



# FARM

## Fund for Adopting Responsible Materials

### INVESTMENT THESIS

FARM is addressing the agricultural plastic waste challenge. It will make catalytic investments to supplant the use of plastic mulch with an environment friendly alternative – a bio-degradable mulch. These regenerative agricultural practices incentivize farmers and mulch producers while reducing agricultural plastic waste and enhancing soil fertility

### CHALLENGE

Agriculture polyethylene (PE) mulch films have been used for decades to increase agricultural crop yield by controlling weeds, soil temperature and water usage. While initially thought to be cost-effective but these thin **PE mulch films are non-biodegradable, non-reusable and non-recyclable**. The immediate post-harvest phase sees residual accumulation during removal, which over the years causes soil quality degradation. The mulch that is successfully removed is often stock-piled and burnt or end up in landfills, due to low scope for recycling.

Plastic pollution due to agriculture mulch usage is a growing environmental challenge in several countries, including the United States. Florida alone generates 25 million of plastic mulch waste annually.

**The key challenge thus are the direct and indirect costs associated with the use of PE agriculture mulch which are currently not valued appropriately. High labor costs to remove the mulch after every harvest season, loss in yields due to reduced soil fertility, presence of micro and nano plastics in the soil due to inappropriate and ineffective disposal methods - all add to not only a dire environmental impact, but also socio-economic impacts in terms of low yields and profits for farmers.**

### SOLUTION

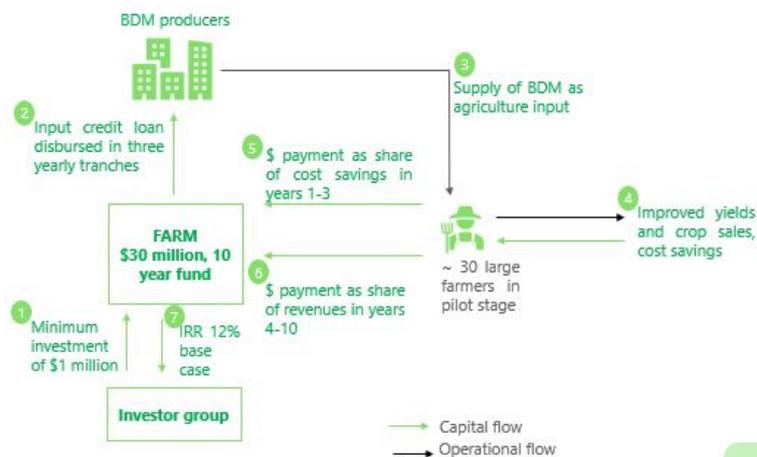
Our solution aims to supplant the usage of plastic mulch with an environmentally friendly alternative, by creating financial incentives to both producers and consumers of alternative solution.

A sustainable alternative to PE mulch is **biodegradable plastic mulch (BDM)**. BDM made from bioplastics perform the similar function of increasing crop yields, do not require removal since they're biodegradable. **This provides a multi pronged benefit - reduced labor costs related to mulch removal, reduction in microplastics in the soil, added fertility of the soil, and reduced waste associated with burning or dumping mulch.** Experimental studies suggest that BDM mulch tilled into the soil lead to consumption of less water, increased retention of heat in the soil, increased crop yields by 20% and improved workload and waste management.

Our fund aims to solve agriculture plastic waste challenge, by linking large farmers and BDM producers through an input credit program. This provides the initial capital that both the BDM producer needs to scale up the technology, and the farmer needs to switch to a new agriculture practice.

### FUND STRUCTURE

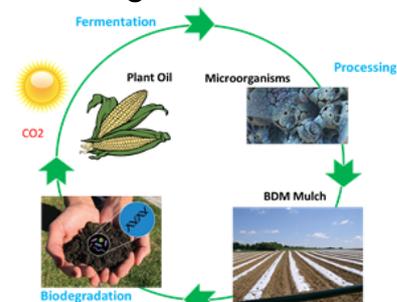
Our solution seeks to incentivize farmers to incorporate BDM films in their farming practices. Our fund will negotiate a fixed price with the BDM producers and provide a non-cash input credit loan to large farmers. Thus, farmers can purchase BDM films without any upfront cost. Over the initial three years farmers only repay a proportion of their labor and recycling cost savings enabled by switching to BDM. As soil get nourished and yields increase, from the fourth year onwards farmers repay a proportion of revenues. We expect full payback of of the input loan before the end of year 7.



### Current PE mulch lifecycle



### Sustainable biodegradable mulch lifecycle

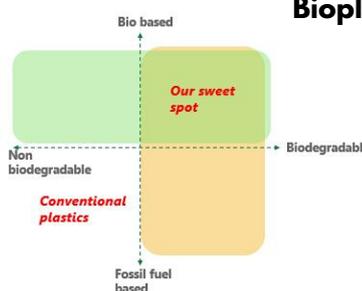


### Bioplastics 101

**Bio-based plastics** - Plastic that made from renewable resources instead of fossil fuels.

**Biodegradable plastics** - Plastic that can degrade by naturally occurring microorganisms such as bacteria, fungi, and algae to yield water (H<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>) and/or methane (CH<sub>4</sub>), biomass, and inorganic compounds.

**Bioplastics** - plastics that are bio-based, biodegradable, or both.



Barriers to adoption addressed by FARM:

- Reduced high upfront costs
- Aligned with the seasonal cash flow associated with farming
- Assured supply to BDM producers, thus spurring investment in scale-up
- Resistance to new, untested farming practices
- Guaranteed reduction in labor costs and increase in yields

## FUND PROFILE

Fund Size	USD 30 million
Investment Criteria	Large farmers in Midwest United States with landholding of greater than 2000 acres. Large farmers enrolled in preferably federal or private multi-peril crop insurance
Target Return	11-14% (gross)
Fees	2% management fee on committed capital, 15% performance fee
Time Horizon	10 years
Investors	Impact Investors, Oil Companies, Institutional Investors
Partners	Investors, Farmers, BDM Producers, Financial Institutions
Potential for scale	With reduced BDM costs adoption is expected to increase across other farmlands in developed markets and emerging markets like China. In several countries there is increased policy push towards curbing plastic waste in agriculture.

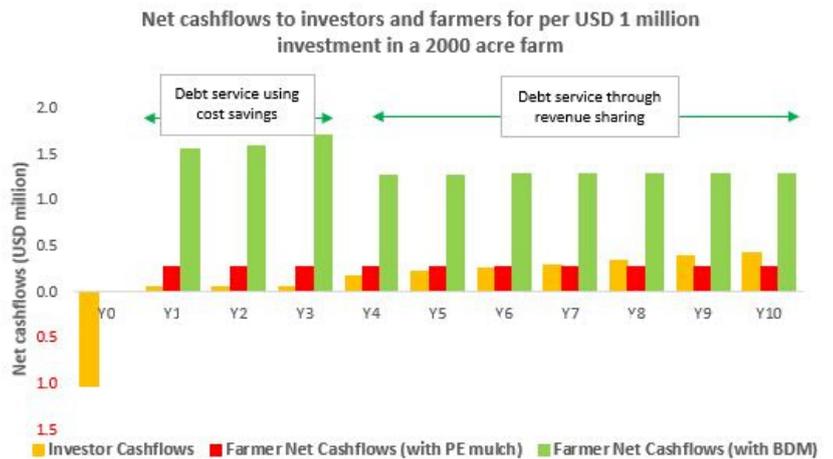
## INVESTOR PROFILE

Multilateral development banks	World bank has issued blue bonds aiming to reduce plastic waste in oceans. The application of BDM film helps solve this issue in the early stage, by incentivizing the BDM industry to invest in marine biodegradable plastics engineering
Impact investors	Investment in agriculture technology are booming these years and investors are willing to put money in projects that could improve food security, while at the same time combatting a key environmental degradation challenge
Big oil companies	Investing in bio-based plastics is a natural hedge for oil companies because of the high positive correlation between crude and conventional feedstocks of plastics
Institutional Investors	A large number of institutional investors have already pledged to interact with leading companies to find solutions on plastic pollution

## RISK AND MITIGATION

Force majeure	Work with farmers to ensure they have access to subsidized federal government Multi-Peril Crop Insurance (MPCI) before being eligible for the fund loans
Downward movement of crop prices	Diversify the crops invested in including speciality and staple crops Engage with USDA to introduce accreditation of bioplastics use-based farming to charge premium prices
Credit risk of farmers	Partner with local natural resource conservation bureaus during screening of farmers to eliminate as much credit risk as possible
Regulation	Increased research and technology innovations has been turning regulations in favour of bioplastics use in agriculture. As a part of this fund we would be working with local policy makers to diffuse information on BDM and lobby for increased use.
Market risk of slow adoption	The business model incentivizes farmers, there is a definite upside in terms of cost savings and BDM films are already similarly priced as PE films in a few markets in Europe. We will be working with local farm bureaus to train other farmers in terms of the current issues with PE mulch, the cost savings and benefits of BDM.

## CASH FLOW ANALYSIS



Projected investor IRR sensitivity to increase in yields and ability to charge price premia

		Yield increase rate (% per annum)			
		0.5%	1%	2%	3%
Price premium (%)	3%	11.64%	12.17%	13.24%	14.32%
	5%	11.93%	12.47%	13.54%	14.62%
	7%	12.22%	12.76%	13.83%	14.91%
	9%	12.50%	13.04%	14.12%	15.20%
	10%	12.64%	13.18%	14.26%	15.34%

## KEY ASSUMPTIONS

- Every large farms requires an investment of USD 1 million for BDM use, which will be disbursed over three annual tranches.
- From years 1-3, debt servicing by farmers is a decreasing component of their cost savings from reduced labor and recycling costs (starting at 15% of cost savings). From years 4-10, debt servicing is an increasing revenue share (starting at 12%) to partake in the higher yields due to better soil fertility and lower plastic waste costs and higher prices as premium charged for sustainable practices.
- Entire current plastic mulch usage will be supplanted by BDM usage in the targeted farms
- Yields are expected to increase with reduced use of plastic mulch and increased use of BDM mulch
- Expectation of ability to charge price premia for farm outputs produced using sustainable practises
- Other farm input costs are expected to grow at the rate of inflation and farm wage growth rate

*Our fund provides evidence that when all direct and indirect costs of agriculture plastic waste are accounted for, farmers have an economic incentive in switching to BDM, which provides cost savings and potential for revenue growth and thus higher profit margins as compared to current unsustainable practices. In our base case event, the input credit to farmers has an implied effective annual rate of 7.31% for 10 years. Our innovative debt service mechanism in the initial years provides farmers a guarantee by only accessing cost savings and thus propelling behavior change and increased BDM adoption, which in the later years benefits as we move to a revenue sharing agreement.*

## ADDRESSABLE MARKET

Global Agricultural films market, a \$ 9Bn opportunity in 2018 is expected to grow @ CAGR of 6% to reach \$ 16.1 Bn by 2028. As the benefits of rising agricultural yields and declining adoption costs spread across farmlands in developed markets, this adoption will spread to emerging markets such as China. Rising environmental concerns and regulatory bans over use of PE mulches such a recent one announced by China will also drive demand for BDM.

## IMPACT

- Reduce Plastic Waste by 422,686 Tonnes per year
- Reduce CO2 emissions by 6x for every kilogram of PE mulch replaced by BDM. Our pilot estimates 2.5 Mn tonnes
- Reduction in ecotoxicity
- Preserve soil quality and enhance yields

