

Innovative farmer selections revitalizing jamun cultivation in Karnataka

Jamun (*Syzygium cumini* Skeels) is an underutilized fruit tree valued for its nutritional richness and potential in dryland horticulture. In Nagadasanahalli village, Bengaluru Rural district, farmer-scientist Dr N C Patel has selected and conserved three elite types, *Patel Jumbo*, *Patel Samruddhi*, and *Patel Akal*, which have been scientifically characterized by ICAR-IIHR. These selections differ in fruit size, sweetness, pulp colour, and maturity period, offering advantages for both fresh consumption and processing. *Patel Jumbo* produces large, sweet fruits; *Patel Samruddhi*, with purple pulp, is rich in anthocyanins and phenolics; while *Patel Akal* extends the harvesting season into July–August. Biochemical profiling highlights their high antioxidant activity, making them promising for nutraceutical applications. From a farmer’s perspective, farmer-led selection of jamun represents a practical, low-input, and climate-resilient livelihood option capable of generating substantial economic returns in rainfed and dryland regions. The complementary strengths of *Patel Jumbo*, *Patel Samruddhi*, and *Patel Akal* enable farmers to cater simultaneously to fresh fruit, processing, and extended-season markets, thereby diversifying income sources and reducing market and climatic risks.

Keywords: Biochemical, Custodian farmer, Jamun, Morphological, *Patel Akal*, *Patel Jumbo*, *Patel Samruddhi*, Promising selection

JAMUN (*Syzygium cumini* Skeels), commonly known as black plum or Indian blackberry, is a multipurpose evergreen fruit tree belonging to the family Myrtaceae. Native to the Indian subcontinent, it is widely distributed across diverse agro-ecological regions, ranging from humid tropical zones to semi-arid and dryland ecosystems. The species is characterized by a tall, vigorous growth habit, a dense canopy, and a deep taproot system, which together confer tolerance to drought, high temperatures, and wind stress. Once established, jamun trees require minimal external inputs and can remain productive for several decades, making the crop inherently suitable for sustainable and low-input farming systems.

Jamun fruits are oblong to oval in shape and turn deep purple to nearly black at maturity, with a characteristic sweet–acidic flavour highly appreciated by consumers. Beyond fresh consumption, jamun has long been valued in traditional medicine systems such as Ayurveda, Unani, and folk medicine. The seeds are extensively used for managing diabetes due to their hypoglycaemic properties, while the pulp and bark are traditionally employed in the treatment of diarrhoea, ulcers, and inflammatory disorders.

Jamun fruits are recognized as a rich source of bioactive compounds with strong antioxidant potential. Studies have reported that jamun pulp contains anthocyanins ranging from ~50 to 250 mg C3GE/100 g fresh weight,

total phenolics between ~120 and 350 mg GAE/100 g, and flavonoids in the range of ~40 to 120 mg CE/100 g, depending on genotype, maturity stage, and growing environment. In addition, the fruits provide appreciable amounts of vitamin C (10–30 mg/100 g), iron (0.5–1.6 mg/100 g), and calcium (15–25 mg/100 g), further enhancing their nutritional value.

The high antioxidant activity of jamun, largely attributed to anthocyanins and phenolic compounds, has attracted increasing interest from the functional food and nutraceutical industries. Extracts from jamun pulp, seed, and peel have been shown to exhibit strong free radical scavenging activity, along with potential anti-diabetic, anti-inflammatory, and cardioprotective effects.

Jamun is a highly cross-pollinated species and has been propagated predominantly through seeds for centuries. This reproductive behaviour has resulted in enormous genetic and phenotypic variability across India, manifested in differences in tree vigour, fruit size, pulp colour, sweetness, seed size, maturity period, and biochemical composition. Numerous local landraces exist; however, only a limited number of improved varieties are available for commercial cultivation. Consequently, consumer-preferred traits such as bold fruits, high pulp recovery, attractive pulp colour, extended harvesting period, and enhanced nutraceutical value are not adequately addressed by currently released varieties.

Selection from seedling populations remains the most effective and practical crop improvement strategy in jamun. Farmer-managed orchards, where long-term observation and selection occur under real field conditions, represent valuable yet underexplored reservoirs of elite genotypes.

In recent years, participatory selection programmes and systematic surveys have gained momentum to identify superior jamun genotypes directly from farmers' fields. One such initiative in the Bengaluru Rural district of Karnataka, undertaken under the aegis of ICAR–Indian Institute of Horticultural Research (IIHR), Bengaluru, documented substantial variability in fruit and tree traits and led to the identification of promising farmer-selected genotypes with superior pomological and biochemical attributes.

Within this framework, the contributions of farmer–scientist Dr N C Patel of Nagadasanahalli village are noteworthy. Through sustained on-farm observation and selection, he conserved and developed three elite jamun selections, *Patel Jumbo*, *Patel Samruddhi*, and *Patel Akal*—which combine high pulp recovery, desirable fruit quality, distinct pulp pigmentation, and adaptability to dryland conditions. Scientific validation of such farmer-led selections through morphological and biochemical characterization is essential for their recognition, wider dissemination, and integration into formal improvement programmes.

Keeping this in view, the present study was undertaken with the following objectives:

- (i) To characterize the morphological and pomological traits of three farmer-selected jamun genotypes in comparison with a released check variety, and
- (ii) To evaluate their biochemical composition, including sugars, anthocyanins, phenolics, flavonoids, and antioxidant activity.

Plant material

The study was conducted on three elite farmer-selected jamun (*Syzygium cumini* Skeels) genotypes—*Patel Jumbo*, *Patel Samruddhi*, and *Patel Akal*—conserved and maintained by custodian farmer–scientist Dr N C Patel at Nagadasanahalli village, Bengaluru Rural district, Karnataka. These selections were identified through long-term on-farm observation based on superior fruit size, pulp recovery, bearing regularity, pulp colour, and taste.

For comparative evaluation, the released variety '*Dhupdal*' was included as a check. All genotypes were evaluated under in situ field conditions, and fruits were collected and brought to the laboratory at ICAR–Indian Institute of Horticultural Research (IIHR), Bengaluru, for morphological and biochemical analyses.

The study site represents a typical dryland agro-ecosystem where jamun is traditionally cultivated with minimal external inputs, allowing a realistic assessment of genotype performance under farmer-managed conditions.

Ten mature fruits per genotype were randomly sampled for morphological and biochemical measurements.

Morphological and pomological characteristics

The three Patel selections—*Patel Jumbo*, *Patel Samruddhi*,

and *Patel Akal*—exhibit clear advantages over the check variety '*Dhupdal*', particularly in fruit size, pulp yield, and market suitability.

***Patel Jumbo*:** It is the largest among the selections, with an average fruit weight of 12.65 g, comparable to '*Dhupdal*' (12.63 g). However, it has a distinct advantage in pulp recovery, recording a pulp percentage of 89.41%, much higher than that of '*Dhupdal*' (83.45%). Its fruits are elliptical with pinkish-white pulp, and their larger size, combined with a reduced seed proportion, makes them highly attractive for fresh consumption. Harvested in June, *Patel Jumbo* is suitable for premium markets where demand for larger, sweeter fruits is high.

***Patel Samruddhi*:** Although smaller (7.1 g/fruit), it has a pulp percentage of 84.51%, again higher than that of '*Dhupdal*'. Its distinctive purple pulp gives it a unique identity in both fresh and processed markets. Farmers value this selection for its heavy bearing capacity, ensuring higher yields per tree compared to '*Dhupdal*'. Despite its smaller size, its unique pulp colour and higher productivity give it an edge in market differentiation.

***Patel Akal*:** It occupies an intermediate position, with a fruit weight of 11.35 g and a pulp percentage of 89.96%, clearly surpassing '*Dhupdal*' in pulp recovery. Its greatest advantage is its late maturity, extending fruiting into July–August, well beyond '*Dhupdal*'s early-season harvest in June. This seasonal extension allows growers to supply fresh jamun when other varieties are no longer available, thereby ensuring continued market presence and better returns.

Biochemical composition and nutritional potential

The biochemical profiling of the Patel selections underscores their superior nutritional value compared to the check variety '*Dhupdal*'.

***Patel Jumbo*:** It offers a sweeter fruit profile, recording the highest total sugars (10.49 g) and reducing sugars (7.63 g) among the selections. Although its phenolic (140.9 mg GAE) and anthocyanin (94.85 mg C3GE) contents are lower than those of *Patel Samruddhi* and *Patel Akal*, it provides a balanced option for consumers who prioritize sweetness over astringency and nutraceutical richness.

***Patel Samruddhi*:** It emerges as the most nutritionally rich cultivar, recording 136.41 mg anthocyanins, 246.38 mg phenolics, and 88.89 mg flavonoids, which translate into strong antioxidant capacity (FRAP 528.18 mg TE and DPPH 506.75 mg TE). These attributes clearly surpass the biochemical profile of '*Dhupdal*', making it highly suitable for the functional food and nutraceutical sectors.

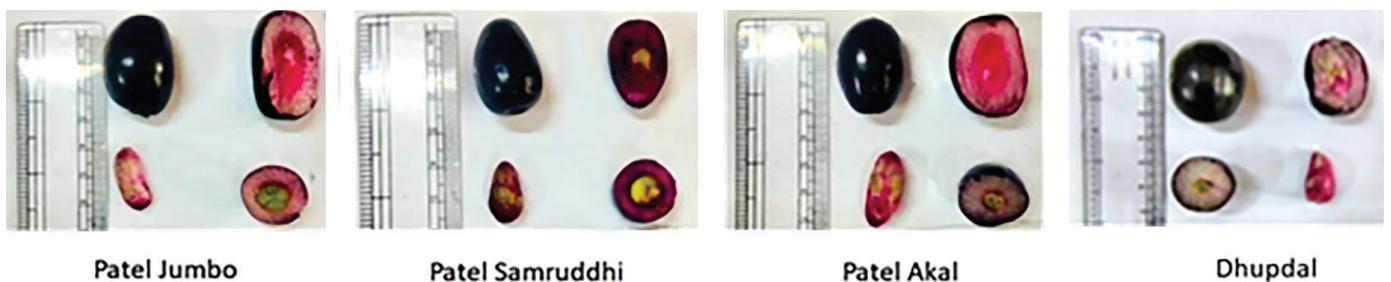
***Patel Akal*:** It closely parallels *Patel Samruddhi* in biochemical strength, with 246.01 mg phenolics, 86.23 mg flavonoids, and antioxidant activity measured at FRAP 529.77 mg TE and DPPH 511.18 mg TE. Its values not only match but also exceed those of '*Dhupdal*' (FRAP 332.25 mg TE; DPPH 778.83 mg TE) in terms of balanced antioxidant potential.

In contrast, although '*Dhupdal*' demonstrates high radical scavenging capacity (DPPH 778.83 mg TE), its relatively lower phenolic (145 mg GAE) and flavonoid content (70.23 mg CE) limit its nutraceutical diversity.

Overall, *Patel Samruddhi* and *Patel Akal* stand out as

Morphological and biochemical traits of promising jamun farmer's selections compared to check variety (*Dhupdal*)

Trait	<i>Patel Jumbo</i>	<i>Patel Samruddhi</i>	<i>Patel Akal</i>	<i>Dhupdal</i>
Fruit length (cm)	2.99	2.08	3.18	3.21
Fruit width (cm)	2.13	1.13	2.36	2.04
Fruit weight (g)	12.65	7.1	11.35	12.63
Pulp weight (g)	11.31	6	10.21	10.54
Seed length (cm)	1.65	1.41	1.08	2.07
Seed width (cm)	0.81	0.72	0.84	0.96
Seed weight (g)	1.21	1.02	1.14	2.09
Fruit: seed	10.45	6.96	9.96	6.04
Pulp: seed	9.35	5.88	8.96	5.04
Pulp %	89.41	84.51	89.96	83.45
TSS (°Brix)	14.02	10.79	13.3	15.67
Titrateable acidity (%)	0.59	0.57	0.59	1.21
Total sugars (g)	10.49	9.56	9.19	13.13
Reducing sugars (g)	7.63	7.05	6.74	6.47
Anthocyanin (mg C3GE)	94.85	136.41	129.2	79.74
Total phenolic content (mg GAE)	140.9	246.38	246.01	145
Total flavonoids content (mg CE)	67.85	88.89	86.23	70.23
FRAP (mg TE)	272.6	528.18	529.77	332.25
DPPH (mg TE)	355.35	506.75	511.18	778.83



Whole fruit, longitudinal and transverse section of fruit and whole seed of *Patel Jumbo*, *Patel Samruddhi* and *Patel Akal* in comparison with check *Dhupdal*

nutraceutical-rich cultivars, combining high anthocyanins, phenolics, and strong antioxidant activities. Their profiles make them especially valuable for functional foods, health supplements, and value-added processing, whereas *Patel Jumbo* retains an advantage in the fresh market due to its higher sugar content and consumer-friendly sweetness.

Relevance for farmers and consumers

The three farmer-led jamun selections—*Patel Jumbo*, *Patel Samruddhi*, and *Patel Akal*—collectively cater to diverse market segments, addressing both fresh consumption and processing needs. *Patel Jumbo* produces large, premium fruits suited for direct consumption; *Patel Samruddhi* offers smaller, vividly coloured fruits with high antioxidant value for processing industries; and *Patel Akal* extends the harvesting season, enabling farmers to generate income over a longer period.

Together, these selections provide a diversified portfolio that enhances both consumer choice and farmer

profitability. Beyond their market appeal, jamun as a crop is highly sustainable. Once established, trees require minimal irrigation and chemical inputs and can tolerate dry spells effectively. This makes them ideally suited for cultivation in rainfed and dryland regions where farming is often risky.



ICAR-IIHR team with Dr N C Patel at his jamun orchard

Model orchards developed by Dr Patel demonstrate that jamun cultivation can generate substantial annual revenue while also supporting biodiversity and improving soil health.

With scientific support from ICAR-IIHR, these jamun selections hold significant promise for strengthening nutritional security, climate resilience, and farmer livelihoods in India.

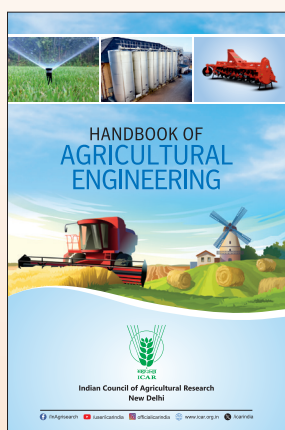
SUMMARY

Patel Jumbo, *Patel Samruddhi*, and *Patel Akal* illustrate the potential of farmer-led selection in diversifying horticultural crops. Each selection combines unique pomological and biochemical attributes, making it valuable for distinct market niches. Their resilience under low-input conditions ensures sustainability, while their nutritional richness enhances consumer appeal.

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