



Dealing with Salty Soils in Order to Grow a Garden

C.E. Swift and P. Garcia¹

The salts common in western Colorado soils are the result of the area being below sea level in earlier times. The salts were deposited along with silt and clay particles when the Cretaceous Seaway (aka Western Interior Seaway) split the continent of North America into two sections. This inland sea was 2500 feet deep, 600 miles wide and over 2000 miles long and extended from northern Canada south. Eastern Utah, all of Colorado and the western half of Kansas were under water. As the land rose due to geological changes, the water of this inland sea was shed leaving deposits of clay, silty-clay loam, and mudrock (called Mancos shale).

These soils and shale contain large quantities of salts, mostly of the calcium persuasion. These salts reduce crop yield and plant growth whenever they are excessive. Information on the salt tolerance of plants can be found at <http://www.ext.colostate.edu/pubs/crops/00503.pdf> and <http://www.coopext.colostate.edu/TRA/PLANTS/stable.shtml> . If you know the salt level of your soil is excessive for the plants you intend to grow, leaching and raised beds are options.

Correcting the Problem

The correction of soils with high salt levels can be approached in two ways, both of which are designed to reduce the soil salts and salty water in contact with the roots of plants.

1. Leaching the soil of salts
 - a. If a water table is high (within three feet of the soil surface) attempting to leach salts out of the plants' root zones may not be possible. To determine the presence of a high water table, dig a hole to a depth of three and one-half feet. If water accumulates at the bottom of the hole the water table problem will need to be corrected before the soil can be leached of salts. When the water table is high the application of water at the surface will create a hydraulic connection to the water table resulting in salt being 'pumped' back to the surface when leaching is stopped and soil evaporation begins.
 - i. Ripping the soil to shatter any hard pan areas may result in the water table dropping below the three foot level.
 - ii. A subsurface drainage system to lower the water table, and/or lining irrigation ditches and ponds may be required to drop the

water table. A soils/water engineer will be able to assist you with these problems.

- iii. If a water table problem cannot be corrected plantings will need to be in raised beds.
 - b. If a high water table is not an issue, the salts can be leached from the root zone of the plants you intend to grow.
 - i. The procedure involves tilling in an organic matter with particles one-quarter to one-half inch or larger in size as deep as possible and then watering to dissolve and move the salts down below the roots. The salts will only move to the depth to which the soil is amended. The key is to move the water into and through the soil not off the surface.
 - ii. To reduce the salt level by 50%, 6 inches of water needs to be applied; 9 inches of water is required to reduce the salt content by 80%. Cans or other containers placed in the area to catch water are used to determine when these quantities of water have been applied.
2. Ground Level Raised Beds built on the existing soil need to be built properly to ensure salts from the underlying soils do not migrate up into the planting mix used to fill the raised beds. To prevent toxins from contaminating products grown in the raised beds avoid the use of treated wood or treat the wood with a non-toxic
- a. Salt Barrier Type 1
 - i. A simple salt barrier consisting of a rubber layer as EPDM Pond Liner 20 to 30 millimeters thick can be installed. If plastic is used, no matter how many layers, it eventually rots and decomposes within two to three years. **Note:** A dense layer of asphalt also works well to keep the planting mix from touching the native soil. This procedure however is not recommended if you plan on growing edible crops.
 1. This solid sheet of EPDM rubber should be placed on the existing soil surface.
 2. The raised bed is then placed on this rubber barrier. The barrier must extend beyond the sides of the raised bed.
 3. The raised bed is then filled with a low-salt planting mix.
 - ii. If the raised bed is made of wood, a separate sheet of this material could be attached to the inner sides of the raised bed to keep moisture away from the wood thereby extending the life of the raised bed. See drawing below.
 - iii. Bark mulch or wood chips should cover those portions of the barrier extending beyond the raised bed to prevent degradation from the sun. No soil should be placed on this barrier or salts from that soil will move into the planting mix from the sides of the raised bed.
 - iv. Care must be taken to ensure no punctures occur in the barrier under the planting mix. Any punctures will need to be repaired.

b. Salt Barrier Type II

- i. This salt barrier is constructed from landscape fabric and gravel.
- ii. It is important this barrier **not be** surrounded by native soil. Therefore this barrier must be on the surface of the native soil.
Note: If placed in a depression in the native soil the depression will fill with water and salts will move through into the planting mix above.
- iii. If the raised bed is made of wood, staple a liner against the inside of the walls of the bed to protect the wood from moisture.
- iv. Place a solid layer of landscape fabric in the bottom of the raised bed extending at least a foot up the four sides of the bed
- v. Place six inches of washed round stones three-quarters of an inch or larger in diameter on the landscape fabric. Place a top layer of landscape fabric, cut to size on top of the stone. Fold the fabric coming up the side of the planters over the top layer of fabric to seal in the stone. (see drawing) The purpose is to create a mattress filled with stone and to keep any soil particles from filling the spaces between the stones. This rock mattress breaks the capillary connection between the planting mix and salty soil below preventing the upward movement of salts.
- vi. This results in a barrier through which water will move from the planting mix, but prevent the movement of salt-laden water from the native soil contaminating the planting mix above. When creating a Salt Barrier for new sod, the challenge becomes intensified because of the need to install an irrigation system. The pipe and fittings for a sprinkler system will need to be laid on top of the final layer of weed barrier below the new top soil compost mix. This should be mixed away from the raise bed. If soil and compost mix with a rototiller inside the bed care must be taken to ensure the salt barrier is not destroyed. If raised beds are used for trees and shrubs, a planting mix of at least 18 inches will be needed.

Schematic of Raised Bed Garden with Salt Barrier

SALT BARRIER FOR GPN BOX



- = ZO-30MIL WIRE: ATTACH TO WOOD, VERTICAL PILES ONLY FOR DOWNIE.
- = WOOD BARRIER: ATTACH TO SIDES OF WOOD; NOTE CONTINUOUS PIECE U.
- = "ROCK MATRES" WRAP, W/ WEED BARRIER.
- = 1" ROUND WASHED RIVER ROCK.

☒ = 6" x 6" x 8' LUTERATED LANDSCAPE TIMBERS (OR 2" x 10" x 8' CEDAR)

||||| = LANDSCAPE PLANT MIX PERL GRAVEL.

— = BOTTOM LAYER = HOME MANURE (MIXED 2" LAYER)

→ NEXT LAYER = MESA TACK

— " — = PRO LANDS SOIL } MIX THESE UP

— " — = TOP SOIL

— TOP LAYER = BAGS OF PLANTING MIX, TURN INTO SUB SOIL.

(POSSIBLY SOME WOOD CHIPS LAYER)

..... → = MOVEMENT OF SALTS; AWAY FROM PLANT ROOTS!

P.A.G.
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Applying washed round stones/gravel over the bottom layer of fabric



Applying the planting mix after the top layer of fabric has been applied. Note the sides of the bottom layer of fabric overlaps the top layer of fabric.

3. Raised beds built off the ground

- a. These raised beds can be built on stilts, concrete blocks, etc. so that the planting mix has no contact with the native soil.
- b. Avoid the use of pressure-treated wood as the chemicals used can contaminate the fruits and vegetables in the raised beds.
- c. “Forever Wood” is a non-toxic choice if treatment of the wood is desired.
- d. Line the inside walls and bottom of this type of raised bed with twenty to thirty millimeter EDPM plastic. If plastic is used it will need to be replaced within a few years due to its breakdown.
- e. Drill one inch holes through the plastic and bottom of the raised bed to ensure proper drainage. Cover the holes with window screening or similar mesh to keep soil from being washed through the drainage holes.
- f. Fill the raised bed with a high quality planting mix. Leaving a one inch space between the top of the planting mix and the top of the sides of the raised beds allows for proper watering.



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¹ C.E. Swift, Area Extension Agent, Horticulture, Tri River Area; P. Garcia, Pauls Falls LLC., Grand Junction.