

Swarna Samriddhi Dhan: A high yielding, multiple stress tolerant rice variety for irrigated and rainfed shallow lowland ecology

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Under the climate change scenario, frequent occurrence of drought or submergence has been identified as key factor to the low productivity of rice in eastern India. A high yielding, multiple stress (drought, submergence, disease and insect pest) tolerant rice variety, Swarna Samriddhi Dhan (IET 24306) has been released and notified for irrigated as well as rainfed shallow lowland agroecology. This rice variety is a medium duration (135–140 days), high yielding (5.5–6.0 t/ha), with desirable grain and cooking quality traits. It is also suitable for cultivation in water limiting irrigated and drought-prone rainfed areas. Beside drought (reproductive stage) tolerant, it can also tolerate 10–12 days submergence (vegetative stage). This variety shows moderately resistance to leaf blast, brown spot, sheath blight, false smut, stem borer, leaf folder, and gall midge insect pest. Adoption of this variety increases net income of ₹18000–25000/ha over farmers adopted local cultivars. Swarna Samriddhi Dhan will significantly contribute to increase the rice productivity of irrigated as well as rainfed ecology and alleviate the socio-economic status of farmers of eastern region.

Keywords: Drought, Multiple stress, Rice, Submergence

RICE is one of the major staple food of India covering nearly one-fourth of total cropped area and providing food to about half of the Indian population. It is cultivated under diverse ecological condition ranging from rainfed to favourable irrigated and rainfed upland rice to deep water rice. In Bihar, rice is cultivated in ~3.31 Mha with production and productivity of 8.09 million tonnes and 2.447 t/ha, respectively. Rice is main source of food for most of the population of the Bihar state. Despite this, its productivity in Bihar is incredibly low compared to developed states. Climate change is one of the main reasons for low productivity of rice in this region. The productivity levels of rice are affected due to several reasons like delay in onset of monsoon, long dry run and erratic monsoon. Frequent occurrence of drought and submergence has been

identified as key to the low rice productivity in Bihar as well as other eastern states. In future, increasing frequency and intensity of droughts and floods under changing climatic conditions will have a more negative impact on rice production and productivity.

In view of increasing population and fulfill the future food requirement, rice production needs to be increased by increasing its productivity. Development of high yielding rice varieties with tolerance to multiple stresses can play significant role in increasing rice production. Under climate changing scenario, there is an urgent need to develop, disseminate and adopt high yielding multiple stress tolerant rice varieties to achieve goal of doubling income of farmers and to ensure the food self-sufficiency at state as well as national level.

A high yielding multiple stress

tolerant rice variety, Swarna Samriddhi Dhan (IET 24306) has been developed by the ICAR-Research Complex for Eastern Region, Patna in collaboration with International Rice Research Institute (IRRI), Philippines. It has been released by the State Seed Sub-Committee (Bihar) and notified by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops, Govt. of India (notification number S.O. 500 (E) dated 29th



Rice variety Swarna Samriddhi Dhan



Panicles of Swarna Samriddhi Dhan

January 2021), for the cultivation in Bihar. It is suitable for cultivation under transplanted condition in irrigated as well as rainfed ecology of Bihar. Swarna Samriddhi Dhan is a medium duration (135–140 days), high yielding (5.5–6.0 t/ha), multiple stresses (drought, submergence, disease, and insect pest) tolerant, lodging resistant with desirable cooking quality traits. Quality wise, Swarna Samriddhi Dhan has 77.8% hulling, 62% milling, 55.6% head rice recovery with desirable intermediate alkali spreading value (ASV) and amylose content (AC) (24.33%). It has soft gel consistency (GC) with very occasionally chalky and long slender grains showing good cooking quality. It is resilient to changes in rainfall distribution. Beside drought (reproductive stage) tolerant, this variety can also tolerate 10–12 days submergence at vegetative stage. This variety possesses semi-erect flag leaf, long slender grain, long and well exerted compact panicle, high tillering (10–12 tillers/hill), with test weight of 25.6 g. Frequent occurrence of drought and submergence are the major challenge to sustain the rice production in the eastern states of India. The rice crop grown in these states invariably suffer due to water stress (drought or submergence) at

the different development stages. Therefore, beside irrigated ecology, rice variety Swarna Samriddhi Dhan also recommended for drought prone as well as flood prone areas of Bihar to ensure the food security in these targeted areas.

Target areas for cultivation

Rice variety Swarna Samriddhi Dhan is primarily targeted for cultivation under transplanted condition in irrigated and rainfed shallow lowland ecology of the state of Bihar. It can also be cultivated in water limiting irrigated areas where rainfall is inadequate to sustain rice production and drought and flood prone rainfed areas of Bihar as well as other states of eastern region.

Yield potential and agronomic adaptation

Rice genotype RCPR 10 (Swarna Samriddhi Dhan) was entered as IET 24306 under irrigated medium duration trial in AICRIP coordinated programme during wet season of 2014. During three years (2014–2016) of national AICRIP testing, this variety showed stable yield in Zone III and found promising for Bihar. Based on three years of testing in Zone III IET 24306 has recorded an overall mean grain yield 5.73 t/ha and showed yield advantage of 17.4, 6.9 and 10% over national (NDR 359), zonal and local checks, respectively (Table 1). Furthermore, based on three-year testing (2014–2016) in Bihar under AICRIP programme, IET 24306 (Swarna Samriddhi Dhan) has recorded mean grain yield of 6.24 t/ha and showed yield gain of 33.7, 12.7 and 35.2% over national, zonal and local checks respectively (Table 2). Based on four years testing (on-station trial at ICAR-RCER, Patna)

under irrigated condition, IET 24306 has recorded an overall mean grain yield 6.98 t/ha and showed yield gain of 16.2% over check variety Rajendra Sweta. Whereas under the drought (reproductive stage) condition, IET 24306 has recorded an overall mean grain yield 3.40 t/ha and performed at par with Sahbhagi Dhan and showed yield gain of 36.2% over check variety Rajendra Sweta. Based on three-year testing (on-station) under submergence (15–18 days) condition, IET 24306 recorded overall mean grain yield of 1.31 t/ha. Whereas, in 8–10-day submergence IET 24306 recorded overall mean grain yield of 3.12 t/ha. Based on two years adaptive trial conducted at various locations of Bihar, IET 24306 has recorded mean grain yield 5.26 t/ha and showed yield advantage of 12.6% over check variety.

Swarna Samriddhi Dhan shows high response to fertilizer application compared to checks. Yield reduction and yield gain at 50 and 150% of recommended nitrogen level showed that normal does of nitrogen is most productive for this culture at most of locations (120–150 kg N/ha) depending on native soil fertility. However, significant response was noticed up to 120:60:40 kg/ha (N:P: K). Swarna Samriddhi Dhan is a semi-dwarf (100–105 cm) genotype which flowers in about 100–110 days and matures in 135–140 days. The genotype IET 24306 has shown non-lodging plant type and produce thick culm. The optimum time for nursery raising of Swarna Samriddhi Dhan is from 2nd to 3rd week of June, but it should be adjusted for a particular location. Seed rate of around 25–30 kg/ha is recommended for Swarna Samriddhi Dhan. A 25 to 30 days old seedling should be used for transplanting. The transplanting should be done at a spacing of row to row 20 cm and plant to plant 15 cm with 1 or 2 seedlings per hill. Application of pre-emergence herbicide within a week of transplanting is advisable. If required application of post emergence (POE) herbicide bispyribac sodium @25 g/ha at 3–4 leaf stage of weeds between 20–25



Kernels and grains of Swarna Samriddhi Dhan

Table 1. Summary of mean grain yield (t/ha) data in AICRIP coordinated varietal trials (Irrigated medium trial, 2014–16)

Mean yield (t/ha)	Name of the trial	Year of testing	No. of locations	IET 24306	National check	Zonal check	Local check	Qualifying genotypes		
								IET 24302	IET 24325	IET 24343
	IVT-IME	I year 2014	8	5.43	4.56	4.58	4.47	5.26	4.99	4.92
	AVT 1-IM	II year 2015	7	6.18	3.52	5.67	5.66	5.89	5.65	5.58
	AVT 2-IM	III year 2016	11	5.66	5.98	5.72	5.46	5.18	5.41	5.29
	Weighted mean		26	5.73	4.88	5.36	5.21	5.40	5.35	5.25
Per cent Increase/decrease over Weighted mean					+17.39	+6.91	+10.03	+6.17	+7.09	+9.05

Note: The mean yield data given in table is pertaining to all the states of Zone III.

Source: ICAR-IIRR, Annual Progress Report 2014, 2015 and 2016 vol. 1, Varietal Improvement

Table 2. Year wise mean grain yield data of Bihar state in AICRIP coordinated variety trials (Irrigated medium trial, 2014–16)

Mean yield (t/ha)	Name of the trial	Year of testing	No. of locations	IET 24306	National check	Zonal check	Local check	Qualifying genotypes		
								IET 24302	IET 24325	IET 24343
Bihar	IVT-IME	I year 2014	2	5.67	5.13	4.40	3.33	5.03	5.06	4.93
	AVT 1-IM	II year 2015	3	6.61	4.16	6.01	4.92	6.09	6.01	5.31
	AVT 2-IM	III year 2016	2	6.27	4.98	5.99	5.45	4.73	5.28	3.83
	Weighted mean		7	6.24	4.67	5.54	4.62	5.40	5.53	4.78
Per cent Increase/decrease over weighted mean					+33.7	+12.7	+35.2	+15.6	+12.9	+30.6

Source: ICAR-IIRR, Annual Progress Report 2014, 2015 and 2016 vol. 1, Varietal Improvement

days after transplanting (DAT) may be done. If required one or two hand/mechanical weeding at 40 and 60 DAS (days after sowing) may be done. Inter-cultivation operation may be carried out when needed for effective and better weed management.

Water management

Normal irrigation like other transplanted rice variety is recommended. Swarna Samriddhi being a drought tolerant rice variety does not require more water if rainfall is normal and well distributed. However, under water scarcity/drought condition, field should be irrigated at critical stages like active tillering, panicle initiation, flowering and grain filling.

Reaction to major diseases and insect pests

Swarna Samriddhi Dhan (IET 24306) has resistance to false smut and moderately resistance to leaf blast, brown spot, sheath blight, rice tungro disease (RTD), and glume discoloration diseases under natural screening. Under artificial screening, it also showed resistance to leaf blast. Although rice variety Swarna Samriddhi Dhan has tolerance to major disease, regular monitoring of the crop is advisable to know the disease appearance and

need based management is needed. Seed treatment with fungicides, carbendazim 50 WP @2 g/kg seed or tricyclazole 75 WP @1.5 g/kg seed is advisable to reduce intensity of fungal diseases. Swarna Samriddhi Dhan has also shown moderate resistance against major insect-pests like stem borer (dead heart and white ears head), leaf folder, gall midge (biotype 1) and whorl maggot in natural conditions but need based application of insecticides is recommended to manage insects. For plant protection of Swarna Samriddhi Dhan, prophylactic sprays of one dose of any systemic insecticide need to be done as and when needed.

Economic benefit

In irrigated areas, farmers used to harvest 4.0–4.5 t/ha rice from medium duration rice variety. While adopting this rice variety (Swarna Samriddhi Dhan) farmers having a yield advantage of 1 to 1.5 t/ha over their local cultivated cultivars. In addition, under drought and submergence condition, this variety also have yield gain of 1 to 1.5 t/ha over local cultivated variety. Therefore, farmers used to get a net benefit of ₹18000 to 25000/ha. In this regard, this variety is having much importance and potential in improving livelihood of farm

families in the region, where frequent drought and flood is common phenomenon.

SUMMARY

Under changing climate situations low rice productivity in irrigated and rainfed lowland ecosystems is threatening food security. The released and notified multiple stress tolerant rice variety Swarna Samriddhi Dhan shows significant yield superiority over the national, Zonal and local check varieties in eastern region, particularly in Bihar. It has also shown desirable grain and cooking quality traits. Swarna Samriddhi Dhan is suitable for cultivation in favourable irrigated, water limiting irrigated and drought-prone rainfed areas. This variety shows moderately resistance to most of the major diseases and insect pests. Adoption of high-yielding, multiple stresses (drought, submergence, disease and insect pest) tolerant, good grain and cooking quality, input-responsive rice variety Swarna Samriddhi Dhan will play significant role in increasing rice productivity and food security among the farm families in the irrigated as well as rainfed shallow lowland areas in Bihar as well as other eastern states.

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