Farm-Scale Plastic Waste Reduction

Pilot Projects in Western Washington State

Zero Waste Washington

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Executive Summary

Zero Waste Washington conducted a two-year project (2023-2025) aimed at reducing plastic waste in Washington State's agricultural sector. With funding from the Washington State Department of Ecology's Public Participation Grant program, the project partnered with farmers across King, Kitsap, Pierce, and Snohomish counties to understand plastic waste practices and implement three pilot waste reduction strategies.

The project had these goals:

- Divert agricultural plastic waste from landfills
- Increase farmer awareness of waste reduction alternatives
- Save farmers money through reuse and better waste practices

Plastic is deeply embedded in modern farming—used in greenhouse films, nursery trays, drip tape, mulch, and more. These plastics allow for extension of growing seasons, avoidance of pesticide use, water conservation and more. Many of these materials, however, are not recyclable through existing systems due to contamination and material complexity. As a result, farmers dispose of these plastics in landfills.

The project included 59 in-depth interviews with farms across 14 counties, representing a wide range of farm sizes and types, and work with an advisory committee to brainstorm, develop and assist with implementation and evaluation of three pilot projects.

Pilot projects

Durable nursery tray cost-share program

This project offered farmers a way to afford long-lasting durable trays (specifically the Winstrip brand) to replace thin, single use trays. Flimsy trays last a few years while the durable thick trays last up to 30 years. Farmers were offered a cost-share opportunity to purchase up to 40 trays at $4.25 each (retail price $8–15), which we purchased in bulk at about $8.50 each. Trays were distributed via local partners, with flexible pickup or delivery. 53 farmers participated.

Free trial of reusable CSA/delivery boxes

This project offered farmers free durable, reusable boxes to replace waxed cardboard boxes. Waxed cardboard boxes are not recyclable and only last approximately 1-15 uses, according to farmers we interviewed. Farmers could select collapsible plastic corrugated boxes, roughneck totes, and flip-lid totes. Farmers received 8-14 boxes and were able to select which type they wanted to test. 36 farmers participated.

Four regional nursery tray and pot recycling events

This project offered farmers free, accessible plastic recycling events. We partnered with DTG Recycle to host the events at four of their locations (all in cities) and send the collected material for processing. We held these four one-day drop-off events in May 2025. 23 people participated in these events (9 farmers and 14 community gardeners).

Results

Overall, 75 farmers and 14 community gardeners participated in the projects, with some farmers participating in multiple projects. We followed up with farmers via online surveys to determine satisfaction with the pilots and solicit feedback on potential improvements. 69 responded to the survey.

Durable nursery tray cost-share program results

98% of the survey respondents who received the trays said that they will keep using the trays. Benefits cited included durability, better transplanting, improved plant health. Minor challenges included the learning curve with watering/soil, difficulty popping plants.

Free trial of reusable CSA/delivery boxes results

89% of the survey respondents who trialed the boxes plan to continue using the boxes. Benefits cited included that the durable boxes are easy to clean, durable, stackable. Challenges included that the size is not always ideal as well as storage concerns.

Four regional nursery tray and pot recycling events

90% of survey respondents did not attend any recycling events. Feedback showed an interest in these events but highlighted the challenges included poor timing of the events, busy schedules, inconvenient locations, and lack of need at the time. Feedback included requests for on-farm pickups, more frequent/longer events, and expanded outreach.

Overall, the pilot programs were well received by the farming community and demonstrated that practical, scalable solutions are possible with adequate support and collaboration. Significant barriers remain, however, including the lack of recycling infrastructure, high costs for durable alternatives, and limited awareness of waste-reducing practices.

The project confirmed that to make long-term impact, system-level change is needed—including expanded recycling capacity, incentives for reusable materials, and stronger policy frameworks to address plastic use in agriculture. Continued investment and collaboration will be critical to support farmers in their transition to more sustainable practices, thus building a more robust circular economy within the agricultural sector.

Introduction

In 2023, Zero Waste Washington, with support from the Washington State Department of Ecology's Public Participation Grant program, launched a two-year project to research waste issues within the agricultural sector and implement waste reduction strategies by working directly with farmers across King, Kitsap, Pierce, and Snohomish counties. Through a series of interviews with farmers across Washington, onsite farm visits, and advisory committee guidance, the project aimed to understand non-organic waste management practices, challenges, and opportunities for intervention. The project concluded with a series of targeted pilot programs designed to test viable solutions to reduce on-farm plastic waste. These included reusable CSA/delivery box trials, cost-shares for durable nursery trays, and free regional recycling events.

Background

In the 1940s, plastic films were introduced to replace glass in greenhouses in the agricultural sector as a way to protect crops and produce higher yields (Moran 2024). This led to more kinds of plastics being introduced in agriculture operations including mulch, irrigation tubing, silage, protective textiles and more. Plastic products became so widely used within this sector that it received its own name: plasticulture (Spane 2021).

On farms, many single-use plastic products are used for their affordability and convenience. These products are used in almost every step of agriculture, from seed to harvest. Plastics minimize water and fertilizer use via drip irrigation systems, and suppress weeds through soil coverings, thus boosting yield and resource efficiency (The Role of Plastics in Modern Agriculture n.d.). Plastic products also support year-round operations and greater crop reliability by extending growing seasons, protecting plants from pests and weather, and conserving soil and moisture (Briggs 2013; Spane 2021)

The majority of these plastic products, however, are not designed with durability in mind. Disposal, reuse, and recycling remain challenging. Once damaged or no longer usable, many of these materials cannot be recycled through traditional municipal systems because of contamination from soil or organic material, mix of plastic types, and lack of collection and processing systems. Soil-contact plastics, such as mulch films, are particularly problematic for recycling due to residue soil contamination (Empson et al. 2021).

Although mechanical recycling is the most environmentally sustainable option, farmers find it is difficult to use due to limited infrastructure, economic challenges, and the high cost of cleaning plastics contaminated with soil (Empson et al., 2021). In 2023, globally an estimated 70% of plastic waste remained uncollected and unrecycled, instead ending up in landfills, stockpiled on farms, openly burned, or leaking into the environment (The Plastic Waste Management Framework, 2023). This contributes to environmental degradation, greenhouse gas emissions, and persistent pollution. Despite these impacts, agricultural plastic waste has received relatively little attention compared to plastic use in other sectors, leaving farmers with few affordable or practical waste management options.

Project Overview

This project had three primary goals: diverting agricultural plastic waste from landfills, increasing farmer awareness about waste reduction alternatives, and saving farmers money.

Through interviews and farm visits, it became clear that most waste decisions on farms are made out of necessity and habit, and farmers are not opposed to change. By introducing reusable products and conducting pilot projects that showcase alternatives in action, the project aimed to empower farmers with tools that support long-term change in waste management practices.

Furthermore, many farmers reported spending hundreds to thousands of dollars annually on hauling waste to transfer stations, not including the cost of labor and fuel. This project aimed to find options to both save time and money.

The project was structured around three main components: preliminary research, farmer interviews, and pilot program implementation and evaluation.

Methodology

Farmer and Partner Interviews

Following a first phase focused on gathering baseline information (reviewing existing literature, rules and regulations, and existing programs) to understand the current state of agricultural waste, we conducted in-depth interviews with farmers. The goal of the interviews was to learn about farmers' specific waste management practices, challenges, and needs.

We conducted in-depth interviews with 59 farmers across 14 counties, with farms that ranged in size from as small as ½ acre to as large as 1,500 acres, with the majority representing small to mid-sized operations. To recruit participants, we used a snowball sampling method, starting with known farmer contacts and expanding outward through recommendations. We also identified farms by searching publicly available sources such as the Eat Local First Washington Food and Farm Finder, farmers market directories, and Google Maps.

The interviews were conducted via Zoom or phone from November 2023 to June 2024 and lasted between 30 minutes to one hour. Interview questions focused on key themes such as types of plastic and other non-organic waste used on the farm, current waste management practices and infrastructure, frequency and cost of hauling waste, efforts to reuse, recycle, or reduce waste, experience with alternatives to common waste items, and ideas and suggestions for support or future solutions. These interviews provided valuable on-the-ground insights that shaped the direction of our pilot programs.

Advisory Committee and Pilot Project Selection

To guide the project and ensure it remained collaborative and informed by regional expertise, we convened an advisory committee made up of professionals representing local government agencies, conservation districts, and statewide agricultural and recycling programs. Members included staff from King, Pierce, Kitsap, and Snohomish counties, representatives from the Washington State Department of Ecology, the Washington Association of Conservation Districts, WSU Extension, and community-based agricultural educators. Their diverse perspectives and deep knowledge of farm systems, solid waste, and food systems provided critical guidance in shaping our pilot strategies and supporting outreach to the farming community.

Interview results were compiled and analyzed to identify recurring themes and most commonly cited waste items. This information was then presented to our advisory committee to review the feasibility, cost, logistical considerations, and alignment with the project timeline for a list of potential pilot projects.

Several ideas were explored during this process that did not make it into the final three pilot projects. One concept was to create a reliable pipeline for collecting woven polypropylene bags to support the work of the Refugee Artisan Initiative (RAI), a nonprofit that trains refugee and immigrant women to upcycle textiles and reduce waste. Woven bags are widely used on farms but lack accessible reuse or recycling options. While this option was compelling, in the end, RAI's facility was undergoing renovations and they indicated that they would not be able to accept materials until 2026, making the pilot unworkable within our project timeline.

Another potential concept addressed drip tape waste. We explored the possibility of partnering with companies that manufacture machinery designed to retrieve and compact used drip tape into coreless bales suitable for mechanical recycling. This system can also process other materials like landscape fabric, hoop house film, and row cover. However, due to budget limitations and the complexity of coordinating a rolling equipment share program across small, geographically dispersed farms, this pilot was deemed unfeasible for this grant period.

Other potential ideas included chemical recycling, soil blocking or paper pot chain systems (to replace nursery trays) and more. These options required additional costly equipment, posed time-efficiency challenges, particularly for larger farms, and were not always a suitable replacement for current systems already in place on many farms.

Pilot Project Implementation

We moved forward with three pilot projects: free trials of reusable CSA/delivery boxes, 50% cost-share program for durable Winstrip nursery trays, and four regional recycling drop-off events for used or broken plastic nursery trays and pots.

To gauge potential participation levels in these pilots and specific needs, we distributed an online interest form to farmers across the region, including those we had interviewed and also farms within the networks of our advisory commit members. The response was overwhelmingly positive. We then selected CSA/delivery box and nursery tray options based on input from farmer interviews, survey responses, and recommendations from our advisory committee.

For the nursery tray and pot recycling events, we researched processors capable of mechanically recycling nursery trays and pots. Ultimately, we partnered with DTG Recycle to host four regional collection sites and to process the materials.

Throughout the implementation phase, we worked with various farm and community partners to identify convenient distribution and drop-off sites, focusing on places already frequented by farmers, such as farm cooperatives, conservation district offices, and local stores.

Finally, we distributed an online survey of participating farmers in the pilot projects to understand satisfaction, feedback and recommendations.

Farmer interviews

Waste data

After completing interviews with 59 farmers across 14 counties, with most in our core counties – King, Kitsap, Pierce, and Snohomish (see Figure 1 for map of farmers who were interviewed) – we collated the data.

We created a heat map table (see Figure 2) showing the top waste items reported by the interviewees. The darkest green indicates the highest-priority waste item per farm, with progressively lighter greens representing second- and third-priority items. Yellow indicates waste items that were still noted but ranked lower.

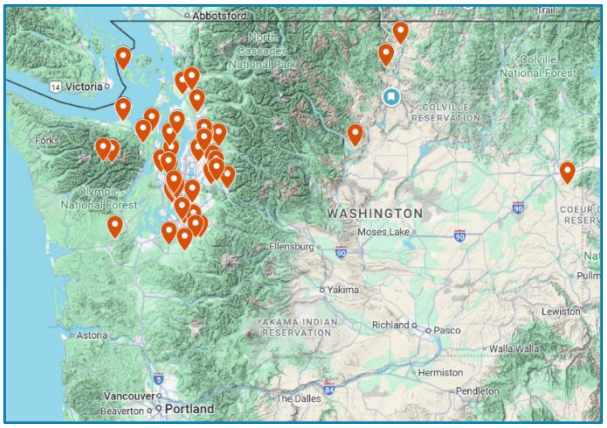


Figure 1. Map of farmers who were interviewed in WA

There were no specific items ranked as highest priority, likely due to the range of farm sizes and specialties. Instead, a trend of the most common plastic waste on farms emerged. Certain plastic waste items such as greenhouse film, nursery trays and pots, drip tape, row cover, and landscape fabric, were commonly cited across the board.

				Priority Waste Items																																		
Interviewee	County	Farm Type	Farm Size (acres)	Greenhouse/hoop film	Nursery Trays/Pots	Drip Tape	Smaller Plastic Bags (soil/fertilizer etc)	Row Cover	Silage film	Landscape Fabric	Plastic Twine/netting	Packaging/Processing Materials	Polyfabric totes/textiles	Waxed boxes	Plastic Mulch	Tarps	Drip Irrigation	Plastic Trellising	Plant tags/protectors/clips	Hoses	Pesticide/Fertilizer Containers	Jugs/Barrels/Buckets	Cardboard	Organic Waste	Reflective Mylar	Milk Hoses	Pallet Wrap	Seed Packaging	Macrobins	Styroblock	Fumigating plastic	Shade Cloth	Deer Netting	Sandbags	Supply Breakage	Wood
Farmer #1	Okanogan	pasture	15																																			
Farmer #2	Skagit	diversified	12																																			
Farmer #3	Pierce	fruit,veg, poultry	10																																			
Farmer #4	King	organic veg	260																																			
Farmer #5	San Juan	fruit, apple orchards, pasture, livestock	30																																			
Farmer #6	King	veg, grains, livestock and poultry	20																																			
Farmer #7	King	fruit, veg, nuts, livestock	10																																			
Farmer #8	King	veg, flowers	5																																			
Farmer #9	King	veg, pasture, livestock, apple orchard	224																																			
Farmer #10	King	veg, flowers	21																																			
Farmer #11	King	veg and culinary herbs	1																																			
Farmer #12	King	perennial crops, orchard, livestock	4																																			
Farmer #13	Snohomish	livestock, poultry, pasture	37																																			
Farmer #14	King	veg, flowers	26.9																																			
Farmer #15	Kitsap	veg, poultry, microgreens	1.5																																			
Farmer #16	Kitsap	veg, flowers	6.5																																			
Farmer #17	Snohomish	veg	1																																			
Farmer #18	King	livestock, poultry	5																																			
Farmer #19	King	veg	14																																			
Farmer #20	Skagit	flowers	6																																			
Farmer #21	Pierce	wholesale seed and seedling producer	25																																			
Farmer #22	King	veg, fruit, livestock	8																																			
Farmer #23	King	veg, mircogreens	0.5																																			
Farmer #24	King	veg, fruit, flowers	80																																			
Farmer #25	Island	veg, flowers, seeds	10																																			
Farmer #26	King	veg	15																																			
Farmer #27	Kitsap	veg	1																																			
Farmer #28	King	veg, fruit, orchard	1																																			
Farmer #29	King	veg, fruit, seeds	1.5																																			
Farmer #30	Kitsap	aquaponics, veg	2.5																																			
Farmer #31	King	veg	1.5																																			
Farmer #32	King	veg, livestock, poultry	20																																			
Farmer #33	Spokane	veg, livestock	180																																			
Farmer #34	Grays Harbor	veg	3																																			
Farmer #35	Snohomish	veg	n/a																																			
Farmer #36	King	seed company	1																																			
Farmer #37	King	veg, flowers	3																																			
Farmer #38	King	veg	0.5																																			
Farmer #39	King	dairy	20																																			
Farmer #40	Chelan	orchard	130																																			
Farmer #41	Pierce	pasture, livestock, poultry,	30																																			
Farmer #42	Jefferson	seed	2																																			
Farmer #43	Pierce	orchards and microgreens	10																																			
Farmer #44	Jefferson	diversified, livestock, orchard	28																																			
Farmer #45	Okanogan	orchard	200																																			
Farmer #46	Jefferson	dairy	8																																			
Farmer #47	Snohomish	hay	1500																																			
Farmer #48	Jefferson	veg, herbs, fruits	4.5																																			
Farmer #49	Clallam	veg, flowers	2																																			
Farmer #50	Pierce	veg, pasture, livestock, poultry	18																																			
Farmer #51	Clallam	veg	100																																			
Farmer #52	Pierce	veg, flowers, poultry	25																																			
Farmer #53	Pierce	veg, livestock	12																																			
Farmer #54	Pierce	livestock	10																																			
Farmer #55	Jefferson	veg	80																																			
Farmer #56	Jefferson	orchard	50																																			
Farmer #57	King	dairy	80																																			
Farmer #58	Thurston	diversified	1200																																			
Farmer #59	Clallam	diversified	35																																			

Figure 2. Heat Map Table of Priority Waste Items

Top 10 Waste Items

Based on the interviews, the 10 most frequently cited plastic waste items on farms were: greenhouse film, nursery trays, drip tape, supply bags (e.g., feed, soil amendment, fertilizer), row cover, landscape fabric, silage film, plastic twine, packaging materials (e.g., waxed boxes, produce bags), and super sacks.

This list was derived by three methods:

- We flagged and sorted every item that farmers reported using and struggling to dispose of in order of most common across farms.
- Then, we sorted the responses by items that were most frequently named as the farm's #1 waste concern.
- Lastly, we examined which items appeared most often within each farm's top three waste priorities.

Despite slight variation in ranking, the same top 5 core items consistently appeared across all sorting methods: greenhouse film, nursery trays, drip tape, supply bags, and row cover. For purposes of the project, we ultimately chose to rely on the first method, overall frequency of mention across all farms, as the basis for our final Top 10 list (see Figure 3). This approach best reflects the items most commonly encountered and managed by farmers, regardless of their rank within an individual farm's priorities.

Figure 3. Top 10 Waste Items

Greenhouse Film

Greenhouse film is a polyethylene-based plastic commonly used in farming to extend growing seasons, protect crops, and increase yields. This material is prone to wear and degradation over time, especially from prolonged sun exposure, strong winds, and animal damage, leading it to tear and fragment into microplastic waste. According to the Food and Agriculture Organization (FAO), the annual global waste generation from greenhouse films is estimated to be similar to that of its global production, approximately 3 million tons (FAO, 2021).

Though manufacturers typically recommend replacing greenhouse film every 3–6 years, many farmers we interviewed reported successful use for 5 to even 20 years, depending on climate conditions, care of handling the plastic film, and crop sensitivity. For example, farms focused on high-value seedlings may replace film more frequently to reduce risking their yield.

To maximize lifespan, farmers often repurpose old greenhouse film for other uses such as solarization tarps for weed suppression or covers for compost piles (Kubalek et al., 2022). Some also pass film along to smaller farms or home gardeners for secondary use on hoop houses.

Durable alternatives to polyethylene film, such as glass or rigid polycarbonate structures, are available but often come with higher costs and infrastructure requirements, such as permanent/semi-permanent foundations. This can be a barrier for farmers who lease land or operate on limited budgets.

Nursery Trays

Nursery trays, typically made from polystyrene, polyethylene or polypropylene, help early plant development by improving germination and survival rates. They are widely used across farm types and sizes. The commonly used trays are thin plastic and are designed to be used for a limited number of seasons and disposed.

Many of the farmers interviewed report having thousands of trays in use, often replacing 50–200 trays each year due to cracking or breakage. While the general lifespan of a standard thin plastic tray is approximately 3 years, damage can occur unevenly and unexpectedly, leading to inconsistent turnover and frequent replacement. To extend the life of their thin, brittle plastic trays, some farmers stack trays together for added support or continue using partially broken trays when possible.

Several alternatives exist, but each comes with trade-offs:

- Paper pot systems offer a compostable option but require specialized machinery and upfront investment and continuous cost for replacement paper inserts
- Soil blocking eliminates the need for cell trays altogether by using specialized equipment to form soil into cube shapes for seeding. This option is time and labor-intensive, especially for larger operations.
- More durable tray options like Winstrip trays are designed to last for decades. Their cost (ranging from $8 to $15 per tray depending on volume purchased) makes them inaccessible for farmers, especially compared to standard trays that cost $1 or less.

Drip Tape

Drip tape is a widely used irrigation material made primarily from high- and low-density polyethylene (HDPE and LDPE), and in some cases, flexible polyvinyl chloride (PVC). These tapes conserve water and deliver precise irrigation directly to plant roots, and when paired with mulch film, significantly reduce water evaporation, improving overall water efficiency and reducing irrigation costs (Scarascia-Mugnozza, Sica, & Russo, 2011).

Drip tape presents several environmental and waste challenges. It is prone to clogging from sediment buildup and can be damaged by rodents, field equipment, or general wear and tear. In many cases, damaged tape leaves behind microplastics in the soil (FAO 2021).

The complex construction of drip tape, which often includes multiple polymer components such as built-in drippers, makes it extremely difficult and costly to recycle. For many farmers, this material is effectively single-use. New tape is purchased and installed each season. While some are able to get 1–3 years of use, most of the interviewees report frequent replacement due to damage.

To extend the life of drip tape, farmers reported that they employ various strategies such as patching holes, promptly retrieving and storing tape after the growing season, and experimenting with careful storage methods. Rolling, folding, or laying it flat to prevent kinks and cracking. Lack of adequate covered storage, however, remains a barrier for many.

More durable alternatives like metal irrigation systems offer long-term use but come at a high financial cost and require fixed infrastructure, which is not feasible for many farms that lease land or rotate crops frequently. Overhead irrigation systems are another option but may be less efficient in terms of water usage and plant health, especially in arid climates or for crops requiring targeted watering.

Supply Bags

Supply plastic bags, used for soil amendments, fertilizers, lime, compost, feed, and other farm inputs, were frequently mentioned by farmers during the interviews, especially on small and mid-sized farms. These bags are typically made from polyethylene (PE) or polypropylene (PP), including woven polypropylene varieties designed for durability and water resistance. Some bags are also marketed as being made from post-consumer recycled content.

Because smaller farms often purchase inputs in 50-pound bags, rather than in bulk or totes, these plastic products accumulate quickly. Many farmers also reported that when purchasing by the pallet, they receive additional plastic waste in the form of pallet wrap and protective coverings, adding to the volume of plastic waste from a single delivery. Disposal volumes vary widely: some farmers only discard around 10 bags annually, while others reported disposal of hundreds per season.

Farmers reported that they try to extend the usefulness of these bags by repurposing them as trash bags, temporary storage, or for hauling materials around the farm. However, despite reuse efforts, their bags almost always end up in the landfill due to the lack of local recycling options. Recycling options for these materials are limited. Some farmers said they have accessed take-back programs such as Wilco Farm Stores' woven bag recycling program in partnership with Purina, but access depends on proximity to participating stores. Others have turned to niche services like Ridwell to recycle non-woven film bags, although they have reported that Ridwell only accepts small amounts at a time.

Row Cover

Row covers are lightweight, gauze-like fabrics made from spun-bonded polypropylene or polyester. They allow sunlight, air, and water to pass through while providing protection from pests and light, with a 90%-95% light transmittance, and a 2 ºF. frost protection (University of Maryland Extension, 2023). Farmers often use them to extend growing seasons, reduce pest pressure, and protect crops.

Row covers are not very durable, common complaints reported by the farmers include damage from wildlife like elk and rodents or tearing from overstretching or being in contact with sharp rocks. Additionally, if not properly cleaned and stored, row covers can quickly become a wet, unusable pile contaminated with organic debris (See Figure 4).

Figure 4. Row cover mixed with organic debris

Many farmers reported getting only 1 to 3 years of use of their row covers, with some having to replace them after just one season. Row covers are not recyclable in current systems, so once they tear, they typically end up in the landfill. Some farmers said they try to extend their use by giving away partially usable covers to smaller growers or by carefully storing them, hanging them in braids or storing them in bags, to avoid rodent damage.

Landscape Fabric

Landscape fabric is a woven polypropylene material commonly used as a permeable weed barrier on farms. The fabric helps suppress weeds, retain some soil moisture, and warm the soil. Some farmers also use it as a more durable alternative to plastic mulch. While designed for multiple seasons of use, a frequent issue with landscape fabric is fraying along the edges (See Figure 5), which leaves behind small strands of plastic that are difficult to fully remove from the soil. Additionally, when soil and organic matter accumulate on top, the fabric can become buried over time and challenging to retrieve.

Figure 5. Plastic strand from fraying landscape fabric

Most farmers reported a lifespan of 5 to 10 years for landscape fabric, with some using it even longer. To prolong its usability, many farmers burn holes in the fabric to plant crops, which prevents fraying around planting spaces. However, this method reduces flexibility in adjusting future planting configurations.

Alternatives to landscape fabric include cover cropping, planting ground cover plants, natural mulch like straw, woodchips, and burlap. Some farmers also use light tillage, although no-till methods are often preferred for soil health. No-till farming helps maintain soil structure, reduces erosion, and keeps nutrients in place, leading to healthier soils and, in many cases, improved harvest results (The Pros and Cons of No-till Farming, n.d.).

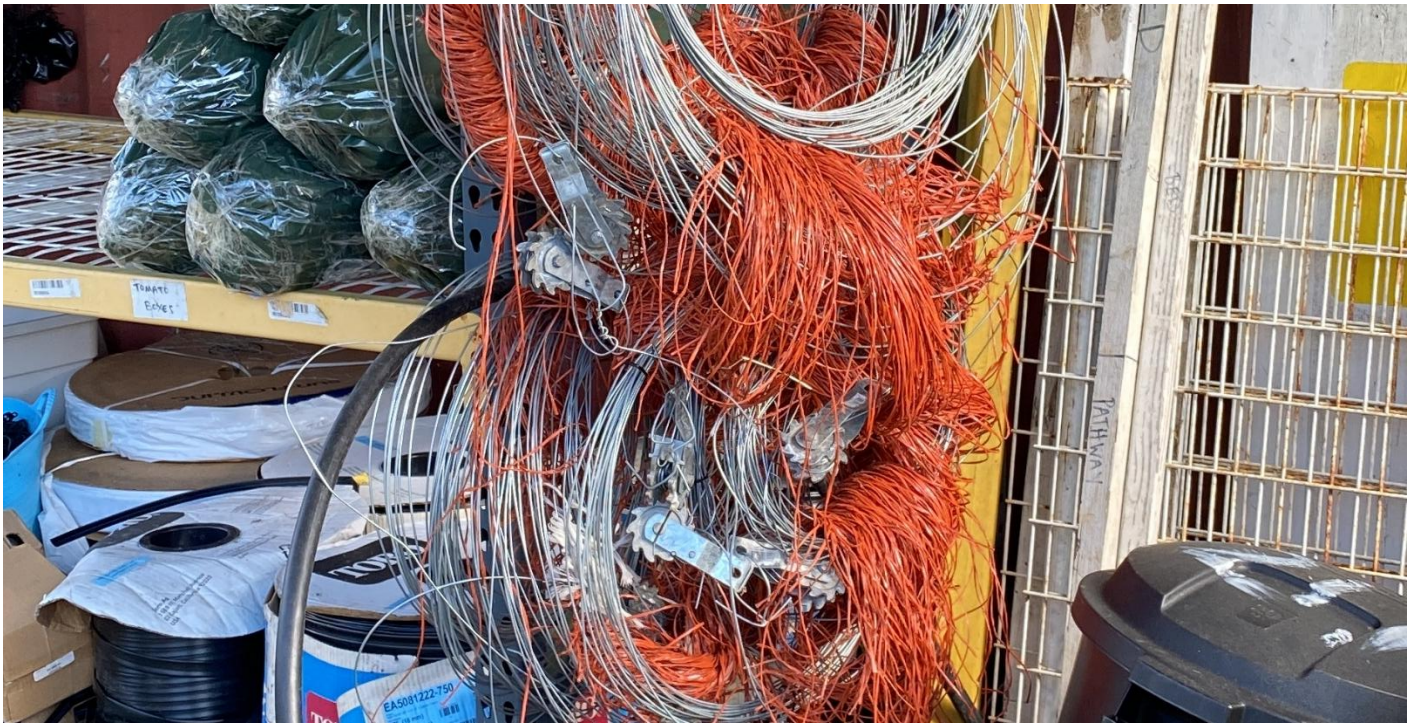
Silage Film

Silage film and bale wrap are widely used in farming operations for both weed management and animal feed preservation. Silage tarps are large impermeable HDPE sheets, commonly black on one side and white on the other, used primarily by small and mid-sized farms for pre-planting weed control, soil moisture retention, and to serve as placeholders between plantings. This practice, known as tarping, is especially popular among farms that use no-till and reduced-till methods because it offers a non-chemical, low-equipment weed control option (Kubalek et al., 2022). While silage tarps are designed to be more durable, with manufacturers' UV rating of 3-4 years, farmers reported in the interviews that they have challenges with damage from machinery, wildlife, and general wear and tear.

Bale wrap (See Figure 5), often made from LDPE, is used to ferment and store forage like haylage in oxygen-free conditions, and the silage film that is used for them accounts for approximately 19% of agricultural plastic demand globally (FAO 2021). While effective at preserving nutritional quality, bale wrap is typically a single-use plastic that is challenging to recycle due to contamination from soil, feces, and other farmyard materials.

Figure 6. Bale wrap waste

Farmers noted that the bulkiness and contamination of both tarps and bale wrap make retrieval, storage, and disposal difficult, especially since these materials often require machinery and labor to handle. Common practices reported include reusing silage tarps over multiple seasons, cutting them to size for different applications, and sharing reusable portions with other farms. Programs in other regions, like Clean Farms in Canada, have shown potential for centralized collection, but logistical and contamination challenges remain barriers to adoption locally. Alternatives to bale wrap, such as shifting from haylage to traditional hay, come with trade-offs in nutritional value and storage requirements (Baillie Haylage 2021).



Plastic Twine and Bale Netting

Plastic twine and bale netting serve a variety of purposes from trellising crops to securing bales of hay and performing quick repairs around the farm. Typically made from UV-resistant polypropylene, plastic twine is inexpensive and easy to use. Square bales are commonly tied with 2-3 strands of plastic twine, while round bales are often wrapped in netting made from HDPE.

Plastic twine typically lasts 2-3 years before fraying and shedding plastic fragments into the soil. Bale netting (See Figure 6), on the other hand, is almost exclusively a single-use item. Farmers reported that while net wrap keeps bales compact and stable for storage, it also generates large volumes of unrecyclable plastic waste each season.

Figure 7. Bale Netting

Some farmers said they are exploring alternatives, such as switching to natural fiber options like sisal or jute twine, which are compostable and reduce plastic waste. Concerns about durability, however, especially in wet conditions, limit the adoption of these options for larger bales. For trellising, more durable alternatives like metal trellising systems (e.g., hog panels or reusable hook trellising systems like Qlipr) can reduce reliance on plastic twine, though these solutions come with higher upfront costs.

Packaging Materials

Packaging materials, especially waxed cardboard boxes, are another source of waste on farms, particularly among those selling through Community Supported Agriculture (CSA) programs, farmers markets, and wholesale outlets. Waxed boxes are coated in polyethylene to resist moisture, making them useful for transporting fresh produce. This coating, however, renders them non-recyclable and non-compostable, meaning they typically end up in landfills after a limited number of uses.

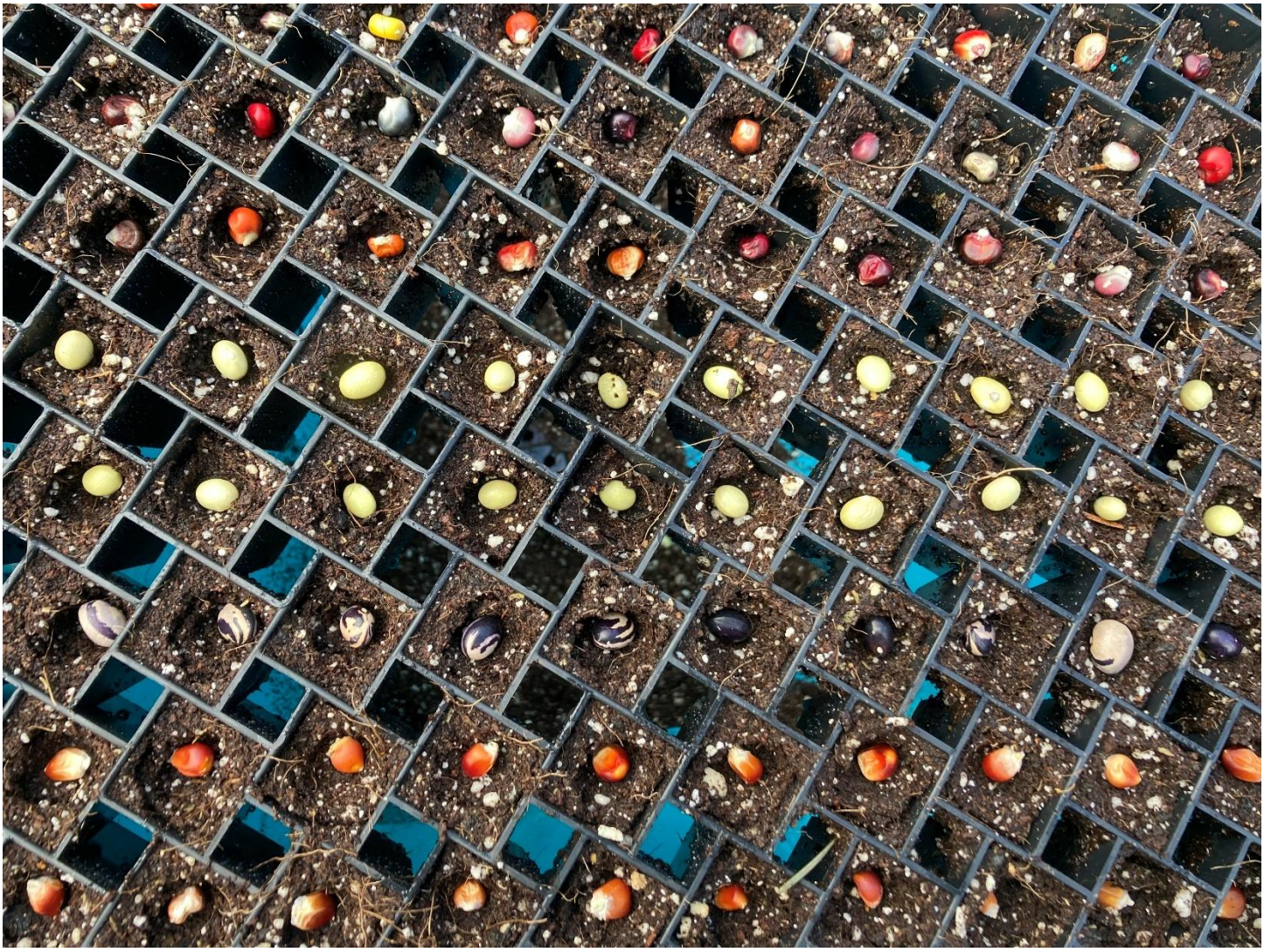
Based on farmer interviews, waxed boxes are often used only a limited number of times, ranging from 1 to 15 uses, before becoming too flimsy, soiled, or lost in the distribution cycle. Farmers selling to wholesale outlets or through food safety-certified channels reported even shorter lifespans for these boxes, as many buyers require brand-new boxes or new plastic liners per delivery due to food safety protocols like GAP (Good Agricultural Practices) certifications and FSMA, the Food Safety Modernization Act. One interviewee with a large farm noted using approximately 90,000 waxed boxes annually, with zero opportunity for reuse due to strict sanitization requirements. Other farms delivering to food banks or local markets reported reusing boxes for several weeks or months, particularly when plastic liners were used, but still faced challenges with return rates and box durability.

Additional packaging materials like plastic produce bags, clamshell containers, and twist ties also contribute to waste. Produce bags (made from polyethylene) were reported to sometimes be recycled at grocery store drop-offs, while clamshells (mostly PET) face inconsistent recycling guidelines depending on the jurisdiction. Overall, packaging waste remains a persistent challenge due to both material limitations and food safety regulations.

Super Sacks (Bulk Bags/FIBCs)

Super sacks, also known as bulk bags or Flexible Intermediate Bulk Containers (FIBCs), are large, woven polypropylene bags commonly used by farmers to store and transport bulk materials like grain, seed, compost, animal feed, and fertilizers. With a weight capacity of 2,000 to 3,000 pounds, these bags are a cost-effective solution for handling both dry and wet materials on farms (FIBC Bulk Bags Sandbaggy, n.d.). Many farmers noted appreciation of their durability, lasting up to five years and capable of multiple uses, along with their ability to reduce labor, as they can be moved efficiently with forklifts rather than by hand.

While super sacks are technically reusable and recyclable, most farmers accumulate large numbers of them without viable reuse or recycling options. Challenges arise because many suppliers will not accept them back for refill due to food safety concerns or product-specific restrictions. Without local recycling programs or take-back systems, these durable bags often end up being stockpiled on farms or sent to landfills. Although they are made from recyclable materials like woven polypropylene and sometimes include food-grade polyethylene liners, infrastructure limitations mean these materials frequently contribute to long-term on-farm waste.



Durable nursery tray in action Photo credit: Jo Vance, Pilot Project Participant

Pilot Projects

Working with our Advisory Committee and informed by the in-depth interviews with farmers, we developed a list of potential pilot projects aimed at reducing plastic waste for farmers. After evaluating each option for feasibility and taking into account cost, logistical considerations, and project timelines, three practical, on-the-ground pilot projects were selected. The projects were carried out in King, Kitsap, Pierce, and Snohomish counties and included:

- A cost-share program for durable nursery trays
- A free trial of reusable CSA/delivery boxes
- Regional nursery tray and pot recycling events

Durable Nursery Tray Cost-Share

A common theme from our farmer interviews was the desire for more durable alternatives to standard thin plastic nursery trays. Durable trays are often designed to last decades compared to the thin, conventional nursery trays that typically cost less than $1 each and often break after just a few seasons. Some brands advertise the strength of their durable nursery trays with demonstrations such as trucks driving over the trays, highlighting their long-term cost-effectiveness and sturdiness.

To help farmers overcome the upfront cost barrier of these durable trays, we launched a 50% cost-share program for Winstrip Trays, one of the more popular durable brands on the market. An individual Winstrip tray retails for over $15 when purchased individually, and, when purchased in bulk (by the pallet), drops to $8 each. This upfront cost can be prohibitive for small to mid-sized farms. Our program offered farmers the opportunity to purchase up to 40 trays at a significantly reduced price of $4.25 per tray, which also covered taxes and shipping.

Farmers could select from a variety of cell sizes (50, 72, 128, 200, or 288 cells) based on their crop needs and preferences. Orders were customized according to each farmer's request. This approach also acknowledged that some farmers already own some durable trays and are interested in expanding their collection, while others had been hesitant to try them due to the high upfront costs.

To make pick-up as accessible as possible, we distributed the trays through local sites, many of which were recommended by farmers themselves in the pre-survey. These locations also served as distribution hubs for the CSA/delivery boxes (described below). Distribution partners included Oxbow Farm and Conservation Center in King County, Kitsap Conservation District in Kitsap County, Pierce Conservation District in Pierce County, and Snohomish Co-op in

Durable trays in action. Photo on left by Ellen Scheffer Pilot Project Participant. Photo on right by Martie Bartley, Pilot Project Participant

Snohomish County. Many of these sites allowed farmers to stop by on alternate days and times if they couldn't make the scheduled pick-up dates. Additionally, personal deliveries were made to farmers who were not able travel to the distribution sites. This approach helped ensure the pilot was flexible and accessible to a wide range of participants.

Durable CSA/delivery Box Trial

To address the issue of single-use waxed cardboard boxes, which cannot be recycled or composted due to their polyethylene coating, we launched a free trial of reusable plastic CSA/Delivery boxes. These boxes are designed for long-term use, with the potential for hundreds of reuses. This reduces the overall volume of waste going to landfills and supports more sustainable packaging practices. Additionally, these boxes are recyclable at the end of their life, making them a more circular option.

For this pilot project, we offered farmers the opportunity to test three styles of durable boxes (See Figure 7), at no charge:

- Collapsible plastic corrugated boxes, which can be easily flattened for storage and reassembled for use.
- Roughneck-style totes, which have detached lids.
- Flip-lid totes, which stack into each other for storage.

Each participating farm chose which style(s) they wished to test. 8 to 14 reusable boxes were distributed to each farm.

For the CSA/delivery box trial, distribution followed the same approach as the nursery tray cost-share pilot, using the same local distribution sites listed above. Farmers picked up their boxes alongside their trays, with flexible pickup options and personal deliveries available to ensure accessibility.

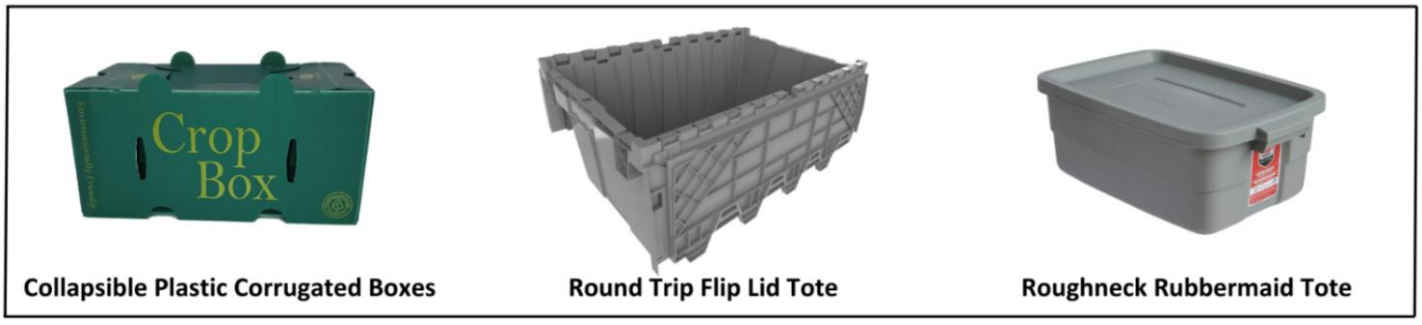


Figure 8. Three styles of durable boxes available to test for the pilot project

Nursery Tray and Pot Recycling Events

The third pilot project focused on providing farmers with accessible recycling options for used nursery trays and pots, materials that often end up stockpiled or landfilled due to a lack of easy recycling solutions. One of the main challenges in designing this pilot was identifying local sites that could serve as collection points while also having the necessary infrastructure, such as baling equipment or machinery to handle and sort materials, to maximize recycling potential.

Ultimately, we partnered with DTG Recycle, who served both as collection site hosts (in May 2025) and as the recyclers for the project. This pilot served as a test run to explore whether DTG Recycle could potentially host these types of drop-off events on a more regular basis in the future. We established four regional drop-off locations: two in King County (Renton and Woodinville), one in Kitsap County (Bremerton), and one in Pierce County (Tacoma). At each site, we hosted a one-day event with a six-hour drop-off window from 10:00 AM to 4:00 PM.

We advertised the events via emails to our participating farmers, through our partner's farm networks and via social media. Participants were able to bring their qualifying nursery trays and pots for

recycling without any associated fees. Given interest from community gardeners, the events were also open to non-farmers who could meet the accepted materials criteria.

Accepted items included plastic nursery trays and pots of any color, provided they were labeled as polypropylene (#5), high-density polyethylene (#2), or polystyrene (#6). We could not accept items made of other plastic types, non-plastic materials (such as biodegradable pots or mixed materials), or any items lacking a visible plastic identification label.

Pilot Project Results

All three pilot projects were completed by the end of May 2025. Following the completion of these pilots, participating farmers received feedback surveys in June 2025 to gather their input and experiences. 69 of the total participating 75 farmers responded. The feedback results are summarized below.

Durable Nursery Tray Cost-Share Pilot Results

A total of 53 farmers participated in the Nursery Tray Cost-Share Project, with 26 participants in King County, 10 in Kitsap County, 10 in Pierce County, and 7 in Snohomish County. Feedback for this pilot was overwhelmingly positive, with 98% of responding farmers (91% of participants) reporting they plan to continue using the durable nursery trays on their farms.

When asked why they applied, common responses included:

- Cost-share and cost savings as their primary motivation (48%)
- A desire for more durable trays with longer lifespans (33%)
- Desire to reduce plastic waste and implement more sustainable practices (25%)

Notably, 92% of participants had previously used standard thin nursery trays on their farms.

When asked how many years of use they get from their standard thin trays before discarding them, the answer was an average of 3.2 years. When asked how many times per year they typically use each individual tray, the average was 3.4 times. Comparing this to the lifespan of Winstrip trays, which are 30+ years when used approximately a dozen times in a season, we estimate that 1 Winstrip tray will replace at least 10 standard thin trays over the span of 10 years.

Farmers shared many positive experiences with the trays. The most common feedback included:

- Appreciation for the trays' durability and long lifespan (46%)
- Sturdiness of trays (35%)
- Ease of use (31%)
- Overall performance (good plant growth/health) (23%).

Challenges were mentioned by farmers included

- Learning curve, especially in adjusting water usage and soil mixes (10%)

- More difficult to pop plants out compared to standard trays (8%)
- Poor water retention (8%)

Comments from farmers included:

"They're great all around. Stackable, washable, happy plants, carry with one hand, hardy in the field, easy to empty soil, and maybe most importantly, their rigidity lets you pop plants so much more effectively - the transplants break less and are much happier at removal - this also makes planting way faster - there is a really strong case to make for their use on purely agricultural grounds apart from waste and plastic concerns. And if they last seven years they should pay for themselves (at my site) at full price, and I imagine they will last longer"

"It is so durable and high quality, and the root development is much healthier, resulting in bigger, faster-growing plants."

"I generate plant starts every year. These trays function very well when generating plant starts. The fact that they are reusable makes them a great investment--like having the right tool for the job."

"Trays are expensive and also I hate that they don't last long. These rigid trays are so much better for plant growth and saving our landfills"

"They are so easy to fill with soil and seeds- major time saver vs. soil blocks/ thin plastic trays"

"These trays combine the benefits of soil blocking (sustainability/less plastic use, higher quality plant starts) and traditional greenhouse trays (ease of use, speed, efficiency). But they are somewhat prohibitively expensive, so accessing them at a reduced price was a great opportunity for us."

Durable CSA/delivery Box Trial Pilot Results

A total of 36 farmers participated in the CSA/Delivery Box free trial pilot, with 12 participants from King County, 10 from Kitsap County, 8 from Pierce County, and 6 from Snohomish County. Feedback was positive, with 89% of responding farmers (97% of participants) indicating they plan to continue using the reusable boxes on their farms.

When asked why they applied, common responses included:

- The cost effectiveness of receiving free boxes (20%)
- They needed a better delivery solution (14%)
- They needed more harvest/produce boxes (14%)
- They wanted to replace waxed boxes (14%)
- They wanted a more sustainable option (9%)

Pilot participants tested out the boxes for various tasks, including:

- Deliveries (43%)
- Storage/Cold Storage (26%)

- CSA (23%)
- Transportation of produce/materials to markets (23%)
- Produce harvest (17%)
- U-Pick (3%)

Many of the participants were already using some form of reusable option for boxes in their operations (54%), while some had previously been using waxed boxes (26%). Other common items used by farmers prior to this pilot include:

- Cardboard boxes (17%)
- Paper Bags (11%)
- Cloth Bags (6%)
- First year farms that had not tested other options (6%)
- Cooler bags (3%)
- Cardboard boxes with plastic liners (3%)
- Buckets (3%)
- Styrofoam (3%)
- Coolers (3%)

78% of those surveyed that had reported they previously used waxed cardboard boxes for their CSA or delivery needs stated that the reusable boxes could serve as a replacement.

The most commonly cited benefits from responding farmers included:

- Ease of cleaning (43%)
- Sturdiness and durability (40%)
- Stackability (23%)
- Secure lids (11%).

The primary drawback mentioned was box sizing, with 23% of responding farmers expressing a preference for either larger or smaller boxes than those provided. A smaller group (14%) noted that the boxes take up additional storage space on their farms.

Comments from farmers included:

“These can permanently replace waxed cardboard with much better durability and stackability.”

“Reusable containers are cost effective and efficient for moving products safely”

“Long-term solutions may cost more, but usually end up being more reliable in the end!”

“I am always a fan of reusable boxes since it is more eco-friendly and also more multi-functional. Before I have to use harvest crate to harvest and then use the cardboard boxes for cold storage, but now I just need one box from beginning to end.”

“The flip lid tote is great for harvesting since I have very narrow pathway and my old harvest crate is too wide for my pathway so before I had to keep on walking up and down the pathway during the harvest, but now I can just bring the tote and put them in my pathway while I harvest. It is also great for cold storage of bulk harvest since it is very deep and spacious. The Rubbermaid tote is also great for storage (I like that it has a lid so it seals in moisture pretty well), and I also use it for delivery. The lid helps seal in the coldness and keeps the vegetable clean during transit.”

Nursery Tray and Pot Recycling Event Results

The nursery tray and pot recycling events experienced the lowest participation rate of the three pilots, with only 23 total participants across all four events. Of these, 10 participated in King County, 6 in Kitsap County, and 7 in Pierce County. Among participants, 14 were home gardeners, community gardeners, or nurseries, and 9 were farmers.

To better understand the low participation, we included specific questions in our feedback survey. Among all surveyed farmers, 90% reported that they did not attend the recycling events. When asked why, the most common responses included:

- Conflicts with the timing of the events (26%)
- Inconvenient location of events (23%)
- Did not need to recycle (22%), though this could reflect either a lack of this specific waste stream or that the timing did not align with their recycling needs.
- They did not have trays to recycle at the time of the events (12%)
- Busy farm schedules (9%)
- They reuse their nursery trays (6%)

Among those who did attend, feedback included requests for on-farm pickup options and for more frequent events with expanded dates and locations. While attendance for this pilot was limited, the survey results revealed valuable insights. There is interest in recycling services, but greater flexibility in scheduling and collection site selection would be necessary to increase farmer participation in future programs.

Key Learnings and Areas for Improvement

Several lessons emerged to inform future efforts. One significant area for improvement was the distribution logistics. Allowing rolling applications for the CSA box trial and nursery tray cost-share increased participation but led to multiple rounds of recalculating inventory and shifting distribution plans, resulting in higher staff time and additional farm deliveries. For future projects, we recommend closing applications by a set deadline prior to distribution and shipping all materials directly to each county's distribution site. This would minimize last-minute changes and make distribution days smoother for both staff and farmers. Additionally, holding multi-day pickup windows, rather than single-day events, and ensuring an adequate number of staff are available to assist with sorting and distribution would increase accessibility and efficiency.

For the recycling events, our primary learning was the importance of extended outreach. Promoting events earlier, at least one month in advance, and using a broader range of outreach channels (such as in-person outreach at farmers markets, direct flyers in businesses where farmers frequent, and potentially paid online promotions) would help increase participation. Encouraging farmers to presort materials by plastic type in advance would reduce time sorting on-site and lower the risk of contamination. It was also clear that having six or more staff or volunteers on-site is critical, especially when dealing with unsorted materials. Access to forklifts or similar machinery was essential for moving heavy materials but this limited us to mostly urban locations for collection, which was less convenient for farmers. Additionally, exploring small participation incentives could make recycling events more accessible and effective.

Conclusion

Key achievements of the project included:

- Overall, the project identified the top 10 plastic waste items that farmers in western Washington use and have challenges in disposing.

- We successfully engaged farmers across King, Kitsap, Pierce, and Snohomish counties in reducing on-farm plastic waste through three pilot projects.

- We distributed durable nursery trays and reusable CSA/delivery boxes to 75 participating farms (22 of which participated in the CSA/Delivery Box Trial, 39 participated in the Nursery Tray Cost-Share, and additional farms 14 participated in both pilots) and hosted four regional nursery tray and pot recycling events.

- Feedback from farmers was overwhelmingly positive for both the durable tray and box pilots, with 98% of respondents indicating they plan to continue using the durable nursery trays and 89% indicating they will continue to use the durable boxes.

- While the recycling events had low participation, they provided important insight into the logistical challenges farmers face when accessing recycling opportunities.

- Across all the pilot projects, farmers expressed strong interest in durable solutions and an eagerness for more accessible, affordable waste reduction programs.

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