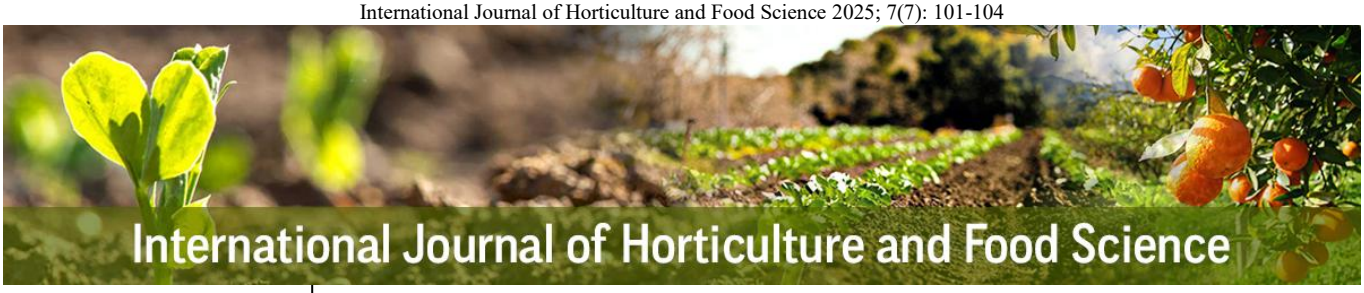

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Evaluating environmental and technological factors for optimized utilization of mulberry fruits in Tamil Nadu

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Abstract
Mulberry (*Morus* spp.) fruits are valued for their nutritional and therapeutic properties but remain underutilized for juice production in India. This integrated study aims to enhance mulberry utilization by evaluating two key aspects: the influence of agro-climatic conditions on fruit yield and the efficiency of different juice extraction techniques. Fruits of popular cultivars were collected from major mulberry-growing regions in Tamil Nadu during the peak fruiting season. Weather data indicated that moderate temperatures (33-36 °C), relative humidity between 50-70%, and moderate rainfall favored higher fruit yield, particularly in regions like Palladam and Salem. In parallel, juice extraction trials using the MR-2 cultivar were conducted with three different methods: press-type, blending-type, and centrifugal extraction. The press-type extractor demonstrated superior performance with the highest juice yield (86.02%) and lowest extraction loss (9.43%). These findings underscore the importance of integrating climatic suitability and processing technology to optimize fruit productivity and juice recovery in mulberry cultivation and commercialization.

Keywords: Mulberry fruit, fruit yield, juice extraction, climatic factors, MR-2, Tamil Nadu

1. Introduction
Mulberry (*Morus spp.*) is cultivated in tropical and temperate regions, primarily for silkworm rearing in Asian countries like India and China, and for fruit production in countries like Turkey and Greece (Gerasopoulos & Stavroulakis, 1997; Ercisli, 2004) [6, 4]. Mulberry fruits are valued for their nutritional and medicinal properties and are processed into various products such as jams, syrups, and juices.

Environmental conditions play a critical role in fruit yield. In Tamil Nadu, the cultivar MR-2 produces 40-50 g of fruit per plant, with higher yields and juice content observed during the spring season compared to summer (Masilamani *et al*., 2008) [9]. In subtropical India, cultivars like MS-9404 yield up to 11 kg of fruit and 8.8 liters of juice per tree, highlighting the potential for commercial exploitation (Singhal *et al*., 2009) [12].

Juice extraction efficiency is equally important in optimizing mulberry utilization. Previous studies have shown that extraction methods significantly influence juice yield and quality. Shamsudin *et al*. (2015) [11] and Yang *et al*. (2011) [13] demonstrated that press-type extraction is superior in maximizing juice recovery while minimizing loss. Variations in technique can result in juice yields ranging from 60% to over 85%, depending on equipment and fruit type.

This study adopts a dual approach: (i) assessing the effect of agro- climatic conditions on mulberry fruit yield across different regions of Tamil Nadu, and (ii) comparing the efficiency of three juice extraction techniques press-type, blending-type, and centrifugation-type using the MR-2 mulberry cultivar.

2. Materials and Methods
2.1. Collection of Mulberry Fruits and Weather Data: The fruits were collected from major mulberry-growing areas in Tamil Nadu including Coimbatore, Salem, Tiruppur district (covering Avinashi, Palladam, and Udumalpet), and Dharmapuri. Fruits from popular mulberry cultivars were harvested at the fully ripened stage during the peak fruiting season, from September to November 2016. The harvested fruits were carefully collected in sterile zip-lock polythene bags and transported under chilled conditions.

Upon arrival, the samples were stored at 4 °C until further analysis.

To understand the agro-climatic influence on fruit yield, weather parameters including maximum and minimum temperatures, average relative humidity, and average rainfall were recorded during the sampling period. The data were obtained from official meteorological sources relevant to each district. Details of prevailing weather conditions across the locations during the study period are presented in Table 1.

2.2. Juice Extraction and Yield Estimation

Freshly harvested mulberry fruits of the MR-2 variety were used for juice extraction. The fruits were carefully inspected to eliminate damaged or spoiled samples and were thoroughly washed in tap water to remove adhering dust and debris. Three different extraction methods were employed: a press-type juice extractor, a blending-type extractor, and an electric centrifugal juice extractor.

For each method, 100 g of cleaned mulberry fruits were used per extraction trial. The extracted juice was filtered using a nylon sieve to separate pulp and solid residues. The weight of the extracted juice was measured using an analytical balance, and the volume was recorded. The juice was stored at 4 °C to allow sedimentation before further analysis (Ndubisi *et al*., 2013) [10].

The following parameters were calculated to assess extraction performance:

- **Juice Yield (%)** = (Weight of juice / Weight of pulp) × 100
- **Extraction Efficiency (%)** = (Weight of juice extracted / (Weight of juice extracted + Weight of residual waste)) × 100
- **Extraction Loss (%)** = ((Weight of feed - Weight of juice extracted + Weight of residual waste) / Weight of feed) × 100

Each extraction method was replicated, and the data obtained were analyzed statistically.

3. Results and Discussion

The results from this study revealed significant insights into both the environmental influence on mulberry fruit yield and the effectiveness of various juice extraction techniques.

3.1. Environmental Factors Influencing Fruit Yield

Analysis of weather data across mulberry-growing regions in Tamil Nadu highlighted that temperature, relative humidity, and rainfall significantly influenced fruit yield. Locations such as Palladam and Salem recorded higher relative humidity (55-68%) and moderate rainfall during the fruiting season (September-November), conditions favorable for mulberry fruit development. In contrast, Dharmapuri experienced variable temperatures and lower humidity in the early months, which may have contributed to inconsistent fruit setting.

Table 1: Climatic parameters recorded during the fruit sampling period (June-November 2016) across major mulberry-growing regions of Tamil Nadu

Month	Location	Max Temp (°C)	Min Temp (°C)	Avg. RH (%)	Avg. Rainfall (mm)	Soil Type
June	Coimbatore#	31.69	23.69	57.06	3.68	Red
	Salem*	32.43	34.26	60.33	4.63	Red
	Dharmapuri¤	36.25	25.96	41.2	2.12	Red loamy
	Palladam˚	33.89	25.48	61.52	4.13	Red loamy
July	Coimbatore	29.36	25.49	53.89	3.5	Red
	Salem	35.2	23.69	57.19	3.95	Red
	Dharmapuri	30.26	24.23	59.36	5.59	Red loamy
	Palladam	32.83	26.36	68.63	5.36	Red loamy
August	Coimbatore	34.58	26.93	42.16	3.6	Red
	Salem	36.96	25.89	62.59	5.5	Red
	Dharmapuri	26.95	21.3	65.12	6.0	Red loamy
	Palladam	30.36	25.49	65.16	5.58	Red loamy
September	Coimbatore	36.03	23.65	42.26	2.02	Red
	Salem	37.28	26.23	58.23	4.2	Red
	Dharmapuri	36.43	25.41	58.05	5.6	Red loamy
	Palladam	38.96	27.39	55.21	3.26	Red loamy
October	Coimbatore	33.11	24.62	51.47	2.1	Red
	Salem	37.56	25.21	63.37	2.68	Red
	Dharmapuri	38.63	27.63	59.46	5.6	Red loamy
	Palladam	38.24	27.89	58.2	4.52	Red loamy
November	Coimbatore	33.68	23.56	51.26	2.37	Red
	Salem	36.45	26.7	67.25	6.37	Red
	Dharmapuri	37.98	24.32	58.25	4.92	Red loamy
	Palladam	37.89	25.63	53.63	6.2	Red loamy

Source: #Department of Agriculture Meteorology, Tamil Nadu Agriculture University, Coimbatore, ˚Technical Service Centre, Palladam, ¤Technical Service Centre, Dharmapuri. *Regional Sericulture Research Station, Salem.

In addition to yield, fruit colour varied distinctly among mulberry cultivars, likely influenced by both genetic factors and agro-climatic conditions. The V1 cultivar produced uniformly black fruits, MR2 exhibited dark purple to black, S13 bore pinkish-black fruits, and S36 displayed red to black fruits. Among all cultivars, MR2 recorded the highest fruit yield, with values ranging from 46.15 g to 55.24 g plant^{-1} season^{-1} across locations like Dharmapuri, Palladam, and Udumalpet Presented in Table 2.

Table 2: Fruit yield and colour characteristics of mulberry cultivars in Tamil Nadu

Cultivar	Location	Fruit yield (g plant^{-1} season^{-1})	Colour of the fruit
V1	Coimbatore	20.23	Black
	Salem	23.63	Black
	Avinashi	19.56	Black
S13	Erikodi	22.26	Pink and black
MR2	Dharmapuri	46.15	Purple and black
	Palladam	55.24	Dark purple and black
	Udumalpet	53.12	Purple and black
S36	Coimbatore	18.12	Red and black

Data expressed as mean ± standard deviation.

This consistent and superior performance under varied conditions highlights MR2 as the most promising cultivar for maximizing fruit productivity in Tamil Nadu. This variation in pigmentation may be attributed to differences in anthocyanin content, which is known to be affected by temperature and sunlight exposure during fruit maturation. These morphological differences are visually illustrated in Plate 1.

Plate 1: Morphological characteristics of different cultivars of mulberry fruits

These findings align with Masilamani *et al*. (2008) [9], who reported higher yields and juice content in MR-2 mulberry during spring compared to summer under optimal weather conditions. Similarly, Ercisli and Orhan (2007) [5] emphasized the impact of regional climatic variations on both fruit yield and quality in Turkish mulberry cultivars.

3.2. Effectiveness of Juice Extraction Techniques

Among the three techniques tested press-type, blending-type, and centrifugal extraction the press-type juice extractor showed the highest juice yield (86.02%) and extraction efficiency (64.11%) with the lowest extraction loss (9.43%). The blending-type method, in contrast, yielded only 61.36% juice with a 28% loss (Table 2).

Table 2: Performance evaluation of different extraction methods of mulberry fruit juice (var. MR-2)

Extraction method	Juice yield (per cent)	Extraction efficiency (per cent)	Extraction loss (per cent)
Press type juice extractor	86.02 ±3.28[a]	64.11±0.95[a]	9.43±0.46[c]
Blending type	61.36 ±2.37[c]	57.36±0.66[c]	28.00±0.4[a]
Centrifugation type juice extractor	83.19 ±0.47[b]	59.16±1.43[b]	10.56±0.30[b]

Values are means ± Standard deviation, a-f values not sharing a common superscript letter within each column differ significantly at $p < 0.05$ (DMRT)

These findings support earlier studies by Shamsudin *et al*. (2015) [11] and Yang *et al*. (2011) [13], which highlighted the superiority of mechanical press-type extractors for maximizing juice recovery from fruits like mulberry and pomegranate.

Ndubisi *et al*. (2013) [10] also reported similar performance variations among extraction methods in tropical fruits, where press-type extractors minimized fiber loss and enhanced juice clarity. The significant difference in efficiency and waste across methods underlines the importance of selecting suitable equipment for commercial juice processing.

3.3. Integration of Climate and Processing Insights

This dual approach highlights that while agro-climatic conditions influence the quantity and quality of mulberry fruit**,** the choice of extraction technique determines the efficiency of juice recovery. For example, MR-2 fruits harvested from Palladam a region with favorable weather conditions combined with press-type extraction demonstrated the potential for maximum juice yield. These integrated findings provide practical guidance for both cultivators and processors to optimize mulberry production and utilization.

4. Conclusion

This integrated study confirms that the press-type extraction method is the most efficient for juice recovery from mulberry fruits. Additionally, environmental factors such as temperature, relative humidity, and rainfall significantly influence fruit yield and quality. Regions like Palladam and Salem, with moderate temperatures and higher humidity during fruiting season, showed better yields for cultivars like MR-2. In contrast, extreme or fluctuating weather reduced fruit productivity.

Overall, the findings highlight the importance of selecting both optimal agro-climatic conditions and suitable extraction methods to enhance mulberry utilization in both agricultural and commercial juice processing sectors.

5. References

1. Anonymous. Statistical data on mulberry fruit production. Government of Turkey Agricultural Statistics; 2016.
2. Chang LW. Development and release of 'Miaoli No. 1' mulberry cultivar for berry production in Taiwan. J Taiwan Agric Res. 2008;57:212-218.
3. Du Q, Zheng J, Xu Y, Zhang Q. Identification and quantification of anthocyanins in mulberry fruit. Food Chem. 2008;109(4):849-857.
4. Ercisli S. A short review of the fruit germplasm resources of Turkey. Genet Resour Crop Evol. 2004;51:419-435.
5. Ercisli S, Orhan E. Chemical composition of white (*Morus alba*), red (*Morus rubra*), and black (*Morus nigra*) mulberry fruits. Food Chem. 2007;103:1380-1384.
6. Gerasopoulos D, Stavroulakis G. Quality characteristics of four mulberry (*Morus* sp.) cultivars in the area of Chania, Greece. J Sci Food Agric. 1997;73:261-264.
7. Khan MA, Singhal OP. Mulberry fruit cultivation and yield evaluation in temperate regions of India. Indian J Seric. 2006;45(2):108-112.
8. Kumarasen K, Ramesh M, Suresh P. Characterization of mulberry accessions based on fruit traits. Indian J Hortic. 2008;65(4):428-432.
9. Masilamani S, Suganthi C, Arivudainambi S. Performance of mulberry variety MR-2 for fruit yield in Tamil Nadu. J Seric Agric Sci. 2008;39(1):21-25.
10. Ndubisi CA, Chinedum EL, Obinna ME. Effect of extraction methods on juice yield and quality of selected tropical fruits. Afr J Food Sci Technol. 2013;4(3):58-63.
11. Shamsudin R, Abdullah S, Osman A. Performance of different fruit juicing methods in terms of juice yield and quality. J Eng Sci Technol. 2015;10(4):16-24.
12. Singhal OP, Khan MA, Raina SK. Potential of mulberry fruit for industrial processing. Indian J Seric. 2009;48(1):33-36.
13. Yang B, Kalakula M, Laaksonen O. Juice recovery efficiency and quality attributes of berry fruits using different extraction methods. Food Bioprocess Technol. 2011;4(6):1220-1228.