Volume 25 No. 2 ISO 9001:2015 Organization ISSN 2394-3289 April-June 2019

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद
Agrisearch with a human touch

भाकृअनुप
ICAR

ICAR NEWS

A SCIENCE AND TECHNOLOGY NEWSLETTER

RESEARCH UPDATE

Promising Technologies

- Technology assessed in zeolite beads 1
- Low cost storage structure enhances shelf life of garlic 3
- Smart optical probe for equipment-free detection of oxalate 4
- Green remedy for hypertension from ICAR-CMFRI 5

New Initiatives

- Soybean processing industries: A new initiative of ICAR-CIAE, Bhopal 8
- Technological advancement in pest management 9

Natural Resource Management

- Interactive effect of applied calcium and boron on biomass yield and boron uptake by tomato in an acid soil (Alfisol) 11

Profile

- ICAR-Central Institute for Women in Agriculture, Bhubaneswar 12

Spectrum

- *Vanashree:* Improved purebred native chicken 18
- *Kashi Krishna:* Black carrot variety 18

Way Forward 20

PROMISING TECHNOLOGIES

Technology assessed in zeolite beads

Storing of seed by the farmers for subsequent use has been in practice in India and other countries for many centuries. Traditionally, farmers have devised many methods for seed storage which can maintain seed longevity fairly well till next sowing. The technologies involved in seed conservation and storage need to be continuously upgraded with the advent of new knowledge about seed physiology and invention of effective drying and cooling methods. Hermetic storage was found to be the most effective form of seed storage where seeds were stored in totally air-tight containers made of "terra-cotta", metal, wood etc. Gradually, knowledge of excluding insect and moisture from seeds was acquired and various methods of drying seeds and herbal concoctions to deter insect /fungi from deteriorating the seeds were practiced.

Specific requirements of a dry storage

Desiccants: Zeolite/alumina desiccants or Silica gel based. Preferably zeolite beads as they are non toxic, zero dust off and can be re-used millions times.

Hermetic storage: Whatever the seed storage containers use, they have to be hermetic/air-tight. For small quantities, PET bottles of 2-5kgs can be used. For bigger quantities, PVC drums with airtight lid and sealing rings to be used.

Recharging ovens and other equipments: Zeolite beads require recharging after they are saturated. Any oven that has the capacity to heat the beads to a temp of 200-250°C can be used. The beads

Indian Council of Agricultural Research
Krishi Bhavan, New Delhi 110 001, India
www.icar.org.in

Result in farms family seed storage with zeolite beads

Enterprises/ crop	Farming situation	Problem diagnosed	Titles of technology	No of trails	Technology assessed	Parameters of assessments	Data on the parameter		
							T1	T2	T3
Chick pea	Traditional	Seeds are converted in cereals due to insect and pest in storage period	Zeolite beads	05	Seed storage with PVC drums and zeolite beads	Damage of grain and increasing of seed viability reduced	40%	50%	0.01%
Wheat	Traditional	Next year the germination is very poor in wheat	Zeolite beads	05	Seed storage with PVC drums and zeolite beads	Germination test	50%	67%	100%

T1, Farmers practices (use of Neem leaves); T2, farmer's practices (seed store in metal tins); T3, seed store with zeolite beads and PVC drums.

are to be heated in an oven for 200-250°C for 2 hours, cooled in sealed containers and then they are ready for use.

RH Monitoring: The RH of the inside of the seed containers have to be monitored so as find out if the beads need to be recharged. A regular cobalt chloride/ humidity indicator paper can be used for this purpose. Else, we can use specialized PP boxes with an RH meter integrated.

Object

(a) To ensure conservation of all local and released diversity.

(b) Conservation of bigger quantities of popular varieties.
(c) Black box/safe deposit storage of farmer's produce of seed.

To ensure conservation of all local and released diversity: The collection of local landraces collected from farmers in small quantities (<2kg) will be stored under ultra-dry condition as long term storage. The zeolite beads will be deployed to reduce the moisture of the seeds to a safe level (1-2%less than IMSCS recommended) and storage under hermetic condition in airtight containers these samples shall be periodically tested for germination and regeneration.

Medium terms conservation of bigger quantities of popular varieties: There will be some varieties in allocation/community which have special characteristics like high zinc, good aroma; cooking quality etc. These may be traditional varieties or high yielding varieties which will be maintained and multiplied by the community seed bank so as to promote their cultivation and use.

For storing these varieties, bigger drums with airtight lids will be used. The capacities will vary from 50 kg to 100 kg, where these seeds will be stored under dry condition. Again the use of zeolite beads will be done where the seeds will be dried to low moisture content and kept sealed till use for the next season.

Black box/safe deposit storage of farmers produce of seeds (medium terms storage): The seed black box concept will be used for farmers who are producing seeds for their own farming, but do not have means to keep them safe till the next season, This consists of having a detailed inventory of the seeds, about the quantity, crops and varieties and keeping them stored

under dry condition in airtight drums till the next season.

Desiccants

The desiccants that we recommend are technically called zeoilite beads or Alumina beads or simply drying beads. These beads have a capacity to absorb 18-20% of its own weight of water from the surrounding air. They make the air around the seeds very dry and in turn water from the seeds evaporates out into this dry air. This dynamic process continues till the beads reach their saturated capacity. By that time the seeds are already dried. The quantity of beads needed to dry a certain amount of seeds depends on the following.

- Initial moisture content (Im): normally for cereals and pulses, after sun drying, the initial moisture is between 9-12%. It is around 8-9% in oilseeds. Expressed in percentage.
- Final moisture content (Fm): This is the desired moisture content till what we need to dry the seeds as a thumb rule; it is good to dry seed till 5-6% SMC for medium term storage. Expressed in percentage.
- Beads capacity (C): This is expressed as a percentage and this is the amount of moisture the freshly recharged beads can absorb at a certain temperature.
- The quantity of seeds in the container (W): The weight of seeds that we need to dry. So more the seeds, more beads are needed to place in the sealed containers to dry. Expressed in grams.

In case of chick pea store in PVC drums with zeolite beads there has been no damage of grain and germination has been excellent in the following year. This technology is very unique and safe for future. The other crop wheat germination is very good after storage is done on seed germination test in farmer's field and germination is 100%. Zeolite is very popular in farmers field.

Satyam Chauriha, Smt Mamata Tripathi, Satish Pathak, and **Dr Chandramani Tripathi**
Deen Dayal Research Institute,
Tulsi Krishi Vigyan Kendra, Chitrakoot, UP 210 206,
e mail: satyamchaurihabioversityctd@gmail.com

Low cost storage structure enhances shelf life of garlic

Garlic, being the second most important underground bulb crop after the onion grown in an irrigated condition is used as a spice or a condiment throughout the country and the world. The crop is an important foreign exchange earner for the country.

In Rajasthan, the crop is largely grown in Baran, Jhalawar, Kota, Bundi (*Haroti region*), Chittorgarh, Jodhpur and Pratapgarh districts, especially along the irrigated tracts. Haroti region is considered as the garlic bowl of Rajasthan, producing 90% of the crop. During the year 2018-19, garlic has been cultivated on 1.32 lakh ha area in Rajasthan and with average productivity of 5.4 metric tonnes per ha 7.18 lakh metric tonnes production is estimated. Since two decades, it is grown in the soybean-garlic based cropping system. The production made in these areas has its fragrance familiarity in many gulf countries too. Spicy preparations based on meat, instant food, chips, *papad*, etc., draw heavily on garlic or its derivatives. Nowadays, the pastes, powder, flakes, garlic capsules are gaining popularity in market.

A view of garlic storage in the low cost storage structure

Effect of height of heap of garlic plants on bulb rotting and weight loss during storage in low cost storage structure

Garlic heap height (Feet)	Bulb rotted (%)	Weight of whole plants(g)	Weight of whole plants after 200 DAS*(g)	Weight loss (%)
Farmers practice (7-8)	34.5	33.45	26.01	22.24
3	3.4	41.57	39.89	4.04
4	5.3	38.21	35.76	6.41
5	7.2	36.34	31.21	14.12

*Days after storage

Low cost thatched roof bamboo garlic storage structure

Garlic is stored as a whole intact plant in a room and requires large space. The farmers of this region face the problem of rotting and pumping of bulb stored in a room. Market price at the time of harvesting is low and storage of garlic bulb at the room temperature causes losses up to 43-50%. In Baran district, the loss of garlic during storage in room is found to be 34.5%.

However, under the RKVY Funded 'Garlic Excellence Centre' project, a low cost thatched roof bamboo garlic storage structure costing only ₹1.0 lakh was developed at the Krishi Vigyan Kendra, Anta, Baran. The structure made from the bamboo sticks with cemented floor measures 15' (w) X 30' (l) X 12' (h) in size with the capacity of storing 10 tonnes of garlic. The structure was inaugurated by the Minister of Agriculture, Government of Rajasthan on 4th March, 2017. This storage structure has become one of the model units for the garlic growers in the local area. The storage was used for storing the produce (bulbs to be used as seeds) of the nearby farmers with the minimal charges at ₹50 per bag of 40 kg and earned ₹20,000 within six months.

Standardization of garlic heap in storage

Garlic is stored in storage as whole plant and requires ventilation to prolong shelf life. The height of the garlic heap is an important factor affecting the shelf life of garlic bulb. The storage of whole garlic plants up to 3 feet height was found most suitable for decreasing the rotting (3.40%) and weight losses of bulb (4.04%) in low cost garlic storage structure due to proper ventilation enabling the circulation of fresh air. The highest weight loss (22.24%) has been found in farmer storage practices. The partition of garlic heaps up to 3.0 feet height is the most effective method of storage in the storage structure for the longer shelf life of garlic.

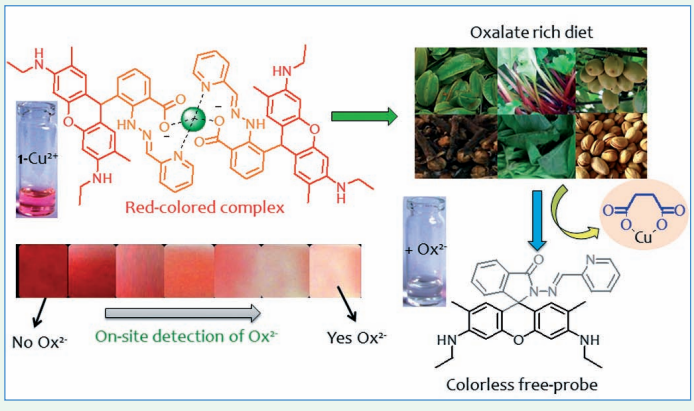
Output

- The low cost model structure of KVK, Anta, Baran has empowered 25 farmers through the skill development in the district for constructing their own low cost storage structures and one of the village - *Madana kheri* has been declared as a garlic storage village in the area.
- The low cost storage structure facility will help in checking the supply volatility and steep rise in garlic price in the long run.

Dr SK Singh
Director, ICAR-ATARI, Zone-ll,
CAZRI Campus,
Jodhpur 342005, Rajasthan
e mail: zpd6jodhpur@gmail.com
zpdzone 6@ yahoo.in

Smart optical probe for equipment-free detection of oxalate

Oxalate is considered as 'antinutrient' due to its strong binding affinity towards physiologically-abundant bivalent metal ions such as calcium, zinc, copper, and magnesium etc. By forming insoluble salts, they can reduce the bio-availability of these metal ions and trigger health problems, like convulsions, irregularity in carbohydrate metabolism etc. In addition to these above-mentioned health problems, the accumulation of excess oxalate salts (insoluble) in kidney tubules causes renal failure, cardiomyopathy disorder, and the development of kidney stones etc. Since there is no enzyme available in the human body for the degradation of oxalate, it is essential to control the amount of oxalate uptake, especially for the patients suffering from hyperoxaluria. Though most of the analytical methods show reasonably high efficiency in the determination of urinary oxalate level, they are mostly found incompetent in analyzing endogenous oxalate content in different agricultural crops. This is probably due to



Portable paper strips detect Oxalate

the interference caused by the carbohydrate derivates present in the plant tissues.

Considering the high abundance of oxalate in the wide range of agricultural crops, Professor Santanu Bhattacharya's guidance Dr Nilanjan Dey, Dr Namita

Kumari, IISc, Bengaluru and Dr Deepa Bhagat, ICAR-NBAIR, Bengaluru have developed a small molecular probe for estimating trace-level oxalate in wide range of agricultural crops. The sensory system shows a highly specific response towards oxalate among a wide range of anti-nutrients and biologically relevant anionic species. Addition of oxalate induces a change in the color of the solution, from pink to colorless, which ensures naked-eye detection of oxalate. The authors have estimated soluble oxalate content (endogenous) in more than twenty-five different crop samples. In each case, the estimated value was independently verified by standard permanganate method. Effect of additives as well as different cooking methods on the oxalate content was also evaluated using present system. It was observed that boiling is most effective in diminishing the soluble oxalate level (~85%) in comparison to 'steaming. Similarly, boiling in presence of milk can further reduce the soluble oxalate level (up to ~91%). Most importantly, oxalate contents at different parts of the crop, such as leaves, seed, stem etc are found to be different.

The authors have developed low-cost, portable paper strips for on-site detection of oxalate. Addition of oxalate discolor the 'red colored' paper strips. Accordingly, the sensing studies using color strips do not require maintenance of proper temperature or pH (or even electric source). Thus, this method is indeed suitable for on-site detection. Because the operational procedure is very simple in this case, even the end users with no basic knowledge of science can use them without much difficulty. Moreover, as the strips are tiny and easily portable, farmers can use them whenever required in the field (no establishment cost). The paper strips were found to be fairly stable at room temperature (open-air condition) for several days. Additionally, high specificity and good accuracy with recovery values ranging from 93.3 to 105.0% were obtained during oxalate estimation in spiked water and human urine samples, confirming the suitability of the present method in estimating trace-level of oxalate in complex matrices. (Reference: Dey, Nilanjan; Kumari, Namita; Bhagat, Deepa and Bhattacharya Santanu. 2018 Smart optical probe for 'equipment-free' detection of oxalate in biological fluids and plant-derived food items *Tetrahedron*, 74, 4457-4465).

Dr Deepa Bhagat
Principal Scientist (Organic Chemistry),
ICAR-NBAIR, Bengaluru
e-mail: deepa.bhgt@gmail.com

Green remedy for hypertension from ICAR-CMFRI

Seaweeds are fast growing and potentially renewable resources that are currently being explored as novel and sustainable sources of compounds for both pharmaceutical and nutraceutical applications. One of the predominant oceanic flora, these invaluable marine herbs are considered as a prolific source of bioactive compounds as they are able to produce a great variety of secondary metabolites characterized by a broad spectrum of extraordinary medicinal properties. Lately the use of seaweeds for the development of new products as well as a source for obtaining high-added value compounds has attracted the food and pharmaceutical industries. ICAR-Central Marine Fisheries Research Institute (CMFRI), Kochi devoted its research programme for the development of promising bioactive molecules for human health and medication from seaweeds.

Bioactive pharmacophore leads from seaweeds were used to develop Cadalmin™AHe, which can be administered to regulate clinical indicators leading to pathophysiology that results in hypertension. Hypertension is one of the risk factors for strokes, heart

Sea weed

attacks, heart failure, and arterial aneurysm, and is a leading cause of chronic kidney failure. A search for safer and effective alternatives to synthetic drugs to combat hypertension led scientists to investigate into seaweeds, for valuable secondary metabolites, which are anti-hypertensive in nature, and could offer relief from hypertension.

Cardiovascular disease is termed as the leading cause of debility and premature death globally and hypertension as the most prevalent trigger for cardiovascular diseases. Angiotensin-I-converting enzyme (ACE-I) in the rennin angiotensin aldosterone system displayed an important part in the modulation of high blood pressure and cardiovascular function. It converts the inactive doctapeptide angiotensin-I (Ag-I) into the potent vasoconstricting octapeptide angiotensin-II (Ag-II), which potentially narrows the opening of a blood vessel lumen and increases vascular resistance. Synthetic drugs are used to manage blood pressure levels in hypertensive patients. The continuous use of the synthetic drugs is often associated with undesirable side effects, such as liver toxicity and adverse gastrointestinal symptoms. Therefore, the search for food-based or naturally derived anti-hypertensive inhibitors are of immense appeal and functional food products could likely perform the necessity. Dietary ingestion of seaweeds has been shown to decrease hypertensive complications in humans and also has strong antioxidant properties.

Cadalmin™AHe contains 100% natural marine bioactive ingredients from selected seaweeds. The active principles of this product effectively inhibit various mediators, which are responsible to cause hypertension through various metabolic pathways. Cadalmin™AHe blocks angiotensin converting enzyme that converts angiotensin I to angiotensin II. Decreased production of angiotensin II enhances natriuresis, lowers blood pressure, and prevents remodeling of smooth muscle and cardiac myocytes. The bioactive ingredients in the nutraceutical product effectively modulate the serum level of oxidative stress marker nitric oxide, lipid peroxidase and the potent vasoconstrictor angiotensin-II. Additionally, the formulation increases the serum level of vitamin E. Angiotensin II also has a direct vasoconstrictive effect, which increases blood pressure, and promotes inflammation and remodeling of cardiovascular system, leading to thrombosis or ventricular hypertrophy. The product regulates increased nitric oxide level in endothelial cells and maintains the normal vasodilation of the pulmonary arterial hypertension.

Animal model anti-hypertension experiments showed that active principles effectively decreased the angiotensin-II levels in the cadmium chloride ($CdCl_2$) induced hypertension in rats. Serum nitric oxide, lipid peroxidase and angiotensin-II levels were significantly decreased in hypertension affected group treated by Cadalmin™AHe. In $CdCl_2$ plus Cadalmin™AHe group serum NO level has been significantly regulated upto 8.5 µg/dL at 100 mg/kg body weight and 9.00 µg/dL at 200 mg/kg body weight compared to diseased group (13.06 µg/dL at 100 and 200 mg/kg body weight) and positive control group (9.17 µg/dL at 100 and 200 mg/kg body weight). The serum lipid peroxidase level in $CdCl_2$+ Cadalmin™AHe group was comparatively lesser 181.95 µg/dL at 100 mg/kg body weight and 179.58 µg/dL at 200 mg/kg body weight than diseased group (307.45 µg/dL at 100 and 200 mg/kg body weight) and positive control group (186.08 µg/dL at 100 and 200 mg/kg body weight). The serum angiotensin-II level in $CdCl_2$ + Cadalmin™AHe group were comparatively lesser 0.205 pg/mL at 200 mg/kg body weight than the diseased group (0.432 pg/mL at 200 mg/kg body weight) and positive control (0.211 pg/mL at 200 mg/kg body weight). Additionally, the serum vitamin E level were comparatively greater (0.23 µM/mg at 100 and 200 mg/kg body weight) than the diseased group (0.08 µM/mg at 100 and 200 mg/kg body weight) but comparable with the positive control group (0.20 µM/mg at 100 and 200 mg/kg body weight).

This vegetarian product with its therapeutic values has a promising consumer appeal and market potential

especially for large vegetarian population in India and abroad. The unique biochemical engineering techniques adopted to retain the antidiabetic activities in preparation of Cadalmin™AHe assures higher shelf life. The product is safe from toxicity studies on experimental subjects.

Preclinical trials showed no toxicity related significant changes in renal or hepatic function, hematological indices and serum biochemical parameters in experimental subjects. The results demonstrated a lack of test substance-related general organ or systemic toxicity and hypertensive disorders following oral administration at a dose as high as 2000 mg/kg/d. Cadalmin™Antihypertensive extract has no side effects (LD_{50}> 4000 mg/kg BW) as proved from preclinical and acute/long term chronic toxicity studies on experimental subjects.

Time dependent shelf life studies were conducted to identify changes in bioactivity profile of the product in an accelerated shelf-life study, which revealed that no significant reduction of anti-angiotensin converting enzyme-I activities and content of active principles of the formulation after end of study period. This product is available in encapsulated form and is to be used orally. Large scale extraction of active principles from raw material was optimized in a factory unit.

Sixth nutraceutical product from ICAR-CMFRI

Cadalmin™ Antihypertensive extract **(Cadalmin™AHe)** is the sixth in the series of nutraceutical products and fifth from seaweeds from ICAR-CMFRI. Earlier, the Institute has developed and commercialized four nutraceutical products from seaweeds and one product from green mussels. *'Cadalmin™Green Algal extract (Cadalmin™GAe)'* and *'Antidiabetic extract (Cadalmin™ADe)'* were developed from seaweeds as green alternatives to synthetic drugs to combat rheumatic arthritic pains and type-2 diabetes respectively. *'Cadalmin™ Antihypercholesterolemic extract (Cadalmin™ ACe)'* and *'Cadalmin™ Antihypothyroidism extract (Cadalmin™ATe)'* to combat dyslipidemia and hypothyroidism respectively are other two nutraceutical products from seaweeds which were commercialised to a biopharmaceutical company. *'Cadalmin™green mussel extract (Cadalmin™GMe)* is the nutraceutical product which was developed from green mussel to combat arthritis.

The rich diversity of seaweeds represents an untapped reservoir of bioactive compounds with valuable pharmaceutical and biomedical use. Seaweed has long been part of the traditional diet of coastal communities. Various nutraceutical or functional food supplements and biomedical products from seaweeds provide a myriad of benefits for human health and multiple life threatening diseases. ICAR-CMFRI is the pioneering marine research institute to work in the frontier area of marine bioprospecting/bioactive molecule discovery from seaweeds and development of high value nutraceutical products as dietary supplements and health management against various lifestyle diseases.

In 2014, production of seaweeds through mariculture (44% of all aquaculture) was estimated at about 27 million tons wet weight, registering annual growth rate of 8% and valued at 7 billion US$ (FAO 2016). Seaweed mariculture in India remained in experimental trials until recently. World seaweed production through mariculture is expecting an increase of 9.8 million tons by the year 2025.

ICAR-CMFRI is in the process of developing more health products from the underutilized seaweeds. The institute is also in the process of standardizing and promoting seaweed farming all along the Indian coasts as a livelihood option for the coastal communities. This is expected to compensate fishermen during lean seasons.

Cadalmin™ AHe was released by Dr Trilochan Mohapatra, Secretary, DARE and DG, ICAR on 25 May 2019. The product is ready for out-licensing to the pharmaceutical/biopharmaceutical company.

e-mail: director.cmfri@icar.gov.in

Attention authors and contributors of *ICAR News*

To maintain high quality of presentation, designing and print quality of the ***ICAR News***, you are requested to provide:

- Good quailty photographs of your work/article **in original form, i.e. high resolution jpeg files**.
- Please provide photographs in its original form, i.e. high resolution jpeg files without any effects/ enhancements/alterations at your end.
- **No PDF files** of photographs and **No internet pictures** please.
- The text with photographs and captions may also be provided in the **MS Word** for reference purpose.

– Editor

Soybean processing industries: A new initiative of ICAR–CIAE, Bhopal

Entrepreneurship Development Programme

Entrepreneurship development programme (EDP) on soybean processing was started in 1995 at ICAR-Central Institute of Agricultural Engineering (ICAR-CIAE), Bhopal. The sole aim was develop enterprise in the area of soybean processing for livelihood opportunities, employment generation and production of high quality protein products at low cost. The EDP module on 'soy based bakery products and soy snacks' was added in the year 2002. ICAR-CIAE is the only Institute in India that offers EDP on soybean processing. Technical guidance and support was provided to the participants in establishment of enterprise and preparation of the produce as and when needed.

Impact

An assessment of impact of the entrepreneurship training programme was carried out that included initially telephonic contact with trainees and personal visits of selected production clusters (Madhya Pradesh, Maharashtra, Punjab, Uttar Pradesh, Delhi, Haryana, Uttarakhand, Gujarat, Rajasthan, Bihar and West Bengal) across the country. 198 soybean processing units are currently operational.

There have been some cases of closure of soy processing units, 14% trainees established the enterprise but closed it at later stage due to marketing constraints.

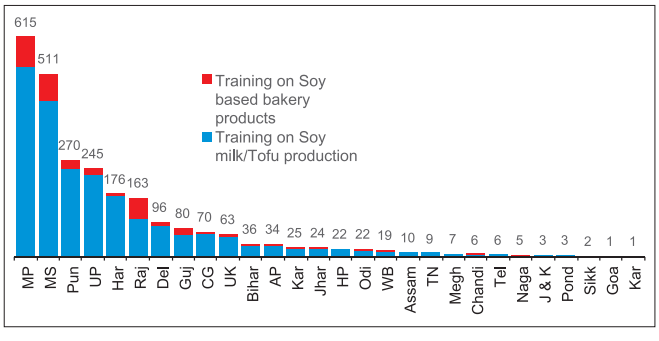
Distribution of soy products manufacturing across working units indicates that 10.4% trainees are involved in soy milk production only whereas 46% are engaged only in Tofu production. 30% are producing both soy milk and tofu. Only 3% trainees are involved in producing products other than soy milk and tofu that includes soy curd, soy nuts and soy flour.

Around 50% trainees are producing around 50 litres of soy milk or 50 kg tofu per day. Most of the trainees producing products more than 250 kg are located in Punjab and Maharashtra. Around 15% of trainees manufacture soy milk or tofu on demand especially in marriage season. Annual production of different soy products manufactured by trainees is presented in figure.

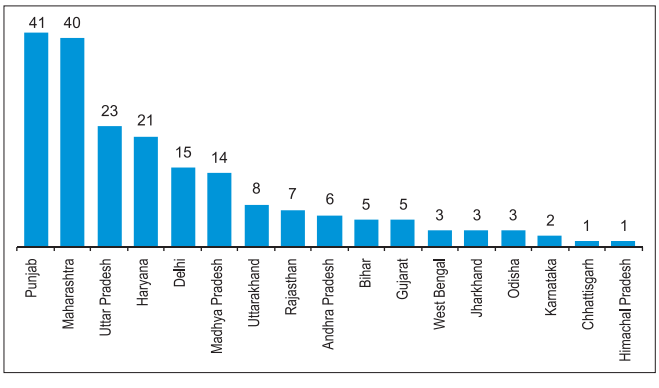
Based on information collected the average annual production of Tofu and soy milk is 2700 ton and 3400 kilo litres, respectively. Total protein content in tofu and soy milk is 14 and 3.5%, respectively.

Economic impact

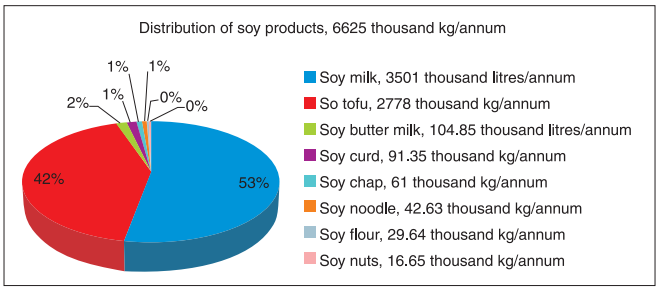
Soybean is processed by 198 entrepreneurs across the country to make different products like milk, tofu, flours, nuts, curd, biscuits, kabab, chap and halwa etc. Annual working days of these units are 203 while



State wise distribution of trainees (Total number 2524)



State wise distribution of units on soybean processing



Annual production of soy products

labour employment was analyzed 4.73/unit. These entrepreneurs are generating employment to the tune of 1.90 lakh man days/annum and provide the monetary benefits of ₹5.70 crore to the 936 workers engaged in running 198 soybean processing units. Annual gross return is ₹28.18 lakh/entrepreneur with an annual gross expenditure of ₹17.00 lakh/ entrepreneur. Thus, annual net return realized to the extent of ₹11.20 lakh/entrepreneur with a BCR of 1.66. annual gross monetary benefit has been generated from 198 entrepreneurs is about ₹56 crore. One hundred ninety eight units of soybean processing established across the country are generating employment of more than 1.78 lakh man-days/annum. Total monetary benefit from 198 entrepreneurs is about ₹51 crore/annum.

Sum-up

The soy food based entrepreneurship development training programme organized by ICAR-CIAE since 1995 has enabled establishment of 198 successful enterprises which are significantly contributing to nation's economy as well in combating malnutrition by adding 768 tons of edible low cost protein every year. The economic impact due to these enterprises is presently about ₹56 crore per annum and is increasing with popularity of soy based food products. Soy based food processing industries operating at cottage to small scale level has been a successful venture in generating income and employment.

Director
Central Institute of Agriculture Engineering,
Nabi Bagh, Berasia Road,
Bhopal 462 038 (Madhya Pradesh)
email: director.ciae@icar.gov.in

Technological advancement in pest management

Pheromone nanosensor integrated with drone: A smart intelligent pesticide spraying technology. A Project funded by BIRAC, DBT, targeted to make revolutionary changes for farmers at BOP (Bottom of Pyramid).

India's arable land area of 159.7 million hectares (394.6 million acres) is the second largest in the world, after the United States. Its gross irrigated crop area of 82.6 million hectares (215.6 million acres) is the largest in the world. India is blessed with 60% cultivable land and farming community strives on agriculture as major source of income and in most cases, the only source of income. There are many challenges faced by our farmers towards the cultivation of varieties of crops such as cash crops, plantations, fruits and vegetables, but technological advancements are well accepted and have benefitted many of the crops in the food chain. There is a significant contribution is basic infrastructure such as irrigation network, flood control systems, reliable electricity production capacity, all-season rural and urban highways, cold storage to prevent spoilage, modern retail and competitive buyers of produce from Indian farmers. One of the grave issues is pest management and related health hazards both for farmers and the consumers. We have to focus on developing a technology with limited or localized spray of pesticides.

Issues and impact

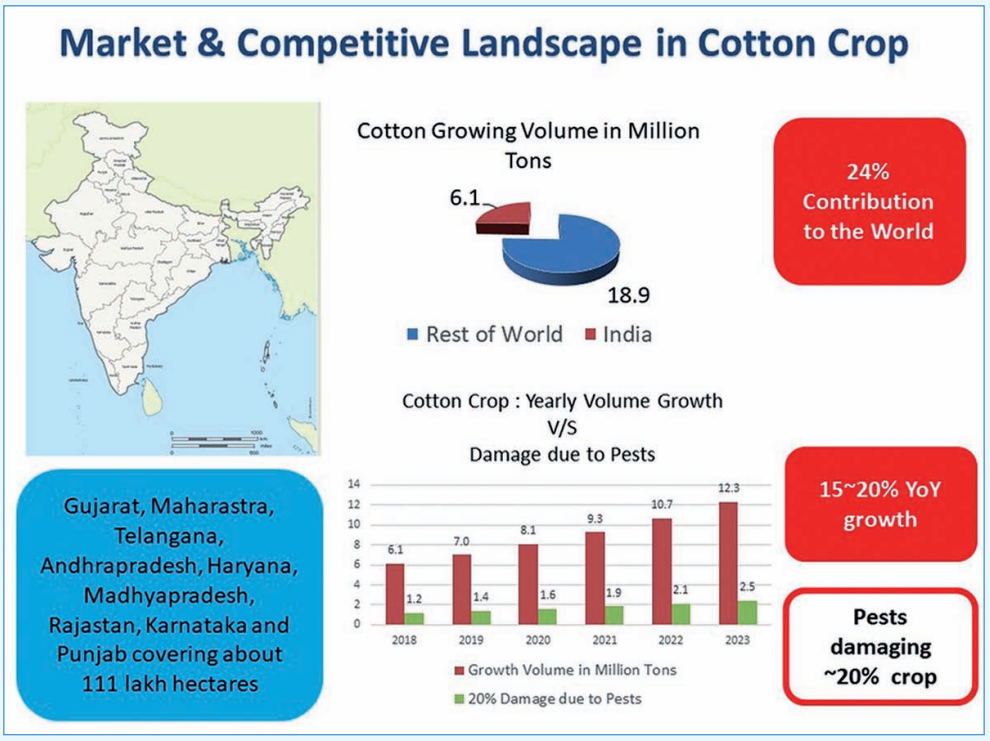
Farmers around the world face the following challenges concerned to pests:

- Low crop yield (nearly 20% loss of crop due to pest attack)
- Lack of agricultural labour (unskilled to analyse pest presence and unavailability for pesticide spraying)
- Lack of prior information on pest attack (absolutely no clue about the timing

of the pest infestation)
- Lack of technologies to avoid use of hazardous pesticides.

Focus areas

- Food crops, plantation crops, cash crops (cotton, pigeon pea, chickpea, coffee, rice etc.) and horticulture crops (fruits and vegetables).
- Being the largest producer of cotton with 25% contribution to the world India has persistent problem of cotton bollworm and the deadly pink bollworm other than the microbial infections during its cultivation. Lack of timely and appropriate management initiatives led to continuous proliferation of these pest related diseases. Hence, there is an urgent need to address these issues at a higher level using technological advancement.



Our approach our solution

- In artificial intelligence we have – drone (UAV) for pesticide spraying, pheromone nanosensors, wireless bluetooth devices and GPS software. Currently these are only individual technologies and serving specific purposes.
- It is important to combine and integrate these technologies to effectively deliver and address the need for an "intelligent and controlled pesticide spraying mechanism".
- Nanosensors will be utilized to selectively detect the presence of pheromones and kairomones in air during the spread of different diseases in cotton. The UAV (drone) integrated with these sensors will then be used to fly over the agricultural land to collect the requisite data over wireless technology based monitoring software. The data will be analyzed and mapped as per the infestation level across the field. The UAV (drone) will further be employed to approach those infected areas and spray appropriate amount of pesticides/fungicides/bactericides in a localized manner.
- Our solution eliminates human labour and therefore the dangers of exposure to harmful pesticides/ fungicides/bactericides, thus saving valuables lives of farmer community.
- The end product is an agri-technology based business opportunity having a social enterprise flavour too.

BIRAC Initiative

We learnt about the encouragement by BIRAC, DBT, through Biotechnology Ignition Grant (BIG) funding program where they nurture innovative ideas to grow and help the agriculture community. The research group, led by Professor Santanu Bhattacharya, Director and Senior Professor, IACS, Kolkata, has recently developed a few pheromone nanosensors for the selective detection of certain agricultural pests. The group collaborated with Industry partner, Mr Raghu BN, to extend this idea of localized spraying using UAV (drone). We thank BIRAC for selecting, encouraging and supporting the project with the start-up grant for its rapid development. We hope to come out with a commercially viable solution to this problem by end of 2020.

Deepa Bhagat,[a] Parikshit Moitra,[b] and Santanu Bhattacharya,[a,c,d] Raghu Burli N[e]

[a]ICAR-National Bureau of Agricultural Insect Resources, Bengaluru 560024

[b]Technical Research Centre, Indian Association for the Cultivation of Science, Kolkata 700032

[c]School of Applied and Interdisciplinary Sciences, Indian Association for the Cultivation of Science, Kolkata 700032

[d]Department of Organic Chemistry, Indian Institute of Science, Bengaluru 560012

[e]GR Agritek (P) Ltd., Bengaluru 560010

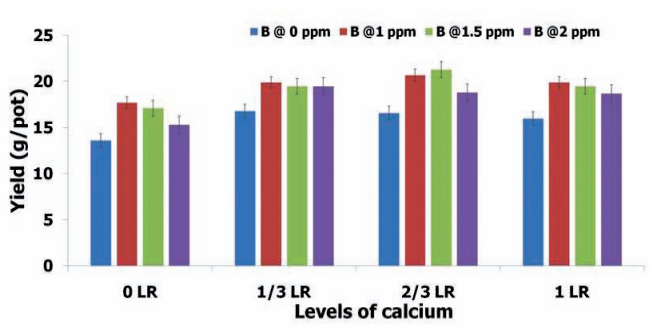
Interactive effect of applied calcium and boron on biomass yield and boron uptake by tomato in an acid soil (Alfisol)

For plant growth and development, boron (B) plays a very important role in soil. 30% of the total cultivable area in India is deficient in boron. For solving this issue, liming practices are widely done, which also increases B requirement of plant due to its similar function with calcium and formation of Ca-metaborate complex reduces availability of B in soil to a further extent. For addressing this issue, effect of applied calcium based on lime requirement with boron on yield and boron uptake by tomato in acid soils of Jharkhand (Alfisol) was studied. Based on lime requirement, experiment was conducted with four levels of Ca (0, 1/3, 2/3 and 1.0 LR) and four levels of B (0, 1.0, 1.5 and 2 mg kg^{-1}) using tomato as a test crop. From the results of experiment, it was observed that biomass yield of tomato was significantly increased with applied Ca @ 2/3 LR over full dose of Ca (1.0 LR). Significant highest biomass yield (19.6 g pot^{-1}) of tomato was recorded with application of B @ 1.0 mg kg^{-1} as compared to B @ 2.0 mg kg^{-1} treatment. The combined use of calcium @ 2/3 LR and B @ 1.5 mg kg^{-1} recorded significant highest biomass yield (21.3 g pot^{-1}) compared to all other treatment combinations. Application of calcium @ 1/3 LR showed significantly higher boron uptake (591µg pot^{-1}) by tomato plant over applied calcium @ 1.0 LR (468 µg pot^{-1}), whereas application of B @ 1.5 mg kg^{-1} significantly increased the boron uptake by tomato plant. The combined application of calcium @ 2/3 LR and B @ 1.5 mg kg^{-1} was most effective in enhancing the yield of tomato. Based on the findings, calcium @ 2/3 LR along with B @ 1.5 mg kg^{-1} can be used in low pH acidic region for enhancing vegetable production as well as for better quality of crop.

Effect of boron application on general appearance of tomato when no Ca (LR) was applied after 30 days after transplanting (B_0, B_1, $B_{1.5}$ and B_2 are levels of applied boron @ 0, 1, 1.5, 2 mg kg^{-1} respectively)

Effect of calcium and boron application on biomass yield (g/pot) of tomato at flowering stage

Levels of Ca (LR)	Levels of boron (B), mg kg^{-1}				
	0	1.0	1.5	2.0	Mean
0	13.6	17.7	17.1	15.3	15.9
1/3	16.8	19.9	19.5	19.5	18.9
2/3	16.6	20.7	21.3	18.8	19.3
1.0	16.0	19.9	19.5	18.7	18.5
Mean	15.7	19.6	19.4	18.1	
SEm (±)	0.169	0.169	0.338		
C.D. at 5%	L= 0.49	B =0.49	L x B = 0.99		



Effect of different levels of Ca (LR) application with different levels of boron on biomass yield of tomato

Effect of calcium and boron application on boron content (mg kg^{-1}) in tomato at flowering stage

Levels of Ca (LR)	Levels of boron (B), mg kg^{-1}				
	0	1.0	1.5	2.0	Mean
0	18.5	30.9	42.3	46.0	34.4
1/3	18.2	28.5	37.4	39.1	30.8
2/3	16.0	28.5	28.5	32.1	26.3
1.0	15.2	25.0	30.5	28.8	24.9
Mean	17.0	28.2	34.7	36.5	
SEm (±)	0.80	0.80	1.60		
C.D. at 5%	L= 2.32	B = 2.32	L x B = 4.64		

LR = Lime requirement

Ajin S Anil, VK Sharma, Mandira Barman, SP Datta and **Kapil A Chobhe**
ICAR-Indian Agricultural Research Institute, New Delhi 110 012

ICAR-Central Institute for Women in Agriculture, Bhubaneswar

Since inception ICAR-CIWA has been undertaking research on issues concerning women in agriculture

Established as National Research Centre for Women in Agriculture (NRCWA) in April 1996 at Bhubaneswar (Odisha) under Indian Council of Agricultural Research, New Delhi, following the recommendation of the Working Group on Agricultural Research and Education, constituted by the Planning Commission for the formulation of the 8th Five Year Plan (1992-97), the Institute has been undertaking research on various issues affecting women's role and participation and the emerging opportunities in agriculture. It focuses on participatory action research in different technology-based thematic areas involving farm women to make farm technologies suitable for them. The Institute also takes up activities to catalyze and facilitate research and development institutions to bring farm women perspective in their research and development programmes. The Directorate has been upgraded and renamed as "ICAR-Central Institute for Women in Agriculture" (ICAR-CIWA) in the year 2014 under XIIth plan EFC.

The importance of such a dedicated institution has grown manifold over the years as gender dynamics in agriculture is poised for a great change, particularly in the context of changing socio-economic, institutional, policy and natural environment. The proportion of women agricultural workers who constituted 71.8% of total women workers in 2001 came down to 65% in 2011. On the other hand, share of women in total agricultural workers that exhibited an upward trend till 2001 declined to about 37% in 2011. The direction and extent of change across Indian states also varies widely. Women in India are subject to varied forms of inequality that reduce their progress. Better understanding of women's involvement in agriculture is also a pre-requisite for planning and promoting and gender responsive actions to achieve the twin objectives of women empowerment and sustainable agricultural growth. As agriculture is less attractive economic vocation for many men and women, it becomes more important to find ways and

means for increasing the productivity of workers, more importantly the women workers, in agriculture as there will be continuous rise in participation of women in agriculture and allied tasks in future.

Timeline of development of the institute

1996 Established NRCWA
1997 Established Sub-centre at CIAE, Bhopal
2004 Occupied permanent building
2007 AICRP on Home Science (10 centres) merged
2008 Upgraded to DRWA
2013 ISO 9001-2008 Certification
2013 Established 3 more centres of AICRP (HS)
2014 Upgraded to ICAR-CIWA.

Gender related research

Since its inception, the Institute has been undertaking research on issues affecting women and their opportunities in agriculture. It is focusing on participatory action research in different technology based thematic areas involving farm women to test suitability of farm technologies for them and suggest refinement. The Institute is also working to catalyze and facilitate research and development institutions to bring farm women perspectives in their research and development programmes.

ICAR-Central Institute for Women in Agriculture (ICAR-CIWA) is exclusively devoted to gender related research in agriculture. It has been providing leadership in the field of gender research, in agriculture through network projects and AICRP centres. The Institute has demonstrated its leadership in the emerging area of research on women in agriculture. AICRP on Home Science being part of the Institute has been able to guide research in different disciplines of Home Science across the country. It has given a new direction to Home Science teaching which had remained a teaching subject with only student centric research work.

- The Institute is coordinating the AICRP on Home Science (AICRP (HS)) 13 centres in 12 states across the country in areas of Food and Nutrition, Family Resource Management, Human Development and Family Studies, Clothing and Textile, Home Science Extension Education. The main thrust of the project is to empower women in agriculture for their improved nutrition, livelihood security and drudgery reduction, occupational health hazards and capacity building of agrarian families.
- New centre of All India Coordinated Research Project on Ergonomics and Safety in Agriculture (AICRP on ESA) is also started at ICAR-CIWA Bhubaneswar during the year 2018 to take up the Ergonomical issues of women workers in rural areas.

MISSION

Generate and disseminate knowledge to promote gender sensitive decision making for enhancing efficiency and effectiveness of women in agriculture.

VISION

Emerge as a leading centre for gender research and serve as a catalyst for gender mainstreaming and women empowerment in agriculture to realize enhanced productivity and sustainability of agriculture.

MANDATE

- Research on gender issues in agriculture and allied fields
- Gender-equitable agricultural policies/ programmes and gender-sensitive agricultural-sector responses
- Co-ordinate research on Home Science.

OBJECTIVES

1. Undertake studies to assess agricultural technologies, programmes, institutions and policies to refine these with a gender perspective;
2. Create and maintain gender disaggregated databases to understand the dynamics and the effect of gender roles in different agro-ecological and production systems for strategic planning;
3. Characterize and understand drudgery and safety related issues of farmwomen and improve their work efficiency;
4. Develop gender sensitive, resilient and sustainable agricultural models and institutional innovations for nutrition and livelihood security;
5. Documentation and knowledge management of gender studies in agriculture;
6. Capacity building of various stakeholders to address gender issues in agriculture.

Research

Since its inception, ICAR-CIWA has focused on participatory action research in different technology based thematic areas involving rural women to test suitability of technologies for women and make them women friendly.

Thrust areas of ICAR-CIWA Research

- Gender disaggregated data and documentation
- Technology assessment and refinement
- Gender issues in farming system
- Drudgery assessment and reduction
- Gender sensitive extension and institution

- Agricultural policies and gender issues
- Research methodology and approaches.

MAJOR ACTIVITIES OF ICAR-CIWA

- Technology assessment and refinement in gender perspective
- Management of operational drudgery for farm women
- Livelihood and nutritional security of farm families
- Gender sensitive extension methodologies
- Repository of gender disaggregated data and policy advocacy
- Gender in Agriculture Partnership (GAP)
- Coordination and monitoring AICRP on Home Science
- Capacity building
- Consultancy services
- Human Resources Development (HRD)
- Collaborative network projects
- National programmes –
  - *Mera Gaon Mera Gaurav*
  - Tribal Sub Plan programme
  - Aspirational Districts
  - *Swachch Bharat Abhiyan.*

Infrastructure facilities

- Technology Block
- Agricultural Knowledge Management Unit
- Institute Technology Management Unit .

Technology Block

- Video Conferencing System
- Conference Hall
- Committee Rooms
- Research Farm
- Residential Quarters
- Well Equipped Laboratories
- Women Farmer's Hostel
- Trainees' Hostel
- Training-Cum-Manufacturing Unit
- Library

Women Farmers' Hostel

National and International linkages and collaboration

IRRI, Philippines, OUAT Bhubaneswar, IGKV Raipur, CUTM, Odisha, IPE Global Limited, RMS Green Affiliates LLP, Mahindra and Mahindra, Odisha Watershed Development Mission (OWDM), Odisha Panagri Consultancy (OPC) Private Limited.

Linkages, Networking and Collaboration

1. ICAR-CIWA signed MoU with Odisha University of Agriculture and Technology (OUAT), Bhubaneswar, Centurion University of Technology and Management (CUTM), Odisha for facilitating students' training/postgraduate research work.
2. ICAR-CIWA marches towards green energy - A power purchase agreement was signed between ICAR- Central Institute for Women in Agriculture and RMS green affiliates LLP for "Design, Manufacture, Supply, Erection, Testing and Commissioning including Warranty, Operation and Maintenance of 150 kWp Grid Connected Roof-top Solar Photovoltaic Plants in RESCO Model", on 9 February, 2018.
3. MOU with IPE GLOBAL LIMITED through project entitled Infrastructure for Climate Resilient Growth In India (ICRG) Programme" as "Project" awarded by DFID (Department for International Development), UK Government for Knowledge Partnership.
4. MOU with Mahindra and Mahindra for a Collaborative Project on Drudgery Mitigation.
5. ICAR-CIWA signed MOU with Panagri Consultancy (OPC) Private Limited, Bhubaneswar for gender empowerment in agriculture.

Major events of 2018-19

Honorable Union Minister of Agriculture and Farmers' Welfare, Goverment of India, Shri Radha Mohan Singh laid down the foundation stone of ICAR-CIWA Women Trainees' Hostel through E plaque from ICAR-NRRI, Cuttack on 26 February, 2019.

The Minister also visited ICAR-CIWA. He interacted with all the staff members of CIWA and encouraged scientists to bring out some women friendly novel farming technologies.

The Nodal Centre of Odisha state for *Pradhan Mantri Kisan Samman Nidhi* launching programme: This launching programme in Odisha was organized at ICAR-Central Institute for Women in Agriculture, Bhubaneswar on 24 February, 2019. The programme was formally launched at national level by the Honorable Prime Minister of India at Gorakhpur, Uttar Pradesh. A *Kisan* mela cum live webcast/ telecast of this launching programme was organized at the Institute in which

Pradhan Mantri Kisan Samman Nidhi launching programme

about 1500 farmers, Goverment Officials and scientists participated. The inaugural function was graced by Shri Gajendra Singh Shekhawat, Honorable Minister of State for Agriculture and Farmers' Welfare, Government of India, New Delhi as Chief Guest and Mr PK. Swain, Joint Secretary (Marketing), Department of Agriculture and Cooperation, Government of India, New Delhi as guest of honour.

Dr Trilochan Mohapatra, Secretary (DARE) and Director General (ICAR), New Delhi graced the *Swachhta Pakhwada* programme at ICAR-Central Institute for Women in Agriculture, Bhubaneswar on 29 December, 2018.

Swachhta Pakhwada at CIWA

The two-days National Conference on ''Revisiting Agricultural Research and Monitoring System for Developing Innovations: To Meet Newer Challenges'' was jointly organized by the Agricultural Research Service Scientists Forum and ICAR-Central Institute for Women in Agriculture at ICAR-CIWA, Bhubaneswar during 24-25 November, 2018.

Regional Expert Consultation Meeting on "Women's Empowerment for Agricultural Development in South Asia: Enabling Policy" from 5-7 September 2018. Smt Krishna Raj, Union Minister of State for Agriculture and Farmers Welfare inaugurated the meeting in which 20 representatives from seven countries attended viz; Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal and Srilanka.

Regional Expert Consultation Meeting on Womens Empowerment for Agricultural Development in South Asia

1st International Extension Congress-2018 from 1-3 February, 2018; Live Webcast of Honorable Prime Minister's Address in *Krishi Unnati Mela* 2018 during Farmers-Scientist Interface at ICAR-CIWA, Bhubaneswar on 17 March, 2018 in which around 800 farmers and farmwomen from Puri, Khordha, Nayagarh and Cuttack districts of Odisha covering 23 villages participated.

1st International Extension Congress

Live Webcast of PM's address in *Krishi Unnati Mela 2018*

RESEARCH OVERVIEW

ICAR-CIWA is carrying out basic, strategic and applied research on various gender related issues in agriculture and allied sectors with thematic approach in creating a repository of gender disaggregated data and documentation; technology testing and refinement; drudgery assessment and reduction; gender sensitive extension approach; capacity building of scientists and functionaries; efficient resource management; and gender mainstreaming.

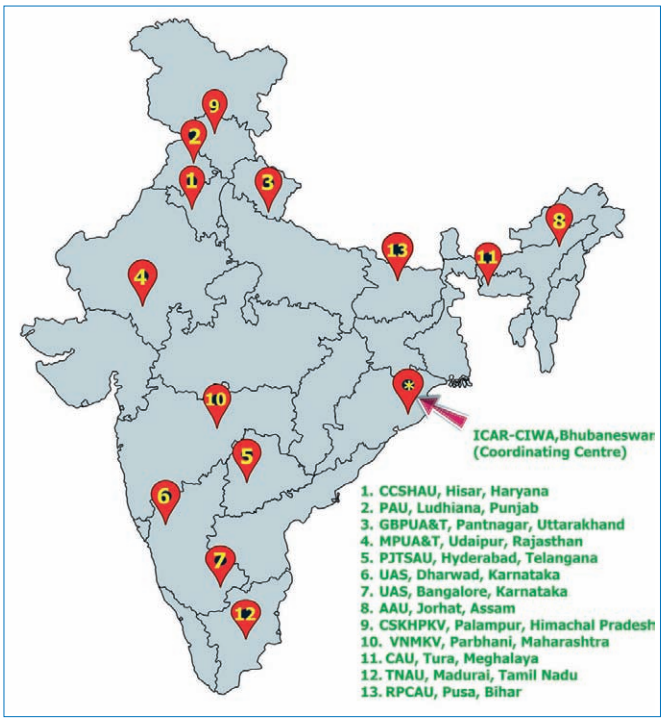
RESEARCH PROGRAMMES

1. Institutional projects
   - i. RPF based
   - ii. Inter institutional
   - iii. Externally funded

2. AICRP (Home Science)

The AICRP on Home Science is in operation in the following ten Centres/State Agricultural Universities:

- i. AAU, Jorhat, Assam
- ii. PJTSAU, Hyderabad, Telengana
- iii. GBPUAT, Pantnagar, Uttarakhand
- iv. CCSHAU, Hisar, Haryana
- v. PAU, Ludhiana, Punjab
- vi. MPUAT, Udaipur, Rajasthan.



AICRP centres

- vi. VNMKV, Parbhani, Maharashtra
- vii. CSKHPKV, Palampur, Himachal Pradesh
- viii. UAS, Dharwad, Karnataka
- ix. UAS, Bengaluru, Karnataka.

Three more new centres have been included in the XII Five Year Plan (2012-2017) viz.,

- i. Central Agricultural University, Tura, Meghalaya
- ii. Tamil Nadu Agricultural University, Madurai, Tamil Nadu
- iii. Sardar Krishi Nagar Dantewada Agricultural University, Dantewada, Gujarat.

ACHIEVEMENTS

The ICAR-Central Institute for Women in Agriculture (ICAR-CIWA) has been consistently working to understand the role and problems faced by women in agriculture. Based on research result, it has also been regularly giving inputs to researchers and policy makers for gender responsive decision making.

- During the year 2018, ICAR-CIWA Bhubaneswar has been recognised as one of the '10 Best Agriculture Institutes in India 2018' by 'The Knowledge Review', an International Education Magazine.

Some achievements of ICAR-CIWA are given below:

- Developed Multi Agency Participatory Extension Model (MAPEM) for promotion of backyard poultry by rural women
- Developed a resource efficient horticulture model including raised bed cultivation of vegetables during

rainy season, trailing system of legume and cucurbits and green leafy vegetables. This model is introduced and adopted by farmers in the villages of Giringaput, Sakhigopal and Kamaninga for yield enhancement.

- Enhanced crop protection knowledge of 556 farm women of twenty villages of Odisha in Khurda, Puri,

Manufacturing Unit

Cuttack and Jagatsinghpur districts through 19 training programmes having knowledge gap (78.4-95.2%) in use of seed treatment and bio-pesticides. Farmwomen are motivated to adopt eco-friendly pest management technologies which resulted in reduction in use of pesticides hazards.

- Popularized gender friendly IPM technologies in 10 agroclimatic zones of Odisha and provided technological support to 896 farmwomen/ farmers in the form of pheromone trap, trouble gum, and yellow sticky trap which are new interventions for them.
- Village level Para-Extension Workers (VPEWs) model has been developed to bridge the gender gap in access to extension services and strengthen the linkage between farmers/farm women and development officials by facilitating two-way flow of information.
- Developed methodologies for integrating gender in agricultural research and assessment of technologies with gender perspective; and a framework to understand relationship between gender and agricultural research and development. A Gender Work Participation Disparity Index (GWPDI) was developed to classify states/countries into low, moderate and high gender disparity categories.
- Action research on backyard poultry resulted in an increase in income of rural women by 3000 with a unit of 6-10 birds and enhanced household nutritional security of 140 farm families. Established 20 Women SHGs for Rural Poultry based farming systems.
- Two millet processing units were established-in Koraput district-managed by women SHGs.
- Developed and commercialized 'DRWA Hand Operated Maize Dehusker-sheller' a women-friendly hand operated equipment for shelling and de-husking of maize with an output of 60 kg/hr.
- Under RKVY funded project, introduced appropriate women friendly farm tools and equipments through State Departments, KVKs, NGOs and manufacturers.
- Developed 12 types of protective clothing namely, *kurta* pyjama, aprons, face cover, ear muffs, aprons etc for combating occupational health hazards in agriculture and allied sectors and adopted by 665 farm women.
- Head load manager developed by PJTSAU, Hyderabad-one of the AICRP centres of CIWA for carrying fuel and fodder and Provisional patent has been filed vide No. 2667/CHE/2014 on 30 May, 2014. It can also be used for transporting manure, seeds, harvested grains, vegetables, fodder and biomass fuel from home, farm and carrying loads in construction sites.
- Eleven gender friendly new tools were developed, tested and refined viz. Sapling carrier bin, Sapling transplanter, Sulbag bag, Rice picker, Sapling carrier bag, Hand comb, Improved sickle, Mulching tool, Head load manager, Flower harvesting bag and cotton picking bag.
- Acid treated and fermented fish silage from visceral waste of fishes to be used as poultry feed replace the costly oil cakes and fish meal in the diets of livestock, poultry and fish. 87 fisherwomen of Samudram Fisherwomen's Federation were trained and have started producing fish silage.
- Developed gender desegregated database from 27,000 women involved in farming, livestock, post harvesting and other allied activities.
- 49 entrepreneurs were established for income generation.
- Nutritional profiling of 3000 adolescent girls were carried out.

PATENTS

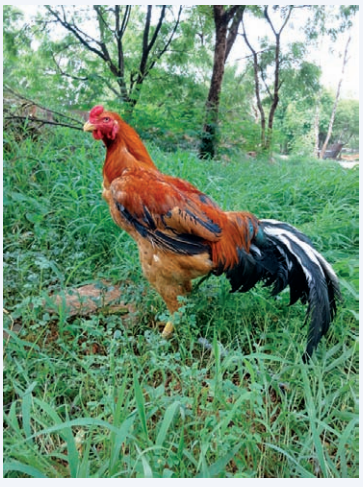
- Provisional patent has been filed vide No. 2667/CHE/2014 on 30 May, 2014 for 'Device to Manage Headload'.
- Patent granted on "Novel Plant dye", 1694/DEL/2006 dated 24/7/2006, publication dated 15/2/2008. Patent No. 249691.
- Patent on 'Sizing agent for textile applications and a method for extracting the same from L*uffa tuberosa* tubers' is filed on March 17, 2017. Patent No. R20174009292.

Dr SK Srivastava
Director, ICAR-CIWA,
Plot No. 50-51, Mouza - Jokalandi, P.O. Baramunda
Bhubaneswar 751 003. Odisha
http://www.icar-ciwa.org.in
email: director. ciwa@ icar.gov.in

Vanashree: Improved purebred native chicken

Native chickens are integral part of free-range or backyard systems of rearing in rural, tribal and hill areas of the country. However, the production potential of native chickens is considerably lesser resulting in lesser output from these systems of production. '*Vanashree'*, an improved purebred native chicken was evolved by selecting the PD-4 (Aseel) birds for higher growth and egg production for the last nine generations at ICAR-Directorate of Poultry Research, Hyderabad to address this issue. The performance of this chicken germplasm was tested at both Institute and farmers' field and impressive production performance was observed. Vanashree birds have attractive yellow coloured plumage, pea comb, yellow shank and red coloured combs, wattles and ear lobes with majestic look.

Vanashree birds in intensive system



Vanashree Male

Birds of *Vanashree* can reach market age at about 12-14 weeks of age under intensive system and around 18-20 weeks of age under backyard/free range systems of rearing depending upon the availability of feed resources in the field. Body weights recorded at 8 and 12 weeks of age were 570.6±0.21 and 1020±12.6g, respectively. Shank length at 8 and 12 weeks of age was 77.08±0.21 and 102.3±0.65mm, respectively. Body weight and shank length of male birds recorded at 20 and 40 weeks of age were 2166±15.4 and 3054±30.86g and 132.1±0.56 and 134.01±0.59mm, respectively while those of female birds at respective age were 1574±8.39g and 2072±14.83g and 106.8±0.24mm and 106.98±0.25mm, respectively.

Average age at sexual maturity observed was 159.7±0.97 days. Average survivors', hen housed and hen day egg production up to 40 weeks of age were 79.97±1.41, 78.64±1.52 and 79.46 eggs, respectively. Average egg weights recorded at 28 and 40 weeks of age were 43.44±0.23 and 48.93±0.29g, respectively. Vanashree birds produced 195±±2.61 eggs up to 72 weeks of age under intensive system in latest generation.

Liveability during 0-8 and 9-20 weeks of age was 95.35% and 98.05% respectively. Liveability of female and male birds during 21-40 weeks of age was 97.63% and 94.44% respectively. Farmers can use the fertile eggs of *Vanashree* birds to produce the subsequent generation on their own as it is a purebred line and unlike crossbred varieties there will not be reduction in the performance of birds.

There is higher demand from farmers for supply of chicks of this improved purebred native chicken.

Santosh Haunshi, U Rajkumar, MK Padhi*, Chandan Paswan and **RN Chatterjee**
ICAR-Directorate of Poultry Research, Rajendranagar, Hyderabad
*ICAR-CARI, Regional Centre, Bhubaneshwar
email: santosh.haunshi@icar.gov.in

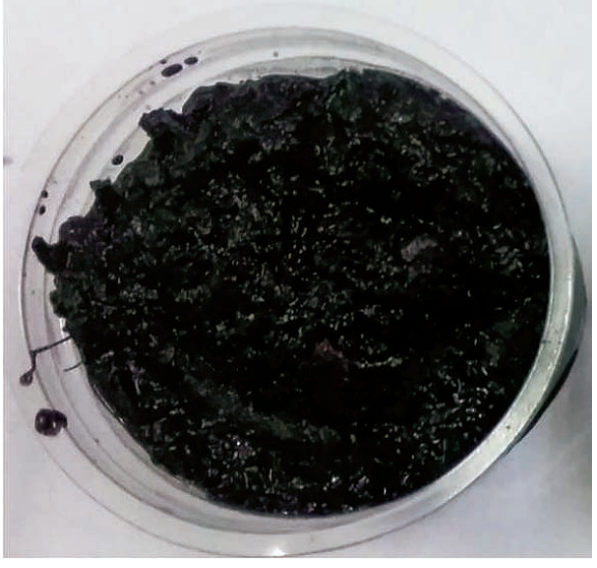
Kashi Krishna: Black carrot variety

Carrot is an important winter season salad vegetable grown and consumed throughout the world for fleshy roots having numerous categories – varying mainly in root colour (red, orange, black, yellow, purple, rainbow and cream), root shape (danvers, nantes and kuroda), flavor/taste and vernalization requirement (tropical and temperate). The presence of anthocyanins, the most versatile polyphenols and a class of pigments, is responsible for the purple and dark purple (almost black) colour of roots.

Kashi Krishna

Kashi Krishna is a variety of black carrot developed at ICAR-Indian Institute of Vegetable Research (IIVR), Jakhini, Varanasi which has been released and notified for Uttar Pradesh state by Central Seed Committee. It is tropical type, annual in nature having green colour leaves, petiole colour purple to green acropetally, root shape danvers type (triangular), bright black colour roots and self-coloured medium sized core. The roots are ready to harvest in around 95-105 days after sowing. The roots are of 22-25 cm length with root weight of 110-120 g and shoulder diameter of 3.2-3.5 cm having longer field stand for 30-35 days. The marketable root of 85-90% having harvest index of 65-70% with yield potential of 210-225 q/ha.

The fresh edible roots of *Kashi Krishna* are excellent source of various antioxidative phytochemicals i.e. anthocyanins, total phenols, total flavonoid and antioxidant potential. The antioxidant capacity of this



Halwa of black carrot

Black carrot drink without lime and Black carrot drink with lime

black carrot variety is almost 18-36 times higher than red/orange carrots and 5 times higher than beet root. Looking towards its specialty, this variety is very much suitable for salad/juice/*halwa*/drink/*kanji*/ pharmaceutical/nutraceutical uses. Anthocyanins, the phytochemicals of interest in black carrots (280-300 mg/100 g), exhibit high antioxidant activity and have a variety of health benefits such as good appetizer; anti-cancerous; glucose tolerance; anti-inflammatory; reduced risk of cardiovascular disease, hypertension and insulin resistance; and ameliorative effect against oxidative stress, eye problem and dyslipidemia.

BK Singh*, B Singh and **PM Singh**
ICAR-Indian Institute of Vegetable Research,
Jakhini 221 305
Varanasi, UP
e-mail: bksinghkushinagar@yahoo.co.in

Published by Dr Satendra Kumar Singh, Project Director, Directorate of Knowledge Management in Agriculture, Indian Council of Agricultural Research, New Delhi 110 012. *Phone:* 011-25842787; *Fax:* 011-25843285; *e-mail:* director.dkma@icar.gov.in. Lasertypeset by M/s Print-O-World, Shadipur, New Delhi 110 008, and printed in India at M/s Royal Offset Printers, A-89/1, Naraina Industrial Area, Phase I, New Delhi 110 028.

Editing : **Seema Burman** ***Design & Production :*** **Dr VK Bharti and Punit Bhasin**

WAY FORWARD

EMPIRICAL evidence confirms that there is a strong correlation between farm mechanization and agricultural productivity. Because of diverse nature of agricultural crops the mechanization requirements of different agricultural crops are widely varied and crop specific. Most critical operations like nursery raising, transplanting, earthing up, weeding and interculture etc. are generally carried out manually and are labour intensive and also involve lot of drudgery. There is an urgent need for mechanization of farm operations for agricultural production in India for timeliness of farm operations, efficient utilization of farm inputs and reduce drudgery of farm workers.

During green revolution, mechanization efforts were focused on cereal crops viz. paddy and wheat. During last two decades attention was on mechanization of pulses, oilseed, millets and sorghum crops. The seedbed preparation, tillage operations, nursery preparation, transplanting, weeding and interculture operations, harvesting and threshing, timely and efficient application of chemicals are important operations in crop management. Machines for harvesting of crops like soybean, pigeon pea, etc. need to be developed. These crops can be harvested by combine harvester with a few modifications. Efforts are also continuing for development of combine harvesters for crops like potato, onion, etc. Harvesting and threshing of agricultural crops are most labour intensive operation and contributes to major cost in production system. Failure to harvest at right stage of maturity means loss of quality and loss of market price. Different types of pumps are available. However, development of an efficient irrigation systems using basin irrigation or drip irrigation needs to be promoted.

The horticultural crop cultivation so far has continued to be excessively labour intensive and country is lagging behind with respect to horticultural mechanization. Horticultural mechanization has to be taken up in two major areas viz. enhancing productivity of labour through effective tools and implements and making available more number of farm machineries to the stakeholders. Because of diverse nature of horticultural crops the mechanization requirements of different horticultural crops are widely varied and crop specific. Operations like coconut and oil palm harvesting involve climbing on tall tree, which requires especially skilled man-power and endanger human life.

Engineering interventions in the form of appropriate technology facilitate in maximizing agricultural productivity and profitability on sustainable basis with a minimum drudgery to farm workers. There is a need to develop partnership among various stakeholders like farmers, extension workers, researchers, financial institutions, agri-business companies, policy makers and consumers for greater synergy in farm production, value addition and marketing. Knowledge centers in rural areas are needed for an effective utilization of available agricultural technologies and experiences by the farmers, to derive benefits. There is a need to have synergy between the agro-techniques and mechanization efforts to accelerate the pace of mechanization, mitigate the adverse effect of climate change, identify the remaining mechanization gaps, and technological needs.

The farm mechanization in agriculture is advocated for enhancing the efficiency of food production processes as it enhances crop productivity by 15-20%, cropping intensity by 5-22%, and gross income to the farmers by 20-30% by potentially reducing the cost of production by *ca*. 20-25%. At the same time, huge post-harvest losses are reported in the country (Source: https://www.ciphet.in/upload/sphl/MOFPI%20REPORT1.pdf). A very comprehensive survey for assessment of harvest and post-harvest losses for 45 crops and livestock produce has been carried out in 107 districts of India covering 14 agro climatic zones. The report reveals that the range of harvest and post-harvest losses was up to 6% for cereals, 8% for pulses, 10% for oilseeds, 18% for fruits, 13% for vegetables, 9% for plantation crops and spices and 11% for livestock produce. In this endeavor too, the ICAR is handholding establishment of 150 Agro-Processing Centres at the district level for processing and value addition of agro-produce available locally, as sponsored by the Union Ministry of Food Processing Industries. As an effort towards doubling of farmers' income, establishment of value chains for various agricultural commodities is being worked out and shared with the line departments for promotion.

Dr T Mohapatra, Secretary (DARE) and Director General (ICAR)

While adoption of equipments and machines in agricultural production in the country is limited, efforts also should be taken to account the small equipments, so developed for enhancing the productivity of an agricultural system, fits into the socio-economic and socio-technical environment. This would rather bring in popularization of agricultural mechanization. Further, it is time to integrate financial linkages for ensuring the functional settings of all spheres of agri-environment such as energy, human resource and market. Promotion of home-grown technologies and machines would enable confidence amongst stakeholders and ensure adoption with vital linkages as indicated above.

Major challenge before us is to improve the income generation for farm and rural families, wherein on-farm and off-farm livelihood opportunities are significant. With the growing shortage of agricultural labourers, it is important that the mechanisms behind agricultural practices and production are made energy-efficient and easy to handle. For instance, mobiles have become quite useful to the farmers to receive agro-advisories. It is time that we work upon ample opportunities that are still ahead to channelize our efforts in developing small-scale, semi- and fully automated equipments.

(T Mohapatra)
e-mail: dg.icar@nic.in