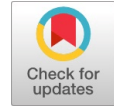


Assessment on Distinct types of Crops in Kanchipuram District using Organic, Fertilizers, Pesticides and Plastic Mulching at Different Seasons

J. Sekar, N. Palaniraj



Abstract: Our nation is a major economic player, providing a significant source of revenue for more than half of India's population. The country's financial area depends on the rural exercises that assume a critical role in the public's advancement. The region picked for the review is Kanchipuram Locale in Tamil Nadu, which absolutely relies upon the horticultural pay from the various yields. The contribution of farming to the economy as well as the monetary state of the ranchers has been ought in this period of innovation. With 47% of the population working in agriculture, it is the most common occupation. Paddy is the major crop developed in Kanchipuram district. Other important crops include Millets like Ragi, Maize, Cumbu and Samai; pulses like Black gram, Green gram, Red gram, horse gram, and cow pea; oil seeds like groundnut, Gingelly, sunflower and Castor and sugarcane. Brinjal and Watermelon started using plastic mulching, which gives 3-4% profit in Kanchipuram's district. The aim of this assessment is to study the agricultural sector of Kanchipuram district's major crops in different climatic environments like Navarai, Samba, Sornawari, etc. However, agricultural pollution has already begun as a result of contemporary agricultural methods like plastic mulching. Comparisons between organic mulching and plastic mulching materials are difficult since outcomes depend on the selected strategy, growth techniques and environmental factors. Due to the current agricultural byproducts like plastic mulching, this process promotes damage to the ecology, land, and environment. To overcome agricultural pollution, organic mulching and greenhouse technology are suggested.

Keywords: Organic mulching, Greenhouse technology, Plastic mulching

I. INTRODUCTION

The advancement of farming and agricultural techniques has made it possible for people to exist in the world today. Agricultural pollution is the contamination of the environment and related surroundings as a result of using natural and chemical products for farming.

This contamination is actually ruinous to all living organisms that depend on the food produced in agriculture [1]. Since the need for food has grown in tandem with population growth, agricultural practices have become more polluting in Kanchipuram district.

On Tamil Nadu's north-eastern coast, the district of Kanchipuram is bordered in the west by Vellore and Tiruvannamalai, in the north by Thiruvallur and Chennai District, in the south by Villupuram District, and in the east by the Bay of Bengal. It is also close to Chennai City and the Bay of Bengal. It is located between latitudes 77° 28' and 78° 50' East and longitudes 11° 00' and 12° 00' North. The district has a shoreline of 57 km and a total geographic area of 4,43,210 hectares. District headquarters are in the temple town of Kanchipuram. This district has a good chance to form indenture farming in groundnuts and pulses. Organic farming is popular in this district. In Kanchipuram district, the agriculture mainly depends on tank irrigation. During the north-east monsoon, the maximum (700–800 mm) rain is received, and the rainwater is stored in the tanks. By utilizing this tank irrigation, the paddy crop has been raised successfully in two seasons, and the groundnut crop has been raised both under rain-fed and irrigated conditions. The water table in this district is only 100–200 feet. Hence, this water is a major strength in Agriculture [2].

Low productivity exists in the soil. The amount of salt in the soil significantly increases as precipitation from remote locations is drained into the soil. This will result in a decrease in the availability of plant nutrients including phosphorus, zinc, copper, and boron, which will have an impact on the soil's productivity. Furthermore, because the district's surface is largely flat, drainage is an issue in the paddy-growing regions. Because of this, highland paddy farming is particularly challenging. In Kanchipuram district, there are five taluks namely Uthiramerur, Kundrathur, Kanchipuram, Sriperumbudur and Walajabad respectively. Each taluk has 130, 89, 128, 99, and 79 villages separately.

However, farming is the backbone of our country, and nowadays, farmers are undergoing modern technologies like plastic mulching. Environmental pollution and food safety are challenging criteria for our country. Fertilizers, pesticides and plastic mulching play a vital role in agricultural pollution. In this work, plastic mulching usage is growing the yield of food crops and also creating serious trouble in the future ecosphere.

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To overcome this agricultural pollution without posing a serious hazard to human health, organic mulching and greenhouse technology are needed. This paper is ordered as follows: Segment 2 summaries literature review of crop yields, Segment 3 illustrates the agriculture pollution root causes and solution, Segment 4 exhibits the discussions of crop yields and productivity in Kanchipuram district and Segment 5 shows the conclusion and future directions.

II. LITERATURE REVIEW

The review of literature presented in this chapter covers earlier research studies relating to food and nonfood crops implementing plastic mulching to improve crop yields.

In V. Navaneetha Pandian et.al [2017], the author shows that in combination with drip irrigation, chilies were observed to respond with greater moisture retention, high yields, maximum water use efficiency, maximum fertilizer use efficiency, and greater weed control [3].

K. Indumathi et.al [2020], the researcher, conducted an analytical study of plastic mulching in Tuberose and Melons in Dharmapuri district of Tamil Nadu. They analyzed about a 15–20% increase in the melons and 18–22% in the tuberose [4][10].

Vinoth Kumar M et.al [2021], the author analyzed that plastic residues were identified in four regions of Tamil Nadu, India: Sular, Nagondapalli, Royakottah, and Krishnagiri. In Sular in the Coimbatore District, where plastic film mulching has been used for growing the tomato (*Lycopersicon esculentus* L.) crop for ten years, the percentage distribution of plastic residues was found to be greater. In comparison to other places, the distribution of plastic residues in Sular was 37.97%, 35.07%, and 36.99% at three different depths, namely 0–10, 11–20, and 21–30 cm. It was discovered that when depth was increased, the spread of plastic residues shrank. In the 0–10 cm depth range, more plastic debris was discovered [5].

M. Jayalalitha et al. [2020] found that Tomatoes were grown on Black on silver, silver on black, white on black, and Mulch with Etc of 100, 80 and 60 %. From the results, white on black was observed, and it recorded the highest yield by 80% compared to other mulches [7][8][9].

Plastic mulching is limited in its use in Tamil Nadu to improve food and nonfood crops. But still, farmers have had to use more chemical fertilizers, pesticides, weed killers, animal hormone treatments, nutrient-rich feed, and other practices to boost the productivity of their farms and fields, which has altered the way farming was historically done.

III. AGRICULTURE POLLUTION ROOT CAUSES AND SOLUTION

In Kanchipuram district, 47% of the population works in agriculture, making it their primary occupation. Its total cropped area is 1,99,001 hectares. Paddy, groundnut, sugarcane, millets, and pulses are the main crops grown. The primary irrigation sources are canals and tanks. Low soil productivity and a lack of resources prevent farmers from implementing agricultural modernization and mechanization. Problematic soils cover almost 50,000 hectares of land. There are numerous ongoing initiatives, including Seed Minikit,

Integrated Cereal Development Program, ISOPOM, and organic farming.

A. Agricultural Pollution's Root Causes

a. Synthetic fertilizers

Ammonia and nitrates, which are mostly nitrogen- and phosphorus-based compounds, improve soil fertility when used in the right proportions. However, chemicals are frequently utilized in excess of what is necessary and end up remaining in the soil rather than improving it.

b. Synthetic pesticides

There are negative financial repercussions for the farmers when pests and insects cause significant losses. Pests are harmful to insecticides and pesticides like organo chlorines, organophosphates, and carbonates. They also have a tendency to bioaccumulate, which means that they build up in an organism's body and cause chronic poisoning. The food chain can spread it. Additionally, certain herbicides are naturally absorbed by plants. In this chapter, agricultural pollution solutions and how to prevent agricultural pollution are discussed. In prevention, the benefits of organic mulching and the implementation of greenhouse technology were deliberated.

B. Agricultural Pollution Solutions

a. Government Regulation

Controlling agricultural pollution is much more difficult than it sounds. Water, soil and industrial pollution must be managed to make the farm clean again. Over the past decade, governments have tightened enforcement of regulations.

b. Awareness of farmers

Farmers often unknowingly damage environmental systems. We should teach them that the overuse of fertilizers and pesticides has a huge negative impact on entire ecosystems. Agricultural pollution can be reduced to some extent by improving farmers' knowledge and awareness.

Appropriate amounts of pesticides and fertilizers are required for proper crop yield. Using a cover crop prevents the soil from being exposed after the actual harvest, preventing soil erosion and the loss of waterways. Plant grass, trees, and fences on the edges of fields bordering water bodies. They may act as buffers, filtering out nutrients before they enter the groundwater, thus avoiding nutrient loss. Reduce tillage to reduce runoff, soil compaction and erosion.

Animal and livestock manure is a major source of agricultural pollution. Dealing with these contaminants is very important. A number of fertilizer treatment processes should be implemented with the aim of reducing the negative impact of fertilizers on environmental systems.

c. Changes in farming practices

Many farms are returning to traditional fertilizers, direct irrigation from local waters, and organic methods to control pest populations. But the process of agricultural pollution needs to be completely stopped

C. Prevention of Agricultural Pollution

a. Organic mulching

- Preventing nitrogen- and phosphorus-rich nutrients from entering water sources near fields and livestock farms is a priority.
- Prevention can never stand alone. State governments, agricultural organizations, collectives and cooperatives, educational institutions, and conservation groups must work together to regulate and reduce water pollution caused by agriculture.
- Plan certain grasses and shamrocks that can absorb and utilize excess nutrients and prevent soil erosion. Planting rows of trees and shrubs around fields and along the edges of rivers and lakes can help as well.
- Over-tillage should be avoided to prevent soil erosion and compaction.
- Proper disposal of animal waste and keeping livestock out of water reduce nitrogen pollution in water.
- Composting, solid-liquid separation, anaerobic digestion and lagooning are manure management methods for different types of animals. Of these, anaerobic digestion is the most effective. Utilizes anaerobic bacteria and heat. The products of this process are nutrient-rich liquids used as fertilizer and methane gas, which can be burned to produce electricity and heat. Anaerobic digestion is the method of choice for odor control associated with fertilizer management.

b. Greenhouse technology

- 10-12% yield increase depending on nursery type, product type and nature reserve
- Consistent quality of crop increments in greenhouse development
- Extend development time
- Expand product variations
- Limit external threats to harvest

In this connection, high openness and labor costs, poor pollination, and the fact that great care must be taken to eliminate pests and diseases so that the next harvest is not spoiled are the shortcomings of greenhouse technology. Even though plastic mulching produces more growth in food and nonfood crops, it has some drawbacks, like debris that releases potentially carcinogenic phthalates into the soil, which can be ingested by crops and pose a hazard to human health if ingested. Plastic debris left in fields can also lead to the accumulation of pesticides and other toxins used on crops.

This poses a hazard to sheep, goats and other animals that graze the plant stalks, as they can ingest the plastic material and the chemicals it emits. By organizing training programs and providing farmers with exposure, these programs assist in introducing new crop varieties, increasing production of paddy, millets, pulses, oil seeds, and maize, and building farmers' knowledge and skills. Farmers should also learn about agricultural pollution's root causes and how to make efficient use of natural resources. Organic mulching, efficient use of natural resources and greenhouse technology may be suggested, and our government should formulate comprehensive development in agriculture against agriculture pollution to raise the level of income and standard of living of farmers in a definite frame.

IV. DISCUSSIONS

Our major food crop is paddy, which is cultivated and raised three times during the Navarai season, according to the statistics given by the Joint Director of Agriculture for the last three years (2020-2021, 2021-2022, and 2022-2023). Table 4.1 shows the different sowing seasons in Kanchipuram district [6]. Table 4.2 shows the Paddy yield area coverage details from the last three years. Paddy crops are cultivated, and it doubles productivity in the years 2021 and 2022, but in the year 2023, only 14% is achieved from the target. It shows the usage of fertilizers and pesticides, which leads to soil contamination and low productivity during the Navarai season. In Millet's crop category, Ragi cultivated and raised growth by 0.5 % among other millets like maize at both Kharif and Rabi seasons. Table 4.3 shows the pulse yield area coverage details from the last three years. In the pulse crop category, Black gram and green gram's growth is decreased by 1/2 times compared to other pulses like horse gram at Rabi season when compared to Kharif season. Table 4.4 shows the pulse yield area coverage details for the last three years.

In the oil seed non-food crop category, Groundnut and Gingelly its growth decreased by 1/2 times among other pulses like Sunflower at Kharif season when compared to Rabi season. Sugarcane's growth is decreased by 3/4 times during the Kharif season. Table 4.5 shows the Oil seeds and sugarcane yield area coverage details from the last three years. In this study, some of the food crops' suitable seasons are Navarai, millet's suitable season is both Kharif and Rabi, pulses' suitable season is Rabi and non-food crops like oil seeds are suitable for Kharif season.

Table 4.1 Shows the Sowing Seasons in Kanchipuram District

Cropping season	Sowing period	Harvesting period	Duration	Crops
Navarai	Nov- Jan	Feb-March	<120 days	Fruits(Banana, Mango), vegetables, cucumber and watermelon
Sornavari (Chithirai pattam)	April – May	August – September	<120 days	Millets (Ragi and Maize)
Samba (Adipattam)	July – August	January – February	>145 days	Paddy and sugarcane
Kharif (Monsoon/Autumn)	July-October	3 rd week of September-October	>300 days	Groundnut, Paddy, Gingelly, Sugarcane
Rabi(Spring)	October-March	April and May	>300 days	BlackGram, Groundnut, Greengram, Gingelly, Sugarcane, Ragi



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Table 4.2 Kanchipuram District- Paddy Crop Area Coverage Details

Sl.No.	Name of the crop	Season	Normal area	2020-21		2021-22		2022-23	
				Target	Achievement	Target	Achievement	Target	Achievement
Unit			Ha.	Ha.	Ha.	Ha.	Ha.	Ha.	
1	Paddy								
		Sornawari	10137	9800	6412	9800	8455	8000	10415
		Samba	16894	21600	14235	20100	15100	15000	13383
		Navarai	10512	8100	27091	8100	27357	19000	28150
	Total		37543	39500	47738	38000	50912	42000	51948

Table 4.3 Kanchipuram District- Millets Crop Area Coverage Details

Sl.No	Name of the crop	Season	Normal area	2020-21		2021-22		2022-23	
				Target	Achievement	Target	Achievement	Target	Achievement
Unit			Ha.	Ha.	Ha.	Ha.	Ha.	Ha.	
2	Millets								
a.	Ragi	Kharif	50	100	37	0	7	39	20
		Rabi	39	100	15	100	20	120	12
b.	Maize	Kharif	0	100	0	0	7	0	2
		Rabi	0	0	0				0
c.	Cumbu	Kharif	0	0	1				
		Rabi	0	0	0	0	20	10	0
d.	Samai	Kharif	0	100	0			0	1
		Rabi	0	0	0			0	0
	Total		89	400	53	100	54	169	35

Table 4.4 Kanchipuram District- Pulses Crop Area Coverage Details

Sl. No.	Name of the crop	Season	Normal area	2020-21		2021-22		2022-23	
				Target	Achievement	Target	Achievement	Target	Achievement
Unit			Ha.	Ha.	Ha.	Ha.	Ha.	Ha.	
3	Pulses								
a.	Blackgram	Kharif	110	96	186	300	124	200	127
		Rabi	823	1264	554	650	352	600	364
b.	Greengram	Kharif	107	300	5	0	1	100	5
		Rabi	426	190	475	400	451	500	385
c.	Redgram	Kharif	0	16	0	0	1	0	2
		Rabi	0	32	7	50	0	0	0
d.	Cow pea	Kharif	0	0	0	0	2	0	2
		Rabi	0	32	91	100	25	100	66
e.	Horse Gram	Kharif	0	0	0	0	0	0	0
		Rabi	0	0	1	0	0	0	1
	Total		1466	1930	1319	1500	956	1500	952

Table 4.5 Kanchipuram District- Oilseeds and Sugarcane Area Coverage Details

Sl. No.	Name of the crop	Season	Normal area	2020-21		2021-22		2022-23	
				Target	Achievement	Target	Achievement	Target	Achievement
Unit			Ha.	Ha.	Ha.	Ha.	Ha.	Ha.	
4	Oilseeds								



a.	Groundnut	Kharif	1020	930	1040	630	762	1200	558
		Rabi	2229	3500	1381	3800	1357	2800	1212
b.	Gingelly	Kharif	168	500	117	200	39	200	29
		Rabi	264	250	260	550	251	800	219
c.	Sunflower	Kharif	0	0	0	0	0	0	0
		Rabi	0	50	0	50	0	50	0
d.	Castor	Kharif	0	0	0	30	0	30	0
		Rabi	0	30	0	0	0	0	0
	Total			5260	2798	5260	2409	5080	2018
5	Sugarcane								
a.	Sugarcane	Kharif	670	780	522	750	557	750	418
		Rabi	344	170	111	150	128	150	79
	Total		1014	950	633	900	685	900	497

Table 4.6 Kanchipuram District (Uthiramerur)- Increase in Yield of Crops through Plastic Mulching Area Coverage Details

Sl.No.	Name of the crop	Season	Normal area	2020-21		2021-22		2022-23	
				Unmulched	Mulched	Unmulched	Mulched	Unmulched	Mulched
Unit			Ha.	Ha.	Ha.	Ha.	Ha.	Ha.	Ha.
6	Vegetables								
a.	Brinjal	Kharif	344	230	260	330	340	430	560
		Rabi	670	470	560	570	760	570	760
b.	Watermelon	Kharif	168	60	80	100	120	160	260
		Rabi	264	250	400	350	500	250	400
	Total		1446	1010	1300	1350	1720	1410	1980

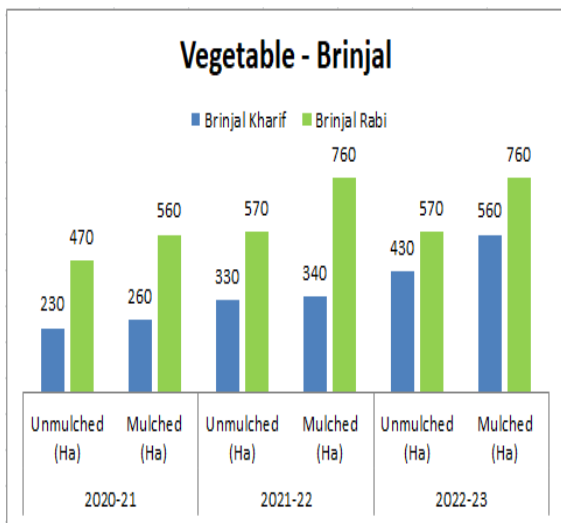


Fig 4.1 (a) Brinjal Crops

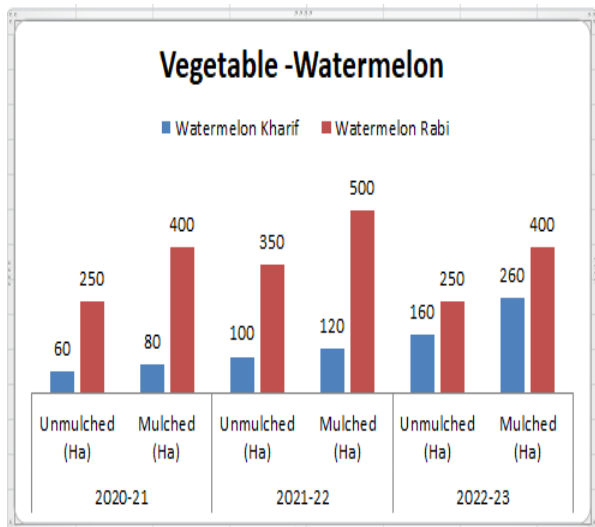


Fig 4.1 (b) Watermelon Crops

Figure 4.1 (a) and (b) show that Brinjal and Watermelon crops achieved the highest productivity at Rabi season using the plastic mulching technique in the years 2020–21 and 2022–22. Since 2020 in Uthiramerur taluk, farmers have started a plastic mulching method to increase the productivity of Brinjal and Watermelon. Table 4.6 shows the Brinjal and Watermelon yield area coverage details from the last three years.

Provide the recipients with high-quality planting supplies for dense planting, technical assistance, a comprehensive package of practices, post-harvest technologies, and a marketing strategy as inputs. The points mentioned can impart to farmers the benefits of better plant growth and high productivity.

Table 4.7 shows the highest yield of Paddy and Green gram crops of the Navarai and Rabi seasons, respectively, from the years 2020–2021, 2021–2022, and 2022–2023, compared to other crops at different seasons in Kanchipuram district, which was collected from the Joint Director of Agriculture, Kanchipuram.

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Table 4.7 Kanchipuram District- Increase in Yield of Crops Area Coverage Details

Sl.No	Name of the crop	Season	2020-21		2021-22		2022-23	
			Target (Ha)	Achievement (Ha)	Target (Ha)	Achievement (Ha)	Target (Ha)	Achievement (Ha)
1.	Paddy	Navarai	8100	27091	8100	27357	19000	28150
2.	Greengram	Rabi	190	475	400	451	500	385

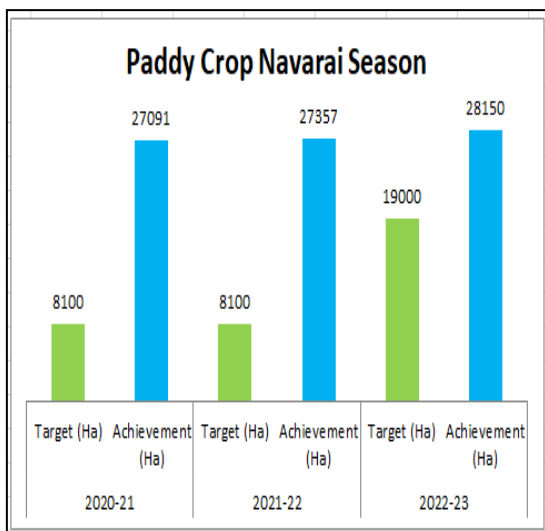


Fig 4.2 (a) Paddy Crops at Navarai Season

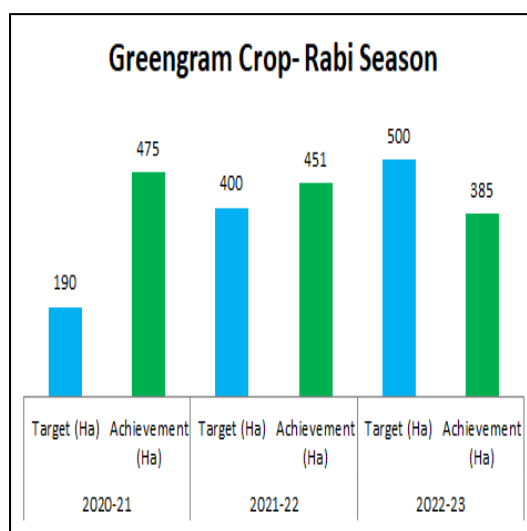


Fig 4.2 (b) Greengram Crops at Rabi Season

Figure 4.2 (a) and (b) show that Paddy crops achieved the highest productivity at Navarai season and Green gram crops achieved the highest productivity only at Rabi season in the years 2020–21 and 2021–22, and productivity dropped in the years 2022–23. To increase crops’ sustainable growth in all types of seasons, farmers should adopt government regulation policies to control the soil environment and also know how to measure and improve nutrition and fertilizer management. Priority measures to improve nutrition and fertilizer management

- Increase the circularity of nutrients
- To handle fertilizer and nutrients more effectively, close information and knowledge gaps.
- Strengthen international regulations to encourage fertilizer usage that is both safe and sustainable
- Increase the amount of time spent teaching the necessary parties in fertilizer and nutrient management
- Make sure fertilizers are available that are appropriate and reasonable.
- Ensure thorough national policies for fertilizer quality control.

In addition, farmers have few financial opportunities to modernize and mechanize agriculture. There are good opportunities for contract cultivation of groundnuts and pulses in this region. This area has good market potential as it is closer to Chennai.

V. CONCLUSION

The availability of agricultural labor is a major problem in our Kanchipuram district. From the assessment, data given by the Joint Director of Agriculture, Kanchipuram district, showed that Paddy crops achieved the highest productivity at Navarai season and Green gram crops achieved the highest productivity only at Rabi season in the years 2020–21 and 2021–22, and productivity dropped in the years 2022–23. Brinjal and Watermelon crops achieved the highest productivity at Rabi season using the plastic mulching

technique in the years 2020–21, 2021–22. Many large landowners are built in the region, and the availability of farm labor is very limited. This problem can only be solved by mechanizing farm work. Soil salinity also increases due to the poor application of organic fertilizer. It must be replaced by various organic products. Due to continuous cultivation after the Green Revolution, the use of chemical fertilizers weakened the structure and texture of the soil. To handle fertilizer and nutrients more effectively, close information and knowledge gaps. Strengthen international regulations to encourage fertilizer usage that is both safe and sustainable. It is necessary to renew the soil by adding organic fertilizer. It's very hard to get the required quantity of organic fertilizer, like cow dung, compost etc. Green manure crops like solar hemp and daincha are thus recommended to be grown on a large scale, thus minimizing yield variation.

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Authors Contributions	All authors have individual partnerships in this article.

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