






Spartan 4F (sulfentrazone) PRE  | New plantings: 3.3-9.0 fl. oz. per acre. Established plantings: 4.5-12.0 fl. oz. per acre. *New plantings:* Apply after planting before weeds and mint emerge. *Established plantings:* Apply to established mint when it is dormant, in the fall after postharvest cultivation, and/or in the spring after cultivation. *Renovation applications:* Up to 8 fl. oz. per acre can be applied at dormancy followed by up to 4 fl. oz. per acre 1-3 days after the first harvest. Dormant and postharvest applications must be at least 100 days apart. Use lower rates on coarse soils with low organic matter. Rainfall or irrigation is required to move herbicide into the soil. Application may injure crop as mint emerges. Application to emerged mint will result in severe injury. Do not exceed 12 fl. oz. per 12-month period. Do not apply to mint grown on sands with less than 1% organic matter. REI: 12-hour. PHI: 92-day for dormant and new planting applications, 55-day for renovation applications. HRAC 14.

Stinger (3) (clopyralid) POST  | 0.33-1.0 pt. per acre. Use 4 fl. oz. of NIS per 25 gals. of spray solution. Apply up to 0.5 pt. in spring or up to 1 pt. in fall. Controls mainly composites and nightshade. To control Canada thistle in spring, apply before bud stage. Do not use mint straw, hay, or spent hay for compost or mulch and do not dispose of on land to be rotated to broadleaf crops due to herbicide remaining in mint hay or straw that will injure broadleaf plants. Do not exceed 1 pt. per acre per growing season. REI: 12-hour. PHI: 45-day. HRAC 04.

Thistrol (2L) (MCPB) POST  | 1-2 pts. per acre. Apply in spring after mint emerges to suppress broadleaf weeds, or apply in fall to control winter annuals. May injure mint. Oil yields may be reduced if mint is more than 6 inches tall at the time of application. Bindweed suppression is best with spring application when weeds are 6-8 inches long. REI: 24-hour. PHI: 40-day. HRAC 04.

trifluralin products (trifluralin) PRE   | Apply 1.0-1.5 pt. per acre of 4 lb. per gal. trifluralin to established, dormant or semi-dormant mint, late winter to spring or in the fall after harvest prior to emergence of targeted weed species. Must be incorporated mechanically or by 0.5 in. rainfall or irrigation within 3 days of application. REI: 12-hour. HRAC 03.

Okra – Horticulture

Major update by Ben Phillips, Liz Maynard – Oct 2020
Reviewed by Liz Maynard – Aug 2021

Crop Description

Okra (*Abelmoschus esculentus*) is a subtropical plant related to hibiscus that is grown for its young green fruit. Okra requires warm weather for best growth. Some varieties have many small spines, similar to vine crops, which can irritate the skin when harvesting. There are also spineless varieties and red-fruited varieties. Though okra is often listed on pesticide labels along with eggplants, peppers, and tomatoes, they are not a related species and share few pests.

Planting and Spacing

Seed 12 to 18 inches apart in rows 36 inches apart. Seed only after the soil has warmed to 65° F to 70° F for several days. Black plastic mulch with drip irrigation will increase yields. Transplants can be used for early production.

Fertilizing

pH: Maintain a soil pH of 6.0 to 6.5. Okra is very sensitive to low pH soils.

Before planting, apply 40 pounds N per acre, 0 to 200 pounds P₂O₅ per acre, and 0 to 300 pounds K₂O per acre based on soil test results and recommendations from your state.

Sidedress with 40 pounds N per acre after the first harvest.

Harvesting

Okra should be harvested every 2 to 3 days to maintain optimal market size (2- to 4-inch long pods). Frequent harvesting increases overall yield since the plant will reset pods faster. Okra will yield 8,000 to 10,000 pounds per acre. Time from transplanting to harvest ranges between 50 to 65 days.

Okra – Diseases

Reviewed by Dan Egel – Sept 2021

Recommended Controls

Wilt of Multiple Crops - Fusarium Fungus

Non-Pesticide

Use disease-free seed and transplants. Avoid fields with a history of the disease. Rotate to non-Solanaceous, non-Cucurbit crops for >6 years. Use raised beds and mulch to improve drainage and reduce splashing. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Okra – Insects

Reviewed by Laura Ingwell, Marissa Schuh – Sept 2021

Recommended Controls

Aphids

Pesticide

Admire Pro (4.6SC) (imidacloprid) | 1.3-2.2 fl. oz. per acre foliar application, 7-14 fl. oz. per acre soil application. Do not exceed 6.7 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day for foliar applications, 21-day for soil applications. IRAC 04A.

Assail 30SG (acetamiprid) | 2.0-4.0 oz. per acre. Do not exceed 16 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 04A.

Beleaf (50SG) (flonicamid) | 2.8-4.28 oz. per acre. REI: 12-hour. PHI: 0-day. IRAC 29.

Closer SC (2) (sulfoxaflor) | 1.5-2 fl. oz. per acre. REI: 12-hour. PHI: 1-day. IRAC 04C.

Malathion 5EC (malathion) | Use 5EC and 57EC formulations at 1.5-1.9 pts. per acre. Do not exceed 5 applications per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 01B.

Movento (2SC) (spirotetramat) | 4-5 fl. oz. per acre. REI: 24-hour. PHI: 1-day. IRAC 23.

PQZ (1.87SC) (pyrfluquinazon) | 2.4-3.2 fl. oz. per acre. REI: 12-hour. PHI: 1-day. IRAC 09B.

Pyganic EC 5.0 II (0.41) (pyrethrins) | *Foliar applications:* 4.5-15.6 fl. oz. per acre. *Soil drench applications* (in greenhouses): 0.375 fl. oz. per 1,000 sq. ft. of growing media/soil. Do not exceed 15.61 fl. oz. per acre. Do not reapply within 3 days except under extreme pest pressure. REI: 12-hour. IRAC 03A. *OMRI-listed.*

Sefina Inscalis (0.43DC) (afidopyropen) | 3 fl. oz. per acre. REI: 12-hour. PHI: 0-day. IRAC 09D.

Sivanto 200 (1.67SL) (flupyradifurone) | 7-12 fl. oz. per acre foliar application, or 21-28 fl. oz. per acre soil application. REI: 4-hour. PHI: 1-day for foliar application, or 45-day for soil application. IRAC 04D.

Torac (1.29SC) (tolfenpyrad) | 17-21 fl. oz. per acre. Do not apply more than 42 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 21A, FRAC 39.

Transform WG (50) (sulfoxaflor) | 0.75-1.0 oz. per acre. Allow 7 days between applications. REI: 24-hour. PHI: 1-day. IRAC 04C.

Caterpillars

Pesticide

Brigade 2EC (bifenthrin) | For armyworms, fruitworms, and loopers. Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 12.8 fl. oz. per acre per season. Do not use 10DF, 10WP, or 10WSB formulations as they are not labeled for okra. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 03A. *RUP.*

Bt (*Bacillus thuringiensis*) products for caterpillars (*Bacillus thuringiensis aizawai* strain ABTS-1857, *Bacillus thuringiensis kurstaki* strain ABTS-351, *Bacillus thuringiensis kurstaki* strain EVB-113-19, *Bacillus thuringiensis kurstaki* strain SA-11) | For armyworms, fruitworms, and loopers. Various Bt products are available for control of young caterpillars (Agree, Biobit, Dipel, Javelin, etc.). Different Bt subspecies have different control properties. Check labels for rates, timing of application and required safety equipment. REI: 4-hour. PHI: See label. IRAC 11A.

Coragen (1.67SC) (chlorantraniliprole) | 3.5-7.5 fl. oz. per acre. For armyworms, fruitworms, and loopers. Can be applied as either a foliar application or via drip chemigation. Chemigation will provide up to 30 days of control. Do not exceed 15.4 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

Entrust SC (2) (spinosad) | For armyworms, fruitworms, and loopers. Use 2SC formulations at 1.5-8.0 fl. oz. per acre and do not exceed 29 fl. oz. per acre per season. Use 80WP formulations at 0.5-2.5 oz. per acre and do not exceed 9 oz. per acre per season. Allow 4 days between applications. REI: 4-hour. PHI: 1-day. IRAC 05. *OMRI-listed.*

Exirel (0.83SE) (cyantraniliprole) | 7-13.5 fl. oz. per acre. For armyworms, fruitworms, and loopers. Do not exceed 61.7 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 28.

Harvanta (0.42SL) (cyclaniliprole) | 10.9-16.4 fl. oz. per acre. For armyworms, fruitworms, and loopers. Use with adjuvant. Do not exceed 49.2 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

Mustang Maxx (0.8) (zeta-cypermethrin) | 2.24-4.0 fl. oz. per acre. For armyworms, fruitworms, and loopers. Allow 7 days between applications. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 03A. *RUP.*

Proclaim (5SG) (emamectin benzoate) | 2.4-4.8 oz. per acre. For armyworms, fruitworms, and loopers. Do not exceed 14.4 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 06. *RUP.*

Pyganic EC 5.0 II (0.41) (pyrethrins) | For armyworms, corn earworms, and fruitworms. *Foliar applications:* 4.5-15.6 fl. oz. per acre. *Soil drench applications* (in greenhouses): 0.375 fl. oz. per 1,000 sq. ft. of growing media/soil. Do not exceed 15.61 fl. oz. per acre. Do not reapply within 3 days except under extreme pest pressure. REI: 12-hour. IRAC 03A. *OMRI-listed.*

Radiant 1SC (spinetoram) | 5-10 fl. oz. per acre. For armyworms, fruitworms, and loopers. Do not exceed 34 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 05.

Rimon 0.83EC (novaluron) | 9-12 fl. oz. per acre. For armyworms, fruitworms, and loopers. Apply when majority of population is at egg hatch to second instar. Do not apply more than 36 fl. oz. per acre per year. REI: 12-hour. PHI: 1-day. IRAC 15.

Sevin XLR Plus (4SC) (carbaryl) | 1.0-1.5 qts. per acre. For fruitworms. Do not exceed 6 qts. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 01A.

Japanese Beetle

Pesticide

Brigade 2EC (bifenthrin) | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 12.8 fl. oz. per acre per season. Do not use 10DF, 10WP, or 10WSB formulations as they are not labeled for okra. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 03A. *RUP.*

EverGreen Pro 60-6 (L) (piperonyl butoxide, pyrethrins) | 2-12.6 fl. oz. per acre. REI: 12-hour. PHI: 0-day. IRAC UN, IRAC 03A.

Malathion 5EC (malathion) | Use 5EC and 57EC formulations at 1.5-1.9 pts. per acre. Do not exceed 5 applications per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 01B.

Pyganic EC 5.0 II (0.41) (pyrethrins) | *Foliar applications:* 4.5-15.6 fl. oz. per acre. *Soil drench applications* (in greenhouses): 0.375 fl. oz. per 1,000 sq. ft. of growing media/soil. Do not exceed 15.61 fl. oz. per acre. Do not reapply within 3 days except under extreme pest pressure. REI: 12-hour. IRAC 03A. *OMRI-listed.*

Mites

Pesticide

Acramite 50WS (bifenazate) | 0.75-1.0 lb. per acre. Do not exceed 1 application per season. REI: 12-hour. PHI: 3-day. IRAC UN.

Agri-Mek SC (0.7) (abamectin) | 1.75-3.5 fl. oz. per acre. REI: 12-hour. PHI: 7-day. IRAC 06. *RUP.*

Magister SC (1.7) (fenazaquin) | 24-36 fl. oz. per acre. Do not make more than one application per year. REI: 12-hour. PHI: 3-day. IRAC 21A, FRAC 39.

Onager Optek (1EC) (hexythiazox) | 12-24 fl. oz. per acre. Do not make more than one application per year. REI: 12-hour. PHI: 1-day. IRAC 10A.

Portal (0.4EC) (fenpyroximate) | 2 pints per acre. Allow 14 days between applications. Do not make more than 2 applications per year. REI: 12-hour. PHI: 1-day. IRAC 21A.

Pyganic EC 5.0 II (0.41) (pyrethrins) | *Foliar applications:* 4.5-15.6 fl. oz. per acre. *Soil drench applications* (in greenhouses): 0.375 fl. oz. per 1,000 sq. ft. of growing media/soil. Do not exceed 15.61 fl. oz. per acre. Do not reapply within 3 days except under extreme pest pressure. REI: 12-hour. IRAC 03A. *OMRI-listed.*

Zeal (72WP) (etoxazole) | 2-3 oz. per acre. Do not exceed 1 application per season. REI: 12-hour. PHI: 7-day. IRAC 10B.

Stink Bugs

Pesticide

Brigade 2EC (bifenthrin) | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 12.8 fl. oz. per acre per season. Do not use 10DF, 10WP, or 10WSB formulations as they are not labeled for okra. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 03A. *RUP.*

Mustang Maxx (0.8) (zeta-cypermethrin) | 2.24-4.0 fl. oz. per acre. REI: 12-hour. PHI: 1-day. IRAC 03A. *RUP*.

Pyganic EC 5.0 II (0.41) (pyrethrins) | *Foliar applications:* 4.5-15.6 fl. oz. per acre. *Soil drench applications* (in greenhouses): 0.375 fl. oz. per 1,000 sq. ft. of growing media/soil. Do not exceed 15.61 fl. oz. per acre. Do not reapply within 3 days except under extreme pest pressure. REI: 12-hour. IRAC 03A. *OMRI-listed*.

Sevin XLR Plus (4SC) (carbaryl) | 1.0-1.5 qts. per acre. Do not exceed 6 qts. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 01A.

Okra – Weeds

Reviewed by Stephen Meyers, Ben Phillips – Sept 2021

Recommended Controls

All Weeds

Okra is a warm-season crop that is nearly always started with transplants in Northern climates.

Postemergence herbicides for broadleaf weeds are limited, so it is important to include preemergence herbicides and mechanical control in the weed management plan. There are several herbicides labeled for the control of weeds preemergence, applied before crops are transplanted, or directed between the rows only after transplanting.

For specific weeds controlled by each herbicide, check the Relative Effectiveness of Herbicides for Vegetable Crops table.


Rates provided in the recommendations below are given for overall coverage. For a banded treatment, reduce amounts according to the portion of acre treated.


Non-Pesticide



A stale seedbed can be prepared prior to transplanting with flame weeding or very shallow cultivation to control emerged weeds, instead of herbicides. Okra can benefit from the soil warming properties of plastic mulch in addition to the in-row weed control it provides. Materials include landscape cloth/fabric, plastic, and biodegradable plastic. Straw mulch can delay growth by suppressing soil temperatures. Weeds between beds and along the edges of beds can be controlled with a combination of cultivation, mowing, or hand hoeing/pulling. Weeds along the edge of the mulches can be a particular challenge to avoid ripping the mulch. Some fresh



market plantings are often small enough to accommodate hand-hoeing or pulling. For larger plantings it may make more sense to mechanically cultivate with tow-able tools between plastic rows or between bare-soil rows.



Pesticide


Aim EC (2) (carfentrazone) POST  | 0.5-2.0 fl. oz. per acre. Apply prior to transplanting or apply between crop rows with hooded sprayer. Do not allow spray to contact crop. Use COC or NIS. Weeds must be actively growing and less than 4 inches tall. Do not exceed 6.1 fl. oz. per acre per season. REI: 12-hour. HRAC 14.


Callisto (40SC) (mesotrione) POST PRE  | 6 fl. oz. per acre. Band to row middles prior to weed emergence. Leave 1 foot over row or 6 inches on each side of row unsprayed. Do not apply directly over the planted okra row or severe injury may occur. Injury risk is greatest on coarse-textured soils (sand, sandy loam, or loamy sands). A postemergence hooded application can be made at 3 oz. per acre when okra is at least 3 inches tall at time of application. Add 0.25% NIS v/v to spray solution. Avoid any contact with okra plant foliage. Do not exceed 1 application and 6 oz. per acre per year. REI: 12-hour. PHI: 28-day. HRAC 27.


Caparol 4L (prometryn) POST PRE   | 1.5 pts. per acre. Apply as a post-directed spray when okra has 7-9 leaves and weeds are less than 2 inches tall. Do not exceed 3 pts. per acre per year. REI: 12-hour. PHI: 14-day. HRAC 05.

Dual Magnum (7.62EC) (s-metolachlor) PRE   | 1-2 pts. per acre. *Indiana, Michigan, Minnesota, and Ohio only. MI 24c exp. 12/31/21. MN 24c exp. 12/31/25. OH 24c exp. 12/31/22.* Apply to okra at least 4 inches tall before weeds emerge. Direct the spray to minimize contact with crop foliage, or apply only between crop rows. Do not incorporate. Do not exceed 2 pts. per acre or 1 application per crop per season. REI: 24-hour. PHI: 60-day. HRAC 15.

glyphosate products (glyphosate) POST   | 0.75-3.75 lbs. acid equivalent (ae) per acre. Use formulations containing 3 lbs. ae per gal. (4 lbs. isopropylamine salt per gal.) at 1-5 qts. per acre, or formulations containing 4.5 lbs. ae per gal. (5 lbs. potassium salt per gal) at 0.66-3.3 qts. per acre. Broadcast at least 3 days before transplanting, or apply between crop rows with hooded or shielded sprayers. Use low rate for annuals and higher rates for perennials. See label for suggested application volume and adjuvants. Remove herbicide residue from plastic mulch prior to transplanting. REI: 4-hour to 12-hour. PHI: 14-day. HRAC 9.

Poast (1.5EC) (sethoxydim) POST  | 1.0-1.5 pts. per acre. Use 1.0 qt. of COC per acre. Spray on actively growing grass. Use high rate on quackgrass. Do not exceed 5.5 pts. per acre per season. REI: 12-hour. PHI: 14-day. HRAC 01.

Sandea (75) (halosulfuron) POST PRE  | 0.5-1.0 oz. per acre. Apply between rows of transplanted crop. Use lower rates on coarse soils with low organic matter. Add 0.5-1.0 pt. of NIS per 25 gals. of spray solution if emerged weeds are present. Avoid contact of the herbicide with the crop. Avoid contact with surface of plastic mulch if present. *Effective against nutsedge*. Do not exceed 2 oz. per acre per 12-month period. REI: 12-hour. PHI: 30-day. HRAC 02.

trifluralin products (trifluralin) PRE  | 0.5-1.0 lb. a.i. per acre. Use 4EC formulations at 1-2 pts. per acre. Use 10G formulations at 5-10 lbs. per acre. Use low rate on soils with less than 2% organic matter. Broadcast and incorporate before transplanting. Not effective on muck or high organic matter soils. REI: 12-hour. HRAC 03.

Onions and Related Crops – Horticulture

Major update by Ben Phillips, Liz Maynard – Oct 2020
Reviewed by Liz Maynard – Aug 2021

Crop Description

Garlic (*Allium sativum*): There are two main types of garlic: softneck and hardneck. Hardneck types overwinter better in the Midwest, have a stronger flavor, and are easier to peel. Softneck types have a longer shelf-life, milder flavor, and smaller cloves. Elephant or great headed garlic (*A. ampeloprasum*) is grown like other garlic, but has a milder flavor.

Leek (*A. porrum*): Leeks do not bulb, but form a straight shank of layered leaves that stay white when buried with soil. They can be planted deeply and hilled to increase the length of the shank. There are nonhardy summer-harvested varieties and frost-tolerant fall-harvest varieties.

Onion (*A. cepa* var. *cepa*): Bulb onions include yellow, red, and white-skinned types, and within each of the colors, there are sweet varieties and pungent storage varieties. Bulb onions are categorized as long-day, intermediate-day, or short-day based on the day-length that stimulates bulbing. Long-day varieties grow best in the Midwest. Some intermediate-day onions can also do well in the Midwest. Sweet onions contain more sugar, and do not keep as well as pungent storage

onions. Any onion variety can also be used as a green onion, but *A. fistulosum* is a species that is commonly used for bunching that does not make a large bulb.

Shallot (*A. cepa* var. *aggregatum* or *A. ascalonicum*): Shallots form clusters of bulbs and are very winter hardy, like garlic. The torpedo-shaped bulbs are smaller than onions and have a milder flavor.

Planting and Spacing

Garlic: Plant in fall 6 to 8 weeks before ground freezes in rows 12 to 36 inches apart with cloves 3 to 6 inches apart in the row. Plant bulbs 3 to 4 inches deep, with top of clove twice the depth of the clove height. Garlic benefits from 2 to 4 inches of straw mulch applied over winter, which can be left on the rows until harvest. For mechanical cultivation, plant flat side of clove perpendicular to the length of the row; for hand cultivation in dense plantings, plant angled side of clove parallel to the length of the row. Remove flower stalks for maximum yield.

Leek: Seed or transplant outdoors about a month before the frost-free date in rows 14 to 18 inches apart with plants 3 to 4 inches apart in the row. Transplants can be started 10 to 15 weeks before planting. Place transplants 4 to 8 inches deep and backfill soil, or hill throughout the season to maintain a long white shank.

Onion: Seed or transplant outdoors about a month before the frost-free date, or as early as soil can be worked on raised beds with two double rows or wide rows spaced 14 inches apart on top of the bed with 12 seeds per foot, or 3 to 4 transplants per foot. A popular transplanting method on farms that are hand-weeded is to plant onions in groups of four that grow up and out as a clover shape. Transplants may also be planted into plastic-much covered beds. When seeding, use 4 pounds per acre of onion seed and consider broadcasting 1 bushel of oats or barley per acre overtop as a nurse crop that can protect young onions from sandblasting and hard frosts. Kill the barley or oats when they are 5 to 6 inches tall with a graminicide. Young onions can withstand several overnight lows in the 23° F to 32° F range, but survivability is less if it is also windy.

Shallots: Seed in the spring like onions with similar row spacing, or transplant bulbs in the fall like garlic with similar row spacings. However, if fall planted, remove mulch in the spring before emergence. Shallot leaves are hollow and are easy to bend and crimp by the movement of straw mulch once they emerge. Transplanting young plants from a greenhouse in the early spring will yield bulbs along the same timeline as garlic.