MANAGEMENT PRACTICES, ISSUES AND PROBLEMS OF COTTON PRODUCERS IN SOUTHWESTERN OKLAHOMA

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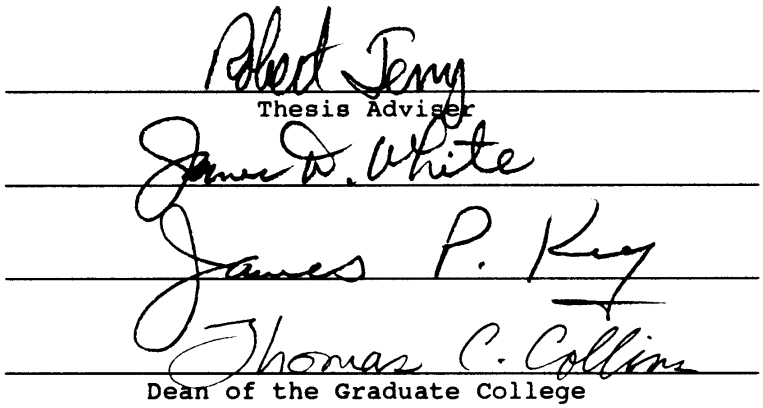

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

It is older than recorded history. Scriptures describe it in vivid detail. The English tried to outlaw it, and most people come in contact with it every day, cotton.

Woven through the history of civilization is the heritage of cotton. Mankind mastered this fiber long before the written word. Archaeologists have unearthed a six-thousand-year-old weaving, and the Old Testament places cotton in the palaces of Biblical kings.

Three hundred years ago, cotton turned criminal. Wool traders fought to keep it outlawed in England. Those who wore it faced heavy fines (Cotton Farming, 1993). Even the dead were forbidden from being buried in cotton. Yet, this ancient plant survived, and with it, grew the strength of our nation.

In 1993, it was estimated that American cotton growers would plant more than thirteen million acres (Cotton Grower, 1993). No crop has made a more lasting impact on history, or touched more lives. By itself, today's cotton plant is a marvel of efficient fiber production, Through the magic of photosynthesis, it transforms sunlight and nutrients into a natural fiber unmatched in versatility as well as value. But operating this factory at peak profitability requires more than hard work. It requires a feel for the land, a sharp mind and a never-ending commitment to quality. Now, more than

ever before, it demands the proven performance of good management.

Cotton production in Southwest Oklahoma is a constant battle against insects, weeds, and diseases, as well as millions of dollars annually in yield and quality reductions in addition to control costs. Proper management of insects, weeds, diseases, and agronomic factors is a major constraint to profitable cotton production. Lack of a topnotch management program results in lowered production, increased costs, and decreased producer profits. Many producers' current cotton profitability could be increased substantially by adopting a management program better suited to their farming operation.

Cotton As a Crop

Cotton (Gossypium spp.) is a unique and intriguing plant. In nature, it is a woody, perennial, semiarid shrub, reaching the size of a small tree. No cottons are true annuals. Some can grow, fruit, and partially mature that fruit within the frost-free portion of a growing season in the temperate zones. Such cottons are referred to as annuals. Because cotton developed over time under very dry conditions, it has the capacity to compensate for considerable drouth (and other) stress.

For thousands of years, man has sought to improve cotton by developing new varieties, by improved fertility and other cultural practices, and by weed, insect and disease control. But the fact remains that, in the temperate zones especially, man is taking a perennial plant and forcing it to behave as an annual within short-

season production (Banks, 1993). Cotton can be very responsive to management inputs. For example, irrigation too soon before flowering or too late after, drouth stress begins and can delay maturity of the fiber and reduces yield.

Cotton Crop Production in Oklahoma

Cotton (Gossypium hirsutum) is the third leading cash crop in Oklahoma, after winter wheat and all hay, with more than 430,000 acres harvested annually and worth more than $72 million to producers (Oklahoma Agriculture Statistics Service Data, 1991). Oklahoma is located on the northern edge of the United States Cotton Belt, and producers normally must contend with cool soil temperatures in the spring, the possibility of early fall freezes, and a short growing season between them.

Cotton production in Oklahoma is concentrated primarily in the southwestern quarter of the state, a subhumid to semiarid environment. Dryland production accounts for approximately 75% of the total cotton acreage in the state while the remainder is produced using irrigation (Oklahoma Agriculture Statistics Service Data, 1991).

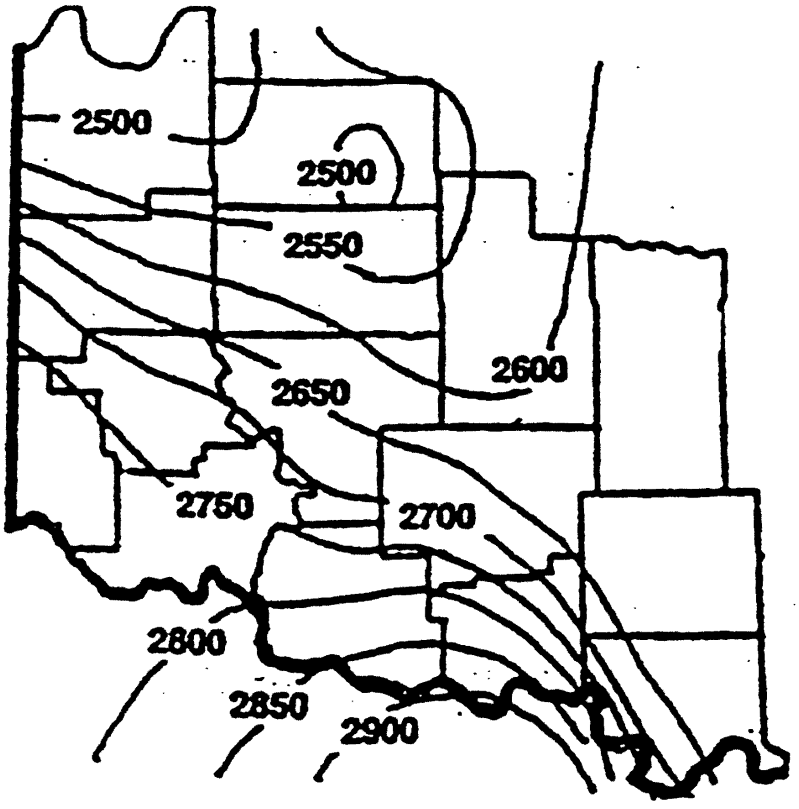
An intensely irrigated cotton production area occurs within the 47,000 acre Altus-Lugert Irrigation District, located primarily in Jackson County (Kirby, 1993). In this area, cotton is furrow irrigated from lake water feeding through a canal system. Other irrigated areas, often supplied by shallow wells, are either sprinkler or furrow irrigated. Yields under irrigation average more than twice those produced on dryland.

Dryland areas normally include cotton as part of a cropping system with wheat, grain sorghum, and/or forages. In some cotton-producing areas of Oklahoma, water and wind erosion are excessive, particularly on coarse-textured soils. Many farmers in those areas have developed specific practices to optimize cotton production, yet minimize soil losses.

Oklahoma's climatic conditions, although not as favorable in many ways as are those in the more southern states, do offer some advantages in cotton production. The winters are often sufficiently severe to drastically reduce numbers of over wintering insects compared to warmer areas farther south. This reduces the need for insecticide applications. In some areas, few (if any) applications are required. A number of other factors such as fewer tillage operations including cultivation, less pressure from hard to control weeds, and once-over stripper harvest also combines to lower the cost of cotton production in the state compared to most other areas of the Cotton Belt.

Statement of the Problem

Oklahoma is on the northern boundary of the cotton growing area and a major limiting factor is availability of heat units (Banks, 1993). Growers plant cotton as early as possible to capture as many heat units as possible to grow higher yielding, longer season varieties that will improve profitability (Stark et al. 1989). Figure 1 shows the average heat units (day degrees, base=60°F) available for cotton production throughout Oklahoma (Banks, 1993). Taking these and other factors into consideration,



Long Season Varieties require approximately 2500° days

Source: Growing Degree Days (GDD). J. C. Banks, 1993. Extension Cotton Research Center, Altus, Oklahoma.

Figure 1. Average Heat Units Source Available in Oklahoma

(Banks, 1993). Taking these and other factors into consideration, cotton farmers in Oklahoma face a wide range of challenges. It was felt that an investigation of management practices, issues, and problems being dealt with by producers could be of benefit.

Also, cotton production practices in Southwest Oklahoma have to constantly change in an effort to improve profitable production and minimize negative environmental consequences. A study of this type was deemed necessary, in an attempt to determine improve crop management practices that might allow producers to balance inputs, economic, and environmental issues. Insects, weeds, and diseases, as well as weather conditions are major obstacles faced during each growing season.

Purpose

The purpose of the study was to investigate cotton producers' management practices and views of issues and problems facing cotton production in Southwestern Oklahoma.

Rationale

It is general knowledge that cotton production in Southwest Oklahoma occurs in a dynamic and scholastic agricultural ecosystem. The important elements of this field ecosystem are Integrated Crop Management and Integrated Pest Management.

Integrated Crop Management (ICM) is vital to the success of cotton production. ICM evolved from the need to incorporate all practices into cotton production that improve efficiency and lessen risks to the environment (Banks, 1993). Since Integrated Pest

Management (IPM) was introduced in Oklahoma in the early 1970's, it has continued to expand in concept and practice. Acceptance and adoption of IPM principles are dependent upon increasing a cotton producer's net returns. The economic implication of several IPM programs indicates energy savings, reduced pesticide use and increased profits (Karner, 1993).

Objectives of the Study

In order to accomplish the purpose of the study, the following specific objectives were formulated:

1. To determine selected demographic characteristics of cotton producers and their production systems.

2. To determine the producers perceptions' of the extent of importance of selected factors (i.e. weeds, insects and diseases, marketing) in terms of limiting cotton production.

3. To determine practices and procedures employed by producers in the selection and use of herbicides and pesticides.

4. To determine practices and procedures related to fertility which were employed by producers.

5. To determine practices and procedures related to harvesting which were used by producers.

6. To determine practices and procedures related to marketing which were employed by producers.

7. To determine some of the sources of information and assistance utilized or needed by producers.

8. To compare certain findings of this study to those of a similar study conducted in 1986.

Assumptions

For this study, the following assumptions were accepted:

1. The respondents answered the survey questions honestly and to the best of their understanding.

2. The survey instrument elicited the responses for which it was designed.

Scope of the Study

Three basic cotton production schemes occur in Southwest Oklahoma: 1) high input irrigated both furrow and sprinkler applied (e.g., Lugert-Altus Irrigated District and from shallow wells); 2) low input dryland; and 3) river bottom land semi-irrigated production. Each type of production involves a unique set of management problems (Banks, 1993).

This study involved a population of 500 cotton producers in Harmon, Jackson, Tillman, Kiowa and Greer counties, who formed 290,000 acres (Oklahoma Agriculture Statistics, 1991). A total of 71 surveys representing 11.7% of planted acres. Most of the respondents were irrigated cotton producers. Irrigated cotton acreage from respondents represented 27.9% (21,003 acres) surveyed acres. Total dryland acres of 12,831 from respondents represented 6.0% of the acres surveyed.

Definitions

Annuals. Plants living one year or less. During this time the plant grows, flowers, produces seed and dies.

Gossypium spp. The cotton genus is represented by approximately 30 species of Old World and New World species.

Gossypium Hirsutum. These are new world cotton species raised in Southwest Oklahoma.

Growing Degree Days (GDD). is defined as 24 hours of time in which the temperature is one degree above the lower temperature threshold (60^{o}--100^{o}). By using this range and the high and low temperatures for each day of the flowering season, the amount of heat available to the cotton, measured in day degrees, can be calculated (Karner, 1993).

Integrated Crop Management (ICM). A total crop program to develop all management practices applied prior to planting to post harvest involving Agronomy, Entomology and Agriculture Economics.

Integrated Pest Management (IPM). Involves all phases of cotton production, and cultural practices to control the abuse of pests, including insects, weeds and diseases.

CHAPTER II

REVIEW OF LITERATURE

Introduction

A review of related literature and research was conducted in order to establish a base and give direction to the study. The review is organized under several headings which were considered to be pertinent to this investigation effect.

Nutrient Management

Soil fertility has a dramatic impact on the profit equation because the lack of fertility limits production. Budgets reveal that fertilizer inputs are generally less than 10% of the variable production costs. Yet, a large number of producers risk $300.00 to $500.00 per acre cotton crops each year by not soil testing (Banks, 1993). To economically produce cotton, soil fertility must be properly managed.

Cotton requires at least 13 nutrients for growth and reproduction. A deficiency in any one of those nutrients will reduce yield. Most of those nutrients are obtained from the soil. For convenience, the nutrients may be grouped as: primary nutrients nitrogen, phosphorus, and potassium; secondary nutrients calcium, magnesium, and sulfur; and micronutrients-boron, manganese, zinc, iron, chlorine, copper, and molybdenum (Thomas et al. ND).

Fortunately, most cotton-producing soils in Oklahoma have adequate supplies of the secondary and micronutrients.

The first step in a fertilizer program is to estimate the nutrient requirements for production of cotton in a specific environment. Fertilizer amounts can be estimated by soil tests, field trials, nutrient removal, plant analyses, and past experience. Probably, the most reliable estimates are obtained by soil testing regularly (with support from the other methods listed). Soil test interpretations are based on many years of calibration research and field verification. Reliable interpretation leads to sound fertilizer recommendations to obtain the desired response. By examining soil test results over a period of years, a general assessment can be made of the fertilizer program being followed. For example, an increase in the test values for a particular nutrient over time will indicate that applications of that nutrient are not being totally utilized by the crop. Conversely, a decrease in test values over time will indicate that the crop is utilizing more of that nutrient than is being replaced by the fertilization program (Procter, 1993). Accumulation of mobile nutrients, like nitrogen, over time indicates an excess is being applied and this is not a desirable result.

Periodically, soil should be sampled below the top six inches. The majority of cotton roots are in the top 24 to 36 inches of the soil profile (Thomas et al. ND). A mobile nutrient may move below the usual six-inch sampling depth and yet be available to the cotton plant for use during the season. Fertilizer recommendations based

on the top six inches of soil might indicate a deficiency of such a nutrient when in fact the nutrient was abundantly available somewhat lower in the soil profile (Thomas et al. ND).

Fertilizer recommendations for cotton are based on realistic yield goals to be expected under existing soil and climatic conditions. The soil and its ability to produce essential nutrients and a favorable root environment for cotton along with climatic conditions (particularly the amount, distribution, and timing of rainfall) largely determine yield potential (Thomas et al. ND). Other factors influencing yield include length of growing season; cotton variety; rotation and cropping system; tillage and management practices; weed, insect, and disease control; and type of fertilization program (Banks, 1993).

The primary plant nutrients (nitrogen, phosphorus, and potassium) are the most important in cotton production in terms of amounts required and frequency and magnitude of plant response (Thomas et al. ND). Nitrogen deficiencies can be partially alleviated by side dressing in the season they occur. Phosphorus and potassium deficiencies should be dealt with before the next year's crop is planted (Banks 1993).

Considerations in Making Decisions on Fertilization

In financially stressful times, it becomes even more important that the producer fertilize the crop, not the soil (Banks, 1993). A soil test for nitrogen should be made every year. A soil test

for phosphorus and potassium can be conducted on alternate years without too much change being expected (Procter, 1993). Any reduction of greater than 20% in normal nitrogen usage will likely adversely affect yield. The producer will lose less by reducing phosphorus and potassium applications than he will by doing so on nitrogen. If the budget is greatly limited, buy only nitrogen. If the producer has a history of phosphorus application on his farm, he can probably skip application for up to two years (maybe more) without detrimental effects on yield. Banding phosphorus properly at planting time can reduce the cost of that element by one-third to one-half, compared to top broadcast application (Banks, 1993).

Other considerations in fertilizer management may be applicable from time to time. For example, well water used for irrigation in some parts of Oklahoma is naturally high in nitrates. If not taken into consideration, over applications of nitrogen may result because extra nitrogen was being applied with each irrigation. An analysis of the water used will allow reasonable estimates to be made. If the producer plants in a skip-row pattern, less nitrogen will be required because the rows bordering the skips are able to utilize the moisture and nutrients in the soil beneath the skips. If cotton was planted following sorghum, more nitrogen is required than if cotton were continuously planted. Cotton following alfalfa requires no nitrogen the first year and a reduced amount the second year. But phosphorus and potassium requirement may be critical. Annual legumes add about 40 pounds of nitrogen per acre each year to the soil (Banks, 1993). Nitrogen should be reduced on late planted

cotton because its yield potential is less than on a normally planted crop. If land is leveled for irrigation, cut areas are often deficient in phosphorus. In summarizing, fertilizer requirements for cotton production in Oklahoma are primarily limited to the annual use of nitrogen, frequent use of phosphorus, and occasional use of potassium. Although cotton production can be reduced if any of the essential elements are deficient, most Oklahoma soils are relatively fertile.

Nitrogen fertilizer requirements can be easily determined from consideration of the yield potential and the available nitrogen reported by a recent soil test. Soil test information is the most reliable way of determining phosphorus, potassium, secondary nutrients and/or micronutrient fertilizer needs. Because adequate, but not excessive, nitrogen is important to the development of high fiber yield, nitrogen management is especially critical to irrigated cotton production. Regular, annual soil testing is an inexpensive approach to good nitrogen management (Banks, 1993).

Cotton Variety Selection

Deciding which varieties to grow is one of the most important decisions a producer must make. Many cotton producers in Oklahoma would increase their lint yield and/or fiber quality, thus their net income, by growing varieties better adapted to the state and to their growing conditions. With the same inputs of capital and labor, some cotton varieties provide a much greater return on the producer's investment than do others.

Cotton variety tests are conducted each year in Oklahoma to obtain the information necessary for producers to select in a logical manner which varieties they should grow (Greenhagen, et al. 1992). The experiments include commercially available varieties from throughout the Cotton Belt that have demonstrated superior performance in Oklahoma or have the potential to do so. These tests are conducted in as unbiased manner as possible at several dryland and irrigated locations. Proper experimental designs are used with randomizations, or unreplicated demonstration plots. The results from this testing program are published and distributed each year to cotton producers throughout the state, to cotton researchers and extension personnel, and to other interested parties (Greenhagen, et al. 1992).

General Considerations

To select one or more cotton varieties which are highly adapted to growing conditions, the producer should study the data from the variety test (or tests) which most nearly corresponds to the characteristics of his farm. Location in the state is important. Obviously, a test will also likely do well on his farm. If the area was intermediate between two test locations, a variety that consistently does well in both tests will also likely do well in his area. For Southwest Oklahoma producers, tests from closely surrounding areas in Texas (specifically the Rolling Plains) are also of value. High Plains conditions are sufficiently different from those in Oklahoma to make variety test results from that area have little meaning here.

Whether the test was irrigated or dryland is also important. Cotton varieties that do well under irrigation relative to others may not do so on dryland and vice versa. Except for years with unusually early freezes, irrigated cotton (regardless of the variety) will normally yield more and do so more consistently than will dryland cotton, but some varieties can more efficiently utilize that extra water than can others. Similarly, some cotton varieties can escape or tolerate the stresses of dryland production more readily than can others. A few cotton varieties do relatively well under both conditions. How a cotton variety will perform under irrigation and/or dryland simply cannot be known until it has been tested there. The producer who irrigates should examine irrigated test results; whereas, the producer who has limited or no irrigation should investigate those from dryland tests.

The producer should consider how the cotton varieties in a test performed are relative to one another. A variety's performance for a trait as an isolated number can be meaningless. It takes on value only when compared to other varieties in the same experiments. Large differences between varieties for a particular trait are probably at least partially genetically based, whereas small differences may not be.

The producers are cautioned that some traits of cotton are more sensitive to environmental differences than are others. Such traits are said to display more variety by environment interactions than do others (Greenhagen et al, 1992). Environmentally sensitive traits in cotton include lint yield and fiber fineness (i.e.,

micronaire). Results from a single experiment for such traits can be, and often are, misleading. More reliable comparisons among varieties can be obtained for such traits in tests averaged over years and/or locations. Differences among cotton varieties in traits such as fiber length and strength are more consistent over environments, and data from only one or two tests will normally give a good indication of relative varietal performance for them.

If cotton acreage is substantial at all, the producer is advised to grow more than one variety. Unforeseen circumstances can occasionally cause a variety to perform below its usual level.

Weed Management in Cotton

Weed management is an important component of cotton production. Weeds reduce yields by competing with cotton for water, nutrients, light and space. Early season competition causes the greatest yield reduction; therefore, weeds that germinate with or soon after cotton emergence cause the greatest losses. The weeds that germinate before or simultaneously with the crop are frequently capable of forming a leaf canopy over cotton. Later emerging weeds may interfere with cotton defoliation and may lower lint grade due to lint stain and foreign materials. Additionally, weeds growing outside the immediate area may affect the crop indirectly by producing seeds that are transferred into the fields and by serving as alternate hosts for insects and pathogens.

Effect of Weeds on Cotton

The statement weeds compete with crops for water, light, and

nutrients has been unquestioned (Greer, et al. ND). Undoubtedly, weeds must cause problems or producers would not spend so much time, effort, and money to manage them. Estimates are frequently presented which illustrates the cost of weeds to crop production. This cost is usually broken down into cost of control and direct losses of cotton due to weed competition; however, usually the estimated value is of the combined costs. It was rather easy to calculate the cost of control by looking at the receipts of purchased herbicides, custom application invoices, or prices quoted by a chemical dealer. It is much more difficult to assess the actual losses caused by weed competition (Greer, ND).

Weed Competition

In order to fully understand the phenomena of weed competition with cotton, it was necessary to reduce this complex issue into smaller more easily discussed or explainable components. There are three main components involved with weed competition: weed species, density of weeds, and duration or critical period of competition (Greer, ND).

It was noteworthy to mention that cotton is also capable of competition. When seed of good viability and vigor are planted with favorable environmental conditions in a well prepared, weed-free seed bed, cotton can establish itself and become very competitive with weeds. Producers should strive to do everything possible and feasible from a cultural stand point to insure a good, uniform, healthy, cotton stand.

General Use of Herbicides

Most herbicides are selective, meaning that they can control some plant species and not control others (Greer, ND). The object of using herbicides was to control the undesirable plants (weeds) and leave the desirable plants undamaged. Since different weeds are controlled by different herbicides, it is very important to select the herbicide that will control the species of weeds that are present in the field to be treated.

Herbicides can be discussed or classified in a number of ways. They can be categorized by chemistry, use, method of application, plant response, residual activity, potential environmental pollutants, as well as by other criteria (Greer, ND).

Soil applied residual herbicides are taken up from the soil by weed seedlings as they germinate, killing them before or soon after emergence. Herbicides available for use in cotton that are applied preplant or preemergence are effective against most annual grasses and many annual broadleaf weeds, but often do not adequately control some annuals that germinate from deep in the soil, such as morning glories or devil's claw, and most soil applied residual herbicides do not control established perennial weeds. These early applied herbicides are an effective treatment because they kill annual weeds that are susceptible to them early before they compete with the crop.

Contact herbicides are used to kill small weeds that are present at the time of herbicide application. Many of these herbicides do not have residual activity which can kill later

germinating weeds. Most contact type herbicides are used at planting to burn off small weeds that have germinated since the soil was tilled. Some of the herbicides used in preemergence applications have contact action on small weeds if mixed with a surfactant or crop oil. Some of these herbicides can be used in postmergence directed applications where the spray is directed over the top of small weeds and to only the lower stem of the cotton plants (Greer, ND).

Foliar applied translocated herbicides are applied to the foliage of emerged weeds and are absorbed through plant leaves. They are translocated through the plants to roots and growing points. They are generally the most effective herbicides for control of perennial weeds and the annual weeds that germinate deep in the soil and are not controlled with soil applied herbicides. Some of these herbicides can be applied over the top of cotton; however, some of the foliar-applied herbicides can injure cotton (Greer, ND). Some of these can be used as special treatments to control perennial weeds if a shield, hood or other special equipment is used to keep the chemical off the cotton. Weeds should be growing vigorously and be in the correct stage of growth for optimum control when this type of herbicide is applied. Treating weeds when they are stressed usually results in poor weed kill. Additives, such as surfactants or oils, may enhance the ability of herbicides to penetrate plant tissue. These additives can improve weed control but they may increase chances for cotton injury also. The label

will guide you on which additives to use with a particular herbicide.

Insect Management in Cotton

Insect management decisions are crucial to the success or failure of the overall cotton crop. Under irrigation, cotton normally cannot be effectively produced without severe insect problems. Annual inputs of $25.00 to $100.00 per acre for insect control must be made under irrigation to maintain high yields (Stoll et al. 1987). Dryland cotton decisions are even more difficult because of uncertainties of yields and fiber quality levels related to moisture, and must be carefully weighed before inputs are applied.

Sampling Insect Populations

Management decisions should be based on actual field observations (sampling) (Hamer, ND). Sampling correctly is a vital component of cotton insect control. It must be done frequently and in a manner that reduces risk. All sampling in insect pest management is done to estimate insect pest population, pest damage, or beneficial insects. How well fields are sampled influences the accuracy of the decision. The ultimate goal of sampling is to give the most precise estimate of total insect populations in the shortest possible time and reduce the risk of making the wrong decision (Hamer, ND).

The most widely used sampling scheme in Oklahoma and across the cotton belt is the fixed sampling size (FSS) method (Karmer, 1993). In this type sampling, a fixed (or previously determined) sample size is taken (commonly either 100 squares or 100 terminals). The FSS method can be highly dependable if the entire field is sampled and if the insect being sampled has a high population density. The general rule in sampling is that large populations are easier to detect and small populations are more difficult. FSS was fairly accurate for sampling boll weevils (25 infested squares per 100 examined is the economic threshold) and cotton fleahoppers (40 insects per 100 terminals is the economic threshold). Accuracy diminishes with FSS with bollworm estimation since the economic threshold for that insect was low (5-10 larvae per 100 plants) (Karner, 1993).

Other Insect Management Decisions

Agronomic practices influence insect pest infestations. Excessive use of nitrogen fertilizer and/or irrigation stimulates vegetative growth (Karner, 1993). The excessive growth can delay maturity, reduce yields, and increase bollworm pressure. Control difficulties also can result due to the rank growth retarding spray coverage. Basing fertilizer needs on yearly soil samples and applying the amount for reasonable projected yields will tend to eliminate this plant growth.

Cotton planted too thickly becomes tall and spindly before setting squares. In many instances, this condition is wrongly

blamed on cotton fleahoppers. Maximum yields are produced when the cotton stand is two to four plants per row foot (Bohmfolk et al. ND). Seed size variation with modern varieties is often to blame. Planters calibrated for one variety may plant 50 percent as much of another variety (Sturgeon, 1985).

Late-season foliage and fruit are important food sources for bollworms and boll weevils. Availability of food increases the number of overwintering pests. The use of growth regulators, crop conditioners, defoliants, and desiccants can reduce this source of food late in the season, decreasing the survival of those overwintering pests (Banks, 1993). Shred stalks and/or plow the fields immediately after harvest to reduce overwintering sites (Karner, 1991).

Dryland Cotton Production

Economic thresholds for cotton insect pests have been established for Oklahoma conditions (Karner, 1993). Those thresholds are the same for both dryland and irrigated production. Cotton insect pests in dryland cotton should be treated the same as irrigated cotton if adequate moisture exists. Protecting dryland cotton from insect damage until moisture becomes limited will ensure the greatest return is made. Scout dryland cotton at least once a week. During periods of heavy insect pressure, reduce scouting intervals to every three to four days. Continue scouting until the crop is mature enough to resist insect attack.

Once dryland cotton encounters drought stress and plant growth begins to slow down and fruit are shed, spray decisions become progressively more difficult because fruit may also be shed naturally after rainfall. In most instances, cotton becomes less attractive to insects as squares and vegetative growth ceases. At this point, spray decisions must be based on the bolls that are still susceptible to insect attack and will be retained by the plant.

Weather conditions in some years (i.e., dry early with rain in August) stimulate the dryland cotton in Oklahoma to initiate new growth into September. This scenario usually effects late-season bollworm and boll weevil populations, making decisions more difficult since squares produced in late August and early September will not have sufficient growing degree days (GDD) to mature (Banks, 1993). However, the regrowth could provide the bollworm with sufficient food to attain a size capable of damaging harvestable bolls. Bolls set on September 1 will be sufficiently mature to resist insect attack by September 21, with average temperature (Karner, 1993). Slice bolls in question with a sharp knife to determine if the bolls are still susceptible to bollworm damage. Bolls easily sliced with a knife are still susceptible. Those which cannot be sliced are less likely to be damaged. If 70% to 90% of the harvestable bolls are still immature and bollworms or boll weevils exceed their economic threshold, the field should be sprayed. If most of the bolls are mature, the field should not be sprayed (Karner, 1993).

Irrigated Cotton Production

Insect management decisions under irrigation are easier to make since water is not a limiting factor. However, irrigated cotton intensifies the insect pressure, requiring timely management decisions.

To ensure that proper decisions are made in irrigated cotton, twice a week, or as needed, scouting is mandatory. Close scrutiny of the crop will ensure each application is properly timed to achieve optimal control (Karner, 1993).

The most difficult decision to make is to determine when insect control in the field should be terminated. A common mistake that irrigated cotton producers make is to quit a control program prematurely. In most cases, this is the result of a producer reaching the monetary limit he has imposed on himself for the season's insect control. Severe damage can be inflicted late in the season by quitting seven to fourteen days early (Karner, 1993). The cost of continuing a spray program to mature harvestable bolls will be less than the loss incurred by letting a damaging infestation go unchecked.

With irrigation terminated the last of August, the bolls which need to continue to be protected are the bolls set before August 25 (Banks, 1993). Without timely rainfall, bolls set after that date stand little chance of maturing.

Fall weather prevents most of the bolls set after September 1 from maturing. The key to determining if the field was near the termination point is the stage of plant. If the cotton has been

protected from insects and an adequate boll set occurred, the plant growth rate will decline markedly. The terminal will initiate no new growth or squares. At this point, insect pressure should diminish because the plant is unattractive to insects. Without lush terminal growth, bollworms cannot achieve the size necessary to attack the bolls set before September 1 (Banks, 1993).

Late-season bollworm decisions (after September 15) should be based solely on numbers of worms present and their size, not eggs (Karner, 1993). Cooler temperatures usually occur at this time of year, thereby, delaying hatching and/or reducing egg viability. Even if the eggs hatch, cooler temperatures will delay larval development. Seven to ten days may be required for a worm to damage harvestable bolls. Unless extreme insect pressure occurs, most fields need not be protected after September 20.

Late-season (after September 1) boll weevil infested square counts usually escalate as the squaring declines. Increase in boll damage will occur as squares decline. Boll maturity should be the final factor in determining when to discontinue the spray program when boll weevils are present. Unlike bollworms which obtain a certain size to damage bolls, boll weevil adults can damage large bolls. Control programs must be continued until 70% to 90% of harvestable bolls resist the knife test (Banks, 1993).

Disease Monitoring and Diagnosis

For an effective crop management program, whoever monitors cotton fields must become familiar with the symptoms of the more common diseases.

All plant disease, regardless of the cause, involves a complex interaction between host plant and environment. The symptoms produced by a disease and the rate at which they develop are influenced by genetic characteristics of the plant, by the stage of growth when infection or stress occurs, by other stress that may occur at the same time, and by environmental conditions such as temperature and humidity (Cotton Farming, 1992).

Examine as many plants as possible for comparisons of disease symptoms. Look for plants showing different stages of disease development to determine how symptoms change as the disease progresses. Do not rely on a single symptom, such as a leaf spot or yellowing, to identify disease, but check all parts of effected plants including roots (Banks, 1993). Different stresses or pathogens may produce similar symptoms if they disrupt the same plant function. For example, soil borne fungi, root-knot nematodes, soil compaction, and improper herbicide applications may all cause stunting because they all interfere with absorption of water and nutrients. A collection of several symptoms is usually needed to diagnose a disease (Cotton Farming, 1992).

It is not always possible to identify diseases with certainty in the field. Some pathogens require special laboratory techniques for isolation and identification. This service can be provided at the OSU Plant Disease Diagnostic Laboratory, 119 Noble Research Center, Oklahoma State University, Stillwater, Oklahoma 74078-9947. There will be a scheduled charge per sample to help defray the expense of laboratory operations (Proctor, 1993).

Growth Regulators

Oklahoma's short growing season dictates that earliness be a prime component in quality cotton production (Karner, 1993). Earliness can be achieved by early planting (weather permitting). Variety selection, proper fertilization, appropriate seeding rate, and insect and disease control. Unfortunately in many instances, planting and stand establishment may be delayed until mid-June or later. In the past, variety selection provided the primary means for utilizing the remaining heat units in the season to mature a crop. Producers were forced to abandon mid to long season varieties in favor of short season varieties, thereby sacrificing potential yield and fiber properties to ensure production (Banks, 1993).

The availability of plant growth regulators in recent years has provided producers with another means to enhance maturity in the cotton plant. Growth regulators are comprised of many compounds which, when properly applied, can modify plant performance (Karner, 1993). Adverse effects result when growth regulators are misapplied or used in production schemes that do not favor their positive action. Possible applications of bioregulators include the inducement of germination, flowering, assimilate partitioning, growth modification, fruit retention, boll opening and yield enhancement (Karner, 1993).

Harvest Aids

Allowing nature to take its course before harvest can be costly to producers if adverse weather conditions occur before a killing

frost. Cotton grown under Oklahoma conditions is ready for harvest aid conditioning after 2000 to 2400 (depending on variety) heat units (growing degree days base 60^{o} F) have accumulated (Banks, 1993). Once the crop exceeds the number of heat units required for maturity, weathering begins. Weather losses associated with delays in harvest can exceed $4.00 to $5.00 per bale per week of exposure to the elements in Oklahoma (Banks, 1993).

As harvest approaches, the greatest threats to Oklahoma cotton are weather related. Other than intensive hail storms, the most devastating influence that can strike is an early freeze of green bolls before they open. A few hours at or below freezing temperatures can damage green bolls to the extent that they will never open. Freezing temperatures, high winds, and prolonged rainy periods are forces that cause obvious infield weathering. Equally serious losses in lint weight, grade, and seed quality occur. Additional losses relate to harvesting efficiencies, lower turnout, and higher ginning costs. Harvest aid chemicals fall into three categories (Karner, 1993):

1) Boll openers (and/or growth regulators)

2) Defoliants and

3) Desiccants

Harvest aid chemicals accelerate the preparation of the crop for mechanical harvest. Earlier harvest, quality preservation (fiber and seed), and maximizing harvestable yield are some of the advantages that may accrue from the timely use of harvest aid chemicals (Banks, 1993).

Marketing

Several marketing alternatives are available to cotton producers in Oklahoma. A basic understanding of when and how to utilize these marketing methods may greatly improve the profitability of the farm business and allows the producer the opportunity to reduce price risks in the cotton markets. It also increases flexibility in making sound short-term and long-term operating decisions needed to strengthen the farm's financial base.

What follows is a brief description of several commonly used pricing methods currently employed by Oklahoma's cotton producers (Anderson, ND).

It was not practical to include all of the detailed information needed to become proficient cotton marketers. Marketing cotton is a continuous learning process. The producer should read and study the educational materials available. Lenders, brokerage firms, professional marketing researchers, and educators can assist in the effort to gather the information necessary during this learning process.

Cotton marketing requires a systematic approach that includes two basic decisions or actions. These decisions are:

1) Locating a buyer to take title to the cotton, transferring all ownership expenses at a time period designated by the producer.

2) Being able to recognize and take advantage of the opportunities available in the cotton markets (Anderson, ND).

Cotton Irrigation

Irrigation decisions are critical for economic cotton production. Under irrigated production, inputs include both variable (approximately $31.00 per acre) and fixed costs (about $18.00 per acre) (Banks, 1993). Irrigation timing can make the difference between profitable, high yield, high quality cotton and late maturing, low yield, poor quality cotton and late maturing, low yield, poor quality cotton.

Cotton is one of the more drought tolerant crops grown in Oklahoma (a subhumid to semiarid environment). The crop is grown under dryland and irrigation. Cotton adapts to changes in its environment, adjusting its vegetative and reproductive development based on available resources, primarily water. Because of its deep root system, it is able to produce a marketable yield through a wide range of moisture conditions.

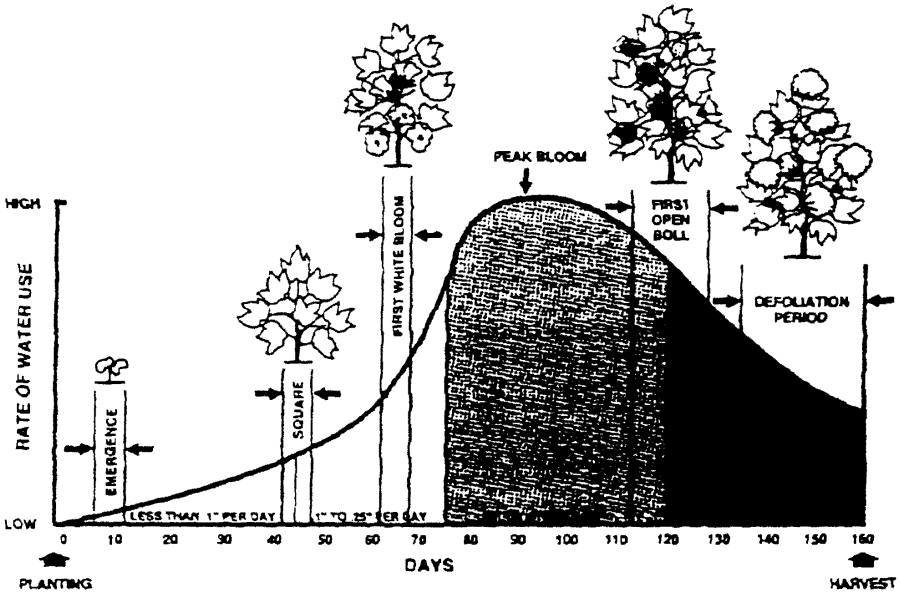
Water Requirements

In the major cotton growing region of the state, well watered cotton will consume about 28 inches of water each year to produce a potential yield of slightly over two bales per acre (Bank, 1993). In a typical year, initial soil moisture and rainfall during the growing season will supply about 13 inches of cotton's water requirement, sufficient to produce a moderate yield, slightly over half a bale per acre. To avoid that reduction in potential yield, 15 inches of additional water must be supplied by irrigation. In an

extremely hot and dry year, slightly more irrigation may be required to maintain the cotton crop in a well watered condition.

The rate of water used by cotton changes through the season as the plant develops (Figure 2). From emergence to square, water use will generally be less than 0.1 to 0.25 inch per day. From early bloom until the first open boll appears is the period of greatest water use. During this peak bloom and fruiting period, water use will range from 0.25 to 0.4 inch per day. This is the period during which most, if not all, irrigation water should be applied. After the first open boll appears, water use will gradually decline to about 0.15 inch per day at harvest (Kizer, ND).

The water use amounts listed are approximate and will vary according to existing weather conditions. Clear days with high solar radiation, high air temperature, low relative humidity, and high wind will cause the highest water use. Under extreme conditions, the crop will enter a transient wilt condition during the hottest part of the day when evaporative demand exceeds the ability of the soil and root system to meet the water requirements of the canopy. The temporary condition can occur even when adequate soil water is available. As atmospheric conditions moderate (usually toward nightfall), plant functions return to normal. During the hottest summer days, wilted foliage observed after midday may not indicate a need to initiate irrigation; it may only be transient wild as described above. Some time is required to irrigate a field. If the producer waits until the crop reaches a critical wilting point to begin irrigation, the last part of the crop to be watered will have suffered severe damage (Banks, 1993).



Source: Mike A. Kizer, Extension Agriculture Engineer, Oklahoma State University, Stillwater, Oklahoma.

Figure 2. Water Requirements for Cotton

Irrigation Water Management

Several factors affect the frequency and amount of irrigation required by cotton. The stage of crop development was an important factor because of the changes in rooting depth from emergence to first bloom and because of the changes in sensitivity to moisture stress between different stages.

Rooting depth is important because it defines the limit of the soil reservoir from which the crop can draw water for growth. Sixty percent of the water used by cotton comes from the upper two feet of the soil; 75% comes from the upper three feet. Usually, that below five to six feet is lost to the plant. The crop can be grown in a wide variety of soils, but does very well in heavier soils with a high water holding capacity. It is important to avoid excessive irrigation which wets the soil profile below the rooting zone. Irrigation water that migrates below the root zone under the pull of gravity cannot be used by the plant, and is effectively lost for production purposes. Many producers believe that water in the subsoil will be drawn back toward the surface by capillary action as the surface soil dries (Banks, 1993). Such upward movement occurs, but not normally to any appreciable amount. Under normal conditions, applying irrigation to depths that exceed the storage capacity of the root zone is simply a waste of water, time, and pumping energy. It also leads to the leaching of plant nutrients (Banks, 1993).

Early in the season, cotton requires very little water. Because irrigation lowers soil temperature and thereby increases the

vulnerability of young cotton plants to seedling disease, the producer should rarely, if ever, apply irrigation to plants shorter than 6 inches. Early irrigation will also prolong vegetative growth and delay reproductive development. By early flowering stage, cotton will have rooted to a depth as great as six feet unless plow pans or rock layers are present at rooting depth. That rooting depth is reached about the time the first bloom appears, normally 60 to 70 days after planting. Rooting depth increases by approximately one inch per day (Banks, 1993).

Controversial Issues

Today's cotton producer must be more conscious than ever of the type of land being farmed and any environmental regulations or requirements that might apply to the operation.

Sound conservation practices make good business sense. Farm program benefits also are dependent on the conservation of land resources and the protection of wetlands as spelled out in provisions of the Conservation Title of the Food Security Act of 1985, most often referred to as the 1985 Farm Act (Cotton Farming).

That title is the most comprehensive, complex and important conservation legislation affecting farmers ever enacted by Congress. The deadline for producers to comply with its regulations was December 31, 1993 (Soil conservation Service). Meeting the deadline was a difficult task, especially for producers who did understand the procedures.

Boll weevil eradication is a dominant controversial topic in the cotton industry. Producers will decide to favor or oppose an eradication program state wide in the near future. The lack of understanding by Southwest Oklahoma producers of the economics and advantages of this program is extremely controversial.

Summary

A cotton cropping system includes cultural practices, harvest management, economics, and marketing which interact and cannot be considered independently. By availing themselves of all parts of the system's components of decision making, producers can better manage their cotton crop. Management is the utilization of components in a systematic fashion with the ultimate goal of profit. Such factors should be examined for their short-term and long-term potential.

Producers who manage their cropping enterprises have an intuitive feel for the risks involved with any given situation. Field and crop selection are done in a planned manner weighing potential pest problems, yields, and net returns. Producers who maintain good records of management problems, yields, costs, and profits can make sound decisions.

One of the most important decisions a producer must make is the yield goal objective for a field. The goal determined should give the producer an idea what level of fertilizers, pesticides, and other inputs are required to reach that goal. Budgets determine the chances for achieving a profit. They also allow the producer to

reexamine his situation and change inputs to improve the probability of increasing his net income.

The most important keys to profitable management are field monitoring, maintaining good records, and using those two factors to make sound decisions. Without cropping histories and up-to-date field information, critical and profitable decisions are less likely. The best way to obtain this information is check the fields on a periodic basis and keep records of short-term and long-term situations. Making effective economic, crop, and market management decisions should be each producer's goal.

CHAPTER III

METHODS AND PROCEDURES

Introduction

The purpose of this study was to investigate cotton producers' management practices and views of issues and problems facing cotton production in Southwestern Oklahoma. The objectives were: (1) To determine selected demographic characteristics of cotton producers and their production systems; (2) To determine the producers perceptions' of the extent of importance of selected factors (i.e. weeds, insects and diseases, marketing) in terms of limiting cotton production; (3) To determine practices and procedures employed by producers in the selection and use of herbicides and pesticides; (4) To determine practices and procedures related to fertility which were employed by producers; (5) To determine practices and procedures related to harvesting which were used by producers; (6) To determine practices and procedures related to marketing which were employed by producers; (7) To determine practices and procedures related to marketing which were employed by producers; (8) To compare certain findings of this study to those of a similar study conducted in 1986.

The purpose of this chapter is to describe the methods used in meeting these objectives. The procedures involved in the completion

of the study were to:

1. Determine the population (cotton producers) for the study;
2. Develop the instrument for data collection;
3. Develop the procedure for data collection; and
4. Select the method of analysis and calculations.

The Population

A mailing list of approximately 500 cotton growers in Harmon, Jackson, Tillman, Kiowa and Greer counties of Southwest Oklahoma was obtained from the Oklahoma Crop Reporting Board in Oklahoma City, Oklahoma. The area surveyed is depicted in Figure 3.

Development of the Instrument

After examining size of the population, it was determined that the best method of gathering data would be through the use of the self-administered mailed questionnaire.

The questionnaire was developed after consulting with OSU cotton specialists and reviewing the instruments used in the surveys taken in 1981 and 1986. It was then field tested outside the survey area among a selected group of cotton producers and revisions were made with the aid of noted cotton specialists. The survey instrument consisted of 51 items designed to arrange the items and alternatives included in the survey so that each item was clearly defined, not open to misinterpretation, and structured so as to have each item as concise as possible. The survey was designed to collect information about management practices, issues, and problems of cotton producers in Southwestern Oklahoma.

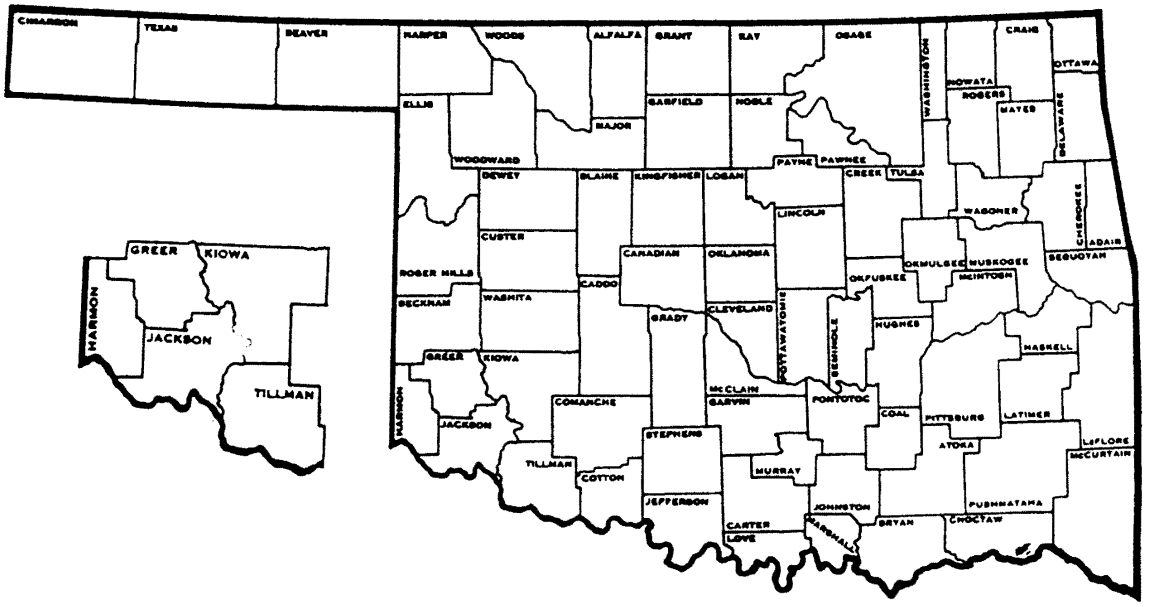


Figure 3. Highlighted area of Harmon, Jackson, Tillman, Kiowa and Greer counties of Southwest Oklahoma from which study population was derived.

The completed survey was reviewed by Agriculture Education staff at Oklahoma State University. All suggestions were incorporated and the final copy was developed and sent to the cotton producers. A copy of the cover letter and survey instrument are included in Appendix A.

Collection of Data

The survey was distributed in the Spring 1994. The survey was mailed with a self-addressed return envelope. Directions explaining how to complete and return the survey were given by the author. A total of 71 completed questionnaires were returned. Altus Cotton Research Extension Center furnished mailing list, labels, postage and also included a separate survey. The researcher was responsible for return postage and preparing materials.

Analysis of Data

Returned surveys were collected and data were analyzed by the researcher. Descriptive statistics such as percentages, ratings, methods, acres treated, and rank order were calculated on various portions of the data.

Some of the producers' views of some important factors relating to cotton production in Southwest Oklahoma were summarized and in certain instances, these were compared to the findings of a 1986 survey.

IRB Approval

At Oklahoma State University, all research which involves human subjects must be granted approval by the Institutional Review Board before it is allowed to proceed. In accordance with that procedure, this study was reviewed and approved by the IRB and assigned the number AG-94-019. A copy of the approval form can be found in Appendix B.

CHAPTER IV

PRESENTATION AND ANALYSIS OF THE DATA

Introduction

This research effort is one of three similar Oklahoma cotton surveys conducted since 1981. Unlike the 1986 and 1994 surveys, which covered all production practices, the 1981 survey addressed only pesticide use and acreage treated (Criswell, 1982). In the 1986 survey, over 200 growers in 10 cotton growing counties were surveyed on production and pest management practices.

Traditionally, cotton production in Oklahoma is not a high input system. Over 80% of Oklahoma's acreage is dryland (Crop Reporting board, 1991) and the majority of the dryland cotton does not receive insecticidal applications (Stoll et al., 1987). Cotton production practices in Oklahoma are constantly changing in an effort to improve profitable production and minimize negative environmental consequences. The Oklahoma State University (OSU) cotton crop management initiative attempts to improve crop management practices that will allow producers to balance inputs, economics, and environmental issues. Insects, weeds, and diseases, as well as weather conditions are major obstacles faced during each growing season. It is hoped that the results of this research effort will contribute in a positive manner to that.

Selected Demographics

As depicted in Table I, the total acres of cotton produced in the five counties included in this study was 290,000. Of these acres, 75,400 (26 percent) were under irrigation, with the remaining 214,600 (74 percent) being produced on dryland. The 71 farmers who responded to this study produced 21,003 acres of irrigated cotton and 12, 831 acres under dryland conditions for a total of 33,834 acres. Respectively, these represented 27.9 percent and 6.0 percent of each type of production in the five-county area. Also, of the acreages produced by respondents, 62.1 percent was under irrigation, with 37.9 percent being dryland and combined they accounted for 11.7 percent of the total produced in this area of the state. Jackson County producers accounted for the greatest amounts of both irrigated and dryland acres reported by responding farmers. Most of the irrigated producers were within the Altus-Lugert Irrigation District.

Comparison of these findings to those of a similar study conducted in 1986, revealed there were currently 40,000 more acres of cotton in production. In that study, respondents reported farming 49,302 acres which accounted for 19.7 percent of the total. At that time, dryland acres farmed by respondents accounted for 52.8 percent of the total they reported raising. Irrigated acreage reported by those respondents totaled 23,271 acres, or 47.2 percent of the total amount they raised.

As was the case with the 1986 study, this research effort collected information as to the age categories into which respondents fit. Figure 4 was constructed to illustrate the findings of the two

TABLE I

ACREAGES OF COTTON PRODUCED BY COUNTY IN AREA STUDIED COMPARED TO ACREAGES PRODUCED BY RESPONDENTS BY COUNTY

Counties	Irrigated		Dryland	
	Acres* Produced	Acres Produced by Respondents	Acres* Produced	Acres Produced by Respondents
Greer	3,700	350	15,400	1,151
Harmon	18,000	2,955	9,300	495
Jackson	46,500	16,518	19,800	4,975
Kiowa	600	280	48,600	1,220
Tillman	6,600	900	121,500	4,900
Total	75,400	21,003	214,600	12,831

*Source: Oklahoma Agricultural Statistics (1991)

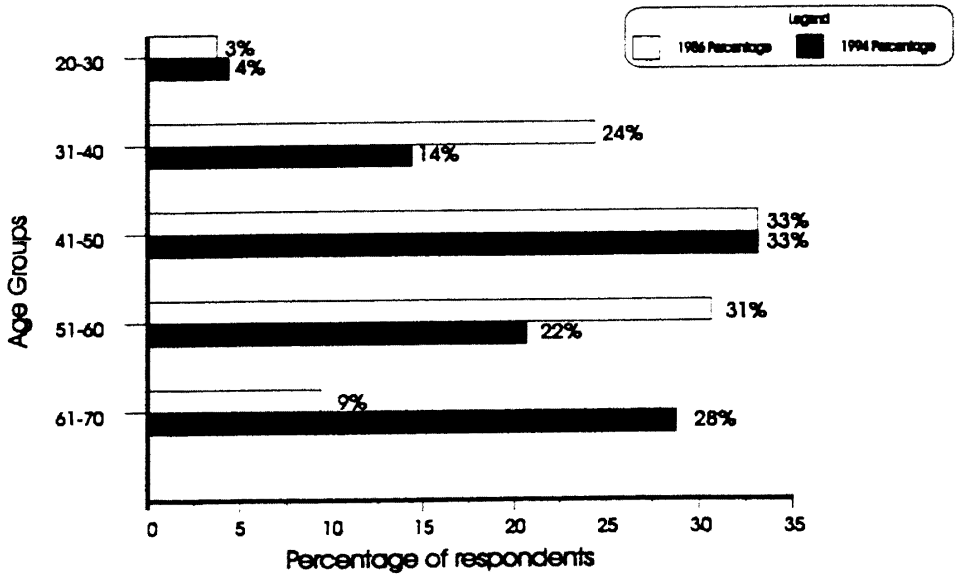


Figure 4. Comparison of Distribution by Age Category of Respondents to 1986 and 1994 Studies

studies in this regard. As can be determined from the figure, only a small proportion of the current respondents fit into the 20 to 30 age group. In the case of the latter, there were almost three times as many respondents in this category in the 1994 study as compared to the 1986 effort. The preponderance of the 1994 respondents ranged in ages from 31 to 60 with the largest percentage being those in the 41 to 50 category. It was interesting to note that the three categories within this range contained relatively similar percentages of the 1994 respondents. As a group, those responding to the 1994 study were older than those who had participated in the 1986 research. On a side note, it appeared that respondents to the current study who were engaged in producing irrigated cotton tended to be older. The average time that individuals produced cotton increased to 28.7 years in 1994 as compared to 22 years in 1986.

Producers were asked to indicate how important they felt the factors of insects, weeds, diseases, and fertility were as problems for cotton production in their area. Table II contains a summary of these findings as well as a comparison of how these problems ranked in 1994 and 1986. Based upon mean ratings, it was found that respondents to this study ranked insects as the problem of most importance by a rather wide margin. Weeds were ranked second. The same rankings were assigned to these two factors by the 1986 respondents. In 1994, Fertility was considered to be the third most important problem, with Diseases being ranked fourth. Interestingly, neither of these two factors were ranked among the top four perceived problems by the group participating in the 1986 study.

TABLE II

PRODUCER RATINGS OF THE IMPORTANCE OF SELECTIVE FACTORS AS PROBLEMS FOR COTTON PRODUCTION IN SOUTHWESTERN OKLAHOMA

Factors	N	Distribution of Responses by Importance Rating* 1	2	3	4	5	Cumulative Rating	Mean Rating	Rank Order 1994	1986
Insects	40	22	11	4	2	1	69	1.73	1	1
Weeds	44	9	13	14	6	2	111	2.52	2	2
Diseases	38	5	1	6	15	11	140	3.68	4	0**
Fertility	36	2	5	11	7	11	128	3.56	3	0**

*1 = most important, 5 = least important
**Not listed as problem in 1986

Variety Selection

Between 1986 and 1994, both dryland and irrigated cotton production had a pronounced change in varieties. The popularity of Lankart 57, Lankart 611 and Paymaster 145 declined on dryland in 1994 as compared to 1986. These findings are presented in Table III. In 1994, the most popular dryland varieties included Paymaster HS-26, Tamcot CABCS, and Lankart 142. The most popular variety grown under irrigation in 1994 was DP 5415, followed rather closely by DP 90, and Paymaster 404 in 1986.

TABLE III

PERCENTAGE OF DRYLAND AND IRRIGATED ACRES PLANTED TO SELECTED VARIETIES IN 1986 AND 1994

	Percentage by Variety Types by Years			
	Irrigated Varieties		Dryland Varieties	
Variety	1986	1994	1986	1994
Paymaster 404	10.5	-	-	-
Cascot 5910	-	-	-	7.8
Chembred 1233	-	14.5	-	-
DP 5690	-	12.0	-	-
DP 90	5.6	19.0	-	-
DP 5415	-	20.0	-	-
Lankart 142	-	-	-	18.0
Paymaster 145	8.9	2.0	22.2	5.0
Paymaster HS 200	-	3.1	-	2.0
Paymaster HS 26	-	9.1	12.3	37.0
PR 75	-	-	5.1	1.5
Stoneville 132	-	8.3	-	-
Stoneville 453	3.4	9.0	-	-
Tamcot CABCS	-	-	-	19.7
Tamcot CD3H	-	-	-	5.1
Lankart 57	-	-	17.1	-
Lankart 611	-	-	12.8	-
All Others	71.6	3.0	46.5	3.9

Weed Problems and Management

Importance of Selected Weeds

Table IV was developed to convey respondents' opinions as to the extent to which certain weeds are important problems in cotton production. As indicated in the table, Silverleaf Nightshade (Solanum elaeagnifolium), a perennial, and Pigweed (Amarathus spp.),

an annual, ranked first and second respectively in importance. Johnsongrass was the third highest ranked weed problem, followed in order by Morning Glory, Devil's Claw, Cocklebur, Yellow Nutsedge, Carolina Horsenettle, Field Bindweed, and Russian Thistle, which together comprised the top ten most important weed problems identified by respondents.

A comparison of current problem weeds to those which were identified as such in 1986 was conducted. As can be determined from Table V, Silverleaf Nightshade was the number one problem then and now. In 1986, Pigweed ranked second and Morning Glory was third. For 1994, the order of these two was reversed. For all of the remaining, except Bindweed, the order of importance was the same for both time periods. Bindweed was not cited among the top six weeds in 1986.

Interestingly, respondents' and Southern Weed Scientists' rankings were similar. Smith et al. (1989) did an extensive weed survey that showed the most prevalent weeds in cotton fields were Silverleaf nightshade, Johnsongrass and Pigweed.

Herbicide Management

As summarized in Table VI, most respondents (70%) applied their own herbicides. Custom Ground applicators were used by 24 percent of the group and the remaining six percent employed Custom Aerial applicators. For insecticide applications, 61 percent utilized Custom Aerial applicators, 38 percent did their own work and one percent employed Custom Ground applicators.

TABLE IV

PRODUCER RATINGS OF THEIR GREATEST WEED PROBLEMS

Weed	Number of Respondents by Level of Importance N	1	2	3	4	5*	Cumulative Rating	Mean Rating	Rank Order	SWA** Ranking
Silverleaf Nightshade	47	14	11	14	5	3	113	2.40	1	1 (31.1)
Carolina Horsenettle	37	3	3	8	8	15	140	3.78	8	- -
Pigweed	44	8	12	16	6	2	114	2.59	2	2 (24.4)
Johnsongrass	45	7	10	14	9	5	130	2.88	3	8 (30.5)
Field Bindweed	43	5	3	6	11	18	163	3.79	9	9 (4.4)
Morning Glory	43	12	6	4	5	16	136	3.16	4	3 (3.3)
Yellow Nutsedge	38	2	2	14	5	15	143	3.66	7	4 (8.3)
Cocklebur	44	7	4	5	12	16	158	3.59	6	- -
Hotpotato	33	2	1	4	4	22	142	4.30	11	- -
Texas Panicum	35	3	0	2	6	24	153	4.37	12	7 (N/A)
Devil's Claw	45	5	8	14	9	9	144	3.20	5	6 (1.7)
Russian Thistle	38	2	2	4	10	20	158	4.15	10	- -

*1 = most important, 5 = least important

**Ranking from 1992 Southern Weeds Proceedings. Number in () indicate estimation of percent acres infested (Smith et al., 1989)

TABLE V

RANK ORDER OF SELECTED PROBLEM WEEDS IN 1986 AS COMPARED TO 1994

Weed	Rank Order by Year 1986	1994
Silverleaf Nightshade	1	1
Pigweed	2	3
Johnsongrass	4	4
Bindweed*	-	5
Morning Glory	3	2
Cocklebur	4	4
Devils Claw	5	5

*Not identified among the top six weeds in 1986

In order to obtain necessary information on herbicides, 34 percent of the respondents consulted chemical dealers, 28 percent relied on label instructions, 15 percent consulted the Cooperative Extension Service, 11 percent used other consultants, and 10 percent consulted with applicators.

Effective application of pesticides is dependent upon frequent sprayer calibration. Sixty-five percent of the respondents reported that they calibrated spray equipment at least once a season, while 13 percent calibrated before each application and 13 percent calibrated only periodically.

Table VII was developed to present responses as to the types of herbicide applications used by producers. Seventy-one percent of the respondents used preplant herbicides. Preplant products most frequently used were Treflan and Prowl. Spot treatment was the second most popular method of herbicide used. Postemergence application was used by 11 percent, followed closely by the 10 percent who used pre-emergence. Postemergence directed applications were reported by eight percent. In 1986, very few (less than 10 percent) of applications were postemergence, using products such as Roundup.

Insect Problems and Management

Importance of Selected Insects

Insects are a major annual concern for Oklahoma cotton production. The severity of insect infestations varies a great deal due to climatic conditions. Respondent's ratings of the extent to

TABLE VI

METHODS OF APPLICATION FOR HERBICIDES AND INSECTICIDES UTILIZED BY RESPONDENTS

Method of Application	Percentage of Respondents	
	Herbicides	Insecticides
Custom Ground	24	1
Custom Aerial	6	61
Producer	70	38

TABLE VII

TYPES OF HERBICIDE APPLICATION UTILIZED BY RESPONDENTS

Application Type Used	*Percent of Respondents
Preplant Incorporated	71
Pre-emergence	10
Postemergence	11
Postemergence Directed	8
Spot Treatment	38

*Some respondents used more than one method making percentage total more than 100 percent

which selected insects were problems for cotton production and their rank order in terms of importance are presented in Table VIII. The Boll Weevil was singled out as the most important insect problem by a rather wide margin, receiving a mean rating of 1.64. Cotton Aphids were assigned a mean rating of 2.58, which placed them second on the list. These pests were followed rather closely by Bollworms, ranked third, based upon the 2.50 mean importance rating. The mean ratings and rank order of the remaining insects were found to be as follows: Cotton Fleahopper (2.98 - 4); Thrips (3.27 - 5); and Spider Mites 3.69 - 6).

In order to compare the extent to which these insect pests created problems for producers in 1986 and 1994, Figure 5 was developed. Inspection of this figure reveals that the Boll Weevil was cited by the greatest problem by 50 percent of the 1994 respondents and 42 percent of the 1986 group. Forty-two percent of the 1986 study participants named the Bollworm as the second most important pest; however, only 15 percent of the 1994 group placed it second. In contrast, in 1994, 20 percent of the respondents named the Aphid as the third most important pest, but it was not named at all by the 1986 group. It should be noted that the Fleahopper was more of a problem in 1986 than in 1994 and the same was true for Spider Mites and other insects. Thrips was not listed as a problem pest in 1986, but was listed in 1994. The rank order of importance of the listed pests in 1994 was found to include the Boll Weevil, Cotton Aphids, Bollworm, Cotton Fleahopper, Thrips, and Spider Mites. For 1986, the rank order was Boll Weevil, Bollworm, Fleahopper, and Spider Mites.

TABLE VIII

RESPONDENTS' RATINGS OF THE IMPORTANCE OF COTTON INSECTS

Insects	N	Responses by Extent of Importance Category* 1	2	3	4	5	Cumlative Rating	Mean Rating	Rank Order
Bollworm	48	10	14	15	8	1	120	2.50	3
Boll Weevil	50	33	7	7	1	2	82	1.64	1
Cotton Fleahopper	49	5	10	18	13	3	146	2.98	4
Cotton Aphids	48	13	10	13	8	4	124	2.58	2
Thirps	48	2	9	18	12	7	157	3.27	5
Spider Mites	39	2	5	7	14	11	144	3.69	6

*1 = most important, 5 = least important

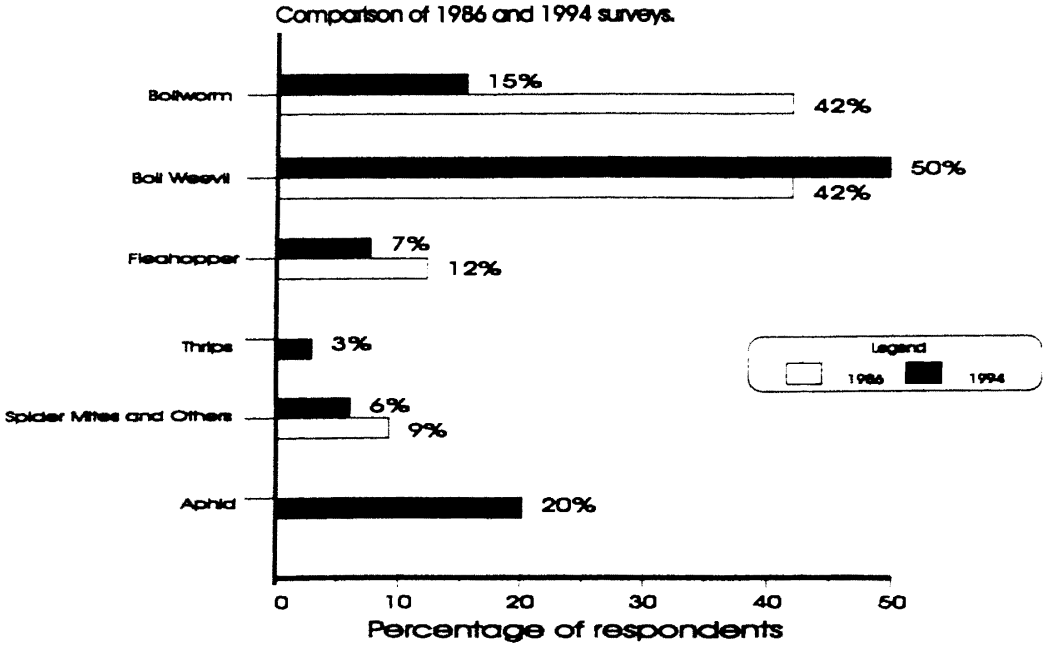


Figure 5. Percentage of Respondents by Most Important Insects in 1986 and 1994

Insecticide Management

Sources of Information. Insecticide selection and timing of applications are important management decisions regarding pest control. Respondents to the study were asked to indicate how they obtained information on which to base decisions in these matters. Responses to this question are summarized in Table IX. Consultants were named by 37 percent, with another 28 percent indicating that they relied upon Aerial Applicators. Twenty percent of the group indicated that they made such determinations on their own. The Cooperative Extension Service was the source identified by the remaining 15 percent.

Number and Frequency of Applications. As with herbicides, the number and frequency of applications of pesticides in a season is dependent upon climatic and other conditions. Respondents were quizzed as to the number of insecticide applications they made on dryland and irrigated crops last year in attempts to control a selected list of pests. Overall, 60.1 percent of those responding treated for Boll Weevils, 53 percent for Bollworms and 46 percent for Cotton Fleahoppers. Most dryland production was not treated for Cotton Fleahoppers because it is not considered an important pest in this type of production. Respondents with irrigated production reported treating an average of three times for Bollworm, four times for Boll Weevils, and one and one-half times for Cotton Fleahoppers, Aphids and Thrips. Only one-half of the dryland cotton production

TABLE IX

RELIANCE OF RESPONDENTS ON VARIOUS SOURCES OF INFORMATION ON INSECTICIDE SELECTION AND APPLICATION RATE

Information Source	*Percent of Respondents
Aerial Applicator	28
Consultant	37
Extension	15
Own Judgment	20

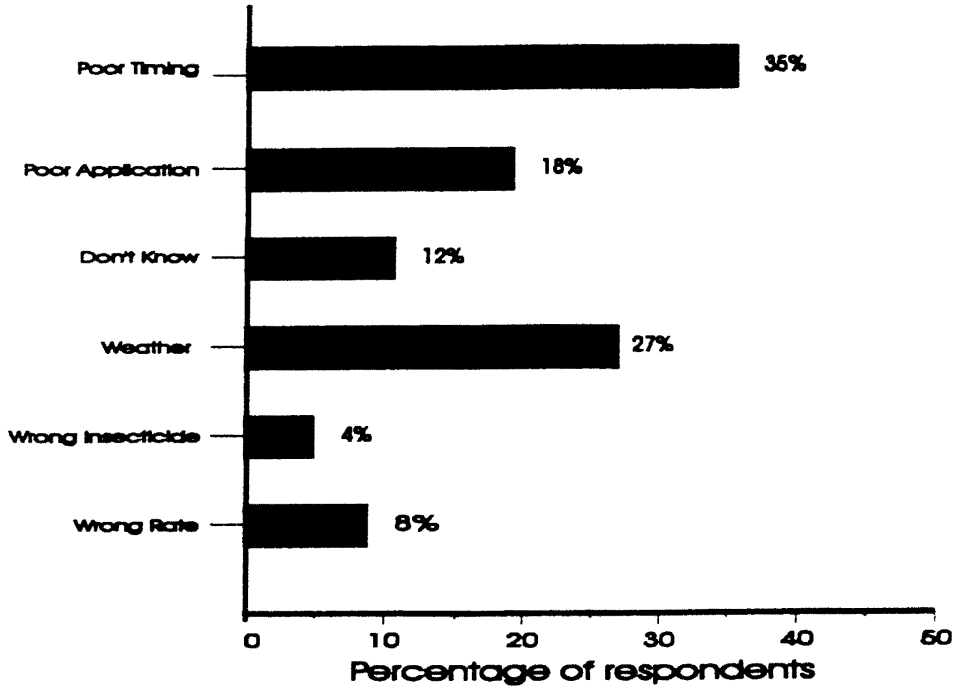


Figure 6. Reasons Cited by Respondents for Failure of Insecticide to Control Insects

acreage farmed by respondents received a Boll Weevil insecticide application, compared to almost 100 percent for the irrigated acres.

Reasons for Failure to Control. Although respondents did not always know the product applied for cotton insects, only four percent blamed selection of the wrong insecticide for failures to control insects, as can be seen in Figure 6. Poor timing was listed by 35 percent of the respondents as a reason for control failures, while weather was cited by 27 percent. Poor application was suspected as the reason for failure by 18 percent of the growers who responded. Wrong rate of application was singled out by eight percent of the group, while 12 percent reported that they did not know a reason for insecticide failure.

Insecticides Used. Seventy-five percent of the respondents had sprayed their acreage to control Boll Weevils. Of the total acres sprayed, most received either Parathion, Methyl Parathion (parathion) or Guthion (azinphos-methyl). The pyrethroid class of insecticides, Fury (cyano-permethrin) was used for Boll Weevil when Bollworm exceeded the economic threshold. Some producers did not identify the insecticide used to control Boll Weevils.

Bollworm control consisted mainly of pyrethroid applications. As reported by respondents, a large number of acres received either Fury (cyano-permethrin), Karate (lambdacyhalothrin), or Ambush (permethrin). Vydate (oxyamyl) was reported by five percent of the respondents. This perhaps indicates some lack of knowledge regarding insecticide selection by these respondents since Vydate is not recommended for Bollworm control.

Forty-six percent of the respondents indicted that they treated to control Cotton Fleahoppers in 1994. The most reported insecticides for this purpose were Orthene (acephate) and Bidrin (dicrotophos), respectively. The remainder of the respondents reported trying to control for both Cotton Fleahoppers and Boll Weevils at the same time. The product of choice for this control was Vydate (oxamyl).

Thrips control was practiced by 42 percent of the respondents in 1994. Orthene was the first choice of insecticide on most of the acres treated. Bidrin was used on many of the acres also. Temik (aldicarb) was used at planting time by 30 percent of those responding.

Views Toward a Boll Weevil Eradication Program

Boll Weevil eradication is a dominant topic in the cotton industry across the production belt. Of those responding to this study, 81.2 percent favored a Boll Weevil eradication program of some type. However, as reported in Table 10, the potential cost of such a program impacts upon their willingness to be supportive. At a projected cost of $10 per acre, of those responding, 36 percent indicated being in favor of an eradication program. With a projected cost of $15 per acre, the proportion favoring dropped to 22 percent. At a potential cost of $30 per acre, only nine percent indicated they would be in favor of an eradication program.

TABLE X

RESPONDENTS' WILLINGNESS TO SUPPORT A BOLL WEEVIL ERADICATION PROGRAM

Program Cost Per Acre	Percentage of Willingness to Support	
	Yes	No
$10/acre	36	9
$15/acre	22	21
$30/acre	9	35

Disease Problems and Management

Importance of Selected Diseases

Plant disease epidemics can drastically affect the cotton crop's potential. In the 1986 study, producers did not list diseases as a significant factor limiting production. In 1994, 13 percent of the respondents listed diseases as the most important limiting factor.

As reported in Table XI, the major disease problems in order of importance assigned by responding producers included: Fusarium Wilt, Bacterial Blight, Seedling Blight, and Verticillium Wilt. Although evaluated as problems, it should be noted that none of the diseases received a mean rating near the mid-point of the importance scale. All of the ratings were 3.64 and below and, thus, all tended toward the lower level of importance.

TABLE XI

RESPONDENTS' RATINGS OF DISEASE PROBLEMS

Disease	N	Percentage by Importance Category 1	2	3	4	5*	Cumlative Rating	Mean Rating	Rank Order
Verticillium Wilt	40	3	2	6	5	24	164	4.12	4
Bacterial Blight	43	2	1	8	4	24	164	3.81	2
Seeding Blight	38	2	2	8	6	20	154	4.05	3
Fusarium Wilt	45	6	6	8	5	21	164	3.64	1

*1 = most important, 5 = least important

Table XII was developed in order to provide a basis for comparing 1986 and 1994 respondents' rankings of disease problems. As can be seen in the table, in 1986, the order of importance of diseases was Verticillium Wilt, Seedling Blight, and Fusarium Wilt. In 1994, the most highly rated disease was Fusarium Wilt, with Verticillium Wilt being evaluated as the least important. Bacterial Blight was ranked second in 1994, but was not even listed as a problem in 1986.

TABLE XII

COMPARISON OF RESPONDENTS' RANKINGS OF DISEASE PROBLEMS IN 1986 AND 1994

Disease	Rank by Year 1986	1994
Verticillium Wilt	1	4
Bacterial Blight	-	2
Seeding Blight	2	3
Fusarium Wilt	3	1

*Not listed in 1986

Only eight percent of the respondents sampled cotton fields annually for nematodes. In 1991, the Plant Pathology Department (Williams et al., 1991) conducted a nematode survey of cotton fields across Southwest Oklahoma. Root-knot nematodes were found in 17.3 percent of tested fields. The highest documented incidence of infested fields and nematode populations was in the Lake Creek area of Greer County. Little, if any, nematicide is used in the region of Greer County due to the low yield potential associated with dryland cotton production.

Nutrient Management

Proper nutrient management is crucial to the success of cotton

production and is often overlooked by producers. Besides the expense, excessive nitrogen application may cause increased growth, delayed maturity, and environmental contamination. Smith (1989) showed high nitrate levels under several cotton fields with levels well over 200 pounds in the top six feet of soil. Over 85 percent of the respondents indicated that they apply fertilizer annually while over 75 percent of them take soil samples of their cotton ground annually. This was a notable improvement from 1986, when only 64 percent of that group of cotton producers annually tested soil. Over 75 percent of the respondents indicated that if they had soil tested, they would follow the recommendations.

As reported in Table XIII, the sources of soil fertility recommendations changed somewhat in the past eight years. In 1986, 36 percent of the respondents indicated that they guessed at fertility rates without consulting soil test results, the fertilizer dealer, or the extension. In contrast, in 1994, all of the respondents sought advice om proper fertility levels.

The percentage of respondents using OSU or an independent soil laboratory remained relatively constant with 57 percent and 65 percent of the respondents in 1986 and 1994, respectively, reporting using OSU with seven and four percent respectively, using independent laboratories for soil testing. In 1994, fertilizer dealers were utilized by 27 percent of the respondents as the source of fertilizer information while none of the 1986 group used this source. A large majority of respondents, over 80 percent, used a bulk pellet, complete mixture, followed by a liquid fertilizer mixture. Ninety-

TABLE XIII

RESPONDENTS' SOURCES OF SOIL FERTILITY RECOMMENDATIONS IN 1986 AND 1994

Information Sources	Percentage of Respondents by Year 1986	1994
Independent Laboratory	7	4
OSU	57	65
Self-test	-	4
Fertilizer Dealer	-	27
Guess	36	0

seven percent of the respondents indicated that they received expected results from recommended fertilizer applications.

Growth Regulators

Before the introduction of growth regulators in the early 1980's, producers were helpless in retarding excessive growth. Excessive growth delays maturity, delays harvest, and reduces cotton quality. In addition, excessive late-season growth insures a food source for insect pests. Based on inputs from 1994 respondents, use of Pix growth regulator (mepiquatchloride) has increased four-fold in

eight years. In 1986, 20 percent of the respondents used Pix compared to 75 percent in 1994. In 1994, 86 percent of the producers using Pix were pleased with the results, compared to 74 percent in 1986.

As can be seen in Figure 7, of those respondents in both 1986 and 1994 who expressed dissatisfaction with a growth regulator, the primary complaint was its failure to control plant height. All of the 1986 and 45 percent of the 1994 respondents cited this as their primary complaint. The next largest group of 1994 respondents who had experienced problems with growth regulators was the 41 percent who felt that they received an increase in yields. The second greatest complaint from the 1986 group, cited by 38 percent, was that growth regulators did not aid in early maturity of the crop, while this ranked third with the 1994 group, with 10 percent thus responding. Five percent of the 1994 respondents indicated that they received no control from the growth regulator, but none of the 1986 group voiced this complaint.

Harvest Aids

Many different types of harvest aids are used by producers to condition cotton for harvest. Three major types of harvest aids include boll openers such as Prep (ethephon), defoliants known as Def or Folex (tribufos), Dropp (thidazuron), and desiccants, one of which is Cyclone (gramoxone paraquat). In many cases, all three types of harvest aids may be necessary to prepare the plant for harvest. Eighty-six percent of the respondents used harvest aids in 1994 compared to 45.6 percent of their counterparts in 1986. One

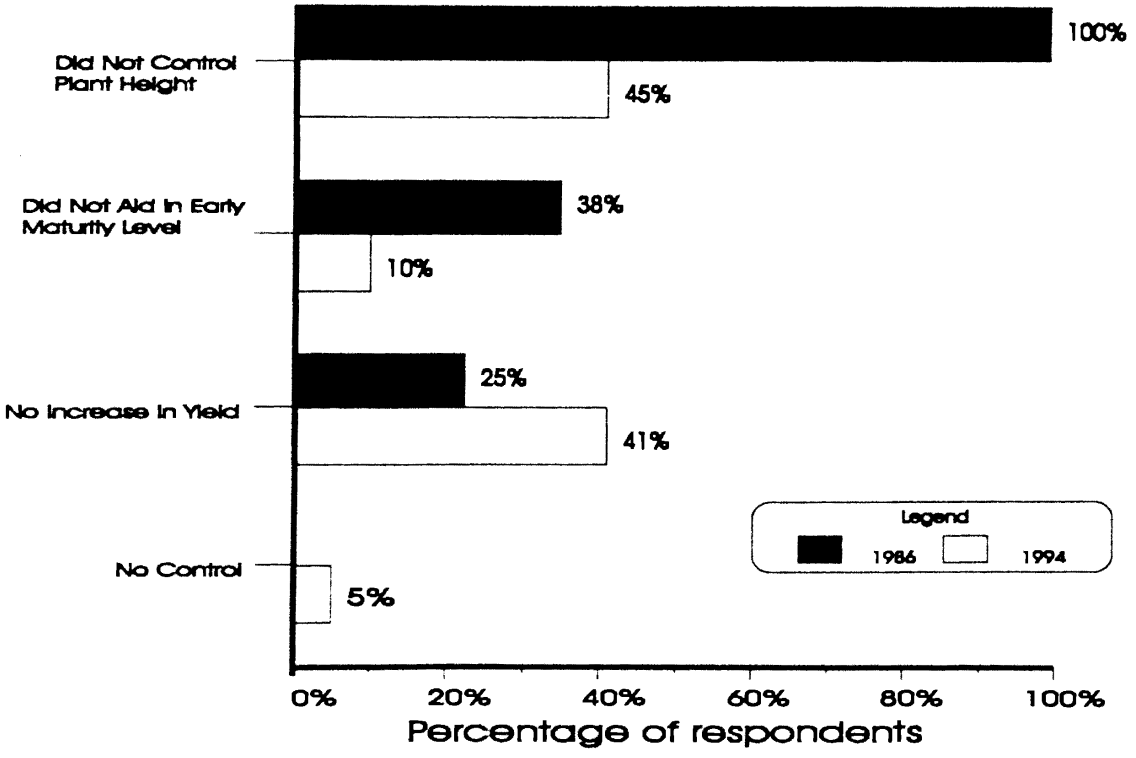


Figure 7. Reasons Cited by Respondents for Failure of Growth Regulators in 1986 and 1994

reason for this difference might be attributed to an aggressive Cooperative Extension Service educational program and increased grower experience with harvest aids.

The usage of harvest aids in 1986 and 1994 on both dryland and irrigated cotton is reported in Table XIV. In 1994, the two most popular products indicated by respondents for dryland cotton were Paraquat and Prep, being used by 30.6 and 29.0 percent of the respondents, respectively. These choices were followed by Def 6 and Dropp. Just under 35 percent of the respondents for 1994 with irrigated production used Prep, with Def 6, Dropp, Paraquat, Accellerate and Chlorate being selected respectively by 16.2, 12.9, 11.5, 11.3, and 9.6 percent of the group. Arsenic Acid has not been used since 1993; however, it was the second most widely used product by 1986 respondents. The first choice of that group was Paraquat, selected by 53.4 and 23.4 percent of the dryland and irrigated producers, respectively. All other products combined were chosen by less than 15 percent of the 1986 respondents.

In 1994, seven percent of the respondents reported not being pleased with the results obtained by use of harvest aids. This result compared to 22 percent of the 1986 group. Figure 8 was constructed to permit comparisons of reasons cited by these two groups for their displeasure with harvest aids. The reason given by the largest proportion of 1994 respondents, 33 percent, was Poor Timing, with Weather being blamed by 31 percent. Poor Application was to blame in the opinions of 16 percent of the group, while Cost Effectiveness was selected by another 20 percent. Fourteen percent gave Crop Condition as a reason for failure of the products. For the

TABLE XIV

HARVEST AID USAGE BY RESPONDENTS ON DRYLAND AND IRRIGATED COTTON IN 1986 AND 1994

Product	Percentage by Year and Type of Production			
	1986		1994	
	Dryland	Irrigated	Dryland	Irrigated
Accellerate	0	6.5	5.4	11.3
Aresenic Acid	32.5	13.5	0	0
Chlorate	0	0	3.0	9.6
Def 6	0	8.3	14.1	16.2
Dropp	2.3	2.3	10.2	12.9
Folex	0	0	8.0	3.1
Paraquart	53.4	23.4	30.6	11.5
Prep	4.6	16.7	29.0	35.4
Other	7.2	29.1	0	0

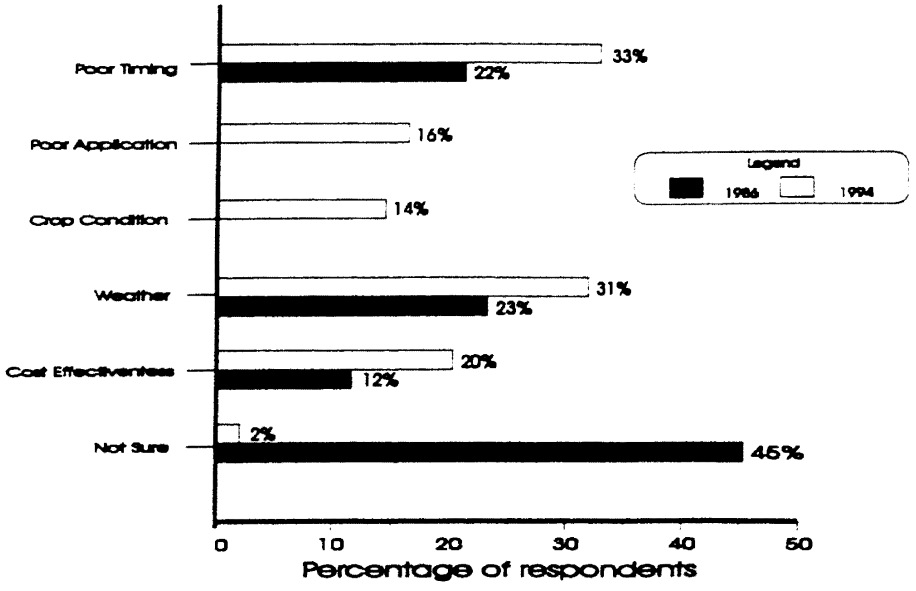


Figure 8. Reasons Cited by Respondents for Harvest Aid Failures in 1986 and 1994

1986 respondents, 45 percent indicated that they were not sure of the reasons for failure. Weather and Poor Timing were the causes of harvest aid failure in the opinions of approximately 23 and 22 percent, respectively, of the 1986 respondents. Cost Effectiveness was cited as the problem by 12 percent of this group.

Harvest Management

Little change occurred from 1986 to 1994 concerning custom harvesting. Custom harvesting was used by 31 percent and 35 percent of the respondents, respectively. The major change has been the type of machine utilized. In 1986, 92 percent of those participating in the survey, used cotton strippers as compared to 79 percent of the 1994 group. This change may be due to producers switching to picker varieties and/or the influence of irrigated acres within the Altus Irrigation District.

Marketing

Only eight percent of the respondents indicated that they had problems in marketing cotton. When asked about their greatest concern in marketing, 49 percent of the respondents selected price, while another 38 percent felt that finding buyers for their product was the greatest problem.

Respondent producers indicated that they utilized several pricing methods in an effort to receive a higher income for their cotton crop. Figure 9 contains a summary of the responses as to the pricing methods employed by the group. More than one-half, 51.1

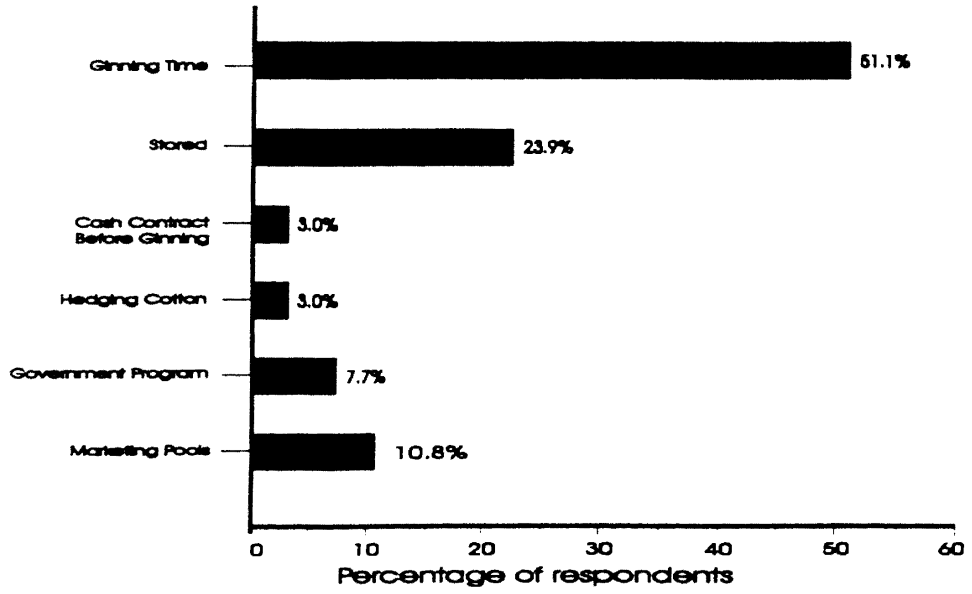


Figure 9. Pricing Methods Used by Respondents in 1994

percent, indicted that they sold their crop on the cash market at the time of harvest and ginning, making this the most often used method of pricing. Storing their cotton for later sale on the cash market was reported by 23.9 percent of those responding. More than 10 percent of those returning questionnaires, 10.8 percent, wrote on their surveys that they attempted to obtain better prices by entering into marketing pools whereby they and other producers consolidated their produce into larger units in order to attract buyers. The government "loan" program was the pricing method selected by 7.7 percent of the respondents. Cash contracting prior to harvesting and various forms of hedging were each used as pricing methods by three percent of those responding.

Irrigation

Moisture is one of the limiting factors for cotton production across Oklahoma. Annually, 75,000 acres are produced under irrigation. Over 50 percent of the irrigated cotton is grown within the Altus Irrigation District and 28 percent of the grower respondents who irrigate received their water from the district via Lugert-Altus. Fifty-four percent of the water for irrigated cotton was from underground well and 15 percent from surface water. Irrigation water quality is a major concern of producers. Of those producers who reported having water quality concerns, high salt content was listed by 90 percent and weed seeds by the remaining 10 percent. Fifty-two percent of the respondents who irrigate reported having problems of some type.

Use of Information and Assistance from Cooperative Extension

OSU Extension Fact Sheets are available to producers to provide information which will help them keep abreast of latest production practices. The percentage of respondents using these Fact Sheets remained the same for 1994 as it had been in 1986, 75 percent. One hundred percent of the respondents utilizing Fact Sheets perceived them as educational and useful. Getting the Fact Sheets to all growers presents a challenge.

Growers participating in the study indicted that they rely more on themselves to check their cotton fields than they do on consultants, commercial applicators and county extension personnel.

Sixty-five percent of the study participants expressed interest in learning more about proper crop scouting techniques by way of a Cooperative Extension-sponsored scouting school. All day sessions, in the field, during summer months was the format that they preferred for such a school.

Comments from Respondents

At the end of the questionnaire, respondents were invited to note comments with regard to areas in which they thought OSU could aid them in their production of cotton, or any other subject about which they had thoughts.

The following inputs about needed assistance from OSU were received:

"OSU is doing a good job on research."

"Irrigation versus growth of cotton"

"Unbiased information on government programs"

"Best watering time for cotton production"

"More information on insects and weed identification"

"Information and research on latest varieties for different conditions, insects and cotton diseases"

"More variety test cotton manuals"

"Feel that the IPM program is very valuable"

"OSU can aid by (1) Improve test plot data and increase number of plots; (2) Reliable soil tests; (3) Regular production workshops, and (4) Innovation and leadership in weed control."

"OSU research center staff, including Banks and Karner are extremely helpful and knowledgeable, but are spread too thin. I would be willing to pay a per acre assessment to OSU for improved services."

The following comments, which were more general, were also noted:

"Cotton is the only crop with any chance of a profit, even at loan level."

"Prices are bad now, but may get better later. Cotton as a rule is still the beset cash crop in my area."

"We are maximizing our crop acreage and trying to stretch our water availability."

"I plan to plant whatever the program allows."

"We're decreasing our cotton acreage because of the Boll Weevil problem."

"We're increasing our cotton acreage because of the 30 inch row production."

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The purpose of this chapter is to provide a summary of the following areas of the study: Introduction, Purpose, Specific Objectives, Methodology and Major Findings. In addition, conclusions and recommendations, based upon the major findings will be presented.

Summary

Introduction

Cotton is older than recorded history and it was first recorded in the scriptures. Archaeologists have unearthed a six-thousand year old weaving and the Old Testament places cotton in the palaces of Biblical kinds.

This plant has survived many centuries and with it grew the strength of our nation. Cotton has become an ever increasing importance crop and comes in contact with all our lives.

American cotton growers planted more than 13 million acres of this marvelous wonder of efficient fiber production in 1994 (Cotton Grower, 1993).

Cotton production in Southwest Oklahoma is constantly battling against insects, weeds, and diseases which result in millions of dollars annually in yield and quality reduction in addition to

control costs. Lack of a top notch management program results in lowered production, increased costs and decreased producer profits. Now, more than ever before, cotton demands the proven performance of good management.

Purpose of the Study

The purpose of this study was to investigate cotton producers' management practices and views of issues and problems facing cotton production in Southwestern Oklahoma.

Specific Objectives of the Study

In order to accomplish the purposes of the study, the following specific objectives were formulated.

1. To determine selected demographic characteristics of cotton producers and their production systems.
2. To determine the producers' perceptions of the extent of importance of selected factors (i.e. weeds, insects and diseases, marketing) in terms of limiting cotton production.
3. To determine practices and procedures employed by producers in the selection and use of herbicides and pesticides.
4. To determine practices and procedures related to fertility which were employed by producers.
5. To determine practices and procedures related to harvesting which were used by producers.
6. To determine practices and procedures related to marketing which were employed by producers.

7. To determine some of the sources of information and assistance utilized or needed by producers.

8. To compare certain findings of this study to those of a similar study conducted in 1986.

Methodology

The scope of this study included cotton producers in Greer, Harmon, Jackson, Kiowa, and Tillman counties located in Southwestern Oklahoma. A list of approximately 500 producers was identified. Assistance for this task was provided by cotton specialists employed by the Oklahoma Cooperative Extension Service who were stationed in that area of the state.

Data were collected by means of a mailed questionnaire, developed by the researcher with the aid of the above mentioned cotton specialists, Agricultural Education faculty, and fellow graduate students. Also, the instruments used in surveys of cotton producers in the same area during 1981 and 1986 were reviewed. The instrument for this study was field tested among a selected group of cotton producers from outside the area to be surveyed. Inputs from this group as well as those from other reviewers were considered in drafting the final version.

At the time this study was being conducted, the above-mentioned extension cotton specialists were sending information to cotton producers in the five counties on Boll Weevil management. They offered to include the questionnaire with the materials they were mailing out in return for being allowed to utilize some of the

findings for future programming efforts. In addition to the questionnaire, an instruction sheet describing the procedure for completing and returning the survey was included. Also, a postage-paid, self-addressed envelop was provided by the researcher for return of the questionnaires. The packets were mailed on February 25, 1994. A total of 71 usable responses were returned by the cutoff date. Therefore, the data reported in this study are those derived from these 71 respondents and the findings can be generalized only to this group.

Descriptive statistics such as percentages, item counts, ratings, and rank orders were applied to the data by the researcher. In certain instances, the data collected from these 71 producers were compared to the findings from a similar study conducted in 1986. Some findings came from asking a selected few about their production practices and the personal knowledge of the author.

Findings of the Study

Selected Demographics. The producers responding to this study farmed a total of 33,834 acres of cotton, with 21,003 (62.1 percent) being irrigated and 12,831 (37.9 percent) being dryland. These "respondent" acres accounted for 11.7 percent of the total for the area surveyed. Compared to 1986, it was found that currently there are 40,000 more acres in production totally. Respondents to the 1986 study reported a much higher proportion of dryland to irrigated production than was true for the 1994 group.

Almost 70 percent of the respondents to this study fit into the age range of 31-60, with the largest proportion of these being in the 41-50 category. Those in the oldest range, 61-70, comprised 28 percent of the total of respondents, with the 51-60 group accounting for 22 percent of the total. There were but few, four percent, in the 20-30 group. In the 1986 study, it was found that the largest group of respondents were also in the 41-50 age range. But, there was a larger proportion in the 51-60 category than as compared to now.

Limitations. Respondents ranked insects as the most important problem limiting their production of cotton. Weeds were ranked second, but were of notably less importance. Fertility and diseases, in that order, rounded out the top four production limitations. Insects and weeds were also rated first and second by respondents to the 1986 study; however, fertility and diseases were not among their top four concerns.

Variety Selection. It was disclosed that several different varieties are currently used by respondents. Paymster HS 26 was the most used dryland variety, selected by 37 percent of the respondents. Rather far back, but of second choice was Tamcot CABCS, followed closely by Paymaster 145, chosen by 19.7 and 18 percent of the respondents respectively. Paymaster 145, Lankart 57, Lankart 611, and Paymaster HS 26, in that order, were the top choices of 1986 dryland respondents. Virtually equal proportions of the 1994 respondents planted their irrigated acres to DP 5415 and

DP 90. These were selected by 20 and 19 percent respectively. The third most popular irrigated production variety was Chembred 1233, planted by 14.5 percent. None of the 1986 respondents producing under irrigation had used DP 5415 or Chembred 1233 and only 5.6 percent selected the DP 90. Their most popular variety was Paymaster 404 which was planted by no respondents in 1994.

Weed Problems and Management. Silverleaf Nightshade, Pigweed, Johnsongrass, Morning Glory and Devil's Claw, in that order, were the weeds identified as causing the greatest problems for cotton production in 1994. Compared to 1986, there had been very little change in the order of importance of problem weeds.

Well over two-thirds of the respondents, 70 percent, reported that they had applied their own herbicides, with just under one-fourth of them hiring Custom Ground Applicators for this treatment. In contrast, for insecticides, 61 percent used Custom Aerial Applicators, with 38 percent applying these products themselves.

Seventy-one percent of these responding indicated they applied herbicides prior to planting while 38 percent used Spot Treatment for weed control. Basically the same proportions, 10 and 11 percent applied herbicides Preemergence and Postemergence respectively.

In order to obtain necessary information on herbicides, 34 percent of the respondents consulted chemical dealers and 28 percent made their own decisions based upon study of product label instructions.

Insect Problems and Management. Insects were the major annual management problem of concern for responding cotton producers both in 1986 and 1994. The Boll Weevil was singled out as the most important insect problem by a rather wide margin by one half of the 1994 group. Aphids were second on the list and Bollworms were a close third in 1994. In 1986, Boll Weevils and Bollworms were identified as major insect problems and by equal proportions of respondents, 42 percent. Fleahoppers and Spider Mites were named by 12 and 9 percent respectively. Neither Aphids nor Thrips were listed as problem insects in 1986.

For insecticide spray decisions and control recommendations, 38 percent of the respondents relied on Consultants, while 28 percent depended on Aerial Applicators. Twenty percent trusted their own judgment in these matters.

Poor Application Timing was listed most often by respondents, 35 percent, as the reason for control failures, while another 27 percent blamed Weather. Poor Application was the cause cited by 18 percent.

Respondents applied insecticides multiple times in the growing season. Boll Weevils, Bollworms, and Cotton Fleahoppers, in that order, were the insects for which applications were intended. Producers with irrigated crops had to treat for more insects and more often than did their dryland counterparts.

Some type of Boll Weevil eradication program was favored by over 80 percent of the respondents. However, as projected costs for

such a program increased, support decreased, dwindling to just 9 percent of the respondents when a cost of $30 per acre was involved.

Treatment for Boll Weevils was primarily with Parathion, Methyl Parathion or Guthion, and Fury being used when Bollworms were also a problem. Bollworm control was attempted with insecticide brands such as Fury, Karate or Ambush, with Vydate being used to a lesser extent. Orthene and Bidrin were the products of choice for Cotton Fleahopper and Thrips control.

Disease Problems and Management. When compared to insects, diseases were not evaluated by respondents as problems of as much significance. However, for those who did report diseases as being problems, it was calculated that the following was the order of important of diseases: Fusarium Wilt, Bacterial Blight Seedling Blight, and Verticillium Wilt. In the 1986 study, Bacterial Blight was not listed as a problem at all, but Verticillium Wilt, Seedling Blight and Fusarium Wilt, in that order, were problems.

Nutrient Management. Over 85 percent of the respondents indicated that they applied fertilizers annually, while over 75 percent of them take soil samples to determine types and rates of fertilizers needed. This was an increase of 11 percent from 1986 in the proportion of producers taking soil samples.

In 1986, 57 percent of the respondents used OSU laboratories to test soil samples and this figure increased to 65 percent for the 1994 group. For the former group, 36 percent had indicated that

they guessed at rates of applications. In contrast, 100 percent of the 1994 respondents sought advice on application rates.

A large majority of respondents in 1994, in excess of 80 percent, applied a bulk, pellet, complete fertilizer formulation, followed by a liquid mixture at another time in the season. Nearly all the respondents, 97 percent, indicated that they achieved expected results from the application of fertilizers.

Growth Regulators. A fourfold increase in the use of Pix growth regulator among 1994 respondents over their 1986 counterparts was discovered. Of the former group, 86 percent reported the use of growth regulators as compared to the 20 percent in 1986. Among those respondents using these products in 1994, 86 percent expressed satisfaction with results as compared to the 74 percent from the earlier study.

For those who indicated dissatisfaction with growth regulators, 100 percent of the 1986 producer-respondents said it was because of the product's failure to control plant height. Voicing this same complaint were 45 percent of the more recent group. Among 1994 respondents, the other reasons cited for dissatisfaction, in descending order were: No Increase in Yield, Did Not Aid in Early Maturity Level, and No Control.

Harvest Aids. Eighty-six percent of the 1994 respondents used products to improve harvest conditions of their crop, compared to 45.6 percent of the 1986 group. Paraquat and Prep were the most

popular brand names of products used, followed in order by Def 6 and Dropp. Arsenic Acid, popular with 1986 respondents, was no longer in use.

Harvest Management. For 1986 and 1994 respondents, 31 and 35 percent respectively, employed Custom Harvesters. Stripper machines were used for harvest by 92 percent of the 1986 respondents group and 79 percent of the 1994 group.

Marketing. Only a negligible proportion of 1994 respondents, eight percent, reported problems with marketing their crop. As to concerns in marketing, 49 and 38 percent indicated price and buyers respectively.

More than one-half of the 1994 study participants sold their cotton on the cash market at ginning times. Almost 24 percent reported storing cotton for later sale on the cash market, while almost 11 percent became a part of marketing "pools" to attract buyers and better prices. Only 7.7 percent utilized the government "loan" program, with cash contracting prior to harvest and various types of hedging being used by only three percent.

Irrigation. Of the irrigated producers who participated in the study, 28 percent obtained water from the Altus-Lugert Irrigation District, with 54 percent reporting water being obtained from wells and the remainder from other surface sources. High salt content was by far the greatest water quality concern.

Use of Information and Assistance from Cooperative Extension. Three-fourths of those returning surveys made use of OSU Extension Fact Sheets, the same proportion found for the 1986 group and all who used them considered them educational and useful.

Respondents indicated they rely more on themselves to check their crops than they do on any other group, including extension personnel.

Almost two-thirds of the respondents expressed an interest in additional training in field scouting and would participate in extension-sponsored, all-day, field-based training during summer months.

Conclusions

Based upon analysis and interpretation of the data obtained from the 71 respondents to this study, certain findings from the similar study conducted in 1986, the review of literature and the researcher's personal experiences in cotton production, the following conclusions were drawn.

1. Producers in this area are an aging group in which there has been little turnover in recent years. Given the lack of young producers among the group, this trend is likely to continue and should be a source of increasing concern for the future.

2. Cotton has become an even more significant crop in the area since 1986 as evidenced by the increase in total acres under production.

3. Insects and weeds continued to be the major factors limiting cotton production, a situation which remains unchanged in recent years. Because control of these factors in the future will likely involve continued use of chemicals and because of the increasing environmental concerns associated with chemical use, these factors are likely to continue to be of major significance into the future.

4. Producers have taken steps to improve the quality of their crop as evidenced by the profound changes in varieties being planted. They are now growing higher fiber strength varieties of cotton that produce lower amounts of gin trash and which is better adapted to the mechanical harvesting methods which result in higher quality grades.

5. Problem weeds have remained basically the same. However, as evidenced by the increased use of pre-emergence chemical applications, producers are taking steps to prevent rather than having to treat weed problems. Also, they have become more careful regarding proper adjustments and calibration of application equipment.

6. Although major insect pests have not changed, the overall extent of problems created by insects has declined to some degree. Problems with Bollworms decreased substantially. Fleahoppers and Spider Mites were less of a problem. However, new problem insects continued to come on the scene. Producers are willing to pay a reasonable fee to fund program designed to eradicate insects, especially the Boll Weevil.

7. For the most part, producers rely on sources of information other than themselves in making decisions on insect pest control.

8. Insect control is a much more serious problem for irrigate producers.

9. The fact that some producers did not know which products were used for control of certain insects and that some chemicals were used to control pests for which they are not recommended raises a serious concern about insecticide safety.

10. Overall, diseases are not yet a significant problem for cotton production in the area, but they appear to be increasing in importance. This is disturbing since nearly all producers use seed treated with fungicides which should prevent such problems.

11. Producers have become more scientific and concerned about cost effectiveness in determining soil fertility needs through testing and are using test results as the basis for decisions as to types and application rates for fertilizers.

12. Producers are aware of and striving to achieve the "earliness factor" as means of producing the best and most cotton. Evidence of this is the increased control of early season insect pests; increased use of growth regulators for cotton plant management; and increased use of harvest aid which enable them to reap the cotton at its highest levels of quality and weight.

13. There has not been a great deal of progress on the part of the producers in the development and use of innovative means of marketing cotton.

14. The fact that 50 percent of the irrigated cotton produced in this region of the state is located within the Altus Irrigation District is a big concern. With the dry year in 1994, the water supply for the district was almost completely exhausted. If this is not replenished before the beginning of the next crop year, the irrigated cotton industry in the area will be in jeopardy.

15. The Southwestern Oklahoma cotton production system varies greatly between dryland and irrigated systems and producers seem to have a good understanding of the proper management of these systems. Areas in which producers have made notable improvements include soil fertility management, variety selection and weed management. Areas of concern for the future include insect management, and cost/benefit analysis of the application of insecticides and harvest aids.

Recommendations

The following recommendations are offered:

1. There is need for more producer education programs in several areas. The areas of most immediate need are the selection and application of pesticides, herbicides and fertilizers. Given sufficient staff and other resources, Cooperative Extension could have an even more significant impact in these areas in the future by developing and delivering such programming. Perhaps the initial effort should be a scouting school, conducted in the summer, which would involve a great deal of instruction in the field.

2. Efforts should be undertaken to not only recruit, but to also promote the retention of larger numbers of younger cotton producers for the area.

3. Respondents to this study accounted for only slightly more than 11 percent of the total acreages of cotton produced in the area. Also, dryland production accounts for 75 percent of the total production for the state, while of these answering this survey, only 38 percent were dryland producers. Therefore, research efforts such as this one should be continued, but there is a need to achieve higher rates of participation by producers overall and to secure more precise representativeness of respondents by type of production system.

4. In order to maintain cotton as a profitable crop for this area, research needs to continue into new production and other types of technology which will reduce the costs of production and enhance producer income. These should be longitudinal research efforts, conducted by interdisciplinary teams, which should focus on several topics, among which should be the following:

a. Research on pest management systems which are being used and which would focus on the efficiencies and profitability of those systems.

b. Research on innovative marketing methods and other means of influencing prices received.

c. Research on prices received for different levels of lint quality produced.

d. Research on the economics of continued use of fungicide treated seed versus in-furrow application of fungicides.

e. Research on alternative sources of irrigation water and upon the proper management of water for irrigation.

f. Research on the most effective means of disseminating the latest information and technology among producers.

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APPENDIXES

APPENDIX A

COVER LETTER AND COTTON PRODUCERS' SURVEY

February 25, 1994

Dear Cotton Producer:

The Oklahoma State University Area Extension Office of Altus, J. C. Banks, Cotton Specialist and Miles Karner, Cotton Entomologist, are working with Jim Strawn, Agricultural Chairman, Western Oklahoma State College at Altus, Oklahoma to gather information on "Management Practices and Issues Facing the Cotton Producer in Southwest Oklahoma." Sound information is needed and will be important to area agriculture.

Your name was selected to be part of the sample. Since the survey questionnaire will be asking for details about chemicals used, formulation quantity of product used per acre, etc., if you choose you may use past records, labels or other data to be better able to answer the survey questions.

Your reply will be kept confidential and will be used only to obtain respondents area averages and statistics.

If you have any questions about this survey, please call Jim Strawn at 405-477-2000, extension 258 or J. C. Banks or Miler Karner at 405-482-8880.

Thanking you in advance,

Jim Strawn, Agriculture Chairman
Western Oklahoma State College

1994
COTTON PRODUCER SURVEY

This survey covers all aspects of cotton production. Please take time to answer this survey. Survey results help research and educational efforts. THANK YOU.

PLEASE MAIL THE COMPLETED SURVEY IN THE ENCLOSED POSTAGE PAID ENVELOPE.

1. County? _____
2. How long have you grown cotton? _____
3. How many acres are irrigated? _____
4. How many acres are dryland? _____
5. What varieties are you growing and how many acres of each variety?

Dryland		Irrigated	
Variety	Acres Grown	Variety	Acres Grown
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

6. I would like to know the extent to which each of the following is a major problem in cotton production for you. (Please circle one, 1 = great - 5 = slight).

Insects	1	2	3	4	5	Diseases	1	2	3	4	5
Weeds	1	2	3	4	5	Fertility	1	2	3	4	5

7. To what extent are each of the weeds below a problem?
(Please circle one, 1 = great - 5 = slight).

Silverleaf Nightshade (Whiteweed)	1	2	3	4	5
Carolina Horse Nettle (Bull Nettle)	1	2	3	4	5
Pigweed (Careless Weed)	1	2	3	4	5
Rhizome Johnson Grass	1	2	3	4	5
Russian Thistle (Tumbleweed)	1	2	3	4	5
Field Bindweed	1	2	3	4	5
Morning Glory	1	2	3	4	5
Yellow Nutsedge (Nutgrass)	1	2	3	4	5
Cocklebur	1	2	3	4	5
Hot Potato (Blueweed)	1	2	3	4	5
Texas Panicum	1	2	3	4	5
Devil's Claw	1	2	3	4	5

Other _____

8. Which of the following types of applications of herbicides do you use in a season?

1. PPI (before planting) ☐
2. Preemergence (after planting) ☐
3. Post emergence (over the top) ☐
4. Post emergence directed ☐
5. Spot treatment ☐
6. Other _____

9. Percentage of applications of herbicides and insecticides?

	Herbicides	Insecticides
% Applied Yourself	_____	_____
% Custom Ground Applicator	_____	_____
% Aerial Applicator	_____	_____

10. If you apply yourself, how often do you calibrate the sprayer?

Each Season ☐
Once in a while ☐
Never ☐

11. From which of the following do you seek information to determine the type and rate of herbicide to use? (Check all that apply)

Extension ☐ Chemical Dealer ☐ Applicator ☐
Label ☐ Consultant ☐ Other _____

12. To what extent are the following insects a problem for you?
(Please circle one, 1 = great - 5 = alight).

Bollworm	1	2	3	4	5	
Boll Weevil	1	2	3	4	5	
Cotton Fleahopper	1	2	3	4	5	
Cotton Aphid	1	2	3	4	5	
Thrips	1	2	3	4	5	
Spider Mites	1	2	3	4	5	
Other	1	2	3	4	5	_____

13. Frequency of spraying. List number of applications and insecticides used on the average to produce a cotton crop each year.

	Dryland Number of Applications	Irrigated Number of Applications
Bollworm	_____	_____
Boll Weevil	_____	_____
Cotton Fleahopper	_____	_____
Cotton Aphid	_____	_____
Thrips	_____	_____
Spider Mites	_____	_____
Other	_____	_____

14. What sources of information do you utilize to select the insecticide and rate?

Extension ☐ Yourself ☐

Consultant ☐ Aerial Applicator ☐ Other _____

15. If insects were not controlled, what were the reasons? (If controlled, do not check box.)

Poor Timing ☐ Wrong Insecticide ☐ Weather ☐

Poor Application ☐ Wrong Rate ☐ Other ☐

Don't know ☐

16. Would you be in favor of a boll weevil eradication program?

Yes ☐ No ☐

16a. Would you favor an eradication program costing you $10.00 per acre per year for 5 years?

Yes ☐ No ☐

16b. Would you favor an eradication program costing you $15.00 per acre per year for 5 years?

Yes ☐ No ☐

16c. Would you favor an eradication program costing you $30.00 per acre per year for 5 years?

Yes ☐ No ☐

17. If no, why are you against an eradication program? _____

_____

_____

18. To what extent are the following diseases a problem for you?
(Please circle one, 1 = great - 5 = slight).

Verticillium	1	2	3	4	5
Bacterial Blight	1	2	3	4	5
Seedling Right	1	2	3	4	5
Fusarium Wilt/Root Knot Nematode Complex	1	2	3	4	5

19. Have nematode samples been taken and analyzed?

Yes ☐ No ☐

20. Do you fertilize annually?

Yes ☐ No ☐

21. Do you soil test?

Yes ☐ No ☐

22. Where do you receive your soil recommendations from?

OSU Soil Test Lab _____

Fertilizer Dealer _____

Other (specify) _____

23. Did you follow the recommendations? If no, why not?

Yes ☐ No ☐ _____

24. What type of fertilizer did you use?

Give analysis _____

25. Did you get the expected results?

Yes ☐ No ☐

26. Do you use a plant growth regulator such as Pix?

Yes ☐ No ☐

27. If yes, were you pleased with the results?

Yes ☐ No ☐

28. If no, why were you not satisfied with the growth regulator results? Explain.

Did not control plant height ☐ Did not aid in early maturity ☐

Did not increase yield ☐ Other (specify) _____

29. Do you use harvest aid chemicals to help prepare your cotton for early harvest?

Yes ☐ No ☐

30. If yes, what chemicals do you use?

	Dryland	Irrigated		Dryland	Irrigated
Paraquat	☐	☐	Prep	☐	☐
Folex	☐	☐	Harvade	☐	☐
Chlorate	☐	☐	Dropp	☐	☐
Def 6	☐	☐	Quick Pick	☐	☐
Accelerate	☐	☐	Other (specify)	_____	_____

31. If yes, were you pleased with the results?

Yes ☐ No ☐

32. If you were not pleased, give reasons.

Poor Timing ☐ Wrong Concentration ☐ Weather ☐

Poor Application ☐ Wrong Chemical ☐ Not Sure ☐

Other (specify) _____

33. What type of harvest machine do you use?

Picker ☐ Stripper ☐ Both ☐

34. Do you own your machine or hire custom work?

Own ☐ Custom ☐ Other _____

35. Do you have problems marketing your cotton?

Yes ☐ No ☐

36. To what extent are the following problems for you in marketing?
Please circle one, 1 = great - 5 = slight).

What price to ask for cotton or how to set your price 1 2 3 4 5

Finding buyers 1 2 3 4 5

Other (specify) _____

37. Please indicate the percentage of the past year's crop you marketed by each of the listed methods.

	Percentage
Selling spot cotton at ginning time	_____
Store baled cotton, then sell later in cash market	_____
Cash contract before ginning	_____
Hedging cotton using cotton futures, sell at ginning time	_____
Storage hedge	_____
Store baled cotton, enter government loan program	_____

38. If you have irrigation, what is (are) the source(s) of water?

Altus/Lugert ☐ Well ☐ Creek ☐ Pond ☐

39. Do you have any problems with the quality of your irrigation water?

Yes ☐ No ☐

40. If yes, what problems do you have with the quality of your irrigation water?
(specify) _____

41. Do you use Oklahoma State University's Fact Sheets that are at the Extension Office located in your area?

Yes ☐ No ☐

42. If yes, to what extent do you think they are educational and benefit you with your farming? (Please circle one, 1 = great - 5 = slight).

1 2 3 4 5

43. Who do you depend on to check your cotton fields?

County Agent ☐ Commercial Applicator ☐

Self, family or hired hand ☐ Private Consultant ☐

Other (specify) _____

44. Are you interested in receiving training on scouting procedures?

Yes ☐ No ☐

45. If so, how would you like to receive this training?

In the field (all day school) ☐ Night class ☐

Other (specify) _____

46. What time of the year would the training be appropriate for you?

Fall ☐ Winter ☐ Spring ☐ Summer ☐

47. Please indicate your age group.

20-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐ 61-70 ☐

48. What person(s) do you depend on to help with your cotton production questions?

_____

_____

_____

49. List the most limiting factor (problem) that most hinders or limits your production practices.

_____

_____

_____

50. Please list areas where you think OSU can aid you in your cotton production.

_____

_____

_____

51. Do you have anything that you would like to contribute or add to this survey?

_____

_____

_____

_____

_____

Thank you for filling out this survey. Please put this survey in the self-addressed, postage paid envelop and return it to me. If you would like a copy of the survey results, please write your name and address below:

_____
Name

_____
Address

_____
City **State** **Zip**

APPENDIX B

INSTITUTIONAL REVIEW BOARD (IRB)

APPROVAL FORM

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
HUMAN SUBJECTS REVIEW

Date: 03-08-94 **IRB#:** AG-94-019

Proposal Title: MANAGEMENT PRACTICES: ISSUES FACING THE COTTON PRODUCERS IN SOUTHWEST OKLAHOMA

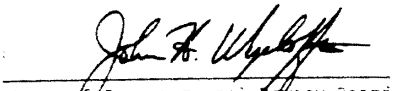
Principal Investigator(s): Dr. H. Robert Terry, Jimmy C. Strawn

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

APPROVAL STATUS SUBJECT TO REVIEW BY FULL INSTITUTIONAL REVIEW BOARD AT NEXT MEETING.
APPROVAL STATUS PERIOD VALID FOR ONE CALENDAR YEAR AFTER WHICH A CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED FOR BOARD APPROVAL. ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO BE SUBMITTED FOR APPROVAL.

Comments, Modifications/Conditions for Approval or Reasons for Deferral or Disapproval are as follows:

Signature:  Date: March 10, 1994

Chair of Institutional Review Board

VITA

Jimmie C. Strawn

Candidate for the Degree of

Master of Science

Thesis: MANAGEMENT PRACTICES, ISSUES AND PROBLEMS OF COTTON PRODUCERS IN SOUTHWESTERN OKLAHOMA

Major Field: Agricultural Education

Biography:

Personal Data: Born in Monahans, Texas, November 17, 1939, the son of G. W. and Nova Strawn. Married to Linda Jackson on August 6, 1964. Three children, David C. Strawn, Gregory K. Strawn, and Nicole L. Strawn.

Education: Graduated from Eldorado High School in May, 1957; Received Bachelor of Science degree in Agricultural Education from Oklahoma State University in May, 1961; completed the requirements for the Master of Science degree at Oklahoma State University in December, 1994.

Professional Experience: Agricultural Education Instructor, Vinson Public Schools, July, 1961 to June, 1962; Carnegie Public Schools, July, 1962 to August, 1965; Kingfisher Public Schools, August, 1965 to June, 1966; Clinton Public Schools, July, 1966 to June, 1974; Eldorado Public Schools, July, 1974 to June, 1976; Owner of Carnegie Building Center July, 1976 to June, 1978; General Manager of Falklands Farms, Schellsburg, Pennsylvania, June, 1978 to December, 1984; General Manager of Quail Run Ranch, Walnut Springs, Texas, December, 1984 to June, 1987; Manager of Tennessee River Music, Inc., Ft. Payne, Alabama, December, 1987 to August, 1988; Agricultural Education Instructor, Eldorado Public Schools, August, 1988 to June, 1991; Agriculture Chairman, Western Oklahoma State College, August, 1991 to present.