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An Early-Planted, Early Maturing Soybean Cropping System: Yield and Harvest Losses

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AN EARLY-PLANTED, EARLY MATURING SOYBEAN CROPPING SYSTEM: YIELD AND HARVEST LOSSES.

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Most soybean varieties used in Kentucky, whether grown full season or double-cropped behind wheat or barley, are from Maturity Groups (MG) IV or V. Some MG III varieties are also grown; however, virtually no MG II or earlier varieties are planted. Agronomists and soybean producers in Kentucky have generally felt that MG IV and V varieties produce the highest yield. Since the driest months in Kentucky are August, September, and October, MG IV and V varieties frequently encounter moisture stress during the important seed fill stage. The use of earlier maturing varieties was initially proposed as a means of getting a major portion of seed fill to occur before the driest part of the growing season, thus getting higher yields in dry years.

There are, however, other potential advantages from the use of early maturing soybean varieties. These varieties would have less frost risk and harvest would be complete before the cool, wet conditions of November and December. In addition, an early September harvest would provide more flexibility in the choice of the following crop. Early harvest could allow planting of alfalfa, canola, barley, or wheat in fields which may not normally be available for planting until the next spring.

The primary objective of this research was to determine if soybean varieties from MG 00, 0, I, and II could produce yields competitive with those of MG III and IV varieties across a range of climatic and soil conditions. A second objective was to measure potential harvest losses of these varieties to determine if increased losses might keep farmers from using them.

Materials and Methods

Twelve soybean varieties (two from each MG from 00 to IV) were planted in each of six tests over four years. Row spacing was 15 inches, planting rate was 160,000 viable seeds/A, and conventional tillage was used. Fertilizers were applied according to UK recommendations. Each variety was planted in plots 8 rows wide and 20 feet long with 4 replications. Four center rows of each plot were harvested at maturity with a small plot combine. None of the experiments were irrigated except in 1988 in Fayette County. This experiment was irrigated with a sprinkler system on a biweekly schedule. Table 1 shows rainfall, planting dates, and harvest dates for each of the six tests. Growing conditions varied from quite dry (Daviess 1988) to very wet (Fayette 1988 irrigated). The experiments were planted well before normal planting dates in most studies.

Results and Discussion

Soybean Yield:

The highest yielding varieties, when averaged across all tests, were from MG II and III, with MG I and IV somewhat lower

(Table 2). Both MG 00 and 0 were substantially lower yielding, eliminating them from consideration for use in Kentucky.

The individual tests showed a wide range of results. For the Fayette test in 1986, MG 00, 0, I, and II all averaged close to 40 bu/A, while MG III and IV were much lower. Yields in Daviess County in 1988 were similar for all MGs, with the yield of the better variety within each MG not much different then the better variety in the other MGs. In the non-irrigated test in Fayette Co. in 1988, yields were better for later MGs, since late August rains helped them but not earlier varieties, which were already close to maturity by the time the rains started. Irrigation in 1988 greatly improved yields of all MG 00, 0, I, and II varieties. However, MG III and IV varieties did no better with irrigation, probably because excessive plant height increased lodging early in reproductive growth. Thus, in the irrigated test, MG II varieties produced the highest yield. In 1989, rainfall was good throughout the season in Fayette County and yield of the better variety from MG II, III, and IV was close to 55 bu/A. There was no advantage to growing later varieties in that test.

In summary, the MG which produced the best yields depended on rainfall distribution, and therefore varied widely across years and locations. Since MG II produced yields equal to or better than MG IV in five of the six tests conducted, growers may want to consider using this MG for early planting. When averaged across all six tests, MG II matured 12 days earlier than MG III and 20 days earlier than MG IV. Thus, our data indicate that MG II will not only produce competitive yields, but can also be harvested earlier.

Essex, a popular MG V variety in Kentucky, was included in only three of the tests shown in Table 2: Fayette 1988 (irrigated), Fayette 1989, and Simpson 1989. Since these were the three highest yielding studies, they should have given Essex a good chance to produce to its yield potential. The yield of Essex compared with Elgin (the highest yielding variety tested in all six environments) was 59.5 vs. 55.2 bu/A for Fayette 1988 (irrigated), 54.5 vs. 53.4 bu/A for Fayette 1989, and 38.0 vs. 50.4 bu/A for Simpson 1989. Thus, Essex was no better than Elgin in two studies, but lower in the third.

The earliest varieties (MG 00 and 0) were usually harvested in early August, with MG I and II about 2 weeks later. Varieties from MG III and IV were usually harvested in early September, mainly due to the early planting dates employed. The best combination of high yield and early harvest appears to result from early planting of MG II varieties.

Stubble harvest losses:

Kentucky farmers usually cut their soybean crops between 2 and 6 inches above the soil surface, with an average cutting height of 4 inches. At any of those cutting heights, harvest losses were excessive for MG 00 and 0 varieties (Table 3). The worst loss was with the very short variety Ozzie, which lost 37% of its yield if cut at 6 inches. Varieties from MG 00, 0, and I had at least 2% losses with a 2 inch cutting height. However, cutting at 2 inches reduced stubble losses to no more than the 1% level for all MG II, III, and IV varieties. At the 4 inch height, stubble losses of MG II varieties were more than those of MG III and IV varieties. If MG II varieties are to be adopted, farmers will need to achieve a lower cutting height in order to obtain to obtain the full yield potential possible.

Conclusions

Kentucky tests have shown that MG II varieties produce better average yields than MG IV varieties when planted earlier than normal. This may partially result from completing seed filling before the driest periods of the summer. However, even when moisture conditions were favorable throughout the summer, later varieties did not produce consistently higher yield than MG II varieties. With the potential advantages of better average yield and earlier maturity (20 days), which leads to less frost risk and a greater range of choice among following crops, Kentucky farmers may want to consider trying early maturing

varieties on a limited basis on their own farms.

If a grower is interested in trying this system, we would encourage them to try MG II varieties. Preliminary data indicate that planting by May 15 is sufficiently early for this system. While our tests were all conducted in 15 inch rows, narrow row planting may not be essential for MG II under early-planted conditions, since the varieties we used have produced a closed canopy in 30 inch rows in six other tests. While the cropping system was hypothesized to result in more stable yields in droughty soils or dry years, its application may not be limited to those situations. Only two of the six studies had below-normal August to September rainfall, while three were below normal for May to July rainfall. Thus, the data set does not appear to be biased in favor of early maturing varieties.

Finally, we would encourage interested growers to try this early-planted, early-maturing cropping system on a portion of their soybean acres. If the farmer's results were favorable, we would still encourage growers to use it in combination with the traditional later maturing package. That would be expected to spread out the ever-present risk of inadequate moisture during critical growth stages.

Kenneth L. Wells
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Table 1. Rainfall, planting date, and first and last variety harvest dates.

County	Year	Deviation from average rainfall[a] May-July	Aug.-Sept.	Planting date	Harvest date First Variety	Harvest date Last Variety
Fayette	1986	-3.5	+1.2	April 24	Aug. 5	Aug. 28
Daviess	1988	-6.5	-0.1	April 29	July 27	Sept. 21
Fayette	1988	-6.0	+0.8	May 11	Aug. 23	Oct. 17
Fayette (irrigated)	1988	+3.8[b]	+4.8[b]	May 11	Aug. 11	Oct. 10
Fayette	1989	+0.8	+2.8	April 25	Aug. 7	Oct. 2
Simpson	1989	+8.5	-0.3	May 2	Aug. 8	Sept. 19

[a]Long-term state averages for May-July are 12.7 inches, and for Aug.-Sept. are 6.4 inches.

[b]This includes the 2.0 inches of irrigation water we applied 5 times during June and July, and 2 times during August. Rainfall was abundant in September 1988, so no irrigation was applied that month.

Table 2. Yields of soybean varieties for each of six tests.

Variety	Maturity Group	Fayette 1986	Daviess 1988	Fayette 1988	Fayette 1988 (irrigated)	Fayette 1989	Simpson 1989	Variety means
		bushels/A						
Maple Arrow	00	40.2[a]	25.1	30.7	37.7	23.7	38.3	32.6
McCall	00	44.2	17.2	17.8	39.2	29.8	28.8	29.6
Ozzie	0	33.8	11.1	17.1	40.8	19.4	27.5	24.9
Dawson	0	45.0	24.3	24.8	43.8	29.7	35.8	33.9
Asgrow 1214[b]	I	37.4	24.9	32.4	42.4	36.4	43.5	36.2
Hardin	I	43.6	20.9	34.3	47.3	40.7	46.0	38.8
Elgin	II	40.1	24.5	38.7	55.2	53.4	50.4	43.8
Century	II	36.8	28.5	36.1	49.6	46.0	45.3	40.4
Pella 86	III	32.1	28.8	38.0	42.3	45.9	50.3	39.6
Williams 82	III	26.6	28.8	42.1	45.6	55.4	37.7	39.4
Union	IV	20.8	24.9	41.4	43.6	49.3	35.5	35.9
Douglas	IV	17.4	24.5	45.7	42.9	55.9	38.0	37.4
Test means		34.9	23.6	33.2	44.2	40.5	39.8	

[a] LSD(0.05) for comparing varieties within a test or tests within a variety was 7.3 bu/A. The LSD (0.05) to compare test means was 3.9, and for comparing variety means was 2.8.

[b] Asgrow 1214 was replaced by Asgrow 1525 in 1989.

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Table 3. Stubble harvest losses of soybean varieties averaged across six tests.

Variety	Maturity Group	Stubble harvest losses at: 2 inches	4 inches	6 inches
		%		
Maple Arrow	00	3[b]	9	18
McCall	00	4	15	29
Ozzie	0	7	23	37
Dawson	0	4	16	30
Asgrow 1214[a]	I	2	10	21
Hardin	I	2	7	16
Elgin	II	1	5	13
Century	II	1	3	9
Pella 86	III	0	2	6
Williams 82	III	0	1	4
Union	IV	0	1	4
Douglas	IV	0	1	2
LSD(0.05)		1	2	2

[a] Asgrow 1214 was replaced by Asgrow 1525 in 1989.
[b] Percent of the total yield left on the stubble when cut at the stated height.