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YEARS

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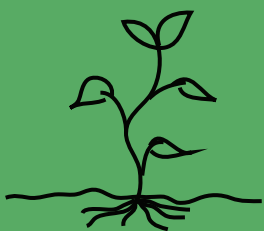
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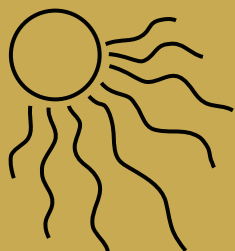
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AGRICULTURE



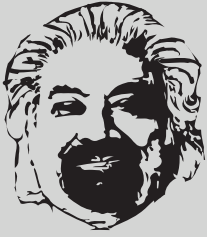
RENEWABLE ENERGY



ANIMAL HUSBANDRY



SUSTAINABILITY



Hearty Congratulations to you and your associates on 50th/Golden Jubilee of NARI.

Sam Pitroda,
Former advisor to PM of India

My best wishes to NARI and for success of the function.....and this special milestone of NARI.

With warm regards,
Rahul Bajaj,
Chairman, Bajaj Group



Thank you very much for your kind letter. I wish the golden jubilee celebrations great success.

Yours sincerely,
M S Swaminathan,
Father of Indian Green Revolution

For me, the visit to NARI a few years ago was a real eye-opener. I would therefore like to wish you the very best for this function and the other events planned in the Golden Jubilee Year.

Sincerely yours,
Sanjay Kirloskar,
CMD, Kirloskar Brothers

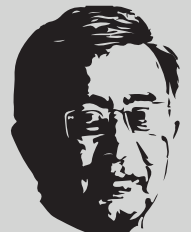


NARI is one of the institutions which is close to my heart. It is a shining example of 'more from less for more'.....I am truly grateful to be a part of this wonderful event (Golden Jubilee Celebration).

Dr. R. A. Mashelkar
Padma Vibhushan Awardee, Renowned Indian Scientist
Chief Guest at the Golden Jubilee Celebration Function

Thanks for your invite to the Golden Jubilee Inaugural function. I would like to wish the function and all your activities great success.

With best personal regards,
Baba Kalyani,
CMD, Bharat Forge



I was very happy to know that you have recently celebrated the Golden Jubilee of Nimbkar Agricultural Research Institute. I take this opportunity to send my best wishes to you and all your colleagues associated with your Institute.

With kind regards,
Dr. Manmohan Singh,
Former PM of India

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About NARI



Nimbkar Agricultural Research Institute (NARI) is an NGO and a non-profit research and development institute. NARI is registered under the Societies Registration Act XII of 1860 and the Bombay Public Trust Act of 1950. It is situated in the rural town of Phaltan (a taluka situated 300 km southeast of Mumbai) in Maharashtra state. It was established in 1968 by Mr. B.V. Nimbkar who remained in the role of President until 1990. Since then Dr. Nandini Nimbkar has held the position of Permanent President.

The basic philosophy of the Institute has been to solve the age-old problems of rural India through application of excellent science and technology. Consequently, highly innovative research and development work has been undertaken on a shoestring budget in the areas of agriculture, renewable energy, animal husbandry and sustainable development.

The Institute is housed in spacious buildings (total area is about 3500 m²) and has about 40 hectares of farm with year-round irrigation facilities for research purposes. NARI also has well-equipped laboratories with sophisticated analytical instruments and computational facilities, a full-fledged workshop, an A Class automatic weather station and a 4G internet connection. Most of the hardware for research is fabricated in the workshop. The Institute has a small, though well-stocked library with about 6000 books and subscribes to about 30 periodicals (both national and international) in the areas of agriculture, energy and animal husbandry.

More than 700 publications have been put out, 7 national patents and 3 trademarks have been filed (and granted) by the staff of NARI in the last 50 years. Most of the publications are research papers in refereed journals, popular articles in magazines and editorials in leading newspapers/websites.



Research at NARI

Agricultural Research

From its inception till the early 1980s, Nimbkar Agricultural Research Institute (NARI) carried out research purely in agriculture. The aim was to help the farmers get higher returns by developing better hybrids/varieties of the locally grown crops like cotton, grain sorghum and safflower; as also to introduce new crops like sweet sorghum, sugarbeet etc. The work done on these crops is summarized below:



Cotton Boll

Cotton was one of the first crops in which extensive breeding was carried out at NARI. The cotton variety Nimbkar-1 developed by NARI spread like wildfire across Maharashtra covering several thousand acres of land in the 1970s. The farmers who grew Nimbkar-1 and hybrid NH-391 got much higher remuneration than those growing the other cotton varieties. Even though the popularity of cotton decreased in western Maharashtra over the next few years due to diseases, NARI carried out its research for over a decade.

Work on **sugarbeet** started at NARI with the aim of introducing an alternative to sugarcane especially in water-short areas. Due to its pioneering work on agronomy of sugarbeet, NARI was made a centre of the All India Coordinated Project on Sugarbeet by ICAR, Gol in 1971. But after a decade, research on sugarbeet was discontinued due to problems faced by the sugar mills in processing beets for manufacturing sugar from them. The ongoing all India project on sugarbeet was converted to one on safflower in the early 1980s.



Sugarbeet Plant

NARI had started breeding of **safflower** in the 1960s but it was only in the 1980s when its research gained momentum. Earlier in Phaltan and surrounding areas, safflower was grown as a rainfed crop. After NARI was able to lift water from the Nira right bank canal, the research on growing safflower with limited

irrigation for getting better yields was initiated. Over the years, NARI has developed and released 5 varieties and 3 hybrids of safflower for cultivation all over the country. All of them are high yielding with some giving high oil yield. NARI also developed suitable agronomy for growing safflower under limited irrigation. World's first non spiny safflower hybrid NARI-NH-1 was developed by NARI. Apart from its traditional usage i.e. for edible oil production, NARI tried to popularize the use of young safflower plants as nutrient-rich leafy vegetable and dried safflower flowers as antioxidant-rich herbal tea. To facilitate the collection of safflower flowers from spiny varieties, NARI also developed a solar-powered petal collector.



Safflower Inflorescence



Sorghum Panicle

Grain **sorghum** used to be a major locally grown crop. The sorghum variety Vasant-1 developed by NARI gained widespread popularity in Maharashtra and Karnataka in the early 1970s. Later in the same decade, NARI for the first time introduced sweet sorghum in India. Since then, the institute has developed several high yielding varieties with high sugar content. Due to its usage for simultaneous production of grain, sugary juice and animal fodder, NARI envisioned sweet sorghum as an excellent multipurpose crop to be grown across the country. For producing ethanol from sweet sorghum juice, NARI set up a solar-powered distillation unit in 1987. NARI also developed the end-to-end technology for producing jaggery and syrup from sweet sorghum hybrid 'Madhura' in the mid-1990s. Based on its excellent anti-oxidant activity and other nutritional qualities, NARI has been popularizing the 'Madhura' syrup for the last two decades.

Most recently, NARI has been working on fodder crops like leucaena, stylo, buffelgrass and opuntia cacti which need relatively less water and other resources to grow and produce nutritional feed.



Opuntia Cactus

In future, NARI plans to work in conservation agriculture; develop precision and container agriculture technologies for fodder production; and also to set up a pilot plant to mechanize the sweet sorghum syrup production.

Renewable Energy Research

Nimbkar Agricultural Research Institute (NARI) started research in renewable energy in 1981. The work can be broadly categorized into household energy, biomass energy, mobility and clean water research. They are summarized below:

Household energy research was initiated to help improve the lives of rural population. In the 1980s one of the major problems in Phaltan (and a lot of other villages in India) was the unavailability of electricity. The kerosene lanterns and wood-based chulhas used by the villagers resulted in indoor pollution. For providing clean cooking and lighting for rural households, NARI envisioned the usage of renewable fuels like ethanol. First step was to minimize the energy consumption in ethanol distillation. Hence, the world's first pilot plant for solar-powered ethanol distillation was set up in 1987. To use ethanol for lighting, a multi-fuel 'Noorie' lantern was developed. Further for cooking, a low-concentration ethanol stove was developed. Finally a device called lanstove (lantern cum stove) running on kerosene, diesel and ethanol was developed for facilitating cooking and lighting simultaneously.



Low-concentration Ethanol Stove

NARI started work on biomass energy to utilize the agricultural waste/residues which otherwise were burned in open fields in Phaltan and surrounding areas causing pollution. The first gasifier developed was wood-based. It gave good insights into the critical parameters of the gasification process. Thus in 1996, NARI developed a 1800 MJ/hr loose leafy biomass gasifier for thermal applications. NARI also did an extensive study of Phaltan taluka and found that the agricultural residues of the taluka were more than sufficient to fulfill all its energy needs. Based on this report, the national policy on biomass-based power plants was made.



Sugarcane Leaves Gasifier



Elecsha

Mobility work was initiated to help increase the remuneration of rickshaw pullers who belong to the lowest economic strata of the society. As a first step, the humble cycle rickshaw was redesigned to produce an efficient and light-weight rickshaw called 'IMPRA' (Improved Pedal Rickshaw). To further reduce the load for rickshaw pullers, IMPRA was modified to run on a motor powered by batteries and was named 'MAPRA' (Motor Assisted Pedal Rickshaw). The feedback on MAPRA showed that a fully electric rickshaw was more desirable. Hence in 2000, NARI developed the world's first fully electric three wheeler 'ELECSHA[™]'. Later, NARI also developed 'MANHARA[™]' (Motor Assisted NARI Handicapped Rickshaw) and a completely electrified trike for handicapped people. This work on electric rickshaws was then extended to develop some battery-powered farm machinery.

The clean water research was carried out in three areas: production of water from soil, treatment of distillery effluent and purifying water cheaply for rural areas-all with the use of solar energy. In the 1980s, there was a major tree plantation drive initiated by the

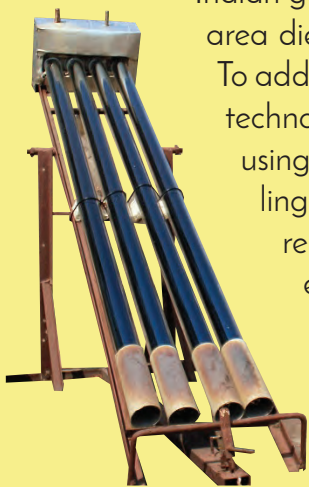
Indian government. Most of the trees planted in Phaltan area died in early stages because of lack of water.

To address this problem, NARI utilized the age-old technology of collecting soil water evaporated using solar energy and watering the tree seedlings. The local ethanol distilleries in Phaltan released very dark coloured and foul smelling effluent without proper treatment. To clean the

distillery waste with the use of a photo-catalyst, NARI developed a solar detoxification unit for diluted effluent. It made the waste water clear, removed the smell and reduced its biological and chemical oxygen demand. To mitigate the problem of lack of potable water in rural areas, NARI designed a low cost and efficient solar water purifier in 2012. Studies on the purifier suggested that it completely killed the coliforms in the water even on a cloudy day.



Solar Detoxification Unit



Solar Water Purifier

In future, NARI plans to improve upon the existing technologies of lanstove and solar water purifier and to disseminate them on a large scale.

Animal Husbandry Research

The Animal Husbandry Division (AHD) of Nimbkar Agricultural Research Institute (NARI) was established in 1990. The chief aim of the AHD is to genetically improve local goats and sheep, and to improve the management of these animals on which the livelihoods of many rural people are dependent. AHD's work over the years can be summarized under the following heads:



NARI Suwarna ewe with her twin lambs

Development of NARI Suwarna sheep was the greatest achievement of the AHD. It was developed by introducing the 'FecB' or Booroola gene from the Garole sheep from Sunderban, West Bengal into the local Lonand Deccani sheep. The resulting NARI Suwarna sheep is taller, larger and faster growing than the Deccani sheep and most importantly, it has a 60% chance of producing twin lambs. Due to increased rate of twinning, NARI Suwarna gives higher returns to the sheep herders. Over the past two decades, NARI Suwarna breed has been disseminated to a large number of sheep owners in Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh.

Boer goat (best meat goat breed in the world) embryos were imported from Australia by NARI and the Maharashtra Goat and Sheep Research and Development Institute. The embryos were then introduced into local goats and a nucleus flock of Boer goats was established. The Boer has proved to be a fast growing and hardy breed for Indian climates and conditions. Thousands of goat keepers from Maharashtra, Tamil Nadu and Madhya Pradesh have benefited by crossbreeding their goats with the Boer breed.



Boer goat

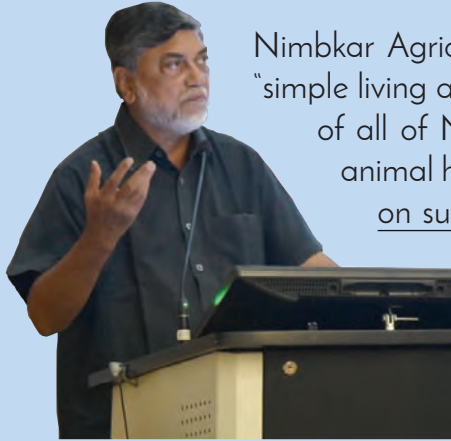
NARI pioneered the development of technology for cervical **Artificial Insemination** (AI) of goats under field conditions in India. The AHD set up a state of the art semen freezing laboratory in 2014 with a grant from the Ministry of Agriculture, GoI. The laboratory stores frozen goat (buck) and sheep (ram) semen in 0.25 ml French mini straws. The usual AI gun is used to inject the straws into sheep and goats. Typically, the inseminated sheep/goats have a conception rate of 60 percent.



Frozen semen laboratory at NARI AHD

AHD has prepared brochures/manuals in simple Marathi, Hindi and English to give **training** in sheep and goat management and artificial insemination. AHD has also conducted more than 100 training programmes and workshops nationally and internationally for sheep/goat keepers, livestock supervisors and veterinarians. The programmes usually range from 2 to 6 days, covering topics such as housing, nutrition, breeding and first-aid for the small ruminants.

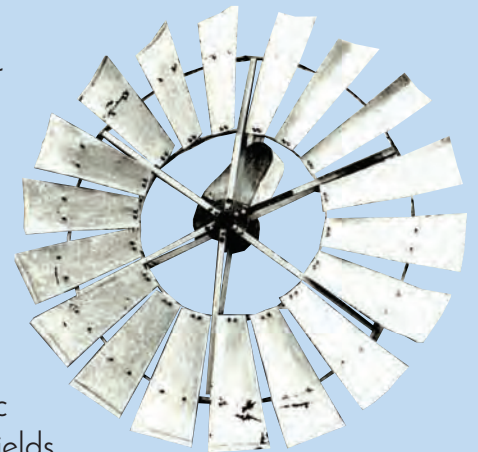
Sustainable Development



Dr. Anil Rajvanshi delivering a talk on sustainability

Nimbkar Agricultural Research Institute (NARI) has always believed in the mantra “simple living and high thinking”. Thus sustainability has always been in the background of all of NARI’s work. Apart from its work in agriculture, renewable energy and animal husbandry, NARI has also been actively formulating and spreading ideas on sustainable development. A few examples are - Conceptualizing a model for sustainable rural restaurants, envisaging a second green revolution through precision agriculture, investigating what should be the true price of farm produce etc. NARI staff have published over 30 articles on sustainable development in major academic journals, newspapers and magazines in the past two decades.

NARI has been using **sustainable practices** for reducing energy consumption and managing waste in the institute campus. A windmill-powered pump is used to fill the overhead water tank. The drinking water for all the staff is purified by the solar water purifier developed by the institute. Also, the distilled water for use in chemistry laboratory is produced by a solar still. In the summer months, a green shade-net and wet gunny sacks on the rooftop of the main buildings provide excellent passive cooling at one tenth the cost of an air conditioner. All the agricultural residues and other organic wastes are put in pits and when composted used as manure in NARI fields.



Fan of windmill at NARI

Bajaj Centre for Sustainable Development (BCSD) is a self-contained facility on NARI’s main campus. It is a venue for educational seminars on sustainable development, spirituality and the

various areas of research in which NARI is involved. BCSD was designed to minimize its environmental footprint. Thus it is equipped with rainwater harvesting system, solar photovoltaic panels

to power the pump for filling water in the overhead tank, solar water heaters for the guest accommodation, evaporative roof cooling for summer months (powered by solar pump), natural lighting and ventilation. Also, all the kitchen waste goes to the composting pit and all the waste water after passing through the septic tank goes into nearby fields for irrigation.



Bajaj Centre



President's Message

Dr. Nandini Nimbkar
President

I am happy to be writing this note for the souvenir of the Golden jubilee celebrations at the Nimbkar Agricultural Research Institute (NARI). I feel that starting such a private research and development organization in the 1960s and successfully running it for 50 odd years is in itself a great achievement. NARI has seen a lot of changes since its inception, though pursuit of novel ideas has been a common thread throughout. Initially the focus was more on breeding of field crops for improving their yield and different characteristics. After the initial years the emphasis shifted to renewable energy research in the early 1980s and most recently in the 1990s research on small ruminants and fodder species was started.

This small souvenir is being published on the occasion of NARI having completed 50 years of its official founding and at the start of the celebrations of its Golden jubilee throughout this year.

Out of the 50 years of existence of NARI, I have been fortunate to be a part of the institute for 37 years and hope to remain involved in its work at least for 13 more - to celebrate my 50 years at the Institute! However, also during the 1960s and 1970s since the institute was right next door to our house I was always aware of the things going on at NARI from the conversations of my parents. Once I went to college in Pune, during the vacations, I was involved in various activities at NARI such as giving seminars based on some scientific journal papers picked out by Mama (Dr. Anand Karve - NARI's first director) or carrying out calculations of data for writing scientific articles etc. I am sure this definitely played a major part in my choosing first Botany and then Agronomy as the subjects for my study, probably a larger part being played by my inability to tackle mathematics.

Though there were many occasions over the last 50 years when the very existence of NARI was in jeopardy, these luckily remain only as distant memories, while the upbeat and joyous incidents are remembered much more vividly. NARI itself and its scientists have been a source of inspiration to many in India and abroad and continue to be so. We constantly experience this to our pleasant surprise. I congratulate all the past and present staff and volunteers for their dedicated work and achievements over the years and wish them the very best in the years to come.

I hope this souvenir gives a glimpse of NARI today and of its glorious past to all who have been a part of the journey and those who wish to join it in the future. As can be seen from the 'Impact of NARI', the institute has many firsts to its credit which we are very proud of as being trailblazers.

We would like to continue such leading-edge work by leaving our former line of crop breeding and pay greater attention to agronomy and soil conservation. In farming it has become very difficult to make ends meet by only concentrating on plants. The animal component is an important addition as it not only provides valuable manure as fertilizer, but also comes handy when ready cash is required during times of emergency.

In recent times keeping cows is becoming increasingly non-remunerative due to the religious and social taboo leading to legal restriction on their slaughter; which forces the farmer to keep on supporting his unproductive cattle or just abandon them. On the other hand there is no such restriction on slaughter of buffaloes and their milk is also in greater demand and fetches much higher price than that of cows. The only problem is that half the offspring are male which are considered as a liability since they are not of any use once they stop being necessary for stimulating the milk flow of the buffalo. However, my father Mr. Nimbkar is of the opinion that farmers can rear both female and male buffaloes, the former for milk and the latter for meat.

The male buffalo calf could well be an income-generating asset and one of the models that we are testing is that which has been successfully used for cattle in Indonesia and Australia. They have been feeding 100% Leucaena (Subabul) and getting very high growth rates of their animals as it provides very good quality protein. My father feels that doing this will solve the twin problems of soil conservation and poverty in vast areas of the state of Maharashtra which suffer from drought and soil erosion.

I give my special thanks to Mr. Rahul Pisharody for his artistic efforts in putting this souvenir together as also successfully organizing the Golden Jubilee inaugural event with his colleagues Mr. Shubham Sharma and Mr. Harishankar T.



Founder's Wisdom

Shri B. V. Nimbkar
Founder & Emeritus President

During the major part of its existence NARI followed the practice of getting the germplasm of various crops of interest from abroad-mainly the U.S. and then carrying out the breeding. NARI also sent many of its scientists abroad for training. First two major projects at NARI-one in safflower and the other in sweet sorghum were funded by the United States Department of Agriculture from their PL 480 funds in India. In the 1960s The Rockefeller Foundation was instrumental in developing the seed industry in India especially based on hybrids of cereals like maize, sorghum and pearl millet, where a number of private seed companies benefitted from their technical assistance. However, during the last 30 years or so, partly as a consequence of the reduction of barriers on the entry of foreign firms, many joint ventures between them and large Indian conglomerates entered the seed market. Also their investments in research tripled just in the first 10 years itself and so small institutions like NARI could not compete with them any more. Therefore, we gravitated towards continuing our work with crops like safflower and sweet sorghum or study of some new crops in which multinational corporations did not have any interest.

By reading some of the books listed below I have come to the conclusion that rapid soil degradation is taking place in the Deccan traps of west-central India and the only way to save these shallow, highly erodible soils is to stop all cultivation and grow pastures of forage grasses and legumes on them with no or minimum tillage. Livestock can be raised on these pastures which will not only save the soils, but enable the production of milk and meat at a lower cost. If the prices of these products can be reduced it will not only boost their domestic demand, but also the international one. I think this is definitely doable as most of the farmers have less than 2 hectares of land with a few animals having limited fodder requirement. Therefore, livelihood for a small family can be earned by rearing buffaloes and small ruminants such as sheep and goats for meat and milk as it is not economical any more to keep cows in India due to the government policies against their slaughter.

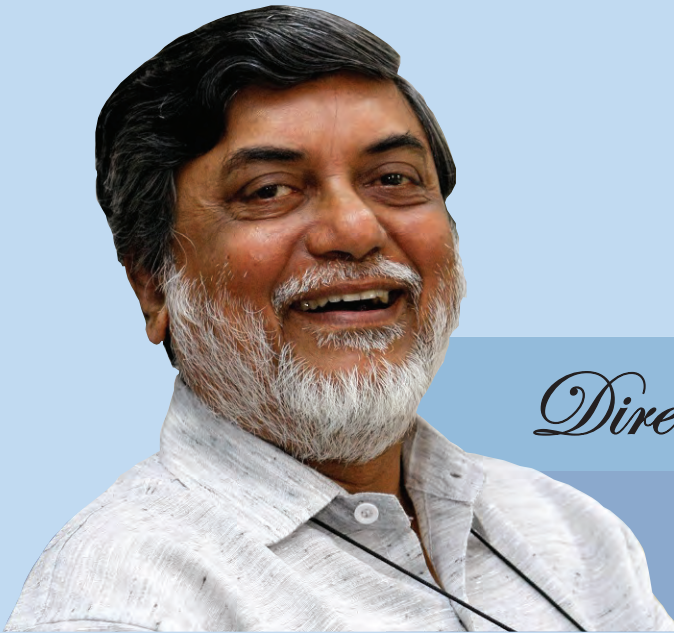
I consider the project on the development of the 60% more productive 'NARI Suwarna' breed of sheep by introducing the FecB gene for twinning from the small Garole sheep of Sundarban into the local Lonand Deccani sheep to be one of the best examples of the high technology research work done by NARI in the last 50 years. It was carried out at the NARI AHD and was funded by the Australian Centre for International Agricultural Research (ACIAR) from 1998 to 2007.

Every year ACIAR publishes a critical appraisal of a sample of past projects funded by them. In their 'Adoption of ACIAR project outputs 2014' document published in 2015 this project was highlighted. I feel among the most beneficial outcomes of this project was that 'NARI Suwarna' as a sheep breed was recognized in Karnataka.

In October 2013 Shri. T. B. Jayachandra the minister from Karnataka then holding the charge of animal husbandry department in addition to others visited NARI AHD. He saw the potential of the 'NARI Suwarna' sheep and arranged for the training at NARI AHD of a large number of farmers and veterinary officers from Tumkur district to which he belongs. He also arranged for the purchase and distribution of the rams of 'NARI Suwarna' by the Karnataka government. In the last eight years 900 ewes and 550 rams of 'NARI Suwarna' have been disseminated to sheep owners' flocks in seven states of India with the majority being given in Karnataka.

Secondly, dryland farming should be promoted as it is not economical to irrigate with the present condition of the soils on the Deccan plateau. Technology is already present around the world for doing this and we have made a start by inviting Dr. Suzanne Boschma, Senior research scientist at NSW department of primary industries in Australia as a consultant for 10 days in February 2017. Her research in Australia has contributed to providing resilient pasture options to maintain feed supply year-round and quantifying and overcoming issues affecting their productivity and persistence. We are also in touch with Dr. Max Shelton, Affiliate associate professor at the University of Queensland in Australia. We hope to collaborate with him on establishment and use of leucaena as fodder.

- (1) Wallace, Robert. 1888. India in 1887 as seen by Robert Wallace. Oliver and Boyd, 363 pp.
- (2) Bennett H. H. 1939. Soil Conservation. McGraw-Hill Company, Inc. 993 pp.
- (3) Faulkner Edward H. 1943. Plowman's Folly. Island Press. 354 pp.
- (4) Bromfield Louis. 1945. Pleasant Valley. Wooster Book Co. 336 pp.
- (5) Kanitkar N. V. 1968. Dry Farming in India. Indian Council of Agricultural Research, New Delhi. 470 pp.
- (6) Montgomery, David R. 2017. Growing a Revolution : Bringing our soil back to life. W. W. Norton, N.Y. 316 pp.



Director's Words

Dr. Anil K. Rajvanshi
Director & Honorary Secretary

Celebration of 50 years is a time for remembrance, reflection and introspection and also to think about the future.

From minimal infrastructure, when I came back from the U.S. in 1981, to having some decent facility now it has been an interesting journey at NARI. That journey has been written up in an aptly titled book "Romance of Innovation - a human interest story of R&D in rural setting" which was released as an ebook by Dr. Mashelkar in 2014 and is now in physical form.

Now as I reflect back, I remember that working and setting up a renewable energy lab in a small rural town in 1981 was not easy. The Institute at that time consisted of a small building and farms with minimum infrastructure. I got an old fan fitted in my office and that was the only fan in the whole Institute. Besides one rarely had electricity so the fan was mostly non-functional!

Telecommunication facilities were almost non-existent in those times and it was a nightmare to make a long-distance phone call to any place. One had to book a call in the early morning and if one was lucky the call would materialize by the evening. So quite a few times when I needed to make urgent and important phone calls I hopped on the bus and went to my friend's office in Pune to make them. The bus journey in those times took about four hours one way.

In the early days of setting up my lab, it was very difficult to get engineers and scientists. It took me nearly four years to make the lab functional and hire decent staff. Even now there is a tremendous problem in getting good staff. The situation has become worse because we cannot compete with the very high pay packets being offered by the industry and the government.

However there was a junoon to do something interesting and it provided the momentum to carry forward the work. Thus with minimum staff, infrastructure and limited budget we have been able to do reasonably good work with lots of innovations and firsts to our name. These are listed in the 'Impact of NARI' section in this souvenir.

One of the unique innovations has been of doing R&D on a shoestring budget. I think good research can be done by thinking deeply about the problems and one can extract a huge amount of information from simple but clever experiments. We have shown this in our lab where we were

able to accomplish the entire R&D in renewable energy from 1981 till now in a total budget of less than Rs. 2.5 crores (Rs. 25 million) only! This to my mind has been the real Romance of Innovation.

One example of this thinking was how NARI was instrumental in formulating a National policy on energy self-sufficient Talukas. In 1990 we received a small grant of Rs. 3 lakhs from ICICI under USAID PACER program. This grant was given to explore the possibility of making a plan for a taluka to become energy self-sufficient. This was based on our idea that agricultural residues can power biomass-based power plants to produce all the electricity demands of a taluka. So in 1990 we did a study on the total amount of agricultural residues produced in Phaltan taluka and then two of us went to the U.S. to look at nearly one dozen biomass-based power plants. In late 1980s U.S. was the pioneer of biomass-based power plants. Armed with this data and knowledge we wrote a detailed project report and submitted it to ICICI in 1992.

In 1995 this report set the tone for setting up the national policy on Energy Self-sufficient Talukas which was run by Ministry of New and Renewable Energy (MNRE). NARI was the principal author of this policy. Incidentally this policy was the forerunner of the PURA program promoted by former President Dr. Abdul Kalam in 2004.

The head of the ICICI PACER program was one Shri. N. J. Jhaveri who later on became the Joint Managing Director of ICICI. I met him in 1997 in a function in Mumbai and he told me that this is the first time in the history of ICICI that a small NGO with the help of a small project was able to help set up a national policy.

Similar was the case for our work on electric mobility. We started the program of electric cycle rickshaws in 1995. At that time this concept was not heard of and somehow caught the fancy of almost everybody. This resulted in our paper on this subject appearing very prominently in 1999 in a journal published by MIT (Boston). Our work also elicited excellent publicity in mass media.

In those days good permanent magnet DC (PMDC) motors running on batteries were not available in India. So we got hold of a small PMDC manufacturer in Pune who designed the motors for us. We gave him feedback on the loading characteristics of the motor by use of a very innovative method. Two of our people would sit in the electric rickshaw, with an ammeter and voltmeter attached to the motor and take reading every 1/2 minute as it went on a ride over pot-holed roads and slopes. These readings for different terrains, speed and duration of drive gave all the data that was needed to redesign the motor. With this data the manufacturer used to tweak the design of the motor and give us a better one. In 2002 I gave an invited talk at the National Center for Sustainable Transportation in UC Davis and they were amazed at the low cost ingenious way we used to collect data as usually such data is recorded via very expensive computer-based systems.

There are many such examples of innovative, low cost methods that we developed for producing technologies and are listed in the book Romance of Innovation. I feel such methodologies should be taught and practised in R&D labs specially those working in rural areas.

I have spent 37 years of my life at NARI. As I reflect on those 37 years they have given me happiness and satisfaction-two most important goals one should try to achieve in whatever profession one chooses. Satisfaction I got in doing things that I enjoyed most, namely innovation and also in spreading the message of Junoon for rural innovations to youngsters in IITs and other colleges.

Happiness I have felt in exploring the nature of life and spirituality. Working at NARI has allowed me to do innovative thinking on the interaction of spirituality and technology and helped me realize that the mantra of India's and mankind's progress could be Spirituality + Technology = Happiness. Spirituality allows us to curb our greed and with the help of high technology allows us to live a holistic, sustainable and emotionally satisfying life. This is an area which I would like to explore and study further and we propose to have workshops and seminars on this theme during our Golden Jubilee year.

Similarly we would also like to conduct workshops, lectures, training sessions on sustainability issues for students and managers. I give such lectures in various IITs and colleges. We hope to have a series of these events here at NARI during the Golden Jubilee Year to educate students in various skills and also train them to be good citizens.

This brings me to the last part - what should our future strategy be. From the experience gained I feel that future roadmap for NARI can be as follows :

Indian farming is in crisis. Farming is non-remunerative and farmers do not want to farm. There is a need to modernize it and make it remunerative. Precision agriculture and container agriculture may help in doing this. We hope to start a serious effort in both these areas specially for fodder production. Together with this is the processing of farm produce. Thus NARI is developing a completely mechanized sweet sorghum syrup plant and setting up a solar-powered cold press for extraction of oil from oilseeds. Both these technologies, we hope, will help in increasing the remunerations to the farmers.

We also want to explore the possibility of multiplying rural S&T NGOs. The problems that exist in rural areas should be solved through innovation and R&D by rural-based S&T NGOs. How do we develop an ecosystem in the country to do this? This will also be the subject of various workshops, talks and seminars. Somehow the Government labs or institutions of higher learning or corporations have not been successful in doing that. I feel a healthy cooperation of S&T NGOs like ours with national labs/institutes and corporates might help in this endeavor.



Director's Note

Dr. Chanda Nimbkar
Director, Animal Husbandry Division

After having succeeded in substantially improving the incomes of thousands of farmers having irrigated land, Mr. B.V. Nimbkar thought of developing more productive sheep and goat breeds for the underprivileged. Mr. Nimbkar, as the chairman of the Sheep and Goat Commission of the Government of Maharashtra in 1989, found that there were hardly any practical initiatives to improve the productivity of these small ruminants and therefore decided to start implementing the Commission's important recommendations. Animal Husbandry Research at NARI, thus started in 1990. Its goal was genetic improvement of local sheep and goats by establishing breeding programs and dissemination of improved genotypes in the form of live animals, semen and training to rearers.

I joined the AHD after completing my MSc in Animal Breeding and Genetics in 1990. Later, I took over as the Director of the Division in 1998. Dr. Pradip Ghalsasi joined the AHD in 1990 as the Veterinary Officer and is now the Associate Director of the Division.

The best known achievement of the AHD is the development of the 60% more productive NARI Suwarna breed of sheep. It was done by introducing the FecB or Booroola gene for twinning, from the small Garole sheep of Sundarban, West Bengal into the local Lonand Deccani sheep. Nine hundred NARI Suwarna ewes and 550 rams have been disseminated since 2010 to sheep owners' flocks in Maharashtra, Karnataka and five other States. They are proving to be extremely profitable for sheep owners and the good genes will permanently remain in these flocks. This project was selected as one of only five livestock projects selected from the world, for inclusion in the 2012 FAO publication 'Biotechnologies at work for smallholders'. Further genetic improvement in the breed continues through selection in the 400-ewe nucleus flock and introduction of the Israeli dairy Awassi and fast-growing indigenous Madgyal breeds into the mix.

For genetic improvement of local goats through crossbreeding, the AHD imported through the more broad-based sister institute, the Maharashtra Goat and Sheep Research and Development Institute, the world's best meat goat breed, the South African Boer goat. Financial assistance for this was obtained from the Australian High Commission in New Delhi. The Boer has proved to be a fast growing and hardy breed for Indian climates and has earned good money for smallholder goat owners as well as entrepreneurs owning stall-fed goat farms. The AHD has also been instrumental in importing and disseminating the tropical dairy goat breed Damascus from Syria.

An initiative of the Division for the improvement of an indigenous goat breed since 2009 has been performance recording and selection among about 5,000 Osmanabadi goats in villages in four districts of Maharashtra under the ICAR-All India Coordinated Research Project for Goat Improvement. Twin or triplet-born buck kids of goats with high milk yields are purchased, reared and sent back to villages for breeding, thus leading to genetic improvement of the breed. These bucks' semen is also frozen and distributed. The Division has established appropriate goat artificial insemination technology for wider use of superior, selected bucks.

A modern buck semen freezing laboratory was set up in 2012 with a grant from the Government of India. Selected Osmanabadi, Boer and Damascus buck semen is made available at low rates and technicians using the semen have reported conception rates of 50 to 60%. This is the only laboratory in India where buck semen straws are produced and distributed in large quantities. More than 70,000 straws have been produced so far and used in 22 districts of Maharashtra and 9 states of India as well as in Nepal. The AHD has so far trained more than 1,000 technicians, veterinarians, paravets and government veterinary officers in goat artificial insemination. More than 10 women workers deputed by the Mann Deshi Foundation and trained at the AHD are now earning a livelihood carrying out goat AI at farmers' houses. The AHD also gives training in advanced management practices in sheep and goats and trainees from many States of India and other countries such as Afghanistan, Nepal, Saudi Arabia and USA have attended these programs.

In future, the AHD plans to strengthen its position as a centre of excellence in applied research and extension in sheep and goats and ensure that more and more rearers benefit from its nationally and internationally recognized work. The Division is grateful to all its past and present staff members and farm workers for their sincere and dedicated hard work.

The story of NARI

1960s



Shri B.V. Nimbkar started NARI's activities in 1964 as the research division of the seed company Nimbkar Seeds.

NARI was registered as a trust and a society in March 1968. It functioned till 1978 in a building gifted by Smt. Jai Nimbkar next to her house in Phaltan town.



The first members of the governing council were Shri. B. V. Nimbkar (President), Shri. V. Nimbkar, Shri. P. D. Pandit, Smt. J. Nimbkar, Dr. A. D. Karve (Director), Shri. S. B. Patel and Shri. D. G. Shembekar.

The major focus was on agronomic research and breeding in cotton; cereals like maize, wheat, sorghum and pearl millet; oilseeds like safflower, castor, soyabean and sesamum; vegetables like okra and new crops like kenaf, sugarbeet and sweet sorghum.



Research was carried out on land made available by the Phaltan Sugar Works Ltd. at Hol near Sakharwadi, by Shri. B. V. Nimbkar at Rajale and by Shri. V. Nimbkar at Wadjal. Initial financial assistance was provided by Nimbkar Seeds.

1970s

A donation made by Shri B. V. Nimbkar in Jan 1971 in the memory of his grandfather, Mr. J. W. Lundy enabled NARI to set up a 14 hectare (ha) research farm at Rajale.



All India Coordinated Research Project on Sugarbeet was approved by the Indian Council of Agricultural Research (ICAR), Govt. of India (GoI). Though sugarbeet was successfully cultivated in the Nira valley on 250 ha the research was discontinued in 1980 due to the difficulties the sugar factories had in processing it.

The Indian Cotton Mills' Federation gave a grant for cotton research. Two sub-stations, one on 8 ha land at Dhamangaon near Amravati for dryland cotton research as well as one at Guntur in Andhra Pradesh were set up.



United States Department of Agriculture (USDA) funded a five-year project to identify insect and disease-resistant safflower varieties and ICAR funded a scheme for improving safflower grown under limited irrigation.

In the 1970s, the cotton variety Nimbkar-1 and the grain sorghum hybrid Vasant-1 developed by NARI covered about 28000 ha in Maharashtra and 20000 ha in Maharashtra /Karnataka respectively.





NARI research staff, 1968

Dr. A. D. Karve in sorghum fields, 1968



Shri A. Zirpe in cotton fields, 1968

Dr. H. H. Muendel in safflower fields, 1968



Shri S. B. Chavan (former CM of Maharashtra) with NARI staff, 1972

NARI main building under construction, 1979





In addition to sponsored projects, small donations of Rs. 1 to 1000 from well-wishers and Shri. B. V. Nimbkar's personal funds supported the research activities.

The custom tractor unit set up with financial aid from CARE and CUSO in 1970 functioned for five years and was at least partly responsible for the enormous growth in farm mechanization in Phaltan taluka.



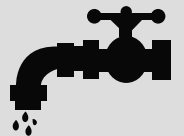
Jointly with M/s Walchandnagar Industries, NARI conducted a seminar on 'Future of Sugarbeet in Maharashtra' in January 1974.

A 10 ha farm to which 10 more hectares were eventually added was purchased near Phaltan in 1976 to extend the ongoing agricultural research.



A research project was granted by the International Foundation for Science, Sweden for a period of three years to study ways and means of increasing productivity under lift irrigation schemes in the Nira valley.

A loan of Rs. 2 lakhs from the Industrial Credit and Investment Corporation of India Ltd. (ICICI) enabled the institute to establish a lift irrigation scheme on the Nira right bank canal in 1977 to make it possible to irrigate 10 ha land of NARI along with 50 ha of surrounding farmers. This was the start of greening of this area near Phaltan.



1980s



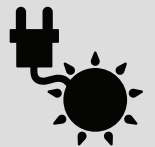
NARI shifted to its present location at Tambmal in early 1980 where approximately 20 ha of land was leased/purchased for agricultural research. The main building of NARI was inaugurated in 1980 by Dr. M. S. Swaminathan, father of Indian Green Revolution.

All India Coordinated Center on irrigated safflower was sanctioned by ICAR at NARI. Dr. P. F. Knowles, world's pioneer safflower researcher, visited NARI.



Having completed their doctorates from U.S.A., Dr. Nandini Nimbkar and Dr. Anil K. Rajvanshi joined NARI in September 1981 as Directors.

NARI started work in renewable energy. Good amount of funding started flowing from various agencies of Govt. of India/Maharashtra and also from USDA (under PL-480) for renewable energy, tissue culture, growth regulators and sweet sorghum research.



The cornerstone of the building for workshop, energy research, warehouses etc. was laid in 1982 by Shri. Maheshwar Dayal, Secretary, Dept. of Science and Tech. (DST), Gol.

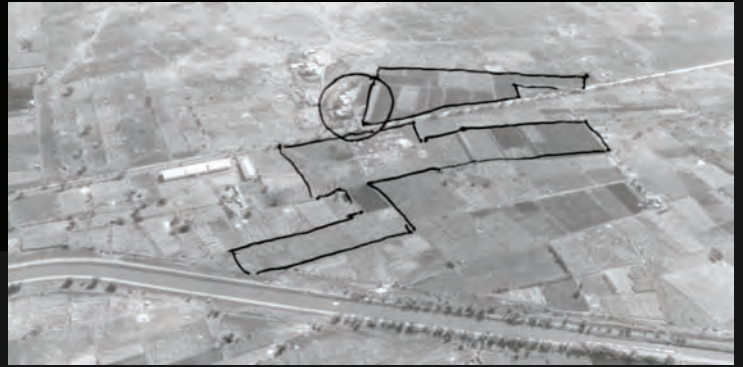
In 1984, Dept. of Non Conventional Energy Sources (DNES), Gol started the national project on gasification. NARI was chosen as one of the five centres in India to work on it.





Inauguration of the NARI building by Dr. M. S. Swaminathan, 1980

Aerial view of NARI farms captured from a plane, 1981



Shri Maheshwar Dayal laying the foundation stone of the Energy Lab, 1982

NARI staff with Dr. P.F. Knowles, 1982



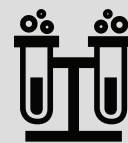
Inauguration of sweet sorghum crusher by Shri P. D. Gune of Kirloskar Brothers, 1982

Advisory Council, 1984

l-r (front row) - Dr. C. D. Basarkar, Dr. G. R. Shah (CFTRI), Dr. C.R. Bhatia (BARC), Dr. B. D. Tilak (former director, NCL), Shri Annasaheb Shinde (former deputy union minister of agriculture), Dr. A.B. Joshi (former dgd, ICAR), Dr. A. K. Rajvanshi, Shri A. Bhunjje, Shri A. Zirpe l-r (back row) - Shri B. V. Nimbkar, Dr. A. D. Karve, Dr. N. Nimbkar, Shri B.Gandhi



NARI became the first private agricultural research institute in India to do agro-chemical (pesticides, growth regulators etc.) testing for many major companies.



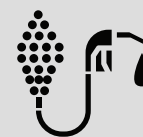
'Noorie' kerosene lantern was developed under the project which was funded by Advisory Board on Energy (ABE), Gol. This was the first such development in kerosene lighting since early 1920s. Mr. B. B. Vohra, Chairman, ABE visited NARI to see this work.

Research on sweet sorghum gathered momentum. Sweet sorghum hybrid 'Madhura' was developed.



Hindustan Lever Ltd. purchased sunflower hybrid 'NSH-7' developed at NARI.

World's first solar-powered ethanol distillation plant was set up at NARI in 1987 (funded by DNES). It produced 50 l/day of 95% (v/v) ethanol from 'Madhura' hybrid.



High yielding safflower variety NIRA was released in 1987 by Dr. M. V. Rao, Special Deputy Director General, ICAR.

Bombay Oil Industries Ltd. (Later Marico Ltd.) funded a 5-year project on developing improved hybrids and varieties of safflower.



1990s



Dr. Nandini Nimbkar became the second President of NARI.

Shri B.V. Nimbkar started work on small ruminants like sheep and goats by setting up the animal husbandry division (AHD) of NARI in 1990.



NARI was the principal author of the national policy on biomass-based power plants implemented by the Ministry of New and Renewable Energy (MNRE), Gol.

In a first such grant given to an NGO in India, Australian Centre for International Agricultural Research (ACIAR) funded a collaborative project, 'Prolific Worm-Resistant Sheep for Maharashtra' between NARI, Univ. of New England (UNE), Australia and National Chemical Laboratory (NCL), Gol.



NARI was awarded a major grant from Rockefeller Foundation (RF) for setting up a 500 kW (thermal) gasifier running on loose sugarcane leaves. This was the first such grant given by RF to any NGO in India. Development of this patented gasifier (the first in the world) spawned many such activities in India and other parts of the world.



Shri B. B. Vohra with NARI staff, 1985

World's first solar powered ethanol distillation plant set up at NARI, 1987



Release of NIRA (safflower variety) by Dr. M. V. Rao, 1987

'Noorie' lantern developed at NARI, 1988



Shri B. V. Nimbkar's visit to Israel to purchase Dairy Awassi sheep for AHD, 1990

World's first loose biomass gasifier set up at NARI, 1995



NARI was the only institute in India to be made a member of the Sweet Sorghum European Network (SSEN) funded by European Economic Community (EEC). This allowed testing of sweet sorghum 'Madhura' for ethanol production in France, Italy, Thailand and Zimbabwe. Dr. David Hall, Co-Chairman, SSEN visited NARI in 1994.



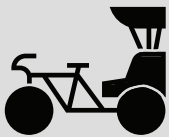
End-to-end technology for syrup and jaggery production from sweet sorghum was developed for the first time in India by NARI.

NARI's work on developing scientific methodology of jaggery-making helped set up research priorities of the All India Coordinated project on jaggery by ICAR.



NARI's land admeasuring 1898 sq.m. in Phaltan town was given on a 99-year lease to the Pragat Shikshan Sanstha to set up a school named Kamala Nimbkar Balbhavan.

In 1995, NARI became the first rural institute in India to get an email connection. It was channeled through the Inter-Univ. Centre for Astronomy and Astrophysics (IUCAA), Pune



Work on electric cycle rickshaws started in 1995. This work - the first in the world was featured as a main story in the Massachusetts Institute of Tech. (MIT) magazine in U.S.

NARI staff won two major awards in this decade. Dr. Nandini Nimbkar recieved the Alumna of Distinction Award from Univ. of Florida (1997) and Dr. Anil K. Rajvanshi was inducted in U. S. based Solar Hall of Fame (1998).



In 1998, NARI got an internet connection which was the first in Phaltan.

2000s

Fully electric three-wheeler was developed (funded by MNES) and christened Elecsha. It was the forerunner of most of the electric rickshaws presently in vogue in the country.



NARI loaned five motor-assisted pedal rickshaws to Pune University. These rickshaws ferried the passengers inside the campus for a year.

R&D on use of ethanol for cooking and lighting started. NARI developed world's first low concentration ethanol stove (funded by MNES). This work inspired similar efforts in many countries in Africa and Latin America.



A major crisis was averted when NARI farm lands at Tambmal were saved from acquisition by the Govt. of Maharashtra for rehabilitation of dam oustees by offering them alternative land which belonged to Mr. B. V. Nimbkar and Dr. Nandini Nimbkar.



Field of sweet sorghum hybrid 'Madhura' at NARI

Sweet sorghum syrup preparation using gasifier, 1996



Sweet sorghum syrup 'Madhura'

Kamala Nimbkar Balbhavan school



World's first fully electric three wheeler 'Elecsha', 2000

Inauguration of MAPRA at Pune University by Shri Madhur Bajaj, 2002





NARI developed world's first solar powered safflower petal collector.

In 2005, Dr. Chanda Nimbkar resumed her duties as the Director of AHD after completing her doctorate from UNE. Dr. Pradeep Ghalsasi was appointed as Associate Director of AHD.



In 2006, the new building to house the 'Livestock Research and Development Centre' of the AHD was inaugurated by the Union minister of agriculture, Shri. Sharad Pawar.

Due to its pioneering work, NARI was made a centre under the All India Coordinated Sorghum Improvement Project of ICAR to carry out research on sweet sorghum.



NARI became the sub-centre for Osmanabadi goat of the ICAR's All India Coordinated Research Project on goat improvement.

First non-spiny safflower hybrid NARI-NH-1 was released in India. Safflower petal herbal tea was popularized by NARI. The spiny safflower hybrid NARI-H-15 and varieties NARI-6 and NARI-38 were also released for cultivation in India.



The Helen Newton Turner memorial international workshop on 'Using the FecB gene in sheep breeding programme' funded by ACIAR, was organized jointly by NARI (AHD), NCL and UNE in November 2008.

Lanstove (lantern and stove combined) running on low ethanol conc. was developed (funded by DST). NARI received the Globe Sustainability Research Award for the work.



NARI and its staff won eight major national and international awards during this decade. The details are given in the accolades section.

Nagarjuna Fertilizers and Chemicals Ltd., Hyderabad and NARI signed a five year contract to breed sweet sorghum as an energy crop. They also purchased NARI's alcohol lantern and stove patents.



2010s

Bajaj Centre for Sustainable Development (BCSD) was inaugurated in 2011 by Shri. Madhur Bajaj, Vice Chairman, Bajaj Auto Ltd. This 1225 sq.m. facility is a green building with a lot of energy-efficient and passive cooling features.



NARI sold the technology of low concentration ethanol stove to a company in Indonesia. They claim that they are manufacturing the stoves on a large scale in China.



Battery powered safflower petal collector developed by NARI in use, 2005

Livestock research and development centre of AHD in Wadjal



NARI Suwarna sheep developed by AHD with her twin lambs



Herbal tea from safflower petals

Bajaj Centre for Sustainable Development, NARI



Inauguration of Bajaj Centre for Sustainable Development by Shri Madhur Bajaj at NARI, 2011

NARI developed the kerosene and diesel-powered lantern. It was tested in twenty-five unelectrified huts and elicited excellent response. The experiment was extensively covered by national and international press.



Two varieties and one hybrid of safflower were released for planting on all India basis. The high oil-yielding safflower variety NARI-57 was licensed by Marico Ltd.

The annual group meeting of safflower was successfully organized at BCSD, NARI in August 2013. About 100 scientists from all over India attended the two day meeting.



A state of the art Artificial Insemination (AI) centre for sheep and goats funded by the Ministry of Agriculture, Govt was established at the AHD campus in Wadjal.

NARI developed a low cost Solar Water Purifier. It was called as one of the ten life changing Indian technologies by a U.S.- based organization, Engineering for Change.



Two major awards were received in this decade. Dr. Anil K. Rajvanshi won the Distinguished Alumnus Award from Univ. of Florida (2014). He was the first Indian to win this award. Also Shri B. V. Nimbkar received the Jannalal Bajaj Award (2016).

A new project entitled "Developing high oleic safflower genotypes through functional genomics" funded by ICAR under National Agricultural Science Fund (NASF) commenced in 2015.



A dedicated high speed Jio 4G internet connection was installed on NARI campus.

Bajaj Fellowships for rural technology development were given to NARI by Bajaj Group as a part of their CSR activities.



Dr. Chanda Nimbkar became a member of the UK Research & Innovation International Development Peer Review College

NARI started the celebration of its golden jubilee year by organizing an inaugural function on 17th March 2018. Padmavibhushan Dr. Raghunath Mashelkar graced the occasion as the chief guest of the event.

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Kerosene Lanstove developed at NARI, 2012

Solar Water Purifier developed at NARI, 2012



Shri T. B. Jayachandra, Minister for Law, Human rights and Animal Husbandry, Karnataka visits NARI, 2013

Inauguration of Frozen Semen Laboratory at AHD, NARI by Mr. Rajesh Aggarwal, Principal Secretary (IT), Govt. of Maharashtra, 2014



NARI Staff at flag hoisting ceremony on Republic day, 2018

Chief Guest Dr. R. A. Mashelkar and other dignitaries at the Golden Jubilee Celebration Function, 2018



Accolades to NARI

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Dr. A.D.Karve received J.G.Kane Memorial Award by Oil Technologists' Association of India for work on safflower.

Dr. Anil K. Rajvanshi was appointed as the member of the Expert Panel on Rural Domestic Energy, ABE, Gol for a period of five years. This was the highest energy policy body in the country set up to advise the Prime Minister on energy matters.

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Dr. Anil K. Rajvanshi was appointed as the member of the Working Group on Rural Cooking Energy Needs, Planning Commission, Gol for a period of one year. The mandate of this group was to prepare the eighth 5-year plan for the nation.



Dr. Nandini Nimbkar was honoured as one of the 47 most distinguished alumnae to graduate from University of Florida. A plaque with their names has been kept at the Plaza of the Americas on the University of Florida campus in Gainesville.

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Dr. Anil K. Rajvanshi was inducted into the U.S.-based Solar Hall of Fame. He is the second Indian to be so inducted.



Dr. Anil K. Rajvanshi was given the Jamnalal Bajaj Award for application of Science and Technology for rural development by Dr. Manmohan Singh.

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Dr. Chanda Nimbkar received the John Allwright fellowship from the Australian Centre for International Agricultural Research from 2002 to 2005 to do a Ph.D. in animal breeding and genetics at the University of New England, Armidale, Australia.

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NARI was given the FICCI Platinum Jubilee Award in recognition of its initiative in rural development. Dr. Anil K. Rajvanshi received it on behalf of NARI from the Prime Minister of India Shri. Atal Bihari Vajpayee.



Dr. Vrijendra Singh was given the Hexamar Agricultural Research and Development Foundation (HARDF) award by the Indian Society of Oilseeds Research for his valuable contributions in safflower breeding, especially the varietal improvement.

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Dr. Anil K. Rajvanshi was appointed as the member of the Core Advisory Group for Rural Technologies, Office of the Principal Scientific Adviser to Gol for a period of three years.

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NARI's work on MAPRA was given the Austria-based Energy Globe Award in AIR category.

Dr. Chanda Nimbkar was appointed as a part-time member of the National Commission on Farmers under the Chairmanship of Prof. M.S. Swaminathan by the Department of Agriculture and Cooperation, Ministry of Agriculture, Gol.

Dr. Anil K. Rajvanshi was appointed as a member of the State Advisory Committee of the Maharashtra Electricity Regulatory Commission (MERC) for a period of ten years.



Padma Shri was conferred upon Shri. B. V. Nimbkar by the Government of India.

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NARI was given the Vasantrya Naik Award for its research and development in agriculture and animal husbandry. The award was given by Shri. Sharad Pawar, the Union Minister of Agriculture.

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Dr. Pradip Ghalsasi was honoured by the Bombay Veterinary College Alumni Association for his scientific and technical work at NARI in sheep and goat reproduction and management.

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NARI along with NCL received the CSIR award for Science and Technology Innovations for Rural Development. The award was given for the “use of the FecB gene in Deccani breed of sheep, to increase lamb production and thereby the incomes of shepherds”. It was received by Dr. Chanda Nimbkar at the hands of Dr. Manmohan Singh.



Dr. Chanda Nimbkar was nominated as a member of the governing body of ICAR Society for a period of three years as a representative of rural interests.

Dr. Pradip Ghalsasi received the 'Best Veterinarian' award of the Jyeshtha Pashuvaidya Pratishthan (Senior Veterinarians' Foundation), Pune.

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NARI was given the prestigious Globe Sustainability Research Award for its work on ethanol lanstove. The award was received by Dr. Anil K. Rajvanshi at the hands of H.R.H. Crown Princess Victoria of Sweden in Stockholm. The other awardees were Tesla Motors and Novo Nordisk.



Dr. Anil K. Rajvanshi was invited to deliver the sixth Dr. B. D. Tilak memorial lecture at the National Chemical Laboratory, Pune.

The case study “development and dissemination of the more productive twinning NARI Suwarna strain of Deccani sheep” was one of only three such studies selected by FAO for presentation in the session on the “Successful application of biotechnologies in the livestock sector in developing countries” in the international conference on agricultural biotechnologies in developing countries held in Mexico.

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Dr. Chanda Nimbkar received the 'Illustrious Alumnus Award' from the Ness Wadia College of Commerce, Pune where she completed her Bachelor of Commerce degree.

Dr. Chanda Nimbkar and Dr. Pradip Ghalsasi were appointed as National Consultants in small ruminant breed conservation and improvement by the South Asia Pro-Poor Livestock Policy Program, a joint initiative of the FAO and the National Dairy Development Board.

Shri B. V. Nimbkar was honoured in the opening ceremony of the 47th All India Marathi Vidnyan Parishad Adhiveshan for his work in the field of science for the benefit of farmers.

Dr. Chanda Nimbkar was invited to deliver the Sixth Dr. C. M. Singh Memorial lecture at the Indian Veterinary Research Institute, Bareilly.

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Dr. Anil K. Rajvanshi was given the Distinguished Alumnus Award of the University of Florida (UF), U.S.A. This is the highest award given by the UF to its alumni and Dr. Rajvanshi became the first Indian to receive it.



Dr. Chanda Nimbkar received a 'Vocational Excellence Award' from the Rotary Club of Pune.

Dr. Chanda Nimbkar was appointed to the board of trustees of International Livestock Research Institute (ILRI), Nairobi, Kenya. Currently, she is the only Indian member on the board.

Dr. Anil K. Rajvanshi delivered the Second Gemini Ganesan Endowment Memorial Lecture at Madras Christian College, Chennai.

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Shri. B. V. Nimbkar was given the Jamnalal Bajaj Award for application of Science and Technology for rural development.

Dr. Anil K. Rajvanshi was selected as one of the notable alumni of IIT Kanpur.

The solar water purifier technology developed at NARI was chosen by the Engineering for Change, a U.S.-based organization (founded by ASME, IEEE and Engineers without borders) as one of the 10 life-changing inventions from India and designated as an example of frugal innovation.

Dr. Chanda Nimbkar was appointed by the Academic Council of the deemed university ICAR-National Dairy Research Institute (NDRI) as an Adjunct Faculty Member.

Dr. Chanda Nimbkar was appointed as a member of the International Advisory Committee of the Centre for Tropical Livestock Genetics and Health, a joint venture of the Roslin Institute of the University of Edinburgh, Scotland's Rural College and ILRI in Nairobi.

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The Impact of NARI



AGRICULTURE

48,000+
hectares

of cotton hybrid Nimbkar-1/grain sorghum variety Vasant-1 planted in the 1970s

35,000+
kg seeds

of safflower/sweet sorghum supplied all over the world in the past 24 years

5,000+

kg syrup

produced from sweet sorghum supplied nationally in the past 2 decades

800+

kg pads

of Opuntia & Nopalea cacti supplied nationally since 2010



RENEWABLE ENERGY

500,000+
ethanol stoves

disseminated across the world whose designs have been inspired by NARI's original work on low ethanol concentration stoves & lanstoves in early 2000s

100,000+
e-rickshaws

running on batteries all across the country whose designs have been inspired by NARI's original work on electric rickshaws in late 1990s

1,000

megawatt

total capacity of biomass power plants set up across the country by IREDA based upon NARI's work on energy self-sufficient talukas



ANIMAL HUSBANDRY

200,000+
doses

of buck semen supplied locally & all over the country in the past 24 years

20,000+

goats

vaccinated/parasite-protected/dewormed in the last decade

10,000+

shepherds

benefitted by the efforts of the Animal Husbandry Division of NARI since 1994

2,000+

sheep and goats

(NARI Suwarna, Boer/Damascus cross) supplied nationally in the past 24 years



NARI's Pioneering Work

F

Private agricultural research institute in India - functioning since 1968

To introduce sweet sorghum crop in India - 1970s

In the world to set up a solar powered ethanol distillation plant - 1987

I

In the world to use a solar still for producing water from soil for tree-planting in deserts - 1988

To introduce and popularize sweet sorghum syrup in India - 1990s

To market safflower petal herbal tea in India - 1991

R

And only NGO in India to run a sheep breeding program for 24 years - since 1994

In Asia to set up a loose leafy biomass gasification plant - 1997

In the world to develop an electric cycle rickshaw - 2000

S

In the world to develop a non-spiny hybrid of safflower - 2002

In the world to develop a solar powered safflower petal collector - 2004

In the world to develop a stove running on low concentration ethanol - 2006

In the world to develop an ethanol lanstove (lantern cum stove) - 2006

T

To develop technology for cervical AI of goats under field conditions in India - 2010

In India to set up a modern goat buck semen freezing laboratory - 2014



Other Contributions of NARI

- Was the principal author of the national policy on Taluka Energy Self-Sufficiency operated by MNRE, Govt. of India in the late 1990s
- Gave the design of the solar soil water still to National Dairy Development Board in Anand for producing potable water in Kutch area, Gujarat, India
- Conceptualized a sustainable model for rural restaurants upon which many subsidised food programmes like Amma Unavagam in India operate
- Donated its building to Pragat Shikshan Sanstha to set up a school, Kamala Nimbkar Balbhavan in Phaltan, Maharashtra, India

NARI and its staff have served in the following committees

- (1983-88) Expert panel on Rural Domestic Energy, Advisory Board on Energy, Govt. of India
- (1990-96) Sub group on Energy and Environment, Planning Com., Govt. of Maharashtra
- (1995-05) Senate, Shivaji University, Kolhapur
- (2000-14) State Advisory Committee to MERC, Govt. of Maharashtra
- (2001-02) Sub Group on Resource Mobilization for NRSE, Planning Com., Govt. of India
- (2003-04) Sub Group on Rural Technology Transfer, Planning Com., Govt. of India
- (2003-05) Core Advisory Group for Rural Technologies, PSA to Govt. of India
- (2004-06) National Commission on Farmers, Ministry of Agriculture, Govt. of India
- (2015-18) Board of Trustees, International Livestock Research Institute, Nairobi, Kenya



Collaborators and Funding Agencies

Industrial

Hindustan Lever Ltd. purchased sunflower hybrid NSH-7 in the 1980s

Nagarjuna Fertilizers and Chemicals Ltd. & NARI signed a 5 year contract to breed sweet sorghum for alcohol in 2000s & NFCL also bought NARI's alcohol stove & lantern patents

Bombay Oil Industries (Marico Ltd.) funded a project on improved safflower hybrids/varieties & also licensed the variety NARI-57 in 2010s

Funding was also given by the following

- Bajaj Group • Kirloskar Group • ICICI Ltd.
- Cummins India Ltd. • Indian Cotton Mills Federation • Nimbkar Seeds Pvt. Ltd.

Institutional

International

- Australia** • Univ. of New England • CSIRO
- Univ. of Melbourne • ACIAR
- U.S.A.** • Rockefeller Foundation • USDA
- Texas A&M Univ. • E&Co.
- Europe** • International Foundation for Science
- Danida Forest Seed Centre • FAO
- Univ. of Oxford • EEC

National

(bodies under Govt. of India/Maharashtra)












- DST • DBT • CSIR • ICAR • MNRE
- MACOST • Advisory Board on Energy • Dept. of Atomic Energy

← NARI's Reach →

 WEBSITE 20,000,000+ views on the institute website since its inception	 MEDIA 10,000,000+ readership on the articles published nationally & internationally	 WORKSHOPS 36,000+ attendees in the workshops & visits conducted at the institute	 BOOKLETS 35,000+ copies of manuals distributed for training in sheep/goat management	 TALKS 10,000+ attendees to the talks delivered by the institute staff outside the campus
 CITATIONS 1,600+ citations in refereed journals	 ARTICLES 700+ publications in refereed journals, magazines & newspapers	 TRAINING 100+ courses conducted nationally & internationally	 INTERNSHIPS 70+ interns from all over India & 9 countries around the world	 PATENTS 7 patents filed & granted nationally

Awards

NARI and its staff have been honoured by the following major awards

 Alumnae of Distinction, University of Florida, U.S.A.(1997)	 Solar Hall of Fame, U.S.A. (1998)	 Jamnalal Bajaj Award, India (2001,2016)	 FICCI Platinum Jubilee Award, India (2002)
 HARDF Award, India (2003)	 Energy Globe Award, U.S.A. (2004)	 Padma Shri, Govt. of India (2006)	
 Vasantrao Naik Agriculture Award, India (2006)	 CSIR Award for Rural Development, India (2007)	 Globe Sustainability Research Award, Sweden (2009)	 Distinguished Alumnus Award, University of Florida, U.S.A. (2014)

NARI has successfully completed more than **90 projects** in the past **50 years** with a total funding of **Rs. 180 million** (450 million at current market price). **Every rupee** spent on NARI's projects has generated a revenue of approximately **150 rupees**.

And the legacy continues...

NARI Trustees

Smt. Jai Nimbkar, Author, Phaltan

Dr. Nandini Nimbkar, Ph.D., Permanent President, NARI

Dr. Chanda Nimbkar, Ph.D., Director, Animal Husbandry Division, NARI

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Mr. B. V. Nimbkar, Founder and Emeritus President, NARI (Special Invitee)

The work done by NARI in the past 50 years would not have been possible without the contributions from all funding agencies/individual donors and the combined effort of past and present staff of NARI. This is gratefully acknowledged.

All the textures, illustrations and logos used in this souvenir have been taken from www.textures4photoshop.com, www.flaticon.com, en.silhouette-ac.com, www.vecteezy.com and www.seeklogo.com



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