

# Problems with Plastics

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Plastics and plasticulture are widely utilized and increasing in modern-day horticulture throughout the world. Around the world, millions of tons of plastic are used each year to mulch crops, cover greenhouses, poly overwintering structures and to construct a variety of plant containers and plug trays. Plastics are light weight and versatile and have thus found a multitude of uses in crop production and landscaping. However, the fate of plastic in our environment is a serious issue that needs to be resolved. Unfortunately, our “green” industry is not so green when it comes to reusing and recycling the vast quantity of plastic generated. Landfills do not seem an appropriate option, and burning can release a number of potentially dangerous compounds into the atmosphere and is banned in most communities. Containers can be reused, but there are issues related to disease pathogens and the lack of standard sizes. Greenhouse coverings and mulch films cannot be reused, since they deteriorate under UV radiation. Another complicating factor is that several different types of plastics are used in the horticultural industry, including low density polyethylene, high-density polyethylene, polypropylene, and high-impact polystyrene. To

maintain the highest quality of the recycled product, these need to be carefully sorted and handled separately. Even if properly sorted, various contaminants including soil and organic matter reduce the quality of recycled plastic compared to virgin material. Every time plastic goes through the recycling process, contaminants and structural degradation reduce the quality of the plastic, such that it is difficult or impossible to manufacture the same product again and again. The list of problems goes on and, to date, more plastic is burned or put in landfills than is recycled or reused.

The market for recycled plastic can be extremely volatile as it was in 2008, with a sharp spike in price followed by a precipitous decline. As expected, this has largely followed the price of crude oil over the same time period. Currently, prices are extremely depressed and plastic recycling plants that were recently planned are now on hold. The cost of collecting, sorting, cleaning, transporting, grinding, and melting combined with reduced quality due to even minor amounts of contaminants impacts the quantity of plastic recycled. In a state such as Michigan, waste management companies typically make more money putting plastic into landfills than they do selling it to recycling companies.



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Under these circumstances, it may require legislation rather than financial returns to stimulate and encourage recycling efforts for horticultural plastics.

**Plastic Types**

There are several different types of plastics used in the international horticulture industry. The price for virgin and recycled starting material for each varies, as does their value for specific purposes. Recycling is affected by the original resin, contaminants of any sort, and any change in structure caused by heat or UV radiation.

**High-Density Polyethylene (HDPE)**

*Uses.* HDPE is commonly used for constructing nursery containers, specifically those used outdoors for trees and shrubs. Outside of agriculture, the most important use for HDPE plastic is for milk containers manufactured through the process of blow molding. HDPE is also used to manufacture fuel tanks for vehicles, various other screw top containers (e.g. bleach, shampoo, and motor oil), and some types of irrigation pipes. HDPE is valued since it resists breakage and does not break down quickly under UV light. It is both thermally and chemically resistant and thus has been extensively used in containers for pesticides.

*Reusing and Recycling.* HDPE-constructed plant containers should be reused only if they are properly sterilized. In particular, it has been noted that the disease *Thielaviopsis* has spores that can persist for years and can infect a subsequent crop if not completely eliminated by appropriate sanitation procedures. *Thielaviopsis* is a serious root disease that can affect a wide range of ornamental plant species. There are also an endless number of different container designs, and so it is difficult or perhaps impossible for growers to reuse unless there has first been a good deal of sorting.

HDPE is one of the easiest plastics to recycle, though major recycling efforts are typically devoted to milk containers. Recycled HDPE is typically not reformed into containers, but rather is made into plastic timber for landscaping, picnic tables, and even railroad ties. Compared to wood, plastic lumber can be very heavy, but is becoming more popular each year. Generally, milk containers are commonly recycled, while other containers made from HDPE are not. Nursery containers are more difficult to recycle into plastic lumber since dirt and other contaminants can reduce the value of timber if not completely eliminated.

**Low-Density Polyethylene (LDPE)**

*Uses.* This relatively inexpensive plastic is used extensively throughout the world to cover greenhouses, nursery overwintering structures and as a plastic mulch. When double layered, it is effective as a cover and thermal barrier for greenhouses in colder parts of the world. It has proven effective as a mulching material for diverse food and ornamental crops such as strawberries, vegetables, field grown cut flowers and even herbaceous perennial plants. It is also commonly used for various types of plastic bags.

*Reusing and Recycling.* LDPE films are not typically reused, though they can be recycled and the secondary product can be made into products such as trash bags and plastic timber. When used as a mulch, the trapped soil reduces the quality of the recycled plastic. Some plastic recycling companies specialize in developing wash line systems for cleaning these plastics, and a wide range of specialized systems have been developed. Still, washing is an extra cost and many plastic recyclers do not have this equipment, which reduces the number of options available to growers. When used as a greenhouse cover, LDPE films break down due

Figure 1: Baled LDPE Greenhouse Film



to UV radiation which also limits the usefulness in recycled products. Unless baled, LDPE film has a very low bulk density and is inefficient to transport (Figure 1). If at all possible, LDPE films should first be baled before transporting. Several types of balers have been successfully developed, and can be rented or purchased. In some cases, recycling companies will provide the baling equipment for a limited amount of time when growers are removing field mulch or greenhouse coverings. In the state of New Jersey, there is a statewide effort to aid growers on the recycling of LDPE films.

### Polypropylene (PP)

**Uses.** Polypropylene is commonly used to construct plant containers, especially those used for greenhouse production of house plants, herbs, annuals, potted flowering plants and bedding plants. It is favored since it is generally durable, lightweight and resists breakage. However, it eventually becomes brittle, especially when exposed to UV light, and is best used indoors or for quick crops. PP is also used for auto parts, food containers, and dishware. Spun-bonded polypropylene (sometimes referred to as woven polypropylene) is used as row covers for frost protection, as a moisture barrier for buildings, and as disposable water repellent clothing.

**Reusing and Recycling.** Reusing PP containers is possible, but carries the same warnings as those for HDPE containers, specifically diseases such as *Thielaviopsis* which can persist as spores. Also, PP can get brittle if exposed to UV radiation. Virgin PP is white, whereas recycled PP will always be darker, or even black due to contaminants, which in some applications presents a barrier.

### High Impact Polystyrene (HIPS)

**Uses.** HIPS is commonly used for molding the trays (flats) used for seedlings and small plants. Pure solid polystyrene is colorless, but generally plug trays are black since they are constructed from recycled plastic. These are inexpensive and extremely lightweight. Polystyrene is also used in cafeteria trays, various cases and toys. Expanded polystyrene, known as styrofoam, has long been used for small plant containers such as forestry seedlings and vegetable transplants for large commercial growers.

**Reusing and Recycling.** HIPS trays can be reused, but again caution should be used due to the need to control root disease pathogens. Growers can accumulate HIPS trays if they purchase and

transplant small plants from a plug producer. HIPS trays are extremely light, difficult to compress and come in a multitude of designs. Unless they are all of the same design, they do not stack or nest. The trays may be clean, but the inserts are typically dirty. Some plastic companies are promoting the fact that they are using recycled HIPS and trying to close the loop so that HIPS can be used again and again. This will be limited by the extent of contamination and the ability of recyclers to completely clean the plastic before melting. Companies that collect and produce can melt HIPS and form it directly into thin sheets which can be molded directly back into trays. This eliminates a step in the recycling process and enhances the financial return. Expanded polystyrene is generally more difficult to recycle, and has a reputation for accumulating in the environment.

### Recycling Horticultural Plastics

**Collection.** Horticultural businesses are often responsible for finding suitable recycling companies for their plastic. Some states, such as New Jersey, offer help to connect growers with recyclers for a specific plastic, in this case, LDPE. In many states and other countries, there is no such state-led facilitation, and growers may have difficulty finding suitable companies.

Many recycling companies require a minimum amount of plastic before pick up. This requires that a grower store plastic until an adequate amount has accumulated, or that several growers band together and combine their plastic. This is possible,

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## Recycling companies and their conditions for acceptance of plastics.

Recycling Company	Plastics Accepted and Conditions
<b>Beta Plastics</b> Matt Bertotti 1001 40th Street, S.E. Grand Rapids, MI 49508 616 218-3769 <a href="mailto:leehammond@bataplastics.com">leehammond@bataplastics.com</a>	Plastics accepted – all types Quantity – all quantities Cleaning – accepting only clean plastic Comments – payments will depend on the material and quantity. Call for specifics
<b>E.R.A., Inc.</b> Greg Meuers, General Mgr. P.O. Box 167 Bowling Green, OH 43402 <a href="http://www.envrecycle.com">www.envrecycle.com</a> <a href="mailto:EnvlRecycling@aol.com">EnvlRecycling@aol.com</a>	Plastics accepted – LDPE Quantity – minimum of 42,000 pounds baled for loading on 53-foot semi-trailer Cleaning – films should be as clean as possible – preferably less than 10% by weight Comments – at this time, process capacity is limited; so, we are obviously going to “cherry pick” the supply. We will offer pick up service, and can offer baling service on site for a fee. To get started, photos of product, with descriptions are requested.
<b>East Jordan Plastics</b> East Jordan, Michigan Nathan Diller <a href="mailto:Nathan@ejplastics.com">Nathan@ejplastics.com</a> <a href="http://www.eastjordanplastics.com">www.eastjordanplastics.com</a>	Plastics accepted – HDPE, PP and HIPS, all types of old pots and pot tags, will consider LDPE (baled) greenhouse films (call) Quantity – Negotiable – but more is better. Will help to coordinate multiple pickups from different growers – can usually arrange a pickup within 2 weeks. Cleaning – knock off excess dirt, but otherwise do not need to extremely clean, do not need to remove adhesive labels, if they can nest, they are clean enough, whitewash on LDPE ok Comments – Pots should be properly sorted, nested or stacked and palletized by plastic type. 8 ft high pallets are preferred over 4 ft because this will increase the net weight of the load. East Jordan plastics is developing increased capacity; working directly with several growers to set up new recycling opportunities.
<b>EcoQuest LLC</b> Carey J. Boote, David Dykstra 13650 172nd Ave., Grand Haven, MI 49417 616 296-0767 <a href="mailto:carey.boote@gmail.com">carey.boote@gmail.com</a>	Plastics accepted – PP PET PS HIPS PC ABS Pots, Trays Quantity – 1000 pounds minimum for pick up Cleaning – light dirt, dust, no loose materials Comments – shipping and costs negotiable depending on types and quantities
<b>Forest Island Recycling, Inc.</b> Tony Joseph Director of Marketing & Business Development 3300 Denton Street Hamtramck, MI 48211 <a href="mailto:tony@forestislandrecycling.com">tony@forestislandrecycling.com</a>	Plastics accepted – LDPE and HPDE, perhaps others in future Quantity – call Cleaning – call
<b>Granger Recycling Center</b> Phil Mikus, Recycling Manager 16936 Wood Rd. Lansing, MI 48906 <a href="http://www.grangernet.com">www.grangernet.com</a>	Plastics accepted - LDPE, HDPE, PP and HIPS Quantity – usually enough to fill a 53-foot semi-trailer Cleaning – to be negotiated Comments – not a recycler, but partners with end users for special collection events

List compiled with the help of Tom Dudek (MSU Extension) and Lucy Doroshko (Dept Environmental Quality). If questions, contact the specific companies or Dr. Art Cameron (cameron@msu.edu).

Recycling Company	Plastics Accepted and Conditions
<b>Green Processing Company Inc.</b> Jeremy Berger Main Plant: 3766 Peter St., Windsor, Ontario N9C 1K2 <a href="mailto:jeremy@green-group.ca">jeremy@green-group.ca</a> <a href="http://www.green-processing.com">www.green-processing.com</a>	Plastics accepted – HDPE, LDPE, LLDPE, HIPS, PS, and PP. Do not accept styrofoam. Quantity – prefer larger volumes but depends on situation Cleaning – in current economic climate, prefer clean plastic, but willing to discuss options. Comments – films should be baled, balers are available at no cost; other plastics should be secured on pallets. Prefer to visit potential customers on request. Also accept a variety of non-Ag plastics.
<b>Maine Plastics, Inc.</b> David Kaplan 1817 Kenosha Road Zion, IL 60099 847 379-9100 <a href="mailto:dkaplan@maineplastics.com">dkaplan@maineplastics.com</a> <a href="http://www.maineplastics.com">www.maineplastics.com</a>	Plastics accepted – HIPS plastic trays, LDPE films, call for further information Quantity – all quantities Cleaning – HIPS trays can have some dirt and water – but in the current economic climate, best if clean. Greenhouse and mulch films should be clean and dry. Comments – also located in Schoolcraft Michigan.
<b>McDunnough, Inc.</b> Darren McDunnough, President, CEO Material & Recycling Solutions for Industry 10732 Plaza Drive Whitmore Lake, MI 48189 <a href="mailto:info@mcduunnough.com">info@mcduunnough.com</a> <a href="http://www.mcduunnough.com">www.mcduunnough.com</a>	Plastics accepted – actively seeking HIPS, LDPE (hoop house films), call on others Quantity – not specified, LDPE must be baled, stacked shrink-wrapped or otherwise secured to pallets Cleaning – not excessively dirty Comments – can provide pickup – call to determine
<b>Mondo Polymer Technologies</b> Ronnie Wesel 27620 State Route 7 Reno, OH 45773 740-376-9396 <a href="mailto:ron@mondopolymer.com">ron@mondopolymer.com</a>	Plastics accepted – PE Quantity – any Cleaning – trace Comments – can provide pickup – call to determine
<b>Padnos Paper &amp; Plastics</b> Ben Westdorp, Scott Thompson Phone: 616-301-7900 <a href="mailto:ben.westdorp@padnos.com">ben.westdorp@padnos.com</a> <a href="http://www.padnos.com">www.padnos.com</a>	Plastics accepted – a variety but will depend on situation, call Quantity – call Cleaning – call Comments – We can handle taking this material in different forms so I would prefer to be able to talk to the company directly as to their capabilities, volume and logistical issues. In most cases, there would be some revenue generated from these materials.
<b>Plaspro LLC</b> Syed Siraj 3680 Suite 100 44th St. Grand Rapids MI 616 446-6176 <a href="mailto:splaspro@gmail.com">splaspro@gmail.com</a>	Plastics accepted – HDPE, LDPE, PE Quantity – all quantities Cleaning – should be relatively clean
<b>Polymer Solutions Inc</b> Tracy Beckwith, National Sales Manager 3384 Park Circle Drive Kalamazoo, MI 49048 <a href="http://www.polymer-solutions.com">www.polymer-solutions.com</a>	Plastics accepted – call Quantity – by the truckload only Cleaning – We have the ability to wash the film prior to processing it. However, we want the level of dirt to be as low as possible. The level of dirt and other contaminants will determine whether we can use the material and what we can pay for the material. Comments – Plastic must be baled or boxed on pallets for loading with forklifts

but to date, the low value of the plastic has not provided adequate incentive, and most is deposited at landfills. Localized collection sites, preferably with capacity to bale and to grind plastic, would be ideal.

Many American communities offer curbside pickup for PET (polyethylene terephthalate) and HDPE (milk containers). However, few offer curbside pickup of horticulture pots and containers for home gardeners. Curbside collection alone does not verify that the plastics are properly recycled. They can be directed to landfills or shipped to China.

Recycle drives using volunteers are still an important means of collecting plastic and directing it to appropriate recycling companies (Figures 2 and 3). These have been organized by communities, botanic gardens, garden centers and retail greenhouses. They generally require large amounts of coordination and volunteers, and may require subsidization, depending on the amount of plastic collected, the density of packing, and the distance to the recycler.

At the Missouri Botanic Gardens in St Louis a program has been developed so gardeners can return plastic to one of several retail nurseries. The plastic is then transferred to the Missouri Botanic Gardens facility where it is sorted, cleaned and ground. This successful program has been in place for over ten years. Recently, there have been some pilot programs from some of the big-box retailers to collect and recycle plastic containers and trays from gardeners, which is very encouraging.

**Sorting and Separation.** The several different types of plastics that are typically returned from recycling must be carefully sorted and cleaned if the plastic is to have a higher resale value. For instance, even small amounts of PP can reduce the quality of HDPE or HIPS. It takes trained personnel to efficiently and effectively sort the various plastics, since sometimes the differences can be hard to detect. In some cases, the recycling companies will sort the plastic. This reduces the value of the plastic sold by the community or grower.

**Contamination.** All contamination, including soil, sand, organic matter, paper, moisture, and improperly sorted plastic reduces the quality of the final recycled plastic. One of the serious limitations of recycling plastic is that the quality of the recycled plastic is always less than that of virgin plastic. Unless new technology is discovered, there can be no improvement in quality and purity during the recycling steps. Because of impurities,

the price offered for recycled plastic is often half of that for virgin plastic. Lower grades of mixed plastics can be formed into timbers that are used for landscaping. Mulch films are particularly a problem since it has begun to degrade and is covered with organic matter, soil and potentially pesticides. Washing is an option, but is only practiced by a limited number of recyclers and this step adds to the cost of recycling.

### *The Future*

Cradle-to-grave or closed loop recycling is a concept where the burden of recycling is placed on the companies that sell the plastic in the first place. Obviously, this may add to the cost of the initial product, but could help close the loop. One Michigan company has initiated a program to close the loop for HIPS trays (Figure 4). This is still in the pilot stages, but represents a step forward. The problem remains that most plastics used in horticultural industries are not of the same quality when recycled as they were when they were first put into use. Until new technology is discovered, this will continue to be a major drawback.



Figures 2 and 3: Plastic Recycling Day at MSU in 2008



As a result of the plastic problems, many researchers and growers have proposed the use of biodegradable pots as a substitute for plastic (Figure 5). They can be made from a variety of plant and animal-based materials including rice hulls, digested cow manure, corn stalks, wood fibers, and keratin. More commercial options have become available, although they are most often heavy and cumbersome, which means they take more space and cost more to ship. Biodegradable pots are being used more for fast crops in order to reduce the chances that the pots will degrade before the crop is sold. Researchers around the world are looking for better solutions, but the percent of biodegradable pots utilized at this time is very small compared to plastic.

Plastics fill a prominent niche in production systems for a wide range of horticulture crops. How to best promote recycling at all levels is still a challenge in the USA and throughout much of the rest of the world. It has been difficult to track innovations since they are often undertaken by private industry. An international meeting to discuss improved methods and practices for plastic recycling and new innovations in biodegradable pots and films could be very timely.

Green Industry businesses wishing to recycle plastics from their business activities will find the listing of recycling firms on page 64 useful. Your feedback is appreciated.

Let's make the "green industry" truly "green" ...Recycle in 2009!

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Figure 5: Biodegradable pots

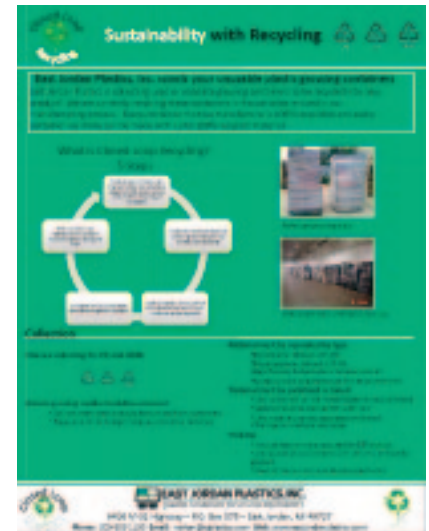


Figure 4: East Jordan Plastics Closed Loop Recycling Program

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