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Entrepreneurial Development in India Doubling Farmer's Income by Creating Wealth from Farm Waste - Activated Carbon

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ABSTRACT

This Conference paper aims at proposing strategies farmers in India can use to double their income. Farming remains as an important industry across India and the world due to it producing food for nourishment yet many farmers fall under poverty and low income categories. This paper proposes strategies the farmers can adopt to help double their income. The proposed strategy involves carbonization of farm waste which can be sold to the industrial and domestic clients. Carbon in an important material which has multiple uses, the main uses include water filtration and carbon as a clean fuel source. Farmers across India mainly discard their farm waste after harvesting their crop and this farm waste can be converted in to valuable carbon which can be sold in the market and help the farmers generate surplus income thus helping also maximize the yield and income generated from their farming practice.

Keywords: Farmer income, Farm waste Management, Carbon Production, Bio Carbon

INTRODUCTION

Food production is an essential requirement across the globe since each person requires food as nourishment, yet in India; many small scale farmers remain poor and can only generate low income from their Farms. This has resulted in many farmers deaths during the past decade due to many farmers borrowing loans which they face difficulty repaying. This makes it essential to propose strategies that Farmers can implement to increase their income. This paper will highlight strategies farmers can utilise to enhance their income. Farming is a primary practice to produce food, cash crops and animal products sold to consumers. Still, at the same time, farming also generates a large amount of crop waste, which is discarded. This paper will propose how farmers can convert their farm waste to a finished product sold in the market. Farm waste carbonisation is a concept that remains under-exploited by farmers across India. Activated carbon can be produced from farm waste and is valuable produce in industrial and domestic sectors. Activated carbon is used for water filtration and is a sustainable and clean energy source. With farms producing more farm waste than the food crop, carbonisation of the farm waste can help a farmer double their income from the farm practices in a single season without requiring a significant investment. The carbonised materials can be sold to industries for manufacturing of products such as Activated carbon filters for water purification and water treatment plants. Many industries also depend on energy to run boilers commonly fuelled by fossil fuels and electricity, and the carbon produced from farm waste can be used as an alternative. Energy sustainability remains an important topic of discussion, especially with the looming concerns relating to global warming. Carbon produced from Agricultural waste is classified as an environmentally friendly fuel, and more importantly, it is a sustainable energy source for future energy needs. This reporting will explore consumer markets and data relating to the farm to estimate earnings farmers can generate from the venture.

Active Carbon Consumer markets

Water filtration and purification

Clean water sources are declining across the India and the world, resulting in high demand for water filtration systems. Activated carbon continues to be among the most effective and economical method of filtering water. With a rising demand for clean water, there is also a rising demand for raw materials required to filter water. This makes Active Carbon a water filtering material likely to register high demand in future (Propolsky et al., 2020).

Domestic drinking water filtration

Today, most households in India have a water filtration system, each of which has an activated carbon filter that requires replacement every few months. As per data collected from the census India website, there are 24.95 crores households in India as per data collected in 2011. (censusindia.gov.in). if only 25% of the households have a water filtration system, this contributes to 60 million households requiring anactivated carbon filter each year. Each Activated carbon filter requires approximately 0.5 KG of activated Carbon which amounts to the domestic water filtration market requiring 30 million tons of Activated Carbon each year. This estimated number is likely to

increase as more households acquire domestic filtration units in the future.

Industrial Water Filtration

Water Purification

Besides drinking water, clean water is also required for washing and plumbing needs, with cities being the largest consumers of clean water. It is impossible to determine the amount of water filtered for the entire Nation therefore; we will examine a large city like New Delhi to acquire the estimate. Delhi currently requires 828 Million Gallons of clean water per day; one gallon is 5 litres; therefore, Delhi requires approximately 4.5 billion litres of water a day. One litre of water requires approximately 20 grams of Activated Carbon; therefore, a city like Delhi will require approximately 90000 metric tons to purify water.

Raw Sewage treatment

Delhi currently requires 828 Million Gallons of clean water per day. The majority of the water is used for cleaning, sanitation and plumbing, and most of the water is expelled as wastewater which requires treatment before being released to the environment. Raw sewage treatment facilities will also require a similar amount of Activated Carbon to process raw sewage before releasing it into the environment.

Industrial Heating Requirement

Most manufacturing industries require a source of energy for heating, and today most depend on fossil fuels and electricity. However, both forms of energy are growing more expensive each day due to the rising energy demand, making it essential for industries to consider alternative and sustainable energy sources that can replace fossil fuels and electricity. Farm waste briquettes and processed carbon briquettes are a viable alternative source of energy that industries can use, which will help increase demand and create a new source of income for farmers that can process and sell carbon produced from farm waste to industries for heating purposes (Wang & Wang, 2019).

Domestic Heating Requirements

Energy for domestic heating is another target market where carbonised farm waste products can be sold. India has observed a sharp rise in natural gas prices, making it unaffordable for many low-income citizens. In addition, many live in urban areas where firewood cannot be used due to smoke and fumes produced by unprocessed fuels. Carbon can be considered a viable alternative as carbonisation processes remove raw matter and moisture, resulting in carbon being pure and clean energy used for domestic heating purposes, even in urban areas. With approximately 250 million households across India, Carbon has a vast scope as a clean alternative energy source for household heating needs.

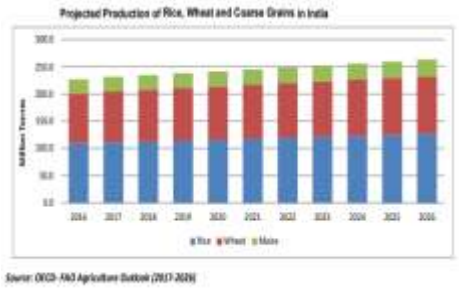
RESEARCH METHODOLOGY

The project research shall be conducted using quantitative research methods. This will generate information and data based on which the conference report will be founded. The primary source of information will be from the Government of India, ministry of Agriculture website where food grain, vegetables and dairy production statistics will be collected. The information and data will then be used to identify important statistics relating to agricultural production based on which farmer income statistics can be estimated. Further investigations will be performed using qualitative research methods to help determine the actual statistics relating to farm waste production based on which accurate carbon production can be estimated therefore delivering more accurate finding to be reported.

Project Viability - Estimated Production and Income

While it is clear that there is a large and growing demand for clean, suitable energy sources, it is essential also to review the sources of raw materials based on which active carbon and fuel carbon production can be estimated. This project focuses on doubling farmer income; therefore, it is essential to estimate the number of raw materials the farmers can produce from the farming practices from which carbon can be produced.

Grain Production - Rice, Wheat and Coarse Grains



Below we will explore different farm products ad estimate the waste generated by the farming practice based on which carbon production quantities can be estimated. Data would be used from the Ministry of Agriculture & Farmers Welfare - Pocket Book of AGRICULTURAL STATISTICS 2017 (Government_of_India, 2017).

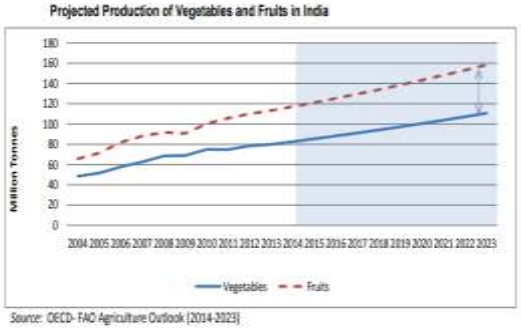
Grain Waste Production Waste

As per data published by the Ministry of Agriculture & Farmers Welfare – in 2017, India produced 250 million tons of grain. Most grain plants are seasonal and produce crops only once; therefore produce a lot of farm waste in the form of stems, braches, husks and roots, which farmers must extract and dispose of from the farm. While each grain plants production varies, we would consider a farm waste production ratio of 2:1 (waste: grain). Therefore farmers are likely to be producing approximately 500 million tons of grain crop waste for each crop each season. Farmers also harvest two crops a year, generating around 1 billion tons of grain crop waste per annum.

Conversion of Grain Waste to Carbon

Waste to carbon conversion occurs at a rate of 25%; therefore, 1kg of waste will produce 250 grams of pure carbon. Therefore grain waste is likely to produce 250 million tons of carbon each year. The current wholesale rate for carbon is 20 Indian rupees per kilogram; therefore, carbon production from grain crop waste can generate 5 billion Indian rupees as surplus income for grain farmers.

Vegetables and Fruits



Source: OECD- FAO Agriculture Outlook (2014-2023)

Vegetables and Fruits Waste Production

Vegetable and fruit farming produces 300 million tons of food each year, but unlike grains, many fruit plants are perennial and do not require annual replacement. This, therefore, reduces the availability of raw materials requires to produce carbon. On the other hand, vegetables require replacement after each crop; therefore also produce waste equivalent to grain. With fruits eliminated, only vegetable waste can be considered, and estimated production will be taken at 150 million Tons with a waste ratio of 2:1 and two crops production per year. This amounts to 150*2*2 = 600 million cost of waste per annum.

Conversion of Fruit and Vegetable Waste to Carbon

The carbon conversion rate will remain at 25%; therefore, 600 million tons of waste will produce an estimated 150 million tons of carbon. This will total approximately 3 billion Indian rupees of surplus income generated for fruit and vegetable farmers.

600*25%*20 = 3 billion India Rupees of surplus income per annum

Animal Husbandry

Livestock Population in India

(Million Numbers)

Species	1951	1982	1987	1992	1997	2003	2007	2012
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Cattle	155.30	192.45	199.69	204.58	198.88	185.18	199.08	190.90
Buffalo	43.40	69.78	75.97	84.21	89.92	97.92	105.34	108.70
Total Bovines	**198.70**	**262.36**	**275.82**	**289.00**	**289.00**	**283.10**	**304.76**	**299.98**
Sheep	39.10	48.76	45.70	50.78	57.49	61.47	71.56	65.07
Goats	47.20	95.25	110.21	115.28	122.72	124.36	140.54	135.17
Horses & Ponies	1.50	0.90	0.80	0.82	0.83	0.75	0.61	0.63
Camels	0.60	1.08	1.00	1.03	0.91	0.63	0.52	0.40
Pigs	4.40	10.07	10.63	12.79	13.29	13.52	11.13	10.29
Mules	0.06	0.13	0.17	0.19	0.22	0.18	0.14	0.20
Donkeys	1.30	1.02	0.96	0.97	0.88	0.65	0.44	0.32
Yaks	NC	0.13	0.04	0.06	0.06	0.06	0.08	0.08
Total Livestock	**292.80**	**419.59**	**445.29**	**470.86**	**485.39**	**485.00**	**529.70**	**512.06**
Poultry	73.50	207.74	275.32	307.07	347.61	489.1	648.88	729.21
Dogs	NC	16.54	17.95	21.77	25.48	29.03	19.09	11.67
Rabbits	NC	NC	NC	NC	NC	0.48	0.42	0.59

Source: Department of Animal Husbandry, Dairying & Fisheries.
NC : Not Collected
Note: Total may not tally due to rounding off

Waste Production from Animal Husbandry

India has the largest dairy industry across the globe, with over 300 million bovines registered with the Ministry of Agriculture. Most dairy farmers depend mainly on the sale of milk as the primary source of income, while animal waste is discarded or used as a form for heating. The dung pats produced are mainly used by rural communities and tend to be smoky and emit a foul smell, therefore not usable in urban areas. Each bovine produces approximately, on average, 40 kg of manure per day there for a single Bovine can produce 14600kgofmanure per annum. The conversion rate for manure is 20% due to the high volume of liquid in manure; therefore, each bovine can produce 2900-3000kg of pure carbon per annum.

Animal Husbandry Waste Conversion

Due to the vast number of bovines In India, we will perform the calculations based on a single bovine, allowing farmers to determine the surplus income generated from a single bovines. This will help simplify the calculations allowing each Farmer to determine the quantity of carbon they can produce from the manure produced by a single bovine. We have determined that a single bovine can produce between 2900 and 3000 kg of carbon per annum from the above calculations. Therefore, 3000kg*20 = 60000 Indian rupees surplus income from a single animal, Furthermore, carbon production does not incur extra costs since the farmers already cover the maintenance costs through the sale of milk, therefore, providing net surplus income.

Benefits of Carbon Production

Surplus Financial Income from Farm Waste

The main benefit of the above project is that it allows farmers to generate income from all parts of their crops. Edible parts can be solved as food while non-edible and waste can be converted to activated carbon or biochar, sold as a water purification additive or as cheap and sustainable. With most crops and farm animals producing more waste than food, Farmers can quickly generate substantial income from converting the farm waste into carbon for sale in urban and rural areas.

Farmer Can Salvage Losses in Case of Crop Failure

Every Farmer remains under the stress of crop failure, and when crop failure does occur, many will lose all their investment. This project will allow farmers to salvage their losses in case of crop failure by converting the failed crops waste into carbon and selling it in the market, which will allow the Farmer to recover their investment ad reduce the losses they incur.

Project and Equipment Costs

Carbon production requires retort kiln and waste materials to convert to carbon. These kilns are self-fuels and only require a small amount of fuels to heat

the kiln. However, the kilt produces flammable gases that ignite and begin fuelling the flame, causing a chain reaction until all flammable gases within the retort kiln are exhausted. Retort kilns can be prepared using 200litre steel drums allowing farmers to move the kiln to the area where the waste is deposited and produce the carbon on-site, significantly cutting down on the raw materials and waste transportation costs.

RESULTS AND DISCUSSION

To double farmer income and promote farmer self-sufficiency it is necessary to develop and promote technologies which will allow the farmers to utilize locally available resources as raw materials. Many farmers discard their farm waste but the above project outlines a strategy where farmers can convert their farm waste in to a highly demanded fuel that can be sold to both domestic as well as industrial consumers? This project can assist farmers double their income therefore reducing financial burden and enhance farmer income generation and financial stability

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