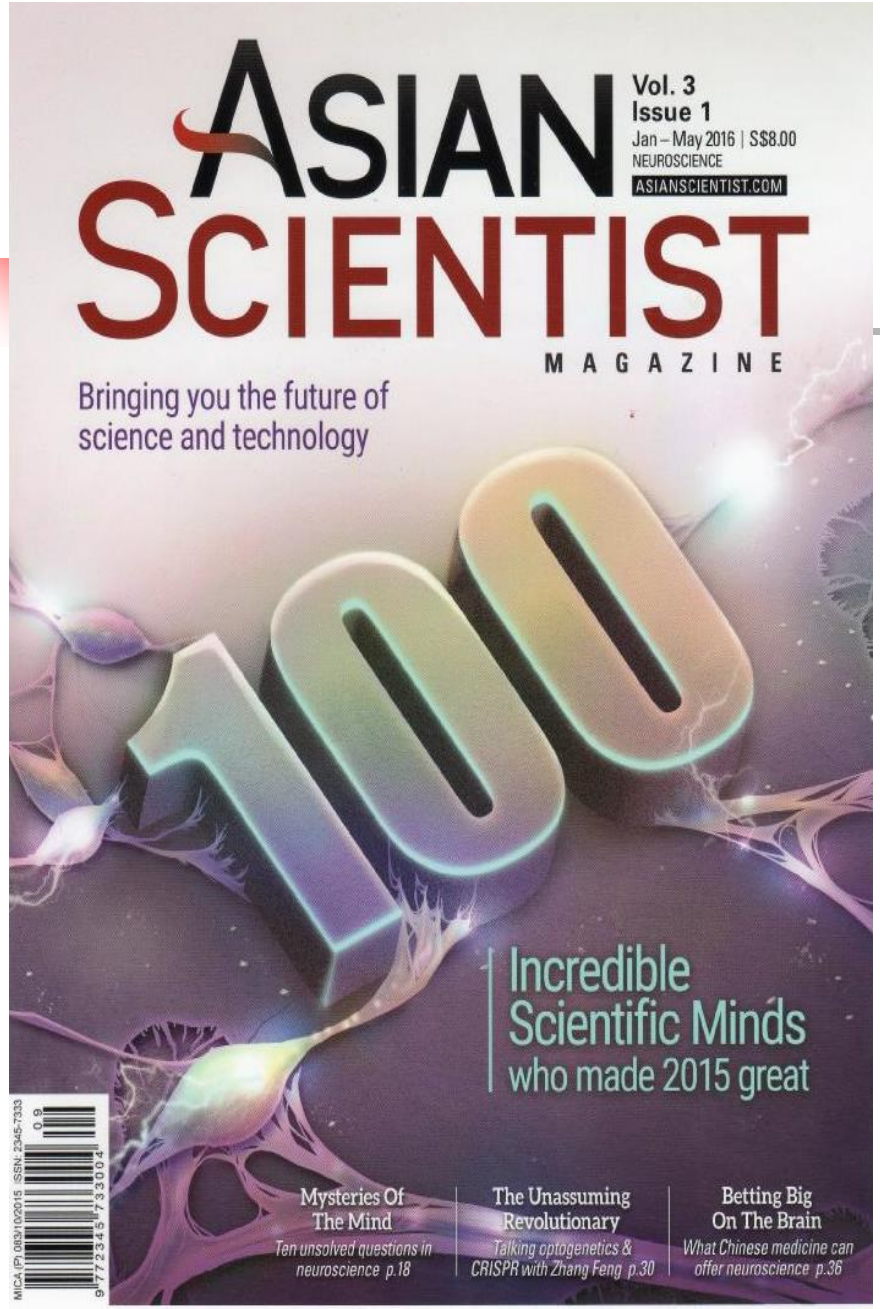
© TemplatesWise.com

5 Filipinos break into top 100 Asian scientists list

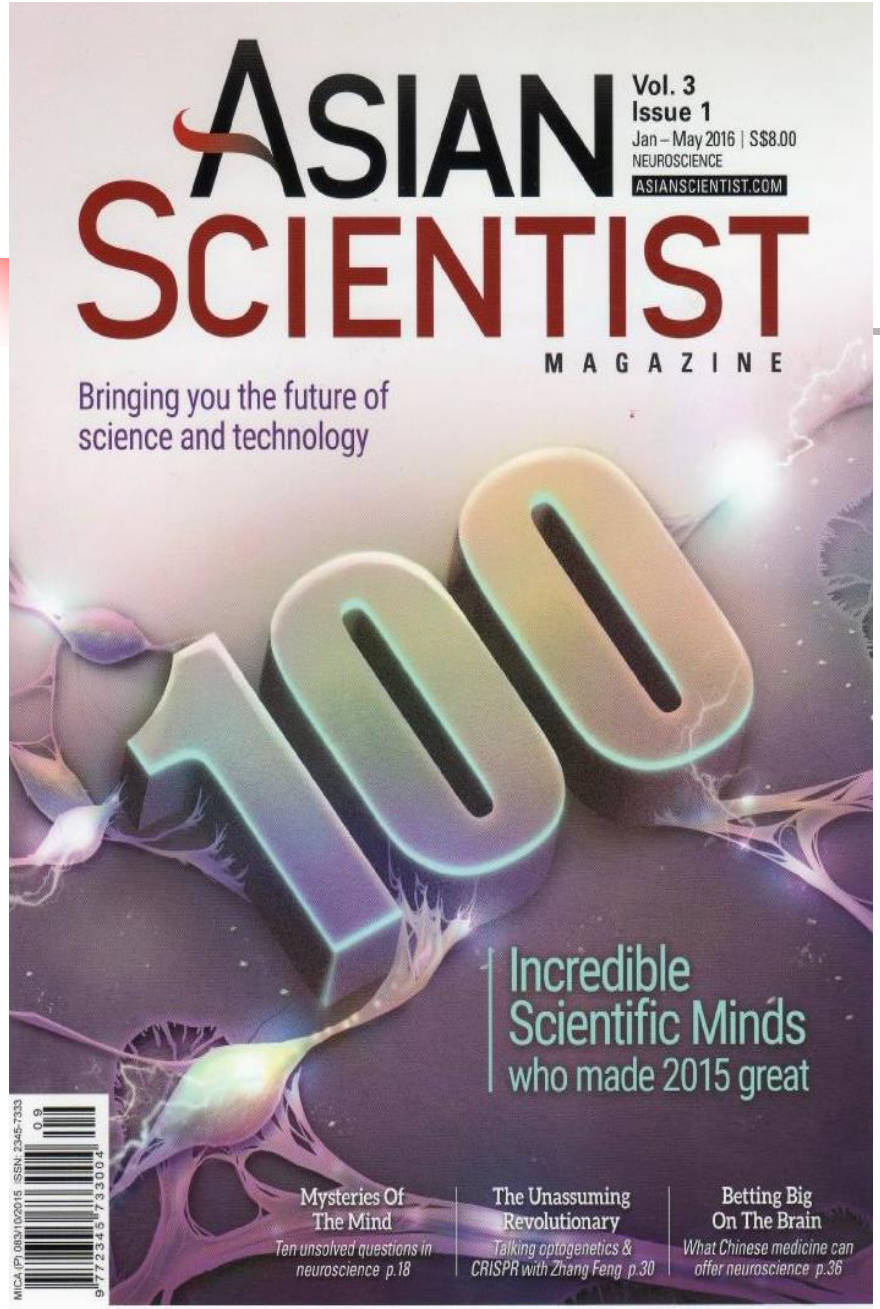
Leading the Filipino scientists on the list is *National Scientist Ramon Cabanos Barba*, ranked third on the list.

3rd **7th** **9th** **10th** **12th**

Left to right:
NS Ramon Cabanos Barba, NS Angel Chua Alcala, NS Edgardo Dizon Gomez, Academician Alfredo Mahar Lagmay and NS Gavino Cajulao Trono, Jr.



<u>The Asian Scientist Magazine, vol 3, issue 1, Jan-May 2016,</u> **released recently the list of "*100 Incredible Scientific Minds who made 2015 great*".**



NATIONAL SCIENTIST RC BARBA
ASIAN SCIENTIST TOP 3

AGRICULTURAL SCIENCES

003

Ramon Cabanos Barba

University of the Philippines Los Banos, the Philippines

Named a National Scientist of the Philippines in 2014 for inventing a way to induce flowering in mango trees regardless of season, boosting the local mango industry.

004

C. L. Laxmipathi Gowda

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), India

Gowda, deputy director-general of ICRISAT, received the 2014 Sano Touzaburo Special Prize—"Asia's World Food Prize"—for developing chickpea cultivars with high yield and resistance to diseases and pests.

005

Li Jiayang

Chinese Academy of Agricultural Sciences, China

Elected a foreign member of the UK's Royal Society in 2015 for establishing forward genetics approaches in rice, which have led to the development of improved rice varieties.

006

Zhang Fusuo

China Agricultural University, China

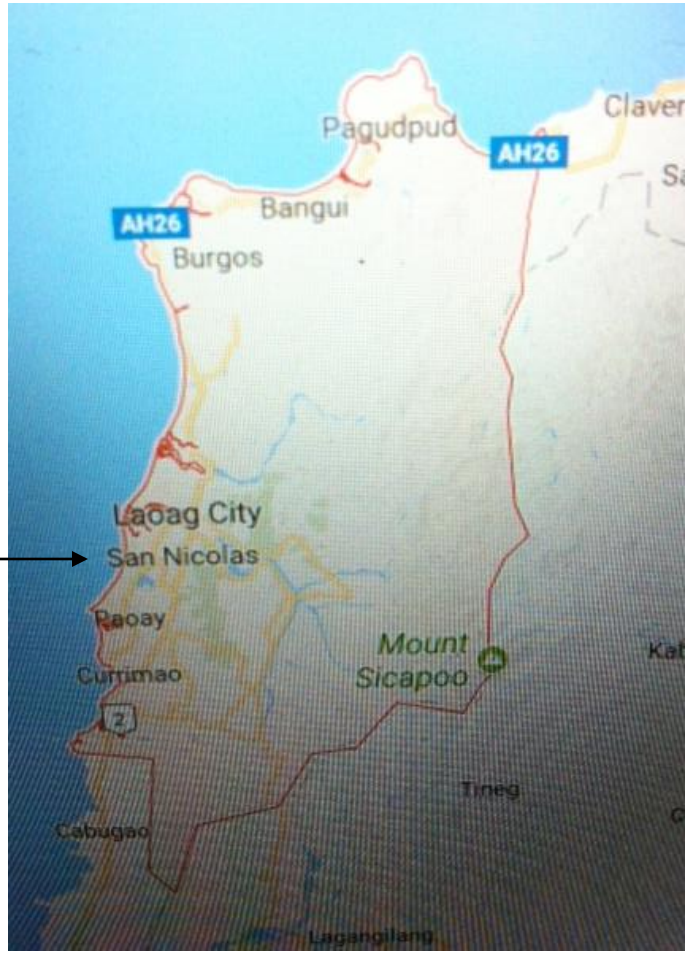
Received The World Academy of Sciences 2014 prize in the agricultural sciences for establishing the principles and technology of integrated nutrient management in China.

I. JOURNEY through ACADEMICS

© TemplatesWise.com

1946-1951, Elementary school

- Sta. Rosa Academy, San Nicolas, Ilocos Nortre



> 1950 to 1954, High School at UP High, Diliman, Q.C.

UPCA College of Agriculture

BSA student (1954-1958),

- with thesis adviser * Dr. Leon G. Gonzales*, first to study "*smudging of mango trees*"(1923)
- Published in Philippine Agriculturist 1923 (now Philippine Agricultural Scientist)

- 1957, Start of interest on mango flower induction

University of Georgia, USA

- 1960 to 1962

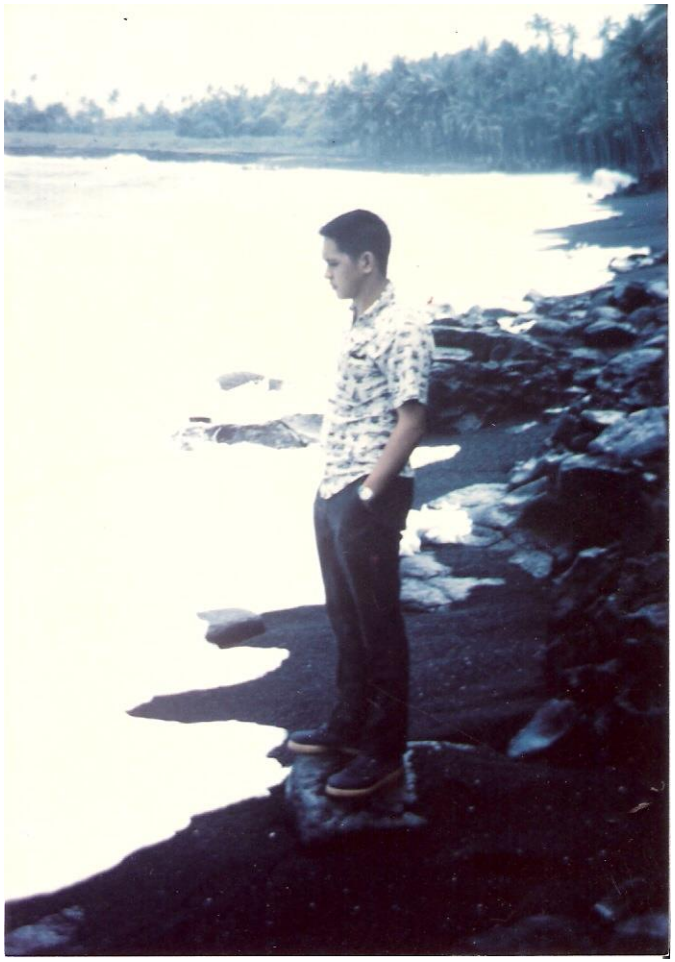
Adviser
Dr. Franklin Pokorny

- Thesis: Flowering of azalea using GA & KNO3

- New ideas on mechanism of flowering

University of Hawaii, USA

- 1967
  - PhD in Horticulture (major in Plant Physiology)
  - East West Center Grant



University of Hawaii, USA

- 1967
  - PhD in Horticulture

- Adviser:
  Dr. Toshio Murashige,
  (famous for MS tissue culture medium)

  - RC Barba,
    1st Ph.D. advisee of Dr. Murashige

Ph.D. University of Hawaii, USA

Dr. Toshio Murashige, RC Barba's adviser moved to University of California Riverside

However, RC Barba did not go with Dr. Murashige to UCR

Dr. Roman Romanowski, new adviser endorsed by Dr. Murashige

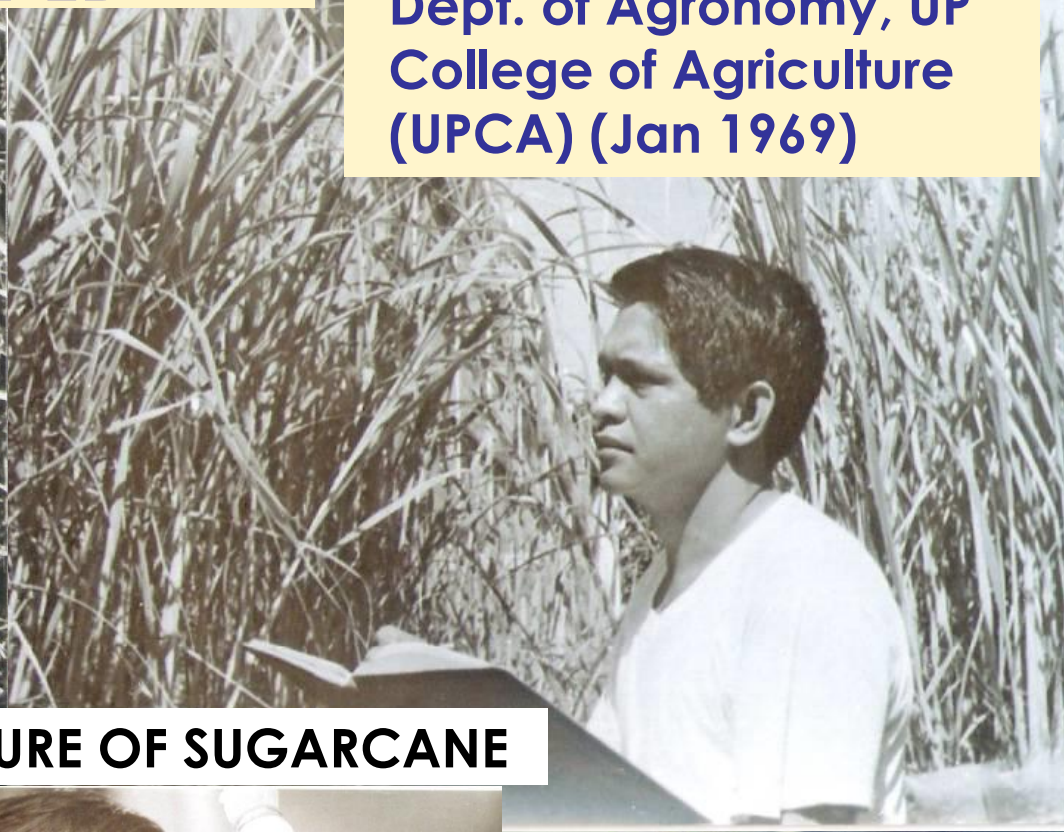
Thesis: mechanism of action of herbicide ametrine in banana

University of Hawaii

- 1967 to 1968
  - Sr. Technician, Hawaiian Sugar Planters' Assoc. (HSPA) to Assistant Physiologist, HSPA
  - Regeneration of sugarcane with Louis G. Nickell
  - Single cell clone, proof of useful somaclonal variation (Larkin & Scowcroft, 1981)

Back (Dec. 1968) to UPCA now UPLB

Assistant Professor 1
Fruit Crops Section,
Dept. of Agronomy, UP
College of Agriculture
(UPCA) (Jan 1969)



TISSUE CULTURE OF SUGARCANE

UPCA Dean Dioscoro L. Umali

- UPCA Dean Dioscoro L. Umali went to University of Hawaii (UH) (1967) to recruit staff to do tissue culture at UPLB
- Dr Louis G. Nickell recommended Dr RC Barba who just finished his PhD at UH and back to UPCA

UPCA now UPLB

- 1969 to 1974, **Assistant Professor 1**

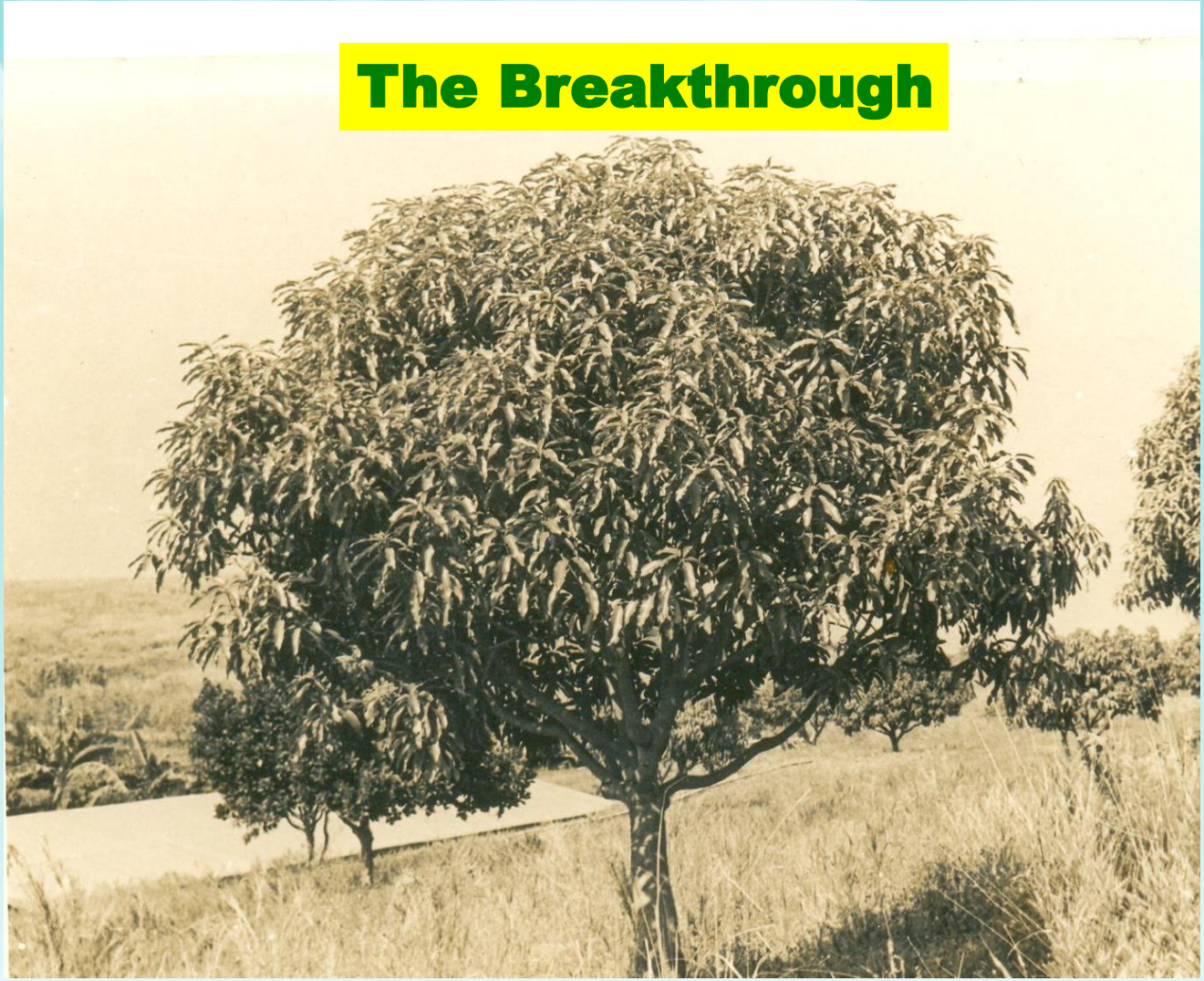
Teaching, Thesis Advising, and Tissue Culture of Sugarcane with Alfinetta B. Zamora as Research Assistant

UPCA now UPLB

- 1969, back to UP College of Agriculture (UPCA)

- Assistant Professor 1
  Fruit Crops Section, Dept. of Agronomy, UP College of Agriculture (UPCA)

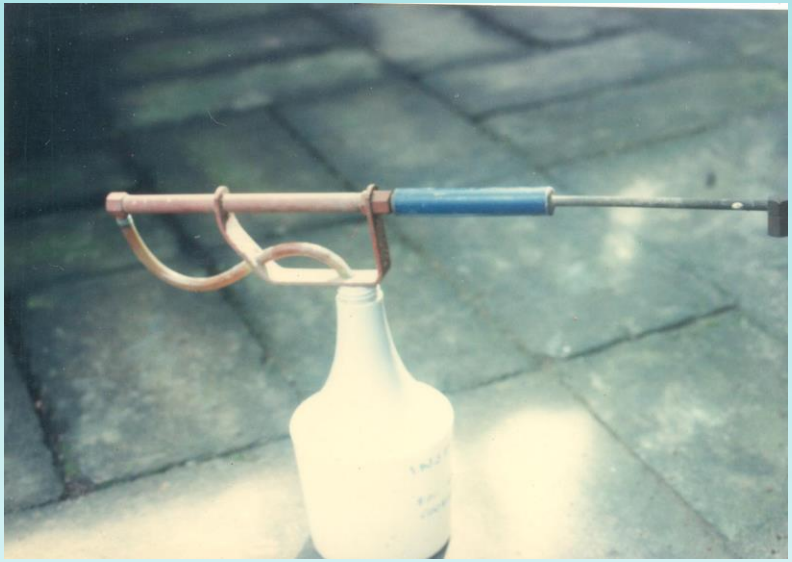
- Idea to induce flowering in mango using chemicals



Discovery of Flower Induction in Mango Using KNO_3 @ Quimara Farm

Discovery of Flower Induction in Mango Using KNO_3

- Personal budget of PhP500.00



- Exploratory test of several chemicals on selected shoots

- 1% KNO_3 induced flowers in 2 weeks

Discovery of Flower Induction in Mango Using KNO_3 (Cont.)

- Within 2 weeks, 100 trees, 10 yrs old & never flowered, were sprayed.
- Produced abundant fruits in 4 mos.
- Complete technology including field application & farmers' adoption in 4.5 mos.

Perils of a Commercially Important Discovery

- 1971, realization of the perils of the discovery and innovation
- Former Research Assistant (RA), Fruits Crops Section, Department of Agronomy, UPCA, requested to visit Quimara Farm
- RC Barba divulged to the RA the chemical, where to buy, conc. and method of application

Perils of a Commercially Important Discovery (Cont.)

- The Research Assistant (RA), promised not to reveal the discovery without RC Barba's permission.
- The RA even requested RC Barba to be his M.Sc. adviser, & the discovery as his thesis.

- <u>RC Barba expected the RA to respect his discovery, and</u>
- <u>that the technology was already completed, rejected RA's proposal to be his M.Sc. thesis.</u>

Perils of a Commercially Important Discovery (Cont.)

- The Research Assistant (RA), disobeyed his own promise, used the technology without RC Barba's permission & divulged the discovery to the Department Chair.
- They tested the technology, claimed the discovery and results published in several publications.
- Another person applied patent for the mango flower induction technology using same chemical (KNO_3).

- Patents from the Philippines, USA, Australia, New Zealand, and United Kingdom

- Never enforced

- So, free use of technology by growers

INTELLECTUAL PROPERTY
PHILIPPINES

October 4, 2007

Mr. Ramon Barba
Inventor

Dear Mr. Barba,

Intellectual property (IP) assets like trademarks, patents and trade secrets, have become more valuable than physical assets in today's competitive knowledge based economy.

To showcase success stories on successful IP asset management, the World Intellectual Property Organization (WIPO) is producing a documentary film about inventors and entrepreneurs who have used IP effectively. These short features will be uploaded on the WIPO website to serve as an educational tool to promote creativity and innovation. It is hoped that these documentaries will also inspire inventors and entrepreneurs to know more about intellectual property rights and manage their IP assets. You may visit WIPO's Webcast homepage to see some examples of previous works at http://www.wipo.int/multimedia/en/webcast/

After a rigid selection process, the Philippines was chosen as one of the two countries from the Asia and the Pacific Region for this project. Among many candidates from around the world, you were chosen as one of the individuals to be featured in this documentary.

We hope that you will agree to participate in this project, which not only gives recognition to your achievements but also brings honor and pride to our country.

The WIPO documentary team will be visiting our country on the second half of November, during which they would like to interview our proposed candidates. If you agree to be interviewed and featured, please let us know and we will communicate your decision to WIPO.

I would like to invite you to an informal meeting on Friday, 19 October, so we can discuss the project in detail. We shall call your office to arrange this meeting at a mutually convenient time.

Thank you and best regards.

Sincerely,

Atty. Adrian Cristobal, Jr.
Director General

Republic of the Philippines
INTELLECTUAL PROPERTY OFFICE
351 Sen. Gil Puyat Ave., Makati City 1200 Philippines • www.ipophil.gov.ph
Telephone: +632-7525450 to 65 • Facsimile: +632-8904862 • email: mail@ipophil.gov.ph

After a rigid selection process, the Philippines was chosen as one of the two countries from the Asia and the Pacific Region for this project. Among many candidates from around the world, you were chosen as one of the individuals to be featured in this documentary.

"After a rigid selection process, the Philippines was chosen as one of the two countries from the Asia and the Pacific Region for this project. Among many candidates from around the world, you were chosen as one of the individuals to be featured in this documentary."

INTELLECTUAL PROPERTY
PHILIPPINES

October 4, 2007

WIPO MAGAZINE

The Scientist, the Patent and the Mangoes - Tripling the Mango Yield in the Philippines

June 2008

Dr. Ramon Barba: Biodata

(Photos: WIPO/J-F Arrou-Vignod)

Born: 1939, Philippines

Education: BS in Agronomy (fruits), University of the Philippines;
MSc Horticulture, University of Georgia (1963),
PhD Horticulture, University of Hawaii, (1967)

Honors: Elected to the National Academy of Science and Technology of the Philippines, 2004

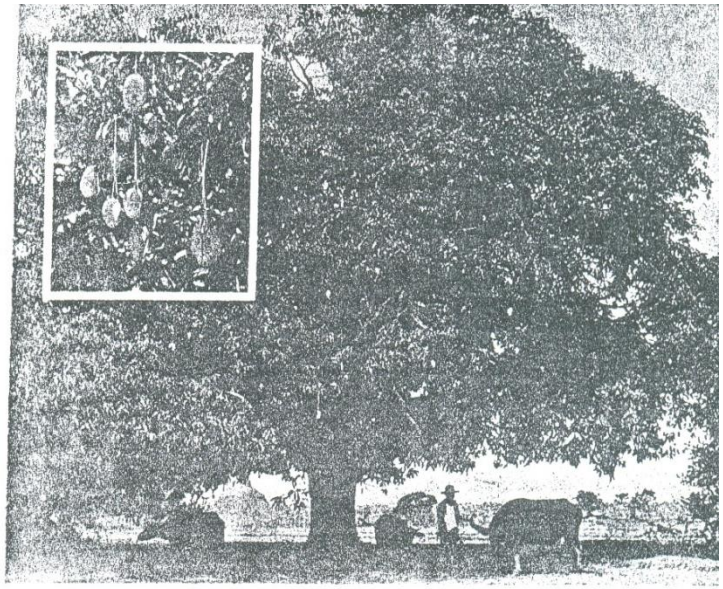
- **Flower induction considered worldwide- most important discovery in mango**

- **Flower induction quickly became worldwide practice**

The young RCB examines mango plants used in his experiments.

- **Generated interest on research on flowering**

- **Mexico used it since 1975, 41% share of world trade**



The Magnificent Mango

By William Warren

This worldwide taste-pleaser has become leading candidate for king of tropical fruits

"Mango, mango, he so delicious. Soothes the body and calms the mind."

In the West Indies they sing this calypso in praise of the fruit which, until recently, was for most only an exotic name in travel books. Now the mango is enjoyed all over the world and is likely to become the king of tropical fruits.

One of the pioneers is the Philippines, where researchers are developing ways to increase production. Scientists at the Los Banos College of Agriculture have found that potassium nitrate sprayed on mangoes in a one percent concentration induces the trees to flower early and profusely. And a chemical plant hormone sprayed on young fruit the size of corn kernels increases their final weight.

1978 Reader's Digest

One of the pioneers is the Philippines, where researchers are developing ways to increase production. Scientists at the Los Banos College of Agriculture have found that potassium nitrate sprayed on mangoes in a one percent concentration induces the trees to flower early and profusely. And a chemical plant hormone sprayed on young fruit the size of corn kernels increases their final weight.

The Department of Horticulture, CA, UPLB honored Dr. Ramon C. Barba in 1999 with a technology award and a citation that highlighted the impact of his mango flower induction technology during the 25th Anniversary of the Department and the 25th year of the technology.

"The advent of flower induction in mango with potassium nitrate is the single most important factor that stimulated growth of the industry. Its multiplier effect is wide and far-reaching benefiting the economic well-being of growers, investors, pesticide manufacturers, baggers, contractors, kaing-makers, bamboo raisers, viajeros, truck and jeepney operators, drivers, middlemen, wholesalers, retailers, exporters, processors, consumers, employers, and employees of mango establishment among many others. A neglected crop grown for fun, shade, and shelter before and after the introduction of the technology, yield of mango was 2 and 6 metric tons per hectare, respectively. Whereas few or none existed in the past, by 1995 alone there were at least 174 professional mango contractors, 33 "dried" mango manufacturers, 105 processed mango products, and about 20 mango growers associations. These and mango's contribution to the national economy, estimated at 7 billion pesos in gross value and 43 million dollars in foreign exchange earnings, are largely due to the technology unraveled at UPLB".

YIELD OF MANGO IN TONS PER HECTARE IN RELATION TO FLOWER INDUCTION

PHILIPPINES			
Before adoption	1970	-	3.3
Early adoption	1975	-	5.1
Full adoption	1980	-	9.6
WESTERN VISAYAS			
Before adoption	1970	-	1.5
Early adoption	1975	-	3.5
	1977	-	12.9
Full adoption	1980	-	22.6
	1985	-	22.6

Ref. Mango Statistics, PCARRD, 1996

VOLUME OF PRODUCTION IN THOUSAND METRIC TONS			
	1995	1996	1997
Banana	1,540	1,521	1,581
Pineapple	840	845	652
Mango	495	520	574
VALUE OF PRODUCTION IN MILLION PESOS			
Mango	7,342	9,188	10,338
Banana	5,035	5,978	7,052
Pineapple	2,973	4,193	6,521
FARMGATE PRICE PESO PER KG			
Mango	7.48	14.83	17.65
Banana	1.91	3.54	4.96
Pineapple	1.80	3.27	3.93

BAS, 1997

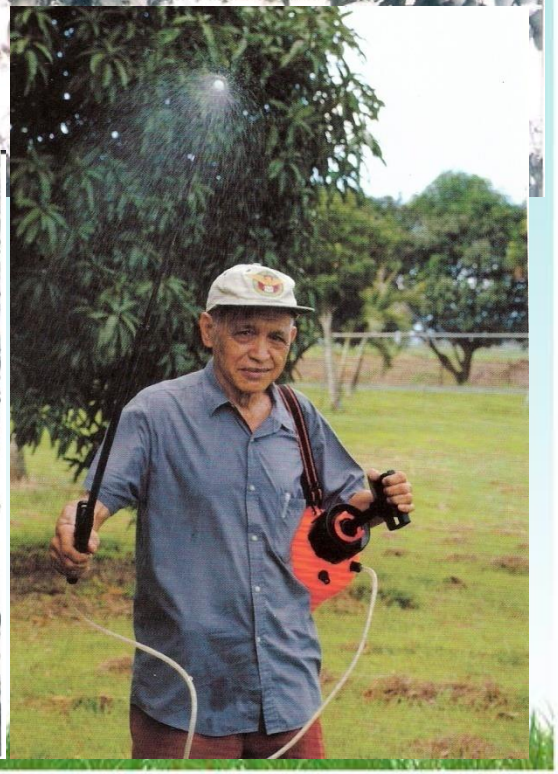
ESTIMATED COSTS AND RETURNS FROM 50 FULL-GROWN GRAFTED TREES. BONDAD, 1985

Item	With Flower Inducer	Traditional Method
Yield ("Kaing")	1,200.00	170.00
Gross Income (P)	124,800.00	11,050.00
Total Production Cost (P)	30,401.80	3,317.60
Net Income (P)	94,398.20	7,735.00

Other countries that have favorably used KNO3:

1. Puerto Rico
2. Kenya
3. Australia
4. Hawaii
5. Africa
6. Venezuela
7. Vietnam
8. Latin American countries
9. Southeast Asia

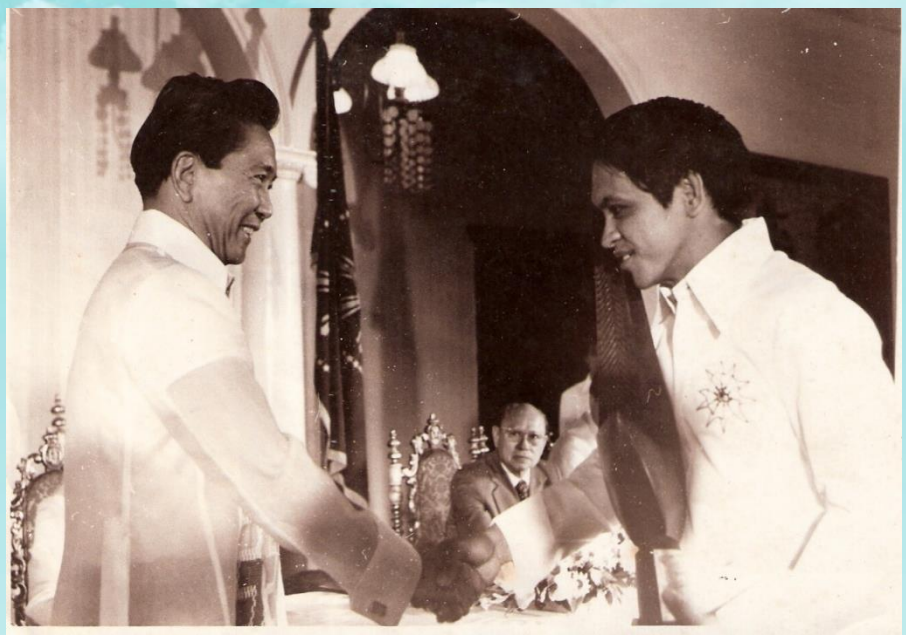
Discovery of flower induction in mango using KNO_3



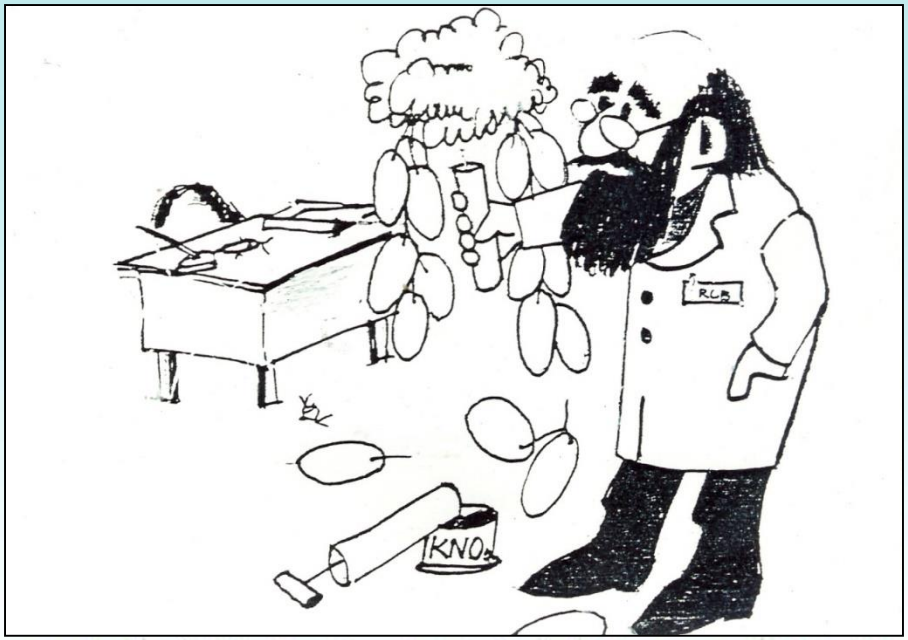
OTHER CONTRIBUTIONS OF DR. RAMON C. BARBA

1. FLUSH, a growth enhancer for tree species.1980.
2. Micropropagation of banana. (CSSP Best Paper Finalist, 1984, DOST Commercialization Award 2010, Featured in Salinlahi, NAST). 1996).
3. Somaclonal variant of banana. (FCSSP Best Poster, 1995).
4. Micropropagation of abaca. 1984.
5. Single cell clones of tobacco. 1963.
6. Tissue culture of sugarcane.1968.
7. Tissue culture of sugarcane in the Philippines. (CSSP Best Paper Finalist, 1975.)
8. New rapid cassava propagation. (CSSP Best Paper 1980).
9. Pilot production of certified potato seeds. (CSSP Best Paper Finalist, 1985.)
10. New Tissue Culture Medium.1975.
11. Propagation of rattan. 1984
12. Ramie and derris. 1984.
13. Commercial micropropagation protocols. 1985-88.
14. Rooting of lanzones stem cuttings for efficient propagation and to reduce the juvenile phase (CSSP 2nd Best Paper, 2004).
15. Propagation of disease-free garlic and shallot.(2006 CSSP Best Poster, Downstream Research, 2006 DA BAR AFMA R&D Oral Paper Finalist).
16. Embryogenesis and plantlet regeneration in mango. (CSSP Best Paper 2001, PFA Best Poster 2000.)
17. Tissue culture protocol for Carabao mango. 2011.
18. Tissue culture of citrus species. (CSSP Best Paper Finalist, l978).
19. Nucellar embryogenesis in pummelo. 1967.
20. Acceleration of growth and propagation of citrus. 1971.
21. Micropropagation of bamboo. 1984.
22. Breeding to improve the carabao mango. (PFA Best Poster, 2011).
23. The influence of photoperiod on rooting of rhododendron cuttings. 1962.
24. Flower forcing of azalea. 1962.
25. Other Researches:
    a) *In vitro* orchid conservation with Altoveros *et al.* (PARRFI Best Research 2003.)
    b) *In vitro* conservation of pummelo and mandarin with R. Avenido, L. Endonela and L. Pateña (CSSP Best Poster, 2004.)

AWARDS

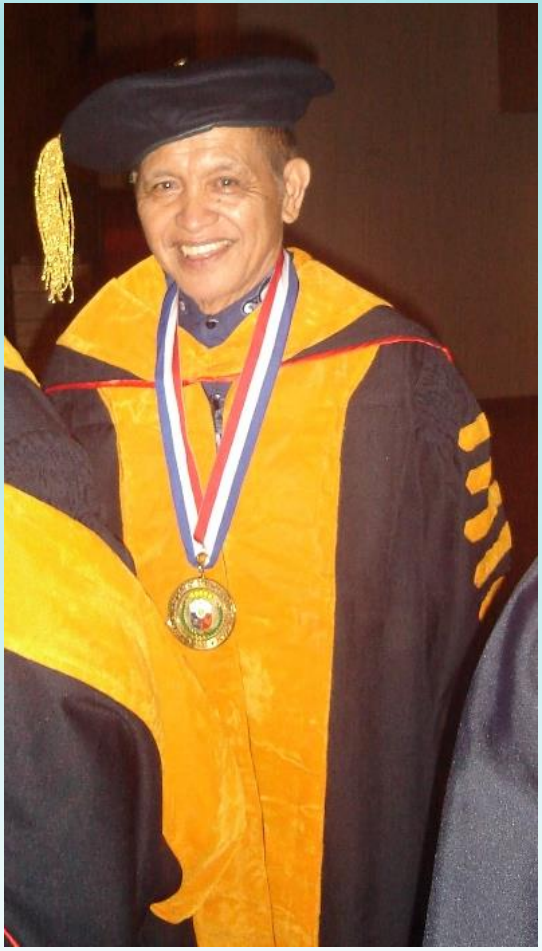


TOYM (1974)



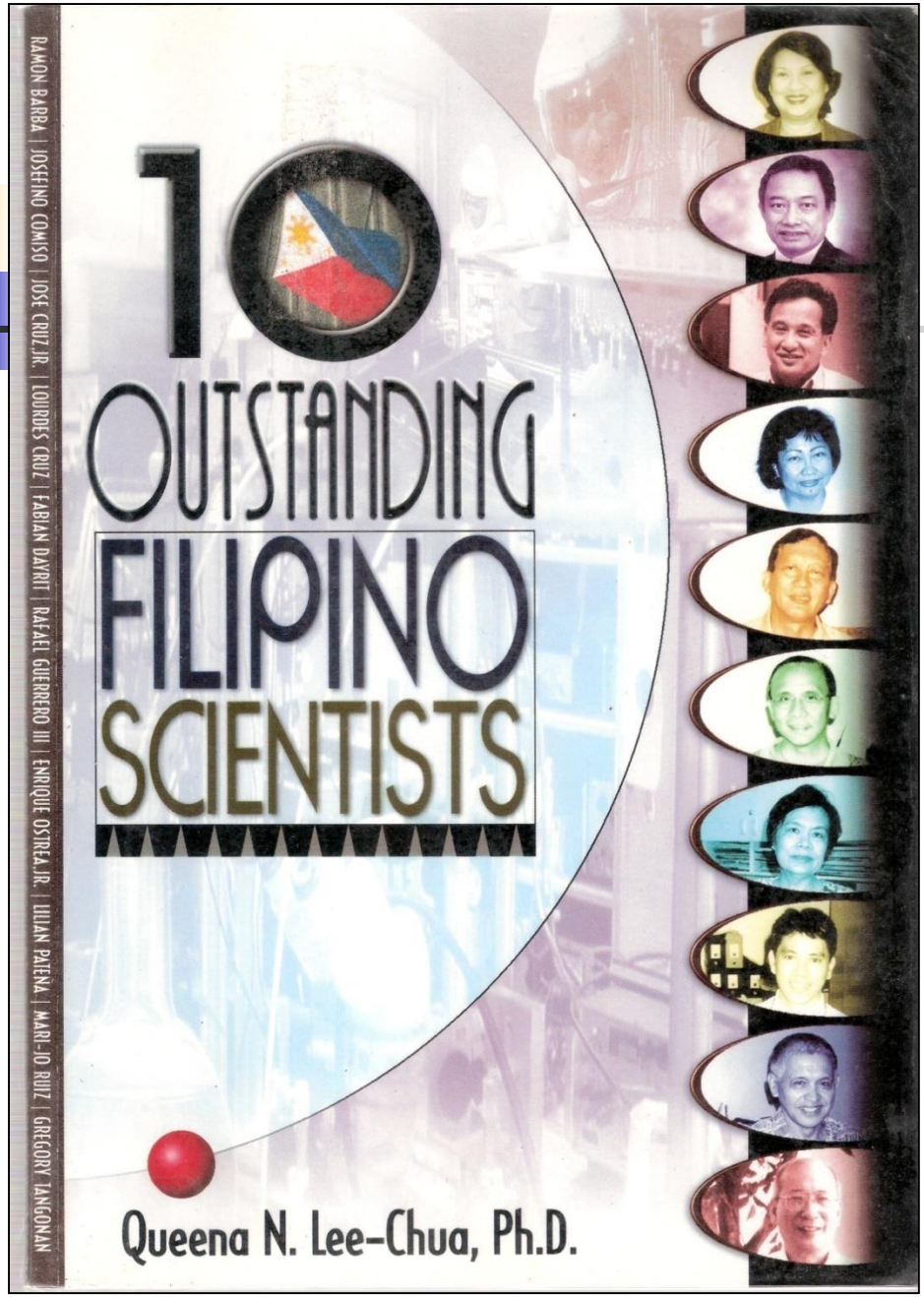
National Academy of Science & Technology

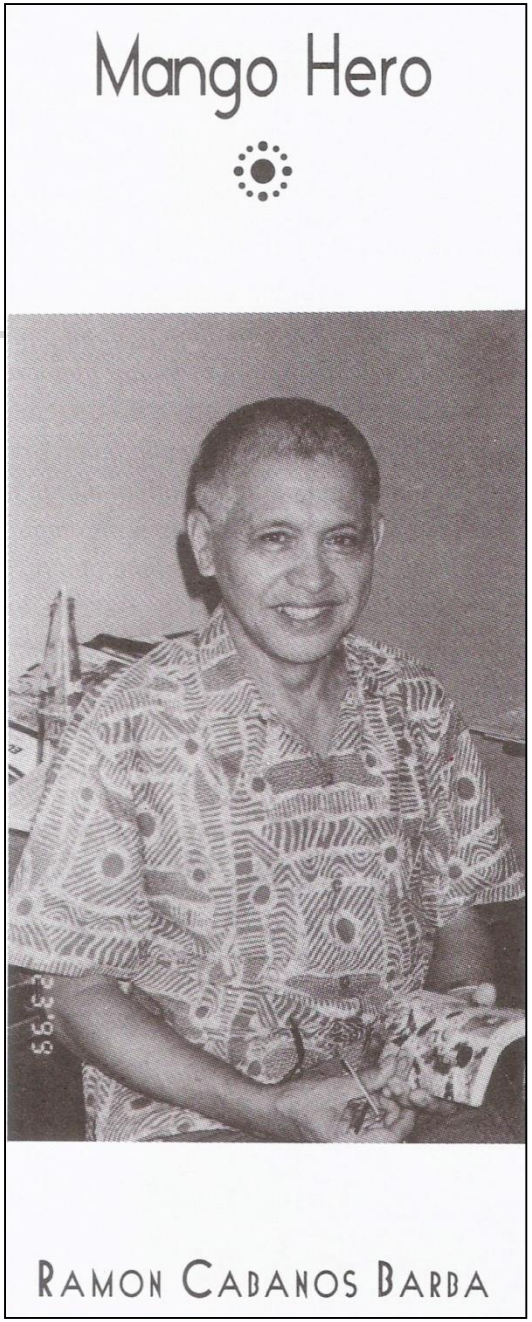
NAST, DOST



Academician, 2004

National Scientist, 2014


RAMON BARBA | JOSEFINO COMISO | JOSE CRUZ JR. | LOURDES CRUZ | FABIAN DAYRIT | RAFAEL GUERRERO III | ENRIQUE OSTREA JR. | LILIAN PATENA | MARLIO RUIZ | GREGORY TANGONAN
10
OUTSTANDING
FILIPINO
SCIENTISTS
Queena N. Lee-Chua, Ph.D.

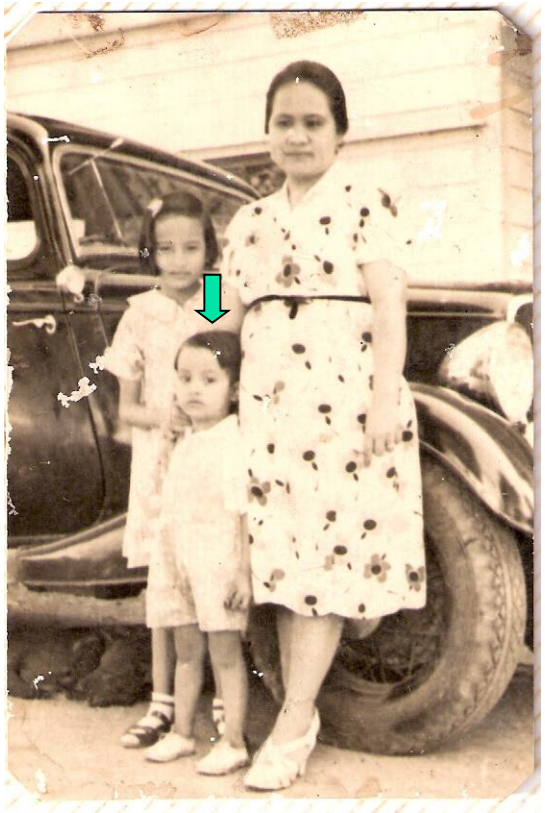

Mango Hero
RAMON CABANOS BARBA

- Featured in a Booklet "Philippine Mangoes the Whole Year Round by Dr. Benito S. Vergara. Philippine Science Heritage Center, NAST, 1996
- Rizal Pro Patria Presidential Award for Tissue Culture (1980)
- IBM/DOST S&T Award (1989)
- SEARCA/Dioscoro L. Umali Achievement Award in Agricultural Development (2011)
- World Intellectual Property Office (WPO) (Switzerland) recognition of technology (2007)

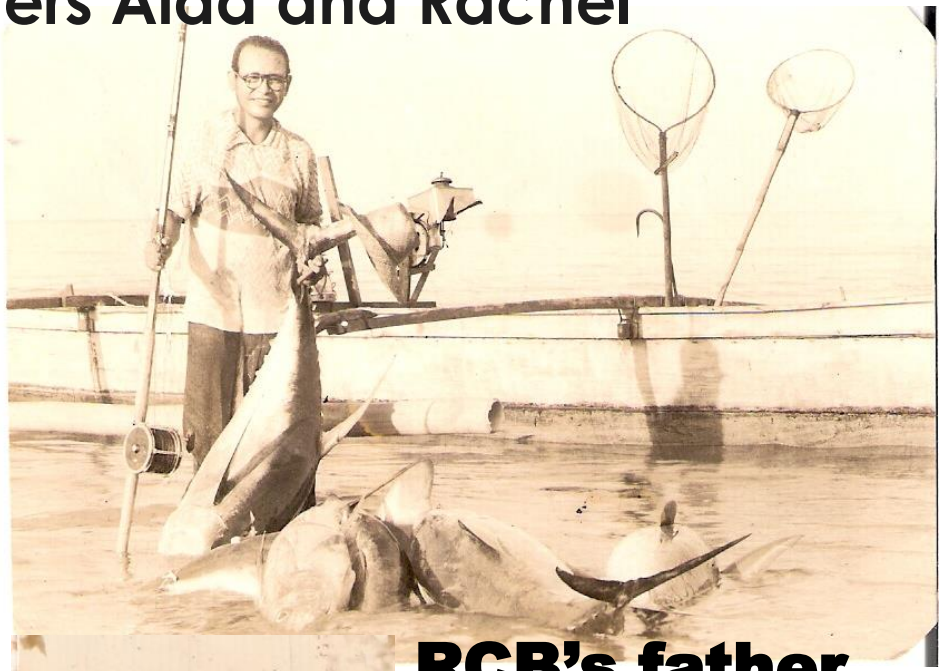
“FAMILY”

"FAMILY"

Parents: Juan and Lourdes; Elder brother Efren, Elder sisters Aida and Rachel

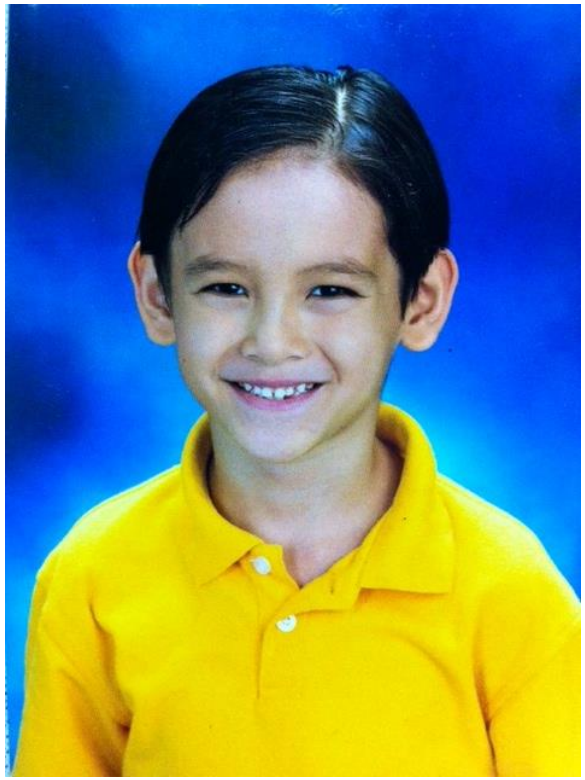


RCB (with blue arrow) and his mother and sister, Rachel



RCB's father, Juan Barba (above) and his mother, Lourdes Cabanos Barba (left)

The Scientist is married to Corazon Veron Cruz and is now a proud Lolo to 9 year-old grandson, Carlitos, son of Ricky and Danie Largo Barba



9 year-old grandson, Carlitos,
The future NATIONAL SCIENTIST

II.RESEARCH GUIDE

A Key to Scientific Research Literature

Research Guide

What he WROTE…

It has been known that…

What he MEANT…

I haven't bothered to look up at the original reference but…

What he WROTE…

Of great theoretical and practical importance…

What he MEANT…

Interesting to me…

What he WROTE…

While it has not been possible to provide definite answers to these questions…

What he MEANT…

The experiment did not work out but I figured I could at least get a publication out of it…

What he WROTE…

The W-P system was chosen as specially suitable to show the predicted behavior…

What he MEANT…

The fellow in the next lab had some already made up…

What he WROTE…

Chi-square test was used to determine statistical significance…

What he MEANT…

My knowledge of statistics is limited to Chi-square…

What he WROTE…

Three of the samples were chosen for detailed study…

What he MEANT…

The results on the others didn't make sense…

What he WROTE…

Accidentally strained during mounting…

What he MEANT…

Dropped on the floor…

What he WROTE…

Handled with extreme care throughout the experiment…

What he MEANT…

Not dropped on the floor…

What he WROTE…

Apparently…
evidently…

What he MEANT…

I think…

What he WROTE…

It is generally believed that…

What he MEANT…

A couple of other guys think so, too…

What he WROTE…

It is clear that much additional work will be required before a complete understanding…

What he MEANT…

I don't understand it…

What he WROTE…

Unfortunately, a quantitative theory to account for these results has not been formulated…

What he MEANT…

Neither does nobody else…

What he WROTE…

Correct within an order of magnitude…

What he MEANT…

Wrong…

Agreement with the predicted curve is:

What he WROTE…	What he MEANT…
Excellent…	Fair
Good…	Poor
Satisfactory…	Doubtful
Fair…	Imaginary

What he said...

Thanks are due to John Doe for assistance with the experiment and to Joe Smart for valuable discussion...

What he meant...

Doe did the experiment and Smart explained what it meant...

THANK YOU

It takes a dream to create a new technology and a new technology creates new dreams!

© TemplatesWise.com