

# Plasticulture

## Should We Continue with It?

Plasticulture is the application of plastics in agricultural cultivation and is fast becoming the most sought-after technique to augment farm yields and farm income. But, there is also a flip side as dangerous toxins released from the polyethylene film can remain in the soil for centuries leading to intense plastic pollution in the agricultural domain. Here, **Arjuna Srinidhi** and **Divya Nazareth** discuss the pros and cons of plasticulture and conclude that we need to go beyond just the ban of plastic bags and address its use across sectors.

The application of razor-thin sheets of polyethylene film across farmlands began in the 1950s when agronomists noticed that it could successfully moderate soil temperature, limit weed growth, and prevent moisture loss. With all the essential factors in crop production, this method was found to increase cotton, maize, and wheat yields by an average 3 per cent. This was a significant achievement, especially in a world where rising populations rely on increased rates of food production to survive. The promise of increased yields at a relatively low cost formed a multi-billion dollar industry for agricultural plastics. Approximately, 2,500 square miles of agricultural farmland utilized polyethylene covering for crop care in 2012, requiring 4.4 million tonnes of plastic. Plastic production for agricultural mulch is expected to see a 69 per cent increase to 7.4 million tonnes by 2019.

### Plasticulture: The Latest Hit

Plasticulture, that is, application of plastics in agricultural cultivation is fast becoming the most sought-after technique to boost farm yields and farm income. In India, it can come in handy to realize the overall aim to

double farm income domestically by 2022. This is more significant particularly since agriculture contributes ~14 per cent to the gross domestic product (GDP) while more than 50 per cent of the population is directly or indirectly dependent on it for livelihood. Moreover, the erratic nature of rainfall during the key monsoon season also exposes national income to risk, hence requiring

mitigation measures. India supports ~18 per cent of the global population with ~2.4 per cent of land area and ~4 per cent of water resources, thereby making judicious usage of water even more paramount. The benefits of plasticulture include a decline in water wastage, prevention of contamination from external agents, and prevention of soil erosion.



Plastic mulch in the farm of Manoj Lababe, Maherbhagaon village, Jalna district, Maharashtra

## The Use of Plastics in Farms

A wide range of plastics are used in agriculture, including polyolefin, polyethylene (PE), polypropylene (PP), ethylene-vinyl acetate copolymer (EVA), poly-vinyl chloride (PVC) and, less frequently, polycarbonate (PC) and poly-methyl-methacrylate (PMMA). These plastics provide the following:

- **Micro-irrigation:** This includes the use of drip irrigation and sprinklers in farms. With proactive steps being taken by various state governments like making it mandatory for farmers cultivating sugarcane to switch to drip irrigation (Maharashtra) and further streamlining of subsidy disbursal mechanisms, the domestic micro-irrigation industry is on a firm footing with robust prospects.
- **Pond liners:** It is the creation of an artificial pond to conserve water during the monsoons. Domestically, Rajasthan and Maharashtra are at the forefront of promoting pond liners in a big way and are witnessing robust growth prospects.
- **Greenhouses:** It is a farming technique wherein the crop is grown in a controlled environment and is covered through firm nets or plastics through a frame.



- **Plastic mulching:** This is a farming technique in which crops are grown through holes in sheet, and laid all over the ground. It prevents the contact of soil with atmosphere, and hence, helps in preventing moisture loss.

## Government of India's Support to Plasticulture

Speaking on the Role of Plasticulture during the three-day Global Rajasthan Agritech Meet 2016 (GRAM 2016) held in Jaipur, Principal Secretary, Agriculture,

Government of Rajasthan, Ms Neelkamal Darbari stated that the agriculture sector has immense opportunities for 'plasticulture'. She further said that in order to achieve the mission of doubling farmers' income by 2022, it is imperative that low-cost and high-quality plastic should be made available to the farmers. Being a scarce and valuable resource, water should be used judiciously and plasticulture will go a long way in limiting its use. New technology and processes should also be made available to the farmers so that the productivity and product quality can be increased with limited usage of water, the Principal Secretary added. Highlighting the role of the Irrigation Association of India (IAI), Mr Arijit Sengupta, Director, IAI, said that the industry leaders, manufactures, and government should work more closely to spread the awareness about plasticulture and make it easily available at a low cost to the farmers.

To enable the Indian Plastics industry to realize its potential FICCI jointly with the Department of Chemicals & Petrochemicals, Government of India and Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture, organized the 5th National Conference on 'Potential of Plasticulture in India' in May 2016 in New Delhi. At the





event, a joint FICCI-TSMG (Tata Strategic Management Group) report titled, 'Role of Plasticulture in Next Generation Agriculture' was released. The report claims that plasticulture can reduce the losses in harvesting and increase the value of output by ₹68,000 crore across the country.

## The Other Side of the Story

However, there is a flip side. Firstly, dangerous toxins released from the polyethylene film can remain in the soil for centuries. Known as white pollution, polyethylene residue is becoming increasingly prevalent in treated soils at levels of up to 300 kg (661 pounds) per hectare. Over time, this decreases soil porosity and air circulation, alters microbial communities, and compromises soil fertility. Polyethylene also releases carcinogenic phthalate acid esters into the soil, which together with other synthetic pesticides can be easily absorbed by the crops. This is a significant risk to human health. What's more, the

polyethylene films used in the coverings are low density by design, which makes the plastic extremely difficult to biodegrade. Any waste from this process is rarely accepted by recycling facilities and often ends up in landfills and oceans, wreaking havoc on ecosystems around the world.

As with the concerns with plastics in other sectors, there are issues with their application in agriculture also. Over time, as scientists have found, film residue can decrease soil porosity and air circulation, change microbial communities, and potentially lower farmland fertility. Fragments of plastic film have also been shown to release potentially carcinogenic phthalate acid esters into the soil, where they can be taken up in vegetables and pose a health risk to human beings when the food is consumed. Film fragments left in fields can also accumulate pesticides and other toxins applied to crops. This is a special risk for sheep, goats, and other livestock grazing on crop stalks because of their potential to ingest plastic material or the chemicals that leach from it. When cotton

crops are grown in plastic-contaminated soil, there is a risk of lint being contaminated. If that were to happen, the quality of the output is downgraded because traces of plastic can interfere with the colouring process. And then there is the plastic pollution that makes its way into rivers and oceans, which can be toxic for aquatic life.

Another issue with regard to the plastic mulch (films) is that it is not easy to recover and reuse them. Although films in the USA, Europe, and India are thicker than 15–20 microns, Chinese films are less than half the thickness of those films and go down to about 8 microns. That thinness makes the material less robust and more difficult to recover after use. China is predicted to increase its use of plastic mulch by 38 per cent to more than 2 million metric tonnes a year by 2024.



*Mulch films on the farm of Popatrao Wagh, Maherbhagaon village, Jalna district, Maharashtra*

According to a study from the University of California and Santa Barbara, as of 2015, approximately 6,300 Mt of plastic waste had been generated in the world, around 9 per cent of which had been recycled, 12 per cent was incinerated, and 79 per cent was accumulated in landfills or the natural environment. If the current production and waste management trends continue, roughly 12,000 Mt of plastic waste will be in landfills or in the natural environment by 2050.

## Why do we Still Continue with Plasticulture?

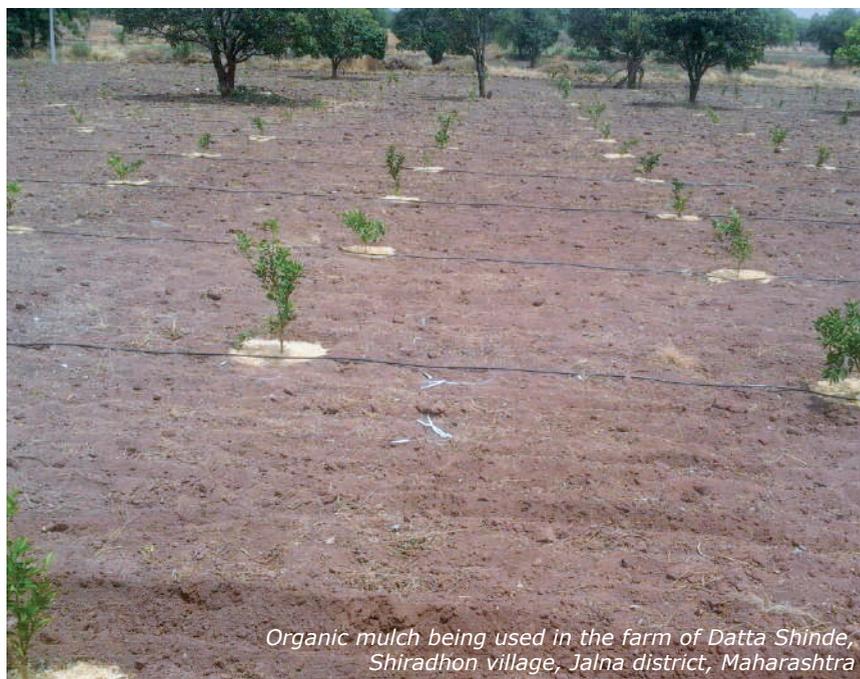
With increasing population and limitation over increase in acreages, augmenting farm yield is the only viable option for increasing agricultural production. Plasticulture, which is indeed a scientifically proven methodology, helps in this pursuit. The Ministry of Agriculture, Government of India, believes that its optimal application is a step in the right direction to achieve the overall vision to double farm income by 2022.

The key benefits of plasticulture include:

- Increase in crop yields (in excess of 20 per cent, water saving (~30–40 per cent))
- Saving in other agri inputs, viz., agro chemicals and fertilizers. Plasticulture can well be imbibed as the mainframe system within the ambit of sustainable agricultural practices domestically
- Its effective implementation is likely to result in robust food grain production and consequent rise in agricultural GDP in excess of 4 per cent.

## The Alternatives

Plastics are no doubt a ubiquitous and a 'necessary' material for humankind but as we look back at the impact and use of plastics in nearly every sector, concerns are rising about what happens



*Organic mulch being used in the farm of Datta Shinde, Shiradhon village, Jalna district, Maharashtra*

to these after use. India hosted the World Environment Day 2018 and has taken a slew of steps in the recent months to ban the use of single-use plastics, mainly in the form of polythene bags and bottles. The use of plastics in agriculture could be the next big segment for plastic manufacturers to target and this is going to be disastrous considering the effects on soil health, microbial communities, potential release of carcinogenic compounds into the food chain, and also loss of commercial value to crops such as cotton.

There are alternatives. A recent UN Environment report discusses the use of: i) alternative natural materials obtained from plants and animals, and ii) newer generation bio-polymers which are plastics made from biomass sources. The report highlights some relatively conventional alternatives to plastics such as paper, cotton, and wood as well as less obvious solutions, including algae, fungi, and pineapple leaves amongst others.

With regard to agriculture in particular, some of the solutions might come with a little more physical effort (using organic mulch) or others that come at a slightly

higher cost (biodegradable materials).

Therefore, state and national policies have to come to the rescue to incentivize good and responsible behaviour.

Steps such as those taken by smart cities in banning single-use plastics and enforcing penalties for non-compliance will certainly help. But we need to go beyond just the ban of plastic bags and address its use across all sectors if we are to make a difference to contamination of our soil, water, food, and air.

And while research and development helps develop more alternatives as commercial options, the traditional resource management principles of reuse, reduce, and recycle (3 R's) will continue to hold true. ■

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