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Cultivating innovation: The role of Indian grape growers in grape breeding

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Abstract
Commercial grape cultivation in India has evolved over approximately seventy years, establishing itself as the most profitable fruit crop in the nation. India ranks as a significant producer of table grapes, yet to dominate the global market, it requires the development of indigenous grape cultivars that exhibit superior fruit quality, diverse aromas, adaptability, climate resilience, and tolerance to various biotic/abiotic stresses. Indian grape growers have leveraged their expertise to identify promising natural mutants and have engaged in clonal selection, which has been pivotal for varietal advancement.

Keywords: *Vitis vinifera*, table grape, cultivar, clone, variety registration etc.

Introduction

Grape (*Vitis vinifera* L.) is a high value fruit crop, particularly celebrated for its role in winemaking. It is believed to have originated in the region bordering the Mediterranean basin and the Caspian Sea, an area historically known as Armenia. From this center of origin, grape cultivation gradually expanded to Asia Minor, Europe, and various other regions where viticulture now thrives. (Olmo, 1976) [6]. Historical evidences showed that grape was known to the Indians since last 4000 years. Ancient Indian medical texts such as the 'Charak Samhita' and the 'Shushrut Samhita' written between 1356-1220BC had mentioned grapes for its medicinal values. (Todkari, 2012) [8].

Although grapes are mainly grown in temperate zones, they are now cultivated widely in tropical and subtropical regions worldwide. Due to its wider adaptability, the grape was acclimatized in India became a premium fruit crop of the country. India has variety of soils and different climatic patterns. Indian grape has highest productivity in world and contributes around 10% of total world fresh grape production. India is 8th major exporter of fresh table grapes in the world (APEDA, 2024) [1]. Indian grape production is concentrated in states like Maharashtra, Karnataka, and Tamil Nadu. Tropical Viticulture in India originated in Nashik region of Maharashtra now the state ranks first in terms of production alone contributing over 67% of the total output in the country.

In the history of Indian viticulture the introduction of exotic grape varieties such as Abi (Bhokari), Fakiri, Habshi, Sahebi, and Anab-e-Shahi by Muslim rulers marked a significant milestone. In India, the systematic introduction of a wide array of grape varieties began under the leadership of S.B.S. Lal Singh, then Professor of Horticulture at Punjab Agricultural College, Lyallpur, who introduced 116 grape varieties in 1928. This effort was further expanded in the late 1950s by Dr. S. G. Randhawa of the Indian Institute of Agricultural Research, New Delhi, who brought in approximately 1,002 grape varieties, particularly from countries like USSR, Yugoslavia, Australia, France, Germany, Italy, Bulgaria, and several others. This extensive introduction enriched the grape gene pool in India, incorporating renowned commercial varieties from around the world, including Thompson Seedless, Perlette, Beauty Seedless, Kishmish Chernyi, Red Globe, Flame Seedless, Fantasy Seedless, Crimson Seedless, Centennial Seedless etc. Drawing from this diverse genetic base, Indian grape growers in the 1970s and 1990s were able to select and develop unique clones with desirable berry and bunch characteristics, leading to the emergence of popular cultivars such as Tas-a-Ganesh, Manik Chaman, Sonaka, Sharad Seedless, Rao Sahebi, and Dilkush. This period laid the foundation for the vibrant and diverse grape industry seen in India today (Chadha, 2019) [4].

Some prominent grape varieties like Crimson Seedless and Victoria from South Africa were imported by the Maharashtra based farmer's co-operative 'Maharashtra Rajya Drakshya Bagaitdar Sangh, Pune; in year 1960 considering the demand in international market. Later on another four grape varieties *viz*. Autumn Seedless, Blush Seedless, Marquis and Autumn Royal were also imported in the year 2008-2009 by the same firm from Davis University, California (MRDBS, 2021) [5].

India is mainly table grape growing country. Indian grape growers used 'clonal selection' as an effective breeding tool for varietal development in table grapes. With their experience, knowledge and efforts Indian farmers developed several promising natural mutants mostly from Thompson Seedless and Kishmish Chernyi. These clones are widely accepted for commercial cultivation and still under cultivation on large area. After the dawn of commercial grape cultivation in India some prominent clones developed by Indian grape growers in early 80s are discussed here due to their popularity amongst grape growing community.

- **Rao Sahebi:** Rao Sahebi was perhaps the first ever clone identified in the country. Rao Sahebi is a natural mutant developed from Cheema Sahebi. Chima Sahebi was the grape variety developed by the great Indian horticulturist Dr. G. S. Cheema during late 30s. Mr. Raosaheb Kadalag, Sangamner, Ahmednagar (Maharashtra) identified Rao Sahebi from Cheema Sahebi in his orchard. Rao Sahebi has elongated berries with strong pedicel attachment compared to Cheema Sahebi.
- **Tas-A-Ganesh**: 'Tas-A-Ganesh' was the first ever clone developed in India from Thompson Seedless by Mr. Vasantrao Arve a grape farmer from Sangali district of Maharashtra. 'Tas-A-Ganesh' responds well to gibberellic acid-3 application and girdling. Its berries are ovoid in shape, displaying a green to amber coloration. The fruit typically contains 20-22° Brix of sugar and with acidity level ranging from 0.50% to 0.65%. It is very popular variety amongst the farmers and still under cultivation.
- **Sonaka:** Sonaka, a standout grape variety, traces its origin to Thompson Seedless, having been meticulously selected as a clone by Mr. Nanasaheb Kale of Nannaj, Solapur (Maharashtra) in 1977. Its berries, measuring 1 to 1.5 inches in length, develop a yellowish hue as they reach maturity. A notably thin pericarp enhances its appeal, making Sonaka highly sought after both as a table grape and for raisin production. The berries are exceptionally sweet, boasting a sugar content between 24 and 26° Brix. Notably, Sonaka exhibits a superior response to Gibberellic Acid-3 treatment compared to its parent, Thompson Seedless.
- **Manik Chaman:** This variety is an excellent choice as a table grape, characterized by its elongated berries. Developed in 1982 by Mr. T. R. Dabade from Solapur district, Maharashtra, through clonal selection from Thompson Seedless, it is known for its high fruitfulness and uniform bunch ripening. The grape clusters typically weigh between 400 and 500 grams. Fruits are elongated with 25 to 38mm in length and turns turn yellowish during ripening. Appealing berry shape and bunch orientation with good yielding capacity are the major attributes of Manik Chaman.
- **Sharad Seedless:** Sharad Seedless is a bud sport identified from the Russian variety Kishmish Chernyi by Mr. Nanasaheb Kale, a grape grower from Nannaj village in Solapur district of Maharashtra. The berries are ellipsoid in shape with an appealing dark blue skin. They feature a crisp pulp and a sweet flavor, with a total soluble solids (TSS) content of 18-20° Brix. The fruit matures approximately 125 days after pruning and delivers a high yield of about 20-25 tonnes per hectare. Sharad Seedless stands out as a promising colored table grape variety, highly favoured by both growers and consumers.
- **Dilkush:** It is a bud sport of a popular variety of southern India 'Anab-e-Shahi'. Mr. Venkatratnam a farmer from Telangana state identified Dilkush. Dilkush produces golden-hued berries that are more elongated than those of Anab-e-Shahi. Its yield potential matches that of its parent variety.
- **Maruti Seedless:** In year 1994; Mr. Maruti Ramchandra Mali, a grape grower from Mhaisal village in Sangli, (Maharashtra) developed Maruti Seedless through clonal selection from Thompson Seedless. It produces triangular-shaped clusters, typically weighing between 400 and 800 grams. The bunches are filled with uniformly round, greenish berries that have abundant pulp and a pleasant aroma.
- **Ambe Seedless:** Ambe Seedless, developed in 2007 by Mr. Vithal Appana Mali of Bedag, Sangli (Maharashtra), is a unique selection derived from Sonaka Seedless. The fruits are distinctively curved, measuring 3-5cm in length and tapering at the tip. Known for their sweetness, the berries contain 20 to 22° Brix of sugar. They feature a thick pericarp and an exceptionally crisp texture. This variety typically yields between 10 and 12 tonnes per acre.
- **Krishna Seedless:** Krishna Seedless emerged as a natural mutant of 'Sharad Seedless' identified in 2006 by Mr. Narayan Sangapa Mali at the Mhaisal station in Sangli, Maharashtra. This variety is distinguished by its uniformly deep purple berries, reminiscent of its parent, Sharad Seedless. The oblong berries, measuring 3-5cm in length, are notable for their resistance to fruit cracking. With a delightfully sweet taste and crisp texture, Krishna Seedless is highly palatable. It also boasts an impressive yield potential of 25-30 tonnes per hectare.
- **Mahadev Seedless:** Mr. Gausmohammed Saipan Shaikh of Boramani, Solapur, Maharashtra developed Mahadev Seedless as a clonal selection from 'Kishmish Chernyi' in 2007. It is grown primarily as a table grape and is characterized by its deep purple skin. The berries are large and crisp, weighing between 10 and 12grams and measuring over 25mm in size. They are sweet, with a sugar content of 20-22°Brix. Bunches are round in shape with an average weight of 700-900g. The average yield of this variety is 25-30 tonnes per hectare.

IPR protected grape varieties of Indian farmer: The grape cultivation in India started in 1960s and thereafter some promising clone were evolved by the grape growers. But the developers of these varieties did not get due benefit due to the absence of intellectual property right mechanism at that time in India. A robust framework for safeguarding plant varieties and upholding the rights of both farmers and

breeders is vital for acknowledging and protecting the invaluable role farmers played in conserving and improving plant genetic resources. Such recognition not only honors their contributions but also incentivizes the creation of new and improved plant varieties. Ensuring the rights of breeders and farmers is fundamental to fostering innovation and advancing research and development within the agricultural sector. To align with the World Trade Organization's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), the Government of India enacted the Protection of Plant Varieties and Farmers' Rights Act in 2001. This legislation serves to protect intellectual property in agriculture by enabling the registration of new plant varieties. Through this system, India has established a mechanism to secure the intellectual property rights of newly developed plant varieties, thereby promoting agricultural innovation and supporting the interests of both breeders and farmers. The Protection of Plant Varieties and Farmers' Rights Authority of India (PPV&FRA) grants registration for newly developed plant varieties upon application. Grape crop was notified in Indian gazette and became eligible for varietal registration in year 2014. Since then several candidate grape varieties were applied for the registration under PPV&FRA. So far total twenty seven varieties are issued registration certificates out of which fifteen are farmers grape varieties (PPV&FRA, 2025) [7]. A brief overview of these varieties is given below (Table 1).

1. **Nanasaheb Purple Seedless:** Nanasaheb Purple Seedless is a clone of 'Sharad Seedless' distinguished by its larger, bolder berries developed by Nanasaheb Kale, a farmer from Nannaj village of Solapur district (Maharashtra). It is table purpose variety with bold (25-26 mm) and uniform oval shape berries. Berries are oblate shape, purple-black, seedless with medium skin thickness. Berry cracking is not evident in this variety. It matures between 115-125 days after fruit pruning. It is a regular bearer variety with a fruit yield of 12-14 tonnes yield per acre.
2. **Sarita Purple Seedless:** This remarkable bud-sport was discovered by Mr. Nanasaheb Kale of Nannaj, Solapur, Maharashtra, as a unique variant emerging from 'Sharad Seedless'. It is a promising table grape variety with elongated deep purple colour berries which are 1.5 to 2 inches long. It has thick skin and does not shows berry cracking. The berries are cylindrical, purple-black, and seedless, featuring a thin skin and high sugar content. Each bunch typically weighs between 400 and 500 grams. The fruit matures 110 to 120 days after pruning, and the variety yields an average of 12 to 14 tonnes per acre.
3. **Jay Seedless:** Jay Seedless is a table grape variety developed by Mr. Haribhau Maruti Waykar, a grape grower from Gunjalwadi (Aarvi), Pune, Maharashtra. This is another clone of 'Sharad Seedless' with bold fruit size. Berries are long elliptical shape, purple-black, rudimentary seeds with medium skin thickness. Berry size of Jay Seedless is bolder than Sharad Seedless with bunch weight varies between 350-500 gm. It matures between 125-135 days after fruit pruning producing 12-14 tonne fruit per acre.
4. **Sudhakar Seedless:** This variety is a natural clone of Thompson Seedless, developed by Mr. Sudhakar Kshirsagar in Shivadi (Ugaon), Nashik, Maharashtra. It is a white table grape known for its firm flesh. The berries are large in size, round, white, seedless, and have a thicker skin compared to Thompson Seedless. The grape clusters are cylindrical, weighing between 350 and 450 grams. The fruit matures 135 to 140 days after pruning, with a yield potential of 15 to 16 tonnes per acre.
5. **DANAKA:** DANAKA is a clonal selection from 'Sonaka' developed by Mr. Dattatray Nanasaheb Kale from Solapur (Maharashtra). This is the fifth variety in a row developed by this innovative grape grower after Sharad Seedless, Nanasaheb Purple seedless, Sarita Seedless and King Berry. 'Danaka' has elongated berries (up to 4cm long) with bold berry size (width 17-18 mm). The berries are crispy due to dense and tight flesh. The firm berry attachment of this variety imparts it stability and better shelf life during distant transport. This variety matures within 120 days after fruit pruning and produces 12-13 tonnes of fruit per acre.
6. **Nath Jambo Seedless:** This exceptional clone of 'Sharad Seedless' was developed by Mr. Vithal Nivrutti Thorat of Kalamb, Pune (Maharashtra) in 2006. The variety features uniformly bold berries, measuring 22 to 26mm, with a delightful crispness and appealing aroma. Its seedless berries display a striking dark blue to black skin. The grape clusters are medium-sized and cylindrical, with prolific bunch formation. Remarkably, bunches reach harvest maturity within just 120 days after fruit pruning.
7. **Utkarsha:** Utkarsha is a coloured grape variety developed by Mr. Ramchandra Dagu Chambhale a grape grower from Nashik region of Maharashtra. It has cylindrical shape berries with blue-black skin colour. It bears medium size cylindrical shape bunches. It has 27-29 mm berry size. Crop matures in 121-130 days after fruit pruning which is 7-10 days earlier than Sharad Seedless. Utkarsha is a good yielder and produces 11-13 kg fruit per vine.
8. **Santy Seedless:** A new seedless variety registered under PPV &FRA by Mr. Santosh Madhukar More from Pimpalgaon Baswant Taluka Niphad, District Nashik, (Maharashtra). Santy Seedless is early maturing variety which matures within 110 days after fruit pruning. Berries are round and green in colour with typical flavour. It produces fruit with 16-18mm berry size. Bunches weigh in the range of 200-500g. Around 12-15 kg fruit yield per vine can be harvested from Santy Seedless.
9. **Rukuchan:** Rukuchan is a green variety with rudimentary seeds. This variety is developed Mr. Palzes Angno form Kargil region of Jammu and Kashmir. The berries are short elliptical in shape. Berry has neutral flavour with high sugar accumulation potential. It produces medium size bunches (200-400g).
10. **Churgun:** Mr. Sonam Tsong, form Skuast-K, KVK Kargil, Ladakh-194103 has developed this variety. Churgun has green-yellow skin coloured berries with rudimentary seeds. The berries are short elliptical in shape with berry size 14-18 mm. Tight berry pulp and firm berry attachments are the unique traits of Churgun. It bears small bunches weighing around 250g. It matures within 130-140 days after fruit pruning.
11. **RK Seedless:** It is green seedless variety with elongated berries and firms pedicel attachment. It bears conical shaped bunches weighing around 750g. It

produces 13-15 kg fruit per vine. It has comparatively less disease incidence than Thompson seedless. RK Seedless mature within 140 days after fruit pruning. The grape grower Mr. Raghunath Kedari Zambre, from Dongarsoni village, Taluka Tasgaon, District Sangali, (Maharashtra) is the owner of RK Seedless.

12. **VSD Seedless:** Mr. Pradeep Shankar Desai, at post-Vadgaon, Taluka Tasgaon, District Sangali, (Maharashtra); has developed VSD seedless. It is a seedless variety with neutral berry flavour. It bears elongated finger shape berries. Bunch weigh more than 500g. Each vine of VSD Seedless can gives 12-14 kg fruit yield.
13. **King Berry:** The variety is developed by Mr. Dattatray N. Kale, a grape grower from Solapur district of Maharashtra. It is the coloured and seedless grape variety which matures in 110-115 days after fruit pruning. Bunches are compact and conical shaped weighing up to 750g. It gives better response to GA_3 application. Around 13 to 15 ton fruit can be harvested from this variety from one acre plantation.
14. **Siddh Golden**: Mr. Shashidhar Potdar and Mr. Ravindra Potdar; the grape growers from from Kavalapur village in Miraj Taluka of Sangli District developed a new grape variety called Siddha Golden. It is bold and elongated grape variety. The berry dropping at maturity is negligible in this variety due to firm berry attachment. Siddha Golden fetches higher price than other grape varieties which is added benefit to grape growers (https://marathi.abplive.com, 2022).
15. **Black Kwin Berry:** Mr. Jaykar Rajaram Mane an innovative grape grower from Sawantpur, Taluka Palus, District Sangli (Maharashtra) developed this variety. It is seedless variety with elongated berries (44-50mm) having blue black skin colour. Black Kwin Berry bears big sized conical shaped bunches weighing more than 500g each. It reaches maturity 120 to 125 days after fruit pruning. It is a good yielder which can produce around 16-18 ton fruit per acre.

Table 1: Registered grape varieties of Indian grape growers till December, 2024

Sr. No.	Name of the farmer	Denomination	Date of filling application	Maximum Protection Period up to
1	Mr. Dattatraya Nanasaheb Kale	Sarita Purple Seedless	20 January, 2015	21 November, 2037
2	Mr. Dattatraya Nanasaheb Kale	Nanasaheb Purple Seedless	20 January, 2015	21 November, 2037
3	Mr. Haribhau Maruti Waykar	Jay Seedless	07 September, 2016	21 November, 2037
4	Mr. Sudhakar Bhaskar Kshirsagar	Sudhakar Seedless	31 October, 2016	21 November, 2037
5	Mr. Dattatraya Nanasaheb Kale	DANAKA	20 January, 2015	22 June, 2038
6	Mr. Pradeep Shankar Desai, Mr. Vijay Shankar Desai, Mr. Dilip Shankar Desai	VSD Seedless	14 July, 2020	16 January, 2037
7	Mr. Dattatraya Nanasaheb Kale	King Berry	14 July, 2020	16 January, 2037
8	Mr. Raghunath Kedari Zambre	RK Seedless	14 July, 2020	16 January, 2037
9	Mr. Shashindra Balkrushna Potdar	Siddh Golden	10 June, 2021	14 November, 2040
10	Mr. Jaykar Rajaram Mane	Black Kwin Berry	21 June, 2021	14 November, 2040
11	Mr. Sonam Tsong	Churgun	04 August, 2016	17 October, 2041
12	Mr. Palzes Angmo	Rukuchan	04 August, 2016	17 October, 2041
13	Mr. Santosh Madhukar More	Santy Seedless	12 July, 2022	17 October, 2041
14	Mr. Ramchandra Dagu Chumbhale	Utkarsha	12 July, 2022	17 October, 2041
15	Mr. Vithal Nivrutti Thorat	Nath Jambo Seedless	03 August, 2018	22 August, 2039

Conclusion

Commercial table grape cultivation in India began to flourish around the 1960s, initially relying on introduced varieties available at the time. Through strategic clonal selection and the adaptation of cultivation practices to suit Indian climatic conditions, the country has since emerged as a global leader in table grape production. Drawing upon their expertise and dedication, Indian grape growers have identified and developed numerous promising natural mutants particularly from Thompson Seedless and Kishmish Chernyi; based on superior berry and bunch characteristics. These clones have gained widespread acceptance for commercial cultivation across the nation. Indian grape growers are increasingly cognizant of the importance of Intellectual Property Rights (IPR) in safeguarding their innovations. To date, fifteen grape cultivars developed by Indian growers have been registered with the Protection of Plant Varieties and Farmers' Rights Authority, New Delhi. While these achievements in varietal development are commendable, there remains a pressing need for grape varieties with a broader genetic base. Future breeding efforts must focus on enhancing fruit quality, productivity, shelf life under cold storage for long-distance transport, diverse maturity periods, uniform colour development in warm and dry climates, cost-effectiveness, and resilience to both abiotic and biotic stresses. Such advancements are essential for strengthening India's position in the global grape export market.

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