

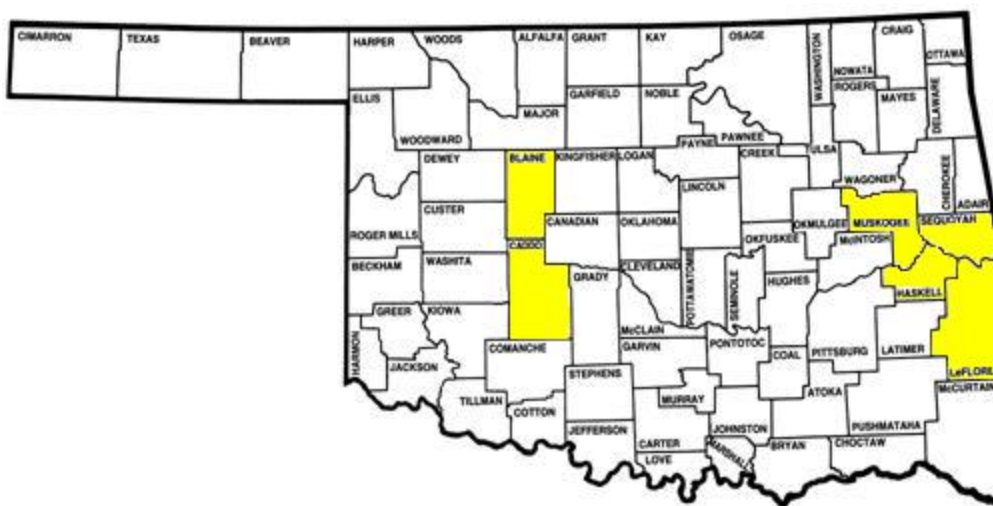
# Crop Profile for Oklahoma Spinach

Prepared: October 31, 2007

## General Production Information

- 2006 Oklahoma Acreage 2200 acres
- Average yearly acreage for Oklahoma 2400 acres
- Oklahoma rank in national spinach production is not reported.
- Average value of spinach production in Oklahoma for 2006 \$1200/a
- Counties spinach grown in Oklahoma Leflore, Haskell, Sequoyah, Muskogee, Caddo, and Blaine.
- Spinach in Oklahoma – 95 % used as Processed Spinach not fresh.
- Other production information unique to Oklahoma Spinach (Oklahoma grows a spring plant from January 1 to February 14 and harvest April 25 to May 10), (fall planted August 25 to September 10 and harvested November 1 to December 15) and (overwinter planted October 1 to December 1 and harvested March 25 to April 25) crop.

## Production Regions



## Critical Points and Common Problems

- Considered a cool season crop for Oklahoma with production periods in spring, fall, and over-winter

- Production includes tops for fresh and processing markets
- High levels of vitamins and minerals
- Bolting (flowering) is undesirable and is caused by long days (day-length longer than 12 hours, be certain to select bolt-resistant cultivars for spring production)
- Leaf textures include: Smooth leaves, savoy (crinkled leaves), and semi-savoy
- Soil preparation should include destruction of weeds and crop debris from previous crops, any debris that ends up in the harvested product can cause serious problems

### **Varieties**

- Recommended: For fall & over-winter (short days) use: Evergreen, Fall Green, Wintergreen, F 380, F 415, Samish; For spring (long days) and fall & over-winter use: Baker, Bolero, Catalina, Olympia

### **Soil Preference**

- Well drained light textured deep sandy loam, or silt loam soils pH of 6.0 to 6.8, lime at pH levels below 6.0

### **Ideal Growing Conditions**

- Cool season crop best grown in spring and fall with cool day (75°F) and night temps (40°F) optimum temps of 60 to 65°F, crop can tolerate lows down into the teens if temps change over 2 or 3 days, but not drastic temperature changes that occur in hours

### **Establishment**

- Direct seeded
- Establish by direct seeding in soils >35°F in spring (mid February-Mid April) and <90°F in fall (September), Over-winter (November-December)
- Seeding depth = ¼ to ½ inch deep
- Seed per lb = 45,000 seeds/lb
- Seeding rate depends on what row and bed configurations will be used for the harvester
  - Hand-harvested 30 to 36 inches between two row beds and in-row spacing of 3 to 6 seeds/foot of row
    - Will need 2 to 4 2/3 lb seed/acre
  - Machine-harvested provide 4 rows per 6 foot wide area, rows can be 12 to 16 inches apart use 6-8 seeds/foot of row
    - Will need 4 to 5 1/6 lb of seed/acre

### **Fertilization**

- Rates given as actual lb/acre of N-P-K
  - (Application rates should be based upon soil test results)
- Overall rate 125-75-200 lb/acre of N-P-K
- Nitrogen
  - 75 lb/acre broadcast pre-plant incorporated
  - 50 lb/acre top-dress 3 weeks after emergence

- Additional N may be needed for desirable color and rapid growth
- If multiple cuttings are to be made top-dress immediately following harvest
- Phosphorus
  - Up to 75 lb/acre broadcast pre-plant incorporated
- Potassium
  - Up to 200 lb/acre broadcast pre-plant incorporated

### **Irrigation**

- 12-15" required
  - Irrigate throughout the growing season critical for establishment, provide on a uniform basis during the remainder of the growing season

### **Harvest**

- Days after planting = 50-90 days
- Harvest when leaves are still young and tender
- Harvest method:
  - Normal method = hand or machine
    - Cut by hand for small acreages or use specialized cutter that can cut and load trucks or containers for larger acreages
    - Leaves for fresh market should be clean and free of any discolored leaves and can be hand bunched for local markets
    - Leaves for processing will be loaded into bulk-bins or directly into trucks for transport to the plant
- Containers
  - Bulk for machine harvest
  - Bushel baskets, crate-carton (1 2/5 bu, 32 lb), Crate-basket (1 bu, 25 lb) carton holding 24 12oz bags (20 lb), carton holding 12 10oz bags (8 lb) for hand harvested
- Grades for fresh leaves = U.S. Extra No. 1, U.S. No. 1, U.S. Commercial
- Based upon: Color, turgidity, cleanness, trimming, and freedom from seed-stems, coarse stalks, and other defects
- Grades can be found at: <http://www.ams.usda.gov/standards/vegfm.htm>
- Anticipated yield/acre = 12,000 to 16,000 lb/acre for processing, 500 to 650 bu/acre for fresh

### **Shipping and Storage Conditions**

- R.H. 95-100%
- Storage temps 32°F for 10-14 days

### **Helpful information**

- Immediate destruction of the crop residue (disking or plowing) after harvest will reduce the potential for white rust to build up in the field, this along with a three to five year rotation program to an unrelated crop is recommended to reduce the incidence of all soil-borne disease problems
- Post-harvest care of tops is particularly important to maintain quality, be sure to cool as soon as possible at 32° F and 95-100% R.H.

- OSU Fact Sheet F-6031 on Greens Production available at: <http://pods.dasnr.okstate.edu/docushare/dsweb/View/Collection-228>
- White Rust is a major disease for this crop and is endemic to the state, cultivars such as Fall Green, Evergreen, Wintergreen, F 380, and F 415 have high levels of tolerance to white rust and should be used when possible to help manage the disease
- Bolting (flowering) is induced by long days (12 + hours) be certain to use bolt resistant cultivars in the spring, check with seed source regarding bolting resistance
- Spinach is very sensitive to many herbicides, be certain to rigorously follow label instructions when using herbicides for weed control in this crop

## Worker Activities

Oklahoma spinach is not transplanted and is planted with typical farm equipment. The only opportunity for worker contact is hand hoeing. Using hoeing for weed control is very common due to the sensitivity of spinach to most herbicides and the desire to keep the crop as weed free as possible. Hand spraying is not used in Oklahoma spinach production. The majority of Oklahoma spinach is used for processed spinach (canned) and is mechanically harvested.

## Insects Pests

- Major insects include:
  - Aphids
  - Cabbage looper
  - Army worms

## Foliage Feeders

Green Peach Aphid (*Myzus persicae*)

Cow pea Aphid (*Aphis craccivora*)

## Controls

**Cultural** – Prevent spinach crop over-laps when possible, date of planting

**Biological** – lady bugs

**Chemical** – Is as follows in the table below.

Group	Trade Name	Common Name	Rate per Acre
1B	Lannate SP*	methomyl	1 Lb.
3	Pounce 3.2 *EC	permethrin	4 oz.
3	Fury*	zeta-cypermethrin	4.3 oz
3	Capture*	bifenthrin	6.4 oz.
4A	Admire 2F	imidacloprid	24 oz.
4A	Provado	imidacloprid	3.75 ozs
4A	Assail	acetamiprid	3-4 oz
3	Azadirect	Neem extracts	2 lbs

\*Restricted Use Pesticide

## Caterpillars

Armyworm (*Spodoptera spp.*),

Hawaiian beet webworm (*Spoladea recurvalis*),

Cabbage loopers (*Trichoplusia ni*)

Overwintered cutworms spring cutworms and corn earworms (*Helicoverpa zea*)

## Controls

**Cultural** – none

**Biological** – parasites, predators, b.t

**Chemical** – Is as follows in the table.

Group	Trade Name	Common Name	Rate per Acre
1B	Lannate SP*	methomyl	1 lb.
18A	Intrepid	methoxyfenozide	10 OZS
5	Spintor	spinosad	4 ozs
3	Pounce 3.2 EC*	permethrin	4 oz.

3	Capture*	bifenthrin	6.4 oz.
3	Mustang*	<i>zeta</i> - cypermethrin	4.3 ozs
5	Pyganic EC 5.0	Pyrethrins	18 oz
3	Azadirect	Neem extracts	2 lbs.
11B2	Dipel DF	Bacillus thuringiensis	1 lb.

## Thrips

(*Frankliniella spp*)

### Controls

**Cultural** – none

**Biological** – predators

**Chemical** – Is as follows in the table below.

Group	Trade Name	Common Name	Rate per Acre
1B	Lannate SP*	Methomyl	1 lb.
3	Pounce 3.2 *EC	Permethrin	4 oz.
3	Fury*	Zeta-cypermethrin	4.3 oz.
3	Capture*	Bifenthrin	6.4 oz.
4A	Admire 2F	Imidacloprid	24 oz.
5	Pyganic EC 5.0	Pyrethrins	18 oz.
3	Azadirect	Neem extracts	2 lbs.
11B2	Safer Soap	Fatty acid soap	

## Diseases

- Major diseases include:
  - White rust (*albugo occidentalis*)
  - Cercospora leaf spot (*Cercospora beticola*)
  - Anthracnose (*Colletotrichum dematium*)
  - Cladosporium leaf spot (*Cladosporium* sp.)
  - Downy mildew (*Peronospora farinosa*)
  - Stemphylium leaf spot (*Stemphylium botryosum*)
  - Damping off (*Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*)
  - Viral diseases including cucumber mosaic virus, beet curly top, beet western yellows (Spread by aphids and leafhoppers)

## Pythium Damping Off

(*Pythium ultimum*)

### Controls

**Cultural** - none

**Biological** – none

**Chemical** – Is as follows in the table below.

Trade Name	Common Name	Rate of Product	MOA	Comments
Ridomil Gold 4E	Mefenoxam	1-2 pt.	4	Broadcast suggested rate or band over the seed tow and incorporate before or water in after planting.
Ultra Flourish 2E	Mefenoxam	2-4 pt.	4	Broadcast suggested rate or band over the seed tow and incorporate before or water in after planting.

## Rhizoctonia Root Rot and Damping Off

(*Rhizoctonia solani*)

### Controls

**Cultural** – none

**Biological** – none

**Chemical** – Is as follows in the table below.

Trade Name	Common Name	Rate of Product	MOA	Comments
Quadris 2.08F	Azoxystrobin	.4 -.8 oz./ 1000 ft. row	11	Apply in furrow at planting or as a band over the row after emergence.
Amistar 80DF	Azoxystrobin	.12 -.25 oz./ 1000 ft. row	11	Apply in furrow at planting or as a band over the row after emergence.

## White Rust

*(Albugo occidentalis)*

Symptoms of white rust begin as chlorotic spots on the upper leaf surface. As lesions develop, small, white, blister-like pustules (sori) are produced on the underside of the infected leaves, rendering them unmarketable.

White Rust is a major disease for this crop and is endemic to the state, cultivars such as Fall Green, Evergreen, Wintergreen, F 380, and F 415 have high levels of tolerance to white rust and should be used when possible to help manage the disease

## Controls

**Cultural** – Immediate destruction of the crop residue (disking or plowing) after harvest will reduce the potential for white rust to build up in the field, this along with a three to five year rotation program to an unrelated crop is recommended to reduce the incidence of all soil-borne disease problems

**Biological** – none

**Chemical** – Is as follows in the table below.

Trade Name	Common Name	Rate of Product	MOA	Comments
Quadris 2.08F	Azoxystrobin	6.2 - 15.4 oz.	11	Begin applications when plants are ? and alternate with a fungicide in a different MOA on 7-day intervals.

Amistar 80DF	Azoxystrobin	2-5 oz.	11	Begin applications when plants are ? and alternate with a fungicide in a different MOA on 7-day intervals.
Aliette 80 WDG	Fosetyl –AL	2-5 lb.	21	Apply on 7-day intervals beginning when plants are small. Do not mix with copper fungicides. <b>May cause leaf injury.</b>
Kocide DF or 101	Copper hydroxide	2-3 lb.	M	Begin applications when plants are small and repeat on 7-day intervals. <b>May cause leaf injury.</b>
Kocide 2000	Copper hydroxide	1.5 - 2.25 lb.	M	Begin applications when plants are small and repeat on 7-day intervals. <b>May cause leaf injury.</b>
Cuprofix Dispress	Copper sulfate	2.5 -4 lb.	M	Apply on 7 to 10 day intervals. <b>May cause leaf injury.</b>
Ridomil Gold/Copper 65 W	Mefenoxam + copper hydroxide	2.5 lb.	4 + M	Apply following use of Ridomil Gold at planting on 14-day intervals. Do not apply within 21 days of harvest.
Ridomil Gold 4E	Mefenoxam	.25 pt.	4	Following use of mefenoxam at planting shank in or side dress suggested rates after each of up to two cuttings.
Ultra Flourish 2E	Mefenoxam	.5 pt.	4	Following use of mefenoxam at planting shank in or side dress suggested rates after each of up to two cuttings.

Ridomil Gold 2.5G	Mefenoxam	5 lb.	4	Following use of mefenoxam at planting shank in or side dress suggested rates after each of up to two cuttings.
Cabrio 20EG	Pyraclostrobin	8 -12 oz.	11	Apply on 7 to 14-day intervals. Make up to 2 sequential applications before alternating with a fungicide from a different mode of action.

## Blue Mold (Downy Mildew)

*(Peronospora tabacina)*

### Controls

**Cultural** – none

**Biological** – none

**Chemical** – Is as follows in the table below.

Trade Name	Common Name	Rate of Product	MOA	Comments
Quadris 2.08F	Azoxystrobin	6.2 - 15.4 oz.	11	Begin applications when plants are ? and alternate with a fungicide in a different MOA on 7-day intervals.
Amistar 80DF	Azoxystrobin	2-5 oz.	11	Begin applications when plants are ? and alternate with a fungicide in a different MOA on 7-day intervals.
Aliette 80 WDG	Fosetyl –AL	2-5 lb.	21	Apply on 7-day intervals beginning when plants are small. Do not mix with copper

				fungicides. <b>May cause leaf injury.</b>
Kocide DF or 101	Copper hydroxide	2-3 lb.	M	Begin applications when plants are small and repeat on 7-day intervals. <b>May cause leaf injury.</b>
Kocide 2000	Copper hydroxide	1.5 - 2.25 lb.	M	Begin applications when plants are small and repeat on 7-day intervals. <b>May cause leaf injury.</b>
Cuprofix Dispress	Copper sulfate	2.5 -4 lb.	M	Apply on 7 to 10 day intervals. <b>May cause leaf injury.</b>
Ridomil Gold/Copper 65 W	Mefenoxam + copper hydroxide	2.5 lb.	4 + M	Apply following use of Ridomil Gold at planting on 14-day intervals. Do not apply within 21 days of harvest.
Ridomil Gold 4E	Mefenoxam	.25 pt.	4	Following use of mefenoxam at planting shank in or side dress suggested rates after each of up to two cuttings.
Ultra Flourish 2E	Mefenoxam	.5 pt.	4	Following use of mefenoxam at planting shank in or side dress suggested rates after each of up to two cuttings.
Ridomil Gold 2.5G	Mefenoxam	5 lb.	4	Following use of mefenoxam at planting shank in or side dress suggested rates after each of up to two cuttings.
Cabrio 20EG	Pyraclostrobin	8 -12 oz.	11	Apply on 7 to 14-day intervals. Make up to 2 sequential applications before alternating with

				a fungicide from a different mode of action.
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## Anthracnose

(*Colletotrichum nicotianae*)

### Controls

**Cultural** – none

**Biological** – none

**Chemical** – listed below.

Trade Name	Common Name	Rate of Product	MOA	Comments
Quadris 2.08F	Azoxystrobin	6.2 - 15.4 oz.	11	Begin applications when plants are ? and alternate with a fungicide in a different MOA on 7-day intervals.
Amistar 80DF	Azoxystrobin	2-5 oz.	11	Begin applications when plants are ? and alternate with a fungicide in a different MOA on 7-day intervals.
Kocide DF or 101	Copper hydroxide	2-3 lb.	M	Begin applications when plants are small and repeat on 7-day intervals. <b>May cause leaf injury.</b>
Kocide 2000	Copper hydroxide	1.5 - 2.25 lb.	M	Begin applications when plants are small and repeat on 7-day intervals. <b>May cause leaf injury.</b>
Cuprofix Dispress	Copper sulfate	2.5 -4 lb.	M	Apply on 7 to 10 day intervals. <b>May cause leaf injury.</b>

Ridomil Gold/Copper 65 W	Mefenoxam + copper hydroxide	2.5 lb.	4 + M	Apply following use of Ridomil Gold at planting on 14-day intervals. Do not apply within 21 days of harvest.
Cabrio 20EG	Pyraclostrobin	8 -12 oz.	11	Apply on 7 to 14-day intervals. Make up to 2 sequential applications before alternating with a fungicide from a different mode of action.

## Weeds

Spinach is very sensitive to many herbicides, be certain to rigorously follow label instructions when using herbicides for weed control in this crop

### Annual Broadleaf Weeds

#### Postemergence

Trade Name	Common Name	Rate of Product	MOA	Comments
Spin-Aid 1.3 EC	phenmedipham	0.5 to 1 lb. a.i per acre	5	For processing spinach past the 4-6 true leaf stage. Do no spray within 40 days of harvest.

### Annual and Perennial Broadleaf Weeds

#### Postemergence

Trade Name	Common Name	Rate of Product	MOA	Comments
Stinger	clopyralid	0.06 to 0.12 a.i. per acre	4	Extreme growing conditions

				prior to, during, or after can increase the chance of crop damage.
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**Grass Weeds  
Postemergence**

<b>Trade Name</b>	<b>Common Name</b>	<b>Rate of Product</b>	<b>MOA</b>	<b>Comments</b>
Select 2EC	clethodim	0.09 to 0.125 lb. a.i. per acre. Always use 1% crop oil concentrate	1	Do not apply more than 8 fl. oz. per acre in a single application. 14 day preharvest interval.

**Emerged Annual and Perennial Grasses  
Postemergence**

<b>Trade Name</b>	<b>Common Name</b>	<b>Rate of Product</b>	<b>MOA</b>	<b>Comments</b>
Poast 1.5 L	Sethoxydim	0.09 to 0.28 lb a.i. per acre. Plus 1% crop oil concentrate	1	Apply to young actively growing grass. Do not apply within 15 days of harvest.

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