2-1976

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COOPERATIVE EXTENSION SERVICE

AGRONOMY NOTES

Vol. 9. No. 2.

February, 1976

THE EFFECTS OF SWATHING WHEAT ON THE DATE OF HARVEST, YIELD AND SEED QUALITY

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In 1975 approximately 350,000 acres were double-cropped using small grain and soybeans in Kentucky. Due to the low acreage of winter barley (48,000 acres) most of the soybeans were either planted by no-till or conventional means following winter wheat. The major problem with winter wheat in a double-cropping system is that the date of planting for soybeans is delayed. Research at the West Kentucky Experiment Station at Princeton indicates that this delay can reduce soybean yields from 7 to 11 bushels per acre depending upon the soybean variety used. The research at Princeton also indicates no reduction in soybean yields following Barsoy barley; however disease and winter-kill problems have reduced acreage in Kentucky in recent years. If barley fits the farming program, however, it could still be considered on part of the acreage double-cropped.

Several procedures have been proposed for "moving-up" the planting date of soybeans following wheat. They are:

1. Earlier wheat varieties. The present wheat varieties (Abe, Arthur, Arthur 71, Oasis) all mature about the same time which is 10 to 14 days later than Barsoy barley. This later maturity reduces soybean yields due to delayed planting. An earlier maturing wheat variety is not presently available. A new variety named "Doublecrop" which is 5 days earlier than Arthur will be available in 2 to 3 years.

2. Interseeding or aerial seeding soybeans in standing wheat in April. This practice has received much attention in 1975, but does not appear to be practical in Kentucky due to severe broadleaf weed problems which occur in the soybeans. With the future development of better post-emergence herbicides this practice may become more practical.

3. Direct combining wheat earlier (20-25% moisture content) and drying the grain. Some farmers that have drying facilities are doing this now and saving some time.

4. Swathing the wheat and combining when the grain is sufficiently dry for storage or earlier if drying facilities are available. This practice has been used on hard red spring wheat in the northern areas of the United States for many years.

Since no information was available on swathing soft red winter wheat in Kentucky these studies were initiated in 1974 with the following objectives:

1) Establish the earliest stage that wheat can be swathed without losses in yield or quality.

2) Determine the time saved between swathing and combining wheat compared to direct combining.

3) Evaluate the effect of swathing on: yield, test weight and germination of the wheat and the weight and number of wild garlic bulblets in the wheat seed.

Materials and Methods

A swather (sometimes called a windrower) is a machine which cuts the standing wheat and moves it by canvas conveyor belts to the center or side of the machine where it is dropped on top of the stubble in an approximately three foot wide swath. When dry, the wheat is picked up from the swath using a combine with a pick-up attachment on the header.

Field experiments were conducted in the Purchase area in western Kentucky and at the Spindletop Experimental Farm, near Lexington in 1974 and 1975. The locations in the Purchase area were: 1974-Hickman County, David Hilliard farm and 1975 - Calloway County, Joe Pat Carroway farm. Two wheat varieties, Abe and Arthur 71, which have nearly identical maturity were used for the studies.

Seed moisture content was determined at regular intervals for the standing wheat starting when the heads were still green and continuing until normal harvest maturity (14% moisture). The procedure followed for moisture determination was to randomly collect and hand thresh 80 heads of wheat, weigh the seed to the nearest 0.1 gram and place in an oven set at 200°F for a minimum of 16 hours. The heads and seed were kept in sealed containers or plastic bags until the seed was weighed the first time to prevent moisture loss. After drying, the seed was reweighed and the percent moisture content determined by dividing the weight of the wet seed into the weight difference between the wet and dry seed (i.e. $M.C.\% = \frac{\text{wet wt. (g.) - dry wt. (g.)}}{\text{wet wt (g)}}$.

Wheat was cut with a swather at several dates and various intervals for both locations in 1974 and 1975 (Table 1). Caution was taken to avoid thin plant stands or skips in the field so that the stubble density was sufficient to support the swath after cutting. The stubble height was 6 to 9 inches. A split block field design was used with three replications. Random head samples were removed from all replications of the cut swathes at regular intervals and the percent moisture content determined. When the seed reached a moisture content of less than 15% both the swathed and standing wheat were combined. The same combine at similar settings was used to harvest all treatments at each location. At harvest two seed samples

each representing 1/100th of an acre were collected directly from the combine hopper for each swathing treatment and the check. Determinations were made for yield (bushels/acre), test weight (pounds per bushel), weight germination and number and percent of wild garlic bulblets (1974 only) for all samples and treatments.

Results and Discussion

By comparing the moisture content to the dates swathed the difference in maturity of wheat at the two locations can readily be observed (Table 1). The wheat seed dried down and matured more than 14 days earlier in the Purchase area than at Lexington. The date that the wheat seed dried to a specific moisture content was similar for both years. The wheat was first swathed in 1974 at approximately 42% moisture content, which was slightly higher than the 35% recommended for hard red spring wheat in the northern United States.

There was no significant difference in yield or test weight between any of the swathing dates and the direct combined check in 1974 (Table 2). This indicated that soft red wheat could possibly be swathed earlier than the hard red spring wheats at moisture contents up to 42% without yield loss. To determine where yield losses would occur the wheat was first swathed at a much higher moisture content (55%) in 1975. Swathing at 55% and 49% moisture content significantly reduced yield and test weight (Table 2) in 1975 with the most severe reductions at the Purchase location (Murray). Similar to 1974, there was no significant reduction in yield or test weight when wheat was swathed at moisture contents of 40% or less. This stage (40-42%) occurred both years when the seed reached the dough stage of development and the plants had just changed to straw colored. At the higher moisture levels where yield reductions occurred in 1975 the plants still had considerable green color and the seed was milky (55% m.c.) to soft dough (49% m.c.) in development.

Regardless of the date swathed there was no effect on the percent germination of the swathed seed compared to the direct combined check (Table 3). This was not surprising since wheat seed will germinate as early as five days after fertilization.

To determine the effect of swathing on wild garlic bulblets, the number of wild garlic bulblets occurring in 500 gram samples was determined in 1974 (Table 4) for both locations. Both the number and weight of wild garlic bulblets in the wheat swathed at 42% M.C. was 40 to 50% less than the number and weight occurring in the check which was direct combined several days later. After counting the wild garlic bulblets in 500 grams of seed they were dried at 100°F for 14 days in a small plot dryer using heat and forced air. To simulate seed cleaning the bulblets were pneumatically blown at a constant setting in a South Dakota model B laboratory seed blower. The number and weight of the wild garlic bulblets remaining in the heavy portion was then determined (Table 4). A similar trend of increased numbers and weight of wild garlic bulblets as the wheat reached harvest maturity still remained. In no case however were all of the wild garlic bulblets removed by swathing or drying and blowing the seed after swathing.

The time required for the wheat to dry down following swathing varied from

1974 to 1975 and depended primarily on the weather and the amount of rainfall that occurred after the plants were swathed (Figure 1). Cut 1 in Lexington in 1974 dried from 41.5% moisture content when swathed to 18.5% in one day. A similar trend was followed for Cut 2 in 1974. However in 1975 the seed that was swathed at 48.7% moisture content (Cut 2) dried to 20.8% in five days and did not reach 15.7% until 7 days after swathing. Likewise, the seed cut at 40.1% moisture content reached 16.7% three days later in 1975. The primary reason for the differences in rate of seed dry down between years was due to the rainfall which occurred after swathing (Figure 1). Only one small rain occurred in 1974 after swathing Cut 1 while no rainfall occurred after Cuts 2 or 3. In 1975 it rained 5 of the 7 days it took for Cut 2 to dry to 15.7% moisture content.

The 1974 results show that wheat seed will rapidly dry in the swath if good sunshine, drying conditions and normal rainfall occurs following cutting. Over four inches of precipitation fell on Cut 4 in 1974 which delayed the time of dry down, however the seed in the swath still dried at a rate similar to the standing wheat. There was no loss of seed in the swath following this heavy rainfall and the yield, test weight and percent germination were not significantly reduced. A similarly heavy rainfall occurred on Cuts 1 and 2 in the Purchase area (Murray) in 1975. As in 1974 no loss in seed yield, test weight or germination was observed. Rainfall and dry down of seed in the swath followed similar patterns in the Purchase area in 1974 and 1975 as occurred in Lexington (Figure 1).

The value of a practice such as swathing can best be measured by the number of days saved without yield and quality loss compared to direct combining the seed. This was determined for both years by comparing the time interval between the date the seed dried to less than 15% moisture content in the swath and the date that the standing wheat dried to a similar level. This difference in "number of days" saved is shown for each swathing date for all locations in Table 5. No yield, test weight or germination losses occurred for that wheat harvested at 41% moisture content or less for both years. If this moisture level is related to days saved (Table 5), from 4 (1975) to 10 (1974) days were gained by using this practice. The wide variation between years was due entirely to the number of days that rainfall did or did not occur each year (Figure 1).

Long term (25 years) rainfall patterns for the months of May and June indicate that the number of days (occurrences) with precipiation at both locations was near normal in 1974 and above normal in 1975. For the approximately 14 days that the study was conducted, four rainfall occurrences would be expected for the Purchase area and five rainfall occurrences would be expected in Lexington. In 1975 rainfall occurred during 8 of the 16 days evaluated in the Purchase area (Murray) and for 7 of 13 days in Lexington. Therefore under "normal" rainfall as in 1974 it is expected that approximately seven or more days should be saved by using this practice.

Summary

After comparing swathing and combining to direct combining of wheat at two climatically diverse locations in Kentucky for two years the following conclusions can be made.

(1) When the wheat was swathed at a moisture content of 40-42% or less there was no reduction in yield, test weight or percent germination of the seed compared to the direct combined check.

(2) By swathing at 40-42% moisture content compared to direct combining the harvest date of the wheat was advanced 9 to 10 days in 1974 and 4 days in 1975.

(3) By swathing the wheat at 42% moisture content in 1974 the number of wild garlic bulblets present in the combine-run seed was reduced 40 to 50 percent compared to the check.

It appears that this practice may be feasible to Kentucky farmers as a procedure for expediting wheat harvest. This will allow earlier planting of soybeans following wheat harvest in a double-crop situation which will mean increased soybean yields. Swathing may be especially appealing to farmers who double-crop large acreages, since it will allow them to spread out the time of wheat harvest and soybean planting.

Table 1. Date swathed and the percent moisture content of wheat seed in 1974 and 1975.

Swathing Treatment	1974				1975			
	Lexington		Purchase		Lexington		Purchase	
	Date	% M.C.	Date	% M.C.	Date	% M.C.	Date	% M.C.
Cut 1	6-13	41.5	5-29	42.4	6-11	54.0	5-23	55.9
Cut 2	6-17	37.1	6-1	38.5	6-12	48.7	5-26	49.4
Cut 3	6-19	30.5	6-4	23.1	6-16	40.1	6-2	38.0
Cut 4	6-21	21.6	-	-	6-18	36.1	6-5	28.9

Table 2. Yield (bushel/acre) and test weight (pounds/bushel) of wheat in 1974 and 1975 following swathing and combining compared to direct combining(Ck) at the Lexington and Purchase locations.

Moisture Content (%)[1/]	1974				1975			
	Yield		Test Weight		Yield		Test Weight	
	Lex.	Pur.	Lex.	Pur.	Lex.	Pur.	Lex.	Pur.
55	-	-	-	-	41.6*	22.8*	56.7*	47.6*
49	-	-	-	-	38.7*	34.8*	56.8*	52.3*
41	42.1	36.4	54.9	54.7	44.5	-	58.9	-
38	39.3	38.6	55.2	55.4	47.2	47.2	59.0	55.9
30	41.0	-	53.6	-	-	54.6	-	56.3
22	40.0	37.1	50.8	55.7	-	-	-	-
CK	44.2	33.7	54.5	56.1	48.2	50.4	59.0	56.8

1/ Approximate moisture content of the seed when swathed for specific percent moisture contents see Table 1.

* Significantly lower than check at the 5% level.

Table 3. Percent germination of wheat seed following swathing compared to direct combined seed (check) for two locations.

Moisture Content (%)[1/]	1974		1975	
	Lexington 2/	Purchase 2/	Lexington	Purchase
55	-	-	94.0	85.7
49	-	-	93.8	85.0
41	90.8	90.3	93.8	-
38	92.5	91.5	93.7	86.3
30	85.6	-	-	86.5
22	90.1	92.1	-	-
CK	93.0	89.0	94.0	90.8

1/ Approximate moisture content of the seed when swathed for specific percent moisture contents see Table 1.

2/ Lex = Lexington, Pur = Purchase

Table 4. Number and weight of wild garlic bulblets following swathing and direct combining (CK) at two locations in 1974.

M.C.% Swathed	Lexington				Purchase			
	500 g.		Dried		500 g.		Dried	
	No.	Wt.1/	No.	Wt.2/	No.	Wt.1/	No.	Wt.2/
41	12.8	.04	0.3	.01	141.6	.67	6.5	.08
38	17.1	.09	1.7	.01	125.1	.67	8.8	.12
30	21.8	.13	2.3	.03	-	-	-	-
22	17.5	.13	3.2	.04	194.5	1.22	16.3	.22
CK	19.5	.18	4.3	.08	206.0	1.34	19.5	.30

1/ Sample was taken directly from combined seed

2/ Wild garlic bulblets were dried at 100°F and blown in a pneumatic seed blower at a constant setting.

Table 5. Number of days saved when wheat is swathed at various moisture levels compared to direct combining1/

Moisture Content	1974		1975	
	Lex	Pur	Lex	Pur
55	-	-	4	8
49	-	-	4	6
41	10	9	4	-
38	7	8	3	4
30	7	-	-	4
22	0	0	-	-

1/ All wheat was combined from the swath and direct after the seed had dried to less than 15% moisture content.

FIGURE 1. MOISTURE CONTENT (%) OF STANDING WHEAT SEED COMPARED TO SWATHED WHEAT SEED IN JUNE 1974 AND 1975 AT LEXINGTON.