BIOFUELS AND BIOPLASTICS COMMERCIAL DEVELOPMENT PLAN

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1. Executive Summary

This document outlines Yield10's plans for commercialization of proprietary, non-commodity Camelina varieties in order to serve three markets: Camelina oil for use as a biofuels feedstock, Camelina meal for use in animal feed, and polyhydroxyalkanoates (PHAs) produced in Camelina seed for use as a biodegradable bioplastic.

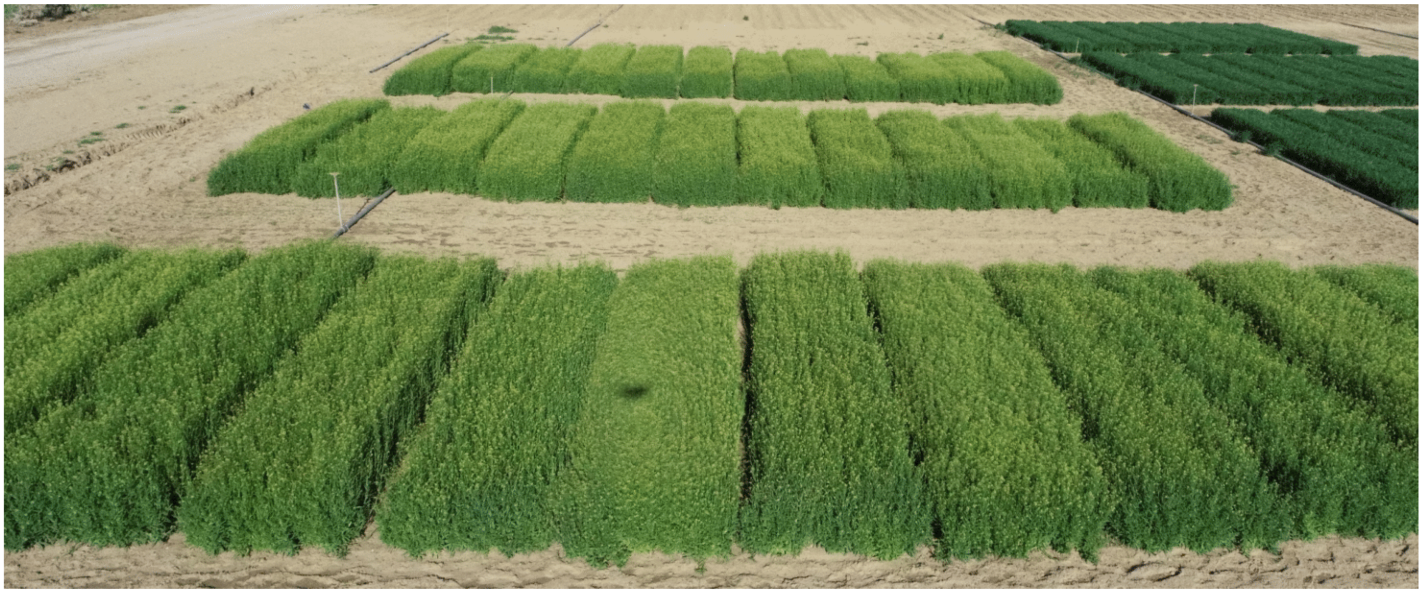

Figure 1: Drone Image of Yield10's Winter Camelina in Idaho, May 25, 2021

The commercial development plan is based on three successive phases. Phase I is the scale-up of Yield10's high performing lines of non-regulated spring and winter Camelina to create an initial commercial footprint and establish offtake relationships in the biofuels and animal feed markets. Phase II is the development of regulated 'Elite' Camelina varieties with the input traits needed to rapidly expand acreage beyond hundreds of thousands of acres (herbicide tolerance) and stacked with value-added oil and yield performance traits to increase revenue. Phase III is the continued development of Yield10's PHA Camelina trait, which already has two years of successful field trials, followed by the commercialization of the trait. This line of PHA Camelina will replace the 'Elite' Camelina lines commercially, offering higher revenues, further increasing acreage, enabling a potentially carbon negative feedstock oil for biofuels offtake, and allowing for cost advantaged PHA bioplastics production at scale. The commercial development plan is designed to be capital light as we grow the business, leveraging contract farming, logistics, and transportation to enable scalability.

This white paper is structured as follows: Section 2 offers background on Camelina and Yield10's history with the crop, Section 3 describes the end markets for the three products, Section 4 describes the identity-preserved value chain that is being built, Section 5 describes the three phases of commercial development along with illustrative economics at each phase, and Section 6 describes the partnering that will be needed.

2. Background

Camelina sativa is an oilseed plant in the Brassicaceae family, that has been cultivated for food in Europe for over 3,000 years (1). Camelina oil has valuable health benefits due to high content of the Omega-3 alpha-linolenic acid (ALA) and good cooking oil properties due to its high smoke point (475˚ F), while Camelina meal has a high protein content (2, 3). More recently, Camelina has attracted interest as a biofuels feedstock because of its high oil yield and low carbon emissions (4, 5). Camelina has both spring and winter varieties. Spring Camelina is typically planted in the spring and harvested in the fall. It has similar preferred agronomic zones to Canola, but its lower water requirements allow it to grow well on marginal land without irrigation (e.g., Eastern Montana). Spring Camelina's improved cold tolerance also allows it to be overwintered in warmer climates such as Georgia. Winter Camelina is planted and emerges in the fall, lies dormant in the winter, and then continues to mature before being harvested in the spring. Winter Camelina performs better in cold, northern regions such as the Midwest (Minnesota, North Dakota), Pacific Northwest (Montana, Idaho) and Southern Canada (Saskatchewan, Alberta, Manitoba) where the winter snow cover protects the plants and provides water. Both spring and winter Camelina enable farmers in many regions to increase revenue in geographies and growing seasons where major crops yield poorly, while also providing a hedge against increasingly common summer weather risks, such as drought.

Yield10 (formerly Metabolix, Inc.) selected Camelina as its platform crop for its PHA bioplastics program in 2010, to enable capital efficient scaling of PHA production and to reduce marginal production costs well below those of competing bioplastics.

Figure 2: Camelina Sativa Plant, credit: Yield10 Bioscience

Camelina was selected based on its unique attributes, including:

- Competitive agronomic performance, despite a short history of modern breeding techniques being applied
- No outcrossing with Canola or other food crops (de-risking stewardship of genetically modified varieties)
- Amenability to genetic engineering improvements in later years this attribute coupled with new genome-editing technology and Yield10's Gene Ranking and Artificial Intelligence Network (GRAIN)[1] has enabled Yield10 to produce improved Camelina lines with proprietary genetics (6) .

Yield10 has already produced a number of high-value traits increasing oil content, yield, and photosynthesis in Camelina. One example, E3902 is a CRISPR genome-edited, non-transgenic, and USDA-APHIS non-regulated trait to increase oil content, with 3 years of consecutive successful field trials The E3902 Camelina line has shown a consistent 4-5% increase in seed oil content as a percentage of seed weight over control plants, while also producing a differentiated seed color (see Figure 3) (7). Yield10's expertise in synthetic biology and metabolic engineering has also been an integral piece in the success of its crop PHA program. The program completed field trials of its first-generation prototype PHA trait in 2020 and 2021, producing PHA in Camelina seed at 6% of total weight.

Figure 3: Wild-Type Camelina Compared to Yield10's CRISPR Genome-Edited Line E3902

3. Products and End Markets

3.1 Camelina Oil for Biofuels

A dramatic increase in biofuels production capacity in the United States and Canada is currently underway. At the start of 2021, proposed and funded renewable diesel facilities totaled a capacity of over 5.3 billion gallons of biofuels per year with less than 10% of that capacity currently operational (8). In the year since, additional biofuels projects have been announced with a total capacity close to another 1 billion gallons per year (9, 10, 11, 12, 13). Biofuels feedstock is supplied mainly from used cooking oil, animal fats (e.g., tallow), and vegetable oil, with the former two feedstock sources already in short supply due to their low carbon footprints and limited production capacity (14). The increase in biofuels feedstock over the next few years will therefore have to come from the latter source, vegetable oils, which has a global production of only 50 billion gallons per year (15). In fact, soybean oil and Canola commodity market prices have already close to doubled in the past year, while the supply may tighten further in the years to come (16, 17).

Figure 4: Camelina Oil, credit: Yield10 Bioscience

In addition to this general trend of increased vegetable oil demand due to the surge in biofuels production capacity, Camelina oil is especially advantaged because of its ultra-low carbon footprint. There are three sets of regulatory incentives in the U.S. meant to increase production of low-carbon biofuels. First are biofuels tax credits of $1.00/gallon across all types of biofuels (18). Second is the EPA's Renewable Fuel Standard (RFS) for which Camelina renewable diesel and biodiesel qualify for class 4 or 5 Renewable Identification Numbers (RIN) credits, which today trade for around $1.50/gallon (19, 20). Notably, palm oil, which accounts for over a third of global vegetable oil production, does not qualify for RIN credits under the RFS due to its higher carbon footprint (21). The third set of incentives comes from regional greenhouse gas reduction mandates for fuel producers. This includes California's Low Carbon Fuel Standards (LCFS) market, which measures the specific carbon intensity (CI) of every type of fuel, assigns a credit/deficit for every gallon of fuel produced based on its CI, and requires all fuel producers selling into California to purchase enough credits to keep their portfolio CI score below a certain baseline. Table 1

[1] *Yield10's proprietary GRAIN platform is a synthetic biology tool that leverages understanding of metabolic pathways to impact targets such as seed yield, oil content, and protein composition.*

displays the CIs of approved renewable diesel pathways for selected feedstocks, showing how Camelina is especially CI advantaged due to its need for less fertilizer and irrigation, as well as other factors. LCFS credits trade at around \$180/MT CO_2, equating to about \$1.70 in tradeable LCFS credits per gallon for renewable diesel from Camelina feedstock oil. Other regions with greenhouse gas reduction mandates for fuel producers include Washington state, which is targeting a 20% reduction in carbon intensity of transportation fuels by 2038, Oregon, which is targeting a 10% reduction in carbon intensity of transportation fuels by 2025, and British Columbia, which is targeting a 20% reduction in carbon intensity of transportation fuels by 2030 (22, 23, 24). Canadian biofuels producers can also take advantage of RINs and California LCFS credits by selling into the U.S. markets, while Canada is simultaneously developing its own national low carbon fuel standards (25).

Feedstock	Carbon Intensity (g CO_2/MJ)
Petroleum Diesel	100.45 (25)
Petroleum Gasoline	100.82 (25)
Tallow	35.04 (25)
Used Cooking Oil	22.09 (25)
Soybean Oil	56.26 (25)
Camelina Oil	18.7 (26)

Note: The Camelina Oil CI was approved only for Sustainable Oil's Camelina lines.

3.2 Camelina Meal for Animal Feed

Camelina meal is a high-quality and high-protein meal that has been approved by the U.S. Food and Drug Administration, as well as by the Canadian Food Inspection Agency, for feed use in poultry and egg-laying hens at up to 10% of the total meal weight (29, 30). Camelina meal has also been approved by the U.S. Food and Drug Administration for feed use in beef cattle and has been approved by the Canadian Food Inspection Agency for feed use in salmon and trout. Cold-pressed Camelina meal has been extensively studied for animal feed, proving it to be very well-tolerated by livestock (28, 31, 32, 33, 34). The meal is also capable of providing substantial health benefits when used as an animal feed, such as an eight-fold increase in the Omega-3 content of chicken eggs (35, 36).

3.3 PHA Bioplastics

Yield10 has a unique competitive advantage to commercialize crop PHA production, based on over 30 years experience producing and compounding PHA bioplastics. Prior to its 2017 rebrand as Yield10 Bioscience, Inc., the Company, as Metabolix, Inc., sold Mirel brand PHA through its Telles joint venture with Archers Daniel Midland (37). Although Telles was the first company to demonstrate commercial production of high-quality PHA bioplastics products for end-use applications (see Figure 5 below), the consumer market was not yet ready to bear the increased cost of bioplastics compared to petroleum plastics.

Figure 5: Mirel PHA Bioplastics Products

A decade after the end of the Telles Venture the market drivers have significantly changed. Regulators are realizing that plastic recycling will remain largely ineffective at curbing production of new plastics and in turn plastic waste, as recycled plastics have limited uses and cannot be recycled endlessly, and they have begun adjusting rules accordingly (38, 39). Canada announced the ban of six-types of single use plastics by the end of 2022 including grocery bags, straws, stir sticks, six-pack rings for aluminum cans, cutlery, and food takeout containers (40). Likewise China has announced a five-year plan to ban most single-use plastics that started in 2021 and India has announced a ban of most single-use plastics by 2022 (41, 42). Many consumer brands are exploring the biodegradable packaging options in preparation for the upcoming shifts in regulation and consumer demand (43, 44, 45). As a result of these market drivers, bioplastics companies are undergoing rapid expansions. PHA producers including CJ CheilJedang, Danimer Scientific, and RWDC Industries, and PLA producers including Natureworks and TotalCorbion are spending billions to quickly expand their production capacities and keep up with increases in market demand for bioplastics (46). PHA is the only natural polymer to enable a broad range of end-use plastics, as the PHA family consists of over 150 different monomers with extremely different properties that are capable of being blended to produce desired attributes (47). Yield10's first-generation prototype PHA Camelina line produces the type of PHA called polyhydroxybutyrate (PHB). PHB has very strong end-use performance when blended with other PHA copolymers, and in fact a review of the patent literature reveals that PHB was a major component of all the Mirel PHA resins. PHB also blends well with polylactic acid (PLA), polybutylene adipate terephthalate (PBAT), polybutylene succinate (PBS), and polycaprolactone (PCL). For PLA, in particular, blending with PHB improves its thermal properties, enabling it to be used for higher-heat applications (e.g., hot cups, microwaveable trays) which PLA alone is not well suited for (48). Furthermore, the main economic problem faced by PHA and PLA producers today is the high capital expenditures of building new bio-fermentation plants. Recent capital expenditures for PHA bio-fermentation plants are estimated at $700 million for 113,000 tons per year capacity and those for PLA bio-fermentation plants are estimated at over $600 million for 75,000 tons per year capacity (46, 49). Offtake of PHB from Yield10's Camelina would enable larger production scale relative to capital expenditure, enabled by blending crop produced PHB with bio-fermentation produced PLA/PHA copolymers, thereby substantially increasing the internal rate of return (IRR) from those large investments. Yield10's estimates show an IRR of 24.2% for a PLA bio-fermentation facility built today versus an IRR of 50.3% for the same facility with PHB offtake from Yield10, and an IRR of 20.3% for a PHA bio-fermentation facility increasing to an IRR of 78.3% with PHB offtake from Yield10[2].

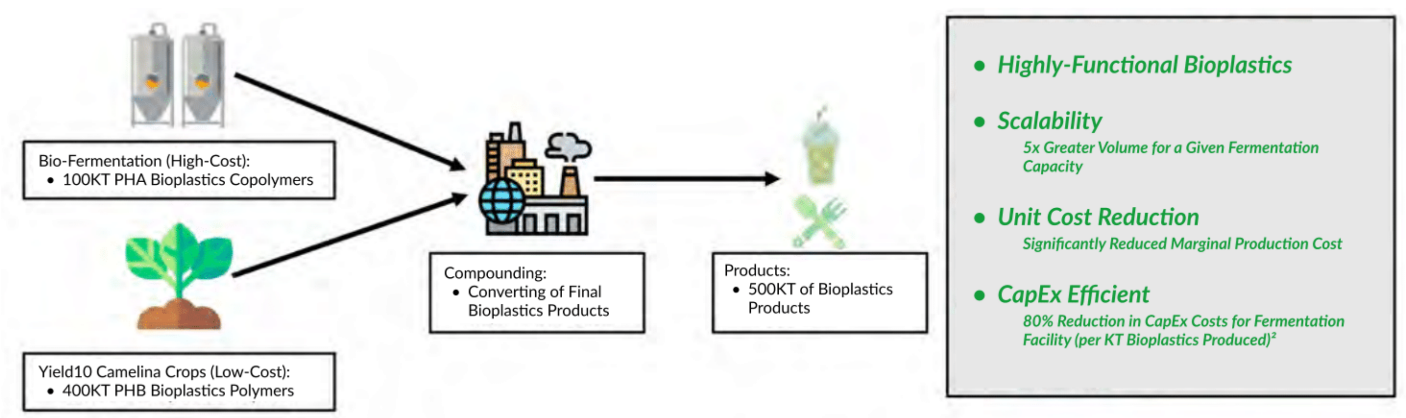

Figure 6: Advantages of Crop PHB Offtake for PHA Bio-Fermentation Producer
(Assuming 80% blending of crop-based PHB and other PHA copolymers)

4. Establishing the Value Chain

As part of its commercialization strategy, Yield10 is establishing an identity-preserved value chain as shown in Figure 7 below. The upstream parts of the value chain, including the development of advanced proprietary Camelina genetics will continue to be owned by Yield10 through its Saskatoon, Saskatchewan-based subsidiary Metabolix Oilseeds. Yield10 will also own the commercial seed operations activities and recently hired a Canola seed industry veteran as the Senior Director of Seed Operations to lead that team. The new Senior Director of Seed Operations has extensive experience managing Canola seed operations at large agricultural as well as hands-on experience building large-scale seed operations from the ground up. Furthermore, they have experience with identity-preserved Canola varieties that will be particularly relevant for the management of Yield10's identity-preserved PHA Camelina varieties.

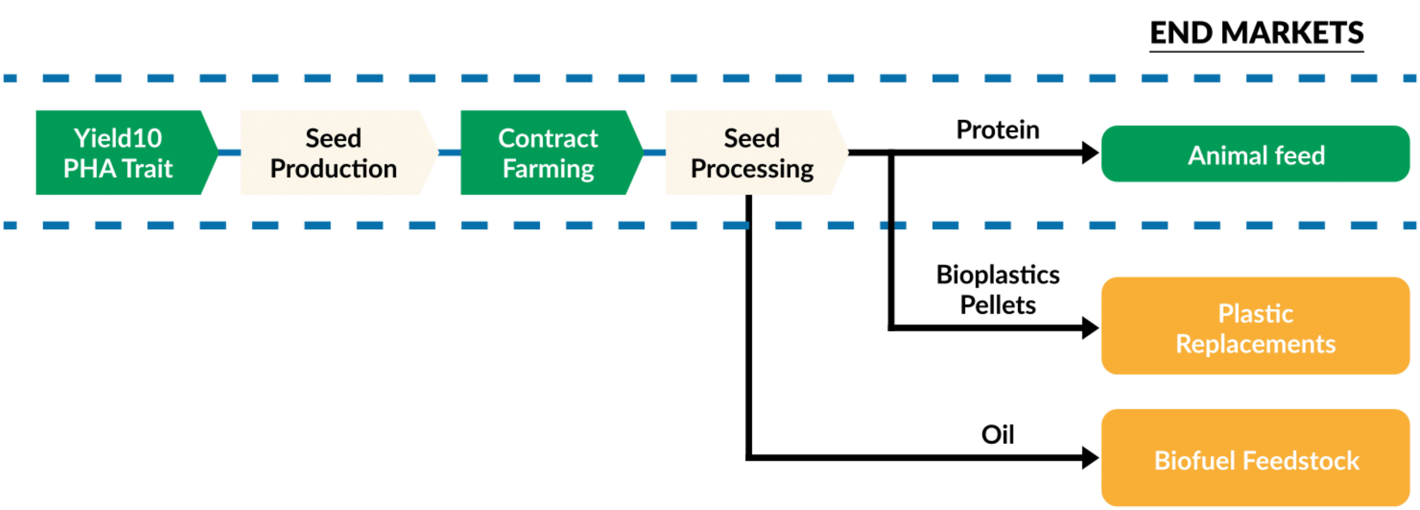

Figure 7: Identity Preserved Value Chain

[2]*Based on public information about capital expenditures for new bio-fermentation facilities, and internal estimates of operating expenditures and blending rates with PHB*

Yield10's seed operations will manage seed production of the commercial lines of Camelina seed and develop a grower network for contract farming. The goal is to leverage farmers' experience, while structuring contracts that reward farmers and incentivize them to produce while being capital light to enable rapid scalability of the business. Yield10 will then use contract transportation and logistics for offtake of seed from the farmers and delivery to seed processors. The seed processing will also be able to leverage existing infrastructure for the separation of oil from the seed. Conventional cold-pressing and hexane (solvent processing) facilities can be used to extract Camelina oil from seeds and leave the protein meal and PHA together. This can be done through contract work with the large seed processing companies (e.g., the ABCDs - ADM, Bunge, Cargill, Louis Dreyfus Company), or through building dedicated facilities (see Section 5.1 for more details on selecting this route). After oil extraction, the PHA can then be separated from the meal either with another solvent extraction step, or with aqueous processing (as the density of the PHA is much higher than that of the protein meal). The infrastructure for this second step will be developed in Phase III of commercial development (see Section 5). The oil, protein meal, and PHA will then be delivered to offtake partners in the biofuels, animal feed, and bioplastics end markets, respectively.

5. Commercial Development Phases

5.1 Phase I - Scale-up of Non-Transgenic Lines

Phase I of the commercial development plan is the scale-up of Yield10's non-regulated Camelina varieties to establish a commercial footprint based on offtake agreements for biofuels feedstock.

The first step of this phase will be to identify biofuels offtake partner(s) (see Figure 9 below). The plan is to partner with one or more biofuels production facilities adjacent to a geography and climate where Camelina is value advantaged over other crops, such as Alberta, Montana, or North Dakota where winter Camelina performs well on otherwise fallow land, or in warmer climates like Georgia where spring Camelina can be overwintered. Growing close to the biofuels production facility not only enables lower transportation costs, but also enables a lower carbon intensity (CI) score by optimizing the entire supply chain from farming through seed processing to renewable diesel production. Outreach to potential biofuels offtake partners in the target geographies for commercial launch is currently underway.

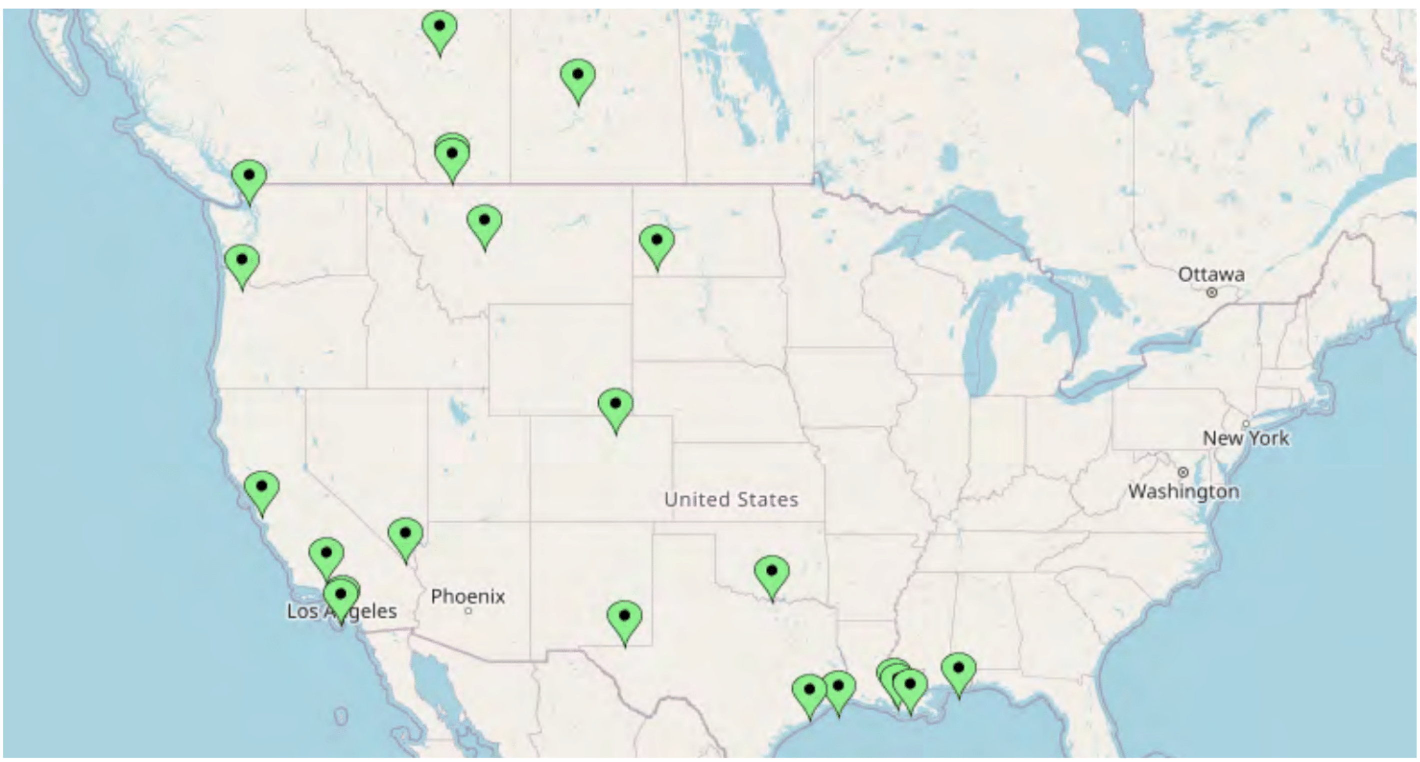

Figure 8: Renewable Diesel and Biodiesel Facilities (Operational or Under Construction) in the U.S. and Canada

Once the biofuels offtake partner is determined, Yield10 will begin to establish the rest of the value chain including the grower network and potential seed processing partners. For 2022/23, Yield10 is targeting contracted farming of up to 1,000+ acres on smaller plots across multiple farms and is currently scaling up seed supply for that purpose. Seed processing will need to be coordinated with the biofuels offtake partner as many facilities are already working to develop those resources or partnerships. For example, some facilities are partnering directly with large seed processing companies, in which case contracted seed offtake would be preferred. In other cases, biofuels production facilities are exploring the acquisition or construction of oilseed crushing and refining equipment themselves, which opens up potential opportunities for co-owning/renting that equipment.

The first year of activity will also require an audited life cycle assessment (LCA) by a certified third-party to quantify the carbon intensity (CI) of the vegetable oil feedstock and final biofuel product. This is critical, since supplying low CI fuel into California's LCFS market is the most likely commercial launch scenario.

After the value chain is established in the first year, the goal in the rest of Phase I will be to increase the grower network and acres being farmed. Although acres can be increased by 150-fold to 200-fold year-over-year when replanting all harvested seed[3], in practice the acreage that can be accessed will be limited by the lack of herbicide tolerance in our non-regulated Camelina varieties. This is because of two distinct reasons. First, Camelina is sensitive to soil residues of Class 2 herbicides, which are often used in the target geographies. Second, the weed pressure without herbicide tolerance may impact some growers' willingness to adopt these varieties of Camelina. While some crops, like flaxseed, have scaled to over a million acres without herbicide tolerance, Camelina will likely be limited to around 100,000 acres in Phase I due to its required close proximity to the biofuels offtake partner, in order to enable the most competitive carbon intensity (50).

5.2 Phase II - Elite Camelina

Phase II is the development of regulated 'Elite' Camelina, where Elite refers to a high-yield germplasm with stacked input traits for Class 2 herbicide tolerance as well as over-the-top herbicide tolerance which is preferred by farmers to reduce risk. These traits are already under development and displayed in Table 2 below.

Category	Trait	Development Status
Herbicide Tolerance	Glufosinate (over-the-top)	Under development and testing since 2021Q2, using a known gene construct approved in Canola
Herbicide Tolerance	Imidazolinones (soil residue)	Have mutagenized germplasm with apparent tolerance
Herbicide Tolerance	Sulfonylureas (soil residue)	Developing mutagenized germplasm with tolerance
Disease Resistance	Downy Mildew Resistance	Assessing mutagenized germplasm with potential resistance
Oil and Yield	E3902, C3004, C3007, C3020	Developed and assessed multiple oil/yield traits - planning to test combinations of these traits in field trials to futher optimize improvements

Once the traits from Table 2 are fully developed, the next step will be to combine all traits in the best germplasm. Depending on how the trait is being developed, this may be accomplished through crossing the mutagenized lines into the highest performing agronomic germplasm, followed by combining the remaining gene modules into a single gene stack. Elite Camelina produced by combining these traits will then undergo the regulatory approval process in the U.S. and Canada.

Yield10 has added significant regulatory capabilities for genetically modified (GM) crops in the past year, and is already reviewing how the recent regulatory changes in the USDA APHIS' SECURE rule, as well as soon-to-be-published revisions to the CFIA's crop genetic approval rules, might be leveraged to enable either simpler and more expedited paths to regulatory approval or potential exemption from regulation (51, 52, 53).

Following regulatory approval, our Elite Camelina germplasm will replace the non-transgenic germplasm used in Phase I for commercial farming. The goal in the rest of Phase II will be to scale to as many acres as possible, supplying a substantial amount of localized feedstock production needs (20+%) for the biofuels offtake partner. While the grower network will increase in scale during Phase II, the rest of the value chain developed in Phase I will continue to be leveraged.

5.3 Phase III - PHA Bioplastics Camelina

Phase III of the commercial development plan is the addition of Yield10's PHA Camelina trait into commercial production.

Yield10's PHA trait research and development is already advanced, with the 1st generation prototype PHA traits having two years of successful field trials in 2020 and 2021, each producing 6% PHA in the seed by weight. Yield10 is simultaneously developing 2nd and 3rd generation PHA traits, with the goal of increasing PHA content to 10%-20% of total seed weight. Once the final commercial PHA trait is developed and proven in field trials, Yield10 will begin the regulatory approval process for the PHA trait added to our Elite Camelina germplasm. Although this is expected to take longer, PHA is a natural polymer, well tolerated and biocompatible. PHA has undergone extensive study both for use as a medical implant material and as a supplement for animal nutrition (54, 55, 56, 57, 58).

During the PHA trait development process, Yield10 will also use the 1st generation PHA producing trait to begin pilot scale PHA extraction from Camelina seed, while growing under permit. The goal of this piloting work will be to establish a low-cost extraction process (either solvent-based or with aqueous processing), that can ultimately be applied at a commercial scale. This will also enable material piloting, in joint work with the PHA offtake partner, to demonstrate final bioplastic products made from crop-produced PHA.

Yield10 will then be positioned to begin construction of the first commercial PHA extraction facility to separate PHA and protein meal. Combined with the grower network and value chain developed in Phases I and II, this will complete the value chain for the PHA Camelina, enabling commercial production shortly after regulatory approval. Ultimately, we anticipate that the higher revenue PHA Camelina will displace Elite Camelina. Initial internal analysis indicates that the Camelina oil co-product may have a highly favorable CI index due to carbon savings from the use of PHA to replace either petroleum plastics or bio-fermentation produced bioplastics, offering significant advantages for the biofuels offtake partner.

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[3] A typical Camelina yield is 1,500+ lb per acre while 6-10 lb per acre are needed for planting.

6. Partnering and Resourcing

Yield10 is working to find two types of strategic offtake partners for commercial development. The first type of strategic partner, or partners, as described in Section 5.1 is for biofuels feedstock offtake of Camelina oil. Together with Yield10 the biofuels partner will set carbon targets for the Camelina oil feedstock, help optimize the supply chain for carbon intensity, and potentially collaborate on the oil extraction step for seed processing.

The second strategic partner, as described in Section 5.3 is a bioplastics offtake partner for PHA. The bioplastics partner will help fund the R&D and pilot scale work for PHA Camelina grown under permit, collaborate on pilot scale PHA extraction and product manufacturing, and potentially co-invest in the commercial scale PHA extraction facility. Depending on the specific commercial arrangement, Yield10 will offer right-of-first-refusal offtake on Camelina-produced PHA at a competitive price with bio-fermentation operating expenditures, thereby enabling substantially lower capital expenditures relative to scale and a much higher return-on-investment.

Although the PHA trait introduced in Phase III currently displaces oil in the Camelina seed at about a 1:1 ratio (i.e., a 1% increase in PHA content in the seed means a 1% decrease in oil content), meaning less oil is produced per acre in PHA Camelina than Elite Camelina, the goals of the biofuels and PHA partners are still aligned for two reasons. First, the current market price of PHA is 3-5x that of vegetable oil, which results in much higher revenue for PHA Camelina, and therefore will secure more acres to be farmed for a higher total oil production. Second, the PHA produced in Camelina offers carbon savings compared to other plastics, which can potentially be used to lower the carbon intensity of the Camelina oil being produced[4]. Life cycle analysis shows that production of the petroleum plastic polypropylene, which is functionally equivalent to PHA in many common use cases, emits 3.3 kg of CO_2 per kg of plastic (59). This means that production of 45kg of polypropylene would emit 149 kg of CO_2[5]. In contrast, if the combined farming inputs (diesel, irrigation, fertilizer), transportation, and seed processing to produce an acre of PHA Camelina led to 145 kg CO_2 emissions, and it produced 45 kg of PHA bioplastics in addition to Camelina, then applying a carbon savings offset for the PHAs versus producing the same amount of polypropylene (minus 149 kg CO_2) could potentially enable a negative carbon intensity biofuel feedstock oil. This carbon offset structure is shown in a simplified diagram in Figure 9, below.

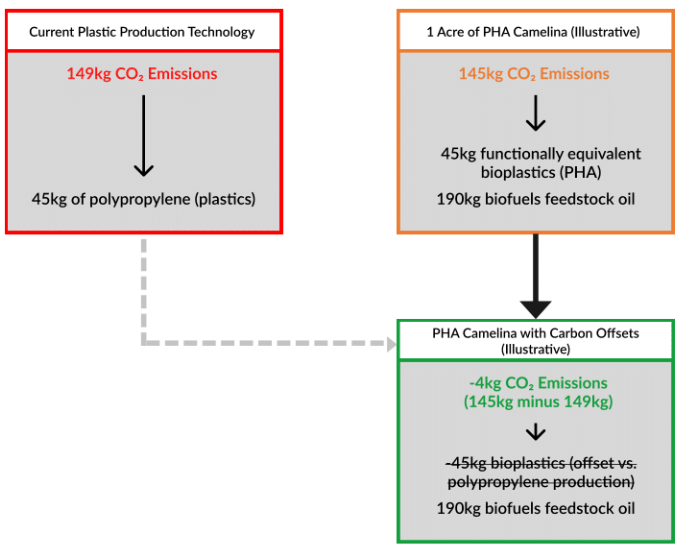

Figure 9: PHA Carbon Offsets for a Potentially Negative CI Oil (Illustrative)
(Note: CI calculations are based on Yield10's internal estimates assuming 145kg of total carbon inputs for farming and logistics, and a Camelina yield of 1500lb/acre with 6.6% PHA and 28.4% oil. These calculations do not include any carbon offsets for meal production, which may also be available.)

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[4] *Based on discussions with third party auditors for California's LCFS*

[5] *In fact, estimates show that production of PHA through bio-fermenation emit 4.9 kg of CO2 per kg of PHA (59). This implies crop produced PHA has at least the same ability to decarbonize bioplastic production as it does petroleum plastic production.*

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Safe Harbor for Forward-Looking Statements

This whitepaper contains forward-looking statements which are made pursuant to the safe harbor provisions of Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended. The forward-looking statements in this release do not constitute guarantees of future performance. Investors are cautioned that statements in this whitepaper which are not strictly historical, including, without limitation, expectations related to Yield10’s Camelina lines increasing oil content, crop yield and becoming a high impact crop for Argentinian growers with good market potential for oil and meal production, the CONABIA decision being a significant step for Yield10’s elite Camelina lines to access markets, Yield10’s product development and future licensing arrangements, and the overall progress of Yield10, constitute forward-looking statements. Such forward-looking statements are subject to a number of risks and uncertainties that could cause actual results to differ materially from those anticipated, including the risks and uncertainties detailed in Yield10 Bioscience's filings with the Securities and Exchange Commission. Yield10 assumes no obligation to update any forward-looking information contained in this whitepaper or with respect to the matters described herein.