

Design and Development of Tea Leaf Harvesting Bag by Using Natural Fabric

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ABSTRACT:

A harvesting bag made from natural materials is designed to enhance sustainability, as well as comfort and efficiency in tea leaf collecting. This harvesting bag is developed with a basket weave method using organic cotton "Gada" fabric. The origins of the bag were based on the traditional baskets used by tea leaf pickers with. Cotton fabrics provide an ultra-light and breathable nature that mitigates worker fatigue with prolonged use. The bag has both a waist strap and shoulder strap for mobility and an ergonomic distribution of weight, and it even has a side pocket for easy access and storing hand tools or small items. The goal of this design is to provide comfort for the user, while also offering more environmentally sustainable harvesting methods by replacing the traditional rigid basketing with cotton fabric.

Key words: Tea Leaf Harvesting, Natural Fabric, Basket Weave, Lightweight Design, Ergonomic Straps

1. INTRODUCTION:

Tea leaf harvesting is an essential process in tea cultivation, requiring efficient, ergonomic, and sustainable tools to enhance worker productivity and maintain tea quality. Traditionally, tea pluckers use rigid bamboo or plastic baskets, which can be heavy, uncomfortable, and environmentally unfriendly. To address these challenges, a tea leaf harvesting bag made from natural cotton "Gada" fabric has been designed using the basket weave method. This innovative bag combines functionality, comfort, and sustainability, offering a practical alternative to conventional harvesting methods. The choice of material plays a crucial role in the effectiveness of the harvesting bag. Cotton Gada fabric is widely used in agricultural applications due to its breathability, durability, and eco-friendliness. The plain weave structure ensures that the bag is lightweight yet strong, allowing workers to carry it comfortably for long hours. Unlike synthetic materials, natural cotton does not trap heat, preventing overheating and preserving the freshness and aroma of tea leaves. The fabric is also pliable, making the bag easy to fold and store when not in use. Additionally, its reinforced seams and double stitching enhance durability, ensuring it can withstand multiple harvesting cycles. A key advantage of the cotton harvesting bag is its breathability and moisture management. The porous fabric structure allows air circulation, reducing the risk of oxidation, mold, and bacterial growth. This feature is particularly important in humid tea-growing regions, where excessive moisture can compromise the quality of harvested leaves. Furthermore, the bag's moisture-absorbing properties help maintain the tea leaves' natural texture and freshness until processing. In terms of ergonomics, the bag is designed for worker comfort and ease of use. It is equipped with adjustable shoulder and waist straps, ensuring even weight distribution and reducing physical strain. Different carrying options, such as sling bags, shoulder bags, or backpack-style designs, allow workers to choose the most comfortable method for harvesting on uneven terrain. The soft cotton fibers prevent skin irritation, offering a significant advantage over synthetic materials that may cause rashes or discomfort. Beyond functionality, this bag contributes to sustainable agriculture. Being 100% biodegradable and recyclable, it replaces single-use plastics and synthetic bags, reducing environmental waste. Once worn out, the fabric can be repurposed for agricultural use, further minimizing ecological impact. By integrating efficiency, comfort, and sustainability, this tea leaf

harvesting bag offers an innovative and eco-friendly alternative to traditional baskets, ultimately benefiting both workers and the environment.

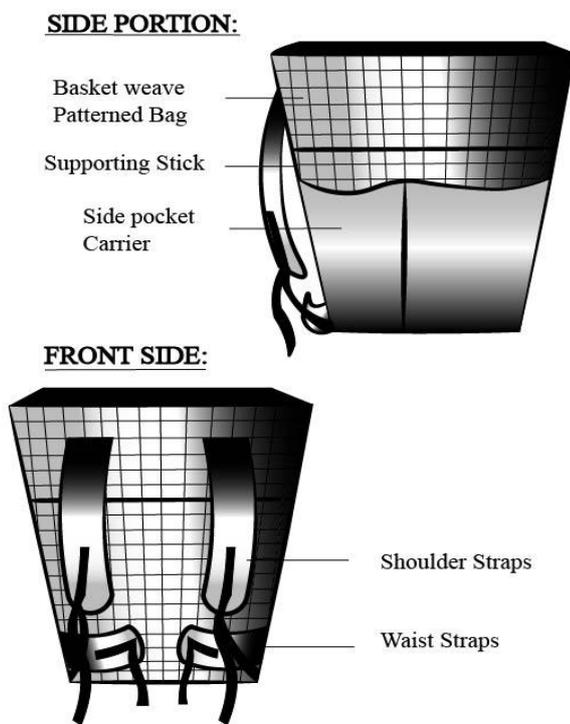
2. METHODOLOGY:

2.1. SELECTION OF MATERIAL:

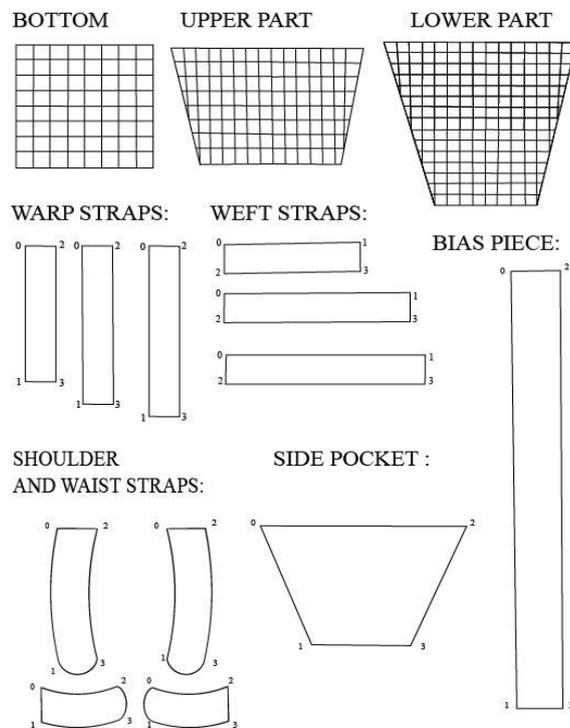
Cotton Gada fabric bags are ideal for tea harvesting due to their breathability, durability, and sustainability. Made from 100% natural cotton in a plain weave, they are lightweight, strong, and flexible for easy storage. The porous structure prevents moisture buildup, mold, and overheating, preserving tea leaf freshness. Reinforced stitching ensures long-term use. Adjustable shoulder and waist straps enhance comfort, reducing strain on workers. Unlike synthetic bags, they are biodegradable, reusable, and eco-friendly, replacing single-use plastics. Additionally, they protect tea leaves from sunlight, maintaining quality, aroma, and flavor while supporting sustainable agricultural practices.

2.2. DRAFT DESIGN AND PATTERN MAKING:

DRAFT DESIGN



PATTERN MAKING



2.3. CUTTING WORK:

To prepare the Cotton Gada fabric, select high-quality material, clean, dry, and iron it to reduce shrinkage. Inspect for defects before cutting on a flat surface. Use a template to mark the fabric, ensuring grain alignment and adding seam allowances (1-2 cm). When cutting, use fabric shears or rotary cutters, maintaining smooth, precise cuts while avoiding fabric distortion. Mark reference points for assembly. Conduct quality checks; inspect edges, sort batches, and store cut pieces properly. Minimize waste by optimizing fabric layout and reusing scraps for reinforcements. Ensure safety by handling sharp tools carefully.

2.4. CUTTING AND CONSTRUCTION PROCESS:

The creation of a tea leaf harvesting bag involves two key phases: cutting and construction, ensuring precision, durability, and functionality.

• **CUTTING PROCESS:**

First, high-quality Cotton Gada fabric is prepared by cleaning, drying, and ironing to reduce shrinkage. The fabric is inspected for defects before being laid on a flat cutting table. Using a template, measurements are marked with tailor’s chalk, ensuring grain alignment and adding seam allowances (1-2 cm). Fabric is carefully cut using shears or rotary cutters, ensuring clean, precise edges. Important reference points, such as pleats and handle placements, are marked. Quality checks ensure consistency, with cut parts sorted, stored, and scraps repurposed for reinforcement or handles.

• **CONSTRUCTION PROCESS:**

The basket weave foundation begins by cutting warp (vertical) and weft (horizontal) strips and weaving them in an over-under pattern. The lower section is secured with a fabric panel, followed by the upper section, reinforced with stitching. A bias piece is sewn along the top edge for added strength. Finally, shoulder and waist straps are securely attached, and a side pocket may be added for extra storage. The finished bag is lightweight, durable, and breathable, designed for comfort and efficient tea leaf harvesting.

2.5. FINAL PRODUCT:



Fig no: 1: Final Product- Tea Leaf Harvesting Bag

3. RESULT:

3.1. PHYSICAL TEST:

3.1.1. TENSILE STRENGTH:

Tensile strength is the maximum amount of tensile (pulling) stress a material can withstand before breaking. It is usually measured in Pascal’s (Pa) or Megapascals (MPa).

Formula for Tensile Strength:

$$\sigma_t = F/A$$

Where:

Where:

σ_t = Tensile Strength (Pa or MPa)

F= Maximum applied force before failure (N)

A= Cross-sectional area of the material (m²)

Given:

Force (F) = 7 N

Cross-sectional Area (A) = 36 m²

Using the tensile strength formula:

$$\sigma_t = F/A$$

$$\sigma_t = 7/36$$

$$\sigma_t \approx 0.194 \text{ Pa}$$

So, the tensile strength is 0.194 Pascals (Pa), which is extremely low.



Fig No: 2: Physical Test- Tensile Strength Result

3.1.2. SURVEY QUESTION TEST RESULT:

- NUMBER OF OPTION CHOSED AND RESPONSE FOR EACH QUESTION:

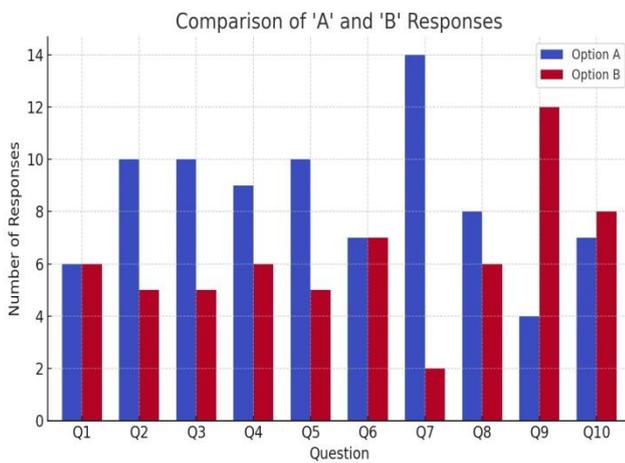


Fig No:3: Comparison Of Option

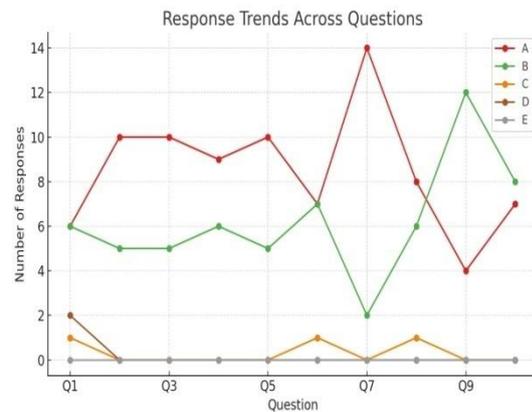


Fig No: 4: Number Of Responded

- OVERALL RESPONDED:

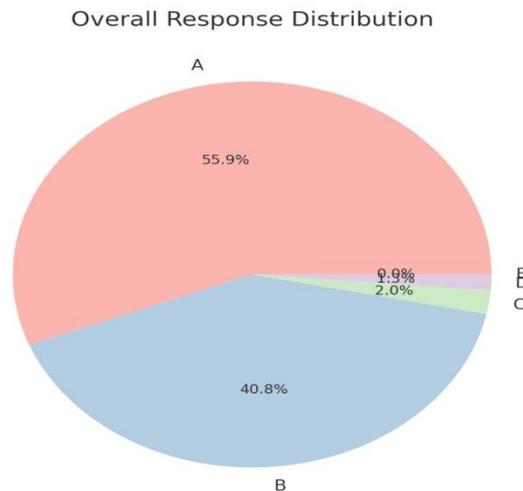


Fig No: 5: Overall Responded

5. DISCUSSION:

The calculated tensile strength of the Cotton Gada fabric was approximately 0.194 Pa, which is relatively low, indicating the fabric alone may not withstand high pulling forces. However, for tea leaf harvesting, where heavy tension is not typically applied, this level of strength may still be sufficient for practical use. To assess real-world performance, a field survey was conducted involving tea workers who used the bag during harvesting. Feedback was gathered on comfort, ease of use, and durability through direct observation and structured questionnaires. Despite the low tensile reading, the overall usability and worker satisfaction were high.

CONCLUSION:

The tea leaf harvesting bag successfully achieved its goals of sustainability, durability, and user comfort. Made from natural cotton in a basket weave, the bag is lightweight yet strong, featuring ergonomic straps and a side pocket for functionality. Field tests and surveys confirmed its efficiency and comfort, showing clear advantages over traditional baskets by reducing physical strain on workers. Minimal adjustments were needed post-evaluation. This project demonstrates a practical, eco-friendly alternative for tea harvesting, aligning with sustainable agricultural practices and offering a long-term, reusable solution that supports both the environment and worker well-being.

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