

Recycling Agricultural Plastics in New Mexico



Produced by
New Mexico Recycling Coalition



This guide is also available online at
www.recyclenewmexico.com

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New Mexico Recycling Coalition, Sarah Pierpont, Executive Director
PO Box 24364, Santa Fe, NM 87502
505-603-0558 or sarah@recyclenewmexico.com
www.recyclenewmexico.com

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INTRODUCTION

New Mexico Recycling Coalition

The New Mexico Recycling Coalition (NMRC) is a non-profit statewide professional membership organization with the mission of inspiring New Mexicans to reduce, reuse and recycle. This goal is reached primarily through education and advocacy projects. With 240 recycling members, the organization supports itself from dues, trainings and conference revenue. Several special projects are funded by grants. Joining NMRC helps support efforts such as this, to educate professionals and the public about the value of recycling.

New Mexico Environment Department: Solid Waste Bureau

The New Mexico Environment Department (NMED) plays a critical role in solid waste and recycling management support with the development of content and instruction of the New Mexico Recycling Facility Operator Certification Course and through the Recycling and Illegal Dumping (RAID) grant funds for scrape tire management, recycling and illegal dumping abatement projects.

Project Background

The New Mexico Recycling Coalition (NMRC) partnered with the Estancia Valley Solid Waste Authority (EVSWA) located in Torrance County to conduct a RAID grant funded study to recycle agricultural plastics in New Mexico. The study began in October of 2016 and concluded in June of 2017 and focused on plastic silage film, as well as other agricultural plastics, utilized within Torrance County and throughout the state. The goal of the study was to identify types and volumes of agricultural plastics used in the state, challenges to recycling, feasibility of recycling the material and potential end markets.

Why Divert Ag Plastics from Landfills

- To extend landfill life span. The US EPA estimates that plastics make up 13% of America's solid waste.
- To provide New Mexico's farmers with an alternative to landfilling or burying the material on their land.
- To save natural resources.
- To spur economic development with the creation of new or expanded end markets for agricultural plastics.
- To serve as an effective tool to rapidly increasing diversion rates.

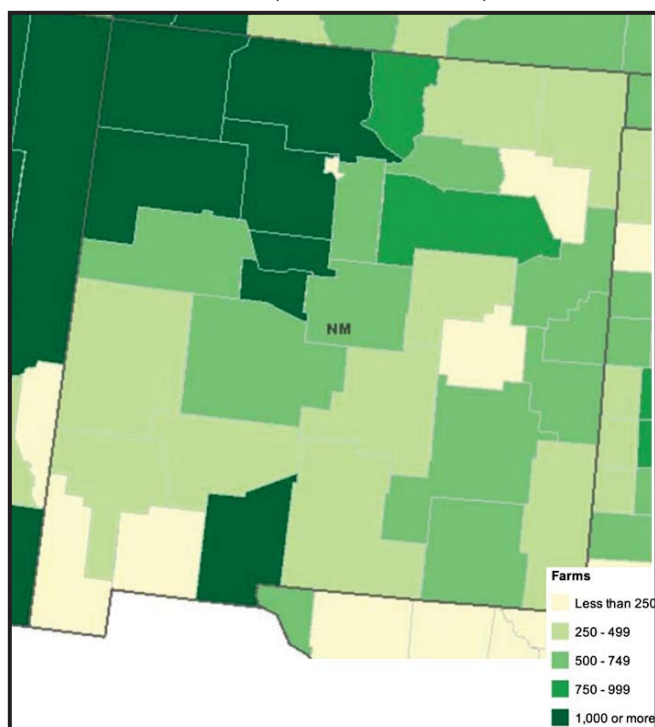


AG PLASTIC RECYCLING OVERVIEW

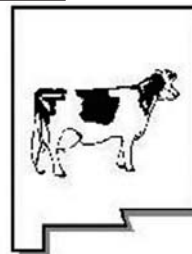
Agriculture in New Mexico

New Mexico has a long and rich history of agriculture with primitive irrigation systems in place as early as 2300 B.C. Today there are approximately 24,721 farms (Figure 1) in the state with 43,200,000 acres of farm/ranch-land. This means that over 55% of all of the land in New Mexico is used for agriculture. The average farm size in New Mexico is 1756 acres (2.75 square miles) (USDA's National Agricultural Statistics Survey - NASS 2016).

Figure 1. Farms in New Mexico (USDA-NASS 2016)



The annual market value of agricultural products sold in New Mexico is \$2.5 billion with nearly half of this income from dairy sales. New Mexico is home to roughly 157 dairy farms generating \$1.22 billion in annual sales. New Mexico is currently ranked 9th in the nation for milk production and 5th in the nation for cheese production (Dairy Producers of New Mexico 2016). Dona Ana County leads the state as the area with the highest percentage of milk cows as percent of all cattle with Curry, Eddy, Chaves, Roosevelt and Lea Counties close behind.



AG PLASTIC RECYCLING OVERVIEW

The information presented in this guide focused on three primary types of agricultural plastics in the Torrance County region: plastic film to cover silage piles; livestock nutritional supplement containers; and pesticide/fertilizer concentrate containers. Details about the composition and volume estimates for each of these is further outlined in this guide.

Challenges to Ag Plastic Recycling in New Mexico

Challenges to recycle agricultural plastics include dealing with contaminants (Figure 2), lack of collection efficiencies, plastics dispersed across rural regions, potentially toxic containers from pesticides and fertilizers, low value of material and difficulty and expense to consolidate the material.

A new challenge to recycling lower-value plastics began in February of 2017. The campaign, launched by the Chinese General Administration of Customs, translates as the “National Sword” and is an enforcement campaign to crack down on recycling operations that lack proper controls and facilities. The crack down focuses on materials that cause severe pollution because of improper recycling at ill-equipped facilities. It is an update to China’s custom policies and targets imported waste, including scrap plastics and electronics.

The result of the “National Sword” campaign is new custom checks on all imported materials. This has quadrupled the time between purchase and consumption of recyclable materials; caused returned shipments to countries of origin; increased official inspections of processing factories and reportedly suspended operations at facilities using improper water-treatment processes. The increased controls have exposed smuggling activities that have led to dozens of arrests and confiscation of over 22,000 tons of material. New Mexico has felt the ripple effect of the National Sword campaign and saw a 17% decrease in market price for natural HDPE from April to May of 2017. The campaign is set to run for one year, however the policy may become the new standard.

Figure 2. Images of contamination from silage plastic film



COMPOSITION & VOLUME

Silage Plastic Film

Figure 3. Used Silage Plastic Film



Silage is essentially chopped forage (primarily corn) that is put into a pit and covered with a plastic film or a “bunker cover” to create an anaerobic environment that ferments the silage for dairy cow feed. There are over 300,000 dairy cattle in New Mexico and

the state has the largest average herd size (2088) in the nation. The plastic film used to make silage (Figure 3) is often weighted down with old tires (Figure 4) and it is at least 5mm thick and made of co-extruded low density polyethylene (LDPE) with a small percentage of Linear LDPE (LLDPE) added for flexibility. Currently, many farmers are burying the material on their property or paying to take it to the landfill.

Feeding New Mexico’s dairy cows is a huge task. One milk-producing cow consumes 50-90 pounds of silage per day. The Dairy Producers of New Mexico estimate that there are 300,000 dairy cattle in New Mexico, which calculates to 7500-13500 tons of silage consumed in New Mexico per day. Silage is fed to New Mexico’s dairy cows year-round.

According to the USDA, New Mexico is 22nd in the country for corn silage production and harvests 75,000 acres of silage production each year. The USDA-NASS sites harvest yields of 23 tons per acre for silage, which calculates to 1,725,000 tons of silage grown in the state each year. However, local farmers in Torrance County noted that they average harvest yields of 32 tons/acre for silage production which would calculate to 2,400,000 tons of silage grown in the state each year.

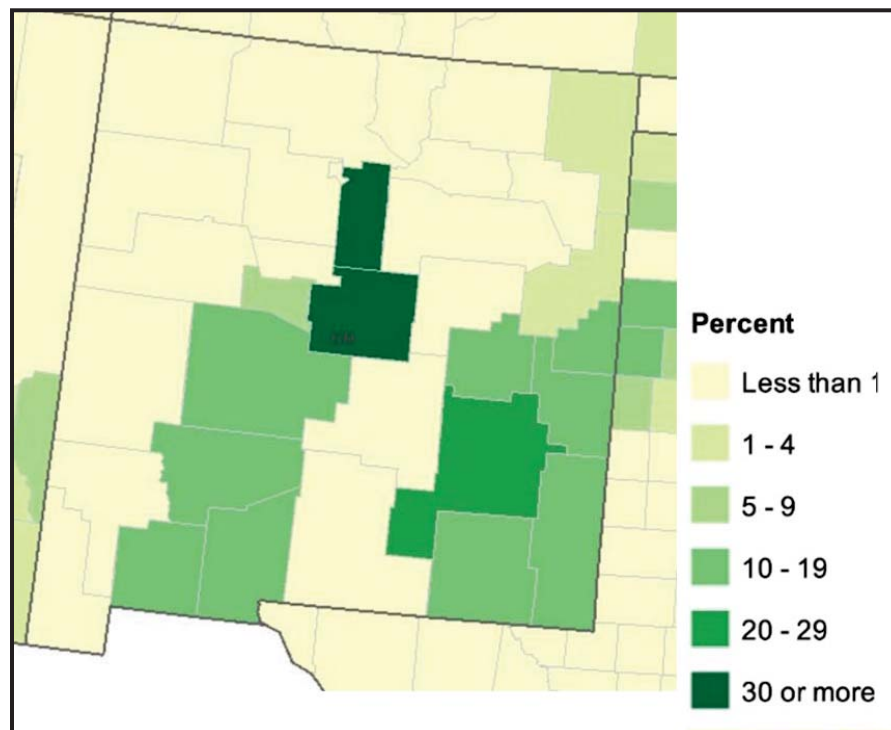


COMPOSITION & VOLUME

Silage Plastic Film Continued

Santa Fe and Torrance County produce the highest acres of corn silage or greenchop harvested in New Mexico as a percent of total acres of harvest crops (USDA-NASS) (Figure 4). Based on calculations conducted at an 1850 acre farm growing approximately 1200 acres of silage forage in Torrance County, we estimated that it takes 6.2 square feet of silage film per ton for bunker covered silage. At 1,725,000 tons of silage grown per year in New Mexico, the total amount of silage film per year equals 10.7 million square feet. Based on discussions with agricultural plastics production companies, this would translate into 350,000 pounds of silage film each year. As a side note, if the 32 tons/acre yield rate is used in the calculation instead of 23 tons per acre, the amount of silage plastic increases to 14.9 million square feet or 486,000 pounds per year (Table 1).

Figure 4. Acres of Corn Silage or Greenchop Harvested as a Percent of Total Acres of Harvested Crops



COMPOSITION & VOLUME

Silage Plastic Film Continued

Industry representatives that provide agricultural plastics recycling in Wisconsin and Minnesota note that nationally, agricultural plastic recyclers estimate four to five pounds of agricultural plastic film per cow per year. This would calculate to 1.2 million pounds of film in New Mexico (Table 1). One reason for the discrepancy could be how the silage is “put up” differently in each state. In Wisconsin, for example, more plastic film is used to individually wrap silage in a “hay wrap” style, compared to New Mexico’s “bunker cover” style of covering silage forage (Figure 5).

Figure 5. Left “hay wraps” as used in Wisconsin, right “bunker cover” silage pile in New Mexico, below additional silage “bunker cover” image



In an effort to better understand the amount of silage film in New Mexico, NMRC staff reached out to distributors that provide the material to farmers in the state. Local distributors estimate that they ship 25-30 semi-trucks per year of silage film to New Mexico. At 48,000 pounds per truck this is 1.2 million to 1.44 million pounds of silage film sent to New Mexico each year. These numbers collaborate with the industry’s estimate of four to five pounds of agricultural plastic film per year per cow (Table 1).



COMPOSITION & VOLUME

Silage Plastic Film Continued

Based on the different calculation scenarios described and outlined in Table 1, it appears the exact pounds of silage film used in New Mexico each year is unknown, however if distributors send 1,200,000 pounds of silage plastic film into New Mexico each year, this amount appears to be the most accurate.

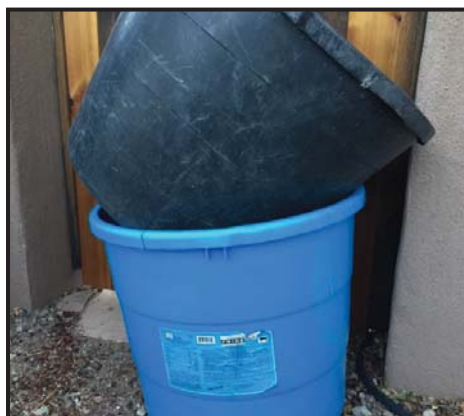
Table 1. Summary of Pounds of Silage Film Used in NM Estimates

Silage Estimate - Scenario 1 based on on-site estimates at a farm		
Tons of Silage Grown in NM Annually	Square Feet of Silage Used (6.2 sq ft/ton)	Pounds of Silage Film Used in NM Annually (1 sq ft = .0327 lbs)
1,725,000	10,695,000	350,000
2,400,000	14,880,000	486,000
Silage Estimate - Scenario 2 based on industry standards		
	Head of Dairy Cow in NM	Pounds of Silage Film Used in NM Annually (4-5 lbs of Ag Plastic Film per cow per year)
	300,000	1,200,000-1,500,000
Silage Estimate - Scenario 3 based on silage plastic distributors		
	Annual Shipments to NM	Pounds of Silage Film Used in NM Annually (48,000 pounds per truck)
	25-30 Semi Loads	1,200,000 - 1,440,000

COMPOSITION & VOLUME

Nutritional Supplement Containers

Figure 6. Used Nutritional Supplement Containers



In New Mexico Dairy and beef cattle, horses, sheep and goats are fed nutritional supplements during winter months (September to May). This supplemental feed comes in large (approximately 10 gallon), colored high-density polyethylene (HDPE) tubs (Figure 6).

An average ranch with 65 beef cows and 4 horses uses approximately 50 tubs per year. New Mexico is home to 1.54 million cows, sheep and goats (USDA) which calculates to ap-

proximately 1.1 million tubs per year in New Mexico (Table 2)). These tubs are currently reused on site or sent to the landfill.

Pesticide/Fertilizer Concentrate Containers

Figure 7. Agricultural Concentrate Containers



Pesticide and fertilizer concentrates are provided to farmers in 2.5 gallon, primarily clear, HDPE containers (Figure 7). Currently the containers are triple rinsed and sent to the landfill. It took an 1850 acre farm approximately 10 years to fill a large trailer. Industry average for containers is 1 jug per ten acres per year, which calculates to 4.32 million HDPE jugs in New Mexico each year (Table 2).

Table 2. Summary of Quantities of Nutritional Supplement and Pesticide/Fertilizer Plastics in NM

Ag Plastic Type	Type of Plastic	Estimated Annual Volumes in NM
Nutritional Supplement Containers	Colored HDPE	1.1 million tubs
Pesticide/Fertilizer Concentrate Containers	Clear HDPE	4.32 million jugs

FEASIBILITY ASSESSMENT

Silage Plastic Test Bale Project

NMRC and Estancia Valley Solid Waste Authority (EVSWA) conducted a test bale project in the spring of 2017 (Figures 8 & 9). EVSWA placed a 30-yard roll-off container specifically for silage plastic film at a local farm. It took one and a half months in the spring to fill up the roll-off at a farm that produces approximately 50,000 tons of silage annually. EVSWA's manual horizontal baler was able to bale the material and made two full (30" x 30" x 60") bales and one half bale. The bale weight for these bales is outlined in Table 3.

Table 3. Bale Weights for Test Baling Project

<u>Bale No.</u>	<u>Full Bale?</u>	<u>Weight (lbs)</u>	<u>Baled Cubic Yards</u>
1	Yes	2,200	1.16
2	Yes	2,160	1.16
3	No	840	0.58
	Totals	5,200	2.89

Each bale took sixty minutes to make with two staff members. Comparatively, it takes approximately 10 minutes to make a bale of single-stream recycling material and 20 minutes to make a bale of cardboard for recycling. Bales of both single-stream and cardboard weigh approximately 1,200 pounds.

Figure 8. Images from Test Baling Project in EVSWA



FEASIBILITY ASSESSMENT

Silage Plastic Test Bale Project Continued

A volume reduction ratio of approximately 10:1 was achieved as 30 cubic yards of loose material was reduced to 2.9 cubic yards (Table 3).

The plastic fed into the baler in an acceptable manner. The test bale included a clear plastic film that is occasionally used as an underlay. If end-markets require plastic separation, it must be done at the source and put into separate containers as it is difficult and labor intensive to separate the different plastics out when making a bale. Plastic that was bundled or rolled into approximately 3 feet diameter by 5 feet long rolls was much easier to handle and bale.

The estimated costs to process one 30 yard roll off container for the test bale include \$150 in labor and \$46 in transportation (40 miles roundtrip), which equals \$196 for the three test bales. This calculates to \$75.38 per ton (Table 4). It is estimated that if the plastic was bundled as noted above and source separated, that the labor time to create a bale would be reduced in half, decreasing the processing cost per ton to \$46.54 (Table 4).

Table 4. Estimated costs for test bale to bale agricultural plastics

	<u>Labor (2 staff for 3 hours)</u>	<u>Transportation (40 miles round- trip)</u>	<u>Total</u>	<u>Processing Cost Per Ton</u>
Test Bale	\$ 150.00	\$ 46.00	\$ 196.00	\$ 75.38
Better Prepared at Source	\$ 75.00	\$ 46.00	\$ 121.00	\$ 46.54

The test bale project identified the following best management practices for recycling agricultural plastics:

- Keep plastic as clean and dry as possible.
- Shake out pebbles & clumps of soil.
- Roll or fold into pillow-sized bundles.
- Store off the ground, out of mud, grit, gravel.
- Separate plastic by color and type.

POTENTIAL SOLUTIONS

Potential Solutions

Silage Plastic Film

Private enterprises have found a solution for this contaminated, hard-to-manage material within the United States through patented cleansing processes to create certified, 100% recycled content resin that can then be used to manufacture new products. A United States based manufacturer would not rely on exporting material to China, which may become increasingly difficult due to the “National Sword.” In the mid-west, private enterprises collect agricultural plastics at no charge to farmers in order to create recycled feed stocks for their plastic manufacturing operations.

In states such as Wisconsin, Illinois, Iowa and Minnesota, if a farmer would like to recycle their agricultural plastic, they can do so at no charge; all that's required is permission to place a dumpster at participating farms for collecting and picking up agricultural plastic.

The profit margins for post-consumer agricultural plastics are low and collection and transportation can be costly. This means that in order for a recycling program to be feasible, there must be a minimum volume of material in the program. To provide a full-scale collection and recycling service in New Mexico, similar to the ones in Minnesota and Wisconsin, the state would need to use 3-5 million pounds of plastic film per year. Smaller volumes of approximately 1 million pounds per year would be needed for partial service, such as collection events or a public/private partnership.

The silage volume calculations based on sales of the material from distributors does show a high enough volume to make it economically feasible for a company to service New Mexico. Additionally, the test bale project proved that consolidating the material can be done with existing rural hub and spoke recycling systems in New Mexico. The biggest hurdle in bringing an agricultural plastic film recycling solution to New Mexico is collection and transportation. Possible solutions include collection events, regional partnerships, and piggy-backing operations onto existing disposal solutions.



POTENTIAL SOLUTIONS

Potential Solutions Continued

Nutritional Supplement Containers

The HDPE #2 (Figure 9) plastic can be recycled with most curbside and drop off recycling programs in New Mexico. Considerations to increase recycling of these containers include education and outreach to inform farmers and ranchers how and where to recycle these items and accommodation for these larger sized containers to be included in drop off and curbside programs. Creative reuse is another potential to divert this plastic. For example, Luna County used the containers as collection bins for recyclables at a school recycling program (Figure 10).

Figure 9. Bottom of Nutritional Supplement Container Showing the HDPE #2 Plastic Recycling Symbol

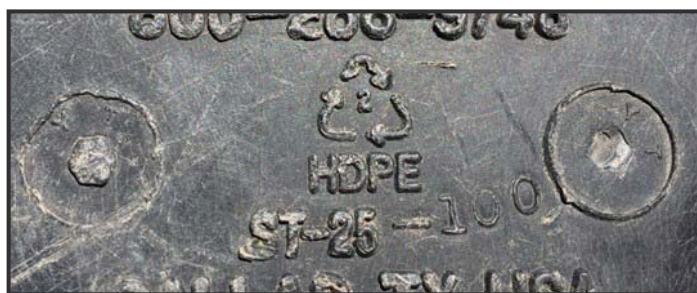


Figure 10. Reuse of Nutritional Supplement Containers for a Luna County School Recycling Demonstration Game



POTENTIAL SOLUTIONS

Potential Solutions Continued

Pesticide and Fertilizer Concentrate Containers



Thousands of farmers and others who apply pesticides nationwide participate in a free recycling programs. The Ag Container Recycling Council (ACRC) is a not-for-profit organization fully funded by their member companies and affiliates that formulate, produce, package and distribute crop protection and other pesticide products. ACRC safely collects and recycles agricultural crop protection, animal health and specialty pest control product containers. Containers are recycled only into approved, acceptable end-use products, such as agriculture drain pipe, highway sign posts and underground utility conduit.

Containers that are eligible for the program are outlined below.



Eligible Containers:

- **Rigid high density polyethylene (HDPE), 55 gallons and smaller, that previously held EPA registered products utilized in Crop Protection, Specialty Pesticides and Fertilizers and Pest Control Operators/Structural Pest Control**



Ineligible Containers:

- Any container constructed of anything other than HDPE, rotationally molded containers, mini-bulk, intermediate bulk containers (IBC), totes, and
- All containers that previously held products utilized in the **Consumer Home & Garden, Pest Control and Swimming Pool Maintenance** markets

POTENTIAL SOLUTIONS

Potential Solutions Continued

Pesticide and Fertilizer Concentrate Containers

ACRC contracts with nine private companies that work regionally to collect and process the materials. New Mexico is serviced by USAg Recycling out of Waller, Texas. Currently they collect containers from approximately 25 farms in the state or only 0.1% of the farms in the state. In 2016 USAg Recycling collected 40,000 lbs of material from New Mexico. As a comparison, USAg Recycling collected 480,000 lbs of plastic from the state of Louisiana in 2016 and Louisiana has approximately the same number of farms, but only 7.75 million acres of farmland, compared to New Mexico's 43.2 million acres. Promoting this free, industry supported, product stewardship program is an easy way to recycle these containers.



USAg Recycling maintains a collection database that they use to contact farmers on a regular basis to schedule pickups. Farmers must enroll to be a part of their collection database, which can be done at www.usagrecycling.com. Farms may need annual or less frequent collections and USAg Recycling can accommodate any pick up frequency required by farmers. They do ask that farms have at least 1000 containers ready for recycling. Once a farm has 1000 containers prepared, USAg Recycling sends a portable grinder directly to the farm and their staff hand-loads the material into the grinder. The plastic must be triple rinsed.

To sign up for the free service, visit www.usagrecycling.com or call 1-800-654-3145

POTENTIAL SOLUTIONS

Potential Solutions Continued

Pesticide and Fertilizer Concentrate Containers

Acceptable plastic containers must meet the requirements in Table 5 below. The plastic must be triple rinsed. When USAg Recycling staff is on site and hand sorting the containers into their grinder, they will not accept any containers that do not meet their definition of acceptable. However, if the farmer can rinse any non-acceptable containers to meet their requirements at that time, they can accept the container.

Table 5. Requirements for participation in ACRC program

 Acceptable	 Not Acceptable
	
Container, thread, and lip are clean	Dried formulation on container
Handle and neck stained but clean	Dried formulation on thread
Inside stained but rinsed clean	Bottom is caked with dried residue
Inside is clean and dry	Liquid residue in container

POTENTIAL SOLUTIONS

Potential Solutions—Case Study

USAgRecycling picked up approximately 1,800 pounds of used fertilizer and pesticide containers from a farm in Torrance County. The team brought a mobile grinder and reduced 2.5 trailers full of containers into one super-sack. The process of putting eligible containers into the granulator took about an hour to an hour-and-a-half.

Figure 11. Images from Torrance County agricultural plastic recycling



AG PLASTICS RESOURCES & REFERENCES

Technical Guidance Resources

NMRC Resource page www.recyclenewmexico.com

Resources include on the site include:

- ◆ Recycling Directory to find where HDPE #2 & therefore the Nutritional Supplement Containers are accepted statewide
- ◆ Local Use of Compost and Mulch Guide
- ◆ Food Waste Management Guides
- ◆ Downloadable Version of This Guide

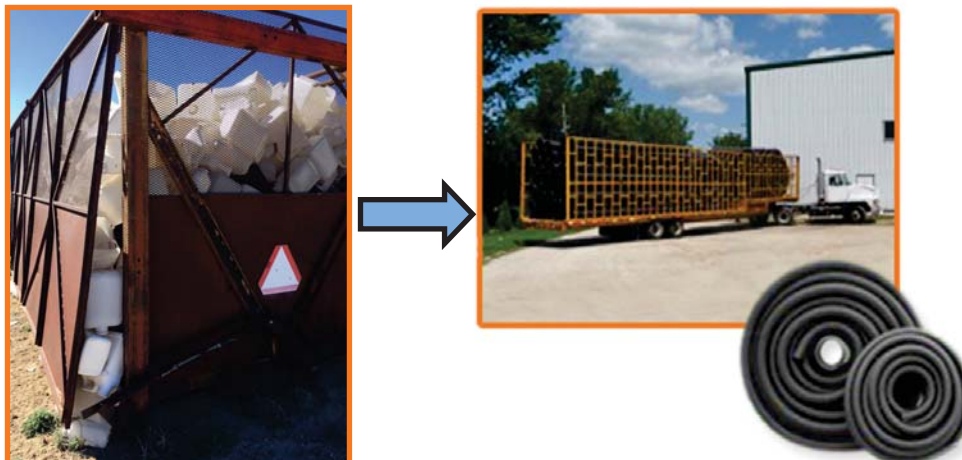
Ag Container Recycling Council: Anyone can sign up for this free service to recycle eligible pesticide and fertilizer containers. Learn more at www.acrecycle.org

USAg Recycling: This company is the service provider for New Mexico for the Ag Container Recycling Council - Richard Marburger USAg Recycling, 979-505-7750, rwm8345@cvctx.com, www.USAgrecycling.com

NM Environment Dept.: Solid Waste Bureau <https://www.env.nm.gov/swb/index.htm>

NM Environment Dept: Hazardous Waste Bureau <https://www.env.nm.gov/hazardous-waste/>

EPA Pesticide Containers Information <https://www.epa.gov/pesticide-worker-safety/pesticide-containers>



NOTES

Recycling Agricultural Plastics in New Mexico

STEPS New Mexico's Farmers Can Take TODAY!



Silage Plastic Film—Partner with area farmers to determine volumes of silage film used in the area and let NMRC know! If New Mexico can prove that the volume is there, then recycling the film will become easier! Contact Sarah Pierpont at sarah@recyclenewmexico.com



Nutritional Supplement Tubs— Visit www.recyclenewmexico.com/directory to find out where the HDPE #2 plastic tubs can be recycled in your area.



Fertilizer/Pesticide Containers—Visit www.usagrecycling.com or call 1-800-654-3145



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