MECHANICAL HARVESTING OF SUNFLOWERS IN TENNESSEE

By

Richard C. Shadden, Instructor
J. A. Mullins, Associate Professor, and
Tom McCutchen, Manager, Milan Field Station
Agricultural Engineering
University of Tennessee
West Tennessee Experiment Station
Jackson, Tennessee

Introduction

Past work with sunflowers at the University of Tennessee Agricultural Experiment Station related to variety testing. The plants were grown in small plots and the heads were harvested by hand. This work and the work at other research centers indicated that mechanical harvesting losses would be a serious problem in sunflower production. Thus, an experiment was begun in 1969 to study mechanical harvesting of sunflowers.

Objectives

The objectives of this experiment were:

(1) To relate moisture content of the seed, heads, and stalks to harvesting efficiency.

(2) To measure the losses in sunflower production due to birds.

(3) To measure field losses using a conventional reel on the combine header.

(4) To measure field losses using a Willmar header attachment on the combine.

(5) To measure losses in the combine (processing losses) when harvesting sunflowers.

(6) To compare seed damage at high and low cylinder speeds.

Procedure and Results

The area used in these tests was located at the University of Tennessee Milan Field Station and consisted of forty-eight, forty-inch rows, 1400 feet long. The soil type was Collins-Vicksburg silt loam and the sunflower variety was Peredovik. The area was seeded on May 2, 1969, at a rate of 5-6 pounds per acre. A 15-15-15 fertilizer at a rate of 400 pounds per acre and ammonia nitrate at a rate of 100 pounds per acre were broadcast previous to planting. Also, a preemergence herbicide, Treflan, was applied broadcast at a rate of 0.75 pounds per acre.

The combine used in these tests was a Model E Gleaner Baldwin equipped with an 80-inch or two-row header. This header was made by cutting down a stock 10-foot header. A Willmar header attachment, made especially for harvesting sunflowers, was also cut down for two rows and used in the tests. Limited tests were conducted using the conventional reel on the header instead of the Willmar header attachment.

Two cylinder speeds, a high and a low, were used in tests with the Willmar header attachment. Only the low cylinder speed was used with the conventional reel on the header. Machine settings are shown in Table I.

For the combine used, the operator's manual recommended a cylinder speed of 800-1000 rpms. However, another combine manufacturer recommended a cylinder speed of 510 rpms for a dry crop, 608-612 rpms for a normal crop, and 800 rpms for a hard-to-thresh crop. The low and high cylinder speeds were chosen to represent the low and high ends of the combine manufacturers' recommended settings. Both manufacturers recommended a rasp cylinder instead of the spike toothed, but a spike toothed cylinder was used in these tests since a rasp type was not available.

An attempt to harvest was first made on August 25, 1969, but the harvested seed was moist and contained too much green material. Therefore, plant samples were collected in the afternoon from two locations in the field. Each sample consisted of 12 randomly selected heads and the upper 1/3 of the stalk from which the heads were collected. The material was divided into three parts for drying; seed, shelled heads and stalks. The samples were dried 48 hours at 150°F and the percent moisture determined on a wet basis in the shelled heads, the stalks, and the seed.

The average moisture content of the two samples was 60.7 percent for the heads, 63.8 percent for the stalks, and 8.2 percent for the seed. (Table II). These results indicate that the moisture content of the seed was satisfactory for harvesting. The moist condition of the machine-harvested seed along with the high content of green material was due to the green stalks and moist heads.

A dessiccant, Paraquat, was applied at a rate of 1 qt./A.to eight outside rows of sunflowers after the unsuccessful harvest attempt on August 25. The outside rows were chosen as the dessiccant-treated area to minimize drift over the rest of the area.

On September 8, 1969 harvesting was again attempted. Four samples were collected for moisture determination employing the same procedure as was used on August 25. Two samples from the dessiccant-treated area and two from the untreated area were dried at 150°F for 48 hours. The results for both harvest dates are shown in Table II.

The moisture content of the heads and stalks had decreased considerably from August 25, both in the area treated with a dessiccant and in the untreated area, (Table II). The moisture content of the heads had decreased to 18.5 percent in the untreated area and to 14.5 percent in the treated area. Moisture content of the stalks had decreased to 23.3 percent in the untreated area and to 16.6 percent in the treated area. Moisture content of the seed had not changed significantly. The treated area was virtually void of green vegetation (weeds) whereas, the untreated area had weeds.

Before the first attempt at harvesting, August 25, it was observed that birds, particularly doves, were beginning to feed on the sunflowers. This was the reason for attempting to harvest at this time. On the same date, heads were collected from three 10-foot, one-row sections. Each row was taken from a different location in the field. These were shelled by hand and since no bird damage was noticeable, the average of three replications, 2490 lbs./A. was considered the potential yield, Table III.

On September 8, again three 10-foot, one-row sections were collected, shelled by hand, and the yields determined. The average of the three replications was 1845 lbs./A., (Table III). Comparing this value with the average value for potential yield, 2490 lbs./A., indicates the difference, 645 lbs./A. or 25.9 percent, was lost to birds.

Tests using the combine for harvesting were first performed with the Willmar header attachment. Three 30-foot, two-row sections were selected in the area of the field where the dessiccant was not applied and harvested with a cylinder speed of 628 rpms. All other machine settings were as shown in Table I.

Yields were determined for each replication by weighing the seed collected in the combine bin. To determine the losses occurring in the combine (processing losses) all the trash was collected from the discharge and the seed separated from it. Separating the seed was accomplished by feeding the trash through a laboratory cleaner, sieving, and finally by hand separation. Field losses, other than through the combine, were determined for the Willmar header attachment in each of the three 30-foot, 2-row sections. These evaluations were categorized as cut and lost or not cut and lost and were made simply by collecting the heads left on the ground and shelling them by hand.

Field losses were also determined over three different 30-foot, 2-row sections using the conventional reel in place of the Willmar header attachment. These were also categorized as cut and lost or not cut and lost and evaluations were made using the same procedure as for the Willmar header attachment, (Table III).

Since the average yield from machine harvesting of 1820 lbs./A., the average of 31 lbs./A. for processing losses, and the average for field losses of 90 lbs./A. were obtained from the same 30-foot, two-row sections, they can be added to give a potential yield of 1941 lbs./A. This is the average yield after bird losses, which would have resulted had there been no processing losses or field losses. However, the potential yield, as determined by hand sampling, after bird losses was 1845 lbs./A. The difference in these two values, 95 lbs./A. is probably due to sampling error.

Relating losses to the potential yield at harvest of 1941 lbs./A. indicates approximately 2 percent was lost through the combine and approximately 5 percent was lost at the header with the Willmar attachment. The loss at the header was approximately 46 percent using the conventional reel.

Seed damage was determined visually by taking samples from the machine-harvested seed and separating the samples by hand into damaged and undamaged seed. Six 0.5 lb. samples were taken from the area which had not been treated with a dessiccant. Three of these samples were collected with the

A dessiccant had a limited effect on the moisture content of the heads, stalks, and seed at the later harvest.

CONCLUSION

This study indicates that equipment is available for satisfactory harvesting sunflowers. Problems lie with the high moisture content of the head and stalk even though the seed are of suitable moisture content for harvesting. The delay necessary to wait for the moisture content of the heads and stalks to decrease resulted in severe bird losses.

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TABLE I

Combine Settings Used in Sunflower Harvesting Tests.

Reel Speed (Willmar header attachment)	34 rpm
Reel Speed (Conventional reel on header)	34 rpm
Cylinder Speeds:	
Low	628 rpm
High	948 rpm
Chaffer Sieve	1/2 open
Shoe Sieve	1/3 open
Wind Regulator	1/2 open
Concave Clearance	1/4 open

TABLE II

Moisture Content of Sunflower Heads, Stalks, and Seed for Two Harvest Dates. (Average of Two Samples.)

Sample Description	Aug. 25, 1969	Sept. 8, 1969 No Dessicant	Sept. 8, 1969 With Dessicant
Heads	60.7 ± 6.1	18.5 ± 5.5	14.5 ± 1.3
Stalks	63.8 ± 3.2	23.3 ± 7.2	16.6 ± 2.6
Seed	8.1 ± 0.4	6.9 ± 2.1	9.2 ± 2.8

source with higher fiber level. Lysine supplementation did not improve the utilization of these diets.

Work with sunflower hulls apparently has been limited. Very few reports appear in the literature.

In the past two years, animal scientists at the University of Minnesota have successfully fed pelleted sunflower hulls to lambs. Their latest work involved the feeding of one pound of pelleted hulls per head daily with good results. The pelleted hulls analyzed 18% protein and 29% fiber.

Additional details of these experiments may be obtained by contacting the animal science departments at the appropriate university.

Sunflower hulls have been treated almost as a waste product. They do have value in the rations for ruminants but research is needed to determine their true value.

Research has been shown that properly processed sunflower meal is a good source of supplemental protein in properly formulated rations for most classes of livestock and poultry.

PROPERLY PROCESSED SUNFLOWER MEAL and PROPERLY FORMULATED RATIONS are the keys to the competitive acceptance of sunflower meal in those markets which have access to various sources of protein. The ration formulator and the computer will eventually place a price on sunflower meal that is directly related to its nutritive value when compared to competing products.

If sunflower meal is to become a real competitor in the protein market special attention will have to be given to processing research so that the best possible product can be produced. An accelerated program of research on the nutritive value of sunflower meal is an absolute necessity if its true worth is to be obtained in the market place.

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