ECONOMIC ANALYSIS OF RANGE IMPROVEMENT PRACTICES IN NORTHWEST OKLAHOMA

By

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ECONOMIC ANALYSIS OF RANGE IMPROVEMENT PRACTICES IN

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CHAPTER I

INTRODUCTION

Sage brush (artemisia filifolia) infects more than one-half million acres in Oklahoma.[1] When infested areas of the adjoining states of Colorado, New Mexico, Texas, and Kansas are included, this figure mounts to 15,000,000 acres of sage infestation in the Southern Great Plains. Of this vast area only an estimated 25 percent had been treated in Oklahoma by the middle of 1957.[2]

Research conducted at the Southern Great Plains Research Station at Woodward, Oklahoma would indicate that a technically efficient method of controlling this plant has been effected. Even though the method has been studied intensively since 1937, there yet remains unanswered questions regarding the feasibility and practicability of its use. Foremost is the question, "Will it pay?" If so under what conditions? Can the practice be considered one of permanent duration and one upon which ranchers can safely reorganize their grazing program so as to profitably utilize this expected increase of available forage?[3] Or, should it be considered a temporary practice and reorganization held to a minimum?

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[1] Clarency Kingery, State Range Specialist, United States Department of Agriculture. See Appendix A.

[2] See Appendix A.

[3] E. H. McIlvain, O. A. Savage, E. A. Tucker and W. F. Lagrone, Fourteen-Year Summary, Range Improvement Studies, Southern Great Plains Field Station, Woodward, Oklahoma, 1937-1950, pp. 17-18.

If sage brush control is economically as well as technically efficient, the Southern Great Plains is a vast potential area of undeveloped resources.

Reseeding low producing or abandoned cropland also may be promising as a method in range resource development. The reseeding process requires three to four years to complete and it entails considerable investment. Therefore, an investigation in the economics of this practice is prerequisite to developing guides to ranchers on its adoption. The same or similar questions arise as did with the brush control practice. What technical and economic conditions assure profitable returns? Likewise, what contributing conditions can be controlled through management?

One factor looms large in the range reseeding practice--weather! Because of its importance to the practice and unpredictability, considerable risk of failure may limit the adoption of reseeding by ranchers. Additional knowledge of weather cycles would contribute to a reduction in this risk. This knowledge could provide guidance to ranchers regarding when to initiate the practice.

Grass varieties studied during the time of this research have varied widely in results. Many grasses failed to withstand both the abuse of grazing and adverse climatic condition and they no longer are used. As a result, this study is confined to those varieties which have shown the greatest promise under all conditions, namely, King Ranch Bluestem, Switchgrass, and Short Grass Mixtures I and II.

It appears that reseeding has been recognized by ranchers as an opportunity for land resource improvement and development. Of the total cropland in Oklahoma about 235,000 acres had been reseeded during 1947

through 1956 in six northwest counties.[4] If reseeding of abandoned cropland in these six counties of Ellis, Harper, Woods, Woodward, Major and Dewey can be considered as having been profitable, then thousands of additional acres of abandoned cropland in Oklahoma may be returned profitably to grass and additional beef production.

The main restriction to increasing beef production in the Great Plains is the amount of forage produced. Range managers and operators have the following alternatives of increasing forage and beef output:

(1) Sage brush control

(2) Reseeding abandoned cropland to improved range grasses

(3) Enlarging ranch units through

a. Renting additional range

b. Purchasing range resources.

Available land and its price per acre is specific to the alternative of unit enlargement. Its influence upon the alternatives of sage control and reseeding is indirect. That is, the price of land is expected to relate to its productivity, and the more productive range land will yield higher returns to developmental practices of sage control and reseeding than low producing range land. Initial size of business is associated with all three alternatives. However, the influence of size of operations upon returns to land improvement practices was excluded from this study.

This study is directed specifically to the alternatives of increasing forage through practices of sage control and reseeding. Special emphasis is placed upon the transition cost of the land resource from its

[4] See Appendix B.

present use to one of increased production resulting from treating sage or reseeding low producing or abandoned cropland.

The general objective of this thesis is to determine the economic feasibility of controlling sage and reseeding abandoned cropland as a means of increasing forage production. More specifically the objectives are:

(1) To obtain estimates of the outputs of forage associated with range improvement practices (sage control and re-grassing),

(2) To estimate the value of these outputs under varying cattle price relations,

(3) To estimate the cost of initiating and maintaining the range improvement practice under varying assumptions in respect to price-cost conditions and resource situations,

(4) To estimate the conditions under which sage control and re-grassing are economically feasible for adoption by ranchers and conditions under which they would not be profitable.

This study is based upon the physical research results obtained at the Southern Great Plains Research Station at Woodward, Oklahoma. Prices and costs used in determining net returns were assembled from secondary sources.

CHAPTER II

METHODOLOGY OF PHYSICAL EXPERIMENTS AND OF ECONOMIC ANALYSIS

Experimental Methods of Sage Control

Sage bursh control was first begun in the early 1940's on the Southern Great Plains Research Station, Woodward, Oklahoma.[1] Mechanical treatment (mowing) was used at that time and the results were successful. However, such a method removed all standing cover, and this frequently created a serious wind erosion hazard. A more important limitation of mowing was the high cost of the practice. Because of this expense, an alternative method of chemical control was developed. This low cost method also provided for a standing protective cover while the grass was recovering. Since chemical control of sage is the currently accepted method, costs and returns were estimated only for this method.

During the early years of the experimental research on sage control, most of the pastures were grazed only during the summer seasons. Later and more recently, all treated pastures have been grazed yearlong. However, all results were placed upon a yearlong basis for this study. This was accomplished by adding to the summer gains of a treated pasture the winter gains of a check plot having like vegetative cover. Results of the control were checked against the pounds of beef produced on comparable

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[1] E. H. McIlvain, A. L. Baker, W. R. Kneebone, Dillard H. Gates, W. F. Lagrone and E. A. Tucker, Nineteen-Year Summary, Range Improvement Studies, U. S. Southern Great Plains Field Station, Woodward, Oklahoma, 1937-1955, p. 1.

pilot areas of untreated native range. Fall weaned steer calves were used in the experiments.

Chemical control of sage consists of treating an area by spraying with 2-4D in May or at a time when the sage plants are in vigorous growth. Grazing is deferred from the treated areas for two successive summers. The delayed grazing permits grass recovery. In addition to deferred grazing, the area is again treated the second year at the same period of the season as the first treatment. During October following this second spring treatment, all experimental pastures are stocked at the yearlong rate of moderate grazing.

Standards of stocking rates on native range pastures were established for all research pastures. Heavy, moderate and light stocking rates were defined as measures of pasture use. Associated with these measures of pasture use were acres of range per animal unit under the different grazing standards. Heavy grazing required six and one-half acres of range per steer; moderate, approximately ten acres and light grazing utilized thirteen acres per steer. These standards were based upon yearlong grazing. All physical data of this study were based upon moderate graxing. Moderate grazing is defined as that rate of vegetative utilization which will leave one inch excess of vegetation at the end of the grazing season in short grass pastures and three to five inches on tall grass range.

Experimental Methods in Regrassing

Varieties of grasses observed and studied in this research experiment were King Ranch Bluestem, Switchgrass, and Short Grass Mixture I and II. Short Grass Mixture I contained one part each of Switchgrass, blue

grama and side-oats grama. Short Grass Mixture II contained one part of blue grama and one part of side-oats grama. Switchgrass and Short Grass Mixtures were observed from 1945 to 1957 and King Ranch Bluestem from 1950 to 1957. Results obtained from these improved varieties were compared with a check plot of native range to obtain the difference in pounds of beef produced per acre. Fall weaned steer calves were used to convert grass to beef as in the sage control study.

Revegating abandoned cropland has been an extremely hazardous and risky range improvement practice in past years. This has been due to uncertainties of weather, insects, and a lack of knowledge about improved range grasses and seeding practices. Research workers at the Southern Great Plains Field Station at Woodward, Oklahoma have developed a method of seeding which has been successful in establishing grass. This method requires approximately thirty months to complete. The general procedure in this practice is as follows: first year, a clean seed bed is prepared in the early spring for sorghum seeding, and in late spring or early summer the sorghum crop is seeded to provide a nurse crop; and, in March or April of the following spring, grass is sown in this protective cover of sorghum stubble. Weeds are controlled but grazing is deferred during the first season of growth. Light grazing may be permitted during the winter dormant season of the year. Second year, following grass seeding, the area is mowed for weed control, and deferred grazing is again practiced. Reseeding may be stocked regularly at a moderate rate beginning in October of this second year provided the establishment has been successful.

Sorghums sown as a nurse crop were grazed during the winter months of the early research years. This practice has been discontinued. Sorghum

grazing created the danger of insufficient seedling protection during the more adverse growing seasons.

Experimental Methods With Steers

Good quality weaner calves selected from high quality commercial herds were used in this study except for the first four years. Throughout these beginning years of research, yearlings were grazed on the experimental pastures.[2] Yearlings always have been grazed on the summer pastures.

Weaners were contracted for in early summer to be delivered the following October. They first were placed upon closed drilled sorghum while being weaned. They were wintered on either sorghum or native range supplemented by one pound of cotton seed cake. Immediately upon arrival each calf was vaccinated for blackleg and malignant edema, castrated and dehorned when necessary, and treated for ear ticks and lice, after which they were given two weeks or more to recover. The animals were then weighed individually on two or three successive days and scored as to feeder grade by a committee of animal husbandrymen. They then were allotted to the research pastures to obtain comparability of steers among pastures in initial weight and grade.[3]

Those steers allotted to summer grazed pastures were assigned in the same manner as yearlong grazed steers. The time of assigning animals to summer grazed pastures varied, due to weather and overall range conditions. This time was generally about April 20. October the 15th closed the

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[2]Ibid., p. 5.

[3]Ibid., p. 5.

summer grazing season at which time the steers graded good to choice at a weight of 700 to 800 pounds. All steers were weighed individually each month and their gains in pounds of beef recorded.

Yields of grass varieties and sage controlled pastures were measured in terms of beef produced per acre.

Methods in Economic Analysis

Price-Cost Relation for Cattle

Price-cost data from the Oklahoma City market were assembled for the years 1949 to 1956. This was the more recent period encompassing a cattle price cycle. Prices were adjusted by the commission cost of purchasing of one dollar per hundred weight for good to choice feeder calves in October and November for the years 1949 through 1956. Price of good feeder steers through the months of October and November for the years 1950-57, adjusted by $3.90 per steer marketing cost, was used in estimating the selling price of steers.

Use of a single average of prices during a cattle price cycle may be misleading for purposes of deciding whether to initiate reseeding or sage control. Therefore, different price levels for steers were developed to depict favorable, average, and unfavorable calf-steer price relations. The average prices of steer calves and feeder steers, adjusted for purchases and selling costs, were used to determine a gross income margin per steer for each of the operational years. An example of how the gross income margin was determined is as follows:

Feeder Steer:

Sale value, 750 pounds @ 20 cents	$150.00	
Marketing charges per head	3.90	
Net sale value		$146.10

Steer Calf:

Purchase price, 450 pounds @ 25 cents	$112.00	
Sale charges @ $1.00 per cwt.	4.50	
Net cost of calf		$117.00
Gross income margin		$ 29.10

Since the same weight of calves and steers were used for computing the gross income margin for each of the operational years, differences in the margin reflect differences in favorability of price margins and levels. Favorable cattle price relation was defined as the average calf and steer prices for the four operational years in the period having the higher gross income margins. Unfavorable cattle price relations was defined as the average calf and steer prices for the remaining four operational years. The four operational years of 1949-50, 1950-51, 1953-54, and 1956-57 were relatively favorable cattle prices and the other four years of 1951-52, 1952-53, 1954-55, and 1955-56 were the relatively unfavorable cattle price relations. The average of the calf and steer prices for the eight years was used to depict average cattle price relations. The following results were obtained by these computations:

Item	Favorable	Average	Unfavorable
Calf	$23.08	$24.30	$25.53
Steer	23.74	20.29	16.84

The gross income margins for the cattle in the experiments for the above price relations were about as follows: favorable--$94, average--$63, and unfavorable--$32.

Associated Costs

In addition to the price-cost relationship for calves and steers are costs associated with practice initiation and maintenance as well as with the management of the animals. Whereas, cattle prices for this study were derived from the most recent price cycle, other costs were estimated from information for the operational year 1957-58. It should be recognized, however, that cost of practice initiation and maintenance may vary widely among operators.

Labor for this study was charged at a cost of one dollar per hour (Table I). This rate may differ among seasons, communities and types of jobs performed. However, information was unavailable for estimating the variation in labor costs in northwestern Oklahoma. Ranchers may anticipate higher labor costs than one dollar per hour with a continual expansion of non-farm income opportunities. This places the rancher with available family labor for use in initiating range improvement practices in a more favorable position than those ranchers without available family labor. Labor cost associated with brush control is the labor required to construct sufficient fencing to control grazing on treated sage areas, and the labor required for controlled grazing on reseeding areas is shown as a part of the fencing cost since it may be assumed that most ranchers would leave such fences as permanent structures following this type of land treatment.

Grass seed cost varied widely among varieties or mixtures. Short Grass Mixture II was the lowest at $4.64 per acre. King Ranch Bluestem was the most expensive grass seed at $8.50 per acre.

TABLE I

SELECTED PRICES AND COSTS USED IN ECONOMIC ANALYSIS

Item	Dollars Per Acre
Labor[a]	$ .88
Grass seed cost[b]	4.64 to 8.50
Sorghum seed[c]	2.00
Brush control[d]	4.25
Fencing material[e]	1.42
Custom rates on machinery:[f]	
Disking	1.00
Plowing	2.35
Drilling	1.00
Mowing	1.00
Supplemental feed, medicines, salt per steer[g]	8.78
Taxes per steer at approximately seven mills	.75
Interest, death loss, and injury (8 percent)[h]	8.42

[a]Labor was estimated at the rate of $1.00 per acre.

[b]

Varieties	Rate/acre	Cost/pound	Cost/acre
King Ranch Bluestem	1 pound PLS	$8.50	$8.50
Switchgrass	2 pounds PLS	4.00	8.00
Short Grass Mix. I	2 pounds PLS	2.88	5.76
Short Grass Mix. II	2 pounds PLS	2.32	4.64

Rate of seed (PLS) was taken from ACP Guidesheet for Seeding Practices 1957, page 638 and prices were obtained from Mr. S. L. Clifton, Chief ACP, Agricultural Center Building, Stillwater, 1957 prices.

[c]Sorghum estimated at one bushel per acre and $2.00 per bushel.

[d]Contract price of plane and material per acre.

[e]Estimated cost of wire, posts and labor per acre to divide 320 acre block into thirds.

[f]E. A. Tucker, Odell L. Walker and D. B. Jeffrey, Custom Rates for Farm Operators in Oklahoma, Bul. B-473, July, 1956.

[g]Supplemental feed consists of CSM estimated at 270 pounds per steer at $60/ton. Medicines estimated at 40 cents per steer and salt 28 cents per steer.

[h]Cost of money was estimated at 6 percent, therefore 2 percent is charged as estimated death losses.

These costs do not have the ACP payment deducted. Grass seed prices tend to fluctuate widely from year to year. This is due primarily to the variation in annual seed production and germination results.

Sorghum seed cost for the nurse crop in the reseeding practice was estimated at $2.00 per acre. This seed cost may vary from year to year, as does the grass seed cost, but with less severity. Since it is important to obtain a complete cover of sorghum, an operator may tend to overseed rather than underseed. If an excessive cover were obtained, it can be reduced through winter and early spring grazing.

Aerial spraying for sage control is a highly skilled profession, therefore, the custom cost, including both material and plane, of $4.25 per acre for 1957-58 is used in this study.

Fencing material costs were for wire, posts and staples required to construct a four wire fence. The estimated $1.42 per acre cost of fencing materials was obtained by estimating the per acre cost to cross fence a 320 acre block of rangeland which was a mile long and one-half mile in width. The same estimated cost per acre was used when computing the fence needs for reseeding. In some cases, field location and shape will make this expense greater than the estimate for the sage control.

Machinery hire costs were custom rates taken from Oklahoma Bulletin B-473 and is, in general, representative of the 1957-58 custom rates for the area.[4] The operator who presently owns necessary machinery for practice execution may have less per acre costs of machinery than used in this study.

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[4]E. A. Tucker, Odell L. Walker and D. B. Jeffery, Custom Rates for Farm Operators in Oklahoma, Oklahoma Agricultural Experiment Station Bul-B-473, July, 1956, p. 12-13.

Steer maintenance costs included cottonseed meal, salt, recommended vaccination and spray for insect control. Cottonseed meal, the more expensive of these items, generally could be expected to vary in price from season to season. However, an alert manager may reduce this cost by seasonal purchases.

Taxes were charged on the average investment per steer. The amount was estimated to be 75 cents per steer under average cattle price relations. Taxes also are variable among communities.

Interest was charged at six percent on the investment in the practices. The operator who has capital with which to initiate range improvement practices may have withdrawn such monies from other investment opportunities in the belief that range improvement would be a more compensatory investment. For this reason, it is necessary to add an interest charge on all investments as an opportunity cost. An additional two percent interest was charged on the calf cost to cover risks of injury or death. Under average cattle price conditions, the interest, injury and death cost, computed at eight percent initial price of calf, amounts to $8.42 per calf.

Methods of Computing Costs and Returns

Sage Control

The major conditions, or assumptions, considered in computing costs and returns from sage control were as follows: (1) no deferred income during initiation of practice, (2) deferred income through two summers of sage treatment, (3) supplemental ACP payments for performance of practice, (4) no supplemental ACP payment for performance of practice, and (5) output or beef per acre at three levels.

No deferred income is applicable to ranchers who do not reduce cattle numbers during the sage treatment. The physiological aspect of successful sage treatment requires that grazing be delayed during the two summers of treatment. Yet, ranchers may be in a position to carry out this deferred grazing without reducing cattle numbers. This position may be possible when the operator has followed moderate to light use of his range resources and a shift is made to heavy grazing on untreated range for the two year duration of sage treatment.

Under this approach, no more than one-third of the range can be treated each season. The shift to heavier grazing does increase operation risks in ranching due to the reduction in flexibility associated with the reduction in excess vegetation at the termination of the grazing season. Also, the plan to increase the rate of grazing on untreated range may be impossible for many ranchers due to a current practice of heavy grazing. It could be an opportunity for operators to improve thier range at a reduced cost. However, since far too often the operators overgraze as a usual practice, this approach to brush control could receive attention except possibly during a period of favorable moisture conditions.

Deferred grazing through two summers of sage treatment is a prerequisite, under most conditions, to a successful establishment of the practice. Deferred income is a cost through loss of returns resulting from deferred grazing or non-use of the treated area. The rancher who is stocking his range at the maximum would have no alternative but to reduce cattle numbers during sage treatment. Or, if through adverse weather conditions, the vegetative growth failed to reach normal growth, the opportunity to intensify grazing on untreated range would not exist.

When reduction in steer numbers is required, the operator experiences a loss of income until the practice is completed. This income loss, or deferment, is an indirect cost to the operator for sage treatment.

Delayed summer use of sage treated range during treatment is desirable as previously emphasized. However, grazing during the dormant period is premissable. In fact, it is recommended. Winter utilization will not retard grass recovery, yet it may defray a large part of the practice inventment if cattle numbers can be varied to take advantage of this opportunity. On the experimental pastures, grass recovered so that by the end of the second summer of deferment, they were stocked at the regular moderate rate of grazing.

Three levels of output were estimated as a means of encompassing the range of probable outcomes to sage treatment. An average of highly variable experimental observations fit ranch or farm conditions less well than do ranges in the experimental results. Thus, three levels of gain per acre, indicated as high, low, and average are used in this study. The high and low levels of gain correspond to the 95 percent confidence limits on the average annual gain per acre obtained in the experiments.

Straight line depreciation was used to estimate the annual cost of sage control. Its application to total investment in sage control allocates this cost equally among the years during the life of the treatment. The annual cost estimate of sage control was determined for a fifteen year duration of the treatment.

Variable costs associated with steer numbers were considered in computing deferred income costs and in estimating additional income to sage treated range. It is assumed that steer numbers are increased to take

advantage of the increase in forage made possible by the practice. A greater number of steers does add an item of variable costs to include in the accounting.

Variable costs are those non-fixed items of investment associated with the range practice. They are associated with inputs which vary with output of forage. Since the need for steers vary with grass production, an increase in investment in cattle following sage treatment can be expected.

Regrassing

Most of the accounting methods, prices, and costs for estimating costs and returns for regrassing were the same as used in an analysis of sage control. The major exception in procedure pertained to (1) assumptions regarding the expected productivity of land being regrassed, (2) non-consideration of the possibility of excluding a deferred income cost to the practice, and (3) consideration of a failure cost in evaluating the practice.

Yield of untreated abandoned cropland provided the alternatives to compare with results obtained in regrassing. The output of forage from such land in northwestern Oklahoma varies from near no production to production about equivalent to regular native range. For purposes of the economic analysis, three levels of production of land to be regrassed were assumed: (1) no production, (2) production at 50 percent of regular native range, and (3) production at 100 per cent of regular native range. These levels refer to expected future productivity without regrassing.

The procedure in the accounting was as follows: first, gross income per acre per year in addition to that expected without regrassing was

estimated for the period of expected benefits; second, costs per acre per year in addition to those expected without regrassing were estimated for the period of benefits and deducted from the gross additional income; and, third, the estimated treatment costs (including direct and deferred income), capitalized and placed on an annual basis, were deducted from the annual net benefits in excess of expected net income without regrassing. The cost for risk of failure was added separately in order to appraise regrassing as a practice with and without this cost.

The possibility of failure in obtaining a stand of grass in the first try, and the consequent need to repeat the operations in regrassing, adds considerable risk to the practice. Estimates of the frequency of failure in experience of ranchers in northwestern Oklahoma were unavailable for use in this study. A study in Colorado indicated about a 20 percent failure frequency by ranchers in that state in reseeding land to crested wheat grass.[5] Thus, in the absence of additional information on this risk, the 20 percent figure was used as an estimate of the failure cost of regrassing abandoned cropland in northwestern Oklahoma.

The non-deferment of income during regrassing was excluded as an alternative in the computations of income to this practice. The time required for regrassing is about twice the length of time required for the sage treatment (3-4 years compared with two) and little possibility exists for utilization of forage of regrassing land in winter months of treatment period, whereas, this is a possibility in sage control.

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[5]Harry G. Sitler, Economic Possibilities of Seeding Wheatland to to Grass In Eastern Colorado, Colorado Agricultural Experiment Station Bulletin ARS 43-64, February, 1958.

CHAPTER III

ESTIMATED COSTS AND RETURNS TO SAGE CONTROL

Yield Estimates

Physical input-output relations are basic to any economic analysis of farm production practices. The experimental data on the sage control practice provided an opportunity to estimate the outputs in terms of (1) average annual yields or gain per acre, (2) variance in the annual yields, and (3) trend in the yields over time, including an estimate of the duration of any treatment effects in excess of native range.

The duration of the sage control treatment was estimated to be 15 years. The equation for this estimate was as follows:

$$Y = 29.66 - 2.109X$$

where Y was gain (pounds of beef) per acre in excess of native range and X was time in years, following initiation of the sage control practice. During the 15 year treatment duration, the estimated average annual gain in pounds of beef per acre was 51.8 pounds (12.8 pounds in excess of native range). Nineth-five percent confidence limits of the average were 48.9 to 54.7 pounds of beef per acre. These limits and the average, provided the three yield levels of low, average, and high as indicated earlier. A conversion of these yields to acres per animal unit with moderate grazing resulted in the following: low--7.9 acres, average--7.5 acres, and high--7.1 acres. Untreated native range required an estimated 9.9 acres per animal unit.

Direct Costs

Direct costs of sage control are composed of spray material, fencing (wire and post), labor or manpower to consummate the control practice, and interest on investment. Estimation of these costs are shown in Table II. The $6.25 per acre cost of spray and fencing material consists of spray chemical and spray plane which amounts to $4.25 per acre, labor and fencing estimated on the basis of 1.6 rods and $1.42 per acre to complete the total of $6.25 per acre.

The interest charge of 6 percent was applied on the above cost for six months the first year and 12 months the second year. It may be assumed that in a steer type of operation, money if borrowed would be repaid the following fall when the steers were marketed. The second interest charge of 39 cents was made on the total first and second years' cost after deducting ACP assistance. These two interest costs total 58 cents per acre.

Eighty percent of the original fencing cost ($1.14) per acre assumed to be salvage value, is deducted from the total outlay to obtain the cost of $5.99 per acre. When ACP assistance of $1.50 per acre is deducted the estimate of net direct cost per acre is $4.49. This ACP assistance reduced the direct cost by 25 percent.

Additional Income to Sage Brush Control

Additional net income to sage control depends upon climatic and economic conditions which affect the input-output relations, the price-cost conditions or both. The additional net income per acre was computed for different combinations of yield and price-cost conditions in

TABLE II

ESTIMATED DIRECT COST OF SAGE CONTROL

Item	Dollars Per Acre
Total cost, spraying and fencing per acre	$6.25
Interest cost (duration of initiation)	.58
Labor cost to salvage fence, per acre	.30
Total outlay	7.13
Less salvage value of fence	1.14
Total direct cost to complete practice	5.99
Less ACP	1.50
Total net direct cost less ACP payment	4.49

order to determine those conditions favorable to adoption of the practice and those unfavorable. The results of these computations are presented by non-deferred grazing and by deferred grazing assumptions for ease in explanation.

Non-Deferred Income

Under the assumption of non-deferred income, additional returns to sage control (excluding cost of treatment) ranged from $.22 per acre for unfavorable cattle price relation and low yields to an estimated $3.11 per acre for the reverse of these conditions (Table III). Deductions of direct costs of the sage treatment, converted to an annual basis, resulted in net income to the practice ranging from a minus 36 cents to $2.53 without ACP payments, and from a minus 20 cents to $2.67 with ACP payments deducted from the practice cost. Significantly, the ACP payment of $1.50 per acre for the practice has little effect upon net income per acre when the income is an estimate per year for the duration of the treatment. The more important variables are yields attributable to the practice and price-cost relations for cattle. However, if the ranchers planning horizon is shorter that 15 years, the $1.50 per acre can be expected to have more significance in the decision on whether to adopt the practice.

When the cattle price relations have no effect on the cost of the treatment, as in case of non-deferred income, the average price relation may be a better basis for extimating returns to the practice than either favorable or unfavorable prices. This is because the mean of possible future prices may be considered more probable for the long run than prices on the extremeties of the distribution. Also, for the same

TABLE III

NET INCOME PER ACRE PER YEAR TO SAGE CONTROL
(Without Deferred Income)

Item	Dollar Per Acre Per Year for Cattle Price Relationship During Benefits of:		
	Favorable	Average	Unfavorable
Additional net returns for increased carrying capacity for range of[a]			
Low	$1.95	$1.09	$ .22
Average	2.57	1.44	.30
High	3.11	1.74	.37
Less direct costs under three yield levels[b]	$ .58	$ .58	$ .58
Net per acre under three yield levels[c]			
Low	$1.37	$ .51	$-.36
Average	1.99	.86	-.28
High	2.53	1.16	-.21

[a]The low, average, and high carrying capacity of range after treatment returned the above estimated income above native range, untreated.

[b]Consists of depreciated investment in practice initiation, plus interest on average investment at 6 percent.

[c]Variable price conditions are not considered--only cattle price relationship under the three yield levels.

reasons, the average yield of the treated range may be considered a better estimate of the future outcome from sage control than the low or high yields. Thus, the best estimate of the net income per year to sage control obtained in this study is 86 cents per acre under the assumption of non-deferred income cost. However, variations in efficiency among ranchers in utilization of range or in management of cattle may have the same affect upon their income expectation as the yield levels and different cattle price relations used in this study to indicate a range in possible outcome from the practice.

Unfavorable cattle price conditions resulted in losses in adoption of the practice at all yield levels assumed. Apparently, the price relations for cattle, or conditions on ranches comparable in effect with this variable, is the more important consideration in deciding whether to adopt the sage control practice.

Deferred Grazing and Income

The necessity for deferred grazing or income during initiation of the treatment adds to the investment, thus increases the annual cost (Table IV). Under the deferred grazing assumption, all combination of yield levels and cattle price relations result in negative net returns to sage control except those with (1) yields average or higher combined with favorable cattle prices, and (2) cattle price relation average to favorable combined with high yields. The "break-even" point was near the combination of conditions of average yields and average cattle prices.

As indicated earlier, the average price relation for cattle may be a better long run estimate than the favorable or unfavorable prices.

TABLE IV

NET INCOME PER ACRE ABOVE NATIVE RANGE WITH DEFERRED GRAZING

Item	Dollar Per Acre Per Year for Cattle Price Relations During Benefits of: Favorable	Average	Unfavorable
Additional net returns for increased carrying capacity for range of:			
Low	$1.95	$1.09	$ .22
Average	2.57	1.44	.30
High	3.11	1.74	.37
Less direct and indirect costs under three cattle price conditions:[a]			
Favorable	$2.23	$2.23	2.23
Average	1.51	1.51	1.51
Unfavorable	.78	.78	.78
Net per acre under three yield levels and different price conditions and during treatment[b]			
Low:			
(1) Favorable	$ .28	$-1.14	$-2.01
(2) Average	.44	- .42	-1.29
(3) Unfavorable	1.18	- .31	- .56
Average:			
(1) Favorable	$ .34	$- .79	$-1.93
(2) Average	1.06	- .07	-1.21
(3) Unfavorable	1.79	.66	- .48
High:			
(1) Favorable	$ .88	$- .49	$-1.86
(2) Average	1.60	.23	-1.14
(3) Unfavorable	2.33	.96	- .14

[a]These are price conditions which are assumed to exist under the above price relationship of cattle, favorable, average, and unfavorable, during the time of each.

[b]Results less the actual cost per acre of the practice initiation plus the indirect cost of non-use of the land resource. ACP incentive payment is not considered in the above table.

However, for a short period, such as the time required to initiate the practice, this may not be the case. According to the estimates of the study, initation of sage control with deferred income a necessary cost is an unprofitable venture if cattle price relations are favorable during treatment except for the combination of average or better yields and favorable cattle prices during realization of the benefits. On the other hand, if the sage treatment can be initiated during periods of unprofitability of cattle production due to price relations, the practice may be expected to pay except under continued unfavorable cattle prices during the life of the treatment effects.

In general, sage control is a questionable practice under price-cost relations and yield expectations below the average of those used in this study. The yields of forage attributable to sage control in the experiment were attained under managerial conditions ranchers probably could not duplicate, i.e., cattle numbers were varied frequently on the experimental plots to maintain moderate grazing. In accordance with results obtained in the experiment, ranchers would need to about double cattle numbers immediately following completion of sage treatment, then reduce numbers gradually year-to-year until the effect of the treatment were dissipated. Only operators of steer enterprises have the flexibility to permit this variation in cattle numbers, and it is doubtful whether trends in annual production of forage on sage treated range can be anticipated by operators of steer enterprises with sufficient accuracy for its efficient utilization. Thus, ranchers may expect less realized gains from sage treatment than obtained in the experiment. If this is the case, the estimates of the potential returns to sage control of this study are higher than those that could be realized in practice by ranchers.

CHAPTER IV

REGRASSING

An analysis of regrassing abandoned cropland involves two basic periods: benefit and treatment. The benefit period consists of approximately ten years, or the estimated duration of production from regrassed range in excess of native range. The treatment period, or period necessary for establishing the grass, encompasses approximately three years. During this period both direct and indirect costs are incurred and the total investment to reseeding is the sum of these costs. Twenty percent was added to the cost of establishment to provide for risk of failure. Assumption that resources being treated will have production equal to native range, 50 percent of native range, or have no production, provide the basis for estimating deferred income costs. Yield levels of low, average, and high during the benefit period and three cattle price situations in both benefit and treatment periods, are used in the accounting.

Benefit Period

Benefits from regrassing are a result of increased production and beef per acre in excess of the estimated production from land without treatment. Estimates of production from regrassed land were made from experimental results for the four grasses: King Ranch bluestem, Switchgrass, and Short Mixtures I and II. A statistical analysis failed to reveal any significant difference among these grasses in average or trend

of output. Thus, they were combined to obtain one output estimate. The 95 percent confidence limit on the average yield of improved grasses was 27.4 to 36.9 pounds of beef per acre above that of native range. The average increase was 32 pounds of beef per acre. The regression equation estimating the ten year duration of yield in excess of native range was as follows:

$$Y = 45.734 - 7.065X_1 \text{ plus } .648X_2$$

where Y was gain per acre in excess of native range, X_1 was time, in years, following treatment period, and X_2 was gain from native range in the particular years of the experiment.

Even though the grass varieties did not differ significantly, the price of seed did vary. Thus, separate estimates of net returns were required. These estimated increases were analysized in association with different prices, yields, and expected productiveness of resources without treatment. Estimated increases in net returns above native range under favorable price relations were all above five dollars per acre even where 100 percent of range resources were treated (Table V). Treatment of 50 percent resources returned an estimate of $9.16 per acre additional under low yields to $11.12 with high yield expectancy. Treatment of range with no production returned the most favorable estimated increase per acre. The advantages of treating this type of land is the fact that any production obtained therefrom represents an advantage of return to the resource. Since no income exists to be deferred, the additional increase per acre above native range reached an estimated $15.13 per acre at high yield levels yet declined to only $13.25 per acre at low levels of yield.

TABLE V

NET RETURNS PER ACRE DURING BENEFIT PERIOD TO RESEEDING CROPLAND FOR DIFFERENT GRASS VARIETIES AND YIELD LEVELS

Expected Production From Resource Levels and Grass Varieties	Dollar Per Acre for Yield Levels and Cattle Price Relation in Benefit Period								
	Low Yields			Average Yield			High Yields		
	U[a]	A[a]	F[a]	U	A	F	U	A	F
No Production:									
King Ranch Bluestem	1.58	7.41	13.25	1.69	7.93	14.18	1.80	8.48	15.13
Switchgrass	1.58	7.14	13.25	1.69	7.93	14.18	1.80	8.48	15.13
Short Grass Mixture									
No. I	1.58	7.14	13.25	1.69	7.93	14.18	1.80	8.48	15.13
No. II	1.58	7.14	13.25	1.69	7.93	14.18	1.80	8.48	15.13
50% of Native Range:									
King Ranch Bluestem	1.08	5.12	9.16	1.19	5.67	10.14	1.31	6.21	11.12
Switchgrass	1.08	5.12	9.16	1.19	5.67	10.14	1.31	6.21	11.12
Short Grass Mixture									
No. I	1.08	5.12	9.16	1.19	5.67	10.14	1.31	6.21	11.12
No. II	1.08	5.12	9.16	1.19	5.67	10.14	1.31	6.21	11.12
100% of Native Range:									
King Ranch Bluestem	.65	3.06	5.45	.76	3.58	6.39	.88	4.15	7.40
Switchgrass	.65	3.06	5.45	.76	3.58	6.39	.88	4.15	7.40
Short Grass Mixture									
No. I	.65	3.06	5.45	.76	3.58	6.39	.88	4.15	7.40
No. II	.65	3.06	5.45	.76	3.58	6.39	.88	4.15	7.40

[a]U, A, and F designate unfavorable, average and favorable cattle price relationship.

There was a wide range in estimated additional income per acre by the range in cattle price relation used in the study. Regardless of the expected productivity of the land without treatment, unfavorable cattle price relations during the benefit period resulted in estimated net returns per acre below $2.00. Although unfavorable (or favorable) cattle price relations may have a low probability of duration for an entire benefit period, the results obtained by use of these levels of prices emphasizes the sensitivity of net returns to cattle prices. Although variation in productivity of land treated has less apparent influence on net returns from regrassing than variation in cattle prices, it is a more important variable from the standpoint of ability of the rancher to predict. Thus, expected productivity of abandoned cropland if left untreated may be a more important criterion of choice as to whether to regrass than expected cattle prices during the period of benefits. However, ranchers may predict cattle prices for the treatment period with a usable degree of accuracy, or sufficient to estimate high or low deferred income costs.

The third factor which influences increased net income in the regrassing program is levels of yield. The difference in net returns attributable to differences in yield is small because of the limited range of the 95 percent confidence limits. The small variation in physical results as obtained in the regrassing experiments is the aim in all experimental endeavor, and thus attainment adds confidence to averages obtained.

Treatment Period

The treatment period as defined earlier, is that time required to fulfill the necessary requirements in establishing grass. Costs incurred are direct (inputs of grass seeding) and indirect or income loss resulting from deferred use of the resource while under treatment. An additional 20 percent is added to the direct and indirect costs as risk of failure.

Direct Costs

Direct costs of establishing grass fall into three rather distinct phases. First, the preparatory phase is the period necessary for constructing fencing for livestock control, seedbed preparation, and seeding a forage sorghum in which to plant grass the following spring.[1] This first year cost is an estimated $9.35 per acre (Table VI). Interest at 6 percent for six months is added and ACP payments deducted to make a first year net cost per acre of $6.63.

Second, the establishment and control phase is the period in which grass is sown in the sorghum stubble and weeds are controlled by mowing. Interest on the first year's investment is carried forward and added to the cost during the second phase. Direct costs during this phase is for grass seed. This cost varies from $8.50 per acre for King Ranch bluestem down to $4.64 per acre for Short Grass Mixture II. Drilling cost and that of two mowings for weed control add three more dollars cost per acre during this phase. Thus, a second year's direct cost or investment total from $18.13 down to $14.27 per acre depending upon the grass variety sown.

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[1]Fencing was estimated on the basis of need to fence one-third of an assumed 320 acres each year.

TABLE VI

ESTIMATED DIRECT COSTS OF REGRASSING DURING PREPARATORY PHASE

Item	Dollar Per Acre
Fencing, 1.6 rods per acre[a]	$2.00
Sorghum production,[b] tillage, drill and seed	7.35
Total Cost	$9.35
Interest,[c] first year cost at 6 percent for 6 months	$ .28
ACP credit[d]	3.00
Total First Year Cost	6.63

[a]Complete cost of fencing is used since it is quite probable that under regrassing fencing will become permanent.

[b]Details of costs are shown in Table I.

[c]Only six months interest is charged the first year since one-half year is the limit of first year's use of money.

[d]U. S. Department of Agriculture, Agricultural Conservation Program Service, Oklahoma State Handbook 1958, p. 16.

When interest on first and second year's costs are added and ACP payments deducted, this total direct cost through the second year is reduced to a range from $10.40 per acre for Short Grass Mixture II to $15.87 per acre for King Ranch bluestem.

Third phase is the third year in which weeds are controlled once during the summer season. Interest is added to make a complete practice cost ranging from $12.05 to $17.85 per acre. Each of these total investment figures are depreciated on a ten year basis. Interest on average investment is added which makes the estimated total annual direct cost by grass varieties as follows: King Ranch bluestem, $2.31 per acre; Switchgrass, $2.04 per acre; Short Grass Mixture I, $1.73 per acre; and Short Grass Mixture II, $1.56 per acre.

Indirect Costs

Indirect costs are highly influencial upon the economic outcome of regrassing. Since the present income of resources being treated is lost for the period of treatment, such loss becomes an income deficit or cost.

Indirect cost or delayed income was determined by the estimated net income from untreated native range. This net income per acre produced by native range was $4.36 per acre. Since the practice requires three years to complete, this would amount to $13.08 per acre for treating land with expected production without treatment of 100 percent native range. Interest on first year at 6 percent, interest on first and second year income, and interest on first, second and third years made a total indirect cost of $14.71 per acre (Table VIII). However, to place this investment on an annual basis it is depreciated for ten years.

TABLE VII

GRASS ESTABLISHMENT AND COMPLETION PHASES

Item	Cost Per Acre by Grass Varieties			
	King Ranch Bluestem	Switch-Grass	Short Grass Mixture I	Short Grass Mixture II
First year direct cost	$6.63	$6.63	$6.63	$6.63
Grass establishment:				
Seed	8.50	8.00	5.76	4.64
Drill	1.00	1.00	1.00	1.00
Mow, July	1.00	1.00	1.00	1.00
Mow, August	1.00	1.00	1.00	1.00
First and second year cost	18.13	17.63	15.39	14.27
Interest, 1st and 2nd year	.74	.73	.68	.63
ACP credit, 2nd year	3.00	4.50	4.50	4.50
Total through second year	15.87	13.86	11.55	10.40
Mow, July, 3rd year	1.00	1.00	1.00	1.00
Interest, 3rd year	.98	.86	.72	.65
Total direct costs	17.85	15.72	13.27	12.05
Depreciation (10 years)	1.78	1.57	1.32	1.20
Interest-average investment	.53	.47	.40	.36
Annual direct cost per acre without risk cost	2.31	2.04	1.73	1.56
With 20 percent allowance for risk	2.77	2.45	2.08	1.87

TABLE VIII

ESTIMATED INDIRECT COST OF ESTABLISHING GRASS
(100 percent Native Range)

Item	Dollar Per Acre
Three years cost at $4.36 per acre per year	$13.08
Total interest charge to complete practice	1.63
Total or practice	14.71
Depreciated at ten years frequency	1.47
Interest on depreciated cost at 6 percent	.44
Total indirect cost per year	1.91

Interest on this depreciated cost at 6 percent totaled 44 cents per acre, and the total annual interest cost was estimated at $1.91 per acre. However, if the treated land has only 50 percent native range production, only one-half, or 96 cents, need to be added to the direct cost. In a similar manner, for land being treated which has no production, the treatment will be only the direct cost plus risk.

The risk cost, or an allowance for failure of the treatment the first try, was an estimated 20 percent increment to the direct and income deferment costs (Table IX). This risk cost is an estimated average for many seedings, and it may be inappropriate as an estimate for individual ranchers. Nevertheless, some allowance for risk of failure by ranchers can be expected. Risk costs other than the 20 percent included in this study easily could be computed from the data presented.

Net Returns to Regrassing

Results of this study indicate that reseeding any land resource is profitable so long as cattle price relationships are not below average in benefit period or above average in treatment period (Tables Xa and Xb). Higher than average yield in the experiment added to thenet returns as would be expected. Treating resources having native range production seem profitable only under a combination of conditions in which existed favorable cattle price relationship in benefit period, and unfavorable cattle prices in treatment period, and yields of reseeded grasses average or above. Estimates for combinations less favorable than these conditions mainly were losses. The estimate of this study is that treatment

TABLE IX

ESTIMATED DIRECT AND INDIRECT COST PER ACRE TO RESEEDING ABANDONED CROPLAND WITH DIFFERENT EXPECTED PRODUCTION WITHOUT TREATMENT

Expected Production Without Treatment and Grass Varieties	Dollar Per Acre for Yield Levels and Cattle Price Relation in Treatment Period								
	Low Yields			Average Yields			High Yields		
	U[a]	A[a]	F[a]	U	A	F	U	A	F
Production @ 50% N. R.									
King Ranch Bluestem	3.02	3.92	4.84	3.02	3.92	4.84	3.02	3.92	4.84
Switchgrass	2.70	3.60	4.50	2.70	3.60	4.50	2.70	3.60	4.50
Short Grass Mixture									
No. I	2.33	3.23	4.13	2.33	3.23	4.13	2.33	3.23	4.13
No. II	2.13	3.02	3.92	2.13	3.02	3.92	2.12	3.02	3.92
Production @ 100% N. R.									
King Ranch Bluestem	3.26	5.06	6.88	3.26	5.06	6.88	3.26	5.06	6.88
Switchgrass	2.94	4.74	6.55	2.94	4.74	6.55	2.94	4.74	6.55
Short Grass Mixture									
No. I	2.57	4.37	6.18	2.57	4.37	6.18	2.57	4.37	6.18
No. II	2.36	4.16	5.98	2.36	4.16	5.98	2.36	4.16	5.98

[a]U, A, and F designate unfavorable, average and favorable cattle price relationship.

TABLE X

NET RETURNS TO INVESTMENT IN REGRASSING PER ACRE
(a) King Ranch Bluestem and Switchgrass

	King Ranch Bluestem			Switchgrass		
	U[a]	A[a]	F[a]	U	A	F
No Expected Production						
Low Yields	-1.19	4.64	10.48	- .87	4.96	10.80
Average Yields	-1.08	5.16	11.41	- .76	5.48	11.73
High Yields	- .97	5.71	12.36	- .65	6.03	12.68
Production 50% Native Range						
Low Yields						
Unfavorable	-1.94	2.10	6.14	-1.62	2.42	6.46
Average	-2.84	1.20	5.24	-2.52	1.52	5.56
Favorable	-3.76	.28	4.32	-3.42	.62	4.66
Average Yields						
Unfavorable	-1.83	2.65	7.12	-1.51	2.97	7.44
Average	-2.73	1.75	6.22	-2.41	2.07	6.54
Favorable	-3.65	.83	5.30	-3.31	1.17	5.64
High Yields						
Unfavorable	-1.71	3.19	8.10	-1.39	3.51	8.42
Average	-2.61	2.29	7.20	-2.29	2.61	7.52
Favorable	-3.53	1.37	6.28	-3.19	1.71	6.62
Production 100% Native R nge						
Low Yields						
Unfavorable	-2.61	- .20	2.19	-2.29	.12	2.51
Average	-4.41	-2.00	.39	-4.09	-1.68	.71
Favorable	-6.23	-3.82	-1.43	-5.90	-3.49	- 1.10
Average Yields						
Unfavorable	-2.50	.32	3.13	-2.18	.64	3.45
Average	-4.30	-1.48	1.33	-3.98	-1.16	1.65
Favorable	-6.12	-3.30	- .49	-5.79	-2.97	- .16
High Yields						
Unfavorable	-2.38	.89	4.14	-2.06	1.21	4.46
Average	-4.18	- .91	2.34	-3.86	- .59	2.66
Favorable	-6.00	-2.73	.52	-5.67	-2.40	.85

[a]U, A, and F designate unfavorable, average and favorable cattle price relationship.

TABLE X (Continued)

(b) Short Grass Mixture I and II

	I			II		
	U[a]	A[a]	F[a]	U	A	F
No Expected Production						
Low Yields	- .50	5.33	11.17	- .29	5.54	11.38
Average Yields	- .39	5.85	12.10	- .18	6.06	12.31
High Yields	- .28	6.40	13.05	- .07	6.61	13.26
Production 50% Native Range						
Low Yields						
Unfavorable	-1.25	2.79	6.83	-1.04	3.00	7.04
Average	-2.15	1.89	5.93	-1.94	2.10	5.24
Favorable	-3.05	.99	5.03	-2.84	1.20	5.24
Average Yields						
Unfavorable	-1.14	3.34	7.81	- .93	3.55	8.02
Average	-2.04	2.44	6.91	-1.83	2.65	7.12
Favorable	-2.94	1.54	6.01	-2.73	1.75	6.22
High Yields						
Unfavorable	-1.02	3.88	8.79	- .81	4.09	9.00
Average	-1.92	2.98	7.89	-1.71	3.19	8.10
Favorable	-2.82	2.08	6.99	-2.61	2.29	7.20
Production 100% Native Range						
Low Yields						
Unfavorable	-1.92	.49	2.88	-1.71	.70	3.09
Average	-3.72	-1.31	1.08	-3.51	-1.10	1.29
Favorable	-5.53	-3.12	- .73	-5.33	-2.92	- .53
Average Yields						
Unfavorable	-1.81	1.01	3.82	-1.60	1.22	4.03
Average	-3.61	- .79	2.02	-3.40	- .58	2.23
Favorable	-5.42	-2.60	.21	-5.22	-2.40	.41
High Yields						
Unfavorable	-1.69	1.58	4.83	-1.48	1.79	5.04
Average	-3.49	- .22	3.03	-3.28	- .01	3.24
Favorable	-5.30	-2.03	1.22	-5.10	-1.83	1.42

[a]U, A, and F designate unfavorable, average and favorable cattle price relationship.

of resources having 50 percent native range production or less with cattle price conditions average to favorable will be profitable. The main conclusion from the estimates, therefore, is that possibilities exist for realizing positive net returns from regrassing abandoned cropland, but possibilities also exist for realizing losses from the practice. Therefore, recommendations to ranchers regarding the practice should be in the form of conditional statements that include as conditions the variables associated with profitability (or unprofitability) of the practice.

SUMMARY AND CONCLUSIONS

Economical means through which forage may be increased has been a major problem of ranchers in the Souther Great Plains for some time. Efforts to solve this problem through research have been made by the Souther Great Plains Experimental Station since about 1937. Both sage brush control and regrassing low producing or abandoned cropland have been included in the experiments. Both these practices have, in the experiments, increased theoutput of forage. However, considerable investment by ranchers were required for either sage control or regrassing, and the major unanswered question is "Are these range improvement practices economically feasible?" or, "Under what conditions can these practices be expected to be profitable to ranchers?" This study is an economic evaluation of sage control and regrassing. Price-cost data assembled from secondary sources for the period since 1949 were used in the study. Conventional farm accounting methods were used in the economic analyses of the experimental data.

Under the assumption of non-deferment of grazing during the treatment period, and the consequent non-deferment of income as a cost, sage control can be expected to be profitable except under conditions of unfavorable cattle prices during the period increased forage is being realized. However, with deferment of income during the treatment period as a necessary cost, sage control can be expected to be a profitable practice only under a combination of yield and/or price cost conditions more favorable than the average of these used in the study.

Possibilities also exist for realizing positive net returns from regrassing abandoned cropland, but possibilities also exist for realizing

losses from this practice. Results of this study indicate that regrassing land with expected output, without treatment, 50 percent or less that of native range can be expected to be profitable provided cattle price conditions are average to favorable. Reseeding land having native range production can be expected to pay only under a combination of price, cost, and yield conditions more favorable than the averages used in this study.

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APPENDICES

APPENDIX A

TO: N. E. Rowley, Soil Conservationist Date: August 19, 1957
State Program Staff, SCS, Stillwater, Oklahoma

FROM: C. E. Kingery, Range Conservationist
SCS, Oklahoma City, Oklahoma

SUBJECT: Acres of Sagebrush Control Needs and Amounts Treated to Date

The following figures are taken from our range work load analysis of the state:

Area I, including Texas, Cimarron, Beaver, Harper, Woods, Woodward, Dewey, and Ellis counties:

362,570 acres needing initial control
113,418 acres treated to date

475,988 total acres sagebrush infested range

Area II, including Alfalfa and Grant counties:

2,740 acres needing initial control
None treated

Area IV, including Roger Mills, Custer, and Washita counties:

14,700 acres needing initial control
8,366 acres treated to date

23,066 acres sagebrush infested range

Area VII, applies to Harmon, Beckham, Greer, Kiowa, and Jackson counties:

43,000 acres needing initial control
7,733 acres treated to date

50,733 total acres sagebrush infested range

Total acres sagebrush infested range in state	529,461 acres
Total acres that have received initial control	123,891 acres
Acres yet needing initial control	405,470 acres

I trust this will supply you the information needed. This survey was based on our records and reports and estimates of our work unit conservationists.

APPENDIX B

Stillwater, Oklahoma
August, 20, 1957

Mr. Ralph W. Leonard
P. O. Box 365
Watonga, Oklahoma

Dear Mr. Leonard:

Your letter of August 12 requesting some conservation needs information has been referred to me for reply.

You were not very specific as to the area on which you wanted this information other than northwestern Oklahoma. We are, therefore, submitting some data to you from one of our administrative areas which includes the three Panhandle counties and Harper, Woods, Ellis, Major, Woodward and Dewey Counties. We are listing below for these counties the total amount of range seeding for the years 1947 through 1956.

1947	12,745 acres	1952	40,551 acres
1948	10,811 acres	1953	22,269 acres
1949	19,187 acres	1954	28,850 acres
1950	24,348 acres	1955	19,079 acres
1951	38,938 acres	1956	18,217 acres

Our range seeding practice includes most of the grass seeding since very little tame pastures are seeded in this area. For example, we report the following acreages of pasture planting (not native grass) for the past three years: 1954, 645 acres; 1955, 238 acres; and 1956, 183 acres. We assume that these seedings would be insignificant for your purpose.

The information requested in the first paragraph of your letter relative to spraying sagebrush has been referred to our Range Conservationist, C. E. Kingery, Oklahoma City. I am not sure that he will be able to get this information for the same area. It is possible he may need to resort ot state-wide figures which would, no doubt, include other areas in the western part of the State. I have asked him to send the data directly to you when he has it assembled.

I trust this material will be helpful to you for your graduate problem.

Very truly yours,

N. E. Rowley
State Soil Conservationist

VITA

Ralph W. Leonard

Candidate for the Degree of

Master of Science

Thesis: ECONOMIC ANALYSIS OF RANGE IMPROVEMENT PRACTICES IN NORTHWEST OKLAHOMA

Major Field: Agricultural Economics

Biographical:

Personal Data: Born in Manhattan, Kansas, April 18, 1912, the son of Arthur J. and Rosa B. Leonard.

Education: Attended rural grade schools near Canton, Lindsay, and Ponca City and the city grade school of Edmond, Oklahoma. Graduated from the Royal Consolidated #6 High School, Canton, Oklahoma in 1933. Received the Bachelor of Science degree from Oklahoma Agricultural and Mechanical College in 1950 with a major in Agricultural Education. Completed requirements for the Master of Science degree in July, 1959.

Professional Experience: Engaged in general farming from 1933 to July, 1942. Served in the Naval Construction Battalions from August, 1942 until December, 1945. Graduate assistant and laboratory instructor, Oklahoma State University from September, 1950 to January, 1952. Assistant County Supervisor, Farmers Home Administration from January, 1952 to April, 1954. County Supervisor, Farmers Home Administration from April, 1954 to date.