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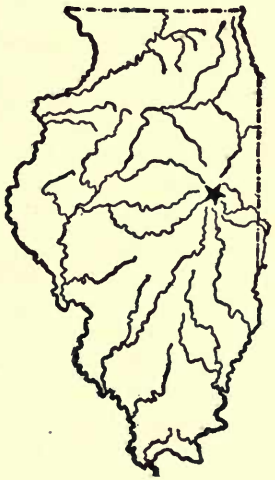
# SUCCESSFUL THRESHING RING MANAGEMENT

By Emil Rauchenstein and C. A. Bonnen



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## SUMMARY

Threshing from the shock makes up approximately 20 to 30 percent of the operating expenses incurred in producing wheat and oats. The amount of labor required in threshing may be reduced if the efficiency of management is increased, both by adjusting the organization of the crew to each particular job and by the use of basket racks.

While the use of basket racks and the elimination of field pitchers has been the usual practice in many parts of the West, it has not come into such general use in Illinois as its merits justify. This practice has been found to save 28 percent of the man labor necessary to get bundles to the machine, altho it required 14 percent more horse labor.

Different farms use varying amounts of labor per 100 bushels of grain threshed during the same season, chiefly because of the degree of efficiency of management. Wide variations from the average also occur during different years because of varying crop and weather conditions.

In central Illinois, approximately 11 hours of man labor have been required to thresh 100 bushels of oats, and 20 hours of man labor to thresh 100 bushels of wheat. In Franklin county, where lower yields are obtained because the soil is low in organic matter and where the equipment is not so efficient, approximately 18 hours of man labor have been required to thresh 100 bushels of oats and 25 hours for 100 bushels of wheat. Under favorable weather conditions and with efficient management, 100 bushels of oats can be threshed without using more than 6 hours of man labor and 10⅔ hours of horse labor.

Threshing machines varying from 20 to 24 inches in width of cylinder, the most common sizes for the small machines, usually thresh from 300 to 450 acres of grain per season. Thirty-six inch machines, the most common sizes for large machines, thresh an average of 800 to 950 acres of grain per season.

Gas tractors capable of developing a maximum of 19 horsepower on the belt are giving satisfactory results in pulling threshing machines 20 inches in width under favorable conditions. Those capable of developing 27 to 32 horsepower can pull 22- to 24-inch machines under practically all conditions. Steam tractors rated 20-60 to 25-80 (commonly termed 20 to 25 horsepower) are used to pull threshing machines with cylinders from 32 to 44 inches in width.

Labor settlements in threshing rings are made on the hour, bushel, or acre basis. These methods are illustrated on pages 392 to 397.

In the cooperative ownership of threshing machines it is advisable to have a definite written agreement from the beginning. A sample agreement is found on page 401. Custom rates are not always equitable for cooperative outfits. The rate can best be set after the threshing season. It should be high enough to cover cash disbursements and a fair rate of depreciation and interest. The allowance for depreciation and interest should be credited to each cooperator in proportion to his investment.

# SUCCESSFUL THRESHING RING MANAGEMENT

By E. Rauchenstein, Formerly Assistant Chief in Farm Organization and Management, and C. A. Bonnen, Associate in Farm Organization and Management

Threshing[1] from the shock, which is the common practice in Illinois, makes up approximately 20 to 30 percent of the operating[2] expenses incurred in producing wheat and oats. In the last Census year (1919), these two crops occupied 30.7 percent of the improved farm area of Illinois, and yielded approximately 200 million bushels of grain. The threshing season usually lasts only from 12 to 20 days in any one locality, which means that large amounts of labor are used within a short time. It is therefore especially important that labor and equipment in threshing be managed efficiently.

Before 1915 practically all threshing in Illinois was done by custom outfits. Steam tractors were the main sources of power. In the more important small-grain growing sections of the state, farmers usually organized threshing rings and each ring hired a custom outfit to thresh for its members.

Since 1915 there has been a rapid increase in the number of small (two- and three-plow) gas tractors used in Illinois. These have been bought mainly for field work, but are also being used to some extent to pull small threshing machines. The 1920 Census reports approximately 20,000 small gas tractors in Illinois, and it is certain that the number has increased materially since then.

Along with the development of this new source of power has come the more general use of the small threshing machine. Many rings that formerly hired large custom outfits, consisting of large threshing machines and steam tractors, have been broken up and reorganized into smaller rings. The small ring usually buys a threshing machine cooperatively, and hires one of its members, who owns a small gas tractor, to furnish the power.

It is hoped that this bulletin will prove helpful in solving some of the problems that have long existed in threshing rings hiring the custom outfits, as well as those arising from the increasing use of small threshing machines, many of which are cooperatively owned. Some of the

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[1]As used here, threshing includes hauling the bundles to the machine, hauling the grain, and stacking the straw, besides the work and expense at the machine.

[2]Operating expenses as used here include all expenses except interest on the land.

Acknowledgments are due the Departments of Farm Mechanics and Agronomy, and Mr. E. R. Dillavou, Associate in Business Law, University of Illinois, for valuable suggestions in the preparation of this bulletin.

more important problems, most of which are common to both situations, are:

1. The selection of a threshing machine of the right size for a given acreage of grain.

2. The selection of a tractor of the right size to pull the threshing machine.

3. The development of standards for the number of hours of labor per bushel and per acre for threshing grain.

4. The development of fair and simple methods of settling labor differences.

5. The application of sound business methods of financing threshing rings which own their threshing machines.

## DATA SECURED BY COST RECORDS AND SURVEY

The data used in making this study of threshing operations have been secured in three different ways:

1. Complete cost-accounting records were kept on a total of fifteen to twenty farms in Hancock and Franklin counties from 1913 to 1922 inclusive, and on a total of ten to fourteen farms in Champaign and Piatt counties from 1920 to 1922 inclusive. These records show the variations in different years and on different farms in the amounts of labor used for threshing.

2. A farm-to-farm survey was made in Douglas, Champaign, and Ford counties during the summer of 1921 while threshing was in progress. Seventy-four threshing rings were visited and 142 farmers interviewed. The total area on which survey records were obtained amounted to 6,514 acres of oats and 2,055 acres of wheat.

Information was secured concerning the organization and management of threshing rings in this area and also the cost of threshing, both per 100 bushels of grain and per acre. These data include the acreage and yields of grain, the amount of time spent in threshing each kind of grain, the number of men and horses used for each operation, such as bundle hauling, field pitching, and grain hauling, and the amount and cost of fuel used.

3. Detailed records on threshing operations for the 1921 season were kept by members of different threshing rings in Champaign and Ford counties. Data were secured from fourteen threshing rings including 166 farms having a total of 9,634 acres of oats and 893 acres of wheat. Since these records were not entirely complete in regard to fuel and machine costs, they are used only to show the labor requirements for threshing.

## NUMBER OF ACRES THRESHED WITH EACH SIZE OF MACHINE

The experiences of the 142 farmers in the 74 rings included in this survey should be of value as a guide in deciding the best size of threshing machine to buy for a ring of a given size.

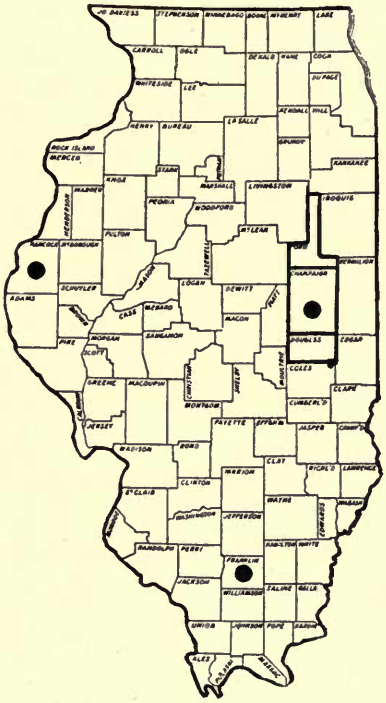

FIG. 1.—LOCATION OF AREA STUDIES

● Areas in which threshing data were secured from detailed cost accounting investigations.

▭ Areas in which survey records were secured.

In east-central Illinois, machines ranging from 20 to 28 inches in width of cylinder are regarded as satisfactory sizes for threshing 300 to 475 acres of grain in a season. Those ranging from 32 to 44 inches in width are considered satisfactory sizes for threshing from 700 to 1,000 acres. The 36-inch machine, which threshed an average of 879 acres, is by far the most common size used.

Both farmers and threshing machine manufacturers[1] are of the

[1]Eleven out of fourteen threshing machine manufacturers questioned, replied that they were in favor of settling upon a few standard sizes.

opinion that it would be a step in the direction of economy and efficiency to settle upon a few standard sizes of machines suited to the needs of different sized threshing rings.

TABLE 1.—ACREAGES THRESHED BY VARIOUS SIZES OF MACHINES IN EAST-CENTRAL ILLINOIS, 1921

| Size of machine[1] | Number of machines | Acres of grain threshed per ring | | |
|---|---|---|---|---|
| | | Average per ring | Minimum | Maximum |
| 20x36 | 3 | 295 | 170 | 395 |
| 22x40 | 3 | 367 | 350 | 380 |
| 23x40 | 5 | 361 | 260 | 410 |
| 24x42 | 3 | 376 | 332 | 450 |
| 26x44 | 1 | 467 | ... | ... |
| 28x48 | 1 | 715 | ... | ... |
| 32x52 | 6 | 684 | 485 | 785 |
| 36x56 | 38 | 879 | 565 | 1250 |
| 40x60 | 11 | 951 | 600 | 1200 |
| 42x64 | 2 | 862 | 725 | 1000 |
| 44x64 | 1 | 997 | 820 | 1175 |

[1]Width of the cylinder in inches.

## SIZES OF TRACTORS NEEDED FOR VARIOUS SIZES OF THRESHING MACHINES

The problem of selecting a gas tractor of the right size for a given threshing machine cannot be solved on the basis of the manufacturers' rating alone, because manufacturers do not have a uniform standard as to the overload which their tractors can carry above the rated horsepower. Fortunately the University of Nebraska has been testing gas tractors since 1920, and the results of these tests are available for most makes of gas tractors. Among other data, the maximum load test on the belt is given. This is the most reliable basis for selecting a tractor for belt work when a definite amount of power is required.

Table 2 shows the results of the Nebraska Tractor Tests for maximum load tests on the belt for the different makes of gas tractors which were included in this survey.

Operators of threshing outfits expressed themselves generally as being satisfied that their engines had sufficient power to pull the machines under favorable conditions such as prevailed during the threshing season in 1921. During this season there was little rainfall, oats were relatively free of weeds, and the straw was not badly tangled.

From the data in Table 2 it may be concluded that gas tractors capable of developing 19 horsepower on the belt under the maximum load test will pull 20-inch threshing machines under favorable conditions. Tractors having a capacity of 27 to 32 horsepower can pull 22- to 2[illegible]-inch threshing machines under practically all conditions.

Most of the large threshing machines were pulled by 20-60 to 25-80 steam tractors. The users of steam tractors were satisfied that they had sufficient reserve power for all conditions.

TABLE 2.—SIZES OF GAS TRACTORS USED WITH VARIOUS SIZES OF THRESHING MACHINES IN EAST-CENTRAL ILLINOIS, 1921

| Makes of tractors | Manufacturers' rating H. P. | [1]Maximum load test on the belt | Sizes of threshing machines |
|---|---|---|---|
| | | H. P. | |
| Fordson | ..... | 19.15 | 20x34 |
| Samson | ..... | 19.39 | 20x34 |
| Waterloo Boy | 12–25 | 25.97 | 20x34 |
| | | | 20x30 |
| Hart Parr | 15–30 | 31.37 | 22x36 |
| | | | 26x46 |
| Titan | 10–20 | 28.15 | 22x36 |
| | | | 23x36 |
| | | | 23x36 |
| Titan | 15–30 | (not tested) | 22x36 |
| | | | 28x40 |
| Huber | 14–28 | (not tested) | 23x36 |
| Wallis | 15–25 | 27.57 | 23x36 |
| Parrett | 12–25 | (not tested) | 23x36 |
| Case | 15–27 | 31.23 | 24x36 |
| Avery | 14–28 | 31.83 | 24x36 |
| Aultman Taylor | 22–45 | 46.66 | 32x52 |
| Aultman Taylor | 30–60 | 75.49 | 36x56 |

[1]From University of Nebraska, Agr. Exp. Sta. Bul. 177.

## AMOUNTS OF LABOR USED VARY WIDELY

The amount of labor used in threshing a given amount of grain varies widely from year to year on the same farms and in different threshing rings during the same year. There are two reasons for these variations: first, the quality and condition of the grain, which is largely the result of seasonal conditions; and second, the efficiency with which the threshing outfit and crew are managed.

By comparing data from similar groups of farms for different years, the effect of weather conditions on the amount of labor used in threshing can be determined somewhat definitely. By comparing data obtained under similar conditions from different farms and rings for the same year, the efficiency of management can be studied.

### VARIATIONS CAUSED CHIEFLY BY SEASONAL CONDITIONS

The data secured from the groups of farms in Hancock and Franklin counties, where detailed cost records were kept from 1913 to 1922, show that the variations in labor were caused chiefly by differences in weather conditions during the growing season and at the time of threshing. The amount of labor required on these farms during each of the ten threshing seasons is shown in Tables 3, 4, 5, and 6.

TABLE 3.—LABOR REQUIRED FOR THRESHING OATS IN HANCOCK COUNTY, 1913-1922

| Year | Average oats yield per acre | Labor per 100 bushels | | Labor per acre | |
|---|---|---|---|---|---|
| | | Man hours | Horse hours | Man hours | Horse hours |
| 1913 | 31.4 | 10.5 | 12.6 | 3.3 | 4.0 |
| 1914 | 33.1 | 8.1 | 8.7 | 2.7 | 2.9 |
| 1915 | 48.0 | 12.9 | 14.3 | 6.2 | 6.8 |
| 1916 | 22.1 | 14.2 | 15.9 | 3.1 | 3.5 |
| 1917 | 49.0 | 7.9 | 9.8 | 3.9 | 4.8 |
| 1918 | 47.0 | 8.2 | 10.1 | 3.8 | 4.7 |
| 1919 | 43.5 | 10.0 | 13.1 | 4.4 | 5.7 |
| 1920 | 52.5 | 7.7 | 9.7 | 4.0 | 5.1 |
| 1921 | 30.0 | 9.3 | 11.7 | 2.8 | 3.5 |
| 1922 | 26.2 | 13.3 | 17.0 | 3.5 | 4.5 |
| 10-year average | 38.4 | 10.8 | 12.3 | 3.8 | 4.5 |

The number of farms represented in Tables 3 and 4 varied from 6 to 11 during the ten-year period.

In 1914 the average rainfall in Hancock county was 25.83 inches, or 10 inches below normal. The resulting short growth of straw and the dry weather during the threshing season explain the small amount of labor used, both per 100 bushels of grain threshed and per acre.

In 1915 the amount of labor required in threshing oats was high. During July, August, and September, the months in which threshing was done, more than 18 inches of rain fell, making the average rainfall for the year 7 inches above normal. Since there were only 54 acres in wheat, or too small an acreage to represent a fair average, the fact that less than the average number of hours of labor was used to thresh 100 bushels may be regarded as more or less accidental.

In 1916 the yields of oats and wheat were extremely low while the growth of straw was about normal. Under these conditions the amount

TABLE 4.—LABOR REQUIRED FOR THRESHING WHEAT IN HANCOCK COUNTY, 1913-1922

| Year | Average wheat yield per acre | Labor per 100 bushels | | Labor per acre | |
|---|---|---|---|---|---|
| | | Man hours | Horse hours | Man hours | Horse hours |
| 1913 | 22.7 | 15.7 | 19.5 | 3.6 | 4.4 |
| 1914 | 22.8 | 13.8 | 17.8 | 3.1 | 4.0 |
| 1915 | 17.3 | 18.1 | 23.2 | 3.1 | 4.0 |
| 1916 | 10.7 | 26.5 | 31.7 | 2.8 | 3.4 |
| 1917[1] | .... | .... | .... | .... | .... |
| 1918 | 19.3 | 22.2 | 22.7 | 4.3 | 4.4 |
| 1919 | 22.8 | 28.0 | 37.7 | 6.4 | 8.6 |
| 1920 | 21.6 | 17.3 | 21.5 | 3.7 | 4.6 |
| 1921 | 21.7 | 18.8 | 27.8 | 4.1 | 6.0 |
| 1922 | 23.4 | 19.9 | 29.6 | 4.7 | 6.9 |
| 9-year average | 20.4 | 20.0 | 25.7 | 4.0 | 5.2 |

[1]No data available.

TABLE 5.—LABOR REQUIRED FOR THRESHING OATS IN FRANKLIN COUNTY, 1913-1922

| Year | Average oats yield per acre | Labor per 100 bushels | | Labor per acre | |
|---|---|---|---|---|---|
| | | Man hours | Horse hours | Man hours | Horse hours |
| 1913 | 15.2 | 12.8 | 10.7 | 2.0 | 1.6 |
| 1914[1] | .... | .... | .... | .... | .... |
| 1915 | 26.6 | 14.4 | 14.7 | 3.8 | 3.9 |
| 1916 | 5.9 | 40.4 | 37.2 | 2.4 | 2.2 |
| 1917 | 38.8 | 11.4 | 10.9 | 4.4 | 4.2 |
| 1918 | 30.6 | 14.8 | 12.6 | 4.5 | 3.9 |
| 1919 | 14.6 | 25.0 | 21.9 | 3.6 | 3.2 |
| 1920 | 26.7 | 11.9 | 11.1 | 3.2 | 3.0 |
| 1921 | 19.9 | 12.6 | 14.0 | 2.5 | 2.8 |
| 1922[1] | .... | .... | .... | .... | .... |
| 8-year average | 22.3 | 17.9 | 16.6 | 3.3 | 3.1 |

[1]No data available.

of labor required to thresh 100 bushels of grain was large, while the amount of labor required per acre was about normal.

The yield of wheat and the amount of rainfall were practically normal in 1919. The heavy growth of wheat straw, which lodged badly, in addition to the fact that during the threshing season sufficient rain fell to make the straw tough and separation difficult, resulted in abnormally high labor requirements.

During the other years of the ten-year period in Hancock county, weather conditions during the threshing season were in no way unusual. The differences in labor used were due largely to the differences in yields of grain and straw.

The effect which weather conditions during the growing season have on labor requirements is well illustrated by the data on oat threshing in Franklin county (Table 5). The soils in this county are generally low in organic matter, and extremes of moisture and temperature cause wide variations in the yields of oats, which, in turn, ap-

TABLE 6.—LABOR REQUIRED FOR THRESHING WHEAT IN FRANKLIN COUNTY, 1913-1922

| Year | Average wheat yield per acre | Labor per 100 bushels | | Labor per acre | |
|---|---|---|---|---|---|
| | | Man hours | Horse hours | Man hours | Horse hours |
| 1913 | 19.8 | 22.0 | 17.8 | 4.3 | 3.5 |
| 1914 | 14.8 | 22.0 | 23.2 | 3.3 | 3.5 |
| 1915 | 12.5 | 32.7 | 28.3 | 4.1 | 3.5 |
| 1916 | 9.7 | 28.6 | 27.5 | 2.8 | 2.7 |
| 1917 | 16.2 | 23.2 | 23.8 | 3.7 | 3.8 |
| 1918 | 17.7 | 26.4 | 22.8 | 4.7 | 4.0 |
| 1919 | 14.3 | 27.4 | 27.4 | 3.9 | 3.9 |
| 1920 | 11.8 | 19.6 | 18.1 | 2.3 | 2.1 |
| 1921 | 14.6 | 23.3 | 26.6 | 3.4 | 3.9 |
| 1922[1] | .... | .... | .... | .... | .... |
| 9-year average | 14.6 | 25.0 | 23.9 | 3.6 | 3.4 |

[1]Data available on only 3 farms.

parently cause wide variations in the amounts of labor used to thresh 100 bushels of grain.

The number of farms represented in Tables 5 and 6 varied from 5 to 9. In 1914 and 1922 no oats were threshed on the farms keeping records. In 1914, when rainfall was 10 inches below normal in Franklin county, oats were a complete failure. In 1922 only 6 acres of oats were grown on the farms keeping records. These were fed as bundle oats.

In 1916, another unfavorable year for oat production, the yield was only 5.9 bushels per acre, while the amount of man labor required to thresh 100 bushels was 40.4 hours.

The season of 1917 was unusually favorable for oats. The average yield was 38.8 bushels per acre, the highest for the ten-year period, yet only 11.4 hours of man labor were used in threshing 100 bushels.

During the four years when the yield of oats in Franklin county was below the average, or 13.9 bushels per acre, 73 percent more man labor was required to thresh 100 bushels of grain than during the four years when the yields were above the average, or 30.7 bushels per acre.

Wheat yields in Franklin county did not vary so much as oat yields, and there was therefore more uniformity in the amounts of labor used in various seasons to thresh 100 bushels. During the five years when wheat yields were below the average, or 12.6 bushels per acre, only 12 percent more labor was required to thresh 100 bushels than during the four years when the yields were above the average, or 17.1 bushels.

## THRESHING IN EAST-CENTRAL ILLINOIS IN 1921

Labor records on threshing were secured in east-central Illinois during 1921 by means of a survey and by field records, as explained on page 4. The weather conditions during the period covered by the investigations were uniformly good for threshing. A summary of the labor required is shown in Table 7.

TABLE 7.—LABOR REQUIRED FOR THRESHING IN EAST-CENTRAL ILLINOIS, 1921

| | Acres included | Yield per acre | Labor per 100 bushels | | Labor per acre | |
|---|---|---|---|---|---|---|
| | | | Man hrs. | Horse hrs. | Man hrs. | Horse hrs. |
| Oats | 16,148 | 32.6 | 10.4 | 14 0 | 3.4 | 4.6 |
| Wheat | 2,948 | 22.6 | 20.5 | 31.8 | 4.6 | 7.2 |

That the labor requirements per 100 bushels of oats and wheat were slightly lower on the cooperating farms in Hancock county during 1921 than they were in east-central Illinois the same season is shown by a comparison of Table 7 with Tables 3 and 4. This may have been due to the fact that the farms in Hancock county were a somewhat selected group, while those in east-central Illinois were representative of average farms in the three counties where the investigations were made.

## VARIATIONS CAUSED BY DIFFERENCES IN MANAGEMENT

Under practically the same crop and weather conditions, different farms and different threshing rings showed marked variations in the amount of labor required for threshing 100 bushels of grain. In order to find out what factors might cause these variations, a more detailed analysis was made of the results obtained on sixty-two farms in 1921, all of which used 36-inch machines. Weather conditions were favorable

TABLE 8.—RELATION OF VARIOUS FACTORS TO AMOUNTS OF LABOR REQUIRED IN THRESHING OATS, 1921

(Threshing survey data on the sixty-two farms using 36-inch threshing machines)

| Number of man hours per 100 bushels threshed | Average number of bushels threshed per hour | Yield per acre (bu.) | Average distance from field (rods) | Number of field pitchers | Number of bundle haulers | Total number of men per crew | Number of farms in group |
|---|---|---|---|---|---|---|---|
| 8.0 ..... | 292 | 34.6 | 123 | 5.4 | 9.4 | 23.0 | 16 |
| 10.1..... | 264 | 32.9 | 139 | 6.3 | 10.2 | 26.3 | 16 |
| 11.9..... | 216 | 30.3 | 133 | 6.2 | 9.8 | 25.3 | 16 |
| 15.0..... | 166 | 28.5 | 101 | 6.0 | 9.3 | 24.5 | 14 |
| Correlation coefficient | −.82 | −.19 | −.14 | .15 | .02 | .099 | |

while threshing was being done on these farms. Field pitchers were used on all but one of the farms. Thus the difference in labor requirements due to weather or to size of machine was eliminated, making it possible to determine more accurately the effects of other factors.

The data from the sixty-two farms were arranged according to the number of hours of man labor required to thresh 100 bushels of oats. All available data on factors which might bear some relationship to the time required for threshing were tabulated (Table 8).

The relationship between these different factors and the time used in threshing 100 bushels of oats is shown by means of correlation coefficients. A perfect positive correlation would give a correlation coefficient of 1; a perfect negative, or inverse, correlation would give an answer of −1; if no relationship existed, the correlation coefficient would be 0.)

### *Efficiency of Labor Increases with Rate of Threshing*

The correlation between the number of bushels threshed per hour and the hours of man labor used per 100 bushels threshed was −.82. This indicates that efficiency in the use of labor increases as the rate of threshing increases.

The question may be raised whether the number of bushels threshed is not low in many cases simply because the crew does not

work hard enough to keep the threshing machine supplied with bundles up to its capacity. General experience and observation, however, indicate that in practically all cases when farmers exchange labor in threshing, enough help is provided and the men work hard enough to keep the threshing machine supplied with grain while running at full capacity. When weather conditions and the condition of the bundles are favorable for threshing a large number of bushels per hour, the failure to do so is almost always due to inefficient management of the threshing outfit. Carelessness in keeping parts adjusted and repaired results in frequent breakdowns[1] and other delays. Idling on the part of the threshing crew is therefore practically always the result and not the cause of a small number of bushels being threshed per hour.

This statement is borne out by a further analysis of Table 8, which shows that there was no significant relationship between the yield per acre, the distance to fields, or the organization of the crew, and the amount of labor used for threshing.

### *Labor Wasted by Failure to Change Organization of Crew to Fit Size of Job*

A study of the organization of the working crews on the farms in fourteen threshing rings showed that very few changes were made in the organization of the crew to meet the varying demands for labor on different farms. Ordinarily the crew was organized to take care of the farm which had the longest haul from the field to the machine and also the farm which had the longest haul from the machine to the grain elevator, and frequently it remained unchanged on all other farms in the ring. Thus any labor which might have been saved thru a better organization of the threshing crew on farms where the grain was hauled a short distance, was lost in waiting or in traveling more slowly. This probably explains why there was no significant correlation between the yield per acre, the distance to the fields, or the organization of the crew, and the time used in threshing.

## SUGGESTIONS FOR MAKING MORE EFFICIENT USE OF MAN LABOR

The labor used in threshing may be reduced on some farms by carefully adjusting the organization of the crew to the size of the job.

By analyzing the various operations necessary in threshing, the points where wastes occur can be located. A good standard can also be established based upon the performance of the well-managed threshing outfits.

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[1]Detailed information regarding the operation of threshing machines is given in Farmers' Bulletin 991, U. S. D. A.

## BUNDLE HAULING—ESTABLISHING TIME STANDARDS FOR EACH PART OF THE JOB

The approximate distribution of the time for getting the bundles from the shock in the field into the threshing machine is shown in Table 9. The average conditions in hauling oat bundles on the sixty-two farms that used 36-inch threshing machines are shown in the first column. In the second and third columns, good standards where field pitchers are used and where basket racks are used, are shown.

The number of bushels of oats per load of bundles is based upon estimates of a number of farmers, and is believed to be representative of the size of loads hauled in 1921, since the average yields at that time were only 32.6 bushels per acre. Forty bushels of oats per load of bundles was considered a fair sized load where field pitchers were used, and 30 bushels where the bundle haulers used basket racks and pitched on their own loads.

The average rate of threshing oats on the sixty-two farms using 36-inch threshing machines was 235 bushels per hour (Table 9, column 1). Since bundles are always pitched from both sides into a 36-inch threshing machine, one load of 40 bushels must be pitched from each side every 20 minutes. This means threshing 80 bushels of oats in 20 minutes or 240 bushels per hour. Allowing about one-half minute between loads brings the actual rate of threshing down to 235 bushels per hour.

The average distance from threshing machine to field was 125 rods. Traveling at a rate of approximately two and one-half miles per hour would require 18 minutes per load. Since an average of 9.67 bundle haulers was used, 99 minutes (1 hour and 39 minutes) was required for each man to make a round trip. The time for unloading and going back and forth from the field was 20 plus 18 minutes, or 38 minutes, leaving 61 minutes for loading up and waiting. Thirty minutes is generally considered a reasonable time for loading bundles containing 40 bushels of oats, so that 31 minutes are allowed out of each 99 minutes for waiting, as insurance against breakdowns or other delays. Six pitchers were used in the field. Hence for every 100 bushels of oats delivered into the threshing machine, 6.7 hours of man labor were used.

In the second column of Table 9, a fair standard is shown, with field pitchers reduced to 5 and the number of bundle haulers reduced to 9. The rate of threshing is set at 300 bushels per hour, which is the average for the nineteen farms that threshed the largest number of bushels per hour. Even with the smaller crew, the time for each operation is reasonable, since six minutes are left in each round trip for delays or rest. When the work is performed at this rate, the number of man hours required for getting bundles from the field into the threshing machine is reduced to 4.7 per 100 bushels of oats threshed.

## BASKET RACKS SAVE LABOR IN GETTING GRAIN TO MACHINE

The third column of Table 9 shows the results that can be obtained under the same conditions by using basket racks for hauling bundles and having each bundle hauler pitch on his own load. This method eliminates special field pitchers but necessitates having about two more bundle haulers with a 36-inch threshing machine. The size of the bundle loads is usually smaller under this system, and has here been

TABLE 9.—AVERAGE TIME TAKEN IN GETTING BUNDLES OF OATS FROM THE FIELD INTO THE THRESHING MACHINE COMPARED WITH GOOD STANDARDS[1]

| | Average of 62 farms using 36" threshing machines | Good standards | |
|---|---|---|---|
| | | Where field pitchers are used | Basket racks used—no field pitchers |
| | 1 | 2 | 3 |
| Distance from machine to field | 125 rods | 125 rods | 125 rods |
| Amount of oats per bundle load | 40 bu. | 40 bu. | 30 bu. |
| Amount of oats threshed per hour | 235 bu. | 300 bu. | 300 bu. |
| Time for each part of operation | | | |
| 1. Pitching off load at machine | 20 min. | 16 min. | 12 min. |
| 2. Going back and forth from field | 18 " | 18 " | 18 " |
| 3. Loading bundles | 30 " | 30 " | 30 " |
| 4. Allowance for delays or rest | 31 " | 6 " | 6 " |
| Total time for each round trip | 99 " | 70 " | 66 " |
| Number of bundle haulers used or needed | 9.67 | 9 | 11 |
| Number of field pitchers used or needed | 6 | 5 | .. |
| Total number of men for getting bundles to machine | 15.67 | 14 | 11 |
| Man labor per 100 bushels of oats threshed | 6.7 hrs. | 4.7 hrs. | 3.7 hrs. |

[1]The standards set up were obtained by taking the performance of the farms most efficient in the use of threshing labor and testing for reasonableness.

assumed to be three-fourths as large as when field pitchers are used. The time for pitching off the load into the threshing machine has accordingly been reduced from 16 minutes to 12 minutes per load. The time allowed for the other parts of the operation is the same as that shown in the second column.

By using basket racks, the number of men required to get the bundles to the threshing machine is reduced to 11, and the number of man hours for getting bundles from the field into the threshing machine to 3.7 per 100 bushels of oats threshed.

While the use of basket racks and the elimination of field pitchers has been the general practice in many parts of the West, it has not come into such general use in Illinois as its merits justify.

Fifteen of the farms using small threshing machines included in the threshing survey in 1921 used basket racks, as did twenty-two of the

farms keeping field records.[1] Farmers using basket racks are strong advocates of them. The racks not only save man labor by eliminating a great deal of unnecessary work in loading, but also help to distribute among a larger number of men the heaviest part of the work, which is pitching the bundles on the wagons. When this work is all done by five or six field pitchers, who have no change of work, a lot of muscular energy per man is required, but if it is distributed among eleven bundle

FIG. 2.—THE USE OF BASKET RACKS SAVES APPROXIMATELY ONE-FOURTH OF THE MAN LABOR NECESSARY TO GET THE BUNDLES OF GRAIN TO THE THRESHING MACHINE

haulers who get something of a change in pitching into the machine and riding back and forth from the field, the men do not tire so easily.

## NUMBER OF BUNDLE HAULERS SHOULD VARY WITH DISTANCE TO MACHINE

The number of bundle haulers should be adjusted according to the distance from the machine to the field. In the cases shown in Table 8 the distances averaged 125 rods. Where farms have a well-planned field system it is usually possible to have the fields less than 80 rods from the threshing machine. A simple calculation will show that for the conditions shown in column 2, a decrease of 53 rods in the distance would have saved the time of one bundle hauler. In other words, if the distance were 72 rods instead of 125 rods, each bundle hauler would save 106 rods of travel in a round trip. Traveling at the rate of 2½ miles per hour, a saving of 8 minutes would be made. Hence for nine bundle haulers a saving of 72 minutes would be made, which is equivalent to the time required for one bundle hauler to complete the

[1]For saving in labor on these farms, see Table 10, page 390.

round trip. When basket racks are used as shown in Table 9, third column, a decrease of 40 rods in distance from threshing machine to field would save one bundle hauler.

The practice of adjusting the number of bundle haulers to the actual needs of a job would save a considerable amount of time during the threshing season, when man labor usually is scarce.

## NUMBER OF GRAIN HAULERS SHOULD BE ADJUSTED TO DISTANCE TO ELEVATOR OR GRANARY

It is a common practice in most threshing rings in east-central Illinois to keep the same number of grain haulers regardless of the distance the threshed grain has to be hauled. In order to avoid waste of labor, the number of grain haulers should be adjusted to the distance. When oats are hauled to a granary or elevator one-fourth mile or less from the threshing machine, three grain haulers[1] ordinarily can haul all the oats if threshing is done at the rate of 300 bushels per hour. This allows 18 minutes for loading each load, and 36 minutes for each hauler to unload and drive back and forth. At a distance of one-half mile, four haulers will be needed unless the men are willing to work exceptionally fast. For every additional half-mile in the distance from threshing machine to elevator, one more grain hauler is needed.

Thus at two miles the time of each hauler[2] would be apportioned approximately as follows:

| | |
|---|---|
| Loading up | 18 minutes |
| Hauling round trip of 4 miles | 80 minutes |
| Unloading and waiting | 22 minutes |
| Total for round trip | 120 minutes |

Since an empty wagon with a capacity of 90 bushels of oats must be at the threshing machine every 18 minutes, it follows that when 120 minutes (2 hours) are required for a round trip there must be as many grain haulers as 120 divided by 18, or 6⅔, which means that 7 grain haulers are needed.

On any job where one man hauls to the granary near by, he will be able to haul one-third of all the oats threshed. With this organization 4 haulers (⅔ of 6⅔) also will be needed to haul to the elevator.

On the 62 farms included in Table 8, the average number of men hauling to the granary was 1.88, and the average number of men hauling to the elevator was 4.6. The average distance from threshing machine to elevator was 2.27 miles. On one of the farms, located 2¼ miles from the elevator, one man hauling to the granary and 5 men hauling to the elevator would have been sufficient.

[1]It is assumed that one or two men will help unload at the granary. The amount of help needed varies with the equipment available for unloading.

[2]Because most Illinois farmers use horses for hauling grain, this analysis has been made on that basis. The same kind of analysis may readily be applied where trucks are used.

### SUMMARY OF TIME REQUIREMENTS UNDER EFFICIENT MANAGEMENT IN FAVORABLE WEATHER

The threshing standard of 300 bushels of oats per hour, which has been suggested for a 36-inch threshing machine, is reasonable under good weather conditions. During seasons when yields of oats are 50 or more bushels per acre, and the straw is short, 360 to 400 bushels may be threshed per hour with a 36-inch threshing machine. Farmers should insist on threshermen having their outfits in good condition at the beginning of the season, so that steady and continuous operation may be assured. When threshermen fail to keep the outfit operating at a fair speed, some stimulation from the farmers may be necessary. Unless a fair rate of speed and steady operation can be obtained, labor cannot be utilized efficiently.

It may be assumed that under good farm organization the average distance from threshing machine to field will not exceed 80 rods. Ten bundle haulers using basket racks and pitching on their own loads can keep the threshing machine supplied with oats at the rate of 300 bushels per hour under average conditions. Assuming also that one grain hauler will haul to the granary on the farm, and five others to the elevator at the average distance of 2¼ miles, the organization and operation of the crew on a one-hour basis would be as follows:

| | *Number of men* | *Man hours* | *Horse hours* |
|---|---|---|---|
| Bundle haulers | 10 | 10 | 20 |
| Grain haulers | 6 | 6 | 12 |
| Stacker[1] | 1 | 1 | — |
| Scooper[1] | 1 | 1 | — |
| Total | 18 | 18 | 32 |
| Time per 100 bushels threshed | | 6 | 10⅔ |

For 20- to 24-inch threshing machines a good rate of threshing oats is 150 bushels per hour. The size of the crew can be cut in two except where an odd number of men is needed to perform a certain operation with the large machines. Thus the number of man hours and horse hours per 100 bushels would remain practically the same as for the 36-inch machines, assuming the same efficiency of management.

## ADVANTAGES OF LARGE AND SMALL THRESHING MACHINES

From the data secured on large and small threshing machines, it has been found that there is no advantage in the saving of labor which can be attributed to the size of the machine.

Most of the farms using the large threshing machines (32 to 44 inches) used field pitchers. The farms using the small threshing machines (20 to 28 inches) used basket racks and no field pitchers. The groups of farms using large threshing machines with and without

[1]Not used on every farm.

field pitchers are compared with those using small threshing machines in Table 10.

The farms reported in columns 2 and 3, which did not use field pitchers, used 28.6 percent less man labor per 100 bushels than those in column 1, which used field pitchers. The amount of horse labor used was increased 13.6 percent where no field pitchers were used. For the

TABLE 10.—COMPARISON OF AMOUNTS OF LABOR USED BY LARGE AND SMALL THRESHING MACHINES IN THRESHING OATS

| | 1<br>32 to 44" machines using field pitchers | 2<br>20 to 28" machines not using field pitchers | 3<br>32 to 44" machines not using field pitchers |
|---|---|---|---|
| Number of farms | 97 | 15 | 22 |
| Hours of man labor per 100 bushels | | | |
| For getting bundles to machine | 7.0 | 5.0 | 5.0 |
| For all other operations | 4.2 | 5.3 | 4.3 |
| Hours of horse labor per 100 bushels | | | |
| For getting bundles to machine | 8.8 | 10.0 | 10.0 |
| For all other operations | 6.1 | 8.3 | 6.8 |
| Relative time required for getting bundles to machine | | | |
| Man labor | 100% | 71.4% | 71.4% |
| Horse labor | 100% | 113.6% | 113.6% |

other operations more labor was used with the small threshing machines (column 2) than with the large machines (columns 1 and 3). This was because nearly three-fourths as many grain haulers were used with the small threshing machines as with the large machines, altho the number of bushels threshed per hour was only one-half as large. This situation, of course, may be attributed to the small threshing machine only to the extent that grain haulers have to wait longer for loading up, a relatively small consideration.

The fuel cost in threshing is a minor item on most farms in east-central Illinois. The average fuel consumption of the steam tractors which furnish the power for the large threshing machines was 110 pounds of coal for 100 bushels of oats threshed. The average fuel consumption of the small gas tractors that furnished the power for the small threshing machines was 2.15 gallons of kerosene for 100 bushels of oats threshed.

Thus the choice between large and small threshing machines must be made on the basis of factors other than economy in the use of fuel and of labor while the machine is in operation.

### *Factors in Favor of the Large Machine*

1. The price of a 36-inch threshing machine is approximately 50 percent higher than the price of a 22-inch machine of the same make, but the larger machine will thresh twice as much grain per season.

2. The large machines require only half as many managers for the same acreage, a situation which should result in the selection of better managers.

*Factors in Favor of the Small Machine*

1. Small threshing machines can be run by small gas tractors, which can also be used for field work. Thus in time the cost for power from small gas tractors should be less than it is now from large gas or steam tractors, many of which are used only for threshing.

2. The bundles are pitched into the small machines from one side. Consequently the machines can be set so that both bundle haulers and grain haulers can work on the windward side and keep out of the dust.

3. Some time is saved by the men in going to and from work, or when long delays occur, owing to the smaller area included in the small threshing ring.

4. Meals at farm houses can be served more easily to 10 or 15 men at a time than to 20 or 30 men.

No doubt the rapid increase[1] in the number of small threshing machines used has been due largely to the advantages just mentioned. While the number of small threshing machines probably will not increase so rapidly in the future as it did during the war period, there no doubt will be a steady increase in the proportion of small machines used, especially in those sections of Illinois where small gas tractors are being used extensively for field work. Twenty thousand of these small tractors were in use on Illinois farms in 1920. These would have furnished sufficient power (allowing 400 acres of small grain per tractor) to thresh the 8,000,000 acres of small grain commonly grown in this state.

## LABOR SETTLEMENTS IN THRESHING RINGS

In exchanging labor between the members of a threshing ring, it is a common practice for each member to furnish one man and team for each 40 acres of grain. For 80 acres of grain, two men and two teams are usually furnished. When the acreage is between 40 and 80 acres, sometimes an extra man is furnished, or two men may combine in hiring an extra man, depending upon the size of the ring, the amount of help needed, and the number of acres of grain grown by the different members.

A detailed study of a number of rings shows that even tho members try to avoid it, large differences occur in the amounts of labor received by some members as compared with the amounts of labor furnished. In one ring of eight farmers, one member was found to have received 256

[1]Fourteen out of fifteen threshing machine manufacturers in the Middle West, when questioned in regard to the relative number of sales of small and large machines, stated definitely that more than 50 percent of their sales were of the small machines.

hours more man labor than he furnished. Another member furnished 140 hours more than he received. No settlement of labor differences was made in this ring, altho the amounts involved were large.

Fifteen of the 27 cooperative threshing rings surveyed did not figure differences in labor on any basis; five settled differences on the basis of the number of bushels threshed, three on the basis of the number of acres of grain threshed, and four on the basis of hours or days of man labor furnished.

The relative fairness of these three methods may be judged by applying them to a specific threshing ring which is somewhat typical of a large number of rings in Illinois.

The data in Table 11 illustrate the conditions in many small rings, where farmers having widely varying acreages and yields of grain exchange help in threshing.

TABLE 11.—DATA USED AS A BASIS FOR SETTLING LABOR DIFFERENCES IN AN ILLINOIS THRESHING RING, 1921

| Name of member | Acres of oats | Yield per acre | [1]Bushels of oats threshed | Number of men furnished | Time for threshing (hours) |
|---|---|---|---|---|---|
| A | 40 | 36.9 | 1 476 | 1 | 16 |
| B | 46 | 46.1 | 2 121 | 1 | 22 |
| C | 25 | 29.6 | 741 | 1 | 8 |
| D | 90 | 49.0 | 4 413 | 2 | 46 |
| E | 57 | 27.0 | 1 536 | 1 | 14 |
| F | 65 | 31.1 | 2 020 | 2 | 15 |
| G | 60 | 28.3 | 1 700 | 2 | 14 |
| H | 43 | 32.6 | 1 400 | 2 | 13 |
| Total | 426 | .... | 15 407 | 12 | 148 |
| Bushels threshed per man | | | 1 284 | | |

[1]Where wheat was grown, 1 bushel of wheat was considered equivalent to 2 bushels of oats.

## METHOD 1: SETTLEMENT ON THE BUSHEL BASIS

To make a settlement of labor differences in the ring described in Table 11 on the basis of the number of bushels threshed, there are two ways of proceeding. The procedure described here, which is generally used, requires few calculations.[1]

In Table 11 it may be noted that a total of 15,407 bushels of oats were threshed by the ring, and that 12 men did the threshing. The number of bushels threshed per man during the season was therefore 1,284. A member who furnished one man for the season would be exactly even with the ring if the ring threshed 1,284 bushels of oats for him. If less than 1,284 bushels of oats were threshed for him, the ring would owe him for the difference, and if the amount were more than 1,284 bushels he would owe the ring for the excess. Those members furnishing two men thruout the season would be exactly even with the

[1]Another method is described in detail in the 1918 Yearbook of the U. S. D. A., in an article entitled "The Threshing Ring in the Corn Belt."

ring if 2,568 bushels of oats or its equivalent in other grain were threshed for them. The amounts below and above the 2,568 bushels would represent amounts due from the ring, and amounts due to the ring.

After figuring the debits and credits in bushels of grain for each member of the ring, the next step is to set a rate per bushel of grain which will distribute the expenses in a fair way. In Table 11 the total time for threshing is given as 148 hours for 12 men, or a total of 1,776 hours of man labor. At 25 cents an hour, this would amount to $444. In many sections of Illinois, man labor only is considered in determining the rates per bushel of grain, since most farmers can furnish any reasonable number of horses at little additional expense. If the members of a ring decide to consider horse labor as well as man labor, both should be recorded and a reasonable rate agreed upon for each.

With man labor amounting to $444 for 15,407 bushels of grain threshed, the rate per bushel would be 2.88 cents or $2.88 per 100 bushels. This method and rate applied to the data in Table 11 give the results shown in Table 12.

In every case where a threshing ring settles labor differences, a treasurer should be elected. In the settlement shown in Table 12, farmers A, B, D, and E would pay the treasurer $5.53, $24.11, $53.14, and $7.26,

TABLE 12.—THRESHING RING SETTLEMENT BASED ON NUMBER OF BUSHELS THRESHED

| Member | Bushels threshed | Men furnished | Bushels threshed | | Dr. at $2.88 per 100 bushels | Cr. at $2.88 per 100 bushels |
|---|---|---|---|---|---|---|
| | | | [1]Above the average Dr. | Below the average Cr. | | |
| A..... | 1 476 | 1 | 192 | ..... | $ 5.53 | ..... |
| B..... | 2 121 | 1 | 837 | ..... | 24.11 | ..... |
| C..... | 741 | 1 | ..... | 543 | ..... | $15.64 |
| D..... | 4 413 | 2 | 1 845 | ..... | 53.14 | ..... |
| E..... | 1 536 | 1 | 252 | ..... | 7.26 | ..... |
| F..... | 2 020 | 2 | ..... | 548 | ..... | 15.78 |
| G..... | 1 700 | 2 | ..... | 868 | ..... | 25.00 |
| H..... | 1 400 | 2 | ..... | 1 167 | ..... | 33.61 |
| Total..... | 15 407 | 12 | 3 126 | 3 126 | $90.04 | $90.03 |

[1]Average number of bushels per man, 1,284.

respectively. The treasurer would pay C, F, G, and H the amounts credited to them, that is, $15.64, $15.78, $25.00, and $33.61.

This method of settlement is fairly satisfactory when the rate used approximates the actual man-labor cost.

### METHOD 2: SETTLEMENT ON THE ACRE BASIS

The second method of settling labor differences in threshing is based upon the number of acres threshed for each farmer. The procedure is as follows:

With 426 acres in the ring and 12 men in the crew (Table 11), the acreage per man is 35.5. Any farmer furnishing one man will be even with the rest of the members of the ring if he has 35.5 acres of grain threshed. Members furnishing two men will come out even if they have 71 acres threshed. Members having more than 71 acres threshed will of course receive more than they give. Consequently, they should pay the ring for the difference. Those having less than the above acreages, but furnishing the same number of men, receive less than they give, and should be paid the differences by the ring.

TABLE 13.—THRESHING RING SETTLEMENT BASED ON NUMBER OF ACRES OF GRAIN THRESHED

| Member | Acres threshed Dr. | Men furnished | Acres entitled to Cr. | Differences in acreage | | At $1.00 per acre | |
|---|---|---|---|---|---|---|---|
| | | | | Dr. | Cr. | Dr. | Cr. |
| A..... | 40 | 1 | 35.5 | 4.5 | .... | $4.50 | ..... |
| B..... | 46 | 1 | 35.5 | 10.5 | .... | 10.50 | ..... |
| C..... | 25 | 1 | 35.5 | .... | 10.5 | ..... | $10.50 |
| D..... | 90 | 2 | 71 | 19 | .... | 19.00 | ..... |
| E..... | 57 | 1 | 35.5 | 21.5 | .... | 21.50 | ..... |
| F..... | 65 | 2 | 71 | .... | 6 | ..... | 6.00 |
| G..... | 60 | 2 | 71 | .... | 11 | ..... | 11.00 |
| H..... | 43 | 2 | 71 | .... | 28 | ..... | 28.00 |
| Total..... | 426 | 12 | 426 | 55.5 | 55.5 | $55.00 | $55.00 |

In order to determine the rate per acre to be paid or refunded, a close estimate must be made of the total number of hours spent in threshing. This number multiplied by the number of men employed gives the total hours of man labor. This amount divided by the total acreage in the ring gives the number of man hours required per acre. Multiplying the man hours per acre by a fair rate, say 25 cents an hour, gives the rate per acre to be paid or refunded.

In this particular ring, 148 hours (14.8 ten-hour days) from each of 12 men, or a total of 1,776 man hours, were required to thresh all the jobs. The total acreage of grain was 426. The number of hours of man labor required per acre was therefore 4.2. To make the calculations easier, 4 hours may be considered correct. At 25 cents an hour, the acre rate for settling differences in acreages threshed would be $1.00. Table 13 shows how a summary of the work done by the ring and the settlement to be made with each member may be made up.

On this basis, farmers A, B, D, and E would pay $4.50, $10.50, $19.00, and $21.50, respectively, to the treasurer, who would pay farmers C, F, G, and H, $10.50, $6.00, $11.00, and $28.00, respectively.

Obviously, this method of settlement is fair only when the yield of grain per acre is fairly uniform thruout the ring. The difficulty of getting the correct acreage for each farm is another disadvantage in using this method.

### METHOD 3: SETTLEMENT ON TIME BASIS

The third method of settling differences which occur in exchanging labor is to make settlement on the basis of the hours of man labor furnished by each member to the ring and received from the ring. With this method a timekeeper is appointed, who may also act as treasurer. The timekeeper will find it convenient to use some such form for recording time as is shown in Table 14. This form is like a regular time sheet except that the names of the farmers for whom threshing is done are listed at the top of each column in place of the different days of the week.

On the line with each farmer's name is recorded the number of hours of man labor which he and his hired help have furnished to the other members of the ring. Delays of more than 15 minutes, for which the member having the threshing done is not responsible, are not charged against him. The records of the same ring used to explain the two preceding methods are used to show the final settlement with this method (Table 14).

Farmer A was the first to thresh. He received from farmers B, C, D, E, F, G, and H, 16, 16, 32, 16, 32, 32, and 32 hours of labor, respectively, or a total of 176 hours. He is therefore indebted to the ring for that number of hours. During the threshing season, farmer A furnished farmers B, C, D, E, F, G, and H with 22, 8, 46, 14, 15, 14, and 13 hours, respectively, or a total of 132 hours, which amount is credited to him. The debits and credits of each member of the ring may be noted in the same way.

If farmer A's total debit is 176 hours, and his total credit 132 hours, he owes the ring for the difference, or 44 hours. Farmer B also received more help than he furnished; he owes the ring for the difference between 242 hours and 126 hours, or 116 hours. Farmer C received 88 hours, but furnished 140; the ring therefore owes him for the difference, which is 52 hours. Farmers D and E received more labor than they furnished, and therefore owe the ring for the differences. Farmers F, G, and H furnished more labor than they received, and the ring owes them for the differences. On the basis of 25 cents an hour, the amounts owed to the ring by A, B, D, and E, would be $11, $29, $64, and $5, respectively. These amounts would be paid to the treasurer, who would then pay C, F, G, and H the amounts owed them, namely, $13, $29, $32, and $35.

### BUSHEL OR TIME BASIS MORE SATISFACTORY THAN ACRE BASIS

Since these three methods of making labor settlements have all been used by various threshing rings in Illinois, an application of all of them to the ring just described gives some basis for judging the merits of each. A comparison of the results arrived at with each method is made in Table 15.

TABLE 14.—THRESHING RING SETTLEMENT BASED ON THE NUMBER OF HOURS OF MAN LABOR FURNISHED AND RECEIVED

| Furnished to ..... / By | A | B | C | D | E | F | G | H | Total hours furnished Cr. | Labor differences | | [2]Cash differences | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Hours owed to ring Dr. | Hours owed by ring Cr. | Owed to ring Dr. | Owed by ring Cr. |
| A | ([1]) | 22 | 8 | 46 | 14 | 15 | 14 | 13 | 132 | 44 | ... | $11.00 | ..... |
| B | 16 | ([1]) | 8 | 46 | 14 | 15 | 14 | 13 | 126 | 116 | ... | 29.00 | ..... |
| C | 16 | 22 | ([1]) | 46 | 14 | 15 | 14 | 13 | 140 | ... | 52 | ..... | $13.00 |
| D | 32 | 44 | 16 | ([1]) | 28 | 30 | 28 | 26 | 204 | 256 | ... | 64.00 | ..... |
| E | 16 | 22 | 8 | 46 | ([1]) | 15 | 14 | 13 | 134 | 20 | ... | 5.00 | ..... |
| F | 32 | 44 | 16 | 92 | 28 | ([1]) | 28 | 26 | 266 | ... | 116 | ..... | 29.00 |
| G | 32 | 44 | 16 | 92 | 28 | 30 | ([1]) | 26 | 268 | ... | 128 | ..... | 32.00 |
| H | 32 | 44 | 16 | 92 | 28 | 30 | 28 | ([1]) | 270 | ... | 140 | ..... | 35.00 |
| Total hours received, Dr... | 176 | 242 | 88 | 460 | 154 | 150 | 140 | 130 | 1540 | 436 | 436 | $109.00 | $109.00 |
| Crew time per farm, hrs.... | 16 | 22 | 8 | 46 | 14 | 15 | 14 | 13 | 148 | | | | |
| Number of men furnished.. | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 12 | | | | |

[1]It is not necessary to record the time of each farmer on his own job.
[2]Labor was figured at 25 cents an hour.

The bushel and time bases give fairly uniform results except in the cases of D and F; D would have to pay more if the settlement were made on the latter basis, while F would receive more. The acre basis is easy on the man with high crop yields, but hard on the man with low yields. To the authors either the bushel basis or the time basis seems the more satisfactory. In cases where the time is affected by weather conditions, or other factors beyond the control of the farmer whose

TABLE 15.—THREE METHODS OF SETTLING LABOR DIFFERENCES APPLIED TO ONE THRESHING RING

| Member | Yield per acre | Bushel basis | | Acre basis | | Time basis | |
|---|---|---|---|---|---|---|---|
| | | Rate $2.88 per 100 bushels | | Rate $1.00 per acre | | Rate 25 cents per hour | |
| | | Dr. | Cr. | Dr. | Cr. | Dr. | Cr. |
| A | 36.9 | $5.53 | ..... | $4.50 | ..... | $11.00 | ..... |
| B | 46.1 | 24.10 | ..... | 10.50 | ..... | 29.00 | ..... |
| C | 29.6 | ..... | $15.64 | ..... | $10.50 | ..... | $13.00 |
| D | 49.0 | 53.14 | ..... | 19.00 | ..... | 64.00 | ..... |
| E | 27.0 | 7.26 | ..... | 21.50 | ..... | 5.00 | ..... |
| F | 31.0 | ..... | 15.78 | ..... | 6.00 | ..... | 29.00 |
| G | 28.3 | ..... | 25.00 | ..... | 11.00 | ..... | 32.00 |
| H | 32.6 | ..... | 33.61 | ..... | 28.00 | ..... | 35.00 |

grain is being threshed, the bushel basis offers the fairest method for settlement. However, one man may have a lot of weeds in his grain, extra rank straw, or have the machine set so far from the fields as to use more than the average amount of time per bushel. Under these conditions the time basis results in the fairest settlement.

## COOPERATIVE OWNERSHIP OF THRESHING MACHINES

Occasionally there is a threshing ring in which both threshing machine and engine are owned by the members of the ring. More often, however, only the threshing machine is owned by the group and the power is hired. Since a large number of small tractors are now used by individual farmers for field work, it is often more advantageous to hire this form of power from one member of the ring or from a farmer outside the ring than for the ring to own a tractor.

### TWO FORMS OF RING ORGANIZATION—PARTNERSHIP AND CORPORATION

The usual form of organization when a threshing machine, or a threshing machine and an engine is owned by the ring, is the partnership, which either is implied or is expressed in a written agreement. Another is the corporation form, which is becoming more common in

farm organizations doing a large business. The chief features of the corporation form in contrast to the partnership are: (1)limited liability, (2) freely transferable shares, and (3) greater permanence. The most advantageous of these features is the limited liability; whatever misfortune may happen to the incorporated organization, the members usually cannot lose more than they have paid in.

In the partnership organization there is no such limitation; under certain conditions each member of a partnership is liable, up to the limit of his resources, for the acts of any other member or members. Several provisions of the Illinois statutes, however, make the matter of unlimited liability of partners less serious than it first seems to be. Among these provisions are the following:

"An act of a partner which is not apparently for the carrying on of the business of the partnership in the usual way, does not bind the partnership unless authorized by the other partners."

"No act of a partner in contravention of a restriction on his authority shall bind the partnership to persons having knowledge of the restriction."[1]

Partners in threshing rings do not ordinarily consider the matter of unlimited liability as being a serious disadvantage, since the members are well acquainted and carefully selected on the basis of integrity and the amount of property owned.

From the standpoint of freely transferable shares, the partnership admits new members only upon the approval of the partners. In the corporation, it is more difficult to control the membership.

The greater permanence of the corporation is not especially important in the ownership of a threshing machine. By the time a machine is worn out, which ordinarily is in ten to fifteen years, the personnel of a threshing ring is likely to have changed considerably. Instead of keeping a fixed capital, members usually prefer to have surpluses distributed. Thus instead of building up a reserve which would be large enough in ten to fifteen years to buy a new machine, they prefer to use this amount as individuals. When a new machine is needed, new contributions are made. The affairs of the old organization are wound up, and a new one is formed. This flexibility is naturally attained under a partnership organization.

## FINANCING COOPERATIVELY OWNED THRESHING MACHINES

If, in a group of farmers, each grows approximately the same acreage of similar grains, the problem of distributing the investment and expenses of a threshing machine in an equitable manner is simple. Each farmer may contribute an equal share in the purchase of a machine. The operating expenses divided by the total bushels threshed would give the rate per bushel that should be charged each member.

[1]Revised Statutes of Illinois 1919. Partnerships.

Having approximately the same acreage and bushels, each will receive about the same benefit from the capital invested in the machine.

If, however, unequal acreages are owned, as is usually the case, the problem is not only that of sharing cash disbursements in proportion to the bushels threshed, but also of getting credit for interest and depreciation in proportion to each cooperator's investment. It is not usually practicable to have the investment of each farmer in proportion to the size of his job, since this is likely to vary considerably during the life of the machine.

In practice, the custom rate in the community is usually charged, and the net proceeds for the year above cash disbursements are distributed or credited to the members in proportion to their ownership. As a rule, each farmer owns an equal part or share in the machine. This method is fair only if the actual expenses in threshing with the cooperative threshing machine, including interest and depreciation, are the same per bushel as the custom rate. Under superior management the expense per bushel will be below the custom rate; under inferior management it may be considerably higher. If the expense per bushel is above the custom rate, the man with the small job will receive less benefit from his investment than the man with the large job. This may be seen in the following example.

Four farmers, A, B, C, and D, have 200, 100, 50, and 50 acres of grain respectively, yielding 8,000, 4,000, 2,000, and 2,000 bushels of oats or its equivalent. If the custom rate is 2½ cents a bushel, the threshing bills would be as follows:

| | | | | |
|---|---|---|---|---|
| A | 8,000 bushels | @ | 2½c | $200 |
| B | 4,000 bushels | @ | 2½c | 100 |
| C | 2,000 bushels | @ | 2½c | 50 |
| D | 2,000 bushels | @ | 2½c | 50 |
| Total | 16,000 bushels | @ | 2½c | $400 |

The cash disbursements for the year would be about as follows:

| | |
|---|---|
| Engine hire 1¼c a bushel | $200 |
| Separator man 16 days @ $3 | 48 |
| Repairs | 40 |
| Total | $288 |

This would leave a balance of $112 to be distributed or credited to the farmers in proportion to their investments, which are assumed to be equal, as is usually the case in practice. At present prices a small separator for threshing 16,000 bushels of oats costs about $1,000. Assuming, then, that each cooperator has a share amounting to $250 the first year, each man would receive a credit of $28, which should cover his share of the depreciation and interest. The actual amount of these two items the first year would be about as follows:

| | |
|---|---|
| Interest 6% on $1,000 | $ 60 |
| Depreciation 10% on $1,000 | 100 |
| Total | $160 |

Interest and depreciation per share $40.

The total expenses for the year would be as follows:

| | |
|---|---|
| Cash disbursements | $288 |
| Interest and depreciation | 160 |
| Total | $448 |

This amount divided by the number of bushels threshed gives the rate, based on actual costs, of 2.8 cents per bushel of oats. A comparison of the cost rate and of the custom rate applied to each job threshed gives the following results:

| | A | B | C | D | Total |
|---|---|---|---|---|---|
| Threshing bill based on cost rate of 2.8c per bushel | $224 | $112 | $56 | $56 | $448 |
| Threshing bill based on custom rate of 2½c per bushel | 200 | 100 | 50 | 50 | 400 |

The settlements based on each member having a $250 share in the machine are as follows:

*1. When cost rate of 2.8 cents per bushel is charged:*

| | A | B | C | D | Total |
|---|---|---|---|---|---|
| Bushels of oats or its equivalent threshed | 8,000 | 4,000 | 2,000 | 2,000 | 16,000 |
| Debit | $224 | $112 | $56 | $56 | $448 |
| Credit[1] | 40 | 40 | 40 | 40 | 160 |
| Balance to be paid treasurer to cover cash disbursements | $184 | $72 | $16 | $16 | $288 |

[1]Based on 6 percent interest and 10 percent depreciation borne equally by each member.

*2. When custom rate of 2.5 cents per bushel is charged:*

| | A | B | C | D | Total |
|---|---|---|---|---|---|
| Bushels of oats or its equivalent threshed | 8,000 | 4,000 | 2,000 | 2,000 | 16,000 |
| Debit | $200 | $100 | $50 | $50 | $400 |
| Credit[2] | 28 | 28 | 28 | 28 | 112 |
| Balance to be paid treasurer to cover cash disbursements | $172 | $72 | $22 | $22 | $288 |

[2]This is the remainder, after cash items have been paid, which is credited equally to each member.

In the above settlements, B would have the same amount to pay in either case, A would pay $12 more in cash when the rate was based on actual cost, while C and D would each have to pay $6 less in cash since each member is given full credit for his share of the depreciation and interest charge.

Charging a lower rate for threshing than actual cost, when the ownership is equally divided, favors the man with the large job, and charging a higher than cost rate favors the man with the small job. These differences are almost negligible when the grain acreages are

nearly equal, but they increase directly with differences in acreage and with variations from the cost rate. It may be concluded, therefore, that custom rates are satisfactory as a basis for settlement when the jobs in a ring are fairly uniform in size. When considerable variations occur in the size of jobs, a rate should be set which will cover all cash disbursements, plus a fair credit for interest and depreciation. The latter two items should be credited to each member of the company in proportion to the number of shares he owns.

## WRITTEN AGREEMENTS PREVENT MISUNDERSTANDINGS

Few threshing companies have any written agreements. For the purpose of having a clear understanding of the rights and duties of officers and other members, as well as having written evidence in case of disagreement, it is well to put all agreements in writing. The following suggested agreement is based upon some agreements which are in actual use and on others of a similar nature.

### *Illinois Threshing Agreement*

We, the undersigned, hereby agree to form and become members of this co-partnership, to be known as the.....Threshing Company, for the purchase, ownership, and operation of a threshing machine. We agree to contribute to the fund the sums set opposite our names.

This agreement shall be effective until it has been declared null and void by a two-thirds majority vote of all the members of the association.

#### SECTION 1. ORGANIZATION

A. A share in this company shall consist of an equal part of the total value of the equipment owned by the company.

B. Any member moving from the neighborhood shall dispose of his share to the remaining members at cost, price, discounted at the rate of 10 percent per year for each year the machine has been used, unless he can dispose of it to some one who will be satisfactory to a three-fourths majority of the other members.

#### SECTION 2. OFFICERS AND THEIR DUTIES

A. The officers of this company shall be a president, a secretary-treasurer, and a timekeeper, each elected for a term of one year.

B. The president, secretary-treasurer, and timekeeper shall constitute the executive board or committee.

C. The president shall set the time and place of all meetings, both regular and special, and shall preside at the same. He shall sign all orders for the paying out of the company's funds.

D. The secretary-treasurer shall keep a record of all meetings and transactions of the company, including a copy of the timekeeper's report and such other reports as are made in the meetings. He shall receive all money belonging to the company and shall pay out the same only on orders signed by the president. He shall attend to all correspondence of the company. He shall notify all members in writing of the time, place, and purpose of all meetings at least five days before the date set for the meetings, unless an emergency such as a breakdown occurs. In such case a meeting may be called as soon as the members can be brought together after verbal notice.

E. The timekeeper shall keep a record of the labor furnished to and by each member, of the acres and bushels of grain threshed for each member, and submit the same in a report at the annual fall meeting. On each job he may also assist the owner in getting the best possible arrangement of the crew.

F. It shall be the duty of the executive committee to carry out the wishes of the shareholders of the company, as expressed by them by vote at any meeting at which a quorum is present. It shall be their duty to secure competent help for the operation of the machinery, for which they shall not pay more than the customary wages. It shall be their duty to keep all property owned by the company in the best possible condition of repair.

G. The executive committee shall hire a reliable engineer, and an engine to furnish the power for the ring.

### SECTION 3. MEETINGS

A. There shall be two regular meetings each year. One shall be held in the month of May, at which time any necessary business pertaining to the coming season shall be taken up and disposed of. The second regular meeting shall be held within three weeks after completion of the threshing season. At this time all accounts owed to and by the company shall be settled, officers for the following year elected, and all other necessary business transacted.

B. A special meeting may be called at any time at the discretion of the president, or upon the request of any two or more members of the company.

C. A quorum shall consist of a majority of the shareholders.

### SECTION 4. MACHINERY AND EQUIPMENT

A. The size and kind of machine to be purchased shall be decided by a majority vote in meeting, after sufficient investigation with respect to the needs of the ring and the respective qualities of the different machines has been made.

B. A shed shall be provided on the farm of Mr.....,
of sufficient size to house all the equipment belonging to the company.

C. Any item of repair which costs more than.....
dollars must be approved by a majority vote of the shareholders.

D. Insurance shall be carried on all equipment owned by the company.

### SECTION 5. RATE TO BE CHARGED

A. The rate to be charged for threshing for members shall be figured at the end of the season. It shall be set high enough to provide funds for paying all cash items, plus 6 percent interest on the value of the machine and equipment at the beginning of the year, 10 percent depreciation on the original cost of the machine, and 4 percent depreciation on the original cost of any shed which has been provided by the company to shelter said machine.

B. Any net profits on custom threshing shall be distributed to the members in proportion to the shares owned.

C. If during any year the members feel that the depreciation on the machine has been above or below 10 percent, a higher or a lower rate may be used, as decided by a two-thirds vote of all the members.

D. One bushel of wheat or rye, and one and one-third bushels of barley shall be considered as equivalent to two bushels of oats.

### SECTION 6. EXCHANGING LABOR AND SETTLING DIFFERENCES

Each member shall furnish one man and team for each.....acres of grain to be threshed.

B. Differences in labor furnished shall be calculated by the timekeeper on the .....[1] basis as described on page.....of Bulletin No..... of the University of Illinois Agricultural Experiment Station.

### SECTION 7. MEALS

Dinner shall be served to all of the crew, and in addition breakfast and supper shall be served to the machine men if requested.

### SECTION 8. CUSTOM THRESHING

Custom threshing may be done after the members have threshed, if the majority of the members are in favor of it.

### SECTION 9. ORDER OF THRESHING

The order of threshing shall be reversed each year.

### SECTION 10. AMENDMENTS

This agreement shall be amended by a two-thirds majority vote of the entire membership.

In witness whereof, we affix our signatures hereto, this..... day of.....19.....

Signatures:.....

.....(Seal)

.....(Seal)

.....(Seal)

.....(Seal)

[1]Bushels or hour basis. If the hour basis is used, delays of 15 minutes or more, for which the member whose job is being threshed is not responsible, should not be charged against him.