

Tolullatranon



TIRUVADI SAMBASIVA VENKATARAMAN

(1884 - 1963)

Foundation Fellow

"I have not so far seen anything so wonderful as this", remarked His Excellency The Viceroy of India, Lord Irwin, after visiting the Sugarcane Breeding Station (now Institute) and listening to the fine exposition from the Head of the Station, 'the squint eyed, short, rather uncouth scientist' TS Venkataraman. This was followed by a Viceregal order in 1927 that all workers in sugarcane in the country must pay a visit to this Mecca of sugarcane. The next year saw the conforment of the title 'Rao Bahadur' on Rao Sahib TS Venkataraman in appreciation of his contributions towards sugarcane research.

"Here is my resignation" quipped the young Botany Assistant, T S Venkataraman with an independent outlook and hurt at the treatment meted to him, and handed over the bit of paper to his boss Dr C A Barber, an Englishman. Fortunately for science, this resignation letter and another to follow were neither pressed nor accepted and this young man became one of the foremost agricultural scientists of all time.

EARLY LIFE AND EDUCATION

TIRUVADI SAMBASIVA VENKATARAMAN was born in June, 1884 at Salem in Madras Presidency (now Tamil Nadu). Born in an orthodox, religious, brahmin family, Venkataraman, right from his childhood was initiated into the scriptures and epics in Sanskrit. Though initially the boy took keen interest in religion, soon he developed a catholicity of views much to the consternation of the parents, who had initiated him early into the 'Brahmacharya' stage with the sacred thread ceremony. By the age of 16, the boy had practically turned an aethist, renouncing religion and discarding the sacred thread. Venkataraman's schooling was at Tiruchirapalli, the centre of missionary activity and where education was at its best. Brilliant as he was, he always stood at the top of his class. However, his deep interest in philosophy and literature led him to spend many hours in discussion with his friends resulting in neglect of his studies and failure in the SSLC examination. A year later, with the completion of the SSLC and then the pre-graduate course, Venkataraman moved to Madras for his degree course at the prestigious Presidency College. In taking botany as his subject for the BA degree, a subject not much in favour with students in those days and chosen as a last resort, he was influenced by the writings of Herbert Spencer. A firm believer in Ahimsa, he abhored zoology with its dissection of frog, cockroach, earthworm etc.

SERVICE AND RESEARCH CAREER

The year 1905 witnessed the graduation of Venkataraman from the Presidency College, with a first class, first rank in BA (Botany). He opted for the MA post-graduate degree in Botany at the Madras University having secured a stipend. This was shortlived with his appointment during the year as Assistant to the Government Botanist at the Agricultural College, Saidapet, Madras on a paultry salary of Rs 50 per month. The shifting of the College in 1908 to Coimbatore resulted in his moving to Coimbatore which is to become the centre of his research activity for the next 35 years. Much to his dislike, teaching was his major activity with research only at leisure moments. His aptitude and flair for research were evident early in his career when he submitted a dessertation on 'Disinclination of the passed students of the Agricultural College to take to farming, its causes and remedies' which won him the coveted Munagala prize. The article displayed his keen sense of observation of human nature, the difficulties of the farming community and the role of agricultural education. Sensing his inclination for research, Dr Barber had him transferred to the research section divesting him of all teaching responsibility.

An incident illustrating his enthusiasm for research and how it was thwarted by his boss is mentioned in the STA publication and must be recorded here. In a plot behind his residence, Venkataraman planted brinjal and was engaged in crossing two varieties outside office hours. Hearing about this, Dr Barber issued a stern warning to him and had the brinjal crop destroyed. Mentioning this incident, Venkataraman says "Those were Lord Curzon days when all the 24 hours of a government servant were considered to belong to the Government and the danger of this particular activity resulted from the assumption that energies thus spent would take off from official work".

A biography of Venkataraman would be incomplete without a mention of the position of the Indian Sugar Industry in the early 1900 to appreciate his gigantic contributions towards the present happy position when we can claim to be the largest producer of sugarcane and sugar in the world. At the start of this century, the import of Sugar from Java (Indonesia) drained the Indian exchequer to the tune of crores of rupees. This was mainly due to the fact that the per unit yield of sugarcane in the country in the main sub-tropical belt was miserably low with the industry unable to compete with Java industry. It was with a view to improve the yield of the indigenous sugarcanes that the decision was taken by the Government of India to start sugarcane breeding in the country. Only two countries, Java and Barbados were engaged in this research at that time. Coimbatore was chosen as the climatic conditions were ideally suited for flowering and setting of fertile hybrid seed. Dr C A Barber, the Botanist to Madras Government stationed at Coimbatore was appointed by the Government of India to the post of Government Sugarcane Expert at the Sugarcane Breeding Station, Coimbatore on October 25, 1912. At that time Dr Barber had two assistants with him whom he used to refer as the two jewels in the section-Dewan Bahadur K Rangacharya who later became the Systematic Botanist to The Government of Madras and T S Venkatarama

When Dr Barber moved over as Government Sugarcane Expert, he took with him one of the jewels, TS Venkataraman, as his Assistant to start the breeding work in sugarcane, which is to bring so much credit and glory to this country. It was the first attempt in the sugarcane world to improve sub-tropical sugarcanes suited to the rigours of the climatic conditions—high temperature, low temperature, waterlogging, salinity etc. The two scientists, Barber and Venkataraman had an uphill task to perform.

As we now know, the success was achieved by the use of the wild species of sugarcane, Saccharum spontaneum (Hindi-Dharba) in the breeding programme to evolve varieties tolerant to the climatic and soil factors. How this idea of utilisation of the wild species occurred to the scientists is an interesting story. Gregor Mendal said "Out of the simplest things shall ye know the truth". How prophetic in the case of sugarcane. An evening walk along the channel bund by the side of the campus where the wild sugarcane was merrily growing gave the idea to use the wild cane in breeding. Truly, "the ability to observe what happens, to understand what is observed, to use the information to discover new ideas is the hall mark of scientists". Thus, Dr Barber and Venkataraman became the first scientists in the world to use the wild species in the breeding programme for improvement of crops.

VENKATARAMAN'S CONTRIBUTION TO SUGARCANE BREEDING

To Venkataraman goes the credit for saving from destruction the first ever batch of sugarcane seedlings raised in the country. During the first year, all the seedlings arising from the hybridisation of the two species, S. Officinarum × S. spontaneum failed to survive. Next year, Dr Barber was away on a tour of North India and Venkataraman raised the hybrid seedlings under ordinary field conditions and spotted a few, unlike any ordinary grass seedlings. The excitement that these may be true sugarcane seedlings brought Dr Barber hurrying to headquarters in response to a telegram. On examination, Dr Barber felt they were not sugarcane seedlings and irked that he had been made a fool conveyed his displeasure to Venkataraman and ordered the seedlings to be destroyed. Venkataraman was positive they were sugarcane seedlings and when his boss cooled down, obtained his approval to keep the seedlings on the clear understanding that no official time and energy would be wasted on them Lo! in a few months much to the exuberation of all, the seedlings developed sugarcane joints. Thus, in the words of Venkataraman "the sugarcane seedlings came into being in our country unknown, unhonoured and unrecognised". Dr Barber at once recognised the role of Venkataraman and recommended an advance increment for his intuition and personal interest in the work. It was turned down by the Government of India for its being against rules.

Venkataraman took over as Head of the Sugarcane Breeding Station in April, 1919 after Dr Barber proceeded on leave preparatory to retirement. He was merely incharge of the station while efforts were made to secure a thoroughly qualified expert from Europe. Fortunately for sugarcane research in the country, no suitable foreign expert was available and Venkataraman was allowed to continue and later made permanent, from which post he ultimately retired in 1942. He was raised to the

gazetted rank in 1918. Venkataraman may be said to be the pioneer and the earliest worker to study the root system of the sugarcane crop in detail, a study so difficult because of the invisible root system below the soil but so important to understand the productivity of the crop, particularly under stress conditions. By simple unorthodox techniques using earthen pots and glass bangles for supporting the sugarcane sets, the scientist was able to show that studies on root system can be conducted in detail and varieties with desirable root system isolated for use in breeding. We now know that considerable importance is attached to the study of the root system of crops. When the Governor of Madras, Lord Willington visited the station, he was shown the experiments on root studies and Venkataraman ended the explanation with the remark "I tackle the problem at its root, my Lord". Later Willington remarked that "the squint eyed scientist at Coimbatore is doing a wonder ful job".

An interesting anecdote regarding the root studies to prove the independent and straightforward outlook of Venkataraman despite the British heirarchy at the time is worth mentioning. In 1916, Mr Howard, holding the topmost post of Economic Botanist to the Government of India, presiding over the agricultural session of the Indian Science Congress claimed to be the first to study the roots of cultivated crops. Dr Barber who was present remained silent, but Venkataraman challenged the statement with evidence. This was not forgotten, for years later, when Venkataraman visited the Agricultural Institute at Pusa, he was refused permission into the botanical garden. "You are the young chap who had the audacity to contradict me", he was told.

Breeding work in sugarcane being new, during the initial years considerable spade work had to be done in understanding the various factors involved. The remarkable results achieved within a short time has been, in no small measure, due to the meticulous planning, powers of observation and dedication shown by Venkataraman with only two assistants to help him. Observations on flowering of varieties, fertility of pollen, artificial culture of pollen, viability of hybrid seed etc. were carefully recorded and coded for use in the hybridisation programme. The station was the first to start induction of flowering in non flowering sugarcane varieties through photoperiodic treatments which has become so common these days. The complicated nature of inheritance in this polyploid, heterozygous crop compelled Venkataraman to discard the normal breeding methods of selfing and inbreeding in favour of outcrossing and obtain maximum variation. The results of this systematic research were outstanding. The first generation hybrids of the two species, S. officinarum × S. spontaneum, Co. 205 and Co. 285 (Co. for Coimbatore) became acceptable commercially in Punjab and replaced the low yielding indigenous varieties giving 50% more yield besides capable of being grown under stress conditions including waterlogging.

This initial success with two species crosses led Venkataraman to plan roping in a third species, S. barberi—the indigenous Indian species—indirectly and effect tri-species hybrids, one of which, Co. 244 was accepted as a commercial variety in Uttar Pradesh. Thus all the sugarcane varieties that emanated from the Coimbato

Institute these years are the products of the three species, S. officinarum, S. spontaneum and S. barberi initially planned by Venkataraman. It is also a fact that the hybrid varieties evolved in some of the sugarcane breeding stations in the world have in them the parentage of Co. canes and thus the three species. Later a fourth species, S. robustum was added to the list of parents.

Venkataraman can be credited with evolving many original techniques relating to sugarcane breeding. One of them was very useful in eliminating contamination of crosses in the field by chance pollen at a time when bagging interfered seriously with seed setting. The technique consisted in isolation of sugarcane stalks through aerial rooting at the nodes using inexpensive tile pots and removing the rooted stalks to isolated sheds for controlled hybridisation away from foreign pollen. In his usual humorous way, Venkataraman styled these isolation sheds as "nuptial chambers" with the sugarcane arrows (panicle) of male and female varieties. This original method of rooting and isolation later led to the development of techniques in other countries for controlled crossing.

Taking advantage of certain cyto-genetical peculiarities in sugarcane conducive to wide crossability, Venkataraman, in 1930, attempted the wide inter-generic cross, sugarcane × sorghum with the specific purpose of evolving short duration (6 months) sugarcane varieties. The cross was a success (at Coimbatore and later in USA) and genuine hybrids were obtained. It is true that no commercially acceptable sugarcane varieties have emanated from this cross, partly because the work was not followed up in all seriousness and in a systematic manner due to sterility problems. It may not be inappropriate to point out here that, during the last two decades, short duration varieties in wheat, rice, pulses etc. have been emphasised by plant breeders. Venkataraman conceived this idea of short duration varieties in the very long duration sugarcane crop over half a century ago. Sugarcane × maize cross was also effected during his tenure of office by Dr Janaki Ammal and one seedling, a genuine hybrid based on cytological studies is still available at the Institute.

Encouraged by the success of the sorghum hybridization programme (even if academic), Venkataraman planned a still wider inter-generic cross between sugarcane and bamboo, to introduce, if possible, the vigour and hardiness in sugarcane varieties which raised many eyebrows among plant breeders and geneticists. The idea of utilizing bamboo (Bambusa arundinacea) came to him during his daily walk along the bamboo grove planted as a fence along the southern border of the campus. The cross was effected in 1936 using male sterile sugarcane varieties as pistil parents and dusting bamboo pollen done under controlled conditions. Seedlings were obtained and there was excitement throughout the plant breeding world. Venkataraman was invited for the International Genetics Congress held at Edinburgh in 1939 and presented the details. The Daily Herald of London described him as "the man who fooled nature and put sweetness in India". It is true some of the seedlings showed characters normally found in the bamboo species. Later, detailed studies revealed that the seedlings resulting from the cross (no doubt under controlled conditions using male sterile varieties) may have been the result of parthenogenesis a factor overlooked with limited knowledge on the subject. Further work by late

scientists has shown that bamboo pollen germinates on sugarcane stigma and normal fertilization takes place. However, at the eight-celled stage of the embryo, the endosperm gets separated from the embryo—a case of somatoplastic sterility—and it perishes for want of nutrition. With our current knowledge of embryo and tissue cultures, it should be possible to nurture the embryo under artificial conditions. Venkataraman has thus sown the seed for such revolutionary research and today we hear of crosses involving wheat and barley, potato and tomato and so on. Venkataraman was a revolutionary scientist and thinker—" One man and one intellect—a host in itself".

The impact of Venkataraman's sustained research on sugarcane breeding and evolving improved varieties has to be judged by the progress on the Indian Sugarcane Industry during the last fifty years. If from an importing country in 1930 India today is not only self sufficient in white sugar but can also export sugar, it is due to the impact of the Co. varieties bred by Venkataraman which heralded the dawn of prosperity for the Indian sugarcane grower. Starting with the release of Co. 205 in the twenties, which along with Co. 285 replaced the indigenous varieties in the Punjab (undivided) with increased productivity, there was a spate of further and greater improvements with varieties suited to almost all soil and climatic conditions. particularly in the subtropical belt. Later the cosmopolitan variety Co. 213 served the industry in Uttar Pradesh, the major cane growing state for a number of years followed by the versatile Co. 312 suited admirably to both the white sugar and gur (jaggery) industries. Co. 313, an early variety did very well in Bihar. Co. 453, a late high yielding variety was popular in Bihar and UP and so also Co. 421 and Co. 527. Co. 419 became universally popular in all the states in tropical India and sustained the industry for four decades as the wonder cane. Such was the merit and popularity of the Co. varieties bred by Venkataraman and his associates that within a decade the indigenous varieties were almost completely replaced with increased yield per unit area and recovery. No wonder, in some quarters it was said in a humourous vein that Venkataraman has done a disservice to the Indian sugarcane industry by his famous Co. varieties since these suited a wide range on soil and climatic conditions and introduced a sense of complacency and laziness in the farming community for improving productivity through human efforts and agronomic practices. The stupendous growth of the sugar industry during the last 50 years in terms of area under sugarcane, yield per unit area, recovery etc. is well known. From a production of one lakh tonnes of sugar in 1930, we now clear around 70 lakhs on an average. The 30 factories in 1930 have multiplied ten times. All this has to be attributed to the impact of the hybrid Co. varieties evolved at the Coimbatore Institute with the hard work done and secure foundation laid during the earlier years by Venkataraman and his associates.

The diverse conditions in the country for which the Co. varieties were bred could not but have its implications worldwide. The Co. varieties were sought after by other sugarcane growing countries. Co. 281 became the main variety in the Louisiana belt of USA as also Co. 290. In Cuba Co. 281 became very popular as one well suited to indifferent conditions. Its high tonnage on poor dry lands.

and high sucrose content and early maturity is bringing it more and more to the front as the best cane with which to replace Crystalina on lands where there is failure from soil exhaustion and lack of fertility.

Science knows no political boundaries. How the Co. Variety Co. 281 saved the South African Sugar Industry from ruin during the thirties is interesting to recall. The indigenous low yielding variety Uba was threatened with extinction. The variety Co. 281, sent on request, not only replaced it but also sustained the sugar industry of South Africa. Later, another variety, Co. 301, occupied large area in the country. Still later N. Co. 310, the outcome of hybrid seed sent from Coimbatore, occupied the largest commercial area in the world for any sugarcane variety, being popular in many countries besides South Africa. As a mark of appreciation, the South African Sugar Technologists Association gifted to the sugarcane Breeding Institute during the period of Venkataraman a wax model of sugarcane wax of Co. 281 and Uba stalks, each stalk four feet with leaves and absolutely realistic which now adorns the museum of the Institute. What more tribute can be showered on a scientist and an Institute than that the South African Sugar Technologists Association elected Venkataraman as an Honorary Fellow and Dr H H Dodds, the then President and Director of the South African Sugarcane Experiment Station wrote to Venkataraman: "This, I believe is the first occasion in which any one living away from South Africa has been elected to honorary membership and is some indication of the very great appreciation felt in the sugarcane industry here of your work in introducing new varieties of sugarcane that have been so valuable to us. The only serious complaint about these new varieties that have so far outstripped our old Uba cane is that they have tended to bring out acute state of overproduction of cane that now exists". In Australia, Co. 290 became popular and in the British West Indies—Barbados, Trinidad, British Guiana—Co. 419 became the mainstay with the growers, with Co. 421 also being grown. At one stage during 1960s, the Coimbatore varieties were under commercial cultivation in 22 countries in the world and sustaining their sugar industry. While the monumental study of Barber on the morphological descriptions and classification of the Indian canes is regarded as a 'classic', Venkataraman ably followed it up by the description of the Co. varieties to aid in their identification and avoid varietal mixtures.

Venkataraman was assisted in his work during the earlier years by P Thomas, a non-matriculate but with a high degree of common sense and practicality in his vision and approach. He stood by Venkataraman and was gifted with the title 'Rao Sahib'. From 1926 when the breeding work for tropical India was started, N L Dutt was next in command to Venkataraman and ably supported him. He is to be considered the architect of the varieties Co 419, Co 421 and Co 453. Co 419 was hailed as the wonder variety for the tropics and served the entire sugar industry below the Vindhyas for well over four decades; Dutt succeeded Venkataraman when he retired on superannuation in 1942.

Publicity being one of the keynotes to success, Venkataraman was not lacking in it. He rightly fitted the adage 'The pen is mightier than the sword'. With a flair for writing and excellent command of English and capability of suttle humour.

the forty and odd scientific publications in various journals give a insight into his love of science, industry in collection of facts, large share of common sense and unbounded patience. The museum room at the Station depicted in a non-scientific manner the mythological origin of sugarcane, India anxiously awaiting sugar supply from Java, the family tree of a Co. hybrid with human figures to indicate the male and female parents, the breeding techniques, the progress of the sugar industry and so on in a style which was self explanatory and easily followed by a layman.

HONOURS AND AWARDS

Right from the start of his career, Venkataraman had shone as a brilliant scientist with keen powers of observation, independent and original thinking, meticulous planning and sincere and dedicated work. No wonder, honours were showered on him right from the early days, both from the scientific side and the administrative (government) side.

Venkataraman presided over the agricultural section of the Indian Science Congress in 1928 when the theme of his address was on 'Indian Sugar Bowl'. In 1929, he visited Java to attend the meetings of the International Society of Sugarcane Technologists and presided over the varietal section. In 1932, he was appointed to the Indian Agricultural Service (IAS then) of the Government of India.

Venkataraman was elected General President of the 1937 Indian Science Congress when he delivered the presidential address 'The Indian Village' interpreting the village to the urban scientists. The problems in the villages with over population of men and cattle, fragmentation of holdings, dependence on monsoon for agriculture, lack of amenities like schools, hospitals, transport etc. were vividly brought out in the address and his final conclusion was clear: "Our duty then is clear, namely, to improve the village, the nucleus of our country life and inject its chief agent, the villager with a chosen culture of the virus of modern age through education and industrialisation". Pre-independence thoughts! For the second time, Venkataraman was President of the agricultural section of the Indian Science Congress in 1938 when he spoke on 'Hybridisation in and within the genus Saccharum. Venkataraman was hailed as the wizard of sugarcane when he attended the 1939 International Genetics Congress at Edinburgh. The Indian Society of Genetics and Plant Breeding had the honour of having him as President for a term. The Andhra University awarded the honorary degree of Doctor of Science (DSc) to Venkataraman.

In 1956, when the International Society of Sugarcane Technologists held its meetings in India, Venkataraman who had retired chaired the cane breeding section. On the occasion, a plaque on the birth of the first commercial hybrid variety Co. 205 (his baby) was unveiled at the Sugarcane Breeding Institute, Coimbatore at the exact place where it was born.

On the Government side, when the first hybrid variety, Co. 205 replaced the indigenous varieties with higher yield, the title of 'Rao Sahib' was conferred on him in 1920. After the Viceroy Lord Irwin's visit to the Station in 1920.

Venkataraman was awarded the title of 'Rao Bahadur' in 1928. The work on sugar cane × sorghum hybridisation got him the title of IE in 1937. To crown all glory, after his work on sugarcane × bamboo crosses, Venkataraman was knighted (the conferment of the title 'Sir') in 1942, the first ever agricultural scientist in the country to be honoured by the British Government. In 1956, the Government of India honoured Venkataraman with the title of 'Padma Bhushan' at the time of the International sugarcane Congress meetings, many years after his retirement.

In 1962, when the Golden Jubilee of the Sugarcane Breeding Institute, Coimbatore was celebrated, the South Indian Sugar Mills Association presented to the Institute a portrait painting of Venkataraman (for which he personally and patiently gave a few sittings) who brought so much name and fame to the Institute internationally. The portrait now adorns the walls of the library room at the Institute.

FAMILY, RETIRED LIFE AND LAST DAYS

Sir T S Venkataraman retired from service as Sugarcane Expert to the Government of India in 1942 after 35 years of dedicated service to the cause of sugarcane research and being given an extension of three years service. He settled down for a while in Coimbatore when he agreed to undertake a survey of sugarcane research in the country. He gave up the assignment on health grounds and settled finally in Madras spending his time reading the Gita, Upanishads etc. He was a frequent writer in the Hindu newspaper 'Letters to the Editor' on diverse subjects from Gita to family planning and birth control. Happily married, Mrs Venkataraman was a deeply orthodox and religious lady shunning publicity and content to be a good housewife. Their only son, V Ramamurthy retired as Assistant Director, National Physical Laboratory, New Delhi.

Sir TS Venkataraman passed away in January, 1963 at Madras, secure in the knowledge that his place in the history of science is assured. Recapitulating the chief factors that have contributed to the success of the Coimbatore work. Venkataraman mentions "(a) the pointed attention paid to the work by every worker at the station, enforced by the temporary nature of the Station with its life extended for very short periods each time; (b) the almost ascetic mind which enabled them to force into service whatever facilities, including apparatus, available at the time instead of waiting for some unit to be received from outside the country: (c) the unorthodox methods adopted including such wide hybridisation as intergeneric and inter-racial (to use a popular term) and (d) last by no means least, the researchers going to their work without looking at the clock resulting from the lively enthusiasm for the work set before them and the ultimate aim of the work viz. to win back to the country its ancient position in the sugarcane world". Today India is the largest producer of sugarcane and sugar in the world-a tribute to the above prophetic statement of Venkataraman and he did live to see his prophesy and dream come true.

Swift in Gulliver's Travels says "Whoever could make two cobs of corn or two blades of grass grow where only one grew before would, deserve better of mankind and do more essential service to his country than the whole race of politicians put together". Truly, Sir Venkataraman made two and often more stalks of sugarcane grow where one or none grew before and is, thus, entitled to the everlasting gratitude of this country. He is entitled to be remembered by every one who adds a spoon of sugar/gur to his daily cup of coffee/tea in the morning, as the author of the sugar revolution which came three decades ahead of the green revolution.

ACKNOWLEDGEMENTS

The author has the unique privilege of being the only student of T S Venkataraman, for MSc degree since the latter did not believe in taking students for post-graduate degrees. It was a sheer good fortune that the author was enlisted as a student during the extension years of service of the scientist. With forty years (1939-79) at the Sugarcane Breeding Institute, Coimbatore, the author feels honoured to write this biographical sketch of the wizard of sugarcane breeding. In the words of Isaac Newton: "If I have seen further, it is by standing on the shoulders of giants".

In writing this biography, the author has drawn freely from the publication of the Sugar Technologists Association of India (STA—1944) entitled. 'Sir T S Venkataraman—the Scientist and the Man'—based on the personal discussions of Mr P N Nayar of the Association with Venkataraman.

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