UNIVERSITY OF IDAHO
College of Agriculture

INCREASING VEGETABLE PRODUCTION WITH PLASTICS

George W. Woodbury

IDAHO Agricultural Experiment Station

Bulletin 474
October 1966

INCREASING VEGETABLE PRODUCTION WITH PLASTICS

George W. Woodbury*

Polyethylene materials such as black plastic and clear plastic films have been tested for a number of years in the production of vegetable crops. Their use as mulches or row covers increased earliness in such crops as melons, cucumbers, peppers, tomatoes and sweet corn—to name a few. Results of experiments in many parts of the country have encouraged the use of these plastics in commercial vegetable productions.

To test the efficiency of these and other mulching materials, experiments were started at the University of Idaho Lewiston field station in 1960 and continued through 1964.

The Lewiston field station is in one of Idaho's warmer areas. The soil is a silt loam. Irrigation water is available. Muskmelons were used for the mulch experiments. Cucumbers and muskmelons were used with the row covers. The details and results of each year's experiments are presented in Tables 1 through 7.

EXPERIMENTAL RESULTS

1960 Mulches

Black plastic, two sources of coniferous bark treatments and a check were used. The black polyethelene was 3 feet wide and 1½ mil thick. The bark material was obtained locally from two different sources, with little difference between them.

Hales Best and Harvest Queen were the two varieties of melons used. In this and all experiments, seed was planted in a mixture of peat and sand in 3-inch peat pots and with average transplanting dates in late May. Mulches were applied at the same time. Plants were watered at planting time and regularly irrigated thereafter. Conventional cultural practices were used throughout.

*Professor and horticulturist, Department of Plant Sciences.

The Hales Best variety significantly outyielded Harvest Queen. The polyethylene mulch outyielded all other treatments at the 5% level or better and both bark mulches outyielded the check at the 1% level. Earliness was calculated on a weighted basis; that is, giving the early-matured melons more importance in the analysis than the later ones. Calculated in this manner, from the standpoint of both melon weight and melon number, the polyethylene plots were superior to the others at the 1% level. Harvest Queen was earlier than Hales Best.

There was a significant interaction between treatments and varieties. Hales Best responded to black plastic mulch much more than did Harvest Queen, indicating that the earlier varieties would be best for use with plastic mulches. An indication of maturity of the combined varieties, with three different mulches and the check, is shown in Table 1.

This table shows that 62% of the melons from the black plastic plots were harvested by the end of the fourth week. During the same period, bark 1, bark 2 and the check had matured 22%, 17% and 20% of the fruits respectively, indicating an earliness factor here of at least a week. Bark 1, bark 2 and the check plots produced at least two-thirds of their total crop during the fifth and sixth weeks. Numbers of melons and total weights for four replicates are shown in Tables 2 and 3.

Table 1. Melon Harvest over a 7-week period expressed in weekly percentages of season's total. Lewiston, Idaho, 1960.

Treatments	Week of Harvest						
	1	2	3	4	5	6	7
	%	%	%	%	%	%	%
Black Plastic	2.2	15.9	29.3	14.9	13.9	20.5	3.5
Bark 1	0.1	2.6	8.6	10.5	39.2	25.9	13.0
Bark 2	0.0	2.6	8.2	6.3	33.0	39.7	10.8
Check	0.0	1.6	8.8	10.0	34.7	33.5	11.3

Table 2. Average number of melons harvested per plot from 4 replicates and 2 varieties variously mulched. Lewiston, Idaho, 1960.

	Black Plastic	Bark 1	Bark 2	Check	LSD 5%
Variety		Number of Melons			
Hales Best	153	134	124	103	15.0
Harvest Queen	77	75	74	65	
Average	115	105	99	84	
Hales Best average per plot					129 fruits
Harvest Queen average per plot					73 fruits
LSD 5%					7.5

Table 3. Average weight of melons harvested per plot from 4 replicates and 2 varieties variously mulched. Lewiston, Idaho, 1960.

	Black Plastic	Bark 1	Bark 2	Check	LSD 5%
Variety		**Melons Harvested (Pounds)**			
Hales Best	403	332	317	266	39.2
Harvest Queen	299	290	282	226	
Average	351	311	300	246	
Hales Best Average per plot				329	pounds
Harvest Queen average per plot				274	pounds
LSD 5%				27.7	

1961 Mulches

Black polyethylene, two different bark mulches, straw mulch and the check were compared in 1961 at Lewiston. One of the bark materials had been supplemented with what appeared to be a nitrogenous fertilizer. This was not well mixed and subsequently it caused some destruction of the plants. Burpees Hybrid and Gold Cup 55 were the two varieties used. Both are classified as 82-day varieties.

The plants were put in the field June 8, almost 2 weeks later than those of previous and subsequent experiments. This season was one of the hottest on record for the Lewiston area. The late planting, followed by extremely hot weather, no doubt accounts for the inconsistency of the 1961 data as compared with those of other years. Harvest began August 5 and continued until approximately September 15. In spite of the trouble noted above with

Figure 1. General view of Lewiston plots showing differences in various mulches. Four rows in right foreground are mulched with plastic; row on left not mulched; light-colored rows mulched with straw.

Table 4. Melon harvest over a 5-week period expressed in weekly percentages of season's total. Lewiston, Idaho, 1961.

Treatments	Week of Harvest				
	1	2	3	4	5
	%	%	%	%	%
Black Plastic	7.0	21.4	38.9	17.8	14.9
Bark 1	9.6	18.9	35.1	19.5	16.8
Bark 2	4.8	10.9	30.5	22.7	31.1
Straw	4.0	14.5	31.1	23.1	27.3
Check 1	6.9	17.3	39.1	16.5	20.2
Check 2	6.2	19.5	43.3	17.6	13.4

one of the bark materials and an outbreak of what appeared to be **Cephalosporium** die-back, yields were fairly representative, as the season was an especially good one for melons.

Percentage of total yields for the four treatments and two checks, expressed weekly over the 5-week period, are shown in Table 4.

It is apparent from Table 4 that not much difference in earliness exists among treatments. In all cases, harvest peak came during the third harvest week, with the exception of bark 2 mulch. There were no great differences in total yield among treatments, except in the bark mulch where some loss of plants reduced yield slightly.

1962 Mulches

The two varieties used were Hales Best and Burpees Hybrid. Plants were grown as previously and were set in the field on May 28. The season, as contrasted with 1961, was cool. Fruit quality was poor, although good average yields were obtained. The treatments were black plastic, an aluminized plastic, straw mulch and the check. Harvest started on August 10 and continued for 6 weeks. Yields from the four treatments, expressed in percentage per week of the total number of melons, are shown in Table 5.

Table 5. Melon harvest over a 7-week period expressed in weekly percentages of season's total. Lewiston, Idaho, 1962.

Treatments	Week of Harvest						
	1	2	3	4	5	6	7
	%	%	%	%	%	%	%
Aluminized plastic	0.1	0.7	19.7	38.6	11.6	6.0	23.2
Black plastic	0.0	1.4	32.9	32.3	9.1	10.3	14.0
Straw	0.0	0.0	5.0	34.0	20.0	16.0	25.0
Check	0.0	0.4	13.3	18.6	20.8	22.2	24.6

Table 6. Yields in number of melons, from 6 replicates of 2 varieties. Lewiston, Idaho, 1962.

Treatments	(No. of Melons)
Black Polyethylene	770 a*
Aluminized Polyethylene	718 a
Straw	100 b
Check	264 b
Varieties	
Hales Best	888 a
Burpees Hybrid	946 a

* Items followed by the same letter are not significantly different from each other.

Actual yields in number of melons from the six replicates of two varieties are shown in Table 6.

It is difficult to explain the low yields of melons from straw-mulched plots and from those where no mulch was applied. Some of the loss in straw-mulched plots might be attributed to lack of available nitrogen. However, these results are not in accord with those obtained in 1961, when the straw mulch resulted in higher yields than anything except the check. Temperatures under the straw remained 6-7°F. lower than those under the plastic during the early part of the season and this insulating effect might have been responsible for poor growth. During the previous warm season temperature was not a factor. Soil temperatures in the check plots were slightly lower than the polyethylene plots but not as cool as under straw.

1963 Mulches

Mulch treatments consisted of clear, black and aluminized polyethylene, in addition to the check. Plants were set in the field on May 24 and the same varieties were used as in 1962, Hales Best and Burpees Hybrid. Melons were harvested over a 5-week period, beginning August 10. The average number of melons per block of six replicates is shown in Table 7.

While the total yields shown in Table 7 are not strikingly different except for the check, there are marked differences in early yields. The peak yield from aluminized and black plastics and the check came during the fourth week of harvest. The second week was the most productive for the clear plastic. The clear polyethylene plots produced more melons the first week than the total of the other three treatments for the same period and almost doubled the next nearest treatment during the same period. These treatment-week interactions are all highly significant and show that the treatments increased earliness.

Table 7. Number of melons harvested per plot of six replicates (2 varieties) from four mulch treatments over a 5-week harvest period. Lewiston, Idaho, 1963.

Treatment	Week of Harvest					
	1	2	3	4	5	Total
			(No. of Melons)			
Aluminized plastic	59	111	203	462	141	976 b*
Black plastic	96	219	229	380	139	1063 ab
Clear plastic	194	384	190	309	161	1238 a
Check	132	77	103	202	107	502 c

* Items followed by the same letter suffix are not significantly different at 5% level.

1964 Mulches

An experiment similar to 1963 was set up for 1964, with direct seeding used instead of transplants. A drenching rain, in which 2 inches fell within an hour or so, packed the soil to the extent that emergence was negligible, making it necessary to abandon the experiment. In previous work of a limited nature, when seed had been planted through the mulch, results were not always satisfactory.

Row Covers

Plant protectors of various sorts have been used for years on an individual plant basis. Such protectors, made usually of a translucent, parchment-like material, are placed over individual plants at transplanting time or over a planted "hill" of melons, corn, cucumber, or other vegetables. In this manner, developing plants are protected from low temperatures and damaging wind. The protectors become less and less important as the plant grows. A certain amount of earliness is realized by this practice which is adaptable to either home garden or commercial enterprise. Glass jars, glass frames or muslin covered frames also have been used to afford protection and promote earliness in vegetable production.

At the Lewiston station in 1962, some row covers were developed for use with cucumbers and muskmelons. Some idea of their construction may be obtained from Figure 2. They were made using 1"x2"x12' wooden strips along the side, with ¼"x2"x6' spruce strips for bows. Spruce bends if wet and it may be kept in position by stretching wires between the two side strips. These frames were placed along the row about 4 feet apart and a continuous roll of 4-mil clear plastic 7 feet wide stretched over them and stapled in place. Cardboard strips, such as are used by upholsterers, were placed over the plastic where it was stapled to the wood-

en frame. Edges of the plastic were covered with soil to prevent damage from wind.

A 6-foot-wide strip of soil was rototilled and fumigated to prevent excessive weed population. Planting was done and irrigation rills were prepared before the covers were placed over the rows.

It was necessary to ventilate the row covers as the days became warmer, especially on bright days. This was done by lifting the leeward edge of the plastic between the frames and supporting it open. The frames or plastic were removed entirely by the middle of June.

Actual yield comparisons between covered plants and non-covered plants were not made. Cucumbers planted with covers in 1962 greatly preceded those with no cover. Approximately 1 ton of cucumbers was picked from a 250-foot row of the cover-treated crop before July 15. With muskmelons the differences were not as great.

In the 2 years that the row covers were used, both transplants and seed were used in starting the crop. Seed seemed to be more satisfactory since temperatures are high under the plastic and even with irrigation it is difficult to prevent transplants from wilting. Some of this difficulty stems from the fact that the transplants were grown in peat pots with a medium of ½ sand and ½ peat moss. The plants derive most of their moisture from the

Figure 2. A continuous strip of polyethylene is placed over wooden frames. Edges of plastic are covered with soil to prevent wind damage.

potting medium for the first few days in the field and this medium is difficult to keep moist. With other media or with plants more easily adapted to transplanting, this difficulty might be lessened.

DISCUSSION

The use of plastics for mulching vegetable crops is an established practice. It is particularly useful in producing an early crop of some of our more important vegetables. For home gardeners, some of these plastics make possible the production of long-season crops in regions where they might otherwise be damaged by frost. While research reported here does not deal with weed problems, plastic mulches will keep weeds at a minimum and preclude the need for cultivation in the row.

NR 2404 5M—10-66