

1969 Wheat Mowing Study in Missouri,  
Colorado, and Oregon

A few years ago members of the Methods Staff of Agricultural Estimates Division began questioning some procedures used in the wheat objective yield survey. Questions raised involved possible selectivity bias in heads clipped for laboratory analysis and differences between units within a sample. To resolve these questions, two studies were completed in 1968 and based on the results of these studies the 1969 study was made.

The results of studies completed in Idaho and Illinois during the 1968 season prompted the recommendation, from the Methods Staff of AED, that procedural changes be initiated for further study - in three States in 1969. The study in Idaho was performed to determine the source of variation in head weight. The analysis of the Idaho data indicated that there is a significant difference between sample units. Thus, it is inefficient to forecast head weight with heads clipped from beside only one of the two sample units.

The Illinois study was conducted to determine if selectivity bias (in the ten head subsample obtained for laboratory analysis) could be eliminated by mowing the stalks before the heads are removed. To obtain a subsample of heads from each unit, the total number of heads per sample must be increased or fewer heads obtained per subsample. Increasing the total number of heads would place a heavier workload on the laboratories. Therefore, an attempt was made to determine if selectivity bias could be eliminated by a mowing operation. Analysis of the 1968 Illinois data indicated no significant difference (at the 99 percent level) between the average head weight of the 10 head mowed subsample and the average head weight of the remaining heads.

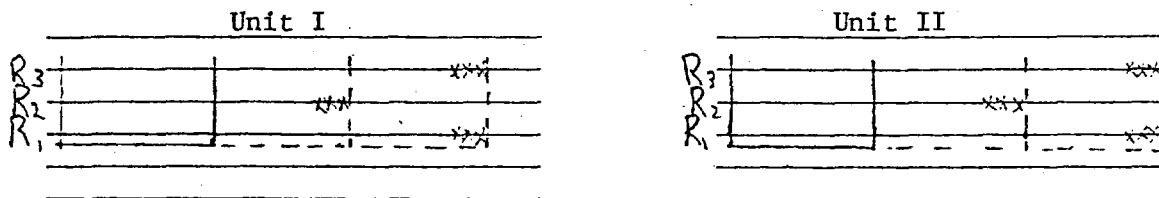
More details of the 1968 Idaho and Illinois studies are included in attached papers.

On the basis that there exists a significant difference in head weight between sample units and that it appears possible to reduce or eliminate selectivity bias by a mowing operation, the clipping procedures were changed in the three States in 1969. The 10 head subsamples were obtained by mowing the stalks before removing the heads. This should eliminate the tendency to overlook smaller heads. In Missouri and Colorado, the 10 head subsample was obtained by mowing two five head subsamples (one subsample to represent unit I and one to represent unit II).

Procedures Followed:

Obtain the 10 emerged head subsample for Form C-1 by mowing two 5-head subsamples. One 5-head subsample is to represent unit I and the second, unit II. To obtain the remaining emerged heads and late boot, clip approximately 1/2 of the balance of the row from which the 5-head subsample was obtained. A special Form C-1 was used so that the data from each unit would be kept separate for later analysis. The data needed for current forecasts was obtained by summing across the two units of a sample.

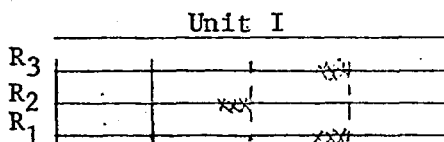
The following diagram depicts the layout of the sample and clip units.  
xxx = 5 head subsample obtained by mowing.



Row 1 was used for the first month a C-1 was required, Row 3 the second month, and Row 2 the third, if required. The mowing operation in Row 2 will not affect the unit as generally if the 3rd C-1 is taken, the sample is in category 6 or 7 in which case the sample is harvested also.

The mowing procedure for use in 1969 in Missouri and Colorado was to mow 5 stalks approximately 2 inches above the ground, without determining that each of the stalks mowed had a head. After the 5 stalks had been mowed, the heads were clipped and placed in a bag. If there were not 5 emerged heads on the 5 stalks, repeat the process mowing sufficient stalks to obtain 5 emerged heads. This procedure was repeated until 5 emerged heads were obtained. Any heads in late boot obtained during this process should be placed with the "remaining heads and late boot clipped".

The procedure for Oregon was merely a repeat of the work done in Illinois during 1968. Here a 10-head-subsample was obtained by the mowing procedure from one row beside the unit. In essence this procedure differs from the current procedure only in laying out two clip units beside Unit I and the mowing operation to obtain 10 emerged heads. See the following diagram:



xxx = 10 head subsample obtained by mowing - the sequence of rows used is again R<sub>1</sub>, R<sub>3</sub>, R<sub>2</sub>.

#### Analysis of Data:

The table below indicates comparisons made and t values obtained. The only independent test showing a significant difference was the comparison between the five head subsample and remaining heads for Unit II in Missouri.

Table of Comparisons

State	5 Head Subsample Unit I vs Remaining Heads Unit I		5 Head Subsample Unit II vs Remaining Heads Unit II		10 Head Subsample vs Remaining Heads From Unit(s)		5 Head Subsample Unit I vs 5-Head Subsample Unit II	
	t Value	d.f.	t Value	d.f.	t Value	d.f.	t Value	d.f.
Mo.	1.109	109	3.210**	110	2.691**	112	1.284	115
Col.	0.331	94	-0.597	86	-1.443	106	1.114	92
Ore.	-	-	-	-	0.935	59	-	-

The comparisons presented above are not all independent comparisons. Considering that these procedures are theoretically sound and more efficient than the old procedures and the fact that there was only one significant independent difference, it appears we should adopt the mowing procedures and the two five head subsamples. The first year the data should be kept separate by subsample for further analysis on the 1970 data.

Objective Yield Wheat - Selectivity Bias in Selecting 10-head Subsample  
For Laboratory Analysis

Each month in which the wheat is in category 3 or above, one row approximately 25 inches long from the clipping unit, which is laid out directly adjacent to the sampling unit, is clipped for laboratory analysis. A 10-head subsample, which is the first 10 heads cut, is analyzed separately from the remaining heads and late boot from the clipping unit. These data are then recorded on Form C-1.

Over the past several years it has been noted that some selectivity bias exists in the selection of the 10-head subsample. The heads in the 10-head subsample normally weigh somewhat more than the remaining heads in the row. This is a natural phenomenon in that humans, being what they are, always try to select the somewhat better or healthier heads. Secondly, in wheat that stands from two to three feet tall and the enumerator is clipping the heads from an upright position, there is a tendency to select the heads that are on the tallest stalks which have had better growing conditions as to sunlight, etc. and will not obtain heads on the lower part or small stalks bent over, etc. Therefore, the 10 heads will probably be somewhat heavier than the remaining heads.

In addition, it seems desirable to have a clipping unit beside each of the sampling units. Hence, in a situation where the sampling units have a significantly different head weight, it is most inefficient to try to estimate the head weight from a subsample beside only one unit.

The use of a clipping unit beside each of the sampling units prior to this time has not been considered because if there is truly a selectivity bias, one could not afford to reduce the number of heads clipped from 10 because of increasing selectivity bias. However, on the other hand, if two 10-head subsamples were clipped, the amount of work in the laboratory would be doubled. A small project was set up in Illinois during the 1961 forecasting season to determine if the selectivity bias could be eliminated by using a mowing procedure. The enumerators were instructed to mow ten stalks about two inches above the ground. Then they were to clip the heads from those stalks. If they did not have ten emerged heads, they were to mow a sufficient number of stalks to obtain ten. This process was repeated until a 10-head subsample was obtained. Illinois was requested to have a supervisory enumerator check each sample some time during the year to see that the mowing procedure was followed strictly. Plots were laid out in the manner depicted by the following diagram.