

## Potential pathways for increasing the productivity of wheat and barley\*

The 55th All India Wheat and Barley Research Workers' Meet was organized to review work done under the All-India Coordinated Wheat and Barley Improvement Programme during 2015–16 and finalization of work plan for 2016–17.

Trilochan Mohapatra (Indian Council of Agricultural Research (ICAR), New Delhi) in his inaugural address congratulated wheat workers for their efforts towards self-sufficiency in production and stressed for strong collaboration with International Maize and Wheat Improvement Center (CIMMYT, Mexico) for achieving world food security. He also remembered M. V. Rao for his significant contributions. He emphasized to increase productivity of wheat from 3 tonne/ha to 5 tonne/ha by exploring the possibility of using rust resistant genes from rice.

S. S. Siwach (Chaudhary Charan Singh Haryana Agricultural University (CCSHAU), Hisar) presented the wheat production scenario in Haryana. G. P. Singh (ICAR-IWBR) emphasized on achieving the projected 140 million tonnes wheat production by 2050. He mentioned that 11 wheat varieties were notified during 2015–16. He also informed that IWBR was the first in the world to sequence Karnal bunt genome and assured that the coordinated programme will proactively handle the new emerging issues, including wheat blast reported across the Indo-Bangladesh border.

J. S. Sandhu emphasized strong monitoring, use of genomic tools, value addition and bridging yield gaps by effective resource management for attaining potential yield.

Martin Kropff (CIMMYT) appreciated the Indian wheat programme for a strong association with CIMMYT and being proactive in introducing semi-dwarf

wheat leading to the green revolution. Gurbachan Singh (Agricultural Scientists Recruitment Board, New Delhi) stressed on 'doubling farmers' Income' through increasing the productivity or savings on inputs. He also emphasized on developing high-yielding varieties with more straw to meet the fodder demand. K. P. Singh (CCSHAU) highlighted contributions made by the university in the development of high-yielding wheat and barley varieties. He added that Haryana was honoured twice with the Krishi Karman Award for highest wheat productivity during 2010–11 and 2011–12. He also remembered the contributions of Rao Bahadur Choudhary Ram Dhan Singh, who was honoured with the Sir Maynard Ganga Ram Prize.

Subject-wise concurrent sessions were organized to review the research done during 2015–16 and setting the agenda for 2016–17. A special session on 'Strategies to increase productivity of wheat and barley under changing climate scenario' was also organized. Kropff in his presentation on wheat research for sustainable food security, emphasized that more food has to be produced using cutting-edge research. He suggested collaborative research between ICAR and CIMMYT apart from implementing open-access data and cross-border germplasm exchange. H. S. Dhaliwal (Eternal University) indicated that *Aegilops* sp. can be used as a donor for powdery mildew, higher iron and zinc content and abiotic stress tolerance. D. S. Brar (Punjab Agricultural University (PAU), Ludhiana), emphasized exploitation of diverse germplasm, physiological breeding, identification and transfer of yield-enhancing loci (*yld1*, *yld2*) from wild species leading to increased biomass and productivity. He suggested for developing apomictic cereals, functional genomics and designer crops, C4 wheat, high-throughput protocols and identification of heterotic gene blocks. H. S. Gupta (Borlaug Institute for South Asia, New Delhi) discussed that hidden hunger in the form of mineral deficiency is costing US\$ 17.2 billion which is 2.5% of GDP. New technologies, germplasm exchange and collaboration with national and in-

ternational institutions can address these issues. He suggested studying the epidemiology of yellow rust and also emphasized on developing varieties to combat terminal heat.

In the session on 'International wheat and barley research', Wolfgang Pfeiffer mentioned that to address the challenge of micronutrient deficiency, an interdisciplinary global alliance 'HarvestPlus' involving more than 200 scientific staff spread over 40 countries is operational. He also asserted that non-contaminating mills/grinders have been developed and distributed to CGIAR & NARS partners to correctly identify the genetic variation. R. P. S. Verma highlighted the association of ICAR with ICARDA barley research programme for over 30 years. He also mentioned that in the forthcoming phase (2017–2022), priority will be to grain legumes and dryland cereals. Robert Park (Sydney University, Australia) presented details on controlling cereal rust in Australia by integrating pathology, genetics and pre-breeding. He was of the opinion that pre-emptive resistance breeding has been successful in dealing with local pathogen variability, but less successful in exotic incursions. Sukhwinder Singh (CIMMYT) delivered a speech on 'Harnessing gene bank and pre-breeding germplasm pool towards next generation climate smart wheat improvement' in which he emphasized that the current yield gain (0.9%) in wheat has to be increased to 2.4% to meet the global need by 2050. D. P. Singh (ICAR-IWBR) spoke on 'Status of wheat blast in South Asian region' and confirmed that there is no incidence in India. Marcellis Acevedo (Cornell University, USA) focused on 'Building the Borlaug Global Rust Initiative to deliver genetic gain in wheat'. Sridhar Bhavani (CIMMYT) elaborated on the efforts and challenges at Kenya in combating stem rust. Ratan Tiwari discussed questions related to the genome sequencing aspects of wheat accomplishment till now, future requirements and benefits, and time-frame to reach the end-users.

The other sessions were programme review for 2015–16 and progress of research in the Central Zone (CZ). The

\*A report on the 55th All India Wheat and Barley Research Workers' Meet held at Chaudhary Charan Singh Haryana Agricultural University (CCSHAU), Hisar from 21 to 24 August 2016, and organized by the ICAR-Indian Institute of Wheat and Barley Research, Karnal in collaboration with the CCSHAU, Hisar.

work plan was formulated for each research team through participatory approach.

Crop improvement team recommended to revise the sowing time under irrigated timely sown (from 10–20 to 1–15 November) and late sown (15–25 to 10–25 December) trials in North West Plains Zone (NWPZ). Yield limit for acceptance of trials in North Hills Zone (NHZ) under rainfed and late sown restricted irrigation was raised by 5 q/ha from the existing level. Targeted breeding programme for developing new genotypes responsive to higher inputs and conservation agriculture practices and developing genotypes with long coleoptiles for deeper seeding to enhance anchorage and lodging tolerance was also a part of the recommendation.

Resource management group recommended adopting zero tillage for better income since yield levels in zero and conventional tillage were almost the same. To improve the nitrogen use efficiency, urea top dressing should be done just before irrigation, which also gives higher productivity; application of Green Seeker technology will improve the efficiency further. Relay cropping of wheat in cotton should be adopted for higher productivity and profitability under cotton–wheat system in which seeding of wheat can be done by broadcasting dry or sprouted seed just after irrigation or zero till drilling by removing alternate rows of cotton using 25–50% higher seed rate.

Crop protection group recommended multiple disease/insect pest-resistant genotypes, contribution of entries in na-

tional genetic stock nursery and reconstitution of wheat disease monitoring nursery for research. The group recommended that susceptible varieties should be sprayed with propiconazole @ 0.1% to contain yellow rust at the time of initiation of symptoms, Fipronil 5 SC @ 125 g/ha mixed in 80 kg sand as broadcasting at crown root stage followed by irrigation for termite control, and foliar sprays of *Metarhizium anisopliae* @ 3 g/litre of water and *Beauveria bassiana* @ 5 g/litre or biocontrol of foliar aphids in wheat.

Wheat quality team recommended strengthening linkages with the industry, involving interested bakers/millers in research planning and product development, improving wheat quality for different products, developing varieties suitable for biscuits and incorporating nutritional quality traits in breeding programmes.

Barley network recommended 60 kg(N)/ha under rainfed conditions in NHZ (2/3 as basal and 1/3 after first rain/snowfall); application of Pinoxaden @ 40 g/ha + carfentrazone @ 20 g/ha or Pinoxaden @ 40 g/ha followed by metsulfuron @ 4 g/ha for weed control in NWPZ; application of Pinoxaden @ 40 g/ha + metsulfuron @ 4 g/ha or Isoproturon @ 750 g + metsulfuron @ 4 g/ha for weed control in NHZ; residue retention @ 6 tonne/ha to enhance productivity and quality under rice–barley cropping system; broadcasting of overnight-soaked and shade-dried barley seed @ 150 kg/ha for relay cropping in cotton and sown during 18 November–2 De-

cember under cotton–barley cropping system to enhance the quality and productivity of barley as well as of cotton.

Social sciences emphasized on timely release of funds to carry out the frontline demonstrations and monitoring, and agreed to conduct demonstrations on the use of 'hydrogel' at ICAR-IIWBR, Karnal in the context of producing more crop per drop.

The varietal identification committee considered a total of nine proposals (eight wheat and one barley) and gave the following recommendations: In wheat, HD3171 and K1317 were recommended for rainfed timely sowing in NEPZ; HI8759(d) for irrigated timely sowing in CZ; MACS3949(d) and HI1605 for rainfed and irrigated timely sowing in Peninsular Zone; PBW723 for irrigated timely sowing in NWPZ. The decision on WB2 and HPBW02 for irrigated timely sowing in all zones was kept pending subject to resubmission considering zone-wise superiority in yield and zinc. In barley, DWRB123 for irrigated timely sowing in NWPZ.

Finally, based on the deliberations and discussions during various technical sessions, as well as recommendations given under each session, the plan of research for the ensuing *rabi* season 2016–17 was finalized.

**Gyanendra Pratap Singh\*, R. K. Sharma and R. Sendhil**, ICAR-Indian Institute of Wheat and Barley Research, Karnal 132 001, India.

\*e-mail: directoriiwbr@gmail.com

## MEETING REPORT

### Pomegranate fruit cracking in dryland farming\*

In India, livelihood security of 70% of the farming community is dependent on success or failure of crops in drylands. Pomegranate is one of the most suitable

horticultural crops that promises sustainable livelihood security in these regions due to its very high return on investment (ROI), and good performance in dryland areas with very low requirement of irrigation. Pomegranate fruits are in great demand in the domestic as well as export market. Further, the fruit has tremendous potential for value addition due to its total utilization as food and pharmaceutical ingredient. A modest estimate of ROI in pomegranate ranges from Rs 2.00 to Rs

10.00 lakhs/ha as net profit against Rs 1.00–2.00 lakhs/ha from traditional crops in dryland farming.

Arid and semi-arid regions occupy almost 53.4% of India's land area, where rainfall is erratic and often comes in a few heavy spells of short duration resulting in high run-off, instead of replenishing the groundwater. In the dry ecosystem, climatic variability results in the regressive pedogenic processes which modify the physical, chemical and biological