

THESIS

ON FACTORS COMMONLY ASSOCIATED WITH
COUNTY EXTENSION AGENT EXPENSES
IN
COLORADO

Submitted by

Fred C. Jans

In partial fulfillment of the requirements
for the Degree of Master of Science
Colorado State College of Agriculture
and Mechanic Arts

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I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY
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L. A. Moorhouse
In Charge of Thesis

APPROVED _____
Head of Department

Recommendation concurred in
COMMITTEE ON GRADUATE WORK COMMITTEE ON FINAL EXAMINATION
~~Committee on Final Examination~~ ~~Committee on Graduate Work~~

W. C. Dwyer
Alvin T. Hager
Geo. T. Amey

L. A. Moorhouse
D. W. Robertson
James E. Foster

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INTRODUCTION

Agricultural extension work in Colorado is governed by Federal and State regulations. Appropriations to Colorado are made through the United States Department of Agriculture by Congress and by the Colorado State Legislature. State and Federal funds are used in payment of all or a major part of salaries of county extension agents. Individual counties pay expenses of the county office and travel expense and subsistence of the worker while away from headquarters.

In connection with the administrative work in Agriculture and Home Economics extension, it frequently becomes necessary to meet with the boards of county commissioners and agree upon the appropriations for county extension agent expenses. One of the chief problems is to arrive at an adequate amount for the conditions to be met in a particular county. The question is often asked as to whether or not relationships exist between expense allowances and such factors as county areas, population, crop values and livestock values.

There has been no answer to such questions, expense allowances being determined from the opinions of state extension officers and the willingness of the county commissioners to contribute the desired amounts. In view of these facts, data were collected and analysed with the purpose of showing what relationships exist between commonly associated factors and expenses, and eventually, of arriving at some equitable appropriation of funds based on definite relationships rather than an opinion. Determining relationships which now exist will aid in future studies also. The data used in the study were available from the audited expense accounts of county ex-

tension agents sent to the state extension office for audit and approval.

There has been no research in extension service procedure in Colorado to date. In correspondence with Mr. M. C. Wilson, In Charge, Extension Studies, Extension Service, United States Department of Agriculture, the information was received that no studies had been printed which involved the relationships covered by the present study. However, McNelly (1) made a farm visit study on the work of Minnesota county extension agents which has not been published. This study included the number of farm visits per agent, the number of farms visited, the number of meetings attended and the number of miles traveled per agent. The following is quoted from the report:

"Farm visits per county varied from 1228 to 1248.

The average miles traveled per farm visit and meeting varied from four miles to 52.4 miles.

One agent traveled 5,800 miles at a cost of \$460 to make 800 farm visits and meetings. Another agent, in a county comparable in size and population, traveled 13,400 miles at a cost of \$1,340 to make 410 farm visits and meetings.

The study also suggests that the cost of farm visits may be greatly reduced both in time and mileage."

McNelly (1) states, "A check was made on the miles traveled and number of farm visits and meetings held in the 13 counties in which a study was made for the preceeding year. This shows that during the year the study was made, the agents traveled on an average 1,213 less miles but made 43 more farm visits or meetings per county, indicating that a study of the problem by the agents has to some extent improved their efficiency." And again, "The study also suggests that the costs of farm visits may be greatly reduced, both in time and mileage. This can be done by better planning and organiza-

tion of the work, and through more systematic time utilisation in increasing the contacts per trip, thus reducing the distance traveled per contact." The complete summary from which the above is taken may be found in the appendix.

It is not possible to use the data and findings of this study for all future procedure relating to county extension agent expenses. The purpose has been simply to study relationships of commonly associated factors, draw certain conclusions as warranted by the data and make recommendations if desirable on the strength of these findings and previous experience. It is hoped that this study will direct attention to the lack of research activity in extension procedure in Colorado.

MATERIALS AND METHODS

Duplicate copies of county extension agents' expenses as audited by the state extension office were used in the study. Data from 17 Colorado counties were used. The counties were: Adams, Arapahoe, Boulder, Costilla, Delta, Garfield, Kiowa, Larimer, Las Animas, Mesa, Moffat, Montrose, Routt, Rio Grande, San Miguel, Sedgwick and Weld. The data used were taken over the period from January 1, 1930, to December 31, 1934, inclusive. In three counties, one month's record was missing due to the absence of the agent for that month. This record was arbitrarily inserted by giving such a value to the missing month as the four similarly named months bore to the total of the other four years. Thus, if July were missing, and the other four similar months showed an average of 18.2 percent of the year's total, such a figure as would be that percentage was inserted. Such insertions are plainly marked on the original data.

Crop and livestock values were supplied in correspondence from the office of Mr. H. L. Collins, Statistician, Bureau of Agricultural Economics, Customs House, Denver, Colorado (2). Area data were obtained from the Colorado yearbook issued by the Colorado Board of Immigration (3). Population data were secured from the 1930 Federal Census report of the Bureau of the Census, Department of Commerce as reported in the 1931 Colorado yearbook (4).

Total county agent expenses in each of the 17 counties were compared with the cost of travel as paid to the agents for each month of the five-year period. Total yearly expense for each county was compared in turn with county area, population, crop values and live-

stock value for each of the five years. Total yearly travel expense for each county was compared with the county area for the same period of five years.

The 42 comparisons mentioned were made by the use of correlation coefficients. Determination of correlation coefficients was made by the use of the Harris Formula (5) for machine computation. The formula is as follows:

$$r_{xy} = \frac{\frac{\sum xy}{N} - (\bar{x} \cdot \bar{y})}{\sqrt{\frac{\sum x^2}{N} - (\bar{x})^2} \cdot \sqrt{\frac{\sum y^2}{N} - (\bar{y})^2}}$$

where x and y are the two variables being compared, \bar{x} and \bar{y} their respective means, N the number of paired values and r_{xy} the coefficient of correlation.

While over 40 counties in Colorado now have extension work, only 17 are included in the list having had extension work continuously for the five years, 1930-1934, inclusive. The sample represented by these 17 counties is fairly representative of conditions in Colorado. Five are typical Western Colorado counties. Two represent the Northwest. North Central Colorado is well represented by three counties and the Northeast section by another. Nearer the central part of the state are included two counties. The Plains section is represented by one typical plains county and another very largely of plains type. One county is included from the San Luis Valley.

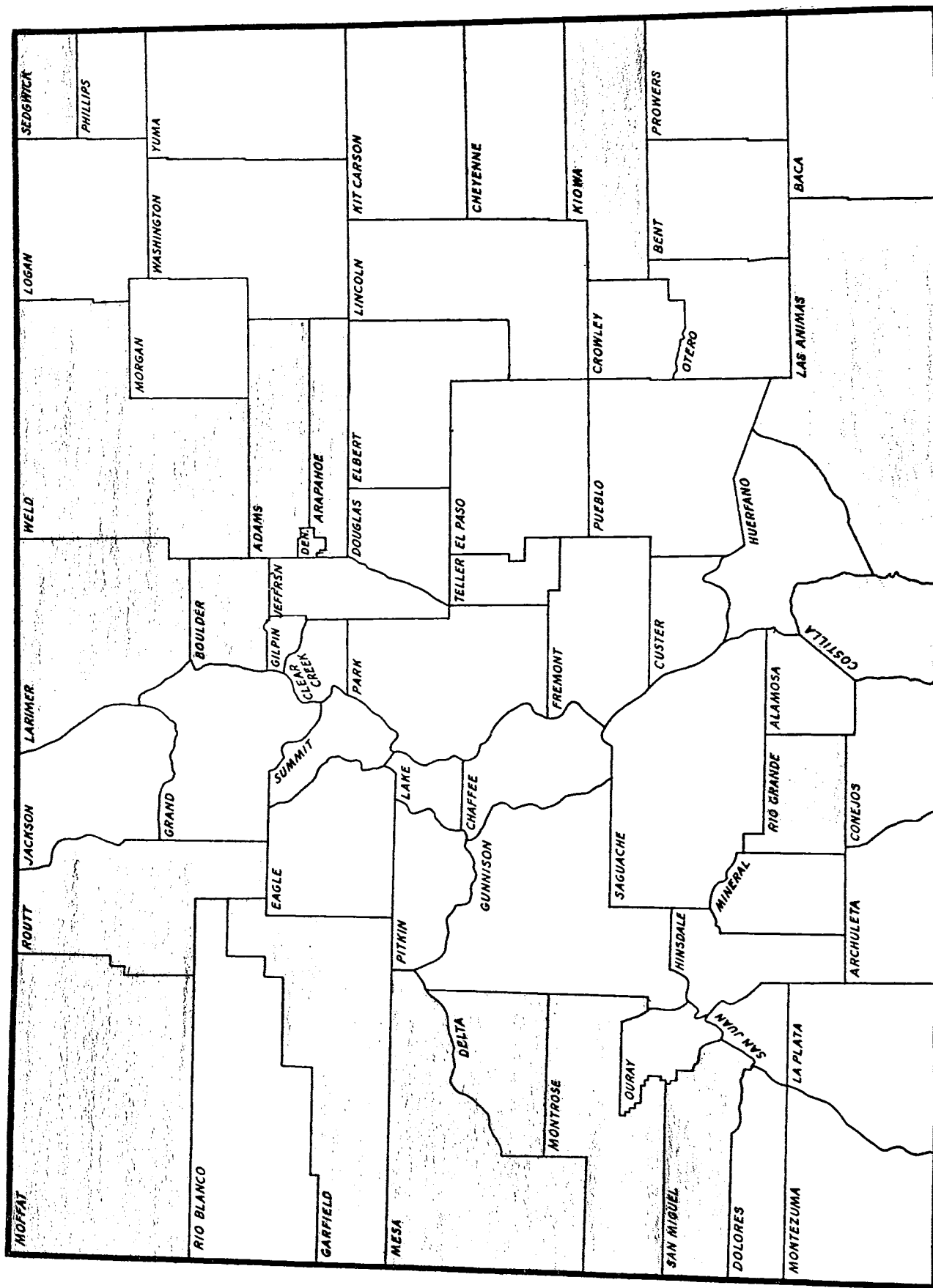
Of these 17 counties, eight are representative of irrigated conditions and three are very representative of dry farming. The remaining six counties have both dry and irrigated farming. Six of

the counties are quite small in area. Seven large counties are included and the other four are moderate in size. Figure 1 on page 7a shows the distribution of the seventeen counties.

To avoid the inclusion of voluminous data, representative data have been given in the appendix. The detailed computations and worksheets are on file in the state extension office. Copies of the audited monthly expense accounts upon which computations are based, are also on file in that office. As the cost of copying and including the detailed data was considered excessive, only representative samples are included in the appendix.

Figure 1. Showing the Seventeen Colorado Counties included in this Study.

COLORADO



DEFINITION OF TERMS

Degrees of Freedom. Leonard, Clark, and Robertson*, in their Field Plot Technic, Part II, state "In the computation of the estimate of any statistical constant for a population, the number of degrees of freedom available is the number of observations that compose the sample diminished by the number of statistical constants of the sample which are directly used in the computation. This is of little importance when a large sample is analyzed, but very important in small samples." "The reason the divisor is $(n' - 2)$ is that from the n' values of y two statistics have already been calculated which enter into the formula for Y , consequently the group of differences, $y - Y$, represent in reality only $n' - 2$ degrees of freedom.**" Thus, while a point of significance is used in testing correlation coefficients of data on the 17 counties in this study, which is $N - 2$ in all but three cases, in these three $N - 3$ is used because an arbitrary value was inserted as previously pointed out. This would reduce the number of degrees of freedom and require a higher value of r to be significant.

Significance. Fisher's 5% point was chosen for significance. In the case of a small sample, the correlation coefficient was calculated which would occur once in twenty tests of similar data due to chance. Therefore, if the correlation coefficient obtained was greater than the one calculated for 19:1 odds it means the possibility of its being due to chance would be less than once in twenty tests. Such a correlation coefficient would be considered significant.

* Leonard, Clark, Robertson, "Field Plot Technic," Part II, 1954.

** Fisher, "Statistical Methods for Research Workers", 1926, p. 117.

RESULTS OF THE STUDY

Total Expense and Travel Expense. The comparison of total expense and travel expense represents the most extensive part of the study. In this comparison, total expense for each month of the entire period of the study is listed with travel expense of the same months opposite. Squares of each variable are shown as well as products of the two variables.

It is evident that such listing and subsequent calculations involving the substitution in the formula would entail much expense and many tedious operations. Instead, data from one county are shown. Adams county, the first on the list, was taken for convenience. Table 1 gives the data from Adams county and illustrates how correlation formula values to be used in the Harris formula (5) for machine computation are obtained.

Table I. Comparison of Total Monthly Expense and Travel Expense for Adams County for the Years, 1930-1934, Inclusive.

Year	Month	Total Expense (X)	Travel Expense (Y)	X ²	Y ²	XY
1930	January	\$ 96.17	\$ 62.40	9248.369	3893.760	6001.008
	February	92.31	63.37	8774.936	4014.839	5457.808
	March	76.01	90.26	5777.520	3716.122	4633.570
	April	94.80	76.47	8987.040	5695.721	7154.556
	May	81.19	72.10	6591.616	5188.410	5853.799
	June	93.77	75.21	8792.613	5656.544	7052.442
	July	105.96	77.86	11227.522	6065.294	8252.165
	August	92.72	72.67	8596.998	5280.829	6757.962
	September	130.31	90.64	16980.696	8215.610	11611.298
	October	84.58	64.95	7153.776	4218.503	5493.471
	November	128.56	61.33	16527.674	3761.369	7884.585
	December	91.87	42.82	8440.097	1832.552	3933.873
1931	January	\$ 105.89	\$ 47.36	11212.392	2242.970	5014.950
	February	94.05	70.00	8845.403	4900.000	6583.500
	March	79.32	53.87	6291.662	2901.977	4272.968
	April	97.20	70.49	9447.840	4968.840	6851.828
	May	101.18	73.06	10237.392	5337.764	7392.211
	June	111.96	66.40	12535.042	4408.960	7454.144
	July	104.68	56.10	10957.902	3036.010	5767.368
	August	93.24	54.63	8693.398	2984.437	5093.701
	September	104.82	60.25	10987.232	3630.063	6315.405
	October	77.70	56.50	6037.290	3192.250	4390.050
	November	105.41	47.30	11111.288	2234.840	5038.588
	December	123.44	45.90	15237.434	2091.210	6036.216
1932	January	\$ 99.00	\$ 43.25	9801.000	1870.563	4281.750
	February	89.72	54.30	8049.376	2948.490	4371.796
	March	102.49	50.88	10504.200	2588.774	5214.891
	April	97.52	44.85	9510.150	2011.523	4373.772
	May	106.52	50.03	11346.510	2503.001	5329.196
	June	97.27	51.35	9461.453	2636.823	4994.815
	July	106.63	49.40	11369.957	2440.360	5287.522
	August	99.63	66.55	9926.137	4428.903	6650.377
	September	100.11	51.60	10022.012	2662.560	5165.876
	October	79.09	41.30	6253.228	1747.240	3305.962
	November	99.09	55.00	9818.828	3025.000	5449.950
	December	109.09	51.31	11900.628	2632.716	5597.408

(Continued)

Table 1. Comparison of Total Monthly Expense and Travel Expense for Adams County for the Years, 1933-1934, Inclusive. (Continued)

Year	Month	Total Expense (X)	Travel Expense (Y)	X ²	Y ²	XY
1933	January	\$ 95.24	\$ 48.93	9070.656	2493.005	4755.853
	February	90.52	46.33	8193.870	2135.789	4374.832
	March	95.79	61.65	9175.724	3800.723	5905.454
	April	87.74	44.36	7698.308	1967.810	3892.146
	May	87.81	62.23	7698.798	3872.573	6096.716
	June	119.42	63.16	14261.136	3991.712	7544.956
	July	73.72	39.06	5434.638	1525.694	2879.503
	August	128.20	88.47	16892.840	7826.941	11450.324
	September	99.07	37.39	9814.865	1393.012	3704.227
	October	91.16	58.86	8310.146	3405.880	5320.098
	November	102.07	29.79	10418.285	887.444	3040.685
	December	113.16	32.54	12805.186	1058.852	3632.226
1934	January	\$ 99.25	\$ 64.39	9850.563	4146.072	6390.708
	February	99.94	81.81	9988.004	6692.876	8173.091
	March	91.87	39.42	8440.097	1553.936	3621.515
	April	107.62	71.15	11582.064	5062.323	7657.183
	May	71.24	50.53	5075.136	2553.281	3589.757
	June	100.22	65.16	10044.048	4245.826	6550.335
	July	121.53	75.42	14769.541	5688.178	9165.793
	August	71.49	42.75	5110.820	1827.563	3056.198
	September	101.80	59.35	10363.240	3522.423	6041.830
	October	41.04	41.04	1684.282	1684.282	1684.282
	November	157.68	52.69	24862.982	2776.236	8308.159
	December	136.09	41.17	18520.488	1694.989	5802.825

Totals \$5937.97 \$3437.95 606393.84 207748.33 343421.88

$$\bar{X} = 98.9661 \quad \bar{Y} = 57.2991$$

$$\frac{\sum X^2}{N} = 10108.5806 \quad \frac{\sum Y^2}{N} = 3462.4721 \quad \frac{\sum XY}{N} = 5723.6946$$

It will be seen that symbols are used which are those of the Harris Formula (5) given on a previous page. If the values from Table 1 are now substituted in the formula we have the following:

$$\begin{aligned}
 r_{xy} &= \frac{5723.6246 - 5360.6685}{\sqrt{10106.5806 - 2733.4104} \cdot \sqrt{3462.4721 - 8283.1868}} \\
 &= \frac{63.0261}{\sqrt{318.1502} \sqrt{179.2853}} \\
 &= \frac{63.0261}{(17.867) (13.395)} = \frac{63.0261}{238.3245} \\
 &= + 0.264
 \end{aligned}$$

For the purpose of comparison, values obtained from data of the other counties treated similarly are shown in Table 2. In the table, counties are arranged alphabetically rather than in the order of value of correlation coefficients secured. The table shows the values of mean total, mean travel expense, and correlation coefficient for each of the 17 counties. Determination of the r-values was made in the same way as in the case of Adams county data.

Table 2 shows a range in r-values from + 0.264 to + 0.889. Fisher (6) gives 0.258⁴ as the expected r-value due to chance showing odds of 19:1 when 60 comparisons are made (58 degrees of freedom). In three cases it will be noted that the expected r-values for odds of 19:1 is slightly higher. This is due to the use of N-5 instead of N-2 for degrees of freedom as it will be recalled that three arbitrary insertions of values were made in the data due to missing months.

The data in Table 2 indicate that the values of all correlation coefficients are significant, all of them showing odds greater than 19:1 that they are not due to chance. Adams and

Larimer counties represent the lowest values and Kiowa, Routt and Sedgwick the highest. Discussion of these data will be found in a later section of this thesis.

Table 2. Comparison of Monthly Total Expense and Monthly Travel Costs for Seventeen Colorado Counties for the Years 1930-1934, Inclusive

County	Mean Total Expense	Mean Travel Expense	Correlation Coefficient(r)	Expected r- [*] Value=(P 0.05)
Adams	\$98.9661	\$57.2991	+ 0.264	0.2546
Arapahoe	76.0838	49.6828	+ 0.786	0.2546
Boulder	88.4025	64.7815	+ 0.718	0.2546
Costilla	87.7922	60.2010	+ 0.561	0.2546
Delta	89.7653	53.6673	+ 0.499	0.2546
Garfield	98.3251	59.6993	+ 0.707	0.2546
Kiowa	77.2028	60.3550	+ 0.889	0.2546
Larimer	82.2501	53.9636	+ 0.382	0.2546
Las Animas	70.1855	53.5030	+ 0.647	0.2569
Mesa	85.9665	61.8691	+ 0.799	0.2569
Moffat	81.9446	60.3703	+ 0.581	0.2546
Montrose	94.6208	64.4700	+ 0.593	0.2546
Rio Grande	79.6545	48.2883	+ 0.729	0.2546
Routt	77.9780	55.2130	+ 0.821	0.2546
San Miguel	86.2610	64.4165	+ 0.667	0.2546
Sedgwick	65.0828	47.3390	+ 0.813	0.2569
Weld	86.4751	67.4170	+ 0.779	0.2546

*From Table V(A), Fisher (3)

Tables 4 to 8, inclusive, result from the treatment of indicated data in similar manner to that employed in developing Table 1. However, instead of having 60 comparisons by months, annual figures for each of the 17 counties were used such as annual total expense and annual travel expense. This resulted in 17 comparisons for each of the five years and consequently a smaller population.

Tables 4 to 8 are shown to give an idea of the data and resulting correlation coefficients. Only the means of the two factors being compared and the coefficients are shown. In order to present the method used, Table 3 is given in which one year of the

five is presented. The year 1930 was chosen for convenience and the factors are total annual expense and area of the 17 counties in the study. The other four years' data were similarly treated and Table 4 shows all five years' results of these comparisons.

Thus, Tables 4 to 8 are the result of five correlation determinations each, but show only the means of the two factors being considered for each of the five years and the resulting correlation coefficient for each year's comparisons.

Table 5. Showing Comparison of 1930 Total Annual Expense and Area for Seventeen Colorado Counties

County	Total (x)Expense	Area (y)	x^2	y^2	xy
Adams	1158.25	1262	1341543.063	1592644	1461711.5
Arapahoe	985.21	842	970638.744	708964	829548.8
Boulder	1241.84	764	1542168.586	583696	948765.8
Costilla	1135.81	1185	1290064.356	1404225	1345934.9
Delta	1053.48	1201	1109820.110	1442401	1265229.5
Garfield	1588.35	5107	1927515.723	2608249	8113603.5
Kiowa	994.04	1798	988115.522	3232804	1787233.9
Larimer	1200.00	2629	1440000.000	6911641	3154800.0
Las Animas	1000.02	4809	1000040.000	23126481	4809096.2
Mesa	1201.82	5163	1444371.312	2665569	6201556.7
Moffat	1014.58	4658	1029381.994	21696964	4725820.5
Montrose	1552.41	2284	1329012.608	5125896	3061856.2
Rio Grande	1189.31	898	1415847.838	806404	1068449.4
Routt	1118.19	2809	1250343.876	7891481	3158900.7
San Miguel	1118.10	1288	1250147.610	1658944	1440112.8
Sedgwick	990.38	581	980852.544	281961	575691.8
Weld	1133.47	4082	1284756.121	16662464	4608916.3
Totals	19325.74	36730	22210218.325	109738808	41881276.5

$$\bar{x}=116.8091 \quad \bar{y}=2160.5982 \quad \frac{\sum x^2}{N}=1306488.45 \quad \frac{\sum y^2}{N}=6455812.2 \quad \frac{\sum xy}{N}=2463604.5$$

Substituting in the formula, we have

$$r_{xy} = \frac{2463604.5 - 2458174.16}{\sqrt{1306488.45 - 1291332.46} \cdot \sqrt{6455812.2 - 6666141.56}} = +0.016$$

Total Expense and Area. Table 4 shows the relation between total annual expense and county areas for the 17 counties for the period of the study. Only the mean total annual expense and mean area with the correlation coefficients are shown. The expected r-value for odds of 19:1 is noticeably higher with the much smaller population used in this table. With only 15 degrees of freedom (N-2) Fisher (8) gives 0.4821 as a significant r-value for odds of 19:1.

It is evident from Table 4 that all the r-values are much too low to be significant. The range is from -0.222 to +0.227. These values were secured in the same manner as shown for Table 3. Table 4 shows the results of five operations. The first dealt with 1930 data; namely, a comparison of total annual expense of each of the 17 counties with its area. The second, third, fourth and fifth operations employed 1931, 1932, 1933 and 1934 data respectively.

Table 4. Comparison of Annual Total Expense and Area for Seventeen Colorado Counties for the Years 1930-1934, Inclusive

Year	Mean Total Expense	Mean Area Sq. Mi.	Correlation Coefficient	Expected r* Value (P=0.05)
1930	\$1136.3061	2160.5882	0.046	0.4821
1931	1100.2076	2160.5882	0.277	
1932	1065.4894	2160.5882	0.0799	
1933	814.9259	2160.5882	-0.222	
1934	919.5253	2160.5882	0.056	

*From Table V(A), Fisher (3)

Travel Expense and Area. The relation between annual travel expense and area was studied for the 17 counties for the period of 1930-1934, inclusive. Results of the calculations are shown in Table 5. The range in r-values is seen to be from +0.116 to +0.559

which latter figure is the only coefficient to show a significant value. With the expected r-value for odds of 19:1 being 0.4821 for 15 degrees of freedom, it is seen that even the value +0.559 is just above the point of significance. Table 5 is the result, first, of comparing 1930 travel expense for each county with its area to arrive at a value of r. In turn similar data for the other four years were treated to secure in all, coefficients of correlation representing relationships for each of the five years.

Table 5. Comparison of Annual Travel Expense and Area for Seventeen Colorado Counties for the Years 1930-1934, Inclusive

Year	Mean Travel Expense	Mean Area	Correlation Coefficient	Expected r-Value (P=0.05)
1930	\$829,4418	2160.5882	0.116	0.4821
1931	779,8759	2160.5882	0.386	
1932	757,0906	2160.5882	0.559	
1933	515,5948	2160.5882	0.248	
1934	604,7412	2160.5882	0.132	

*From Table V(A), Fisher (3)

Total Expense and Population. Table 6 shows the results of computing the correlation between total annual expense and population. All five correlation coefficients are very small, two being negative. The range is seen to be from -0.0057 to +0.255 and in no case exceeds the expected r-value due to chance of +0.4821 with 15 degrees of freedom.

Total expense for each county was compared with its population to secure a correlation coefficient. Each year's data was treated the same. Table 6 summarizes r-values and the two means for each year of the study for these two factors. In the table, mean

population reads 184.2352 which is the mean of all county populations for each year after such populations were reduced by moving the decimal point two places to the left. The relationship as shown by the table is not changed thereby.

Table 6. Comparison of Total Annual Expense and Population for Seventeen Colorado Counties for the Years 1930-1934, inclusive

Year	Mean Total Expense	Mean Population	Correlation Coefficient	Expected r-* Value (P=0.05)
1930	\$1136.8081	184.2352	0.140	0.4821
1931	1100.2076	184.2352	-0.0057	
1932	1065.4394	184.2352	0.111	
1933	814.9259	184.2352	-0.059	
1934	919.5253	184.2352	0.255	

*From Table V(A), Fisher (6).

Total Expense and Livestock Value. That no significant relationship exists between total annual expense and livestock value in these 17 counties over the period 1930-1934 is shown in Table 7. Here the range is from an r-value of -0.242 to one of +0.257 and still much below the expected r-value for odds of 19:1.

As with the three previous tables, each year's data were secured from a comparison of annual total or travel expense and area, or population. Table 7 shows the five years' group of means and r-values. Mean livestock values shown in the table are the means of all livestock values for 17 counties for each year after each such value was reduced by moving the decimal point three places to the left in order to deal with smaller numbers. Relationships shown by the r-values were not affected thereby.

Table 7. Comparison of Annual Total Expense and Livestock Value for Seventeen Colorado Counties for the Years 1930-1934, Inclusive

Year	Mean Total Expense	Mean Livestock Value	Correlation Coefficient	Expected r-Value (P=0.05)
1930	\$1156.8081	\$1226.2941	0.257	0.4821
1931	1100.2076	977.7882	0.207	
1932	1085.4395	671.3529	0.014	
1933	814.9259	577.9411	-0.242	
1934	919.5253	656.8235	0.048	

*From Table V(A), Fisher (6)

Total Expense and Crop Value. Table 8 differs little from Tables 4 to 7 in r-values secured, when comparing total annual expense with crop value. The lowest value occurred in 1931, being +0.001, while the range varies from -0.139 to +0.311 for the highest coefficient. In no case is the coefficient value significant.

Table 8 shows the mean total expense for each of the five years of the study, and the mean crop value for corresponding years. The correlation coefficients given in the table were obtained from comparisons between the total expense for 17 counties and the crop value for the same 17 counties for each of the five years studied. Mean crop values shown in Table 8 result from crop values of each of the 17 counties in the study for each year after such values were reduced by moving the decimal point to the left three places. This resulted in the use of smaller numbers but relationships shown by the correlation coefficients were not affected thereby.

Table 8. Comparison of Annual Total Expense and Crop Value for Seventeen Colorado Counties for the Years 1930-1934, Inclusive

Year	Mean Total Expense	Mean Crop Value	Correlation Coefficient	Expected r^* Value ($\alpha=0.05$)
1930	\$1136.8081	\$5199.5529	0.192	0.4821
1931	1100.2076	1798.5294	-0.139	
1932	1065.4394	1142.9411	0.811	
1933	814.9259	1871.4117	0.001	
1934	919.5255	1633.0000	0.170	

*From Table V(A), Fisher (6)

DISCUSSION

In the comparison of total and travel expense, it is evident that a wide range of correlation coefficient values exist. This is not due to the size of appropriation so much as to the nature of travel engaged in by the county agent, and the division of expenses between travel, office, demonstration and miscellaneous. The range of values in this study showed a correlation coefficient in the Adams county data of +0.264, and reached +0.889 in the case of Kiowa county data. With an expected r-value for odds of 19:1 of 0.254 with 58 degrees of freedom, it is evident that even in the case of Adams county a significant correlation exists between total expense and travel expense for the period studied.

Why Adams and Larimer counties show low correlations is best explained by sample monthly expense summaries from these two counties and from Routt and Kiowa counties which had coefficients of .621 and .889 respectively.

Table 9. Showing Expense Summaries for April, 1935 for Adams, Larimer, Routt and Kiowa Counties

	% of Adams Total		% of Larimer Total		% of Routt Total		% of Kiowa Total	
Travel	\$65.74	64.06	\$66.82	59.03	\$48.85	79.85	\$75.26	80.73
Office	33.34	32.48	44.77	39.56	7.22	12.31	9.29	10.24
Demonstrations								
Miscellaneous			1.00	.88				
Subsistence	1.45	3.46	.80	.53	4.80	7.84	8.20	9.05
Total expense	102.63	100.00	113.19	100.00	58.67	100.00	90.75	100.00

It is evident that in Adams and Larimer counties travel did not take as large a part of the total expense as in Routt and Kiowa

counties. Offices having a very heavy calling list by farm men and women, and agents who work thru groups by demonstration more than personal calls to farms account for lower relative travel costs.

Agreements between the State Extension Service and the counties state the amount to be spent for total expense. That this sum did not prove inadequate can be shown by copies of contracts and records of total expense actually incurred. A review of Table 1 shows the importance of travel in the total expense. However, the ratio of travel and total cost is not equal in all counties. This is shown in Table 1. A further effect on the importance of travel is brought about by the habit of the rural people in regard to their methods of trading and visiting. These habits often lead to calls upon the county agent, whereas their absence would necessitate his calls to the farm or farm home. The question of travel costs and possible improvement in efficiency is of greatest importance. Numerous preliminary surveys and questionnaires have brought to light the variation in travel efficiency among county agents, which because of the supervision, should be higher than that of the average county or state employee. No doubt the limitation of expense funds plays a part in the amount of expense incurred and the nature of such expense. This is also shown in the McNelly (1) report for Minnesota.

The location of the rural communities is of considerable importance in both travel costs and amount of office calls at the agent's headquarters. Long distances between a particular community and the office of the agent might reduce the number of calls by the farmer or farm woman upon the agent and thus cause him to travel more.

No doubt one of the most important factors not fully studied is the ability of the county agent to make the utmost use of the money and time available.

While only one correlation coefficient in that part of the study relating to travel cost and area showed significance, no coefficient in the study on total expense and area reached such a value. The most common opinion is that a large county should provide a large travel allowance. Experience does not prove this to be a necessity.

Results of the study indicate that above all things an adequate allowance for travel should be made regardless of size of county.

To study the efficiency of travel and costs of individual farm visits would require data on the number of farm visits made and the number of meetings held as well as other data of such meetings and visits. The present study was not made to determine such costs.

In attempting to show the relationship between total expense of county extension agents and the crop value for the counties, it was for the purpose of answering the question of whether the rich irrigated county should pay a great deal more toward extension work than the moderate-sized plains county. The question raised by some county officials is the inability of the county to meet the suggested budget for expense because of a small crop area, or a cropping program which is very modest in value. That no relationship exists in the period covered by this study between total expense and crop value is very evident from Table 7. While it is true that the population considered in these tables is very small, the absence of any

considerable number of significant correlation coefficients indicates a lack of relationship between crop value and total expense for the period studied.

Of interest to the entire State of Colorado in the past five years has been the tremendous decline in livestock values. Whether declining livestock values had their effect in reducing total expense of county agents can be answered by reference to Table 7. No relationship exists between the two during the period of this study.

The attempt to show what relationship, if any, existed between the total or travel expense of an agent and such factors as area, population, crop values and livestock values for the period 1930-1934, inclusive, was made with the hope that such a study would be the beginning of several others carried in similar fashion but reaching into the field of supervision and procedure to a far greater degree.

CONCLUSIONS

1. A definite relationship exists between total expense and travel expense of county extension agents based on a study of 17 Colorado counties over the period 1930-1934, inclusive.

2. No significant relationship exists between total expense on one hand and area, population, crop value or livestock value on the other, over the same period.

3. In only one year of five was there a correlation coefficient showing significance when travel expense and area were compared, based upon the same counties and over the same period.

4. On the basis of this study, travel expense becomes an important consideration in determining adequate county appropriation for county extension agents.

RECOMMENDATIONS

1. The future supervisory program should give serious consideration to the most effective use of travel on the part of the county extension agents.

2. Research in extension costs and procedure should be made a regular part of the extension program in Colorado.

3. A long-time program of research in extension methods and procedure should be prepared and made available to all members of the extension organization. Employees of the extension service should be encouraged to take part in such a program in order that their experience be combined with intensive study and thus result in valuable information for the extension service in this and other states.

4. All county extension agents and assistants should be supplied with summaries of all extension studies as soon after completion as possible.

5. Immediate steps should be taken on studies relating to extension costs other than travel and on state specialists' costs.

LITERATURE CITED

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- (2) Collins, H. L., 1935. Correspondence.
- (3) Colorado State Board of Immigration, Colorado Year Book, 1933-1934, pages 12 and 12 A.
- (4) Colorado State Board of Immigration, Colorado Year Book, 1931, page 16.
- (5) Hayes, H. K., and Garber, R. J., 1927. Breeding Crop Plants. McGraw-Hill, pages 48-55.
- (6) Fisher, A. A., 1932. Statistical Methods for Research Workers, Oliver and Boyd, Table V (A).

COOPERATIVE EXTENSION WORK
IN
AGRICULTURE AND HOME ECONOMICS

STATE OF MINNESOTA

University Department of Agriculture
U. S. Department of Agriculture
County Extension Services
Cooperating

Agricultural Extension Division
University Farm
St. Paul, Minnesota

August 14, 1935

Mr. Fred C. Jans
Administrative Assistant
Extension Service
College of Agriculture
Fort Collins, Colorado

Dear Mr. Jans:

Your recent letter relative to farm visit studies came to my office during my absence on a two weeks vacation, hence the delay in answering.

You refer to your thesis on "A Study of County Extension Agent Total Expense Compared to Travel Cost, County Area, Population, Livestock Value and Crop Value." I will say in reply that I have not approached the study of the farm visits from that angle. I had planned on using the material given in the study in connection with a thesis at some later date. Altho I doubt if it would be of use to you, I am enclosing a few pages from a summary of the preliminary study several years ago.

Very truly yours

(Signed)
C. L. McNelly
District County Agent Leader

CLM:IC
Enclosure

"As will be noted, the preliminary study was based on actual records of agents. The questionnaire was based on both facts and opinions of agents.

"In compiling data from monthly and annual reports, less exact figures are obtainable. Here the actual number of farm visits made by each agent was tabulated; as was also the number of different farmers visited; and the number of miles traveled per agent. Because the agents did not differentiate in their reports between mileage spent on farm visits and meetings, the meetings per agent were included with visits for the purpose of making a rather rough tabulation. The total transportation cost, the cost per mile traveled, the cost per farm visit and meeting and the miles traveled per farm visit and meeting, were also tabulated.

"The analysis and tabulation of the data secured from the various sources has been checked with two other states. Their data is comparable and their conclusions, coincide with ours. Some of the facts brought out by the data and conclusions pertaining thereto, follow:

Farm visits per county varied from 228 to 1248, with an average of 663 per county.

The average miles traveled per farm visit and meeting varied from four miles to 32.4 miles, the average being 9.3 miles per farm visit and meeting.

Comparisons of the Ten High and Ten Low Counties

"Comparisons are often interesting and sometimes enlightening. The ten low counties, in point of miles traveled per farm visit and meeting, averaged 7,081 miles for 928 farm visits and meetings. The ten high counties on the same basis averaged 10,963 miles for 568 farm visits and meetings; the low counties averaging a farm visit for 7.6 miles of travel, and the high counties requiring 19.3 miles of travel per farm visit. The cost to the low counties was \$614.30 for 928 farm visits and meetings, and the high counties, \$1,096.31 for 568 farm visits

and meetings; or on the basis of 1,000 visits, the cost to the low counties was \$747, and the cost to the high counties \$1,930.

"Counties in the low group, comparable in size and population to counties in the high group, were compared. The following is a rather typical comparison: One agent traveled 5,800 miles at a cost of \$460 to make 800 farm visits and meetings. Another agent, in a county comparable in size and population, traveled 13,400 miles at a cost of \$1,340, to make 410 farm visits and meetings.

"A comparison was made of mileage traveled by agents receiving a 10 cent * per mile mileage rate, and those receiving less.

"In 1929 - 36 counties used a 10 cent mileage rate, averaged 8,738 miles of travel, whereas 36 counties using less than the 10 cent rate averaged 8,036 miles of travel. Thirteen counties with the 10 cent rate traveled over 10,000 miles, whereas but five counties with the 8 cent rate traveled over 10,000 miles. A check of the above figures will show that the agents who travel most, actually make fewer farm visits and hold less meetings. Agents with a lower mileage rate apparently find it advantageous to systematize and organize their farm visits.

"A check was made on the miles traveled and number of farm visits and meetings held in the 12 counties in which a study was made for the preceding year. This shows that during the year the study was made, the agents traveled on an average 1,213 less miles but made 43 more farm visits or meetings per county, indicating that a study of the problem by the agents has to some extent improved their efficiency.

"A study of the number of different farmers visited by agents shows a range of from 5.2 per cent to 30.1 per cent of the different farmers of the county visited. The average for the state indicates that 14.4 per cent of all farmers in counties with county agents were visited during the year. In some cases the variation in percentage of farmers visited differed (according to population) but

* The maximum rate is now 5 cents

not as much as might be supposed. Certain counties in the high-low groups are comparable in population and area. For instance, in one county with 20 townships and 2,511 farms, 7.1 per cent of the farmers were visited, whereas in a nearby county, with 20 townships and 2,501 farms, 33.2 per cent of the farmers were visited.

Why the Farm Visit

"In place of discouraging the farm visit, we feel that it should be encouraged to the extent that it is accomplishing a worth-while purpose as compared with other methods used. As a matter of fact, it is not true in Minnesota that agents are making fewer visits now than in the early days of the work. Comparing recent records with those of earlier agents, we find that agents now are making about twice the number of farm visits per year that the earlier agents did. This is possible because of the wonderful improvement in roads, and because cars are much more efficient in operation and speed.

"The analysis of the data secured indicates that the farm visit is a most valuable method in promoting extension work. It is valuable, because first, it involves a most important educational method; namely individual instruction; second, the information reaches the subject when he is in the most receptive mood. (In 43.4 per cent of the cases, the visit was made at the request of the farmer); third, the personal contact tends to build good will and establish confidence in the work and for the worker; and fourth, it furnishes probably the best means available for the agent to become intimately acquainted with the farmer and the farm problems of the county.

"The study also suggests that the cost of farm visits may be greatly reduced both in time and mileage. This can be done by better planning and organization of the work, and through more systematic time utilization in increasing the contacts per trip, thus reducing the distance traveled per contact."

Table 1. Correlation of Total Expense and Travel Expense in Seventeen Colorado Counties for the Years 1930-1934, Inclusive, Showing the Calculated Values Used in the Formula to Determine the Correlation Coefficient.

	ADAMS	ARAPAHOE	BOULDER	COSTILLA	DENVER
Σ	98.9661	76.0538	88.4025	87.7922	89.7653
\bar{Y}	57.2991	49.6828	64.7815	50.2010	55.6873
$\Sigma \bar{Y}$	5660.6385	3780.0582	5726.8497	5285.1782	4719.2566
$\Sigma \bar{Y}^2$	9788.4104	5788.7446	7815.0020	7707.4704	8057.9091
\bar{Y}^2	3283.1868	2468.3806	4185.6427	3624.1804	2884.3262
$\Sigma x^2/N$	10106.5206	6069.8958	8613.7888	7951.0190	9222.8568
$\Sigma y^2/N$	3462.4721	2812.2150	4813.8956	3785.3210	3199.2623
$\Sigma xy/N$	5723.0946	4024.8963	6347.8383	5384.9705	5021.6393
$r =$	+.234	+.736	+.718	+.561	+.499

	GARFIELD	KIOWA	LARIMER	LAS ANIMAS
Σ	98.3251	77.2028	82.2601	70.1853
\bar{Y}	59.6983	60.3550	53.9838	53.5030
$\Sigma \bar{Y}$	5869.3399	4559.5750	4440.1565	3855.1241
$\Sigma \bar{Y}^2$	9667.9254	5980.2723	6765.0799	4925.8963
\bar{Y}^2	3565.0184	3642.7260	2914.2290	2792.5110
$\Sigma x^2/N$	10425.2546	6333.7073	7392.3351	5390.9411
$\Sigma y^2/N$	3959.3533	4073.8563	4302.1075	3334.2185
$\Sigma xy/N$	6256.2911	5018.2958	4796.7928	4243.4800
$r =$	+.707	+.889	+.592	+.647

(Continued on next page)

Table 1. (Cont'd) Correlation of Total Expense and Travel Expense in Seventeen Colorado Counties for the Years 1930-1934, Inclusive, Showing the Calculated Values Used in the Formula to Determine the Correlation Coefficient.

	MESA	MOFFAT	MONTROSE	RIO GRANDE
Σ	85.9665	81.9446	94.6208	79.6545
\bar{Y}	61.8691	60.3703	64.4700	49.2983
$\Sigma X_i \bar{Y}$	5318.6700	5147.0201	6100.2029	3945.3924
ΣX_i^2	7390.2391	6714.9174	8953.0958	6344.8394
\bar{Y}^2	3827.7855	3644.5731	4156.3809	2351.7599
$\Sigma X_i^2 / N$	8119.8471	7820.8021	9603.4730	6904.3576
$\Sigma Y_i^2 / N$	4284.6823	4149.1085	4781.2948	2819.4393
$\Sigma XY / N$	5785.3935	5546.9039	6478.6480	4227.2846
$r =$	+.799	+.591	+.593	+.729

	ROUTT	SAN MIGUEL	SEDGWICK	WELD
Σ	77.9780	86.2610	65.0826	86.4751
\bar{Y}	55.2130	64.4165	47.3390	67.4170
$\Sigma X_i \bar{Y}$	4305.3923	5556.6317	3080.9452	5829.8918
ΣX_i^2	6080.5985	7440.9904	4235.7449	7477.9429
\bar{Y}^2	3048.4753	4149.4855	2240.9809	4535.0519
$\Sigma X_i^2 / N$	6743.0321	7950.7771	4684.3588	8119.6380
$\Sigma Y_i^2 / N$	3538.7418	4508.7708	2493.7170	4977.8761
$\Sigma XY / N$	4772.2033	5842.2160	3354.7363	6245.7685
$r =$	+.821	+.657	+.813	+.779

Table 2. Correlation of Travel Expense and Area in Seventeen Colorado Counties for the Years 1930-1934, Inclusive, Showing the Calculated Values Used in the Formula to Determine the Correlation Coefficient.

	1930	1931	1932	1933	1934
Σ					
\bar{y}	829.4418	779.8759	757.0906	515.5949	604.7412
Σy	2160.5882	2160.5892	2160.5882	2160.5882	2160.5882
Σxy	1792082.186	1684990.667	1592549.253	1113988.041	1306596.701
Σx^2	687975.670	608208.419	543502.503	266857.998	565711.819
\bar{y}^2	4868141.370	4868141.370	4668141.370	4668141.370	4668141.370
$\Sigma x^2/N$	718174.31	616494.67	557631.71	275347.82	371940.35
$\Sigma y^2/N$	6455212.20	6455212.20	6455212.20	6455212.20	6455212.20
$\Sigma xy/N$	2116276.61	1751911.21	1620855.85	1147090.54	1320542.35
$r =$	+ .116	+ .386	+ .559	+ .248	+ .152

Table 3. Correlation of Total Expense and Area in Seventeen Colorado Counties for the Years 1930-1934, Inclusive, Showing the Calculated Values Used in the Formula to Determine the Correlation Coefficient.

	1930	1931	1932	1933	1934
ΣX	1136.8051	1100.2076	1085.4394	814.9259	919.5253
ΣY	2160.5882	2160.5882	2160.5882	2160.5882	2160.5882
ΣXY	2456174.16	2377095.55	2301375.79	1760719.23	1986715.51
ΣX^2	1292332.66	1210456.76	1135161.11	664104.22	845526.78
ΣY^2	4668141.36	4668141.36	4668141.36	4668141.36	4668141.36
$\Sigma X^2/N$	1306483.43	1218504.70	1151599.816	685947.172	876889.408
$\Sigma Y^2/N$	6455212.20	6455212.20	6455212.20	6455212.20	6455212.20
$\Sigma XY/N$	2463604.50	2426896.90	2315661.40	1716749.10	1988052.80
$r =$	.046	.377	.0769	-.222	.056

Table 4. Correlation of Total Expense vs. Population in Seventeen Colorado Counties for the Years 1930-1934, Inclusive, Showing the Calculated Values Used in the Formula to Determine the Correlation Coefficient.

	1930	1931	1932	1933	1934
\bar{x}	1133.8061	1103.2076	1065.4384	814.9252	919.5253
\bar{y}	184.2352	184.2352	184.2352	184.2352	184.2352
$\bar{x}_1\bar{y}$	209440.07	202696.97	196291.44	150138.04	139403.93
\bar{x}_1^2	1292232.66	1210463.76	1135161.12	684104.22	845526.73
\bar{y}^2	33942.61	33942.61	33942.61	33942.61	33942.61
$\sum x^2/N$	1306483.43	1228504.70	1151599.82	685947.17	876886.41
$\sum y^2/N$	58917.4	58917.4	58917.4	58917.4	58917.4
$\sum xy/N$	212076.14	202575.82	198541.19	146420.07	176566.18
$r =$	.140	-.0057	.111	-.059	.255

Table 5. Correlation of Total Expense vs. Livestock Value in Seventeen Colorado Counties for the Years 1930-1934, Inclusive, Showing the Calculated Values Used in the Formula to Determine the Correlation Coefficient.

	1930	1931	1932	1933	1934
Σx	1136.3081	1100.2076	1065.4394	814.9259	919.5253
Σy	1226.2941	977.7882	871.3529	577.9411	656.8255
Σxy	1394061.07	1075770.01	715285.83	470979.17	605965.85
Σx^2	1292332.66	1210456.76	1135161.12	664104.22	845526.78
Σy^2	1503797.22	958069.78	450714.72	334015.92	431417.11
$\Sigma x^2/n$	1306483.43	1243504.70	1151599.82	685947.17	876888.41
$\Sigma y^2/n$	2043799.77	1322725.17	865741.47	480774.06	614772.82
$\Sigma xy/n$	1416369.36	1092358.31	726959.42	457294.70	607627.99
$r =$	.257	.207	.014	-.242	.048

Table 6. Correlation of Total Expense vs. Crop Values
in Seventeen Colorado Counties for the Years
1930-1934, Inclusive, Showing the Calculated
Values Used in the Formula to Determine the
Correlation Coefficient.

	1930	1931	1932	1933	1934
\bar{x}	1136.8061	1100.2076	1065.4394	814.9259	919.5253
\bar{y}	3199.3529	1798.5294	1142.9411	1871.4117	1633.00
$\bar{x}_1\bar{y}$	3637050.29	1978755.71	1217734.48	1525061.86	1501584.81
$\bar{x}_2\bar{y}$	1292332.68	1210456.76	1135161.11	684104.22	845528.78
\bar{y}^2	10235858.98	3234708.00	1306314.36	3502181.75	2686689.00
$\sum x^2/N$	1306483.43	1228504.70	1151599.82	685947.17	876888.41
$\sum y^2/N$	31923756.76	9864515.00	5240665.47	10215003.29	6886971.49
$\sum xy/N$	3740100.81	1930667.29	836265.43	1525448.22	1561025.14
$r =$	.192	-.139	.311	.001	.170

Table. 7. AREA AND POPULATION OF
SEVENTEEN COLORADO COUNTIES*

ADAMS	807,690 Acres	20,245 Population
ARAPAHOE	538,880	22,647
BOULDER	488,960	32,456
COSTILLA	758,400	5,779
DELTA	768,640	14,204
GARFIELD	1,988,480	3,375
KIOWA	1,150,720	3,788
LARIMER	1,682,560	33,137
LAS ANIMAS	3,077,760	36,008
MESA	2,024,320	25,903
MOFFAT	2,981,120	4,861
MONTROSE	1,448,960	11,742
RIO GRANDE	574,720	9,953
ROUTT	1,477,760	9,352
SAN MIGUEL	824,320	2,184
SEDGWICK	339,840	5,580
<u>WELD</u>	<u>2,574,080</u>	<u>65,097</u>

*From 1931 Colorado Yearbook

Table 8. CROP VALUES IN SEVENTEEN COLORADO COUNTIES OVER
THE PERIOD 1930-1934, INCLUSIVE*

COUNTY	1930	1931	1932	1933	1934
ADAMS	\$3,660,560	\$2,096,690	\$ 368,830	\$1,931,580	\$1,584,540
ARAPAHOE	1,426,100	787,830	285,480	690,320	558,960
BOULDER	2,442,040	1,695,250	791,960	1,503,670	1,762,970
COSTILLA	821,090	710,490	467,600	710,910	785,560
DELTA	2,269,940	1,728,300	1,610,890	1,851,920	1,740,270
GARFIELD	1,692,520	1,001,290	1,122,540	1,246,930	1,134,900
KIOWA	1,001,640	485,410	69,200	391,050	138,510
LARIMER	4,906,730	3,251,590	1,825,840	2,573,770	2,562,970
LAS ANIMAS	990,590	851,690	368,170	598,860	290,120
MESA	3,495,030	2,030,120	1,676,710	1,901,180	2,577,660
MOFFAT	811,910	349,370	302,950	331,580	339,420
MONTROSE	2,106,760	1,172,230	1,351,980	1,864,550	1,304,990
RIO GRANDE	3,527,810	1,080,080	1,150,370	3,124,700	1,657,880
ROUTT	1,317,450	686,650	692,500	814,650	949,490
SAN MIGUEL	258,370	97,760	102,760	115,250	102,590
SEDGWICK	2,478,420	900,910	610,250	818,940	644,940
WELD	21,185,870	11,648,810	6,312,640	11,743,430	8,928,430

*From Office of Crop and Livestock Estimates, B.A.E., U.S.D.A.

TABLE 9. LIVESTOCK VALUES IN SEVENTEEN COLORADO COUNTIES OVER THE PERIOD 1930-1934, INC.*

COUNTY	1930	1931	1932	1933	1934
ADAMS	839,880	750,010	568,990	472,640	537,840
ARAPAHOE	610,270	497,935	336,600	211,305	360,405
BOULDER	658,360	552,600	453,430	329,910	382,830
COSTILLA	276,080	209,065	128,795	103,920	146,425
DELTA	1,240,610	1,035,455	704,615	576,620	620,765
GARFIELD	1,739,730	1,474,105	1,054,185	804,220	858,990
KIOWA	582,120	446,120	288,280	257,015	319,395
LARIMER	1,742,683	1,204,530	910,610	689,110	853,940
LAS ANIMAS	2,316,249	1,704,564	1,165,835	1,115,215	1,344,289
MESA	2,228,245	1,617,205	1,041,575	913,440	945,990
MOFFAT	1,108,320	916,705	523,405	595,725	649,153
MONTROSE	1,202,440	995,905	649,750	594,530	649,685
RIO GRANDE	823,340	478,540	345,702	310,604	369,595
ROUTT	1,753,340	1,434,510	892,740	783,965	923,150
SAN MIGUEL	453,975	358,685	218,320	124,501	252,300
SEDGWICK	432,050	335,350	238,320	211,027	222,040
WELD	2,841,310	2,550,160	1,889,940	1,629,820	1,859,740

*From Office of Crop and Livestock Estimates, B.A.E., U.S.D.A.

THESIS BRIEF

ON FACTORS COMMONLY ASSOCIATED WITH COUNTY EXTENSION AGENT EXPENSES IN COLORADO

Agricultural extension work in Colorado is carried on through a state organization and a county organization consisting of county extension agents and assistants. Salaries of county workers are paid almost entirely by state and federal funds. Expenses of the work within the counties are paid by the counties cooperating.

Administrative officers connected with the State Extension Service meet with boards of county commissioners at stated intervals to draw up agreements for extension work. These agreements involve a certain appropriation for the expense of the agent in his office and field work. It has been customary to base requests for county appropriations on experience and willingness of county boards to accept the figures recommended by such administrative officers. It is very common in such meetings between the Extension Service representatives and county officers to discuss appropriations in terms of county area, population, crop values, and livestock values. It has not been possible to cite actual evidence regarding the relationship of expense allowances and the factors mentioned.

It was the purpose of this present study to assemble and analyze available data to determine if definite relationships did exist between county extension agents' expenses and commonly associated factors. It was decided that any relation between agents' expenses and the factors mentioned for a period for which adequate

data was available could be shown by the use of correlation studies. The Harris machine formula was used because of its convenience in machine calculations.

The first correlations determined were between the total expense and travel expense. Each month's total expense was listed with the travel expense for that period for seventeen Colorado counties from January 1, 1930, to December 31, 1934, inclusive. Correlation coefficients were determined for each of the counties. The remaining correlations were determined from data on an annual basis. In these determinations the annual expense for each county was listed with the area for each county, thus making five correlations between these two factors during this period. In turn, travel expense and area, total expense and population, total expense and livestock values, and finally total expense and crop values were compared. The results of these correlation studies are found in the thesis.

It has been extremely difficult to find any reference to similar work elsewhere. A preliminary report from Minnesota was of value in pointing out the importance of travel expense of county agents. A few summary pages of this report are found in the appendix of the thesis.

Fisher's tables for the significance of correlation coefficient values for odds of 19:1 were used to test the significance of the correlation coefficient values determined.

In the seventeen correlations between total monthly expense and monthly travel expense, all coefficients determined were

above the point of significance, indicating that during the period covered, there was a definite positive and significant correlation between total and travel expense. In the remaining twenty-five correlations, only one was significant. Thus for the period studied, no relation existed between total expense of county extension agents and area, population, crop value, and livestock value for the seventeen counties. In the five correlations representing the five years of the study relating to travel expense and area, only one value was determined which was above the significant point.

The study was not made to determine what relationships exist in any county at any time between agents' expenses and the commonly associated factors, but only to study a given period, and involving such counties as had extension work continuously for that period. It was hoped that this study would call attention to the lack of research in extension procedure and would be a small beginning in a definite research program in extension procedure. Attention is called to the lack of information on costs other than travel which make up total expense and on efficiency in the use of time and money at the disposal of county extension agents.

The conclusions drawn from the study are as follows:

1. A definite relationship exists between total expense and travel expense of county extension agents based on a study of 17 Colorado counties over the period 1930-1934, inclusive.

2. No significant relationship exists between total expense on one hand and area, population, crop value or livestock value on the other, over the same period.

3. In only one year of five was there a correlation coefficient showing significance when travel expense and area were compared, based upon the same counties and over the same period.

4. On the basis of this study, travel expense becomes an important consideration in determining adequate county appropriation for county extension agents.

Primarily for the use of the Extension Service in Colorado, recommendations were included in the thesis, and are as follows:

1. The future supervisory program should give serious consideration to the most effective use of travel on the part of the county extension agents.

2. Research in extension costs and procedure should be made a regular part of the extension program in Colorado.

3. A long-time program of research in extension methods and procedure should be prepared and made available to all members of the extension organization. Employees of the extension service should be encouraged to take part in such a program in order that their experience be combined with intensive study and thus result in valuable information for the extension service in this and other states.

4. All county extension agents and assistants should be supplied with summaries of all extension studies as soon after completion as possible.

5. Immediate steps should be taken on studies relating to extension costs other than travel and on state specialists' costs.