Header-type unit in operation.

Combine Used in Corn

two types of gathering attachments successful in harvesting trials in 1954

Roy Bainer, J. R. Goss, R. G. Curley, and D. G. Smeltzer

An ordinary grain combine—when equipped with either a rasp-bar or angle-bar cylinder—is suited for shelling ear corn under California conditions.

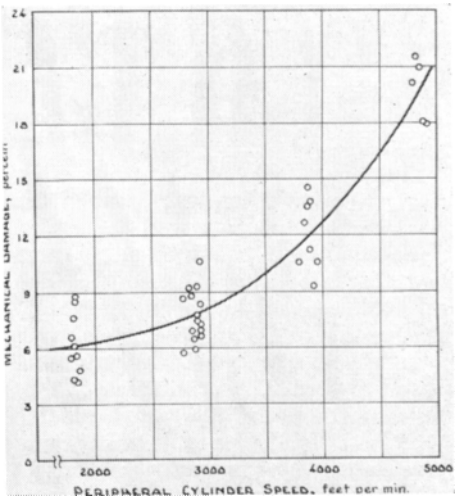
The adjustments necessary to adapt the combine for shelling corn are to increase the clearance between the cylinder and concave and to reduce the cylinder speed. The clearance at the front is usually set at 1″ to 1¼″, and the rear at ¾″ to 1″. The peripheral speed of the cylinder is reduced to a range of approximately 2,500 to 3,000 feet per minute—about one half that used for threshing wheat and barley. Minor changes of sieve openings and air flow in the cleaning shoe are usually desirable to improve the final cleaning of the grain.

The chief problem is that of cutting and introducing the stalks or ears into the combine without loss of grain. The losses may be due to dropping entire ears or the partial shelling of ears as they are removed from the stalk prior to entering the cylinder.

Field tests and observations made during the 1954 harvest season were on combines equipped with six different gathering attachments. The entire group of attachments was experimental and of two general types: First: those that performed as headers, as shown in the photograph at the lower left, cutting sufficient stalk to insure getting the ear and then introducing this portion of the plant into the cylinder. Gathering chain speeds were regulated to insure that the stalks were introduced into the cylinder with the cut ends leading. Second: those that removed the ears from the stalk by stripper bars mounted immediately above snapping rolls, as pictured at the lower right.

As shown in the table on the next page, the total harvesting loss was about the same for machines equipped with either type of gathering attachment. Shelled corn loss for the snapper-type gathering unit was more than three times that lost by the header. On the other hand, the shelled corn loss over the rear of the combine was seven times greater for the header-equipped machine because of the difficulty of separating the threshed grain from the large volume of material handled by the combine. The over-all losses for the combines were in the same range of losses, as determined by tests reported by others with picker-shellers, but slightly higher than for tests on picker-huskers.

A detailed study on two combines was made at Davis. One was a self-propelled unit equipped with a two-row header,

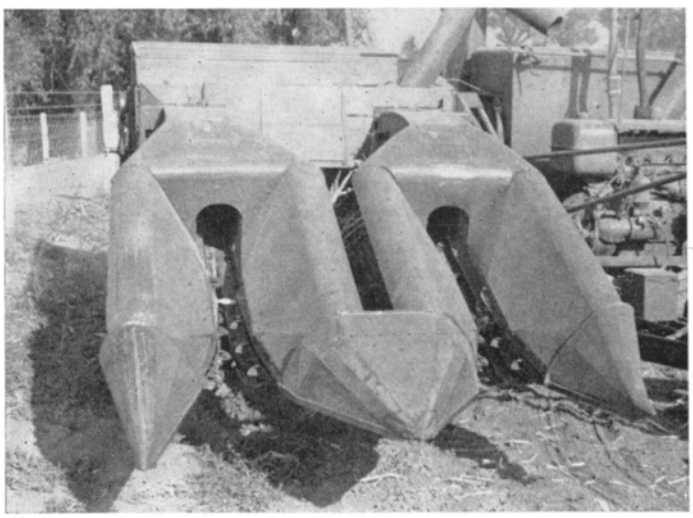


The relation of mechanical damage to shelled corn versus cylinder speed for a combine equipped with a header. Kernel moisture content varied from 12.4% to 18.5% and the feed rate from 128 to 367 pounds per minute.

and the other a straight-through type equipped with a two-row snapping unit. Both machines had rasp-bar cylinders. Seventy-one tests in all were run. After about one third of the tests were run, the corn was badly lodged following two days of wind. The kernel moisture varied from 18.5% to 12.1%, and the average yield was 3,600 pounds of shelled corn per acre.

The commercial grading of corn takes

***Below: Left*—A two-row header attached to a self-propelled combine. The stalks are conveyed to that cylinder on a draper. A series of beaters, operating above the draper, assist in the feeding operation. *Right*—A two-row snapping roll unit attached to a straight-through type combine. Ears of corn are removed from the stalks and fed direct to the cylinder.**



into consideration, among other factors, the per cent of cracked corn and foreign material. This factor of cracked corn and foreign material is determined by the amount of the sample that will pass through a 12/64″ round hole sieve, plus the foreign material that is retained on the sieve. The maximum tolerance for this factor for grade No. 2 corn, which is the basic grade in trading channels, is 3%. In these tests, corn harvested with a header and threshed at cylinder speeds up to 3,800 feet per minute was below the 3% tolerance.

In addition, although it does not affect the grade, the amount of mechanically damaged kernels—chipped or broken—that did not pass through the 12/64″ round hole screen was determined in laboratory analyses. This information helps to evaluate the shelling action of the cylinder. The presence of such kernels may complicate the storage of wet corn. There was a definite correlation between the speed of the cylinder and the per cent of this type of mechanically damaged kernels. The damage to the kernels in the self-propelled machine varied from an average of 6% at 1,800 feet per minute to approximately 20% at 4,800 feet per minute.

Only two cylinder speeds—approximately 1,800 and 2,800 feet per minute—were used with the straight-through harvester with snapper unit. Mechanical kernel damage in this unit was also related to moisture content of the kernels and the clearance between the cylinder and concave. The damage was greater at higher moisture contents, or when the clearance between the cylinder and concave was less.

The cylinder loss—unthreshed corn—was related to the kernel moisture. The trend, as indicated by a limited amount of data taken at a cylinder speed of approximately 2,800 feet per minute, showed losses varying from about 1% to 13.5% moisture to 3% at 18.5% moisture for the combine equipped with the snapping unit.

The machine losses—exclusive of header—were definitely influenced by the feed rate. The graph, at the lower right on this page, represents results of selected tests on the self-propelled unit

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Corn Harvesting Losses on Machines Tested in Riverside and Kern Counties.

	Average loss in per cent of total yield	
Gathering unit loss	**Header**	**Snapper**
Ear corn	2.9	2.0
Shelled corn	0.9	3.2
Total	3.2	5.2
Combine loss—exclusive of gathering unit		
Unshelled corn	0.4	0.6
Shelled corn	2.8	0.4
Total	3.2	1.0
Total harvesting loss	6.4	6.2

Kernel moisture content varied from 9.9% to 20.6%. Yield varied from 2,700 pounds to 7,000 pounds of shelled corn per acre.

Field Corn Pickers

tests indicate two operational factors have important effect on field losses

W. N. King, Lloyd Peterson, and R. G. Curley

Corn picker field tests made in Kern and Los Angeles counties in 1954 show that ground speed and snapping roll adjustment are the most important factors determining picking losses.

Corn moisture content has usually been considered to be the most important factor influencing losses, but in these tests, there was no apparent correlation between machine picking losses and moisture content.

The tests were made in fields—selected at random—where harvesting equipment was in use. Practically all makes and models of corn pickers operating in the test areas were included.

Ear corn on the ground was gleaned from the test area before and after the picking operation. It was air-dried, shelled, and weights recorded as ear corn loss. Shelled corn losses were estimated by tossing a 40″ × 40″ frame in the test area and gleaning kernels included in its boundaries. This process was repeated until an average scattering of shell corn could be determined. Shell corn weights were determined and recorded as shell corn loss. Ground speeds and adjustments of the machines were noted in each case. Grain samples were taken for moisture determination.

The tests results showed that corn losses chargeable to machine picking ranged from a low of 96 pounds per acre to a high of 685 pounds per acre, with

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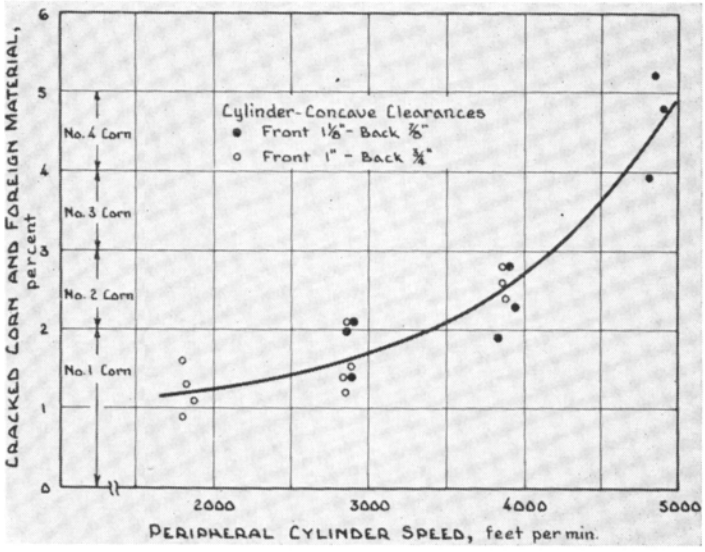
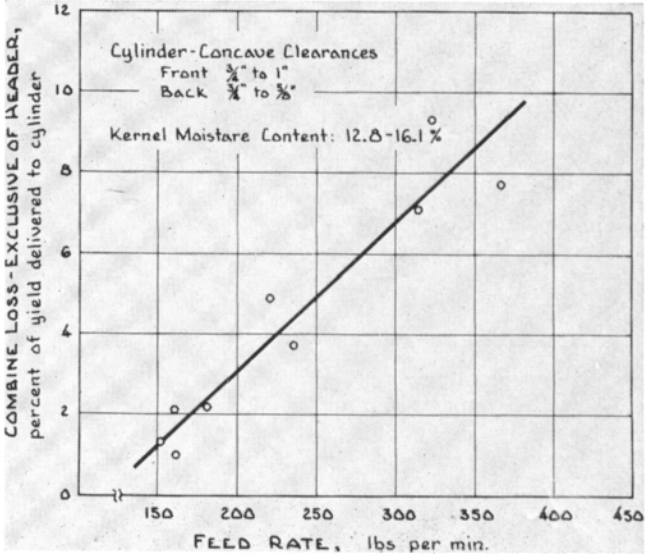
The commercial grade of corn as influenced by cylinder speed for the header-equipped machine.



Combine losses, exclusive of header loss, as affected by feed rate for the self-propelled unit.



Hybrid Corn Trials

effect of summer temperatures on corn maturity in Santa Barbara County

Harwood L. Hall

Temperature differences may be so great between relatively nearby areas as to cause hybrid corn varieties to perform in widely different ways.

Hybrid corn trials conducted during the past few years showed clearly that hybrids will perform quite differently in the coastal area of Lompoc, in the intermediate area of the Santa Ynez Valley, and in the inland area of the Cuyama Valley. Maturity observations at Bakersfield supported the Santa Barbara County trials. However, in general the early varieties tested proved the most profitable for grain purposes in the coastal area.

In the Santa Barbara County areas, corn is a major crop whether for silage or grain.

Considering only the months of June, July, and August—when most of the corn growth takes place—records of weather stations in the trial areas show the following comparison of temperatures for three-year averages:

Temperature averages

	1952	1953	1954	Av.
Lompoc	60.50	60.27	59.87	59.88
Santa Ynez	64.50	66.10	65.60	65.40
Cuyama	70.10	71.10	70.70	70.63
Bakersfield Kern County	78.27	79.12	78.57	78.65

From one station to the next the change is about five degrees—except for the eight degree difference between Cuyama and Bakersfield.

In 1952, duplicate trials were established in the Santa Ynez and Cuyama valleys. To cover the range of maturity, six varieties of DeKalb hybrid corn were used in the trials, with one Northrup King variety as a check. The DeKalbs ranged from the early DeKalb 240 to the late 1022; K3A was the Northrup King variety.

At each location, varieties were planted in the same field and at the same time. Maturity was judged by the moisture content of the whole plant, considering 67% moisture the proper condition for the best silage. Sampling was done every five days until the optimum was reached.

The following results were obtained:

Time from Planting to Harvest at 67% Moisture. 1952 Trials.

Variety	Santa Ynez Days	Cuyama Days
DeKalb 240	133	127
DeKalb 459	140	131
DeKalb 666	140	132
DeKalb 850	143	134
DeKalb 1002	152	135
DeKalb 1022	155	137
K3A	137	129

In 1953, similar trials were conducted at Lompoc and Santa Ynez except that fewer varieties were used. These results were as follows:

Time from Planting to Harvest at 67% Moisture. 1953 Trials.

Variety	Lompoc Days	Santa Ynez Days
DeKalb 459	156	141
DeKalb 666	164	147
DeKalb 1002	169	154
K3A	156	

In these trials, the DeKalb 459 was considered the early variety, and the days from planting to maturity compared very favorably with the previous year's record. The K3A responded similarly to DeKalb 459, as it had the previous year. The other varieties also responded to the climatical conditions very much as they had the previous year.

From these records and those of several others taken at the same time, the following general statement of maturity in the various districts can be made:

Approximate Maturity of Hybrid Corn in Various Areas of Production. (Days from Planting to Harvest for Silage—67% Moisture.)

Varieties	Lompoc area	Santa Ynez Valley	Cuyama Valley	Bakersfield
Early				
DeKalb 459	145	140	130	110
Midseason				
DeKalb 666	165	145	132	115
Late				
DeKalb 1002	169	154	135	120

At the same time that the maturity records were being kept for the several varieties, replicated plots to determine grain yield were maintained. The 1952 and 1953 trials were on the same ranch in the Santa Ynez Valley; the 1954 trial was located in the Cuyama Valley. The results of these trials were as follows:

Results in Pounds Per Acre.

Variety	1952 4 rep.	1953 8 rep.*	1954 4 rep.
Early			
FM Grain	9,125	8,603	9,078
Pfister 347	9,250	8,549	7,924
DeKalb 459	....	7,986	8,416
Midseason			
DeKalb 666	7,385	7,714	....
Pfister 381	8,960	7,423	8,678
Late			
DeKalb 1002	9,125	6,970	8,209
Pioneer 302	9,480	8,748	8,641

* Least significant difference 798 pounds.

It can be reasonably concluded that many of the early maturing varieties produced equally well as the later ones.

Yields being equal, other characteristics become the determining factors in selection of varieties in the coastal areas when grain, not silage, is the end product.

Early varieties could be harvested 10 days earlier than the midseason and 20 to 25 days earlier than the late varieties. Under field conditions this is an advantage since fall winds and early rains cause severe lodging, especially of some of the taller, later maturing varieties.

Picking is easier on man and machine with earlier varieties. The average height of the early varieties, in these trials, was 8.5′; of the midseason, 9.5′; and of the later varieties, over 10′. Mechanical difficulties were greater and harvesting was slower with the greater bulk of the later varieties.

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COMBINE

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with the header attachment. The feed rate is shown in pounds per minute and does not include the weight of the shelled corn. The loss ratio was about 4-to-1 for feed rates of 350 to 150 pounds per minute.

The number of ears lost by the snapper unit was related to the per cent of ear-bearing stalks that were lodged. Also, the forward speed had some influence on loss. Under conditions where 35% of the corn was lodged, the ear loss at a forward speed of two miles per hour was approximately 12%.

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