Effect of leaf drying on yield and quality of turmeric (Curcuma long L.) leaf essential oil

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ABSTRACT
An experiment was carried out to assess the influence of leaf drying on yield and quality of turmeric (Curcuma long L.) leaf essential oil during 2022-2023 at Kittur Rani Channamma College of Horticulture, Arabhavi. The experiment was laid out in CRD (Completely Randomized Design) with three replications and seven treatments. The results indicated that the drying percentage, leaf essential oil content and yield was recorded highest (34.67%, 0.34% and 33.95 g/10 kg shade dried leaves, respectively) at 48 hours of shade drying. The influence of shade drying on turmeric leaf essential oil quality was found the highest α-phellandrene (39.99%) with shade drying of leaves for 48 hours (T7) and 1,8 cineole was recorded highest (12.66%) with shade drying of leaves for 12 hours (T4). The α-Pinene and β-Pinene was found highest (3.49 and 5.93%, respectively) with shade drying of leaves for 6 hours (T3) and para cymene was found highest (12.01%) with shade drying of leaves for 3 hours (T2).

Key words: Turmeric, Yield, Quality and Leaf essential oil content.

Introduction
Turmeric, also known as the Golden Spice of India, holds a revered status as a long-used and highly valued spice. This rhizomatous perennial herbaceous crop grows to a height of 60 to 90 cm, boasting a short stem and large oblong leaves. Its rhizomes, which are often branching and brownish-yellow in color, take on an ovate, pyriform or oblong shape. Turmeric belongs to the Zingiberaceae family and falls under the order Scitaminae. Its origin can be traced back to South East Asia, and it is characterized by its triploid nature (2n=63) and a basic chromosome number of X = 21. The genus Curcuma encompasses various plant species with subterranean rhizomes and roots. Among the 42 curcuma species native to India, Curcuma longa is the most commercially farmed. This spice thrives in hot and humid climates, making it suitable for cultivation in countries such as China, India, Indonesia, Jamaica, Peru, Pakistan, Malaysia, Myanmar, Vietnam, and Thailand (Kumar, 1997).

Turmeric is the primary coloring spice in Indian and other cuisines. Its therapeutic benefits have been recognized for a long time and it is regularly used as a treatment for hypercholesterolemia, arthritis, dyspepsia, and liver problems. Apart from spice, other part of turmeric plant like leaf which can add critical value to the crop. Leaf essential oil is extracted were α-phellandrene (9.1%), terpinolene (8.8%), 1,8-cineole (7.3%) and undecanol (7.1%) and p-cymene (5.5%) are the major chemical constituents in leaf oil.
(1.0% to 1.5%) Raina et al. (2001). On the other-hand the major components of the rhizome oil (5.0% to 6.0%) were α-turmerone (31.7%), δ-turmerone (12.9%), δ-turmerone (12.0%) and (Z)-δ-ocimene (5.5%) Leela et al. (2002). The leaf oil is rich in monoterpenes while the rhizome oil is predominating the ketones sesquiterpenes with biological activity (Lawrence, 2000).

The present investigation was taken up with an objective to the influence of leaf drying on yield and quality of turmeric leaf essential oil.

Materials and Methods

The experiment was conducted at post graduate laboratory of department of Plantation, Spices, Medicinal and Aromatic crops, KRCCH, Arabhavi, Karnataka during 2022-2023 in CRD (Completely Randomized Design) with three replications and seven treatments. The harvested fresh biomass of turmeric leaves at 240 DAP were dried in the shade over a period of time to eliminate the moisture from the leaves. Then the dried plant herbage was comminute and filled in still extracted in hydro-steam distillation for 3 hours. The hydro-steam distillation unit of still volume was approximately 10 kg herbage capacity and fitted with suitable heating coil and cold-water supply system. The hydro-steam distillation unit was fabricated with SS-316 according to the design patented by CSIR-Institute of Himalayan Bio Resources Technology, Palampur (Tiwari et al. 2022). The leaf essential oil collected in the graduated receiving after passing through condenser along with small quantity of water was transferred into a borosilicate separation fennel and allowed to settle for 30 min after adding anhydrous sodium sulphate salt to the mixture. Thus, settled water was removed from below and the essential oil was transferred to a clean glass bottle of known weight and stored under cool, dry and dark condition for further study and analysis through GC (Gas Chromatography) Sandeep et al. (2018). The treatment details of the experiment are T1: Fresh leaves (Immediately after harvest), T2: Shade drying of leaves for 3 hours, T3: Shade drying of leaves for 6 hours, T4: Shade drying of leaves for 12 hours, T5: Shade drying of leaves for 18 hours, T6: Shade drying of leaves for 24 hours, T7: Shade drying of leaves for 48 hours. The observations recorded are drying percentage, Essential oil content (%), yield (g/10 kg of leaves), Quality analysis of turmeric leaf essential oil and mean data were statistically analysed following standard procedure as suggested by Panse and Sukhatme (1967).

Results and Discussion

Statistically, significant results were obtained for all attributes in shade drying of turmeric leaves was furnished in Table 1 and 2.

The drying percentage was significantly determined by the treatments adopted. The maximum drying of 34.67 per cent which was significantly superior over shade drying for 24 hours (25.00%) and the least drying percentage was recorded with fresh leaves (0%). The considerable difference among the treatments for the leaf essential oil content. It was significantly highest (0.34%) when they were shade dried for 48 hours (T7) and the least was recorded in fresh leaves (0.18%). The leaf essential oil yield was

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Drying percentage (%)</th>
<th>Leaf essential oil (%)</th>
<th>Yield (g/10 kg shade dried leaves)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1: Fresh leaves (Immediately after harvest)</td>
<td>0.00 (1.00)</td>
<td>0.18</td>
<td>17.89</td>
</tr>
<tr>
<td>T2: Shade drying of leaves for 3 hours</td>
<td>3.00 (1.99)</td>
<td>0.21</td>
<td>21.03</td>
</tr>
<tr>
<td>T3: Shade drying of leaves for 6 hours</td>
<td>5.00 (2.44)</td>
<td>0.22</td>
<td>22.12</td>
</tr>
<tr>
<td>T4: Shade drying of leaves for 12 hours</td>
<td>9.67 (3.26)</td>
<td>0.19</td>
<td>18.95</td>
</tr>
<tr>
<td>T5: Shade drying of leaves for 18 hours</td>
<td>14.67 (3.95)</td>
<td>0.24</td>
<td>24.11</td>
</tr>
<tr>
<td>T6: Shade drying of leaves for 24 hours</td>
<td>25.00 (5.09)</td>
<td>0.23</td>
<td>23.13</td>
</tr>
<tr>
<td>T7: Shade drying of leaves for 48 hours</td>
<td>34.67 (5.97)</td>
<td>0.34</td>
<td>33.95</td>
</tr>
<tr>
<td>Mean</td>
<td>13.14 (3.39)</td>
<td>0.228</td>
<td>23.03</td>
</tr>
</tbody>
</table>

Digits in the parenthesis are square root transformed values (y = sqrt (1+x))
significantly influenced by the shade drying intensities. At 48 hours of shade drying recorded the highest leaf essential oil yield of 33.95 g/10 kg leaves, while the least (17.89 g/10 kg leaves) was recorded in (T1). Drying leaves for an appropriate period help to reduce their moisture content. Too much moisture in the leaves can hinder the extraction process, as water may compete with the oil during extraction. Therefore, fresh leaves are shade dried to increase the drying percentage, leaf essential oil content and yield from (0% to 34.67%, 0.18% to 0.34% and 17.89 g to 33.95 g/10 kg shade dried leaves), respectively. The choice of 48 hours of drying period should be considered for extraction process to ensure consistent and high-quality turmeric leaf oil production was confirmed by Mahayothee et al. (2020).

The chemical composition of the leaf essential oils with the area per cent. Some of the compounds were identified in *Curcuma longacv. Salem leaf oil. α-Phellandrenene (39.99%) was found highest in (T7) with shade drying of leaves for 48 hours. The maximum concentration of 1,8 cineole (12.66%) was noticed in (T4) with shade drying of leaves for 12 hours. At 6 and 24 hours of shade drying of leaves recorded the highest α-Pinene and β-Pinene (3.49 and 5.93%). The shade dried leaves for 3 hours (T2) recorded the highest para cymene (12.01%).

The variations in the chemical composition of the essential oil extraction from *Curcuma longa* leaves can be attributed to the different drying conditions. Longer drying times (e.g., 48 hours) may favour the retention of specific compounds like α-phellandrene, while shorter drying times (e.g., 6 and 12 hours) may preserve other compounds like α-pinene, β-pinene and 1,8 cineole more effectively. The drying process plays a crucial role in the composition and quality of essential oils extracted from plant materials further supported by Jayasundara and Arampath (2021).

**Conclusion**

In the present study, among the different shade drying intervals. It was found that shade drying of turmeric leaves for 48 hours is advantageous for distillation process to ensure consistent and high-quality turmeric leaf oil production.
Acknowledgement

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Conflict of interest

The authors have declared that no conflict of interest exists.

References


