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Production of Cole Crops on Phosphatic Clays in Florida

1

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INTRODUCTION

Cabbage is an important cole crop in the Florida vegetable industry with production during the winter and spring months. Cabbage production had been centered in north Florida until a few years ago when severe freezes caused production to move southward. Broccoli and cauliflower have acreages less than that of cabbage and are considered minor crops in Florida. Production of all three crops would be favored by the relatively mild winter climate of south central Florida. Land availability, climate, and proximity to state and east coast US markets combine to make the Polk County area especially attractive for winter cole crop production. This publication presents guidelines for culture of cole crops on the phosphatic clay mined lands of Polk County and surrounding areas.

PLANTING PERIODS

Cole crops have been very successfully produced on the phosphatic clays. Research at the Polk County Mined Lands Center near Bartow showed that plantings made from November 1 through January 20 were especially successful. This period coincides with the dry period of the year when clay tillage and planting are easiest.

CLAY TILLAGE

Vegetable crops on the clay benefit from being produced after a cover crop of alfalfa. The cover crop helps de-water the clay which aids in tillage. In addition, the alfalfa provides organic matter and nitrogen for the succeeding cole crop.

Cole crops should be grown on raised beds to facilitate water drainage after rains. Beds should be prepared several days ahead of planting so that the clay can be worked into the proper tilth for seeding or transplanting. If a legume cover crop (alfalfa) is tilled in, then prepare soil no more than three to four weeks ahead of planting. This time frame will allow for nitrogen mineralization but not for large amounts of subsequent nitrogen leaching. In the case of tilling fallow land or non-legume land, then it is less critical that a short period intervene between tilling and planting because fertilization can be made close to planting. In this case, the beds can be formed by disk hillers or bedding disks that heap the soil into 15 to 20 inch beds. This tillage can be done well ahead of planting (e.g. summer) to allow for natural rain weathering and mellowing of the beds. Weeds may need chemical destruction just before planting.

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Mellowed beds can be used for direct-seeding or for transplanting with or without plastic mulch.

If beds are prepared close to planting time (within 2 weeks) then multiple passes of a disk and rotary harrow (roterra) will be needed to break the clay clods. Trials with tillage equipment have shown that suitable beds can be prepared by first two to three passes of a large bedding disk to heap the soil into large beds. The bedding disk should be followed by two passes of a rototiller with tines set at 280 rpm. Research has shown that the clod mellowing can be sped along by applying about 1/2 to 3/4 inches of water by overhead sprinkling after the initial bedding by bedding disks. Alternating wetting and drying will assist in clod degradation so that light rototilling will fracture the clods. Soil will then be ready for bedding.

PLASTIC MULCH

The use of polyethylene (plastic) mulch is a standard practice for vegetable production in Florida. Black mulch speeds crop development resulting in earlier harvests and it reduces weed growth in the row obviating the need for hoeing. Mulch is applied by machine to formed, fertilized, and pressed beds. The crop is then established through the mulch. Research at the Mined Lands Center has shown that traditional "sand land" tillage, bedding, and mulching equipment works well on the clays. Polyethylene mulch can be used for at least two crops before it degrades. Squash following broccoli on mulch has been a successful double-cropping sequence on the clays.

FERTILIZER

Considerable research has been conducted for cole crops on the phosphatic clays. Only minimal amounts of fertilizer are needed for production on the clays compared to the sandy soils of Florida. The clays contain very high levels of calcium, magnesium, phosphorus, and potassium so that no additions of these elements from fertilizers appear justified. Transplants might benefit from a small amount of liquid starter fertilizer containing nitrogen, phosphorus, and potassium applied in the furrow at transplanting.

Very little research has been conducted for micronutrients. Mild deficiencies of manganese have

been observed on cole crops grown at the Mined Lands Center. Since the clay soil has a high pH (7.5 to 8.0), it is suggested that the following amounts of micronutrients be applied: 5 lbs manganese, 3 lbs copper, 3 lbs Zn, and 2 lbs boron. Tissue testing should be practiced during the early part of the season to identify any potential problems.

Nitrogen fertilizer requirements are about 120 to 150 lbs per acre when no alfalfa has preceded the cole crop. This rate can be reduced to 80 to 100 lb per acre following alfalfa.

Fertilizers for cole crops should be incorporated in the bed where plastic mulch is to be used. Where the crop will be grown on open ground (without mulch) about 25 to 50% of the fertilizer can be broadcast in the bed with the remainder banded (knifed) in the bed shoulders during the early part of the season.

PLANTING

Direct-seeding can be accomplished with vacuum seeders on well-mellowed beds. Direct-seeding is not recommended for unmellowed beds that cannot provide adequate seed/soil contact and seed coverage. The highest degree of success with direct vacuum seeding can be obtained when seeding is performed on stale seed beds that have mellowed over the summer.

Transplanting can be conducted with relative ease on most bed soil conditions. Transplants grown in the containerized tray (root ball) system are preferred over bare-root transplants. There are machines available to facilitate transplanting through plastic mulch. Table 1 contains information on plant spacing.

CULTIVARS

Several cultivars for each cole crop are recommended for Florida. Consult Univ. Fla. Coop. Ext. Circ 503 for the latest cultivar recommendations. Successful cultivars grown at the Mined Lands Center include "Green Duke" and "Emperor" broccoli, "White Fox" cauliflower, and "Bravo" and "Gourmet" cabbage.

IRRIGATION

One of the advantages to vegetable production on the phosphatic clay is the reduced irrigation needs. Successful crops have been produced without supplemental water (irrigation). In most years, the major need for irrigation was for soil mellowing and for stand establishment (to assist in seed germination).

Recent studies have shown the merits for drip irrigation, especially under plastic mulch. Extremely successful cabbage cropping has been done under mulch with drip irrigation during the dry winter of 1988-89. The advantages of drip irrigation include 1) facilitates fertilizer applications ("spoon feeding") to the crop, 2) reduces the total amount of water applied to the crop because only the root zone is wetted, 3) permits continued access to the field even during irrigation since the row middles and alleys are not wetted as with overhead sprinklers, and 4) facilitates fertilizer and chemical applications in a double-cropping system.

INSECTS and NEMATODES

Vegetable culture so far has not been hampered by nematodes in the clay. However, nematodes can survive in the clays so that fumigation might be needed in continuous cropping systems. It is suggested that soil samples be analyzed for presence of nematodes.

Many insects can cause yield and quality losses in cole crops. The worse insect problems include aphids, cabbage looper, imported cabbage worm, diamond-back moth, leaf miners, grasshoppers, and cutworms. Information on identification and control can be obtained from the IFAS Insect Control Guide in hardcopy or computer data base format. Contact the Extension Service for this information.

DISEASES

Serious cole crop diseases include downy mildew, damping-off, wire stem, *Alternaria* leaf spot, *Cercospora* leaf spot, blackrot, and bacteria soft rot. Disease-free seed and transplants are essential first steps in controlling many of these diseases. Specific information is available from the Disease Control Guide or via computer.

WEEDS

Weeds can be especially troublesome in the clay soils since mechanical cultivation can only be done when the soil surface is dry. In general, work with cole crops in the winter at the Mined Lands Center has not faced serious weed pressures. Warm-season annual weeds are not serious in the winter.

Best control of weeds is by a combination of chemical and mechanical control measures. For recommended herbicides, consult the Weed Control Guide available from the Extension Service in hardcopy or computer format.

HARVESTING

Cauliflower often requires tying of the wrapper leaves over the curds to maintain a snow-white color. Some cultivars are "self-blanching".

Broccoli and cauliflower are highly perishable so should be harvested, packed, and cooled as rapidly as possible. Detailed information on harvesting is available from Circ. 555. Cabbage harvest information is available from Circ. 117.

All cole crops should be rapidly cooled following harvesting to help maintain freshness and quality. Packing and grading should be done according to USDA Grade guidelines.

ADDITIONAL LITERATURE

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5. Kovach, S. P. 1984. Injection of fertilizers into drip irrigation systems for vegetables. Univ. Fla. Coop. Ext. Circ. 606.
6. Maynard, D. N. 1987. Commercial vegetable cultivars for Florida. Univ. Fla. Coop. Ext. Circ. 530-C.
7. Olson, S. M., and M. Sherman. 1985. Broccoli and cauliflower production in Florida. Univ. Fla. Coop. Ext. Circ. 555.
8. Stall, W. M. 1987. Weed control in Florida vegetables - Cole or crucifer crops. Univ. Fla. Coop. Ext. Misc. Pub. VEC-CR 1.87

Table 1.

Table 1. Seeding and planting information^{yz}			
	Broccoli	Cauliflower	Cabbage
Distance between single rows (in)	24-40	36-40	36-40
Distance between twinrows on a bed (in)	12-15	15-18	15-18
Distance between plants in a row (in)	9-12	15-18	10-12
Seeding depth (in)	1-1 ½	1-1 ½	1-1 ½
Seed per acre (direct)	1-2 lbs.	1-2	1-2
Seed per acre (transplants)	1 lb	1	1
^y Use only hot-water treated, disease-free seed			
^z From Univ. Fla. Ext. Circs. 117 and 555			