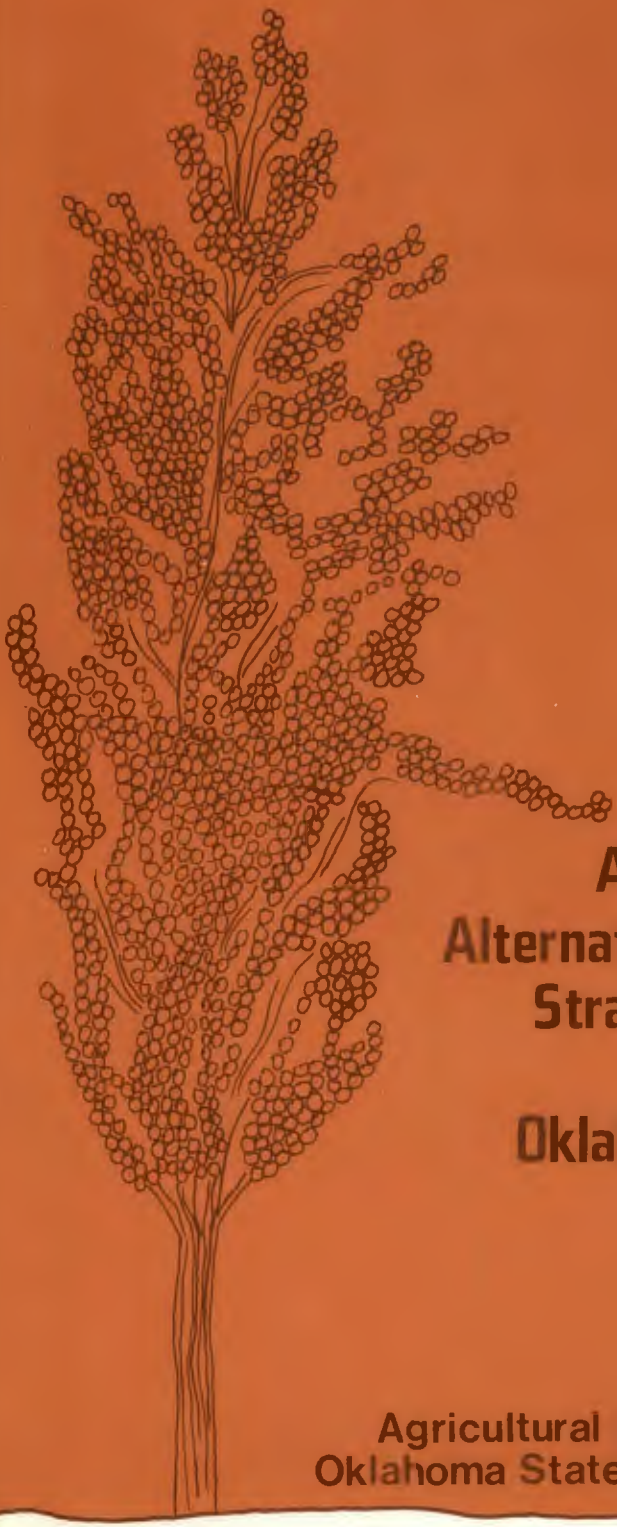

An Economic Analysis of Some Alternative Pest Control Strategies for Grain Sorghum in the Oklahoma Panhandle

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An Economic Analysis of Some Alternative Pest Control Strategies for Grain Sorghum In The Oklahoma Panhandle

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Introduction

One of Oklahoma's major crops is grain sorghum. Approximately 1.2 million acres are grown each year yielding approximately 15.12 million hundred weights. At the 1974 price of $4.90/cwt. this production represents a value of 74 million dollars annually. Several insect pests have the potential to significantly affect an annual grain sorghum crop. The most common, and the one to be studied here is *Schizaphis graminum* (Rondani), better known as the greenbug. Greenbug infestations, if left uncontrolled can cause serious damage and result in major crop losses to growers. The primary method currently used to control the pest is the aerial application of ethyl parathion. The control method is relatively inexpensive, effective in the short-run but thought by some to be environmentally harmful.

In view of the potential environmental harm the purpose of this study is to examine current control practices and formulate and evaluate alternatives. More specifically, the objectives are:

1. To delineate feasible methods of greenbug control on grain sorghum in the Oklahoma Panhandle;
2. estimate the effect of using each method of control on producers net returns, and;
3. list the general effect of each method of control on the major exogenous factors of interest.

For purposes of manageability, the Oklahoma Panhandle is used as the study area. The major crops produced in the area are feed grains (primarily sorghum and corn), wheat and alfalfa. The Panhandle area typically produces more than 50 percent of Oklahoma's total supply of grain sorghum, or about 4 percent of the nation's output. Although the application of pesticides per acre of grain sorghum is not as great as for some other crops, approximately 170,000 pounds of Parathion was used

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to control insects on grain sorghum acreage in the Panhandle area during 1973, making the area an important study location. Alternative controls found feasible for use in the Panhandle, would in all likelihood be useable in other grain producing areas of the nation, since the greenbug is a pest in other sorghum growing areas.

The remainder of this report contains five sections. The first section describes the pest situation in the Panhandle. Included are the type of pest problems, the degree to which natural predators maintain control and current control methods employed. The externalities associated with current control methods are also discussed.

Alternative pest control techniques are outlined in section two. The possibility of using biological, cultural, mechanical, chemical and integrated strategies to control greenbugs in grain sorghum production in the study area are discussed. The control strategies listed at the close of section two are evaluated in section three. A detailed cost and return analysis is presented for current practices and five alternative strategies to assess the financial feasibility of each. The environmental consideration of each are also examined. The alternative control methods are ranked and compared on the basis of economic and environmental factors in section four. Conclusions and summary are presented in the final section.

The Current Situation

The Pest and Predator Insects

There are five important pest species found on sorghum grown in the Oklahoma Panhandle. These are the greenbug, *Schizaphis graminum* (Rondani); Banks grass mite, *Oligonychus* spp.; sorghum midge, *Contarinia sorghicola* (Coquillent); fall armyworm, *Spodoptera frugiperda* (J. E. Smith); and corn leaf aphid, *Rhopalosiphum maidis* (Fitch). At the present time only the greenbug and Banks grass mite pose a serious problem. The midge can be a problem in late season but is avoided by planting early-flowering hybrids. The following discussion and resulting strategies deal primarily with the control of the greenbug. The other pests are omitted because they pose less serious threats.

Greenbug infestations can occur any time during the sorghum-growing season (June through October). Infestations vary in magnitude from several insects to several thousand per plant. The greenbug harms the plant by injecting a toxin into the plant and by sucking juice from the leaves and, if mature, the grain head. Generally, a large infestation on a less-than-mature crop is very harmful.

The primary enemies of the greenbug are the braconid wasp, *Lysiphlebus testaceipes;* the lady beetle, primarily *Hippodamia* spp.; and the

green lacewing, *Chrysopa* spp. The lady beetle, adult and larvae, and the lacewing larvae are predators of the greenbug. The braconid wasp is the number one enemy of the greenbug. This parasitoid controls the greenbug by parasitizing (laying eggs in) the pest. The greenbug, after being parasitized, no longer acts as a pest but as a cocoon for the wasp. Varying environmental conditions from year to year determine the impact the parasitoid has on the greenbug population. If conditions are ideal for a greenbug population increase the parasitoid cannot keep the host population below an economically damaging level. The reason for this being the short life cycle and reproductive potential of the greenbug. Under other conditions the parasitoid may maintain enough control of the host population to delay the population peak by 1 or 2 weeks.

In some situations weather can help control the greenbug. When the sorghum is less than 18 inches tall, hard rain, and to some extent high winds, will knock the greenbugs off the plants. As the plants mature and acquire more leaf area, which acts as a buffer to the rain and wind, the amount of control from these sources decrease.

Control Techniques Employed

Man-imposed measures are necessary to maintain low pest levels when natural controls fail. Chemical control is the only commonly used measure currently employed. The current practice in control of greenbugs is to spray by either airplane or various ground apparatus. Most farmers who spray for greenbugs employ aerial applicators. The most predominant chemical used is ethyl parathion and the average quantity is 6 ounces of active ingredient per acre [13]. Application rates vary, however, from 4 to 8 ounces of active chemical per acre. The cost of materials and application is approximately $3.00 - $3.50 per acre, application costs are approximately $1.85 per acre.

Survey data [13] indicates virtually all Panhandle farmers sprayed with organo-phosphate materials to control greenbugs in 1971. Similar data indicating the proportion of grain sorghum acreage sprayed in other years is not available. However, extension specialists working in the Panhandle area indicate from 50 to 100 percent is sprayed each year, depending on the intensity of the greenbug infestation, with some acreage being sprayed more than one time per year. The remainder of this report assumes the current practice to control greenbugs is one spray per year at a cost of $3.50 per acre.

A Cooperative Extension Service and USDA supported pest management program using scouts to make insect counts in farmers' fields was initiated on 22,000 acres in 1973. The first two years of results indicate scouting programs of this type may be an effective means of reducing

chemical application in the future providing they can be used on a larger proportion of the area's production. Scouting programs are discussed in more detail in a later section of this report.

Externalities Produced

Identification and measurement of pesticide produced externalities is not easy. The most common examples are water and soil pollution, death and injury to wildlife, farm animals, and man. Most documentation of pesticide residue and harm to mammals stems from the past uses of chlorinated hydrocarbon material such as DDT [8].

Chlorinated hydrocarbon material is not being used in the Panhandle. All chemicals are of an organo - phosphate variety. Because of the chemical nature of these pesticides, those that are not systemic in action break down very rapidly after application. Consequently, the possibilities for water and soil pollution are minimal. Chemical residue on the crop is not a problem because of the lag time between spraying and harvesting of sorghum.

Unlike chlorinated hydrocarbons, many organo - phosphate pesticides are extremely toxic if encountered upon application. The possibility for injury or death to non-target organisms does exit. However, all chemicals are applied mechanically and farm workers seldom enter sprayed areas immediately following chemical application. The authors were unable to document any cases of injury to humans in Oklahoma during the past several years. No records are available reporting the number of chemically related farm animal deaths, but the number is expected to be small.

It is concluded, that the accidental poisoning of people and farm animals have not resulted from controlling grain sorghum pests in the Panhandle. The major externality produced is probably short-run air pollution. However, the use of chemicals on greenbugs interferes with the natural pest-predator relationships. This may lead to the build-up of potential pests, such as Banks grass mites, to damaging populations necessitating further chemical controls.

Alternative Control Techniques

Chemical application is only one method available to control greenbugs. Additional types of control include (1) biological control; (2) mechanical control; (3) cultural control; and (4) integrated control methods. Each of these methods is theoretically suitable for the control of insects given the proper circumstances. This section examines each of these general methods of control and identifies specific strategies thought to be appropriate for use in the Panhandle area.

Biological Control

The basis of biological control is to allow nature to maintain insect levels. Whenever pest levels become too large for naturally occuring predators and parasitoids to control them man helps with insect releases designed to bring pest-levels down below the economic threshold. In general, there are three ways in which this can be accomplished depending on (1) the objectives of the user, (2) the biological nature of the pest and (3) the cost. The choices include the release of predators, release of sterile male pests or pests with mutant genes. Each of these is considered in turn.

When pest populations reach levels too large for the existing predators to control, additional predators are added to the predator population to feed on increased pest numbers. In the case of the greenbug both lady beetles and braconid wasps have been released to control greenbug infestations.

In 1973, the Department of Entomology at Oklahoma State University [9] completed a biological control experiment. Lady beetles and wasps were released in various quantities and at different times during greenbug infestations on controlled plots. In general, the tests were less successful than hoped. The reasons for failure were numerous. First, it was determined that far more wasps per acre were needed than could feasibly be raised. Second, the greenbug was able to reproduce in colder weather than the parasitoid. Further, as mentioned earlier, the reproductive potential of the greenbug is so great that it can out-produce the parasitoid even in warm weather.

Even if biological experimentation proved successful, the resource requirements necessary for the rearing and distribution of predators would be too large for individual farmers to feasibly adopt the strategy. The space, time and expertise needed to rear lady beetles and/or wasps make this alternative infeasible [9], given 1974 grain prices.

If the objective of the user is the eradication rather than a pest-predator balance then introduction of sterile males or mutant gene species may serve this purpose. In the first case the male is unable to fertilize the female and the species is eradicated. In the second, the male fertilizes the female but the offspring never hatch because of a genetic deficiency, or die soon after birth. Both of the above approaches are not feasible because the greenbug reproduces asexually.

Mechanical Controls

The concept underlying mechanical control is to imitate the action of wind or rain, both of which are known to have some effect in controlling greenbugs. In the production of other crops, e.g. corn, where a

major problem is ground-dwelling insects, post-harvest plowing and discing are of value. Greenbugs, however, are migratory making the usual kinds of mechanical operations of little or no value. Thus, the number of mechanical operations available to control greenbug infestations are limited.

The operations theoretically workable are those of brushing, blowing, or washing insects from leaves. In the 1973 study referred to earlier [9], brushing was performed at various times during the growing season. The grain yield on brushed plots did not differ significantly from the yield of the no control strategy. The yields from chemical control on similar plots were approximately double. The researchers concluded that brushing would not replace insecticide unless the pests could somehow be prevented from crawling back on the plants once removed.

The mechanical burning of insects on sorghum has been suggested.[1] This approach, however, is only in the experimental stage and does not appear to be a technically feasible control alternative in the near future.

Cultural Controls

Cultural control practices involve an alteration in the established pattern of farm operations. Typical changes which can be made to lessen pest levels are (1) removing vegetative growth from drainage ditches, roadways, and fallowed ground; (2) strip cropping; (3) crop rotation, or the establishment of alternate crops, and (4) the development of pest-resistant varieties of existing crops.

Clearing excessive vegetative growth in drainage ditches and on fallowed ground destroys pest habitats and will help control insects. However, it requires additional labor and machine time. It is also of limited use for greenbugs which can migrate relatively long distances.

Strip cropping can be used to maintain a balance of pest and predator populations. It has been shown to be effective in controlling insect pests in cotton where cotton and sorghum are grown together [7]. However, the use of strip cropping may be difficult to accomplish in grain sorghum production in the Panhandle area. There are economies of field size in planting and harvesting sorghum. The presence of narrow stips of alternate crops interferes with the mechanical farming operation reducing the built-in economies resulting from large field operation. Thus, farmers resistance to this alternative is expected to be inversely related to the width of the strips required to achieve greenbug control.

Since a major contributing factor to pest problems is man's reliance on a monocultural type of agriculture [8], the evaluation of strip crop-

[1]Discussions with Dr. Stan Coppock, associate professor of entomology, Dr. Dale Weibel, professor of agronomy, and Dr. R. D. Eikenbary, professor of entomology, all of Oklahoma State University, helped to formulate these ideas.

ping and/or crop rotation may be worthwhile. The use of crop rotations to control insect pests is also based on maintaining a balance of pest and predator populations. It may be possible to shift some grain sorghum acreage to millet production in an effort to reduce the concentration of grain sorghum production in the area. Researchers report that its use in Africa and India is quite large and its similarity to sorghum close [9]. However, little is known about producing and marketing millet in the Oklahoma Panhandle at the present time and its acceptability is not evaluated in this study.

A promising cultural control technique currently being researched indicated fully resistant hybrids can produce identical yields and require the use of no insecticide application [9, p. 60]. A few problems remain such as the quality of the seed in some cases. However, plant breeders expect to eliminate the problems and have resistant hybrids generally available to producers within four years. Thus resistant hybrids are the most likely cultural alternative to insecticides. When the problems are solved, farmer acceptance should be no problem. Once planted, environmental pollution from insecticides applied for greenbug control will be eliminated.

Integrated Control Strategies

Integrated control of insects consists of the combined use of two or more control methods in a complementary manner to manage pest infestations. The extent that nonchemical control methods will reduce pest damage is not known, making it impossible to evaluate a full range of integrated control strategies. Thus, the integrated control strategies evaluated in this report include some insecticide applications. The methods discussed in this section consider the use of low-dosage applications and scouting programs as part of integrated control strategies.

A 1972 Texas study [11] reports that very low dosages of organic phosphate material are sufficient to adequately control greenbug populations. Additional evidence indicates that when less active ingredient is used, greater care is needed in the timing and method of application to achieve adequate control. Although proper mixing of the material, uniform application and avoiding drift are important regardless of the level of active ingredient used, these considerations become more important as the amount of active ingredient is reduced. In addition the timing of the application is critical because the residual chemical effect is small.

A scouting program can be used to achieve regular surveillance of pest populations and proper timing of chemical controls. At present, a publicly supported program is in existence in the Oklahoma Panhandle and results indicate that farmer acceptance is growing. The purpose of

the program is to identify the existance, types and magnitude of insect infestations, the level of beneficial populations and the necessity of spraying. If farmers place their confidence in the recommendations of the scouting program, unnecessary applications can be eliminated. An educational program could be conducted as a joint effort to encourage proper dosage, mixing and uniform application.

Control Methods For Further Analysis

The preceding discussion suggests several strategies and combinations of strategies for further evaluation in this study. These are (1) current chemical control with aerial applicators, (2) current chemical control with high clearance ground applicators, (3) no control, (4) the application of various chemical dosage levels based on commercial scouting reports, (5) low chemical dosage level without scouting, (6) insect resistant hybrids. These control alternatives are compared on a cost and return basis as well as on the basis of several additional considerations in evaluating their relative desirability.

Costs and Returns Per Acre for Six Alternative Control Strategies

Current Control Method

The current method of controlling the greenbug by aerial spraying of organo-phosphate materials is discussed in the first section of this report. Table 1 contains the net returns per acre to land, overhead expenses of the business and management for employing conventional control techniques and conventional production methods.[2] Appendix I contains the detailed budgets listing each of the production expenses. For purposes of comparison four types of sorghum production are considered. These are (1) dry land production on clay loam soils; (2) dry land production on sandy loam soils; (3) irrigated production using a moderate level (11 inches) of water and (4) irrigated production using a high level (24 inches) of water. These four types of grain sorghum production were chosen to illustrate the effect of the alternative control measures on the profitability by type of farm operation.

It is assumed that the sorghum price is $4.90/cwt. The yield per acre and the cost of seed, fertilizer, pesticides, machinery operations, irrigation expense, and labor are listed for each type of production in Appendix I. Any changes in the yields, prices and production costs for the other control methods are noted in the discussion of the strategy.

[2]Depreciation, personal property taxes, insurance, and interest on the machinery and equipment are included as a cost in making the net returns estimates in this report. The overhead expenses referred to here include the fixed and variable expenses, of the business that cannot be allocated to an individual crop or livestock enterprise. Costs such as utilities, accounting expenses and telephone are included in this category.

Table 1. Conventional Control Method

Type of Production	Net Returns/Acre[1]
Clay Land	$29.52
Sandy Soil	66.86
11″ Irrigation	135.56
24″ Irrigation	217.63

[1]The figures are net returns to land, overhead expenses of the business, and management. A land and management charge has not been deducted in preparing these estimates. Depreciation, personal property taxes, insurance and interest on the machinery and equipment have been deducted, but other overhead expenses of the business have not been considered in deriving these estimates.

High Clearance Sprayer (Hiboy)

Environmental concerns with aerial application procedures suggest an alternative strategy is to apply chemical insecticides using other methods. Two basic control alternatives exist for applying insecticides in the absence of airplanes. The first is the use of sprinkler systems. This alternative is limited to those farmers who have sprinkler irrigation operations or the potential to install an irrigation system. Furthermore, the technical aspects of achieving uniform application of chemicals through a sprinkler irrigation system have not been worked out and harmful externalities from drift and runoff are likely to result. Because of these problems this alternative is not explored. The best option available to both dryland and irrigated operations appears to be application of chemical insecticides using a self-propelled high clearance ground sprayer (hiboy).

The costs associated with the use of the hiboy are two-fold. First is the fixed cost which includes depreciation, taxes, insurance and interest. Second are the variable costs associated with use of the machine. These costs include fuel, lubrication, labor and repairs. To compute depreciation, interest, taxes and insurance, it is assumed the machine is owned eight years, has 2,000 hours of life and is used 150 hours per year. The hiboy can spray approximately 12 acres per hour. The fixed costs total $7.18 per hour, while fuel, lubrication and repairs total $3.12 per hour of use. The operator's labor is included at $2.50 per hour. Appendix II contains the operating coefficients and details of the cost computations for the hiboy.

Table 2 lists the returns for both conventional methods and the hiboy. The four types of production are included for comparison.

The changes in net farm revenue are positive but very small. However, these results assume no loss in yield. It is possible that the increased time required to apply the insecticide would result in some insect damage. If a scouting program were in operation the immediate reporting of an infestation would possibly allow the slower hiboys to adequately spray the infested acreage.

Table 2. Comparison of Net Returns Per Acre For Conventional Versus High Clearance Sprayer Control[1]

Type of Production	Conventional Control	High Clearance Sprayer	% Δ
Clay Land	$29.52	$30.46	+3
Sandy Soil	66.86	67.80	+1.4
11″ Irrigation	135.56	136.49	+ .6
24″ Irrigation	217.63	218.56	+ .4

[1]The figures are net returns to land, overhead expenses of the business, and management. A land and management charge has not been deducted in preparing these estimates. Depreciation, personal property taxes, insurance and interest on the machinery and equipment have been deducted, but other overhead expenses of the business have not been considered in deriving these estimates.

Two factors arise when farmers consider the hiboy strategy. First is the labor required to remove the gated irrigation pipe from the end of the fields. Secondly, the time required for the field to dry enough for a hiboy to operate in the field. This could be from 2 to 6 days depending on soil type, plant cover, and weather conditions. This delay could result in severe greenbug damage to the crop.

The high clearance sprayer strategy is a pure chemical strategy. To this extent the amount of chemicals applied will probably be equal to the conventional strategy. An environmental advantage arises because the release of chemical is closer to the plants. Less drift occurs due to wind and fewer non-target areas are sprayed. In this respect the controllability of the chemical should be superior.

No Control Strategy

One alternative to chemical control is no control. Farmers following this strategy would incur crop losses when a greenbug infestation occurs. They would also avoid chemical control costs of $3.50 per acre each year. The effect of implementing a no chemical control strategy on expected net returns per acre is discussed below.

The field operations to produce grain sorghum with the no control strategy are approximately the same as those with current chemical controls. The major change is the non-use of any chemical insecticide. When insect damage occurs less grain is harvested. Thus, a second change expected is a reduction in harvesting and hauling costs.

Estimates of yield losses, which are crucial in evaluating the no-control strategy, are based on several sources [1, 4, 9]. These studies and private communications with extension specialists familiar with greenbug control in the study area indicate the average yield of grain harvested would be reduced by 25 percent[3]. Even though the studies referenced

[3]Mr. Jim Howell, the Area Specialized Agent in Agronomy, from the Guymon extension center, Guymon, Oklahoma, agreed that a 25 percent loss was a reasonable expectation.

supported this figure, it is a long run average. Two of the studies [1, 4] indicate that a loss in yield of up to 45 percent may occur in uncontrolled areas and the figure could be larger. A larger infestation of greenbugs during the pre boot or milk stages of growth, if uncontrolled, may lead to a zero yield. Thus 25 percent appears to be a good estimate of the average loss, but the loss in any year may vary from 0 to 100 percent for an individual farmer.

Net returns per acre were calculated for this strategy for each of the four methods of production. The detailed cost and return estimates for the no-control method are listed in Appendix III. In each of the four cases the amount of grain produced, harvested and hauled was reduced 25 percent and the $3.50 insecticide cost was removed.

Table 3 lists the expected net returns to land, overhead and management per acre for the conventional control and the no control method. Results indicate that net returns per acre are thirty to thirty-four percent lower with the no-control strategy than with conventional controls.

The lower expected net returns and the greater uncertainly probably make the no-control strategy an unattractive alternative from the producers standpoint. However, it may have some advantages from an environmental standpoint. These considerations are taken up later in this report.

The Application of Current Chemical Dosages Based on Scouting Reports

The Pilot Program

A pilot insect scouting program was initiated in the Oklahoma Panhandle during 1973. The program has been operated by the OSU

Table 3. Comparison of Net Returns Per Acre for Conventional Versus The No-Control Strategy[1]

Type of Production	Conventional Control	No Control	%Δ
Clay Land	$29.52	$20.07	—32%
Sandy Soil	66.86	44.92	—32%
11″ Surface Irrigation	135.56	88.79	—34%
24″ Surface Irrigation	217.63	145.47	—33%

[1]The figures are net returns to land, overhead expenses of the business, and management. A land and management charge has not been deducted in preparing these estimates. Depreciation, personal property taxes, insurance and interest on the machinery and equipment have been deducted, but other overhead expenses of the business have not been considered in deriving these estimates.

Extension Area Specialized Agent in Entomology. The program is experimental, and publicly financed.

The 1973 operation involved the use of 6 scouts covering 22,000 acres of sorghum. Each scout surveyed 3,000 to 4,000 acres. The current practice is to check each field one to two times per week. The findings i.e. pest and predator counts, condition of the crop and expected developments are relayed by the scout to the area entomologist and the farmer.

Cost and Returns With Commercial Scouting

Tentative estimates of the costs for a commercial scouting firm and the acreage covered have been prepared for use in evaluating the returns growers could expect if they employed the firm. Most of the estimated inputs and costs have been determined from conversations with the extension area specialists. Table 4 lists the requirements and their monthly costs. First, an individual trained as an entomologist would be required on a full-time basis to manage the business. Directly under him would be one supervisor to direct 4 or 5 scouts. Depending on the degree of participation by the community the number of scouts needed and hence supervisors would vary. Since scouting would be performed primarily during the summer months, college students or part-time people would be optimal. Other personnel required would include an office worker to serve as a secretary.

A full time office would be required. Vehicles would be needed for each scout or scout team. Scouts could use motor bikes to some extent and be transported to field areas by the supervisors. To insure communications between supervisors and the central office, mobile telephones or radios would be required in each supervisors vehicle.

With this operation an estimated 4,000 acres a week could be thoroughly scouted by each scout and hence a team of one supervisor and 5 scouts could handle 20,000 acres. Taking into account the differences in planting dates and varieties, which would determine the growth stage of the plants at a given time, it more than likely would not be necessary to check all of the 20,000 acres twice a week at the same time. Once a field is sprayed it is removed from the list of fields to be checked twice a week, unless reinfested. Therefore, it would be possible to check fields twice a week, once they were infested, until sprayed and still be able to cover the 20,000 acres.

Scouting not only sorghum and corn during the summer, but also wheat and alfalfa through the winter and spring could keep the permanent personnel of the scouting firm busy about nine months per year. It appears this would be necessary to sustain a commercial scouting business.

Table 4. The Estimated Cost of Operating A Commercial Scouting Program

Item	One Crew of Scouts			Two Crews of Scouts		
	No.	Cost/Month	Cost for 3 Months	No.	Cost/Month	Cost for 3 Months
Manager	1	$1,500	$4,500	1	$1,500	$4,500
Supervisor	1	650	1,950	2	650	3,900
Scouts	5	500	7,500	10	500	15,000
Office Help	1	500	1,500	1	500	1,500
Auto Expense ($4000 initial cost/unit)	2	200	1,200	3	200	1,800
Motor Bike Expenses ($400 initial cost/unit	5	20	300	10	20	600
Mobile Phone	2	100	600	3	100	900
Business Radios ($1500 initial cost/unit)	3			4		
Office Rent, Utilities and Miscellaneous			1,500			1,500
Total Cost			$33,500			$51,700
Acres Scouted with Two Scoutings Per Week			20,000			40,000
Average Cost Per Acre			$1.67			$1.29

The information in Table 4 indicates it would cost approximately $33,550 to operate an office and employ five scouts for the three-month season. An operation of this magnitude could effectively scout 20,000 acres for insect pests. Thus, it is estimated that a cost to the farmer of approximately $1.67 per acre for two scoutings would be required to make commercial scouting profitable. It is conceivable that as more acres were enrolled, the cost per acre would fall. These figures suggest that expanding the size to two crews of scouts would reduce costs per acre approximately 23 percent.

Assuming a cost of $1.67 per acre for scouting fees and no other production changes, the returns per acre were calculated for the usual four methods of production. Crucial to the return estimates is the amount of pesticide sprayed in conjunction with the scouting program. If farmers are using more applications than necessary, the presence of the scouts will lower insecticide use. In times of large infestations, however, the usual spraying may be required. To account for these variable rates three

Table 5. Comparison of Net Returns Per Acre for Conventional Versus A Scouting Program With Current Dosage Levels[1]

(1) Type Of Production	(2) Conventional Strategy	(3) Scouting with No Spray[2]	(4) Scouting With Half Usual Spray[2]	(5) Scouting With Full Spray[2]
Clay Soil	29.52	31.50	29.61	27.71
Sandy Soil	66.86	74.24	66.95	65.05
11″ Irrigated	135.56	137.54	135.65	133.75
23″ Irrigated	217.63	219.61	217.71	215.82

[1]The figures are net returns to land, overhead expenses of the business, and management. A land and management charge has not been deducted in preparing these estimates. Depreciation, personal property taxes, insurance and interest on the machinery and equipment have been deducted, but other overhead expenses of the business have not been considered in deriving these estimates.

[2]See Appendix IV for budgets.

spray levels were assumed and the associated returns were estimated. They were no spray, half the usual spray and full spray per acre. Table 5 lists the returns employing a scouting program with variable spraying requirements.

The figures in Table 5 indicate that if the volume of chemical is reduced net returns will increase employing the scouting program. As shown in column (3) if no spray is necessary then scouting programs return a higher net revenue than conventional practice. Even if one-half the past spraying is required, column (4), the returns are slightly higher than those employing conventional methods. Column (5) assumes the scouting program is joined and full chemical application is required. In this case net returns are lowered but the average reduction in net returns is only 5 percent. This figure does not include any gains in income earned from additional advice given by the scouting firm.

These figures indicate that even at a cost of $1.67 per acre for hiring a private scouting firm, the changes in net revenue with or without chemical application are small. It is conceivable, however, that large farm firms may be willing to hire scouting services to transfer the responsibility of pest management. Even though the increased returns per acre are not large the time saved by not dealing with pest control could be used to expand the operation or increase leisure.

Environmental Advantages

The environmental advantages of a scouting program are two fold. Obviously, close monitoring of fields and the recommending of chemical application in only needed situations reduces chemical use. A second, and possibly overlooked, advantage of a complete scouting program is the

information provided to farmers regarding all phases of the farm operation other than insect problems.

The manager, and in some cases the scout supervisors, will be able to advise farmers on limiting operations (no till systems), alternative crops, proper residue management, irrigation scheduling, herbicides, and other matters. In this manner, farmers hiring the scouting services will not only receive proper insect control advice, but they may also receive a broader range of management services. The benefits from these additional services are worth mention even though hard to quantify.

Low Dosage Application Rates

The amount of active chemical ingredient currently used per acre varies from 4 to 8 ounces and averages about 6 ounces. These dosages conform to current recommendations by the Oklahoma State University Extension Service. Dealers recommend a dosage within the acceptable range. Research being conducted in Texas [11] indicates that lower amounts of equivalent material have been used to successfully control greenbug populations on grain sorghum. The research indicates an application of as little as 1.6 ounces of active ingredient per acre provides satisfactory control. Thus, a low-dosage strategy is an alternative to current practice.

The only change required in current grain sorghum production practices to implement a low-dosage strategy is in the nature of application. Since less active material is being applied per acre, it is particularly important that the material be mixed thoroughly and applied uniformly to the grain sorghum crop. These considerations may make this alternative unattractive to many aerial applicators. Adoption of a low dosage strategy by the majority of farmers would greatly reduce pesticide sales resulting in higher prices per ounce of active ingredient. Thus adoption of a low dosage strategy is expected to increase the purchase price of the chemical and the cost of aerial application.

The cost of chemicals was about $1.65 per acre and the application cost $1.85 in 1974. Assuming the cost of chemicals will be $.82 per acre and the application costs will double, a total charge of $4.52 per acre will cover material and application. The detailed cost and return estimates for each method of production is given in Appendix V.

The net returns per acre for the low dosage and conventional control strategies are compared in Table 6. In each of the cases, the increase in spray cost results in a small reduction in net revenue. Adoption of this strategy would not change grower net returns per acre significantly. This suggests low dosage control might be a viable alternative considering net revenue and environmental factors.

Table 6. Comparisons of Net Returns Per Acre For Conventional Versus Low Dosage Control Strategy[1]

Type of Production	Conventional Control	Low Dosage	% Δ
Clay Land	29.52	28.42	—3%
Sandy Soil	66.86	65.76	—1.6%
11″ Irrigation	135.56	134.46	— .8%
24″ Irrigation	217.63	216.52	— .5%

[1]The figures are net returns to land, overhead expenses of the business, and management. A land and management charge has not been deducted in preparing these estimates. Depreciation, personal property taxes, insurance and interest on the machinery and equipment have been deducted, but other overhead expenses of the business have not been considered in deriving these estimates.

The reduction in chemical pollution in the environment is an important advantage of this alternative. Reduced pollution can be expected both because less active ingredient will be applied and because relatively calm periods, will be selected for application, resulting in less drift and less effect on non-target organisms out of the treatment area.

The idea behind the low-dosage technique is not eradication but control of a pest to a level where beneficial insects can maintain a balance. In this manner, another advantage of the low-dosage method is that pests and predators remain at equilibrium levels to prevent secondary outbreaks of new pests. Evidence indicates that normal use of chemicals will kill both greenbugs and their predators leaving the area susceptible to Banks grass mite infestation. The mite is resistant to most phosphate material and is difficult to control. Thus, it is essential to maintain balanced insect populations to prevent potential pest populations from increasing to damaging levels.

Insect Resistant Hybrids

As mentioned above, insect resistant hybrids would be the most desirable of all alternative strategies. No changes in farm organization or production methods would be required. No scouting for greenbugs would be necessary and, in all probability, no chemicals would be required to control pests [9, p. 60]. Plant breeders indicate the pollination problems in producing resistant hybrids will make the seed about 25 percent more expensive than nonresistant hybrids. Thus, the only cost charge required at the farm level would be a 25% increase in seed cost. No outlay for either insecticides or their application would be needed.[4]

[4]Greater difficulties in pollinating resistant as opposed to non-resistant hybrids is expected to raise the cost of producing commercial seed about 25 percent.

Table 7 lists expected net returns from using resistant hybrids. The usual four types of dryland and irrigated operations are compared.

As shown, the use of these varieties would be somewhat more profitable than existing hybrids. The net return figures assume that (1) no yield losses will occur with the use of the hybrids and (2) that no chemicals are used. Both claims have been supported by researchers at Oklahoma State University. Appendix VI includes the detailed production costs for the resistant hybrid strategy.

The use of resistant sorghums has both positive and negative environmental aspects. In the short run the elimination of chemicals has obvious environmental advantages. In the long run, however, unforeseen problems may occur. The varieties now being developed are green bug resistant only. They may not be resistant to other pests, such as the banks grass mite and sorghum midge and upsurgencies may give rise to a new set of problems.

Comparison of the Alternative Strategies

Five alternatives to current pest management practices – the application of currently used chemicals with high clearance sprayers, no control, application of current dosage rates based on scouting reports, the use of low dosage rates, and resistant hybrids – have been formulated and appear to be feasible for the Panhandle. However, feasibility is only one condition required for farmer acceptance. Farmer acceptance of the strategies suggested depends on the profitability, reliability, and management problems associated with the strategies, as well as content with the current practice. Public acceptance of the strategies depends on the frequency and severity of pollution problems resulting from use of the strategy, as well as its reliability in controlling the pest.

Table 7. Comparison of Net Returns Per Acre For Conventional Control Versus Greenbug Resistant Hybrids[1]

Type of Production	Conventional Control	Resistant Varieties	% Δ
Clay Dry Land	29.52	33.03	+12%
Sandy Soil	66.86	70.37	+ 5.2%
11" Surface Irrigation	135.56	138.86	+ 2.4%
24" Surface Irrigation	217.63	220.72	+ 1.4%

[1]The figures are net returns to land, overhead expenses of the business, and management. A land and management charge has not been deducted in preparing these estimates. Depreciation, personal property taxes, insurance and interest on the machinery and equipment have been deducted, but other overhead expenses of the business have not been considered in deriving these estimates.

Comparison On Net Returns

Table 8 lists the net return per acre for the six strategies considered in the study. Column (4) (from Table 5, column 4) is the scouting strategy with one-half the conventional chemical application. This particular strategy was selected, rather than scouting with no chemical or full chemical treatment, so that a likely or average outcome could be examined. Other column headings are self-explanatory.

The resistant hybrid strategy has the highest net returns per acre. The only additional cost is an increase in seed cost which is more than offset by the reduction in insecticide cost. No additional machine time is needed as in the high clearance sprayer strategy, and no crop losses are incurred as in the no control strategy. Along with high returns it appears insect resistant varieties will be high yielding and will not be greatly affected by greenbug attack.

The use of ground sprayers to apply insecticides ranks second in net returns but is both a straight chemical control method and risky. The risk arises because of the speed of application. Since hiboy sprayers only cover about 12 acres per hour, a massive infestation on a young crop could lead to a crop loss before the sprayers could spray the infested acreage.

The scouting program, appears profitable because of lower chemical and application expenses. Scouting would prove more profitable if the management advantages, discussed previously, could be calculated. Scouting is risky because farmers are known to spray at the wrong times and for harmless insects. Scouting programs will add a high degree of certainty to the identification and control of harmful insects.

Table 8. A Comparison of Net Returns Per Acre For the Seven Control Strategies[1]

	(1) Conventional	(2) High Clearance Sprayer	(3) No Control	(4) Scouting ½ Chem.	(5) Low Dose	(6) Resistant Variety
Clay Land	29.52	30.46	20.07	30.13	28.42	33.03
Sandy Soil	66.86	67.80	44.92	67.47	65.76	70.37
11″ Irrigation	135.56	136.49	88.79	136.17	134.46	138.86
24″ Irrigation	217.63	218.56	145.47	218.23	216.52	220.72

[1]The figures are net returns to land, overhead expenses of the business, and management. A land and management charge has not been deducted in preparing these estimates. Depreciation, personal property taxes, insurance and interest on the machinery and equipment have been deducted, but other overhead expenses of the business have not been considered in deriving these estimates. Overhead expenses include utility payments, accounting fees, telephone bills and clerical work.

The low-dosage application ranks fourth. Even though less chemical is applied, chemical cost per ounce is expected to increase and application cost double, resulting in lower net returns per acre. The probability of misapplying chemicals exists which could result in large greenbug infestations and significant yield losses. Although the low dosage strategy has some environmental advantages it is unlikely it will be adopted as described here because of lower net returns and the risk of yield loss.

The net returns from a no control strategy depend on the amount of infestation occurring during the season. To plant grain sorghum and hope for no pests can be expected to result in yields from zero to normal levels over a period of years. The estimated average annual yield reduction of 25 percent makes this strategy very unattractive from a net return standpoint.

Current Content With Existing Practices

The current control practice relying on chemical application sprayed by airplane is relatively fool proof in the short run. Farmers are content with it for three reasons. First, they are fairly certain of obtaining satisfactory control over greenbug infestations. By applying 4 to 8 ounces of parathion per acre once or twice during the growing season there is assurance of maximum yield. Second, in light of high grain prices this method of control is relatively cheap. A farmer using 11 acre inches of irrigation water per acre can expect about 4,200 pounds of grain per acre.[5] At a price of $4.90 per cwt. the gross value of the crop is over $200 per acre. The cost of spraying is only 3 or 4 dollars per acre. A cost this low to protect a large expected return is regarded as cheap insurance. Spraying also reduces the management time required — the third reason for current content. Farmers can spray and virtually ignore the insect pest problem. This releases time for attention to other management problems of their business.

Current content could change very quickly if greenbugs in the Panhandle area develop insecticide resistance. Such resistance has been reported in Texas. As mentioned earlier, the banks grass mite problem is expected to increase. For these reasons it appears current content with existing chemical controls may be short lived.

Comparison on Exogenous Factors

A qualitative comparison of the seven strategies on the basis of several important exogenous factors is given in Table 9. Two strategies, resistant hybrids and low dosage application based on scouting reports

[5]See budget in Appendix I.

Table 9. Comparison of Strategies on Exogenous Factors

	Current Practice	High Clearance Sprayer	No Control	Scouting With ½ Acreage Sprayed Conventionally	Low Dose Without Scouting	Resistant Hybrids
Assurance of Control	Excellent	Good-Fair	None	Excellent	Good	Excellent
Harmful to Beneficials	Very	Very	None	Less	Less	None
Pollution Reduction	No	Yes	Yes	Yes	Yes	Yes
Economic Impact on Community	No	Yes	Yes	Yes	Yes	Yes
Reduced Control		Unknown	Yes	No	Yes	No
Compatible With Nature	No	No	Yes	Partially	To a much greater extent	Yes

stand out as being the more desirable. Both should result in excellent control of the greenbug, reduce pollution and result in little or no harm to beneficial insects. Both would have some economic impact on the community. In the case of resistant hybrids, the additional cost of seed is a minor increase and the other effect would be reduced activity in the purchase of chemicals and aerial spraying. The reduction in these areas is largely offset by the additional scouting firms required with the low dosage application with scouting.

Summary

The major pest of grain sorghum in the Oklahoma Panhandle is the greenbug. The current method of control is by aerial application of various organo-phosphate compounds at rates of from 4 to 8 ounces/acre. The control method is judged effective and is widely employed.

Many citizens are concerned about this method of control. Their concern is not only in the Panhandle, but in all parts of the U.S., where tons of toxic materials are used yearly in the production of food.

This study proposes alternative control practices that could be used in the Panhandle to control insect pests on grain sorghum. The six alternatives evaluated are a subset of the possible alternatives, many of

which were tested in Oklahoma and discarded. The alternatives were limited to those that can be initiated with current technology.

The control strategies evaluated include current chemical controls, the use of high clearance sprayers to apply current chemical dosage levels, no control, various chemical dosage levels based on scouting reports, the use of low dosage application rates, and resistant hybrids. Of these alternatives resistant hybrids appear to be the best strategy both in terms of net returns for producers and impact on exogenous factors. The use of ground sprayers and scouting reports were selected as the next best alternatives to current controls. Although expected net returns per acre were not a lot larger than current controls, the strategy ranked almost as favorably on exogenous factors as the use of resistant hybrids. The use of low dosage rates in combination with scouting reports may become particularly useful if greenbug resistant varieties do not have the desired degree of resistance and/or other pests become of increasing importance.

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[13] USDA-ERS - Unpublished Figures from a 1971 Farm Expenditure Survey of Counties in Texas, Kansas and Oklahoma.

APPENDIX I
Production Budgets Employing Conventional Control Strategies

GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING CONVENTIONAL CONTROL STRATEGIES
CLAY DRYLAND

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	11.000	53.90
SORGHUM STUBBLE	AUMS	0.0	0.750	0.0
TOTAL RECEIPTS				53.90
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	4.000	1.08
INSECTICIDE	ACRE	3.500	1.000	3.50
CROP INSURANCE	DOL.	0.060	20.000	1.20
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	11.000	0.88
TRACTOR FUEL COST	ACRE			1.05
TRACT REPAIR COST	ACRE			1.22
TRACTOR LUBE COST	ACRE			0.16
EQUIP REPAIR COST	ACRE			0.60
TOTAL OPERATING COST				13.68
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				40.22
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	7.371	0.66
TRACTOR INVESTMENT		0.090	19.997	1.80
EQUIPMENT INVESTMENT		0.090	10.475	0.94
TOTAL INTEREST CHARGE				3.41
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				36.81
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			2.60
EQUIPMENT	DOL.			1.69
TOTAL OWNERSHIP COST				4.29
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				32.52
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.199	3.00
TOTAL LABOR COST				3.00
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				29.52

APPENDIX I CON'T.

GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING CONVENTIONAL CONTROL STRATEGIES
SANDY SOIL-DRYLAND

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	21.000	102.90
SORGHUM STUBBLE	AUMS	0.0	0.750	0.0
TOTAL RECEIPTS				102.90
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	4.000	1.08
NITROGEN	LBS.	0.070	50.000	3.50
INSECTICIDE	ACRE	3.500	1.000	3.50
CROP INSURANCE	DOL.	0.060	30.000	1.80
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	21.000	1.68
TRACTOR FUEL COST	ACRE			1.65
TRACT REPAIR COST	ACRE			1.92
TRACTOR LUBE COST	ACRE			0.25
EQUIP REPAIR COST	ACRE			0.89
TOTAL OPERATING COST				20.26
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				82.64
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	8.316	0.75
TRACTOR INVESTMENT		0.090	31.452	2.83
EQUIPMENT INVESTMENT		0.090	13.577	1.22
TOTAL INTEREST CHARGE				4.80
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				77.84
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			4.10
EQUIPMENT	DOL.			2.17
TOTAL OWNERSHIP COST				6.26
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				71.57
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.885	4.71
TOTAL LABOR COST				4.71
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				66.86

APPENDIX I CON'T.

IRRIGATED GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING CONVENTIGNAL CONTROL STRATEGIES
11" SURFACE IRRIGATION

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	42.000	205.80
SORGHUM STUBBLE	ACRS	0.0	1.000	0.0
TOTAL RECEIPTS				205.80
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	7.000	1.89
NITROGEN	LBS.	0.070	100.000	7.00
INSECTICIDE	ACRE	3.500	1.000	3.50
HERBICIDE	ACRE	5.630	1.000	5.63
CROP INSURANCE	DOL.	0.060	60.000	3.60
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	42.000	3.36
TRACTOR FUEL COST	ACRE			1.65
TRACT REPAIR COST	ACRE			1.93
TRACTOR LUBE COST	ACRE			0.25
EQUIP REPAIR COST	ACRE			1.35
IRRIG FUEL COST	ACRE			2.68
IRRIG LUBE COST	ACRE			0.49
IRRIG REPAIR COST	ACRE			1.33
TOTAL OPERATING COST				38.66
RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT				167.14
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	9.613	0.87
TRACTOR INVESTMENT		0.090	31.532	2.84
EQUIPMENT INVESTMENT		0.090	21.814	1.96
IRRIGATION SYSTEM INVESTMENT		0.090	28.343	2.55
TOTAL INTEREST CHARGE				8.22
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				158.93
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			4.11
EQUIPMENT	DOL.			3.64
IRRIGATION SYSTEM	DOL.			5.37
TOTAL OWNERSHIP COST				13.12
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				145.81
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.890	4.73
IRRIGATION LABOR	HR.	2.500	2.209	5.52
TOTAL LABOR COST				10.25
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				135.56

APPENDIX I CON'T.

IRRIGATED GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING CONVENTIONAL CONTROL STRATEGIES
24" SURFACE IRRIGATION

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	62.000	303.80
SORGHUM STUBBLE	AUMS	0.0	1.400	0.0
TOTAL RECEIPTS				303.80
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	10.000	2.70
NITROGEN	LBS.	0.070	125.000	8.75
NITROGEN	LBS.	0.140	25.000	3.50
HERBICIDE	ACRE	5.630	1.000	5.63
INSECTICIDE	ACRE	3.500	1.000	3.50
CROP INSURANCE	DOL.	0.060	80.000	4.80
MACHINE HIRE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	62.000	4.96
TRACTOR FUEL COST	ACRE			2.36
TRACT REPAIR COST	ACRE			2.76
TRACTOR LUBE COST	ACRE			0.35
EQUIP REPAIR COST	ACRE			1.73
IRRIG FUEL COST	ACRE			2.44
IRRIG LUBE COST	ACRE			0.45
IRRIG REPAIR COST	ACRE			1.21
TOTAL OPERATING COST				49.13
RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT				254.67
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	15.819	1.42
TRACTOR INVESTMENT		0.090	45.086	4.06
EQUIPMENT INVESTMENT		0.090	26.029	2.34
IRRIGATION SYSTEM INVESTMENT		0.090	25.767	2.32
TOTAL INTEREST CHARGE				10.14
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				244.52
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			5.87
EQUIPMENT	DOL.			4.36
IRRIGATION SYSTEM	DOL.			4.88
TOTAL OWNERSHIP COST				15.12
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				229.40
LABOR COST:				
MACHINERY LABOR	HR.	2.500	2.703	6.76
IRRIGATION LABOR	HR.	2.500	2.008	5.02
TOTAL LABOR COST				11.78
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				217.63

APPENDIX II
Production Budgets Employing A High Clearance Sprayer

GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING A HIGH CLEARANCE SPRAYER
CLAY DRYLAND

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	11.000	53.90
SORGHUM STUBBLE	AUMS	0.0	0.750	0.0
TOTAL RECEIPTS				53.90
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	4.000	1.08
INSECTICIDE	ACRE	1.650	1.000	1.65
CROP INSURANCE	DOL.	0.060	20.000	1.20
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	11.000	0.88
TRACTOR FUEL COST	ACRE			1.05
TRACT REPAIR COST	ACRE			1.22
TRACTOR LUBE COST	ACRE			0.16
EQUIP FUEL COST	ACRE			0.08
EQUIP LUBE COST	ACRE			0.01
EQUIP REPAIR COST	ACRE			0.75
TOTAL OPERATING COST				12.08
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				41.82
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	5.840	0.53
TRACTOR INVESTMENT		0.090	19.997	1.80
EQUIPMENT INVESTMENT		0.090	12.579	1.13
TOTAL INTEREST CHARGE				3.46
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				38.36
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			2.60
EQUIPMENT	DOL.			2.07
TOTAL OWNERSHIP COST				4.67
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				33.69
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.294	3.23
TOTAL LABOR COST				3.23
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				30.46

APPENDIX II CON'T.

GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING A HIGH CLEARANCE SPRAYER
SANDY SOIL-DRYLAND

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	21.000	102.90
SURGHUM STUBBLE	ACRS	0.0	0.750	0.0
TOTAL RECEIPTS				102.90
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	4.000	1.08
NITROGEN	LBS.	0.070	50.000	3.50
INSECTICIDE	ACRE	1.650	1.000	1.65
CROP INSURANCE	DOL.	0.060	30.000	1.80
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	21.000	1.68
TRACTOR FUEL COST	ACRE			1.65
TRACT REPAIR COST	ACRE			1.92
TRACTOR LUBE COST	ACRE			0.25
EQUIP FUEL COST	ACRE			0.08
EQUIP LUBE COST	ACRE			0.01
EQUIP REPAIR COST	ACRE			1.04
TOTAL OPERATING COST				18.66
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				84.24
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	6.785	0.61
TRACTOR INVESTMENT		0.090	31.452	2.83
EQUIPMENT INVESTMENT		0.090	15.681	1.41
TOTAL INTEREST CHARGE				4.85
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				79.39
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			4.10
EQUIPMENT	DOL.			2.55
TOTAL OWNERSHIP COST				6.64
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				72.75
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.980	4.95
TOTAL LABOR COST				4.95
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				67.80

APPENDIX II CON'T.

IRRIGATED GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING A HIGH CLEARANCE SPRAYER
11" SURFACE IRRIGATION

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	42.000	205.80
SORGHUM STUBBLE	ALMS	0.0	1.000	0.0
TOTAL RECEIPTS				205.80
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	7.000	1.89
NITROGEN	LBS.	0.070	100.000	7.00
INSECTICIDE	ACRE	1.650	1.000	1.65
HERBICIDE	ACRE	5.630	1.000	5.63
CROP INSURANCE	DOL.	0.060	60.000	3.60
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	42.000	3.36
TRACTOR FUEL COST	ACRE			1.65
TRACT REPAIR COST	ACRE			1.93
TRACTOR LUBE COST	ACRE			0.25
EQUIP FUEL COST	ACRE			0.08
EQUIP LUBE COST	ACRE			0.01
EQUIP REPAIR COST	ACRE			1.50
IRRIG FUEL COST	ACRE			2.68
IRRIG LUBE COST	ACRE			0.49
IRRIG REPAIR COST	ACRE			1.33
TOTAL OPERATING COST				37.05
RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT				168.75
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	8.082	0.73
TRACTOR INVESTMENT		0.090	31.532	2.84
EQUIPMENT INVESTMENT		0.090	23.919	2.15
IRRIGATION SYSTEM INVESTMENT		0.090	28.343	2.55
TOTAL INTEREST CHARGE				8.27
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				160.48
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			4.11
EQUIPMENT	DOL.			4.02
IRRIGATION SYSTEM	DOL.			5.37
TOTAL OWNERSHIP COST				13.50
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				146.98
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.985	4.96
IRRIGATION LABOR	HR.	2.500	2.209	5.52
TOTAL LABOR COST				10.48
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				136.49

APPENDIX II CON'T.

IRRIGATED GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING A HIGH CLEARANCE SPRAYER
24" SURFACE IRRIGATION

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	62.000	303.80
SORGHUM STUBBLE	AUMS	0.0	1.400	0.0
TOTAL RECEIPTS				303.80
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	10.000	2.70
NITROGEN	LBS.	0.070	125.000	8.75
NITROGEN	LBS.	0.140	25.000	3.50
HERBICIDE	ACRE	5.630	1.000	5.63
INSECTICIDE	ACRE	1.650	1.000	1.65
CROP INSURANCE	DOL.	0.060	80.000	4.80
MACHINE HIRE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	62.000	4.96
TRACTOR FUEL COST	ACRE			2.36
TRACT REPAIR COST	ACRE			2.76
TRACTOR LUBE COST	ACRE			0.35
EQUIP FUEL COST	ACRE			0.08
EQUIP LUBE COST	ACRE			0.01
EQUIP REPAIR COST	ACRE			1.88
IRRIG FUEL COST	ACRE			2.44
IRRIG LUBE COST	ACRE			0.45
IRRIG REPAIR COST	ACRE			1.21
TOTAL OPERATING COST				47.53
RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT				256.27
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	14.288	1.29
TRACTOR INVESTMENT		0.090	45.086	4.06
EQUIPMENT INVESTMENT		0.090	28.133	2.53
IRRIGATION SYSTEM INVESTMENT		0.090	25.767	2.32
TOTAL INTEREST CHARGE				10.19
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				246.08
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			5.87
EQUIPMENT	DOL.			4.74
IRRIGATION SYSTEM	DOL.			4.88
TOTAL OWNERSHIP COST				15.50
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				230.58
LABOR COST:				
MACHINERY LABOR	HR.	2.500	2.798	6.99
IRRIGATION LABOR	HR.	2.500	2.008	5.02
TOTAL LABOR COST				12.01
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				218.56

APPENDIX III
Production Budgets Employing No Control Strategy

GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING NO CONTROL STRATEGY
CLAY DRYLAND

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	8.250	40.42
SORGHUM STUBBLE	AUMS	0.0	0.750	0.0
TOTAL RECEIPTS				40.42
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	4.000	1.08
CROP INSURANCE	DOL.	0.060	20.000	1.20
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	8.250	0.66
TRACTOR FUEL COST	ACRE			1.05
TRACT REPAIR COST	ACRE			1.22
TRACTOR LUBE COST	ACRE			0.16
EQUIP REPAIR COST	ACRE			0.60
TOTAL OPERATING COST				9.96
RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT				30.46
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	4.016	0.36
TRACTOR INVESTMENT		0.090	19.997	1.80
EQUIPMENT INVESTMENT		0.090	10.475	0.94
TOTAL INTEREST CHARGE				3.10
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				27.36
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			2.60
EQUIPMENT	DOL.			1.69
TOTAL OWNERSHIP COST				4.29
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				23.06
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.199	3.00
TOTAL LABOR COST				3.00
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				20.07

APPENDIX III CON'T.

GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING NO CONTROL STRATEGY
SANDY SOIL-DRYLAND

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	15.750	77.17
SORGHUM STUBBLE	ALMS	0.0	0.750	0.0
TOTAL RECEIPTS				77.17
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	4.000	1.08
NITROGEN	LBS.	0.070	50.000	3.50
CROP INSURANCE	DOL.	0.060	30.000	1.80
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	21.000	1.68
TRACTOR FUEL COST	ACRE			1.65
TRACT REPAIR COST	ACRE			1.92
TRACTOR LUBE COST	ACRE			0.25
EQUIP REPAIR COST	ACRE			0.89
TOTAL OPERATING COST				16.76
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				60.42
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	5.108	0.46
TRACTOR INVESTMENT		0.090	31.452	2.83
EQUIPMENT INVESTMENT		0.090	13.577	1.22
TOTAL INTEREST CHARGE				4.51
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				55.90
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			4.10
EQUIPMENT	DOL.			2.17
TOTAL OWNERSHIP COST				6.26
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				49.64
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.885	4.71
TOTAL LABOR COST				4.71
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				44.92

APPENDIX III CON'T.

IRRIGATED GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING NO CONTROL STRATEGY
11" SURFACE IRRIGATION

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	31.500	154.35
SORGHUM STUBBLE	ALMS	0.0	1.000	0.0
TOTAL RECEIPTS				154.35
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	7.000	1.89
NITROGEN	LBS.	0.070	100.000	7.00
HERBICIDE	ACRE	5.630	1.000	5.63
CROP INSURANCE	DOL.	0.060	60.000	3.60
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	31.500	2.52
TRACTOR FUEL COST	ACRE			1.65
TRACT REPAIR COST	ACRE			1.93
TRACTOR LUBE COST	ACRE			0.25
EQUIP REPAIR COST	ACRE			1.35
IRRIG FUEL COST	ACRE			2.68
IRRIG LUBE COST	ACRE			0.49
IRRIG REPAIR COST	ACRE			1.33
TOTAL OPERATING COST				34.32
RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT				120.03
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	5.845	0.53
TRACTOR INVESTMENT		0.090	31.532	2.84
EQUIPMENT INVESTMENT		0.090	21.814	1.96
IRRIGATION SYSTEM INVESTMENT		0.090	28.343	2.55
TOTAL INTEREST CHARGE				7.88
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				112.15
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			4.11
EQUIPMENT	DOL.			3.64
IRRIGATION SYSTEM	DOL.			5.37
TOTAL OWNERSHIP COST				13.12
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				99.04
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.890	4.73
IRRIGATION LABOR	HR.	2.500	2.209	5.52
TOTAL LABOR COST				10.25
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				88.79

APPENDIX III CON'T.

IRRIGATED GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING NO CONTROL STRATEGY
24" SURFACE IRRIGATION

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	46.500	227.85
SORGHUM STUBBLE	AUMS	0.0	1.400	0.0
TOTAL RECEIPTS				227.85
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	10.000	2.70
NITROGEN	LBS.	0.070	125.000	8.75
NITROGEN	LBS.	0.140	25.000	3.50
HERBICIDE	ACRE	5.630	1.000	5.63
CROP INSURANCE	DOL.	0.060	80.000	4.80
MACHINE HIRE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	62.000	4.96
TRACTOR FUEL COST	ACRE			2.36
TRACT REPAIR COST	ACRE			2.76
TRACTOR LUBE COST	ACRE			0.35
EQUIP REPAIR COST	ACRE			1.73
IRRIG FUEL COST	ACRE			2.44
IRRIG LUBE COST	ACRE			0.45
IRRIG REPAIR COST	ACRE			1.21
TOTAL OPERATING COST				45.63
RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT				182.22
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	12.611	1.13
TRACTOR INVESTMENT		0.090	45.086	4.06
EQUIPMENT INVESTMENT		0.090	26.029	2.34
IRRIGATION SYSTEM INVESTMENT		0.090	25.767	2.32
TOTAL INTEREST CHARGE				9.85
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				172.36
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			5.87
EQUIPMENT	DOL.			4.36
IRRIGATION SYSTEM	DOL.			4.88
TOTAL OWNERSHIP COST				15.12
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				157.24
LABOR COST:				
MACHINERY LABOR	HR.	2.500	2.703	6.76
IRRIGATION LABOR	HR.	2.500	2.008	5.02
TOTAL LABOR COST				11.78
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				145.47

APPENDIX IV

Production Budgets Employing Insect Scouting And Various Chemical Applications

GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING INSECT SCOUTING AND NO INSECTICIDE
CLAY DRYLAND

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	11.000	53.90
SORGHUM STUBBLE	AUMS	0.0	0.750	0.0
TOTAL RECEIPTS				53.90
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	4.000	1.08
SCOUTING	ACRE	1.670	1.000	1.67
CROP INSURANCE	DOL.	0.060	20.000	1.20
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	11.000	0.88
TRACTOR FUEL COST	ACRE			1.05
TRACT REPAIR COST	ACRE			1.22
TRACTOR LUBE COST	ACRE			0.16
EQUIP REPAIR COST	ACRE			0.60
TOTAL OPERATING COST				11.85
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				42.05
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	5.694	0.51
TRACTOR INVESTMENT		0.090	19.997	1.80
EQUIPMENT INVESTMENT		0.090	10.475	0.94
TOTAL INTEREST CHARGE				3.25
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				38.79
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			2.60
EQUIPMENT	DOL.			1.69
TOTAL OWNERSHIP COST				4.29
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				34.50
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.199	3.00
TOTAL LABOR COST				3.00
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				31.50

APPENDIX IV CON'T.

GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING INSECT SCOUTING AND NO INSECTICIDE
SANDY SOIL-DRYLAND

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	21.000	102.90
SORGHUM STUBBLE	AUMS	0.0	0.750	0.0
TOTAL RECEIPTS				102.90
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	4.000	1.08
NITROGEN	LBS.	0.070	50.000	3.50
SCOUTING	ACRE	1.670	1.000	1.67
CROP INSURANCE	DOL.	0.060	30.000	1.80
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	21.000	1.68
TRACTOR FUEL COST	ACRE			1.11
TRACT REPAIR COST	ACRE			1.30
TRACTOR LUBE COST	ACRE			0.17
EQUIP REPAIR COST	ACRE			0.87
TOTAL OPERATING COST				17.17
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				85.73
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	6.534	0.59
TRACTOR INVESTMENT		0.090	21.232	1.91
EQUIPMENT INVESTMENT		0.090	12.119	1.09
TOTAL INTEREST CHARGE				3.59
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				82.14
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			2.76
EQUIPMENT	DOL.			1.96
TOTAL OWNERSHIP COST				4.72
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				77.42
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.273	3.18
TOTAL LABOR COST				3.18
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				74.24

APPENDIX IV CON'T.

IRRIGATED GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING INSECT SCOUTING AND NO INSECTICIDE
11" SURFACE IRRIGATION

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	42.000	205.80
SORGHUM STUBBLE	AUMS	0.0	1.000	0.0
TOTAL RECEIPTS				205.80
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	7.000	1.89
NITROGEN	LBS.	0.070	100.000	7.00
SCOUTING	ACRE	1.670	1.000	1.67
HERBICIDE	ACRE	5.630	1.000	5.63
CROP INSURANCE	DOL.	0.060	60.000	3.60
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	42.000	3.36
TRACTOR FUEL COST	ACRE			1.65
TRACT REPAIR COST	ACRE			1.93
TRACTOR LUBE COST	ACRE			0.25
EQUIP REPAIR COST	ACRE			1.35
IRRIG FUEL COST	ACRE			2.68
IRRIG LUBE COST	ACRE			0.49
IRRIG REPAIR COST	ACRE			1.33
TOTAL OPERATING COST				36.83
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				168.97
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	7.936	0.71
TRACTOR INVESTMENT		0.090	31.532	2.84
EQUIPMENT INVESTMENT		0.090	21.814	1.96
IRRIGATION SYSTEM INVESTMENT		0.090	28.343	2.55
TOTAL INTEREST CHARGE				8.07
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				160.91
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			4.11
EQUIPMENT	DOL.			3.64
IRRIGATION SYSTEM	DOL.			5.37
TOTAL OWNERSHIP COST				13.12
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				147.79
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.890	4.73
IRRIGATION LABOR	HR.	2.500	2.209	5.52
TOTAL LABOR COST				10.25
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				137.54

APPENDIX IV CON'T.

IRRIGATED GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING INSECT SCOUTING AND NO INSECTICIDE
24" SURFACE IRRIGATION

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	62.000	303.80
SORGHUM STUBBLE	AUMS	0.0	1.400	0.0
TOTAL RECEIPTS				303.80
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	10.000	2.70
NITROGEN	LBS.	0.070	125.000	8.75
NITROGEN	LBS.	0.140	25.000	3.50
HERBICIDE	ACRE	5.630	1.000	5.63
SCOUTING	ACRE	1.670	1.000	1.67
CROP INSURANCE	DOL.	0.060	80.000	4.80
MACHINE HIRE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	62.000	4.96
TRACTOR FUEL COST	ACRE			2.36
TRACT REPAIR COST	ACRE			2.76
TRACTOR LUBE COST	ACRE			0.35
EQUIP REPAIR COST	ACRE			1.73
IRRIG FUEL COST	ACRE			2.44
IRRIG LUBE COST	ACRE			0.45
IRRIG REPAIR COST	ACRE			1.21
TOTAL OPERATING COST				47.30
RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT				256.50
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	14.142	1.27
TRACTOR INVESTMENT		0.090	45.086	4.06
EQUIPMENT INVESTMENT		0.090	26.029	2.34
IRRIGATION SYSTEM INVESTMENT		0.090	25.767	2.32
TOTAL INTEREST CHARGE				9.99
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				246.50
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			5.87
EQUIPMENT	DOL.			4.36
IRRIGATION SYSTEM	DOL.			4.88
TOTAL OWNERSHIP COST				15.12
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				231.39
LABOR COST:				
MACHINERY LABOR	HR.	2.500	2.703	6.76
IRRIGATION LABOR	HR.	2.500	2.008	5.02
TOTAL LABOR COST				11.78
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				219.61

APPENDIX IV CON'T.

GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING INSECT SCOUTING AND HALF DOSE CHEMICAL APPLICATIONS
CLAY DRYLAND

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	11.000	53.90
SORGHUM STUBBLE	AUMS	0.0	0.750	0.0
TOTAL RECEIPTS				53.90
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	4.000	1.08
SCOUTING&INSECT.	ACRE	3.420	1.000	3.42
CROP INSURANCE	DOL.	0.060	20.000	1.20
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	11.000	0.88
TRACTOR FUEL COST	ACRE			1.05
TRACT REPAIR COST	ACRE			1.22
TRACTOR LUBE COST	ACRE			0.16
EQUIP REPAIR COST	ACRE			0.60
TOTAL OPERATING COST				13.60
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				40.30
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	7.298	0.66
TRACTOR INVESTMENT		0.090	19.997	1.80
EQUIPMENT INVESTMENT		0.090	10.475	0.94
TOTAL INTEREST CHARGE				3.40
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				36.90
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			2.60
EQUIPMENT	DOL.			1.69
TOTAL OWNERSHIP COST				4.29
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				32.60
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.199	3.00
TOTAL LABOR COST				3.00
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				29.61

APPENDIX IV CON'T.

GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING INSECT SCOUTING AND HALF DOSE CHEMICAL APPLICATIONS
SANDY SOIL-DRYLAND

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	21.000	102.90
SORGHUM STUBBLE	AUMS	0.0	0.750	0.0
TOTAL RECEIPTS				102.90
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	4.000	1.08
NITROGEN	LBS.	0.070	50.000	3.50
SCOUTING&INSECT.	ACRE	3.420	1.000	3.42
CROP INSURANCE	DOL.	0.060	30.000	1.80
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	21.000	1.68
TRACTOR FUEL COST	ACRE			1.65
TRACT REPAIR COST	ACRE			1.92
TRACTOR LUBE COST	ACRE			0.25
EQUIP REPAIR COST	ACRE			0.89
TOTAL OPERATING COST				20.18
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				82.72
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	8.243	0.74
TRACTOR INVESTMENT		0.090	31.452	2.83
EQUIPMENT INVESTMENT		0.090	13.577	1.22
TOTAL INTEREST CHARGE				4.79
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				77.93
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			4.10
EQUIPMENT	DOL.			2.17
TOTAL OWNERSHIP COST				6.26
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				71.66
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.885	4.71
TOTAL LABOR COST				4.71
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				66.95

APPENDIX IV CON'T.

IRRIGATED GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING INSECT SCOUTING AND HALF DOSE CHEMICAL APPLICATIONS
11" SURFACE IRRIGATION

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	42.000	205.80
SORGHUM STUBBLE	AUMS	0.0	1.000	0.0
TOTAL RECEIPTS				205.80
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	7.000	1.89
NITROGEN	LBS.	0.070	100.000	7.00
SCOUTING&INSECT.	ACRE	3.420	1.000	3.42
HERBICIDE	ACRE	5.630	1.000	5.63
CROP INSURANCE	DOL.	0.060	60.000	3.60
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	42.000	3.36
TRACTOR FUEL COST	ACRE			1.65
TRACT REPAIR COST	ACRE			1.93
TRACTOR LUBE COST	ACRE			0.25
EQUIP REPAIR COST	ACRE			1.35
IRRIG FUEL COST	ACRE			2.68
IRRIG LUBE COST	ACRE			0.49
IRRIG REPAIR COST	ACRE			1.33
TOTAL OPERATING COST				38.58
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				167.22
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	9.540	0.86
TRACTOR INVESTMENT		0.090	31.532	2.84
EQUIPMENT INVESTMENT		0.090	21.814	1.96
IRRIGATION SYSTEM INVESTMENT		0.090	28.343	2.55
TOTAL INTEREST CHARGE				8.21
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				159.01
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			4.11
EQUIPMENT	DOL.			3.64
IRRIGATION SYSTEM	DOL.			5.37
TOTAL OWNERSHIP COST				13.12
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				145.89
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.890	4.73
IRRIGATION LABOR	HR.	2.500	2.209	5.52
TOTAL LABOR COST				10.25
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				135.65

APPENDIX IV CON'T.

IRRIGATED GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING INSECT SCOUTING AND HALF DOSE CHEMICAL APPLICATIONS
24" SURFACE IRRIGATION

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	62.000	303.80
SORGHUM STUBBLE	AUMS	0.0	1.400	0.0
TOTAL RECEIPTS				303.80
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	10.000	2.70
NITROGEN	LBS.	0.070	125.000	8.75
NITROGEN	LBS.	0.140	25.000	3.50
HERBICIDE	ACRE	5.630	1.000	5.63
SCOUTING&INSECT.	ACRE	3.420	1.000	3.42
CROP INSURANCE	DOL.	0.060	80.000	4.80
MACHINE HIRE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	62.000	4.96
TRACTOR FUEL COST	ACRE			2.36
TRACT REPAIR COST	ACRE			2.76
TRACTOR LUBE COST	ACRE			0.35
EQUIP REPAIR COST	ACRE			1.73
IRRIG FUEL COST	ACRE			2.44
IRRIG LUBE COST	ACRE			0.45
IRRIG REPAIR COST	ACRE			1.21
TOTAL OPERATING COST				49.05
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				254.75
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	15.746	1.42
TRACTOR INVESTMENT		0.090	45.086	4.06
EQUIPMENT INVESTMENT		0.090	26.029	2.34
IRRIGATION SYSTEM INVESTMENT		0.090	25.767	2.32
TOTAL INTEREST CHARGE				10.14
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				244.61
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			5.87
EQUIPMENT	DOL.			4.36
IRRIGATION SYSTEM	DOL.			4.88
TOTAL OWNERSHIP COST				15.12
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				229.49
LABOR COST:				
MACHINERY LABOR	HR.	2.500	2.703	6.76
IRRIGATION LABOR	HR.	2.500	2.008	5.02
TOTAL LABOR COST				11.78
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				217.71

APPENDIX IV CON'T.

GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING INSECT SCOUTING AND FULL DOSE CHEMICAL APPLICATIONS
CLAY DRYLAND

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	11.000	53.90
SORGHUM STUBBLE	AUMS	0.0	0.750	0.0
TOTAL RECEIPTS				53.90
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	4.000	1.08
SCOUTING&INSECT.	ACRE	5.170	1.000	5.17
CROP INSURANCE	DOL.	0.060	20.000	1.20
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	11.000	0.88
TRACTOR FUEL COST	ACRE			1.05
TRACT REPAIR COST	ACRE			1.22
TRACTOR LUBE COST	ACRE			0.16
EQUIP REPAIR COST	ACRE			0.60
TOTAL OPERATING COST				15.35
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				38.55
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	8.902	0.80
TRACTOR INVESTMENT		0.090	19.997	1.80
EQUIPMENT INVESTMENT		0.090	10.475	0.94
TOTAL INTEREST CHARGE				3.54
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				35.00
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			2.60
EQUIPMENT	DOL.			1.69
TOTAL OWNERSHIP COST				4.29
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				30.71
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.199	3.00
TOTAL LABOR COST				3.00
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				27.71

APPENDIX IV CON'T.

GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING INSECT SCOUTING AND FULL DOSE CHEMICAL APPLICATIONS
SANDY SOIL-DRYLAND

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	21.000	102.90
SORGHUM STUBBLE	AUMS	0.0	0.750	0.0
TOTAL RECEIPTS				102.90
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	4.000	1.08
NITROGEN	LBS.	0.070	50.000	3.50
SCOUTING&INSECT.	ACRE	5.170	1.000	5.17
CROP INSURANCE	DOL.	0.060	30.000	1.80
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	21.000	1.68
TRACTOR FUEL COST	ACRE			1.65
TRACT REPAIR COST	ACRE			1.92
TRACTOR LUBE COST	ACRE			0.25
EQUIP REPAIR COST	ACRE			0.89
TOTAL OPERATING COST				21.93
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				80.97
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	9.847	0.89
TRACTOR INVESTMENT		0.090	31.452	2.83
EQUIPMENT INVESTMENT		0.090	13.577	1.22
TOTAL INTEREST CHARGE				4.94
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				76.03
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			4.10
EQUIPMENT	DOL.			2.17
TOTAL OWNERSHIP COST				6.26
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				69.77
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.885	4.71
TOTAL LABOR COST				4.71
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				65.05

APPENDIX IV CON'T.

IRRIGATED GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING INSECT SCOUTING AND FULL DOSE CHEMICAL APPLICATIONS
11" SURFACE IRRIGATION

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	42.000	205.80
SORGHUM STUBBLE	AUMS	0.0	1.000	0.0
TOTAL RECEIPTS				205.80
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	7.000	1.89
NITROGEN	LBS.	0.070	100.000	7.00
SCOUTING&INSECT.	ACRE	5.170	1.000	5.17
HERBICIDE	ACRE	5.630	1.000	5.63
CROP INSURANCE	DOL.	0.060	60.000	3.60
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	42.000	3.36
TRACTOR FUEL COST	ACRE			1.65
TRACT REPAIR COST	ACRE			1.93
TRACTOR LUBE COST	ACRE			0.25
EQUIP REPAIR COST	ACRE			1.35
IRRIG FUEL COST	ACRE			2.68
IRRIG LUBE COST	ACRE			0.49
IRRIG REPAIR COST	ACRE			1.33
TOTAL OPERATING COST				40.33
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				165.47
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	11.144	1.00
TRACTOR INVESTMENT		0.090	31.532	2.84
EQUIPMENT INVESTMENT		0.090	21.814	1.96
IRRIGATION SYSTEM INVESTMENT		0.090	28.343	2.55
TOTAL INTEREST CHARGE				8.36
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				157.12
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			4.11
EQUIPMENT	DOL.			3.64
IRRIGATION SYSTEM	DOL.			5.37
TOTAL OWNERSHIP COST				13.12
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				144.00
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.890	4.73
IRRIGATION LABOR	HR.	2.500	2.209	5.52
TOTAL LABOR COST				10.25
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				133.75

APPENDIX IV CON'T.

IRRIGATED GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING INSECT SCOUTING AND FULL DOSE CHEMICAL APPLICATIONS
24" SURFACE IRRIGATION

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	62.000	303.80
SORGHUM STUBBLE	AUMS	0.0	1.400	0.0
TOTAL RECEIPTS				303.80
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	10.000	2.70
NITROGEN	LBS.	0.070	125.000	8.75
NITROGEN	LBS.	0.140	25.000	3.50
HERBICIDE	ACRE	5.630	1.000	5.63
SCOUTING&INSECT.	ACRE	5.170	1.000	5.17
CROP INSURANCE	DOL.	0.060	80.000	4.80
MACHINE HIRE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	62.000	4.96
TRACTOR FUEL COST	ACRE			2.36
TRACT REPAIR COST	ACRE			2.76
TRACTOR LUBE COST	ACRE			0.35
EQUIP REPAIR COST	ACRE			1.73
IRRIG FUEL COST	ACRE			2.44
IRRIG LUBE COST	ACRE			0.45
IRRIG REPAIR COST	ACRE			1.21
TOTAL OPERATING COST				50.80
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				253.00
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	17.350	1.56
TRACTOR INVESTMENT		0.090	45.086	4.06
EQUIPMENT INVESTMENT		0.090	26.029	2.34
IRRIGATION SYSTEM INVESTMENT		0.090	25.767	2.32
TOTAL INTEREST CHARGE				10.28
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				242.72
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			5.87
EQUIPMENT	DOL.			4.36
IRRIGATION SYSTEM	DOL.			4.88
TOTAL OWNERSHIP COST				15.12
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				227.60
LABOR COST:				
MACHINERY LABOR	HR.	2.500	2.703	6.76
IRRIGATION LABOR	HR.	2.500	2.008	5.02
TOTAL LABOR COST				11.78
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				215.82

APPENDIX V
Production Budget Employing A Low Dose Strategy

GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING A LOW DOSE STRATEGY
CLAY DRYLAND

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	11.000	53.90
SORGHUM STUBBLE	AUMS	0.0	0.750	0.0
TOTAL RECEIPTS				53.90
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	4.000	1.08
INSECTICIDE	ACRE	4.520	1.000	4.52
CROP INSURANCE	DOL.	0.060	20.000	1.20
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	11.000	0.88
TRACTOR FUEL COST	ACRE			1.05
TRACT REPAIR COST	ACRE			1.22
TRACTOR LUBE COST	ACRE			0.16
EQUIP REPAIR COST	ACRE			0.60
TOTAL OPERATING COST				14.70
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				39.20
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	8.306	0.75
TRACTOR INVESTMENT		0.090	19.997	1.80
EQUIPMENT INVESTMENT		0.090	10.475	0.94
TOTAL INTEREST CHARGE				3.49
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				35.71
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			2.60
EQUIPMENT	DOL.			1.69
TOTAL OWNERSHIP COST				4.29
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				31.41
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.199	3.00
TOTAL LABOR COST				3.00
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				28.42

APPENDIX V CON'T.

GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING A LOW DOSE STRATEGY
SANDY SOIL-DRYLAND

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	21.000	102.90
SORGHUM STUBBLE	AUMS	0.0	0.750	0.0
TOTAL RECEIPTS				102.90
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	4.000	1.08
NITROGEN	LBS.	0.070	50.000	3.50
INSECTICIDE	ACRE	4.520	1.000	4.52
CROP INSURANCE	DOL.	0.060	30.000	1.80
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	21.000	1.68
TRACTOR FUEL COST	ACRE			1.65
TRACT REPAIR COST	ACRE			1.92
TRACTOR LUBE COST	ACRE			0.25
EQUIP REPAIR COST	ACRE			0.89
TOTAL OPERATING COST				21.28
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				81.62
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	9.251	0.83
TRACTOR INVESTMENT		0.090	31.452	2.83
EQUIPMENT INVESTMENT		0.090	13.577	1.22
TOTAL INTEREST CHARGE				4.89
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				76.73
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			4.10
EQUIPMENT	DOL.			2.17
TOTAL OWNERSHIP COST				6.26
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				70.47
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.885	4.71
TOTAL LABOR COST				4.71
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				65.75

APPENDIX V CON'T.

IRRIGATED GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING A LOW DOSE STRATEGY
11" SURFACE IRRIGATION

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	42.000	205.80
SORGHUM STUBBLE	AUMS	0.0	1.000	0.0
TOTAL RECEIPTS				205.80
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	7.000	1.89
NITROGEN	LBS.	0.070	100.000	7.00
INSECTICIDE	ACRE	4.520	1.000	4.52
HERBICIDE	ACRE	5.630	1.000	5.63
CROP INSURANCE	DOL.	0.060	60.000	3.60
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	42.000	3.36
TRACTOR FUEL COST	ACRE			1.65
TRACT REPAIR COST	ACRE			1.93
TRACTOR LUBE COST	ACRE			0.25
EQUIP REPAIR COST	ACRE			1.35
IRRIG FUEL COST	ACRE			2.68
IRRIG LUBE COST	ACRE			0.49
IRRIG REPAIR COST	ACRE			1.33
TOTAL OPERATING COST				39.68
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				166.12
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	10.548	0.95
TRACTOR INVESTMENT		0.090	31.532	2.84
EQUIPMENT INVESTMENT		0.090	21.814	1.96
IRRIGATION SYSTEM INVESTMENT		0.090	28.343	2.55
TOTAL INTEREST CHARGE				8.30
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				157.82
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			4.11
EQUIPMENT	DOL.			3.64
IRRIGATION SYSTEM	DOL.			5.37
TOTAL OWNERSHIP COST				13.12
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				144.70
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.890	4.73
IRRIGATION LABOR	HR.	2.500	2.209	5.52
TOTAL LABOR COST				10.25
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				134.46

APPENDIX V CON'T.

IRRIGATED GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING A LOW DOSE STRATEGY
24" SURFACE IRRIGATION

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	62.000	303.80
SORGHUM STUBBLE	AUMS	0.0	1.400	0.0
TOTAL RECEIPTS				303.80
OPERATING INPUTS:				
MILO SEED	LBS.	0.270	10.000	2.70
NITROGEN	LBS.	0.070	125.000	8.75
NITROGEN	LBS.	0.140	25.000	3.50
HERBICIDE	ACRE	5.630	1.000	5.63
INSECTICIDE	ACRE	4.520	1.000	4.52
CROP INSURANCE	DOL.	0.060	80.000	4.80
MACHINE HIRE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	62.000	4.96
TRACTOR FUEL COST	ACRE			2.36
TRACT REPAIR COST	ACRE			2.76
TRACTOR LUBE COST	ACRE			0.35
EQUIP REPAIR COST	ACRE			1.73
IRRIG FUEL COST	ACRE			2.44
IRRIG LUBE COST	ACRE			0.45
IRRIG REPAIR COST	ACRE			1.21
TOTAL OPERATING COST				50.15
RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT				253.65
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	16.754	1.51
TRACTOR INVESTMENT		0.090	45.086	4.06
EQUIPMENT INVESTMENT		0.090	26.029	2.34
IRRIGATION SYSTEM INVESTMENT		0.090	25.767	2.32
TOTAL INTEREST CHARGE				10.23
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				243.42
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			5.87
EQUIPMENT	DOL.			4.36
IRRIGATION SYSTEM	DOL.			4.88
TOTAL OWNERSHIP COST				15.12
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				228.30
LABOR COST:				
MACHINERY LABOR	HR.	2.500	2.703	6.76
IRRIGATION LABOR	HR.	2.500	2.008	5.02
TOTAL LABOR COST				11.78
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				216.52

APPENDIX VI
Production Budget Employing Insect Resistant Varieties

GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING INSECT RESISTANT VARIETIES
CLAY DRYLAND

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	11.000	53.90
SORGHUM STUBBLE	AUMS	0.0	0.750	0.0
TOTAL RECEIPTS				53.90
OPERATING INPUTS:				
MILO SEED	LBS.	0.340	4.000	1.36
CROP INSURANCE	DOL.	0.060	20.000	1.20
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	11.000	0.88
TRACTOR FUEL COST	ACRE			1.05
TRACT REPAIR COST	ACRE			1.22
TRACTOR LUBE COST	ACRE			0.16
EQUIP REPAIR COST	ACRE			0.60
TOTAL OPERATING COST				10.46
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				43.44
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	4.163	0.37
TRACTOR INVESTMENT		0.090	19.997	1.80
EQUIPMENT INVESTMENT		0.090	10.475	0.94
TOTAL INTEREST CHARGE				3.12
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				40.32
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			2.60
EQUIPMENT	DOL.			1.69
TOTAL OWNERSHIP COST				4.29
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				36.03
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.199	3.00
TOTAL LABOR COST				3.00
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				33.03

APPENDIX VI CON'T.

GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING INSECT RESISTANT VARIETIES
SANDY SOIL-DRYLAND

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	21.000	102.90
SORGHUM STUBBLE	AUMS	0.0	0.750	0.0
TOTAL RECEIPTS				102.90
OPERATING INPUTS:				
MILO SEED	LBS.	0.340	4.000	1.36
NITROGEN	LBS.	0.070	50.000	3.50
CROP INSURANCE	DOL.	0.060	30.000	1.80
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	21.000	1.68
TRACTOR FUEL COST	ACRE			1.65
TRACT REPAIR COST	ACRE			1.92
TRACTOR LUBE COST	ACRE			0.25
EQUIP REPAIR COST	ACRE			0.89
TOTAL OPERATING COST				17.04
RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT				85.86
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	5.108	0.46
TRACTOR INVESTMENT		0.090	31.452	2.83
EQUIPMENT INVESTMENT		0.090	13.577	1.22
TOTAL INTEREST CHARGE				4.51
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				81.35
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			4.10
EQUIPMENT	DOL.			2.17
TOTAL OWNERSHIP COST				6.26
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				75.08
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.885	4.71
TOTAL LABOR COST				4.71
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				70.37

APPENDIX VI CON'T.

IRRIGATED GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING INSECT RESISTANT VARIETIES
11" SURFACE IRRIGATION

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	42.000	205.80
SORGHUM STUBBLE	AUMS	0.0	1.000	0.0
TOTAL RECEIPTS				205.80
OPERATING INPUTS:				
MILO SEED	LBS.	0.340	7.000	2.38
NITROGEN	LBS.	0.070	100.000	7.00
HERBICIDE	ACRE	5.630	1.000	5.63
CROP INSURANCE	DOL.	0.060	60.000	3.60
CUSTOM COMBINE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	42.000	3.36
TRACTOR FUEL COST	ACRE			1.65
TRACT REPAIR COST	ACRE			1.93
TRACTOR LUBE COST	ACRE			0.25
EQUIP REPAIR COST	ACRE			1.35
IRRIG FUEL COST	ACRE			2.68
IRRIG LUBE COST	ACRE			0.49
IRRIG REPAIR COST	ACRE			1.33
TOTAL OPERATING COST				35.65
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT				170.15
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	6.446	0.58
TRACTOR INVESTMENT		0.090	31.532	2.84
EQUIPMENT INVESTMENT		0.090	21.814	1.96
IRRIGATION SYSTEM INVESTMENT		0.090	28.343	2.55
TOTAL INTEREST CHARGE				7.93
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				162.22
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			4.11
EQUIPMENT	DOL.			3.64
IRRIGATION SYSTEM	DOL.			5.37
TOTAL OWNERSHIP COST				13.12
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				149.10
LABOR COST:				
MACHINERY LABOR	HR.	2.500	1.890	4.73
IRRIGATION LABOR	HR.	2.500	2.209	5.52
TOTAL LABOR COST				10.25
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				138.86

APPENDIX VI CON'T.

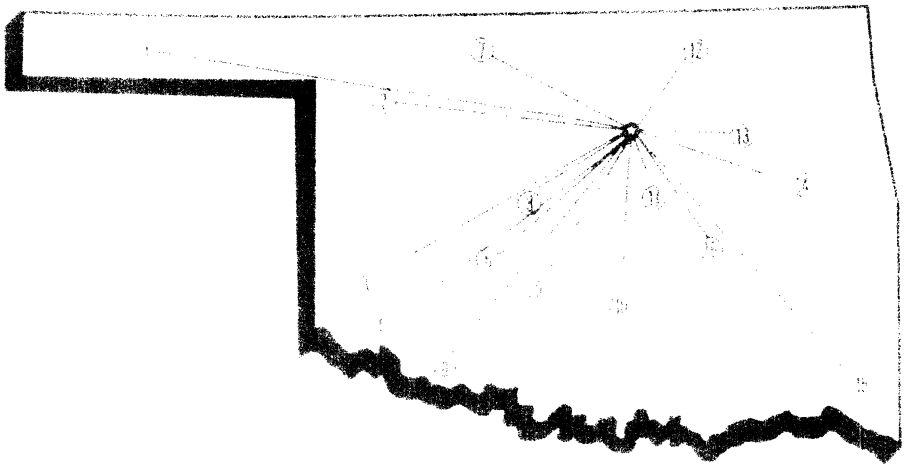
IRRIGATED GRAIN SORGHUM
PRODUCTION BUDGET EMPLOYING INSECT RESISTANT VARIETIES
24" SURFACE IRRIGATION

CATEGORY	UNITS	PRICE	QUANTITY	VALUE
PRODUCTION:				
MILO	CWT.	4.900	62.000	303.80
SORGHUM STUBBLE	ACRS	0.0	1.400	0.0
TOTAL RECEIPTS				303.80
OPERATING INPUTS:				
MILO SEED	LBS.	0.340	10.000	3.40
NITROGEN	LBS.	0.070	125.000	8.75
NITROGEN	LBS.	0.140	25.000	3.50
HERBICIDE	ACRE	5.630	1.000	5.63
CROP INSURANCE	DOL.	0.060	80.000	4.80
MACHINE HIRE	ACRE	4.000	1.000	4.00
CUSTOM HAULING	CWT.	0.080	62.000	4.96
TRACTOR FUEL COST	ACRE			2.36
TRACT REPAIR COST	ACRE			2.76
TRACTOR LUBE COST	ACRE			0.35
EQUIP REPAIR COST	ACRE			1.73
IRRIG FUEL COST	ACRE			2.44
IRRIG LUBE COST	ACRE			0.45
IRRIG REPAIR COST	ACRE			1.21
TOTAL OPERATING COST				46.33
RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT				257.47
CAPITAL COST:				
ANNUAL OPERATING CAPITAL		0.090	12.611	1.13
TRACTOR INVESTMENT		0.090	45.086	4.06
EQUIPMENT INVESTMENT		0.090	26.029	2.34
IRRIGATION SYSTEM INVESTMENT		0.090	25.767	2.32
TOTAL INTEREST CHARGE				9.85
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT				247.61
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)				
TRACTOR	DOL.			5.87
EQUIPMENT	DOL.			4.36
IRRIGATION SYSTEM	DOL.			4.88
TOTAL OWNERSHIP COST				15.12
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT				232.49
LABOR COST:				
MACHINERY LABOR	HR.	2.500	2.703	6.76
IRRIGATION LABOR	HR.	2.500	2.008	5.02
TOTAL LABOR COST				11.78
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT				220.72

OKLAHOMA

Agricultural Experiment Station

System Covers the State



Main Station — *Stillwater, Perkins and Lake Carl Blackwell*

1. Panhandle Research Station — *Goodwell*
2. Southern Great Plains Field Station — *Woodward*
3. Sandyland Research Station — *Mangum*
4. Irrigation Research Station — *Altus*
5. Southwest Agronomy Research Station — *Tipton*
6. Caddo Research Station — *Ft. Cobb*
7. North Central Research Station — *Lahoma*
8. Ft. Reno Livestock Research Station — *El Reno*
9. South Central Research Station — *Chickasha*
10. Agronomy Research Station — *Stratford*
11. Pecan Research Station — *Sparks*
12. Veterinary Research Station — *Pawhuska*
13. Vegetable Research Station — *Bixby*
14. Eastern Pasture Research Station — *Muskogee*
15. Kiamichi Field Station — *Idabel*
16. Sarkeys Research and Demonstration Project—*Lamar*

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