

EARTH ROOT

Volume **38**
JULY, 2024

Our task must be to free ourselves ... by widening our circle of compassion to embrace all living creatures and the whole of nature and its beauty.
—Albert Einstein (1879-1955).



About E-magazine

“Earth Root” is an open access e-magazine in the discipline of Environmental sciences published by Earth Root Foundation. The aim of the e-magazine is to provide information and upgradation of knowledge about environmental issues on wider scale and to share ideas and resources to the readers. Using essential knowledge people can lead a healthy life, which is more sustainable and can connect with ongoing efforts for stopping catastrophically the climate change. E-magazine caters to all related environmental aspects ranging from big issues like climate change, renewable energy and pollutants in the atmosphere to the health of human and living beings on Earth. We also take topics of water resources and efforts and measurement to provide optimum use of it; including large scale atmospheric circulation linked with oceans and ecology.

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"INDIA'S HOTTEST JUNE: A WAKE-UP CALL FOR CLIMATE ACTION"

Dr. Vivek Panwar
Assistant Professor

Sri Venkateswara College, University of Delhi

June 2024 will be remembered as a historic month for India, marking the hottest June the country has ever experienced. This record-breaking heatwave affected millions of lives, disrupted daily routines, and brought into sharp focus the urgent need to address climate change and its impacts.

Throughout the month, temperatures soared to unprecedented levels across the nation. Northern India, particularly the states of Rajasthan, Punjab, Haryana, and Uttar Pradesh, bore the brunt of the heat. Cities like Jaipur, Delhi, and Lucknow saw temperatures consistently above 45°C (113°F), with some areas even reaching 48°C (118°F). This extreme heatwave did not spare Southern India either, with states like Tamil Nadu, Karnataka, and Andhra Pradesh also experiencing sweltering conditions.

The impact on human health was immediate and severe. Hospitals reported a dramatic increase in cases of heat-related illnesses such as heat exhaustion and heat stroke. The elderly, children, and those with pre-existing health conditions were particularly vulnerable.

Public health advisories urged citizens to stay indoors during peak heat hours, stay hydrated, and avoid strenuous activities. Despite these warnings, the sheer intensity of the heatwave overwhelmed many, leading to numerous fatalities and a strain on healthcare facilities.

The scorching temperatures also had a significant economic impact. The agricultural sector, a cornerstone of India's economy, was severely affected. Farmers struggled to protect their crops from the relentless heat, with many reporting losses due to wilting and heat stress. Livestock, too, suffered, with heat-related deaths becoming a common occurrence. The decrease in agricultural productivity not only threatened food security but also the livelihoods of millions of farmers and agricultural workers. Urban areas faced their own set of challenges. The demand for electricity surged as air conditioning units and fans ran non-stop, leading to frequent power outages. The energy grid, already under pressure, struggled to keep up with the increased demand. Blackouts became a common occurrence,

further exacerbating the discomfort and health risks associated with the heatwave. The intense heat also took a toll on infrastructure. Roads and railway tracks expanded and buckled under the extreme temperatures, causing transportation delays and disruptions. In cities, water shortages became a pressing issue as reservoirs and water bodies dried up faster than usual. This scarcity of water compounded the difficulties faced by urban residents, making daily life even more challenging.

The environmental consequences of the heatwave were equally alarming. Forests in various parts of the country were more prone to wildfires, and several regions reported significant wildfire outbreaks. These fires not only destroyed vast tracts of forest but also released large amounts of carbon dioxide and other pollutants into the atmosphere, further contributing to climate change. The heatwave also had a profound impact on India's rivers and lakes. Reduced water levels and increased evaporation rates led to a decrease in the availability of fresh water, affecting both human populations and wildlife. Aquatic ecosystems were stressed, and fish populations declined, impacting the livelihoods of communities dependent on fishing.

This extreme weather event was a stark reminder of the broader trend of global warming. Climate scientists pointed out that such heatwaves are becoming more frequent and severe due to the ongoing accumulation of greenhouse gases in the atmosphere. The increased concentration of carbon dioxide, methane, and other pollutants is trapping more heat, leading to a gradual rise in global temperatures. The presence of a persistent high-pressure system over India during June exacerbated the situation, creating a 'heat dome' that trapped hot air and prevented cooler air masses from moving in. This atmospheric phenomenon, combined with already elevated baseline temperatures, resulted in the extreme heat observed.

India's response to the heatwave underscored the need for both immediate and long-term strategies to combat the impacts of climate

change. On the immediate front, state and local governments set up cooling centers in urban areas, providing refuge for those without access to air conditioning. Water distribution points were established to ensure access to drinking water, and public awareness campaigns were launched to educate citizens on how to protect themselves during extreme heat conditions.

However, these measures, while crucial, are not sufficient in the long run. The events of June 2024 highlighted the need for more comprehensive and sustainable approaches to climate resilience. The Indian government has recognized this and is taking steps to address the root causes of climate change and enhance the country's ability to cope with its impacts.

On the agricultural front, efforts are being made to promote climate-smart farming practices. This includes the adoption of drought-resistant crop varieties, improved irrigation techniques, and better soil management practices. Providing farmers with access to timely weather information and climate advisories can also help them make more informed decisions and reduce their vulnerability to extreme weather events.

International cooperation is essential in the fight against climate change. India is actively participating in global climate negotiations and is committed to meeting its obligations under the Paris Agreement. Collaborating with other countries to share knowledge, technology, and resources will be crucial in building a more sustainable and resilient future.

June 2024 will be remembered as a turning point, a month that brought into sharp focus the realities of climate change and the urgent need for action. The record-breaking heatwave underscored the vulnerabilities of India's population and infrastructure, highlighting the importance of building resilience and reducing greenhouse gas emissions. As the world continues to grapple with the impacts of climate change, India's experience in June 2024 serves as a powerful reminder of the need for collective action to protect our planet and ensure a sustainable future for generations to come.

BIOCHAR: A SUSTAINABLE PATH TO SOIL HEALTH AND CARBON SEQUESTRATION

Ankur Goel
Director-
Copper Cross Solutions

Biochar, an ancient agricultural practice gaining modern traction, stands at the forefront of sustainable soil management and climate change mitigation. This carbon-rich product, derived from organic material through pyrolysis, offers a plethora of environmental benefits that align with the urgent need for sustainable agricultural practices and carbon sequestration strategies.

The process of creating biochar involves heating organic material, such as crop residues or wood waste, in the absence of oxygen. This thermal decomposition not only produces a stable form of carbon that can be sequestered in soils for centuries but also yields bio-oil and syngas, which can be used as renewable energy sources. The resulting biochar, when applied to soils, enhances their fertility, structure, and water-holding capacity, leading to improved crop yields and resilience against drought.

One of the most significant advantages of biochar is its ability to sequester carbon.

By converting biomass that would otherwise decompose and release carbon dioxide into the atmosphere, biochar effectively locks away carbon in a stable form. This carbon sequestration potential is crucial in the fight against climate change, as it helps to offset greenhouse gas emissions from agricultural practices and other sources.

Moreover, biochar's porous structure provides an ideal habitat for beneficial soil microorganisms, fostering a thriving soil ecosystem. These microorganisms play a vital role in nutrient cycling, enhancing soil fertility and plant growth. Additionally, biochar's ability to retain nutrients and water reduces the need for chemical fertilizers and irrigation, further contributing to sustainable agricultural practices. In terms of future prospects, the adoption of biochar is poised to grow as awareness of its benefits spreads among farmers, policymakers, and environmentalists. Governments and organizations worldwide are beginning to recognize biochar as a valuable tool in their climate action plans. For instance, the European

Union has included biochar in its Common Agricultural Policy, promoting its use as a soil amendment to enhance soil health and combat climate change.

Research and innovation continue to expand the potential applications of biochar. Advances in production technologies are making biochar more accessible and cost-effective for large-scale use. Researchers are also exploring the use of biochar in urban environments to improve soil quality in green spaces and mitigate the heat island effect. Additionally, biochar's potential in wastewater treatment, animal husbandry, and bioenergy production opens new avenues for its application beyond traditional agriculture.

Despite its numerous benefits, the widespread adoption of biochar faces challenges.

The initial cost of biochar production and application can be a barrier for small-scale farmers. Ensuring consistent quality and effectiveness of biochar products is another critical issue that requires standardized guidelines and regulations. Addressing these challenges through research, policy support, and financial incentives will be essential to unlocking biochar's full potential.

In conclusion, biochar represents a promising solution at the intersection of sustainable agriculture and climate change mitigation. Its ability to enhance soil health, improve crop yields, and sequester carbon makes it a valuable tool in the quest for a sustainable future. As research and innovation continue to advance, and as awareness grows, the future of biochar looks bright, offering a path toward resilient agricultural systems and a healthier planet.

How else can Biochar be applied?



source:- <https://www.biochar-industry.com/biochar/>

SORGHUM (SORGHUM BICOLOR L.) (JOWAR): AN IDEAL CROP FOR A DETERIORATING CLIMATE

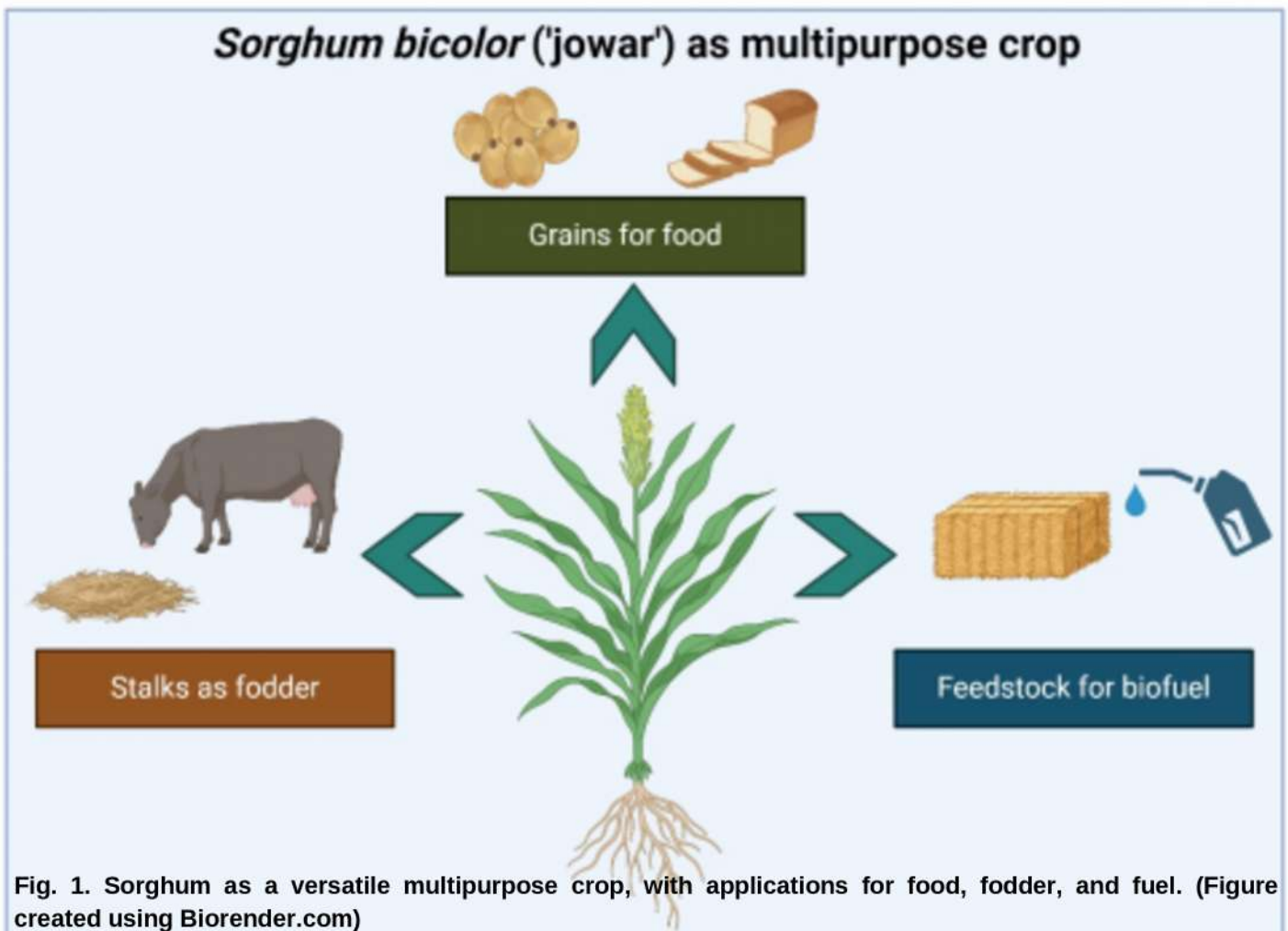
-Anisha Maheshwari and Namrata Dhaka

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With brutal heatwaves striking Indian cities mercilessly this year, and water scarcity increasing day by day, human, animal, and plant lives are being impacted drastically. Moreover, with increasing global warming and environmental decline, these climate change and water shortage problems seem to be only the tip of the iceberg, as compared to what we may have to face in the future. Among a multitude of steps that we need to take immediately in order to address these issues, one lies in increasing the use of crops that are drought resilient and require less water for optimum growth. One such cereal crop is Sorghum (*Sorghum bicolor* or jowar in Hindi). (Fig 1)

Sorghum is a C4 plant belonging to the family Poaceae, and is extensively utilised all over the world as a source of food, feed, biofuel, etc. [1] It is a drought-resistant crop with minimal nutritional requirements; therefore, it can be grown to boost water productivity and improve food security, especially in areas where water shortage is a concern and producing other crops is difficult [2].

Sorghum grain and its components are nearly the same as maize, consisting of about 8–12% protein, 65–76% starch, and 2% fibre. In addition, the germ is an excellent resource of oil, comprises a substantial amount of protein content, nearly about 19%, and ash having 10% content [3]. Sorghum is considered to be a major source of carbohydrate and a staple diet for millions of people living in arid and semi-arid regions and is also referred by the name "king of millets" [4]. Sorghum has gained attention as a viable option for producing both sugar and lignocellulosic biofuels due to its efficiency and adaptability. It requires relatively low inputs and has the capacity to flourish on marginal lands, making it an attractive option for sustainable biofuel production [5]. In addition to being a healthy source of dietary fibre, proteins, fats, and carbohydrates, sorghum may be substituted for wheat in a variety of gluten-free baked goods and is suggested as a safe food for celiac disease patients [6]. Further, sorghum grains are rich in micronutrients, antioxidants, and are often referred to as 'nutricereal' due to multiple health benefits.



The five countries that produce the majority of sorghum globally are the United States, Nigeria, Sudan, Mexico and India with about 8 million, 6.7 million, 5 million, 4.8 million and 4.4 million metric tons respectively (<https://www.statista.com>). In India, Maharashtra and Karnataka are the major sorghum producing states accounting for 54.99% of the crop followed by Rajasthan, Tamil Nadu, Uttar Pradesh, Madhya Pradesh & Andhra Pradesh contributing 15.93%, 8.39%, 7.83%, 5.98 & 5.58% respectively (<https://angrau.ac.in>). (Fig 2). With respect to the application and characteristics, sorghum has been classified into four major types: sweet, forage, biomass and grain. Grain and forage are primarily grown for human use and animal feed respectively. Grain sorghum is mainly produced to enhance the accumulation of dry matter in the form of grain [7]. Forage sorghum shows remarkable adaptability, thriving in saline soil and exhibiting tolerance against soil toxicities in contrast to other cereal crops. Furthermore, it also offers economic advantages by requiring limited

irrigation and fertilizer inputs for grow. [8]. On the other hand, cultivars of sweet sorghum rich in soluble sugar concentration are mostly produced for their sugar syrup which may be distilled into alcohol [9]. Sweet sorghum, which is known for its high sugar content and ease of extractability, has become one of the top feedstock crops for next-generation biofuels, reinforcing its position as a leading choice in this innovative energy sector [5]. Biomass sorghum being photoperiod sensitive has extended vegetative growth, resulting in increase in green and dry mass production. Additionally, it features low humidity, broad tolerance, short life cycle and higher calorific value as compared to other biofuel crops [10].

The current leading cereal crops of the world, i.e. maize, wheat, rice are comparatively more susceptible to environmental threats, and require more water for growth. Contrarily, sorghum is comparable with these crops in terms of calorific value, and is better in terms of nutritional content. Thus, the potential of sorghum as multipurpose cereal crop, low water

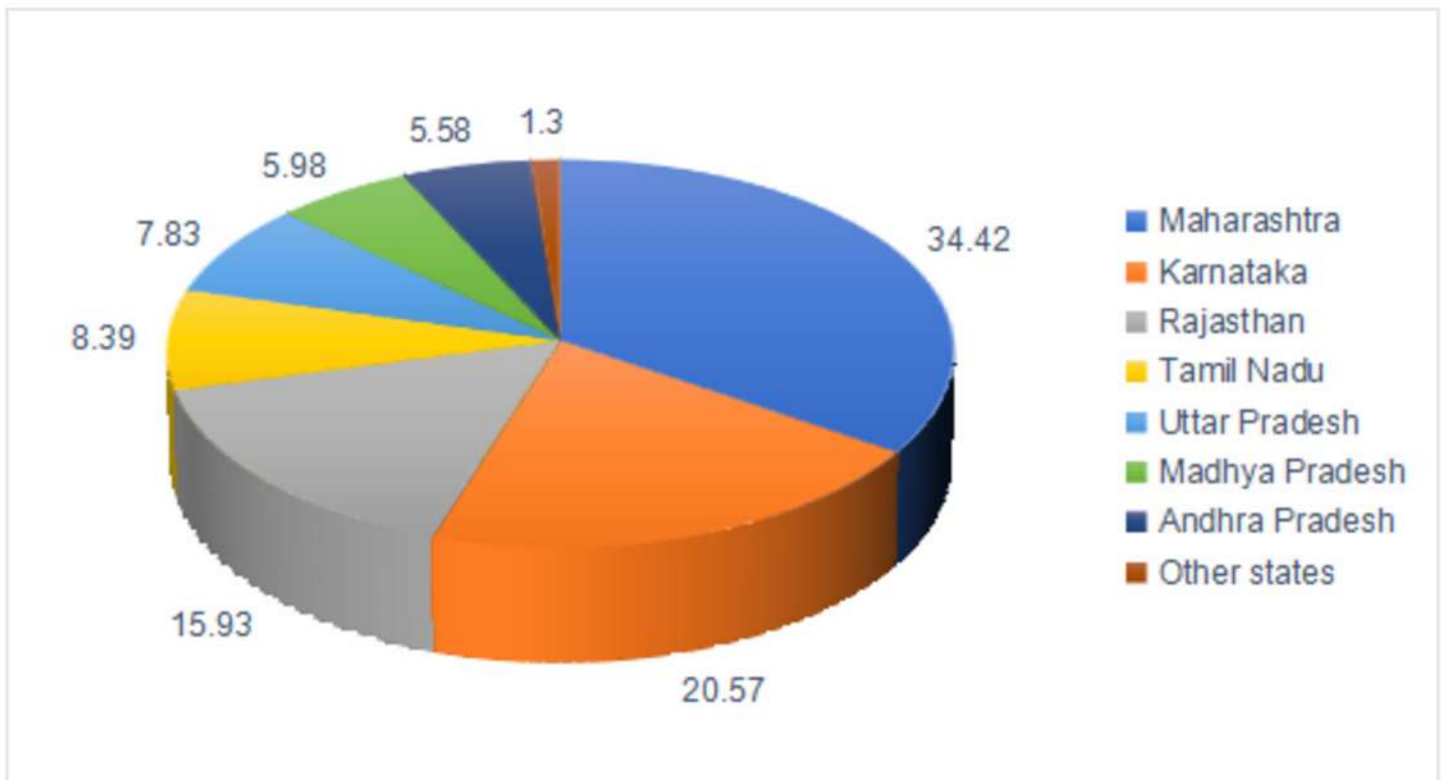


Fig 2: Percentage distribution of sorghum production across states in India.

requirements, and its high adaptability to adverse environmental conditions make it an ideal crop for the future to ensure food and nutritional security in a deteriorating environment.

Acknowledgement

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PROJECT GULZAR

AN INITIATIVE BY ENACTUS SRI VENKATESWARA COLLEGE

Do you remember the last time you offered flowers at the temple or used them for decoration? Have you ever pondered about what happened to them after you had used them? Were they reused or were they disposed of recklessly? Floral waste is one of the most unnoticed and overlooked waste that is straining the environment. India being a culturally rich country values and inculcates flowers as a symbol of auspiciousness and piety in almost every tradition and occasion, thus generating a lot of floral waste. Every year approximately 8 million tonnes of floral waste is dumped into water bodies posing a huge threat to marine life.

But floral waste is not the only waste that is being neglected. Another seemingly unnoticed waste that is generated in exceedingly large amounts is paper waste. India alone generates 4 million tonnes of paper waste every year, which gets dumped into landfills and burned eventually. Burning of paper has a huge environmental impact, as paper is not just wood but also a result of bleach and various other chemicals which get released upon burning, making the air extremely toxic.

Having identified these issues, Enactus SVC launched Project Gulzar in 2021, which not only helps to reduce waste but also empowers underprivileged women by providing them with easy employment opportunities, ensuring a reliable source of income with no health risks because all business operations take place in their neighbourhood.

But how is all of this done?

Under Project Gulzar, we provide 2 product ranges.

The Plantable Range: Tons of paper waste generated every year in India contributes immensely to the overflowing landfills. With this parallel we focus on recycling waste paper into seed paper products while sourcing it from scrap dealers.

Our plantable range of products consists of bookmarks, greeting cards and envelopes. These are made using handmade seed-paper and organic, chemical-free flower dyes. Shortly after they are planted in soil and watered, they grow into plants.

The Non-Plantable Range: Flowers add to floral waste that ultimately gets dumped into rivers and other water bodies, choking and polluting them which affects marine life and influences the global climate by increasing carbon footprint.

Our most recent launch in the non-plantable range is Gulzar Agarbattis, that are hand rolled by underprivileged women using recycled flower waste and natural essential oils to soothe the mind and soul. With an aim to promote sustainability and reduce waste, these incense sticks are manufactured by a group of women beneficiaries, thus uplifting the community and providing them a source of income. Infused with three rejuvenating fragrances and a longer burning time, its freshness of floral aura is the best therapeutic relaxation one could ask for:

Mogra: Known for their ability to promote relaxation, reduce stress and uplift mood, experience the aphrodisiac effects of mogra flowers with our "Mogra Agarbatti". Its pure scent helps calm the mind, reduce anxiety and promote better sleep.

Chandan: Symbolising sacredness with its earthy fragrance, our organic "Chandan Agarbatti" transports you to a state of peace and tranquillity. Known for centuries in Ayurvedic for its healing and medicinal properties, it enhances concentration, improves focus and boosts productivity.

Rose: Often used in aromatherapy to promote emotional balance and mental clarity, our sweet scented "Rose Agarbatti" is just perfect for meditation or study sessions. With its antibacterial properties that purify the air and improves respiratory health, its alluring fragrance enhances emotional well being, hence elevating your daily routine!

We at Project Gulzar are continually trying to improve the quality of our products and provide the best and eco-friendly items to our consumers, while also ensuring that the products meet the criteria of the target market. We are excited to expand our non-plantable line by offering new perfumes, designs, and patterns.

The primary short-term goal of Project Gulzar remains to expand the plantable range of products by establishing good and consistent distribution channels, collaborating with local bookstores and companies, and setting up stalls at book fairs and college fests to attract college students as potential buyers.

All of this would enable us to develop our business and provide an extra source of income for poor women (beneficiaries) who lost their employment as a result of the epidemic, assuring them financial independence and social upliftment.

As a long-term goal, Project Gulzar aims to replace manual methods of production with advanced technology.

The project will be scaled up by introducing printing processes for seed paper goods. Furthermore, we plan to broaden the product range by adding seed paper visiting cards,

calendars and notebooks. Our list of sustainable packaging ideas also includes introducing seed paper to businesses and organisations as a zero-waste alternative to standard paper packaging.

Gulzar managed to increase the income of the women beneficiaries by 12.5% during its first four months of operation in the year 2021 by its sales which is a reflection of sustainable and environmentally conscious choices of consumers in the market.

We have prevented 70.92 kgs of CO2 emission into the environment while addressing four of the UN SDGs namely:

SDG 1- No poverty

SDG 8- Decent work and economic growth

SDG 10- Reduced inequalities

SDG 12- Responsible consumption and production

By solving issues of poverty and worsening environmental conditions, we aim for a better India.



PROJECT FANKAARI

AN INITIATIVE BY ENACTUS SRI VENKATESWARA COLLEGE

Did you know that every year, ten million tonnes of plastic waste, 50% of which is single-use plastic, are dumped into the ocean? In addition to that, India is known for producing a high amount of single-use plastic, which accounts for 43% of the overall amount of plastic garbage produced. 80% of all marine waste is made up of plastic, which harms human health, marine life, and climate change.

Plastic is currently the most widely used raw material for the manufacture of packaging products in India. While people find it challenging to recycle and decrease plastic packaging, the food packed in plastic containers raises several health issues. On the other hand, restaurants too are attempting to move away from plastic packaging even though it is more convenient to transport and generally less expensive, keeping in mind their social responsibility to become more sustainable.

This is where **Project Fankaari** introduced by **Enactus SVC** steps in where we seek to replace the single-use plastic packaging with terracotta packaging. With the help of the potters who make eco-friendly packaging substitutes out of terracotta, our project enables individuals to eliminate the use of plastic packaging, thereby lessening the strain on landfills and water bodies. Through this, we also aim to strengthen local artisans, protect the environment by lowering ocean pollution, and promote economic growth by giving people access to new sources of income.

Project Fankaari focuses on bringing two-fold sustainable change. Firstly, empowering the potters' community by providing them with a year-round source of income. This allows social and economic independence and monetizes their cultural heritage. Secondly, preserving the environment by replacing single-use plastic with terracotta packaging which is a biodegradable and reusable alternative of the same.

We do this by incorporating a circular economy model to recycle improperly disposed terracotta products.

The plan is to replace single-use plastic food packaging with terracotta. Terracotta products offer various health benefits and add to the nutritional value of the food, which is reduced and tampered with while using plastic packaging. By sustainably procuring, manufacturing, using and disposing of Handis and Kulhads, we envisage multiple uses of discarded handis and kulhads as serve-ware, as pots in home gardening and as kulhad candles. Currently, our product range consists of the following two products:

Scented Kulhad Candles: These Kulhad candles are made by upcycling used kulhads, which is a step towards sustainable development. The candle has scented soy wax, which is a renewable source and thus does not produce any waste by-product like the black soot. It's a mood booster and helps to reduce stress and anxiety.

Handis: Made by the skilled artisans of Uttam Nagar, the Handis are made with terracotta, eliminating the hazardous health impacts of plastic food packaging. Compared to aluminium or other metallic utensils, clay pots heat slowly and cook food gently. Due to clay's porous nature, which allows heat and steam to permeate the meal, food is thoroughly cooked while still retaining its aroma. Available in different sizes and made using one of the most eco-friendly materials, it positively impacts the environment and contributes to uplifting the potter's community.

Terracotta is sourced from natural sources and even preserves the nutritional value of the food making it a sustainable material for eco-friendly packaging. Around 200 g CO₂ is emitted per kg of terracotta production/baking which is a lot less than plastic which emits at least 2 kgs of CO₂ per kg of plastic produce.

At present we have upcycled over 150 used kulhads through our circular economy model, into kulhad plants and kulhad candles whilst providing gainful employment to impoverished women, providing them with an additional

source of income to support their families while addressing the following UN SDGs:

SDG 1- No poverty

SDG 8- Decent work and economic growth

SDG 10- Reduced inequalities

SDG 12- Responsible consumption and production

Our goal is to decrease the usage of single-use and harmful plastics for packaging in restaurants and cafes by replacing them with terracotta packaging. We will also replace the plastic cups, bowls, plates, etc used in serving food with the terracotta kulhads, bowls, plates, etc.

In the long run through our circular economy model, we collect all the waste and single-time used terracotta products and convert them into useful products such as planters and candles. Our primary aim is to provide proper market value to these art forms and reduce the plastic waste generated in the food industry. We also plan to venture into other art forms dealing with other forms of waste that are hampering the environment.

We look forward to lesser plastic production and usage, a sustainable impact with lesser plastics littering our cities and oceans, and contributing to health problems in all living beings.

HANDI product at Fankaari



MOVIE RECOMMENDATION

MOTHER!

Directed by

- Darren Aronofsky

Written by

- Darren Aronofsky

Produced by

- Scott Franklin
- Ari Handel

Starring

- Jennifer Lawrence
- Javier Bardem
- Ed Harris
- Michelle Pfeiffer

Cinematography

- Matthew Libatique

Edited by

- Andrew Weisblum

Production company

- Protozoa Pictures

Distributed by

- Paramount Pictures

Release dates

- September 5, 2017 (Venice)
- September 15, 2017 (United States)



Synopsis

The film opens with a woman, referred to as Mother (Jennifer Lawrence), living in a large, isolated house with her husband, a poet referred to as Him (Javier Bardem). Mother is working on renovating the house, while Him struggles with writer's block. Their peaceful existence is interrupted by the arrival of a stranger, referred to as Man (Ed Harris), who claims to be a fan of Him's work. Despite Mother's discomfort, Him invites Man to stay with them.

The next day, Man's wife, referred to as Woman (Michelle Pfeiffer), arrives. Her presence further disturbs Mother, as Woman's intrusive behavior and probing questions create tension. The situation escalates when Man and Woman's two sons arrive and have a violent argument, resulting in one son's death.

As the house becomes a hub of chaotic activity, more and more uninvited guests arrive, turning the home into a scene of destruction. Mother becomes increasingly distressed and isolated as she tries to regain control of her home and life. Him, however, seems to welcome the attention and adoration of the guests, further straining their relationship.

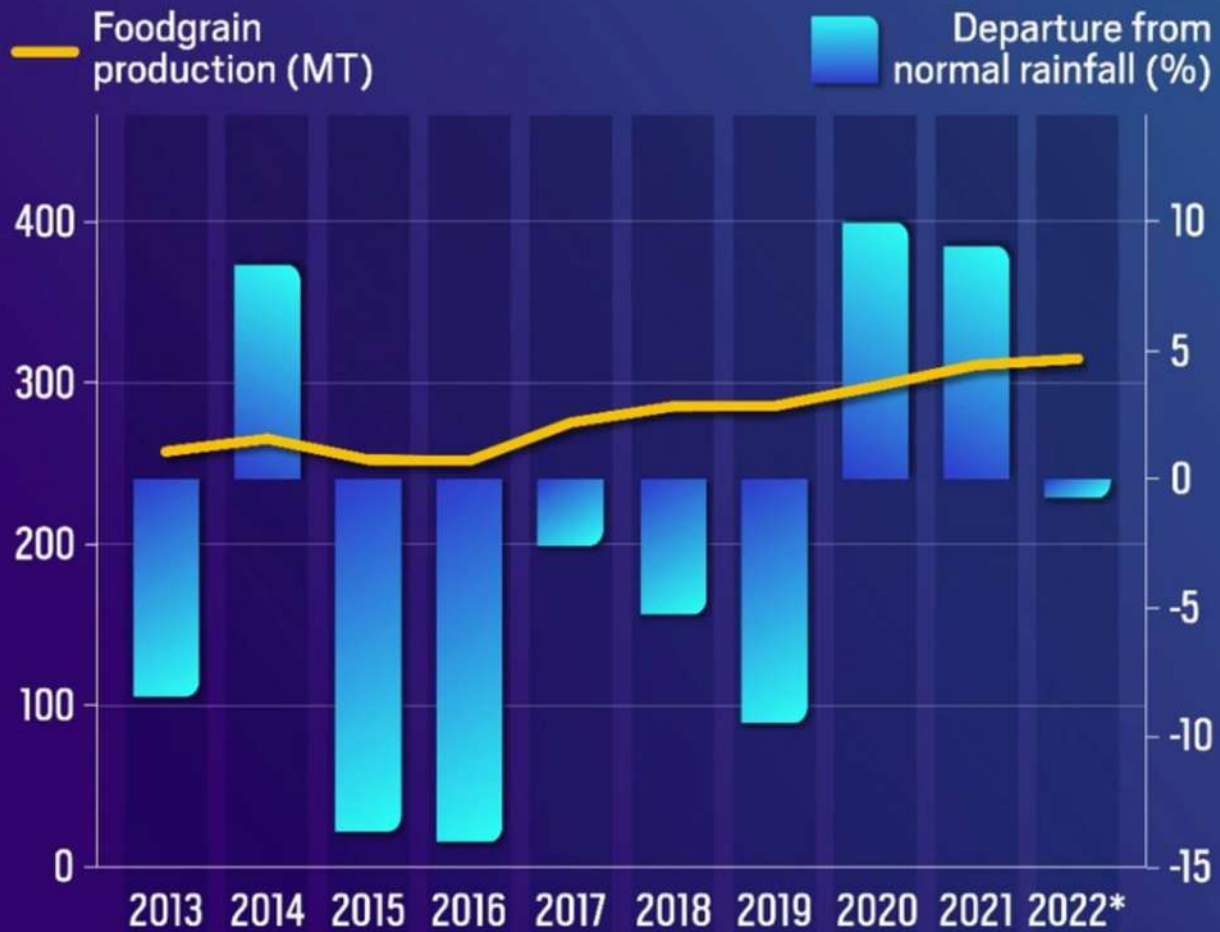
The film culminates in a series of surreal and nightmarish events, culminating in a violent and tragic climax. Mother ultimately confronts Him, leading to a devastating conclusion that leaves the house in ruins.

"mother!" is a complex allegory, with various interpretations ranging from a critique of celebrity culture to a retelling of biblical stories. The film's intense and disturbing imagery, combined with its ambiguous narrative, has led to mixed reactions from audiences and critics alike.

For more detailed analysis and interpretation, you can refer to reviews and articles on platforms such as IMDb and Rotten Tomatoes:

- IMDb "mother!" (2017)
- Rotten Tomatoes "mother!" (2017)

LESS RAIN DOESN'T MEAN LOW FOOD PRODUCTION



Note: Rainfall departure for financial year & food grain production for crop year

Source: Indian Institute of Tropical Meteorology, IMD, Ministry of Agriculture and Farmers Welfare

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