

Biofertilizers and Biopesticides for Enhancing Agricultural Production

A Success Story



Progress Through Science

Trust for Advancement of Agricultural Sciences (TAAS)

Avenue II, Indian Agricultural Research Institute,
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Foreword

With more than 60 per cent of land under agriculture in India, this sector is crucial both for millions of farmers and our national economy. During the past six decades, agricultural production, productivity and farmers profitability did steadily increased due to enhanced use of advanced technologies - high yielding, disease resistant, input responsive and nutritionally rich varieties and improved agronomic practices for diverse and varied production systems. As a result, the food grain production in India has increased by almost six fold in the past six decades. This became possible due to increased use of chemical fertilizers and biocides. Today, India is the second largest consumer and importer of mineral fertilizers. Currently, country provides a subsidy of around INR 88,000 crores annually on fertilizers. Continued use of high doses of fertilizers and pesticides is leading to an obvious problem of unhealthy food production along with soil health degradation, environmental and groundwater pollution, eutrophication and making agriculture a cause of climate change due to enhanced greenhouse gas emission. Despite these, sustainable use of fertilizers and biocides are vitally important to feed our everincreasing population which is expected to rise to 1.51 billion by 2030.

The covid-19 pandemic has further highlighted the importance of nutritious and healthy food. In the changing climatic and covid-19 pandemic scenario, it is now increasingly realized that there is an urgent need for reorienting existing farming practices towards sustainable agricultural production that is based on integrated nutrient management (INM) using more of soil friendly inputs like biofertilizers and biopesticides.



However, this transformation process has to be gradual and systematic efforts need to be made to address the core issues like productivity, profitability and sustainability. This obviously necessitates increased use of biofertilisers and biopesticides using an integrated nutrient management approach.

We are aware that the UN has proclaimed 2020 as an International Year of Plant Health. As such, the Criyagen Agri. and Biotech Pvt. Ltd. is offering one-stop solution through utilization of biofertilizers and biopesticides for integrated nutrient and pest management. It envisions focusing on integration of three segments of crop nutrition, animal nutrition and human nutrition to evolve a holistic approach that can sustain long-term growth in agriculture. The biofertilizers have a two-pronged strategy of enriching the soil to ensure a long-term evolution of natural fermentation of micro-organisms needed to sustain our soil fertility and maintaining productivity with high nutritive value. The biopesticides act as supplements or tonics that can ensure sustainable crop yields with enhanced nutritional value. Large number of low cost eco-friendly products have been produced which are benefitting farmers in enhancing crop productivity and production along with saving soil and plant health. This publication amply demonstrates these benefits.

I appreciate quite commendable efforts by Dr. Basavaraj Girennavar, a young entrepreneur, in collaborating with TAAS to bring out this important publication entitled "*Biofertilizers and Biopesticides for Enhancing Agricultural Production: A Success Story*". I also thank Dr. Bhag Mal, Senior Consultant and Dr. S.S. Singh, Consultant, TAAS for their help in editing the manuscript. I am sure this publication will be of immense use to policymakers, researchers, young entrepreneurs and Indian farmers.



Raj Paroda

Former Secretary, DARE & DG, ICAR and
Chairman, TAAS



Acronyms and Abbreviations

ABLE	Association of Biotechnology Led Enterprises
AMY	Agriculture, Meditation and Yoga
BPO	Business Process Outsourcing
CGPA	Cumulative Grade Point Average
DG	Director General
DNP	Dynamic Nutrient Provider
DoAC	Department of Agriculture and Cooperation
DSIR	Department of Scientific and Industrial Research
ERP	Enterprise Resource Planning
GKVK	Gandhi Krishi Vigyan Kendra
GRE	Graduate Record Examinations
IARI	Indian Agricultural Research Institute
IAS	Indian Administrative Service
ICAR	Indian Council of Agricultural Research
ICT	Information and Communications Technology
INM	Integrated Nutrient Management
INR	Indian Rupees
IoT	Internet of Things

IPM	Integrated Pest Management
JRF	Junior Research Fellowship
KVK	Krishi Vigyan Kendra
LLC	Limited Liability Company
MoU	Memorandum of Understanding
PUC	Pre-University Course
R&D	Research and Development
SSLC	Secondary School Leaving Certificate
TiE	The Indus Entrepreneurs
TOEFL	Test of English as a Foreign Language
UAS	University of Agricultural Sciences
USA	United States of America

Background «



The genesis of Criyagen Agri. and Biotech Pvt. Ltd. dates back to the agrarian ancestry and rural upbringing of the start-up organization's Chairman & Managing Director, Dr. Basavaraj Girennavar Ph. D. from Texas A&M University (USA). Born in a rural ethos with agriculture and relative activities being the major source of income and livelihood in an environment very often not conducive for agricultural best practices, he plunged into the business of finding solutions to problems besetting the farming community. An atmosphere of perennial drought, poor cropping patterns and overwhelming dependence on chemical fertilizers were hurting farmers very badly jeopardizing the upliftment of their prospects of economic prosperity. The deep roots in the agrarian culture pushed him to pursue basic and higher levels of education in agriculture and allied activities with the intention of seeking remedies for ills that had been plaguing the farming community, which was steeped in traditional methods borne out of generational practices rather than built on the foundation of scientific temper or practical realities of sustained ecological evolution.



Initial Establishment



The strong grooming in an agricultural background was the backbone of support for Dr. Basavaraj Girennavar to venture into the domain of bio-agricultural manufacturing with a view to shaping a bright future for the farming community based on theoretical knowledge acquired from his academic pursuits as well as practical realities that he encountered from a very young age. With this idea of resolving farming issues always in the back of his mind from a young age, Dr. Girennavar became a first generation, high impact entrepreneur with scientific acumen and enterprising ideas. He has more than a decade of experience in the industry and research both in India and the USA. His passion is to bring sustainability to the field of food production while securing the fragile ecology through scientific and innovative interventions. In fact, the seeds for Criyagen in India were sown in the US in 2007 when he launched Criyagen LLC at Texas A&M University soon after completion of his Ph. D. However, unable to sustain that venture there and also with a strong desire to return home, he wound up the USA venture in 2008 and headed to India. He took this decision after a lot of thinking and consideration in the light of the stiff opposition that he faced from every quarter including family and (friends and family). Fortunately, his mentors and professors always backed him to return to his home land to utilize his knowledge for the betterment of the farming community.



Thus, Criyagen has transcended the process of conception in the US, evolution in Dharwad, expansion in Doddaballapura and innovation (AgriApp) in Gandhi Krishi Vigyan Kendra (GKVK), Bengaluru to become a socially responsible organization with a view to providing end-to-end solutions to farmers and the farming community. The organization is working towards creating a holistic life cycle process for the rejuvenation of the soil, sustaining productivity and profitability as well as ensuring the balance of food security of the country. Until 1980s, farmers across the country used to follow the traditional or natural practices of farming very often sowing and reaping crops depending on the rainfall pattern to grow nutritious crops, albeit at lesser quantities and lower profitability. However with the need to feed a burgeoning population becoming a priority in 1990s, the farming community at large was drawn towards utilizing chemical fertilizers without realizing that they would only provide short-term gains. The unprecedented dependence on chemical fertilizers past the 1990s had an adverse impact in the long run, further deepening the crisis of the farming community - either due to drought or floods.

The paradigm shift in the agricultural practices using chemical fertilizers was a boon to the farming community, but their joy was short-lived as their soil gradually started losing its natural potential and farmers again began to stare at the prospects of infertility with the added vagaries of the weather caused by climate change, which was turning into a massive global phenomenon. Of late, there has been a new school of thought towards reorienting and rejuvenating farming practices so that the yield remains the top agenda, while the soil status is also maintained. However, this transformation process has to be gradual and systemic efforts need to be



made wherein the core issues like productivity, profitability and sustainability are adequately addressed. Criyagen is now focusing on offering such a solution based on the soil status of farmers so that they slowly start reducing the usage of chemical fertilizers over a period of time by when their soil would have the necessary nutrients through utilization of biofertilizers and biopesticides. The biofertilizers have a two-pronged strategy of enriching the soil to ensure a long-term evolution of natural fermentation of micro-organisms needed to sustain the soil fertility and sustaining productivity with the right nutritional value. The biopesticides act as supplements or tonics that can ensure sustainable crop yields with enhanced nutritional value.

Infrastructure and Further « Strengthening



Dr. Basavaraj Girenavar has envisioned to create tools and technologies in redefining 'farming for food and fuel' to reduce human impact on geology and carbon footprints. He played a pivotal role in launching an innovative mobile based app (Criyagen AgriApp) for transforming agriculture information sharing and communication with farmers around the world. As Founding Chairman of Rico Winery, Vineyards located at Krishna Valley, Karnataka, he drives the Criyagen team on a day-to-day basis to achieve the objective of fulfilling the needs of farming community on a sustainable basis. He has a strong desire and aptitude to strive hard and contribute towards the fulfillment of vision of making India a global provider of food by utilizing optimally the huge land area for agriculture as well as strong agricultural workforce of the country wherein more than 50 per cent of the population is involved in agriculture or agriculture related activities as their main source of income.

In 2007, on successful completion of his Ph. D., he once again came across the challenge of 'what next' and sought the advice of his mentor Dr. Borlaug, who strongly believed it would be better for him to get back to India. But his family back home in India insisted strongly to pursue a career in the US, where he had many opportunities. Caught in the dilemma of 'to return or not to return', he registered Criyagen LLC in Texas A&M University based on the confidence and

knowledge that he had gained by working with people from different countries as well as learning from their approaches and attitudes. Fortunately, five members of his Ph. D. Advisory Committee included five different people from different continents, namely, USA, South America, Europe, Africa and India. While he always turned to Dr. Borlaug for sound advice, the perspectives from the Chairman and other members of the Ph. D. Advisory Committee gave him deep insights on various aspects of life. In 2008, on the advice of Dr. Borlaug, Dr. J.H. Kulkarni and Dr. S.A. Patil, he made the bold decision of returning to India much to the chagrin of his family as well as friends. In fact, some people even ridiculed his idea of reversing the trend of returning to India, while most youth of his time were looking for bigger and better opportunities in the USA on completion of their higher education courses. But, he was determined on returning to India to utilize his higher educational skills for the benefit of the people in his home country.

The University of Agricultural Sciences (UAS), Dharwad beckoned him with open arms and he set-up his first incubation center with well equipped laboratory in the field of bio-agriculture at the University of Agricultural Sciences (UAS), Dharwad (Fig.1) after registering Criyagen as a company in Bengaluru. This migration from USA to UAS, Dharwad also saw the emergence of Criyagen as a start-up Agri. and Bio-Tech Company. Because of his strong commitment towards agricultural research, UAS gave his incubation center unlimited access to infrastructure as well as research and development (R&D) facilities. Those were the days when the concept of incubation centers or start-ups hardly existed. In spite of the strong resistance from the family and friends, he also made another smart move by launching a second company - a winery in Vijayapura. The Karnataka Government

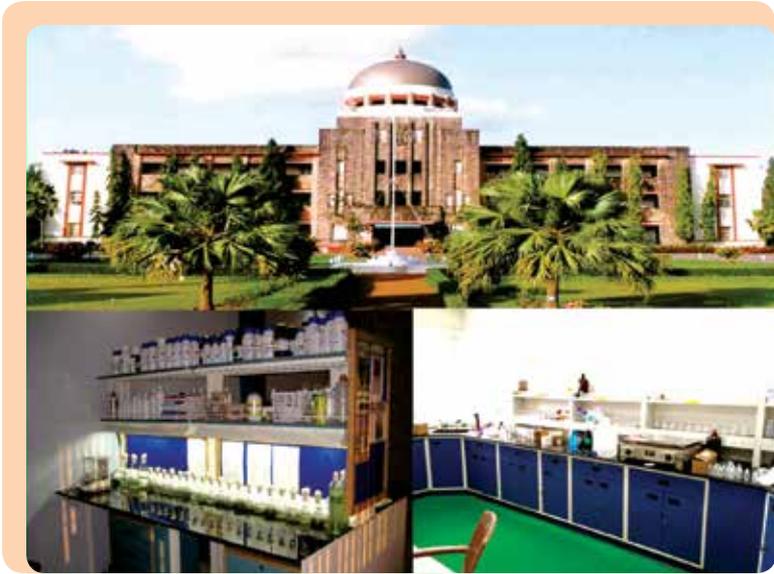


Fig.1. Ciyagen incubation center at UAS, Dharwad

was just then in the process of developing its wine policy based on the model adopted by the neighboring Maharashtra State. Vijayapura and Bagalakote are grape growing hubs of Karnataka and he wanted to tap the potential of the nascent industry as Plan B in case the cynicism of family and friends turned out to be true. As a result of his hard work, concerted efforts, sincerity and support from family as well as a committed team with strong will power, he has achieved success in both his business plans and today is on the verge of reaching higher echelons.

The center set-up in Dharwad successfully launched its first product called dynamic nutrient provider (DNP) in 2009 (Fig.2) along with other biofertilizer and biopesticide products. In 11 years time, DNP production has reached up to 22,000 tons (Table 1).





Fig.2. The launch of dynamic nutrient provider (DNP), the first product, by Dr. R.S. Paroda, the then Director General, ICAR, in the presence of Dr. S.A. Patil, Director, IARI, Dr. J.H. Kulkarni, Vice-Chancellor and Dr. Manamohan Attavar, Founder of Indo-American Hybrid Seeds at the University of Agricultural Sciences (UAS), Dharwad

Table 1. DNP production during the period 2009-2019

S. No.	Financial Year	DNP production (tons)
1.	2008 - 09	0
2.	2009 - 10	500
3.	2010 - 11	2,000
4.	2011 - 12	5,000
5.	2012 - 13	7,000
6.	2013 - 14	10,000
7.	2014 - 15	12,000
8.	2015 - 16	15,000
9.	2016 - 17	18,000
10.	2017 - 18	20,000
11.	2018 - 19	22,000

The price for powder formulation of DNP is INR 695, while for granules it is INR 795 per 50 kg packing. The DNP is marketed in various states of the country such as Karnataka, Maharashtra, Tamilnadu, Andhra Pradesh, Haryana and Kerala. The product has been patented and is one of the top selling products of Criyagen (Fig. 3). Zen-bio fertilizer and Bio Maxx are also patented and other six products are under development.

DNP literally hit the ground running and took off as a major product on demand and even today it is the best selling product among the various products of Criyagen. There is an urgent need to look for the expansion options. Connecting the technical knowledge about DNP with the market demand for a specialty fertilizer was the key to the success of his DNP product. This is an innovative product and has a huge demand due to its promising result as a

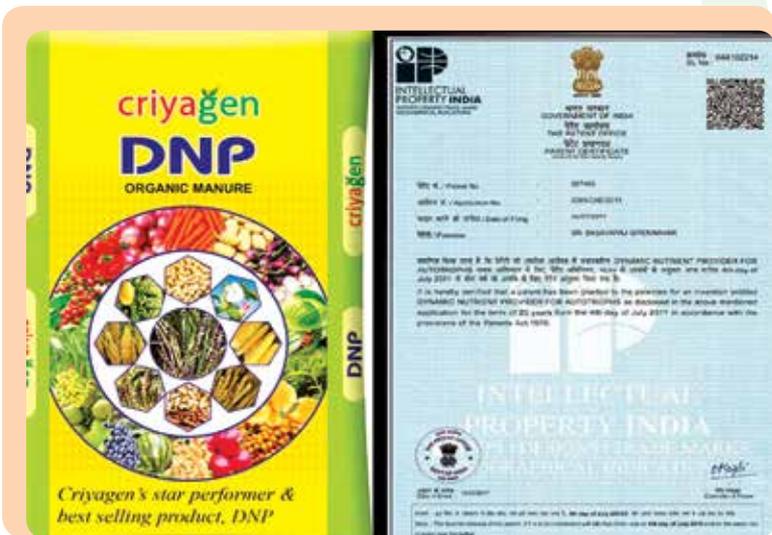


Fig.3. The Criyagen manufacturing facility near Doddaballapur



combination of biofertilizer and growth boosters. Being an organic product with beneficial microorganisms, it has the potential to enhance the soil fertility.

With the success of this revenue generation model, he ventured into other biofertilizers, namely, enriched organic fertilizer, humate fertilizer, amino acid based fertilizer and foliar spray products in the organic category to focus on his avowed mission of sustainable agricultural practices with emphasis on productivity and profitability. Bengaluru as an emerging 'Global City' was the best suited destination and the University of Agricultural Sciences, GKV Bengaluru and the then Vice-Chancellor, Dr. Narayana Gowda offered full support and facilities similar to that offered by UAS, Dharwad and a laboratory was established soon in GKV campus, Bengaluru which subsequently launched its products and also focused on utilizing technology for the benefit of farmers by creating the Criyagen AgriApp.

The corollary to setting-up laboratories in UAS, Dharwad and GKV Campus, Bengaluru was to launch a bigger manufacturing facility to meet the growing market demands for biodegradable products such as fertilizers and pesticides. Strategic planning is the key to the success of any business venture and hence Doddaballapura was strategically chosen to set-up his major manufacturing unit because of its proximity to Bengaluru, the international airport at Devanahalli, proximity to farmers as well as the farming community and options for future scalability of operations. He wanted to make sure that the benefits of his company's products directly reached farmers and in return the company could get direct feedback from farmers and stay connected with the farming community. Thus, setting-up the manufacturing facility on the Doddaballapura-Nelamangala state highway, about 12 km from Doddaballapur town (Fig.4),

has turned out to be the ideal place in a serene setting. Inspiring words from Dr. Borlaug and other experts proved to be a great source of motivation for the management, staff and visiting farmers. The laboratories at Criyagen are recognized by the Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology and the facilities are state-of-the-art with the extensive soil testing facilities supporting integrated nutrient management (INM) programs (Fig.5).

Criyagen has also established satellite units for innovative fertilizer and pesticide formulations wherein active ingredients are formulated and packed in tablet and capsular forms for local distribution in Vijayapura (Karnataka), Anantapur (Andhra Pradesh) and Sonipat (Haryana). The main focus is on Doddaballapur, while satellite units are season driven and contribute 30-35 per cent of total production. These satellite formulation units are currently acting as warehouses. The satellite centers are set-up on an innovative collaborative basis wherein Criyagen utilizes resources/ infrastructure capacity of



Fig.4. The Criyagen manufacturing facility near Doddaballapur



Fig. 5. State-of-the-art facility for large scale production at Criyagen, Doddaballapur, Bengaluru

collaborative partners to formulate the products and pack it for local consumption. Only in areas where the organization has its own infrastructure, it will set-up the end-to-end facility. But, this journey of business success has not been very satisfactory all through as he had to overcome minor hiccups and major challenges at every step with turn of events. However, with a strong positive attitude, he looked at every failure as a bigger stepping stone to success. A true scientist with very little business acumen, he initially had to deal with traders who would take the products but not pay the appropriate price and also the staff was not very competent on the subject or lacked commitment. Overcoming all the obstacles conscientiously and judiciously, the growth of Criyagen had witnessed a steady growth. Though the stumbling blocks have impacted adversely the profitability margin of the organization, such niggles would be overcome and the company will have a broader positive impact with faster growth in the long run.

Current Production Scenario and Significant Achievements



Criyagen today is a well recognized state-of-the-art production as well as R&D center with some of the best equipments, such as the automated soil testing equipment which very few such laboratories in the whole state own, and three 15 kl capacity fermenters (Fig.6), spray dryer and granulator for production of various formulations of biofertilizers and biopesticides in solid, liquid and granular forms. Bio-NPK is a microbial formulation containing strains of bacteria which are able to synthesize/ assimilate atmospheric nitrogen, solubilize phosphate and potash into available form, thereby supplementing balance nutrition to crops. It



Fig. 6. The fermentation unit with large capacity fermenters

converts non-available forms of micro-nutrients into available form. The organization produces 25,000 tons per annum of powder formulation of biofertilizers and has the necessary infrastructure to scale it up to 100,000 tons as and when demand increases.

A complete range of products required right from land preparation to harvesting stage is being manufactured by Criyagen. The Criyagen has been successful in producing 50 products in the past 10 years (Fig.7). Three products have already been patented which include DNP, Zen-Bio Fertilizer and Bio-Maxx and other products under patent applications are Bio-Phosphates, Bio-Humates, enLife, emPower, O'N Plant, Bio-N, Super-16. Some innovative fertilizer and pesticide formulations in tablet and capsular form are given Fig.8.

The organization is concentrating on integrated nutrient management by producing biofertilizers, enriched organic fertilizers, humate fertilizer, amino acid based fertilizer and foliar spray products so that the promising results

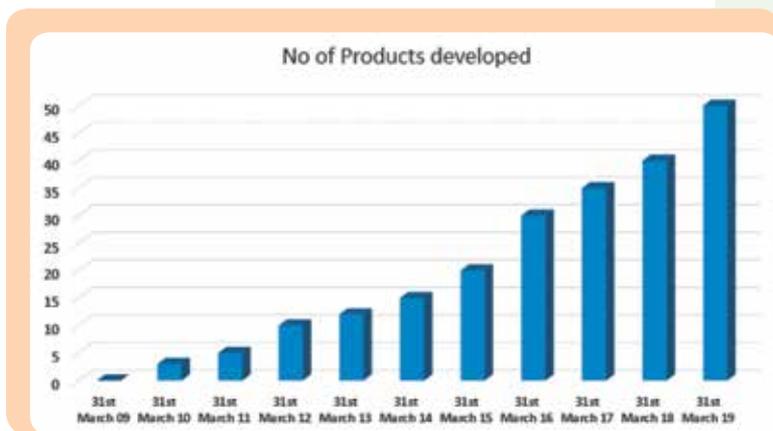


Fig.7. Number of products developed during 2009-2019



Fig.8. Innovative fertilizer and pesticide formulations in tablet and capsular forms

Table 2. Details of products and quantity produced

S. No.	Product	Quantity
1	Biofertilizer	500,000 litres & 1,000,000 kgs
2	Enriched organic fertilizer	50,000 tons
3	Humate fertilizer	5,000 tons
4	Amino acid based fertilizer	500 tons
5	Foliar spray products	200,000 litres

are achieved and in turn farmer gets better returns for his investment. The details of products and quantity produced are given in Table 2.

As the organization aims at reaching sustainability in agriculture by developing high quality low cost ecofriendly products, the farmer friendly products are being manufactured considering the financial status of the farming community. Criyagen is charging 10-20 per cent less as compared to the price charged by other competitors.

In support to the manufacturing unit, the organization has also set-up a state-of-the-art Microbiology and Soil Health Laboratory for R&D pilot experiments and quality check (Fig. 9). The significant involvement of the dedicated



Fig.9. *The state-of-the-art R&D laboratory at Criyagen*

team of qualified professionals has enabled the organization to achieve tremendous progress in terms of quality products with total focus on customer satisfaction. All the efforts have led to application of various patents and ability to build a potential product line for integrated nutrient management (INM) inputs. Focusing on rendering service to the farming community, the soil testing laboratory at Criyagen has so far tested 8,500 soil samples and planned to analyze around 10,000 samples from farmers per year from Karnataka, Andhra Pradesh, Tamil Nadu, Maharashtra and Haryana free of cost. This shall be scaled-up to 300,000 samples per year testing facility under Global Soil Health Service (GSHS) program to make soil data a democratic initiative. The soil is tested for 13 parameters i.e., pH, EC, OC, N, P, K, S, Na, Zn, Mn, Fe, Cu and B, though it is common practice to test for only 5 parameters and the cost of testing is INR 250 per sample in a state-of-the-art automated machine imported from Germany. The automated machine ensures that there is no tampering of readings manually and the report is automatically generated in a prescribed format.

Farmers are also given recommendations based on the soil test report on the type and amount of biofertilizers and/or biopesticides that they need to use to enrich the soil and increase its nutritional value on a sustainable basis as a part of the package of practice that they need to follow. The Criyagen laboratory with state-of-the-art facilities for R&D (Fig.9) also conducts water test and petiole analysis free of cost.

Considering the current scenario of soil health in our country, Criyagen has started soil testing service for the benefit of farmers and analyzed around 7,600 soil samples. The cost for analysis of soil, water and plant tissue is given in Table 3.

Table 3. Cost of analysis of various parameters

Sl. No.	Cost for analysis	Cost/sample (INR)
1	For 6 Parameters (pH, EC, OC, N, P, K)	50
2	For 13 Parameters (pH, EC, OC, N, P, K, S, Na, Zn, Mn, Fe, Cu, B)	250
3	For entire soil nutrition and biology	499

The significant progress of Criyagen in a little over one decade journey is well evident from the innumerable success stories shared by farmers from various districts of Karnataka and other regions of the country and the details of a few are enumerated below:

1. A sugarcane farmer in Belagavi district with 20 acres of land holding saw a phenomenal increase in cane yield (Fig.10) by utilizing Criyagen products such as dynamic nutrient provider (DNP), foliar application; Bio-Maxx, and sugarcane special biofertilizer. His yield increased



Fig.10. Mr. Suragouda Patil, farmer from Belagavi District with his bumper sugarcane crop

to 161 tons per acre from the previous 90 tons per acre and this achievement has been certified by the Department of Agriculture, Government of Karnataka. In the following year, he achieved another milestone of producing 148 tons per acre of ratoon cane.

2. A paddy cultivator from Davanagere increased his yield to 4,225 kg per acre from 2,925 kg per acre by using DNP, Bio-Maxx, biofertilizer and integrated nutrient management (INM) product.
3. A potato farmer from Kolar district harvested 12,500 kg per acre of potato with good tuber size by using DNP, foliar application and Bio-Maxx despite drought-like situation compared to 5,500 kg per acre produced by other farmers.
4. In a classic case of rejuvenation of areca plantation, a farmer from Koppa taluka of Chikkamagalur district used

Criyagen's DNP over a sustained period of time. His areca plantation which was on the verge of withering away due to yellow leaf disease not only revived, but also produced a yield of 13 quintals per acre as against the previous yield of 8 quintals per acre.

5. A cotton farmer from Bagalakote District enhanced his yield to 18 quintals per acre by utilizing DNP, Bio-Maxx and Bumper Crop Kit along with INM. His previous yield was 10-11 quintals per acre.
6. A turmeric farmer, also from Bagalakote District, increased his yield to a profitable 45 quintals per acre by using Criyagen's DNP, Bumper Crop Kit, PH-50 and foliar sprays such as Bio-Maxx, Criyazyme and Total.
7. A grape grower from Mudhol increased his crop yield to 9 tons per acre by using Criyagen's Bio-NPK, PH-50 and foliar sprays such as Bio-Maxx, Total and Criyazyme.
8. A red gram farmer from Ballari District of Karnataka purchased biofertilizers and other products through the AgriApp and sprayed them on 11 acres of his red gram cropped area. He followed the exact protocol provided by AgriApp scientists from sowing to harvesting obtained a yield of 6.5 quintals per acre against the previous yield of 2 quintals per acre. He appreciated the support and guidance provided by Criyagen and personally visited its office to thank the scientists for their timely inputs and seek further advice.
9. A progressive sugarcane farmer from Bulandshahar district of Uttar Pradesh has been an active user of the AgriApp for more than one year. He purchased Criyagen's sugarcane special and super cane kit for his five acres of land and followed the instructions of the AgriApp

scientists through the chat with expert service. He increased his yield to 40 tons per acre from the previous 30 tons.

10. A marigold and bitter gourd farmer from Chikkodi taluka of Belagavi district in Karnataka purchased agrochemicals and biofertilizers through the AgriApp for 1.5 acres of his land and the yield of these two commodities increased by 35 per cent.

The achievements of Criyagen can also be judged from revenue generated in the past 11 years (Table 4)

Table 4. Revenue generated during the period 2009-2019

S. No.	Financial Year	Revenue (INR)
1.	2008-09	0
2.	2009-10	5,66,781
3.	2010-11	59,28,987
4.	2011-12	3,99,21,193
5.	2012-13	4,15,27,363
6.	2013-14	6,28,68,358
7.	2014-15	19,12,91,882
8.	2015-16	25,03,83,626
9.	2016-17	31,63,82,591
10.	2017-18	32,09,92,014
11.	2018-19	34,19,56,991

Efforts Towards Value Addition « and Marketing



Criyagen was not just contented with providing farmers or the farming community with one-stop solutions towards sustainable, productive and profitable agricultural practices. It wanted the information to be shared on a wider platform to reach more farming families by utilizing the benefits of technology and this formed the basis for developing Criyagen AgriApp (Fig.11). the seeds for which were sown when Dr. Girennavar was pursuing his Ph. D. in USA. At that time, the call centers handling his US



Fig.11. Criyagen AgriApp

credit card, insurance and automobile related matters used to converse with him in his native Kannada language. He amazingly realized that American companies were targeting Indian customers in USA through their native languages by availing call centers or business process outsourcing (BPO) based out of India. Recognizing by his name itself, the call center executive used to converse with him in his native Kannada language by politely asking about his physical well-being and so on. Realizing this, a thought struck in his mind that when American companies can use targeted call centers to reach their customers through technology, why not use the same technology to reach information out to the farming community back home in India.

The App was launched by integrating all agricultural concepts and within a short span of time reached more than 500,000 downloads without much marketing effort by the organization. The App was also among 20 winners from among 1,100 organizations in the Union Agriculture Ministry's 'Agriculture Grand Challenge' in tie-up with Startup India under the category 'Price forecast system for pulses/ oilseeds/ potato/ onion/ tomato at the time of sowing'. It is planned to further fine-tune the App to make every farmer an entrepreneur and every farm into a factory in terms of management so that the farming community can take data-based decisions and market-based production planning. The enterprise resource planning (ERP) for such a platform has been done and will be launched after trials in the forthcoming months for the benefit of farmers especially when it comes to the pricing of farm produces. He quotes the example of onions where the price today fluctuates between INR 2-.80, which is unscientific and a gross mismanagement of the market. More than 50 per cent of consumers in India are farmers themselves, thus when they grow onion they don't

get the right price and when they consume without growing they have to pay a huge price. He envisions mapping data of the market driven economy that can evolve an algorithm for 10-15 per cent variation based on demand and supply, and not the 1,000 per cent variation, which sometimes happens now.

The enhanced features of the AgriApp, when launched, will help farmers to connect with the organization to get information on products and services as well as awareness about soil testing, fertilizers, pesticides whatever inputs farmers want based on their preference such as organic or natural farming. The App will be a handy tool of information and awareness irrespective of whether the farmers heed the advice or are agnostic to it. The deep-rooted confidence on evolving a tangible device is based on the fact that he and his team have a thorough knowledge of farming ground realities as most of them hail from the farming community. They have insights on issues and challenges that farmers face be it dryland, irrigated land, intensive cultivation or cash crop farming. They can feel the true pulse of the farmer and are aware where the money owned by a farmer would go, they know how farmers of the various segments behave and above all they are strongly grounded in the fact 'one size does not fit all'. Hence, they need to come-up with both broader customized solutions as well as geospecific, crop-specific and individual farmer-specific answers to evolve a sustainable system of farming activity that would also address the food security concerns of the country with a huge and burgeoning population.

Criyagen as a life science company with the mission to deliver low cost, ecofriendly inputs for sustainable agriculture and develop carbon neutral energy means for better tomorrow has evolved an impressive array of products based on deep research and understanding the ground realities of the farming community and the farmers are highly satisfied with Criyagen

products (Fig.12). There are a few benchmark products of Criyagen which include DNP, which is a unique and special fertilizer consisting of organic carbon, organic booster like amino acids, agriculturally important micro-organisms like nitrogen fixing bacteria, phosphorous solubilizing bacteria and plant disease controlling fungi *Trichoderma viride* and also traces of essential minerals. DNP intends to provide most comprehensive crop nutrition to improve the physico-chemical and biological properties of the soil ecosystem, while enhancing crop productivity. It can be used on field crops (cotton, paddy, wheat, sorghum, maize, sunflower, groundnut, potato, mustard, pulses, soybean and sugarcane), fruit crops (banana, mango, guava, sapota, pomegranate, custard apple, orange and citrus fruit); and vegetable crops (tomato, chilies, brinjal, onion and bitter gourd). Bio-Maxx, which is a comprehensive plant nourishing tonic, is suitable for all agricultural, horticultural, plantation and ornamental



Fig. 12. A satisfied women farmer displays Criyagen product for improved growth in the plants

crops. The tonic enhances the growth and development of crops; promotes flowering and fruit setting, increases fruit size and crop yield; corrects deficiency of nutrients and enhances quality; and helps plants to endure environmental stresses.

The other products of Criyagen in the biofertilizer and biopesticide categories include: PH-50 potassium humate based plant nourishing granules which help in nutrient uptake, crop growth and enhanced yield. Amino G is a plant growth promoting amino acid base organic fertilizer which helps in comprehensive nutrient uptake, crop growth and good yield. Bio-NPK a microbial formulation containing strains of bacteria which can synthesize/ assimilate atmospheric nitrogen, solubilize phosphate and potash into various forms supplementing balance nutrition to crops. Zen Bio-Fertilizer is a power of five trillion microbes for crop nutrition. Amino-Proteins combination of essential amino acids and proteins based on organic fertilizer helps in comprehensive nutrient uptake, crop growth and good yield. Multi-Maxx is a comprehensive plant nutrient which is required for proper growth. Criya-Zyme is a plant nourishing tonic which helps in vigorous crop development and better yield. Total is highly economical and environmentally safe. Bio-Humate is a plant nourishing tonic, which helps vigorous shoot and root development as well as better yield. Bio-NPK Kit; Bio-N a nitrogen fixing *Azospirillum* bacteria; Bio-P formulation of 'P' solubilizing *Pseudomonas* bacteria; Bio-Kb Biofertilizer based on a selective strain of potash solubilizing beneficial bacteria *Frateuria aurantia*; Bio-Zn contains *Thiobacillus thiooxidans* bacteria that effectively solubilize zinc in soil; and various other microbial formulations and crop specific tonics that provide balanced nutrition and reduce disease incidence. All these products including DNP increases 25 per cent yield in field crops while in case of flowering crops, yield increase is 25-50 per cent.

Economics - Returns Over « Investments



Working for an agricultural economy in India today means looking at a lower profitability. The Founder Chairman, Dr. Basavaraj Girenavar and other team members at Criyagen have integrated the concept of lower profits over a sustained period as a part of their bigger plan for strengthening the organization. The current focus is on working with a motto of achieving ‘sustainable agriculture practices’ with emphasis on productivity and profitability of farmers. Based on the University trials, it has been observed that there is 20-25 per cent enhancement in yield with use of biofertilizers. Hence, it is possible to achieve cost: benefit ratio up to 1:5 and in case of cash crops it can be achieved up to 1:10. Higher cost: benefit ratio is based on various factors including quality and market price realization for cash crop. With agriculture and agricultural practices ingrained in their bloods, they are striving to bring about a major dimensional shift in the minds of farmers to help them achieve sustainable goals and at the same time ensuring there is no compromise in every operation whatsoever. Despite resistance from the farming community to adapt to newer soil and plant ingredients, they are working on a sustained plan to bring about positive changes in the agricultural scenario of the country.

Because of his quest for knowledge, friendly disposition and ability to build a rapport, Dr. Girenavar has got the

benefit of expert advice from renowned professionals in the field of agriculture. Apart from thousands of farmers who have visited his manufacturing facility for various purposes, including training sessions, Criyagen has regularly been hosting high profile visitors from across the country on a regular basis. He feels blessed to have got advice from the father of India's Green Revolution, Prof. M.S. Swaminathan, who has been one of his mentors. Prof. Swaminathan despite age-related disability visited the Criyagen facility and his very presence was a great source of inspiration as well as motivation for the entire Criyagen team (Fig.13). He gave expert insights on what the priorities should be for the next 50 years for ensuring the security of farmers and agriculture in India. He advised that human beings should cultivate the habit of living harmoniously with nature and ecology. He also explained the need for giving farmers the right market-led price for their produce and asked the Criyagen team to be enterprising and innovative so that they could solve big



Fig.13. Prof. M.S. Swaminathan at Criyagen facility at UAS Dharwad
- A monumental day for the team

problems in an economically sustainable manner. He launched Criyagen's tablets patented in 151 countries and its second flagship product DNP-16, which is a complete meal for crops. Prof. Swaminathan strongly advocated that farmers need solutions and not subsidies.



Problems/ Constraints and « Lessons Learnt



Dr. Basavaraj Girenavar strongly believes that patronizing farmers by giving subsidies alone will not solve the problems of the farming community in the long run. Farmers have to be empowered as entrepreneurs through right information, right market, right pricing and insurance. There are some winds of change, but they are happening at a slow pace. They have to gather into a breeze and a friendly storm through a systemic process taking into consideration the needs of all stakeholders - farmers, traders, consumers, governments and the whole spectrum of society as a strong agricultural system will be a true backbone of the society, especially in a country like India where more than 50 per cent of the population thrives on the agrarian economy. Criyagen as a responsible organization in the industry is evolving a process through integrated nutrient management and integrated pest management for crops in the first few years and then moving on to organic and eventually settling down to natural production systems. Farmers at the microeconomic level can't reduce their productivity or profitability and at the macroeconomic level the balance of the nation's food security needs to be maintained so that changes don't drastically affect the national food production goals.

World over the leaders such as George Washington and Mahatma Gandhi had hailed farming as the cornerstone of any civilization, but unfortunately today in India there is a

huge imbalance in the farming community. There have been instances of farmers earning lakhs of rupees and at the same time there have also been examples of farmers losing lakhs of rupees. It is in this context that wedding agriculture with technology will result in the farming community donning roles of successful entrepreneurs. Unfortunately, today we do not have a concept or process for auditing in agriculture such resources, assets, liabilities and opportunities. Farmers have not adopted or adapted to changes over a period of time and have just followed traditional practices without batting an eyelid on whether such systems would benefit them or not. There needs to be an element of market integration, an element of rationality and awareness on what price points are profit points. If such a system is evolved then farmers can integrate seamlessly with the market to ensure sustainability and profitability. With agriculture being the primary source of income for more than 50 per cent of the population, we need to work hard with conviction and creativity to ensure farmers become the strong backbones of our agrarian society.

Failure is the stepping to success and Criyagen typically exemplifies how initial failures have been strong lessons learnt to build a strong foundation for future success. Lessons have been learnt both at the individual levels and Criyagen as an organization, especially when it came to convincing farmers to gradually switch over to organic products instead of chemical fertilizers, which initially provided good returns in terms of yields and disease management. However, problems faced initially helped evolve an approach and attitude for solving bigger problems with various possible value-added outcomes. Being a start-up with quality products as well as a good team with support from various

State Agricultural Universities (SAUs), CRIYAGEN began to educate farmers and the farming community about the importance of organic fertilizers and biocontrol agents on their role in retaining soil fertility and long-term benefits in retaining available natural resources.

An innovative entrepreneur sees big problems as big opportunities, especially in a strongly agricultural backed country like India that is beset with agrarian crisis. Converting problems into opportunities by resolving issues, ensuring sustainability and making it an engine of growth as well as making it a source of wealth generating employment opportunities will make agriculture a thriving business in the country. Globally, today, India is best suited to chart a strong and sustainable agricultural growth as its population depends on farming activities as their primary source of income. In developed countries, only 2-5 per cent of the entire population is involved in agricultural practices. Despite India having the biggest share of land holding for agriculture in the form of acreage, the productivity is very low. In USA, one farmer produces food for about 150 people, whereas in India one farmer produces food for only two people. Along with such low productivity, the safety standards in the use of pesticides or fertilizers are also very low in India. Bridging the enormous productivity gap by scientifically joining the dots of inadequacies to segment the food basket into safe, healthy, for domestic, organic or naturally-farmed healthy as well as nutritious food will go a long way in making India and the Indian agricultural sector top notch providers of nutritious food for the rest of the world.

Food is the only means of building a healthy next generation, which no technology can provide. So focusing on healthy food, healthy body, healthy mind, healthy life

style and a healthy country eventually will ensure that agriculture gains a new momentum. In the 1950s, India was a calorie deficit country but in 2000 the country fulfilled the calorie requirement based on 2 major crops rice and wheat, which resulted in obesity and other lifestyle related diseases sometimes life threatening too. In view of this, there is need to shift the focus from restricting agriculture to just producing food to connecting it to employment, national health, people's health, economics and eventually the overall well-being of the people. The mission now should be to produce healthy food for the whole world utilizing the human resource capacity in agriculture and connecting it to the massive agricultural land holding as well as diversity in crops and diversity in outputs. Such an opportunity can have a positive impact on society to drastically cut down farmer suicides, recurring drought and poor productivity (sometimes as low as one-third of global standards) and soil erosion.

Key Factors of Success «



The credit for the overwhelming success of any organization can be attributed to the strong efforts of all stakeholders including owners and promoters, dedicated staff, retailers/ traders and the end users. Criyagen was able to establish a strong market presence at the very outset of the launch of its products due to its innovative nature of tying technical capabilities with market needs resulting in the launch of a unique bouquet of products. It has inbuilt capability to build a potential market by developing promising products based on market needs. The satisfaction of end-users is ensured by the team working closely with the farmers to understand their general needs and specific requirements. The constant end-user interaction helps the organization to chalk out measures for improvising products on a regular basis to enhance relevance and efficiency based on the crop and conditions. Additionally, implementation of technology in routine tasks has helped in managing time, resources and funds through information and communication technology (ICT) and m-commerce platforms. Criyagen activities and progress are depicted in nutshell in Fig.14.

Farmer-friendly initiatives of developing products to ensure sustainability with productivity and profitability through well-developed R&D efforts, highly motivated team members as well as strong support from friends and family have resulted in scripting the success story of Criyagen. The organization is open to business and financial advice



Fig.14. A pictorial nutshell of Criyagen's activities and progress

from experts and well wishers, which has also contributed towards the steady success. Timely help from financial institutions for funding and support have given a fillip to the establishment of infrastructure and state-of-the-art laboratories. Criyagen provides direct employment to 125 personnel, including marketing staff in Karnataka and other states of India such as Maharashtra, Andhra Pradesh, Haryana and Tamil Nadu. It also provides employment to 100 farm laborers through a contract system.

In order to keep the team connected with the vision, mission and goal of sustainable agriculture with focus on productivity and profitability, meetings are regularly held at macro and micro levels on a monthly, quarterly and annual basis. Of late, an advisor has also been engaged to help the team and get the staff motivated and work tirelessly towards achieving a common goal. The annual meetings are held

outside in a resort with good ambience wherein staff members get an opportunity to open-up their thoughts to prioritize what should be the agenda for all as an organization, as a team and as individuals. After that the team gets motivated and charged-up and returns with zest to fulfill the vision and mission of the organization. It would be an ongoing and evolving, more robust and intense exercise so that all staff members would be on the same page as far as the organization as well as the vision and mission are concerned.

Criyagen now envisions evolving and focusing on three segments of crop nutrition, animal nutrition and human nutrition. The concept is to connect the nutritional aspects of all the three components to evolve a holistic approach that can sustain long-term growth for the benefit of the human beings. A farmer has to grow food and feed crops to foray into crop nutrition with rejuvenating soil fertility through micro-organisms. Farmers also venture into dairy activities and hence have to focus on cultivating or outsourcing crops required as animal feed. The farmer, his family and farming community members need nutritious food, which again the farmer has to grow. To evolve this holistic approach, the farmer need to work as an entrepreneur with focused commitment to ensure sustained and profitable crop production. Thus, a farmer can connect with the big problem, convert it into big opportunities to grow organic and naturally grown and nutritious crop varieties. This concept may take a long time of 5- 10 years to evolve, but the organization wants to chart the course with a view to benefitting the farming community. As suggested by Dr. Trilochan Mohapatra, Secretary, DARE & Director General, ICAR during his visit to Criyagen (Fig.15), there are good prospects of signing the MoU with ICAR because they have

huge infrastructure and a massive budget outlay. The matter is currently under discussion with ICAR. The aim is to reach out to more farmers and farming community members through the 720 *Krishi Vigyan Kendras* (KVKs) of the ICAR, utilize the benefits of its research centers and getting closer to multilocations with agrarian situations or opportunities.

Dr. S.A. Patil, former Vice-Chancellor, University of Agricultural Sciences (UAS), Dharwad, former Director, Indian Agricultural Research Institute (IARI) and former Krishi Mission Chairman, Karnataka State Agriculture Department, is one of the key persons, mentors, advisors and a regular visitor to Criyagen facilities. He has advised the Criyagen team to keep the farmer at the centre stage for evolving any products or solutions. Dr. Ashok Dalwai, Additional Secretary, Government of India on his visit to the Criyagen campus suggested that



Fig.15. *Dr. Basavaraj Girenavar explaining the activities and progress of Criyagen to Dr. T. Mohapatra DG, ICAR and Dr. S.A. Patil, Former Director, IARI during their visit to the facility*

the soil testing services be scaled-up on the pattern of the human blood testing model. Ms. Neeraja Shastri, IAS also visited the facility representing the Secretary, Department of Agriculture and Cooperation (DoAC), Government of India. She was highly impressed by the work done at Criyagen and suggested that they should continue the good work and assured all support from the DoAC.

Shri N.H. Shivashankar Reddy, Hon. Minister for Agriculture, Karnataka; Shri Jagadish K.G. Commissioner of Agriculture; Director of Agriculture, Government of Karnataka and other experts (Fig.16); Shri Vijay Bhaskar, Chief Secretary, Government of Karnataka and Shri Basavaraj Patil Sedam, Former Member, Rajya Sabha have visited Criyagen and were highly impressed with the achievements made and encouraged the Criyagen team to continue intensive efforts for the welfare of farmers. The other visitors include Heads of Cooperatives from Maharashtra and around 1,000 dealers/society retailers and all these visitors were greatly benefited.



Fig.16. Minister for Agriculture, Government of Karnataka and other experts visiting Criyagen facility

Impact of The Work



Criyagen has developed a wide range of solutions to give farmers the needed confidence to grow more low cost and high quality ecofriendly products. The innovative products are the result of constant improvement and the investment in the R&D. The R&D Department at Criyagen seeks new solutions to existing problems keeping farmers' needs and sustainability in mind. The strong research orientation ensures that implementation of tomorrow's solutions is planned today.

The avowed vision in establishing Criyagen as an Agri and Biotech Company has been to finding right solutions for making agriculture a sustainable business proposition with a farmer becoming an entrepreneur. Towards this end, the organization has been undertaking awareness programs to share the right information and provide inputs at the right time, which in turn have greatly benefited farmers in achieving better returns for their investment along with safe INM and IPM solutions leading to better outcomes while being ecologically and economically relevant.

The organization is fully aware that it still has a long way to go in terms of reaching each and every farmer with required products, information, knowledge and services at their finger tips with the intervention of technology in agriculture. In this context, AgriApp another start-up of Criyagen team is working closely to bridge the ICT, IoT, Big

Data and m-commerce gap. The goal is to help farmers in achieving the best results for their investment by providing quality products at the right time. This will in turn help farmers to achieve ecologically and economically sustainable agricultural products with a fair margin of profitability akin to an entrepreneur running his business venture. The products and services of Criyagen are instrumental in vigorous crop growth (Fig.17) and enhanced income and the farmers are indeed very happy about the contribution of the organization towards their wellbeing.

In recognition of his efforts and the efforts of his company, Dr. Basavaraj Girenavar received the Udyoga Rattan Award for his achievements in the field of agriculture. Criyagen has been working for over 10 years in Karnataka to create awareness among the farming community about scientific agriculture practices and sustainable agriculture. Criyagen has strong technical collaboration with the State



Fig.17. Happy farmers with Criyagen products and services

Agricultural Universities at Dharwad and Bengaluru to carry out research & development projects. Sincere efforts are being made to evolving a team of dedicated staff who are willing to work in rural environments to create an impact in the lives of farmers. Criyagen apart from its direct employment and hiring farm laborers has also created several jobs in rural areas through which current youth can stay connected with their rural agriculture practices instead of migrating to cities. Improving products is a constant endeavour at Criyagen, which is playing a pivotal role in improving soil fertility and increasing soil productivity.

Specific Suggestions



Concerted efforts need to be made for a massive shift in focus towards tangible sustainable agricultural practices through technological interventions to combat with disastrous consequences of climate change and global warming. The next agricultural revolution in India must focus on empowering farmers as sources of a healthy society by looking at alternative forms of foods such as nutritious millets, medicinal herbs, fruits and vegetables since India is the home of Ayurveda. With more than hundred herbs of medicinal and health promoting value, India can become the super power of food pharmacy rather than a generic pharmacy. The entire world including India is investing heavily on the pharmaceutical industries to develop molecules. While medicines and healthcare services continue to remain significant, the priority should now shift to investing in agriculture and farming related activities. So the big opportunity today can be in promoting healthy nutraceuticals by connecting it with trained man power, market-managed economy, prioritized investment, capital flow and the right policy decision by the government.

The young entrepreneurs need to be encouraged to seek and come up with various innovative solutions to help our current agriculture scenario. It could be in the form of mechanization in agriculture, implementation of easy

access to information technology in agriculture, looking for alternate strategies to help farmers for easy marketing of the agriculture produce or creating awareness of organic foods and its benefit to mankind. There is a need for hand holding of young entrepreneurs who want to venture into the area of bioagriculture and biotechnology with a view to finding sustainable solutions with the focus on productivity and profitability for farmers. Having availed of the benefits of incubation centers at UAS, Dharwad in 2008 when such a concept hardly existed and UAS, Bengaluru, it is strongly suggested that a proper platform needs to be provided to hard working young entrepreneurs. The success of any entrepreneur depends on understating of the end-user requirements and delivering quality products which will satisfy the customers. Based on learning and experience, the young entrepreneurs must focus on their core strength and come-up with market-fit product/ service along with assessing the economic viability and scalability. Once a detailed business planning is done, it will help navigate the business over a period of time to build traction and achieve business objectives while solving the biggest of big problems in the field of agriculture.

Criyagen, in the long-term, will play a constructive role with collaborators (organizations or individuals) in constructively working towards reducing carbon footprints in the agricultural domain by tapping hugely available solar energy. Every farmer and farming activity should be driven by the power of the solar energy, especially in a tropical country such as India. As farming activities are largely done during the day time, it will be prudent and tangible to tap solar energy sources. However, this would require collaborative effort from various stakeholders both

in the government and the private sector. A substantive role is to be played in creating awareness and working out possibilities for utilizing solar power for farming activities in joint venture. Factors such as cost of installing solar panels and related issues need to be addressed, awareness about the benefits of solar energy needs to be created and the necessary infrastructure needs to be built. Though it may look like an arduous task, a strong will and commitment towards such a venture will help overcome challenges and make it a practical reality.

Deeply involved in the holistic business of agricultural activities, Criyagen plans to promote a new concept of agriculture, meditation and yoga (AMY) and a syllabus for a diploma program on AMY will be developed with the strong belief that agriculture is yoga. This will connect agriculture with a spiritual note to offer the course either through online (YouTube) presence or regular classes at Criyagen facility. The diploma program is planned to be launched next year by when a suitable syllabus will be developed. Similar innovative efforts can be made by other entrepreneurs.



Dr. Basavaraj Girenavar, CMD receiving the Udyoga Rattan Award



Dr. Basavaraj Girenavar receiving an award at KBIT Start-up Promotion 2018 for AgriApp from Honorable Minister for Agriculture Krishna Byre Gowda and Minister for IT/BT Priyank Kharge

Important TAAS Publications

- Regional Policy Dialogue on Scaling Conservation Agriculture for Sustainable Intensification, Dhaka, Bangladesh, September 8-9, 2017.
- Policy Brief on Scaling Conservation Agriculture in South Asia, December 2017.
- Retrospect and Prospect of Doubling Maize Production and Farmers' Income – Strategy Paper by Dr. N.N Singh, September 10, 2017.
- Indian Agriculture for Achieving Sustainable Development Goals - Strategy Paper by Dr. R.S. Paroda, October, 2017.
- Strategy for Doubling Farmers' Income - Strategy Paper by Dr. R.S. Paroda, February, 2018.
- Livestock Development in India - Strategy Paper by Dr. A.K. Srivastava, Member, ASRB & Trustee, TAAS, February, 2018.
- Policy Brief on Agricultural Policies and Investment Priorities for Managing Natural Resources, Climate Change and Air Pollution - April, 2018.
- Women Empowerment for Agricultural Development - Strategy Paper by Dr. R.S. Paroda, May, 2018.
- Brainstorming Meeting on Harnessing Intellectual Property to Stimulate Agricultural Growth – Proceedings and Recommendations, July 27, 2018.
- Road Map on Motivating and Attracting Youth in Agriculture (MAYA), November 2018.
- Regional Conference on Motivating and Attracting Youth in Agriculture (MAYA) - Proceedings and Recommendations, August 30-31, 2018.
- Motivating and Attracting Youth in Agriculture - Strategy paper by Dr. R.S. Paroda, November, 2018.
- Tenth Foundation Day lecture on “Can India Achieve SDG 2 – Eliminate Hunger and Malnutrition by 2030” by Dr. Prabhu Pingali, Professor in the Charles H. Dyson School of Applied Economics and Management at Cornell University, January 24, 2019.
- Urgency for Scaling Agricultural Innovations to Meet Sustainable Development Goals (SDGs) – Strategy Paper by Dr. R.S. Paroda, April, 2019.
- Horticulture for Food and Nutritional Security - Strategy Paper by Dr. K.L. Chadha and Dr. V.B. Patel, October, 2019.
- Crop Biotechnology for Ensuring Food and Nutritional Security - Strategy Paper by Dr. J.L. Karihaloo and Dr. R.S. Paroda, December, 2019.
- A Road Map on Policy Framework for Increasing Private Sector Investments in Agriculture and Enhancing the Global Competitiveness of Indian Farmers, December, 2019.
- A Road Map on Efficient Land Use and Integrated Livestock Development, February, 2020.
- National Dialogue on Land Use for Integrated Livestock Development – Proceedings and Recommendations, 1-2 November, 2020
- A Road Map on Stakeholders Dialogue on Way Forward for the Indian Seed Sector, June, 2020.

About Author

After initial schooling up to 7th standard in Government Kannada Boys' School in his native Janamatti village, Dr. Basavaraj Girennavar went to the High School in the neighboring village for his 8th standard and subsequently completed his 9th and 10th standards from RMG Composite Junior College, Mudhol. On completing his Secondary School Leaving Certificate (SSLC) with first class, he joined Basaveshwara Science College for his Pre-University Course (PUC) in the science stream in the English medium and scored 80 per cent marks. To pursue his B. Sc. in Agriculture he got admission in the College of Agriculture, Vijayapura and successfully completed his graduate studies with 9.2 CGPA (Cumulative Grade Point Average). He learnt about the Indian Council of Agricultural Research's (ICAR) Junior Research Fellowship (JRF) program to pursue higher education. He appeared for the ICAR's all India examination and got 15th rank, which enabled him to join Chaudhary Charan Singh Agricultural University, Haryana for his M. Sc. along with the JRF. He pursued his postgraduate studies with zest and fervor to get more deeply involved in subject of agriculture and agricultural related activities.



The question of 'what next' cropped up again on successful completion of his M. Sc. Because of his deep interest in academic research, he came across the achievements of noble laureate Dr. Norman Borlaug. Inspired and motivated by the work of Dr. Borlaug, who had invested his Nobel Prize money for starting a research center in Texas A&M University, he applied for a Ph. D. Course in Texas A&M University along with completing his Graduate Record Examinations (GRE) and Test of English as a Foreign Language (TOEFL) tests with high scores. His high academic excellence ensured that he got admission in Texas A&M University (a dream come true) with a scholarship and teaching fellowship, which completely took care of his expenses during studies in USA.

Dr. Girennavar is the recipient of Udyoga Rattan Award, Start-up Promotion for AgriApp Award and several other national and international awards. He serves as a member in Vidhana Soudha (the seat of the State Government) as Executive Member on Karnataka State Horticulture Agency and Research Advisory Board for the University of Horticultural Sciences, Bagalakote. He is also member of The Indus Entrepreneurs (TiE) and Association of Biotechnology Led Enterprises (ABLE) and actively engages and advises emerging entrepreneurs with unique ideas and perspectives.