



ICAR Research Complex for Eastern Region, Patna

भारतीय कृषि अनुसंधान परिषद् का पूर्वी अनुसंधान परिसर, पटना

ICAR RCER NEWS

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“Our mandate is to undertake strategic and adaptive research for efficient integrated management of natural resources to enhance productivity of agricultural production systems in Eastern India”

Eastern region of the country need to be transformed from “Low productivity – high potential” zone to “High productivity region” for food, nutritional and livelihood securities through technological interventions. Inadequate supply of quality seed and planting material, low livestock productivity, low productivity of flood and flood plain ecologies, climate change impact, high population density (616 persons/km² compared to 382 persons/km² at national level), slow pace of mechanization, fragmented land holdings, poor supply of cost effective energy to the agricultural sector, the lowest per capita income, maximum number of economically most backward districts (69 out of 150 at national level) and thereby poverty (32.1% below poverty line population) in the region are some of the limitations of holistic agricultural development in Eastern region.

ICAR Research Complex for Eastern Region undertakes multi-commodity and

multi-disciplinary research to enhance the productivity of agricultural production systems, efficient management of available natural resources and dissemination of developed technologies in diverse agro-climatic zones of eastern region. To address the emerging needs of the farmers, Institute has developed several economically and environmentally viable technologies for enhancing food and nutritional security and farmers’ income in the region. The present issue of Newsletter contains the salient research achievements during the last six months highlighting the high productivity of September sown pigeonpea, identification of nematode and wilt resistant tomato hybrids, antioxidant potential of underutilized leafy vegetables, identification of rice genotypes for aerobic conditions, utilization of solar energy for dry season irrigation, etc.

BP Bhatt
Director

RESEARCH HIGHLIGHTS

September Arhar holds promise in North-East Plains

The temporal and spatial intensity of rainfall in North-East plains (central and eastern Uttar Pradesh, Bihar, Jharkhand, west Bengal and north-eastern states) often leads to water logging, causing partial to complete mortality of pigeon pea seedlings during rainy season. September planting may be adopted as an alternate approach to address the issue of water logging. Research conducted at ICAR RCER, Patna has shown that sowing of 'Pusa 9' during the second week of September after harvest of green cob maize provided up to 3.0 t/ha grain yield under minimum management condition (one-two weeding, one-two insecticide spray at 10 days' interval commencing from second fortnight of February).



Similarly, 'IPA 203' sown on September 20, 2018 yielded more than 4.0 t/ha under normal management condition (N:P:K: :20:40:0; two weeding; one irrigation during second fortnight of

December; spray of imidacloprid @1mL/L water, the first on 15th of February, and the second on 1st March, 2019). These findings indicate that the system is agronomically feasible, economically highly remunerative and ecologically sustainable. Besides, September arhar may be taken as one of the best alternative crops instead of growing Indian mustard/toria. Moreover, it may be suited to contingency crop planning under aberrant situation in upland ecology of north-east plains.

(AK Choudhary and Rakesh Kumar)

Performance of vegetable based cropping sequences in Eastern hill plateau region

Development of strategies for increasing the water productivity of vegetable based cropping sequences can play very important role in increasing the area under vegetables under the eastern plateau and hill region. Keeping this in view, the study is being undertaken at Ranchi to evaluate the performance of different vegetable based cropping sequences under different water management practices. In this study, the water management practices include drip irrigation (DI), drip irrigation with bicolor polythene mulch (DIM) and furrow irrigation (FI) and different cropping sequences include cabbage-okra-tomato, cauliflower-cowpea-vegetable soybean and broccoli-french bean-capsicum in *Rabi-Zaid-Kharif*. DIM resulted highest curd yields of 31.17, 27.07 and 13.01 t ha⁻¹ in *Rabi* season for cabbage, cauliflower and broccoli with respective water productivities of 9.6, 6.8 and 3.2 kgm⁻³.

In case of summer crop, DIM resulted in highest fruit yield of 6.33, 6.6 and 3.33 t/ha for okra, cowpea and french bean, respectively. DIM also showed significantly highest water productivity for these crops. The highest yield of 6.88, 6.94 and 3.26 t ha⁻¹ was observed under drip irrigation with mulch with respective economic water productivity of 29.8, 31.0 and 29.1 Rs m⁻³ for *Kharif* crops of tomato, vegetable soybean and capsicum, respectively. Thus the drip system in conjunction with polythene bicolour silver black mulch technology found effective for commercial cultivation of vegetables under different seasons in Eastern Hill Plateau Region.

(BK Jha, SS Mali and SK Naik)

Solar water pumping systems to enhance dry season irrigation in Eastern Gangetic plains

The Eastern Gangetic Plains (EGP) is characterized with by the dominance of rice-wheat and is the major contributor to rice and wheat production. Despite of technological advancements, the crop diversification and crop productivity is limited. Poor access to irrigation water, particularly during the dry season and low agricultural innovation are the twin factor responsible for land to remain fallow during dry season. At present technical, social and economic constraints have limited the effective use of groundwater and pond irrigation, and large areas of land remain fallow during the dry months. Intensive cultivation of these lands calls for better technological and social interventions. Technical interventions like

solar based ground water pumping (3hp), drip irrigation in vegetable crops and sprinkler irrigation systems for wheat were demonstrated in the farmers' field at Madhubani. The social interventions mainly focused on collective management of agriculture and irrigation infrastructure. Assessments showed that solar pump operated drip and sprinkler irrigation systems had better uniformity with uniformity coefficient of 87 and 91 % in case of sprinkler and drip, respectively. Tracking of solar panels in the pattern of morning (110°), afternoon (170°) and evening (260°) during winter season increased the daily pump discharge by 16% (81 to 95 m³/day), while during summer, tracking of panels did not affect pump discharge significantly.



The economic assessment considering actual operation of pump for three cropping seasons revealed that the unsubsidized and subsidized solar bumps of 3hp capacity will have a payback period of about 15 and 2 years, respectively. This envisaged for subsidies on solar pumping and cultivation of high value crops for shorter payback period and getting more profits from these systems. With the introduction of solar pumping systems and improved irrigation infrastructure the cropping intensity increased from 100% to 280%. The approach 'collective farming'

played a key role in managing the irrigation infrastructure (solar pumps, drip and sprinkler systems). In this approach farmers also worked collectively to complete farm operations like input purchasing, field operations and marketing. Improved technological solutions like solar pumping systems, drip and sprinkler backstopped with social interventions of ‘collective farming’ can lead to better utilization of rice-fallows and play a crucial role in improving production and productivity of the Eastern Gangetic plains.

(Santosh S Mali and A Rahman)

Identification of nematode and wilt resistant hybrids in tomato

Tomato production is limited by many biotic stresses of which root knot nematode (*Meloidogyne incognita*) and bacterial wilt (*Ralstonia solanacearum*) incur heavy yield losses. Nine F1 crosses developed from resistant germplasm were screened for resistance against these pathogens. Among them, HAT-296 x HAT-

311, Swarna Lalima x HAT-311 and HAT-296 x HAT-310 were the best in terms of yield, quality and resistance to root knot nematode and bacterial wilt.

(P Bhavana, AK Singh, S Maurya and JS Choudhary)

Evaluation of selected lesser yam genotypes for yield and nutritional traits

Lesser yam (*Dioscorea esculenta*) is an edible tuber crop of Eastern India. Seven genotypes of lesser yam were collected from Eastern and North Eastern parts of India. These genotypes were evaluated along with one check variety Sree Latha for tuber yield and nutritional traits like total carbohydrate, anti-oxidant activity and total mineral content. Tuber yield ranged from 13.36 to 30.77 t/ha. The genotype Lotni of Dr. Rajendra Prasad Central Agricultural University, Pusa, Bihar recorded the highest tuber yield followed by Adamoulu (29.79 t/ha). The range for total carbohydrate content of tuber was 17.76 to 25.15%. The genotype Adamoulu of ICAR Research Complex for North Eastern Hill Region, Barapani recorded highest total carbohydrate content followed by the genotype Lotni (22.24%). Total mineral content ranged from 407.59 to 642.55 mg/100g FW of tuber. The genotype DE-17 recorded highest total mineral content followed by Sree Latha (615.50 mg/100g FW) and Adamoulu (613.11 mg/100g FW). The anti-oxidant activity ranged between 76.91 to 218.10 mg AEAC/100g FW of tuber. The line DE-96 recorded highest anti-oxidant activity followed by the genotype Lotni (187.95 mg AEAC/100g FW). Among

		
Swarna Lalima x HAT-311	HAT-296 HAT-310	x HAT-296 x HAT-311
BWR (80% survival)	BWR (82.5% survival)	BWR (80% survival)
Nematode resistant	Nematode resistant	Nematode resistant
Yield 51.38 t/ha	Yield 43.17 t/ha	Yield 52.37 t/ha

the seven genotypes, two genotypes Lotni and Adamoulu were found to be very promising for tuber yield, total carbohydrate, anti-oxidant activity and total mineral content. These two genotypes can be promoted under tribal farming system in Eastern Plateau and Hill Region.



Lesser yam genotype
Lotni



Lesser yam genotype
Adamoulu

(RS Pan, Tania Seth, Anuradha Srivastava, Reshma Shinde, Bikash Das, Moanaro, AK Singh and BP Bhatt)

Antioxidant potential of underutilized leafy vegetables collected from Northern parts of West Bengal

A total of ten underutilized leafy vegetables were collected and identified from Northern parts of West Bengal. These underutilized leafy vegetables were collected from local haats, house premises and farmers' fields of Siliguri, Jalpaiguri, Fulbari and Maynaguri areas under Darjeeling and Jalpaiguri districts of West Bengal. The collection includes leaves, stolon and edible fern that are consumed by the local people of North Bengal. Among the collections, leaves are consumed for eight vegetables viz., *Bacopa monnieri* (Indian pennywort; Bramhi), *Corchorus olitorius* (Jute; Paat), *Leucas plukenetii* (Danda Kalash), *Lagenaria*

siceraria (Bottle gourd; Lau), *Enhydra fluctuans* (Water cress; Helencha), *Hygrophila auriculata* (Marsh Barbel; Kulekhara), *Paederia foetida* (Gadalpata) and *Typhonium trilobatum* (Kharkhol), stolon is for *Colocasia esculenta* (Taro; Kachurlati) and young fronds for *Diplazium esculentum* (Vegetable fern; Dheki saag). The antioxidant properties of these ten vegetables were estimated. The FRAP (Ferric reducing antioxidant power) content ranged from 1.7 to 41.2 $\mu\text{mol TE/g FW}$ and CUPRAC (Cupric reducing antioxidant capacity) content ranged from 4.3 to 91.3 $\mu\text{mol TE/g FW}$. The leafy vegetables *Leucas plukenetii*, *Corchorus olitorius*, *Bacopa monnieri* and *Lagenaria siceraria* recorded highest anti-oxidative properties. The study indicates that these underutilized leafy vegetables may be used as cheap and potential protective foods for healthy diet.



Fig 1: *Leucas plukenetii*



Fig 2: *Corchorus olitorius*



Fig 3: *Bacopa monnieri*



Fig 4: *Lagenaria siceraria*

(Tania Seth, RS Pan and Tanmay K Koley)

Improving livelihood of farmers through control of parasites and mineral mixture supplementation in animal: A saga of success in Jharkhand

Under the Farmers first Project being implemented by Research Centre, Ranchi of the institute, technology demonstration on area specific chelated mineral mixture and management of endo- and ectoparasites in livestock and poultry was initiated for improving the productivity of animals in four villages near Ranchi viz Malti, Kutiyatu, Pindarkom and Tetri. Benchmark survey revealed that 1565 animals are being reared by a total of 955 household in project villages. The cattle population constitute the major share (51.12%) followed by goats (30.67%), buffaloes (8.95%) and pigs (4.97%). Animal husbandry contribute a considerable proportion of income of marginal (< 1.0 ha), small (1-2 ha) as well as medium (2-5 ha) farm holding sections in adopted villages, which stands at 29.70%, 33.50% and 28.0%, respectively. Farmers from 343 households were educated and trained in use of mineral mixture as a supplement in animal feed. They were also trained to administer anthelmintic for the control of endoparasites.

Smt. Pushpa Tirkey, a small holder farmer in Kutiatu village, rears a herd of 8 cattle of which 3 are in milk. When interventions had started, she used to obtain 12.0 litres of milk per day. After 3 months of deworming and regular use of mineral mixture, all other factors remaining same, the milk yield gradually increased to 16.5 litres per day. Since

January 2019 she has also started purchasing the 'area specific chelated mineral mixture' from the market. By adoption of this technology, she has been able to increase her net income by Rs. 3000 per month approximately. The benefit cost ratio was 4.5:1.

Smt. Mariam Kachhap is a marginal farmer in Tetri village, whose main source of income is animal husbandry. She maintains a herd of 15 pigs, 12 goats and a flock of 20 hens. Every month, she used to sell at least one pig (weighing 50-60 kg) @ Rs 140/- per kg live weight, one goat (weighing 15-18 kg) @ Rs 480/- per kg live weight and 150-160 eggs @ Rs 5/- per piece. Her gross income was nearly Rs 15000/- to Rs 16000/- per month. After eight months of deworming treatment and regular supplementation of mineral mixture, the weight of marketable pig and goat were 85 kg and 22 kg, respectively. Apart from this, litter size of pig increased from 4-6 to 8 number per sow and there was no incidence of piglet anaemia. She could earn additional net income of Rs 5700/- in three months. The benefit cost ratio was worked out to be 1:1.7. It is also expected that with increased litter size, she will be able to sell at least 15-18 numbers of pig per year.

(Asit Chakrabarti, Soumen Naskar, Priya Ranjan Kumar, VK Yadav, S. Maurya, Sonal Kumari, SK Roy, AK Singh, BP Bhatt and Bikash Das)

Identification of rice genotype for aerobic condition

An aerobic rice genotype IET 25640 (RCPR 22) has been identified by Varietal Identification Committee (VIC) held on 31st May, 2019 during the 54th All Indian

Annual Rice Research Group Meetings in ICAR-National Rice Research Institute, Cuttack. IET 25640 has been identified for



Zones II (Haryana), III (Odisha, Bihar and Jharkhand), V (Chhattisgarh) and VI (Gujarat and Maharashtra). IET 25640 is a early duration (115-120 days), semi-dwarf, high yielding (4.5-5.0 t ha⁻¹), multiple stresses (drought, disease and insect pest) tolerant rice genotype with desirable cooking quality traits and high micronutrient (zinc) content. IET 25640 is suitable for cultivation under direct seeded condition in water limiting irrigated areas and rainfed shallow lowland to medium upland ecosystems. This genotype showed desirable quality parameters like high hulling (76.3%), milling (66.36%), high head rice recovery (63.2%), intermediate amylose content (22.52%), alkali spreading value (ASV=4.0) and a soft GC with very occasionally chalky and short bold grain type.

(Santosh Kumar, SK Dwivedi and JS Mishra)

Identification of rice genotype for irrigated ecosystem

A medium duration, semi-dwarf, high yielding rice genotype IET 24306 (RCPR 10) has been developed by ICAR RCER, Patna from the segregating materials of cross IR72022-46-2-3-3-2 /IR57514-PMI5-B-1-2 under ICAR-IRRI collaborative project STRASA. It is suitable for cultivation in irrigated as well as rainfed shallow lowland ecology under transplanted condition. During three years testing under irrigated medium duration trial in AICRIP programme, IET 24306 has recorded an overall mean grain yield 5729 kg/ha and showed yield gain of 17.39, 6.91 and 10.03% over national, Zonal and local checks respectively. Based on the performance in national testing programme as well as on-station and on-farm trials, IET 24306 has been found promising for Bihar state. IET 24306 is



resistant to lodging and shattering, fertilizer responsive and moderate tolerant to abiotic (drought and submergence) and biotic (several diseases and insect pests)

stresses with desirable cooking and grain quality.

(Santosh Kumar, SK Dwivedi and JS Mishra)

Water conservation in wheat under various irrigation and tillage management practices

Water conserved under various irrigation and tillage management practices in wheat (W) has been studied during 2018-19 in a field experiment. Three irrigation application methods i.e., based on farmers' practice (I1), soil moisture (I2), and deficit irrigation (I3) have been used. Irrigation applied under farmers' practice implies the application of irrigation water when the soil surface of the field is apparently dry. In soil moisture based practice, irrigation is applied when the tensiometer reading is in between 60-70 kPa, and under deficit irrigation practice, irrigation is applied at tensiometer reading in between 70-80 kPa. Wheat was grown under two tillage management practices, i.e., conventional (CT) and zero tillage (ZT). Thus, the experiment comprises of six treatments with three replications. The yields of wheat under ZT were observed higher than CT under similar irrigation application case. 4.62% higher wheat yield and 22.22% savings in irrigation water, respectively have been observed in W-ZT-I2 than W-CT-I2. 2.13% higher yield of wheat under treatment W-ZT-I2 was observed in comparison to W-ZT-I1 (5.58 t/ha) with 18.18% savings of irrigation water. There was also 18.18% less volume of irrigation applied in W-ZT-I3 in compare to W-ZT-I1, however, 3.36% less yield has been

observed in W-ZT-I3 than W-ZT-I1. Thus, this study showed that wheat grown under conventional tillage with farmers' irrigation practice can be replaced by zero tillage with soil moisture based irrigation scheduling.

(Surajit Mondal, Akram Ahmed, Rakesh Kumar)

A novel pea (*Pisum sativum* L.) phenotype with black hilum seeds and triple flower per node

A market survey on nutritive food and vegetable was conducted during year 2018-19 in which a unique character of field pea line having black hilum was seen. Black hilum is very common in cowpea but rare character in pea. To do a detail study the seed was sown in field during *Rabi* season 2018-19. It was interesting to notice that black hilum seed germinating plant produce triple flower per node. The line was characterized by normal leaf shape, profuse tendrils tall but straight plants and black hilum seeds. Further genetic stability study of this line has been planned in next growing season.



Black hilum seeds of *Pisum sativum* L. (left) triple flower per node (right)

(Kumari Shubha and AK Choudhary)

Acute phase response and serum tumour necrotic factor alpha as possible indicator of pathogenesis of *Theileria annulata* in clinical bovine Theileriosis

Study was undertaken to evaluate the acute phase response by measuring serum amyloid A (SAA) protein in *Theileria* sp. negative animal and different grades of *Theileria* sp. infected animals. Similarly, serum tumour necrotic factor alpha (TNF α) was also evaluated in these animals. SAA is one of the acute phase reactive protein present in serum of many animal species including cattle. In cattle, SAA is generally perceived as an indicator of acute inflammation, whereas haptoglobin another acute phase response protein is more slowly reacting and thus reflects the presence of chronic inflammatory conditions. SAA level in many infectious disease of cattle has been studied but not reported in bovine theileriosis. We observed significantly ($P < 0.05$) higher 41.28 ± 14.97 mg/L levels of acute phase response of SAA in clinical *Theileria annulata* with high Giemsa stained blood smear (GSBS) positive animals while non-significantly higher (12.58 ± 7.09 mg/L) in non-symptomatic *Theileria* sp. Giemsa stained blood smear (GSBS) positive animals compared to health cattle (6.78 ± 1.22 mg/L) with GSBS negative results. This indicates role of acute phase response mediated by rise in SAA level in serum in pathogenesis of clinical theileriosis. It was also observed that TNF α was significantly higher (1.89 ± 0.64) in clinical *Theileria annulata* with high Giemsa stained blood smear (GSBS)

positive animals and value was positively correlated with severity of parasitized cells compared to health cattle (0.31 ± 0.12 mg/L) with GSBS negative results. The findings are attributed to higher cytokine production (especially TNF- α) by stimulated parasitized macrophages and erythrocytes are a protective mechanism to control the parasitaemia, but it also induces toxic lesions, leading to death. This cytokine may be responsible for inducing the major clinical symptoms of acute tropical theileriosis.



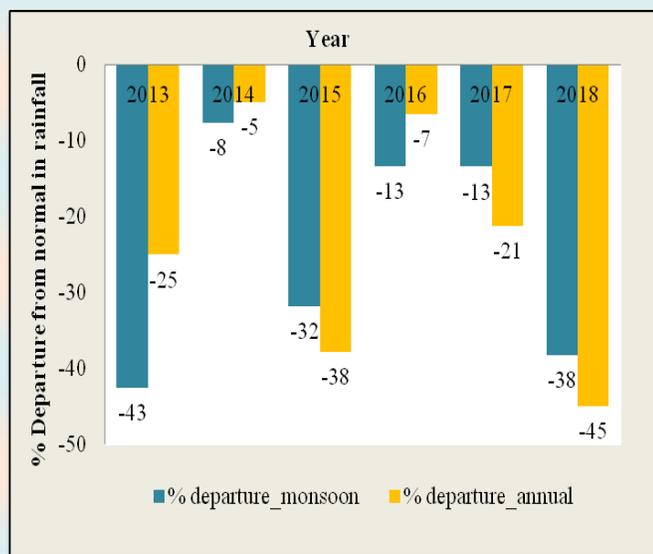
T. annulata infected cattle (Left) and tick vector (Right)

(Pankaj Kumar, Shimpi Kumari and Kamal Sarma)

Changes in rainfall pattern

Since its inception in Oct 2012, rainfall data (in mm) was recorded on daily basis during morning hours at 0830 IST (giving rains of last 24 hours) at Agrometeorological observatory of ICAR-RCER, Patna. Total annual rainfall and seasonal rainfall for monsoon months (from June – September) received in year was analysed for last six years (2013-2018). Only monsoon season was considered for analysis because it constitutes the major portion of annual rainfall which is usually more than 75 % and is the major growing season for kharif crops in the region, hence becoming more important than the other seasons. Rainfall departure (in %) from normal was

calculated for annual and monsoon time periods and it was found that this location has not yet witnessed any incidence of above normal rainfall though it remained normal for 2014 and 2016 only (departure of -19 % to + 19 % is considered as normal in meteorology) but still on the negative side. For rest of the four years observed rainfall was deficit (-59 % to -20 % is considered as deficit) in both the cases annual as well as monsoon rainfall, except for year 2017 when monsoon rainfall remained under normal category. This analysis also reveals that every year we are facing the issue of rainwater shortage with increasing trend of more deficient rainfall in the region.



Percentage departure from normal for annual and seasonal rainfall
(Manisha Tamta)

EVENTS ORGANIZED

Live telecast of Pradhan Mantri Kisan Samman Nidhi Yojna

On the occasion of launching programme of *Pradhan Mantri Kisan Samman Nidhi Yojna*, Sri Narendra Modi Jee addressed the Farmers on 24th February 2019. The live telecast broadcasting of the programme and *Krishak Vaigyanik Vartalap* was arranged by KVK, Buxar. The total number of 256 farmers participated in the programme. Officers of Line Departments were also present in the programme. In *Krishak Vaigyanik Vartalap* major focus was given on farm mechanization, crop residue management, organic farming, protective cultivation, micro irrigation and vegetable cultivation.

Skill development training programme under Agriculture Skill Council of India

KVK Ramgarh organized 200 hours skill development training sponsored by Agriculture Skill Council of India, New



Delhi on the topic “Quality Seed grower” and “Nursery Worker”. During this

programme 20 farmers/youth were selected for each of the training course.



Skill development training programme on vermicompost producer

Training programme on seed production and certification

One day training programme on seed production and certification was organized with the collaboration of Bihar State Seed and Organic Certification Agency (BSSOCA) on 6 February, 2019. Total number of 52 farmers participated in the training programme.



Training programme on integrated nutrient management

A training programme of 15 days certificate course for fertilizer input dealers were organized by KVK, Buxar during 1 March to 18 March 2019. Total number of 39 input dealers was enrolled for training programme. Training programme was inaugurated by Sub

Divisional Officer, Buxar Sh. Krishna Kumar Upadhyay.

Field day on Oilseed and different Pulses

KVK Buxar organized the field day on oilseed crop “Mustard” and different pulses “Pigeonpea, Chickpea, Lentil and field pea” demonstrated in farmer’s field to popularize the demonstrated technology amongst the gathering of farmers. In each field day scientific staff, technical staff, social workers, members of FPO and progressive farmers and farm women’s were participated and know about the demonstrated technology in the different crops.



Farmers training on recent advances in goat production and management

Series of three 3 days training programs sponsored by Kosi Basin Development Program was conducted for stake holders of Kosi region. The first training was successfully conducted from 13-15 June, second one from 19-21 June and third training from 25-27 June, 2019. A total of 83 farmers were trained under the programme. Recent developments in goat rearing for augmenting goat

productivity vis-à-vis endurance of livelihood security was discussed with the participating farmers. Few important topics covered under the programme included housing management of goats, goat feeding and nutrition, round the year fodder productivity, breeds and breeding techniques in goats, and economically important diseases of goats and health care management. Apart from classroom discussion, the farmers were taken to the institute goat farm and were shown scientific practices of managing goats for higher profitability. One of the training programme was graced by Shri Vinod Singh Gunjyal, IAS, Director, Department of Animal & Fisheries Resources, Govt. of Bihar, in which he explained the farmers about various government schemes on goat rearing and informed the farmers to avail maximum benefit out of them.



Celebration of international yoga day

ICAR Research Complex for Eastern Region, Patna celebrated 5th International Yoga Day on 21st June, 2019. To mark the occasion, Director ICARRCER, Patna

along with the scientists and staff of the institute performed Yoga from 8:00 AM to 9:00 AM under the instruction of Dr J.J. Gupta, Principal Scientist and Yoga Expert of the institute. He also briefed about the importance of practicing yoga in controlling an individual's mind, body and soul. The Director of the institute also narrated that the yoga brings together physical and mental discipline to achieve a



peaceful body and mind and helps in managing stress and anxiety and keeps relaxing the individuals. He also emphasized that yoga helps in increasing flexibility, muscle strength and body tone besides improvement in respiration, energy and vitality. Regular practice of yoga can help lose weight, relieve stress, improve immunity and maintain a healthier lifestyle. An essay competition on a topic entitled "Role of yoga in the context of Indian Agriculture" was organized among the employees of the Institute. Yoga day was also observed at its research centers at Ranchi and Darbhanga, and KVKs at Buxar and Ramgarh.

AWARDS

- **A. Upadhyaya** was conferred 'ISAE Fellow Award – 2018' for his valuable contributions to the field of Agricultural

Engineering by Indian Society of Agricultural Engineers at BHU, Varanasi on 28 January, 2019 at BHU, Varanasi.



- **A.K. Choudhary** received the 'Best Researcher Award' from EET CRS, Research Wing for Excellence in Professional Education & Industry, Noida (Delhi NCR) on January 27, 2019.
- **Nongmaithem Raju Singh** has been awarded ASPEE Foundation Gold Plated Silver Medal in the Fourteenth Annual Convocation of Navsari Agricultural University, Navsari held on 10/01/2019 for securing the highest Overall Grade Point Average and rating of the thesis in the Degree of Ph.D. (Forestry).
- **Pankaj Kumar** received Best Scientist Award from EET CRS, Research Wing for Excellence in Professional Education & Industry, Noida (Delhi NCR) on January 27, 2019.

OUR NEW COLLEAGUES

- **Mrs. Arti Kuimari**, Scientist w.e.f. 12-04-2019
- **Mr. Sanjay Kumar**, Technical Assistant (Library) w.e.f. 04-05-2019

RETIREMENT

- **Shri Bisheshwar Oraon**, SSS, 30-06-2019

EDITORIAL COMMITTEE

JS Mishra, Pankaj Kumar, Surajit Mondal, PK Sundaram and Bikash Das

ICAR Research Complex for Eastern Region
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