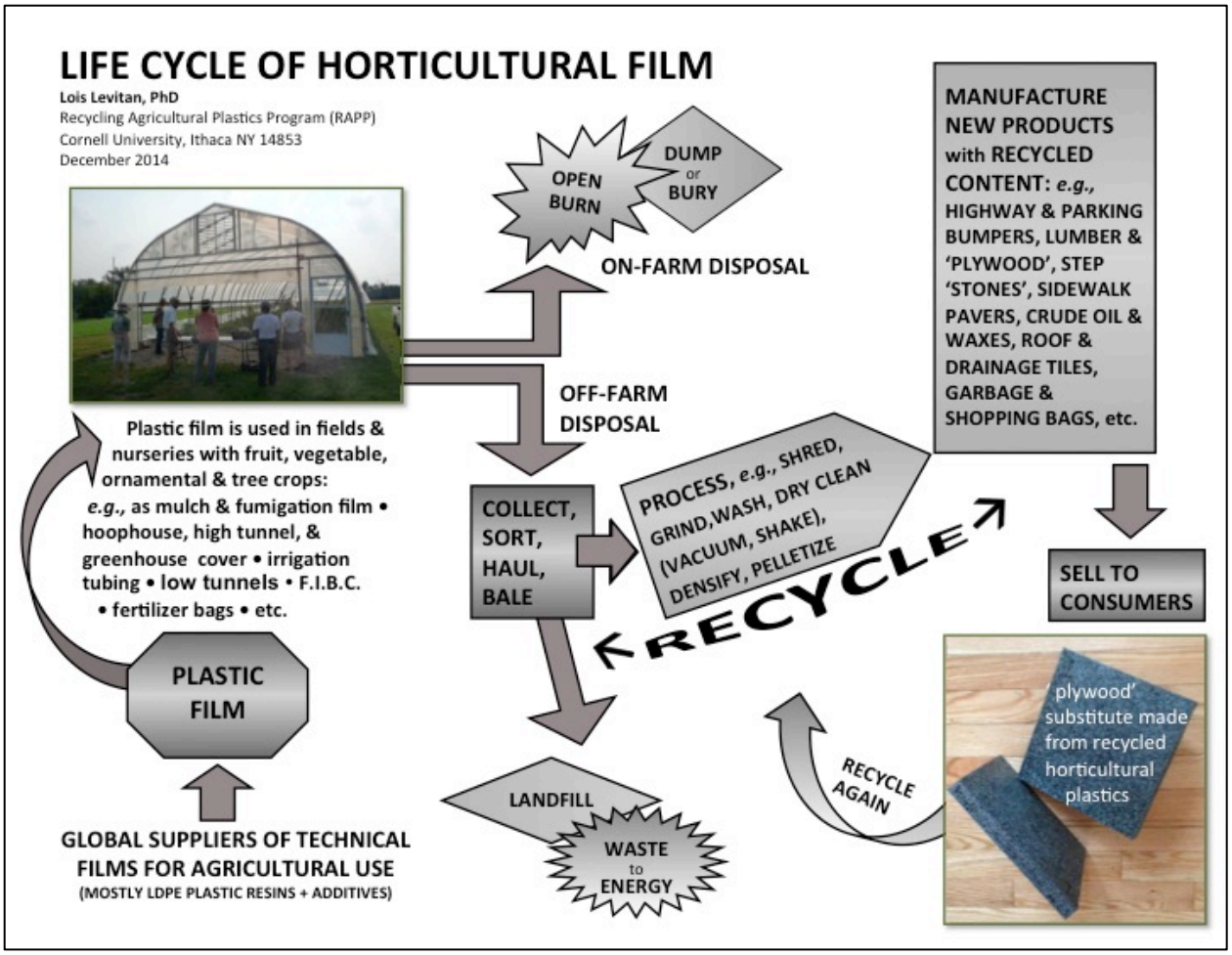
Recycling Horticultural Films: Handling and Marketing

Lois Levitan, PhD
Recycling Agricultural Plastics Program (RAPP)
Cornell University, Ithaca New York 15853

Recycling horticultural films is challenging. But the challenges are surmountable. What follows is a quick summary of the challenges, how they can be surmounted, and what exactly is meant by ***recycling***.

Recycling is a multi-stepped process that involves collecting used material, reclaiming it, and then manufacturing new products with the recycled content. The term usually refers to mechanical transformation of used material, *e.g.,* shredding old plastic and then heating and molding the pieces into a new form. However, pyrolysis and related technologies use heat, pressure and, in some cases, a catalyst to chemically recycle plastic back to oils, gases, waxes, and simple monomers. Materials that enter the recycling stream are not fully recycled until they are made into something new by one of these processes. *I.e.*, simply hauling recyclables away from the farm (or other place where they were used) does not constitute recycling.

The recycling life cycle involves users who separate recyclables from garbage, haulers who collect the recyclables, and reclaimers (also called processors) who do some of the following: clean, shred, compact, densify, pelletize, etc. Reclaimers will buy plastic recyclate from haulers only if they can sell their processed plastic to manufacturers who will incorporate it into new products. (To increase efficiency, improve the profit margin, and guarantee that they will have an adequate supply, many recycling companies carry out more than one of these recycling functions. They will, for example, both



collect and process plastic, or process and also manufacture new products.) Very importantly, for recycling to be successful and sustainable over time, consumers—industrial and commercial buyers, government procurement offices, and individuals—must choose to buy products that are made with recycled content. Purchasing power is the fuel that keeps the gears of recycling turning.

At risk of overplaying this metaphor, the quality of the recyclate is the throttle on the recycling engine. The system will chug along smoothly only when the material intended for recycling meets the quality specifications of the designated recycling market. If it does not, the market will not accept the plastic and the delicately balanced system will grind to a halt.

Horticultural films include several quite different products: mulch and fumigation films, low and high tunnels, greenhouse and hoophouse covers, irrigation tubes, bags for inputs and storage, and more. At this point in time, virtually all are recyclable, though each with some challenges. These challenges fall into one of three categories: *(i)* characteristics inherent to these plastics, *(ii)* characteristics of the products after use on farms and in nurseries, and *(iii)* cost and logistics of collection and transport from fields (or nurseries) to recycling markets.

Characteristics of horticultural films. Though sheets of horticultural film may look simple, they are highly technical products designed for performance. Even the thinnest of films is likely to have multiple extrusion layers, each with additives for specific purposes such as inhibiting UV degradation, reflecting sunlight, repelling insects, retaining heat, holding moisture, adding flexibility or stretch, adding rigidity or tensile strength, shortening or adding to useful life, preventing the transfer of oxygen, etc.

Some of these additives and physical characteristics affect recyclability. For example, an oxygen barrier layer is embedded between layers of some polyethylene mulch films. If the barrier layer is made of nylon, most recyclers are unable to process it because nylon has a much higher melt temperature than polyethylene. But if the barrier layer is EVOH (ethylene vinyl alcohol), many recyclers find that it can be a small percentage of the mix without affecting processing.

And although color does not alter the processing characteristics of plastics, it will often determine whether a recycler is eager or unwilling to accept the plastic for recycling. Most recyclers put a higher value on clear and white plastics, in part because color specifications of new products are difficult to meet when dealing with a varied or dark-colored supply stream. Thus dark-colored films—even if clean—might languish because of lack of market demand.

Characteristics of horticultural plastic products after use. It is a truism that most horticultural films get wet and dirty simply doing the job they are designed to do. They come in contact with mud, soil or soilless growth medium, fertilizer and pesticide chemicals, grit and gravel. If used outdoors they are exposed to sun, rain, snow and wind.

If the films that cover greenhouses (also hoophouse and tunnels) can be removed and compacted efficiently, without landing on the ground and becoming contaminated by mud and grit, they are a high quality plastic sought by recyclers. The challenge to recycling these films is in establishing protocols for removal that meet the time constraints of growers and quality requirements of recyclers.
[→ Please contact the author if you have developed such a system. It could serve as a model for others.]

On the other hand, mulch film and other products that lay on the ground (*e.g.,* irrigation tubing, drip tape, fumigation film) are likely to be wet and dirty by the time they come off the field. In the past, this dirt load precluded their recycling. However, with advances and improved efficiencies in equipment, increasing numbers of recyclers are investing in washlines or in vacuum or shaker systems for dry cleaning these plastics. Thus even mulch films can be cleaned sufficiently to meet the specifications of

certain recycling markets that specialize in handling dirty plastics (mulch film plastics are also challenging because they are so thin and often incorporate a mix of plastic resins).

However, until the mulch film goes through the washline, it may be carrying 70% of the bale weight in moisture, plant debris and soil. The costs of transporting such a load may be prohibitively high, limiting the geographic radius the market can reasonably serve. High transportation costs are a strong argument for developing practices and equipment to remove the bulk of the debris in the field, during the process of lifting the film and rolling or otherwise compacting it for transport.

Another argument for cleaning plastic in the field is to avoid transporting soil pathogens and weed seeds from one region to another, as could occur with long-distance transport of moist film. Attention should also be paid to where and how the residues from cleaning are disposed. If residues cannot be returned to the field they come from, they could perhaps be used as landfill cover. Field research is needed to determine how such residues should best be handled; *e.g.,* whether the soil should be sterilized prior to being spread, especially if it will be spread on horticultural fields.

Cost and logistics of collection and transport from farms to recycling markets. With new generations of recycling equipment and technologies, it is now technically feasible to recycle even difficult materials like horticultural mulch film. The biggest stumbling block that remains in most areas of the country is that the value of used horticultural plastic (*i.e.,* the amount that recyclers will pay) is less than the full cost of collection and transportation. The challenge is to integrate recycling into agricultural production systems, integrate agricultural recycling with broader infrastructures for materials management, and figure out how costs will be covered and allocated.

Several large-scale processors of mulch film have recently opened their doors in the horticultural hotbeds of the country, potentially simplifying the logistical challenges in the areas they serve. Despite other differences in their business models, all deal directly with large farms within a small radius of their plant. These markets have set protocols for drop-off or collection, dictated how the plastic should be prepared (left loose, rolled, baled, etc.) and set the terms of trade, which typically involves no cash back but also no tipping fee. (Elsewhere, some recyclers have charged a penny a pound to accept mulch and similar films.) These terms are advantageous to growers as long as costs to recycle are less than for other means of disposal.

However, in regions of the country where production is less concentrated, markets are unlikely to be able to guarantee their supply by working directly with farmers. In these areas, intermediaries are needed to *(i)* educate growers how to prepare plastic to meet market specifications, *(ii)* organize collections in order to amass sufficient quantity to market (typically the threshold is 40,000 lbs to fill a tractor-trailer), *(iii)* acquire means to compact or otherwise prepare the plastic for long-distance transport, *(iv)* identify a storage location where plastic can sit until a full load is collected, *(v)* ensure that the location is equipped with a loading dock and/or machinery to load the truck (and has personnel to do the work), *(vi)* identify suitable markets for the material, and *(vii)* find funds to cover these costs.

The Recycling Agricultural Plastics Program (RAPP) has explored a number of alternatives and options at each of these decision points, and will discuss them in more detail during the conference presentation. Resources are posted on the program website and staff can be consulted with questions.

The tricky business of identifying suitable markets for difficult-to-recycle plastics will also be discussed. Because markets are fluid. and because markets that are viable in some areas of the country may be out of the question for more distant supply streams, specific markets are not named here. Instead program organizers are advised to search the online PlasticsMarkets.org database, which will soon incorporate some of the specific criteria needed to identify viable markets for agricultural/horticultural plastics.