United States Department of Agriculture

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

RAISED BEDS

CODE 812

(sf)

UNDER EVALUATION

DEFINITION

Create an above ground growing environment.

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- Reduce concentration of, or exposure to, salts or other chemicals in the soil that limit the desired use
- Reduce field operation-induced particulate emissions
- Improve plant health and productivity

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to land in inhabited areas where the desired reuse of a site is for crop production where the existing growing media is unsuitable for in-ground production.

The practice is applicable for managing the production of agricultural crops where soil conditions are significantly impaired due to the presence of salts, heavy metals, or other contaminants that pose an environmental and/or safety risk to the producer and/or the intended crop.

This practice does not apply to roof top agriculture, container gardening or indoor vertical farming. This practice does not apply to aquaculture production of fish or seafood.

CRITERIA

General Criteria Applicable to All Purposes

Create raised beds that are between 6 and 36 inches above the existing soil surface to support healthy root system development. Determine the required bed area and depth by analyzing the needs of planned crops.

Design the width of the raised bed to limit the need for stepping into or on the raised bed. When access is available from all sides, raised beds will have a working width maximum of 5 feet. When access is possible from only one side, the working width shall be limited to a maximum of 3 feet. The length of a raised bed will be based on the available space and slope of the site.

Raised beds can be made into any shape desired. Beds may be framed or unframed.

Levels of contaminants will be determined by soil testing for potential contaminants or heavy metals based on site history (refer to the Iowa NRCS Contaminated Soils Pre-Screening Tool), or by implementing a Site Assessment and Soil Testing for Contaminants (CEMA 207) activity.

NRCS reviews and periodically updates conservation practice standards. To obtain the current version of this standard, contact your Natural Resources Conservation Service State office or visit the Field Office Technical Guide online by going to the NRCS website at https://www.nrcs.usda.gov/ and type FOTG in the search field.

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General Criteria Applicable to All Purposes Continued

Soil testing for electrical conductivity (EC) is required to document unsuitable conditions due to the concentration of salts when the drainage or irrigation water cannot be managed to leach salts out of the root zone. Refer to Irrigation Water Management (449) and Drainage Water Management (554).

Determine the need for a root barrier between the existing soil and the growing media based on soil contamination levels. When detection of contamination is at or exceeds the Environmental Protection Agency (EPA) Regional Screening Level (RSL) for Residential Soil (https://www.epa.gov/risk/regional-screening-levels-rsls), a 4oz. heavy duty non-woven geotextile root barrier, such as landscape fabric, shall be placed between the in-situ soil and the new growing substrate to reduce the exposure of plant roots to contaminants. The root barrier must allow water to pass through slowly for proper drainage. Fabric must extend below the frame of framed beds and outside the growing substrate for unframed beds to prevent root development into degraded soil.

Growing media that is free of debris and contaminants shall be used to fill the raised beds. Characteristics of the chosen growing media will support the needs of the plants to be grown. See additional growing media considerations below.

To the extent feasible, the growing media in the beds should be made level or nearly level to facilitate even distribution of water.

Designated walkways or travel lanes to control foot traffic and movement between beds shall provide adequate width to accommodate foot traffic and equipment.

For organic or transitioning operations, it is the producer's responsibility to ensure that all methods and materials used are consistent with USDA National Organic Program requirements for certified organic production.

Framed raised beds shall be constructed of durable materials providing a minimum of 5 years of use with adequate operation and maintenance. Non-framed raised beds will be rebuilt as needed for the 5-year lifespan with clean growing media brought onto the site.

The raised beds will have adequate vertical bracing for wall rigidity and stability. Braces will be installed either inside the raised bed or on the outside of the wall.

Acceptable framing materials include:

- Wood —
    - Lumber - Untreated, naturally rot resistant lumber. Catalpa, black locust, black walnut, Osage-orange, redcedar, white mulberry, white oak are approved products.
    - Pressure treated wood that is EPA approved for residential use and ground contact (alkaline copper quaternary (ACQ) or copper azole (CA-B, CAC)) may be used when separated from the raised bed soil with a continuous layer of a 4 oz non-woven geotextile barrier such as landscape fabric.
    - Felled logs - Must be one of the approved tree species under wood lumber.
- Other materials. These materials may include —
    - Wood-Plastic Composite (WPC) Materials.
    - Large Natural Stone, Cobblestone, or Stacked Rock Walls – Sand-based mortar, approved for residential use will be utilized to stabilize this type of constructed frame.
    - Galvanized or other metal sheets may be used when separated from the raised bed soil with a continuous layer of 4 oz non-woven geotextile barrier such as landscape fabric.
    - Manufactured raised bed kits

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General Criteria Applicable to All Purposes Continued

Acceptable framing materials, continued:

- Hardware—
    - Metal connectors, bolts, screws, and nails will be hot-galvanized, stainless steel, or aluminum alloy materials.
    - Rebar (7/16 inch or larger) may be used to lock the bed in a set position on the soil, driven through pre-drilled vertical holes in the wall of the frame.
    - All screws and nails must be sufficient length and gauge to secure the materials.
- Braces —
    - All braces will be of the approved materials listed above.
    - Braces made from pressure treated wood that is EPA approved for residential use and ground contact (alkaline copper quaternary (ACQ) or copper azole (CA-B, CAC)) may be used when separated from the raised bed soil with a continuous layer of a 4 oz non-woven fabric barrier such as landscape fabric OR the braces are on the exterior of the frame.
    - Metal bracing will be hot- galvanized, stainless steel, or aluminum alloy materials.

UNACCEPTABLE materials for the construction of raised beds or for brace materials include:

- Used lumber or galvanized/metal sheets
- Railroad Ties, either new or used
- Utility poles
- Landscape timbers
- Wood treated with Chromate Copper Arsenate (CCA) or Methyl Bromide - including pallets,
- Plywood, MDF, or Particle Board products (glued wood products)
- Styrofoam
- Tires or rubber materials
- Fiberglass panel
- Miscellaneous plastic materials including polyvinyl chloride (PVC) products
- Metals subject to rust or corrosion
- Any product unlikely to last the 5-year lifespan of the practice due to material, size, etc.

CONSIDERATIONS

Framing is recommended for beds that will be 6 inches or more in depth. In the case of contaminated soil, a minimum of 12-inch depth is recommended.

Consider the presence of utilities while planning. “Call all before you dig” (Iowa One Call) applies to digging any size/depth hole, pounding stakes or posts, terracing for garden beds and landscaping, installing new watering or drainage systems, and installing new gardens. Producers are responsible for notifying Iowa One Call, if applicable. Visit https://iowaonecall.com/homeowners/ for more information.

If wood is used for framing, a minimum nominal dimension for board lumber is 2 X 4 (actual dimensions 1 1/2 inches by 3 1/2 inches) is recommended. Using 2-inch boards or greater is especially recommended for beds that will be deeper than 12 inches as thicker boards are less likely to bow.

Consider the need for a water supply and irrigation system. Hand watering can be used, but is less feasible when there are many beds. Consider installing a microirrigation system with drip lines on the bed surface or small overhead sprinklers. Refer to the Iowa conservation practice standard for Irrigation System, Microirrigation (441).

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Considerations Continued

Walkways should be covered with growing vegetation, natural mulch, gravel, stones, bricks, or other durable materials to provide a barrier between workers and the contaminated soil conditions. Non-woven geotextile barriers may also be used as a pathway underlayment to provide additional strata between workers and contaminated soils. Consider using the Iowa conservation practice standards for Critical Area Planting (342) or Mulching (484) to reduce dust emissions between-bed space. Refer to the Iowa conservation practice standard for Trails and Walkways (575) to establish hardened paths.

Travel walkways 18 to 24 inches wide are recommended for general use. To provide access for wheelchairs, carts, and wheelbarrows, allow at least 4 feet between beds. Wider travel lanes will be needed if larger equipment or vehicles need access between the beds.

For best light exposure, plan to build beds in a north/south orientation. Consider light exposure (seasonal sun angle) and shading when planting crops. In summer, it may be beneficial to use taller crops to partially shade shorter crops. However, if the shorter crops require full sun, orient the planting to avoid shading by taller crops.

When growing crops that sprawl, such as squash or watermelon, consider planting in a bed by themselves. Trellising, caging, netting, pruning, and training plants may be necessary. Consider choosing varieties of plants with compact growth habits, such as “bush” varieties.

The producer may practice multispecies cropping, conservation crop rotation, cover cropping, and/or single species cropping. If disease carry over is a concern and crop rotation is not possible, crop residues should be removed and composted to the appropriate temperatures to avoid potential contamination of the next crop. If residues are removed, cover crops should be considered for soil health, to prevent erosion and/or to increase organic matter.

Consider pest and nutrient management strategies consistent with an integrated pest management system and nutrient management plan. If compost will be used as growing media or nutrients will be applied to crops, consider the site location (e.g. sites within the floodplain or risk of leaching) while planning nutrient management strategies to prevent risk of negatively impacting water quality.

On sites where the soil is formed from construction debris material, it is possible to find elevated concentrations of salts derived from the decomposition of concrete or other materials. These conditions could produce elevated pH levels. Consider adjusting pH levels with natural mulch, compost, or biochar materials to prevent the mobility of known heavy metals.

Growing media in raised beds should be light and well-drained. Iowa State University Extension and Outreach recommends a soil mix prepared by mixing equal parts imported mineral topsoil, organic matter (natural mulch, compost, or peat), and coarse sand. The amount of fill material needed can be calculated by multiplying the length, width, and height of the wall materials.

Within raised beds with structural framing, to prevent oversaturation of the growing media, ensure installation of non-woven geotextile barrier and the growing media characteristics allow for proper drainage.

Consider site preparation methods that limit the amount of disturbance to the natural soil surface to reduce the chance of contact with potential contaminants. Avoid creating any excess dust and wear gloves. Avoid translocating contaminated soil by cleaning equipment, tools, gloves, and shoes after contact with the soil. If sod is present, only remove sod within the footprint of the planned raised beds, maintain as much sod/grass cover as possible. See Iowa 812 Raised Beds Guidance Document (GD) for more site preparation methods and recommendations.

Consider adopting a produce safety plan that aligns with the United States Food and Drug Administration (FDA) Food Safety Modernization Act (FSMA) rule “Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption” also known as “The Produce Safety Rule.” Additional resources can be found on the Iowa State University Safe Food site: https://safeproduce.cals.iastate.edu/ .

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PLANS AND SPECIFICATIONS

Prepare plans and specifications for the installation and placement of raised beds in accordance with the criteria of this standard. The completed 812 Implementation Requirements (IR) sheet can serve as the plan and specifications for this practice. As a minimum, plans and specifications will include the following:

- Refer to the 812 Raised Bed practice standard and supporting documents located in the Iowa eFOTG, **Section I - General Resource References, Under "Section 4 Temporary Folder"**
- Site Assessment and site history to identify degraded and unsuitable growing substrate (Refer to the Iowa NRCS Contaminated Soils – Pre-Screening Tool)
- Soil testing for salts or likely contaminants as identified by the site assessment OR Soil Testing for Contaminants Activity Report (CEMA 207 or similar) documenting the degraded growing substrate
- Site preparation method(s)
- Location and layout of raised beds on the tract
- Height, width, and length of each bed
- Requirements for imported growing media (substrate components, amendments, and source)
- Framing and bracing material, if used
- Root barrier material specifications, if used
- Designated walkway or travel lane specifications

Refer to FOTG > Section 1 > Section 4 Temporary Folder > Raised Beds for the conservation practice documents (Guidance Document, Implementation Requirements, ESJAA).

OPERATION AND MAINTENANCE

An operation and maintenance plan will be provided to and reviewed with the operator/landowner. The plan will include the following items and others as appropriate:

- Monitor and maintain height of raised beds and material within the raised beds.
- When compost or high organic matter material is utilized as growing media, it can be expected that material should be replenished more often to maintain the minimum planned depth.
- If framed beds are used, periodically check all frame joints and boards for rot, mold, or other damage and repair or replace any failures, rot defects, or moldy materials as soon as possible.
- Maintain all travel and working surfaces in a smooth and graded condition, free of ruts and depressions that can collect and hold water.
- Irrigate beds as needed. If microirrigation is used, periodically inspect and repair the system as needed.
- Monitor site erosion and implement appropriate conservation practices to address erosion concerns.
- Inspect and maintain associated surface and subsurface drainage practices to manage erosion and concentrated flows.
- Soil testing will occur every 4 years. At a minimum test for the identified site contaminant(s), soil pH, and soil organic matter (SOM). Annual testing for salts is recommended in high tunnels and for crops that require high levels of fertilization.
- Conduct growing and maintenance operations in a manner that will not compromise the structural integrity of the root barrier or the framed bed and will not cause soil compaction.

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REFERENCES

Iowa 812 Raised Beds Implementation Requirements (IR)

Iowa 812 Raised Beds Guidance Document (GD)

Iowa NRCS Contaminated Soils – Pre-Screening Tool

Iowa NRCS Contaminated Soils – Urban & Inhabited Site Evaluation Guide

USDA-NRCS - Natural Resources Conservation Service. 2024. Technical Note No. 470-03 - Soil Health. Site Evaluation for Urban Soil Health.

Environmental Protection Agency (EPA). 2011. Reusing Potentially Contaminated Landscapes: Growing Gardens in Urban Soils.

Environmental Protection Agency (EPA) Regional Screening Level (RSL) – Generic Tables

Environmental Protection Agency (EPA) - Overview of Wood Preservative Chemicals. 2025.

United States Food and Drug Administration (FDA) Food Safety Modernization Act (FSMA) "Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption

Healthy Soils, Healthy Communities: Metals in Urban Garden Soils. 2015. Cornell University.

Hettiarachchi, G.M., N.O. Nelson, S.C. Agudelo-Arbelaez, Y.A. Mulisa, J.L. Lemunyon. 2012. Phytoremediation: Protecting the Environment with Plants. Kansas State University.

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