Rotation of Onion and Collards with

Summer Legume Southern Peas

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Purposes

- To conserve soil and water through the use of vegetation
- To maintain and/or to improve soil availability, quality, 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

In this one year rotation, onion and collards are raised as spring and fall crops with southern pea, a highly adapted summer cover, edible forage, and green manure crop. This scientifically planned rotation is recommended on the basis of the research conducted on high yielding varieties of these crops on Memphis silt loam soil at Alcorn State University from 1992 to 2003. Each crop was raised three times to collect the most reliable data.

Planting of Onions (*Allium cepa* :) Frost-tolerant, biennial and cool season crop onion grows well in many types of soil but favors deep, loose, fertile and friable soil. Sunny position, lightly acidic and firm soil, a pH of 5.5 to 6.5, and temperatures between 55° and 75° are essential for best results. In the southern part of USA, onion thrives in the fall, winter, and spring and in the north, they are largely a spring, summer and fall crop. Southern gardeners use "short day" onions whereas northerners plant "long-day" onions. Intermediate or day-neutral onions are accommodative to all regions. Onions are generally planted in multiple rows with sets, direct seeding and transplanting. Plant onion seeds ¼-½" deep and seedlings 4" apart. Sets must be spaced from 4-6" (10-15 cm) apart. Organic manure/compost and raised beds develop the soil and water holding capacity for this crop. 100 to 120 days are needed for seeds to mature. Sets and transplants mature early. Onions are ready for harvest when their tops dry and fall over.

Planting of Southern peas (*Vigna unguiculata)* also called cowpeas, purple hull peas, Crowder peas, field peas, or black-eyed peas are a drought tolerant and warm-season crop. This annual, herbaceous, legume from India and West Africa is capable of adjusting well on low fertility soils and drawing nitrogen from the atmosphere. Southern peas thrive on various soil types, but produce abundantly on well drained sandy loams. With proper irrigation and fertilization, they offer good yields even on sandy soils. Planting time should be late spring or early summer. A soil temperature of 65°F and above, a pH of 5.7 to 7.0 will ensure better seed germination and seedling development. Seeds have to be sown 1 inch deep, spaced 4-6 inches within the row, and 30-42 inches between rows. Special care should be given to the plants during blooming and adverse weather. Peas are ready to harvest usually after 65 to 90 days following seeding, at different stages of maturity: as green snaps, green-mature or dry, depending on variety and weather.

Collards: *Brassica oleracea* is a hardy cool-season vegetable green and a member of the cabbage family. Collards are generally grown as annuals, but they can also be raised as biennials or perennials in warmer climates. They endure low temperatures and are tolerant of heat as well. Collards are raised from transplants or from seed and sown directly in the garden. In the Southern USA, cultivate collards from fall through March and in the North, plant twice: in early spring, and in July or August. For best results, a soil temperature of 60 to 65 F, well-drained soil rich in organic matter, a pH of 6.0 to 7.5, adequate supply of nitrogen and moisture are necessary. Collards grow on diverse soils but heavier loamy soils will produce premium crop. Sow seeds ½ to 1 inch deep and thin seedlings to 6 to 12 inches apart to give ample space. Collards are ready to harvest after 75 to 95 days from planting. Transplants require 75 to 85 days and seeds need 85 to 95 days to mature.

Crop Rotation is an inexpensive and effective cultural strategy used in crop production **f**or maintaining healthy soil, controlling diseases, and reducing insects and weeds. Rotation prevents soil deterioration and contamination of surface water, builds up organic matter, nutrients, soil fertility and structure for successive crops and offer high yield. In order to make crop rotation a success, record-keeping and planning are needed. Being a heavy feeder, onions return very little nutrients to the soil therefore selecting crop rotations with legumes are advised to solve this problem. Onions prefer composted soil.

Suitable preceding crops for onion in a rotation include Brassicas, including broccoli, cauliflower, cabbage, kale etc. Beneficial succeeding crops are vegetables like carrot, beet roots, leeks and lettuce. Carrots or potatoes in a rotation with onion simply prevent the buildup of disease and insect pests.

Southern peas play a major part in increasing the microbial activity in a rotation. Its multi use as a nitrogen fixing crop, an intercrop, a green manure, a summer cover crop, and an erosion controlling legume is outstanding. Being an inexpensive seed, numerous resistant varieties of southern peas are raised prior to planting a very susceptible crop for destroying the root-knot nematode. Its beneficial effect on subsequent crops continues even for the second succeeding crop. Rotating peas with cereal crops put an end to herbicide carry-over. Southern peas can be preceded by Irish potatoes, vegetable brassicas and cereal grains and succeeded by sweet corn and tomatoes.

Lately, collards are used as a trap crop at minimizing diamondback moth larvae on cabbage with perimeter trap cropping method. Also, they naturally are gifted in keeping away root-knot nematodes. For a minimum period of 3 years, crops in the crucifer family should be avoided when collards are in cultivation. Preceding crops for collards include tomato, snap beans, sweet corn or another summer crop. Crop rotation controls insects and diseases very economically**.**

Cover crops have many positive impacts in the fields of soil and water conservation, environmental and ecological protection, sustainable farming systems, and agricultural and economical growth resources. They are generally raised between cash crop cycles, or combined with the main crops to cover the ground for controlling erosion, pests, crop injury, runoff, crusting and pollution of surface waters. Cover crops improve tilth and soil physical properties by increasing fertility. They supply nitrogen (N) to the succeeding crops, add organic matter to the soil through plant biomass and progress soil physical properties. Cover crops planted in mixture provide a diverse habitat and attract soil organisms and beneficial insects into cropping systems; encourage nutrient cycling and develop soil structure. Cover crop residue acts as a protective shield against weeds and safeguards the crop. In this rotation, southern pea is a summer cover crop and also a food legume.

Mulching is an efficient cultural method, practiced globally to help conserve soil moisture, prevent erosion**,** moderate soil temperature, control weed infestations and maintain healthy plants. Mulching improves soil structure, water-holding capacity and provides plants with nutrients and better growing conditions. Organic mulches encourage beneficial earthworm and microbial activity. When they decay, mulches turn into topsoil and provide compost to the plants. Mulched onions have the tendency to resist pests and diseases with vigor. Limited mulching around onions keep soil soft and encourage healthy formation of bulbs. Mulching is essential for over wintered onions. Composted manure mulches, especially surface mulches produce high quality Southern peas and hugely eliminate pests and diseases. Collards require mulching for vigorous growth and better yields. Fall production can be doubled with seaweed mulch. A thick layer of straw

clippings, bark chips, pine needles and compost mulch will protect the crop in summer and act like a sustainable alternative to herbicides.

Pest & Disease Control: Onion family repels many pests. Thrips and maggots that attack onion can be eliminated with biological insecticides, insecticidal soap sprays or sevin and insecticides like Malathion or Diazinon. Diseases such as Blight and purple blotch have to be prevented with the help of a multipurpose spray of fungicide like daconil. Prevention is the most effective defense for Southern peas. Insecticide soap sprays and fungicides will take care of most of the pests. Usage of resistant varieties and crop rotation will destroy aphids, viruses, powdery mildew, root rot and wilt diseases. Collards have the tendency to keep away the root-knot nematode. Pests like flea beetles and aphids badly attack collards and have to be controlled with insecticidal soap spray and frequent dustings of rotenone. Raising catnip along with collards easily prevent flea-beetle damage. Planting early in well-prepared soils, using certified seeds, shallow cultivation, avoiding overhead irrigation, yearly changing of planting site, weekly checking, burying crop debris very deep, rotation, avoiding crop injury during harvest, general sanitation, getting guidance from the local Cooperative Extension office, etc. are good ways of weed, pest and disease control.

Disking is a longstanding method in farming that help prepare early seed bed, control biennial and perennial weeds and diseases, mix plant residues into the soil etc. This procedure helps quicken decomposition and oxidization of crop residues, break up clods and compacted soil, hasten the process of soil organic matter, and spread granules neatly over the cultivating area. Minimal addition of fertilizer during disking will enrich the soil. Defects of disking include soil and crop residue loss, chances of soil erosion, expenditure, dust, etc. Disking wet soils leads to soil compaction, lower yields and limited root development. Practicing no-till system has the benefit of saving large quantity of soil surface, crop residue, labor, time, expenses and helpful insect habitat.

Residue management is a method that can harness the leftover crop residue after harvest. Crop residue management can be conducted throughout the year. This strategy includes various field operations, starting with crop selection, cover crops usage, several tillage systems etc. Crop residue is needed for a good conservation plan. It is a vital source for soil sustainability and the environment. Residue improves soil carbon, water quality, soil structure, soil tilth and soil-holding capacity. Crop residue noticeably reduces soil compaction and prevents soil run-off. Further, it adds organic matter and plant nutrients to the soil as it decomposes and saves time, energy and labor for the planter. It shields soil particles from wind and rain until plants produce a protective canopy. Residue cover planning must begin at harvest. Crop residues must be uniformly spread over the field. Ensure that they do not conflict with the seeding process. Since tillage pass buries crop residue, number of tillage passes must be minimized. Reduced till, ridge-till, mulch-till or no-till can be practiced in crop residue management. Poor residue management will lead to low germination and low crop yield.

Onion residue: Onion crop residues left on the surface before or during planting reduce tillage and fuming. This crop must be cultivated at shallow levels with appropriate equipments (like straight pointed chisel plows,) operated at low speed. Onion provides only 35-40% canopy cover during maturity. The maximum fresh residue cover after harvesting and disking recorded is 7%. Total fresh residue mass ranges from 7000 to 8000 pounds per acre (910 to 1040 pounds of dry residue.) The maximum root depth recorded in Memphis silt loam soil is 8 inches. Onion residue contains 37% carbon (C) and 2.5% nitrogen (N). At this rate, this crop returns 370 pounds of carbon and 26 pounds of nitrogen per acre to the soil.

Southern pea residue: This summer legume has high leaf area index and percent canopy cover, deep root system, and returns high quantity of residue, carbon and nitrogen. Southern pea as a soil conserving legume is recommended for rotation programs with other non-leguminous spring and fall crops. It returns 100 to 135 pounds of nitrogen per acre. Southern pea returns 2,500 to 2,750 pounds of dry residue per acre. Its residue contains 39% carbon and at this rate, it returns 975 to 1075 pounds of carbon per acre.

Collard residue: Collards provide a moderate canopy with more than 50% vegetation after 60 days of planting, but the maximum fresh plant residue cover after harvesting and disking recorded is only 20%. The yield ranges from 30,000 to 40,000 lbs per acre. Total fresh residue mass ranges from 7,000 to 8,000 lbs/acre (1700-1750 of dry residue). Collard residue contains 38% carbon (C) and 1.89% nitrogen (N). At this rate, this crop returns 645 to 665 lbs of carbon and 32 to 33 lbs of nitrogen per acre to the soil.

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