

THESIS

On

The Possible Use of the Modal Mean in Farm Management  
Investigation

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THE POSSIBLE USE OF THE MODAL MEAN IN FARM  
MANAGEMENT INVESTIGATIONS

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## Introduction

As we advance further in the study of any science, we find its methods becoming more and more quantitative, i.e., the extent, size, degree, sum or amount of the object sought receives greater attention. The statistical method of research as an introduction of the element of quantity study, is being increasingly used in all branches of science, since the aim of all science is to acquaint itself as completely as possible with the facts presented to it by experience. The rapid extension of the statistical method is evidenced by the increasing volumes of literature of recent publication on this subject.

One of the great values of the statistical method lies in that it is the only scientific method that describes and analyzes a group or mass of items in terms of the groups own attributes. As one of its most common phases, the statistical method uses summarizing expressions that show the constant characteristics of a group as a composite unit. By these summarizing expressions of groups we are afforded opportunity to find why the groups come to have the characteristics which they possess. In other words these summarizing expressions give us an analytical description of the group as a whole.

Of the summarizing expressions most commonly used, the arithmetic mean or average has always ranked



first. This term may be defined best by stating how it is computed, i.e., by dividing the sum of the items by their number. The average expresses that condition of affairs in a series that if the sum total of items remained unchanged, they would all be of the same size. Or in other words the average gives the general weight of the fact. Illustrations of the average as a mean are, because of its constant common usage, unnecessary here.

The median, a mean of considerable less repute than the average, is that summarizing expression situated at the mid-most position in a series, i.e. one half of the entire number of items of a series are found below the median and the other half above it. From this it may be seen that the chances are even that any item taken at random from a series will be greater or less than the median. The median therefore is sometimes called the probable occurrence.

The process of finding the median is very simple--the items are arrayed in serial order and the middle term chosen if the number of items is uneven, or half the distance between the two middle terms, if the number is even. Illustration of the use of the median may be found in studies of wages, distribution of wealth, etc. The median wage for certain purposes is as a mean much superior to the average wage.

The mode, a sadly disregarded mean, is that summarizing expression that represents the prevailing

condition or central tendency of the items in a series. The most frequent occurrence is the one most in mind when attention is called to some commonplace event. The clothier, when trying to sell a hat to a man who does not know what size fits him, will offer that size of hat that is most frequently called for or sold, i.e. the modal size. The mode represents that which predominates in any field of observation; it is the normal or typical happening.

Farm management data as collected by the survey method are statistics, i.e., aggregates of facts, "affected to a marked extent by a multiplicity of causes," numerically stated, enumerated, or estimated according to reasonable standards of accuracy, collected in a systematic manner for a predetermined purpose, and placed in relation to each other. Such being the case we do not need to dwell on the justification of the use, in farm management research, of statistical methodology, and by statistical methodology is meant all those devices of analysis and synthesis by means of which statistics are scientifically collected and used to describe and explain phenomena either in the individual or related capacity.

In farm management studies we are constantly dealing with the summarizing expressions of enumerated facts, gathered by the regular survey method. The summarizing expression most generally used has been the arithmetic mean or average. It has been said to repre-

sent the normal or the outstanding type of any particular series.

Like all new sciences farm management began with the descriptive and comparative stages. The facts were gathered, described and compared with one another and for this purpose the average was and is a mean most well suited. As we go further into research studies, however, we must be more exacting in our technic as is the chemist as he advances from the simple stages to the more complex. Terms we used in the elemental stages may not be suitable for all purposes in the advanced stages. It is the purpose of this thesis to present and discuss the mode as a 'mean' that appears in many respects more suitable for statistical studies in farm management than does the present arithmetic mean used.

#### Definition of Terms

Before entering the discussion of our subject it may be well to define the meaning of certain terms as used in this paper and found prevalently throughout farm management studies, namely, the 'mean', 'average,' 'normal', and 'type'. The need for careful distinction between terms, so that some standard of usage in farm management and economic investigation might be developed and thus confusion avoided, is very great.

First what distinction may be made between 'mean' and 'average'. Bowley says, "the best distinction may be made by deciding that an average is a purely arithmetic

conception--the 'mean' is to be applied to some objective quantity". Stewart Mills says, "the mean, for purposes of inductive inquiry is not the average or arithmetic mean." Here we have statistician and logician agreeing that the 'mean' and 'average' do not represent the same thing.

The 'average' has been used as a term to express the general concept of all summarizing units but this is wrong, as it can't represent the 'median' and 'mode'. By virtue of its very definition 'the sum of the items, divided by their number' it is impossible for it to represent them.

W. B. Bailey says, "As commonly understood, the term average signifies that mean quantity found by adding together particular quantities of one category and dividing the sum by the number of particular quantities entering into it." This definition of the average is identical with the arithmetic mean. Both logicians and statisticians use the common expression 'arithmetic mean' or 'average' as one, meaning that they are identical. The average is not the 'mean' but is itself a 'mean'.

Of necessity there is need for some class term to cover all summarizing expressions. For this purpose the best generic term perhaps is the 'mean' as all seem agreed that various summarizing expressions are all means--namely, a value occupying a position about midway between the extremes. The English "theoretic" statisticians use the 'mean' in a generic sense and express type by some particular 'mean'.



For the reasons given, then, the following classification seems logical as a basis of distinction between the various summarizing terms:

<u>General expression, Generic</u>	<u>Particular expression Type</u>
mean	arithmetic mean (average) median (probable) mode (normal)

Next, how may the term normal be defined? The normal farm, the normal farm income, the normal number of acres per man, etc. are what we are interested in in a farm management survey of a representative normal region during a normal season. What is the normal? The normal, the most regular, is that state of affairs where conditions are favorable for the phenomena to perform its proper function. It is the conformation to some established law, type or standard. It would be the regular occurrence.

The U. S. Bureau of Crop Estimates says, the normal yield of a crop is found "with normal weather conditions, and without unusual loss from disease, insects, or other adverse influences", i.e., "This expected yield is a 'full crop', such as he (the farmer) has harvested in the past in favorable seasons. It is neither a maximum possible or even a bumper crop, which occurs only at rare intervals when conditions are exceedingly favorable, nor a medium or small crop grown under one or more adverse conditions. Neither is it an average crop, which rarely occurs because of the effect on the average of extremely low or extremely high yields in exceptional seasons. It is rather the typical crop represented by the average

of a series of good crops, leaving out of consideration altogether the occasional bumper crop and the more or less frequent partial crop failures. This expected yield at planting time--is the 'normal or standard'. Copeland (20)

The normal therefore appears under favorable but not unduly favorable conditions. Of course ordinarily when we speak of the normal we do not mean the strict 'proper function' but rather we mean the manifestation of it that occurs the largest number of times. When we say the normal yield of wheat in one section is thirty bushels we mean that thirty bushels is the manifestation of the normal that seems to appear the largest number of times or is most prevalent in that section. The true normal yield would be somewhat higher.

The normal, as we commonly use it therefore, is the manifestation of the most proper function, the most regular occurrence. Warren says, "Perhaps the first object of a (farm management) survey is to find out the normal condition--- The normal, or usual thing, is often too common to be noticed." That being the case, in our farm management survey work we want to find that summarizing term that most closely and concretely expresses the normal.

It is also desirable here to establish the meaning of type as used in this thesis to express the representativeness of a mean to the individuals of the class under consideration. We say that a certain mean represents a type of a series meaning it gives a general form or plan of structure common to a large number of the individuals.

From this we may say that the mean giving the most representative and general form or structure common to the greatest number of the items will be the best indicator of type.

### Source of Material

The writer believes that the normal or type of any series of farm management data is more truly shown by the mean known as the mode than by the arithmetic mean or average commonly used. The problem therefore is to show the much more desirable characters of the mode as a 'type' indicator over the arithmetic mean as a type indicator in farm management survey data, and if possible a uniform and practicable method of determining the mode in any such data.

The data used in working out this problem was collected by the department of farm management of the Oregon Agricultural College in three representative areas in Oregon, consisting of 104, 96, and 93 farms respectively for the years 1914 and 1915 and 550 farms in Sumpter County, Georgia for 1918, furnished by the Office of Farm Management, Washington, D. C. The regular farm management survey method of collecting the data was followed in all cases.

The discussions and arguments that follow have been selected only from such sources as would make them authoritative. No attempt has been made to make a complete survey of all possible authorities, but selection has been made rather of those most prominent and pro-

gressive in their attitude towards statistics and their usage.

### Citations from Leading Authorities

As has been stated then it is believed that for farm management data the mode is more representative of the normal or typical than is the arithmetic mean. The following citations of authority are offered in support of this belief.

C. B. Davenport, in speaking of taking random samples of a large number of individuals, says;

"The 'means' of measurement will naturally be found; but, most important of all, far more significant, than the mean (average), is the mode or the most frequent class. The mode gives the typical condition of the lot of individuals measured." Again he says:

"Finally, if there is one representative of a biological series that is more apt to be significant than any other, it is the value that occurs with the greatest frequency or, in other words, the commonest value. Since this value may be said figuratively to be the most fashionable one, it has been called the mode. The peculiar value of the mode lies in this, that it is not the result of calculation and is not an ideal value merely, but is the prevailing or typical actual condition." (21)

A. L. Bowley says:

"Now is the 'average' workman the man who earns \$1.73 per diem, the simple average of the whole group or a man making \$1.20 the mode? In ordinary speech the latter



is meant. The 'average clerk' is not the one whose measurable qualities are an arithmetic mean of all similar qualities, but one whose qualities are found in the same degree in the greatest number of his fellows."

"No single measure expresses completely even the economic conditions of a group of workmen, but if we are taking a single measurement, that of the 'mode' is often the most useful. It is at the mode that we find the greatest number of whose greatest good we may be thinking."

"If there is a type the mode will show it." (25)  
From G. V. Yule we take the following:

"Clearly, the mode is an important form of average in the cases of skew distribution, though the term is of recent introduction. It represents the value which is most frequent or typical." (26)

From Franz Zezek:

" the predominant, most usual, or normal value, the mean of density, or place of greatest density--the value occurring most frequently in a series of items and around which the other items are distributed most densely--the mode represents the most probable value of the element of observation represented in the series--the importance of the mode lies in the fact that it is the average best suited to represent the 'normal' or 'typical' size of a variable phenomenon--the fact that of all means the mode is the easiest to estimate makes it the most widely used mean of everyday life. If the man in the street wants to

characterize a variable phenomenon by a single expression he usually resorts to the relatively most frequent size which has clung to his memory, and he feels instinctively that this value has a special importance, that it indicates, so to speak, the normal case of the phenomenon." (10)

"We may then define the mode as the commonest single value, or the commonest condition." G. M. Whipple (22)

"When we speak of the 'average American citizen' we really have in mind the typical citizen, the one most frequently met with--The primary use of the mode is, therefore, to characterize a type." G. M. Whipple (22)

"Statistical workers of recent years have inclined to use of medians and modes in preference to the traditional and time-honored average,---The statistician may justify his preference with ample proof that the choice of medians and modes insures a more accurate estimate of a statistical situation." A. C. Hedges (23)

"In the case of skewed distribution the crude mode has the obvious special advantage of being closest to the 'typical' amount of the trait." E. L. Thorndike (31)

"From the fact that the mode is the value of greatest frequency in the series, it has been given the name of the normal of typical value of the series." Bailey & Cunningham (7)

"For many economic and business purposes interest lies chiefly in the thing that is characteristic. Legislation is not generally enacted for the few, but rather for the many. Business policies are most frequently map-

ped out and changed in light of that which seems to be characteristic." H. Secrist (16)

"The mode, a summary figure of wide applicability."

"The mode can likewise be used in establishing standards from the figures obtained in time studies of factory operations." M. T. Copeland (20)

"The modes are obviously better than averages for this purpose since the modes are not influenced by the figures for any exceptional store at either extreme."  
M. T. Copeland

"Since the modal class or deviation is that of greatest frequency; that is, since more variates belong to that class than to any other, the mode is the most typical of all the variates of a distribution. If any one variate is to be selected as descriptive of the data the modal variate should be that variate."

"The significance of the mode as a type depends, of course, on the relative preponderance of its frequency--Data showing a strong tendency to concentrate about the mode is said to be highly stable or true to type--To repeat, a distribution with small frequencies at the ends of the range and with the frequencies concentrated at a point is said to be true to type, to be highly stable."  
C. J. West (27).

#### Statistical Evidence

From the above citations we gain support in the belief that the mode is the most significant mean figure in the biological and economic fields to represent the

predominant, the prevailing, the common condition, the characteristic, the typical or the normal. We also learn that the significance of the mode depends on the preponderance of the frequencies around it, and that the mode with great tendency for concentration of frequencies around it, is true to type and highly stable.

The writer, feeling sure that the statements from such authorities have sufficient weight to fairly establish the above inferences, wishes to present illustration of the representative qualities of the mode as a mean by showing how deviations from the mode, by the total number of items in the series, is less than from the arithmetic mean, whenever of course data is homogenous and highly true to type.

Table I.

Number of Animal Units Per Farm in Three Areas				
Means		Number of Farms	Sum of Deviations from means	
Mode	Average		Mode	Average
11	15	96	657	673
23	28	104	1211	1213
11	16	93	759	768

Cost of Producing Cotton Per pound lint.

Table II.

Means		Number of farms	Sum of deviations from means	
Mode	Average		Mode	Average
.24¢	.27¢	550	35.50	35.58



# Percent Cost of Operation of farms

Table III

Means		No. of farms	Sum of deviations from means	
Mode	Average		Mode	Average
39%	47%	394	6237	6285

At first it would seem that the differences of the sums are too small to enter as evidence, but if it is pointed out that according to the nature of the mode, it is not affected by the extremes at either end, ("The mode is useful in cases in which it is desirable to eliminate the influence of extreme variations or observations which are unrepresentative." F. S. Chapin (18),) we then see the real significance of the tables, i.e., regardless of the fact that the mode is not affected by the extremes, it has a less divergence, of the items from it, than does the arithmetic mean or average. It is the amount of the deviation that counts and not the direction.

## Objections to the Mode

The objections to the mode as a type are well stated in the following citations: "If the figures in the series are fairly evenly distributed, without pronounced concentration, the mode is difficult of determination and of limited usefulness.--If the number of items in the series is small, it is not worth while to attempt to use the mode since its position may be changed by the addition of a few more items; in this case the average is more significant."

M. T. Copeland (20

W. I. King sums the situation up as follows:

"In many cases, no single, well defined type actually exists.--The mode is not at all useful if it is desirable to give any weight to extreme variations. --It can not be located by any simple arithmetic process."

Just what weight have the above objections when applied to farm management data? That farm management data shows a tendency to concentrate around some one position in the series has been found very evident by the writer in working on this problem. Indeed, if we take any table on the relationship of some one factor to labor income, from the great numbers of farm management publications, we will find, wherever the investigator has followed the correct method of using classes of even breadth, there is a concentration of frequencies around some point and small frequencies at both ends.

Illustrations as follows:

Table IV

Utah Bulletin No. 160		New Jersey Bulletin No. 320	
Range of Capital	No. of Farms	Crop Index	No. of farms
Under \$5000	39	70 or less	24
5000-10000	126	71-85	65
10000-15000	81	86-100	83
15000-20000	32	101-115	68
20000 & over	31	116-130	29
Total	309	131 & over	31
		Total	300

New Jersey Bulletin No.294	
Tenants Capital	No. of Farms
\$1000 & less	4
1001-2000	18
2001-3000	38
3001-4000	<u>43</u>
4001-5000	<u>34</u>
5001-7000	12

Cornell Bulletin No. 295	
Capital range	No. of Farms
\$2000 or less	36
2001-4000	200
4001-6000	<u>183</u>
6001-8000	94
8001-10000	45
10001-15000	44
over 15000	13

Minnesota Bulletin 172	
Labor units per farm per year	No. of farms
200 & under	19
201-400	102
401-600	<u>131</u>
601-800	<u>73</u>
801-1000	41
1001 & over	29

West Virginia Bulletin No.153	
Crop Acres	No. of Farms
20 & less	23
21-40	41
41-60	<u>51</u>
61-80	41
81-100	18
over 100	18

U. S. D. A. Bulletin No. 648	
Cost of Fertilizers per Acre	No. of Records
\$2 & less	23
2-4	<u>56</u>
4-6	35
6-8	13
8-10	9
10 & over	7

U.S.D.A. Bulletin No. 651	
No. of crop acres per work animal	No. of Farms
11 or less	7
12-15	13
16-19	<u>33</u>
20-23	28
24-27	23
28 or more	6

Where the material is homogeneous it is seen farm management data has a strong tendency to concentrate and commonly exhibits the predominance of some type through some one class. On the other hand all farm management data must of necessity be homogeneous since it is essential to all farm management surveys that they be taken in an area representative of the type of farming or condition to be studied. It is also essential to correct statistical practice, to arrange data in classes of equal width as is shown in the above tables from various bulletins, although this is not always done as may be frequently observed throughout farm management publications.

The second objection to the mode, that it does not give any weight to the extreme variations, is easily met.

Warren says, "The exceptions are conspicuous, attract attention and result in exactly the wrong conclusion." The exceptionally successful farm or the very unsuccessful farms are not the ones we are chiefly interested in when trying to find the status of some agricultural area or group of farms or some controlling factor in their management, but rather it is the normal or typical farms or condition that we want to know about first. We are therefore not interested in the extremes at either end. In all farm management work we want to deal with the normal condition and then give consideration to the extremes in their due place and time.

The third objection to the mode, that it can not be found by any simple arithmetic process is the only one that has any great weight with reference to its use in farm management data. It is true that the mode is not as readily and easily found as is the arithmetic mean but in view of the fact that it is the mean figure most suitable to represent the normal and typical in farm management data, we are scientifically justified in taking the extra trouble to determine it, especially if it is possible to determine and use some uniform method of procedure in finding the mode.

(Note - It might be well here to state why no mention of the median as a mean has been taken up in



this discussion. Zezek says, "The median is a typical value only if it appears at a point of concentration." Further; "While it is generally called an average it is more accurately a measure of partition or distribution." H. Secrist. "its use is undesirable in cases of discontinuous variation." G. V. Yule. "The value of the median ordinate depends not on the actual values of the variates but solely on the relative value." C. J. West. "The average tells the general weight of the fact, the mode tells its usual or typical amount and the median gives a mongrel result. E. L. Thorndike. It is sufficient to say that farm management data concentrates around the mode and not around the median, also that in farm management we are dealing with actual measurable values many of which give discrete or discontinuous distributions.)

#### The Special Value of the Mode

The special value of the mode to farm management investigation may be gleaned from Zezek where he says, "The mode is of special importance, since it is that average which is easiest to estimate and, therefore, can easiest be obtained in an investigation by direct questioning. It has been mentioned that in investigations the questions asked are frequently for the 'predominant, prevailing, normal, or usual' price or wage, and these questions are asked of persons who are considered to be especially competent to correctly estimate the 'normal' wage and the 'usual' price on the basis

of their experience. The normal or usual magnitude is often asked for because it is much easier for an expert to estimate the mode than any other average."

In the above statement, we find direct agreement with farm management investigators; they obtain their data by direct questioning, from persons especially competent to correctly estimate the quantity wanted, and the 'prevailing' condition sought for, is found.

Other possible values of the mode may be found in its use in finding inner, controlling, basic facts which can not be found on the surface. In determining basic standards by which to value and guide future performances; or to establish series of facts that suggest tendencies and causal relations.

Summarizing in brief it may be said that the statements of the ablest authorities and the study of a considerable amount of farm management data lend support to the belief that the modal mean is more representative of the 'normal', the 'typical', the 'predominant', the 'prevailing', the common or most frequent condition found in farm management investigation, than is the arithmetic mean.

#### A Fixed Method for Determination of the Mode

The next step is to present the possibility of a fixed method for the determination of the mode in farm management investigations. As has been said the great-

est disadvantage of the mode lies in its not having the same ease of calculation as has the 'average' but as Yule says, "too great weight must not be attached to mere ease of calculation, to the neglect of other factors."

Perhaps, we are scientifically justified in calculating the mode even though the process is somewhat more complicated than for other means. The method presented here is in the main the standard 'grouping process' as used by statisticians, which has been carried by the writer to a greater degree of refinement and is believed applicable for use where the mode is required in any field of investigation.

By the standard 'grouping process' the mid value of the size of item whose frequency is constantly contained in the maximum group is taken as the mode of the series. This gives an approximate mode suitable for most purposes but of less refinement for advanced scientific research work. In a 'modified grouping process' worked out and herein proposed by the writer as a fixed procedure in obtaining the mode, instead of taking the mid-value of the size of item constantly contained in the maximum frequency group for the mode, <sup>the</sup> arithmetic mean of the mid-values of the classes of the maximum frequency group, is taken as the true mode of the series.

This 'modified grouping process' is based on the assumption that in seeking for the mode of any series we are making repeated observations or measurement of the same object or series. Where repeated measures of

the same object are made, the arithmetic mean is the mean figure that must be used.

We know, that in locating the mode in any one series, for every grouping we will get a slightly different modal figure located in each of the maximum frequency groups. Assuming the 'grouping process' as a correct measuring device of statistics to locate the mode, as we group and regroup we are measuring and re-measuring for the mode of that series as does the chemist as he weighs and reweighs some substance taking the average of the various weights to obtain the 'most probable' weight of the substance. Thus in the 'modified grouping process' we take the arithmetic mean of the mid-values of the classes of the maximum frequency group and find the 'most probable' mode.

Repeating, for each grouping of the series with varying class widths we get a mid-value of the class of the maximum group that may be taken as a single measure of the mode. Taking the arithmetic mean of a number of these class mid-values will give us a more accurate approximation of the true mode than does any single measure or mode of any one of the groups. The object we are seeking is the 'most probable' value of the true mode of the series just as is the machinist when he takes the average of a number of caliper readings of the diameter of an iron rod. The average of repeated measurements of the same object or series is the most true representation of the true value of the object or series measured.



Zezeck says, "In series of repeated measurements of the same object we are concerned with establishing the true size of the object with the greatest possible accuracy."

To determine the mode by this 'modified grouping process'. The following steps are taken.

First tabulate the original data into frequency classes of the narrowest possible width. The narrowness of the class width is very essential to this process and where the single unit can be used it is much better. Care should be taken that there are no vacant frequencies near center of data.

Next group those frequencies found by twos and threes etc. as described in King's Elements of Statistical Methods. For the farm management data worked with it has been found desirable to carry this grouping up to the first grouping by fours which gives seven maximum groups.

After the grouping has been completed find the mid-values of the classes for each of the maximum frequency groups. Then find the arithmetic mean of these mid-values. This figure is the 'most probable mode' of that series.

Demonstration of the method described, using data on the Percent Cost of Operation on 394 Oregon farms, is given herewith to make the procedure clear.

DETERMINATION OF MODE  
by  
"Modified Grouping Process"

Features of Procedure:	Narrow Classes	Small Frequency	Grouped by Twos	Upper Limits shifted	Grouped by threes	Upper Limits shifted	Upper Limits again shifted	Grouped by fours	(1-6)-0	0	10	36	88	208	Maximum frequencies Class for each maximum frequency Mid-value of class	Cost of Oper- ation Percent.
									(7-12)-0	10	36	88	208			
									(13-18)-10	36	88	208				
									(19-24)-26	78	129	158	156			
									(25-30)-52	103	158	156	208			
									(31-36)-51	106	146	118	91			
									(37-42)-55	105	118	91	107			
									(43-48)-50	91	66	47	33			
									(49-54)-41	88	47	33	28			
									(55-60)-27	50	23	20	11			
									(61-66)-23	39	24	17	15			
									(67-72)-16	24	17	15	11			
									(73-78)-8	17	15	11	11			
									(79-84)-9	15	11	11	11			
									(85-90)-6	11	11	11	11			
									(91-96)-5	11	11	11	11			
									55-(37-42)-39.5 105-(37-48)-43.5 106-(31-42)-36.5 146-(37-54)-45.5 158-(25-42)-33.5 156-(31-48)-39.5 208-(24-48)-36.5 7) 274.5 39.27 Aver-					age of mid- values		
														'Most probable mode' is <u>39</u>		

### Mode Found most Representative of Central Tendency

As has already been said, in farm management surveys we are interested in finding what is the prevailing condition, the prevailing cost of production, etc., in the area surveyed. It has been shown how the modal mean is more representative of the prevailing conditions. That being the case if we can show that the items of the series have less deviation from the mode found by this 'modified grouping process' than any other figure situated in the 'central tendency', we are scientifically justified in taking this mode as the 'most probable mode'.

The 'central tendency' is the term used to describe those classes in the series that surround and include the modal class, i.e. the classes adjacent to the modal class and in some instances the classes on each side of these or in other words the classes in the realm of concentration. The tabulation that follows shows how the mode as found by the modified grouping method has least deviation from the items of a series, <sup>within central tendency</sup> of any mode. This is proved by comparing the sums of the deviations of the different modes.

Table V

Mode*and Possible Modes	Sum of Deviations from Mode* and Possible Modes within central tendency	% of items falling with- in central ten- dency	Source of data
.2348	6.4614		
Mode*.2349	6.4611	50%	Cost of cot- ton produc- tion, 550 farms
.2350	6.5608		



	37	2913		% Cost of operation
	38	2889		394 farms
Mode*	39	2889	79%	
	40	2911		
	41	2955		
	10	302		A. U. per farm
Mode*	11	295	82%	96 farms
	12	298		
	22	299		
Mode*	23	284	57%	No. cows per
	24	289		farm, 104 farms
	44	841		% cost of oper-
Mode*	45	838	75%	ation, 96 farms
	46	841		

The series of items in this table were taken at random to illustrate what may be found of the mode as obtained by the modified method, in relation to the "central tendency" and also the variation in limits of the 'central tendency'.

The data in table V is from actual mode calculated for cost of production, cost of operation, etc. Taking the second series in the table, we find that 79% of the items of the series fell within the 'central tendency' and for this 79% of items the mode of 39 had less deviation from it than did any other figure within this range. The modal figure 39 was found by the 'modified grouping process'. It so happened in this particular case that the deviation from 38 was the same. Either above or below 39 we see that the deviation gets larger within this range of the 'central tendency'. Other series of this table establish the same point as does other data not presented.

#### Comparison of Average and Mode

The data in table 6 is given to show what the



mode and average both give for the data of one representative area. A great divergency is apparent. It gives rise to the question whether in farm organization and other farm management work we want the prevailing condition upon which to base our recommendations or a hypothetical mathematical conception of that condition.

Table 6.

General Comparison of Mode and Average

Farm Management Survey Data, Yamhill  
County, Oregon  
Financial Summary 93 Farms

	<u>Mode</u>	<u>Average</u>
Average size of farm (acres)	127	156
Capital invested	\$10,856	\$19,932
Total receipts	\$ 1,542	\$ 2,313
Total expense	\$ 828	\$ 917
Farm income	\$ 785	\$ 1,396
Int. on investment	\$ 529	\$ 996
LABOR INCOME	\$ 228	\$ 400

## Other Factors

	<u>Mode</u>	<u>Average</u>
Working capital	\$ 1,228	\$2,240
Value of dwelling	\$ 1,028	\$1,139
Value of other buildings	\$ 470	\$ 820
Value of tools & machine	\$ 276	\$ 547
Value per acre	\$ 123	\$ 124
Crop area (acres)	56	99
No. A. U. per farm	11	16
Receipts per A. U.	\$ 66	72
Receipts per cow	\$ 40	\$ 55
Percent rec. from stock	33%	54%
Percent cost of operation	34%	46%

50

The average farm is a mathematical conception of a farm in that particular area if all qualities of every farm could be made to be constantly contained in each of them in the same degree, thus making all of the same status in every respect. The average financial summary is purely a mathematical concept of the area, therefore uniformity is found, i.e., labor income and interest on the investment added together will always give the farm income even though neither of them express the exact prevailing condition.

The mode is not a mathematical conception and never can be such. It is a mean figure of position, that position of greatest similarity. It gives a picture of the area showing where the largest number of similar cases fall or, put in another way, it shows the actual prevailing condition as determined by the most frequent occurrence. Hence the mode not being a mathematical concept, does not necessarily give uniformity of progression in the financial summary as has been shown the average does. Labor income plus interest on investment does not necessarily equal farm income, etc. Five percent of the modal capital does not necessarily give the identical modal interest on investment as five percent of the average capital does on the average investment. The modal capital fell at that position in the series as the result of many unknown causes, each working its own way and not being brought or drawn to a hypothetical uniformity as is the case in the use of the average. The mode tells the type as determined by

the position of clustering of the items. The modal figure is the result of actual existing common conditions in any area while the average is the result of a rigid mathematical manipulation.

#### Application.

From the evidence here produced it is reasonable to believe that the modal mean is more representative and significant for farm management data as a mean with which to express the 'normal, typical, prevailing, predominant, characteristic, or common condition' than is the average - at least for most computation work in farm management.

The mode is especially applicable in farm organization, cost of production and regional studies, where we are seeking basic standards or units of present occurrences for guiding present and future performance. The cost per pound or the cost per acre for any area is best expressed by the most common occurrence found in the area, and it is this figure that it is most logical to use when working out some problem for present and future improvement.

The present true normal cost of producing cotton correctly determined, may give us the fact upon which to base our judgment as to where we might fix the price to stimulate the needed production of cotton or other farm product when price fixing is pertinent, as it was during the war.

A normal days work, a standard days work, receipts



per animal unit, animal units per farm, diversity index, crop index, and many other factors, standards and units sought in advanced farm management, regional studies and the like, may be, it is believed, more correctly and truly determined and expressed by the mode than by the common mean now used.

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