Upscaling the livelihood of smallholders

through adoption of 'Maudamani' super rice variety

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In Indian subcontinent, rice is not only an important food for natives but is the way of life itself. In India more than 80% of the farmers are marginal and small and about 56% of the farm families are engaged in rice cultivation which provides livelihood options to 40% of the rural poor. However, the meagre productivity of rice is one of the prime factors for distress which has direct connotation with their livelihood. Therefore, the strategy will have to upscale the smallholders in aspects in which they have skills and have direct bearing on their livelihood. In this context, technological options available to ensure a respectable livelihood to smallholders are discussed.

Key words: Livelihood, Maudamani, Productivity, Smallholders, Super Rice, Technological options, Yield advantage

THE principal focus of antecedent farm reinforcement manoeuvres was farm output which was momentous for pushing Indian agriculture towards self-sufficiency and food security. Despite the desired results of these manoeuvres, the farmers' socio-economic status has not revamped at the same pace. More than one fifth of households with self-employment in agriculture as their principal occupation are having income less than poverty line. Besides the emerging challenges to farm sector, lies paragon of fortuity which has potential to leverage farmers' socio-economic status while meeting the challenges of food security. Production coupled with accessible market and premium price has wherewithal to revert the heading trends. Diverse attempts are being made by several crop and animal based institutes of Indian Council of Agricultural Research (ICAR) to strengthen the country on the production front. ICAR-National Rice Research Institute (NRRI), Cuttack is one among them which has developed several high yielding rice varieties, among which 'CR Dhan 307' super rice variety, popularly known as 'Maudamani' has

Fig. 1. FFP adopted cluster.

Fig. 2. Field picture of Maudamani.

Table 1. Seed distribution of popular rice varieties in the FFP cluster during 2nd year (in kg)

Varieties	Ecology	Duration	V1	V2	V3	V4	Total
CR Dhan 303	Favourable medium land/ Irrigated	125 days	-	100 (10)	-	-	100 (10)
CR Dhan 307 (Maudamani)	Favourable medium/ irrigated/ shallow lowland	135 days	650 (65)	650 (65)	350 (35)	350 (35)	2,000 (200)
Pooja	Shallow lowland	150 days	300 (30)	300 (30)	300 (30)	400 (40)	1,300 (130)
CR Dhan 409 (Pradhan Dhan)	Shallow lowland	160-165 days	300 (30)	300 (30)	250 (25)	150 (15)	1,000 (100)
	Total		1,250 (125)	1,350 (135)	900 (90)	900 (90)	4,400 (440)

Villages (V1: Satyabhamapur, V2: Biswanathpur, V3: Ganeswarpur and V4: Laxminarayanpur)
Figures in parentheses indicate the numbers of farm families covered.

the yield potential of 11 t ha^{-1}. The seed of Maudamani was introduced in a cluster of four adopted villages through ICAR-sponsored "Farmer FIRST (Farm, Innovations, Resources, Science and Technology) Programme" (FFP) and the farmers' responses to the interventions were exemplary.

In India, where about 60% of the farmers are engaged in paddy cultivation, this crop has an edge to reach plenty and benefits the farmers directly. A quality seed of rice in right time and in right quantity is one of such strategy in incentivising the millions of small and marginal peasants. NRRI has reached to about 800 farmers during 2016-17 in a cluster of four villages namely Satyabhamapur, Biswanathpur, Ganeswarpur and Laxminarayanpur in Cuttack district of Odisha state (Fig.1) with different interventions under each module of FFP. Under the crop based module of FFP, Maudamani (Fig. 2) seed was supplied to farmers in the cluster and their feedback was obtained.

This article is principally focused on Farmer FIRST interventions in the cluster villages under crop based module, varietal attributes of Maudamani, farmers' reaction for the variety and its implications on livelihood of millions of small and marginal farmers. The varietal and associated attributes provided here will enrich its readers about the importance of Maudamani for livelihood security of millions of smallholder rice cultivators and help in addressing their problems by disseminating the information about the clairvoyant Maudamani for its rapid dissemination.

Farmer FIRST interventions

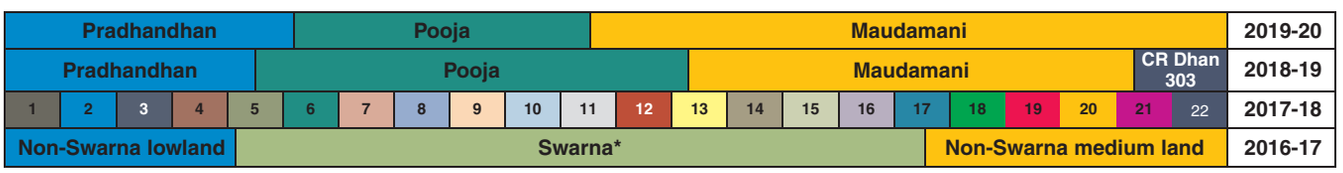
21 newly released and promising rice varieties were demonstrated during first year of FFP intervention (*kharif* 2017-18) by providing total of 4,000 kg seeds via 10 kg seed minikits to over 400 farm families covering about 80 ha area. Based on performance of these 22 demonstrated rice varieties and farmers' preference, only 4 varieties namely, CR Dhan 303, CR Dhan 307 (Maudamani), Pooja and CR Dhan 409 (Pradhandhan) were provided to the farmers in second year (*kharif* 2018-19) for the prominent ecologies of the locality (Table 1). Based on the farmers demand, out of total 4,400 kg seeds, 2,000 kg of only Maudamani seed was supplied to 200 farm families in the second year, i.e., *kharif* 2018-19 (as against only 200 kg seed to 20 farmers during *kharif* 2017-18) for favourable medium and shallow lowland ecology. These 4 varieties resulted into replacement of about 90 ha of area under popular variety 'Swarna' and other local varieties in the cluster in the second year alone.

Reallocation of area under different rice varieties after FFP intervention (in 2018-19) indicates that Maudamani alone has replaced about 40 ha of Swarna area which is about 45% of demonstration area under different rice varieties (Fig.3). Also, because of its performance and popularity among the farmers, the takers of Maudamani have witnessed a 10 fold increase from 20 (in 2017-18) to 200 (in 2018-19) takers just after one year of intervention, and went on increasing in subsequent years too.

About 43 crop cutting experiments (CCE) were conducted during *kharif* 2019-20. Results of crop cutting experiments revealed that the yield of Maudamani ranged between 5.4–8.84 t/ha in the farmers' field with an average grain yield advantage of 33.31% over local popular Swarna. The yield stability was higher for Pooja (Table 2).

Muadamani: A new wine in old bottle

CR Dhan 307, popularly known as Maudamani, derives its root from parents such as Naveen/Dandi and released by ICAR-NRRI in the year 2014. The important varietal characteristics of Maudamani are presented in Table 3.



*Area under Swarna rice variety which is substituted after FFP intervention in favourable medium/ shallow lowland ecology.
Note: Year 2016-17 was FFP intervention year, but 2017-18 was first year of varietal demonstration of rice in the cluster.

Fig. 3. Temporal shift in area among rice varieties in the cluster after FFP intervention.

Table 2. Grain yield advantages of demonstrated rice varieties in the adopted cluster

Demonstrated rice varieties	No. of crop cuttings	Max yield (t/ha)	Min yield (t/ha)	Avg. Yield (t/ha)	Local check	Avg. yield (t/ha)	Yield Gain (%)
CR Dhan 303	3	6.32	4.40	5.20	Swarna	5.20	0
CR Dhan 307 (Maudamani)	16	8.84	5.40	6.88	Swarna	5.20	33.31
Pooja	12	6.52	5.48	5.68	Swarna	5.20	9.23
CR Dhan 409 (Pradhandhan)	12	7.00	4.68	5.52	Varshadhan	5.04	9.52

Source: Field data

Table 3. Varietal attributes of CR Dhan 307 (Maudamani)

Indicator	Varietal attribute	Indicator	Varietal attribute
Parent	Naveen/Dandi	Milling recovery	72 %
Suitable ecology	Irrigated/fav. medium/ shallow lowland	Amylose content	23.73%
Duration	135 days	Gel consistency	26.0 mm
Yield potential	11 t ha^{-1}	Test weight	21.40 gm per 1000 grains
Yield on farmers field	7 t ha^{-1}	Resistance* to	SB, BPH, LF, RWM, GLH, GMB5, RH and RT
Grain type	Short bold	Tolerance* to	ShB, LB, NB, BS

(SB: Stem borer; BPH: Brown plant hopper; LF: Leaf folder; RWM: Rice whorl maggot; GLH: Green leaf hopper; GMB5: Gall midge biotype 5; RH: Rice hispa; RT: Rice thrips; ShB: Sheath blight; LB: Leaf blast; NB: Neck blast and BS: Brown spot.*Moderately Resistant/ Tolerant)

Sources: ICAR-NRRI Annual Report 2014-15, and Pradhan *et al.* (2018).

Juxtaposition between Maudamani and Swarna: farmers' assessment

The yield influencing varietal attributes like test weight of grains (weight of 1,000 seeds), number of grains per panicle, number of panicles per plant and number of fertile grains per panicle are some of the major factors which are desired by the farmers to maximize their net returns. The milling recovery is one of the crucial attribute for the processors, while a consumer is interested in the after-cooking qualities. In the intervention cluster, Swarna is one of the rice varieties mostly preferred by the farmers. We have collated the important traits between the locally popular variety "Swarna" and one of the intervention variety "Maudamani" while considering important attributes and preference of the stakeholders (Table 4).

Farmers' perception about Maudamani

Feedback from the treatment farmers (assisted with seeds of Maudamani) in the intervention cluster revealed that majority of them witnessed a yield advantage of 20-40% than that of control farmers (not enrolled in the FFP) who cultivate Swarna in the same cluster. Few of the farmers were of opinion that the acceptability of grains of Maudamani is higher than that of Swarna in the cluster owing to its higher milling recovery (72 %) as against Swarna (68.9 %). Thus, it can be inferred that, higher milling recovery of Maudamani becomes a push factor for its easy access to value chain network. Incremental yield coupled with higher market acceptability of Maudamani fetches premium returns 18.33% higher to the producers. In the opinion of the respondent farmers, strong culm prevents the lodging of crop during the events of high winds and it also promotes its mechanical harvesting. In contrast to it, Swarna lacks strong culm and therefore is susceptible to lodging in the events of high wind which discourages its mechanical harvesting. Varietal attributes like higher spikelet fertility, and tolerance to diseases and pests are other factors which are supplemental to higher yield of the Maudamani. Also, the short duration of Maudamani facilitates early field preparation for vegetable production in the succeeding *rabi* and therefore is more efficient in terms of yielding higher grains per unit of inputs and time. Some beneficiaries had opinion that due to 10-15 days shorter in duration of Maudamani as compared to Swarna, they can utilize the available soil moisture for subsequent pulse crops like black gram or green gram. Thus, Maudamani has the potential to promote crop diversification in the village which is an important strategy

Table 4. Comparison between Maudamani and locally popular rice variety Swarna

Indicator	Maudamani	Swarna
Farmers' attributes		
Test weight (gm/1000 grains)	21.40	22.40
No. of grains per panicle	250-450	125-250
No. of panicles per plant	5-10	12-18
Weight of panicle (gm panicle ^{1})	7-10	2-5
Yield (t ha^{-1})	10-11	5-6
Processors' attributes		
Milling recovery (%)	72	68.9
Grain type	Short bold	Long slender
Agronomic and morphological attributes		
Spikelet fertility rate	Relatively high	Relatively less
Maturity duration (Days)	135	145-150
Resistant to lodging	Yes	No
Suitability to mechanical harvesting	Yes	No
Tolerance to external environment	Tolerant to cold stress and high temperature during flowering.	Less tolerant
Tolerance to insect pests and diseases	Tolerant to sheath blight and BPH	Susceptible to sheath blight and moderately tolerant to BPH

against risk mitigation and stabilizing farm income. Not only in the adopted cluster, but also from the field trials conducted by the authors in other parts of Odisha, Jharkhand, West Bengal, Madhya Pradesh and Chhattisgarh, etc, it is reported that this variety has yielded as high as 11.73 t/h in Ranchi.

Maudamani and livelihood security

The concept of livelihood security encompasses a decent and sustainable income avenues and means to fulfil key needs (access to safe and hygienic food, safe drinking water, health amenities, educational fortuity, housing, social integration and time for community participation). Therefore, food and nutritional security are integral part of livelihood security. Maudamani being a high yielding rice variety has quite a few clandestine precedence over the popular varieties. First, it has significantly higher yield than many of the popular rice varieties i.e. the land on which it has been cultivated offers higher production or in other words, the productivity of Maudamani cultivated land is higher than the lands where other rice varieties are cultivated. Second, the daily productivity of Maudamani is 50.96 kg day^{-1} against 35.86 kg day^{-1} for Swarna. In other words, Swarna will take 192 days to give equivalent yield to Maudamani. Third, under the assumption of equal water requirement for nursery and field preparation for Maudamani and other rice varieties and total consumptive usage of water for rice crop to be 1,240 mm, the water productivity for Maudamani is about 5.55 kg mm^{-1} as against 4.19 kg mm^{-1} for the other variety under comparison. Fourth, the high yield per hectare per season of Maudamani is supplemental to the easy availability of food grain which is a prerequisite for food security for all. In India, where more than 85% land holdings are small and marginal; land ranges from highly fertile to marginal (problematic lands); ground water is depleting at an alarming rate, the quality seeds are one of the sure shot mitigating alternatives. Owing to these multiple benefits and emerging challenges, Maudamani can be an innovative and sterling product in the market.

Conclusion

Amidst the challenges of increasing demand of food grains, natural resource degradation, trifling farm income and plateauing farm productivity, Maudamani super rice variety has the potential to provide mitigation to these challenges. The results of demonstrations under FFP by ICAR-NRRI show that the variety has a massive yield potential and hence can be promoted in other suitable ecologies. There is need to channelize the seeds of Maudamani in formal seed chains for its rapid spread which would not only fulfill the stated objective of rapid spread but will also help in augmenting net value addition from the farm sector and raising farm income.

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