

Extended Season Lettuce Production

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Center for Crop Diversification Fact Sheet

Lettuce (*Lactuca sativa* L.) is a high-value cool-season crop with many retail and wholesale markets. Optimal temperature for growth is 60-65 degrees F, yet it may be possible to grow a lettuce crop year-round in the Mid-Atlantic region using a combination of suitable varieties and season extension technology (Figure 1).

Lettuce is the second most widely grown crop within high tunnels in the United States behind tomatoes and there are several types. Bibb and romaine head lettuce are two popular head lettuces. Bibb lettuce, also known as butterhead lettuce, has loose, open heads with soft or tender leaves. Bibb lettuce is an excellent choice for expanded local production because it does not ship well over long distances. Romaine, also known as cos, has long, firm leaves with prominent midribs, a more upright growth pattern and produces a very dense head (Figure 2). Both types of head lettuces can be harvested at the baby stage for specialty markets.

Transplant Production

For high tunnel lettuce production, the crop should be established from transplants, which allow for earlier and more uniform harvest. Pelletized seed, if available, should be chosen. Suitable containers such as 96- or 128-cell plug trays are used (Figure 3). Optimal temperature for transplant growth is 65-75°F, and 200 ppm nitrogen solution is used to fertilize the growing transplants each week. The plugs are ready to be transplanted approximately 28 days from seeding.

Planting Within a High Tunnel

Lettuce can be established within a high tunnel every season of the year. Under optimal conditions, 50-75 days from seeding will be needed before harvest, variety and weather dependent. When planted later in the year, the length of time from seeding to harvest increases. However,



Figure 1. High tunnels can be used for extended season head lettuce production.



Figure 2. Bibb (left) and Romaine (right) lettuce for extended season production.



Figure 3. Head lettuce should be established as transplants for early and uniform maturity.



head lettuce for winter production should be planted before mid-November in West Virginia. Sequential planting for

Recommended Varieties

Table 1. List of lettuce cultivars recommended for high tunnel production in West Virginia.

Cultivar	Days to maturity ^z	Description
Bibb types:		
Alkindus	60	Red bibb
Nancy	52	Boston bibb type
Rex	50	Hydroponic type with good heat tolerance
Skyphos	47	Red buttercrunch
Red Cross	48	Red buttercrunch with heat tolerance
Buttercrunch	46	Green bibb
Batavian types:		
Nevada	48	Green batavian; heat & cold tolerant
Magenta	48	Reddish green batavian
Cherokee	48	Red batavian
Romaine types:		
Dov	76	Heat tolerant summer romaine for extended season production
Monte Carlo	53	Green romaine
Jericho	58	Green romaine with heat tolerance
Coastal Star	58	Green romaine with heat tolerance
Breen	45	Red mini romaine
Green Forest	56	Green romaine
Salvius	58	Green romaine
Winter Density	54	Dark green romaine
Pomegranate Crunch	54	Miniature red romaine

^zFrom direct seeding under optimal conditions.

uninterrupted supply can be done every two to three weeks until mid- to late November. Bibb lettuce should be spaced 8-10 inches apart within the row and 8-12 inches between rows. Romaine and Batavian lettuce (a summer crisp type that tolerates hot weather) should be spaced 10-12 inches between plants and between rows on the bed. Typically a three- to four-row bed is optimal for lettuce production within a high tunnel. Plastic mulch is recommended since the mulch will be effective in regulating soil temperature and reducing soil moisture evaporation. In addition, the mulch helps to reduce soilborne diseases and weeds.

Black plastic mulch (embossed) is recommended for early spring, fall and winter lettuce production, while white or reflective mulch should be used for summer lettuce production (Figure 4).

Lettuce requires frequent irrigation for optimal yield and quality. Drip irrigation with medium flow drip tape should be used for full season lettuce production.

Each bed should have two to three drip line laterals. A six- to nine-hour irrigation cycle per week should be followed depending on the season of the year. Beginning in mid- to late November, irrigation can be curtailed.

Nutrient Management

The optimal pH for lettuce production is 6.5-6.8. Approximately 1 pound of actual nitrogen (N) per 1,000 ft² is applied prior to planting lettuce. The remaining 0.5 lbs. of actual N per 1,000 ft² of bed space can be applied through the drip system over the remaining four to six weeks of growth. Phosphorus (P) and potassium applications should be based on the most recent soil test. If phosphorus and potassium levels are optimal, fertilizer such as calcium nitrate (15.5-0-0) is recommended for lettuce production.

Six pounds per 1,000 ft² can be applied prior to planting, and the remaining 3.2 lbs. injected in the irrigation water over a four- to six-week period.



Figure 4. Shade cloth (30-50%) and white polyethylene plastic mulch are used to grow lettuce in mid-summer, while black plastic mulch and row covers are used for spring and winter lettuce production.

Table 2. Yield and quality of cold weather lettuce trials 2016-17.

Variety	Type	Wt./head (lbs.)	Diameter (in.)	Quality	Marketable (%)
Green Forest	<i>Romaine</i>	1.1	10.5	4.8	72
Truchas	<i>Romaine</i>	0.6	9.2	4.6	56
Monte Carlo	<i>Romaine</i>	1.2	10.3	5	83
Bambi	<i>Romaine</i>	0.8	8.2	4.2	89
Dragoon	<i>Romaine</i>	0.8	10.4	3.7	61
Muir	<i>Batavian</i>	1.1	11.9	4.4	78
Concept	<i>Batavian</i>	1.1	11.7	4.6	72
Nevada	<i>Batavian</i>	0.9	10.7	4.1	72
Magenta	<i>Batavian</i>	1.3	11.3	4.8	89
Cherokee	<i>Batavian</i>	0.8	11.3	5	89
Ilema	<i>Lollo rosa</i>	0.7	11.3	4.6	72
Mirlo	<i>Bibb</i>	1.1	11	4.5	92
Red Cross	<i>Bibb</i>	0.8	12.6	5	89
Skyphos	<i>Bibb</i>	0.7	10.6	5	78
Buttercrunch	<i>Bibb</i>	0.9	10.2	3.7	94
Green Star	<i>Leaf</i>	1	12.3	3.5	84
Green Sweet Crisp	<i>Salanova</i>	1	12.5	4.4	94
<i>Standard error</i>		<i>0.03</i>	<i>0.2</i>	<i>0.1</i>	<i>3</i>

High Tunnel Temperature Management

Venting should be utilized to reach a temperature of 65-75 degrees F, the optimal temperature for production of head lettuce. A 30-50% shade cloth can be used to reduce air temperature within the high tunnel, as lettuces often bolt (produce a seedstalk), develop tipburn or become bitter when air temperatures exceed 85 degrees F for extended periods of time. Summer lettuce should be grown on white plastic mulch and irrigated daily. Most head lettuces will grow if the temperature is greater than 40 degrees F. When the minimum (night) temperatures are forecast to be lower

than 40 degrees F, row covers should be applied to the lettuce crop. A 0.8-1.0 oz./yd² row cover is recommended to modify temperatures for lettuce growth. The following morning (temperature permitting), the row covers can be removed. Avoid growing lettuce for extended periods of time under row covers as this will often produce tipburn symptoms on the leaves.

Pest Management

Common pests of lettuce and other leafy greens include aphids, slugs and grasshoppers. Routine scouting should be done to detect aphid “hot spots.”

Economics of High Tunnel Head Lettuce Production

Table 3. High tunnel head lettuce enterprise budget per 1,000 ft² (≈1,980 heads).

Production Expense	Unit	Quantity	Price (\$)	Labor (rate/h)	Type	Hours	Total Costs (\$)
Variable Costs:							
Pre-planting:							
Soil test	Entire high tunnel		12	10	M	0.5	17
Tillage			5	10	M	0.5	10
Raised bed formation				10	M	3	30
Fertilizer and lime		1.3 lbs. N	7.8	10	M	0.5	12.8
Plastic mulch		189 linear ft.	7.56	10	M	1.5	22.56
Irrigation drip tape		189 linear ft.	4.7	10	M	0.5	9.7
Plant Costs:							
Planting trays	128 plug trays	1 case	89				89
Transplant labor	1980 plugs	15 trays		10	M	17	170
Seed (pelleted)	1000 seeds	5000	1.95				3.9
Rooting media	3.8 ft ³	1 bale	19				21
Starter fertilizer	20-20-20	1 lb.	2.5				2.5
Production Costs:							
Insect/Slug control		6 sprays		10	M	3	90.9
Fungicide	Oxidate	18 ozs.	9.28	10	M	3	39.28
Irrigation/Fertigation	15.5-0-0	6 lbs.	10				10
(Quick Hoops)	pipe	38 pipe	2.5	10	M	2	-114.5
Row covers	roll	1	67				67
(Shade cloth)	roll	1890 ft ²	0.25/ft ²				-472.5
Anchor pins	box	500 pins/box	35				12
Fuel and oil	gallons	10	3.5				35
Temp. mgt ^z .	hrs.	1.2 h/week		10		7.5	75
Transplanting	hrs.			10		8	80
Harvesting Costs:							
Cutting/washing	hrs.	1 h/bed		10		2.2	22
Postharvest Costs:							
Boxes/Lugs	lugs	12	14				168
Total Costs							
							987.64
Total Revenue^y							
	heads	1782	1.5				2673
		1782	2				3564
Net Revenue							1685.36
							2576.36

^zVenting labor varies with growing season

^yAssumes 90% marketable yield

These areas can be treated before the pest invades the rest of the crop. There are several organic and “soft” pesticides for aphid control.

Slugs can be controlled with iron phosphate baits (growers should consult their local extension office or the [Mid-Atlantic Commercial Vegetable Production Recommendations](#) for more information), while larger insects such as grasshoppers or crickets can be controlled with insect exclusion screens.

Harvest and Postharvest Handling

Lettuce is very perishable and must be harvested very carefully. Bibb and romaine lettuce are ready to harvest when the head diameter is 6-12 inches wide. Fresh weight of the head will range from 1/4 to 2 lbs. Individual heads are hand-cut and any discolored leaves removed. Harvest containers such as plastic lugs are ideal for harvesting and storing lettuce (Figure 5). Individual heads can be washed prior to marketing. If the lettuce is stored, the optimal temperature is 32-36 degrees F with 95% relative humidity.



Figure 5. Plastic harvest lugs are used to harvest, wash and store head lettuce.

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