Vol. 1, Issue 1

ISO 9001:2015 Organization

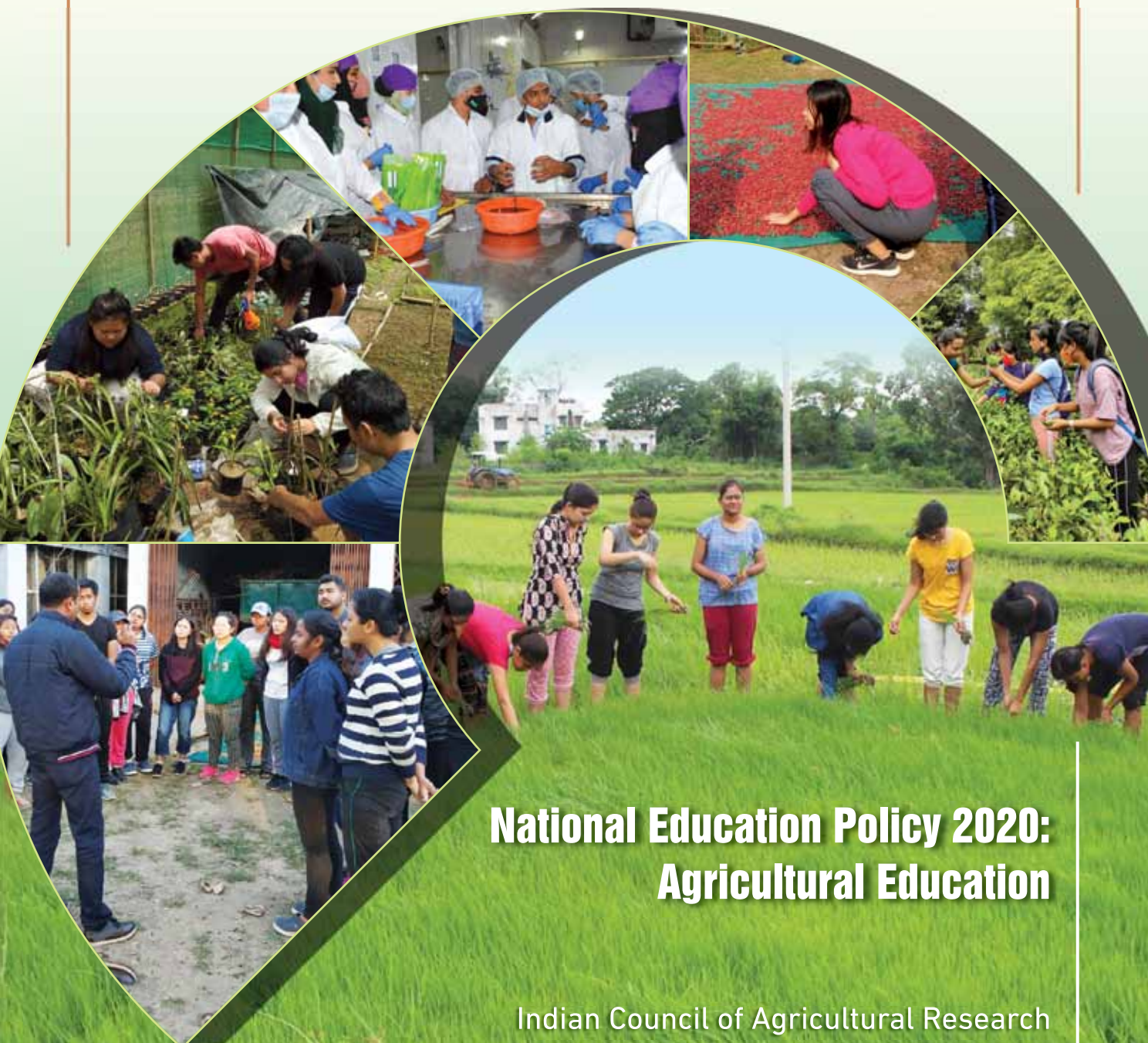
भाकृअनुप
ICAR

Azadi Ka Amrit Mahotsav

agri rise

Agricultural Education Digest

OCTOBER-DECEMBER 2022



National Education Policy 2020: Agricultural Education

Indian Council of Agricultural Research

/InAgrisearch /user/icarindia officialicarindia www.icar.org.in /icarindia

agri-rise

VOL. 1, ISSUE 1; OCTOBER-DECEMBER 2022

for editorial queries
e-mail: agririse@icar.gov.in

CONTENTS

agri rise
Agricultural Education Digest

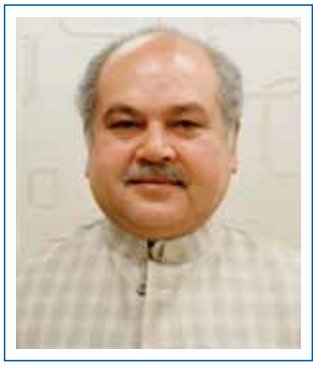
The broad contents of the magazine are as follows:

i. Education centric articles.
ii. Profile of Experiential Learning Units (ELP).
iii. Student's success stories.
iv. Agricultural University profile.
v. Events organized.
vi. Forthcoming events / conferences, etc.

नरेन्द्र सिंह तोमर
NARENDRA SINGH TOMAR

सत्यमेव जयते

कृषि एवं किसान कल्याण मंत्री
भारत सरकार
Minister of Agriculture &
Farmers Welfare
Government of India
Krishi Bhawan, New Delhi



संदेश

"कृषि देश के लिए सबसे महत्वपूर्ण क्षेत्रों में से एक है और मानव संसाधन अपनी आजीविका के लिए इस पर निर्भर हैं। भारतीय कृषि अनुसंधान परिषद (भाकृअप) ने कृषि को मजबूत करने के लिए प्रौद्योगिकियों को शामिल करने में एक महत्वपूर्ण भूमिका निभाई है जिसने कृषि को एक उद्यम में बदलने में मदद की है। कृषि देश की अर्थव्यवस्था की प्राथमिकता और ताकत है। विपरीत परिस्थितियों में भी कृषि भारतीय अर्थव्यवस्था की रीढ़ की हड्डी का काम करती है। मैं राष्ट्रीय शिक्षा नीति 2020 के माध्यम से स्कूल और उच्च शिक्षा स्तरों पर कृषि शिक्षा को मुख्य धारा में लाने के लिए हमारे प्रधान मंत्री श्री नरेंद्र मोदी जी की पहल की सराहना करता हूं।

भारतीय कृषि अनुसंधान परिषद ने कृषि में उच्च शिक्षा में उत्कृष्टता को प्रोत्साहित करने में एक प्रमुख भूमिका निभाई है। देश में उच्च कृषि शिक्षा की गुणवत्ता में सुधार करने और उसे बनाए रखने के लिए भाकृअप ने राष्ट्रीय कृषि शिक्षा नीति के लिए कार्यान्वयन की कार्यनीति तैयार की है जिसका मैंने दिनांक 28 सितंबर 2021 को विमोचन किया।

मैं भारत में कृषि शिक्षा में सुधार के लिए एक नई पत्रिका शुरू करने के लिए भाकृअनुप को हार्दिक बधाई देता हूं। यह त्रैमासिक पत्रिका देश में कृषि शिक्षा के महत्व को समझने में मदद करेगी।"

(नरेंद्र सिंह तोमर)
केन्द्रीय कृषि एवं किसान कल्याण मंत्री,
भारत सरकार

कैलाश चौधरी
KAILASH CHOUDHARY

सत्यमेव जयते

कृषि एवं किसान कल्याण राज्य मंत्री
भारत सरकार
Minister of State for Agriculture
& Farmers Welfare
Government of India

संदेश

कृषि भारतीय अर्थव्यवस्था की रीढ़ है जो सकल घरेलू उत्पाद में लगभग 16 प्रतिशत का योगदान करती है। भारतीय कृषि अनुसंधान परिषद हमेशा देश भर में कृषि शिक्षा की गुणवत्ता को मजबूत करने के लिए प्रतिबद्ध है। राष्ट्रीय शिक्षा नीति-2020 एक ऐसा प्रयास है जिससे छात्र कृषि के बारे में अधिक से अधिक जान सकें और रोजगार के बेहतर रास्ते खुल सकें ।

कृषि शिक्षा पर भारतीय कृषि अनुसंधान परिषद द्वारा इस त्रैमासिक पत्रिका ''एग्री-राइज'' का प्रकाशन कृषि क्षेत्र को अधिक मजबूत और रोजगार योग्य बनाने की दिशा में एक बड़ा प्रयास है। मैं पत्रिका के सफल प्रकाशन हेतु अपनी शुभकामनाएं प्रेषित करता हूँ।

मंगलकामनाओं सहित ।

(कैलाश चौधरी)
कृषि एवं किसान कल्याण राज्य मंत्री,
भारत सरकार

शोभा करांदलाजे
SHOBHA KARANDLAJE

सत्यमेव जयते

कृषि एवं किसान कल्याण राज्य मंत्री
भारत सरकार
Minister of State for Agriculture
& Farmers Welfare
Government of India

MESSAGE

"In India, the national agricultural research, education and extension system under the ICAR-SAU network need to address the challenges faced by farmers. To this end, ICAR along with the relevant stakeholders is dynamically bringing out reforms in higher agricultural education in the country leading to quality human resource development and for maintaining and upgrading quality and relevance of education in Agricultural Universities. The publication of this magazine is a great effort by ICAR in this direction. It would educate students about the enormous employability, research and teaching opportunities in the field. I wish the magazine a great success."

(Shobha Karandlaje)
Minister of State for Agriculture and Farmers Welfare,
Government of India

डॉ हिमांशु पाठक
Dr HIMANSHU PATHAK

सत्यमेव जयते

सचिव कृषि अनुसंधान और शिक्षा विभाग एवं
भारतीय कृषि अनुसंधान परिषद
कृषि भवन, नई दिल्ली 110 001
Secretary, Department of Agricultural Research
and Education (DARE)
and Director General, Indian Council of
Agricultural Research (ICAR)
Krishi Bhawan, New Delhi 110 001

MESSAGE

Indian agriculture is unique, diversified and vast, providing livelihood and income to more than half of our population. It is well-known that today India is one of the forerunners in agriculture among the developing countries. Since independence, Indian agriculture has changed from a 'ship-to-mouth' status to self-sufficiency, to presently a food-exporting nation. This was possible due to science, technology, innovation (STI) and policy-backed agricultural revolutions including green, white, blue, yellow, silver, brown, gray and rainbow that transformed Indian agriculture. The overall effect of these revolutions and other aspects of the agricultural strategy and policy is that the per capita production of food in the country has more than doubled during the last 50 years, despite the 237% increase in human population.

One of the mandates of ICAR/DARE includes promotion and coordination of education in agriculture, agro-forestry, animal husbandry, fisheries, home science and allied sciences in the country, which forms the backbone of STI in the agriculture sector. India has a fairly strong agri-education system in place, comprising four Deemed Universities (DUs) under ICAR, 63 State Agricultural Universities (SAUs), 3 Central Agricultural Universities (CAUs) and 4 Central Universities (CUs) with agriculture faculty, with research/technological support from 109 ICAR institutes. These Agricultural Universities and DUs are providing advanced degrees in over 30 disciplines of agriculture and allied sectors. While the agri-education system has been very beneficial for improving agricultural

development in the country, policy shifts (such as National Education Policy 2020) and new challenges (climate change, resource depletion, low priority by youth to take agriculture as a profession, and agricultural education and sciences as a career) require continuous upgradation of the existing structure.

Accordingly, ICAR has in place an institutional mechanism of 'Dean's Committee' for periodic revision and improvement of course curricula to meet the changing demand of higher agricultural education to ensure strengthening educational standards, graduates employability, better research, extension outcomes, and trained quality human resources. The 5th Deans' Committee recommended 12 UG degrees in Agricultural Sciences as professional degrees. In developing the curricula, the committees internalized the Government's major initiatives, *viz*. National Food Security Mission, Rashtriya Krishi Vikas Yojana, Make-in-India, Start-up-India, Skill India, Digital India, etc. Student READY (Rural Entrepreneurship Awareness Development Yojana), including Experiential Learning (Business Mode), Experiential Learning - Hands on Training (Skill development), Rural Awareness Work Experience (RAWE), In Plant Training/Industrial attachment/Internship and Student Project. Six common courses related to climate smart agriculture, agribusiness, marketing, and ICT have been included across agricultural sciences. Further, four new degree programs covering biotechnology, nutrition, community science and sericulture have been designed. The Committee kept the major global initiatives and foresight in mind towards developing leadership in agricultural sciences to ensure economic attractiveness, global competitiveness, social equity and environmental sustainability. In December 2021, the 6th Deans Committee' was constituted by ICAR for necessary curricula modifications to develop a roadmap to implement the provisions in the NEP 2020 and its report is awaited, which aims at a good Agriculture Education Ecosystem to make farming more remunerative and empower the people involved in the agriculture ecosystem. At this juncture, when ICAR is embarking upon an ambitious step to strengthen the agri-education system, it was considered most appropriate to start a magazine 'Agri-Rise' as a one-stop shop for enhancing the cognitive level of students about agriculture to increase their interest and gain useful contemporary knowledge on the subject. We welcome comments and suggestions from the readers for the improvement of the magazine in future.

(Himanshu Pathak)

Launching of the Agri Rise: Agriculture Education Digest

Agriculture plays a very prominent role in the overall development and growth of the country's economy. In order to address the challenges in agriculture creation of skilled, talented and entrepreneurial human resource is crucial. Agriculture Education is an important component of our education system and is guided by National Agriculture Research and Education System (NARES) led by Indian Council of Agricultural Research (ICAR) which includes Agricultural Universities.

The New Education Policy (NEP) 2020, announced by Hon'ble Prime Minister, lays particular emphasis on the development of the creative potential of each individual. It is based on the principle that education must develop not only cognitive capacities - both the 'foundational capacities' of literacy and numeracy and 'higher-order' cognitive capacities, such as critical thinking and problem solving – but also social, ethical, and emotional capacities and dispositions. In this direction, a number of activities are being taken up in agricultural universities including implementation of NEP 2020. The other initiations taken by universities related to experiential learning programmes, entrepreneurship development, success stories and various other activities/events need proper reflection.

It is a matter of immense pleasure to inform that ICAR is initiating this magazine entitled AGRI RISE - Agriculture Education Digest exclusively for the Agricultural Education. Presently, there is no magazine/periodical exclusively for agricultural education.

The New Education Policy (NEP) 2020, announced by Hon'ble Prime Minister, lays particular emphasis on the development of the creative potential of each individual.

This quarterly magazine would contain education centric articles, Agricultural University profile, Experiential Learning Programmes (ELP) of Agricultural Universities, student's success stories, information on events organized and forthcoming events related to agricultural education.

Each issue of the magazine would have a broad theme. This inaugural issue is mainly focused on New Education Policy 2020 with regard to Agricultural Education. It contains articles starting from history of agricultural education to making the agriculture education system in India future ready. Profile of the first Agricultural University in the country, *viz.* Govind Ballabh Pant University of Agriculture & Technology (GBPUA&T), Pantnagar, and first Deemed University, *viz.*, Indian Agricultural Research Institute (IARI) is presented. Besides the education centric articles, the details of the Experiential Learning Programmes (ELPs) along with some success stories of student entrepreneurs is also included.

It is believed that the magazine will be very much useful, informative and beneficial for the students and other stakeholders. The editors express their gratitude to all the authors for developing and providing the articles. We sincerely thank Hon'ble Minister of Agriculture and Farmers' Welfare, Hon'ble Ministers of State of Agriculture and Farmers' Welfare, Government. of India and Secretary, DARE and Director General, ICAR for their guidance and support in bringing out this magazine. We are also thankful to the ICAR-Directorate of Knowledge Management in Agriculture, New Delhi for all support in printing this magazine.

(RC Agrawal)

R C Agrawal[1] and Vanita Jain[2]

History of AGRICULTURAL EDUCATION IN INDIA

India has a rich heritage of higher education, including agricultural education. However, higher education in agriculture was not given any importance before independence. Numerous recurring and unexpected as well as overlapping challenges from natural and man-made disasters made agriculture vulnerable, and pushed the population to the brink of starvation. In 1876, the Madras Veterinary College started in Chennai to offer diploma and certificate course in veterinary and animal sciences. Later in 1903 it attained the status of a college and got affiliated to University of Madras in 1936. The first ever structured attempt by British Government for higher agricultural education was made during 1901-1905 when 6 agricultural colleges were established at Coimbatore, Kanpur, Layallpur (now in Pakistan), Nagpur, Pune and Sabour. In 1927, Bihar and Orissa Veterinary College was established having the distinction of being the 5th oldest veterinary college of undivided India. The college started functioning from 7 April 1927 and became fully operational in 1930 and was known for its research in various branches of veterinary medicine and disease control. In 1948, only 17 agricultural colleges (13 Agriculture, 3 Veterinary existed in India with facilities for training of only 160 postgraduate research students.

In 1876, the Madras Veterinary College started in Chennai to offer diploma and certificate course in veterinary and animal sciences. Later in 1903 it attained the status of a college and got affiliated to University of Madras in 1936

After independence, need was felt for a scientific and pragmatic policy to reconstruct higher education including agricultural education. This became imminent with the appointment of University Education Commission in 1948 by Government of India. The commission gave the concept of rural universities, thereby opening the way for setting a new pattern for initiating agricultural education. However, the setting up of SAUs became a reality only after the recommendations of the first Indo-American Team in 1955.

The First Indo-American Team reported to set up universities on the Land Grant pattern

The Government of India, in view of growing food shortages, approached United States Technical Cooperation Mission for solution. Consequently, a Joint Indo American Team was constituted in 1954. The Team in its report submitted to the Government in 1955 advised to

Major milestones in higher agricultural education

Year	Milestone/Landmark
1948	First University Education Commission of India to review all higher education
1955	Report of the first Indo-American team- proposal to the Government of India for establishing Land-grant style universities
1958	Deemed University Status to IARI
1960	Report of second Joint Indo-American Team on agricultural research, education and extension to frame specific proposals for the third five year plan
1960	Emergence of SAUs, starting with Pantnagar, based on the recommendations of the Joint Indo-American Teams (7 SAUs established by 1964)
1962	Report of Cumming's Committee to advise state governments on the legislation for establishment of agricultural universities
1965	Standing Committee on Agricultural Education replaced the Education Panel
1965	ICAR reorganization with four Divisions including Agricultural Education
1965	1st Deans' Committee constituted
1966	Report of the Education Commission (1964-66) for establishment of agricultural university in each state
1966	First Model Act developed by ICAR for uniformity across agricultural universities
1966	JRF initiated for MSc Students
1973	Second reorganization of ICAR with the establishment of Department of Agricultural Research and Education (DARE) to provide greater autonomy to ICAR, and Regional Committees to take care of regional needs, and creation of Agricultural Research Services (ARS) and Agricultural Scientists Recruitment Board (ASRB)
1974	Norms and Accreditation Committee (NAC) replaced Standing Committee on Agricultural Education
1995	Agricultural Human Resource Development (AHRD) project, with World Bank Support, launched (ended in 2001)
1994	Centres for Advanced studies established
1996	International Scholarship started
1996	Establishment of Accreditation Board for Higher Agricultural Education replacing NAC
1997	Initiation of All India Entrance Examination for Admissions
1998	ICAR initiated Post Graduate Scholarship (PGS)
1999	ICAR initiated National Talent Scholarship (NTS)
2006	Niche Area of Excellence started
2009	1st Broad Subject Matter Area Committee (BSMA) constituted for revision of PG courses
2011	Initiation of Netaji Subhash International Fellowship
2015	Student READY Programme launched
2016	Post Doctoral Fellowship initiated
2016	Declaring the UG degrees in agriculture and allied subjects as Professional Degree Courses
2017	Initiation of Ranking of agricultural universities National Agriculture Higher Education Project implemented
2021	Implementation Strategies of National Education Policy 2020 in Agricultural Universities by ICAR
2021	Initiation of BIMSTEC international fellowship
2022	Initiation of ASEAN international fellowship
2022	MoU with Heartfulness Education Trust for the meditation and yoga in AUs.

Agricultural Universities (AUs) in India

Domain of AU	Number
State Agricultural Universities	39
Veterinary Universities	15
Horticulture Universities	06
Fisheries Universities	03
Deemed Universities	04
Central Agricultural Universities	03
Central Universities with Agricultural Faculties	04
Total	**74**
Doctoral Programs 80; PG level Subjects 95; UG Level subjects 11	

setup colleges on land grant pattern as a solution to solve the problem of agricultural education. The team recommended strengthening of post graduate teaching and research in agricultural subjects as well as effective coordination of agricultural education, research and extension. These recommendations laid the foundation for the creation of agricultural universities and research in agricultural sciences. The contracts were signed with the 5 US land grant universities. According to contracts, each contracting US university had to work with agricultural colleges and research station in India for some definite period.

In 1955, Government of Uttar Pradesh in consultation with University of Illinois, presented a proposal to the Government of India for establishing a university on the land grant pattern. A contract between the Government of India, the Technical Cooperation Mission and few US land grant universities, was signed to promote agricultural education in India. The task of mentoring the proposed university in Uttar Pradesh was assigned to the University of Illinois. The University was dedicated to the Nation on 17 November 1960. Illinois faculty served the university in designing its education system and putting in place an effective research and extension system for a period of 12 years. In 1958, the second joint Indo American Team on Agricultural Education Research and Extension was appointed to frame proposals for third Five Year Plan. The Team reinforced proposals to adopt land grant pattern, with autonomous status, integrating agriculture and allied areas as well as teaching research and extension.

The initial establishment of Govind Ballabh Pant University of Agriculture and Technology (GBPUAT) University brought about a revolution in agricultural education, research and extension, and it paved the way for setting up of 29 other state agricultural universities in the country by the year 1999.

Reorganization of ICAR and establishment of Division of Agricultural Education

Though ICAR aimed to undertake, aid, promote and coordinate agricultural education in the country, however, it had a very limited role before 1966, as it had neither financial resources nor statutory authority to discharge this responsibility. In 1966 ICAR was reorganized and a full-fledged Division of Agricultural Education was established to coordinate and support the development of AUs. The various fellowship schemes for staff development and student welfare were initiated. ICAR developed first Model Act in 1966 to provide legal base for establishment, functioning and uniformity of agricultural universities across AUs.

In 1966 ICAR was reorganized and a full-fledged Division of Agricultural Education was established to coordinate and support the development of Agricultural Universities

The ICAR through its Agricultural Education Division strives for maintaining and upgrading quality and relevance of higher agricultural education through partnership and efforts of the ICAR-Agricultural Universities (AUs) system. Hence, the quality assurance of higher agricultural education was given the major thrust through policy support, accreditation, academic regulation, personnel policies, review of course curricula and delivery systems, development support for strengthening and creating infrastructure, improvement of faculty competence and admissions through All India competitions.

In 1973, ICAR went through another major re-organisation. The new Department of Agricultural Research and Education (DARE) was created under Ministry of Agriculture to provide ICAR required linkages to deal directly with central and state governments as well as international organizations.

Student READY: Introduced in V Deans Committee report

Hon'ble Prime Minister launched the Student READY (*Rural Entrepreneurship Awareness Development Yojana*) in 2015 for the development of agri-entrepreneurs. This has been introduced in the UG programme in all the disciplines of agricultural and allied sciences as approved in Fifth Deans' Committee. It is one complete year activity integrated with the last year of the UG programme of Agriculture, Agriculture Engineering, Biotechnology, Community Science (earlier Home Science), Dairy Technology, Food Technology, Forestry, Fisheries,

Horticulture and Sericulture. It aims developing young agri-preneurs for emerging knowledge intensive agriculture.

Implementation of National Education Policy in Agricultural Universities

The New Education Policy 2020 of India was rolled out on 29 July 2021. NEP 2020 provisioned that "the design of agricultural education will have to be strengthened towards developing professionals with the ability to understand and use local knowledge, traditional knowledge and emerging technologies, while being cognizant of critical issues of declining profitability and/or productivity but enhanced economic aspirations of farmers, climate change, food sufficiency, *etc*."

Based on the principles and philosophy of NEP 2020, a roadmap and Implementation Strategy for NEP 2020 in Agricultural Education System has been prepared and released on 28 September 2021 during the Annual Vice Chancellors Conference in New Delhi (ICAR 2021).

ICAR has been given the responsibility of Professional Standard Setting Body (PSSB) for the Agriculture Education. To align the vision and mandates of the NEP-2020 the higher agricultural education aims to:

1. Increase enrolment of students to higher agricultural education.
2. Making India a global destination for higher agricultural education
3. Rooting Indian agricultural education and research in ancient culture and heritage.

Some of the major highlights of NEP 2020 are: Enhancing the GER, defining Minimum Standards of Quality of Agricultural Education and ensuring their adherence by all stakeholders, improvement in research contributions, importance of staying relevant and providing placement along with right skills. Various timelines for implementation of NEP by AUs were also defined by the committee.

Starting with multiple exit and entry points into higher education, relaxation of the residential requirements of UG, PG and PhD programmes, restructuring and reformulation of the UG curriculum in accordance with the new system advised by NEP, compliance with Academic Bank of Credits as per the directives of the Ministry of Education, Deemed universities of ICAR initiated the process for transforming them into Multidisciplinary Education and Research University (MERU). AUs to start increasing seats on annual basis by 10% until the target is achieved. By 2025-2030 all institutions, located in the same premises, offering either professional or general education may aim to organically evolve into multi-disciplinary institutions/clusters offering both seamlessly, and in an integrated manner. By 2035, achieving 50% Gross Enrolment Ratio (GER) in higher agricultural education

including vocational education, All higher education institutions (HEIs) should aim to become multidisciplinary institutions by 2040.

Through the implementation strategies of NEP-2020 developed by ICAR, following goals are being targeted:

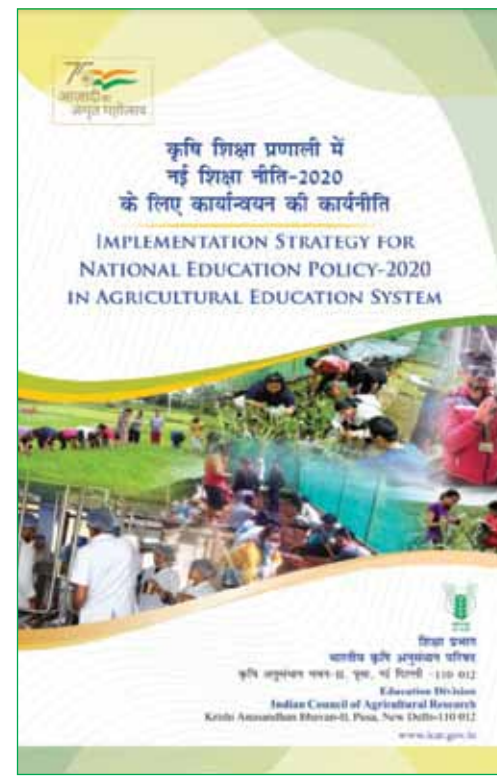
- A paradigm shift in education, from 'teaching to learning', and of expanding the reach and opportunities for learning will necessitate going beyond the current initiatives of establishing new central agricultural universities and upgrading the deemed universities as a global destination for agricultural education.
- Agricultural research, education and extension for development (AREE4D) to be mainstreamed into national policies.
- Scientific projects which may be able to respond faster to societal demands. This may require re-structuring of the organisational model of research units, from rigid ones to flexi-program mode dynamic research consortia led by program leaders on the pattern of international organisations.
- **Integrating Agricultural Education with job creation**
  Higher agricultural education and training for capacity building to gain access to employment and self-employment will be necessary. The avenues are plenty in agriculture. Hence, in addition to awarding formal degrees, Agricultural Universities (AUs) will be required to initiate job driven vocational programmes to build avenues of off-farm work. In order to promote Agri-entrepreneurship, the establishment of agribusiness incubation centres at each of the AUs to shall give a boost to start-ups in the agriculture and allied areas.
- **Global outreach**
  Agricultural education is to be harmonized with existing and emerging issues related to WTO and free market economies. Worldwide, agriculture is becomingcompetitive both price-wise and quality-wise. Price and brand equity have become more prominent than before. Indian agriculture is no exception and its objectives have to align with stakeholders' needs, clients' perspective, peer concerns and market vibes.
- **Strengthening of infrastructure and resources**
  The AUs are charged with complete integration of teaching, research and extension for holistic rural development. Most of the SAUs have not been able to achieve integration of these functions due to limited physical, financial and appropriate human resources. In addition to enhanced government support, the AUs will be required to generate their own resources through innovative programmes, consultancy, enrolment of foreign students, sale of seed/ planting material *etc.*).
- **Innovations in curriculum**
  Inclusion of disciplines *viz.* nanotechnology, artificial intelligence *etc.* in the course curriculum along with increased emphasis on secondary agriculture. Enabling environment for effective teaching-learning with national and global linkages would need to be established. Agricultural Universities are concentrating mainly on formal education while there is also need for non-formal education especially in respect of knowledge and technological empowerment of vast section of work force in rural areas.
- **Attracting and retaining talent**
  As rural and agricultural markets are transforming, with higher demand and prices, more integrated supply chains, greater rural-urban connectivity in many areas and exponential growth in urban markets, new opportunities are emerging for young people to start up and run profitable agribusinesses which is possible when possessing range of agricultural as well as

By 2035, achieving 50% Gross Enrolment Ratio (GER) in higher agricultural education including vocational education, All higher education institutions (HEIs) should aim to become multidisciplinary institutions by 2040.

financial skills and knowledge.

- **Linkages and collaborations**
  Interactions/ collaborations/ linkages with other universities, ICAR institutes and institutions like IITs and IIMs are almost missing which impinges upon the teaching-learning process as well as the academic environment in the institution. It is important to maintain regular university- alumni interface. Greater linkages at national and international levels are required for improving the quality assurance mechanism and process, faculty and student competence, *etc*.
- **Digital Education**
  Improvement and expansion of e-learning platforms to meet the demand for formal/ informal education for capacity building. Address inequalities in digital access, expanding access to affordable and reliable internet connectivity for households and education and training institutions, including through public partnerships. New areas of specialization in Database Technologies, Cloud Computing, Process Automation, Human Machine Interaction, Block Chain Platforms, Software Application Development, Geo informatics, Artificial Intelligence and Machine Learning, e-commerce and social media specialty, Technical Leadership and Architecture Experience be created in the agricultural universities in a phased manner.
- **Empowering farm women**
  Gender is an important dimension that influences opportunities to build and utilize capacities of youth in agriculture. Empowerment of farm women by ensuring equal access and opportunity will lead to a foundational transformation in India's rural economy, improving lives of millions. The challenges of reaching young women – who are frequently constrained by heavy household workloads, traditional customs and beliefs, and even constraints on their mobility in some societies – with education and training initiatives, are huge.
- **Agricultural marketing**
  The potential returns of capturing the opportunity to engage today's young people in the challenge of raising agricultural production in terms of food security, poverty reduction, employment generation, as well as peace and political stability are enormous. E-commerce that directly connects producers to consumers is likely to be a new normal and is expected to induce private investment in Agri-tech start-ups connecting farmers directly to the consumers. These would bring primary processing facilities and branding closer to the farm-gate, provide a big push to rural industrialization, and compel value chain participants to comply with domestic and international food safety standards. Increasing use of tech-based solutions and e-markets would create a new vertically coordinated marketing system, driven by the institutions, such as contract farming, cooperatives, and farmer producer organizations (FPOs). Efficient market intelligence, tracking domestic and international demand and supply-side factors should be in place. There is need to tap the global market for surplus crop output, nutria-cereals, fruits and vegetables, industrial crop products, organic and medicinal crop outputs.

[1]Deputy Director General (Agricultural Education), ICAR and
[2]Principal Scientist, Agricultural Education Division, ICAR KAB-II, Pusa, New Delhi 110 012
Email: ddg.edu@icar.gov.in



R S Paroda

Tailoring India's agricultural education for the 21st century youth

India with 1.41 billion people is the second most populous country in the world after China (1.452 billion) and is projected to surpass China soon and reach an estimated figure of 1.668 billion by 2050, as per the 2022 edition of United Nations' World Population Prospects. The Ministry of Statistics and Programme Implementation, Government of India (GoI) in its recently released report on 'Youth in India 2022' has estimated that youth in the age group of 15-29 years comprised 27.2 % of the population in 2021, which is expected to decrease to 22.7 % by 2036. Today, India has the largest global youth population of 356 million between 10-24 age group with greater proportion of nearly 200 million young people living in the rural areas. The overall rate of literacy among India's youth has increased, with approximately 90 % being able to read or write. Coupled with the prevalence of social media and internet penetration, the youth are largely digitally savvy population, accessing online resources that encourage learning and enhancing skills. Thus, the country has the advantage of a 'demographic dividend'. When this vast resource of young citizens enters the workforce, it could lead to greater economic growth resulting a shift in a population's age structure, mainly when the working-age population is larger than the number of dependents. These young people are driving a culture of innovation, entrepreneurship and diversity and need to have greater inclusion in the agricultural sector, which contributes to nearly 20% of the country's gross domestic product (GDP).

Today, India has the largest global youth population of 356 million between 10-24 age group with greater proportion of nearly 200 million young people living in the rural areas. The overall rate of literacy among India's youth has increased, with approximately 90% being able to read or write.

Challenges in retaining youth in agriculture

The COVID-19 crisis has amply demonstrated that even under the most severe lockdown of economic activities, agriculture needs to continue producing without fail. Many countries have reported economic recession and efforts to

revive their economies to overcome shocks due to the pandemic are underway. Education in general, and agricultural education in particular, would be the most crucial for this process. It is only with high quality, inclusive and equitable training, countries will succeed in overcoming the pandemic setback, which has affected millions of children, youth, and adults, especially in the lower income groups. In agrarian countries like India, agriculture is a central activity contributing significantly to the national GDP. In the years to come, the agriculture sector will take another qualitative leap, taking the benefits of digitalization and other technological advancements.

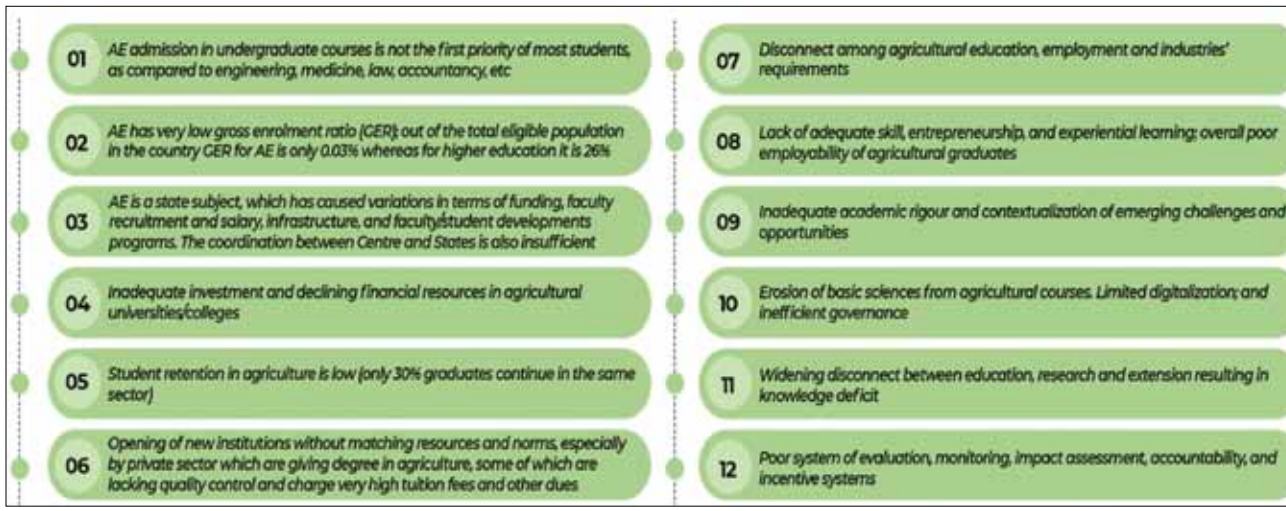
Why youth are reluctant to join agricultural sector?

Over the years, the farming community has been affected adversely due to small land holdings, which comprise over 80% of total farm households. Multiple risks associated with agriculture intensify the challenges owing to over-exploitation of natural resources linked with rapidly increasing globalization, soaring fuel and food prices, volatile markets and growing climatic volatility. It is estimated that only around 5% of youth is currently involved in agriculture. This is because they do not find agriculture a creative, profitable and/or a respectable profession.

Youth is a great resource, to be used for agricultural development and hence the challenges to retain youth in agriculture are to be effectively addressed. A major dilemma in the developing world is the poor social image of agriculture due to which, rural youth are moving towards the urban sector, looking for alternative and better opportunities.

It is evident through successful business models of leading public and private sector organizations, as well as multinational companies (e.g. IT sector), that youth are more innovative and productive as well as receptive to new technologies. On the contrary, in the agriculture sector, there is a wide gap between energy (youth) and experience (older people), which is a cause of backward nature of farming and slow adoption of innovations and new technologies. Due to poor technology dissemination, science is delinked with the society, which makes farming non-remunerative as well as non-resilient. Unless the intellectually satisfying technologies are in place, the youth is not likely to get attracted towards agriculture.

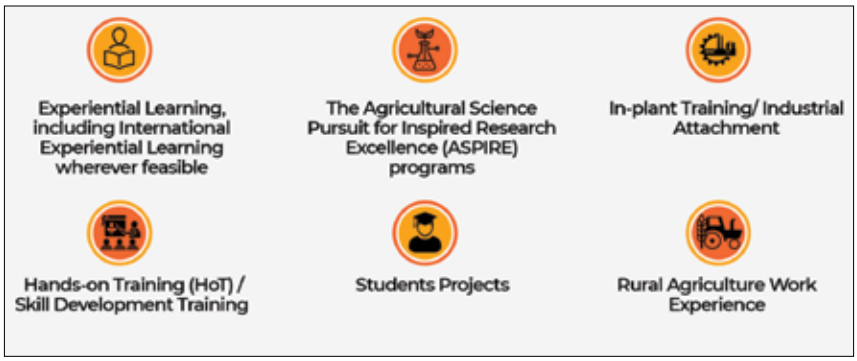
In fact, rural youth (both men and women) need vocational trainings in the potential areas like information communication technology (ICT), high-value agriculture, processing, value-addition, packaging, supply-chain management, storage, *etc*. This will empower them with knowledge and skills in priority areas like specialty agriculture, high-tech horticulture, protected cultivation, IPM/biocontrol, dairying, fisheries, bee keeping, community nursery, seed production, linking farmers with markets, *etc*. Well-trained and competent youth will certainly embrace agriculture with high degree of confidence. Thus, under the above scenario, agriculture is not seen to be a



Major concern of Agriculture Education (AE) in India

remunerative and respectable profession, particularly by youth and is not considered a sustainable pathway to meet food, nutrition and livelihood security. It is well understood that youth (both men and women) of today have a different mind-set and outlook and like to pursue intellectually satisfying, commercially viable and socially empowering activities.

Unfortunately, in developing countries like India, there exists an 'aspiration-attainment gap'. Hence, their aspirations must be addressed on priority. Therefore, youth must be motivated through advances in innovation, capacity development, partnership and a participatory approach, through enhanced skills and a positive attitude towards their role in the overall agricultural and rural development of the country. It would require a paradigm shift in the mindset, from traditional agriculture as the means of livelihood to a business-oriented, specialized agriculture involving skilled youth in rural areas. The current agricultural occupation scenario has to be made attractive and remunerative through scaling new innovations and entrepreneurships. Quality/ skilled youth can only be attracted and retained in farming if it is associated with improved rural infrastructure and better educational and related facilities. The comprehensive strategies for plausible transformation in future would demand more rewarding jobs in all agro-based and agro-related activities with equal opportunities and facilities in rural and urban areas, better options for public–private sector investments in agriculture and rural-sector infrastructure, and promotion of small agri-firms and producer companies to promote agri-food and value-chain systems. To empower rural youth, including women, is an urgent need to also transform the extension system into an innovation extension platform that delivers technology-orientated knowledge, inputs



and value-added services. The extension approach would have to focus on farming communities rather than an individual farm household approach, as had been the case in the past. All these are critical for future growth and development of any nation and would therefore, need an enabling environment through policy and institutional support by all concerned.

Major concerns of agricultural education in India

The National Agricultural Research and Education and Extension System (NAREES) of India is one of the largest agricultural education systems with 4 Deemed-to-be-Universities, 3 Central Agricultural Universities, 3 Central Universities, 63 State Agricultural Universities (SAUs), 113 ICAR Institutions and 762 *Krishi Vigyan Kendra* (KVKs) under the aegis of Indian Council of Agricultural Research (ICAR). Over the years, it has contributed significantly both for research and technological outputs around agriculture. Besides the concerns in agricultural education below, two other systemic weaknesses in the current system are: (i) the curricula are not integrally linked to development programs, and (ii) there is a disconnect between agri-graduates and farming community, with the former not providing the required services to the later. Also, over the years, knowledge creation has invariably taken a back seat due to over-emphasis on technology transfer and 'location-specific regional research' by SAUs. Further, the students tend to aspire executive positions from the beginning of their career, creating a deficit for the skilled operations at the lower levels of farm sector.

Transforming agri-education system

Keeping in view the changes in aspirations and lifestyle, there is a need to bring about changes in the agri-education ecosystem, to motivate and attract youth to agriculture and allied fields. Youth can be retained in agriculture only when required knowledge and education, technical skills, sustained encouragement and enabling policy environments are provided. In addition, the required policies, incentives, and rewards need to be put in place to attract young talents to undertake innovative farming that is not only profitable and sustainable but also respectable. This will inspire as well as attract the youth to adopt agriculture as a profession for their happy living. Such an approach should be a strategic priority at the local, state and country level to ensure youth-led inclusive

growth in agriculture. Thus, the new strategy should be to reorient present-day agriculture from crop based to farming system based with emphasis on 'plough-to-plate' approach, which is more relevant, efficient, demand-driven, productive, competitive and profitable. It must also ensure food, nutrition and environmental security for all.

The ICAR, in collaboration with all relevant stakeholders in the recent past, has undertaken some important reforms in AE

in India. Quality assurance in higher agricultural education has been introduced through accreditation system, framing of minimum standards for higher education, academic regulations, personnel policies, review of course curricula and delivery systems, support for creating/ strengthening infrastructure and facilities, improvement of faculty competence and admission of students through All India Examination. The ICAR's Fifth Deans' Committee Report restructured the course curricula to underpin relevant practical skills, entrepreneurial aptitude, self-employment, leadership qualities and confidence among graduates and attracting and retaining youth in agriculture. It also suggested norms for establishing new colleges. In order to harness regional specialties and to meet region-specific needs, certain optional courses such as coastal agriculture, hill agriculture, tribal agriculture *etc.* were formulated.

The ICAR's Fifth Deans' Committee Report restructured the course curricula to underpin relevant practical skills, entrepreneurial aptitude, self-employment, leadership qualities and confidence among graduates and attracting and retaining youth in agriculture.

In compliance with the Student READY programme launched in 2015, the Committee has designed one year programme in all the UG disciplines.

The ongoing World Bank supported National Agricultural Higher Education Project (NAHEP), built on the preceding World Bank projects, particularly NATP and NAIP, is strengthening capacities of faculty and students, foster linkages of the national system with global knowledge economy, facilitating international experiential learning, promoting learning-centred education and fortifying agriculture with private industries.

Notwithstanding the above initiatives, there is still good scope for further improvement in the AE ecosystem for motivating and attracting youth (MAYA) in agriculture through greater attention on technical and policy aspects as follows:

Technical aspects

- As articulated in the NEP 2020, agricultural education must maintain such standards to ensure that agricultural graduates from India are professionally well equipped to handle national as well as international challenges.
- The NAREES should assess the manpower needs of the fast transforming, knowledge-intensive agriculture to make necessary adjustments in curricula and skill development, emphasizing on experiential learning and exposure to national and international issues.
- More technological interventions are likely in the disciplines of ICT, digitalization, biotechnology, nanotechnology, agro-processing, precision agriculture and systems simulation, hence the associated manpower demand and shift in the pedagogy be accordingly included.

- Pluralistic approach and public-private partnership focusing on business/ marketing/income orientation are needed for making the local extension sensitive to the challenges at micro level, strengthening the feedback mechanism and setting the right priorities.
- Promoting entrepreneurship and agri-startups, encouraging market-led extension strategies and intensive use of electronic media should be duly covered in the educational programs.

Policy aspects

- The Ministry may consider setting-up an 'Agricultural Education Council of India (AECI)' as a regulatory authority which should work on similar lines as that of the Veterinary Council of India (VCI).
- Since higher education is on the concurrent list, agricultural education must be brought into the concurrent list in order to bring uniformity in proposed reforms.
- World class institutes should be set-up along the lines of IITs and IIMs with needed autonomy for decision making.
- The focus should be shifted to instil employable skills in agriculture graduates who are expected by employers in today's competitive business scenario; invest on non-formal education and vocational training in agricultural technologies.
- Educational reforms must now embrace non-formal degree programs around diploma and certificate courses to impart skill oriented vocational training programs for empowering youth to be 'job creator' rather than 'job seeker'. This would demand SAUs to widen their training programs for being more relevant and foresight oriented.

Conclusion

Agricultural education sector, as in other subjects, requires a trained human capital with youth who:

- Possess social consciousness and are connected and committed to rural communities
- Have strong entrepreneurial skills and spirit, and are capable of initiating new job opportunities;
- Are guided by positive values and high ethical standards
- Are committed to a new vision towards sustainable agricultural production;
- Have a solid grounding in the scientific and technical principles that underlie the practical experience so critical for building confidence
- Undertake generalist preparation that will enable them to develop holistic solutions to the problems that they will encounter in their careers
- Are innovators with the confidence to be creative and address real problems
- Possess strong leadership, interpersonal and team building skills and demonstrate strong communication skills, including effective use of international business languages and information technology
- Have 'business skills' to generate employment and wealth and able to work particularly with rural communities.

Motivating youth through enabling-environment, institutional support and hand holding will not only attract the youth to agriculture but would ensure accelerated growth of agriculture sector to contribute at least one trillion out of targeted five trillion economy envisioned by our Prime Minister.

This needs a paradigm shift in our approach and policy focused on youth to transform them from 'job seekers to job creators'. Capacity development of youth through informal and vocational training and creating awareness of new opportunities in agriculture, including secondary and specialty agriculture, would attract youth in agriculture, help bridge the gap between rural and urban and boost rural economy for contributing towards faster national economic growth. Finally, motivating youth through enabling-environment, institutional support and hand holding will not only attract the youth to agriculture but would ensure accelerated growth of agriculture sector to contribute at least one trillion out of targeted five trillion economy envisioned by our Prime Minister.

Former Secretary, DARE and Director General, ICAR and Chairman, Trust for Advancement of Agricultural Sciences (TAAS), New Delhi
Email: raj.paroda@gmail.com

Himanshu Pathak[1], R C Agrawal[2] and Hema Tripathi[3]

Role of the National Agricultural Higher Education Project in achieving SUSTAINABLE DEVELOPMENT GOALS

In 2015, United Nations came up with 17 Sustainable Development Goals (SDGs), which aimed to build on the Millennium Development Goals (MDGs) and complete what MDGs could not achieve. These goals are integrated, indivisible and balance the three dimensions of sustainable development: economic, social and environmental.

Along with umpteen activities in Education, Research and Teaching, the Indian Council of Agricultural Research (ICAR) commenced National Agricultural Higher Education Project (NAHEP) with the assistance of the World Bank (WB) in November 2017. The overall objective of NAHEP was to support Participating Agricultural Universities and ICAR in providing more relevant and higher-quality education to the students. NAHEP endeavours to increase agricultural productivity and supports quality improvements of higher education to create a more skilled workforce that continuously improves the productivity of key sectors, including agriculture. The project is also a multi-Global Practice collaboration (Agriculture and Education) and supports activities and results directly related to cross-cutting strategic areas of climate change, jobs and gender.

NAHEP is supporting the Agricultural Universities (AUs) under the ICAR education system through 3 major components such as;

NAHEP endeavours to increase agricultural productivity and supports quality improvements of higher education to create a more skilled workforce that continuously improves the productivity of key sectors, including agriculture.

Institutional Development Plans (IDP)

Supports 22 AUs for quality enhancement, business entrepreneurship and employability for Undergraduate (UG) students;

Centre for Advanced Agricultural Science and Technology (CAAST)

Supports 16 AUs for scientific entrepreneurship, employability and research effectiveness for Postgraduate (PG) students; and

Innovation Grants (IG)
Supports 24 AUs/ Colleges for attaining accreditation.

NAHEP is also supporting 3 ICAR institutes under Component 2 of NAHEP to focus on institutional reforms and ICT infrastructures. Altogether, NAHEP has supported 62 AUs and 3 ICAR institutions across 23 states of the country.

While implementing the activities to meet the project's objective, NAHEP has contributed significantly to achieving SDG goals, directly or indirectly, since its implementation.

SDGs addressed by NAHEP

Along with agriculture and education, NAHEP interventions have either direct or indirect bearing on innovation, climate change, conservation of soil, water (specifically marine water), sustainable energy, gender equality, *etc*. Activities or achievements made under the project are mentioned below, which explains how NAHEP directly/indirectly supports the achievement of SDG goals:

Goal 4 Quality Education: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Education enables socioeconomic mobility upward and is a key to eliminating poverty. Indicator 4.4 of SDG 4 states that "By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship". NAHEP interventions are suitably addressing this target.

NAHEP Project Appraisal Document (PAD) rightly identifies that NAHEP promotes: (a) equal access to affordable vocational training; and (b) greater gender and wealth equity through universal access to quality higher education. Specifically, NAHEP interventions intend to increase the supply of qualified technicians (through certificate programs at AUs) and teachers (through international cooperation for teacher training and faculty exchange).

To date, partner/awarded AUs under NAHEP have organized thousands of skill development trainings for AU students and aspiring entrepreneurs. Training themes include vocational skill development, entrepreneurship development, technical themes in agriculture and allied science, effective communication *etc*. It is also important to note here that there have been remarkable outcomes from these activities and training programs, such as:

- Students from partner AU under the IDP component have established their own start-ups during the final year of under graduation (Building Entrepreneurship capabilities).

- Students from several partner AU have started advisory and inputs services for crops, horticulture, livestock, poultry and fish farming in their area. The input and advisory services are helping farmers in sustainable production, and at the same time, students are also earning decent remuneration.

In addition to national-level skill development and thematic trainings, visits to foreign universities under NAHEP have also been organized for beneficiary students with an aim to provide them exposure in cutting-edge areas of science and technologies. One of the key outcomes envisaged through these trainings is to build the entrepreneurial spirit among students around innovative and cutting-edge technologies in agriculture. Such skill development programs have been organized mainly to cater to the current market needs and enable the students to emerge as "Job Creators" rather than "Job Seekers".

SDG indicator 4.3 states that "By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university." NAHEP has played a pivotal role in meeting this indicator as well. With the help of the Agricultural Education Division (AED) of ICAR, Project Implementation Unit (PIU) NAHEP has taken an initiative to attract talented men and women in Agricultural higher education. Under the aegis of NAHEP, partner AUs have been organizing an "Agricultural Education Fair" targeted to HSE and intermediate students to create awareness and showcase career opportunities in agriculture and allied sectors. For this novel initiative, PIU NAHEP has been able to reach 10,000+HSE students across the country to date.

Goal 2 Zero Hunger: End hunger, achieve food security and improved nutrition and promote Sustainable Agriculture (SA)

Globally, there has been insufficient investment explicitly targeting the food security and nutrition of the extreme poor, who are largely rural people. Investing in small producers, family farmers, fisherfolks, livestock breeders, forest users, rural workers, and indigenous peoples can promote growth and development in rural areas. Increasing their access to resources, employment, and incomes will lead to better food security and nutrition. At the same time, it helps ensure sustainable stewardship of the planet's natural resources, raises productivity and contributes to national economic growth.

Promoting Sustainable Agriculture (SA), food security and improving the nutritional status of food produced for humans well as for animal consumption are a few of the key focus areas under the CAAST component of NAHEP.

For example, a few partner AUs have established the School of Natural Resource Management and Sustainable Agriculture to introduce various sustainable practices in Agriculture while improving the environmental, soil and water health, specifically in the northern region of India.

SDG 2.4 states that "By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality". Partner AUs under CAAST have taken several initiatives to meet this goal, such as:

- AUs have ensured sustainable agricultural practices by developing and adopting Internet of things (IoT)based technologies to improve irrigation efficiency and timely assess soil health. For example, the innovation under irrigation- 'Auto PIS', helps to schedule the irrigation without any human intervention based on sensors. After the adoption of Auto PIS technology, farmers can apply the precise amount of water on the field, which will save electricity, water and labour cost and ultimately increases crop productivity and contribute to better soil health. On the other hand, the '*Phule Soil Moisture Sensor*' helps farmers to understand soil health through moisture sensors and the need for nutrition, irrigation timing *etc*. Through these innovations, partner AU has benefitted more than 6000 farmers.
- Under the CAAST, 'Introgression lines of mustard from *B. rapa D. erucoides*' has been developed. These introgression lines will be useful in breeding mustard cultivars resistant to Alternaria blight (one of the major diseases in mustard).

- Developed Sub-Baric Food Grain Storage Bin: Sub-baric storage method involves (manually or automatically) placing food grains in a storage structure, removing air from inside and sealing. The intent of vacuum storage is usually to remove oxygen from the container to extend the shelf-life of food grains. Vacuum storage reduces atmospheric oxygen, limiting the growth of aerobic bacteria or fungi and preventing the evaporation of volatile components. The sub-baric storage bin can be used for storage of cereals, pulses and oil seeds for extension of the shelf-life of food grains.
- Partner AU have developed horticulture crop cultivation under various conservation agriculture (CA) systems such as Arecanut based cropping system: Arecanut + Carrot-Mint-*Kharif* onion, Mango-Arecanut based cropping system: Mango + Arecanut + French bean – Amaranthus - *Kharif* onion, Mango based cropping system: Mango + Guava + Berseem - Pumpkin *etc*. Continuos efforts to promote such diversification for sustainable agriculture through various field demonstrations and awareness programs for farmers are being conducted under NAHEP.
- Partner AU have developed several crop advisory based mobile applications to increase efficiency, decrease cost of cultivation and improve yields.
  - Urea Guide App application provide recommendations to the farmers on the usages of fertilizers and pesticides on the basis of leaf colour combinations. The adoption of the Urea Guide App based N management practices helps in optimizing the fertilizer N use, increases farmers' income, reduces insecticide and pesticide consumption and also addresses the challenges related to air and water pollution. It also led to an equivalent grain yield with an average saving of 50-80 kg N per hectare in Rice and 50 kg N per hectare in wheat in comparison with the farmers' usual practice.
  - Time variable rate fertilizer application has also developed, which help in precise real time application of fertilizer according to the spatial variability of the field. Also, it helps in reducing the fertilizer usages by about 10-25%, and decreasing the cost of production while protecting the environment by reducing leaching.
  - An intelligent pest and disease forewarning system for Rice, Pigeon pea, and Grape using information and communication technology

(ICT) and the Internet of things (IoT) is a promising system in the area of pest and disease forewarning. It aims to increase farm productivity for better managing crops. Web portal forecasts the occurrence of pests and diseases using automated weather station (AWS) data and micro climatic parameters. Farmers receive pest and disease forewarning information as well as effective crop management practices through electronic media such as SMS and mobile applications.

Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

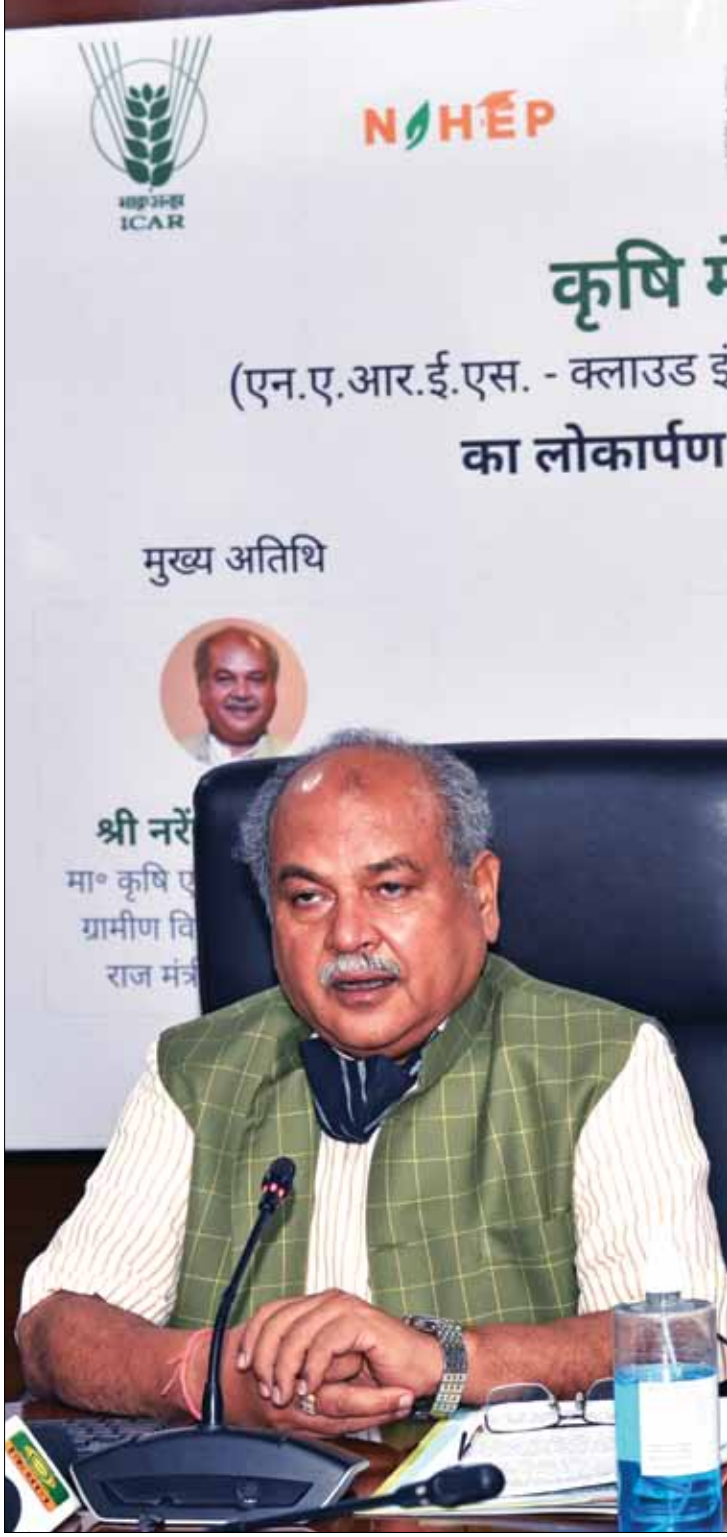
Agriculture and allied sector in India accounts for around 17 % of the GDP, 13 % of exports, and 55 % of employment. However, a 2014 assessment of human resource requirements shows an annual deficit of 14,000 qualified individuals in India's agricultural and allied sectors.

The exposure given to students through training programmes and internships under NAHEP-IDP has motivated agricultural students to become budding entrepreneurs.

NAHEP suitably addresses unemployment issues, particularly for rural youths, through improving employment opportunities and entrepreneurship capabilities. Partner AUs have taken several initiatives to meet this goal, such as:

- Many students of partner AUs got placement in renowned companies. Outcome-focused trainings conducted under NAHEP–IDP and NAHEP-Component 2 helped students to achieve this milestone.
- Several students of partner AUs have established their own start-ups during their final year of under-graduation.

Career Development Centres (CDCs) build under Component 2 is also empowering and enriching the student's professional skills to cope up with global challenges in the agriculture and allied sector. CDCs have created student-centric career development platform to achieve professional
excellence through comprehensive career counselling, innovative educational programming, promotion of agri entrepreneurial skills for better employability.



Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

NAHEP, since its inception, has consistently focused on developing resilient infrastructure in agriculture and allied sectors across the country. Due to social distancing measures and travel restrictions during the

Covid-19 pandemic, Resilient Agricultural Education System (RAES) has been introduced under NAHEP, wherein teaching and learning operates seamlessly across multiple situations and contexts, with minimal impact on the learners and other operational aspects such as assignments and examinations of the learners. Therefore, NAHEP is Promoting a Resilient Agricultural Education System (RAES). The focus is strengthening existing Digital infrastructure and online learning platforms in AUs, developing a discipline-specific Digital Content repository and a system-wise Digital Capacity building program.

Facilitative units have been established to enable the academic and research infrastructure of AUs (IIIC-Industry Institution Interaction Cell/Start-up Cell/ Incubation Cell/Placement Cell, etc.) under NAHEP. These fully equipped facilitative centres have been established to enhance the teaching effectiveness of faculties and students' learning outcomes. Here are a few initiatives undertaken by partner AUs to meet the goal:

NAHEP is Promoting a Resilient Agricultural Education System (RAES). The focus is strengthening existing Digital infrastructure and online learning platforms in AUs, developing a discipline-specific Digital Content repository and a system-wise Digital Capacity building program.

- Established Learning and Assessment Centre to demonstrate the anatomy of animals/birds, perform virtual surgeries through simulation models, *etc*.
- Established artificial intelligence (AI) laboratories with an aim to get students acquainted with advanced technologies such as artificial intelligence, robotics, drones, sensors, CAD designing and simulation and precision agriculture.
- Established Innovation Cell and Incubation Facilities at the AUs level, which provides a platform to boost students' activities - research in niche areas, ideation, prototype development, market research, and start-up ecosystem.
- Established language labs in AUs to help students learn foreign languages, namely, English, French, German and Spanish. It benefits the students to opt for academic opportunities abroad.
- To ensure future readiness, and to mitigate the risk of fire, terrorist attacks, and natural calamities, the ICT infrastructure of Indian Council of Agricultural Research-Agricultural Universities (ICAR-AU) system is being strengthened by establishing the Disaster Recovery Centre (DRC). ICAR- Data Centre (ICAR-DC) and ICAR-DRC are synchronized with each other and its

technologies helped to build ICAR - Cloud with capabilities to support Artificial Intelligence (AI) and Video Streaming applications along with the existing web and Mobile Apps. Network integration between the institutions is providing seamless access to the application services running on these centers to the users.

The key outcomes envisaged through the establishment of such facilitative Centres are to increase student placement rates, increase on-time graduation rates, improve faculty research effectiveness, *etc*. This, in turn, would promote inclusive and sustainable industrialization and foster innovation in agriculture and the allied sector.

Goal 13 Climate Action: Take urgent action to combat climate change and its impacts

Agriculture has a major role to play in responding to climate change. While temperature rises pose a real threat to global food production, investments in agriculture sectors can simultaneously support climate change adaptation and mitigation while improving rural people's livelihoods.

NAHEP focuses on education, awareness-raising and human and institutional capacity for climate change mitigation, adaptation, impact reduction and early warning. The NAHEP interventions specifically target AU curricula reform to internalize climate change and resilience in current and future course content and tie this with experiential learning for the certificate, undergraduate (UG) and post graduate (PG) students for practical career applications.

Partner AUs have also entered in MoUs with institutes such as International Water Management Institutes (IWMI), Colombo, Sri Lanka, National Institute of Abiotic Stress Management (NIASM), Malegaon (Kh), Baramati, Water and Land Management Institute, Aurangabad, Watershed Organisation Trust (WOTR), Pune, Grass Roots Action for Social Participation (GRASP), Aurangabad to collaborate in understanding the industry and research needs on Climate Smart Agriculture.

Goal 7 Affordable and Clean Energy: Ensure access to affordable, reliable, sustainable and modern energy for all

Energy has played a key enabling role in achieving food security and better nutrition. Energy prices influence food prices. Food systems, which currently consume 30 % of the world's energy, will gradually need to de couple from fossil fuel dependence to deliver more food with less and cleaner energy.

To ensure affordable, reliable and sustainable energy, partner AUs under the CAAST component of NAHEP has developed solar operated irrigation system. This innovation promotes the conservation

The NAHEP interventions specifically target AU curricula reform to internalize climate change and resilience in current and future course content and tie this with experiential learning for the certificate, undergraduate (UG) and post graduate (PG) students for practical career applications.

of energy and supports achievement under the SDG indicator 7.2, 'Increase substantially the share of renewable energy in the global energy mix of SDGs'.

The Solar operated irrigation system installed at AU is currently working on the university farm for a demonstration to the farmers and industry stakeholders. The technology is currently being used in high-value crops with zero use of electricity and ensuring high water use efficiency (WUE).

Goal 5 Gender Equality: Achieve gender equality and empower all women and girls

Globally, Gender equality and women's empowerment have advanced in recent decades. Therefore, girls' access to education and, in turn, their contribution to society's development have been well received. The same has also been taken into consideration in designing and implementing NAHEP.

NAHEP suitably addresses the gender nuances of the project through the effective implementation of 'Social Safeguard measures'. These measures ensure timely sensitization and capacity-building programs for project stakeholders on gender issues and preparation and implementation of Equity action plans (EAPs) for all partner AUs. EAP addresses gender and social inclusion issues, with special attention to the needs of female and SC/ST students.

NAHEP, while incorporating the two World Bank Global Practices-Agriculture and Education ensures the AUs' reform process benefits from innovations in both sectors across India and internationally. With the enhanced focus while corroborating NEP 2020 and strategic priority interventions at the Central and State levels, NAHEP will have profound and long-term impacts on agricultural higher education in India.

As NAHEP is in its ongoing implementation phase, it is envisaged that the project would further evolve and newer outcomes would emanate and contributemore towards meeting the additional SDG goals as well as enhance contribution to the current SDGs.

[1]Secretary, Department of Agricultural Research and Education (DARE) and Director General, Indian Council of Agricultural Research (ICAR), Krishi Bhawan, New Delhi;
[2]Deputy Director General (Agricultural Education) and National Director, NAHEP (ICAR); and
[3]National Coordinator (M&E), NAHEP (ICAR),
Email: dg.icar@nic.in, ddg.edu@icar.gov.in

Tej Partap

FOUR PILLARS OF EDUCATION: Making it happen is our challenge of the future

Education is at the heart of both personal and community development; its mission is to enable each of us, without exception, to develop all our talents to the full and to realize our creative potential, including responsibility for our own lives and achievement of our personal aim. There is therefore every reason to place renewed emphasis on the moral and cultural dimensions, apart from what is taught presently, enabling each person to grasp the individuality of other people and to understand the world's progression towards an uncertain future.

The 21st century is showing all signs of providing unprecedented means for communication and for the circulation and storage of information. Therefore, it will impose on education two demands which at first sight may appear contradictory. Education must transmit, efficiently and on a massive scale, an increasing amount of constantly evolving knowledge and know-how adapted to a knowledge driven civilization, because this forms the basis of the skills of the future. At the same time , it must find

and mark the reference points that will make it possible, on the one hand, for people not to be overwhelmed by the flows of information, invading the public and private domains, and on the other, to keep the development of individuals and communities as its end in view. Education must, as it were, simultaneously provide maps of a complex world in constant turmoil and the compass that will enable people to find their way in it.

In this view of the future, traditional responses to the demand for education that are essentially quantitively and knowledge based are no longer appropriate. It is not enough to supply each student with a store of knowledge to be drawn on from then on. Instead, each individual must be equipped to seize learning opportunities throughout life, both to broaden her or his knowledge, skills and attitudes, and to adapt to a changing, complex and interdependent world.

If it is to succeed in its task, then education must be organised around four fundamental types of learning, which throughout a person's life, will in a way be the pillars of knowledge:

- *Learning to know*, that is acquiring the instruments of understanding
- *Learning to do,* so as to be able to act creatively on one's environment
- *Learning to live together*, so as to participate and cooperate in all human activities
- *Learning to be,* an essential progression which proceeds from the previous three.

NEP 2020 aims to enable each individual to discover, unearth and enrich his or her creative potentials, to reveal the treasure within.

These four paths of knowledge, all form a whole with many points of contact, intersection and exchange among them. As against this imperative, our present formal education traditionally focusses mainly on two forms, learning to know and to some extent on learning to do. The other two dimensions of learnings are left to chance.

There is need to advocate the view, and NEP 2020 fully endorses this viewpoint, that an academic environment be created that offers equal attention in all organized learning to each of these pillars. Meeting the challenges of the coming century would necessarily entail changing the aims of education, stressed by NEP 2020 and the expectations people have of what education can provide.

A broad encompassing view of learning, as envisioned in NEP 2020, therefore should aim to enable each individual to discover, unearth and enrich his or her creative potentials, to reveal the treasure within. This implies going beyond an instrumental view of education, as a process one submits to, in order to achieve specific aims, in terms of skills, capacities, or economic potential, to one that emphasizes the development of a complete

person, in short that is, learning to be.

i. Learning to know

As a means it serves to enable each individual to understand at the very least enough about his or her environment to be able to live in dignity, to develop occupational skills and to communicate. At an end its basis is the pleasure of understanding knowing and discovering. The trend towards a longer period of education and more free time should lead to an increasing number of adults being able to appreciate the pleasures of personal research. The widening of the field of knowledge which enables people to understand the various aspects of their environment better arouses intellectual curiosity, stimulates the critical faculty and enables people to make sense of reality, by acquiring independence of judgement. From this view point it is vital, that the students of higher education in agricultural disciplines as well as of other subjects should be able to acquire a knowledge of the scientific method in some appropriate form, and in the terminology of UNSCO Education Commission, become 'friends of science' for life. In agricultural education disciplines, the initial training must provide all students with the instruments, concepts and references that scientific progress and contemporary paradigms make available.

As knowledge is manifold and constantly changing, and it is becoming increasingly futile to try to know everything. After basic education, omnidisciplinarity is an illusion, but specialization, even for future researchers, must not exclude general knowledge. Today, a really well trained agricultural graduate needs a broad background and the opportunity to study a small number of subjects indepth. Both need to be encouraged during the whole period of education.

General education brings a person into contact with other areas of knowledge. General education bonds societies together in time, space and fosters receptiveness to other areas of knowledge, enabling fruitful synergies to develop between disciplines. That is how significant advances knowledge, particularly in research, are made on the boundaries between disciplines. Contrary to it, specialists invite the danger of losing interest in what other people are doing and they may find it difficult to cooperate.

It would be dangerous to imagine that memory has become unnecessary because of the incredible capacity to store and circulate information now at our disposal. One has to be selective about what he learns by heart. Exercise of the faculty of thought must entail a two way traffic between the concrete and abstract. In teaching and research it is therefore important to combine the two methods the deductive and the inductive, and a coherent thinking requires a combination of the two.

ii. Learning to do

Learning to do is more closely linked to the question of vocational training; how can students be taught to put what they have learnt into practice and how can education be adapted to future work when it is impossible to foresee exactly

how that work will evolve? In this connection, it is necessary to distinguish between the industrial economies, dominated by wage-earning occupation and other economies, such as farming/ agriculture based livelihoods, that are still broadly dominated by independent and informal work. The substitution of human labour by machines may have the effect of making human labour redundant / immaterial. It is accentuating the knowledge related nature of work even in industry, challenging their capability to make use of advances in knowledge into innovations that generate new business and new jobs. Learning to do, therefore no longer carries simple meaning it had.

The ascendancy of knowledge and information, as factors in production systems, is making the idea of occupational skills obsolete and is bringing personal competence to the fore. Technical progress is ineluctably changing the skills required by new production processes. The demand for higher skills at all levels has a number of causes. The juxtaposition of prescribed tasks and individual operations is frequently being replaced by organizations into 'WORK TEAMS' or 'PROJECT GROUPS'. Instead of requiring a skill, which they see as still narrowly linked to the idea of practical know-how, employers are seeking competence, a mix, specific to each individual, of skill in the strict sense of term, acquired through technical and vocational training, of social behaviour, of an aptitude for team work and of initiative and a readiness to take risks.

Therefore, if we add to those demands the requirement for personal commitment on the part of the worker, regarded as an agent of change, it becomes clear that highly subjective qualities, innate or acquired, that often company heads call 'life skills', combine with knowledge and know how, that education must maintain with the various aspects of learning.

Dematerialization of the economies and rise of the service sector

The consequences to education: Services, which form a very varied category, can best be defined by what they are not; they are neither industrial nor agricultural and despite their variety, have in common the fact that they do not produce any material goods. Many services are defined principally in terms of the interpersonal relationships they involve. It can be imagined that in the high-tech organizations of the future, relational difficulties might create serious dysfunctions calling for new type of skills, more behavioural than intellectual. This creates opportunities for people with few or no formal educational qualifications. Intuition, flair, judgement and the ability to hold a team together are not necessarily abilities peculiar to those with the highest paper qualifications. How and where are these qualities to be taught? It is not easy to imagine the content of training programmes that will produce the required abilities and aptitudes. The same problem arises in connection with vocational training. NEP has taken note of this concern and recommended restructuring course curricula to address the issue.

Pointers: Four Pillars of Education

Education thoughout life is based on the following four pillar:

- *Learning to know,* by combining a sufficiently broad general knowledge with the opportunity to work in depth on a small number of subjects. This also means learning to learn, so as to benefit from the opportunities education provides though out life.
- *Learning to do,* in order to acquire not only an occupational skill but also, more broadly, the competence to deal with many situations and work in teams. It also means learning to do in the context of young peoples' various social and work experiences which may be informal, as a result of the local or national context, or formal, involving courses, alternating study work.
- *Learning to live together,* by developing an understanding of other people and an appreciation of interdependence – carrying out joint projects and learning to manage conflicts – in a spirit of respect for the values of pluralism, mutual understanding and peace.
- *Learning to be*, so as to develop one's personality better and be able to act with ever greater autonomy, judgement and personal responsibility. In that connection, education must not disregard any aspect of a person's potential : memory, reasoning, aesthetic sense, physical capacities and communication skills.

iii. Learning to live together with others

A learning that is probably be a major issue in education today. Is it possible to devise a form of education which might make it possible to avoid hatred and conflicts, among communities and nations, or resolve them peacefully by developing respect for other people, their cultures and their spiritual values.

The general climate of competition that is at present characteristic of economic activity, within and between nations, tend to give priority to the competitive spirit and individual success. Such competition now amounts to ruthless economic warfare and a tension between rich and poor that is dividing nations and the world. It is regrettable that education has been misinterpreting the idea of emulation, resulting in facilitating competition. It would seem, therefore, that education must take two complementary paths; on one level, gradual discovery of others and, on another, experience of shared purposes through out life. It seems to be an effective way of avoiding or resolving latent conflicts. The task of education should be to teach at one and at the same time, the diversity of human race and an awareness of the similarities between , and the interdependence of, all humans.

iv. Learning to be

Education must contribute to the all round development of each individual-mind and body, intelligence, sensitivity, aesthetic sense, personal responsibility and spiritual values. All humans be enabled to develop independent, critical thinking and form their own judgement, in order to determine for themselves what they believe they should do in the different circumstances of life. Education must enable every person 'to solve their own problems', make his own decisions and shoulder his own responsibilities. Education's essential roles seems to be to give people the freedom of thought, judgement, feeling and imagination they need in order to develop their talents and remain as much as possible in control of their lives.

In an ever changing world in which social and economic innovation seems to be one of the main driving forces, a special place should doubtless be given to the qualities of imagination and creativity. The 21st century needs this variety of talents and personalities; it also needs the exceptional individuals who are also essential in any civilization. It is therefore important to provide students / youth with every possible opportunity for discovery and experiment, be it aesthetic, artistic, sporting, scientific, cultural and social.

The aim of development must be complete fulfilment of man, in all the richness of his personality, the complexity of his forms of expression and his various commitments, as

individual member of a family and of a community, citizen and producer, inventor of techniques and creative dreamer. Education as a means to the end of a successful working life, is thus a very individualized process and at the same time a process of constructing social interactions.

The four pillars of education described above cannot and must not be related exclusively to one phase of life or to a single place. The phases and areas of education must be rethought and must complement and interpenetrate one another. It is only through such a perspective of education that all can drive the greatest benefits, though their lives, from an ever broadening educational environment.

This perspective of four pillars of education, is advocated by the UNESCO International Commission on Education for the twenty first century, for both developing and the developed world. The perspective presented above in the National Education Policy (NEP) 2020 document reasserted the need for it to reform the present Indian education system. Our present formal higher education system tends to emphasize the acquisition of knowledge to the detriment of other types of learning. But it was considered vital to conceive imparting education in a more encompassing fashion. Such a vision has been described in the new NEP 2020. It is expected to guide future educational reforms and policy, in relation to both contents and to methods.

The 6th Deans Committee of ICAR that has been tasked to restructure the existing course curricula of agricultural education *vis* a *vis* NEP 2020, has used this perspective of four pillars of education as a guiding thought, along with several other aspects of NEP, in reframing the new course curricula across all disciplines of agricultural education.

Former Vice Chancellor, GBPUA&T,
Pantnagar; SKUAST-K Srinagar;
CSK HPKV Palampur
Email: tpartap52@gmal.com

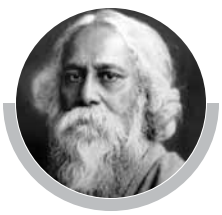
Agricultural Education Day: Genesis and importance

Seema Jaggi[1] and R C Agrawal[2]

Education is an essential pillar of an individual and a nation that ignite minds, enlightens, foster creativity and empower the human. It is a purposeful activity directed at transmitting knowledge, cultivate skills and character traits which includes the development of understanding, rationality, attitude, kindness and honesty. It increases self-confidence and assists in developing the personality of an individual. India celebrates National Education Day on 11 November every year since 2008 to mark the birth anniversary of the first Minister of Education of independent India, Maulana Abul Kalam Azad who regarded schools as the laboratories that can produce the brilliant minds of the future.

Agriculture plays a very important role in an economy and well-being of a society as well as it is considered to be the backbone of the economic system for developing countries. For decades, agriculture has been related with the production of vital food crops. Agriculture not only provides food and raw material but also offers employment opportunities to a considerable proportion of the population. It is important to understand that agriculture is not limited to farming alone, rather it is a sustainable way of life. Agricultural Sciences and Technology are evolving and advancing to face a variety of challenges and problems. The agricultural education system embodied with the latest advances in technologies and management strategies is important.

Agriculture education has opened up number of avenues for the students. Agriculture has many of disciplines with components



> "The highest education is that which does not merely give us information but makes our life in harmony with all existence"
>
> Rabindranath Tagore

ICAR has designated December 3 as Agricultural Education Day to commemorate the birth anniversary of first President of Independent India and Union Minister of Agriculture, Bharat Ratna Dr Rajendra Prasad for his role in upliftment and development of agriculture education in India.

related to biotechnology, engineering, computer science, animal science, nanotechnology, space technology, etc., which would match the diverse aspirations of the current generations. The young minds need to explore agriculture for addressing the issues of multiple challenges and serving the farmers of our country. In this context, ICAR has designated 3 December as Agricultural Education Day to commemorate the birth anniversary of first President of Independent India and Union Minister of Agriculture, Bharat Ratna Dr Rajendra Prasad for his role in upliftment and development of agriculture education in India. The objective of this day is to expose students including schools to various facets of agriculture and its relevance to country's development, inspire them and attract them towards agriculture, so that they develop interest in agriculture and allied subjects, choose professional career after schooling in some of these courses, engage themselves in agriculture and related activities or become agri-entrepreneurs in future. The day was initiated in the year 2016.

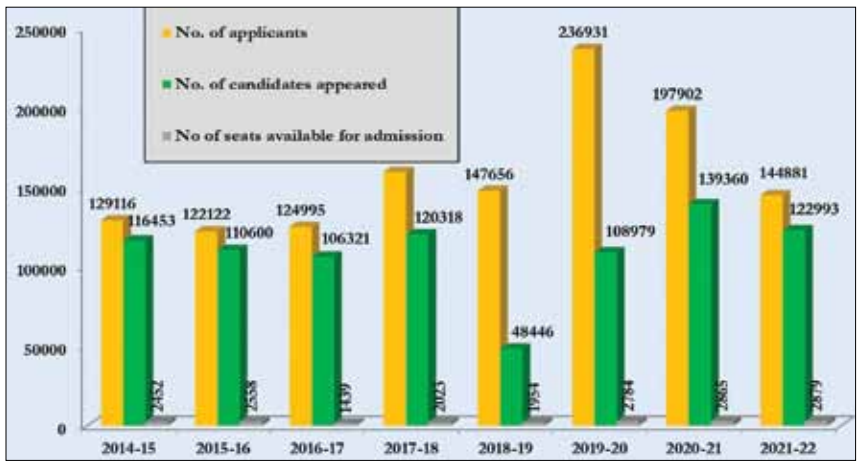
Indian agriculture has continuously evolved to remain responsive to meet the growing and diversified needs of stakeholders in the entire production to consumption area. Creation of skilled, talented and entrepreneurial human resources to harness demographic dividend in an equitable manner is one of the crucial parameters for sustainable development of agriculture in India. To realize the targets of growth rate set out in the agriculture policy, adequate trained manpower, that is professionally competent, socially sensitive and ethically strong, is required to provide the technical backstopping.

"The purpose of education is to make good human beings with skill and expertise. Enlightened human beings can be created by teachers"

A P J Abdul Kalam

Agricultural education in India is undertaken through partnership and efforts of the components of the Indian Council of Agricultural Research (ICAR) – Agricultural Universities (AUs) System comprising 63 State Agricultural Universities (SAUs), 4 Research Institutes having Deemed-to-be-universities (DUs) status, 3 Central Agricultural University (CAU) and 4 Central Universities (CUs) with Agricultural Faculty. These institutions impart education in Agriculture and Allied Sciences and are striving hard in imparting quality education to the students. Human resource is being developed to meet not only the regional needs but also the states' and country's requirements to refurbish the growth rate in agricultural sector. Over the years, the number of students opting for agriculture education is increasing which is seen from the distribution of the number of students in All India Entrance Examination for Admission (AIEEA) to Undergraduate Courses conducted by ICAR .

The primary goal of Agricultural Education Day is to introduce children to many areas of agriculture and their



Distribution of the number of students in All India Entrance examination for under graduate admission conducted by ICAR

importance in the growth and development of the country. On this day, an endeavour is made to encourage and motivate children to pursue careers in agriculture so that they may acquire an interest in the sector. Creating awareness among youth and especially school children is the main objective to initiate this programme. To apprise and expose students to various facets of agriculture including its importance, scope, relevance for the country, job opportunities and agri-entrepreneurial avenues. Attracting and retaining youth to agriculture and making agriculture more profitable are big challenges. Celebrating this day is a step towards strengthening higher agricultural education in the country and for attracting talented students in agriculture and allied sciences.

The Agricultural Education day is celebrated by ICAR institutes and agricultural universities, its colleges, Krishi Vigyan Kendras, other research organisations across the country by organizing various events focussing on importance of agricultural education.

The day is celebrated by ICAR institutes and agricultural universities, its colleges, Krishi Vigyan Kendras, other research organisations across the country by organizing various events focussing on importance of agricultural education. Seminars by agricultural educationists highlighting the growing importance of quality education in different agriculture and allied subjects are organized. A number of other activities conducted are visits of school students to the agricultural institutes/universities, fields, laboratories and museum for awareness and exposure, organizing interaction and open discussion sessions with students and farmers, career counselling, stakeholders meet, launching of products, distribution of products and literature, various competitions, honouring the best agricultural universities *etc*. These events are organised to educate school students and encourage them to choose agriculture as a profession by explaining the job prospects. The ultimate aim of these activities is to reach to the youngsters and popularize this important subject. There is hope that with a strategy for nation-wide smooth transition of farm education, agricultural education in India will be fully transformed to meet the future challenges.

[1]Assistant Director General (Human Resource Development), ICAR and [2]Deputy Director General (Agricultural Education), ICAR, KAB-II, Pusa, New Delhi 110 012
Email: adg.hrd@icar.gov.in; seema.jaggi@icar.gov.in




Nazir Ahmad Ganai

Aligning agricultural education to NEP 2020: SKUAST-Kashmir Model

National Education Policy (NEP) 2020 is a holistic policy initiative that encompasses the whole national education system, bringing sweeping changes that will have far-reaching effects to make India the Knowledge Superpower (*Vishwa Guru*). The policy has been drafted in line with India's commitment to Sustainable Development Goal-4 of the 2030 Agenda, which seeks to *'Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all'*. It highlights the need for a learning ecosystem based on *up-skilling and re-skilling* for competence and relevance for the emerging job markets, building upon the 4Cs: Critical thinking, Creativity, Communication and Collaboration among faculty members and students. To achieve these four pillars, it seeks to bring changes from governance mechanisms to administration, content development to delivery, cooperation to collaboration and local relevance to global engagement.

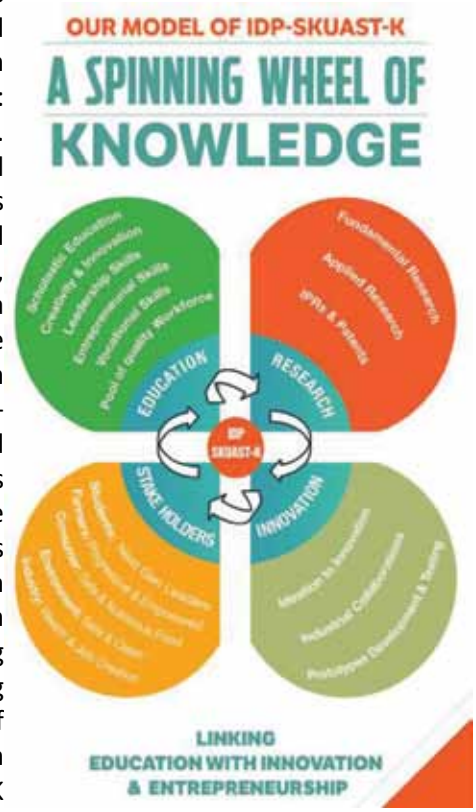
Over the last two years, major educational administrative bodies such as UGC, MHRD, ICAR and other ministries have been evolving their policy and action frameworks to sync their educational policy planning for the future in line with the NEP-2020. ICAR, the apex governing body of agricultural education was well in the process of reforms through World Bank funded National Agricultural Higher Education Project (NAHEP). SKUAST-Kashmir among the best performing SAU's in India, riding on its scintillating performance in NAHEP, has developed a model agri-education system aimed to "Re-orient agricultural Education to LEED". This ambitious vision is aimed to unleash the potential of this sector nationally, by creating an ecosystem that helps students build the best versions of themselves and transform them into Leaders, ready to take up the challenges of the 21st century for sustainable development; to upskill and reskill them as creative and innovative Entrepreneurs who will enable the shift from subsistence to sustainable commercial farming, and create jobs for the rural people; built their technical and soft skills for better chances of Employability in the industry; and inspire them as Discoverers of new knowledge and solutions to the problems of agriculture in the country.

SKUAST-Kashmir among the best performing SAU's in India, riding on its scintillating performance in NAHEP, has developed a model agri-education system aimed to "Re-orient agricultural Education to LEED".

SKUAST-K has always been at the forefront of implementing reforms initiated at the national level, which helped it stay relevant as an institution with promise and potential. Much before the draft of NEP 2020 was unveiled for public opinion, the reform window provided to SKUAST-K by the ICAR-World Bank-funded National Agricultural Higher Education Project (NAHEP) helped the university to formulate the vision for higher education that is future-oriented, innovative, transformative, inclusive and sustainable. The Institutional Development Plan of SKUAST-K under NAHEP was based on the futuristic education model that sought to bring the same structural, functional and governance changes as envisaged in NEP 2020. Riding on its institutional commitment towards a reformed higher education, SKUAST-K embarked upon an ambitious set of changes in structure, operation and governance around three main pillars of institutional excellence: faculty, student and ecosystem. Much of SKUAST-K's institutional progress in the last two years has been a result of innovative and futuristic approaches in teaching, research and outreach, with a strong reflection that shaped the university's education system to be multidisciplinary, choice-based and skill directed aimed at developing global citizens as has been envisaged in the NEP 2020. When NEP 2020 was unveiled SKUAST-K found itself in a comfortable stage of operation with many reforms already having taken off in the university showing tangible impacts in terms of improved student performance in scholastic endeavours. SKUAST-K has been able to submit operational frameworks for implementing NEP to the J&K government. The working model developed for the purpose stands submitted to the Indian Council of Agricultural Research, New Delhi and deliberated upon in the 6th Deans' Committee meeting held at Srinagar. The SKUAST-K model has been received well and shall form the basis of the Revised Curriculum for Agriculture and Allied Disciplines.

SKUAST-K model of agricultural education

SKUAST-K model of higher education is primarily proposed for agricultural universities but can be effectively applied to other mainstream educational systems with comparable success. It is based on the premise that education as a public service by higher education institutions is not a stand-alone activity and can only deliver its purpose when it is connected with all its catchments, effectors as well as beneficiaries. As an activity of public good it can help nations fulfil their commitments of social and economic progress when delivered as an integrated domain that connects it with processes, *viz.* research, innovation, discovery, deliverables, *viz.* technology, products, services as well as stakeholders, *viz.* students, farmers, industry, and government.



The apparent appeal and synergy of our proposed model stem from the appraisal of strengths and weaknesses of existing educational systems across SAUs. We connected and identified the contributing forces for the substantial success of the existing system mainly driven by a fair amount of Structural and Functional Autonomy enjoyed by

SAUs, generous financial support by the government and an effective monitoring system within institutions through statutory bodies that link its functioning with all stakeholders including the government. We identified major bottlenecks in existing content and its delivery mechanism. The existing curriculum for agricultural and allied sectors for undergraduate and PG degree programmes warrants a complete overhauling as the challenges, priorities and opportunities for Indian Agriculture are different now than what they were a few years back. New Education Policy 2020 has made it mandatory for all educational institutions to revamp the present educational system and develop the pedagogy and curriculum in such a way that accommodates high flexibility for the students to tailor their degree programmes most conveniently. It gave the student several options to choose the courses according to their needs, choices and professional requirements and stimulate and nurture the individual capabilities and faculties of the students in the best possible manner and enabling ecosystem.

The working model encompasses the modalities on:

1. A flexible curriculum with the concept of cafeteria courses both online and offline for wider choices for the students.
2. Structured mechanism for multiple entry and exit (MEE) options with each year comprising of a complete module with defined skill sets.
3. Certificate and Diploma in agriculture focusing on skills and vocational training to empower and enable the students to start their entrepreneurship ventures.
4. An apportioned Student Ready programme with comparable credit distribution across four years instead of staked in the 4th year.
5. Shuffling of approved courses in a manner befitting the requirements of the certificate and the Diploma in Agriculture.
6. Skill-based courses and courses with the entrepreneurial potential to be streamed during 1st and 2nd year of the graduate programmes in place of fundamental type of courses.
7. Hard core science-based and advanced type courses to be aligned during the 3rd and the 4th year of the programmes.

The key features of this model are as under:

A. Foundation programme

It is an innovative immersion programme designed to integrate multiple stream students at the beginning of admission and aims at instilling life skills, identifying diverse potentialities and creating a platform for students to learn from each other's life experiences. It will comprise sessions from alumni, business leaders, outstanding achievers in diverse fields and people with inspiring life experiences. During the programme, the students will also know about the operational framework of the academic process in the university, the challenges of being a science student and the opportunities that they can explore in life.

B. Restructuring curriculum for degree by design at UG level

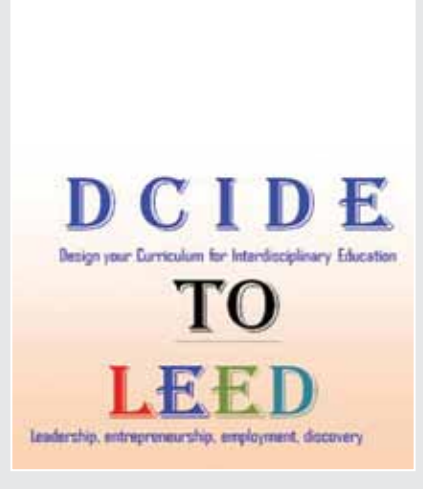
The aim is to make the curriculum

Flexible, Choice-based and Inter-disciplinary to:

1. Create a window for multiple entries and exit system (MEES) and develop core skill-based Certificate and diploma courses.
2. Promote Soft Skills (reflecting social, life, communication and leadership skills).
3. Promote Higher Order Skills compliant with the 4th industrial revolution driven by artificial intelligence, machine learning, IoT and robotics, satellite-driven agriculture, precision farming, bioinformatics, computational biology, *etc*.
4. Business and entrepreneurship skills to enhance employability in high-paid industries and to groom them as entrepreneurs.
5. Creativity and Innovation Skills to unleash his/her potential to provide new solutions to the problems of society and the industry.
6. National/International Internship for better exposure.

To achieve these goal, total credit load of 180 hours during a four-year degree programme has been suggested to be redistributed, as under:

- Foundation Program for Freshers of 2 credits. This is during first 2 weeks of the admission to the university
- Core Credits of UG degree program: 120 credit hours to build the foundations of fundamental knowledge and skill in core discipline
- Designer Courses: (Choice based Skill Courses of 20 credits) aimed at skilling the students in a particular trade for entrepreneurship / start-up. This is an improvised form of the Experiential Learning spread over first 2 years. It shall facilitate the degree by designed program, and provide options for exit with practical skills.
- Soft Skill Courses of 5 credits, during 2nd to 6th semesters, to inculcate the leadership and personality development.
- Higher Order Skill Courses of 10 credits, during 3rd to 6th semesters, to expose the students to new age technologies and make them industry ready and also to drive the Agri-4 revolution india. The courses include like Data Science, AI-ML, IoT and Automation, GIS-RS, Precision Agriculture, Vaccine Technology, Molecular Diagnostics, *etc*.
- Study Tours, Internship/ industry / lab attachment, Project Work each of 1, 5 and 4 credits respectively.
- Deep Rural Exposure of 10 credits .this is an alternative and improvised version of the RAWE Program.
- Audit Courses through MOOCS. This is flexible and aimed to add value to degrees.



C. Concept of the cafeteria courses

It is a concept that provides a platform to the students for utilising the option and flexibility for designing their degree programmes and the skill sets they wish to hone.

Faculties and colleges will develop a large Cafeteria of Courses to accommodate optional Choice based components comprising of:

- Subject Domain courses on electives
- Vocational modules on skill development
- Courses on leadership, communication, culture and Indian languages
- Courses on creative and critical thinking, innovation skills, Higher order skills, Data science, artificial intelligence, Precision farming, Bioinformatics and Computational Biology, Nanotechnology, *etc*.
- Online Courses on a variety of subjects as additional optional courses
- Additional non-credit courses audited by the students to hone the special skills will be developed or identified by the Faculties or the online sources.

All these courses can be developed by the Dean's Committee to have uniformity across course numbers, titles and contents in all the SAUs or Universities can be given option to formulate their own cafeteria of courses under their IDP.

D. UG degree by design

The focus of the NEP 2020 is on the holistic development of graduating students which includes "arming them with new-age skills that drive the Agri-4 revolution globally and can help lay the foundations of a knowledge-based and technology-driven agri-economy in the country". The

existing system of agri- education is uniform and inflexible with a rigid structure with no choice for the students to harness his / her individual creativity creating a huge mass of unemployable graduates. The result is that India lags behind in innovations and tech-based entrepreneurship. Students will create an approved program of study that fulfils their academic and career goals.

SKUAST-K has proposed the "DEGREE by DESIGN Model", in which the student shall complete all the core courses required for a degree program in 120 credit hours. The remaining 40-60 Credits shall be distributed as outlined above.

The concept empowers students with a value-added graduate degree with add-on specialization in a specific sub-sector of his/her interest that they would otherwise acquire after post-graduation. Examples of Degree by design in Agriculture and Horticulture.

Agriculture

- BSc Agriculture (Seed Production)
- BSc Agriculture (GIS and RS)
- BSc Agriculture (Organic Input production)
- BSc Agriculture (Integrated Farming System)

Horticulture

- BSc Horticulture (Commercial Floriculture)
- BSc Horticulture (High Tech Nursery management)
- BSc Horticulture (Protected Vegetable Cultivation)
- BSc Horticulture (Precision Farming)
- BSc Horticulture (GIS and RS)

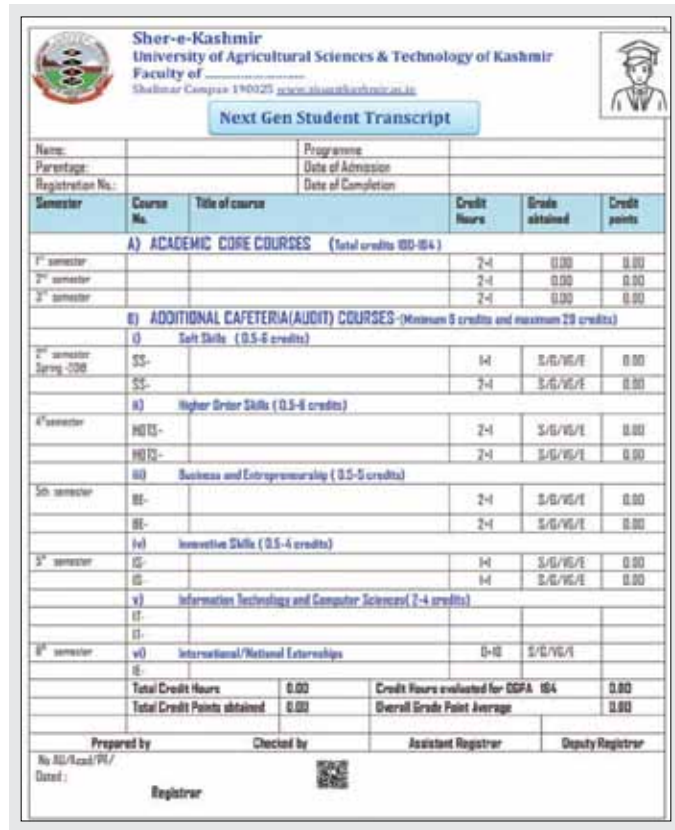
Similar designer UG degrees shall be offered in other Agri-allied disciplines.

E. Multiple Entry and Exit System (MEES)

The multiple entries and exit system as envisaged in NEP 2020 poses an important operational challenge before institutions to ensure a module for certificate and diploma courses that is laden with specific skill sets to address the basic bottleneck of education-skill disconnect identified in NEP 2020. SKUAST-K has developed a model restructured undergraduate programme that is front-loaded with skill-based programmes and ensures that students exiting at certificate (1 year) and diploma (2-year) programmes are adequately skilled to be employable or can create their own entrepreneurship. The restructured model not only addresses core skills but also provides an option for students to choose from a cafeteria of structured skill-based courses that can add value to their education at an early exit. The model also contains a framework for lateral/ re-entry for the students that opt to join after a specific time lag.

F. Next Gen Student Transcript©

This is the working model for the Academic Bank of Credits. Next Gen Student Transcript© is SKUAST-K's innovative concept reflecting the ultimate outcome of the NEP 2020. It is a comprehensive record of the student life, social and technical, innovative and entrepreneurial skills acquired by him/her in a flexible choice-based credit system. It can also be said as the student customized document containing the breakup of his/her academic achievements in the core subjects which the university prescribes as the minimum requirement for the award of a graduate degree plus a record of additional optional (audit) courses undertaken by the student for honing his/her life, social and technical skills required in his/ her future endeavours and overall personality development from among the cafeteria of courses.



Sher-e-Kashmir
University of Agricultural Sciences & Technology of Kashmir
Faculty of _____
Shalimar Campus 190025 www.skuastkashmir.ac.in

Next Gen Student Transcript

Name:		Programme	
Parentage:		Date of Admission	
Registration No.:		Date of Completion	

Semester	Course No.	Title of course	Credit Hours	Grade obtained	Credit points
	A) ACADEMIC CORE COURSES (Total credits 100-104)				
1st semester			2+1	0.00	0.00
2nd semester			2+1	0.00	0.00
3rd semester			2+1	0.00	0.00
	B) ADDITIONAL CAFETERIA(AUDIT) COURSES-(Minimum 5 credits and maximum 20 credits)				
	i)	Soft Skills (0.5-6 credits)			
2nd semester Spring /2nd	SS-		1+1	S/G/VG/E	0.00
	SS-		2+1	S/G/VG/E	0.00
	ii)	Higher Order Skills (0.5-6 credits)			
4th semester	HOTS-		2+1	S/G/VG/E	0.00
	HOTS-		2+1	S/G/VG/E	0.00
	iii)	Business and Entrepreneurship (0.5-5 credits)			
5th semester	BE-		2+1	S/G/VG/E	0.00
	BE-		2+1	S/G/VG/E	0.00
	iv)	Innovative Skills (0.5-4 credits)			
5th semester	IS-		1+1	S/G/VG/E	0.00
	IS-		1+1	S/G/VG/E	0.00
	v)	Information Technology and Computer Sciences(2-4 credits)			
	IT-				
	IT-				
8th semester	vi)	International/National Externships	0-10	S/E/VG/I	
	IE-				
	Total Credit Hours	0.00	Credit Hours evaluated for OGPA 104		0.00
	Total Credit Points obtained	0.00	Overall Grade Point Average		0.00

Prepared by	Checked by	Assistant Registrar	Deputy Registrar

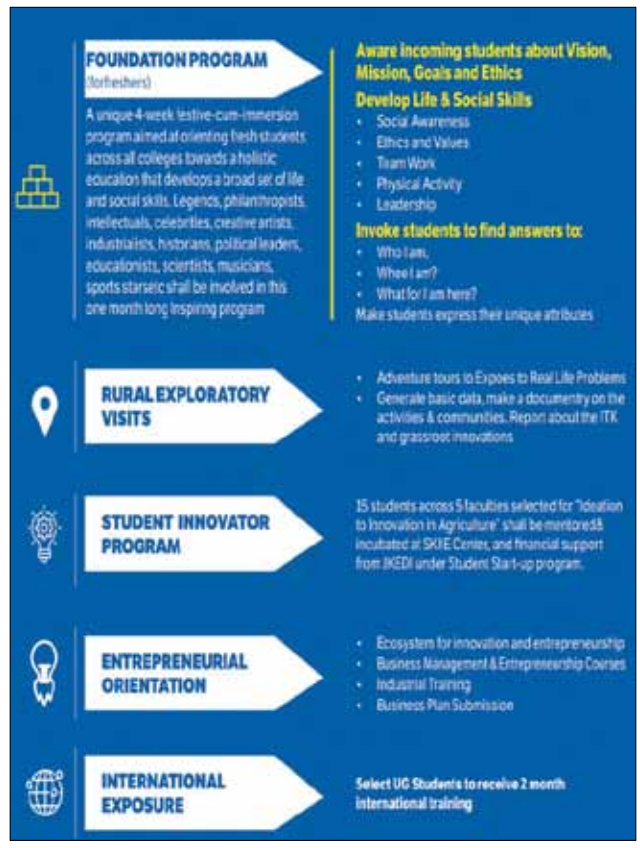
No. SU/Acad/PR/
Dated :

Registrar

G. Postgraduate programmes in sandwich/twinning mode

It is a concept towards improving the quality of education, student research and exposure to other institutions where the two universities sign an MoU to host the PG students of each other. The duration of stay will be 06 and 12 months for MSc and PhD degrees respectively. A consortium of institutes and universities is being formed that shall come together under a multilateral Memorandum of Agreement to collaborate in running the postgraduate programme in twinning/ sandwich mode.

Other initiatives that align agricultural Education to NEP 2020 on cards at SKUAST-K include:



Bachelor of Vocational Programmes (BVoc): Bachelor of Vocational Programmes is a type of Degree with Honours or specialization in a particular vocation or electives to be chosen by the student. He/ she will be required to do the internship in that vocation during his /her graduation and be awarded BSc (Hons) Agri/ Horti (Nursery Management/ Mushroom Cultivation), *etc*. SKUAST-K has drawn an ambitious plan to establish a separate Vocational College with support from the Department of Higher Education Govt. of J&K.

Making Faculty Multi-disciplinary: NEP 2020 seeks to make universities multidisciplinary. It recommends including basic sciences, social sciences and humanities and frontier sciences, Indian languages and culture and skill training centres as a part of the agricultural education system to improve the quality of education and basic and applied outcome-based education. SKUAST-K is in itself a multidisciplinary University that offers 7 Undergraduate and more than 50 Master's and Doctoral Programmes at its 5 faculties of Agriculture, Horticulture, Veterinary and Animal Husbandry, Fisheries and Forestry, and two colleges of Sericulture and Agri-Engineering. Perspective plans are in place to further diversify by adding colleges of Community Sciences, Liberal Arts, Dairy Technology, and Business and Media studies.

Innovations,

Entrepreneurship and Skill Development as a part of Formal Education

Besides domain area courses in Agriculture and allied sciences, these cafeteria courses will include courses on higher order skills, *viz.*, artificial intelligence and machine learning, ICT, data science, blockchain, IoT, robotics, drone technologies, hydroponics and vertical farming, precision and smart agriculture, nanotechnology, biotechnology, mathematics, entrepreneurship and innovations; product development, branding, digital marketing; design thinking; business development; green marketing; market analytics and intelligence; Agri-preneurship; agro and food processing industries, on soft skills; communication; leadership; Indian languages, art and culture; History; ITK; Humanities, critical and creative thinking and some advanced basic science be a part of the Cafeteria. Business Incubator and Special Purpose Vehicles (SPV) are being established for incubating innovations into Startups.

Conclusion

Two years of learning from the implementation of the World Bank-funded NAHEP has placed SKUAST-K at a higher

pedestal and given it a head-start to lead the region and the nation in implementation of the NEP 2020. Over the SKUAST-K has demonstrated its ability to emerge as a front-runner among the Universities in J&K and Agricultural Universities at the National Level. It has consistently improved its ranking over the years to become the 6th Best State Agricultural University accredited as Grade A by ICAR and has been graded BAND EXCELLENT under the Atal Innovation ranking of the Ministry of Education. It has been able to build an idea bank of 100 innovative ideas, nurture 10 start-ups, acquire eight patents and win numerous faculty and student awards. With all these strengths, SKUAST-K is poised to emerge as the first innovation-led farm university in the country and become a preferred destination for agricultural education.

Sustaining reform-led progress: Policy support system from government

The success of the university system as envisaged in educational policies has largely come from institutional mechanisms of functionality appraisal as well as substantial freedom to operate by state governments. In fact, the role of some of the leading science and education entities of India such as IITs, IIMs, and IISc as well as governing bodies such as MHRD, ICAR, UGC, *etc*. has been possible primarily because of the functional autonomy given to them to assess and manoeuvre their role in creating science and educational leaders that shaped India's current leadership position in some of the frontier areas such as agricultural research, space technology, IT, drug discovery, *etc*. The freedom encompasses all the domains such as academic and research services, financial management, recruitment and engagements with the global science and education leaders. Our system has evolved as an adaptive system that can drive India's science and technology growth of India in a highly competitive global scenario. We have been able to reorient our poise time and again to stay relevant to challenges and our national priorities. The government should continue to help higher education to grow by providing operational autonomy, financial resources as well as policy support to be able to achieve the goal of making India the Vishwa Guru.

SKUST-K has consistently improved its ranking over the years to become the 6th Best State Agricultural University accredited as Grade A by ICAR and has been graded BAND EXCELLENT under the Atal Innovation ranking of the Ministry of Education.

Vice Chancellor, Sher-e-Kashmir University of Agricultural Science and Technology of Kashmir, Srinagar, Jammu and Kashmir 190025
Email: drnazirahmad@gmail.com

Bidyut C Deka[1] and K Karthikeyen[2]

Upskilling agri-graduates in entrepreneurship: Role of agri incubators

The role of business incubators cannot be overemphasised for those entrepreneurs who are striving to give life to innovative ideas, bring world-class products and services to customers, scale up and sustain their ventures. The growth of any incubator and startup ecosystem depends on building the awareness of the value that they add to such innovative enterprises. As per a recent study report by Tracxn, one of the renowned research firms in the US, there are over 450 incubators in India (as of June 2021). Most of the incubators are in the Technology driven space and about 30 of them cater to agriculture and food sector.

In 2016, ICAR introduced student READY (Rural Entrepreneurship Awareness Development Yojana) programme in all the SAUs, CAUs and other accredited Universities with an objective to enhance rural awareness, research expertise, industry experience and entrepreneurship skills of final year Under-graduate students across all degree programmes (4-year) of agricultural sciences.

Business incubators: ICAR's initiatives

In India, there are several institutions that support the establishment of business and technology incubators. It is a well-known fact that ICAR has been the pioneer in the establishment of Agri Business Incubators (ABIs) across ICAR Institutes and State Agricultural Universities, under the National Agriculture Innovation Project (NAIP). Under the ABI programme, Business Planning and Development

(BPD) Units were set up in ICAR Institutions. These BPDs facilitated new startups and agri enterprises with innovative technologies by providing need-based physical, technical and business support, networking facilities, testing and validation services for successful scale up. These ABIs/ BPDs strived to assist new entrepreneurs in commercial activities conducted both on-farm, as well as off-farm such as crop cultivation, livestock improvement, agro-processing, food manufacturing and other critical farm support services *etc.* ABIs since its inception have met with considerable success in the recent past. They have become synonymous as an alternative and effective extension mechanism for the growth of the agribusiness sector in the country.

In 2016, ICAR also introduced student READY (Rural Entrepreneurship Awareness Development Yojana) programme in all the SAUs, CAUs and other accredited Universities with an objective to enhance rural awareness, research expertise, industry experience and entrepreneurship skills of final year Under-graduate students across all degree programmes (4-year) of agricultural sciences. Likewise, ABIs have been set up under various flagship programmes for startups by the Department of Agriculture Cooperation & Farmers Welfare, Government of India.

These initiatives include the RKVY- RAFTAAR (Rashtriya Krishi Vikas Yojana – Remunerative Approaches for Agriculture and Allied Sector Rejuvenation) Programme. Under this particular programme, SAUs are offered funding to the tune of approx. ₹ 6 crore each, for setting up physical incubation centre infrastructure for entrepreneurs, facilities for testing and validation of technologies, pre-seed and seed funding for startups, mentoring and networking activities and events, *etc.*

Impact of incubation centres set up by agricultural universities and ICAR institutes

Across the country, currently there are 29 Incubation Centres under the RKVY-RAFTAAR Programme, mostly set up in the Agriculture Universities and a few specialised ICAR institutions. These centres have come up as late as in the year 2018-19 across the country and each of these Centres at the SAUs have been imparting training, mentoring and coaching sessions to budding entrepreneurs across the country. Most of the SAUs have been able to promote and commercialise few technologies which have been developed by them. In short, such programmes have paved the way for technology popularisation and commercialisation and therefore, it is fair to state that the SAUs have now four pillars of work to address – Education, Research, Extension and Entrepreneurship. Entrepreneurs incubated and funded at these SAUs and ICAR Institutions have brought out some innovative solutions to the problems faced by the communities. They may be broadly categorised into innovations around Farm Mechanisation; Agri Logistics and Supply Chain; Post Harvest Food Technology and Value Addition; Allied Agri Sectors such as Dairying, Poultry, Fisheries, Animal Husbandry;

Waste to Wealth and Agri Inputs; Smart and Precision Agriculture *etc*.

Some of these incubation centres have been successful in attracting young people in creating employment avenues. However, it has been observed that non-agriculture graduates are taking early advantage of this emerging situation and more than 90% agri startups have been set up by non-agri graduates. Agriculture graduates are much behind in this endeavor and only a handful of them have been successful in utilizing their knowledge, expertise and skills towards developing entrepreneurship activities. Realizing the importance of the issue, many SAUs felt that a new mechanism may perhaps be inbuilt in the 4th year degree programme to train the UG students from 1st/ 2nd year itself so as to start an eco-system for entrepreneurship development with an objective that the students start their business enterprise immediately after completion of their graduation. National Education Policy (NEP) 2020 also emphasizeson consistent integration of skills and experiences through credit based formal system.

Initiatives taken by Assam Agricultural University

Realizing the need for upscaling the entrepreneurship skills in agricultural graduates, the Assam Agricultural University (AAU), Jorhat, has embarked on a plan and has developed a unique structured entrepreneurship development course. This course has been administered by the Assam Agricultural University's Incubation Centre for Startups – NEATEHUB (North East Agriculture Technology Entrepreneurs Hub) - which is an Atal Innovation Centre of the Govt. of India and a Centre of Excellence of the Department of Agriculture's RKVY-RAFTAAR programme. The course is spread across three years –right from the second year of UnderGrad prog upto the final year of UnderGrad. The primary objective of this course is to handhold those students who have the potential to become real entrepreneurs or initiate own startups after their graduation and provide them with industry mentors, business coaches, market linkages and access to venture funding. Likewise, AAU

has decided to implement IDEA (Internship for Development of Entrepreneurship in Agriculture) program for students enrolled in *Post Graduate programme* in-lieu of regular thesis research work for few motivated students. Further, AAU has put in place its own *Innovation, Startup and Entrepreneurship Policy* to enable the faculty members of AAU to collaborate with students, patent their technologies and embark on their own agri-ventures. Such initiatives at university and academic level will slowly but surely fuel the fire in the belly and the passion amongst the student community to pursue their dream ventures. The goals of NEP are surely in sight with integration of such initiatives at University level.

The road ahead

Finally, the roadmap for these incubation centres is to integrate various stakeholders – not just the producers/ farmers and the market players, but to also create a cadre of professionals who play an integral part of the entire supply and value chains in agribusinesses. For this, it will be critical to integrate the principles of NEP into the Universities and "catch them young". Students will need to be provided with skill sets and guiding principles of entrepreneurship right when they step into these academic institutions; there is a great merit in prodding them and assessing their inclination towards own venture pursuit. Towards this, Universities can play a pivotal role in providing them access to technologies already developed by the former, support and facilitate them with research and testing resources, provide them mentorship through technical and business experts, and above all, facilitate the flow of funds to assist in prototyping, proof of concept, market-testing, *etc*. In short, the spirit of integrating NEP should be to impart necessary education that lies beyond the classrooms and textbooks and "create ecosystems where all stakeholders including industry prosper".

[1]Vice Chancellor, Assam Agricultural University, [2]CEO, Assam Agricultural University Incubator (NEATEHUB), Jorhat, Assam 785 013
Email: bidyutdeka@yahoo.com

Pankaj Mittal

Role of academic **Bank of Credits** for multidisciplinary **Agricultural Higher Education**

The National Policy on Education 2020 has introduced many innovative reforms for improving the teaching learning process and the quality of education while recognizing the fact that education is fundamental for achieving full human potential and for promoting national development. It has laid emphasis on the fact that the world is undergoing rapid changes in the knowledge landscape and global ecosystem necessitating reimagining of Indian Universities in the new paradigm. When we are reimagining Indian Universities, we are in fact reimagining the future of our children and the future of the entire nation.

The NEP is a forward looking, innovative, democratic and a student centric policy with a lot of freedom, flexibility and autonomy built in. In particular, the students have been given the freedom of choosing multiple subjects in an academic program, freedom of choosing multiple universities and freedom of speed for completing the program with an opportunity for life long learning. This freedom is envisioned through the establishment of an Academic Bank of Credit (ABC) which would digitally store the academic credits earned from various recognized Higher Education Institutes so that the degrees from an HEI can be awarded taking into account the credits accumulated over a time.

Students have been given the freedom of choosing multiple subjects in an academic program, freedom of choosing multiple universities and freedom of speed for completing the program with an opportunity for life long learning.

WHAT IS ABC?

ABC would be a digital/virtual/online entity to function like a Bank with students as account holders to whom the bank shall provide a variety of services including credit accumulation, credit verification and authentication. ABC may provide credit deposit accounts to all the students who are studying in any recognized Higher Education Institute (HEI) or even to those who are not students at present but wish to pursue education as a freelancer. The academic credits earned by a student from multiple institutions, both in online or regular mode, can be automatically credited to his account. After accumulation of credits up to a given threshold

level while completing the core credits, a student can redeem the credits for a academic degree at any convenient time.

OBJECTIVE OF ABC

One of the major objectives of ABC is to facilitate student mobility across the system and includes, mobility between campus-based education and ODL, mobility between Skill-based programs and formal degree programs and mobility between universities. In other words, students can pursue their passion of learning and acquiring knowledge in any subject, area of interest for the life time, while having an opportunity to redeem the credits into a degree.

WHO CAN USE ABC?

This facility is for university students who want to consolidate their academic records for employment or educational purposes. It enables a student to accumulate institutional credits from numerous and/or various sources into his credit account. The ABC shall be a service to facilitate the integration of the campuses and distributed learning systems, by creating student mobility within, inter and intra university system. It will help in seamlessly integrating skills and experiences into a credit based formal system by providing a credit recognition mechanism which will help the students to plan their own learning curve and the pace at which they would like to learn. It will promote access, flexibility, mobility, collaboration,

transparency, recognition and integration to improve the competitiveness and efficiency of our Education System.

BENEFITS OF ABC

Academic credits would be freely transferable through the Bank (ABC) which will maintain the academic records of the students and issue an official transcript which would be recognised by all the member universities of ABC. As students' progress through a program of study, they can accumulate the credit value of the modules or units they have completed successfully. If they are working towards a qualification, they will have to accumulate sufficient credits, to gain the total overall credit value of the qualification. Students may be able to transfer the credits they have been awarded as part of one study program to another, offered by the same Institution, and/or transfer credit when moving from one institution to another. The ways students can transfer credits is determined by each Institution's assessment regulations. However, the transfer of credits between HEIs of similar category may be allowed to ensure quality. A mechanism of credit equivalence between HEIs shall be worked out to maintain standards. The amount of credit awarded shall be based on the required learning outcomes, irrespective of the type of learning, the place or other context in which the learning takes place, or the way in which the learning is assess. Institutions that use credit should follow the same guidelines for awarding credit.

Academic credits would be freely transferable through the Bank (ABC) which will maintain the academic records of the students and issue an official transcript which would be recognised by all the member universities of ABC.
As students progress through a program of study, they can accumulate the credit value of the modules or units they have completed successfully.

There must also be confidence in the quality assurance processes that underpin the teaching, learning and assessment that result in the award of credit. These assurances are provided by the Institution's own internal quality assurance mechanisms and externally by the Accreditation, Quality Assurance Agency for Higher Education through its audit and review processes.

At present, many innovations are seen in the field of Agriculture in terms of use of Artificial Intelligence, Internet of Things, Drones, multiple apps and use of technology in agricultural practices. Many courses both short term and curriculum based are available online. The students, with the establishment of ABC would be able to complete these courses with ease to update their knowledge, while earning credits and accumulating these credits into their accounts with a possibility of redeemingthem into a degree at a later point of time.

It is fact that the Academic Bank of Credit shall be a revolutionizing steps towards democratizing quality education providing a life time opportunity for anytime, anywhere, any-type and any-mode learning.

Secretary General, Association of Indian Universities, 16 Comrade Indrajit Gupta Marg, New Delhi 110 002
Email: sgoffice@aiu.ac.in

Rajendra Barwale

Making the agriculture education system in India future ready

Agriculture continues to be a major sector in India, particularly in terms of supporting the economic well being of over half the population of the country. Indian agriculture has come a long way in making the country self-sufficient from being import dependent. This achievement has been possible due to progressive application of science in Indian agriculture. The development and the deployment of scientific knowledge and practices to improve Indian crop productivity has played an important role in achieving food self sufficiency. It is entirely to the credit of our agricultural education system, that we have been able to develop agricultural professionals which has enabled the green revolution.

The landscape of Indian agriculture is transforming in the recent years. The changing trends include larger acreages moving under high value commercial agriculture, greater application of smart tools including sustainable practices, and improving market linkages, apart from increasing agricultural exports-strengthening globalization of our agriculture. Indian agriculture has the potential to evolve as a competitive future supplier of food and agri commodities to global markets, apart from meeting the growing domestic demand. The trend also indicates the increasing role of private sector in the progress of Indian agriculture across the value chain. Given these changes, our agricultural education needs to undergo transformation to enable agri professionals to be future ready.

Indian agriculture has the potential to evolve as a competitive future supplier of food and agri commodities to global markets, apart from meeting the growing domestic demand.

Agriculture and food industry in the private sector employs significant number of agriculture professionals. The key functions where the skilled manpower resources from the agricultural education system of the country, used are research and development, production and processing, marketing of agri

inputs and outputs, *etc*. The existing system of agricultural Education emphasises largely on imparting knowledge of agricultural sciences and their dissemination. However for the system to create future ready agri professionals, imparting the following skills sets would be critical for achieving the goal.

Knowledge of digital applications

Agriculture is evolving towards protected farming – whether it is soil health, crop nutrition, crop care, post harvest value chain management, market intelligence, *etc*. The key tool for such protected farming is leveraging digital technology. The tools of Remote sensing are increasingly deployed for measuring soil and crop health. The digital market places for agri commodities are being experimented for minimizing the traditional information skewness, thereby improving the price discovery process for the farmers. Similarly, the crop research is evolving in to a combination of deep knowledge of plant science with the expertise of computing sciences. For instance, digital tools of marker assisted breeding technology are bringing greater precision in plant breeding activity besides making it less time intensive. Most of these precision farming and research tools are based on the application of digital knowledge combining with specific domain knowledge of agricultural sciences. Given such evolution, our Agriculture education system needs to include and strengthen the relevant curriculum in appreciation and usage of digital technology and its application in the Domain of agriculture.

Encouraging innovations and entrepreneurship

Smart agriculture going forward would involve continuous innovations. Use of innovative tools and processes are replacing traditional practices to improve crop productivity, quality and minimize costs. For instance, labour replacing innovations like herbicide tolerant crops would not only save on labour and inputs, but also improve productivity and minimize environmental impact. Use of drone technology for the application of crop protection chemicals would reduce labour, bring greater precision and effectiveness in its application. Innovation in the field of development of biological fertilizers would not only minimize the chemical fertilizer costs, but also minimize the adverse environmental impact of chemical fertilizers. Climate change, expectation of achievement of Sustainable Development Goals and the disruptive innovations in the market place, are posing great challenges for agri-professionals in carrying out their activities. To be successful, they will have to deal with both, the extent of innovation and also the speed of innovation. Therefore, they will need to be exposed to an ecosystem, which enables curiosity, risk-taking and experimentation at an early stage.

Indian agriculture, as mentioned earlier, would see greater participation by the private sector in the future. This would require more entrepreneurs to invest and build agri and food related businesses. An impression currently about a number of agristart ups which have come up in the last few years in India is that most of them are promoted by non-agriculture professionals. It is important also to get more of agricultural graduates to promote agri related startups, as they would have a better understanding of Indian farming and farmers.

Improving communication capabilities

A good and effective communication capability as part of professional training is increasingly becoming more important, facilitating greater mobility of human resources in the private sector. The requirement of good communication is pronounced more in certain functions like Marketing, and also when one has the responsibility of leading teams in any function. With greater degree of globalization

expected of Indian agriculture in the future, good communication skills – both written and spoken, would be helpful for the Industry. The improved agriculture education system needs to incorporate courses and tools to enhance this soft skill amongst the younger generation.

Enhancing leadership capabilities

The greater professionalization of Indian agriculture with increasing role for the private sector would necessitate greater requirement of professionals to fill up the leadership positions in the coming years. It would be appropriate to strengthen the leadership capability of the future agriculture professionals. Such capabilities could be developed by not only with academic inputs in the subjects of leadership development like strategic thinking, team building, decision making *etc*., but also by actively encouraging co-curricular and extra-circular activities like sports, internships and other action learning methodologies.

Indian agri-food processing Industry for the future will require domain experts with deeper and updated knowledge of agricultural science on the one hand and professionals with better leadership capability, digital knowledge, Innovation and entrepreneurial drive, on the other hand. The adequate supply of youngsters with these competences by our Agriculture education system will be the pivot to drive the pace of future growth of Indian agriculture benefitting all the stakeholders of Indian agriculture.

The adequate supply of youngsters with these competences by our Agriculture education system will be the pivot to drive the pace of future growth of Indian agriculture benefitting all the stakeholders of Indian agriculture.

[1]Chairman, Mahyco Grow Mahyo Grow Pvt. Ltd., Ashok Centre, Jhandelwalan Extn. New Delhi 110055
Email: raju.barwale@mahyco.com

G Sugumar

Fisheries research and education in India

Fisheries, the sunrise sector of India has reached its due relevance by significantly contributing to the national economy, food and nutritional security, livelihood, and employment generation. Realising the potential of the sector, a new ministry was formed in 2021 and a comprehensive scheme for development of the sector named *Pradhan Mantri Matsya Sampada Yojana*, a scheme to bring about Blue Revolution through sustainable and responsible development was introduced. The growth of the fisheries sector has been phenomenal, especially in recent years due to various technical advancements, government policies and initiatives in both capture and culture fisheries. India witnessed a booming production of marine products and became the leading producer and exporter of seafood. India's achievement is attributed to its abundant resource potential, investment in research & development, and human capital in transforming the fisheries sector. The fisheries sector at present has evolved through decades of developments, enhancing the fields of research, education and extension.

Fisheries, the sunrise sector of India has reached its due relevance by significantly contributing to the national economy, food and nutritional security, livelihood, and employment generation.

Historical background

Early studies, investigations and findings by researchers such as James Russel (1785-89), Dr Buchanan Hamilton and Col. Alcock, starting of the Indian Marine Survey Station in 1875 and the launching of the survey ship 'Investigator', marked the beginning of fisheries in India.

- **Indian Fisheries Act, 1897**
  The Government of India (GOI) assigned Dr Francis Day to investigate the freshwater resources of South India, and then of India and Burma as a whole. Dr Day's pioneering efforts resulted in legislative measures to conserve fisheries. In light of that, the Indian Fisheries Act (Act IV of 1897) was passed for the entire country, making dynamiting, and poisoning of waters for the purpose of killing fish illegal. The enactment of this Act was a significant milestone in the history of Fisheries of India.

- **Establishment of Madras Fisheries Department**
  The Madras Presidency was the first in India to establish a Bureau of Fisheries in 1907, following Sir F. Nicholson's proposals. In 1908, Sir Nicholson was appointed Honorary Director of the Bureau of Fisheries. Mr Henry Wilson, a pisciculturist and Mr James Homell, a marine biologist, were appointed to assist him. The above three officers and their successors worked hard to develop fisheries in all fields, and the Madras Fisheries Department became the country's forerunner in fisheries development.
  - Fish preservation methods such as fish curing yards were started by the Department during 1924.
  - Extensive surveys, fishing experiments and exploratory fishing conducted by the Department led to the discovery of fishing and trawling grounds.
  - Special unit in the Department was organised in 1945, to design and build small motorised boats.
  - Fishing demonstrations with long lines, surface gill netting and boat seines were held at specific centres.

Development of fisheries extension

The Credit Cooperative Societies Act of 1904 marked the commencement of the cooperative movement in India. At Malpe in South Kanara, the first fishermen's cooperative society was established in 1913. It was thought that cooperatives could be an effective instrument for improving fishing communities. The Madras Government outlined the department's principal responsibility in the development of the fishing community in 1918 and ordered that the spread of cooperative methods among fishermen be sped up. The officers of the Fisheries Department were given the authority to form fishermen cooperative societies and to audit the books in recognition of the fact that fisheries officers were in the best position to oversee the cooperative work among fishermen.

Following the recommendations of the Royal Commission on Agriculture (1928), the government of India decided to develop the country's fishing industry. Attempts to develop fisheries through technology transfer were made as early as 1928, and is still in progress. The following are some of the significant attempts made so far in India for technology transfer in fisheries.

- In 1942, Mr K H Alikunhi initiated research on inland fisheries through the ICAR-sponsored Madras Rural Pisciculture Scheme, and hundreds of rural fishery demonstration ponds sprang up throughout the Madras Presidency. This was the first extension project that translated research findings into production programmes, and it was the forerunner of the highly successful Fish Farmers Development Agency (FFDA) scheme.
- In 1945, training centres for fisheries were established in Barrackpore, Kolkata and Mandapam, as recommended

by the Grow More Food Campaign (GMFC) in 1940. In 1947, a Central Fisheries Research Station was established at Barrackpore (which has later become CIFRI).

- The First All India Fisheries Conference, held in New Delhi in 1948, recognised the importance of the fishing industry in the hands of concerned officials from the central and state governments, and focused its attention on the need to develop the fisheries industry. This conference gave birth to the idea of subsidising a portion of capital expenditure.

- The All India Co-ordinated Research Project (AICRP) on composite carp culture began in 1971 with the goal of demonstrating the technology in various macroclimatic zones.
- In 1971, the AICRP on air breathing fish culture was established in West Bengal, Karnataka, AP, Bihar, and Assam with the goal of developing appropriate technology for freshwater air breathing fish culture in public water bodies.
- The Marine Products Export Development Authority (MPEDA) was established in 1972 to increase fisheries production and promote seafood exports.
- Krishi Vigyan Kendras (KVKs) were established as district-level institutionsto provide farmers, unemployed youth and extension workers with need-based and skill-oriented vocational training in agriculture and allied fields through work experience at the grass root level. The first KVK was established in Pondicherry in 1974.
- The Rural Aquaculture Project of the International Development Research Centre (IDRC) was launched in 1975 with the goal of demonstrating various aspects of carp culture and carp seed production by providing all necessary inputs and know-how to improve the rural economy. This was carried out in 75 villages across West Bengal and Odisha.
- The Government of India established the Fish Farmers Development Agency (FFDA) in 1974-75 to popularise fish culture as an alternative means of employment generation and poverty alleviation for the rural poor.
- The Inland Fisheries Project (1979), funded by the World Bank, began by providing credit assistance for the construction of modern fish seed hatcheries. This project resulted in the establishment of 62 hatcheries in North India.
- The Lab to Land Project began in 1979 with the goal of transferring technology from research laboratories to farmers' fields in order to improve the economic conditions of small and marginal farmers.
- Brackish-water Fish Farmers Development Agencies (BFFDA) were established between 1985 and 1990 with the goal of utilising the country's vast brackish water resources for fish/shrimp culture.
- The Institute Village Linkage Programme (IVLP) was established in 1996 to assess and improve technology considering biophysical and socioeconomic constraints. IVLP was established to provide a technology package suitable for the microsystems in which farmers operate.
- The Agricultural Technology Information Centre (ATIC) was founded with the goal of providing farmers and entrepreneurs with a "single window system" for product, information, and analytical services.
- The *Jai Vigyan Mission* (2000) was launched in Odisha, Chhattisgarh, and Assam to ensure household food and nutritional security by

increasing the productivity of fisheries in tribal, backward, and hilly areas.

Development of fisheries research

The foundation for fisheries research in India was laid by some of the early naturalists, zoologists and botanists from European countries. Many taxonomists studied fishes, crustaceans and other aquatic organisms from Indian coastal waters. Cuvier, Valenciennes, Lacepede, Bloch, Schneider, Forsskal, Bleeker, and Albert Gunther were the notable ichthyologists among them. The prominent carcinologists among them were Fabricius, H Milne Edwards and De Man.

- **Early marine expeditions**

Interest in marine resource surveys in the Indian oceans was sparked by the HMS Challenger Expedition in the late 1960s and early 1970s. The RIMSS Investigator then conducted deep-water and coastal surveys in the Bay of Bengal and the Andaman Sea. Numerous interesting species have been discovered as a result of these resource surveys. The studies of Alfred Alcock, Lloyd, and Lt. Col. R B Seymour Sewell, who worked as surgeon naturalists aboard the Investigator for the Navy, are among those that are most valuable. 'A NATURALIST IN INDIAN SEAS', written by Alcock in 1902, is a fascinating account of the numerous discoveries he documented while on his travels. Sewell was a recognised expert on marine Copepods. Sewell then joined the Zoological Survey of India, and his study on the hydrology and plankton of the Rhamba Bay, which was published in the Memoirs of the Indian Museum as part of the Survey of the Chilka Lake, is a remarkable achievement.

- **Zoological Survey Of India (ZSI)**

Interest in marine resource surveys in the Indian oceans was sparked by the HMS Challenger Expedition in the late 1960s and early 1970s.

The Zoological Survey of India (ZSI) was established in 1916 to encourage survey, exploration and research leading to the increase of our understanding of many elements of the extraordinarily diverse life of the erstwhile 'British Indian Empire'. The survey was born in 1875, when the Indian Museum in Calcutta established its Zoological Section. Since its foundation, the Zoological Survey of India has served as a centre for study on fish, fisheries, and marine biology. It served as the country's main repository for both terrestrial and aquatic creatures gathered in the Indian subcontinent. Its esteemed Directors, particularly Nelson Annandale, who started research on the hydrology of upland lakes, coastal lagoons, and lakes, made this feasible. Stanley Kemp, the captain of the British Antarctic Expedition in 1924, R B Seymour Sewell, an expert in marine biology and oceanography, Baini Prashad, a specialist in Indian molluscs and fisheries, and Sunder Lal Hora, a world-renowned ichthyologist, ecologist, and fish taxonomist. Up until the middle of the 1950s, the Zoological Survey of India held the top spot among Indian scientific organisations thanks to their leadership and research productivity. Each of them made a unique contribution to the early growth of fish and fisheries research in India.

- **Fishery Survey of India (FSI)**

The Indian government established the Deep Sea Fishing Station, as a pilot project in 1946 to advance deep-sea fishing and increase food production. In 1974, the project became a survey institute and was given the moniker Exploratory Fisheries Project. All of the maritime states were home to the Offshore Fishing Stations Institute's base offices. The programmes assigned to it included exploratory fishing, mapping of fishing grounds, training of fishing crews and evaluating the commercial viability of deep-sea fishing. A growing demand for resource information arose with the declaration of the Exclusive Economic Zone (EEZ) and subsequent changes in priorities in the development of marine fisheries. The Institute underwent a significant structural and functional restructuring in 1983

to better meet the demands that were emerging. It was reorganised, promoted to the status of a National Institute, and given the new name, Fishery Survey of India (FSI).

- **State Fisheries Department**

The Madras Presidency played an important role in Human Resource Development (HRD) for fisheries research and management in the early years, as many of its scientists, went on to head State Fisheries Departments, National Fisheries Research and Development Institutions or hold responsible positions in the Department itself. The study carried out in the coastal waters, notably in the Gulf of Mannar where a great deal of effort was put into the Chank and pearl oyster fisheries, was reported in the Madras Fisheries Bulletin of the past. The contributions of T. Chari are notable among many. Mr. Wilson, the father of inland fisheries development in the south,established trout culture in Nilgiris and breeding of larvicidal fishes. The department had the distinction of establishing a hydrobiological station in Chetpet, Madras, in the mid-1940s. Tamil Nadu pioneered reservoir fisheries development.

The Indian government established the Deep Sea Fishing Station, as a pilot project in 1946 to advance deep-sea fishing and increase food production.

The departments of fisheries in other states also engaged in both research and development efforts. As the "Father of Mechanisation" of fishing boats in India, Dr S B Setna initiated research and development projects in the former Bombay State Presidency, which included the present-day Gujarat (excluding the former Saurashtra State), Maharashtra, and North Kanara districts.

These projects were skilfully continued by C V Kulkarni and A G Kalawar. With S T Moses, C B Srivatsa, and K Chidambaram leading the Fisheries Department, Gujarat, including the former Saurashtra, saw a quick growth in its maritime industry. The majority of fish landings in India occur

Logo	Name of the Institute	Established year
CMFRI	ICAR-Central Marine Fisheries Research Institute, Kochi, Kerala	1947
	ICAR-Central Inland Fisheries Research Institute, Barrackpore, West Bengal	1947
	ICAR-Central Institute of Fisheries Technology, Kochi, Kerala	1957
	ICAR-Central Institute of Fisheries Education, Mumbai, Maharashtra	1961
NBFGR	ICAR-National Bureau of Fish Genetic Resources, Lucknow, Uttar Pradesh	1983
CIFA	ICAR-Central Institute of Freshwater Aquaculture, Bhubaneshwar, Odisha	1987
CIBA	ICAR-Central Institute of Brackishwater Aquaculture, Chennai, Tamil Nadu	1987
	ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, Uttarakhand	1987

today in the Gujarati fishing port of Veraval. T VR Pillai, who wrote about "The Fishes of Kodinar" and published it in the Journal of the Bombay Natural History Society, left Gujarat and continued to Calcutta, where he worked for the Center for Inland Fisheries Research for a while before joining the FAO. In the racial studies of *Hilsa ilisha* and *Pzmtiussarana*, Pillai conducted exceptional study that hasn't yet been equalled.

In the beginning, Karnataka included fisheries in the Animal Husbandry Department, but it had committed scientists like B S Bhimachar, A David and HDS Iyengar who made significant contributions to the knowledge of reservoir and riverine fisheries, identifying natural spawning grounds, and research on the benefits of integrated aquaculture of paddy-cum-fish. The Department of Fisheries of Bengal, Bihar and Odisha was a linked unit. T Southwell, the director of Bengal Fisheries, founded the fisheries laboratory in the Calcutta Indian Museum. This lab produced a number of scientific articles, some of which were co-authored by Southwell and Baini Prashad. The latter was appointed as the government of India's first Fisheries Development Adviser by the Ministry of Food and Agriculture.

When Odisha established its own Department of Fisheries, it was GN Mitra's catholic beliefs that shaped it and kept it going with studies on marine capture fisheries, Chilka lake fisheries, population dynamics and aquaculture engineering, the latter of which was his obsession. He eventually rose to the position of Fisheries Development Adviser for the Government of India,

Mr Wilson, the father of inland fisheries development in the south, established trout culture in Nilgiris and breeding of larvicidal fishes.

Central Inland Fisheries Research Station (CIFRI), 1959

Barrackpore, 1947

Mangalore

CIFE

where he promoted creative research initiatives in the Fisheries Research Institutes. GB Dubey started reservoir fisheries research and bund carp rearing in Madhya Pradesh.

- **Internationally funded projects**

Pelagic Fisheries Project (PFP) – The primary goal of this globally funded initiative by FAO/ UNDP, was to estimate the pelagic fishery resources in neritic and oceanic areas using pelagic fishing equipment and acoustics from the all-weather FAO Research Vessel Rastrelliger. The Project also employed a smaller vessel, but equally well-equipped with acoustic instruments, the R V Sardinella, for work in shallower coastal waters. Standardizing acoustic procedures involved extensive research. This was the first time an innovative acoustic survey programme to evaluate fish stocks and fishery resources was tried in tropical waters.

Bay of Bengal Programme (BOBP) – The idea of social scientists, anthropologists and economists being involved in fisheries research was foreign to the Indian system prior to the 1970s. Our perspective was reoriented thanks to the Bay of Bengal Programme. The initiative of FAO/ UNDP has opened up new areas for sociologists and economists to investigate problems, develop models, propose development strategies, and conduct malady-remedy analysis.

- **Fisheries research institutes**

In a Memorandum headed "Post-War Development of Indian Fisheries," Dr Baini Prashad, the Director of the

Zoological Survey of India in 1943, emphasised the necessity of establishing fisheries institutes in India. His recommendation for the establishment of research institutes in fisheries was included in the "Report of the Fish Sub-Committee of Policy No. 5 on Agriculture, Forestry, and Fisheries" dated 18 January 1945. The Government of India referred this recommendation to Lt Col. R B Seymour Sewell, on whose recommendation the Central Marine Fisheries Research Station (currently known as the Central Marine Fisheries Research Institute) was established. The Central Inland Fisheries Research Station was founded in Barrackpore, West Bengal in 1947, and later changed its name to the Central Inland Fisheries Research Institute (CIFRI). The Central Fisheries Technology Research Station was established in Cochin in 1957, and the processing wing was constructed the following year to handle research on handling, preservation, processing, product development, and quality control. The Centre was given institute status in 1961 and became the Central Institute of Fisheries Technology (CIFT). CMFRI, CIFRI, and CIFT were transferred from the Ministry of Agriculture to the Indian Council of Agricultural Research in 1967, and CIFE in 1979. The Central Institute of Fisheries Education (CIFE), which was founded in 1961 in Versova, Mumbai, was given the status of a Deemed University in 1989.

- **Indian Council of Agricultural Research (ICAR)**

Agricultural research and education received substantial funding during Lord Curzon's tenure as Viceroy of India in the first decade of the twentieth century. In 1929, the Royal Commission established the independent Imperial (now Indian) Council of Agricultural Research (ICAR). With a non-lapsing fund of ₹ 5 million, it was tasked with promoting, guiding, and coordinating agricultural research. The ICAR's establishment boosted agricultural research in India. A significant reorganisation was carried out in 1987 with the goal of enhancing and streamlining the research, instruction, extension, and training activities of the fisheries institutes under ICAR. The previous institutes were repositioned throughout this procedure, and the following institutes were founded:

- **State Agricultural Universities (SAUs)**

The ICAR's establishment in 1929, boosted agricultural research in India. However, the ICAR had no administrative control over provincial research institutions. Only 17 agricultural and veterinary colleges were established at the time of independence in 1947 to focus on agricultural training of students, whereas the State Departments of Agriculture and Community Development focused on research and extension. There were no close links between agricultural colleges and research departments to ensure that proven technologies were used to their full potential.

Recognizing the shortcomings of the existing educational system and the need to link agricultural education programmes with production programmes, the University Education Commission (1948), led by Dr S Radhakrishnan, proposed the establishment of "Rural Universities." This recommendation was strengthened by two Joint Indo-American Teams' proposals (1955 and 1960), which supported the establishment of State

KUFOS

TNJFU

Vishakapatinam

Chennai

Goa

Cochin

CMFRI, 1994

Initiation of Cage Culture in 1970's

Agricultural Universities (SAUs). SAUs in India were developed with the assistance of the United States Agency for International Development (USAID) and American land-grant universities. The SAUs were granted autonomy and direct funding from state governments. They were self-governing organisations with state-wide responsibility for agricultural research, education, and training, as well as extension education.

The establishment of SAUs, modelled after land-grant universities in the United States, was a defining moment in reorganising and strengthening India's agricultural education system. These universities became research branches of the ICAR and partners in the National Agricultural Research System (NARS). The ICAR, through the Department of Agricultural Research and Education (DARE), facilitates research collaboration with the Consultative Group on International Agricultural Research (CGIAR) System, NARS, and research foundations around the world. DARE oversees all facets of agricultural research and education that need collaboration between federal and state agencies. SAUs, also on the other hand, work directly with these international organisations. The State Departments of Fisheries' research operations and duties were transferred to the State Agricultural Universities (SAUs) with their founding after the 1960s.

Development of fisheries education

The Indian fisheries education system began with major and sustained efforts of government of India to reduce illiteracy among fishermen. At Tanur on the West Coast, the Fisheries Department established a unique Fisheries School in 1913. By 1919, the government had approved the establishment of a training centre in Calicut where school teachers of fisheries schools received specialised technical instruction in the field of fishing. In 1929, free education for the children of fishermen was provided by 30 day schools and 4 night schools. With a total enrolment of 19,510 students in 1950, there were 49 elementary and 10 higher elementary schools. Cauvery poompattinam, Sathankuppam, and Alambarikuppam in Madras had just 3 elementary schools left after the 1956 state reorganisation.

In India, agricultural universities in their respective states are responsible for education in all agricultural sciences, including Fisheries. Prior to the establishment of these universities in the early 1960s, no Indian university offered higher-level fisheries education. The central and state governments were required to hire graduates in any of the basic sciences to fill managerial positions in the fisheries sector. However, because these recruits were unfamiliar with the multidisciplinary field of fisheries, governments resorted to establishing a series of in-service training centres at various levels. In 1945, the Government of India established two All India Fisheries Training Courses, one in Barrackpore and one in Madras. While the latter, which dealt primarily with marine fisheries, has since been discontinued, the former, which dealt with inland fisheries, is still in operation under a different structure. The polytechnics in Tamilnadu, Kerala, and Andhra Pradesh used to offer a diploma level training course in fishery technology and navigation.

The Government of India established two national level institutes, the Central Institute of Fisheries Education (CIFE) in Bombay in 1961 and the Central Institute of Fisheries, Nautical and Engineering Training (CIFNET) in Cochin in 1963, on the recommendation of the Fisheries Education Committee, which was formed in 1959. The Marine Products Processing Training Centre (MPPTC) was also established in Mangalore in 1963 as a result of Indo-Japanese collaboration to train fish processing technologists for the newly emerging fish processing industry. The introduction of mechanised fishing in our coastal waters in the 1950s resulted in the establishment of fishermen training centres for mechanised fishing in all maritime states. Most state governments also established a network of in-service training facilities for their technical personnel at various levels.

- **Professional fisheries education**

Professional fisheries education in India began much later than veterinary and agricultural education. In 1969, University of Agricultural Sciences of Karnataka took the bold step of establishing the country's first professional fisheries education at the university level, with the establishment of its College of Fisheries in Mangalore. A new era of professional fisheries education in India began at the State Agricultural/Veterinary Universities. The success of this institution led to the establishment of many fisheries colleges within agricultural universities in India.

Fisheries Education in India has grown manifold and evolved in the last four decades as a professional discipline consisting of Bachelors, Masters, and Doctoral programmes in various branches of Fisheries Science. At present, 28 Fisheries Colleges offer four-year degree programme in Bachelor of Fisheries Science (BFSc), while 22 of them offer Master of Fisheries Science (MFSc) in various disciplines and 16 offer Doctoral programmes.

The Government of India established two national level institutes, the Central Institute of Fisheries Education (CIFE) in Bombay in 1961 and the Central Institute of Fisheries, Nautical and Engineering Training (CIFNET) in Cochin in 1963.

Composite fish culture in 1970's

Survey ship 'Investigator'

- **Fisheries universities**

Development in Fisheries Education has led to the establishment of Fisheries Universities in recent years. Fisheries Universities are exclusively dedicated to studies in fisheries and allied disciplines.

Kerala University of Fisheries and Ocean Studies (KUFOS)

Kerala University of Fisheries and Ocean Studies (KUFOS), the first fisheries University of India was established in 2010, under the State Ministry of Fisheries. KUFOS is Kerala State's main and most effective tool for supplying the human resources, expertise, and technology needed for the long-term growth of Fisheries and Ocean Studies. KUFOS offers high-quality education that is on pace with international standards and promotes research-oriented studies together with beneficial extension activities. The pursuit of graduate and postgraduate teaching and research programmes in newly emerging fields of fisheries science is designed to achieve academic quality. Specialised courses are developed in the needy sectors in order to create professionals and experts while also addressing the requirements of state and national priorities. It is important to disseminate the findings of research from emerging fields that have produced successful technology, to the end consumers. The mission of the University is to serve as a flagship University of higher learning through demonstrated and growing excellence in teaching, research, extension, training, scholarship and creative work in Fisheries and Ocean Studies, comparable with global standards that will benefit the country and the world at large.

Fisheries Colleges in the country

State	Fisheries college
Tamil Nadu (TNJFU)	Fisheries College and Research Institute, Thoothukudi
	Dr MGR Fisheries College and Research Institute, Ponneri
	Dr MGR Fisheries College and Research Institute, Thalainayeru
	College of Fisheries Engineering (CoFE), Nagapattinam
	Institute of Fisheries Postgraduate Studies (IFPGS), Vaniyanchavadi
	Annamalai University, Chidambaram
Kerala	Kerala University of Fisheries & Ocean Studies (KUFOS), Kochi
Karnataka	College of Fisheries, Mangalore
Andhra Pradesh	College of Fishery Science, Muthukur
Telangana	College of Fishery Science, Pebbair
Odisha	College of Fisheries, Rangeilunda
Chattisgarh	College of Fisheries, Kawardha
Maharashtra	Central Institute of Fisheries Education, Mumbai
	College of Fisheries, Ratnagiri
	College of Fishery Science, Udgir
	College of Fishery Science, Telankhedi, Nagpur
Gujarat	Postgraduate Institute of Fisheries Education and Research (PGIFER), Gandhinagar
	College of Fisheries, Veraval
	College of Fisheries, Navsari
Madhya Pradesh	College of Fisheries Science, Jabalpur
Jharkhand	College of Fisheries Science, Gumla
West Bengal	West Bengal University of Animal & Fishery Sciences, Kolkata
Bihar	College of Fisheries, Kishanganj
	College of Fisheries, Dholi
Uttar Pradesh	College of Fisheries Science and Research Campus, Etawah
	College of Fisheries, Kumarganj
Rajasthan	College of Fisheries, Udaipur
Punjab	College of Fisheries, Ludhiana
Jammu & Kashmir	Faculty of Fisheries, Srinagar
Uttarakhand	College of Fisheries, Pantnagar
Assam	College of Fisheries, Raha
Tripura	College of Fisheries, Lembucherra

Tamil Nadu Dr J Jayalalithaa Fisheries University (TNJFU)

Tamil Nadu Dr J Jayalalithaa Fisheries University (TNJFU) is the second fisheries university of India formed in 2012. The State Agricultural University (SAU) model and syllabi are used by the State-funded Tamil Nadu Dr J Jayalalithaa Fisheries University (TNJFU), an institution of higher learning for fisheries in India. TNJFU offers professional education, training, research and research funding to enhance fish production and utilisation. The university has a bold vision of "Harnessing the Science of Fisheries for Food,Nutrition and Livelihood" and works with a mission to Excelling in teaching, research, and extension initiatives in fisheries sciences to produce professionally acclaimed and socially responsible graduates achieving nutritional security and sustainable development of the fisheries sector. Its mandates are to coordinate the research activities of the faculty of the Tamil Nadu Fisheries University, to collaborate and cooperate with the Department of Fisheries, Government of Tamil Nadu Fisheries Development Corporation, *etc*., to disseminate the salient research findings through the mass media, audio-visual aids, *etc*. for the benefit of the farming community, and to formulate new research project proposals for Govrnment of India, and Govrnment of Tamil Nadu and other external funding agencies. The Fisheries University in Tamil Nadu has expanded its quality manpower generation with the establishment of three Fisheries College and Research Institutes, and one College of Fisheries Engineering. It also offers paraprofessional courses in three disciplines to cater to the needs of the industries. Postgraduate education in Fisheries is offered in 13 disciplines, the highest in the country. Over 200 graduates pass out from the university every year.

Andhra Pradesh Fisheries University (APFU)

Andhra Pradesh Fisheries University (APFU), the third fisheries university of India was established in the year 2020, to impart education in different branches of fisheries science; to undertake the extension of Fisheries Science to the rural people of Andhra Pradesh and to promote research, technology refinement programmes in production and post-harvesting technology including processing and marketing of Fisheries and to streamline the Fisheries education, affiliate, recognise colleges imparting Fisheries education; in order to facilitate comprehensive development of fisheries for increased contribution to State's economy and set benchmark standards through appropriate interventions in fisheries production, teaching, research and extension. The Andhra Pradesh government has decided to conduct the courses from the current academic year (2022–2023).

Regulation of fisheries education

There is a substantial need for professionally competent graduates in Fisheries to man the expanding sector. However, fisheries education needs to be regulated as being done by the Veterinary Council of India (VCI) to prevent mushrooming of quality-compromised institutes and to ensure quality in SAUs offering Fisheries courses. There shall be minimum standards established and enforced in terms of infrastructure and faculty strength at all levels in Fisheries institutions to produce competent manpower to man the ever-growing fisheries sector.

Vice-Chancellor, Tamil Nadu Dr J Jayalalithaa Fisheries University, Nagapattinam
Email: sugumar@tnfu.ac.in, vc@tnfu.ac.in

Anuradha Agrawal[1] and R C Agrawal[2]

Popularizing agriculture as a school subject for achieving ATMA-NIRBHAR BHARAT

Agriculture is one of the mainstays of the Indian economy with nearly 70% percent of rural households deriving and sustaining their livelihoods from it. Our Prime Minister has said that the agricultural sector is a key to fulfilling India's aspirations of becoming a $5 trillion economy by 2025 and achieving the ambitious target set by the Government of India of doubling the income of farmers by 2022-23. Agriculture is the primary source of livelihood for over 52% of the workforce and contributes 16% to the GDP. Through rapid modernization and diversification of the agriculture value chain, bolstered by policy level initiatives and adoption of contemporary technologies, the sector has been able to make the country food sufficient in production. Mega production trends, coupled with growing internal consumption have made India the largest producer, consumer and importer of pulses in the world. India continues to lead the world's production and consumption trends for other major agricultural produce such as – milk, jute, wheat, sugarcane, cotton, groundnuts, vegetables and fruits. This led to the great Indian agricultural revolutions - green, white, blue to enhance production and productivity in crops, dairy, fishery, irrigation etc. However, agriculture today remains largely input intensive, dominated by low-tech farm practices and scarce mechanization. The adoption of modern technology and sophisticated scientific methods will facilitate greater yield, reduce average costs, raise farmers' incomes and address issues of food and environmental security.

India continues to lead the world's production and consumption trends for other major agricultural produce such as – milk, jute, wheat, sugarcane, cotton, groundnuts, vegetables and fruits.

Despite achieving production self-sufficiency, India continues to face the food paradox – high agricultural productivity and high rates of hunger and malnutrition. Currently, India ranks 102 out of 119 countries on the Global Hunger Index, with a score of 30.3. Furthermore, India has the second highest under-nourished population in the world. Much of the disequilibrium is with respect to supply of agricultural produce and demand realization can be attributed to structural issues – income poverty, poor distribution governance and production inefficiencies (inefficiencies in the utilization of factors of production, resource intensive techniques of production, and a primary focus on cereal production) – in addition to lack of trained and skilled agri-personnel. The development and application of advanced sciences and management at the farm level requires skills, knowledge and investments in human capital in agriculture and allied sciences. The need for acceleration in agricultural research and innovation and its translation into practice is critical and the contribution of the Indian agricultural education system towards developing skilled human resources is vital.

Status of agricultural education in India

Recognizing that agricultural education system plays an imperative role in driving sectoral growth, the same has been given high priority by the central and state governments. Universities specializing in agricultural education make up for 5% of the total number of universities in the country. This is higher than universities offering popular specializations such as law (2.4%) and management (2.1%). Despite the extensive coverage, enrolments in agriculture sciences at under graduate (UG) and post graduate (PG) levels as compared to popular disciplines such as medical and social sciences are low. This lacuna in agricultural higher education can be attributed to the fact that agriculture and allied sectors are not necessarily "aspirational". There is low awareness about the need for entrepreneurship skills in the sector which largely stems from the lack of clarity about qualifications in agriculture and the pathways to agricultural higher education.

National Education Policy (NEP) 2020

The NEP 2020 rolled out by Government of India, addresses the many growing developmental imperatives of the country, by revising and revamping all aspects of the education structure, including its regulation and governance. The policy sets out to create a new education system that is aligned with the aspirational goals of 21st century, including global education development agenda reflected in the Goal 4 (SDG4) of the 2030 Agenda for Sustainable Development, adopted by India in 2015, while also building upon India's traditions and value systems. With respect to agricultural education system, the NEP 2020 focuses on redesigning the curriculum with greater push towards developing professionals with the ability to understand and use local and traditional knowledge, and emerging technologies while being cognizant of critical issues such as declining land and productivity, climate change, food sufficiency for our growing population, *etc*.

Agricultural education would play a significant role in boosting the economy and accelerate the development process of our country. It can create a landmark in achieving food security and sustainability for >1.4 billion Indians. Lack of education and guidance among children about agriculture is the biggest challenge in making agriculture an aspiration avenue for India. Education increases productivity by improving the decision-making ability and capability to make informed choices and decisions concerning the selection and the combination of input for better output.

Enrolment ratio in higher education in some disciplines in India

Sector	Under Graduate	Post Graduate
Medical sciences	4.18%	4.01%
Social sciences	3.17%	1.8%
Agriculture sciences (including horticulture, fisheries, veterinary and animal sciences)	0.96%	0.82%

Need for agricultural education in schools

The NEP 2020 calls for reinvigorating the agricultural education system to increase agricultural productivity through the development of a generation of students with active interest in agriculture and allied disciplines, driving cutting-edge research and innovation in addition to developing agricultural skills as life skills. To attract young talent in agriculture, it is important to strengthen the pathway from school to higher education. The Education Division of Indian

MACE OBJECTIVES

- To deliberate on the need to mainstream agriculture as a core subject at school level
- To study the various modes and mechanisms of scaling up of agriculture as a subject at primary, secondary and higher secondary levels
- To study the desired policy support required to promote agricultural education through State and Central education boards
- To discuss the framework of developing and exploring agricultural vocational teaching pedagogy at school level
- To explore students' experiences and perceptions about agricultural programmes at primary, secondary and tertiary education levels

Inaugural session of MACE 2022

Council of Agricultural Research (ICAR) has taken cognisance of the fact and prepared a roadmap of activities in order to mainstream agriculture as a subject in school education. Mainstreaming of agriculture as a core subject in school curriculum by combining theoretical and practical approaches, to expose students to the basic principles of agriculture and explain the various components of agro-based industry, may be deemed vital. This will not only allow a child to have a better and practical knowledge about agriculture but will also help in developing positive habits such as food affinity, better eating habits as well as a conscious and open mind set towards agriculture-based career orientation.

To attract young talent in agriculture, it is important to strengthen the pathway from school to higher education. The Education Division of Indian Council of Agricultural Research (ICAR) has taken cognisance of the fact and prepared a roadmap of activities in order to mainstream agriculture as a subject in school education.

With an aim to attract young talent towards agricultural higher education and improve retention within the sector, there is a need to create greater sensitization among school goers at primary, secondary and higher secondary levels about the importance and scope of agriculture and allied sectors in promoting economic growth and human development. There is a concern around children's lack of knowledge and understanding of food sources and production, and more broadly around their apparent disconnection from nature. Literature is available demonstrating the degrading agricultural knowledge among the children. Young people's knowledge of how their food is produced and how it gets to their plate seems to be very restricted. Therefore, there is urgent need for greater awareness among school goers about agriculture and allied sectors, and associated careers. To achieve this, a four phased approach is proposed to introduce agricultural education in schools that entails curriculum changes, course creation, outreach programs, and capacity building.

A view of some participants of MACE 2022

There is also a need to provide specialized training to equip teachers on focussed pedagogy.

Brainstorming session on Mainstreaming Agricultural Curriculum in School Education (MACE)

To address the above needs, ICAR organized a brainstorming session on 'Mainstreaming Agricultural Curriculum in School Education' (MACE) on 14 June 2022, with specific objectives. Participants of the brainstorming session comprised representation from key educational bodies like Central Board of Secondary Education (CBSE), National Council of Educational Research and Training (NCERT), State Council of Educational Research & Training (SCERT), Principals and Teachers from public and private schools from Delhi, National Capital Region, subject matter experts from ICAR and its institutes.

Shri Narendra Singh Tomar, Hon'ble Minister of Agriculture and Farmers Welfare, Government of India, graced the occasion as the Chief Guest of the inaugural session. In his inaugural address, he applauded the efforts of ICAR to align with NEP 2020 and undertake the initiative. He mentioned that this is a first but firm step towards deliberating upon the need for scaling up of agriculture as a core subject in school curriculum to develop students' knowledge and understanding of agricultural enterprises, practices and skills required in refining the "farm to fork" value chain. He also assured that the government is making concerted efforts to bring agriculture curriculum into the mainstream of school education under the NEP 2020. Shri Tomar said that if the interest towards agriculture sustains in the children from the school level, then they will be able to move towards agriculture after college. In the present circumstances, agriculture sector is going to create a lot of employment opportunities in the foreseeable future. In this regard, he mentioned about linking agriculture with technology and setting up of a Agriculture Infrastructure Fund.

The Inaugural session was followed by four panel discussions, wherein participants provided insights and offered their perspectives on the thematic topics.

All the panellists unanimously agreed that agriculture as a subject must be introduced in schools as an equivalent subject to physics, chemistry and mathematics. They recommended to increase the awareness about agricultural education in the schools and introduce agriculture and allied

PANEL DISCUSSION THEMES IN MACE

- The need for mainstreaming agriculture in school education
- Opportunities and challenges in introducing agriculture as a mainstream subject in line with NEP 2020
- Curriculum level changes required to introduce agriculture as a mainstream subject in secondary education
- Prospects for employability in agriculture by introducing agriculture as a mainstream subject in secondary education

sciences in school education curriculum.

In order to increase awareness about agricultural education, it was strongly suggested that ICAR conduct seminars, workshops and other engagement activities in schools involving parents, students and teachers to showcase the changing face of agriculture across the country. This will help to spark children's interest in agriculture. Schools can implement unique, customised programs for students to promote/increase awareness about agriculture. Schools should leverage upon the large network of agricultural universities and other agricultural facilities across India and introduce outdoor activities for students such as nature walks a, field trips to farms and agri-communities and plan special visits during summer and winter holidays. In contrast to science disciplines, agricultural curriculum should be 70% practical + 30% theoretical. ICAR could make a portal for students which will describe career option, fee, scope, sources, institutions, and reflection should be there in curriculum framework. Introduction should be make for internships in educational research and real-world training as choices for undergraduates' professional growth. Training sessions to help develop agricultural skills for entrepreneurship in agriculture can be helpful as well. All participants appreciated the organization of the brainstorming session and showed keen interest in adopting the outcome of deliberations in their respective organzations/institutes.

In order to move forward, ICAR will be organizing state level brainstorming sessions to discuss curriculum level changes, define credit system for secondary and senior secondary schools. Through this initiative of ICAR, it is hoped to strengthen capacity development of young talent in our country in the agri-sector, and make India truly "*Atmanirbhar*".

[1]National Coordinator,
NAHEP, ICAR, KAB-II, Pusa,
New Delhi 110 012
Email: anuradha.agrawal@icar.gov.in
[2]Deputy Director General (Agricultural Education) and National Director
NAHEP, ICAR, KAB-II, Pusa,
New Delhi 110 012
Email: ddg.edu@icar.gov.in

A K Singh[1] and C Viswanathan[2]

The seat of higher learning in agriculture: ICAR-Indian Agricultural Research Institute, New Delhi

The Indian Agricultural Research Institute (IARI) is the premier institute for agricultural research, education and extension in the Country. It was established as the Imperial Agricultural Research Institute at Pusa in Darbhanga, in 1905. Following a massive earthquake which damaged the Institute at Pusa, IARI was shifted to Delhi in 1936. The Institute was renamed as Indian Agricultural Research Institute, post-independence. Currently IARI has 20 Divisions, 5 multi-disciplinary Centres situated in Delhi, 8 Regional Stations and 2 Off-season Nurseries across India.

The Imperial Agricultural Research Institute at Pusa in Darbhanga, before 1934

Prof. M S Swaminathan Library at Indian Agricultural Research Institute, New Delhi. Inset: Left top corner: Postal stamp released by Government of India in recognition of Green Revolution; Right top corner: Postal stamp released by Government of India on the occasion of 100 years of IARI's service to the Nation.

IARI has provided human resources and technologies to bring about a radical transformation of Indian agriculture. The achievement of IARI is synonymous to the food security of the Nation.

IARI, the Seat of Green Revolution and Sustainable Food Security

IARI has provided human resources and technologies to bring about a radical transformation of Indian agriculture. The achievement of IARI is synonymous to the food

A 1965 picture showing MS Swaminathan (left) and Norman Borlaug in the wheat fields of the Indian Agricultural Research Institute (IARI), New Delhi.

security of the Nation. In 1960s, the Country faced the "ship-to-mouth" situation. In 1966, 30 million people in India were facing "dire distress" in getting food. IARI played a key role in making the Green Revolution, and in fact ***the seeds of green revolution were born in the laboratories of IARI***. IARI played key role in introduction, development and widespread adoption of semi-dwarf, photo-insensitive, input-responsive and high yielding varieties of wheat which contributed to an unprecedented jump in wheat yield, and thus green revolution. But for the Green Revolution, India could not have survived the population bomb.

IARI continues to apply frontier science in agriculture, and thus maintaining its leadership role in contributing the food and nutritional security, rural livelihood security and environmental sustainability. Today IARI's crop varieties occupy a prime place in the farmers' field. Currently, ***IARI wheat varieties contribute nearly 60 million tons of wheat to nation's granary worth ₹ 80,000 crores annually***, thus contributing significantly towards food and nutritional security. ***IARI wheat variety HD2967 has contributed to an estimated economic surplus of ₹ 81,928 crores between 2011-2020***.

IARI basmati rice varieties occupy about 98% of the Basmati area of the Country. The annual economic surplus generated from PB1121 is estimated at ₹ 14,707 crores during triennium ending 2018-2019. The earnings from PB 1121 are about 96% of the total expenditure of the entire NARES (₹15,379 crores) during TE 2018-19.

IARI basmati rice varieties occupy about 98% of the Basmati area of the Country. ***The annual economic surplus generated from PB1121 is estimated at ₹ 14,707 crores during triennium ending 2018-2019. The earnings from PB 1121 are about 96% of the total expenditure of the entire NARES (₹ 15,379 crores) during TE 2018-19***. Every year, IARI basmati rice varieties contribute to about ₹ 30,000 crores of export earnings.

In ***Yellow Revolution***, the contribution of IARI is highly significant. Pusa mustard varieties are grown in about 45% of mustard grown area in the Country. ***The total economic surplus generated from Pusa Mustard 25 is estimated at ₹ 14323 crores (at 2018 prices) during the past 9 years (2010-2018).*** The first ever canola standard cultivar in the country, double zero Indian mustard variety, **Pusa Double Zero Mustard 31**, with an average seed yield of 2.32 t/ ha, was released by IARI.

HD2967, the blockbuster wheat variety of IARI. It covered >10 ha, beating all records for a single variety or hybrid of any crop to cover such a large area.

Pusa Basmati 1121, a blockbuster basmati rice variety of IARI. It holds the Guinness book of record for the world's longest grain basmati rice variety.

Now IARI is focusing on nutritional security, and released several biofortified varieties of food crops. In fruits, IARI's Amrapali Mango variety, released in 1979, is vary popular export quality variety and is being commercially grown in more than 2,00,000 ha in India. Several vegetable varieties developed by IARI have contributed to enhance the vegetable production and bringing nutritional security of India.

In 1990s, United States Environmental Protection Agency blamed by showing that paddy cultivation by India leads to emission of 37.8 Tg $CH_4 yr^{-1}$ methane. IARI played a major role in combating this claim and showed that the methane emission from Indian paddies is as low as 4.0 Tg yr^{-1}. This helped India to protect its rice cultivation and thus food security. IARI continues to provide inputs to IPCC and actively participates in preparation of IPCC reports. IARI's Neem coated urea technology is fully adapted by fertilizer industry in India (Govrnment vide notification dated 25 May 2015) and from 1st September 2015, 100% urea produced is neem coated urea. ***IARI Neem-coated urea technology saves 5 kg urea for each bag of Urea sold in the Country every year***.

The Institute has developed several technologies for natural resource management, water management, pest control, microbial biofertilizers, novel plant protection chemical, *etc*., that contributed to enhanced productivity and environmental sustainability. The institute is well known for its pioneer work on remote sensing applications in agriculture since 1970's starting with coconut wilt disease detection till date. IARIhas significantly contributed in developing protocols and technologies through basic and strategic research on remote sensing. The extension and economic policy research have contributed immensely in the Nation's agricultural extension and economic policies.

IARI, the Seat of Higher Learning in Agriculture

Agriculture education in IARI was started in 1923 with two years Post Graduate Diploma, associates of IARI, equivalent to the M Sc degree. The Institute was granted with the status of a Deemed University in 1958 under UGC Act 1956. The Post Graduate School of IARI was inaugurated on 6 October 1958. This led to the start of M Sc and PhD degree programs in agriculture. Now IARI offers M Sc/M Tech and PhD programmes in 26 disciplines in association with Indian Agricultural Statistics Research Institute (IASRI) New

Rev. Mother Teresa, Chief guest, at the 31st convocation of IARI.

Prof. M S Swaminathan
World Food Prize 1987

Dr S K Vasal
World Food Prize 2000

Dr Sanjaya Rajaram
World Food Prize 2014

Prof Rattan Lal
World Food Prize 2020

Delhi, National Institute for Plant Biotechnology (NIPB) New Delhi, National Bureau of Plant Genetic Resources (NBPGR) New Delhi, IARI-Assam, IARI-Jharkhand, ICAR-CIAE, Bhopal, ICAR-IIHR, Benguluru, ICAR-NIASM Baramati, ICAR-NIBSM, Raipur and ICAR-IIAB Ranchi.

Till 2022, Institute has awarded degrees to 10,783 (903 IARI Associateship, 4617 MSc 84 MTech and 5179 PhD) students including 414 international students. The graduates of IARI continue to constitute the core of the quality human resource in India's agricultural research and education. IARI alumni have been giving leadership to the NAREES/ CGIAR systems. About 11 IARI alumni have been conferred with Padma Award of Govt of India. IARI is the only Institution of India which produced four World Food Laurates, namely Prof. M. S. Swaminathan (Father of Green Revolution in India) Dr Sanjaya Rajaram, Dr SK Vasal and Dr Rattan Lal.

IARI Alumni awarded with World Food Laurate Award

IARI has also played key role in establishing Afghan National University of Agricultural Sciences and Technology (ANASTU), Kandahar, Afghanistan and Advanced Centre for Agricultural Research and Education (ACARE) at Yezin Agricultural University, Myanmar.

The academic excellence was recognized by NAAC rating of A+. ***IARI was ranked 23 in NIRF ranking among all Institutes/ University of India in 2017. The Empowered Expert Committee (EEC), constituted for selection of Institution of Eminence (IoE) by MHRD, Govt of India***, recognised the contribution of ***ICAR-IARI,*** New Delhi and placed it under ***Special Institution Category***. IARI is ranked at 26 in the overall ranking of Institutes/universities in India by Center for World University Rankings.

Now IARI is determined to become Multidisciplinary Education and Research University (MERU) as envisaged in National Education policy 2020. From 2022-23 academic year, IARI is stating undergraduate programs namely B Sc (Hons) Agriculture, B Tech Biotechnology, B Tech Agricultural Engineering and BSc Community Science, and diploma/certificate courses. Towards becoming a global university, IARI also envisages faculty diversification and internationalization.

Agriculture education in IARI was started in 1923 with two years Post Graduate Diploma, associates of IARI, equivalent to the M Sc degree. The Institute was granted with the status of a Deemed University in 1958 under UGC Act 1956.

IARI was ranked 23 in NIRF ranking among all Institutes/University of India in 2017. The Empowered Expert Committee (EEC), constituted for selection of Institution of Eminence (IoE) by MHRD, Govt of India, recognised the contribution of ICAR-IARI, New Delhi and placed it under Special Institution Category.

[1]Director, ICAR-Indian Agricultural Research Institute Pusa New Delhi 110 012
[2]Joint Director, ICAR-IARI
Email: director@iari.res.in

M S Chauhan[1] and S K Kashyap[2]

Profile of the trend setter: Govind Ballabh Pant University of Agriculture & Technology (GBPUA&T) Pantnagar

The GB Pant University of Agriculture and Technology, Pantnagar emerged in World QS ranking in year 2022 after tremendous strategic interventions towards international visibility, networking, collaboration, research prioritization, focus on higher-order cognitive skills of students, soft skills enhancement, infrastructural updating, development of entrepreneurial acumen of the students, alumni network strengthening, strategic industry linkage and international exchange opportunities of University faculty and students. The all-round efforts could place Pantnagar among the top-rankers in ICAR ranking in last consecutive years. The placement performance could enhance substantially, on-time graduation rate could improve, industry-academia interaction could reach to the next level, research and technology transfer initiative enhanced substantially, count of national and international training could get manifold, the faculty and student inbreeding could substantially reduce. The urge and the urgency of the University to emerge as a global centre of excellence in the field of agricultural education, research and capacity building pushed the mandates of the institution go further according to the pressing needs of the agricultural sector of the country.

GB Pant University of Agriculture and Technology, Pantnagar emerged in World QS ranking in year 2022

The multi-disciplinarity and the international outlook

The NEP 2020 provides a deep insight of much-required future thrust to the Indian Universities with a strategic planning. Pantnagar University contained an element of multi-disciplinarity since inception with agricultural sciences, veterinary and animal sciences, community science, basic science and humanities, fishery sciences, agricultural engineering, civil engineering, computer engineering, information technology, production engineering, electrical and mechanical engineering, agribusiness management, electronics and communication engineering, running simultaneously and synergistically which provided opportunity to the University students dwell across the disciplines for different courses for having comprehensive exposure and understanding. Across the colleges also, the different disciplines collaborated for every practical purpose of teaching, training, research and extension. Many undergraduate courses were taught by 7-8 faculty members with their specific domain of expertise and their own labs which provided the students, a fulfilling experience. Team teaching and collaborative teaching has been a distinction of Pantnagar classes as yet another normal for decades. The thrust of practical focus to classroom teaching has been an essence with significant tilt of each course towards practical classes, field based labs, tutorials, practical crop production, experiential learning, rural agricultural work experience, work programme, earn while you learn, skill-oriented projects and assignments, plant clinic, industry attachment, village attachment and

many more to provide the students immense opportunity to emerge as a scholar with deep-woven skill sets, humbleness, work culture, discipline and pride of manual labour. This emerged as the core value at Pantnagar which people called as Pantnagar Culture.

The roots were very strong

G.B. Pant University of Agriculture and Technology came into existence on 17 November 1960, as the first State Agricultural University of India in tarai-belt of the Nainital district (presently Udham Singh Nagar district of Uttarakhand state). Geographically, tarai marks the junction of the Shivalik range at the foothills of the Himalayas with a vast exposure of the fertile Gangetic plain. With the dawn of Independence on 15 August 1947, the first priority set by the great national leaders was to attain self-sufficiency on the agricultural front which culminated in the appointment of University Education Commission in 1948 under the Chairmanship of late Dr S Radhakrishnan. The Commission showed serious concern about large imports of food grain to the tune of 4.5 million tonnes worth ₹ 200 crores, and recommended that agricultural education be recognized as a major national issue. To specify the organisation and functions of a rural university, a joint team under the Chairmanship of Shri KR Damle was formed, in accordance with the resolution of the Ministry of Food and Agriculture, Govt. of India. In the light of the recommendations of this joint team, Pantnagar University came into existence on the pattern of American Land Grant Institutions in 1960. The University was dedicated to the nation by Pt. Jawaharlal Nehru, the first Prime Minister of independent India.

Pantnagar has played a pivotal role in ushering in the era of Green Revolution in the country by developing a large number of high-yielding varieties of field crops, vegetables, flowers, fruits and fodder.

The University has 8 constituent colleges, *viz.* Agriculture, Veterinary and Animal Sciences, Technology, Home Sciences, Basic Sciences and Humanities, Fisheries, Agri-Business Management and Post-Graduate Studies. The University is currently running undergraduate degree in 14 disciplines, masters degree in 71 disciplines and Ph.D. degree in 55 disciplines. A total of more than 50,000 students have graduated so far. The graduates trained in various disciplines have proven their worth and credentials across the world by leading the industry and academia from key positions.

Pantnagar has played a pivotal role in ushering in the era of Green Revolution in the country by developing a large number of high-yielding varieties of field crops, vegetables, flowers, fruits and fodder. It has transformed the quality of life of the farmers of the country by providing them high quality seed and technology. The tarai region which was initially rehabilitated by the refugees after attaining the freedom, has been transformed into a grain bowl by the initiatives of the University and the farmers of tarai has acted as role models for other farmers. This has been well acknowledged by the Nobel Laurate Dr Norman E. Borlaug, Prof. M S Swaminathan

and other dignitaries. Some of the wheat varieties *viz*. Sonalika (RR 21), Kalyan Sona (Sona 227) and UP-262 have made impact in the neighbouring countries as well. Tara Seed Project (Tarai Development Corporation) of ₹ 20 crores which was sponsored by this University and supported by the State, the Centre and the World Bank was launched in 1969, has contributed significantly in mass scale seed production and related activities.

The University is operating 411 research projects funded by various national and international agencies. The University has been reorienting its research priorities in view of the arising needs and has launched research programmes in organic farming, conservation of biodiversity, tea cultivation, herbal and medicinal plants, cold water fisheries, inland fisheries, embryo transfer technology and biotechnology for plants and animals. A centre of Plant Genetic Resource is functioning effectively and has conserved more than 5000 germplasm/landraces in which 2000 wheat, 252 rice, 88 maize, 273 barley, 437 pulses, 1089 oil seeds, 633 millets, 72 vegetables, 175 soybean, 42 amaranth germplasms are there as a rare repository. Identification of noble germplasm is also an eminent mandate.

The University has given highest priority to transfer of technology to the farmers through mass media and farmers' fair. The extension work is being carried out through 11 Krishi Vigyan Kendras and Agricultural Technology Information Centre (ATIC) which is operational at the University and conducts round the year training programmes for farmers and officials. Two farm magazines, viz. Kisan Bharti and Indian Farmer's Digesthave gained wide popularity amongst farmers.

The saga of glory and development of the University could not have been materialized without the blessings of very eminent persons from time to time since its inception including Pt. Govind Ballabh Pant, Dr S Radhakrishnan, Smt Indira Gandhi, Dr V V Giri, Giani Zail Singh, Shri Chandra Shekhar, Shri I K Gujral, Shri C Subramaniam, Shri N D Tiwari and Dr A P J Abdul Kalam. The role of Major H S Sandhu, Shri A N Jha, Dr H W Hannah, Shri W V Lambert, Shri K A P Stevenson are worth mentioning in the development of the Tarai State Farm and the University. Recognizing its contributions in agricultural and rural development, the Indian Council of Agricultural Research bestowed this University thrice with Best Institution Award in 1997, 2005 and 2020. The Consultative Group on International Agricultural Research (CGIAR) has also recognized the role of rice-wheat cropping system research.

Showcase of life-changing agricultural education

The University proved that an academic institution can take multi-faceted responsibilities of skill-based teaching, intensive research as well as to carry the research findings to the farmers' fields on mass scale to bring agricultural transformation over all. It was three-fold responsibility as compared to any traditional university but agricultural professionals took it courageously to lead the country up to Green Revolution which was a magnificent task and achievement. Since then, the University has never looked back and has significantly emerged as a unique centre of higher education and research in the field of agriculture and allied sciences with astonishing outcomes in research, teaching as well as extension. The University could maintain the sincerity and discipline in academic endeavor which is depicted through regular academic sessions with net 200-210 instructional days each year. The academic calendar including teaching, hourly examinations, final examinations, results, session etc are adhered inch by inch without any slackness.

Pantnagar: The unending endeavours

Being the leader, the University experimented and evolved many patterns and innovations in various areas of agricultural education, research and extension. Some of the initiatives in this regard include:

1. The University established in the year 1960 adopted the trimester system of education. It changed over to the semester system of education in 1985-86 and the course curricula were modified /updated accordingly.
2. The 'Practical Crop Production' course started by the College of Agriculture in 1962 for the first batch of the students.
3. 'Earn While You Learn' programme initiated, which envisaged professional training and work experience amongst students.

4. Rural Agriculture Work Experience (RAWE) Programme of 20 credits started in 1992 for agriculture graduates for enhancing their competence, confidence and employability.

5. Experiential learning package of 20 credits was introduced in the colleges since 2012 to improve the hands-on training and develop entrepreneurial capability of students.

6. Course curricula, infrastructure, organizational pattern, research priorities etc. reviewed by a high-level committee and recommendations implemented.

7. Educational Technology Cell has been established for regular faculty training on instructional skills. Employability skills training for students also initiated at regular basis.

8. Initiation of programmes of Biotechnology and Food Science & Technology at under graduate level.

9. Establishment of University-industry and University-farmer linkages for enriching teaching, research and extension activities

10. Providing opportunity to students to 'Earn While You Learn' through practical crop production, poultry rearing, pet animal keeping and other such programmes, and promoting a sense of dignity of labor among students through compulsory work programme at undergraduate level.

11. Collaboration with more than 100 international and national institutions for collaboration in teaching, research and extension.

IDP-NAHEP: The great game-changer

The National Agricultural Higher Education Project of ICAR emerged as a brilliant opportunity which Pantnagar availed and utilized to its fullest. It was like going ahead for millions of miles on the path of academic transformation. The strategic interventions made under the project were innovative and eye-opening. The international exposure, focused trainings to cater to higher-order cognitive skills, e-content development, regularizing students internship through industry networking, innovations in international tie-ups, alumni network strengthening, strengthening of e-governance models, concept of improvised remedial classes, language classes, entrepreneurship classes, adjunct faculty, guest faculty, amalgamation of educational technology advancements in the teaching-learning ecosystem of the University became a part of the University system through IDP-NAHEP intervention. The salient and brilliant impact and tangible outcome and output led the university to unique accolades.

Towards an enriching and bright future

In the advancing epoch of

knowledge society, the University aims to pro-actively generate stronger bridges with all its stakeholders. This integration will play a crucial role in assimilation and dissemination of knowledge and further strengthen the spirit of agriculture in the country. We aim to focus our research on technology based production and engineering and further transmitting the new techniques and tools to the farming community, progress on the path of pedagogy and pedagogical skills to have a cadre of world class teachers besides having eminent scientists and researchers, and collaborate extensively with extension functionaries to bring changes at grassroot levels. Even the contribution of our alumni has been immense. With all enthusiasm and vigilance, the University is ready to move ahead and serve the cause of integrated development in an agile manner.

[1]Vice Chancellor, [2]Dean,
G B Pant University of Agriculture & Technology,
Pantnagar, Uttarakhand 263 145
Email: vcgbpuat@gmail.com

Tea production and marketing

Assam Agricultural University

The Experiential Learning Programme (ELP) developed by ICAR has been successfully implemented in the Department of Tea Husbandry & Technology (THT), Assam Agricultural University (AAU), Jorhat under the module Tea Production and Marketing. Initially the programme was a university programme and since 2018 onwards the programme has been receiving financial assistance from ICAR. The number of students trained under this programme since 2018 is 132. From the inception of this programme, it has been a persistent journey for the faculty of the Department of THT, AAU, Jorhat to take up various farm based activities for the 4th Year students with an approach to *learning by doing* and *seeing is believing*. The technical knowhow on various aspects of tea leaf production, processing, packaging, planting material generation, value added tea products such as masala tea, spice tea, ginger tea, cinnamon tea *etc*. are showcased to the students under the expert guidance of the faculty members of the department. Garden fresh black tea as well as green tea and other products as mentioned above are much sought-after products developed and marketed by ELP students. Production of tea plants from single leaf tea cuttings and raising these in the nursery and production of rooted black pepper saplings are also done by students during this programme.

IMPACT

This programme has been running very successfully since its inception as the students are given the opportunity to develop marketable tea products such as green tea, black tea, value added tea products like ginger tea, cinnamon tea, masala tea, ice tea. Intricacies of tea processing and marketing with packaging technology are demonstrated to the students by the faculty members of this department. Following the success of past students in generating revenue, the ELP on Tea Husbandry is today a much "sought after" programme at AAU, Jorhat as the students foresee a new entrepreneurial journey here.

Experiential Learning Programme (ELP) developed by ICAR has been successfully implemented in the Department of Tea Husbandry & Technology (THT), Assam Agricultural University (AAU), Jorhat under the module Tea Production and Marketing.

LESSONS LEARNT

Imparting knowledge in the field of tea production, processing and marketing is very important especially for the students of North-eastern part of India where the production of tea is highest amongst the different tea producing regions of India. Globally, India ranks 2nd in terms of tea production which shows the vast potential that it holds to provide employment to the majority of population of north east India along with opening a door for entrepreneurship development.

ELP on Tea Husbandry is today a much "sought after" programme at AAU, Jorhat as the students foresee a new entrepreneurial journey here.

Various products made and marketed by ELP students

ELP students during tea processing

ELP students preparing black pepper saplings for sale as rooted cuttings

ELP students preparing poly sleeves for propagation of tea plants

Showcasing of ELP products by ELP students to visiting dignitaries

Showcasing products made by ELP students

Considering the importance, various aspects of tea production, processing as well as marketing and value addition in tea are demonstrated to the students under the guidance of faculties of the department of Tea Husbandry & technology. All the students may not be equally interested to start a career as an entrepreneur but some of the students may become future agri-preneurs for whom exposure to line departments is very essential during this programme. Students are critically observed and are given access to technology, stakeholders and mentors which are considered to be very essential for the budding agri-preneurs.

Following financial assistance given by the ICAR, the Department of Tea Husbandry & Technology is presently well equipped with necessary logistic support to run this ELP module successfully. AAU has its own tea garden, tea processing unit and experienced faculty members. From the inception of this programme, this module has been proved to a resounding success for Assam Agricultural University, Jorhat.

CHALLENGES

At a time when our farm sector is depicted with distress scenes making national headlines, it is high time for us to attract our young generation specially the agricultural graduates to take up farming in a professional approach. A time has come up to train our students to become *Job givers rather than Job seekers*. Encouragement to final year students is the need of the hour to pursue them to start a professional career in agriculture. The fact that farming is profitable has to be imbibed by our young, talented students. This can be achieved through development of entrepreneurial skills and confidence building measures along with brushing up of their management capabilities through well designed programmes. This will inspire more and more budding agricultural graduates of this region and help them in building a wonderful career.

SUCCESS STORIES

This programme has encouraged students of Assam Agricultural University, Jorhat to start small agro-based industries of their own. Following is the list of few students turned entrepreneurs who had completed ELP in Tea Husbandry & Technology:

A. Name of the Student Entrepreneur	**Saranga Pani Mahanta**
Address	Banmukh Chutia Gaon, P.O. Joyrapar, Sivasagar District (Assam)
Email ID and mobile number	sarangapanimahanta20@gmail.com 8133943543
Name of the university	Assam Agricultural University, Jorhat-13
Name and address of college	College of Agriculture, Assam Agricultural University, Jorhat-13
Year of passing	2017
Experiential learning programme attended	Tea Production and Marketing, Production of Biofertilizer, Biopesticide and Bioagents
Title and start date of enterprise	Supoha Tea, 17/10/2020
Nature/Details of the enterprise	Premium Assam CTC and orthodox tea packet, also supply Boutique tea on demand
Approximate turnover per year	₹ 10,00,000
Approximate net profit per year	₹ 3,00,000
Number of persons employed	3
Any other relevant information	Planning to open ready to drink tea outlets in near future
B. Name of the Student Entrepreneur	**Ms Deepsikha Saikia**
Address	House no. 573, N. B. Road, Ward no. 04, Golaghat-785621
Email ID and mobile number	dsaikia1986@gmail.com 8254852008
Name of the university	Assam Agricultural University, Jorhat-13
Name and address of college	College of Agriculture, Assam Agricultural University, Jorhat-13
Year of passing	2018
Experiential learning Programme attended	Tea Production and Marketing, Production of Bio-fertilizer, Bio-pesticide and Bio-agents
Title and start date of enterprise	Started own tea farm, 07/04/2017
Nature/Details of the enterprise	Small Tea Garden Farm Area: 2.5 ha Crop grown: Tea Production- 1150 kgs in 2018 (Young Tea Plants)
Approximate turnover per year	₹ 2,50,000
Approximate net profit per year	₹ 50,000
Number of persons employed	4
Any other relevant information	The vermi-compost applied in the field is produced in the farm itself

A. Name of the Student Entrepreneur	**Saranga Pani Mahanta**
C. Name of the Student Entrepreneur	**Mr Allen Baruah**
Address	Hamdoi Village, P.O Purana Titabor, Jorhat District (Assam) Pin-785635
Email ID and mobile number	baruahaleen@gmail.com, Mob. 7002837178
Name of the university	Assam Agricultural University, Jorhat-13
Name and address of college	College of Agriculture, Assam Agricultural University, Jorhat-13
Year of passing	2018
Experiential learning programme attended	Tea Production and Marketing, Production of Biofertilizer, Biopesticide and Bioagents.
Title and start date of enterprise	Tea cultivation and processing , stevia Cultivation, August 2018
Nature/Details of the enterprise	About 70000 kg of CTC tea, Stevia in 0.1 acre
Approximate turnover per year	₹ 1,40,00,000
Approx. net profit per year	₹ 28,00,000
Number of persons employed	20
D. Name of the Student Entrepreneur	**Mr Shounak Ganguly**
Address	Harispur Tea Estate, Namrup, Dibrugarh
Email ID and mobile number	shounak.ganguly98@gmail.com, Mob.7896891395
Name of the university	Assam Agricultural University, Jorhat-13
Name and address of college	College of Agriculture, Assam Agricultural University, Jorhat-13
Year of passing	2020
Experiential learning programme Attended on	Tea Production and Marketing, Production of Biofertilizer, Biopesticide and Bioagents.
Title and start date of enterprise	Specialty Tea; May, 2020
Nature/Details of the enterprise	Area 10 Ha, Crop: Tea Product : Handcrafted Orthodox Black Tea
Approximate turnover per year	₹ 2,00,00,000
Approx. net profit per year	₹ 40,00,000
Number of persons employed	30
Any other relevant information	All compost applied is produced on–farm Bio-pesticide production unit

Assam Agricultural University, Jorhat 785 013
E-mail: vc@aau.ac.in

Promoting entrepreneurship among agri graduates

Tamil Nadu Agricultural University

Tamil Nadu Agricultural University is one of the pioneers in promoting agriculture related businesses in the country. The Directorate of Agribusiness Development, TNAU was established in 2007 with the major mandate of supporting startup companies in agriculture including Food Processing, Farm Machinery, Horticulture, Renewable Energy, Wealth products from agricultural wastes, Bio-inputs, Organic vegetable cultivation, Hi Tech / Vertical Farming, IoT and AI based Agriculture and Drones for farming through business incubators.

The "Technology Business Incubator" (TBI) funded by National Science and Technology Entrepreneurship Development Board, New Delhi, was established in the Directorate of Agribusiness Development, TNAU, Coimbatore in 2011. The TBI extends its support and motivates startups and entrepreneurs in the field of agribusiness by providing technical guidance, quality certification, financial guidance and market linkages through business promotional activities.

The Ministry of Agriculture and Farmers' Welfare, RKVY Division, New Delhi has established a RKVY-RAFTAAR Regional Agribusiness Incubators (R-ABI) centre at the Technology Business Incubator, DABD, TNAU, Coimbatore from 2019 for implementing two programmes. Under RKVY-R-ABI, two programmes *viz*., (i) Agripreneurship Orientation Program (AOP) (ii) Startup Agribusiness Incubation Program (SAIP) are implemented every year since 2019. Among 11 grantees under APO, 6 were TNAU graduates and among 17 SAIP grantees one was from TNAU.

Following TNAU graduates were supported in establishing startups in Agriculture for the last 3 years by the TBI through RKVY RAFTAAR Programme.

- **Dr Gowthaman Ramasamy,** M/s Kultivate India Private Limited engaged in enabling farmers and enterprises in using advanced ICT technologies and able to generate annual turnover around ` 61 lakhs.
- **Dr Devikarani K T,** M/s A2 Milk Products is engaged in production of value added products such as curd, ghee and maltodextrin and chemical free milk powder from Indian Native breed cow milk.
- **Dr V Anusheela,** M/s. Herbomill Nutrolites dealt with production of multi millet muesli which is devoid of artificial ingredients and chemicals. She was able to generate an annual turnover of ` 6 lakhs.
- **Ms R N Jana Bharathi,** M/s. J S Foods is involved in production of value added millet products and generate annual revenue of ` 7.2 Lakhs.
- Some of the student entrepreneurs **Mrs K Akila** M/s Aalam produces herbal Tea / decoction and **Mr M Vasanth Kumar,** M/s Gravity Pest Solutions manufactures low cost pest trap. **Ms P Padma Priya,** M/s Sesha Purification, manufacturing solar based desalinator has just initiated production and marketing the products with the support of Technology Business Incubator, TNAU.

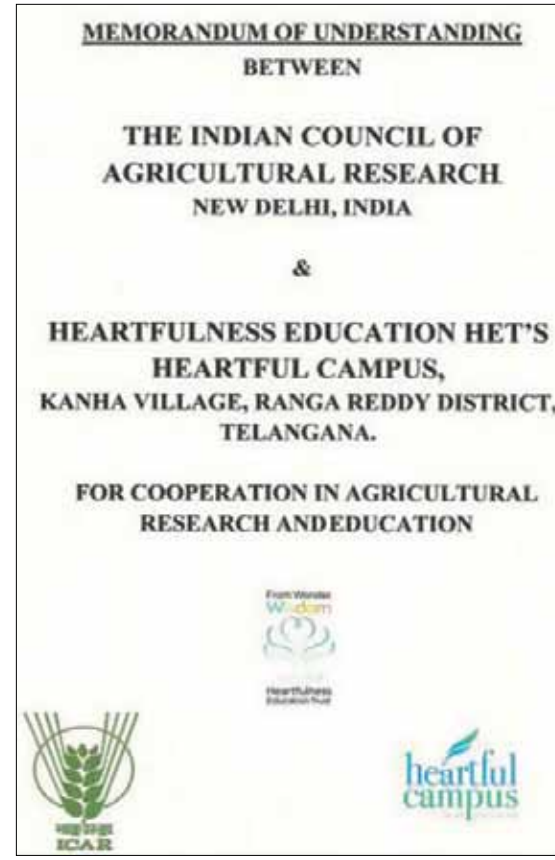
Technology Business Incubator,
Directorate of Agribusiness Development, Tamil Nadu Agricultural University, Coimbatore
Email: business@tnau.ac.in

Meeting of Vice Chancellors of Agricultural Universities

A meeting of the Vice Chancellors of all State Agricultural Universities/Deemed Universities/ Central Agricultural Universities/ Central Universities with Agriculture Faculty was held at Kanha Shanti Vanam, Hyderabad during 30 September to 2 October 2022. The meeting was jointly organized by Indian Council of Agricultural Research (ICAR), New Delhi and Sri Konda Laxman Telangana State Horticultural University (SKLTSHU), Mulugu, Siddipet District, Telangana. Inaugural session was graced by Honorable Governor of Telangana and Lieutenant Governor of Puducherry Dr Tamilisai Soundararajan on the first day.

A number of issues related to NEP 2020, NAAC accreditation, QS ranking, revenue generation models, providing best facilities to the students at SAUs were discussed.

A historic Memorandum of Understanding (MoU) was signed between ICAR and Heartfulness Education Trust (HET), Kanha Shanti Vanam, Hyderabad on 1 October 2022, during the meeting for cooperation in agricultural research and education. HET proposes to organize various programmes related to life skills, wellness, meditation, yoga, leadership, socio-emotional learning, *etc*., as credit courses in degree curricula of all agricultural universities.


MEMORANDUM OF UNDERSTANDING

BETWEEN

THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH
NEW DELHI, INDIA

&

HEARTFULNESS EDUCATION HET'S HEARTFUL CAMPUS,
KANHA VILLAGE, RANGA REDDY DISTRICT, TELANGANA.

FOR COOPERATION IN AGRICULTURAL RESEARCH ANDEDUCATION

ICAR

heartful campus

Agricultural Education Division
ICAR, KAB-II, New Delhi 110012
Email: ddg.edu@icar.gov.in; adg.hrd@icar.gov.in

All India Agri Start-up Convention 2022

Under the ICAR-NAHEP Institutional Development Plan (IDP) project, University of Horticultural Sciences (UHS), Bagalkot organised the All India Agri Start-up convention from 18-20 October 2022, to bring together all stakeholders: budding agriprenuers, industrialists, farmers, business incubators, research institutionson a single platform to present and share theirinnovations, experience, expertise, business models and success stories of Agri Start-ups. The event was organised into six technical sessions, inviting academicians, industrialists and entrepreneurs to discuss entrepreneurial opportunities and challenges in the agriculture sector. The University also arranged multiple events such as incubating start-ups at the UHS Technology Business Incubation, launching entrepreneurs' products, Agri-startup exhibitions, hackathons and oral and poster presentations to motivate and support the students and budding entrepreneurs.

The convention was inaugurated Dr RC Agarwal, DDG (Agricultural Education) and National Director NAHEP, ICAR. A compendium of abstracts of participants on different agri-business ideas and success stories was released by Dr Veeranna Chananthimath, the Hon'ble MLA, Bagalkotand a great patron of UHS, Bagalkot. Dr K M Indiresh, Hon'ble VC, UHS, Bagalkot, highlighted the activities of UHS, Bagalkot, such as the student READY programme, ELP and certificate and vocational courses for making students job-ready as well as entrepreneurship ready.

Start-ups need-based following 6 technical sessions with different themes were conducted in consultation with MANAGE, Hyderabad and C-CAMP, Bangalore, who have been supporting and handholding the start-ups through incubation:

Theme 1: Farm Inputs-Opportunities and Challenges for Agri-Start-ups

Theme 2: Hi-Tech Farming for new age agripreneurs

Theme 3: Value addition for Agri Produce -A boon to Agri Start-ups

Theme 4: Farm to Plate - Optimizing supply chain management in Agriculture

Theme 5: Mechanization and Automation- An Arena for new generation entrepreneurs

Theme 6: Market Linkages and Networking facets for Agri-startups

Experts from academia, industry and entrepreneurs in their respective fields were invited to share their knowledge and experience on entrepreneurial opportunities in different sectors. More than 500 students from different universities in Karnataka, Andhra Pradesh, Tamil Nadu, Maharashtra, Gujarat, Tamil Nadu, Rajasthan and Jammu and Kashmir attended the event. In addition, 52 start-ups showcased their products and ideas in the Agri-Start-up exhibitions.

University of Horticultural Sciences,
Bagalkot, Karnataka 587 104
Email: vc@uhsbagalkot.edu.in

National symposium on mainstreaming private education in agriculture

Under National Agricultural Higher Education Project (NAHEP), Component-2, ICAR-National Academy of Agricultural Research Management on 29 September 2022, organized a National Symposium on "Mainstreaming of Agricultural Higher Education by Private Universities in India" at its campus at Hyderabad. Dr RC Agrawal, Deputy Director General (Edn) and National Director of NAHEP in his inaugural address highlighted the need for transformation of agricultural education in the country in the wake of the National Education Policy-2020 and also to revisit the land grant pattern of State Agricultural Universities. The ICAR is keen in supporting private agricultural universities in terms of student admissions, and scholarships *etc*, to those who comply with guidelines such as accreditation. The one-day symposium deliberated on four important themes *viz*. equal opportunity in education and employment, quality assurance in agricultural education, enabling environment for quality education and accreditation in the context of national education policy. More than 100 delegates participated in the event, which include Chancellors, Vice Chancellors, Dean and Directors from 31 Private Universities from various parts in the country, these universities have agricultural faculty. Dr Ch Srinivasa Rao, Director, ICAR-NAARM highlighted the importance of quality education and the accreditation process. He also extended an invitation for the capacity building of faculty of private universities at the Academy. Dr S K Soam, Head of Division at NAARM was the Convener-Cum-Organizing Secretary of the symposium.

ICAR-National Academy of Agricultural Research Management,
Hyderabad, Telangana 500 030
Email: director@naarm.org.in

FORTH COMING EVENTS

Agri-Sports
20-24 February 2023, at CCS Haryana Agricultural University (HAU), Hisar

Agri-Unifest
13-17 March 2023, at University of Agricultural Sciences (UAS), Bengaluru

International Conference on Blended learning Ecosystem for Higher Education in Agriculture: 21-23 March 2023 at National Agriculture Science Complex (NASC) New Delhi, India

NEXT ISSUE THEME

Empowering Youth with New Age Technologies

LIST OF AGRICULTURAL UNIVERSITIES IN INDIA

S.N.	State Agricultural Universities	University Link
1	Acharya NG Ranga Agricultural University, Guntur, AP	https://angrau.ac.in
2	Dr YSR Horticultural University, Venkataramannagudem, AP	https://drysrhu.ap.gov.in
3	Sri Venkateswara Veterinary University, Tirupati, AP	http://svvu.edu.in
4	Assam Agricultural University, Jorhat, Assam	http://www.aau.ac.in
5	Bihar Agricultural University, Sabour, Bhagalpur, Bihar	https://bausabour.ac.in
6	Bihar Animal Sciences University, Patna, Bihar	https://basu.org.in
7	Indira Gandhi Krishi Vishwavidhyalaya, Raipur, Chhattisgarh	https://igkv.ac.in
8	DAU Shri Vasudev Chandrakar Kamdhenu Vishwavidyalaya, Anjora, Durg, Chhattisgarh	https://cgkv.ac.in
9	Sardar Krushinagar Dantiwada Agricultural University, Dantiwada, Gujarat	http://sdau.edu.in
10	Anand Agricultural University, Anand, Gujarat	http://www.aau.in
11	Navsari Agricultural University, Navsari, Gujarat	https://nau.in
12	Junagarh Agricultural University, Junagarh, Gujarat	http://www.jau.in
13	Kamdhenu University, Amreli, Gujarat	https://www.kamdhenuuni.edu.in
14	Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana	http://hau.ac.in
15	Lala Lajpat Rai University of Veterinary & Animal Sciences, Hisar, Haryana	http://www.luvas.edu.in
16	Maharana Pratap University of Horticulture, Anjanthali, Karnal, Haryana	http://www.mhu.ac.in
17	Ch. Sarwan Kumar Himachal Pradesh Krishi Vishwavidyalaya, Palampur, Himachal Pradesh	http://www.hillagric.ac.in
18	Dr. Yaswant Singh Parmar University of Horticulture & Forestry, Solan, Himachal Pradesh	http://www.yspuniversity.ac.in
19	Birsa Agricultural University, Ranchi, Jharkhand	http://www.bauranchi.org
20	Sher-e-Kashmir University of Agricultural Sciences & Technology, Srinagar, Jammu & Kashmir	http://www.skuastkashmir.ac.in
21	Sher-e-Kashmir University of Agricultural Sciences & Technology, Jammu, Jammu & Kashmir	http://www.skuast.org
22	University of Agricultural Sciences, Bangalore, Karnataka	http://www.uasbangalore.edu.in
23	Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar, Karnataka	http://kvafsu.edu.in
24	University of Agricultural Sciences, Raichur, Karnataka	http://www.uasraichur.edu.in
25	University of Agricultural Sciences, Dharwad, Karnataka	http://www.uasd.edu.in
26	University of Horticulture Science, Bagalkot, Karnataka	http://www.uhsbagalkot.edu.in
27	Keladi Shivappa Nayaka University of Agriculture & Horticulture Sciences, Shivamogga, Karnataka	http://uahs.edu.in
28	Kerala Agricultural University, Thrissur, Kerala	http://www.kau.in
29	Kerala University of Fisheries and Ocean Studies, Panangad, Kochi, Kerala	http://www.kufos.ac.in
30	Kerala Veterinary and Animal Sciences University, Pookode, Wayanand, Kerala	http://www.kvasu.ac.in
31	Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, Gwalior, Madhya Pradesh	http://www.rvskvv.net
32	Nanaji Deshmukh Pashu Chikitsa Vishwavidyalaya, Jabalpur, Madhya Pradesh	http://www.ndvsu.org
33	Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh	http://www.jnkvv.org
34	Dr. Balasaheb Sawant Kokan Krishi Vidyapeeth, Dapoli, Maharashtra	http://www.dbskkv.org
35	Maharashtra Animal & Fisheries Sciences University, Nagpur, Maharashtra	http://www.mafsu.in
36	Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra	http://www.vnmkv.ac.in
37	Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra	http://mpkv.ac.in
38	Dr. Punjabrao Deshmukh Krishi Vishwa Vidyapeeth, Akola, Maharashtra	https://www.pdkv.ac.in
39	Orissa University of Agricultural & Technology, Bhubaneswar, Orissa	http://www.ouat.ac.in
40	Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab	http://www.gadvasu.in
41	Punjab Agricultural University, Ludhiana, Punjab	http://web.pau.edu
42	Maharana Pratap University of Agriculture & Technology, Udaipur, Rajasthan	https://www.mpuat.ac.in
43	Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan	http:// www.raubikaner.org
44	Rajasthan University of Veterinary & Animal Sciences, Bikaner, Rajasthan	http://rajuvas.org
45	Sri Karan Narendra Agriculture University, Jobner, Rajasthan	http://www.sknau.ac.in
46	Agriculture University, Kota, Rajasthan	http://aukota.org
47	Agriculture University, Jodhpur, Rajasthan	http://aujodhpur.ac.in
48	Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu	http://www.tnau.ac.in
49	Tamil Nadu Veterinary & Animal Sciences University, Chennai, Tamil Nadu	http://www.tanuvas.ac.in
50	Tamil Nadu Dr J Jayalalithaa Fisheries University, Nagapattinam, Tamil Nadu	http://www.tnjfu.ac.in
51	Sri Konda Laxman Telangana State Horticultural University, Hyderabad, Telangana	http://skltshu.ac.in
52	Sri PV Narsimha Rao Telangana Veterinary University, Hyderabad, Telangana	http://tsvu.nic.in
53	Professor Jayashankar Telangana State Agricultural University, Hyderabad, Telangana	http://www.pjtsau.ac.in
54	Govind Ballabh Pant University of Agriculture & Technology, Pantnagar, Uttarakhand	http://www.gbpuat.ac.in
55	VCSG Uttarakhand University of Horticulture & Forestry, Bharsar, Uttarakhand	http://www.uuhf.ac.in
56	Chandra Shekhar Azad University of Agricultural & Technology, Kanpur, Uttar Pradesh	http://csauk.ac.in
57	Acharya Narendra Deva University of Agriculture & Technology, Faizabad, Uttar Pradesh	http://www.nduat.org
58	Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh	http://www.svbpmeerut.ac.in
59	U.P. Pt. Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwavidhyalaya Evem Go Anusandhan Sansthan, Mathura, Uttar Pradesh	http://www.upvetuniv.edu.in
60	Banda University of Agricultural and Technology, Banda, Uttar Pradesh	http://buat.edu.in
61	Bidhan Chandra Krishi Vishwavidhyalaya, Mohanpur, West Bengal	http://www.bckv.edu.in
62	West Bengal University of Animal & Fishery Sciences, Kolkata, West Bengal	http://wbuafscl.ac.in
63	Uttar Banga Krishi Vishwavidhyalaya, Cooch Behar, West Bengal	http://www.ubkv.ac.in
	Central Agricultural Universities	
64	Central Agricultural University, Imphal, Manipur	http://www.cau.ac.in
65	Rani Laxami Bai Central Agricultural University, Jhansi, Uttar Pradesh	https://collegedunia.com
66	Dr. R P Central Agricultural University, Pusa, Samastipur, Bihar	https://www.rpcau.ac.in
	Deemed Universities	
67	Indian Agricultural Research Institute, New Delhi	https://www.iari.res.in
68	Central Institute of Fisheries Education, Mumbai, Maharashtra	http://www.cife.edu.in
69	Indian Veterinary Research Institute, Bareilly, Uttar Pradesh	http://www.ivri.nic.in
70	National Dairy Research Institute, Karnal, Haryana	http://www.ndri.res.in
	Central Universities with Agricultural Faculty	
71	Aligarh Muslim University, Aligarh, Uttar Pradesh	https://www.amu.ac.in
72	Nagaland University, Medziphema, Nagaland	http://nagalanduniversity.ac.in
73	Banaras Hindu University, Varanasi, Uttar Pradesh	http://www.bhu.ac.in
74	Visva Bharti (Pali Siksha Bhavana) P.O. Santiniketan, Bolpur, West Bengal	http://www.visvabharati.ac.in

Published by Project Director (DKMA), on behalf of Indian Council of Agricultural Research, Krishi Anusandhan Bhavan I, Pusa, New Delhi 110012, and printed at M/s Royal Offset Printers, A-89/1, Naraina Industrial Area, Phase-I, New Delhi 110028.
Editor : Dr Seema Jaggi, agririse@icar.gov.in