MULCHING VEGETABLES

practices and commercial applications

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COLLEGE OF AGRICULTURE COOPERATIVE EXTENSION SERVICE

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MULCHING VEGETABLES

MULCHING PLANTS to improve their growing conditions is a practice that dates back to very early agriculture. Although their objectives may differ, both commercial growers and home gardeners use mulches. Mulching vegetables can increase yields, promote earlier harvest, and reduce fruit defects when the plant is growing under less than ideal conditions. Mulching also reduces weed growth and keeps the vegetables clean. In addition, mulching in the garden may permit more efficient use of space.

Mulch can be defined as any substance such as straw, sawdust, plastic, or paper spread on the ground to protect the roots of plants from heat, cold, or drouth, or to keep fruit clean. Specifically, mulch modifies the soil and air microclimate in which a plant is growing. Mulches are selected to take advantage of their properties which will create a favorable environment for plant growth. Many think that mulches always increase crop yields and are disappointed when this does not occur. Although substantial increases in production often result from use of mulch, equivalent or reduced yields may occur under some circumstances. The crop, time of year, type of soil, rainfall, and soil and air temperatures all influence plant response to mulching. When mulches improve the environment in which a plant is growing, better growth and higher yields will result.

MULCH MATERIALS

Mulches may be grouped into natural materials, usually organic in nature, and synthetic man-made constructions.

Organic Mulches

Organic materials most frequently used for mulching include (1) plant residues such as straw, hay, crushed corncobs, peanut hulls, leaf mold, and composts; (2) peat; (3) wood products such as sawdust, wood chips, and shavings; and (4) animal manures.

Natural mulch materials are not usually applied with machines and require considerable hand labor. Most organic materials are bulky and must be hauled to the place of use. Often suitable organic materials are unavailable in quantities for commercial operators. For these reasons organic materials are used mostly by home gardeners and only on a limited scale by commercial vegetable growers.

Organic mulches return organic matter and plant nutrients to the soil and improve soil tilth as they decompose. Most organic materials require additional nitrogen fertilizer to prevent a deficiency of nitrogen to the mulched crop. (See page 13.)

Synthetic Mulches

Synthetic mulches include paper, polyethylene, paper-polyethylene combinations, wax-coated papers, aluminum and steel foils, and asphalt spray emulsions. Some of these are listed below. These materials have been used with varying degrees of success since 1914 when asphalt-treated paper was found to promote plant growth. Synthetic mulches will become more common in specialized agricultural production because they are easily adapted to mechanization, they may be designed for individual crop situations, and they may be produced in quantity at low cost.

New techniques in mulch fabrication will undoubtedly result in improved and more specialized mulches using light-reflecting or light-absorbing coatings, strip combinations, controlled disintegration, color fading, and many other techniques.

Synthetic Mulch Fabrications

Kraft paper (black and natural)
- Combinations
  - Polyethylene coatings — clear, black
  - Wax coatings — clear, black, aluminum
  - Aluminum foil lamination

Polyethylene (clear, smoke gray, black, white, aluminum colored)
- Combinations
  - White binded to black
  - Black sprayed with various colored paints

Foils (steel, aluminum)
- Steel foil tin plated
- Kraft paper with aluminum foil lamination
- Aluminum foil with 9-inch black center stripe

Polyethylene film. Polyethylene film is used in a thickness of 1 or 1½ mils[1] and a width of 3 to 6 feet. Polyethylene film is inexpensive and is easily applied with machines. Black or gray film is preferred, although clear film may be used to obtain higher soil temperatures when weeds are controlled by fumigation or selective herbicides.

[1] 1 mil equals 0.001 inch.

Polyethylene film can be obtained from most agricultural centers, hardware stores, and mail order houses.

The serious limitation of polyethylene film is that it does not decompose when in contact with the soil and must be removed at the end of the crop season (Fig. 1). Otherwise the film will remain in the soil to become entangled in tillage equipment, interfere with precision seeding, and be an unsightly nuisance for many years to come. This fact has limited the acceptance of polyethylene for commercial use.

Paper constructions. Kraft mulching papers are resistant to fungal attack and have wet-strength and extensible properties important in field application. Natural brown and black pigmented papers, 3 to 4 feet wide, have been used successfully in University of Illinois field test plots for several years (see photos on cover).

Thin polyethylene or polymer coatings, usually ¼ of a mil in thickness, or a special wax treatment of the paper, combine the advantages of polyethylene film with the primary advantages of paper — controlled decomposition and ease of disposal in the field (Fig. 2).

Aluminum and steel foils. There is current interest in aluminum and steel foils for mulching vegetables. These materials reflect energy and cool the soil. This will probably limit their use in Illinois for early production but may prove advantageous for main crop production when cooler soils are beneficial. The reflective characteristics increase the light for plant growth and also have been reported to repel certain harmful insects.

The application of a black stripe down the center of aluminum foil

Black polyethylene mulch film will not decompose on the soil and must be removed by hand after the cropping season. (Fig. 1)

mulch seems to improve growth of warm-season crops (Fig. 3). The black stripe warms the soil as shown by the following temperatures recorded at a 2- to 3-inch depth in 1969:

Mulch	*Temperature difference under mulch compared with soil (°F.)*
Aluminum foil on paper	− 5.0
Aluminum foil on paper with black stripe	
Under stripe	+11.0
Under foil	− 3.3
Black polyethylene	+11.3
Black poly-coated paper	+13.5

Paper or paper-combination mulches may be disked into the soil where they will decompose after the cropping season. (Fig. 2)

Aluminum foil paper mulch (left) and experimental black stripe applied on the foil (right). (Fig. 3)

Asphalt emulsions. Much research has been conducted in recent years on use of petroleum resin emulsions for mulch. This material is sprayed as a band directly over the row to increase soil temperatures to promote early germination of seeded vegetables. Problems of formulation, application, weed control, and rapid breakdown with rainfall have limited the use of these materials in Illinois, although they have been effective under arid conditions.

PRINCIPLES OF MULCHING

Mulch changes the environment in which the plant is growing. These changes have the most influence on crop development during periods when growing conditions are less than ideal. Weather conditions that commonly result in plant stresses are low rainfall, cool air temperatures, and cool soil temperatures. Mulch may help alleviate these stresses. Mulch also creates a physical barrier that controls weeds, evaporation, leaching, soil compaction, and root pruning. Although all the environmental factors are interrelated, changes in soil moisture and soil temperature are usually the most important in determining crop response to mulching.

Moisture. Mulches reduce the evaporation of water from the soil by 10 to 50 percent, or more. Permeable organic mulches increase the rate at which the soil will absorb rainfall. Mulches also save water for use by crop plants by reducing competition from weeds. This is an important factor in dry seasons. See Figures 4 and 5.

Soil temperature. Mulching modifies soil temperatures. Organic, light-colored, and light-reflective mulches reduce soil temperatures while black, gray, and transparent mulches increase soil temperatures.

Low soil temperatures during the spring growing season may reduce plant growth and early yields. However, during the heat of mid-summer soils cooled by mulches may be more productive.

The elevated soil temperatures provided by black and clear polyethylene films and by black papers hasten early plant development, especially when soil temperatures are less than ideal for plant growth (Table 1).

The effectiveness of a mulch material often depends on the soil-temperature requirements of the crop plant. This is one reason why the warm-season vine crops such as melons and cucumbers respond so well to soil-warming mulches early in the growing season in Illinois.

Table 1. — Effect of Mulch on Soil Temperatures[a] (Dixon Springs Agricultural Center, 1967)

Time	Bare soil	Soil mulched with		
		Black paper with ¼-mil transparent polyethylene	Natural paper with ¼-mil black polyethylene	Black polyethylene (1-½ mil)
	°F.	*°F. warmer than bare soil*		
7 a.m.	69.2	2.6	2.8	3.2
9 a.m.	77.4	3.4	5.2	5.0
11 a.m.	86.2	8.0	10.8	10.8
1 p.m.	90.6	8.8	12.0	12.0
3 p.m.	93.8	8.2	13.0	11.8
5 p.m.	90.6	10.2	13.2	11.6
7 p.m.	85.3	8.0	11.3	9.5

[a] Temperatures taken at 2- to 3-inch depth under the mulch in full sun. Averages of five daily readings between May 25 and June 23.

The benefit of soil moisture conservation by mulching is shown by the corn growing on sandy soil under dry conditions. An unmulched row is shown in the foreground. (Fig. 4)

Weed control. Properly applied mulches reduce weed growth and the competition of weeds for light, water, and nutrients. Fine-grained organic mulches, applied 2 inches or more deep around the crop plants, inhibit weed growth. Loose, porous materials are less effective and usually do not give sustained weed control.

Synthetic mulches are made in opaque and transparent forms. The opaque films and sheets prevent light penetration necessary for weeds to grow. If a transparent form such as clear polyethylene is used, a

Staked tomatoes mulched with straw to help preserve soil moisture. (Fig. 5)

selective herbicide or soil fumigation will be necessary to control weeds germinating under the mulch.

Soil structure. Mulches help maintain good soil structure by preventing soil crusting and compaction. Mulched soil remains loose and friable, thereby providing good aeration for plant roots. The organic matter added to the soil as mulch improves soil tilth as it decomposes.

Root development and injury. An extensive root system develops in mulched soil, especially in the upper 2 inches where drying of unmulched soil, crusting, and cultivation often limit root growth. The mulch provides a physical barrier that prevents root pruning and injury by cultivation and hoeing. These factors contribute to a healthy root system and more efficient use of nutrients.

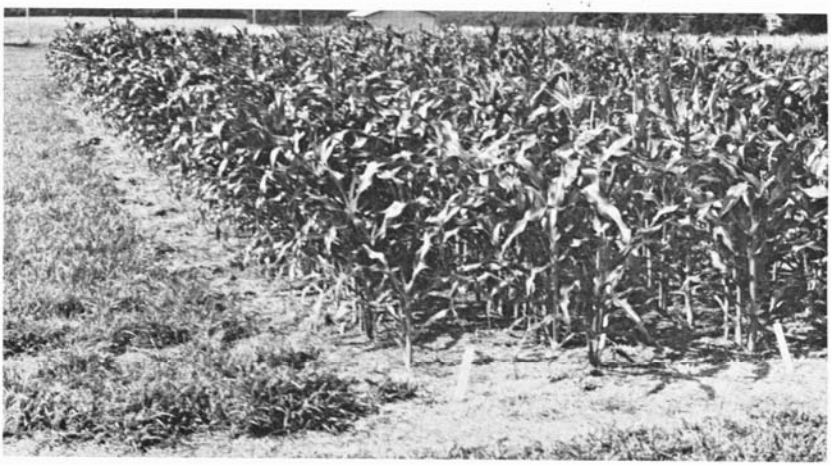
Biological aspects. The biological activity of soil microorganisms is increased due to the loose, well-aerated soil condition, uniform moisture, and higher and uniform temperatures. This results in a more rapid breakdown of organic matter in the soil and the release of plant nutrients for crop growth. See page 13 for discussion of organic mulches and nitrogen requirements.

Erosion control. Organic mulches help reduce wind and water erosion of the soil. They also maintain conditions favorable for infiltration of water, thus reducing runoff (see Figure 6).

Fumigation. The application of a synthetic mulch provides an ideal situation for fumigation of the soil under the mulch. In a study on sandy soil, fumigation controlled weeds and parasitic nematodes while increasing yields (Table 2).

Table 2. — Compaison of Muskmelon Yields With and Without Soil Fumigation and Mulch (Oquawka Sand Farm, 1965)

Treatment	Number of melons	Weight of melons	Average weight of melons
		lb.	*lb.*
No fumigation, no mulch	12	32	3.1
Fumigation, no mulch	53	195	3.8
Fumigation and mulch	85	335	4.3



No-till or zero-tillage culture, showing sweet corn planted in sod. The corn is planted directly in sod with special equipment after which the sod is killed to form a mulch that protects against soil erosion. This method of planting is used commercially for field corn in southern Illinois. It has only been tried experimentally for sweet corn. (Fig. 6)

MULCHING COMMERCIAL VEGETABLES

To justify mulching in commercial production, an economic return must be realized, either from increased yields or from savings in operating costs. Some vegetables respond to mulch with earlier production, increased growth and greater yields, or a reduction in ground rots. Mulched plants usually grow and mature more uniformly than non-mulched plants. The response will depend on the crop, time of year, soil conditions, and variations in weather during the season.

Synthetic row mulch has potential commercial use in Illinois for early market cucumbers, summer squash, muskmelons, eggplant, and early market tomatoes (see Appendix Tables). In special market situations mulching of sweet corn, watermelon, gourds, squash, and pumpkins may be justified.

MULCHING GARDEN VEGETABLES

Many vegetables may be mulched in the home garden where labor and mechanization for application are not limiting factors. Properly applied mulches can effectively reduce hand weeding and watering throughout the summer. The following suggestions for mulching garden crops are based on response and objective:

1. To promote earliness and increase yields, use black or gray polyethylene film 1 to 1½ mils thick and 3 to 4 feet wide; or use polyethylene-coated paper, 3 to 4 feet wide, for snap beans, lima beans, cucumbers, eggplant, muskmelons, peppers, summer squash, early-planted sweet corn in northern Illinois, tomatoes, and watermelons (Fig. 7).

The soil-warming benefits of black polyethylene mulch are shown by the growth of summer squash in early planting. Mulch on the left side of the picture, soil on the right. (Fig. 7)

2. To improve crop growth and yield during the regular growing season, use black polyethylene or polyethylene-coated paper for broccoli, cabbage, and sweet potatoes, particularly in northern Illinois. Use straw, hay, peat moss, or other plant residues for asparagus, potatoes, and rhubarb, particularly in southern Illinois where high temperatures prevail.

3. To improve quality, reduce soil rots, and enable close planting for efficient utilization of space, use black polyethylene-coated paper, peat moss, or straw for staked tomatoes, groundbed tomatoes, cucumbers, and muskmelons.

MULCHING GREENHOUSE TOMATOES

Mulches are regularly used in the production of greenhouse tomatoes to reduce soil compaction and loss of soil moisture from evaporation.[1] The mulch also minimizes fluctuations in soil moisture and temperature.

Organic mulches, primarily wheat straw and peanut hulls, also serve as a source of organic matter to improve soil tilth when they are incorporated into the soil. Light-reflecting white and aluminum-coated polyethylene has been used experimentally in some greenhouses.

USING ORGANIC MULCHES

Many gardeners prefer to use organic materials because they improve the soil. The availability, cost, appearance, and durability are factors that often determine which organic mulch is used. Other considerations are the ultimate effect of the mulch upon the soil, diseases and weeds, and the possibility of a fire hazard.

Application. Generally, the garden soil is prepared, fertilized, and usual cultural practices are followed.[2] The mulching material is applied around the established plants when they are 4 to 6 inches tall. Hoe out weeds and apply enough mulch to prevent new weed growth. Apply the mulch soon after a rain or when the ground is reasonably moist.

Weeds. If finer materials such as sawdust are used to prevent weed seeds from germinating, a minimum mulch depth of 2 inches is needed. Coarser materials are less effective for this purpose and must be applied 3 to 4 inches deep. Organic mulches will not control weeds such as bermudagrass, quackgrass, and nutgrass. These and other

[1] See "Growing Greenhouse Tomatoes in Ohio." Ohio State University Cooperative Extension Service SB-19.

[2] See Circular 882, "Illinois Vegetable Garden Guide."

Table 3. — Composition of Some Organic Mulch Materials and Amounts of Nitrogen Required for Decomposition

Organic mulch material	Fertilizing constituent[a]			Amount of nitrogen required for decomposition
	Nitrogen	Phosphorus	Potassium	
	Percent			*lb. per ton of mulch*
Hay, alfalfa	2.45	.24	1.97	excess[b]
Buckwheat hulls	.48	.02	.27	20.4
Cocoa pods	1.20	....	....	6.0
Corn cobs, ground	.37	.04	.37	22.5
Cottonseed hulls	.62	.06	.87	17.6
Hay, fescue	1.12	.20	1.43	7.6
Oak leaves	1.49	....	....	....
Peanut hulls	1.07	.06	.82	8.5
Sawdust, fresh	.20	.10	.20	26.0
Wheat straw	.62	.07	1.18	17.6

[a] Taken from F. B. Morrison, Feeds and Feeding. Morrison Pub. Co., Clinton, Iowa.
[b] When organic materials contain more than 30 pounds of nitrogen per ton (1.50 percent nitrogen), excess nitrogen will be released during the decomposition process.

weeds that grow through the mulch must be hand pulled during the season.

Avoid using mulch materials that contain weed seeds. This is particularly important with wheat straw and hay mulch materials.

Diseases. Naturally occurring mulches may contribute to plant diseases unless disease-free material is used.

Nitrogen. Generally, organic materials are not of primary value for adding large quantities of plant nutrients to the soil (Table 3). In particular, most organic materials are naturally low in nitrogen and contain insufficient amounts for decomposition. As a result, the microorganisms decomposing the organic matter may use most of the available nitrogen in the soil resulting in a deficiency in the mulched crop. Nitrogen must be provided for both crop growth and decomposition of the mulch. The amounts of fertilizer required to supply the nitrogen needed for decomposition of various organic mulch materials are given in Table 3. These amounts should be applied in addition to the regular fertlizer program.[1]

If the garden has been well fertilized each year, extra nitrogen may not be needed until the mulch is plowed under and mixed with the soil. Supplemental nitrogen fertilizer may be needed for the following two or three seasons. Be alert for signs of nitrogen deficiency (light

[1] See Circular 882, "Illinois Vegetable Garden Guide," for fertility recommendations.

green or yellowish coloring, particularly of the bottom leaves) and reduced growth.

Is sawdust toxic? Historically, farmers observed decreased yields when undecomposed sawdust was used as a mulch and they considered the sawdust toxic to their plants. Most of this reasoning has been false. In reality the lower yields were the result of depletion of available soil nitrogen.

However, do not use black walnut or cedar sawdust as they may contain harmful toxins. Other woods do not contain toxic substances.

The amounts of fertilizer required to supply the nitrogen needed to decompose fresh dry sawdust are given in Table 4.

Sawdust varies in acidity from pH 3.5 to nearly neutral (pH 7.0), depending on the kind of wood. However, sawdust has little effect in changing the pH of soil. On soils that are naturally low in pH (lower than pH 6.0), it may be advisable to mix limestone with the acid sawdust woods. One pound of agricultural limestone per bushel of dry sawdust will help neutralize acid sawdust (oak, maple, and cypress for example).

Hardwood or softwood sawdust may be used and it may be freshly cut or partially decomposed. The fresh material will last longer but the partially decomposed sawdust will become humus more rapidly in the soil and it is less likely to create a nitrogen deficiency.

Weathered or partially decomposed sawdust is preferred over fresh sawdust because the fresh material will build up heat which could injure tender plants if the material is applied deeply around them. Some gardeners weather their sawdust by storing it in a pile for a year prior to usage.

Fire. Dry and loose organic materials such as straw, hay, and leaves are a potential fire hazard. Be careful with cigarette butts and trash fires.

Table 4. — Amounts of Fertilizer Required to Supply the Nitrogen Needed to Decompose Fresh Dry Sawdust

Fertilizer	Amount needed to decompose 1 bu. of sawdust
	lb.
Urea (45.0% N)	.6
Ammonium nitrate (33.5% N)	.8
Ammonium sulfate (21.0% N)	1.2
10-10-10 or 10-6-4 (10.0% N)	2.7
5-10-5 (5.0% N)	5.0

USING SYNTHETIC ROW MULCHES

Soil preparation. The field or garden to be mulched should be plowed and prepared in the normal manner. Plow down or work in the lime and fertilizer indicated by a soil test. Experience may show that less fertilizer is required where row mulch significantly reduces loss of nutrients by leaching. Better contact will be made between the soil and synthetic mulch with careful land preparation. The soil should not be dry or too wet but rather should have a good moisture supply.

The mulch, although usually applied in the field immediately prior to planting, may be applied when soil conditions permit at any time up to several weeks prior to planting. Early application has the advantage of warming the soil prior to planting warm-season crops.

Laying mulch. Machines, simple in design, for laying row mulches are available (see page 17). Some growers build their own modifications. Most machines are adjustable to lay mulch in widths of 2 to 6 feet. The mulch-laying machine, properly adjusted for soil conditions, will do an excellent job of installing polyethylene or paper. The edges of the mulch are pressed down into furrows and firmly covered by soil (Fig. 8). The covering discs should fill the furrow without throwing excess soil on top of the mulch.

The same principle of installing the mulch may be followed in the home garden. A push-type, one-wheel cultivator works nicely to open and close furrows. The mulch may also be installed simply by covering the edges using a rake or shovel. Generally it is advisable to use synthetic mulches in rows rather than attempt to cover all of the cropped area.

The area between the rows of mulch must be cultivated or sprayed with a herbicide to control the weeds. The growth of weeds along the covered edge of the mulch can be a special problem. Application of a selective herbicide to the exposed soil area is one way to solve it. The choice of chemical will vary with the crop and current recommendations should be consulted.[1] Otherwise this area must be carefully cultivated and hoed.

Planting and transplanting. Few machines acceptable to commercial growers for planting seeds and transplants through row mulches are available. Experimental seeding machines have been built by the University of Illinois (Fig. 9) and by several other universities and some commercial companies. These companies and their addresses are given on page 17.

[1] See Circular 907, "Herbicide Guide for Commercial Vegetable Growers," revised annually.

A Yellow Devil mulch applicator with modifications for laying paper mulch. (Fig. 8)

The Union Carbide Corporation Zendel planter may be leased from distributors of Zendel polyethylene mulch film. Celluponic Systems, Inc., offers a planting-mulching service on a contract basis (Fig. 10). Mulch applicators and seeding equipment may be purchased from the Gator Manufacturing Corporation (Fig. 11) and the Engine Parts Manufacturing Company. The St. Regis Paper Company has developed a system of mulch-laying equipment using prepunched paper mulch (Fig. 12). A seeder or seed tape layer, also supplied by St. Regis, mounts on the mulch-laying machine. Seed plates for the seeder or the tape for the seed tape machine are supplied by the grower.

At present, however, most planting, whether of seeds or plants, is done by hand. This is a laborious, time-consuming job and is justified only where high economic returns can be expected.

An experimental seeding wheel for paper mulches built by the Department of Agricultural Engineering at the University of Illinois. (Fig. 9)

Seeds may be hand-planted through holes cut in the mulch or with a hand corn planter. A bulb setter or post-hole digger greatly facilitates transplanting (Fig. 13). A double-row planting system (rather than a single row down the center of the mulch) is practical for some crops. Also see Figure 14.

SOURCES OF EQUIPMENT

Mulch applicators (some also supply fumigation attachments)

Celluponic Systems, Mosinee, Wis. 54455

Engine Parts Manufacturing Co., 1360 W. 9th St., Cleveland, Ohio 44113

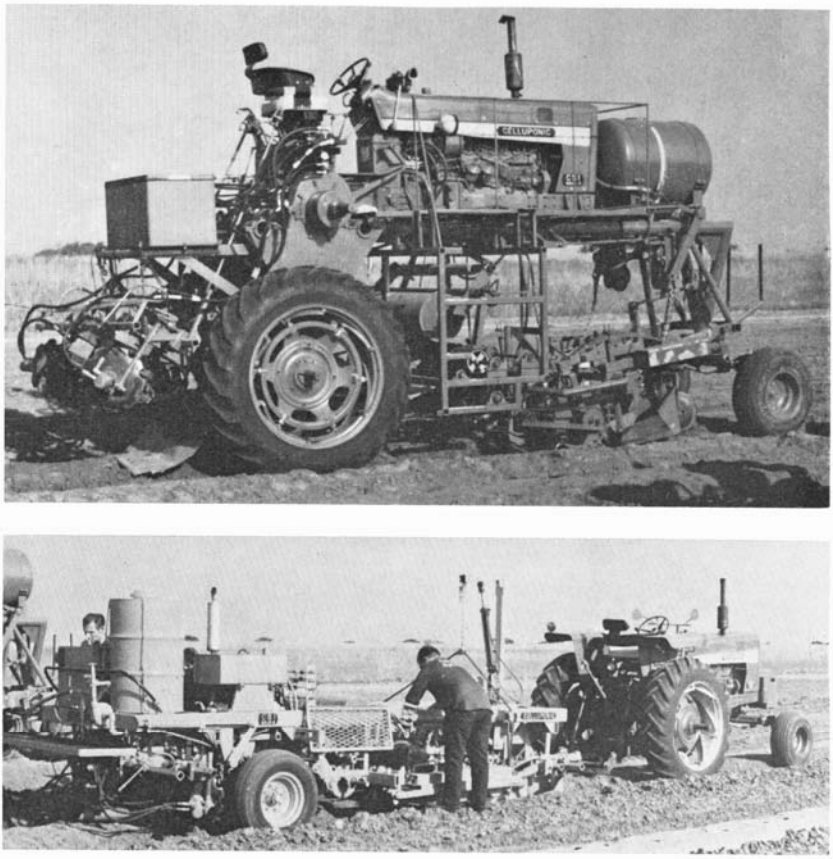
DAO Corp., Box 659, Terre Haute, Ind., 47801

Gator Manufacturing Corp., Inc., W. Highway 20, Watertown, S. Dak. 57201

MIZU Co., 11906 E. Westminster Ave., Garden Grove, Calif. 92640

Russ Pennington, Inc., R.D. 3, Oak Road, Bridgeton, N.J. 08302

St. Regis Paper Co., Agricultural Service Section, West Nyack, N.Y. 10994



Self-propelled and tractor-drawn prototype mulching machines developed by Celluponic Systems. The machines apply mulch, punch holes in synchronization with a planting mechanism, and spray herbicide along the edge of the mulch. (Fig. 10)

Seeding and transplanting systems

Celluponic Systems, Mosinee, Wis. 54455

Gator Manufacturing Corp., Inc., W. Highway 20, Watertown, S. Dak. 57201

St. Regis Paper Co., Agricultural Service Section, West Nyack, N.Y. 10994

Union Carbide Co., Films Dept., 75 Stylon Rd., Wayne, N.J. 07470

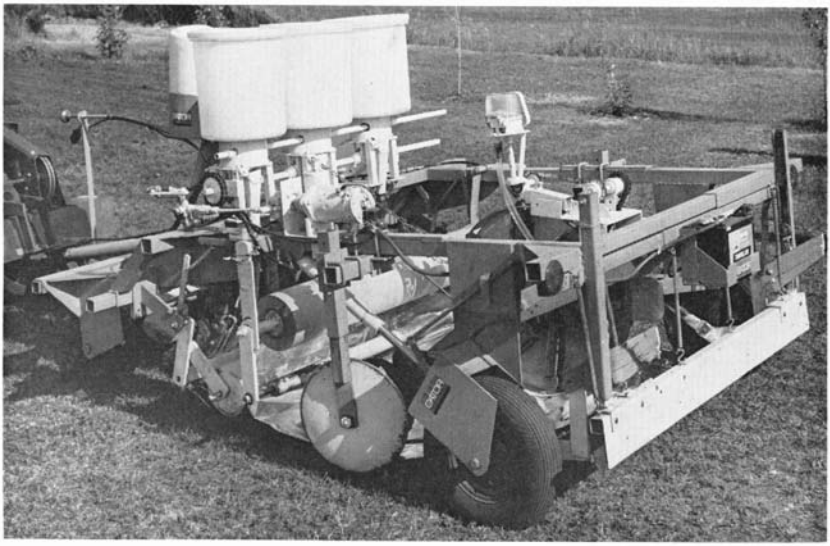
Paper mulch constructions

Anaconda Aluminum Co., Mulch Division, Box 1654, Louisville, Ky. 40201

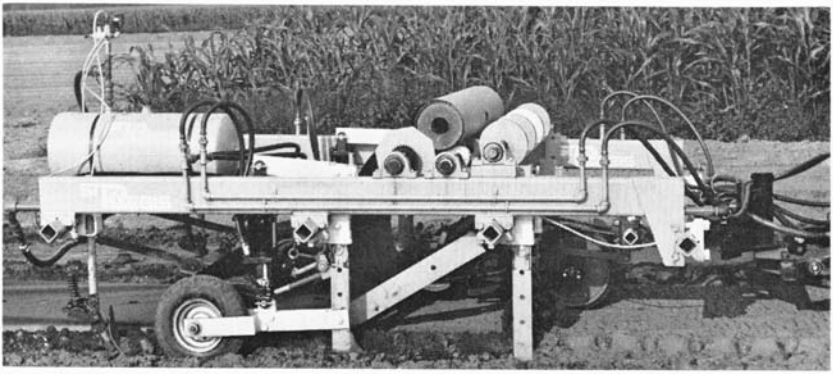
Fox Paper Co., Box 15099, Lockland, Cincinnati, Ohio 45215

Mosinee Paper Co., Mosinee, Wis. 54455

St. Regis Paper Co., Agricultural Service Section, West Nyack, N.Y. 10994



The Gator Manufacturing Company prototype mulch applicator forms a seedbed, applies fertilizer and mulch, and plants seed through the mulch. This machine is not as yet in production. (Fig. 11)



The St. Regis prototype seeder and mulch layer. (Fig. 12)

Polyethylene mulch

Benson-Maclean, Bridgeton, Ind. 47836

Central States Paper and Bag Co., Inc., 5221 Natural Bridge, St. Louis, Mo. 63115

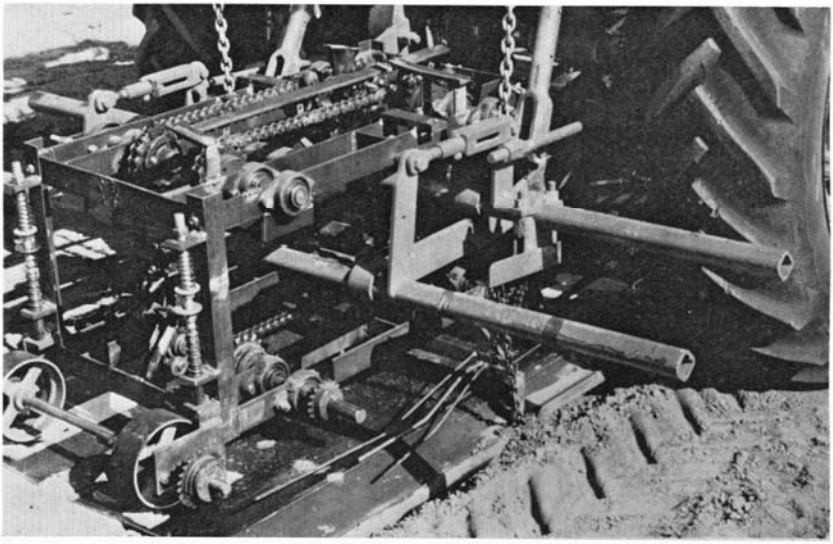
Cincinnati Cordage & Paper Co., E. Wayne & Scott St., Lima, Ohio 45801

Continental Extrusion Corp., #2 Endo Blvd., Garden City, N.Y. 11100

DAO Corporation, P.O. Box 659, Terre Haute, Ind. 47801

Dow Chemical Co., Midland, Mich. 48640

When transplanting through mulch, a bulb planter or other similar device is helpful in making the hole. (Fig. 13)



A prototype transplanter attachment for Celluponic mulch-laying machines. (Fig. 14)

E. I. du Pont de Nemours & Co., Wilmington, Del. 19800
Ethyl Corp., VisQueen Div., Box 2422, Baton Rouge, La. 70821
Gering Plastics Co., Kenilworth, N.J. 07033
Glick Twins, Pharr, Tex. 78577
Kordite Co., Macedon, N.Y. 14502

Lamex Inc., Norcross, Ga. 30071
Peter & Co., 3618 Lexington Rd., St. Mathews, Ky. 40200
Rough Brothers, 4229 Spring Grove Ave., Cincinnati 23, Ohio 45223
Sinclair-Koppers Co., Koppers Bldg., Pittsburgh, Pa. 15219
Sound Screen Supplies, Inc., 2625 Grand Concourse, New York, N.Y. 10068
X. S. Smith, Inc., P.O. Box 272, Red Bank, N.J. 07701
Staff Industries, Inc., 78 Dryden Rd., Upper Montclair, N.J. 07087
Yoho & Hooker, 523 Williamson, Youngston, Ohio 44500

Steel foil mulch

U.S. Steel Corp., Commercial New Product Development Division, Box 86, Pittsburgh, Pa. 15230.

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Proceedings of the National Agriculural Plastics Conference. Vol. 1-9, 1960-1969. Copies may be purchased from B. J. Hall, 5555 Overland Ave., San Diego, Calif. 92123.

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APPENDIX TABLES

Appendix Table 1. — Effect of Mulching on Yield of Muskmelons

Cumulative harvest by weeks	Soil		Black polyethylene		Poly-coat kraft paper	
	Madison County, 1967	Kane County, 1968[a]	Madison County, 1967	Kane County, 1968[a]	Madison County, 1967	Kane County, 1968[a]
	Number of melons per acre					
1	560	27	....	381	1,767	681
2	1,880	408	....	600	3,765	1,362
3	3,557	....	....	....	4,930	....
Season	3,782	....	....	....	5,067	....

[a] Early harvest only.

Appendix Table 2. — Effect of Mulching on Yield of Tomatoes (Urbana, 1967)

Variety	Soil	Poly-coat kraft paper
	Tons per acre	
Hunt 282	20.9	26.8
Campbell 17	22.2	25.9
H-6201	22.5	30.6
ES-24	30.6	36.9
H-1350	31.7	34.8
Roma	35.1	41.2

Appendix Table 3. — Effect of Mulching and Kind of Transplant on Yield of Eggplant (Dixon Springs Agricultural Center, 1967)

Mulch	Bare root plants		3-inch peat pots	
	Early	Late	Early	Late
	Bushels per acre			
None	61	224	166	462
Clear poly-coat on black kraft paper	121	342	247	607
Black poly-coat on brown kraft paper	151	342	193	576
Black polyethylene	109	350	230	608

Appendix Table 4. — Effect of Mulching on Yield of Cucumbers and Summer Squash (Dixon Springs Agricultural Center, 1962)

Mulch treatment	Cucumbers		Summer squash	
	Early	Season	Early	Season
	Bushels per acre			
None	142	478	396	1,447
Black paper[a]	225	608	561	1,998
Black polyethylene	259	614	646	1,977

[a] Uncoated mulch paper.

Appendix Table 5. — Comparison of Different Synthetic Mulches for Muskmelons (Madison County, 1969)

Week of	Mulch					
	None	Natural kraft paper	Black kraft paper	Wax coating on black kraft paper	Aluminum foil on black kraft paper	Clear poly-coat on black kraft paper
	Cumulative yields, no. of melons per 1,000 foot of row					
July 20	12	46	84	83	17	195
July 27	81	214	220	251	324	531
August 3	288	426	405	392	619	682
August 10	415	620	634	588	848	780
August 17	436	646	678	628	892	817

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