



# University of Arizona

College of Agriculture  
Agricultural Experiment Station

## AN ECONOMIC STUDY OF RANGE SHEEP PRODUCTION IN ARIZONA

K. P. PICKRELL AND E. B. STANLEY

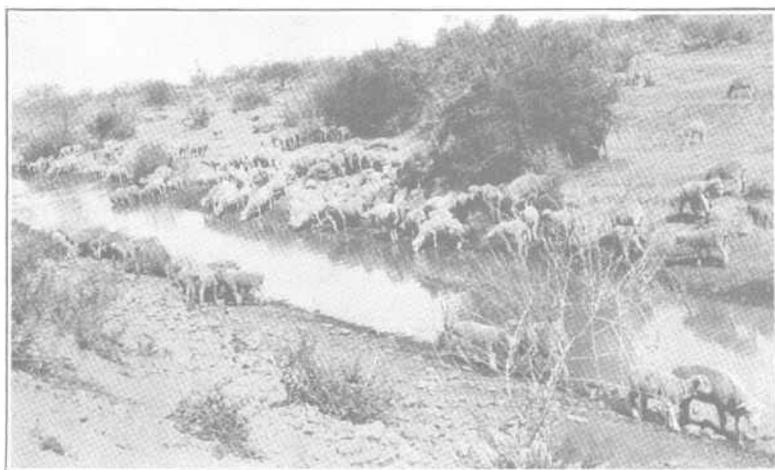


Photo by C. U. Pickrell.

Sheep at Desert Watering Place.

PUBLISHED BY  
**University of Arizona**  
TUCSON, ARIZONA

# ORGANIZATION

## BOARD OF REGENTS

HIS EXCELLENCY, JOHN C. PHILLIPS, Governor (Ex-officio).....Phoenix  
HON. CHARLES O. CASE, State Superintendent (Ex-officio).....Phoenix

## Appointed Members

HON. ROBERT E. TALLY, B.S., M.E., Chancellor.....Jerome  
HON. CHARLES M. LAYTON.....Safford  
HON. GEORGE M. BRIDGE, Treasurer.....Somerton  
HON. ROY KIRKPATRICK, Secretary.....Globe  
HON. FRANKLIN J. ORRER, M.S., Vice-Chancellor.....Superior  
HON. THEODORA MARSH.....Nogales  
HON. WILLIAM C. JOYNER.....Phoenix  
HON. HENRY L. McGLUSKEY.....Phoenix

HOMER L. SHANTZ, Ph.D., Sc.D.....President of the University

## EXPERIMENT STATION STAFF

ELMER D. BALL, M.S., Ph.D.....Dean and Director

### AGRICULTURAL ENGINEERING DEPARTMENT (Irrigation)

GEORGE E. P. SMITH, C.E., D.Eng.....Agricultural Engineer  
HAROLD C. SCHWALEN, B.S. in M.E., M.S. in C.E.....Associate Agricultural Engineer  
ARTHUR G. CAENS, B.S.....Field Assistant in Irrigation and Horticulture  
WILLIAM A. STENBERGEN, B.S. in C.E.....Assistant Irrigation Engineer

### BOTANY DEPARTMENT

JOHN J. THORNBEE, B.S., A.M.....Botanist

### DAIRY DEPARTMENT

WALTER S. GUNNINGHAM, M.S.....Dairy Husbandman  
RICHARD N. DAVIS, M.S.....Associate Dairy Husbandman

### PLANT BREEDING DEPARTMENT

WALKER E. BRYAN, M.S.....Plant Breeder  
ELIAS H. PRESSLEY, M.S.....Associate Plant Breeder

### ENTOMOLOGY DEPARTMENT

CHALES T. VORHIES, B.S., Ph.D.....Entomologist  
LAWRENCE P. WEHRLE, M.S., Ph.D.....Assistant Entomologist

### HORTICULTURE DEPARTMENT

ALLEN F. KINNISON, M.S.....Horticulturist  
DAVID W. ALBERT, M.S.....Associate Horticulturist (Phoenix)  
MALCOLM F. WHARTON, M.S.....Assistant Horticulturist

### AGRONOMY DEPARTMENT

RALPH S. HAWKINS, M.S.....Agronomist  
STANLEY P. CLARK, B.S.....Assistant Agronomist  
IAN A. BRIGGS, M.S.....Assistant Agronomist  
CHARLES HOBART, M.S.....Research Assistant in Agronomy and Horticulture (Mesa)

### ANIMAL HUSBANDRY DEPARTMENT

ERNEST B. STANLEY, M.S.....Animal Husbandman  
EVERETT L. SCOTT, M.S., Ph.D.....Associate Animal Husbandman

### PLANT PATHOLOGY

JAMES G. BROWN, M.S., Ph.D.....Plant Pathologist  
RUBERT B. STREETS, M.S., Ph.D.....Associate Plant Pathologist  
MILTON M. EVANS, M.S.....Research Assistant in Plant Pathology

### AGRICULTURAL CHEMISTRY AND SOILS DEPARTMENT

PAUL S. BURGESS, M.S., Ph.D.....Agricultural Chemist  
†JAMES F. BREAZEALE, B.S.....Research Biochemist  
WILLIAM T. McGEORGE, M.S.....Research Chemist in Soils  
THEOPHIL F. BURRER, M.S., Ph.D.....Physical Chemist  
HOWARD V. SMITH, M.S.....Assistant Agricultural Chemist  
ROBERT O. GREENE, M.S.....Assistant Agricultural Chemist

### POULTRY HUSBANDRY DEPARTMENT

HARRY EMBLETON, B.S.....Poultry Husbandman  
HUBERT B. HINDS, M.S.....Assistant Poultry Husbandman

### HUMAN NUTRITION DEPARTMENT

MARGARET OAMMACK SMITH, A.M., Ph.D.....Nutrition Chemist  
EDITH LANTZ, M.S.....Research Assistant in Nutrition

### RANGE ECOLOGY DEPARTMENT

WILLIAM G. McGINNIE, B.S.....Range Ecologist

†In cooperation with United States Department of Agriculture, Bureau of Plant Industry.

## CONTENTS

Foreword .....	519
Introduction .....	519
Period Covered.....	520
Method of Securing Data.....	520
Methods of Sheep Operation in Arizona.....	520
Explanation of Statement Form.....	523
Interpretation of Data.....	524
Capital Investment.....	524
Expenses .....	527
Labor .....	527
Supplies .....	528
Taxes .....	528
Leases and Permits.....	528
Winter Pasture.....	528
Automobile .....	529
Miscellaneous .....	529
Purchases .....	529
Depreciation .....	530
Interest .....	530
Manager's Salary.....	531
Decreases and Increases in Inventory.....	531
Maintenance and Operation.....	531
Receipts .....	542
Income .....	542
Fleece Weight and Value of Wool.....	542
Lamb Crop.....	543
Lost and Slaughtered.....	543
Percentage Distribution of Receipts.....	544
Climate .....	544
Summary .....	551

## STATEMENT OF COOPERATION

This study was carried on in cooperation with the Bureaus of Animal Industry and Agricultural Economics of the United States Department of Agriculture and the Agricultural Experiment Station of New Mexico.

Particular mention is due K. K. Hennes, who acted as Field Investigator during the first year, and V. V. Parr, who supervised the project in behalf of the Department of Agriculture.

# AN ECONOMIC STUDY OF RANGE SHEEP PRODUCTION IN ARIZONA

*By*

K. P. PICNRELL, Field Investigator, U. S. D. A., cooperating with  
the Experiment Stations of Arizona and New Mexico, and E. B.  
STANLEY, Animal Husbandman, University of Arizona.

---

## FOREWORD

Without the assistance of the sheepmen of Arizona, this publication would not have been possible. These men with their bookkeepers and the Secretary of the Wool Growers Association gave generously of their time and patience in furnishing the material on which the bulletin was based. It is hoped that any information gained from it will fit in with their spirit of willingness to learn by experience, to exchange views, and ever to seek methods which will bring about more desirable results to their industry.

## INTRODUCTION

Investigational work in range livestock problems has been very limited. Grazing range studies of forage conservation and utilization have been under way for several years but only to a limited extent and largely under the direction of the Forest Service.

Accurate information pertaining to such facts as costs, death losses, lamb crops, and management practices underlying the range livestock industry in the Southwest has not been available. Approximations, private opinions, and hearsay evidence have been the only offerings on the economic phases of the livestock industry. An investigation of the livestock industry in the Southwest, including Arizona, was made in 1926.\* The purpose was to gather information that would enable the Agricultural Experiment Station to function constructively in meeting the needs of an industry whose great magnitude and complex phases of operation hamper the efforts of research agencies. One of the recommendations of that investigation was that the economic and animal husbandry problems of the sheep and goat industries should be included in a special study confined to outfits dealing in only this kind of livestock. This bulletin reports the results of a 3-year cooperative study of the economics of the sheep industry in Arizona, undertaken in response to this request.

---

\*U. S. D. A. Tech. Bul. No. 68.

The main trend of the study was an analysis of the expenses involved in the production of wool and lambs, the prices received for them, the reasons for variations, with the thought that these items could be used as a guide in future sheep raising. The object of the study was to present the facts and results as they were found to exist on the outfits interviewed.

#### PERIOD COVERED

The records upon which this report is based cover the 3-year period 1927 to 1929 inclusive. The information obtained is presented for each year separately and for the period as a whole.

#### METHOD OF SECURING DATA

At the beginning of the project 20 Arizona outfits, engaged exclusively in the sheep business, were chosen from which data were to be secured. The outfits selected were thought to be representative of the industry and the owners indicated their willingness to furnish the information desired. The original plan was to carry these same outfits over a period of 3 years in order to determine, as far as possible, how the various factors affected their income. At that time it was impossible to foretell the many changes in management, size, and location that that would take place during the following years in these outfits. At the completion of each year's business and on taking up that of the following year many changes among the outfits previously studied had taken place. Some outfits had sold out, some had changed their period of lambing, while others had made marked changes in the size of their holdings. In order to maintain the desired number of outfits some of these changes made it necessary to select new outfits so all of those reported on are not represented over the entire period. Individual record books were used for each outfit, which provided an accounting of business records and, in addition, notes on herd management practices. Each of the cooperating sheepmen was interviewed personally at regular intervals throughout each year to keep all business records and other items of importance posted up to date. These records and all the information secured from the various outfits have been accepted as confidential. The records bear no names and are identified by key numbers only.

#### METHODS OF SHEEP OPERATION IN ARIZONA

The varied systems of sheep production in Arizona necessitates a brief description of them in the way of explanation of the methods adopted in presenting the results of the study.

Arizona probably represents a wider variation of systems in its range sheep operations than does any other state engaged in the industry. This is attributed principally to the many types of ranges and the wide differences in climate existing in the State. These pronounced variations make it possible to lamb, shear, and market lambs over a wide period. There was also a wide range in expenses and receipts. It is difficult for one unfamiliar with conditions as they exist in Arizona to realize how extreme are these variations. In the south-central part of the State during the late winter can be seen herds of sheep with their wool shorn, lambs at their sides grazing on green feed, while within a day's travel to the north can be seen herds browsing on sage, watering on snow, with a long wait ahead of them before shearing and lambing.

The sheep industry is not a statewide enterprise in Arizona. Sheep, however, are grazed at elevations ranging from 1,100 feet to as high as 10,000 feet. The principal area used by sheep can be roughly pictured by considering an open fan placed on the map of Arizona with the base or handle in the vicinity of Phoenix in the south-central part of the State and the circular edge extending to the Grand Canyon and the Navajo Indian Reservation on the north with the edges extending diagonally to the east and west boundaries. (See sketch page 522.) By placing a band about 50 miles in breadth across this fan approximately two-thirds from the base toward the circular edge, the area covered would represent the summer range of a high percentage of the Arizona range sheep except those owned by Indians. To the north and south of this band are to be found the areas occupied by these sheep during the winter months and lambing season. Those sheepmen wintering their herds to the north of this band are forced by climate to lamb in May, shear in June, and sell their lambs in the fall, usually as feeders. This is the method referred to as "May lambing" in this bulletin. The date of lambing, time of shearing, and class of lambs produced by those sheep wintering south of this band depend largely on just how far south they migrate. The operations in this southern area are of two distinct types. In one case the ewes are taken directly to the irrigated pastures of the Salt River Valley and lambed on green feed of alfalfa and winter grain. These outfits start lambing about November 1 and continue for a period of approximately 40 days. This same feed is used for finishing the lambs for spring delivery if the adjacent desert has not had sufficient rainfall and warm weather to produce native forage. The ewes in this group are sheared, as a rule, during the months of February and March. At an elevation of approximately 1,100 feet above sea level and with a temperature seldom reaching the freezing point it is possible to have

green feed at this time of year, to lamb without shelter, and to practice early shearing. This method is referred to as "early lambing."

The other method followed in handling sheep that are taken south is to move the ewes from the summer ranges in the fall to the foothills adjacent to the desert where they remain through the winter months, lamb in February, are shorn in February and March, depending on weather conditions, and produce a high percentage of fat lambs for late summer delivery after returning to the summer range. This type or method is referred to as "February lambing."

Among the outfits studied there were some which divided their ewes and practiced both of the last-mentioned methods. These have been grouped and referred to as "combination lambing."

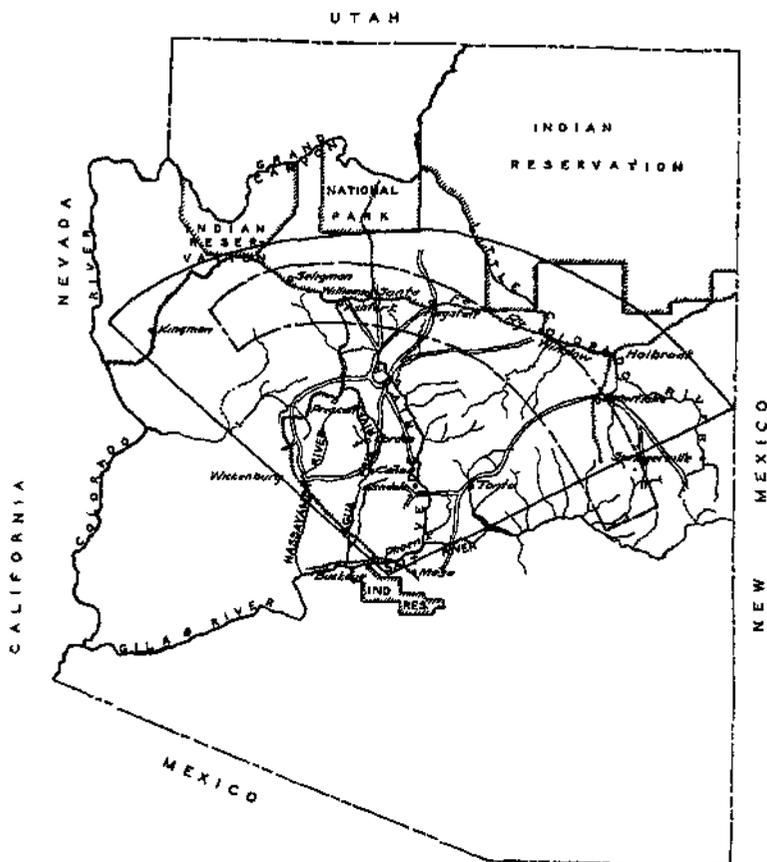


Fig. 1.—Sketch showing location of principal sheep range areas in Arizona.

The movement of sheep from winter to summer ranges and *vice versa* takes place, for the most part, over driveways set apart for this purpose. These driveways have been roughly located on the map (page 522). In addition to the movement of sheep over the driveways some use is made of the railroads for this purpose. This latter method is more common in the fall with those sheep lambing early. The high temperature and the dry state of the driveways during the early fall at a time when the ewes are advanced in pregnancy usually necessitates some rail transportation. There is some movement by railroad of the sheep lambing in February which have been kept on the northern winter ranges until just before lambing so that time and weather conditions do not permit the use of the driveways. Larger numbers of sheep usually use the driveways when returning from southern winter ranges. The lack of time before the breeding season prevents some from returning in this manner, while other owners do not possess a driveway permit. These driveways are controlled by the Forest Service and their capacity is not of sufficient size to accommodate all sheep to be moved.

The grouping of the different outfits as heretofore explained, according to their respective lambing seasons, was made to eliminate the marked differences in the methods of operation. In this manner the individual sheepman is afforded a comparison with outfits operated under conditions more nearly like his own than would have been the case if the outfits had been taken as a whole or segregated into groups according to numbers of sheep.

#### EXPLANATION OF STATEMENT FORM

Vass of Wyoming\* and Barber of Idaho† in their studies arrived at a method of determining the depreciation on a ewe and the cost of ram service in their states. In order to arrive at such a figure it is necessary to know the period of usefulness of a ewe or ram, their value as mutton when they have lived through this period, and the number and relative value of each of the various ages of sheep in the individual herds. The fact that there are so many variable factors which must be considered in order to determine such a figure makes it impossible to arrive at an accurate figure on depreciation of Arizona sheep. For that reason the statements for each outfit and those for the group have been prepared under the inventory method.

During the period of this study nearly all Arizona sheepmen culled their herds of the old ewes and replaced them with younger ones. When this practice is followed and the purchases of sheep are included in

\*A. F. Vass and Harry Pearson, Idaho Agr. Exp. Sta. Bul. No. 156.

†Barber, Special Rept. to Idaho Wool Grow. Assn.

the expenses as well as the costs of producing the ewe lambs retained, this automatically takes care of depreciation. At the beginning of the study a reasonable market value was placed on ewes, yearling ewes, and rams. It happened that there was very little fluctuation in the price of ewes during the 3 years included in the study so that the same values were used throughout except in some cases where the operators failed to maintain their herds by replacement with young ewes and rams.

In using the inventory method, the current market value of all the sheep of an outfit at the beginning of the year's business was compared with the value of all sheep in the herds at the close of the year's business. If a decrease was shown this amount was included as an expense. If an increase occurred the expense was credited with that amount. It is usually customary to include an increase in inventory in the receipts; however, it was deducted from the expenses in this report in order to show the cost of operating and maintaining the outfits at a value equal to that at the beginning of the year's business.

The tables include figures on each of the 3 years' operation and an average of the entire period. At the head of each column is shown the number of animals at the beginning of the year's business. This number represents the ewes, yearling ewes, and rams and is the one used in arriving at the items on the per head basis which appear in the tables.

## INTERPRETATION OF DATA

### CAPITAL INVESTMENT

Capital investment has been divided into sheep, range, improvements, and equipment. The item of range includes owned land and a value placed on forest permits, trail rights, and group leases. Other publications have never given consideration to these latter values as capital investment. It is no longer possible, and has not been for some time, to secure a permit on the National Forests of Arizona other than by purchase from a former user. Arizona sheepmen have been paying large sums for these permits. Under these conditions the authors felt justified in including the current value of these permits in capital investment. In several cases the cost price of these permits was available; where it was not, valuations on similar ones were applied.

The average capital investment of all outfits was \$19.81 per head as shown in table I. There was a range among the individual outfits from a minimum of \$8.89 per head to a maximum of \$42.15 per head. Compared according to their respective groups, the May lambing outfits had the highest capital investment per head and the early lambing group the lowest.

In the distribution of capital investment some outfits had a higher percentage investment in range than in sheep. This difference was not maintained, however, in the average of each group and the entire State. With the exception of the combination group in the year 1927 the highest item of investment was in sheep. The outfits in the combination group added to their herds in 1928, changing this relation. The average amount invested per head for all the outfits was \$10.95 in sheep, \$6.22 in range, \$2.06 in improvements and 58 cents in equipment, showing a respective percentage distribution of 55.2 percent, 31.4 percent, 10.4 percent, and 3.0 percent.

There was little difference in the value per head of sheep in the various groups. The investment in range per head showed a great variation among the outfits and groups, so that the relative percentage investment in range varied accordingly. The early lambing group had the lowest investment in range, amounting to \$1.76 per head. This condition comes from the fact that the sheep in this group do not winter on land representing any capital investment to the operator while they are grazing on the pastures of the Salt River Valley. Incidentally there were outfits in this group which did not have any capital investment in range. This statement should not be taken to mean that the sheep business can be carried on with success in Arizona by the utilization of public domain alone. The outfits operating in this manner were small and though they were able to make some use of the public domain they were obliged to lease controlled range from others. Individuality of the outfits had a great bearing on the amount invested in range among all groups. Those outfits lambing in February had the next lowest investment in range, amounting to \$4.80 per head for the group, while the May and combination groups had investments of \$8.24 and \$9.36 respectively in range per head. All outfits which possessed summer range had about the same investment per head. However, the investment in winter range appeared to be higher with the May group than any other. Their location required more controlled range and their ranges as a whole had a higher value per acre.

Improvements include the appraised value of buildings, fences, corals, vats, and water development, but not the city residences of the operators. A higher investment in range by the May group was accompanied by a corresponding higher investment of \$5.93 in improvements. More water development and fencing were required on the winter ranges of this group, and the early lambing group had only 42 cents per head in improvements.

Under equipment were included special lambing equipment, automo-

TABLE I.—THE AMOUNT AND PERCENTAGE DISTRIBUTION OF THE FORMS OF CAPITAL INVESTMENT ON A PER HEAD BASIS FOR EACH GROUP AND THE TOTAL OVER THE 3-YEAR PERIOD, 1927-29

	Sheep Inventory		Range		Improvements		Equipment		Total capital Investment	
	Amount per head	Pct. of total	Amount per head	Pct. of total						
May lambing.....	\$10.40	41.6	\$8.24	33.0	\$5.93	23.7	\$0.43	1.7	\$25.00	100
Combination lambing.....	10.98	49.4	9.36	42.1	1.25	5.6	0.65	2.9	22.24	100
Early lambing.....	12.14	81.3	1.76	11.8	0.42	2.8	0.62	4.1	14.94	100
February lambing.....	10.36	60.3	4.80	27.9	1.41	8.2	0.61	3.6	17.18	100
All Arizona.....	10.95	55.2	6.22	31.4	2.06	10.4	0.58	3.0	19.81	100

biles, horses, and burros. There was little variation among the groups in the amounts invested in this item.

#### EXPENSES

It is next to impossible to secure a list of uniform itemized expenses from a group of sheep outfits. There was found to be nearly as many methods of keeping books as there were outfits. An expense entered under one head by one outfit was often found entered under another head by other outfits. The many variations in methods of operation and individuality of outfits in Arizona give very little meaning to detailed items in the way of comparison among individual outfits and, since the purchases of sheep and the changes in inventory have such a bearing on the amount of expenses and receipts, the only logical basis for determining the economic status of an outfit or by way of comparison with other outfits is the *net income*. Sufficient figures are included in the table statements to permit analysis by different methods.

When preparing a statement on some of the individual outfits considerable itemizing could have been done; however, when several outfits were being considered and all of them were not subject to the same expenses, then only those that were common to all could be segregated and the balance placed under miscellaneous. This accounts for the large miscellaneous item.

#### LABOR

The item of labor varies somewhat among the outfits and is not absolutely definite as it appears in the tables. It includes shearing and foreman or "corporal" wages, but not the manager's salary. It is customary for the Arizona sheepmen to purchase clothing and personal supplies for the labor through the supply account. While these items are deducted from the wages of the men they are not always transferred to the labor account. The payment for labor, clothing, etc., is often made with cash and such expense entered under miscellaneous rather than under labor.

The expense for labor, exclusive of manager, was found to be \$2.34 per head for a 3-year average. The May group had the smallest labor expense, \$1.81 per head, with the other groups ranging up to \$2.68 per head. The May group not only used less man labor per sheep but was not found to be paying the high wages that some of the individuals in the other groups were paying. In connection with this latter point, it seems evident that the numerous other factors influencing the success or failure of the sheep business in Arizona make it impractical to make

a comparison of herder wages under the various systems of management. Herder wages were found to range from \$35 to \$110 per month.

#### SUPPLIES

As has been mentioned, the item of labor can cause the item of supplies to vary.

It is not uncommon to have salt, supplementary feed, material for repairs and replacements to equipment, water, and even automobile expense charged under supplies.

Supplies averaged 88 cents per head per year with no marked difference in any of the groups.

#### TAXES

No effort was made to segregate the taxes paid on sheep from those paid on land and improvements. The item of taxes includes both in the tables.

The average tax per head over the period was 23 cents. This figure varied according to the amount and value of range and improvements owned. In some counties the tax on one breeding ewe would be more than this amount, the lower figure being accounted for by the fact that the total tax paid was divided by the number of sheep in the opening inventory. This number included yearling ewes which are not subject to taxation.

#### LEASES AND PERMITS

Leases on state and private land have been grouped with those of grazing fees on Forest permits. It was not a purpose of this study to make a comparison of the costs and usage of private or leased range with that of the National Forests. The amount of expense under this item would naturally vary among the outfits according to the amount of range owned or leased and the length of time they used Forest permits. A record of the acreage that each outfit was using was secured; however, acreage requirements were not determined because of the wide difference in ranges, the extensive use of public domain, and the production of range forage and alfalfa pasture being so dependent upon rainfall and climate

#### WINTER PASTURE

This item appears only in the tables for the early lambing and combination groups. It consists mostly of green feed, though there were a few cases in which it included some hay and grain used during the winter.

The most pronounced change occurring in any item of expense was that of winter pasture. This item represented 17 percent of the cash expenses of the early lambing sheep in 1927, 33 percent in 1928, and

47 percent in 1929. On the per head basis it amounted to \$1.94 in 1927, \$3.01 in 1928, and \$5.27 in 1929, or an increase of 170 percent over a period of 3 years. The smaller amount in 1927 was caused primarily by the use of the desert during February and the remainder of the spring. During the following years the sheep were on pasture the entire period and also were charged a higher rate per day.

The other group (combination) subjected to pasture expense experienced a like increase with the sheep they kept on pasture. Of their total number of sheep the numbers on pasture were approximately 4,000 in 1927, 7,500 in 1928, and 9,000 in 1929. The sheep from these outfits brought to pasture were bred to lamb early, and at a later date the rams were placed in the herds to bring February lambs. In this manner the ewes were subjected to two breeding periods. If they did not give birth to an early lamb on pasture they were usually moved from the pastures to the range to await February lambing. The ewes composing the early lambing bands of these combination outfits are those of more advanced age. It was the practice each year to place the oldest of the February lambing ewes in the early bands and when they had reached the end of their usefulness as early lambers they were sent to market in the spring.

#### AUTOMOBILE

The average automobile and truck expense was 23 cents per head per year with no marked difference in the groups.

#### MISCELLANEOUS

Miscellaneous expense is naturally rather large since it must include all items which cannot be classified under one of the other heads. The principal expenses included under miscellaneous are workmen's compensation, legal fees, insurance, supplementary feed, dipping, association dues, repairs, trail fees, and freight.

The item of miscellaneous expense would be expected to vary, since it includes expenses which one outfit or group had that another did not have. It amounted to 73 cents per head for a 3-year average of all outfits.

#### PURCHASES

Purchases include the amount paid for additional breeding ewes as well as that for rams. Some operators chose to purchase the replacements to their breeding stock rather than to retain the ewe lambs from their herds.

If each outfit operated from year to year with approximately the same number of ewes the item of purchase would represent the value

of ewes and rams needed for replacement; however, some outfits increased considerably in numbers by the purchase of ewes and ewe lambs so that this item has little comparative value among outfits or groups.

#### DEPRECIATION

Depreciation on improvements, when the actual amount could not be determined, was placed at 5 percent of their value. Ten percent was placed on equipment with the exception of automobiles, which varied from 20 to 40 percent.

Only depreciation on improvements and equipment has been entered in the tables. This varied, of course, according to the amount invested in these items. The average depreciation per head for the 3 years was 23 cents.

Depreciation on ewes was not entered in the tables. Any amount representing depreciation on Arizona sheep would have little application to more than one outfit or group. Some outfits were observed culling their ewes at 5 and 6 years of age while others had ewes in their herds 11 years old. Conditions vary so much in Arizona that no definite age can be set at which a ewe reaches the end of her period of usefulness. When a sheepman sets a definite age for culling his ewes, the yearling ewes have the same yearly value and his cull ewes bring the same amount from year to year; then and only then can a satisfactory figure be placed on depreciation.

Neither can a satisfactory figure be placed on the cost of ram service in Arizona, owing to the various ages at which the rams are culled and the amounts for which they sell. There is a wide range in the price being paid for rams. The average price paid was \$25.31 in 1927; \$23 in 1928, and \$28.89 in 1929. The majority of rams purchased were yearlings. In addition to rams purchased, some outfits saved rams from their own breeding.

#### INTEREST

Practically all outfits reported paying interest on borrowed money. Some had no indebtedness while others reported large amounts up to \$20 per head. Under these circumstances a comparable report could not be made of outfits operating under both conditions with the item of interest entered as cash expense. By charging 8 percent (the usual rate paid by sheepmen on borrowed money) on the total capital investment and assuming that the cash requirements for the year's business did not exceed the amount of capital invested, the item of interest will appear as a like charge to all outfits regardless whether cash is being paid on borrowed money or not.

## MANAGER'S SALARY

The item of manager's salary is somewhat similar to that of paid interest. Some outfits were operating with paid managers, while others were being operated by owners, which made comparison difficult.

It is the contention of some economists that a man's ability can be judged only by the final outcome of his endeavors. The authors chose to handle this point on what appeared to be a practical basis and one which would put all outfits on an equal basis. The most practical method of doing this was to divide the total of the salaries these managers were being paid by the total number of sheep they were paid to manage. When this was done the result was found to be 51 cents per head per year for the 3-year period. In none of these tables does the actual salary of the managers appear in the item of labor but has been made to appear separately on all sheep at 51 cents per head.

## DECREASES AND INCREASES IN INVENTORY

There is little significance in these items for comparison of outfits or groups. Owing to market prices, drouth, etc., some outfits culled their herds closer and did not save the necessary numbers of ewe lambs to prevent a decrease in inventory. Others increased their herds either by purchase or by saving ewe lambs.

## MAINTENANCE AND OPERATION

This item as handled in the tables has a direct relation to receipts, since any increase in inventory was deducted from the total cash expense in determining its amount. If an outfit or group saved ewe lambs the amount of sales was lessened and the inventory was increased, provided the value of lambs saved exceeded the value of animals lost and sold. On the other hand, the selling of all ewe lambs without the purchase of replacements resulted in a decrease in inventory. The two methods were about equally practiced among the outfits studied so that the figures on maintenance and operation should be representative as an average. The average maintenance and operation expense for all outfits for the 3 years was \$6.82 per head as shown in Table II. The early lambing group ran the highest with \$10.78 (Table III), the combination group next with \$6.61 (Table V), followed by the February group with \$5.91 (Table IV), and the May group was lowest with \$4.41 (Table VI). This amount ran to extremes depending upon the number of ewes and lambs sold or kept in the herds of the individual outfits as well as upon the amount of expense.

TABLE II.—CONSOLIDATED STATEMENT AND DATA ON ARIZONA SHEEP OUTFITS OVER ENTIRE STATE.

CAPITAL INVESTMENT	1927 Amount on 53,297 head	1928 Amount on 78,950 head	1929 Amount on 80,891 head	Av. Amount on 71,046 head
Sheep inventory.....	*\$565,922	\$864,802	\$902,634	\$777,786
Range .....	350,412	474,832	500,524	441,923
Improvements .....	120,453	157,532	161,960	146,648
Equipment .....	32,134	44,925	47,375	41,478
Total capital investment.....	1,068,921	1,542,091	1,612,493	1,407,835
EXPENSES				
Cash:				
Labor .....	124,743	181,742	192,371	166,285
Supplies .....	45,548	69,772	72,545	62,622
Taxes .....	11,735	18,557	18,158	16,150
Leases and permits.....	15,968	30,482	29,885	25,445
Winter pasture.....	28,525	97,713	166,242	97,493
Automobile .....	9,378	18,983	20,428	16,263
Miscellaneous .....	33,513	53,999	67,699	51,737
Purchases (sheep).....	11,328	40,107	82,116	44,517
†Total cash expense.....	280,738	511,425	649,444	480,512
Non-cash:				
Depreciation on improvement and equipment .....	8,352	21,183	20,096	16,544
Decrease in sheep inventory.....	51,541	.....	.....	17,180
Total non-cash expense.....	59,893	21,183	20,096	33,724
Total expense.....	340,635	532,608	669,540	514,236
Less increase in inventory (if any)	.....	49,819	39,822	29,880
Total maintenance and operation	340,635	482,789	629,718	484,356
Per head maintenance and opera- tion .....	6.39	6.12	7.78	6.82
RECEIPTS				
Ewes .....	33,599	53,776	68,258	51,878
Rams .....	4,339	4,577	25,942	11,953
Lambs .....	307,415	424,407	444,693	392,172
Wool .....	131,893	243,022	209,657	94,857
Felts .....	1,355	2,012	1,362	1,576
Miscellaneous .....	3,284	6,802	6,058	5,381
Total receipts.....	481,885	734,596	756,970	657,817
Receipts per head.....	9.04	9.30	9.36	9.26

\*Cents omitted.

†Does not include interest paid on borrowed money or paid manager's salary.

TABLE II.—(Continued.)

	1927 Amount on 53,297 head	1928 Amount on 78,950 head	1929 Amount on 80,891 head	Av. Amount on 71,046 head
INCOME				
Income, exclusive interest and manager .....	141,250	251,807	127,252	173,436
Income per head, exclusive interest and manager.....	2.65	3.18	1.58	2.44
Less interest 8% on total capital ...	85,514	123,367	128,999	112,627
	55,736	128,440	-1,747	60,809
Manager salary pro-rated 51c per head .....	27,181	40,264	41,254	36,233
Net income.....	28,555	88,176	-43,001	24,576
Net income per head.....	.54	1.12	-.53	.35
OTHER DATA				
No. breeding ewes start year's business .....	41,491	67,388	66,178	58,352
No. lambs marked.....	38,193	63,862	60,083	54,046
Lamb percent.....	92	95	91	92+
No. lambs sold.....	31,248	45,529	41,657	39,478
No. lambs held for replacement....	7,859	25,990	17,280	17,043
Total value lambs sold and replaced	374,862	563,435	597,067	511,788
Value per lamb sold or replaced....	9.57	9.23	10.13	9.64
Fleece weight (shearing count)....	7.9	8.4	9.3	8.6
Value wool per head (shearing count) .....	2.64	3.21	2.68	2.87
Pct. of total receipts (all lambs)	68	64	66	66
Percent of total receipts (wool)....	24	28	23	25
Average price per lb. wool.....	.33	.38	.29	.33
‡Percent total death loss.....	9.2	6.2	7.3	7.8
Percent ewe death loss.....	11.2	8.4	8.0	9.2
Percent ram death loss.....	16.5	20.3	11.5	16.1
Percent lamb death loss.....	6.3	5.3	5.8	5.7

‡Includes animals slaughtered for camp use.

TABLE III.—CONSOLIDATED STATEMENT AND DATA ON ARIZONA SHEEP OUTFITS LAMBING EARLY.

CAPITAL INVESTMENT	1927 Amount on 7,252 head	1928 Amount on 20,285 head	1929 Amount on 19,180 head	Av. Amount on 15,572 head
Sheep inventory.....	*\$87,267	\$243,762	\$236,031	\$189,020
Range .....	15,000	35,620	31,621	27,414
Improvements .....	7,441	5,339	6,700	6,493
Equipment .....	4,556	12,019	12,233	9,603
Total capital investment.....	114,264	296,640	286,585	232,530
EXPENSES				
Cash:				
Labor .....	15,697	40,024	40,976	32,232
Supplies .....	2,980	11,693	14,315	9,663
Taxes .....	918	3,191	3,361	2,490
Leases and permits.....	3,286	14,513	9,496	9,098
Winter pasture.....	14,098	61,016	101,298	58,004
Automobile .....	610	5,181	6,154	3,982
Miscellaneous .....	9,271	19,976	34,678	21,308
Purchases (sheep) .....	1,436	17,422	19,844	12,901
†Total cash expense.....	48,296	173,016	230,122	150,478
Non-cash:				
Depreciation on imp. and equipmt.	942	5,183	3,091	3,072
Decrease in sheep inventory.....	33,660	7,962	1,054	14,225
Total non-cash expense.....	34,602	13,145	4,145	17,297
Total expense.....	82,898	186,161	234,267	167,775
Less increase in inventory (if any)	.....	.....	.....	.....
Total maintenance and operation..	82,898	186,161	234,267	167,775
Per head maintenance and operation .....	11.43	9.18	12.21	10.99
RECEIPTS				
Ewes .....	6,745	20,368	7,681	11,598
Rams .....	80	3,702	21,217	8,333
Lambs .....	88,513	156,490	186,284	143,762
Wool .....	14,693	60,800	55,191	43,561
Pelts .....	194	702	372	423
Miscellaneous .....	1,497	1,507	.....	1,001
Total receipts.....	111,722	243,569	270,745	208,679
Receipts per head.....	15.40	12.01	14.12	13.40

\*Cents omitted.

†Does not include interest paid on borrowed money or manager's salary.

TABLE III.—(Continued.)

INCOME	1927 Amount on 7,252 head	1928 Amount on 20,285 head	1929 Amount on 19,180 head	Av. Amount on 15,572 head
Income, exclusive interest and manager .....	28,824	57,408	36,478	40,303
Income per head, exclusive of interest and manager.....	3.97	2.83	1.90	2.63
Less interest 8% on total capital....	9,140	23,731	22,927	18,602
	19,684	33,677	13,551	22,301
Manager salary pro-rated 51c per head .....	3,699	10,345	9,782	7,942
Net income.....	15,985	23,332	3,769	14,359
Net income per head.....	2.20	1.15	.20	.92
OTHER DATA				
Number breeding ewes start yrs. business .....	6,695	19,332	17,708	14,578
Number lambs marked.....	5,849	17,809	16,952	13,537
Lamb percent.....	87	92	96	93
†Number lambs sold.....	5,672	15,934	13,962	11,855
No. lambs held for replacement.....	81	1,584	2,108	1,258
Total value lambs sold and replaced .....	63,482	177,364	212,535	151,127
Value per lamb sold or replaced....	11.03	10.12	13.22	11.52
Fleece weight (shearing count)....	7.9	8.1	10.3	9.0
Pct. of total receipts (all lambs)	73.0	67	72	70
Percent of total receipts (wool)....	17.0	23	19	20
Value wool per head (shearing count) .....	2.41	2.97	2.96	2.89
†Percent total death loss.....	4.3	7.2	7.9	6.9
Percent ewe death loss.....	5.8	9.1	11.8	8.8
Percent ram death loss.....	15.9	7.2	11.0	11.1
Percent lamb death loss.....	2.4	4.7	5.4	4.3

†Includes animals slaughtered for camp use.

TABLE IV.—CONSOLIDATED STATEMENT AND DATA ON ARIZONA SHEEP OUTFITS LAMBING IN FEBRUARY.

CAPITAL INVESTMENT	1927 Amount on 23,064 head	1928 Amount on 17,648 head	1929 Amount on 17,753 head	Av. Amount on 19,488 head
Sheep inventory.....	*\$241,075	\$183,508	\$181,338	\$201,974
Range .....	98,119	96,197	86,427	93,581
Improvements .....	30,600	27,052	24,991	27,548
Equipment .....	13,653	13,004	8,961	11,873
Total capital investment.....	383,447	319,761	301,717	334,976
EXPENSES				
Cash:				
Labor .....	54,096	49,536	46,857	50,163
Supplies .....	21,354	20,745	18,394	20,163
Taxes .....	4,341	4,243	3,943	4,176
Leases and permits.....	7,676	8,115	9,408	8,400
Winter pasture.....				
Automobile .....	5,098	4,837	3,745	4,560
Miscellaneous .....	12,698	11,943	8,555	11,065
Purchases (sheep).....	2,390	4,207	13,044	6,547
†Total cash expense.....	107,653	103,626	103,946	105,074
Non-cash:				
Depreciation on improvements and equipment .....	3,074	3,445	3,413	3,311
Decrease in sheep inventory.....	31,882		11,092	14,325
Total non-cash expense.....	34,956	3,445	14,505	17,636
Total expense.....	142,609	107,071	118,451	122,710
Less increase in inventory (if any) .....		22,431		7,477
Total maintenance and operation	142,069	84,640	118,451	115,233
Per head maintenance and opera- tion .....	6.18	4.80	6.67	5.91
RECEIPTS				
Ewes .....	20,749	4,995	39,339	21,694
Rams .....	1,318	275	1,715	1,103
Lambs .....	107,977	77,852	51,087	78,972
Wool .....	53,518	54,014	44,392	50,641
Pelts .....	1,061	566	223	617
Miscellaneous .....				
Total receipts.....	184,623	137,702	136,756	153,027
Receipts per head.....	8.00	7.80	7.70	7.85

\*Cents omitted.

†Does not include interest paid on borrowed money or manager's salary.

TABLE IV.—(Continued.)

INCOME	1927 Amount on 23,064 head	1928 Amount on 17,648 head	1929 Amount on 17,753 head	Av. Amount on 19,488 head
Income, exclusive interest & Mgr.	42,014	53,062	18,305	37,794
Income per head, exclusive interest and manager.....	1.82	3.00	1.03	1.94
Less interest 8% on total capital....	30,676	25,581	24,137	26,798
	11,338	27,481	-5,832	10,996
Manager salary prorated 51c per head .....	11,763	9,000	9,054	9,939
Net income.....	-425	18,481	-14,886	1,057
Net income per head.....	-.02	1.05	-.84	.054
OTHER DATA				
Number breeding ewes start year's business .....	20,738	14,936	12,825	16,166
Number lambs marked.....	15,844	15,139	11,278	14,087
Lamb percent .....	76	101	88	88
Number lambs sold.....	11,625	9,203	5,941	8,923
No. lambs held for replacement....	2,426	4,574	4,047	3,682
Total value lambs sold and replaced	130,103	116,071	83,245	109,806
Value per lamb sold or replaced....	9.26	8.42	8.33	8.71
Fleece weight (shearing count)....	7.2	8.2	8.4	7.9
Value wool per head (shearing count) .....	2.47	3.20	2.62	2.74
Pct. of total receipts (all lambs)	63	66	49	60
Percent of total receipts (wool)....	26	31	26	27.5
‡Percent total death loss.....	12.0	8.8	9.2	9.6
Percent ewe death loss.....	12.0	7.8	8.0	9.5
Percent ram death loss.....	21.0	32.8	14.0	21.2
Percent lamb death loss.....	11.2	9.1	9.1	9.8

‡Includes animals slaughtered for camp use.

TABLE V.—CONSOLIDATED STATEMENT AND DATA ON ARIZONA SHEEP OUTFITS LAMBING A PORTION OF SHEEP EARLY AND BALANCE IN FEBRUARY (COMBINATION).

CAPITAL INVESTMENT	1927 Amount on 12,790 head	1928 Amount on 23,062 head	1929 Amount on 28,717 head	Av. Amount on 21,523 head
Sheep inventory.....	*\$139,630	\$249,200	\$320,272	\$236,367
Range .....	161,935	198,185	245,021	201,714
Improvements .....	12,211	28,510	39,852	26,858
Equipment .....	10,000	13,180	18,480	13,887
Total capital investment.....	323,776	489,075	623,625	478,826
EXPENSES				
Cash:				
Labor .....	38,073	58,912	74,964	57,316
Supplies .....	11,873	21,221	27,115	20,070
Taxes .....	4,648	6,220	7,236	6,035
Leases and permits.....	2,995	3,660	8,048	4,901
Winter pasture.....	14,152	34,972	62,478	37,201
Automobile .....	2,694	6,030	7,108	5,277
Miscellaneous .....	9,109	12,603	18,354	13,355
Purchases (sheep).....	4,514	10,999	37,464	17,659
†Total cash expense.....	88,058	154,617	242,767	161,814
Non-cash:				
Depreciation on improvement and equipment .....	2,436	2,973	3,450	2,953
Decrease in sheep inventory.....	.....	.....	.....	.....
Total non-cash expense .....	2,436	2,973	3,450	2,953
Total expense.....	90,494	157,590	246,217	164,767
Less increase in inventory (if any)	8,870	27,521	33,567	23,319
Total maintenance and operation.	81,624	130,069	212,650	141,448
Per head maintenance and operation .....	6.38	5.64	7.41	6.57
RECEIPTS				
Ewes .....	3,595	9,570	13,298	8,821
Rams .....	1,700	.....	3,018	1,573
Lambs .....	81,950	130,719	174,426	129,032
Wool .....	37,807	76,850	79,871	64,843
Pelts .....	100	744	428	424
Miscellaneous .....	1,688	4,495	6,025	4,069
Total receipts.....	126,840	223,378	277,066	208,762
Receipts per head.....	9.92	9.64	9.65	9.70

\*Cents omitted.

†Does not include interest paid on borrowed money or manager's salary.

TABLE V.—(Continued.)

INCOME	1927 Amount on 12,790 head	1928 Amount on 23,062 head	1929 Amount on 28,717 head	Av. Amount on 21,523 head
Income, exclusive interest and mgr.	45,216	92,309	64,416	67,314
Income per head, exclusive interest manager .....	3.54	4.00	2.24	3.15
Less interest 8% on total capital....	25,902	39,126	49,890	38,307
	19,314	53,183	14,526	29,007
Manager salary pro-rated 51c per head .....	6,523	11,762	14,646	10,977
Net income.....	12,791	41,421	-120	18,030
Net income per head.....	1.00	1.80	-0	.84
OTHER DATA				
Number breeding ewes start year's business .....	10,650	19,156	23,547	17,784
Number lambs marked.....	10,100	20,304	23,123	17,842
Lamb percent .....	95	106	98	100
Number lambs sold.....	7,343	13,249	17,443	12,678
No. lambs held for replacement..	2,800	6,437	6,583	5,273
Total value lambs sold and replaced	106,350	185,415	230,290	174,018
Value per lamb sold or replaced....	10.49	9.42	9.59	9.69
Fleece weight (shearing count)....	8.3	8.8	9.1	8.8
Value wool per head (shearing count) .....	3.02	3.47	2.84	3.10
Pct. of total receipts (all lambs)..	70	67	69	69
Percent of total receipts (wool)....	25	28	24	26
‡Percent total death loss.....	7.4	6.0	5.0	6.1
Percent ewe death loss.....	10.8	7.9	6.9	8.5
Percent ram death loss.....	12.3	22.4	14.1	16.3
Percent lamb death loss.....	3.0	3.4	3.5	3.3
Number of ewes lambing early.....	4,000	7,500	9,000	6,800

‡Includes animals slaughtered for camp use.

TABLE VI.—CONSOLIDATED STATEMENT AND DATA ON ARIZONA SHEEP OUTFITS LAMBING IN MAY.

CAPITAL INVESTMENT	1927 Amount on 10,191 head	1928 Amount on 17,955 head	1929 Amount on 15,241 head	Av. Amount on 14,462 head
Sheep inventory.....	*\$ 97,950	\$188,332	\$165,001	\$150,428
Range .....	75,360	144,830	137,455	119,215
Improvements .....	70,201	96,631	90,408	85,747
Equipment .....	3,925	6,822	7,702	6,149
Total capital investment.....	247,436	436,615	400,566	361,539
EXPENSES				
Cash:				
Labor .....	16,877	33,270	29,574	26,574
Supplies .....	9,341	16,113	12,721	12,725
Taxes .....	1,828	4,903	3,618	3,450
Leases and permits.....	2,286	5,920	5,399	4,535
Winter pasture.....				
Automobile .....	976	2,934	3,421	2,444
Miscellaneous .....	2,435	9,477	6,112	6,008
Purchases (sheep).....	2,988	7,549	11,764	7,434
†Total cash expense.....	36,731	80,166	72,609	63,170
Non-cash:				
Depreciation on improvements and equipment .....	1,900	9,582	10,142	7,208
Decrease in sheep inventory.....				
Total non-cash expense .....	1,900	9,582	10,142	7,208
Total expense.....	38,631	89,748	82,751	70,378
Less increase in inventory (if any)	5,131	7,829	18,401	10,454
Total maintenance and operation...	33,500	81,919	64,350	59,924
Per head maintenance and opera- tion .....	3.29	4.56	4.22	4.14
RECEIPTS				
Ewes .....	2,790	18,843	7,940	9,858
Rams .....	961	600	992	851
Lambs .....	28,975	59,346	32,897	40,406
Wool .....	25,875	51,358	30,203	35,812
Pelts .....			339	113
Miscellaneous .....	99	800	33	311
Total receipts.....	58,700	130,947	72,404	87,351
Receipts per head.....	5.76	7.29	4.75	6.04

\*Cents omitted.

†Does not include interest paid on borrowed money or manager's salary.

ABLE VI.—(Continued.)

INCOME	1927 Amount on 10,191 head	1928 Amount on 17,955 head	1929 Amount on 15,241 head	Av. Amount on 14,462 head
Income, exclusive interest and mgr.	25,200	49,028	8,054	27,427
Income per head, exclusive interest and manager.....	2.47	2.73	.53	1.90
Less interest 8% on total capital....	19,795	34,929	32,045	28,923
	5,405	14,099	-23,991	-1,496
Manager salary pro-rated 51c per head .....	5,197	9,157	7,773	7,376
Net income.....	208	4,942	-31,764	-8,872
Net income per head.....	.02	.28	-2.08	-.61
OTHER DATA				
Number breeding ewes start year's business .....	7,027	13,964	12,098	11,030
Number lambs marked.....	6,400	10,610	8,730	8,580
Lamb percent.....	91	76	72	78
Number lambs sold.....	3,573	7,687	4,311	5,190
No. lambs held for replacement....	2,552	2,895	4,452	3,300
Total value lambs sold and replaced	49,391	84,586	70,544	68,174
Value per lamb sold or replaced....	8.05	7.99	8.05	8.03
Fleece weight (shearing count)....	9.4	8.6	9.1	9.0
Value wool per head (shearing count) .....	2.68	3.19	2.09	2.67
Pct. of total receipts (all lambs)....	62	54	64	59.2
Percent of total receipts (wool)....	33	33	27	31.1
‡Percent total death loss.....	11.5	7.5	9.3	9.1
Percent ewe death loss.....	14.6	8.8	8.0	9.8
Percent ram death loss.....	15.4	21.7	9.3	15.6
Percent lamb death loss.....	6.5	4.8	7.8	6.3

‡Includes animals slaughtered for camp use.

## RECEIPTS

The item of receipts represents the net amount after freight, commissions, etc., were deducted. The sales of ewes and rams represent animals of all ages, including the rams raised by some of the outfits. Total receipts per head, when all outfits were placed in one statement (Table II), show a very uniform amount, increasing from \$9.04 in 1927 to \$9.36 in 1929, with an average of \$9.26 for the 3 years. The early lambing group had the highest group receipts. Their highest year was 1927 with \$15.39 per head; in 1928 it was \$12.03, and in 1929, \$14.12. In 1929 this group received less per pound for their wool but the increased fleece weight that year caused the wool to bring as much return per head as in 1928. As the majority of lambs produced by the early lambing group are sired by black-faced rams and since their high value in the spring for slaughter does not justify saving them for breeding stock, the receipts from this group represent practically their entire production. The various numbers of ewe lambs retained for breeding stock had a bearing on the amount of receipts from the other groups. The average price received for wool for the 3 years was 33, 38, and 29 cents respectively with a 3-year average of 33 cents. There was no marked difference in price that any one group received for its wool.

## INCOME

Income, exclusive of interest and manager, was arrived at by subtracting the item of total maintenance and operation from that of total receipts. The net income is this amount less 8 percent interest on total capital investment and managerial salary pro-rated at 51 cents per head.

The subject of income has been so handled in the tables with the thought that it could be analyzed according to the reader's viewpoint.

The average 3-year income, exclusive of interest and manager's salary, was \$2.44 per head. The item of interest showed \$1.58 per head and the managerial salary was constant at 51 cents, leaving a net profit of 35 cents per head. It developed that for each of the 3 years at least 36 percent of the outfits failed to pay interest on investment and a manager's salary, yet the remaining 64 percent made a sufficient profit above these items to make the average net profit 35 cents per head.

## FLEECE WEIGHT AND VALUE OF WOOL

The fleece weight and value of wool per head were based on the shearing count and not on the number of animals appearing at the column head.

The average fleece weight increased from 7.9 pounds in 1927 to 9.3 pounds in 1929 with an average of 8.6 pounds. The value of wool per head averaged \$2.87 on the actual number of sheep sheared, with an average price per pound of 33 cents.

#### LAMB CROP

Lamb crop percent in all cases was based on the number of breeding ewes at the beginning of the year's business plus any ewes purchased before lambing, compared with the number of lambs marked. Under this method the percent crop in the early lambing and combination groups, particularly the former, is expressed lower in proportion to the other groups since lambing on the first-mentioned group takes place 10 to 11 months after the beginning of the year's business, while the other two groups lamb 2 to 5 months after the beginning of the year's business.

The 3-year average lamb crop, based on the number of breeding ewes at the beginning of the year's business and the number of lambs marked, was 92 percent. The highest average appearing in any group was 100 percent in the combination group. The early lambing group was next with a 93 percent lamb crop, followed by the February group with 88 percent and the May group, the lowest, with 78 percent. The highest yearly percent of all the outfits as a whole was in 1928 with a 95-percent lamb crop. In Table III is shown a gradual increase in the lamb crop of the early lambing group. This is largely accounted for from the fact that some of the outfits in the group commenced the practice of early lambing during the first year of the study and during the following years a higher percentage of ewes had adapted themselves to the change in the breeding season.

The average value of lambs sold or replaced on all outfits was \$9.64. The early lambs averaged \$11.52 per head, the combination \$9.69, the February \$8.71, and the May \$8.03.

Accurate weights on all early lambs was not secured. The majority of the February lambs were shipped to California and sold on the per head basis so that their weight was not determined. The average weight of the May lambs sold as feeders was 75 pounds in 1927, 68 pounds in 1928, and 72 pounds in 1929.

#### LOST AND SLAUGHTERED

The number of animals missing during the year was secured. An attempt was made to separate the number of animals slaughtered for camp use from this number, but as it was only an estimate in practically all outfits the missing animals were considered under one item "lost

and slaughtered." The percent figures on loss and slaughter were based on total possibilities, that is, numbers on hand at the beginning of the year's business plus any purchases, and lambs marked were compared with the number lost and slaughtered.

The average yearly loss and slaughter percent of all animals was found to be 7.8 percent. The ewe loss was 8.7 percent, ram loss 16.9 percent, and lamb loss 5.7 percent. There was not sufficient evidence to show that one group was liable to a larger loss than any of the others except that the February lambing group had the highest loss in lambs during each of the 3 years with an average of 9.8 percent.

The amount of loss from causes that could be termed preventable losses, such as "cuts" or strays, poison plants, and predatory animals, appeared closely related to the management practices of the individual outfits. Some heavy losses occurred following unexpected storms and bloat caused considerable loss to sheep on pasture, being more prominent in 1927 than the following years. The largest individual losses in grown sheep resulted from supposedly *hemorrhagic septicemia*. Losses in lambs from an ailment commonly termed "stiff legged" occurred throughout the period. The last two mentioned causes of loss are ones of which the sheepmen have little knowledge or control and which justify investigation.

#### PERCENTAGE DISTRIBUTION OF RECEIPTS

Receipts other than from lambs and wool slightly influenced the percentage distribution of the different items sold. Over the 3 years with all outfits the lamb receipts represented 66 percent, the wool 25 percent, the balance, or 9 percent, being made up of ewe, ram, pelt, and miscellaneous receipts. The ratio for the groups was 70:20 for the early lambing group, 69:26 for the combination, 60:27 for the February, and 59:31 for the May.

#### CLIMATE

The predominating physical factor affecting the sheep industry in Arizona is the climate. Its bearing upon the methods of sheep production in State is of such importance that data covering it is presented. Situated in a subtropical region of low rainfall and high temperature, drought periods are not infrequent. The almost entire dependence upon the native forage production under these conditions renders the sheep business in a particularly sensitive position in relation to the amount of precipitation.

Smith, H. V., in a summary statement of "The Climate of Arizona" concerning precipitation, says: "The normal annual precipitation for the

State is 13.6 inches. The lowest, 3.10 inches, is at Yuma, and the greatest, 32.42 inches, is at Crown King. The greatest part of the rainfall occurs during two seasons, the winter rains in December, January, February, and March, and the summer rains in July, August, and September. The summer rains are local in nature, and of short duration. The winter rains are gentle and may continue for several days. Rainfall seems to be directly correlated with altitude.

"Snow seldom falls in southern Arizona except at high altitudes. At the higher altitudes in northern Arizona 48 to 60 inches of snow during the winter is common."

Those outfits, in particular the early and February lambing groups, that use the desert are often confronted with droughty conditions and subjected to a prolonged feed expense. An instance to illustrate this condition occurred during the period of the project. Heavy winter rains in December, 1926, and February, 1927, followed by favorable growing weather produced an abundance of late winter and early spring feed. Early lambing outfits were enabled to move from the costly pasture feed and the February outfits remained on the abundant and cheaper desert feed. Winter rains in 1928 and 1929 were inadequate to produce ample desert feed and outfits were required to purchase pasture feed, materially increasing their overhead costs.

Not only is the amount of precipitation important but also the time of year it occurs, as the above would indicate.

The accompanying table shows the precipitation records over the sheep areas by months for the period of the study in comparison with the normal precipitation.

MONTHLY AND ANNUAL PRECIPITATION AT U. S. WEATHER BUREAU STATION IN THE VICINITY OF AREAS  
GRAZED BY SHEEP, 1926-1929 INCLUSIVE.

Station	County	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Annual	
Ashdale Ranger Sta.....	Maricopa	3700	1926	0.90	1.16	3.56	7.42	0.40	0.06	3.50	4.24	2.76	0.43	0.15	7.02	28.60
1927			0.03	9.48	2.94	1.29	0.15	1.46	0.27	5.65	5.25	0.82	0.80	4.84	32.98	
1928			0.98	2.95	0.55	0.30	0.37	0.00	0.37	4.51	1.25	2.09	0.35	1.95	15.67	
1929			2.45	1.80	1.15	2.15	.....	.....	.....	0.50	3.64	1.43	0.78	0.17	0.00	.....
Normal			3.40	2.44	2.48	1.96	0.39	0.21	2.67	3.01	2.12	1.48	1.73	3.45	25.34	
Ashfork.....	Yavapai	5160	1926	0.14	1.31	1.82	4.73	0.49	0.00	1.70	0.80	0.75	0.28	0.27	2.49	14.78
1927			0.67	2.71	1.29	0.50	0.11	3.26	0.84	5.72	3.21	0.50	0.58	1.85	21.24	
1928			0.18	2.01	0.28	0.78	0.87	0.17	0.94	0.49	0.02	1.36	0.35	1.30	8.75	
1929			0.56	0.31	0.46	0.36	0.00	.....	.....	.....	.....	T	T	0.00	.....	
Normal			1.04	1.20	1.16	0.87	0.42	0.65	1.99	2.12	1.07	0.94	0.54	1.10	13.10	
Buckeye.....	Maricopa	980	1926	0.30	0.16	0.60	2.07	0.00	0.00	2.72	0.17	2.07	0.16	0.03	2.83	11.11
1927			0.05	1.61	0.41	0.43	0.00	0.46	0.25	1.00	1.38	0.21	0.60	1.01	7.41	
1928			0.00	0.70	0.12	0.00	T	0.00	1.53	0.88	0.22	0.65	T	0.95	5.05	
1929			1.09	0.12	0.02	0.02	0.00	0.00	0.67	1.17	0.65	0.00	0.02	0.00	3.76	
Normal			0.91	0.75	0.72	0.34	0.08	0.07	1.13	0.88	0.53	0.50	0.73	0.97	7.71	
Cedar Glade.....	Yavapai	4600	1926	0.10	1.32	0.92	.....	.....	0.26	1.81	.....	1.60	.....	0.10	3.58	.....
1927			0.42	4.54	0.98	0.50	0.90	0.78	0.86	2.17	2.03	1.50	0.00	2.46	17.14	
1928			0.21	1.48	0.12	0.14	0.77	1.07	0.43	1.41	0.38	1.00	0.22	1.86	9.09	
1929			0.68	0.30	0.22	0.30	0.23	0.00	0.62	1.17	.....	0.30	T	0.00	.....	
Normal			1.39	1.38	1.10	0.74	0.56	0.39	2.00	2.40	1.35	1.51	0.57	1.52	14.91	

MONTHLY AND ANNUAL PRECIPITATION AT U. S. WEATHER BUREAU STATION IN THE VICINITY OF AREAS  
GRAZED BY SHEEP, 1926-1929 INCLUSIVE.

Station	County	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Annual	
Crown King.....	Yavapai	6000	1926	0.83	1.50	1.84	9.00	0.14	0.18	1.10	1.31	1.45	1.31	11.53	.....	
			1927	.....	.....	.....	2.26	0.00	0.50	1.38	11.50	5.93	3.05	0.00	5.71	.....
			1928	0.73	3.20	.....	0.38	0.56	0.00	2.49	2.78	1.23	1.58	1.00	3.15	.....
			1929	1.89	2.87	1.58	1.83	0.02	0.00	2.59	5.31	2.27	0.90	0.12	0.00	19.38
			Normal	3.84	2.91	(2.96)	2.96	0.73	0.51	4.18	4.70	2.25	2.11	1.07	4.20	(32.42)
Flagstaff.....	Coconino	6907	1926	0.23	1.19	2.54	3.18	0.77	0.11	1.98	1.29	1.26	0.14	1.06	2.83	16.58
			1927	0.82	4.44	1.34	0.87	0.39	1.19	2.39	4.43	4.62	1.05	0.44	1.85	23.83
			1928	1.11	1.90	0.40	0.35	0.62	0.05	2.30	1.82	0.17	2.69	1.82	1.65	14.88
			1929	1.76	1.20	1.10	1.65	0.38	T	5.43	3.03	0.74	0.14	0.08	0.01	15.52
			Normal	2.82	2.30	2.58	1.23	1.16	0.41	3.17	2.76	1.43	1.42	1.46	2.06	22.80
Fort Valley.....	Coconino	7300	1926	0.14	1.58	2.58	4.09	1.93	0.60	2.00	1.39	1.14	0.59	1.02	3.36	20.42
			1927	1.22	6.22	1.66	1.38	0.90	1.87	2.01	3.75	4.71	1.27	0.67	2.15	27.81
			1928	1.07	1.94	0.80	0.58	1.12	0.10	1.95	5.78	0.44	3.07	2.28	2.02	21.15
			1929	3.24	2.50	2.14	0.97	0.84	T	4.89	7.24	1.88	0.40	0.03	0.01	24.13
			Normal	2.08	2.13	2.33	1.51	0.87	0.60	3.36	2.68	2.11	1.76	1.22	2.15	22.80
Holbrook.....	Navajo	5069	1926	0.27	0.36	1.99	1.23	0.37	0.03	0.26	1.25	1.97	0.17	0.22	1.11	9.23
			1927	0.04	0.69	0.68	0.09	0.00	3.34	1.58	2.34	2.34	0.02	0.59	0.42	12.13
			1928	0.06	0.95	0.12	0.57	0.29	0.00	0.65	0.47	1.33	1.11	0.94	0.41	6.90
			1929	0.41	0.54	0.10	0.36	0.26	T	3.79	1.97	0.65	0.36	0.14	0.02	8.60
			Normal	0.66	0.62	0.64	0.55	0.26	0.43	1.83	1.44	0.96	0.70	0.70	0.64	9.43

MONTHLY AND ANNUAL PRECIPITATION AT U. S. WEATHER BUREAU STATION IN THE VICINITY OF AREAS  
GRAZED BY SHEEP, 1926-1929 INCLUSIVE.

Station	County	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Annual	
Kingman .....	Mojave	3326	1926	0.50	0.10	0.81	1.97	0.00	0.00	1.02	0.11	0.00	0.20	3.69	8.40	
			1927	0.57	4.39	1.58	0.20	0.00	0.06	1.48	0.90	1.00	2.08	0.17	1.20	13.63
			1928	0.16	1.98	0.21	0.02	0.00	0.00	0.00	0.04	0.00	0.17	0.08	1.03	3.69
			1929	1.00	0.78	0.03	0.32	0.00	0.00	0.68	2.70	0.42	0.03	0.00	0.00	5.96
			Normal	1.39	1.46	1.24	0.67	0.39	0.18	1.12	1.41	0.89	0.74	0.75	1.26	11.50
Mesa .....	Maricopa	1245	1926	0.46	0.12	2.14	1.76	0.21	0.00	0.57	0.21	1.79	0.08	T	2.10	9.44
			1927	0.08	1.99	0.42	0.55	0.13	0.30	0.25	0.68	3.53	0.24	0.24	1.01	9.42
			1928	T	1.57	0.10	T	T	0.00	T	0.37	1.67	0.56	0.35	0.65	5.27
			1929	0.90	0.27	0.23	0.49	T	0.09	0.79	1.14	0.57	0.04	0.00	T	4.52
			Normal	0.99	0.86	0.89	0.44	0.12	0.13	1.17	1.14	0.76	0.50	0.80	1.11	8.91
Phoenix.....	Maricopa	1108	1926	1.00	0.10	1.63	3.36	0.18	T	1.31	0.11	3.52	0.07	0.01	2.68	13.97
			1926	0.01	1.06	0.24	0.35	0.17	0.13	0.24	0.69	0.83	0.57	0.14	1.30	5.73
			1927	T	1.33	0.13	T	0.03	0.00	0.11	1.47	0.44	1.51	0.16	1.01	6.19
			1929	0.92	0.28	0.13	0.43	0.01	T	0.79	2.09	0.19	0.09	0.11	T	5.04
			Normal	1.17	0.72	0.49	0.43	0.03	0.12	1.07	0.96	1.01	0.35	0.96	0.59	7.90
Prescott .....	Yavapai	5320	1926	0.87	0.56	1.93	6.90	0.58	0.24	3.32	2.34	1.26	0.48	0.90	4.80	24.18
			1927	1.33	10.59	1.88	1.08	0.22	0.61	2.48	6.10	4.87	1.13	1.00	2.68	33.97
			1928	0.79	2.34	0.70	0.31	0.43	0.00	0.48	1.53	0.93	2.05	1.57	2.65	13.78
			1929	1.81	1.74	1.58	1.06	0.10	0.00	2.61	4.14	2.66	0.05	0.13	0.00	15.88
			Normal	1.76	1.85	1.84	0.99	0.51	0.30	2.95	3.11	1.35	0.98	1.15	1.73	18.52

MONTHLY AND ANNUAL PRECIPITATION AT U. S. WEATHER BUREAU STATION IN THE VICINITY OF AREAS  
GRAZED BY SHEEP, 1926-1929 INCLUSIVE.

Station	County	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Annual	
Seligman.....	Yavapai	5219	1926	0.00	0.29	0.92	2.76	0.45	0.30	0.71	0.20	0.22	0.37	0.32	2.26	8.80
			1927	0.10	2.34	1.07	0.30	0.10	1.49	1.23	2.00	3.04	0.95	0.39	1.73	14.74
			1928	0.04	0.88	0.26	0.70	0.84	0.00	0.57	0.25	0.22	0.00	0.62	0.55	4.93
			1929	0.28	0.28	0.04	0.04	0.00	0.00	0.83	1.95	0.72	0.52	0.00	0.00	4.66
			Normal	0.84	0.95	1.20	0.52	0.14	0.30	2.30	2.06	1.10	0.91	0.79	1.17	12.28
Snowflake.....	Navajo	5644	1926	0.67	1.80	3.00	3.02	2.31	0.46	2.86	0.26	2.20	0.51	0.27	0.80	18.16
			1927	0.00	0.35	0.18	0.32	0.00	2.33	2.44	4.08	1.98	0.47	0.00	1.82	13.97
			1928	T	1.49	T	0.69	0.74	0.00	0.45	1.57	0.48	1.18	1.18	0.38	8.16
			1929	0.71	0.85	0.56	0.85	0.10	T	5.93	2.87	2.14	1.18	0.33	T	15.52
			Normal	0.70	0.83	0.87	0.70	0.44	0.66	2.34	2.45	1.31	0.91	0.54	0.74	12.49
Springerville.....	Apache	6862	1926	0.75	0.12	2.10	1.74	1.07	0.87	2.20	1.46	2.39	0.40	0.76	0.94	14.80
			1927	T	0.43	0.24	1.04	0.20	1.62	2.97	8.83	1.51	T	0.00	0.73	12.57
			1928	T	1.10	0.29	1.00	2.13	0.00	1.47	2.00	.....	0.43	1.19	0.50	.....
			1929	0.33	0.70	0.25	0.45	0.69	0.00	4.54	5.80	1.63	1.09	1.06	0.02	16.56
			Normal	0.50	0.51	0.51	0.46	0.33	0.66	3.24	2.81	1.41	0.75	0.52	0.72	(12.42)
Tonto Ranger Station	Yavapai	4732	1926	1.22	1.13	1.17	4.76	0.27	T	1.74	0.43	1.07	0.46	0.45	.....	.....
			1927	.....	.....	1.88	0.79	0.00	0.55	2.02	4.38	3.65	1.91	0.12	3.75	.....
			1928	1.10	1.81	0.00	.....	0.33	0.00	2.20	1.22	0.51	.....	0.38	.....	.....
			1929	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
			Normal	1.81	1.48	1.36	1.18	0.46	0.29	2.40	2.20	1.35	0.71	1.37	1.47	(16.08)



## SUMMARY

Figures in this bulletin should be taken to indicate results obtained under conditions and under the prices which prevailed only during the period 1927-1929 inclusive. Cost figures on Arizona sheep outfits have little meaning without consideration of the methods and practices under which they operate.

Based on conditions which existed during the period 1927, 1928, and 1929, an Arizona sheep outfit operating in the respective groups as discussed in this bulletin in order to pay 8 percent on its total capital investment and a customary managerial salary should have had the following:

	Early Lambing	February Lambing	May Lambing
Capital investment per head.....	\$15.00	\$17.00	\$25.00
Lamb crop percent.....	93	88	78
Value per lamb.....	\$10.60	\$ 8.64	\$ 8.00
Fleece weight, pounds.....	9	7.9	9
Price for wool per pound.....	\$ .33	\$ .33	\$ .33
Maximum loss and slaughter:			
Ewes (percent).....	8.8	9.5	9.8
Rams (percent).....	15.0	21.0	15.6
Lambs (percent).....	4.3	9.8	6.3
Maintenance and operation cost per head.	\$10.78	\$ 5.91	\$ 4.14
Cash receipts per head.....	\$13.41	\$ 7.85	\$ 6.68

It is shown by the figures that there did not exist a great difference in the profits among the groups, although there was found to be a wide difference in the expenses and receipts.

This report has dealt almost exclusively with the economic or business side of the sheep industry in Arizona. Included in the project were sub-projects on management practices, comparative range utilization, and quality of wool. Report on these other phases will be made under separate publications.