TURNIP: Role of this Cool Weather Root Tuber in Conservation Planning

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Turnips *(Brassica rapa.)* are considered a native of Eurasia and have been in existence since pre-historic times. This hardy biennial, cool-weather, drought-resistant root crop is a member of the Cruciferae/Brassicaceae family and is generally grown as an annual, around the globe. It is an established livestock feed also and the European immigrants brought this multi-use crop to the Americas. In spring and fall, the leafy tops of Turnip are used as first-rate greens. Roots (round, flat or long in shape with white or off-white flesh) of this versatile crop are consumed like potatoes and beets. By selecting appropriate cultivars and varieties, turnip tops and bulbs can be cultivated and made available, all year round.

Purposes:

- To conserve soil and water through the use of vegetation
- To maintain and/or improve soil availability, quality, structure, and soil nutrients
- To suppress weeds, reduce insect pests and diseases, and increase crop yield
- To improve soil tilth, soil organic matter, and soil structure

Planting: A multipurpose crop, Turnip is adapted to either spring or fall and resists mild heat also. It produces quality roots during moderately low (40 to 60^0F**)** temperatures, but bolting occurs below temperature 10^0C. Early spring is the right time to plant turnip and this biennial crop involves in seed production throughout the second year. Turnips succeed in deep, well-drained and fertile soil with a pH between 5.5- 7.5 and need full sun or partial shade to grow. Sandy loans are favorable for early roots/greens, and they mature in 6-10 weeks. Develop the seed bed earlier by adding organic manure, compost tea, peat moss, etc. 1 inch water weekly is necessary for keeping the roots soft and tasty. Short growing season makes them a catch crop and successive planting at 10 days intervals grants later harvests of superior roots or greens.

Spacing and harvest: Diverse rows on a raised seedbed extend production capability per unit of land. Seedbeds can range from 3 to 5 feet wide depending on planting and cultivating equipment. Sow seeds ½ inch deep and 3 to 4 inches apart. 1 week later, when they are about 3 inches tall, thin turnip seedlings (avoid thinning if they are grown for greens only). Adding liquid fertilizers like, compost tea, liquid kelp or fish emulsion and thick mulch (2 inches) to the young plant will enhance growth. Tender turnip greens (4-6 inches tall) must be harvested early, ensuring the weather is below 80^{0} F. Pull the entire plant cautiously for the roots (when they are 2 to 3 inches in diameter).

Crop Rotation: It is the productive system of growing diverse crops on one field at different times. Proper rotation practices results in fertile fields and constant production. Rotation is mainly estimated to balance nutrient demands, halt insect and disease attacks, and deter weeds. Moving the crops around in a structured rotation prevents the buildup of pest problems and makes it harder for emerging insects to find their preferred food, each season. Further, the threat of pest tolerance to insecticides and herbicides are reduced with rotations. Also, this process increases organic matter and improves the environment for biological activity. Make sure to rotate a warm season crop in the summer for cool season turnips and then follow a winter crop to harvest in early spring. Peas and onion family are good companion plants for turnips. As a low residue crop, turnip needs the support of cover crops/green manures to increase biomass yield. Soil biological diversity expands when crop rotations are more complex and include sod crops. In addition, turnips leave very little residue after the final harvest, and usually exposes the soil for erosion. Therefore it is strongly recommended to raise cool season cover crops in the fall, such as hairy vetch, until the spring crop is planted.

Mulching: It is a long established horticultural practice. Mulches are substances spread on the ground to shield plant roots from heat, cold and drought. There are inorganic (pebbles, stone, gravel, newspaper, black plastic, landscape fabrics, etc) and organic mulches (composted manure, wood shavings, bark, shredded leaves, straw, grass clippings, etc.) Mulches lessen the wash down of soil particles by speeding water and prevent soil erosion. Organic mulches decompose and enrich soil, add on nutrients and progress soil structure. Further, mulching sustains soil warmth during cold times, protects roots and promotes vigorous plant growth. Evidently, for cool season crops like turnip, winter mulches are essential for regulating and insulating plant roots as well as the entire plant from adverse temperatures.

Weed Control: Weeds are not problematic once the turnip crop is established. However, perennial grasses including yellow and purple nut-sedge, Bermuda grass, annual grasses, and various broadleaf weeds are generally found in turnip farms. Brassicaceae fields (mustard family) are naturally known for turnip mosaic virus and insect pests, and so the latter should be controlled in and around the fields. Hand weeding and timely shallow cultivation drastically reduce weed pressure. Sod and annual weeds are controllable chemically and culturally before planting. Crop rotation with cover crops or green manure successfully diminishes weeds. Usage of pre and post herbicides, cleansing of farm equipments after use, tillage before planting, application of mulches etc. are competent methods of weed management in turnips. Utilize floating row cover to guard crop from early pests.

Residue Management: It is a valuable and established technology for reducing erosion and improving runoff water quality from agricultural lands. Crop residues influence soil quality,

nutrient cycling, microbial process, and contribute significant amounts of N to the main crop. Surface residue help reduce water loss and erosion. The rate of crop residue decomposition is imperative to both agricultural and environmental standpoints. Residue inputs subsequently modify soil properties essential to soil quality and crop production. Since many pathogens survive in and on crop debris, crop residue should be incorporated by disking or plowing soon after turnip harvest to promote rapid decomposition. Deep plowing prior to planting turnips also is beneficial for burying crop and weed debris, which may harbor pathogens.

Turnip is a low residue crop that produce relatively small amount of above-ground residue that generally decay rapidly due to its low C:N ratio. The lack of residue cover after this crop harvested leaves the soils vulnerable to wind erosion until the next crop is established. Wind erosion is associated with soil management and cropping systems which do not provide adequate surface cover. Farmlands with low residue crops need the best management practices (BMP). The objectives of the BMPs are to (1) establish and maintain vegetative cover on the land, (2) maintain clods and roughness combined with vegetative cover (3) use vegetative barriers and strip cropping for additional protection, and (4) apply emergency control measures when the soil is inadequately protected during periods of high erosion potential.

A one-season study on fall wind erosion control followed by low residue cropping was conducted by the Natural Resources Conservation Service (NRCS). Results showed that a fall-bedded treatment retained considerably more roughness over winter than either disc/pack or a late-seeded grain cover crop. Based on the dust collection over the critical wind erosion period, fall bedding was superior to disc/pack, and the cover crop was intermediate in effectiveness to these two treatments for controlling wind erosion.

Vegetative barriers and strip cropping reduce erosion and crop damage from windblown sand on low residue cropped lands. NRCS specifications for vegetative barriers consider such factors as barrier height, row direction, and plant density or barrier porosity for maximum effectiveness. The costs of establishing the barrier strips have also been determined and are usually shown to be economically feasible.

Cover crops have the potential to control wind erosion, especially with turnip which leaves very little residue for protecting soils from fall until early spring. In addition to wind erosion, cover crops can also reduce water erosion, improve soil structure, maintain and build soil organic matter, enhance soil fertility, suppress plant pests, and reduce nitrate leaching.

Turnip provides moderate vegetation with more than 60% canopy cover during maturity, but the maximum fresh plant residue cover after harvesting and disking recorded is only 13%. The yield ranges from 20,000 to 23,000 pounds per acre. Total fresh residue mass ranges from 15,000 to 16,000 pounds per acre (1000 to 1,100 pounds dry residue.) The maximum root depth recorded is 12 inches. Turnip residue contains 36% carbon (C) and 4.6% nitrogen (N.) At this rate, the crop returns 360 to 400 lbs of carbon and 45 to 50 lbs of nitrogen per acre, to the soil.

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