

Introduction of hybrid rice cultivation: A boost on rice productivity and livelihood security of farmers

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The Farmer FIRST Programme (FFP) of ICAR-Directorate of Weed Research, Jabalpur, was initiated in 2017 in Barauda and Umariya Choubey villages of Panagar block, Jabalpur district, Madhya Pradesh, to enhance rice productivity and farmers' livelihoods through the introduction of hybrid rice cultivation and improved weed management practices. Initially, the entire rice area in these villages was under the traditional, long-duration variety 'Kranti', which limited productivity and delayed wheat sowing. Through participatory interventions, high-yielding hybrid rice varieties i.e. 'Arize Gold 6444' and 'Ganga Hybrid' were introduced, coupled with the use of broad-spectrum, high potency, low dose ready-mix herbicides in rotation and robust capacity-building efforts. As a result, hybrid rice adoption expanded to over 99% of the rice area in both villages by 2023–24. Over seven years, grain yield increased by 33–34%, and net returns improved by 62–65% compared to traditional farmers' practices. The sustained adoption of these technologies, even after the project transitioned to a new site, highlights the long-term positive impact of the programme on productivity and profitability in rice cultivation.

Keywords: Capacity building, Economic impact, Farmer First Programme, Input support, Participatory technology dissemination, Weeds management

RICE (*Oryza sativa* L.) is a vital staple food crop for more than half of the world's population. In India, it plays a pivotal role in national food security, cultivated on approximately 51.42 million hectares, with an annual production of 149.07 million tonnes (MoAFW 2024, USDA 2024). Hybrid rice, introduced to exploit heterosis, offers a 15–30% yield advantage over conventional varieties and is currently cultivated on 3.5 million hectares, constituting around 8% of the total rice area in India (ICAR-NRRI 2021). In Madhya Pradesh, rice is predominantly grown during the *kharif* season under upland irrigated and rainfed conditions. However, productivity remains suboptimal due to the prevalence of long-duration, low-yielding traditional varieties such as 'Kranti'. Additionally, late harvesting of such varieties delays wheat sowing, ultimately reducing wheat yields. To address these issues, the Farmer FIRST Programme (FFP) of ICAR-DWR, Jabalpur, introduced hybrid rice cultivation combined with improved weed management practices in Barauda and Umariya

Choubey villages of Panagar block, Jabalpur district of Madhya Pradesh.

Interventions

Before the adoption of the Farmer FIRST Programme (FFP), farmers in these villages primarily depended on the traditional long-duration rice variety 'Kranti', which resulted in low yields and inefficient use of resources. The baseline appraisal of the adopted villages after the inception of FFP led to the introduction of hybrid rice varieties 'Arize Gold 6444' and 'Ganga Hybrid', which significantly improved rice productivity. One of the key components of the intervention was enhancing the managerial skills of the farmers in modern integrated weed management practices, particularly for hybrid rice cultivation. Hands-on training sessions were organized to equip farmers with technical know-how and practical skills on advanced weed management strategies developed by ICAR-Directorate of Weed Research (ICAR-DWR), Jabalpur. Regular trainings, farmer-

scientist interface meetings, and exposure visits to ICAR-DWR research farms enriched farmers' understanding of improved weed control techniques, spraying methodology, use of seed treatments, and cultivation of high-yielding rice varieties. The introduction of high-yielding hybrid rice varieties like 'Arize Gold 6444' and 'Ganga Hybrid', along with broad-spectrum weed management using new-generation, high potency, low dose ready-mix herbicides like cyhalofop-butyl 5.1% w/w + penoxsulam 1.02% w/w OD and triafamone 20% w/w + ethoxysulfuron 10% w/w WG in rotation to minimise the problem of weed flora shift, provided a substantial boost to rice productivity. The continuous adoption of hybrid rice cultivation combined with advanced weed management practices delivered through FFP interventions led to a 33–34% increase in grain yield and a 62–65% increase in net returns over the last seven years of the project. Beginning in 2018, the FFP team introduced the following key interventions:

- **Hybrid rice varieties:** 'Arize Gold 6444' and 'Ganga Hybrid' were introduced based on their high yield potential and suitability for upland irrigated conditions.
- **Weed management:** Broad-spectrum, new-generation, high potency, low dose ready-mix herbicides like cyhalofop-butyl 5.1% w/w + penoxsulam 1.02% w/w OD and triafamone 20% w/w + ethoxysulfuron 10% w/w WG, using in rotation to minimise the problem of weed flora shift, were promoted for effective and timely weed control.
- **Capacity building:** Hands-on training, field demonstrations, and farmer-scientist interface meetings focused on hybrid rice cultivation, herbicides and herbicide application techniques, and good agronomic practices.
- **Input support:** High-quality seeds of hybrid rice and herbicides were provided as critical inputs to ensure successful adoption.

Adoption of hybrid rice

Before the intervention, 100% of the rice area in both villages was under the traditional long-duration variety 'Kranti'. Following sustained awareness, training, and demonstration activities, hybrid rice adoption increased significantly.

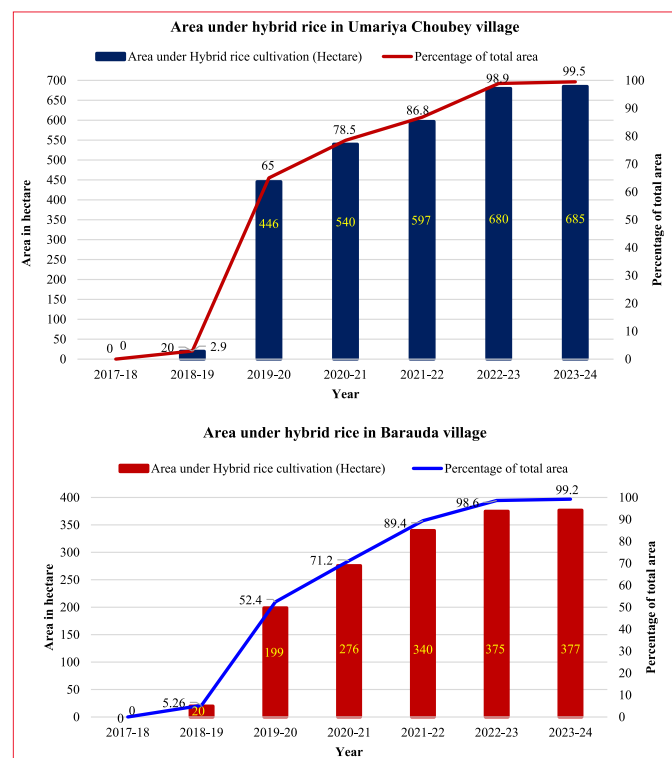
Table 1. Area under hybrid rice before and after FFP intervention

Intervention	Area		Area	
	2017–18	2023–24	2017–18	2023–24
	Umariya Choubey		Barauda	
Introduction of hybrid rice cultivation technology (Variety Arize Gold 6444 and Ganga hybrid) and weed management practices	688 ha area under Kranti (100%)	685 ha area under Hybrid rice (99.5%)	380 ha area under Kranti (100%)	377 ha area under Hybrid rice (99.2%)

Note: (Umariya Choubey total area-688 ha and Barauda total area-380 ha)

Table 2. Increasing area of hybrid rice cultivation from 2017–18 to 2023–24

Introduction of hybrid rice cultivation technology (Variety Arize Gold 6444 and Ganga hybrid) and weed management practices	Umariya Choubey (ha)	Barauda (ha)
2017–18	100% area under Kranti (Long duration traditional variety)	100% area under Kranti (Long duration traditional variety)
2018–19 (Inception of FFP)	2.9% area under Hybrid rice	5.26% area under Hybrid rice
2019–20	65% area under hybrid rice	52.4% area under Hybrid rice
2020–21	78.5% area under Hybrid rice	71.2% area under Hybrid rice
2021–22	86.8% area under Hybrid rice	89.4% area under Hybrid rice
2022–23	98.9% area under Hybrid rice	98.6% area under Hybrid rice
2023–24	99.5% area under Hybrid rice	99.2% area under Hybrid rice



Yield and economics

The continuous adoption of integrated crop management technologies-including the cultivation of high-yielding hybrid rice, application of balanced fertilizers at recommended doses, and improved weed

management practices resulted in significant yield and economic gains under the Farmer FIRST Programme. In Umariya Choubey village, the intervention led to an additional grain yield of 7.5 q/ha (16%)–11.09 q/ha (19.3%) compared to the farmers’ practice. The corresponding increase in net profit ranged from ₹10,379/ha (20%)–31,309/ha (39%).

Similarly, in Barauda village, an additional grain yield of 5.0 q/ha (11%)–10.98 q/ha (19%) and an increase in net returns of ₹8,873/ha (19%)–₹28,886/ha (36%) were recorded over the farmers’ practice (Table 4). The cumulative impact of hybrid rice cultivation over seven years under FFP, thus demonstrated consistent and substantial improvements in both grain yield and profitability, validating the effectiveness of the integrated technological package introduced.

Table 3. Economics of hybrid rice cultivation in Umariya Choubey village from 2017–18 to 2023–24

Year	Yield (q/ha)		Net returns (₹/ha)		BC ratio	
	Farmers’ practice	Inter-vention	Farmers’ practice	Inter-vention	Farmers’ practice	Inter-vention
2017-18	47.5	55	51907	62286	3.39	4.12
2018-19	35	46.48	35167	55160	2.64	3.87
2019-20	50.52	59.28	58402	75156	2.72	3.26
2020-21	46.6	66.1	50501	89519	2.46	3.64
2021-22	43.7	62.95	39053	74998	1.85	2.59
2022-23	46	77.47	48115	116885	2.05	3.84
2023-24	57.6	68.69	80016	111325	2.75	3.73

Table 4. Economics of hybrid rice cultivation in Barauda village from 2017–18 to 2023–24

Year	Yield (q/ha)		Net returns (₹/ha)		BC ratio	
	Farmers’ practice	Inter-vention	Farmers’ practice	Inter-vention	Farmers’ practice	Inter-vention
2017-18	45	50	45698	54571	2.90	3.38
2018-19	36.9	46.58	37076	55278	2.73	3.87
2019-20	51.87	62.49	60872	81032	2.79	3.43
2020-21	45.1	66.20	47417	87557	2.29	3.43
2021-22	45.94	64.95	48048	82753	2.17	2.91
2022-23	46.4	77.25	48931	116437	2.07	3.83
2023-24	57.3	68.28	79361	108247	2.74	3.65



Training Programme conducted on “Weed Management in Field Crops” among the adopted farmers under FFP and distribution of seeds of Hybrid rice (*Ganga Hybrid*) to the farmers



Popularization of Arize Gold 6444 and *Ganga* hybrid rice among the farmers of adopted villages under FFP

SUMMARY

The Farmer FIRST Programme (FFP) was initiated on 1 February 2017 in the villages of Barauda and Umariya Choubey under the Panagar block of Jabalpur district, Madhya Pradesh. Participatory Rural Appraisal (PRA) revealed that nearly 100% of the cultivable land in both the villages was under the traditional long-duration rice variety ‘*Kranti*’ during the *kharif* season, which not only limited rice productivity but also delayed wheat sowing, leading to significant yield reduction of wheat. Farmers largely relied on conventional agricultural practices, resulting in low productivity and inefficient resource use. To address these challenges, FFP interventions included farmer trainings, interface meetings, and exposure visits to ICAR-DWR research farms, enhancing farmers’ knowledge of hybrid rice cultivation and advance weed management technology were introduced. High-yielding hybrid rice varieties like ‘*Arize Gold 6444*’ and ‘*Ganga Hybrid*’ were introduced alongside broad-spectrum, high potency, low dose ready-mix herbicides in rotation resulted in significant improvement on crop performance. Continuous adoption of these technologies, with technical support from the FFP team, led to expansion of hybrid rice cultivation to 99.5% in Umariya Choubey and 99.2% in Barauda, resulting in an average yield increase of 33–34% and net profit enhancement of 62–65% over farmers’ practice during the seven-year period. Even after the project was shifted to a new site, farmers in both villages have continued growing hybrid rice during the *kharif* season, sustaining the impact of the programme.

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