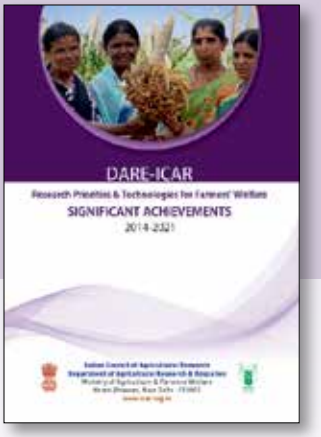
DARE-ICAR

Research Priorities & Technologies for Farmers' Welfare

SIGNIFICANT ACHIEVEMENTS

2014-2021

Indian Council of Agricultural Research
Department of Agricultural Research & Education
Ministry of Agriculture & Farmers Welfare
Krishi Bhawan, New Delhi -110001
www.icar.org.in



March 2022

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FOREWORD

The Indian Council of Agricultural Research since its inception in 1929 played a pivotal role in the science-led growth and development of Indian agriculture in the country. The organization has made tremendous progress in the development of new varieties of field and horticultural crops. The noteworthy achievements during the past seven years is development of 71 biofortified varieties to alleviate malnutrition. Hon'ble Prime Minister dedicated 17 biofortified varieties to the nation on the occasion of World Food Day 2020. Higher replacement of old varieties with new ones and availability of high-quality seeds of such varieties contribute to pulses revolution during 2016-21. The country also witnessed sugar revolution which is attributed to sugarcane varieties mainly Co 0238 which gives 20 tons/ha more cane yield and about 12% higher sugar recovery. In horticultural crops, an all-round progress has been seen in varietal development of fruits, vegetables, plantation and medicinal plants. Digitized seed portal, sea route transportation protocols, etc. have been quite successful in expanding the reach of seeds and export markets of banana. The conservation and improvement of indigenous animal breeds is national priority. Our concerted efforts resulted in registration of 56 animal breeds including poultry. Improved breed of Frieswal cow was declared a new breed in 2019. Besides, new varieties of pig, sheep, poultry were also developed with better meat quality and productivity. Towards better animal health and hygiene, we focused on developing new vaccines and diagnosis kits for efficient management of animal diseases and increasing animal productivity. The induced breeding technologies, with a focus on ornamental fishes, standardized along with technology backstopping for promotion of open-sea cage farming. Several nutraceutical/health products from sea-weeds were developed and commercialized. In order to hasten the process of soil health analysis, Minilab for soil testing at affordable price was developed and deployed. To reduce the chemical foot print in the soil and environment, new and remunerative integrated and organic farming system models were developed. These IFS models are being upscaled by different States. To ensure high-quality higher agricultural education, we strengthened the process of accreditation of agricultural universities/colleges and implemented measures to attract talent in agricultural education and research. Greater emphasis was on skill and entrepreneurship development under National Agriculture Higher Education Project (NAHEP). Our efforts to reach out to as many farmers as possible was intensified through the development and use of ICTs particularly through the energized KVK system. Our KVKs strived, through mass awareness

in the villages of Haryana, Punjab and western UP, for the in-situ management of rice residues. This effort, along with farm mechanization through the financial support of the Central Government, we could register over 52% reduction in the residue burning events in 2019 over 2016. ICAR placed greater emphasis to work for remote, disadvantaged and difficult areas such as Leh-Ladakh, NEH and in A&N Island. To harness the synergy to excel in research in challenging areas and address farmers problems, ICAR inked MoUs with Science Departments/organizations namely DBT, CSIR, ICMR, ICFRE, IIT, Delhi and IMD. Our collaboration was strengthened with Government Departments such as MoFPI, MoRD, MSME and WCD for convergence. The coordination and collaborations under bilateral cooperation with neighboring countries and on multilateral platforms like BRICS, BIMSTEC and ASEAN as well as with international research centres and organizations improved very significantly bringing visible impacts. We also planned and initiated 75 weeks celebrations under Azadi ka Amrut Mahotsav with national and sectoral awareness campaign and lecture series one in every week, publication on 75 years of achievement and documentation of success stories of 75000 farmers with doubling of their income.

Many structural reforms, and new initiatives were implemented to enhance the much-needed efficiency and transparency and chart new courses to meet the current and future challenges. Three new institutions and Rani Laxmi Bai Central Agricultural University as well as new facilities for phenomics, climate change research and 'state of the art' convention centre were also established.

ICAR was rewarded with Global Gene Stewardship Award 2018 by the Borlaug Global Rust Initiative for the work on systematic gene deployment to manage rust diseases in wheat; conferred with Digital India award-2020 under open data champion category; bagged International King Bhumibol World Soil Day award of FAO. We also had a proud moment: for the first time, ICAR Tableau on 26th January 2019 with the theme 'Kisan Gandhi' won the Best Tableau Prize.

Through this document, we have compiled and presented the significant achievements of DARE-ICAR during 2014-2021 providing a comparison with the previous seven years with a trust that it will provide a glimpse of our honest and sincere efforts in agricultural R&D for the benefit of the country. The feedbacks and suggestions are welcome and shall strengthen our activities in future.

New Delhi
24 March 2022

(T. Mohapatra)
Secretary, DARE & Director General, ICAR

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"...the country is very well familiar with the green revolution and white revolution. Time has come to bring about the changes in the lives of our fishermen brothers through blue revolution and to supplement the income of our farmers through honey-bee keeping and honey production. We have been working to bring blue revolution, sweet revolution along with green revolution and white revolution."

Prime Minister of India at the Golden Jubilee Celebration of BAIF at Pune on 24 Aug 2017

Pusa Alpana, a Floribunda type, highly fragrant, recurrent bloom rose variety

Indian Council of Agricultural Research
Department of Agricultural Research & Education

The year 2022 is 75th Year of India's Independence. The Government is celebrating the 75 weeks starting from 12th March 2021 coinciding with the initiation of Dandi March in 1929 by Gandhiji to 15th August 2022, as *Azadi Ka Amrut Mahotsav*. Amongst several sectors that made unprecedented progress during last 75 years, Agriculture can be placed on the top for two reasons. Firstly, in spite of declining availability of land and water for farming and escalating abiotic and biotic stresses like drought, floods, pests and diseases

the food grain production has increased from 50.82 million tons in 1950-51 to 308.65 million tons in 2020-21; production of horticultural commodities increased to 331.05 million tons and similar increase recorded in milk, meat, egg, and fish as well as in the nonfood crops. Secondly, the agriculture remained the biggest employment provider and shock absorber under the adversities including the global pandemic like COVID-19. The technological advancements such as improved varieties, better production and protection technologies, health, nutrition and breed improvement in livestock, poultry and fisheries along with innovative institutional mechanism for frontline extension through KVKs have been vital in realizing the progressive increase in production and growth in value of output of agriculture. This is evident from the fact that our technologies fare equally attractive against the global standards. Today, the productivity in many commodities such as wheat and some fruits and vegetables are equal to or greater than the average world productivity. In many temperate countries, the duration of harvest is much longer than ours. Our productivity is around these countries in terms of per day productivity but we have lower productivity in many commodities on unit area basis than the developed countries. Despite significant achievements in the past, agriculture in our country has many complexities and challenges that need to be addressed at the earliest.

Centrality of Water

Water has taken a central stage in all spheres of agriculture including research and planning. Agriculture uses over 80 percent of the total available clean water in India. The water conservation and management are amongst the highest priorities today. ICAR is working for developing technologies and effective measures for enhancing water productivity in agriculture. The Council has embarked upon developing regional crop plans by the year 2022 for efficient water management, amongst others. Under NICRA (National Innovation on Climate Resilient Agriculture) 446 climate-resilient villages in 151 clusters have been developed. This has been planned to scale up to 300 climate resilient clusters by 2024. Development of 200 climate resilient varieties are also planned by 2024. Our focus on development and deployment of climate resilient varieties and technologies would continue.

Food & Nutrition

India has committed to SDGs 2030 for zero hunger and food security led health and nutrition to all. The Council has targeted to develop 30 additional bio-fortified varieties by the year 2024 to strengthen the 'Malnuterious Free India' programme along with promotion of natural food systems, with

mineral, protein and vitamins enriched food grains, oilseeds, etc.

Import Substitution and Export Promotion

Enhancing food production, the export promotion and import substitution are the focus through local to global and one district one product initiatives. The processable varieties could be one potent tool to enhance the availability of raw material for processing industries and reduce their imports. ICAR has targeted to develop 30 processable varieties of field and horticultural crops by the year 2024 to substitute imports. The import substitution in edible oil is also targeted by developing 30 high yielding varieties of annual oilseed crops by 2024. The promotion of export through better varieties in fruits and vegetables matching the consumer preference and markets is also on the agenda. ICAR has also embarked upon putting in place the regional crop plans for commodities having export potential.

Conservation of Indigenous Breeds

Emphasis is being laid on the protection and improvement of indigenous breeds. Gazette notification of 197 notified indigenous breeds was done by 2020. This will help in conservation and improvement of local breeds. For the first time in 2021, three breeds of dogs were also registered in India. These are suitable for hunting, guarding and intelligence. In order to make India FMD free by 2025, the council has prepared a road map to disseminate thermo-stable high potent FMD vaccine by the year 2022.

Grazing flock of Barbari goats

Reducing Chemical Footprint

Realization of higher agricultural production has been associated with higher chemical footprints in the environment. Unbalanced use of fertilizers in agriculture in certain crops /regions is leading to land degradation, water & air pollution, unhealthy ecosystem and unsafe food posing risks to human health. This has brought focused attention of all concerned chemical free farming including organic farming techniques that recover, revitalize and restore the soil and the environment. Reducing the chemical fertilizer use by 20-25% is one amongst the several national priorities that has been set for future agriculture. ICAR shall be working for standardization, validation and demonstration of organic farming including chemical free technologies such as biofertilizers, biopesticides and bio-control agents through its research institutes and KVK network.

Reaching the Unreached

In order to reduce to the technological gap between Farmer's Farm and Scientist's Lab, the emphasis has been on increasing KVK's engagement

Farmer-first, Top priority

with farmers through increased use of digital platforms. For example, KVKs have been linked with 3.50 lakh rural common service centers for demand driven information and services to be delivered to the needy farmers by the specialists of KVKs, and research institutes. Besides, two-way communication would be made routine through us of the digital platform named Kisan-SARATHI. So that the knowledge gaps between the farmers and scientists are effectively bridged. Appropriate programs are being conducted by the KVKs in the aspirational districts and low water availability districts.

Digital tools in Agriculture

In order to facilitate timely monitoring of weather, plant and soil indicators and provide AI based advisory to farmers, the ICAR developed a network of institutions on precision agriculture. This challenging program will be helpful for innovators including school and college going students for digital innovation in agriculture and allied activities by way of their participation in agri-hackathons. It is proposed to set up smart farms in 15 agro-climatic zones, which will fulfill the requirements of teaching, HRD, capacity-building and R&D in the area of smart farming using drones, digital platforms and data analytics. The systematic research on sensor-based economical use of water and fertilizers in farming is required. Strategies and protocols for use of drones, sensor based automation, solar photovoltaic pumping systems etc. that would be demonstrated at these sites, will pave the way for their large scale adoption by the farmers.

Frontier Scientific Research

Research on agricultural genomics and genome editing would be the core research activity that ICAR will carry forward. In the past, substantial progress has been achieved in these areas.

ICAR has developed genomic resources of 16 different commodities including whole genome sequences of two crops, two fish, one insect species, ten microbes and one pathogen species. Genome editing in mega rice cultivar MTU1010, Pusa 44 and Pusa Basmati 1 has been a success. Pod borer resistant transgenic lines of pigeonpea expressing two different Bt genes (Cry1AcF and Cry2Aa) developed, late blight resistant transgenic potato lines expressing RB gene and virus resistant transgenic potato (RNAi against ToLCV) advanced to BRL-1 trial stage, aphid resistant mustard (expressing lectin gene) taken to the advanced stage of glasshouse trials.

Rice variety MTU 1010 used for Gene Editing

Transgenic banana for fusarium wilt resistance, potato for amelioration of cold induced sweetening and sugarcane for abiotic stress tolerance were advanced to different stages of glasshouse trials. This will be augmented in the coming years.

Doubling the income of Farmers

Indian Council of Agricultural Research has focused on supporting establishment of primary agro-processing units near major agricultural production areas to reduce the post-harvest losses in crops, especially in horticultural crops. Enhanced primary processing will add value and bring more returns to the farmers. Fifty-One multi- enterprise integrated farming system models (1-2 hectares) involving field and horticultural crops, agro-forestry, livestock, fisheries, etc can enhance income of small and marginal farmers from 1.5 lakh to 3.5 lakh under different agro-ecological regions. To achieve higher value of organic produce, 51 organic farming practices have been developed. The livestock (goat, poultry) and fisheries are also given special attention for improving productivity. ICAR constituted State Level Coordination Committees (SLCC) with Vice-Chancellors of one of the Agricultural Universities of the state and directors of ICAR institute appointed

as conveners. The SLCC developed a comprehensive strategy document on doubling farmers' income by 2022. The KVKs adopted 2 villages in each district to transform them into model DFI villages by deploying ICAR DFI modules. The case studies of 75000 farmers with doubled income will be documented as part of Azadi Ka Amrut Mahotsav. Our efforts to further enhance farmers' income would be further intensified.

Impact of ICAR Technologies

The ICAR technologies have benefited to the farmers as well as agricultural workers. The economic impacts of some of the recent technologies are presented as under:

1. **Pusa Basmati 1121:** The semi-dwarfvariety is cultivated on about 1.1 m ha area in Punjab, Haryana, Delhi, Himachal Pradesh, Uttarakhand, Jammu and Kathua districts of J&K and 27 districts of West Uttar Pradesh. The productivity of thevariety at farmers field is 4 tons/ha. The length of cooked grain is~ 20 mm with pleasant aroma. Post PB 1121 introduction, the export earnings from Basmati rice has increased to Rs 32,806 crore in 2018-19 and PB-1121 alone accounted about Rs 19,939 crore.
2. **CSR 30:** Suitable for salt affected soils, Basmati CSR 30 yields up to 28 q/ha. Basmati CSR 30 generated Rs. 365 crores (at 2018-19 prices) total economic surplus during the period 2000-01 to 2018-19. The revenue generated was Rs. 1,186 crore during the same period.
3. **CSR 36:** The total economic surplus generated by this salt-tolerant rice variety was Rs. 8,374 crores (at 2018 prices) during 2006-07 to 2018-19. The annual economic surplus from CSR 36 is estimated as Rs. 644 crore.
4. **Pusa Mustard 25:** Grown in about 20 % of the mustard area by 2017-18. The variety yields 1.47 tons/ha with oil content ranging from 36 to 41%. The variety generated total economic surplus of Rs 14,323 crores (at 2018 prices) during 2010-2018 and Rs 2,919 crores annually (TE 2018-19).

5. **HD 2967 Wheat:** This variety has covered ~ 40% of wheat area in north eastern and north western plain zones by 2016-17. The variety generated Rs 12,889 crore (at 2018 prices) economic surplus for TE 2018-19.
6. **Co 0238 Sugarcane:** Covers over 80% area in UP with average yield of 81 tons/ha and sugar recovery above 12%. The total benefit from sugar and by-products was estimated at Rs. 7,199 crores every year and the economic surplus of Rs 10,064.3 crores during 2014-2018. The surplus production due to this variety enabled sugarexport of Rs. 6,400 crores during 2018-19.

Sugarcane variety Co 86032

7. **Co 86032 sugarcane:** Widely cultivated in Karnataka, Maharashtra, Gujarat and Kerala (~ 50% area). It yields 10-12 tones/ha additional yield at the farmers' fields. Additional economic benefits estimated at Rs. 27,639.9 crores during 2002-2016.
8. **Grapes - Dogridge rootstock:** Growing grapes on *'dogridge rootstock"* improved yield and quality of grapes and profits to farmers. The total economic benefits was estimated at Rs 15,212 crores for the period 1996 to 2018 (at 2018 prices) with economic surplus of Rs 1,721.6 crores in 2017-18. The export earnings from fresh grapes was Rs 2,335 crores

and from raisins $ 26.217 million during 2018. About 90% of these exportearnings was realized from grapes raised on *dogridge rootstock*.

9. **Phule Bhagwa Pomegranate :** The variety developed in ICAR-All India Coordinated Research Project on Arid Fruits at MPKV, Rahuri has occupied 86% of pomegranate area during 2015-16. The total economic surplus since 2003-04 is Rs 46,100 crores (at 2018 price) and Rs. 9,617 crore in 2017-18. The export earnings increased from Rs. 21 crores in 2003-04 to Rs 688.47 crores in 2017-18.

Phule Bhagwa Pomegranate

10. **Kufri Pukhraj:** It covers about 33% of the total potato area of the country. The potential of Kufri Pukhraj is 35-40 tons/ ha. The variety generated total economic surplus/ benefit of Rs 92,650 crores during 1998 to 2018 (at 2018 prices) with the economic surplus of Rs 4,729.0 crores in 2017-18.

Kufri Pukhraj

11. **Arka Rakshak & Arka Samrat:** Tomato hybrids Arka Rakshak and Arka Samrat are resistant to tomatoleaf curl virus (ToLCV), bacterial wilt (BM) and early blight (EB) having yield potential up to 80 tons/ha. The total

economic surplus/benefits since 2010 is estimated at Rs 237.82 crore.

12. **Attenuated PPR Vaccine:** Peste-des-Petits Ruminants (PPR), an acute contagious disease in sheep and goat is the serious health constraint. The vaccination of ICAR-IVRI developed live-attenuated vaccine resulted into an estimated economic surplus of Rs. 11673 crore in 2018-19.
13. **Rinderpest vaccines and diagnostics:** Rinderpest has been a persistent problem in India for centuries. It is now eradicated by the use of vaccines and diagnostics. The estimated total economic surplus for the period 2004-2025 is Rs 51,325 crore at 2018 prices. Most of these benefits will accrue to small and landless farmers, and thus will have direct impact on poverty reduction.
14. **Jayanti Rohu :** Jayanti Rohu was developed by selective breeding. The economic benefits due to reduction in the cost of production is up to Rs. 12 per kg. The annual market value of Jayanti Rohu is Rs. 1313 crores. The net gain due to technology is about Rs 275 crore and the estimated economic surplus for the period 1992 to 2018 is Rs 2547 crore.

Jayanti Rohu

Cage with seaweed rafts

15. **Open Sea cage Farming:** Cage farming yields 40 times more yield than the conventional marine fish farming. The gross earnings generated through cage farming at current level of adoption are Rs. 400 crores. The estimated gross earning is to the tune of Rs. 9,200 crores by 2030. The total economic surplus generation from the open cage sea farming technologyis estimated at Rs.1,866 crores (at 2018 prices) during 2005-2030.

16. **Fishing Crafts:** ICAR-CIFT in collaboration with Goa Shipyard Limited designed and developed the multi-purpose fishing vessel Sagar Harita. The benefit of Rs 4854 crores (at 2018 prices) is estimated for the period of 25 years since the project inception in 2012-13. The annual benefits is estimated at Rs 194 crores. Besides, about 0.38 million tons CO_2 production valued at about Rs 3193 crores could be averted.

17. **Manual Cono-weeder:** The net saving on weeding by conoweeder is estimated at Rs 2280/ha. The economic surplus generated using cono-weeder is estimated at Rs 2,617 crore during TE 2018-19 (at 2018 prices). The approximate economic benefits to the country from adoption of technology are estimated at Rs 13,685 crores during 2009- 2019.

18. **Drum Seeder:** Operating cost of seeding using Drum Seeder is Rs 400/ha as compared to Rs 6,250/ha in manual transplanting. Thus, there is a saving of Rs 5,850/ha over manual transplanting. The economic surplusis estimated at Rs 3,020 crore during TE 2018-19 (at 2018 prices). The total economic surplus accrued from adoption of technology is estimated at 16,472 crore during the period 2009-10 to 2018-19.

19. **Bt Cotton Planter:** The Bt-cotton planter saves on cost of seed, labour (in thinning) and planting. The annual economic surplus is estimated as Rs 1,157 crore (at 2018 prices). The total economic surplus from adoption of Bt Cotton Planter is estimated at Rs 7,180 crore during the period 2009-10 to 2018-19.

20. **Happy Seeder:** An estimated 23 million tones of crop residue are burnt each year in Punjab, Haryana and western Uttar Pradesh. During 2018-19 season, ~5 lakh hectares of wheat was sown using Happy Seeder in Punjab. The direct sowing using Happy seeder has enhanced yield of wheat by 2-5 quintal/ha. The additional economic surplus due to Happy seeder in Haryana is estimated to be Rs. 59.2 crore during 2009-10 to 2018-19 (at 2018 prices).

21. **Mridaparikshak:** Mridaparikshak mini-lab enabled preparation of about 20% soil health cards in the country. Soil health card scheme has phenomenal impact in reducing the cost on fertilizers (8-10%) and increasing the production (5-6%) in the country. Mridaparikshak mini lab has generated a royalty of about Rs. 30 million to ICAR-IISS, Bhopal.

A minilab for soil health assessment & fertiliser advisory

22. **Zero tillage technology:** Development of the zero tillage machine enabled farmers to practice no-till farming on a commercial scale. The total economic gains from the adoption of zero tillage in wheat are Rs. 20833 crores for the period 2000-01 to 2018-19 i.e., Rs. 1096 crores per annum.

23. **Pre-cleaner:** Pre-cleaning of cotton improves the ginning performance and lint quality in cotton. The horizontal pre-cleaners developed by ICAR with 3.5 – 6 tons/hour cleaning capacity and 30-40% cleaning efficiency could result annual benefit of Rs. 208 crores due to bale value improvement and incremental ginning out-turn (5%) to the ginning factories.

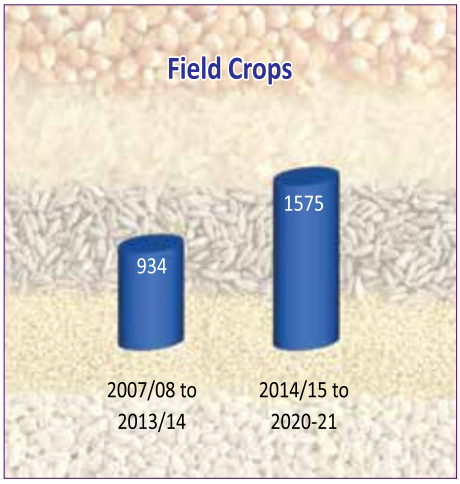
ICAR-CICR cotton variety Suraj Bt for Central Zone

SIGNIFICANT ACHIEVEMENTS 2014-2021

A. Food Security and Nutrition

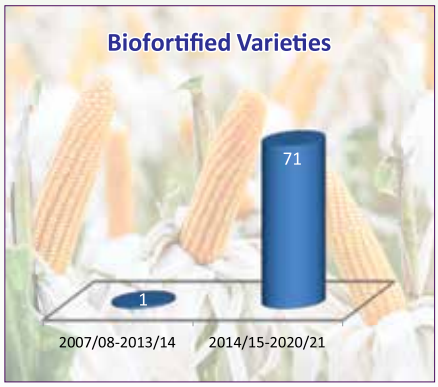
A.1 Field Crops

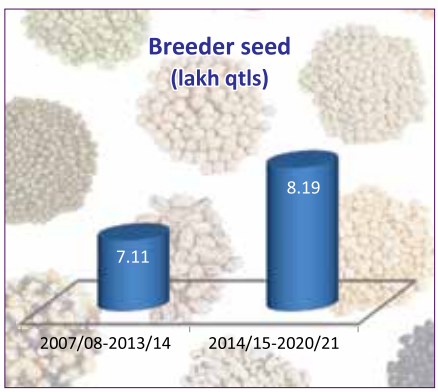
- High Yielding Varieties and Hybrids of field crops are the major drivers for augmenting the productivity and production for ensuring adequate and nutritious food to all people of India as well as meeting the exports demands. During 2014-21, total of 1575 high yielding varieties of field crops were released against 934 during 2007-14. All these varieties were gazette notified for income



augmentation of the farmers. In field crops, more than 1300 varieties out of 1575, are climare resilient varieties. Specific traits like drought and sub-mergence tolerance, disease resistance and improved nutrition quality have been introgressed in 47 varieties of field crops using genomic tools like marker assisted selection (MAS) in comparison to eight before 2014.

- 71 crop varieties either bio- fortified with higher levels of Fe, Zn, protein, pro-vitamin A etc. in the edible parts or with reduced level of anti- nutritional factors were developed during 2014-21 against only one variety during 2007-14. A total of 11282 quintals of breeder seed of 29 such varieties have been produced during 2016-17 to 2020-21.
- ICAR is the nodal agency for coordination of Breeder Seed production. The breeder seed production increased from 7.11 lakh qtls in 2007-14 to 8.19 lakh qtls during 2014-2021. The seed replacement rate in pulses, oilseeds and cereals increased substantially over time.





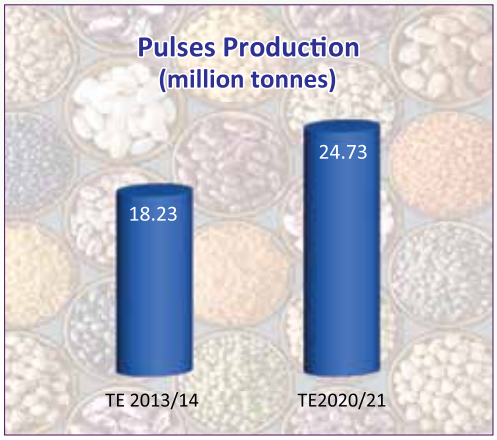
"Over the years, there has been a lot of great work in the country in the research and development of such seeds; and I congratulate all the agricultural universities and agricultural scientists for the same. While only one variety of this type reached farmers before 2014, today 70 Bio-fortified Varieties of different crops are available to farmers. I am glad that some of these bio-fortified varieties have been developed with the help of local and traditional crops."

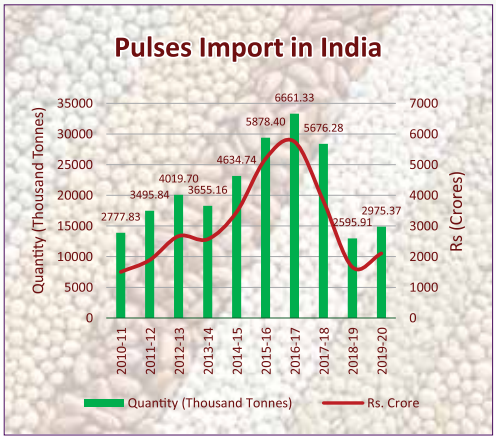
Prime Minister

(On the occasion of the 75th Anniversary of FAO, October 16 2020)

Pulses Revolution

During last 7 years the pulses production increased by 6.5 million tons from 18.23 m tons (TE 2013/14) to 24.73 million tons (TE 2020/21). The productivity has also increased by more than 100 kg/ha. ICAR played a catalytic role by making quality seeds of HYVs available to farmers through the 130 seed hubs and cluster demonstrations organised by KVKs. The enhanced production has drasticalluy cut the imports bills of the country. The pulses imports were cut by Rs. 18223.61 crore in 2019-20 comared to 2016/17.





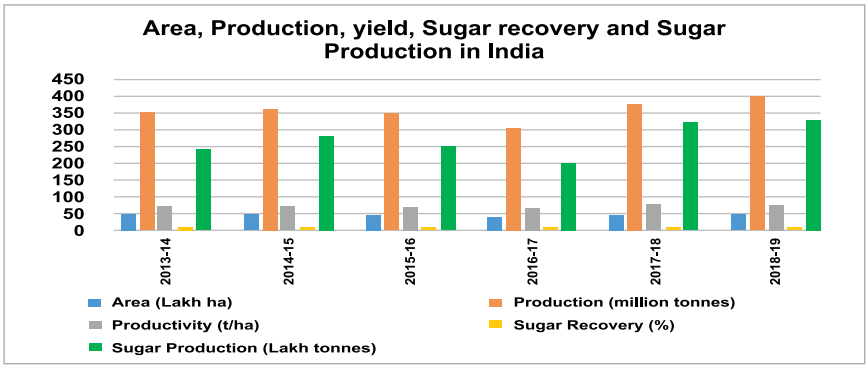
Sugar Revolution

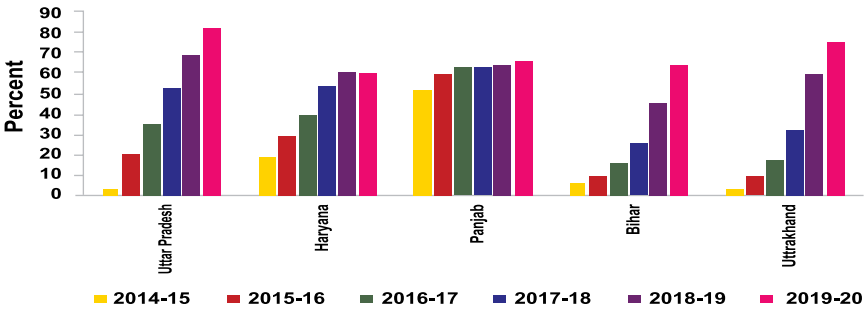
During 2014/2021 the cumulative sugarcane production was 2565.5 million tons with average 34.7 million tons increase in production every year over 2322.3 million tons of sugarcane production achieved in TE 2007/08. The productivity increased by over 9 tons per ha over 2013/14. The improved varieties like Co 0238 were the prime contributors to this sugar revolution in the country. This variety produces more than 20 tons cane per ha over the best existing varieties and hence occupied over 80% sugarcane area in U.P. and other northern States. The sugar recovery is close to 12%. The farmers were benefitted with an average yield gain by Rs. 51239/year due to higher yields and sugar recovery. Demonstrations and trainings on sugarcane technologies and working with sugar millers have given additional benefits of Rs. 23541 crores to sugar mills and Rs. 43468 crores to farmers during 2014-15 to 2019-20. The export of surplus sugar earned the country Rs. 13923 crores.

Sugarcane variety Co 0238

Sugar Revolution in India

Co 0238 has revolutionized sugar production in India. This variety produces >20 tons per ha yield and give ~12% sugar recovery. Over 80% area in UP and northern States is occupied this high yielding variety. The variety could lead to additional benefits of Rs. 18027 Cr to sugar mills during 2014/15 to 2018/19 and Rs. 28033 crore (i.e., Rs. 51239 per year) to the farmers.

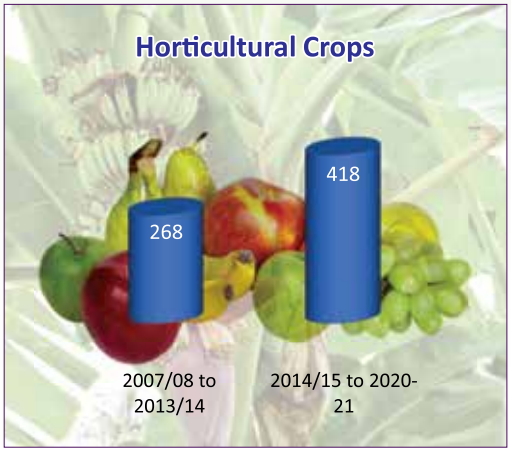




Variety responsible for Sugar Revolution - Co 0238

A. Horticultural Crops

- New and improved varieties and hybrids of horticultural crops have played pivotal role in augmenting the production of fruits and vegetables for nutrition and income augmentation. In horticultural crops, 418 varieties were developed during 2014-21 to supplement nutrition and income security against only 268 during 2007-14. These varieties also included processable varieties of tomato, onion and potato as well as biofortified varieties.



Biofortified (Fe 21ppm & Zn50ppm) potato 'Kufri Manik' with 25-30t/ha productivity in Eastern Plains

Okra 'Kashi Lalima' with 140-150 q/ha productivity in 105 days

- Pomegranate variety ´Sholapur Lal´ with higher nutrient content identified: It has 23 to 27t/ha productivity with 19.4-19.8 mg/100g Vitamin-C, 385-395 mg/100g Anthocyanin, 5.6 – 6.1 mg/100g iron content in fresh arils.

Sweet Potato var. Bhu Krishna

- Biofortified varieties of sweet potato Bhu Krishna (Anthocyanin 90mg/100g) and Bhu Sona (β carotene 14mg/100g) with 18 to 19.8 t/ha productivity identified and notified for cultivation.
- **Vittal Cocoa Hybrid -6:** One high yielding cocoa hybrid (2.5 to 3 kg dry seeds/ tree) with 50-55% fat content was released and identified for cultivation in Kerala. It will further strengthen chocolate industry in the country. It is tolerant to black pod rot and tea mosquito bug.

Vittal Cocoa Hybrid-6

- Efficient production technology of shiitake mushroom patented: An indigenous strain of shiitake mushroom "DMR Shiitake 388S" was identified. The production technology with higher Biological Efficiency (110 to 130%) in comparatively short duration (45 to 50 days) was standardized as against 90-120 days in normal practice.

DMR Shiitake 388S

- **Medicinal Plants:** Three varieties one each of kalmegh, ashwagandha and isabgol released during 2014-21.

Vallabh Ashwagandha-1

Vallabh Isabgol-4

Vallabh Kalmegh-1

- **Digitization of seed portal:** A digitized seed portal was developed by ICAR-Indian Institute of Horticultural Research, Bengaluru by integrating with YONO Krishi app of SBI and inaugurated by the Honourable Minster of Agriculture and Farmers Welfare, Govt. of India. It has benefitted the farmers and other stakeholders of 28 states and 6 union territories. The sales proceeds worth Rs. one crore received in six months period.
- **Popularization of Kamalam (dragon fruit):** Large-scale propagation and popularization of *Kamalam* fruit (dragon fruit) has resulted in multiplication of approximately 9.5 lakh plants for covering 200 ha under this exotic fruit. A total of 15 trainings for 3,600 farmers of seven states were conducted for popularizing *Kamalam* fruit in India.

Kamalam crop at ICAR-NIASM, Baramati


High density apple orchard at fruiting stage

- **High density planting in apples:** High density planting systems in apples were standardized and successfully demonstrated with significant increase (8-9 t to 30-35t/ha) in productivity.

- Horticulture revolution hinges on the availability of quality planting material for horticultural expansion. The production of quality planting materials in ICAR institutes enhanced by 85.3% in cuttings from 62.82 lakh during 2007-14 to 116.42 lakh during 2014-21. Similar increase was also recorded in bulbs and saplings. The production of breeder seed of vegetables also increased substantially during 2014-21.

- **Sea route transport protocol:** The packaging and precooling protocol for transport of Banana that keeps the fruits freshfor 40-50 days. This technology reduces transport cost by 80% of air freight. It is now adopted by Kerala and Tamilnadu. The technology has helped promotion of transport of banana through sea route.

Disease free plants for supporting establishment of healthy orchards for higher productivity

B. Agricultural genomics for genetic resources & gene discovery

- Developed genomic resources of 16 different commodities including whole genome sequences of two crops, two fish, one insect species, ten microbes and one pathogen species.
- Besides the above, genomes of pigeonpea and mango were sequenced to reference quality level, while that of jute to an advance draft level.
- Eight Genes responsible for specific agronomic traits were identified in

Cotton leafhopper

Catla

A productive cluster bean line at ICAR-CAZRI

six crops by allele mining and gene based association analysis, of which one *gene (rice SHMT3)* was validated by genetic transformation.

Export quality mango

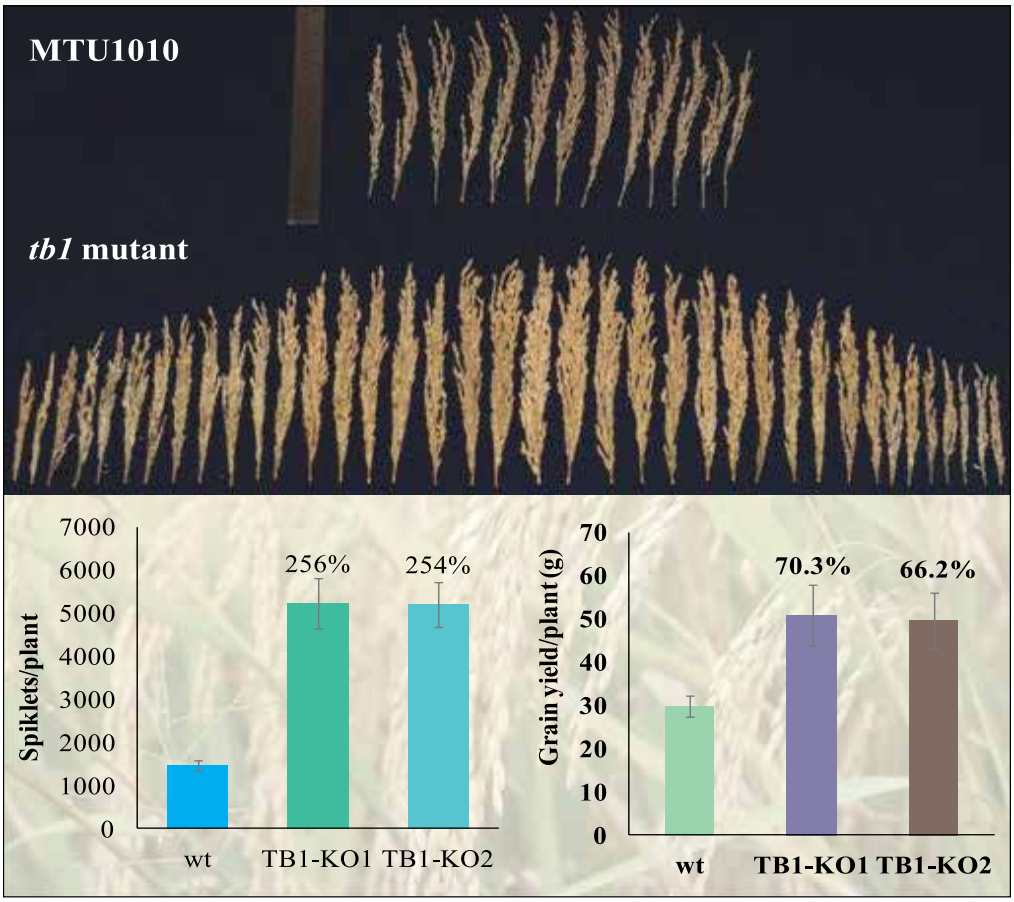
- Identified trait-associated genes through transcriptomes studies for skeleton muscle in goats, milk in cattle & buffaloes, muscle growth in catla (fish), insecticide resistance in cotton leafhopper and salt stress in *Chromohalobacter*.
- Developed High Density SNP chip for goat (→601,000 SNP markers), which was validated on 480 animals of 15 goat breeds from different agro-ecological regions of the country.
- Developed a quick and reliable qPCR and LAMP-based diagnostic assay to detect *Tilletia indica* (sensitivity 100 fg) and identified PCR-based molecular marker for specific detection of *Magnaporthe grisea* infecting pearl millet.
- *Chromohalobacter salexigens* ANJ 207 isolated from vaporized water salt crystal identified to contain salt & drought tolerance genes, which can be prospected for abiotic stress.
- Developed two online databases *viz*., PinigSSRdb: A microsatellite database on black pepper SSRs and cbSIR: Clusterbean SNPs and INDELs Repository for easy access to these genomic resources.

C. Genome editing for enhanced productivity and stress tolerance

Genome editing is a precision mutagenesis tool for genetic improvement of crops. Transgene free genome edited mega rice cultivar MUT1010 with enhanced yield and stress tolerance was developed by editing four different genes.

- Rice *Teosinte Branched1 (TB1)* gene, a negative regulator tillering, was edited to crease a loss of function mutant of *TB1* gene with 13 bp deletion in rice cv. MTU1010. The transgene free *tb1* mutant produced about 35 tillers as compared with 15 tillers in WT MTU1010 plants and yielded 66-70% higher grain yield per plant.
- *DENSE AND ERECT PANICLE1 (DEP1)* codes for G protein γ subunit, involved in the regulation of number of grains per panicle. By using CRISPR-Cas9, a single base pair insertion mutant of *dep1* was created in MTU1010. The *dep1* mutant produced 52-54% higher grains/plant and 21-15% higher grain yield per plant as compared with WT MTU1010.

- The OsCKX2 (Cytokinin oxidase/dehydrogenase2) gene catalyzes the degradation of active cytokinin and thus reduces the grain number. Hence this gene function was knocked out by using CRISPR-Cas9 in rice cv. in MTU1010. The *ckx2* mutant in MTU1010 produced about 53-64% increase in the grains per panicle as compared with WT plants.
- The *DROUGHT AND SALT TOLERANCE (DST)* gene, a Zinc finger transcription factor that negatively regulate salt tolerance, was edited by using CRISPR-Cas9 in MTU1010. Three homozygous Transgene free mutants were developed with both seedling stage and reproductive stage tolerance to salinity stress.



Genome edited TEOSINTE BRANCHED1 gene knock out mutant of MTU1010 produces higher number of tillers and grain yield

D. Genetic modification of crops with new traits

- For imparting resistance to the devastating insect pod borer in Pigeonpea, transgenic lines expressing two different Bt genes (Cry1AcF and Cry2Aa) were developed and advanced to the Event Selection Trial stage (applied for trial permission). Bioassay using the pod borer insects revealed high level of resistance in the transgenic plants (T) as compared to non-transgenic wild type (WT) plants.
- Late blight resistant transgenic potato lines expressing RB gene and virus resistant transgenic potato (RNAi against ToLCV) were advanced to BRL-1 trial stage (applied for trial permission)
- Aphid resistant mustard (expressing lectin gene) were taken to the advanced stage of glasshouse trials.
- Transgenic banana for fusarium wilt resistance, potato for amelioration of cold induced sweetening and sugarcane for abiotic stress tolerance were advanced to different stages of glasshouse trials.

Performance of Bt pigeonpea transgenic lines resistant to pod borer insects
(WT – Non-transgenic wild type; T – Transgenic line)

E. Animal Sciences: Indigenous Breeds, Health and Nutrition

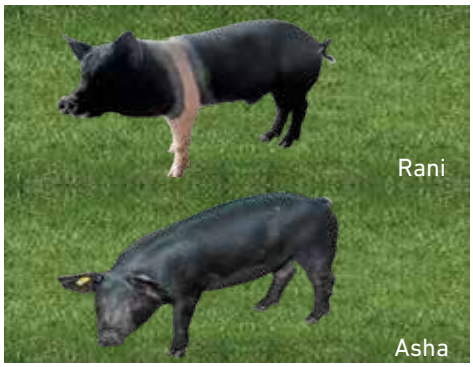
- The description of non-descripted breeds and their registration is the primary activity for conservation of indigenous breeds of cattle, buffaloes, goats, sheep, pigs, poutry, etc. During 2014-21, 56 new breeds of animal and birds were registered/accessioned as compared to 15 breeds during 2007-14. So far 197 breeds of animal and birds were Gazette notified. This shall strengthen the protection and provide IPR safety to our breeds.

- For the first time in India, 3 breeds of dogs (Rajapalayam, Chippiparai and Mudhol Hound) were also registered and Gazette notified. These dog breeds can suitably be utilized for guarding, hunting and shepherding.

Rajapalayam Male

- Improved breeds/varieties- Frieswal declared as a cattle breed on 3rd November, 2019, having mature lactation yield as 3628 kg and Vrindavani cattle having lacataion milk yield of 3220 kg

Frieswal Cow



New varieties of pigs

- Developed 9 varieties of pigs (Rani, Asha, HD-K75, Jharsuk, Mannuthy white, Lumsning, TANUVAS KPM Gold, SVVU-T-17 and Lnadly) with higher body weight at marketable age of 8 months.

- A prolific master mutton sheep strain Avishaan developed with average live weight of 22 kg at six month age at farmer's door and average daily milk yield of 716 g.

ICAR-CSWRI -prolific sheep strain Avishaan with 4 kids

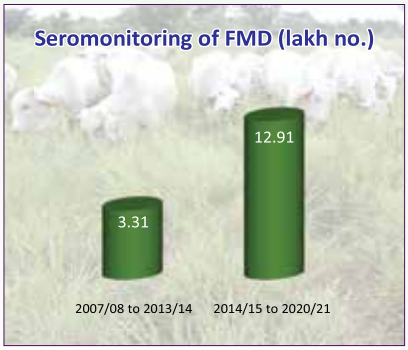
- Developed 12 poultry varieties (Srinidhi, Kamrupa, Narmadanidhi, Jharsim, Himsamridhi, Janapriya, CARI Saloni, CARI Gracy, CARI Dhawal, CARI Prabal, Multicoloured turkey, CARI Sunahari (Japanese Quail- CARI, Izatnagar) suitable for backyard poultry with egg production ranging from 118 to 260 eggs per year and body weight 1300 g to 2850 g at 20 weeks age.

Himsamridhi

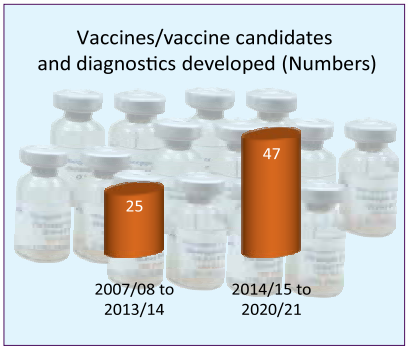
Jharsim

Narmadanidhi

- Developed High/ Medium Density DNA Chips for indigenous cattle with 608,000 markers; Buffalo with 603,000 markers; Backyard poultry with 610,000 markers; Goat with 605,000 markers and; Medium Density DNA Chip of Camel with 180,000 markers.
- First de novo genome assembly (3Gb) of Indian Mithun (Bos frontalis), with coverage of 91.5% and annotation of 28,044 protein-coding genes .
- The FMD surveillance was stepped up by three times during 2014-21. The sero-monitoring has been increased by 4 times in terms of testing of serum samples. During 2014-21, 12.91 lakh samples were tested as against 3.31 lakh during 2007-14 for all three virus subtypes. ICAR-DFMD has been recognized as FAO-Reference Centre for Foot and Mouth Disease (FMD).



- For better health management, new vaccines/vaccine candidates and diagnostic kits were developed for animal and poultry diseases. During 2007-14, 25 vaccines/vaccine candidates and diagnostic kits were developed, which almost doubled to 47 during 2014-21, of which 9 were commercialized.



- The major vaccines/ vaccine candidates included (i) H5N2DIVA marker vaccine against avian influenza virus (ii) Sheep pox vaccine (Srinagar strain); (iii) Gumboro vaccine (VLP based) for infectious bursal disease (IBD) in poultry; (iv) Classical Swine Fever live attenuated vaccine; (v) Heat tolerant type 'O' FMD vaccine candidate; and (vi) Brucella *abortus* mutant vaccine.

ICAR -NIHSAD- PRRS Antibody ELISA Kit

- Diagnostic kits for Porcine Reproductive and Respiratory Syndrome (PRRS) virus antibody and avian influenza antibody detection, anti-structural FMD virus antibodies; monoclonal antibody-based ELISA kit for Brucella infection in bovines Japanese encephalitis; IgM ELISA kit for JE antibodies in pigs , etc developed.

ICAR-NIHSAD-Avian influenza detection kit

ICAR-DFMD-Anti-FMD Structural Antibody Detection Kit

- A urinary metabolite-based pregnancy detection kit; Preg-D for pregnancy detection in cows and buffaloes; and a peptide-based immunoassay for early pregnancy diagnosis in goats were developed.

ICAR-CIRB-Pregnancy Detection Kit for Cow & Buffalo

- Developed an anti-methanogenic supplement (Harit Dhara) with Tamarind seed husk. Supplementing ruminant's diet up to 5% with Harit Dhara can reduce methane emission by 18-20% without any adverse impact. Harit Dhara is an ionic mishran effective for the prevention of hypocalcemia, minimizing the occurrence of milk fever and other similar metabolic disorders and increases milk fat by 0.4-0.5 units, and also helps in ameliorating reproductive disorder as the animals.
- BUFCOL-A, a patented complete diet formulation for enhanced survivability & growth of neonatal buffalo calves was developed at NDRI Karnal and CIRB, Hisar. Specific mineral mixture for breeding bulls (Bullmin) developed for better quality of semen production. Seven alternate feed resources and 9 feed additives were developed for poultry.

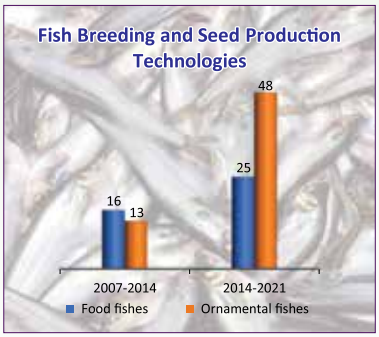
Cloning of cloned bull Hisar Gaurav

- Using simplified handmade cloning technology, several cloned buffaloes were produced. Recently, production of 7 copies of elite buffalo bull of Murrah bull No. M-29 and 1 re-cloning pregnancy of Hisar Gaurav (normal fertility 55%) were achieved. Currently, 12 live parentage tested progenies of Hisar Gaurav are available. Fertility of cloned bulls similar to non-cloned bulls, and so far produced → 60 progenies using cloned bull's semen.
- Developed 7 paper strip based tests for rapid detection of common adulterants in milk at NDRI viz., neutralizers, salt, glucose, maltodextrin, added urea sucrose and hydrogen peroxide. This is a rapid (10 mts), simple and cost-effective assay. The technology has been commercialized.
- A qualitative rapid and highly sensitive test developed at NDRI, Karnal and patented for detection of detergent in milk. This kit is highly sensitive and cam detect the level of adulteration as low as 20 mg/100 ml of milk. The results become available in 2 minutes. The color based method for detection of detergent in milk; spore based kit for detection of antibiotic residue, paper strip assay for rapid detection of pesticide residues in milk and other food matrices; and PCR based test for A1 and A2 types of milk and milk products have also been developed.
- The COWCAM kit developed for detecting cow milk adulteration in camel milk and vice versa. The PCR-RFLP based technique for identifying

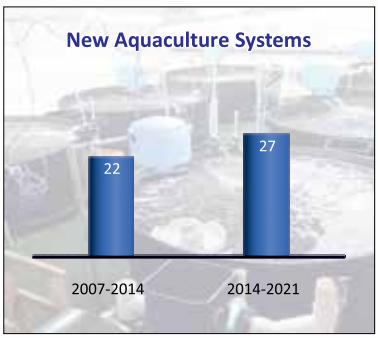
genetic disease such as Bovine Leukocyte Adhesion Deficiency (BLAD) and LAMP Assay based rapid detection of cow components in buffalo milk/meat were also developed.

F. Fishery Technologies for Blue Revolution

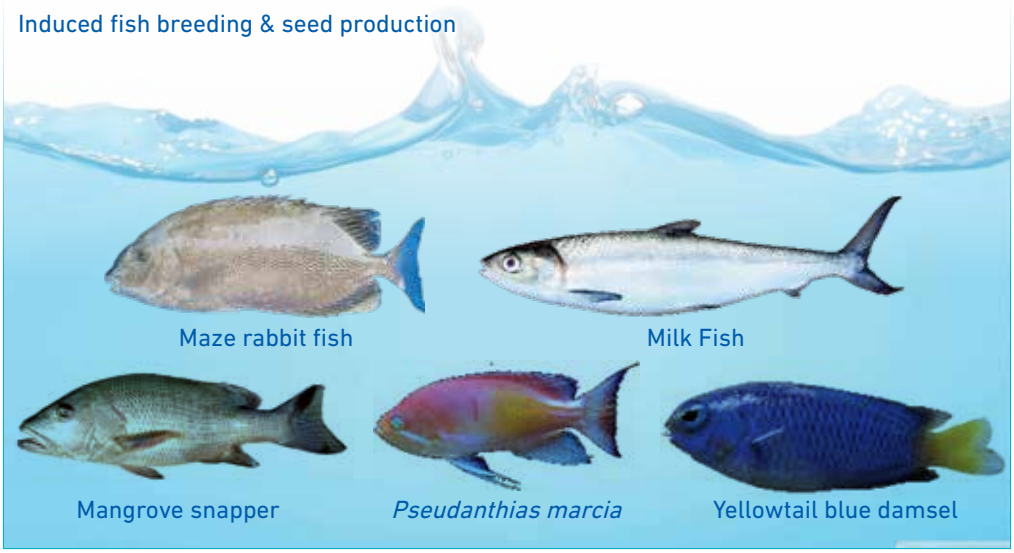
- To augment the fish production and raise the income of the fish growers in the country, fish breeding and seed production technologies were developed for 25 species of food fishes during 2014-21 as compared to 16 species during 2007-14. Further, in case of ornamental fishes, the number increased from 13 species during 2007-14 to 48 species during 2014-21.



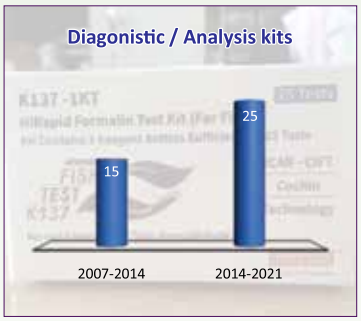
- The diversification in aquaculture systems are taken on priority that led to designing and development of 27 improved/new aquaculture systems for finfish/shellfish culture during 2014-21 against 22 such systems during 2007-14.



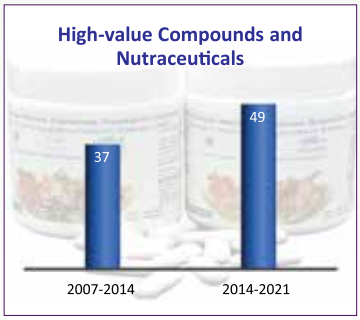
- The diagnostic/analysis kits for disease diagnosis, water quality analysis and adulterants/contaminants in fish have



been increased to 25 numbers during 2014-21 as against 15 numbers during 2007-14. Out of the 25 diagnostic/analysis kits, 8 kits have been commercialized.



- The research for development of high-value compounds and nutraceuticals from seaweeds and marine organisms has been augmented during 2014-21. As a result, 49 high-value compounds and nutraceuticals from seaweeds and marine organisms were developed during 2014-21 compared to 37 in 2007-14. Out of 49 high-value compounds and nutraceuticals developed during 2014-21, 26 have been commercialized through licensing to different companies.



- The fish feed formulations for various life stages play a critical role in augmenting the fish productivity. During, 2014-21, 25 indigenous fish feed for various life stages of diversified aquaculture species were developed against 15 such feed during 2007-14.

- To augment the fishing activities including deep-sea fishing, 62 fishing crafts/ equipment/gadgets were designed for fisheries and aquaculture management during 2014-21 as compared to 55 in the previous seven years.

- During 2014-21, 41 value-added fish products and 6 commercial products from fish waste were developed as against 18 value-added fish products during 2007-14.
- Marine cage culture with cobia (*Rachicentron canadum*), silver pompano (*Trichinotus blochi*) and seabass (*Lates calcarifer*) has emerged as one of the highly remunerative system. During 2014-21, marine cage culture has been expanded

all along the coast with more than 3500 cages as compared to only 476 cages during 2007-14.

High Value compounds /Nutraceuticals

ICAR-CIFT designed green fishing vessel Sagar Harita

G. Natural Resources Management & Climate Resilient Agriculture

- The land resource inventories of 314 blocks were developed during 2014-21 against only 19 during 2007-14 for effective agricultural land use plans. Land resource inventory also developed for 27 aspirational districts in 8 states.
- The soil health scheme was rolled out as a National Priority. A solution to the challenge of rapid analysis was provided by developing a portable and low-cost soil test kit/mini lab (Mridaparikshak) in 2015-16 for rapid analysis, and distribution of soil health cards to farmers. During 2014-21, 11399 units were sold which facilitated soil testing service at farmers' door step.

Mridaparikshak: a mini soil testing Lab.

- Developed granular minerals fertilizers using low-grade rock-phosphate and feldspar, as an alternative to conventional P and K fertilizers. A matrix of slowly decomposing C compounds prepared by chemically treating mixture of indigenous leonardite and cellulosic waste. The application of these mineral fertilizers on various crops gave comparable yield at par with DAP and MoP but with half of their cost. As such these mineral fertilizers could be promising substitute of DAP and MoP.
- Developed soil biological health kit based on substrate induced respiration. The kit contains assemblies to incubate soil with a defined substrate along with an indicator "Gel probe" which changes its color based on the amount of CO_2 evolved from soil. The color-change of the gel exhibits positive correlation with actual measure of CO_2 and soil biological quality index. The kit is a simple, quick and cost effective to monitor soil biological health without much scientific skill and equipment.
- Developed a machine for coating of seeds with different microrganisms like *rhizobium*, azotobacter, azospirillum, phosphorous solubilizing bacteria one after other with a sticking agent through film-coating method. The formulation enhanced the yield of maize, ragi, red gram and groundnut by 17-34%, with a cost benefit factor 1.31-2.97 and prolonged

the survival of the microbial inoculants on the seed (about 103cfu/seed) up to 90 days of storage.

- Designed and standardized mini pan evaporimeter of 30 cm diameter GI (20 gauge) with a height of 25 cm for on-farm irrigation scheduling in Eastern India.
- ICAR-FUSICONT is a bio-formulation developed using antagonistic fungal isolate CSR-T-3 of *Trichoderma reesei* and a bacterial PGPR isolate CSR-A-11 of *Lysnibacillus fusiforms* in a unique IPR protected media with a dynamic substrate. This bio-formulation is used to control the wilt diseases in banana, vegetables (tomato, potato, capsicum, chillies) and spice (cumin and fenugreek) crops. This is the only validated effective formulation in the country for the management of devastating outbreak of banana Fusarium wilt disease caused by TR-4. The technology was successfully validated and commercialized recently through Agrinnovate India Ltd. for a global license

FUSICONT treated fields of the adopters in hot spot region of Ayodhya district of U.P.

Fusarium wilt TR4 non adopters fields of the Ayodhya district in U.P.

- Developed an Android Platform-based Mobile App (FarmTree) for Agroforesters (https://play.google.com/store/apps/details?id=com.cafri.farmtree) based on the package of practices of 25 promising agroforestry tree species of India. This application provides a user-friendly, bilingual (Hindi and English) e-platform to have necessary and crisp information on all aspects of agroforestry tree species to farmers.
- The drip fertigation has been identified as an innovation for higher nutrient use efficiency in crops and copping systems. During 2014-21, standardized drip fertigation schedules for 18 crops and cropping sequences during 2014-21 against 17 during 2007-13.

- The integrated farming system (IFS) models are the potential tool for enhanced farm productivity and income of small and marginal farmers. During 2014-21, 42 Multi - enterprise integrated farming system (IFS) models were developed as compared to 18 such models during 2007-13. Higher income to the tune of Rs. 1.5 - 3.6 lakhs per annum per hectare can be realized with these models. NABARD has identified 32 bankable IFS models developed by IIFSR, Modipuram.
- Climate change research facilities such as high through-put phenotyping platforms, free air temperature elevation (FATE), carbon dioxide and temperature gradient tunnels (CTGC), rainout shelters, animal calorimeter, shipping vessel, flux towers and satellite data receiving station etc.have been established at various partner institutes viz., IARI, New Delhi; CRIDA, Hyderabad; IIHR, Bengaluru; ICAR-RC NEH, Umiam; CMFRI, Kochi; NRRI, Cuttack; NDRI, Karnal under NICRA project. With these facilities studies on impact of elevated CO_2 and temp on crops, livestock, fisheries, soil, water, pests and diseases using simulation models and GHG inventorization and C sequestration under predominant production systems have been undertaken. More than 1200 scientists, 105 Ph.D. and 51 M.Sc. students and 872 young research fellows across the country are involved under this climate change network research project. Capacity building on climate resilient agriculture benefitting 5.15 lakhs stakeholders including farmers has been undertaken.

Climate change research facilities at IARI, New Delhi

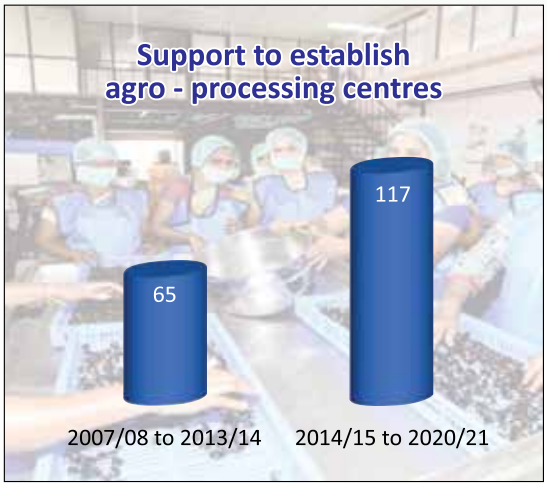
- Theorganic farming has been identified important for augmenting income of the farmers and also arresting the soil degradation. To accomplish this task, developed 37 organic farming packages of practices during 2014-21 against 14 during 2007-13.
- The Climate Resilient technology practice demonstrated at 13138 farmers' fields during 2014-21 against 5241 during 2007-2014.
- **Vulnerability Atlas of Indian Agriculture:** Based on the framework of IPCC's Fifth Assessment Report, district level risk and vulnerability assessment of agriculture to climate change indicated 193 districts of Rajasthan, Maharashtra, Jharkhand, Odisha, Arunachal Pradesh, Chhattisgarh, Madhya Pradesh, Karnataka under 'high' or 'very high' vulnerable category. Climate change risk is 'very' high' in 109 districts of Rajasthan, Uttar Pradesh, Bihar, Kerala, Uttarakhand, Odisha, and 'high' in 201 districts of Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Rajasthan, Karnataka, Maharashtra, etc. The focused efforts to address the climate change in the high risk or high vulnerability districts needs to be taken in accordance of the sources of the vulnerability.
- **Updation of 435 District Agriculture Contingency Plans (DACPs):** These updated plans provide contingency measures and technological solutions for minimising the impact of weather aberrations. The two-step implementation of district plans involves preparedness and real-time activation of the contingency measures. Also, developed 24 district drought proofing action plans for Karnataka (16), Andhra Pradesh

Climate change research facilities at CRIDA, Hyderabad

(4) and Rajasthan (4) states. These action plans were further taken up by National Rainfed Area Authority for implementation along with respective state governments on pilot basis. Organised 15 interface meetings with Department of Agriculture of different states to enhance their preparedness for addressing weather aberrations.

H. Farm Mechanization and Post-Harvest Operations

- The total machine developed during 2014-21 were 230 against 218 farm machines during 2007-14. The farm machine prototypes development increased to 25719 during 2014-21 against 23499 during 2007-13. This has helped availability of new farm machines to farmers for higher efficiency in farm operations with less drudgery.
- ICAR supported the establishment of agricultural machinery custom hiring centers in Madhya Pradesh. During 2014-21, a total of 1261 rural youth were trained and supported for establishment of custom hiring centres by ICAR-CIAE as against 255 during 2007-14.



- ICAR supported the establishment of agro-processing centers for capacity development of the entrepreneurs in the food processing and post-harvest management. During, 2014-21, 117 agro-processing centers were established which are technically backstopped by ICAR against 65 during 2007-14.
- ICAR backstopped establishment of 30 food testing labs during 2014-21 for the very first time.
- Sugarcane bud chip settling transplanter has been developed and licensed to three farm machinery manufacturers. The machine has been included under subsidy programme of Tamil Nadu state and more than 52 units of machinery sold in India and abroad during last one year.
- The Makhana popping machine developed in 2013-14 by ICAR has become very popular and eliminated drudgery to negligible level in the popping

of makhana besides adding more value to the finished products. Three private licensees are manufacturing this machine and and 5 value-added products have been made. The makhana and its value-added products grew by about 40% in past 3 years.

- Developed technology for accelerated retting of jute. This technology saves 50% water and 10-day time in retting of jute. The fibre quality is improved by 1-2 grade enabling additional income of Rs. 4500 per tons of jute fibre. It is commercialised as NINFET-Sathi through signing MoA with M/s Quality Export and Jute Corporation of India. It has become popular in West Bengal among jute growers
- The mechanization solutions were provided to combat burning of crop residues in the northern Indian states. ICAR-AICRP Centre at PAU, Ludhiana designed Happy Seeder and other machines numbering 56150 were distributed through a Central Sector Scheme to the farmers that enabled 51.9% reduction in straw burning events in 2019 as compared to 2016.

Happy seeder in operation

- ICAR-CIRCOT developed technology for commercial utilization of the cotton stalks, as source of renewable energy as briquettes and pellets. The sale of chipped cotton stalks can provide additional income of Rs 3000 per hectare to the cotton farmers. Cotton stalks briquetting and pelleting based 30 enterprises are running successfully in Vidharbha region of Maharashtra with about Rs. 120 Crore turn-over per annum.

I. Strengthening Higher Agri-Education

- In order to enhance the standards of higher agricultural education, ICAR has introduced:
  - Ranking Framework of Agricultural Universities
  - Guidelines for Accreditation of Higher Agricultural Education Institutions
- The accreditation of SAUs helped enhancing the quality standards in agricultural education in the Agricultural Universities. While only 4 SAUs came forward for accreditation during 2007-14, the number soared to over 15 times to 62 during 2014-21.
- Total 485 experiential learning units were established in the SAUs benefitting over 82830 students. Besides, 102 new experiential learning modules were also provided to the SAUs during 2014-21.
- Emeritus Professor Scheme (100 numbers) initiated in 2016-17, 45 are put in place to harness the potentials of experienced teachers in the State Agricultural Universities

Students have undergone international training under National Agriculture Higher Education Project (NAHEP).

- Netaji Subhash International Fellowship for overseas doctoral degree programme enhanced from 25 to 30 slots. International fellowship provided to 55 professors.
- Student-READY programme was launched in 2015 and implemented across agricultural universities since 2016-17 exposing more than 71000 undergraduate students to various facets of agri- entrepreneurship.
- The number of scholarships to PG students has increased from existing 202 to 300 per year for ICAR- JRF/SRF and from existing 425 to 600 per year for ICAR-PG during 2014-21 as compared to 2007-2013-14.
- Implemented National Agriculture Higher Education Project (NAHEP) in the year 2017 enabling 377 students and 120 faculty members from agricultural sciences trained abroad in cutting edge technologies and emerging areas of agricultural sciences
- Fifty Four new pilot courses added / upgraded on communication skills, entrepreneurial skills, creative and innovative thinking, leadership skills under NAHEP to enhance the learning outcomes of the students

Students observing rice crop

- Towards the contribution to digital agriculture, more than 30 mobile and web-based applications were developed by partner AUs under NAHEP, these applications will not only support students, faculties, entrepreneurs but will also act as an advisory source for farmers
- Ag-Tech-Hackathon KRITAGYA (Krishi Takniki Gyan) organized, with the participation of about 784 teams of students, faculties and innovators entrepreneurs, start-ups from universities and technical institutions and other organizations, to promote technology solutions for enhancing farm mechanization specifically the women friendly equipments.
- The Krishi Megh (Cloud Infrastructure and Services) established which included (i) CAR Data Centre (DC) with HCI infrastructure & GPU Server having Artificial Intelligence (AI) capabilities at ICAR-IASRI; and (ii) ICAR Disaster Recovery (DR) Centre established at ICAR-NAARM
- Two portals http://accreditation.icar.gov.in (accreditation portal) for the online process for the accreditation of Higher Agricultural Educational Institutions and https://alumni.icar.gov.in (alumni portal)) for management of alumni of Agricultural Universities launched.

ICAR Publications

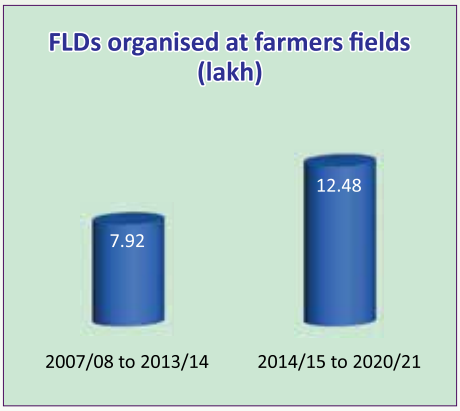
- Academic Management Software (AU-AMS) has been developed under NAHEP and successfully implemented in 52 AUs across the country. ICAR-IASRI has also developed AU-PIMS- a workflow-based system developed with an objective to create unified information base for research projects. This system facilitates in information management and improved decision making with long term objective to check duplication in research projects at AU level.
- In order to track the progress of various subprojects under components, Monitoring and Evaluation (M&E) team has developed a web application named Project Monitoring and Tracking System (PMTS) to provide automated solution to users.
- Virtual Classrooms in 18 Agricultural Universities have been established. The Agri-DIKSHA Web Education Channel initiated for online learning in Agricultural Universities.

J. Lab to Land and Farmers Outreach

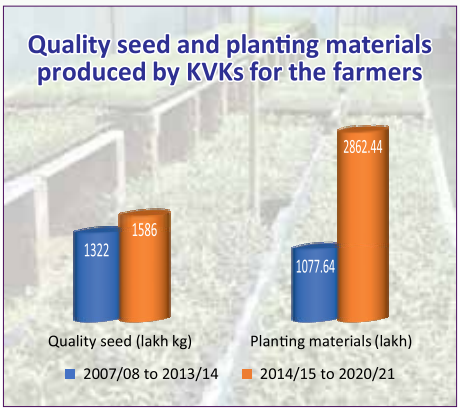
- With the penetration of mobile connectivity deeper in the villages, the KVKs are reaching out to unreached. This is evident with the soaring agro-advisories provided through mobiles during recent years. The number of mobile agro-advisories provided by KVKs increased to 91.43 crore during 2014-21 against 0.42 crore agro-advisories during 2007-14.
- Training of farmers and capacity development of extension personnel of the States Department of Agriculture and the line departments is the core activity of KVKs. They trained 100.05 lakh farmers and 9.50 lakh extension personnel during 2014-21 as compared 97.22 and 7.61 lakh respectively during 2007-14.

Hon'ble Agriculture Minister and MoS addressing the farmers

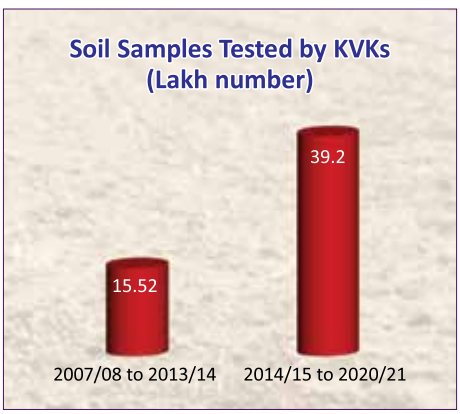
- The number of FLDs organized by the KVKs increased by 57.6% during 2014-21 to 12.48 lakh frontline demonstrations (FLDs) as compared to 7.92 lakh FLDs during 2007-14. The FLDs enabled capacity building of 100.05 lakh farmers including farm women and rural youth during 2014-21. This included 7.88 lakh exclusive FLDs for pulses and oilseeds.



- The KVKs also produced quality seeds and planting materials, those were provided to the farmers. The seed production in KVKs increased by about 20% from 13.22 lakh quintals to 15.86 lakh quintals. The production of quality planting materials increased 166% from 1077.64 lakh to 2862.44 lakh during 2014-21 as compared to 2007-14.



- The KVKs also provide improved strains of the livestock and finger lings of fish to farmers. During 2014-21 the KVKs produced 1631.0 lakh quality stains of livestock and fish fingerlings against 873.9 lakh strains and fingerlings during 2007-2014.
- To compliment the efforts of soil health assessment, KVKs offered their services for the analysis of soil samples of the farmers. The analysis of soil samples of farmers' fields by KVKs increased by 153% from 15.52 lakh samples in 2007-14 to 39.2 lakh samples in 2014-21.



- The reach out to farmers through on-farm trials of improved technologies at farmers' fields increased by 28%

with 2.44 lakh on farm trials during 2014-21 against 1.91 lakh on-farm trials during 2007-14.

- Established 7251 units of agro-enterprises benefitting 16707 rural youth under the newly launched program, 'Attracting and Retaining Youth in Agriculture' (ARYA).
- To catch up with digital revolution, focused efforts by ICAR led to development of 208 mobiles apps on different farm and farmers related services during 2014-21, against 15 apps during 2007-14. These ICAR apps are being integrated on one common platform called KISAAN.
- The Farmer FIRST (Farm, Innovations, Resources, Science and Technology) initiative was launched during this period by ICAR with enhanced farmers-scientists interface to move beyond production and productivity; the programme is under implementation at 51 centers under ICAR and SAUs spread over 20 states of the country benefitting 50000 farm families of 250 villages. A total of 82469 participatory demonstrations, and 4369 extension programmes have been organized under the project.
- 13500 villages were adopted under a new initiative called Mera Gaon - Mera Gaurav (MGMG) to promote the lab to land process benefitting over 6 lakh farmers

Women farmers learning drying technique of apricot at KVK, Kargil

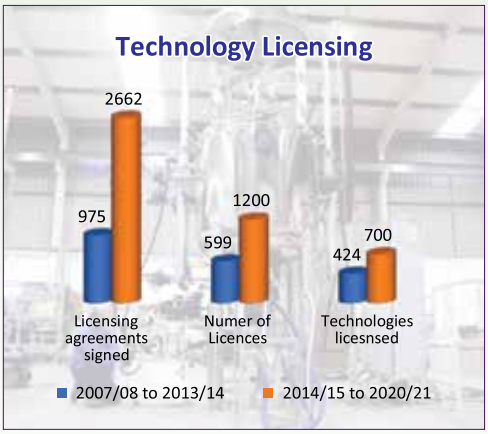
CRIDA NICRA demonstration plots

- Climate resilient technology packages of natural resource management, crops and livestock production systems were demonstrated (3.79 lakh demonstrations) in 151 villages of 121 vulnerable districts of the country covering 1.45 lakh ha area and 3.82 lakh farm animals of 4.83 lakh famers under the Technology Demonstration Component of NICRA.
- For the first time, ICAR provided skill development training aligned with the National Skill Qualification Framework to 40141 rural youth by organizing 1975 training courses
- The KVKs organized strategic Information, Education and Communication (IEC) campaign for in situ management of crop residues in ~700 villages in the northern India that was participated by 2 lakh farmers which resulted in the drop of burning incidences by 52% in 2019-20 over 2016.

K. Technology Commercialization and Agri-Entrepreneurship Development

- Under commercialization of technologies, the licensing agreements grew by 173% from 975 agreements during 2007-2014 to 2662 during 2014-21. The number licensees during 2014-21 increased to 1200 including government agencies, private industries, MNCs, NGOs, startups and

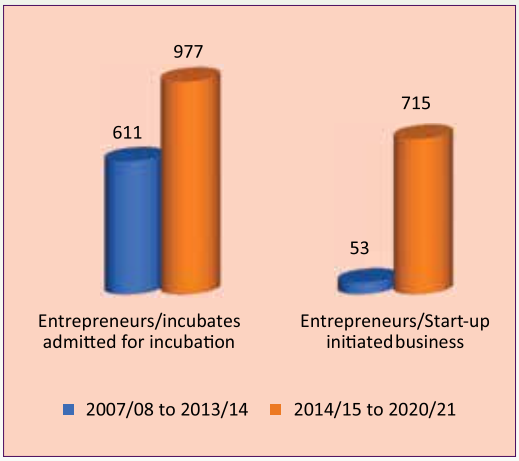
entrepreneurs against 599 during 2007-14. These vigorous efforts resulted into 65% increase in the commercialization of technologies to 700 technologies during 2014-21 against 424 during 2007-2014



- Agri-Startup and Entrepreneurship Conclave was organised on 16-17 October, 2018 at NASC Complex, New Delhi for unleashing the potential in agriculture for young agripreneures (UPAYA). The programme was also graced with the presence of Union Minister and MOSs of Agriculture & Farmers Welfare, Ministers of Petroleum and Natural Gas; and Skill Development and Entrepreneurship. The conclave was attended by about 700 participants including 104 startups/ entrepreneurs / licensees nurtured by ABIs of ICAR
- ICAR established 25 Agri Business Incubators (ABIs) in 2017 for providing handholding to entrepreneurs and startups. These ABIs, on the

Hon'ble President Shri Ram Nath Kovindji interacting with ICAR supported entrepreneurs at Rashtrapati Bhawan on 19th March 2018

recommendations of experts after reviewing the performance has been doubled to 50 ABIs in 2019. Consequently, the enrollment of entrepreneurs and startups enhanced by 160% to 977 during 2014-21 against 611 in 2008-2014.



- The participation of entrepreneurs increased substantially under Entrepreneurs Development Programmes. As compared to only 47 participants per programme during 2008-2014, the number increased to 59 participants during 2014-21. Total 586 programmes were conducted during 2014-21
- In the SIH 2018, three teams were awarded with the cash prize of Rs. 1 Lakh, 75k, 50k respectively.
- In-house on-the-job training from ISO professionals were organized to sustain the Quality management systems certification license (ISO 9001-2008/9001-2015) is being organized from 2013-14 onwards for the staff of DARE/ICAR (headquarters) was provided.

L. International Cooperation

- ICAR hosted the 4th ASEAN-India Ministerial Meeting on Agriculture and Forestry on 11-12 January, 2018 and organized International Seminar exclusively for BIMSTEC Countries in December, 2019 on Climate Smart Farming Systems
- ICAR represented India and participated in the G20-Chief Scientists Meeting held in Japan
- ICAR represented India and participated in the CGIAR System Council Meeting held in China
- The Global reach of ICAR has been enhanced with the signing of 36 new MoUs and finalization of 22 Work Plans since mid-2014. These include 15 Foreign Universities, 12 CGIAR Centres, 3 Academies, and 8 International Organizations.
- Organized International Conference on Global Potato Conclave (GPC)

Hon'ble PM inaugurated Global Potato Conference virtually

during January 2020 at Gandhinagar for sharing of global expertise and Agricultural Statistics during November 2019 at New Delhi.

- 11th meeting of BRICS Agriculture Ministers under the theme BRICS Partnership for Strengthening Agro Biodiversity for Food Security and Nutrition was held on 27th August 2021 at New Delhi. The Union Minister of Agriculture & Farmers Welfare, Government of India, Shri Narendra Singh Tomar and the Ministers of Agriculture of the Federative Republic

of Brazil, the Russian Federation, the People's Republic of China, and the Republic of South Africa participated in the meeting. Hon'ble AM announced the operationalization of BRICS-ARP prepared by India to intensify cooperation in agricultural research, technology, innovations and capacity building

- ICAR represented in series of CGIAR System Council Meeting held during 2019-21 to discuss and develop the mechanism for One CG System.
- Hon'ble President of India dedicated Advanced Centre for Agricultural Research and Education established by ICAR to the People of Myanmar on 12th December 2018 in presence of Minister of Agriculture, Livestock and Irrigation and Minister of Education, Government of Myanmar. The Hon'ble President also unveiled India-Myanmar Friendship Plaque, and interacted with the students and faculty of ACARE

Hon'ble President of India inaugurating the ACARE on 12 December 2018 in Myanmar

- The MoUs signed with AVRDC (World Vegetable Centre), Taiwan; International Centre for Bamboo Research, China, and Heinrich-Heine University, Germany and Asia Pacific Association of Agricultural Research Institutes (APAARI), Bangkok for International Cooperation with international agencies and Universities were signed.

DG, ICAR signing MoU with Heinrich-Heine University, Germany

M. National Collaborations

- ICAR signed MoUs with prominent scientific organizations such as CSIR, ICMR, ICFRE, DBT and IIT (Delhi) to break the silos in frontline research and advance the inter-departmental research in frontier areas. Under

these MoUs with premier national organizations, the Joint Working Groups (JWGs) and Steering Committees were formed and new joint research projects initiated.

- ICAR also signed Umbrella MoUs with 34 Agricultural Universities/CAUs to implement sponsored and collaborative programmes.
- To strengthen the outreach, 5 MoUs were signed with national organizations such as MANAGE, Hyderabad, NABARD, Mumbai; ASCI, Hyderabad, ICICI Foundation, Patanjali Bio Research Institute (PBRI), Haridwar and IFFCO Ltd., New Delhi.
- For convergence with the schemes and programmes of the Central Ministries and Departments, the MoUs were signed with MoFPI, MoRD, MSME, Common Service Centre under MeitY and National Cooperatives Development Corporation (NCDC) under Ministry of Cooperation.

N. Human Resource Management

- In order to strengthen the human resource management in the NAREES, a dedicated unit of Human Resource Management was established in ICAR in 2014. Subsequently, ICAR HRM Policy: Training and Capacity Building was put in place in 2017 in sync with National Training Policy-2012.
- Since 2014, 473 new specialized programmes organised and 6433 employees trained under various categories of which 75.9% participants availed the the training for the first-time as freshers or after assuming specific charge.
- On an average 3338 employees of all categories trained annually during 2014-21 as compared to 2409 during 2013-14. Interestingly, compared to 2013-14, ICAR-Institutes organized 45.0 and 965.7 per cent more training programmes for Technical and Skilled Support Staff, respectively
- The Online Training Management Information System (TMIS) developed and implemented for effective and efficient training management in ICAR. This has helped in achieving paperless training management of about 17,100 employees.
- The study conducted on the effectiveness of trainings revealed medium effectiveness of training (PTEI 3.86). Significant behavioural changes were observed in the participants after the trainings.
- The ICAR initiatives on HRM was recognized in the Conference of Heads of Administrative Training Institutes (ATIs) and Central Training Institutes

(CTIs) organized by DoPT, on 4 December, 2017 at New Delhi. The ICAR learning facilitated a decision for formulating the training programmes for the categories who are never exposed to training to develop Knowledge, Skills and Attitude.

O. ICAR-State Interface

- The functioning of 8 Regional Committees strengthened with clearly defined action points along with timelines for each state, based on their needs, and actions taken according to the timeline.
- Agricultural Technology Application Research Institutes (ATARIs) were increased to 11 from 8 to sharpen the linkages in extension services with the the State Department of Agriculture and other line departments.
- Strategic Action Plan for Doubling of Farmers' Income was prepared for all the States of the country through duly constituted State Level Coordination Committees, which were provided to the States for implementation
- Provided technical inputs for the Kharif and Rabi campaigns organized by Department of Agriculture, Cooperation and Farmers' Welfare, Govt. of India; documented technological information disseminated particularly about the newly released varieties to be immediately promoted by the States.

Hon'ble Agriculture Minister and MoS (A) in Vice Chancellor Conference

- For the first time, one of its kind brainstorming sessions on 'Technological Innovations and Strategies for Farmers' was organized on 13 July for Rajasthan farmers and 26-27 August 2019 for MP and Chhattisgarh farmers including the Padma Awardee farmers and innovative/ progressive farmers representing all the districts of the three States. Hon'ble Union Minister for Agriculture & Farmers Welfare Shri Narendra Singh Tomar and MoS Shri Kailsah Choudhary addressed the participants and provided guidance.

P. Reforms in DARE/ICAR

- Agricultural Scientists Recruitment Board (ASRB) detached from ICAR, restructured and made functional as an attached office of Department of Agricultural Research & Education (DARE) with several other changes for greater efficiency and transparency.
- An online system for inter-institutional transfer of Scientific positions implemented. Similarly criteria based posting of newly recruited scientists in online format was operationalized successfully.
- ICAR sponsored All India Coordinated Research Projects (AICRPs) rationalized for rightsizing the human resources and financing which could result into a saving of over Rs. 100 crores annually.
- The Cadre Review of Scientific positions carried out in ICAR. The entry level scientific positions enhanced expanded adding to a flexi pool of scientific strength to address the emerging research needs.
- The Cadre Review of Administrative positions was undertaken and the recommendations already implemented.
- Implementation of e-office with over 95% e-file works in ICAR Hq and almost all the institutes under ICAR.
- Digital Technology applications increased in research governance and facilitation with transparency at its core. The Finance Management System, Online Transfer Systems, Foreign Visit Management System and Online Examination for UG/PG admissions were introduced.

Q. Azadi ka Amrut Mahotsav (AKAM)

- ICAR has planned several activities during 75th Year of India's independence to celebrate Azadi ka Amrut Mahotsav. The major activities include 75 mass awareness campaigns; 75 lectures on agriculture and allied areas;

publications of 75000 success stories of doubling farmers income and 75 years of agricultural development. The mass awareness campaigns, webinars and lecture series will be organized at National Level on different key areas in which public leaders, farmers, self help groups, FPOs, input providers, civil society organizations, scientists, academia, students, teachers along with personnel of ICAR institutes and KVKs will participate. The first national campaign was organized on 22nd March, 2021 on the occasion of World Water Day.

R. Special Campaigns

- A special awareness campaign 'Information, Education and Communication (IEC)' carried out for in-situ management of crop residues in about 700 village in Punjab, Haryana and western Uttar Pradesh districts. Over one lakh people participated in the campaign including school children which created large-scale awareness leading to significant reductionin straw burning events.
- Hon'ble Prime Minister launched National Animal Disease Control Program (NADCP) for FMD and Brucellosis and Nationwide Artificial Insemination (AI) programme on 11th September, 2019 at Mathura, Uttar Pradesh in 600 districts having less than 50% AI coverage. Simultaneously, the workshops on vaccination, disease management and AI were organized at 651 KVKs. Sixty five MPs and 106 MLAs led the program at KVKs and 1,33,140 farmers participated. Vaccination and Artificial insemination were carried out on 65,262 animals.
- ICAR in collaboration with IFFCO organized a tree plantation campaign on 17th September, 2019 in which 7,10,740 plants were planted. The tree plantation was conducted at 649 KVKs with the participation 1,41,243 farmers, 34 Hon'ble Member of Parliaments, 50 MLAs and 2000 other VIPs. During 2020, under Poshan Abhiyan the vegetable seed packets in each KVKs were distributed amongst farmers and over one lakh saplings of trees were planted.
- ICAR-KVKs organized 557 melas under Jal Shakti Abhiyan with participation of over 3.14 lakh farmers and school children
- ICAR-KVKs reached out to 5.58 crore farmers through national and state-specific advisory translated into all 15 regional languages during COVID-19 Pandemic

Hon'ble Prime Minister at the Nanaji Desmukh National Phenomics Facility, IARI, New Delhi

S. New Institutions, Facilities and Awards

- Hon'ble Prime Minister dedicated the Nanaji Deshmukh National Phenomics Facility at IARI New Delhi on 11 October, 2017 to the Nation to foster understanding of climate change impacts on crops
- State-of-art multipurpose ICAR Convention Center was commissioned for national service on 20th February, 2019 by Hon'ble Union Minister of Agriculture & Farmers Welfare
- 4 New Institutions were established during 2014-2021 for cutting edge and upstream research in agriculture and addressing the regional priorities, only 2 were established during 2007-14. The 4 institutions are:
  - Indian Agricultural Research Institute (IARI), Jharkhand
  - Indian Agricultural Research Institute (IARI), Assam.
  - MG Integrated Farming System Research Institute, Motihari, Bihar
  - Rani Laxmibai Central Agricultural University in Jhansi, Uttar Pradesh.
- The ICAR-IARI, Gogamukh (Assam) was dedicated to Nation by Hon'ble Minister of Agriculture & Farmers Welfare virtually on 25th September, 2020 in the presence of Hon'ble Chief Minister of Assam.

Hon'ble Prime Minister inaugurated RLBCAU's Academic & Administrative Building on 29 August, 2020

- Hon'ble Union Minister of Agriculture and Farmers' Welfare dedicated the IARI-Jharkhand campus to Nation with administrative and academic building named as Dr. Shyama Prasad Mukherjee Bhawan on 6 July 2020.
- Administrative cum research building of Rani Laxmibai Central Agricultural University in Jhansi, Uttar Pradesh inaugurated by Hon'ble Prime Minister on 29th August, 2020 virtually.
- Upgraded the Rajendra Agricultural University, Pusa, Bihar to a Central University and renamed it to Dr Rajendra Prasad Central Agricultural University with four colleges.
- Established 6 new colleges under the Central Agricultural University, Imphal, raising the total number of colleges to 13.
- The Collage of Agri Business Management and College of Horticulture under Rajendra Prasad Central Agricultural University, Pusa Bihar was inaugurated in 2020 by Hon'ble Prime Minister.
- To facilitate multidisciplinary agricultural research in cold arid region of Leh and Ladakh, ICAR- CAZRI, Regional Research Station-Leh inaugurated by Hon'ble MOS (A) on December 16, 2020
- The 'state of the art' administrative cum research building of National Institute for Abiotic Stress Management (NIASM) Baramati inaugurated on 21 December, 2020 by Union Agriculture Minister of State.

- Instituted two new awards for the farmers: (i) Haldar Organic Farmer Award and (ii) Pandit Deen Dayal Upadhyay Antyodaya Krishi Puruskar. Another award initiated to recognize the contribution of the farm science centres (KVKs) - Pandit Deen Dayal Upadhyay Krishi Vigyan Rashtriya Protshahan Puraskar.

T. ICAR Response to COVID-19 Pandemic

- ICAR system disseminated 1287 advisories/ messages in different states in 15 regional languages through digital platforms reaching out to over 55.8 million farmers of the country. The handholding of farmers was also strengthened by distributing about 52003 q of quality seeds, 78.78 lakhs of planting material and 13.0 lakh fish fingerlings by KVKs.
- ICAR Research Institutes; NIHSAD, Bhopal, IVRI, Izatnagar, and NRC on Equines, Hisar and PDFMD, Bhubaneshwar were designated for COVID-19 testing in humans. These institutes were also designated by MoEF, GoI for COVID testing of samples from Zoo animals. Over 549655 human samples were tested atthese three institutes. ICAR-CIFT, Cochin produced rapid detection kits for distributing to food safety inspectors, exporters and State Governments. 2 Real Time PCR machines was provided to Govt of Kerala Health Mission for strengthening COVID-19 diagnosis.
- The services of the veterinary doctors of Institutes under ICAR and Veterinary Universities were extended to conduct COVID 19 tests and organize relief operations. The services of Veterinary Doctors/Scientists was availed by Telangana and Jammu & Kashmir. ICAR National Institute for Plant Biotechnology (NIPB), New Delhi conducted comparative analysis of more than 400 Coronavirus sequences in NCBI and traced its origin from bats to human in China based on sequence phylogeny.
- Developed a seaweed-based hand sanitizer to control the spread of the corona viral infection. The formulation of the developed product includes isopropyl alcohol (above 60%) possessing antimicrobial activities and seaweed extract from red algae with pronounced antiviral properties.
- The COVID-19-led lockdown caused heavy reverse migration of labourers from cities to villages. ICAR developed an action comprising of 4266 awareness programs, 14895 training programs, 898 skill development training courses of ASCI and 51130 technology demonstrations including income generation activities. The plan was implemented in 705 KVKs

with major emphasis on livelihood activities for labourers in the severe reverse migration affected States.

- DARE/ICAR family contributed about Rs. 6.06 crores in the PM CARE Fund. Besides, several officials, Clubs and Labour Welfare Funds contributed to PM-CARES.

U. Recognitions to ICAR

- ICAR was conferred with Global Gene Stewardship Award 2018 of the Borlaug Global Rust Initiative.

Dr. T. Mohapatra, Secretary, DARE & DG, ICAR received the prestigious Borlaug Global Rust Initiative (BGRI) Gene Stewardship Award on 14th April, 2018 in Morocco. Ms. Kheya Bhattacharya, Ambassador of India in Morocco and Indian wheat team joined him on the occasion.

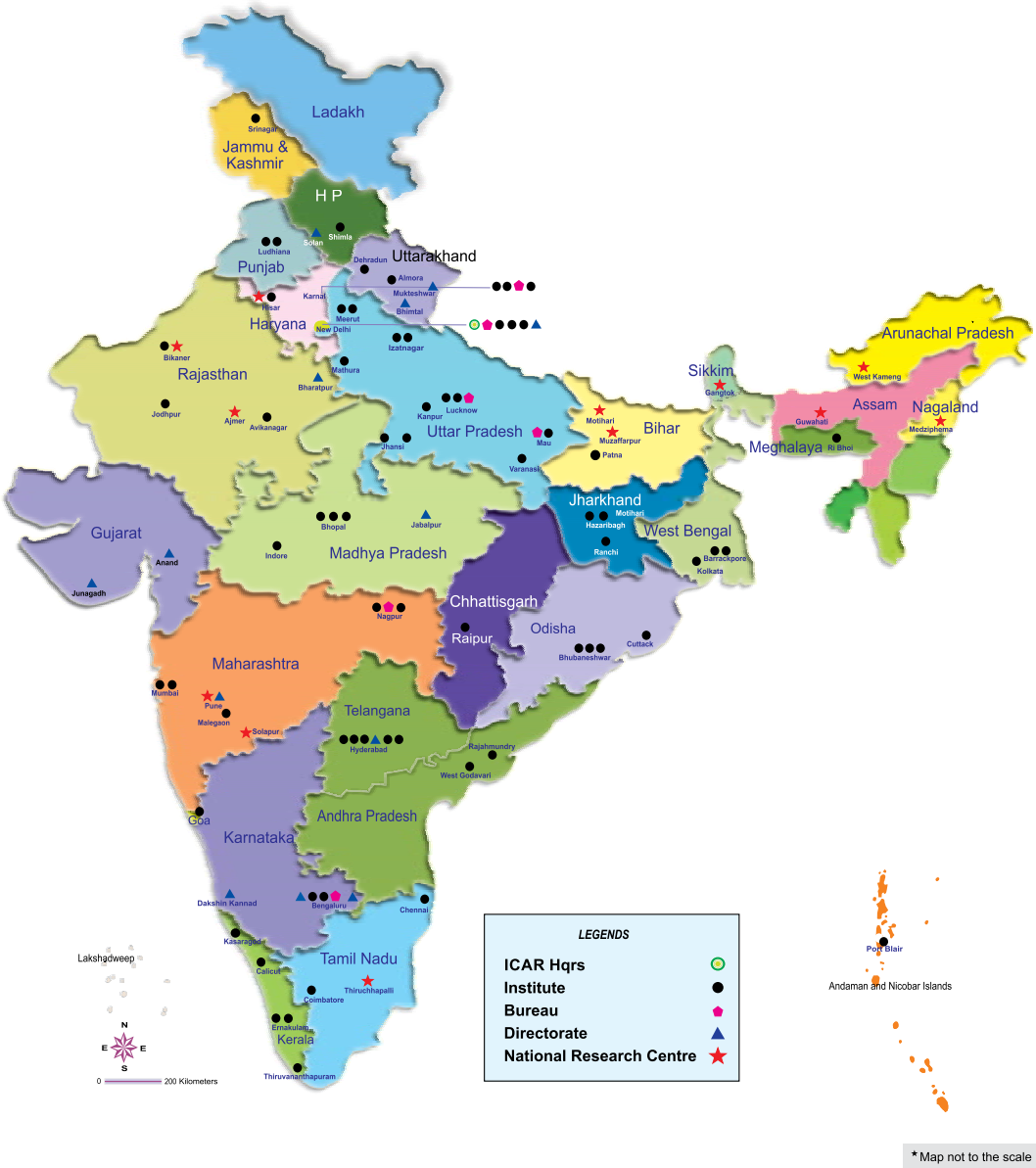
- ICAR commended by Department of Administrative Reforms and Public Grievances, GoI for significant progress in e-Governance in 2017-18
- ICAR bagged the prestigious International *King Bhumibol World Soil Day Award* conferred by the Food and Agriculture Organization (FAO), Rome on 5th December 2020. The prestigious global award was received by ICAR-IISS, Bhopal as the lead institution, for its commitment to raising awareness of the importance of healthy soils.
- Acquisition of status of International Depository Authority (IDA) by "National Agriculturally Important Microbial Culture Collection", Unit of ICAR-NBAIM by World Intellectual Property Organization (WIPO), Geneva
- ICAR conferred with Digital India Awards - 2020 under Open Data Champion Category.

Hon'ble President conferred *Digital India Awards on ICAR* virtually

- FAO included ICAR Advisories as Voluntary Guidelines for the benefit of Fisheries Sector across the Globe, FAO publishes ICAR-CIFT's work on Food & Gear loss in Gill Net Fisheries.
- ICAR Tableau rolled in Raj Path on 26 January for the first time in 2018 and again in 2019; the *tableau* with the theme `Kisan Gandhi' won the Best Tableau prize in 2019.

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

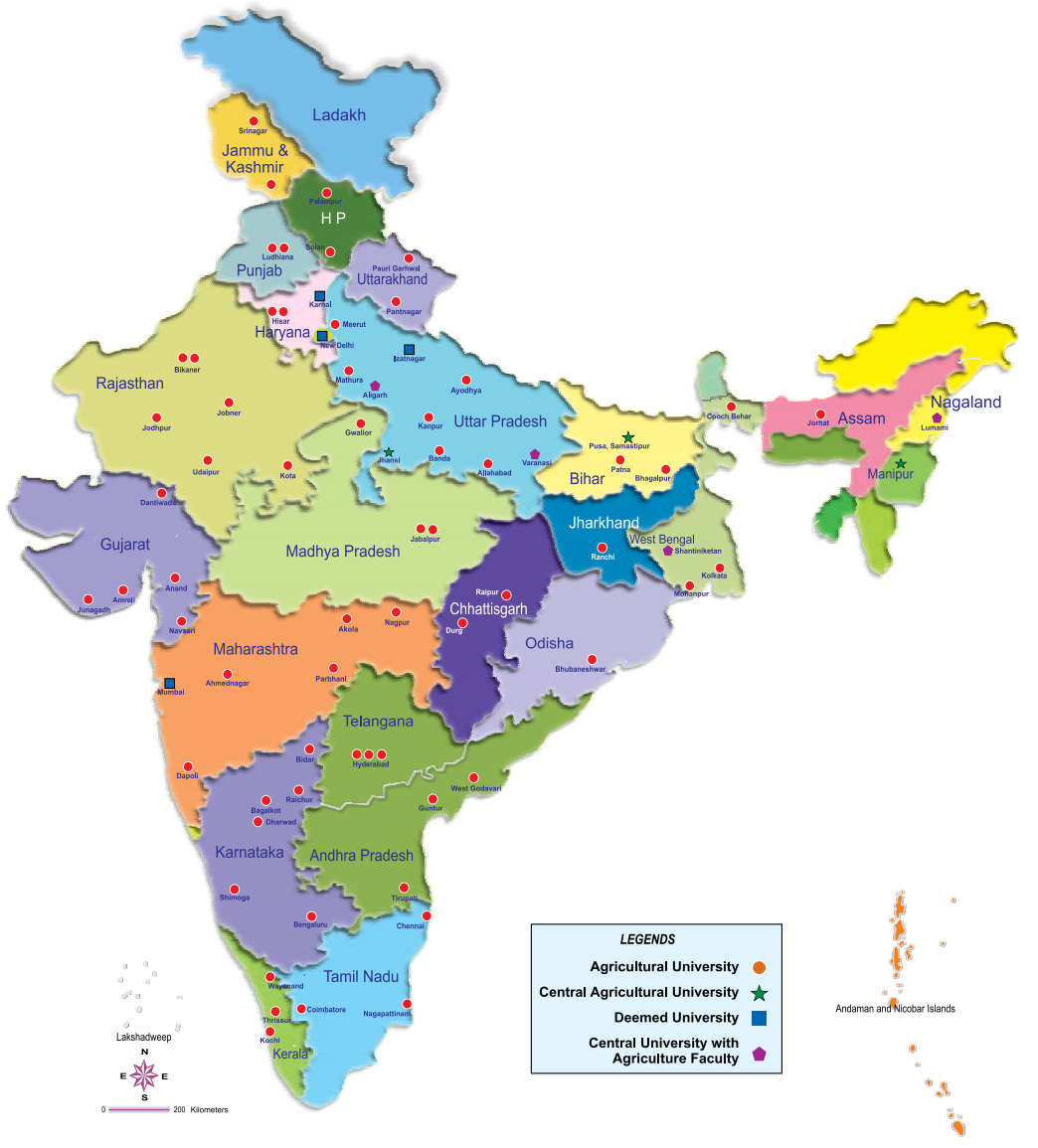
Institutes, Bureaux, National Research Centres and Directorates



• 72 Research Institutes • 6 Bureaux • 12 Directorates • 12 National Research Centres

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

Agricultural Universities



- 63 State Agricultural Universities (SAUs)
- 3 Central Agricultural Universities
- 4 Deemed Universities
- 4 Central Universities having Faculty of Agriculture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