KHUDWANI

Mountain Research Centre for Field Crops
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Jammu & Kashmir

Given the great economic importance of the crop, rice improvement work was started in the State during early 1950s with the establishment of Rice Research & Regional Station, Khudwani, Anantnag (1560 m amsl) with a well defined mandate of evolving high yielding, early maturing rice varieties having built-in tolerance to the biotic and abiotic stresses prevalent in the target environment. The Research Station has an area of 20 ha out of which 15 ha are available for research and seed production purposes. To cater to the needs of high altitude region, High Altitude Rice Research Sub-Station, Larnoo, Anantnag (2286 m amsl), having an area of 2.9 ha, was set up in 1978 under the administrative and technical control of Khudwani Station. With the establishment of Sher-e-Kashmir University of Agricultural Sciences and Technology in 1982, the station was transferred to the University and re-designated as Rice Research and Regional Station, presently known as Mountain Research Centre for Field Crops (MRCFC), Khudwani.

Major contributions to AICRIP

Crop Improvement

Plant Breeding

Varieties/hybrids released/identified

- Recent releases, particularly Shalimar Rice-1, Shalimar Rice-2 & Shalimar Rice-3 usually churn out around 10 t/ha in station trials Though the rice varieties with a genetic yield potential of 4.5-5.0 t/ha have been developed for high altitudes of Kashmir valley, having reasonable tolerance to cold, are available for cultivation, the rice yields in this ecosystem are low (2-2.5 t/ha) and fluctuating due to climatic aberrations.

- Sixty three rice cultures were nominated to coordinated trials during 2000-2014.
- The station got breakthrough by developing its own high yielding, farmer preferred and cold tolerant varieties such as K-39 (*Indica* type) and K-78 (Barkat) a *Japonica* type.
- Some of the popular varieties developed include Jhelum and Chenab. These varieties together with cost effective technologies made the farmers able to harvest record yield of 8-10 t/ha.
- After thorough survey of fertility status across the valley and other comprehensive fertility experimentation at the research station, standardization of fertility dose was chalked out for different varieties and recommended to realize the actual potential of these cultivars.
- Weed management is a big challenge before the farming community; the use of herbicide gave them a big solace that in turn deemed it as a real revolution because it could triumph over their miseries and discomforts.
- Rice Research Station, Larnoo located in district Anantnag at an altitude of 2280 m amsl made a landmark achievement by developing a cold and blast tolerant and high yielding variety K-332 which replaced most of the landraces namely Siga, Marva and Kuchh traditionally grown by the farmers under high altitude ecology of Kashmir (1900 to 2300 m amsl).
- In the last decade university has bred a number of varieties with striking characteristics and recommended for different ecologies under the name of Shalimar series such as Shalimar Rice-1, Shalimar Rice-2 and Shalimar Rice-3. Shalimar Rice-1 has yield advantage and blast resilience, whereas, Shalimar Rice-2 with good height and strong culm is most suitable for water logged areas of the valley.
- The varieties developed at MRCFC, SKUAST-Kashmir, Khudwani have been adopted for cultivation in other countries as well, including Nepal and Bhutan.
- The centre has a pride of developing varieties notably K 39 and Barkat (K 78-1) that are being internationally used as reference entries for identifying rice genotypes with characteristics conferring tolerance to cold besides being utilized as reliable donors for cold tolerance.

Development of temperate CMS lines

- Two CMS lines from IRRI (IR68888A and IR68897A) were utilized to develop locally adapted temperate CMS lines using backcross breeding.
- K348 (used as recurrent parent), a medium-duration, cold-tolerant variety maintained at the MRCFC, Khudwani, showed 100% pollen and spikelet sterility when test-crossed with these CMS lines at flowering and maturity, respectively.

- With efforts, two cold tolerant CMS lines *viz*., SKAU 7A and SKAU 11A (first temperate CMS lines in India) were developed with better agro-morphological and floral characteristics.

Progress of AICRIP trials

Name of trial	No of accessions evaluated	Remarks
AICRIP Trials conducted during last ten years	36 different trials	Promising material out of early hills and medium hills has been used in generating variability with the well adapted genotypes and useful material were bred presently in released, pre-released or pipeline status.
Rice cultures bred at Khudwani centre and nominated for evaluation in coordinated trials during last ten years	45	The lines have shown average performance under All India Coordinating Rice Improvement Programme.
Breeder seed/foundation seed produced during last ten years	Breeder Seed produced=563q Foundation seed =6500q	The seed has been produced as per the indent of different seed indenting agencies i.e. State Department of Agriculture and NSC for further multiplication and onward distribution to farmers.
Breeding material generated during last ten years	Fresh crosses and material advancement is being done every year	Every year hybridization among diverse material with well adapted germplasm lines is being done and lot of variability has been generated by advancing the material to different generations using both pedigree and backcross method of breeding.

Crop Production

Agronomy

- Evaluation of different crop establishment methods for increasing the rice yield revealed that System of rice intensification (SRI) and integrated crop management (ICM) were promising and recorded higher grain yields as compared to farmers and standard (recommended) practice.
- Evaluating different principles of SRI for their contribution towards enhancement of grain yield indicated that among the SRI components, age of seedling proved crucial for determining the yield.
- Highest grain yield of 7.9 t ha-1 was realised by transplanting younger seedlings of 12 days age, with 75% inorganics + 25% organics under weed management through cono-weeder and water management by saturation.

- The experiments conducted over years on response of selected AVT-2 (Early and Medium Hill) rice cultures under high and low input management, identified quite a good number of promising nitrogen responsive cultures (varieties) which were then released by CVRC.
- Weed management trials conducted for evaluating the effectiveness of new herbicide molecules in transplanted rice identified promising ones and recommended for use. These include Bensulfuronmethyl, Oxadiazone, Pretilachlor, Cyhalofop-butyl, Penoxsulam, Pyrazosulfuron, Flucetosulfuron. Penoxsulam @ 0.0225 kg ha^{-1} applied 0-5 days after transplanting, found very effective and recorded higher grain yield comparable to Butachlor 1.5 kg ha-1 and weed free plots.
- Pre-emergence application of Penoxsulam @ 0.0225 kg ha^{-1} proved quite effective in improving the grain yields comparable to weed free situation. The increased yield recorded with herbicidal application over control was 44.8%.
- Experiments on screening of rice gemplasm for higher Fe and Zn accumulation showed that IR 36, China 1007, K-116, China 988, Uri zag, SKAU-302, SKAU-334, SKAU-309 accumulated higher Fe and Zn contents and hence proved promising for exploitation in biofortification.

Crop Protection

Entomology

- Pest scenario: The insect pests in comparison to diseases are of minor importance, however, for the last few years, due to climate change, insect pest incidence is emerging as one of the potent threat to rice production.
- Among insect pests, grasshopper (Oxya nitidula, Hieroglyphus spp, Attractomorpha pscittacina) and long-horned grasshopper followed by rice skipper are the major ones. The incidence starts from 45 to 80 days of transplanting.
- Many insecticides were evaluated against grasshopper and found that Acephate +EK Boond was most effective.
- Triazophos was found best against grasshopper at 3 days after treatment whereas, Tricyclazole was the best against blast disease at 10 days after treatment.

Plant pathology

- Research activities on various aspects of diseases under AICRIP and station programme have yielded successful technologies in addition to development of blast resistant varieties for diverse agro-climatic zones of the valley.

- New fungicidal formulations viz., RIL-FA (Kresoxinmethyl), Nativo 75 WG (Trifloxystrobin 25%+Tebuconazole 50%) and Fillia (Tricyclazole and Propiconazole) were found effective against blast, Febuconazole 24 SC and RIL-FA against glume disclouration and brown spot, respectively.
- Among commercially available fungicides Sivic 75 WP (Tricyclazole) was effective against blast whereas, Contaf, Rhizocin and Sheathmar were found promising against sheath blight and Tilt 25 EC (Propiconazole) and Bavistin 50 WP (Carbendazim) against glume discoloration.
- Botanical/Biopesticide formulations viz., Tricure and defender were effective against all the diseases, whereas Biotos was effective against blast and sheath blight and Florezen-P against blast.
- Large numbers of entries were evaluated every year under NSN-1, NSN-2, NHSN, NSN-H and DSN nurseries against blast, sheath blight, sheath rot and brown spot diseases and a good number of promising entries have been identified. Some of these promising entries have been used as donors in disease resistance breeding programme of the station.
- Using blast differential set in the background of LTH and CO-39 procured from IRRI, Philippines, virulence range of blast pathogen population and identification of effective blast resistant gene(s) have been attempted, towards incorporation of durable blast resistance in commercial cultivars.
- Among the varieties released so for, Shalimar Rice-1, Shalimar Rice-2 and Shalimar Rice-3 recommend for low altitudes and K-332 and SKUA-402 for higher mountain ecologies of Kashmir exhibit resilience to blast under natural field conditions.
- Frontline demonstration - Frontline demonstrations totaling 610 ha for the period 2007-2014 registered an yield advantage of more than 25% over the farmers own varieties.