

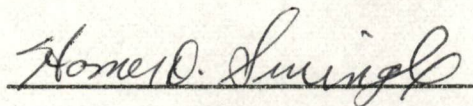
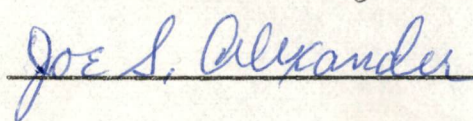
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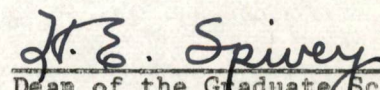
I am submitting herewith a thesis written by Fakirappa C. Angadi entitled "Variety and Topping Effects on Yield and Quality of Okra." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Horticulture.


Major Professor

We have read this thesis
and recommend its acceptance.

Accepted for the Council:


Dean of the Graduate School

VARIETY AND TOPPING EFFECTS ON YIELD AND QUALITY OF OKRA

A Thesis

Presented to

the Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

by

Fakirappa C. Angadi

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CHAPTER I

INTRODUCTION

A report from The University of Tennessee Extension Service indicated 9,000 acres of okra was produced in Tennessee in 1960 (9). Most of this production was channeled into the processing plants. Varieties that have proven to be adapted to Tennessee conditions and also good for processing have been limited. Recently, Emerald and Gold Coast varieties were released and showed promise in some areas as being superior to Clemson Spineless, in some respects. In order to evaluate these new varieties for yield under Tennessee conditions as well as for processing characteristics, a variety trial was conducted in 1960 using Clemson Spineless, Emerald and Gold Coast.

Okra being an indeterminate plant (18) the lateral branches tend to be suppressed until the terminal buds are well advanced. This makes for a very low yield on the first several harvests since only one terminal branch on each plant fruits during this early period. Since pods must be harvested two or three times per week, this involves a great deal of hand labor with low yields each time.

With several flower plants (chrysanthemum, carnation, dahlia) a practice of removing the terminal growth when the plant is quite small is used to encourage axillary branching. These axillary branches develop at a fairly uniform rate, producing several flower buds on each plant at about the same time.

As a part of the variety trials, an experiment involving topping of the okra plants at various heights was initiated to determine the influence on yield by harvest periods. If several branches of each plant bore pods at the same time, this would reduce the labor required per bushel of okra harvested.



CHAPTER II

REVIEW OF LITERATURE

I. IMPORTANCE OF OKRA

Okra is sometimes called "Gumbo" although that name is commonly related to the soups and other dishes containing okra.

The origin of okra is traced to the Abyssinian center of cultivated plants - an area that includes present day Ethiopia, the mountains and plateau portion of Eritrea and the eastern part of the Anglo-Egyptian Sudan. Little is known of the early history and distribution of okra. It did spread from Arabia to North Africa, completely round the Mediterranean and eastward. It apparently reached India after the beginning of the Christian era (36).

In India, okra does not occupy a very large acreage and is in fact a minor vegetable.

It is assumed that it was introduced into the United States of America by the French colonists of Louisiana in the early 1700's. The increase in popularity of okra in the U. S. A. can be seen by acreages grown in 1939, 1949 and 1954 (48).

<u>Year</u>	<u>Okra Acreage in U. S. A.</u>
1939	8,273
1949	16,843
1954	22,695

Practically all of this production is in the Southern States as can be seen from the figures below:

<u>Zone</u>	<u>Okra Acreage</u>	
	<u>1949</u>	<u>1954</u>
North	475	376
South	15,928	21,847
West	440	472

Geographically, it is concentrated in the South Atlantic, East South Central and West South Central states, and statewide the acreages are:

<u>Region and State</u>	<u>Okra Acreage</u>	
	<u>1949</u>	<u>1954</u>
South Atlantic		
South Carolina	822	1144
Georgia	4055	4578
Florida	3563	2848
East South Central		
Tennessee	683	1894
Alabama	2153	2499
West South Central		
Arkansas	114	1075
Louisiana	1211	2208
Texas	2606	4546

II. USE OF OKRA

In India, okra pods are used to prepare a large variety of vegetable dishes, both individually and in combination with other vegetables. The pods are also used to prepare very tasty "chutneys."

Okra is principally used as a flavoring in soups. The young, tender pods are excellent in soups and stews. It combines well with other vegetables, especially tomatoes. The pods when boiled and chilled go well in combination salads.

The major use of okra has been for fresh consumption. In recent years it has gained in importance as a process crop, both canning and freezing. The latest figures for okra acreage in Tennessee show an increase from 683 in 1949 to 9000 for 1960 (9). This increase has been largely due to improved techniques in freezing and processing. This has brought about a need for evaluation of new varieties for adaptability to processing as well as yield ability.

The stems and mature pods are sometimes used in the manufacture of paper (54).

III. VARIETY DESCRIPTION

Descriptions of the varieties included in this study are as follows:

a. Clemson Spineless. This is a variety developed by the South Carolina Experimental Station. It is a spineless strain of Perkins Mammoth Long Green, a fine canning, market and garden variety most impressive for its uniformity of plant and practically spineless pods. Plants grow 4 to 5 feet all with moderate foliage and are very prolific. Pods develop to 9" long by 1-1/2" in diameter, but should be harvested much smaller. They are straight, ridged, spineless and tapered near the tip; green in color and of good quality. Pods are a little thicker than Perkins Dwarf Green Long Pod (8, 42). This is now the most widely used variety and is considered the standard for comparison.

b. Emerald. This is a very attractive new early (ready for harvest in 50-55 days) dark green variety of the "velvet" type especially desirable for canning or freezing, developed by Campbell Soup Company. It has excellent qualities for brining. Plant is $2\frac{1}{2}$ to 3 feet tall, sturdy, well branched with medium dark foliage. Pods are 8 to 9" long by about $\frac{3}{4}$ " in diameter; round, practically free of spines and smooth with fewer seed than varieties with ridged pods. They have an appealing dark emerald green color. The plants are high yielding and the pods attain 2 to 3 times the length of most varieties before becoming hard (8, 42, 44).

c. Gold Coast. This is a new release from the Louisiana Experiment Station developed from a cross between Louisiana Market and a plant introduction (P. I. 3650) from the Gold Coast of Africa. Plants are resistant to heat and bear fruit over a long period of time. Plants are $3\frac{1}{2}$ to 4 feet tall, and set fruits about every 2" along the stem; have semi-cut leaves with long petioles making harvesting easy. Pods are short and round (3 to 6" long, and $\frac{1}{2}$ to $\frac{3}{4}$ " thick), dark green, straight, spineless and very attractive. This is a garden, canning and freezing variety (8, 42).

IV. HARVESTING

Okra starts bearing about 60 days after planting and continues to do so until cool weather sets in and the plants are killed by frost. Okra exhibits a marked correlation between vegetative growth and seed formation. When pods are allowed to mature on the plants early in the season, stem elongation and flowering soon ceases, whereas when the young pods are harvested regularly, stem elongation and fruiting continue

until the plants are killed by frost (21). Except in unusually hot weather, an okra pod reaches a good eating stage from 3 to 8 days after the flower opens, during which time there is a constant change from simple to complex compounds. The pods of most popular varieties are only 3 to 3½ inches long at this stage and are tender and free of fiber. One or two days delay beyond this stage will yield pods that are tough and of poor quality. The pods are at the best edible stage when about half grown. As they become older, their walls become hard and fibrous; the test for edibility is the ease with which they may be cut with a sharp knife. Young, tender, fresh clean pods of small to medium size, ranging from 2 to 4 inches in length are usually of good quality. Pods that are in good condition, fresh and tender, will snap easily when broken and they are easily punctured. Pods that have passed their prime will present a somewhat dull, dry appearance. They usually are hard, woody and fibrous and the seeds are hard.

As the pod is the only part of the plant used primarily for food, it is desired to obtain a rapid and continuous growth in order to secure the greatest quantity of marketable pods. When pods are developing rapidly, the plants should be gone over at least every second day to harvest pods of the best size and quality. Harvesting is done by severing the peduncle just below the pod.

Woodroff and Shelar (56) state that the physical characteristics of okra pods varied with the variety and age from the time of blossoming. Size of pods, hardness, dullness, shape, weight, and internal changes, such as changes in resistance to shearing, per cent of pod wall, per cent placenta, per cent seed, amount of mucilage and flavor were correlated

with age. As the pods grew there was a decrease in the amount of mucilage, an increase of fibers in the pod wall, and an increase in the weight of the seed, markedly affecting the texture and flavor.

In Tennessee the harvest season is from July to October. In order to get the best quality pods they must be harvested every 2 or 3 days throughout this period. Harvesting small amounts of each harvest with costly labor is expensive. During the period July to October, labor is required to perform many other tasks on the farm.

V. YIELD

The yield of okra is extremely variable. The time of planting, the variety used, the amount of culture and fertilizer used, the fertility of the land and the amount of rain or irrigation during the growing season are contributing factors. If pods are allowed to remain on the plant for seed production, the total number of pods per stem for the season will be from 12 to 20; but if the pods are cut while young for table use, a single stem will produce from 25 to 40 pods in one season. Yield gradually decreases until frost, when the entire plant is killed (55).

Perkins, Miller and Dallyn (33) carried out an investigation with three okra varieties viz. Louisiana Green Velvet, Louisiana Market, and Gold Coast to obtain information on the influence of the method of harvest on total yield and the reproductive-vegetative behaviour of the plant. Their results provided a clear representation of the phenomenon of alternate bearing as it occurred in the plots for mature harvest. The plants of all three varieties bore heavily for a short time during the early part of the season, then a period of practically no pod production

followed by a short period of heavy yield and then another period of no production. The results indicate that the alternate type of bearing on the mature harvest plots was due to maturation of the seed pods. Evidently, during the period when the seed is maturing, most of the growth capacity of the plant is utilized in this function; and few, if any, new flowers are borne.

Plants in the immature-pod harvest area had no period of seed maturation and thus suffered no check in growth and flowering. Their yield continued long beyond the time the plants in the mature harvest area reached their first peak production. The importance of frequent and complete harvesting of okra for the fresh market is clearly evident.

The method of harvest also had a marked effect on plant height. All three varieties were severely stunted by the maturing seed pods. Some varietal difference was evident in this respect with the decrease in height of Gold Coast being considerably less, proportionally, than that suffered by the others.

Results of this investigation may be summarized as follows:

1. Okra plants harvested every 3 or 4 days produced 3 times as many pods as did plants on which the pods were allowed to mature.
2. Seed maturation caused a severe check in plant growth.
3. Plants which were harvested frequently bore continuously; those on which the pods were allowed to mature exhibited alternate bearing or "fruiting waves."
4. The importance of frequent and complete harvesting of okra for the fresh market was pointed out.

Yields of the more important varieties in a trial in Georgia are shown in Table I.

VI. STRUCTURE OF THE OKRA PLANT

The okra (*Hibiscus esculentus*, L.) plant is a tender annual, although it may grow for 2 years in frost-free regions. The plant develops rapidly in areas that are suitable for it, requiring only 2 months from planting to harvest of the first pods. It resembles the cotton plant in form and branching, since both belong to the family Malvaceae. The okra plant is branched, sturdy and woody and reaches a height of 3 to 6 feet. The stems are cylindrical and they become woody with age. Several lateral branches arise from near the base of the main axis and assume a fairly erect position. According to Jones and Rosa, (21) when the terminal bud is destroyed, stem elongation is never resumed through growth of axillary shoots from the upper part of the stem. The leaves are ovate in shape and are variously lobed; they are covered with stiff hairs which are very irritating to the hands of the pickers. The flowers occur singly, in all the leaf axils of the central stem and branches. They form progressively from the base toward the top at the rate of one per day on each stem, when the plants are growing rapidly. They are large and showy, perfect and mostly self-fertilized, though some crossing does take place through insect visitation. The stamens form a column about the pistil and are anther bearing along their entire length. The fruit consists of an elongated, ribbed, hairy pod. The pods become 4 to 12 inches long and are hard and woody at maturity. When dry, they dehisce

TABLE I

OKRA VARIETY TRIALS - YIELD IN POUNDS PER ACRE OF PROCESS GRADE

Variety	1953	1955
1. Emerald F-6	10,279	- -
2. Emerald D-6	10,273	- -
3. Dwarf Green Long Pod	8,113	- -
4. Clemson Spineless	- -	8,051
5. Emerald D-4	7,973	- -
6. Emerald F-46	7,893	- -
7. White Velvet	7,429	- -
8. Dwarf Green	7,379	- -
9. Emerald F-52	- -	6,785
10. Perkins Spineless	- -	6,577
11. Hastings Imp. Perkins	- -	6,019
12. Louisiana Green Velvet	5,870	- -
13. Emerald H-8	- -	5,548
14. Hastings Dwarf	5,398	- -

Georgia Agricultural Experiment Station Bull. 44; Aug. 1957.



along the sutures, scattering the seed. The color of the immature pods varies from deep green to nearly white in different varieties, and the degree of ribbing also varies. For freezing, brining, and canning there is a preference of pea-green color. Okra blackens along the ridges and around the base and tips of the pods due to bruising, loses greenness when held in hampers without refrigeration for more than a day; and turns brown when brined warm or with insufficient salt or when frozen with inadequate blanching (56).

VII. TOPPING

Okra being an indeterminate plant (21) the lateral branches tend to be suppressed until the terminal bud growth is checked. Among the several methods of removing or cutting vegetative portions of plants, the practice of topping is commonly used to concentrate harvest periods with some crops, e.g., chrysanthemums. When the terminal bud is removed, lateral branches develop at a fairly uniform rate, maturing several flowers at about the same time. The terminal bud could be removed either on the basis of time or on the basis of height of plants. In case of the former, topping may be done say 4 weeks after planting, or 6 weeks after planting, and so on, on the basis of the time interval. In case of the latter, topping may be done at the 4th node, at the 5th node, at the 6th node, and so on, on the basis of height of topping. Different crops and even different varieties of the same crop may give variable results with regard to the topping treatment. The inherent characters of the variety or crop together with the influence of the environment

viz. climate, pests and diseases, cultural practices will govern the responses of different varieties of one crop or different crops to the topping treatment.

The cultivated cotton plant, like okra, is characterized by an indeterminate growth habit. The main stem can bear lateral branches of two types. Frequently, but not always, the lower branches are monopodia, often carrying secondary sympodial branches, while the upper branches are usually sympodia. Occasionally monopodial branches may occur side by side with sympodial branches at upper nodes on the main stem. Because of the indeterminate development of the fruiting structure,* the number of fruiting points produced by different plants growing under similar conditions may vary considerably. Furthermore, loss of fruiting bodies due to shedding may be compensated by development of new buds elsewhere on the plant. Both these factors are of considerable economic importance.

Many investigators (e.g., Eaton (10), Eaton and Ergle (12) Singh and Choudri (43) Hamner, (16)) have removed flower buds from plants for various periods in attempts to improve yield. A consistent finding from experiments of this sort is that disbudded plants grow taller and have a higher dry weight than control plants although the effect on yields have varied. The data by Dale (6) support the classical theory of cotton plant nutrition in that there is evidence that maturation of bolls proceeds using nutrients which could otherwise be used for further growth and development of fruiting structure.

*Here the term "fruiting structure" is reserved for that part of the plant framework bearing bolls, buds and flowers which are referred to as "fruiting bodies." "Fruiting points" are those points on the fruiting structure which bear, or have borne, fruiting bodies.

In addition to the environmental factors determining the response of plants to the discontinuation of disbudding, there is apparently a further factor, inherent in the plant, leading to the production of small and malformed bolls. The interaction of these factors will determine the effect of disbudding on yield.

Observations by Dale (6) clearly show that increase in fruiting structure as a result of disbudding comes from further growth of both sympodial and monopodial branches. Balls (2) describes an ideal cotton plant as one which has no monopodial branches and in which growth of the main stem ceases soon after fruiting commences. How does such a plant respond to disbudding? Direct evidence is not available but the variety U₄, which has poorly developed monopodial branches (Parnell, 31) when grown under Uganda conditions suffers heavily from shedding due to insect pests and does not show continued compensatory growth and thus yields lower than BP-52 selections. While this phenomenon may be a response to an adverse environment (which is not, it follows, adverse for growth of BP-52) it may be linked with an inherent inability of such cotton to continue growth and production of new fruiting points indefinitely at a rate sufficiently fast to enable a crop to be set within the normal cotton season. The effect of the indeterminate growth habit on yield in such cotton is masked by a slow growth rate in the latter part of the growing season. Heath's data (19) support this. Mason (26) stated that the cessation of growth of the main axis of Sea Island cotton observed by Harland (17), and increased susceptibility

to shedding could be correlated with a factor tending to channel metabolites from the plant apex to the basal fruiting branches.

Increased growth of individual sympodial branches, production of more and bigger secondary sympodia from buds which would normally remain dormant, all are responses of plants to disbudding and it may be concluded from their vigorous development that these stem and branch apices are well supplied with necessary nutrients.

Mason's hypothesis (26) says that "when fruiting commences some kind of controlling mechanism is either brought into play or modified, to effect partition of available nutrients between potential 'sinks'."

Dale's data (6) shows that the presence of fruiting bodies is important in causing a reduction in growth and it may be that the primary site of the mechanism is to be found in developing fruit.

Peebles (32) conducted an experiment to effect a material delay in the development of ratooned cotton, so that it would begin flowering at about the same time as annual cotton. The means utilized for delaying the crop was early topping, or the removal of all new growth shortly after the first flowers appeared.

Results (32) showed that the cotton (Amsak-American-Egyptian) was materially delayed by removal of the new growth from the plants one week after the first flower appeared. The initial delay amounted to nearly 5 weeks. Consequently, the topped ratooned Amsak reached the flowering stage at about the same time as annual American-Egyptian cotton.

Various methods of removing plant parts to increase early yield or increase size or improve quality have been practiced by growers of

many crops. In some sections the method used in tomatoes is to cut off the foliage of the 4-5 week old seedling, leaving just the main stem and four leaf stalks. Others practice "topping" 2 to 3 weeks before the plants go to the field, terminating the central stalk just above the first cluster. Rosa (37) states that this increased the yield in his experiments.

The general recommendation that any sort of pruning reduces the yield of the plant cast doubt on the wisdom of cutting back young plants, yet it would be desirable if two, three, or four branches could be made to produce their first clusters at the time normal, unpruned plants bring in their one cluster. Work by Ernest H. Casseres (5) confirms many reports on pruning (20, 24, 25, 45, 46, 49) which show that under various conditions, removal of vegetative tissue does not favor an increase in the early yields and has little or no effect on the total yields.

Westover (53) showed that when tomato seedlings were topped they reduced the early yields from two varieties (Early Baltimore and Marvelous), but as the season advanced, the yield differences decreased and lack statistical significance. Both varieties apparently responded to treatment in the same manner. These findings, together with the fact that differences obtained in the previous studies were generally small or inconsistent, suggest that the topping treatment may be practical as an emergency measure in holding young plants late in the season, particularly when the entire crop is to be marketed.

Westover, however, indicated from another experiment (52) that topping tomatoes tended to increase the early yields but reduced the season's

yields and fruit set in the majority of cases. The increase in early yields are difficult to explain unless the growth checking effect of the topping treatment during the early development of the plants was quickly outgrown, and an increase in fruit set resulted which contributed to the increased yields during the early season. Although the treatment response with respect to variety was not entirely consistent, the fact remains that the early yields of at least one of the varieties (Marvelous) was increased each year, and the yield losses, if any, of the other variety were of little significance. The treatment definitely reduced total yields and fruit set.

Sayre (39) also indicated that topping tomato plants would be advisable when the plants would have to be held for some time.

Some other conclusions by Sayre (39) are that topping tomato plants at a height of 9" will prevent the plants from becoming too leggy and will produce more compact plants that stand transplanting better. These results were similar to the results of previous experiments indicating that topped plants will also produce larger yields if transplanting is unduly delayed.

Edmo	significant difference between
the total c	taked, topped, pruned
plants and	plants. Topping did
not prove t	
Topp	effect on yield or quality
of the frui	ffman, and C. E. Steinbauer (7

Another interesting effect of topping noted was in sugar beets. Field tests (35) showed that a loss of sugar occurred as topping of the beets was delayed. Soluble and harmful nitrogen increased in the beets during the same period. A greater percentage of the increase in soluble nitrogen appeared as "harmful" nitrogen as the period between lifting and topping increased.

In growing dahlias, Stuart Ogg (28) recommends that when the plants are about 8" to 1 foot in height, the tip should be taken out from the main leader, which makes them "break" sooner than they would do normally. In addition he states that this also prevents the plants becoming too tall and top heavy and produces well finished ones instead, which are not such a target for the autumn gales.

Rose and Kiplinger (38) conducted an experiment to compare several methods of "pinching" three varieties of potted chrysanthemums. Their results showed that the length of time required to produce a flowering plant varied with the treatment; for example, cuttings not pinched matured earlier than those given either a single or double pinch, even though all of them were potted the same day. Some differences were noted between treatments in the number of flowers per pot. Plants not pinched had the least number of flowers and for this reason it is not recommended that this system of growing be used. The double pinched plants produced the most flowers as would be expected because of the greater number of stems per plant. It appeared that if larger specimen plants are desired, the double pinch method of handling is necessary. Although the no pinch system required the least number of days, the scarcity of flowers and the rather stiff upright growing habit is not in its favor. Chrysanthemum plants which were pinched 15 days after planting required about 4 months

from planting to cutting. When no pinch was given, about 3 months were required for the crop.(34).

"Time pinching" is a new development in the growing of chrysanthemums. Instead of pinching when the plants are from 6 to 8" tall, the plants are pinched according to the time required to produce blooms. Preliminary tests have shown that if the pinch is made at the right time, the crown bud never forms and the result is a straight stem without any joints or crooks which are usually present when a crown bud develops.

Results from work done by Gifford and Kiplinger (15) indicate that the time pinch, if made at the right time, does eliminate the crown bud on some varieties of standards. However, some varieties appear to be unaffected by the time pinch.

Daphne Vince and D. T. Mason (50) undertook an investigation of the behavior of lateral shoots which develop on non-vernalized plants when the growing point and part of the stem are removed. Their results showed that under certain conditions the flowering of non-vernalized plants of *C. morifolium*, var. Sunbeam, was markedly accelerated by removing an apical section of the stem. The laterals which developed as a result of decapitation elongated normally and flowered rapidly in short photoperiods, while the apices of the control (intact) plants continued to show rosetted, diageotropic growth, and terminal inflorescences developed only after considerable delay. Flowering in response to decapitation occurred in wholly non-vernalized plants and was not increased by partial chilling, and in fully vernalized plants, decapitation delayed flowering.

This response to decapitation in non-vernalized plants occurred only when they had attained a certain age; the lateral shoots remained vegetative when plants were cut back less than 20 weeks from the date of potting. Maximum response occurred when plants were cut back after more than 28 weeks of growth in short potoperiods. This response may be related to plant size rather than to plant age since, in three other experiments which gave nearly 100 per cent flowering after cutting back, the plants were 22 to 26 weeks old. The effect of decapitation is to remove most of the inhibitor, which is localized in the growing region.

Schwabe (41) found that there was acceleration of flowering in non-vernalized chrysanthemums by the removal of apical sections of the stem.

Investigations by Kamp and Hall (22) to study the effect of height of topping on "Antirrhinum Majus" showed that there were differences between the number of shoots on plants topped at the 3rd node and those topped at the 5th node. This difference was not consistent in the different varieties. In all six varieties, the lower topping produced longer spikes.

The increase in number of spikes with the higher topping varied from 3.3 per cent to 48.2 per cent, according to variety, but the trend was consistent in all cases. On the average the increase was $29\frac{1}{2}$ per cent. In all varieties, plants topped at the 5th node came into production earlier than those topped lower and held this production lead for several weeks. On the basis of these results, therefore, topping at the 5th node can be recommended as giving both a greater number of

spikes and also an earlier crop. The most remarkable difference, however, was in the time of flower production. Those plants topped high produced the bulk of their flowers in a heavy early crop, whereas those plants topped lower produced a later crop over a longer period of time. The planting upon which these conclusions were based was made for a fall and early winter crop of blooms.

The inhibiting effect of a terminal bud upon lateral bud development is called "apical dominance" and is much more pronounced in some species than in others. The phenomenon of apical dominance is observed in many herbaceous and woody plants on which true terminal buds form. The lateral buds on current shoots usually do not develop unless the terminal bud is destroyed. Development of the lateral buds on older shoot parts is of more frequent occurrence, suggesting that the inhibitory effect of the apical bud diminishes with greater distance of the lateral buds from the apex of the stem.

According to Meyer, Anderson, and Bohning (27), the controlling effect of the apical bud in apical dominance apparently results from its auxin content. Experiments clearly support the assumption that the growth of lateral buds is checked by auxins formed in the apical buds. Even though there is no doubt that auxins play a key role in the phenomenon of apical dominance, the exact mechanism of their operation in this kind of growth correlation is not known with certainty. One suggestion is that the auxin exerts a direct retarding effect on the development of lateral buds.

Other more elaborate interpretations of how auxins inhibit lateral bud development have been made (27). It has been suggested that certain other substances necessary for bud growth are diverted to regions of relatively high auxin concentration such as terminal buds and that lateral buds fail to develop because of their lack of these substances in adequate quantities.

Another suggested explanation, for which there is considerable supporting evidence, is that under the influence of auxin, a growth inhibitor is found that is responsible for the inhibition of lateral bud growth (27).

In herbaceous plants a growth correlation also appears to exist between cambial activity and flower production. The correlations between flower formation and cambial activity suggest the operation of a hormonal mechanism.

Experimenters have demonstrated that the development of buds is controlled by the leaf and not by factors in the stem axis. The mechanism of this control is unknown but is probably of a hormonal type (27).

A later planting failed to respond in a similar way. In order to see whether the time of planting was responsible for the late crop's failure to respond to topping, Kamp and Hall (23) repeated the experiment in the 1946-47 season at three planting dates, giving an early, an intermediate and a late crop of blooms. Results indicated that the influence of topping was confined largely to that planting designed to produce a fall or early winter crop of flowers.

Reports in the literature indicate that in several unrelated species removal of the apical section of the stem results in accelerated flowering, or in the flowering of lateral shoots which would otherwise have been inhibited in growth. Wareing (51) reported that males cones of "*Pinus sylvestris*" could be produced prematurely on "juvenile" trees by removal of the terminal bud. Kikuyu grass flowers only when the herbage is grazed or cut (Edwards, 14, Parker, 30). Carr and Eng Kok Ng (4) have shown that the suppressed lateral buds are vegetative but begin to initiate spikelets immediately the stolon tip is removed in the Kikuyu grass.

VIII.. OBJECT OF THIS EXPERIMENT

In addition to an evaluation of 3 varieties of okra (i.e., Clemson Spinless, Emerald and Gold Coast), this study deals with the topping of okra plants at 3 heights in relation to concentrating the harvest into a shorter time period. If this could be accomplished, harvesting cost and consequently total production cost could be reduced and thereby encourage the further expansion of okra production for canning and freezing.

CHAPTER III

EXPERIMENTAL PROCEDURE

I. LAYOUT OF THE EXPERIMENT

The area selected for the experiment was a plot on the Morgan Farm with a silt loam soil of the Abernathy series. The soil was well prepared by turning and discing. The total area 2400 sq. ft. (40 x 60) to be used for the experiment was marked off for a Randomized Block design with 6 replications.

FIELD PLAN

	Rep I		Rep II		Rep III		Rep IV		Rep V		Rep VI	
Row No.	Variety	Treatment	Variety	Treatment	Variety	Treatment	Variety	Treatment	Variety	Treatment	Variety	Treatment
1	GC	1	E	3	CS	4	CS	4	CS	1	CS	1
2	GC	2	GC	2	GC	2	GC	2	CS	4	CS	2
3	GC	3	CS	2	E	4	GC	4	E	1	GC	4
4	GC	4	CS	4	CS	2	GC	3	E	2	GC	3
5	CS	1	E	1	E	2	E	4	E	4	CS	4
6	CS	2	GC	3	GC	1	E	3	GC	2	E	1
7	CS	3	GC	1	GC	4	CS	2	GC	4	E	4
8	CS	4	GC	4	CS	1	GC	1	E	3	E	2
9	E	1	CS	1	GC	3	CS	1	CS	2	CS	3
10	E	2	E	4	CS	3	E	2	GC	3	GC	2
11	E	3	E	2	E	3	CS	3	CS	3	E	3
12	E	4	CS	3	E	1	E	1	GC	1	GC	1

Varieties:

GC = Gold Coast
CS = Clemson Spineless
E = Emerald

Design: Randomized Block

Treatments:

1 = No Topping
2 = Topped at 5th Node
3 = Topped at 7th Node
4 = Topped at 9th Node

Treatments and the three varieties were randomized.

II. FERTILIZER APPLICATION

A 5-10-5 fertilizer was applied at the rate of 800 lbs. per acre. Half was broadcast and half banded along the rows. The fertilizer was applied before planting. No side dressing was given.

III. PLANTING

On June 1, 1960, okra seeds of the three different varieties were sown in rows 4 ft. apart, with five feet of row being used for each treatment. Seeds had been treated with Captan as a fungicide.

IV. CULTURAL PRACTICES

a. Weeding. The plot was hand weeded on the 29th and the 30th of June. The average height of the plants at this time was 2.56 inches. Two more weeding were also given.

b. Thinning. The plants were thinned to 2 plants per foot of row on the 29th and the 30th of June. They were further thinned to one plant per foot of row on the 7th of July 1960. Thinning was accomplished by gently pulling out the weak and poor plants by hand, causing as little mechanical disturbance as possible to the other plants. Care was taken to have as straight a row of plants as possible, and also to have a uniform one foot spacing between plants in the row.

c. Topping. Topping was accomplished by simply pinching the central growing shoot at the desired node by hand. Topping at the different nodes was done as follows:

Topping at the 5th node, 8th July.

Topping at the 7th node, 1st August.

Topping at the 9th node, 9th August.

d. Irrigation. No irrigation was given because there was sufficient rainfall.

e. Pest and disease control. All the varieties were free from pests and diseases; hence no pesticide program was followed. Due to favorable conditions, the plants made rapid growth. Late in the growing season in October, darkish green raised pimples were observed on the pods, severe on Clemson Spineless, less on Emerald and least on Gold Coast. There did not appear to be any serious drawback in the quality of the pods due to this, except resulting in a poorer appearance. This would lessen the value as a fresh market product.

V. HARVESTING

Harvesting of the tender pods began on the 2nd of August 1960 and continued until the 20th of October 1960, after which the plants were killed by frost. To insure best quality, okra was generally harvested every 2 or 3 days. It was harvested by severing the peduncle just below the pod.

VI. RECORDS

After each harvest the number of pods and the weights of the three grades - A, B and culls, for each of the three varieties and for each of the four treatments were recorded by replicates. Grade specifications used were:

Grade A	1-1/3 to 3 inches (length of pod)
Grade B	3 to 5 inches (length of pod)
Culls	Over 5 inches (length of pod)

Pod characteristics were recorded and an analysis made for fiber and pod-to-seed ratio for the three varieties.

In early October, near the end of the harvest season, a count was made of the fruiting branches on each treatment as well as the height and spread of plants.



CHAPTER IV

RESULTS AND DISCUSSION OF RESULTS

Average yields of okra by varieties, treatments, harvest periods and grades are recorded in Table II.

I. VARIETY

The average yields in pounds per replication for the entire season of the three okra varieties are shown in Table II. Gold Coast is significantly lower in yield than either Clemson Spineless or Emerald. The yields of Clemson Spineless and Emerald are not significantly different.

II. TREATMENTS

An average comparison of the treatments for the three varieties for the three periods and three grades can be seen in Table II.

No topping gave the highest yield followed by these topped at 9th node. Plants topped at the 5th node are not significantly different in yield from those topped at the 7th node.

From Table III it is seen that in both Emerald and Gold Coast varieties, the non-topped plants yielded significantly more than any of the topping treatments.

In Clemson Spineless, the non-topped plants and those topped at the 9th node yielded equally well; and both gave significantly more yields than plants topped at the 5th node and those topped at the 7th node.

TABLE II

AVERAGE YIELDS OF OKRA BY VARIETIES, TREATMENTS,
HARVEST PERIODS AND GRADES

	Average Pounds Per Plot	Yield per Acre Lbs.
1. Variety		
Clemson Spineless	0.999	19.582
Emerald	1.010	19,798
Gold Coast	0.837	16,406
L.S.D. 0.05 Level	0.053	
2. Treatments		
No Topping	1.105	
Topped at 5th Node	0.877	
Topped at 7th Node	0.870	
Topped at 9th Node	0.943	
L.S.D. 0.05 Level	0.063	
3. Periods		
August	1.276	
September	1.350	
October	0.220	
L.S.D. 0.05 Level	0.053	
4. Grades		
A	1.30	
B	0.80	
C	0.74	
L.S.D. 0.05 Level	0.053	

TABLE III

INFLUENCE OF TOPPING AT DIFFERENT NODES ON YIELD
OF THREE OKRA VARIETIES (POUNDS PER PLOT)

Treatments	Clemson Spineless	Emerald	Gold Coast
No Top	1.035	1.235	1.044
Top at 5th	0.880	1.004	0.746
Top at 7th	0.983	0.865	0.763
Top at 9th	1.099	0.936	0.793
L.S.D. 0.05 Level	0.1066		

III, PERIODS

Table II shows a general comparison between the three harvest periods of August, September, and October. It is seen that the highest average yield per replication is in September, followed by August, with the lowest in October. The yields during each period differ significantly. October yields are the lowest due to the cold weather bringing about the cessation of plant functions and activity, since okra is a warm season plant and cannot stand cold weather.

From Table IV it is seen that when all treatments are considered together, October yields are significantly less than either August or September yields in all varieties. Yields during August and September in Clemson Spineless and Emerald are not significantly different, whereas September yields in Gold Coast are significantly higher than August yields.

IV. GRADES

From Table II significant differences are observed between yields of the different grades, with grade A being the highest, followed by grade B and grade C or culls.

From Table V it is seen that the highest yield of grade A okra in all varieties is from plants topped at the 5th node and is in September, and their differences are statistically significant.

The highest yield of grade B okra in both Clemson Spineless and Gold Coast is in August in the non-topped plants. In Emerald it is

TABLE IV

YIELDS BY MONTHLY PERIODS OF THREE OKRA VARIETIES
(POUNDS PER PLOT AVERAGE 6 REPLICATES ALL GRADES)

Periods	Clemson Spineless	Emerald	Gold Coast
Aug.	1.397	1.384	1.046
Sept.	1.430	1.339	1.280
Oct.	0.170	0.307	0.184
L.S.D. 0.05 Level 0.095			

TABLE V

INFLUENCE OF TOPPING AT DIFFERENT NODES ON YIELD BY GRADES AND
HARVEST PERIODS OF THREE OKRA VARIETIES (LBS. PER PLOT)

Treatment	August			September			October		
				Grade					
	A	B	C	A	B	C	A	B	C
CLEMSON SPINELESS									
No top	1.48	1.51	2.29	2.04	1.05	0.66	0.17	0.08	0.00
Top at 5th	1.21	0.89	0.91	2.60	1.38	0.69	0.17	0.05	0.00
Top at 7th	1.15	0.74	1.79	2.22	1.03	1.18	0.54	0.11	0.04
Top at 9th	1.43	1.04	2.27	1.88	1.18	1.21	0.58	0.23	0.03
EMERALD									
No Top	1.34	1.32	2.76	1.89	1.22	1.60	0.74	0.17	0.05
Top at 5th	1.00	0.96	1.21	2.05	1.33	1.56	0.56	0.13	0.04
Top at 7th	1.01	0.88	1.27	1.43	0.93	1.15	0.80	0.22	0.07
Top at 9th	1.06	1.19	2.42	1.19	0.68	0.99	0.60	0.23	0.02
GOLD COAST									
No Top	2.21	1.71	0.76	2.72	1.34	0.16	0.45	0.01	0.00
Top at 5th	1.05	0.45	0.07	3.11	1.48	0.13	0.31	0.07	0.00
Top at 7th	1.17	1.26	0.12	2.37	1.03	0.26	0.54	0.10	0.00
Top at 9th	0.40	1.65	0.49	1.56	1.03	0.12	0.59	0.09	0.00
L.S.D.									
0.05 Level	0.47								

in September in the topped at 5th node plants. The differences between the highest grade B yields of the three varieties are not significant.

The highest yield of grade C okra is in August in the non-topped plants for all three varieties, and the differences are significant at the 5.0% level.

Table VI shows that Gold Coast yielded significantly more grade A okra than either Clemson Spineless or Emerald. Between the latter two varieties Clemson Spineless yielded more grade A okra than the Emerald variety.

All three varieties yielded almost the same amount of grade B yields.

Emerald produced the greatest amount of grade C okra, followed in decreasing order by those of Clemson Spineless and Gold Coast. The differences between these are all statistically significant.

In Clemson Spineless and Gold Coast varieties, grade A yields are significantly more than both grade B and grade C yields, whereas in Emerald only grade A yields are more than grade B yields.

On the whole, results are as expected and anticipated. A comparatively high grade C or culls yield is seen for Clemson Spineless and Emerald. This was due to an unavoidable delay in harvesting in the first week in August.

V. YIELD BY HARVEST INTERVALS

With regard to yield by harvest intervals, it is observed from Table VII and Figures 1, 2 and 3 that all varieties produced nearly 90-95% of their yield in August and September. They produced

TABLE VI

YIELD BY GRADES OF THREE OKRA VARIETIES
(POUNDS PER PLOT AV. 6 REP. ALL TREATMENTS)

Grades	Variety		
	Clemson Spineless	Emerald	Gold Coast
A	1.293	1.143	1.476
B	0.778	0.775	0.855
C	0.926	1.112	0.169
L.S.D. 0.05 Level 0.095			

CRANES  CREST

TABLE VII

TOPPING INFLUENCE ON YIELD OF THREE OKRA VARIETIES (IN LBS.) AT TEN DAY INTERVALS

Variety	Treatment	August			September			October	
		1-10		11-20	1-10		11-20	1-10	11-20
		1-10	11-20	21-31	1-10	11-20	21-30	1-10	11-20
Clemson Spineless	No Topping	1.4	1.7	1.8	2.3	0.9	0.8	0.1	0.2
	Topped at 5th node	0.3	0.2	2.5	3.0	1.0	0.6	0.1	0.2
	Topped at 7th node	1.3	1.3	1.2	1.9	0.9	1.8	0.3	0.5
	Topped at 9th node	1.8	1.4	1.4	1.4	0.8	1.8	0.3	0.5
Emerald	No Topping	1.9	2.1	1.5	1.9	1.1	1.7	0.3	0.6
	Topped at 5th node	0.4	1.1	1.9	2.1	1.3	1.5	0.3	0.5
	Topped at 7th node	1.2	1.0	1.0	1.2	0.8	1.3	0.4	0.7
	Topped at 9th node	1.4	2.1	1.1	1.0	0.6	1.3	0.3	0.6
Gold Coast	No Topping	1.1	2.4	1.2	1.4	1.0	1.6	0.2	0.2
	Topped at 5th node	0.2	0.3	1.1	2.1	1.3	1.1	0.3	0.1
	Topped at 7th node	1.3	0.7	0.6	1.3	1.0	1.4	0.4	0.3
	Topped at 9th node	1.0	2.0	0.8	0.5	0.6	1.6	0.4	0.3

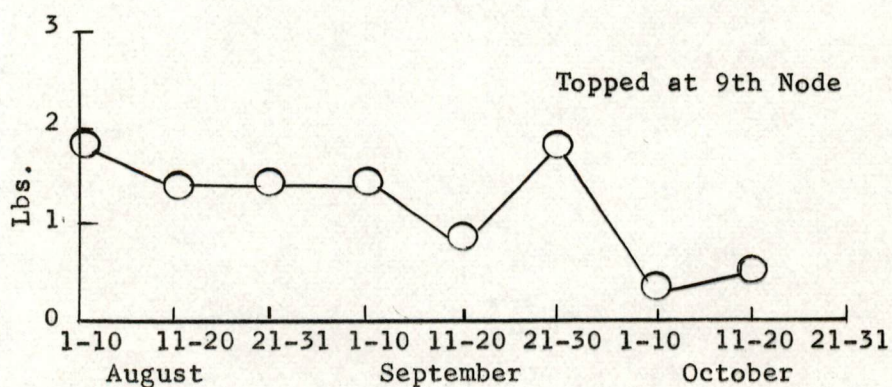
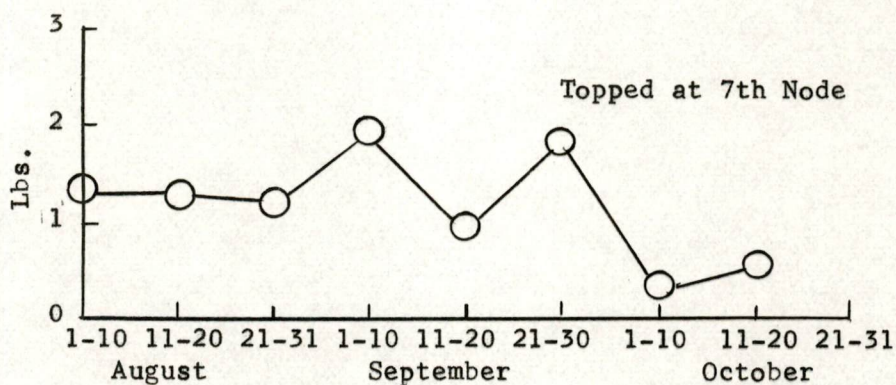
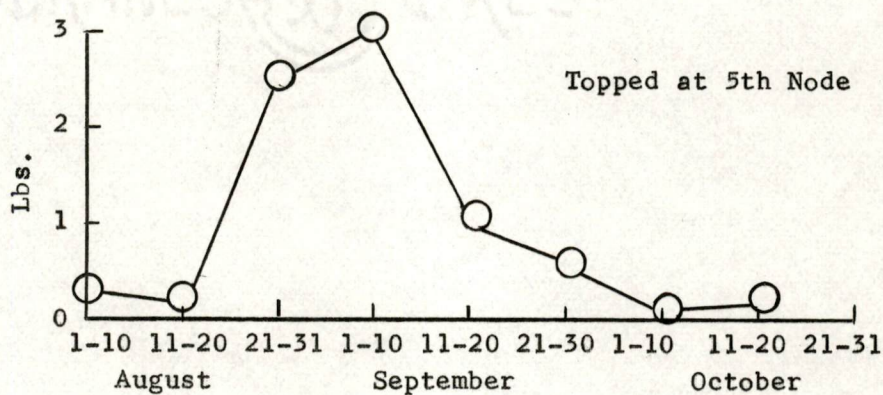
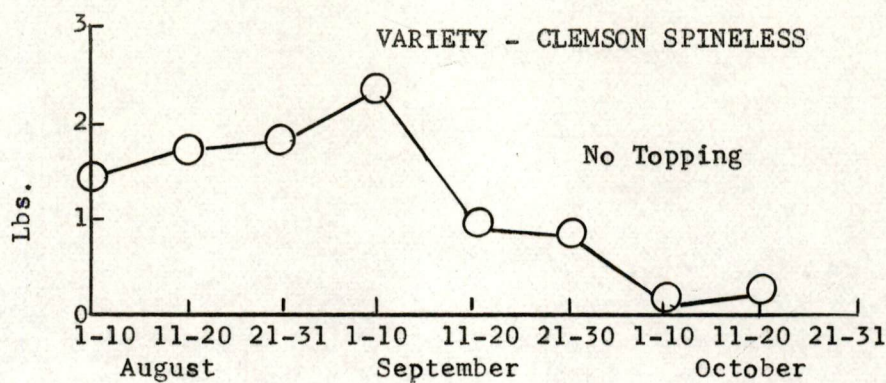


Figure 1. Influence of Topping on Yield of Okra.

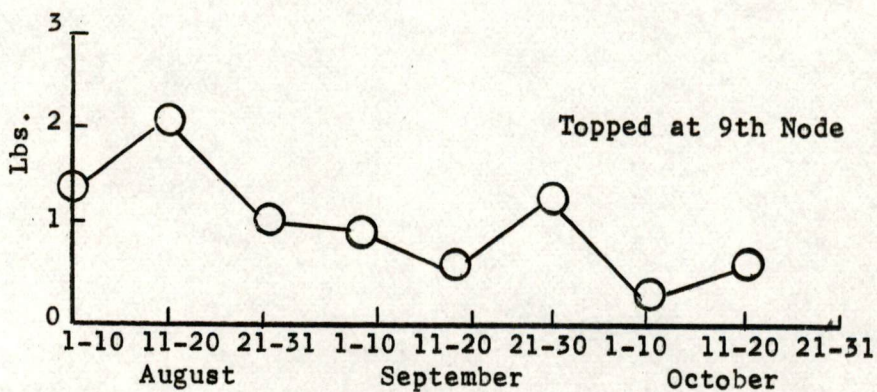
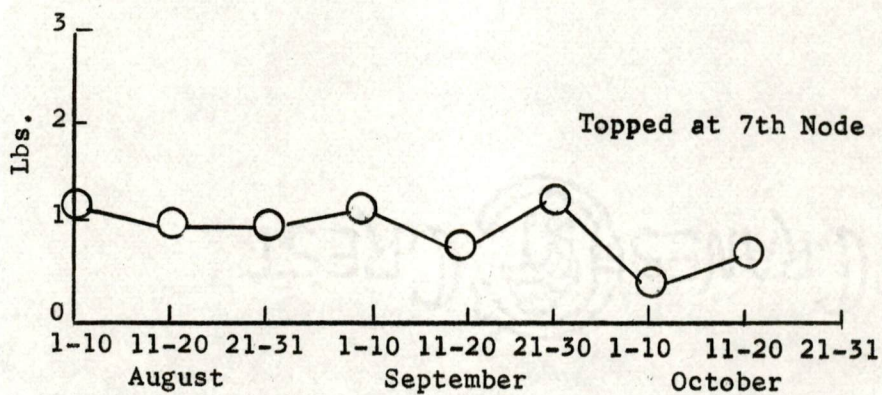
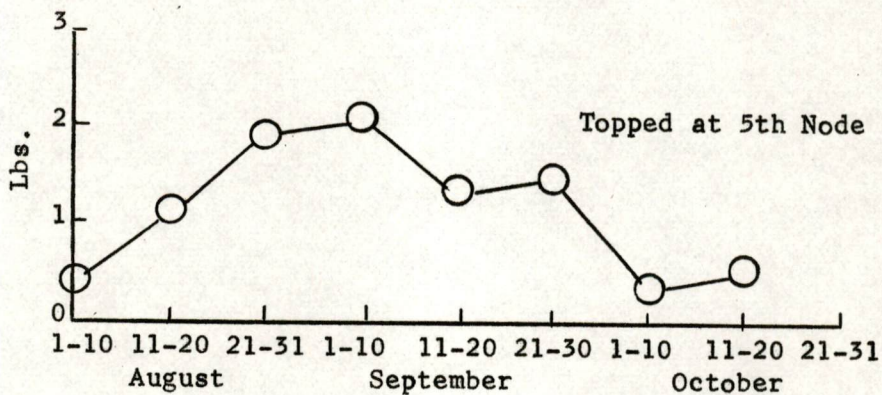
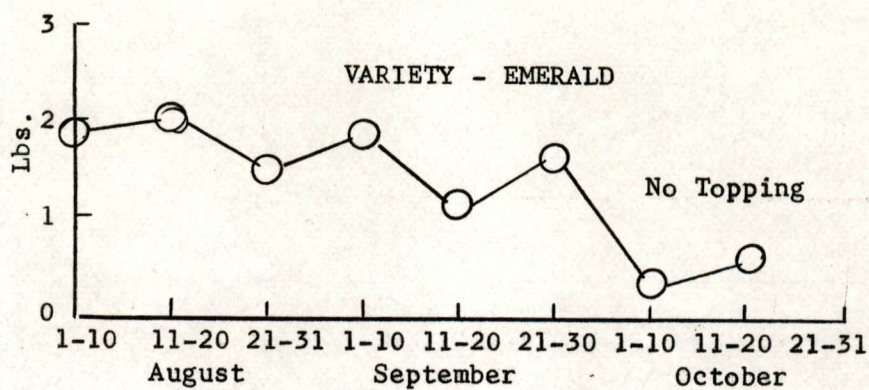


Figure 2. Influence of Topping on Yield of Okra.

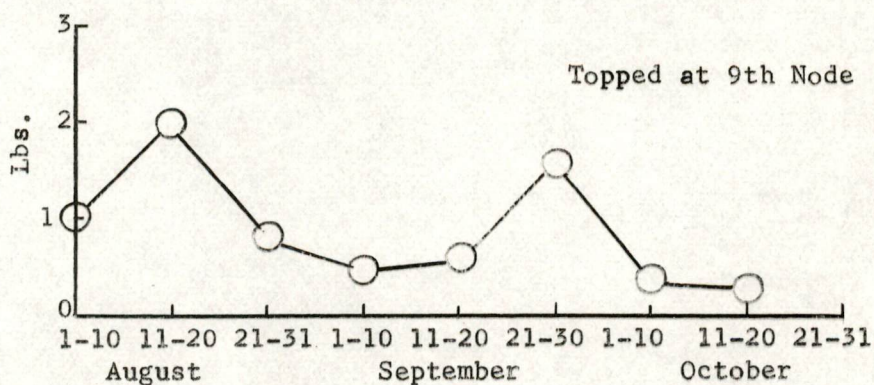
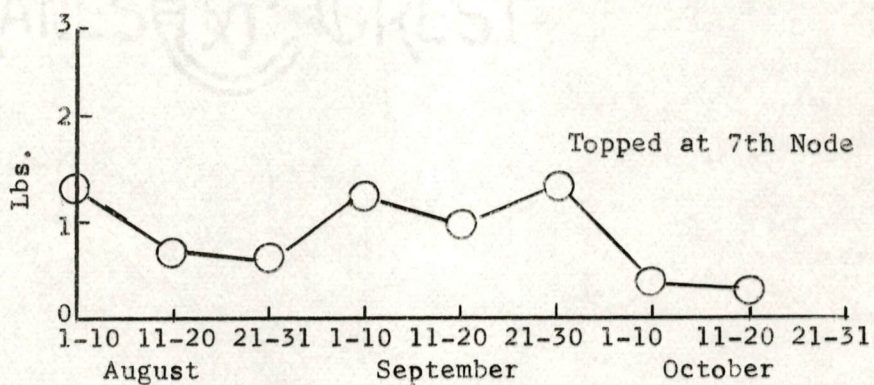
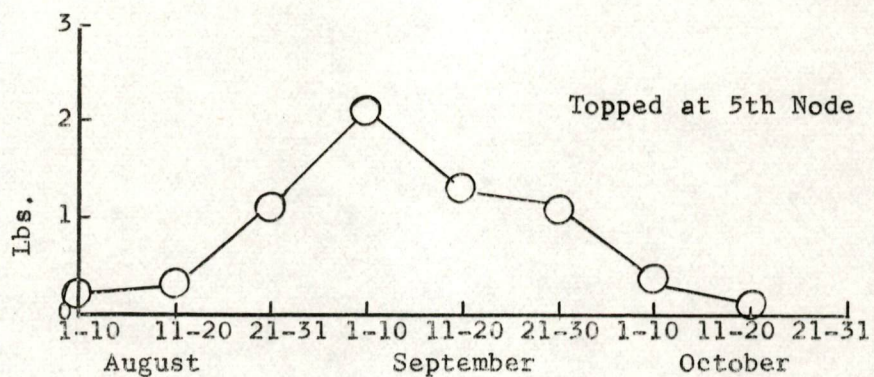
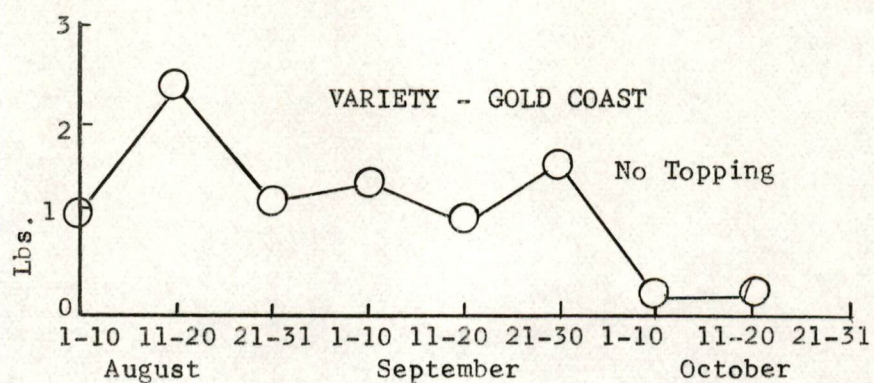


Figure 3. Influence of Topping on Yield of Okra.

almost equally during these two months. On this basis it is questionable whether October harvests would be profitable. Both Clemson Spineless and Emerald produced equally high yields, while Gold Coast produced the lower yield.

Topped at the 5th node plants had a shortened harvest season as compared with those topped at the 7th, at the 9th node and those non-topped.

VI. QUALITY (CRUDE FIBER AND SEED CONTENT) OF OKRA

An analysis of crude fiber and seed content of whole pods of the three varieties of fresh okra were made by the Food Technology Department. The results are tabulated in Table VIII.

In regard to crude fiber content, the differences could not be correlated with age of pods.

In all three varieties, there is an increase in seed content of the pods with increasing maturity of the plant as pods were of the same size at each harvest period. There is a possibility that the pods at each successive harvest were older due to the maturation of the plant, taking longer to develop pods of $3\frac{1}{2}$ to $4\frac{1}{2}$ inches long due to the less efficiency of woody maturing tissues to manufacture and transport foods.

TABLE VIII

CRUDE FIBER AND CONTENT OF WHOLE PODS* OF THREE VARIETIES OF
FRESH OKRA

Date Received	Emerald		Gold Coast		Clemson Spineless	
	Fiber	Seed	Fiber	Seed	Fiber	Seed
	<u>Percent</u>		<u>Percent</u>		<u>Percent</u>	
8-15	.77	14.2	.78	14.1	.69	15.3
8-18	1.00	11.3	.72	15.1	.78	17.8
8-24	.87	12.3	.74	12.6	.70	18.2
8-26	.96	14.8	.78	16.8	.78	20.8
8-29	.93	12.7	.78	16.2	.74	22.0
9-2	1.04	16.9	.83	19.8	.75	23.0
9-6	.91	20.7	.84	23.8	.69	29.0

* $3\frac{1}{2}$ to $4\frac{1}{2}$ inches in length.

VII. INFLUENCE OF PROGRESSIVE MATURITY ON WEIGHT,
LENGTH AND DIAMETER OF OKRA

Observations were also taken to find the effect of progressive maturity of pods on their weight, length and diameter. Fully opened blooms as uniform in size and shape as possible were tagged on Sept. 17th 1960. All the blooms were selected on the main stem or on the top-most lateral sucker. Since it was towards the end of the season, sufficient uniform blooms in each of the three varieties were not available for tagging. As such, only 16 blooms in Clemson Spineless, and 40 each in Emerald and Gold Coast were tagged. The first harvest of pods was made on 22nd, of September -- 5 days after tagging the fully opened blooms. The second, third and fourth harvests were at regular intervals of 2-3 days. At each harvest, $\frac{1}{4}$ th of the tagged fruits were harvested. The weights of the fruits were recorded. The individual lengths and diameters (at the base of the pod) were also taken and their averages recorded. All the observations are shown in Table IX.

It is to be noted that since all the blooms were tagged on the same day, the pods were becoming more and more mature at each subsequent harvest date.

From Table IX it is clearly seen that in the Clemson Spineless, Emerald and Gold Coast varieties of Okra, with progressive maturation, the weight, length and diameter of the pods increased.

It is seen that pods of Emerald elongate fastest, followed by Clemson Spineless and Gold Coast.

TABLE IX
EFFECT OF PROGRESSIVE MATURITY OF PODS ON THEIR WEIGHT, LENGTH AND DIAMETER FOR
THE THREE OKRA VARIETIES

Harvest Dates	Clemson Spineless				Emerald				Gold Coast			
	No. Harvested	Average Weight of each (ozs.)	Average Length of each (in.)	Average Diameter of each at base (in.)	No. Harvested	Average Weight of each (ozs.)	Average Length of each (in.)	Average Diameter of each at base (in.)	No. Harvested	Average Weight of each (ozs.)	Average Length of each (in.)	Average Diameter of each at base (in.)
22nd Sep. '60	4	0.3	1.45	0.65	10	0.2	1.82	0.51	10	0.10	1.20	0.50
24th Sep. '60	4	0.5	2.59	0.90	10	0.3	3.32	0.59	10	0.20	1.56	0.55
26th Sep. '60	4	1	4.18	1.03	10	0.5	4.47	0.81	10	0.40	2.45	0.87
29th Sep. '60	4	1.5	5.06	1.10	10	1.2	6.65	0.87	10	0.60	3.40	0.96
Average Increase in Length per Day			0.51				0.79				0.31	

It is also observed that, 9 days after tagging the blooms, pods of the Gold Coast variety are still less than 3" in average length; whereas, in both Clemson Spineless and Emerald the pods average more than 4" in length. It therefore appears that the number of harvests of pods for Gold Coast may be less than for either Clemson Spineless or Emerald.

The slow rate of elongation of pods was perhaps due to the cooler weather which occurred in late September.

VIII. INFLUENCE OF TOPPING ON FRUITING SUCKERS AND ON HEIGHT AND SPREAD OF PLANTS

In early October, near the end of the season, observations were taken to see whether the topping treatments had any influence on the total number of fruiting suckers, the height and spread of plants. The central branch was included. Fruiting suckers were counted on five plants in each treatment and their averages are recorded in Table X.

In Clemson Spineless, there is a significant increase in number of suckers resulted from topping at the 9th node when compared with no topping; but, no differences occurred between the other treatments.

In Emerald and Gold Coast, no significant differences are noted.

Concluding, it can be said that there are no significant differences due to topping.

The height was measured from the ground level to the top most node. The spread was measured at the widest spread of the branches;

TABLE X

INFLUENCE OF TOPPING AT DIFFERENT NODES ON TOTAL NUMBER OF FRUITING SUCKERS IN THREE OKRA VARIETIES

Replica- tion	Clemson Spineless				Emerald				Gold Coast			
	No Topping	Topped at 5th Node	Topped at 7th Node	Topped at 9th Node	No Topping	Topped at 5th Node	Topped at 7th Node	Topped at 9th Node	No Topping	Topped at 5th Node	Topped at 7th Node	Topped at 9th Node
I	2.0	2.8	4.0	3.4	2.8	3.4	3.6	2.8	2.6	2.6	4.2	2.4
II	2.8	3.0	1.6	2.6	2.2	2.6	4.2	2.4	2.6	4.4	3.0	2.8
III	0.4	0.4	0.4	2.0	2.0	0.8	2.0	2.0	0.8	1.4	2.4	2.2
IV	0.6	0.0	1.0	1.8	1.6	2.4	2.2	1.6	1.0	1.0	1.8	2.2
V	0.4	0.2	0.6	0.6	0.6	0.8	2.0	1.0	0.8	1.8	0.6	1.4
VI	0.0	0.2	1.4	2.0	1.6	2.0	1.8	0.8	1.0	1.2	2.0	2.2
Total	6.2	6.6	9.0	12.4	10.8	12.0	15.8	10.6	8.8	12.4	14.0	13.2
Mean	1.03	1.10	1.50	2.06	1.80	2.00	2.63	1.76	1.46	2.06	2.33	2.20
L. S. D. 0.05 Level 1.10					0.95				1.44			

the furtherest leaf extremities on either side were the limits for the actual measuring positions. In both cases, for each variety, each treatment and each replication, measurements for five plants, were noted and their averages for height and spread are recorded in Table XI and Table XII respectively.

In Clemson Spineless, Emerald, and Gold Coast with regard to height, none of the treatments brought about any significant change.

As regards spread, none of the treatments brought any significant changes in Clemson Spineless, Emerald and Gold Coast.

TABLE XI

EFFECT OF TOPPING THREE OKRA VARIETIES AT DIFFERENT NODES ON HEIGHT OF PLANTS (FEET)

Replica- tion	Clemson Spineless				Emerald				Gold Coast			
	No	Topping	at 5th Node	Topped at 7th Node	Topped at 9th Node	No	Topping	at 5th Node	Topped at 7th Node	Topped at 9th Node	No	Topping
I	4.3		3.8	3.9	3.6	4.2		3.8	3.4	3.4	3.2	
II	3.6		3.0	4.0	3.6	4.4		3.6	3.2	3.6	2.9	
III	3.4		3.8	3.0	3.9	3.4		3.5	3.3	3.6	2.5	
IV	3.7		3.5	3.6	3.1	4.1		3.6	3.1	2.9	2.6	
V	3.8		3.6	3.9	3.3	3.6		3.4	2.9	3.1	3.2	
VI	4.0		4.0	4.0	3.5	4.1		3.9	3.2	3.2	3.1	
Totals	22.8		21.7	22.4	21.0	23.8		21.8	19.1	19.8	17.5	
Average	3.8		3.6	3.7	3.5	3.9		3.6	3.2	3.3	2.9	
L. S. D. 0.05 Level 0.6						1.4					0.4	

TABLE XII

EFFECT OF TOPPING THREE OKRA VARIETIES AT DIFFERENT NODES ON SPREAD OF PLANTS (FEET)

Replica- tion	Clemson Spineless						Emerald						Gold Coast					
	No Topping	Topped at 5th Node	Topped at 7th Node	Topped at 9th Node	No Topping	Topped at 9th Node	Topped at 5th Node	Topped at 7th Node	Topped at 9th Node	No Topping	Topped at 5th Node	Topped at 7th Node	Topped at 9th Node	No Topping	Topped at 5th Node	Topped at 7th Node	Topped at 9th Node	
I	2.5	2.3	2.9	2.8	2.6	2.9	2.9	3.4	3.2	2.6	3.2	2.6	3.2	2.8	2.6	3.2	2.8	2.3
II	2.2	2.7	2.2	2.6	2.4	2.7	2.7	2.8	2.3	2.4	2.3	2.4	2.9	2.7	2.4	2.9	2.7	2.3
III	2.1	2.6	2.1	2.6	2.1	2.3	2.3	2.1	2.6	2.1	2.6	2.4	2.5	2.5	2.4	2.5	2.5	2.4
IV	1.9	2.3	2.4	2.2	2.0	2.2	2.2	2.5	2.3	2.0	2.3	2.1	1.8	2.6	2.1	1.8	2.6	2.4
V	2.2	2.1	3.5	2.4	2.4	2.0	2.0	2.5	2.4	2.4	2.4	2.5	2.8	2.8	2.5	2.8	2.8	2.3
VI	2.6	2.8	3.0	2.7	3.0	3.0	3.0	2.7	2.6	3.0	2.6	2.9	3.1	2.7	2.9	3.1	2.7	2.7
Totals	13.5	14.8	16.1	15.3	14.5	15.1	15.1	16.0	15.4	14.9	15.4	14.9	16.3	16.1	14.9	16.3	16.1	14.4
Average	2.2	2.5	2.7	2.6	2.4	2.5	2.5	2.7	2.6	2.4	2.6	2.5	2.7	2.7	2.5	2.7	2.7	2.4
L. S. D. 0.05 Level	0.6				0.4										0.3			

CHAPTER V

CONCLUSION AND SUMMARY

This study dealt with an evaluation of three varieties of okra viz. Clemson Spineless, Emerald and Gold Coast, as regards the yield, periods of harvest, quality and rapidity of maturity.

In addition, this study deals with the influence of topping the three varieties of okra at three different nodes viz. 5th, 7th and 9th; in total number of fruiting suckers, and on concentrating harvest into any particular period. The results indicate that:

1. Both Clemson Spineless and Emerald gave higher yields than Gold Coast.
2. The bulk of the harvest was in August and September in all three varieties.
3. As regards quality, Emerald seems to have the higher fiber percentage, followed in diminishing order by Gold Coast and Clemson Spineless. The highest percentage of seed is seen in Clemson Spineless, and the lowest in Emerald. Results show that Emerald is the most rapid in elongation of pod of the three varieties followed by Clemson Spineless and Gold Coast.
4. Topping at the 5th, 7th or 9th node did not bring about an increase in the total number of fruiting suckers in any of the varieties.
5. There was an influence of topping at the 5th node in concentrating harvest.
6. In general, topping treatments reduced the total yields in all three varieties.

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