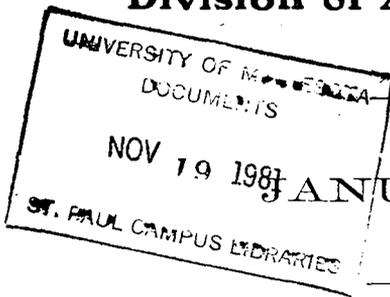


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Division of Animal Husbandry.



JANUARY, 1903.

EXPERIMENTS IN SHEEP HUSBANDRY.

1. CHANGING THE BREEDING HABIT IN SHEEP.
 2. PASTURING WETHERS WITH AND WITHOUT GRAIN.
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EXPERIMENTS IN SHEEP HUSBANDRY.

THOMAS SHAW.

This bulletin contains two experiments. The first of these relates to changing the breeding habit in sheep, and the second to pasturing wethers with and without grain.

SECTION No. 1.

CHANGING THE BREEDING HABIT IN SHEEP.

In some of the large cities of the East a considerable demand is springing up for, what is commonly termed, winter lambs, although the term hot-house lambs has also been applied. They are called winter lambs because they are put upon the market at that season, although not yet weaned. And they are called hot house lambs, because they are reared under what may be termed forcing conditions, and under conditions of protection more complete than those which usually apply to lambs. The latter term, however, is something of a misnomer, as, in growing them, the conditions as to temperature do not of necessity require to be much warmer than those suitable for other lambs. Winter lambs may be dropped at any time from October to the end of January or February, and they are usually ready for the market at the age of 60 to 90 days. At that age they should weigh from 50 to 60 pounds, if they and their dams have been properly fed.

Advantages in Growing Winter Lambs.—The advantage in growing such lambs lies, first, in the relatively high price which they bring at a season of the year when such meat is regarded as a delicacy; second, in the fact that the labor of growing them comes at a season when labor is not so valuable as at others seasons; third, in providing a source of revenue at a time when the labor does not ordinarily interfere with the work of the farm, and fourth, in making it easily possible to dispose of the dams at a good price because of the season at which they may be marketed. The price for such lambs usually runs from 10 cents upward per pound,

live weight, when they are marketed with promptness and in an intelligent way. As the ewes must be fed freely while suckling their lambs, they are in that condition as to flesh and the ability to take on flesh rapidly when the lambs usually are weaned, which, in a short time makes them ready for the block if it should be desired to dispose of them thus. At such a time the price is usually higher than at other seasons of the year.

The Industry is Comparatively New.—Not many years have elapsed since winter lambs began to be grown in this country. It is making rapid strides however, particularly in the Eastern and in some of the middle states. The demand for such meat, which is in a sense a luxury, comes from cities where wealth has accumulated. The cities of New York, Boston and Philadelphia are chief among these, but the demand is rapidly extending to the large cities of the Lake regions and to those of the Mississippi basin. It is fair to infer, therefore, that winter lamb will soon be a regularly appearing commodity in all the great cities of the United States.

Who Should Grow Winter Lambs.—Those only should attempt to grow winter lambs who are so located that they can ship them readily. They ought to be near a railroad station, and should be within easy reach of telegraph and telephone communication, in order to readily supply customers as they forward orders. They should also be so situated that they can grow and store a sufficient supply of field roots and other foods suitable for ewes and dams. And they should have ample shed room and divisions in their sheds to admit of feeding ewes and lambs in groups or lots, according to the special needs of each. Moreover, they should have one or more lambing pens, at least, reasonably warm.

Difficulties to be Overcome.—The chief difficulties to be overcome in the meantime in this Western country are, first, the scarcity of the materials from which such lambs can be bred, and second, the opening of suitable markets in the West. The first named difficulty arises from the fact that only two breeds have the property of dropping winter lambs at the season of the year desired. These are the Dorsets and

the Tunis. The latter are not numerous as yet in the United States, nor is the habit of producing such lambs so pronounced in them as in the Dorset. So few in numbers are the Tunis in the United States, that it would seem scarcely necessary to consider them a factor in the present discussion. The Dorsets have increased with great rapidity in this country, but in the pure form they are too dear for one to invest in Dorset females for the sole purpose of furnishing winter lambs for the block. Ewes that cost less money would seem to be a necessity to induce farmers to engage in this work. The hope of obtaining such material led to the experiment outlined in this bulletin. The other difficulty may be expected to adjust itself in time. With a supply of such a commodity properly furnished, the demand may be expected to come from cities not far distant.

Time Covered by the Experiment.—The experiment began in the summer of 1895 and it continued until the Autumn of 1901, thus covering a period of 6 years. But, as previously stated, it was not conducted with that orderly sequence that could have been desired. For instance, the number of the dams kept over from year to year was not always the same, nor was the proportion of the ewe lambs the same from year to year. It is impossible, therefore, to give the results of what could be regarded as a complete experiment. Nevertheless, the results obtained are from data sufficiently complete to furnish a reasonably safe basis on which to ground conclusions.

Objects of the Experiments.—The following were chief among the objects of the experiment: First—To ascertain whether the habit in common ewes of dropping lambs in the spring, could be so changed that they would drop them in the fall or early winter through successive matings with pure bred Dorset sires, accompanied by a close selection. Second—To learn, if possible, how many generations of breeding would be necessary before the habit became at all fixed in character. Third—To find out whether food played any important part in the change of the breeding habit, and if so, to glean information with reference to the same that would be turned to practical account. And fourth—To ascertain, whether, in the event of a change in the breeding habit hav-

ing been effected, it would not then be possible to mate the dams with sires of some of the other mutton breeds so as to improve mutton quality in the lambs. Among the minor objects were the following: First—To glean information with reference to the foods that could be used with the greatest advantage in feeding ewes and lambs under Minnesota conditions. And Second—To glean information with reference to marketing the lambs that could be turned to practical account. It should be stated here, however, that the congested condition of our sheep sheds during the major portion of the time, prevented us from carrying out the details of the experiment in that regular and exact way that would give the results, therefore, should be regarded as only close approximations to the truth.

Animals Used in the Experiment.—The ewes chosen for the experiment came from the flock of Mr. Hugh Paul, Dundee, Minn., and also from the ranges of Montana. In both instances they were simply common grade ewes of very mixed breeding. It would be impossible of course to be quite sure of all the blood elements in them, and of the proportions in which they preserved these. But, it would be safe to say, that in them was the blood of two or three of the dark faced breeds, more particularly the Shropshire and Oxford Down, also that of the Cotswolds or Lincolns, and of the American Merinos.

The presence of all these blood elements was not evidenced in each of the ewes individually, but the presence of some two or three or even more of them was evidenced in the make up of various individual females chosen for the work. Merino blood, as witnessed in the fleece, the wool on the head and the wrinkles in the skin, was the most pronouncedly in evidence. But two Dorset rams were used during the experiment. The first, Austin, No. 4554, lambed in December, 1893, was used during the first two years of the experiment. The second, Paso, No. 6700, lambed in 1896, was used during the remainder of the same. Both were good specimens of the breed, particularly the last mentioned.

General Plan of the Experiment.—The following plan was followed as closely as the circumstances would permit. The first summer the ewes were bred as soon as they would

mate. Subsequently, those of them that had produced lambs early were bred when practicable, while yet in the sheds, but subsequently to the disposal of their lambs. To hasten the time of mating, stimulating grain food such as barley and wheat, accompanied with a moderate supply of roots, was fed with some freedom to the ewes after they had been dried. In many instances, but not in all, ewes would mate within a short period after they had been fed thus. Subsequently to their being turned out on grazing, it was noticed that the ewes would not mate until a considerable period after leaving their winter quarters, and this, notwithstanding that the grain food was continued. This arose, probably, in part at least, from that reduction of the system which usually follows in a greater or less degree, when animals are turned into succulent grazing in the spring. In some instances, but not many, the ewes would mate too early in the season if allowed to do so. It was not considered desirable to have the lambs dropped before October 1st, as otherwise they become too large and heavy to take the market readily by the time that winter lambs are in demand. No attempt was made to breed them twice a year, as, under our conditions, there would seem to be no good reasons for thus taxing the powers of the ewes so severely, such breeding would be pretty certain to result in reduced stamina, and it would bring the second crop of lambs into the market at a time when the price of mutton is usually low.

In the winter the ewes were kept in sheds with small yards attached. Unless in extremely cold weather, both ewes and lambs had easy access to sheds and yards during the day. No attempt was made to keep the lambs any warmer than the other sheep of the flock, except from birth until they were a few days old. Both ewes and lambs were fed with much freedom until the latter were sold, but the ewe lambs to be retained for breeding were not as a rule pushed along so rapidly. Owing to local market conditions the lambs were not always marketed at the proper age. Some had reached too large a size and too old an age to command highest prices. In summer, the ewes and lambs retained for breeding were grazed on pastures other than

grass as shown below. The ewes that lambed late and also their lambs were discarded for breeding uses. The wether lambs not disposed of early, were usually fattened and sold the following winter.

Foods and Feeding.—Before dropping their lambs, the ewes were simply fed enough of such foods as were in season to keep them in a good condition of thrift. Afterwards they were fed lightly for a few days, but, from the time the lambs had reached the age of one week until they were sold, the ewes were fed most generously, and also the lambs from the time they would take food. The favorite grain food for the dams was oats and bran, in proportions about equal in measure. Of this they were given virtually what they would consume with a relish. Some corn was also added in nearly all instances, and some oilcake, less probably than 5 per cent of the latter. Good clover hay was the favorite fodder. Next to this was a mixture of peas and oats grown together, and third in order was corn. Some millet was fed, but it was not so keenly relished as the other fodders. Sometimes only one of these fodders could be fed at once. At other times two or three of them were fed. Field roots, usually mangels, but in some instances sugar beets and also carrots were fed with much freedom. In fact the ewes were given of these about all they would eat.

A creep was put in for the lambs as soon as they would take grain, which was usually about three weeks subsequently to the birth period. They were given bran and oats to begin with. Later, corn cracked and oilcake were added. The proportions of these foods were by bulk as follows:—Oats 3 parts, bran 3 and corn 1, and the oilcake was about 10 per cent or a little less than that of the whole mixture. They were given all that they would take of this mixture until they were sold. Roots were also given quite as freely as the grain, choice fodder was also given to the lambs until they became able to help themselves to fodder along with the ewes. The fodder was fed uncut. The grain was fed unground, except the corn, which was cracked for the lambs, and the roots were sliced for both ewes and lambs. Salt and water were accessible at all times, and much care was exercised in keeping the pens nicely bedded.

Ewes and Progeny.—Table I gives the ear No. of the respective ewes used in the experiment; the number of the cross or grade of each; the lambs produced by them, and the respective date at which the lambs were produced.

TABLE I.—Ewes, Progeny and Date of Birth of Progeny.

EWE		LAMBING. Winter '96-97.			LAMBING. Winter '97-98.			LAMBING. Winter '98-99.			LAMBING. Winter '99-'00.			LAMBING. Winter '00-'01.		
No.	Cross	Month	Day	No. & Sex	Month	Day	No. & Sex	Month	Day	No. & Sex	Month	Day	No. & Sex	Month	Day	No. & Sex
65	1st	Jan.	20	1 Ram	Jan.	8	1 Ewe	Dec.	24	1 Ewe	Feb.	4	1 Ewe 1 Ram			
271	1st	Nov.	26	1 Ewe	Oct.	30	Aborted	Oct.	8	1 Ram	Sept.	6	1 Ram 1 Ewe	Feb.	20	2 Ewes
66	1st	Feb.	4	1 Ram 1 Ewe	Jan.	24	1 Ewe 1 Ram	Jan.	2	1 Ewe 1 Ram	Oct.	27	1 Ewe 1 Ram	Oct.	14	1 Ram
61	1st	Feb.	27	1 Ewe	Feb.	13	1 Ewe 1 Ram	Dec.	29	1 Ram	Jan.	7	1 Ram 2 Ewes	Dec.	27	2 Rams
59	1st	Mar.	6	2 Ewes	Feb.	9	1 Ewe 1 Ram	Jan.	10	Died Lamb'g						
64	1st	Feb.	21	1 Ram	Feb.	16	1 Ram Ruptured									
268	1st	Jan.	30	1 Ram			Killed									
269	1st	Feb.	25	1 Ram												
272	2d				Dec.	20	1 Ewe 1 Ram	Jan.	5	1 Ewe 1 Ram	Dec.	28	1 Ewe 1 Ram	Jan.	14	2 Rams
273	2d				Oct.	12	1 Ewe 1 Ram	Jan.	14	2 Rams	Oct.	25	1 Ewe 1 Ram	Oct.	12	2 Rams
275	2d				Dec.	30	1 Ewe									
317	2d				Jan.	19	1 Ram									
270	1st				Jan.	23	1 Ram	Dec.	24	2 Ewes	Jan.	23	2 Ewes			
274	2d				Jan.	25	1 Ram	Jan.	19	1 Ewe	Jan.	19	2 Ewes			
219	2d				Jan.	31	1 Ewe 1 Ram	Dec.	31	1 Ewe 1 Ram	Oct.	27	1 Ewe 1 Ram	Oct.	6	1 Ewe
211	2d				Jan.	31	2 Ewes									
255	2d				Feb.	5	2 Rams	Jan.	31	2 Ewes	Jan.	16	1 Ram	Dec.	21	1 Ewe
79	1st				Feb.	12	1 Ewe 1 Ram	Jan.	16	1 Ewe	Feb.	4	1 Ewe 1 Ram	Feb.	17	1 Ram
310	3rd							Oct.	9	1 Ewe	Sept.	1	1 Ewe	Jan.	11	1 Ewe
302	3rd										Feb.	22	2 Ewes			
313	2d							Jan.	2	1 Ewe	F A T T E N E D					
298	2d							Jan.	14	1 Ewe				Mar.	6	1 Ram
312	2d							Jan.	14	1 Ewe	Jan.	24	2 Ewes	Jan.	23	1 Ram
315	3rd							Jan.	2	1 Ram	F A T T E N E D					
300	3rd							Jan.	7	1 Ewe						
267	1st							Jan.	24	1 Ewe	Jan.	13	1 Ram	Jan.	15	1 Ram
								Feb.	4	1 Ewe 1 Ram	Jan.	22	2 Ewes	Jan.	15	2 Rams
299	1st										Jan.	23	1 Ram	Jan.	29	1 Ram

EWES AND THEIR PROGENY.

It will be observed that, of the 27 ewes in the experiment but 12 were of the first cross, 11 of the second and but 3 of the third. The number of the third cross ewes would have been greater, but for the fact, that several of them kept over were devoted to other lines of breeding. In fact, the entire experiment was in a sense a side issue, as some of the animals of these respective crosses, not in the experiment proper, were from time to time used in other lines of experimenting. But those retained for the experiment were fairly representative.

Lambs Born in Certain Months.—Table II gives the dates at which lambs were born in certain months from ewes of the respective crosses.

TABLE II.—Months in which Lambs were Born.

CROSS	LAMBING. Winter '96-'97		LAMBING. Winter '97-'98		LAMBING. Winter '98-'99		LAMBING. Winter '99-'00		LAMBING. Winter '00-'01	
	Month	No.								
1st	Nov.	1	Oct.	1	Oct.	1	Sept.	1	Oct.	1
	Jan.	2	Jan.	3	Dec.	2	Oct.	1	Dec.	1
	Feb.	4	Feb.	4	Jan.	2	Jan.	4	Feb.	2
	Mar.	1	Dec.	1			Feb.	2	Jan.	2
2d			Oct.	1	Dec.	2	Oct.	2	Oct.	1
			Dec.	2	Jan.	6	Dec.	1	Jan.	1
			Jan.	5			Jan.	4	Dec.	1
			Feb.	1					Mar.	1
3rd					Oct.	1	Sept.	1	Jan.	2
					Jan.	3	Jan.	1		
							Feb.	1		

The advance in the average period of earliness at which the lambs were dropped by the ewes of the second and third crosses, is not what should be looked for, but it is partly explained by the fact, that none of the ewes of any cross would mate for some time subsequently to the period when grazing began. This explains why scarcely any lambs were dropped during the month of November. More October lambs could have been obtained, had they been desired, from ewes of the

second and third crosses. Had the ewes been turned out on rich blue grass pastures, it may be that the results would have been different.

Disposal of the Lambs.—No attempt was made to sell the lambs in a special market for the same. The chief object of the experiment was to ascertain if they could be grown beginning with ewes of common and mixed blood. The numbers on hand were too limited to justify the attempt to establish a permanent market for such lambs in the Twin Cities, hence they were disposed of variously, and usually too late in the season to bring highest market prices.

In 1897 one ewe lamb was sold April 8th, to E. M. Prouty & Co., of South St. Paul. The age was 134 days, the weight 69 pounds, and the price paid was 16 cents per pound live weight, amounting to \$11.04. The other ewe lambs were kept for breeding, and the lambs were fed under experiment the following winter.

In 1898, four lambs were sold to F. W. Luly, St. Paul, on April 6th. The average weight shrunk was $63\frac{3}{4}$ pounds. The price paid was 10 cents per pound, live weight, amounting to \$6.37 on an average per lamb. The ewe lambs were kept for breeding and the other wether lambs were fed for experiment the following winter.

In 1899, six lambs were sold on March 31st, to J. H. McCormick, St. Paul. The average weight was $55\frac{1}{3}$ pounds. The price paid was 10 cent per pound, live weight, amounting to \$5.53 per lamb, on an average. The ewe lambs and the remaining wether lambs were used as stated the previous year.

In 1900, seven lambs were sent to Chicago, along with fat lambs of the previous year. Of these, five weighed on an average $70\frac{1}{2}$ pounds, and brought 11 cents per pound, thus averaging \$7.75 per lamb. The other two average 115 pounds, and being over-heavy sold for 9 cents per pound, thus averaging \$10.35 per lamb. The other lambs of the same grade were used as in the previous year.

In 1901, eight lambs were delivered on May 16th, to Haas Bros., St. Paul. On May 30th, eighteen lambs were delivered to the same firm. The first averaged 45 pounds and the second lot 75 pounds. The price paid was \$3.60 on

an average per lamb for the first lot, and \$6.00 on an average for the second. The other lambs were used similarly to those kept in preceding years. In the meantime the process of eliminating the ewes that were least suitable for retaining went on from year to year.

Progeny of the Southdown Cross.—In the summer of 1900, several of the Dorset ewes were mated with a Southdown ram. The object was to get lambs that could be shown at the International Fair to be held in Chicago in December of the following year. From the progeny thus begotten seven lambs were selected to be fitted for the said show. Five of these were shown in the class for fat grade lambs and open to the world. They won first honors as best pen of five, and also for best single grade lamb in the exhibit. In the contest for best fat lambs, open to all the Agricultural Colleges on the Continent, they won first, second and third prizes. Four of the number were then slaughtered and shown in the dead meat class with the result that they won first and third prizes, competing against the world. They also formed part of the exhibit from the Minnesota Experiment Station, which won first prize for the best exhibit of the show in the dead class.

The mutton form of the grade lambs of this cross was superior to that of lambs from the pure Dorset sires and they were also more easily kept in a good condition of flesh.

CONCLUSIONS.

The following are the more important of the conclusions based upon the results from the above experiment:

1. That the breeding habit in ewes which usually drop lambs in the spring may be so changed that they will produce them in the fall and early winter.

2. That this change can be effected sufficiently for practical uses in from two to three generations of judicious crossing when accompanied by a judicious selection.

3. That it may be effected thus quickly by choosing very common ewes of mixed breeding, and mating them with pure bred Dorset rams, always reserving the earlier dropped lambs for breeding uses.

4. That in the transforming process, the dams which have suckled winter lambs may usually be bred more readily

before being turned out on grass than subsequently, and especially when fed a stimulating grain portion while yet in the sheds.

5. That when the change sought has been thus effected in the dams, a superior quality in the lambs may be obtained by using rams in service of certain of the dark-faced types and more especially of the Southdown and Shropshire breeds.

6. That such foods as clover hay, and corn fodder, bran, oats, barley, corn and oilcake, also fields roots prove very satisfactory under Minnesota conditions for the production of such mutton in winter.

7. That in the markets of the West the demand for such lambs is not yet so good relatively as in certain markets further East.

SECTION No. 2.

PASTURING WETHERS WITH AND WITHOUT GRAIN.

The keeping of sheep chiefly on pastures sown for them is of but recent introduction in America. As far as known to the writer it was first practiced at the Minnesota University Experiment Station in 1895. Since that time the principle involved has become incorporated more or less into the practice of many of the flockmasters of the country. It has been found that even the partial practice of such a system promises to revolutionize the methods of keeping sheep in the United States. The following are chief among the benefits flowing from it: First—It enables the flockmaster to maintain a much larger number of animals than he could otherwise. Second—It makes it possible for him to give them more or less of succulent pasture from spring until fall, which is favorable to their development. Third—It makes it possible for him to destroy nearly all forms of weed life, and cheaper and more effectively than it can be done in any other way, and Fourth—It enables him to fertilize his land so that it shall be in a good condition to grow other crops, particularly grain crops without anyother fertilizing.

While experimenting thus in growing pastures, the thought came up in the mind of the writer as to whether it would pay to add grain to the pasture, especially when the

object was to fatten the sheep while being thus grazed. Some experimenting had been done in that line in Ontario when conducting the Agricultural department of that Station, but it related to feeding grain on fall rather than on summer pastures. This experiment was undertaken for the purpose of throwing light upon this question, and it is the only one of the kind up to the date of the experiment which the writer can recall.

Plan of the Experiment.—The plan in a general way included the securing of two lots of wethers and pasturing them until they should be in condition for the block. They were to be put on grazing as soon as it should become plentiful. The grazing was to consist of crops sown for this purpose other than grass, and in a succession such as would provide food for them in a seasonable condition. This means grazing which would be eaten by the animals when in that condition which would cause them to eat it with a relish, and when it would be sufficiently plentiful to satisfy their appetites. One lot was to be given one-half pound each per day of oats during the experiment proper. The other lot was to have no grain supplement. When the experiment proper ceased it was proposed to pasture them for some time subsequently, that their behavior at such a time might be noted and studied.

The Time Covered by the Experiment.—The experiment proper began May 2nd, 1899, and extended to August 21st following. It was divided into four periods of 28 days each, and therefore covered in all 112 days. But the subsequent behavior of the sheep was noted until about the close of the grazing season.

The Object of the Experiment.—Chief among the objects of the experiment were to ascertain: First—The relative increase made by sheep on spring and summer grazing with and without a small grain supplement. Second—The relative return, if any, obtained from feeding the grain. Third—The relative condition of the animals as to flesh at the close of the experiment proper, and Fourth—The behavior of the two lots while on grazing during the remainder of the grazing season.

The Animals Chosen.—The animals chosen were wethers.

They were purchased at the the New Brighton Stock Yards, from Mr. Kenneth McLean, of Miles City, Montana. They were purchased in the Autumn of 1898, were brought to the Station and wintered on moderate fare. They were not given much grain during the winter season. They were in a fair condition as to thrift when the experiment began. They were lambs reared on the range. They were possessed of a Merino foundation, and had more or less of Down blood, as indicated in the more or less of dark shading of the face and legs. They were what may be termed a fairly good type of range wethers.

The Pastures Grazed.—The following were the pastures grazed and the respective dates of grazing them:

Winter Rye.....	May 2nd to May 29th
Peas and Oats.....	May 29th to June 26th
Barley and Oats.....	June 27th to July 5th
Rape and Kale.....	July 6th to Aug. 13th
Rape.....	Aug. 13th to Aug. 17th
Peas and Oats.....	Aug. 17th to Aug. 26th

Winter rye was first in season. It, of course, had been sown in the fall, and the wethers were turned on it to graze almost as soon as it had become plentiful. The peas and oats and barley and oats were sown early in the spring. All the grains were sown at the rate of about 2½ bushels per acre. The rape and Kale were sown broadcast, reasonably early in the season, and at the rate of 5 pounds of the seed per acre. The peas and oats last mentioned were of second growth.

Management of the Wethers.—The wethers were turned in to graze on the same kinds of food morning and afternoon. They were given the shelter of the sheep shed during the heat of the day. But they were not given darkened apartments in the shed, which would doubtless have been to their advantage in the time of flies. They also lay in the yards of the shed at night. Both lots had free access to water in the sheds and also to salt. The wethers comprised two lots with ten animals in each lot. One of these designated lot 1 were not given any grain during the experiment. The other lot were given one-half pound each of a supplement of oats daily, during the continuance of the experiment. The wethers were weighed at the end of each period.

Weights of the Wethers.—Table III gives the aggregate

weights of the wethers in each lot when the experiment began and ended, the total increase made, and the averages of these.

TABLE III.—Weights and Increase.

WEIGHTS WHEN EXPERIMENT.				
LOT		Began May 2nd.	Closed Aug. 21st	INCREASE
1	Total	805.0	973.0	168.0
	Average	80.5	97.3	16.8
2	Total	809.0	1078.0	269.0
	Average	80.9	107.8	26.9

The increase made was not very large by the wethers of either lot, but it was very much better in the case of the wethers to which grain was fed. Those in lot one made a gain of only 16.6 pounds each, or at the rate of but 4.5 pounds per month of 30 days. Those in lot two made a gain of 26.9 pounds, or 7.2 pounds per month. These gains were, however, all that could be reasonably looked for at that season of the year, especially under the conditions. In hot weather and when flies are plentiful, sheep will not make the gains that they do in the fall.

Table IV, gives the increase made by the wethers of each lot during each period of the experiment, and the averages of such increase.

TABLE IV.—Increase by Periods.

GAINS BY PERIODS.						
LOT		First	Second	Third	Fourth	Total
	May 2—May 29—June 26—July 24—Aug. 21.					
1	Total	24.0	26.0	23.0	95.0	168.0
	Average	2.4	2.6	2.3	9.5	16.8
2	Total	71.0	54.0	33.0	111.0	269.0
	Average	7.1	5.4	3.3	11.1	26.9

It will be noticed that during the first period while the wethers were pasturing on rye, those in lot two made practically three times the increase made by the wethers in lot one. This is what should be looked for under such conditions. During the second period, when the pasture was chiefly peas and oats, the lambs in lot two gained more than twice as much as the lambs in lot one. During the third period, neither lot made the increase that was to be expected. It may be accounted for in part, by the less advanced condition of the rape as compared with the same during the following period, in part by the nature of the wethers, and possibly in part by the variations in the weights of animals which are known to occur from day to day. The gains made during the fourth period were excellent in the wethers of both lots.

After the close of the experiment proper the wethers in lot one were also given a grain portion of $\frac{1}{2}$ pound each of oats per day and the same grain supplement was continued with the wethers in lot two. The grazing was also continued until Nov. 6th, that is to say, it was made to cover 77 days, or two periods of 28 days each and a third period of 21 days. From Sept. 14th to Oct. 18th the pasture was cabbage, and from Oct. 18th to Nov. 6th it was rape.

Table V shows the increase made by the lambs of both lots during the experiment proper, and also during the subsequent grazing.

TABLE V.—Gains by Periods During the Entire Experiment.

GAINS BY PERIODS.									
LOT		1st	2d	3rd	4th	5th	6th	7th	Total
		May 2—May 29—June 26—July 24—Aug. 21—Sept. 18—Oct. 16—Nov. 6.							
1	Total	24.0	26.0	23.0	95.0	6.0	89.0	17.0	280.0
	Average	2.4	2.6	2.3	9.5	.6	8.9	1.7	28.0
2	Total	71.0	54.0	33.0	111.0	2.0	60.0	20.0	341.0
	Average	7.1	5.4	3.3	11.1	.2	5.0	2.0	34.1

It will be noticed, first, that the relative increase was reversed during the after experiment, that is, during the subsequent period of grazing. In the 112 days of the experiment proper the wethers in lot two made an aggregate increase of 269 pounds or 7.2 pounds per month of 30 days and the wethers in lot one made an aggregate increase of 168 pounds or but 4.5 pounds per month. In other words the wethers in lot two gained 60 per cent more than the wethers in lot one. In the 77 days of the continuance of the after experiment the wethers in lot one made a gain of 112 pounds or 4.4 pounds per month of 30 days. While the wethers in lot two gained but 72 pounds or 2.8 pounds per month. In other words the wethers in lot one increased 50 per cent more than the wethers in lot two. Second, the increase during the fifth period of very hot weather is so slight as to be scarcely worth mentioning, and third, the increase during the last period was also small, owing to the fact probably that the wethers had reached that point when rapid gains could not be incurred without feeding grain heavily.

Cost of Increase.—The cost of increase cannot be accurately ascertained owing to the difficulty of properly valuing the pasture consumed, but the result from feeding grain to the lambs in lot two can be ascertained at least approximately. During the experiment proper, the wethers in lot two consumed 560 pounds of oats which at 21 cents per bushel, the market value at the time, amounts to \$3.69. As they gained 101 pounds more than the wethers in lot one, the cost of making 101 pounds extra of increase was \$3.63, and this cost would probably be still further reduced by some saving effected in the consumption of pasture, because of the grain fed. This, however, could not be certainly ascertained, as under the circumstances there was no means of determining the relative amount of pasture consumed by the wethers of either lot. Since, however, the cost of the extra increase made by the wethers in lot two was less than the market value of the same at the time, and since the wethers in this lot were in a better condition for marketing at the close of the experiment proper than those of lot one.

It is very evident that the small grain supplement fed was a paying investment.

CONCLUSIONS.

The following are chief among the conclusions that may be shown from the experiment:

1. That in this experiment, during the 112 days of its continuance, the wethers in lot two which were given a grain ration of $\frac{1}{2}$ pound oats each per day, gained 60 per cent more than the lambs in lot one which were given no grain.

2. That, during the experiment proper the extra increase made by the wethers was worth more than the cost of the grain used in making it.

3. That the wethers in lot two were in a better condition of flesh at the close of the experiment proper than those of lot one, and consequently if marketed at that time would have sold for a better price.

4. That since the wethers in lot two gained 60 per cent more than those in lot one during the 112 days of the experiment proper, and since the wethers in lot one gained 55 per cent more than those in lot two during the 77 days of the after experiment, the conclusion would seem to be legitimate that the power of a grain supplement such as that used in the experiment to produce increase lessons after it has been fed for several months.

5. That feeding a small grain supplement of oats to wethers that are being grazed is profitable for a period of several months after which it becomes less profitable, if indeed, profitable to any extent.