A Review of Soybean Production Costs, Yields and Returns

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As producers seek out crops with more profit potential, they continue to increase the number of acres of soybeans seeded each year. The continued growth in acreage of herbicide tolerant (HT) soybeans, often referred to as Roundup-Ready® soybeans, continues to raise the question as to how they compare in profitability to the conventional or non-herbicide tolerant (NHT) varieties. This report is the third in a continuing annual review of the profitability of soybeans in east-central North Dakota.

Data for this report was gathered directly from producers enrolled in the Carrington Area Farm Business Management Program. This program is operated in conjunction with the North Dakota Farm Business Management Education Program which is under the direction of the North Dakota Department of Career and Technical Education. The primary geographic area from which the data for this study was collected included an area approximately 20 miles north or south and approximately 50 miles east or west of Carrington, North Dakota.

The data in this study was confined to that involving soybean grown on cash-rented land only. This specific production group was chosen because it carries a direct land charge as compared to owned or share-cropped acreage. The data used for the HT and NHT comparison was collected on a total of 44,966 acres (Table 1) from 164 fields and 75 farms. Some farms that grew soybeans each year were included up to three times during the course of the study. Of the total acreage, 34,806 acres representing 107 fields were strictly designated as HT with 7,577 acres from 50 fields and 22 farms being designated as NHT soybeans. Seven fields that were not specifically HT or NHT were not included in either of the two main groups. The data reviewed for the seeded row width comparison (Table 2) included a total of 168 fields and 45,472 acres for the three-year period.

Table 1. Soybean Costs and Returns for 2002-2004 on Cash-rented Land (per acre basis).

		Average	100% Herbicide Tolerant	Non-Herbicide Tolerant
Number of Fields (4 removed for hail losses)		164	107	50
Number of Farms		75	59	22
Total acres of crop		44,966	34,806	7,577
Yield in bushels per acre	Bu.	29.0	28.8	30.0
Value per bushel (Includes LDP)	$	5.78	5.79	5.87
Total crop income per acre	$	167.64	166.78	176.13
Misc. income per acre (Insur. & other)	$	9.24	10.11	1.62
Gross income per acre	$	176.88	176.89	177.75
Direct Costs/Acre				
Seed		25.36	28.18	16.53
Fertilizer		11.08	10.09	12.99
Crop chemicals		14.02	11.28	22.96
Crop insurance		7.25	7.35	8.19
Fuel and oil		6.23	5.98	6.96
Repairs		8.96	8.32	11.46
Custom hire		5.33	5.15	3.76
Land rent		34.46	34.48	34.48
Misc.		0.21	0.22	0.04
Operating interest		2.91	3.13	2.16
Total Direct Costs/Acre	$	115.81	114.18	119.53
Return over Direct Costs/Acre	$	61.07	62.71	58.22
Overhead Costs/Acre				
Hired labor		3.33	3.55	3.22
Machinery & building leases		1.89	2.18	0.80
Farm insurance		1.96	2.00	1.87
Utilities		1.32	1.32	1.55
Dues and prof. fees		0.37	0.33	0.40
Interest		2.21	2.28	2.13
Machinery and building depreciation		12.68	12.84	12.03
Miscellaneous		3.51	3.10	5.46
Total Overhead Costs/Acre	$	27.29	27.60	27.48
Total Listed Costs/Acre	$	143.10	141.78	147.01
Net Return per Acre without Gov't. Payments	$	33.78	35.11	30.74
Direct Costs per bushel	$	3.99	3.96	3.98
Total Listed costs per bushel	$	4.93	4.92	4.90
Net Return per bushel	$	1.16	1.22	1.02
Breakeven yield per acre at listed value	Bu.	23.2	22.7	24.8
Total Costs/$5.00/bu. (No Gov't.Payments)	Bu.	28.6	28.4	29.4
Gov't. payments (Direct & Co.Cyc.) per acre	$	10.51	10.62	10.47
Breakeven yield with Gov't. payments	Bu.	21.3	20.9	23.0
Breakeven Yield at CCC Loan Rate of $4.51	Bu.	27.4	26.8	29.9
Total costs including $35/acre for estimated operator labor and principal payments	$	178.10	176.78	182.01
Breakeven yield including estimated operator labor and principal payments	Bu.	27.4	27.0	28.9
Breakeven Yield at CCC Loan Rate of $4.51	Bu.	35.1	34.6	37.7

***Source: Carrington Area Farm Financial and Enterprise Analysis Reports, 2002-2004**

Table 2. Soybean Production Results by Seeded Row Width for 2002-2004 on Cash Rented Land*

Field Data by Year		2002	2003	2004	**Totals or**
				Frost on 8-20-04	**3 Year Average**
Number of Fields		38	50	80	**168**
Number of Farms		20	27	31	**78**
Number of Acres		7,523	16,269	21,680	**45,472**
Yield in Bushels		32.03	31.09	21.84	**28.32**
Value per Bushel	$	5.16	6.31	6.02	**5.80**
Total Value of Bushels	$	165.34	196.10	131.40	**164.28**
Misc. Income per Acre	$	8.00	0.69	26.67	**11.79**
Gross Return per Acre	$	173.34	196.79	158.07	**176.07**
Seed Cost	$	22.42	25.92	27.74	**25.36**
Fertilizer	$	12.59	10.43	9.94	**10.99**
Chemical	$	13.77	14.59	14.00	**14.12**
Total Direct Costs	$	113.45	117.03	117.85	**116.11**
Overhead Costs	$	25.51	27.02	28.84	**27.12**
Total Costs	$	138.96	144.05	146.70	**143.23**
Net Return without Gov.Pay.	$	34.38	52.74	11.37	**32.84**
Gov't. Payment (Direct, CC)	$	10.11	11.33	10.06	**10.50**
Net Return/Acre with Gov.P.	$	44.49	64.07	21.43	**43.34**

						Frost on 8-20-04			
		2002		2003		2004		**Totals or**	**Totals or**
Field Data by Row Width		Row Widths		Row Widths		Row Widths		**3 yr. Avg.**	**3 Yr. Avg.**
		<10"	10"-18"	<10"	10"-18"	<10"	10"-18"	**<10"**	**10"-18"**
Number of Fields		22	15	28	21	28	44	**78**	**80**
Number of Farms		11	9	20	8	8	18	**39**	**35**
Number of Acres		4,734	2,623	8,120	7,629	3,429	15,982	**16,283**	**26,234**
Yield in Bushels		30.53	34.37	26.00	36.45	22.91	21.42	**26.48**	**30.75**
Value per Bushel	$	5.21	5.09	6.14	6.45	5.75	6.02	**5.67**	**5.84**
Total Value of Bushels	$	158.97	174.87	159.58	235.26	131.81	128.98	**150.12**	**179.70**
Misc. Income per Acre	$	11.22	2.69	1.38	0.00	3.33	33.46	**5.31**	**12.05**
Gross Return per Acre	$	170.20	177.56	160.96	235.26	135.14	162.44	**155.43**	**191.75**
Seed Cost	$	23.10	21.28	29.05	22.41	30.31	27.21	**27.49**	**23.63**
Fertilizer	$	13.47	11.38	8.58	12.28	14.85	9.41	**12.30**	**11.02**
Chemical	$	13.14	14.79	14.34	15.13	13.70	14.24	**13.73**	**14.72**
Total Direct Costs	$	119.00	104.05	120.56	112.70	124.40	115.99	**121.32**	**110.91**
Total Overhead Costs	$	24.92	27.22	24.07	30.75	28.29	29.58	**25.76**	**29.18**
Total Costs	$	143.92	131.27	144.63	143.45	152.69	145.57	**147.08**	**140.09**
Net Return without Gov.Pay.	$	26.28	46.29	16.33	91.82	-17.55	16.87	**8.35**	**51.66**
Gov't. Payment (Direct, CC)	$	10.32	9.80	11.80	10.87	9.78	10.13	**10.63**	**10.27**
Net Return/Acre with Gov.P.	$	36.60	56.09	28.13	102.69	-7.77	27.00	**18.98**	**61.93**

***Source: Carrington Area Farm Financial and Enterprise Analysis Reports, 2002-2004**

The data for this study was collected from the operators' field record books or computerized accounting programs in conjunction with all other financial and enterprise records for the farm units. Whenever possible actual scale tickets and assembly sheets were used for determining yield quantities, but some quantities recorded were based upon estimated bin measurements as recorded by the appropriate producers. For the HT and NHT study, four fields were removed from the database due to extreme hail losses during the 2002 growing season. These fields and their accompanying insurance payments were included in the row-width study.

The data for HT and NHT soybeans revealed three-year production averages of 28.8 and 30.0 bushels, respectively. This data did include the 2004 year when a frost occurring on August 20 of that year did significant damage to the final yields. The 2004 HT and NHT soybeans averaged 22.0 and 21.5 bushels, respectively. The three-year average prices received were calculated to be $5.79 and $5.87 with a slight advantage for the conventional or NHT soybeans. Average gross income per acre was also slightly in favor of the NHT at $177.75 with the HT averaging $176.89 for the three-year period.

The combination of seed and chemical cost for the HT soybeans was $39.46 per acre while the NHT soybeans registered a slightly higher cost at $39.49 per acre. Total direct costs per acre favored the HT varieties at $114.18 with the NHT combining for an average total of $119.53 per acre. Total costs continued on this track with the HT soybeans at $141.78 per acre compared to the NHT soybeans at $147.01 per acre. Total net return excluding the direct and counter-cyclical payments favored the HT soybeans at $35.11 per acre which was an advantage of $4.37 per acre over the NHT varieties. The direct and counter-cyclical payments were very similar for the HT and NHT soybeans with per acre incomes of $10.62 and $10.47, respectively.

When a $35.00 charge per acre was added to cover operator labor or management and principal payments and the miscellaneous income per acre was also included, the projected breakeven yields at a CCC loan rate of $4.51 per bushel were then calculated to be 34.6 and 37.7 bushels respectively for the HT and NHT soybeans. At prices of $5.79 and $5.87 per bushel the respective breakeven yields for HT and NHT soybeans were calculated to be 27.0 and 28.9 bushels per acre.

In addition to the type of soybean produced, the question as to the most appropriate or profitable row width spacing is one that also arises. The data collected over the three-year period was separated into those soybeans planted at less than 10" row spacing and those seeded at 10" to 18" row spacing. Row spacing of less than 10" included those soybeans seeded in 10" rows where the seed is flared out from 2 to 3 inches from the center of the row, resulting in the newly established plants being only 4 to 6 inches apart in row width.

It is also appropriate to again note that this three-year database comes directly from producers and is not associated with test plots or other types of more scientific study. A total of 42,517 acres were included in the row-width spacing study. The less than 10" row-width spacing was recorded on 78 fields from 39 farms and totaled 16,283 acres. The 10" to 18" row-width spacing data was recorded from 80 fields represented by 35 farms and a total of 26,234 acres. Ten fields

included in the total database were not used in the row-width study because they did not fit the prescribed criteria for row width.

The average yield for the less than 10" row-width spacing group was 26.48 bushels while the wider spacing averaged 30.75 over the three-year period. Total expenses favored the wider row-width spacing by just slightly under $7.00 per acre. Government payments were also very similar and varied by only $.36 per acre. Total net return including government payments favored the wider spacing by an average of $42.95 per acre. The greatest impact on this three-year average occurred in 2003 when an advantage of $74.56 per acre was recorded for fields with the wider spacing. The advantage for the 2002 and 2004 years also went to the wider rows at $19.49 and $34.77, respectively. These two years combined for an additional average profit of $27.13 per acre on the soybeans seeded in the 10" to 18" rows.

It should be noted that the 2004 yields in Table 2 were very similar due to the onset of frost on August 20 of that year. Even with the frost factor included the wider spacing group produced the highest gross and net returns due to an average insurance income of $33.46 per acre as compared to only $3.33 for the less than 10" row width group. This may lead to the conclusion that those producers using the wider row-width spacing also had established higher yields for insurance purposes. Due to the nature of this information it is intended that the collection and publication of this data be continued in the future.

Discussion as to the feasibility or adequacy of including a charge of $35.00 per acre for operator labor and management and principal payments would certainly be appropriate and encouraged. The size of the farm and the level of indebtedness would certainly be factors in determining the optimum amount to include the fore-mentioned items. Individual farm operators are encouraged to determine their own profitability levels based upon their own operational costs and returns.

References

Metzger, S.S. Carrington Area Farm Financial and Enterprise Analysis Reports, 2002-2004. Carrington Area Farm Business Management Program, Carrington, ND and Carrington Research Extension Center, NDSU.