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VITICULTURE IN MADHYA PRADESH: A REVIEW

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Abstract

In spite of the fact that grapevine may thrive in a variety of climates, it grows best in areas that satisfy particular climatic criteria. Tropical areas are those latitudes between the Tropics of Cancer and Capricorn where grapes may be found in abundance. In recent years, viticulture operations in tropical areas have grown considerably, and nations like Brazil, Venezuela, India, & Thailand situated in tropical and subtropical climates provide quality table grapes, wine, grape juice, and raisins. Global advances in communications technology, as well as in geography, provide tremendous opportunity for developing better ways to disseminate precise viticultural information. A number of helpful instruments for monitoring and controlling vine growth have been developed thanks to recent technology advancements. Precision viticulture, on the other hand, aims to use as many observations as possible to characterize the vineyard's geographic variability at a high resolution as well as provide management suggestions to increase quality, output, and sustainability. The study provides a short overview of Madhya Pradesh's precision viticulture technology state-of-the-art.

Keywords: Viticultural practices; Vitis vinifera; Fermentation; Vine making; Viticulture

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1. Introduction

Vines are grown in many climatic zones throughout the globe, each with its own set of advantages for cultivating high-quality grapes. The temperate climate belt includes most of the world's viticulture areas, which are situated between latitudes of 40° and 50°N in the northern hemisphere and between latitudes of 30° and 40°S in the southern hemisphere. Tropical viticulture has lately attracted a lot of attention, and commercial grape cultivation in tropical areas has been practiced for around 50 years. The intertropical zone includes several grape-growing areas between the Tropics of Capricorn and Cancer.

In India, 78% of grapes are utilised for table uses, 17%–20% are dried for raisin manufacture, and 2% are used for juice and wine production. In 2004–05, India exported 35,936 metric tonnes of fresh grapes worth Rs. 1106.7 million to markets in 23 countries. India imported fresh grapes for Rs 519.86 lakh worth of 1111.27 tonnes that year. Indian grape, raisin, & wine making now meets "international quality standards", which bodes well for the country's future expansion of the fresh grape, raisin, and wine industries to keep up with domestic demand as well as the growing export market, particularly in the European Union and countries in South Asia.

Figure 1: Vineyard

1.1. Viticulture

In viticulture, grapevines are studied and practised in order to produce fruit that is appropriate for a certain end use. When humans began to realism that "Vitis vinifera's (the Eurasian grapevines)" fruit was tasty yet difficult to get to because of its height, it became popular. Researchers already know about viticulture how to control the vine after it was planted where it was simpler to maintain.

It's not easy to manage grapevines, especially if the product you're producing from the grapes is wine. The winemaking method brings out and enhances characteristics in the fruit that aren't present when consumed fresh. Several variables influence vine quality and yield, include environmental ones (such as

soil, temperature, as well as sunlight) as well as management-related ones. Additionally, the vines will react differently depending on which of these variables is present.

1.2. The Grape Vine

The grapevine is a “woody climbing vine” known as “a liana” that is supported by other plants or buildings. It began its existence on the forest floor, where there's little light, as well as quickly grew to the summits of the forest canopy as a result of natural selection. It developed blooms and fruit after it reached the tops of the trees and was fully exposed to the lig.

Grapevines are referred to by a variety of different names. The dormant cane, which is composed of nodes and internodes, is visible at the commencement of the growth season if we look at it from that point on. This season's growth will be supported by the shoots that emerge from each node's bud. From every node site, leaves will begin to appear as the shoots develop. Nodes 3-4 may contain clusters of flowers, and a branch may have zero to three clusters or more, according to the vine type. A tendril will extend from each leaf opposing the flower clusters. The vine's leaf and tendril growth is indeterminate, so as long as the circumstances are right, it will keep growing.

After summer's hot temperatures, fall brings colder temperatures that halt development and harden the shoot stem, making it more resistant to the freezing temperatures of winter. Vitis vinifera can usually tolerate temperatures as low as -20°C, with some newer crosses capable of withstanding temperatures as low as -30°C. An enormous amount of work has gone into creating hardy varietals like the Northern Grapes Project (see related websites) in order to broaden the range of regions where wine may be grown.

2. Vine Making Technology

“Pre-fermentation, fermentation, and post-fermentation activities” make up the bulk of winemaking. Grape wines undergo pre-fermentation during which the fruit is crushed to release juice. While red and white wines have their juice removed from their skins, white wines do not. Sedimentation or centrifugations are the most common methods for clarifying white wine juice. The clarified juice is then mixed with yeast to begin the fermentation process. It is common practise in red winemaking to keep the crushed grapes' pulp, skins, and seeds together throughout the fermentation process. To get to the taste and flavour, this is how it's done. The crushed pulp (must) used in red winemaking is fermented with yeast.

The carbohydrates in the juice are converted to ethanol and carbon dioxide during fermentation. During fermentation, the sugars are used by the yeasts. A stalled fermentation happens when the available sugar is really not fully used by the yeasts, as well as the pace of fermentation slows or stops. Centrifugation, racking, filtration, and/or filtering may all be used to clear the mixture. Non-traditional approaches to winemaking use an anaerobic fermentation method and supply nitrogen needed for yeast development using di-ammonium phosphate (DAP). Post-fermentation procedures are those that are carried out after fermentation has finished or when it has reached the desired stage. In stainless steel

containers or oak barrels, wine is drained off the -yeast lees. The wine may be strained, cold stabilized, fined, or mixed while it's in storage.

Commercially available fining agents, including as enzymes, bentonite, diatomaceous earth, and egg albumen, might help clarify wines when added. During maturity, wine undergoes many changes, and after the wine has reached the proper stage of development, it is filtered and packaged.

3. Literature Review

(Bates, 2021) [1] The agricultural assemblage from the Indus Civilization included grapes (Vitis vinifera L. ssp. vinifera), which have been recognised as part of the species. This non-native crop's appearance in northern South Asia between 3200 and 1300 bc has been cited as evidence supporting crop diffusion, long-distance commerce, as well as the acceptance of foreign agricultural techniques and foodways since its wild progenitor does not grow in the area. It's difficult to distinguish between wild and cultivated grapes, in particular. Determining the term "grape" in South Asian antiquity may be difficult. The over-reliance on measures of length, width, and thickness, as well as a lack of description and uniformity, are taken into account. It turns out, however, that a study of the region's flora reveals many Vitaceae taxa that might be 'grape' candidates. For the complex societal interpretations of "what grapes signify in the Indus," identification criteria for local Vitaceae must be further established to better comprehend the function of Indus grapes.

(Santos et al., 2020) [2] Various European areas' socioeconomics depend heavily on viticulture and winemaking. When it comes to the characteristics of a particular wine area, climate has a significant impact on canopy microclimate, vine development, vine physiology, yield, and berry composition, all of which work together to define wine qualities and typicity. Grapevine production is highly reliant on weather and climatic conditions, therefore new problems are expected to emerge as a result of climate change. Many wine areas have already seen shifts in viticultural appropriateness during the past few decades, whether in general viticulture or the usage of particular varietals. However, climate change is expected to worsen these current trends in wine production suitability, notwithstanding their geographical heterogeneity. Such changes may alter the geographic distribution of wine-producing areas, and in many instances, wine typicity will be at risk. This will need the adoption of effective risk reduction measures that are well thought out, appropriate to the local climate as well as cost-effective. There is still work to be done to fully understand the potential of the many adaptation alternatives. Nevertheless, their acceptance will be critical to the long-term socioeconomic and environmental sustainability of Europe's hugely valuable viticulture and winemaking industry.

(Mishra & Sajnani, 2020) [3] There is so much for the Indian tourist sector in Madhya Pradesh, which is rightfully regarded as the heart of Incredible India. Aside from the three UNESCO world historic sites located in the state, nine national parks and twenty-five animal sanctuaries dot the landscape. Since the state government began making significant efforts to promote the state's tourist potential and establish its new tourism strategy, which it touts as one of the most progressive in the nation, its full potential has

just recently been apparent. As a vineyard destination, Madhya Pradesh has grown in popularity over the last decade due to the reasons examined in this article. In addition, the case study seeks to examine how the advertising effort has contributed to the expansion of the grape industry in the state.

(Maghradze et al., 2019) [4] The "National Wine Agency of the Republic of Georgia's Research Project for the Study of Georgian Grapes and Wine Culture" produced a multilingual guidebook on contemporary viticulture as one of its outcomes. "Agrometeorological study of environmental resources and limits" was the focus of the initial parts of the handbook, which included an overview of "Georgian climate and agrometeorological characteristics", followed by regional cards with more specific information. Agrometeorological data gathered by Georgian and international networks was used for the study, which spanned the years 1974-2013. "Multiple agricultural-meteorological indices" were computed to determine the resources and limits of viticulture across Georgia's wine-growing regions, giving essential information for grape-growing and wine-making.

(Photiadou et al., 2017) [5] The production of wine is significantly impacted by climate change and fluctuation. Due to a changing environment, each region's wines will have different characteristics as natural year-to-to-year climatic fluctuations enhance the unpredictability of wine companies' revenue and therefore impact profitability and economic resilience. The challenge for the viticulture industry is to keep an eye on these developments and adjust business methods as necessary. The "European Climate Assessment and Dataset (ECA&D)" and its gridded counterpart, the "European Oceanographic Observing System (E-OBS)", are instruments for tracking changes in Europe's climatic conditions, with a focus on severe weather. ECA&D and E-OBS for viticulture are discussed in detail in this article. In the last several decades, regions that have been too cold for Chardonnay production have expanded, while those that have been appropriate in the past have shrunk. In the last stages of grape ripening, the diurnal temperature range changes, as does the frequency of heavy precipitation. Finally, the first findings from a new South American dataset are revealed.

(Banjanin et al., 2017) [6] The current status of viticulture development in Bosnia and Herzegovina is discussed in this article. There is a comprehensive review of the literature used in this study. Several secondary data sources were used to supplement the primary data. Small, family-run vineyards predominate in BiH's viticulture (up to 2 ha). In older vineyards, the majority of the cultivars are autochthonous, while in newer vineyards, the cultivar selection is more contemporary. Despite the fact that Bosnia and Herzegovina has great viticultural potential and favourable climatic conditions, wine imports are almost five times higher than exports. Because of this, professional, scientific, and governmental organisations must work together more effectively with grapevine farmers and wineries to improve the production process. In order to organise the production of virus-free propagation material, introduce new cultivars, and preserve indigenous variety in BiH's vineyards, this collaboration is critical.

(Matese & Di Gennaro, 2015) [7] Viniculture with an eye toward precision strives to make the most of a vineyard's oenological potential. For wine areas with high quality requirements, this is particularly true, since site-specific management methods improve both quality and yield at the same time. As new technologies for assisting vineyard management are introduced, efficiency and quality of output may be increased, while environmental effect is minimised. Global advances in communications technology, as

well as in geography, provide tremendous opportunity for developing better ways to disseminate precise viticultural information. A number of helpful instruments for monitoring and controlling vine growth have been developed thanks to recent technology advancements. Precision viticulture, on the other hand, aims to use as many observations as possible to characterise the vineyard's geographic variability at a high resolution as well as provide management suggestions to increase quality, output, and sustainability. Precision viticulture technologies are briefly summarised in this review. In the first part, geolocation and distant & proximal sensing are covered, while in the second, variable-rate techniques and innovative agricultural robots are discussed.

(Swami et al., 2014) [8] An overview of wine production from different fruits, categorization of wines, and the current state of the wine business are all covered in this article. This article discusses several types of wine, including grape wine, fruit wine, berry wine, vegetable wine, plant wine, and raisin wine. Various "tropical and subtropical fruit wines" including mango, banana, and apple cider production updates are also provided.

(Jones et al., 2014) [9] On the one hand, scientists are trying to better understand how climate and viticultural techniques affect fruit quality during harvest as well as the quality of sparkling wine. As a way to achieve the required level of quality in the harvested food product, factors including variety, soil type, planting density, pruning technique, climate, and future climate warming are addressed. There had been a general consensus that grapes intended for sparkling wines were subjected to less rigorous viticultural care than those destined for table wines. There aren't many researches on fruit control in sparkling wine production. Research on canopy control, leaf removal, as well as yield modification for the production of table wines shows promise for use in sparkling wine production. Even though fruit quality objectives differ from area to region, different combinations of variety, clone, and management are being utilised to meet those goals. The research on viticultural management, in particular that alters the temperature of the clusters and the exposure to incident light, yield manipulation and fruit quality, is likely to best inform production methods that result in fruit quality suitable for the manufacture of premium sparkling wine. Climate change impacts fruit production in premium sparkling wine production in terms of flavour development and high acidity, creating new difficulties such as the need for more automation to keep costs low. Growing areas are shifting to colder locations where high-acid fruit may be produced, as well as increasing research into new cultivars and clones that do better in a warmer environment.

(Kok & Faculty, 2014) [10] In spite of the fact that grapevine may thrive in a variety of climates, it grows best in areas that satisfy particular climatic criteria. Tropical areas are those latitudes between the Tropics of Cancer and Capricorn where grapes may be found in abundance. In recent years, viticulture operations in tropical areas have grown considerably, and nations like Brazil, Venezuela, India, and Thailand situated in tropical and subtropical climates provide quality table grapes, wine, grape juice, and raisins. Tropical locations employ different grape-growing production methods than typical temperate areas. Table, raisin, & wine grape varieties predominate among the grapes produced in these areas. There should be early ripening grapes that are resistant to fungal infections and short growth cycles for tropical areas.

4. Viticulture In Madhya Pradesh

Ambi Vineyard, Ratlam, is Madhya Pradesh's only vineyard. The AMBI's mission is to become the most respected organisation in the wine and spirits sector by delighting customers with unmatched brand value and constant innovation that continuously exceeds their expectations. [11]

Figure 1: Ambi Vineyard, Madhya Pradesh

In 1982, MR. AMBARAM PATIDAR, the 'Father of Grapes in M.P.,' planted the first plant of grapes in his organisation, 'KISAN SABJI AND FAL UTPADAK SANGH' (Farmer's vegetable and fruit grower association). After developing 'Mutual Working Formula' with the goal of giving farmers more control and fostering cooperation in society, he founded AMBI, a company designed only by farmers for farmers. It was decided to build up winery by a group of tiny 18 households sitting atop choupal of hamlet TITARI enjoying finest viticulture climate conditions. PATEL WINE AND FRUIT PROCESSING INDUSTRIES, after tremendous success with 'PRAGRATISHIL KRISHK CLUB,' has entered the ancient and beautiful art of winemaking under the banner. AMBI FAMILY is made up of these relatives who have all come together to form a single unit. After making their decisions, they were bound to the 'AMBI' project as it developed. [12]

5. Recommendations

Despite the fact that viticulture confronts many challenges, the world's vineyards are expanding at an increasing rate. These steps should be considered for the modernisation of vineyard technology on both ancient and newly created vineyards: [13]

- To introduce fresh clones of standard and autochthonous varieties into production, as well as novel and domestic kinds, to update the vine collection.
- To tighten and subsidise standards for high-quality manufacturing and virus-free seedling material.
- To improve the cadaster of a vineyard.
- To better position a product on the market, create clusters or use other methods of association.
- In order to identify and prescribe suitable growth systems, and correspondingly plant spacing and plant density.
- Intensify collaboration between manufacturers and expert advice services.
- To provide agricultural budget money for the development of viticulture.

6. Conclusion

There is a dearth of information in the literature on the relationship between soil characteristics and grape or wine quality; therefore the viticultural sector may want to explore this more in the future.

Furthermore, global warming poses a serious threat to the production of premium sparkling wine since it threatens flavour development and high acidity in the fruit used in the wine. Fruit production has major challenges as a result of global warming, including slower ripening and acidity loss. With the current and probable future shift to alternate kinds and clones, more study will be required, as will the relocation of production to colder areas, which will present new difficulties including late frost and greater disease burden.

The wine business must take appropriate steps to deal with the effects of climate change, primarily by establishing appropriate regional plans. Since timely strategic planning will offer competitive benefits, wine grape farmers are becoming more conscious of this issue. Nevertheless, as climate change progresses, more study is required to properly deal with the anticipated changes. As a result, it is incumbent to wine industry decision-makers and stakeholders to put climate change mitigation measures in place. These initiatives will have a significant impact on the state's viticulture industry's long-term economic viability and environmental sustainability.

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