



(ICAR-Indian Agricultural Research Institute Regional Station, Shimla-171 004, Himachal Pradesh, India)

Decadal Salient Achievements

PREFACE



North-Western Himalayan region comprising two hill states Himachal Pradesh, Uttarakhand and two union territories, Jammu & Kashmir and Ladakh, where wheat is a staple food and horticulture is lively hood economy of the people. I am happy to note that Regional Station at Shimla is bringing first issue of

Himgiri-Newsletter highlighting its decadal salient achievements on cereals and horticultural crops. Among 20 wheat and 9 barley varieties developed by the Station, two high yielding genotypes HS542 and HS562 and one barley variety BHS400 were released and notified by CVRC for cultivation in North-Western Himalayan region during the last 10 years.

Around 370q breeder seed of above two wheat varieties has been supplied to the seed producing agencies so as it is made available to the hill farmers under seed chain. Additionally, 15 genetic stocks developed through conventional and molecular marker assisted breeding were registered. DH1 an unique genetic stock resistant to stripe rust developed through *Imperata* mediated doubled haploidy approach was also registered with NBPGR.

A unique walnut genotype identified named as "Pusa Khor", came into bearing after 2 years of its grafting. It has both lateral and terminal bearing features. Besides, a dwarfing rootstock belongs to *Prunus japonica* is identified as a rootstock for temperate stone fruits. RT-PCR protocol for detection of 5 apple viruses and one apple scar skin viroid deteriorating apple quality have been optimized. In addition to research, farmers field days, training programs for farmers under TSP, MGMT and Front Line Demonstrations were also organized. During this period the scientists brought many laurels including the most prestigious fellowship awarded to Dr. Dharam Pal by the NAAS.

I am sure that the technical information highlighted in this Newsletter would be extremely useful to its readers. I wish to congratulate all those who contributed their work for this e-Newsletter and the editors for bringing out the first issue.

Dr. AK Singh
Vice-Chancellor & Director, ICAR-IARI

RESEARCH

Improved wheat varieties for North Western-Himalaya

HS542 (Pusa Kiran) is a bread wheat variety released and notified for cultivation in Northern Hills Zone (NHZ-Himachal Pradesh, Uttarakhand, Jammu & Kashmir and North-Eastern States) of India. It is high yielding genotype giving an average grain yield of 33.0q/ha under early sown rainfed situations.



Possessing chapati making quality score 7.88/10. This variety is also good for bread making. Around 152q of breeder seed has been supplied to seed producing agencies under seed chain so as to ensure its availability for the hill farmers. HS542 is a suitable substitution for wheat varieties HS277 and VL829.

HS562 is a bread wheat variety released and notified for cultivation under rainfed and irrigated conditions of NHZ. It is high yielding genotype giving an average grain yield of 36.0q/ha under timely sown rainfed situations. It yields up to 52.0q/ha under irrigated conditions. Possessing adult plant resistance to leaf and stripe rusts. Rich in micronutrients like Fe (38.4ppm) & Zn (34.5ppm) contents. Also possess chapati and bread making qualities.



Around 221q of breeder seed has been supplied to seed producing agencies for its large scale seed production so as to ensure its availability for the hill farmers. HS562 is a suitable substitution for wheat varieties HS507, HPW349 and VL907.

Genetic stocks of wheat developed through molecular marker assisted breeding

HS628, is developed from a cross HS240*2/FLW20 (Lr19)//HS240*2/FLW13 (Yr15) using Bulk-Pedigree method of breeding. It has shown resistance to all the pathotypes of brown rust except 77-8. It is also carrying rust resistance to all the pathotypes of yellow rust and black rust. HS628 has been validated to carry Lr19/Sr25 using molecular marker wmc221 (Fig.1). The rust resistance gene pool present in HS628 would be a useful source for developing potential rust resistant genotypes in India.

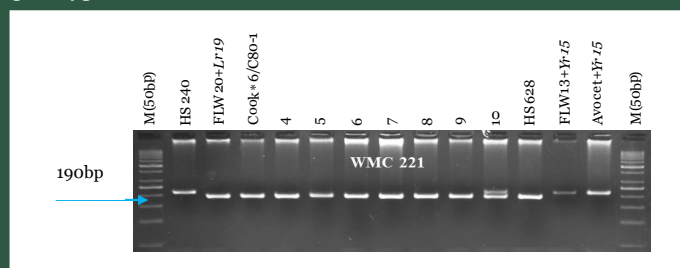


Fig 1: Validation of HS628 for Lr19/Sr25 with wmc221

HS661, is developed from a cross HS295*2/FLW20 (Lr19)//HS295*2/FLW13(Yr15) using Bulk-Pedigree method of breeding. HS661 carry for seedling resistance to wide array of rust pathotypes of all the three rusts. HS661 has been postulated and validated to carry Lr19/Sr25 using molecular marker wmc221. The rust resistance gene pool present in HS661 would prove a useful source for developing potential rust resistant genotypes in India.

Germplasm with multiple genes for rust resistance

Two genotypes IND393 (G16) and WBM3934 (G12) were identified to carry Lr19/Sr25, Lr24/Sr24, Lr34/Yr18/Pm38/Sr57 and Lr24/Sr24, Lr34/Yr18/Pm38/Sr57, Lr46/Yr29/ Pm39 gene combinations, respectively (Fig. 2). These multiple gene sources of resistance prould prove useful in rust resistance wheat breeding.

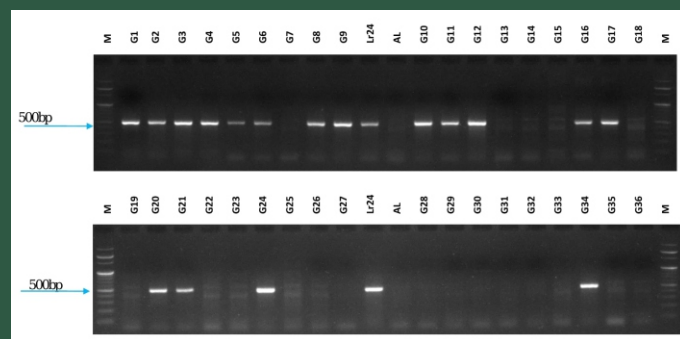


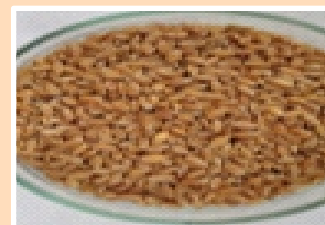
Fig.2: Lane M-100bp ladder, 1-36: genotypes; G1 to G6, G8, G9, G10 to G12, G16, G17, G20, G21, G24, G34 showing amplification of Sr24#12 marker for Sr24/Lr24; Lr24(+ check)

Wheat Genotypes Developed via Doubled Haploidy Approach

A total of 18 doubled haploid genotypes were developed through Imperata mediated doubled haploidy.

DH-1:

Doubled haploid genetic stock was developed following Imperata cylindrica mediated chromosomal elimination technique by crossing wheat F₁s (HS542/ China 84-40022) with Imperata cylindrica. It has shown resistance against all the prevailing pathotypes of stripe and leaf rust in seedling stage (except for 77-5 race of leaf rust) and is also resistant to both the rust in adult plant stage.



Improved Barley variety for North Western-Himalaya

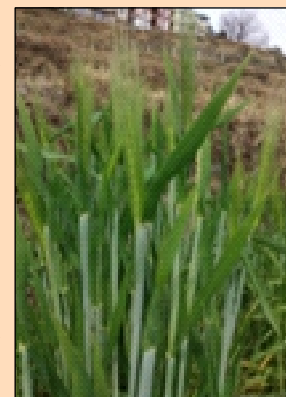


BHS400 (Pusa Sheetal) is a six rowed hulled barley variety suitable for cultivation in Himachal Pradesh, Uttarakhand, Jammu & Kashmir. It is high yielding genotype giving an average grain yield of 32.7q/ha under timely sown rainfed situations of this region. Possessing resistance to stripe rust.

Genetic Stocks of Barley Registered

BHS474 (BBM 777) is a barley (*Hordeum vulgare* L.) genetic stock resistant to all the prevailing pathotypes of stripe and leaf rust at seedling stage and adult plant stage. BHS474 also possesses seedling resistance against all the pathotype of stem rust except for pathotype 11.

BHS 478 (BBM 800) is resistant against all the prevailing pathotypes of stripe and leaf rust at seedling stage. Also shown resistance to both the rusts at adult plant stage.



Horticultural Crops

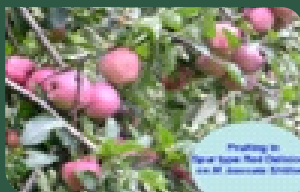
Apple hybrids in fruit growers orchards

Pusa Amartara Pride is an apple hybrid developed by crossing Royal Delicious and Prima (Scab Resistant Variety) with objective to produce Apple Scab Resistant variety having good quality of Royal Delicious. It is 7 to 10 days earlier than Royal Delicious and having good colour than Royal Delicious.

Pusa Gold is another apple hybrid developed by crossing Golden Delicious and Tydeman's Early Worcester (TEW) with objective to produce Early variety having good quality of Golden Delicious. It is earlier than TEW and having both colour development of Red and Golden. It is tasty and juicy as well as having good shelf life. It is also used as pollinizer for early varieties of apple.

Pusa Apple Rootstock-101 Identified

PAR-101 is a selection from *Malus baccata* Shillong. It is often cross pollinated and seedlings raised from the seeds collected from bagged flowers exhibit more homogeneous, semi vigorous growth.



It has graft compatibility with commercial cultivars with semi-vigorous canopy. Planting distance of 3m × 3m is ideal for high density orcharding for stable and sustainable yield by optimum utilization of sunlight interception, photosynthesis and uptake of nutrients. The scion wood grafted on PAR-101 starts bearing from 4th year onward. Chilling unit requirement is < M9 and MM106 making it suitable to low elevation areas. Easy to propagate through mound layers, hard wood cuttings through bottom heated technique. Fruit yield is > 25 tons/ha when grafted Spur Type Red Delicious on it. It has shown resistance to powdery mildew, moderate resistance to apple scab and tolerance to white root rot. Highly resistance to woolly aphid.

Dwarfing root stock for stone fruits identified

The dwarfing rootstock belongs to *Prunus japonica* has been identified as a rootstock for temperate stone fruits viz., apricot, peach, plum, nectarine, prune, almond and cherry. This rootstock has potential to be used as dwarfing rootstock which could be used in high density plantations as well as kitchen/roof gardening.



Unique Walnut Genotype Identified

A unique walnut genotype identified from Chamba district of Himachal Pradesh named as "Pusa Khor", came into bearing after 2 years of its grafting. It has shown both lateral and terminal bearing habit. "Pusa Khor" bore almost 60.9% laterally and 39% fruits terminally; while all the fruits borne terminally by other walnut trees. The oil per cent was recorded 55.4 and 49.8, respectively. This walnut genotype at the age of 4 years showing cluster bearing habit of 7 fruits in bunch.



Walnut genotype showing cluster bearing habit

Integrated management of diseases in fruit crops

RT-PCR protocol for detection of 5 apple viruses viz., Apple Chlorotic Leaf Spot Virus (ACLSV), Apple Mosaic Virus (ApMV), Apple stem pitting virus (ASPV), Apple Stem Grooving Virus (ASGV), Prunus necrotic ringspot virus (PNRSV) and Apple scar skin viroid (ASSVd) were optimized (Fig 3).

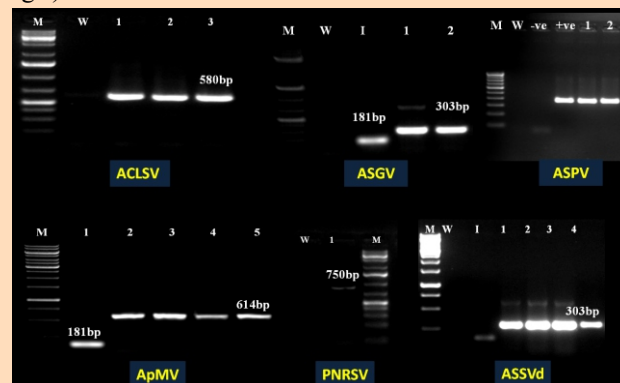


Fig. 3 Optimization of PCR protocol for detection of viruses

- ASSVd infection not only deteriorate the quality of apple fruits but cause huge losses in term of yield, as 17.80 quintal less fruit production was recorded in the affected orchards.
- Among 8 fungicides (03 contact, 04 systemic and 01 contact + systemic) evaluated against *Marssonina coronaria* causing premature leaf fall (PLF), tebuconazole +trifloxystrobin, fluxapyroxad +pyraclostrobin and fluopyram + tebuconazole were found to be effective to control PLF.

A total of 267 virus-free elite mother selected from Trans-Himalayan region of India were indexed through DAS-ELISA and RT-PCR. Only 4.86% plants were found free from virus/viroid infection. For sustainable supply of quality planting material, these virus free elite mother plants were multiplied and distributed to the farmers for establishment of mother blocks in different sites of Kinnaur and Lahaul-Spiti. Besides, ecofriendly woolly aphid trap was developed to manage the apple woolly aphid and popularized among the farmers of Trans-Himalayan region of India.

Extension

Transfer of technologies through TSP, SCSP & MGMG

Training programs were organized on "Improved technologies of Horticultural and cereal crops" for Scheduled Tribe farmers in Mehala (Chamba), Lari, Batsari and Sapni (Kinnaur) of HP. One hundred farmers participated in each training. Kits containing fungicides, nutrients, shade net, tree guard, anti-hail net, anti-bird net, apple plants, folders were distributed to the farmers. During scientist-farmers interaction queries of farmers were addressed.

Farmer's field days and front line demonstrations were organised to popularise IARI technologies among the hill farmers.



Awards/Recognitions

Scientist	Award/Recognition
Dr Dharam Pal	NAAS Fellowship, Nana ji Deshmukh ICAR Multidisciplinary Team Award (as associate), ISGPB Fellowship, SAWR Fellowship
Dr KK Pramanick	STA Fellowship, INSO Outstanding Scientist Award, SSDAT Fellow, Life Time Achievement Award by STA & SSDAT, GMF Award
Dr AK Shukla	APJ Abdul Kalam Award by STA, Young Scientist Award by JTA, Fellow of ISAH and JTA.
Dr Madhu Patial	Nana ji Deshmukh ICAR Multidisciplinary Team Award (as associate), The woman of excellence award by Vigyan Varta and Omm Shanti Narayan Foundation Trust.
Dr S. Watpade	Young Scientist Award-GNRSA-2020.

Research Publications

Research Papers in >10 NAAS Score Journals : 06
 Research Papers in 6 to <10 NAAS Score Journals : 34

Externally funded DBT/DST projects sanctioned

- Genetic enhancement of wheat by pyramiding of rust resistance genes through molecular approaches in Northern hills of India (Budget: 32.28 Lakh)
CCPI: Dr Dharam Pal.
- Establishment of virus free elite mother block of apple in the tribal areas of Kinnaur and Lahaul Spiti in Himachal Pradesh (Budget: 40.37 Lakh)
PI: Dr. Santosh Watpade.
- Genetic enhancement of rust resistance in wheat through MAS and Imperata cylindrica mediated doubled haploidy approach (Budget: 35.00 Lakh)
PI: Dr. Madhu Patial
- Characterization, race profiling and genetic analysis of wheat powdery mildew pathogen (*Blumeria graminis* f.sp. *tritici* (DC) Speer (Syn. *Erysiphe graminis* DC.f.sp. *tritici*) in India (Budget: 76.32 Lakh) CC-PI: Dr Santosh Watpade.

Compiled & edited by

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