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WEATHER MARKETS: U.S. CORN AND SOYBEANS

by

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Introduction

The July and August weather in the corn and soybean production areas is the most important single determinant of the supply of corn and soybeans. Because the corn and soybean belts are small enough to be greatly influenced by a regional drought, their markets are hypersensitive to regional weather developments during this period. This hypersensitivity to summer weather gives the corn and soybean markets strong seasonal tendencies that are the subject of this paper.

Methodology

The seasonal characteristics of the corn and soybean markets will be analyzed by simulating a position in the futures market using a decision rule. The decision rule will focus on determining the trend of the market and will employ a trend following strategy, that is, evaluate the profitability of a long position in the futures market when the trend is up and likewise a short position if the trend is down. A broad parameter range will be evaluated. At one extreme of the parameter range the trend determination, as made by the decision rule, will tend to be quick to change on the basis of short-term price action. At the other extreme, the decision rule will be quite slow to interpret a trend change.

The profitability of these simulations will be captured according to when they occur during the calendar year. Since trending markets will tend to yield profits and sideways markets will tend to yield losses in these simulations, an understanding of the seasonal trend characteristics of the market can be interpreted from seasonal profitability results.

The Decision Rule

The decision rule employed in these simulations evaluates each day's price action against its recent history measured in days. The highest and lowest price achieved in the previous X days determines an X-day high low range. Intraday price activity is included in this determination.

The initial condition of the simulation assumes no position in the market. To initiate the simulation, price action is monitored each day relative to the most recent X days. If on any particular day the market price at any time exceeds the high of the previous X days, the simulation assumes a long position at one "tick" above the X-day high. Or, if prior to making a new high relative to the previous X days the market makes a new low relative to the previous X days, then the initial position is a sale at one "tick" below the low of the previous X days.

Once the simulation has assumed either a long or a short position in the market, it continues to hold either a long or a short position at all

times. If a long position is held, it is retained as long as the market remains above the low of the previous X days. In this case if the low of the previous X days were penetrated at any time during the trading day, the simulation would assume an offset to the long position and establish a short position at a price level one "tick" below the X day low. It would remain short until the market action on some subsequent day was able to penetrate the high of the previous X days. Then it would assume an offset of the short position and the establishment of a long position at a price level one "tick" above the X day high. Therefore, the price action of the previous X days can be thought of as breathing room for the price action. A reversal of position requires that price action move entirely across the breathing room space that has been allowed and establish a new price precedent relative to its recent price history. Failing to do that, price action within the breathing room zone is judged to be insignificant and the trend unchanged from the previous day's trend determination (see Figure 1).

The use of a price one "tick" above or below the high-low range of the previous X days approximates the results of a trading account that uses stop loss orders. In special cases, when the market opens higher or lower than one "tick" above or below the previous X days price range thereby indicating a position reversal on the opening, the opening price is the price used to offset the previous position and establish the new position. The simulation recognizes commission costs at the rate of $100 per transaction.

The Simulation Against Corn Futures Data

The simulation was conducted against corn futures market data for the years 1973 through 1983 inclusive. Within the year, the December futures contract was used for the period March 1 through November 30 and the March futures contract was used for the period December 1 through February 28.

The X-day history was simulated with X set equal to 2 through 40, with these and various intermediary results presented in Table 1. Forty-eight time cells were created that were approximately 1 week in length and are identified on the left-hand side of the table. For example, January 1 represents the date range January 1 through 7. January 2 represents the date range January 8 through 15. January 3 represents the date range January 16 through January 23 and January 4 represents the date range January 24 through 31. Similar date ranges were established for all months.

Within each time cell is accumulated the profits or losses that result daily from the simulated position. For example, during the second period of July under conditions of X equal to 5, we register 28. The cumulative profits and losses that occurred on all dates between July 8 and 15 for the years 1973 through 1983 summed to 28 cents per bushel when the simulation was conducted with X set equal to 5.

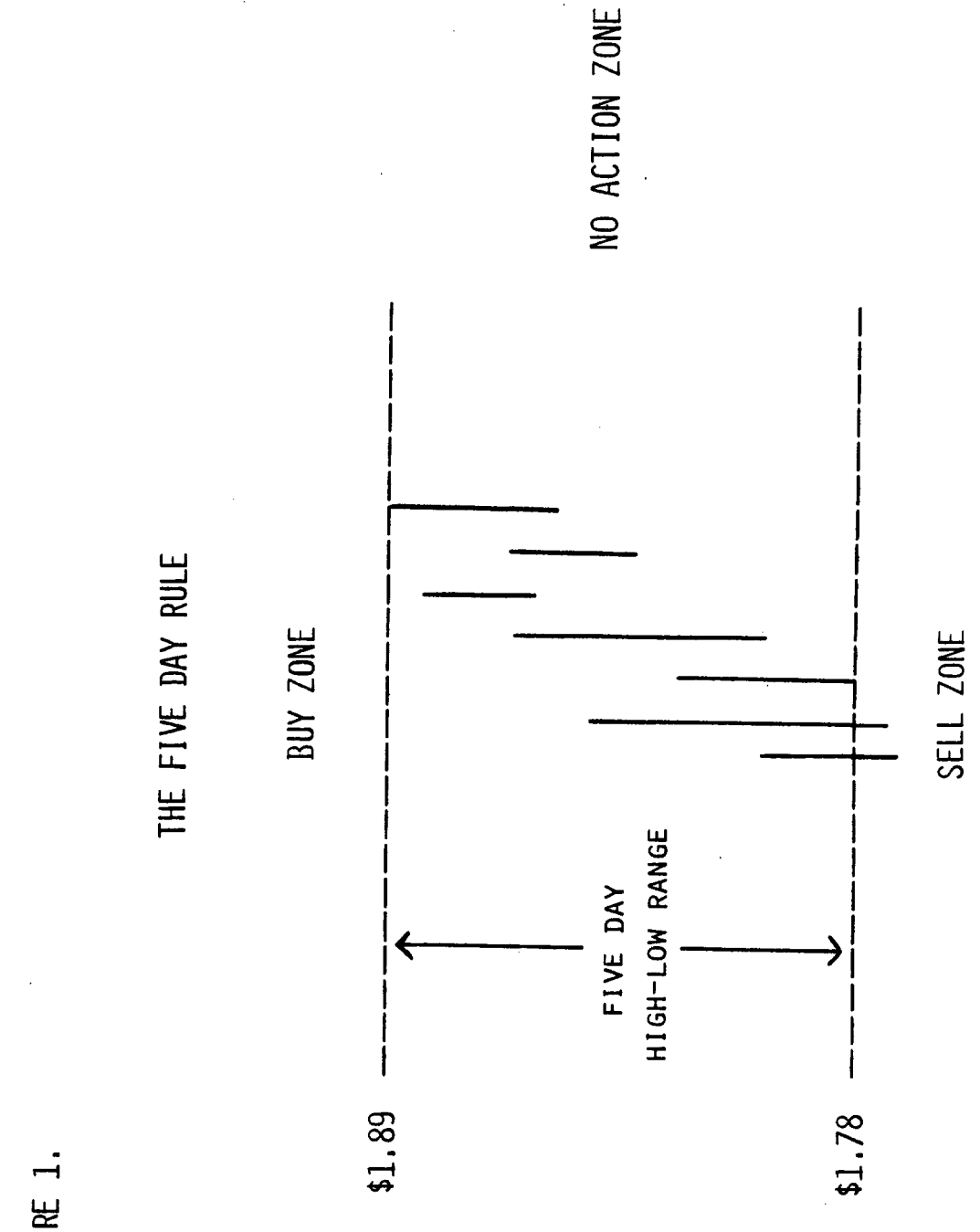

THE FIVE DAY RULE
BUY ZONE
NO ACTION ZONE
SELL ZONE
$1.89
$1.78
FIVE DAY
HIGH-LOW RANGE

FIGURE 1.

Table 1.

CORN SIMULATION
1972 Through 1983
Cents/Bushel

X Day Rule:		2	3	4	5	6	7	8	9	10	15	20	25	30	35	40
January	1	-2	0	-17	-8	-4	-17	6	-5	-12	-16	13	18	7	7	8
	2	-29	-15	-5	-3	-9	-5	4	3	-3	1	30	35	38	38	37
	3	-28	-27	-26	-24	-28	2	16	12	12	9	10	10	7	33	15
	4	-32	-6	1	0	3	1	-13	5	34	23	4	5	35	31	35
February	1	-66	-13	-37	-45	-42	-22	-23	-35	-37	-40	-45	-42	-36	-45	-23
	2	-67	-16	-28	-34	-32	-13	-5	0	-4	15	21	27	23	39	34
	3	24	44	38	38	45	61	48	57	57	48	46	55	61	70	72
	4	42	15	-1	-5	6	-8	-4	-2	-2	3	5	6	1	1	3
March	1	-51	-7	-15	-12	-1	-11	5	0	-5	-11	25	33	28	28	3
	2	-86	10	19	42	41	36	14	17	13	32	-4	-8	-24	-25	-25
	3	-30	-4	-19	-11	-6	21	27	24	22	1	-3	-4	-4	2	29
	4	0	-15	-13	-4	25	28	51	59	59	38	32	14	16	-7	8
April	1	-50	-13	15	9	3	4	3	17	17	24	20	12	13	22	17
	2	-76	-41	-53	-47	-50	-46	-46	-36	-46	-60	-64	-66	-40	-26	2
	3	-64	-38	-42	-31	-21	-33	-36	-35	-37	-12	-4	3	7	26	-4
	4	-31	-19	-4	-9	14	0	-1	-5	-12	-22	-61	-25	-17	-4	9
May	1	-9	-11	18	-1	14	15	15	11	10	2	-12	-8	0	55	60
	2	-62	-48	-13	-19	1	13	29	26	24	24	22	22	-11	-17	7
	3	-59	-66	-46	-23	-20	-22	-35	-48	-23	17	19	17	15	27	30
	4	-21	-27	-22	-38	-23	-29	-30	-23	-24	20	27	33	33	42	32
June	1	-24	-9	8	2	33	25	22	22	22	26	23	24	22	30	13
	2	-37	16	15	12	-6	-16	-3	-7	-16	-10	-15	13	13	13	-2
	3	-52	-20	-4	-1	11	0	7	20	18	13	13	35	35	25	53
	4	7	-1	-32	-46	-14	-20	-8	-24	-13	-53	-53	0	0	6	-19
July	1	-7	-25	-33	-52	-49	-29	-43	-58	-15	-24	14	20	22	24	19
	2	10	24	26	28	48	34	46	43	32	17	17	47	49	22	82
	3	58	72	53	77	94	99	91	91	78	63	63	69	70	78	68
	4	47	33	56	143	143	154	150	146	146	117	100	110	107	66	112
August	1	39	72	81	62	68	71	101	101	101	101	105	90	85	85	90
	2	11	-20	-8	46	58	76	52	51	57	52	55	55	55	55	60
	3	15	-5	-10	-27	-49	-32	35	19	20	-4	-6	-7	-7	-7	-33
	4	-74	-45	-6	-11	-4	18	-36	-34	-30	-19	-38	-53	-46	-46	-51
September	1	34	16	23	11	41	34	-11	1	16	-11	35	15	-3	6	-8
	2	-78	-30	-67	-67	-64	-67	-74	-60	-48	-42	-63	-44	-19	14	3
	3	-39	-61	-73	-56	-29	-20	-20	-22	-13	-26	-17	-13	5	4	31
	4	-14	-17	27	-1	1	-2	-15	-16	25	-34	-15	-35	-18	-9	38
October	1	7	3	-12	-22	-9	-22	-20	-30	-43	-27	-6	-26	-20	-49	-50
	2	-66	-79	-112	-82	-83	-82	-81	-98	-108	-17	-49	-60	-6	-12	-5
	3	-41	-44	-46	-41	-38	-2	-5	-9	-10	-16	9	-7	9	10	-21
	4	12	13	-17	9	-19	-13	-5	29	29	9	21	38	39	16	30
November	1	-39	17	32	10	2	-1	-9	15	15	-3	-6	-4	-7	-13	-20
	2	16	44	26	8	36	30	14	16	13	-24	26	-15	-15	0	37
	3	42	46	67	55	41	44	40	39	38	24	17	-14	-25	26	19
	4	-42	-59	-73	-47	-61	-55	-54	-72	-73	-23	-34	-28	-28	-28	-30
December	1	-31	-51	-45	-22	-28	-4	0	-2	-4	-15	-2	16	6	21	8
	2	-1	8	33	52	49	31	33	29	33	60	60	51	51	21	13
	3	-54	-34	-12	-4	7	-9	-11	-12	-41	-13	-13	-14	-8	-8	-2
	4	-17	-22	-28	-35	-27	-36	-39	-39	-48	-23	9	8	3	3	2
Number of Trades:										146	102	67	53	42	35	23
Jan 1 - Jul 1:		-806	-333	-297	-309	-110	-65	-2	-4	39	49	62	229	243	395	412
Jul 2 - Aug 2:		164	181	208	355	410	433	440	431	414	349	340	371	365	305	412
Aug 2 - Dec 4:		-369	-299	-292	-270	-235	-190	-256	-246	-229	-202	-73	-192	-88	-52	-42

Note: All numbers rounded to the nearest cent.

The most notable feature of the resulting grid is the large positive numbers between July 8 and August 15. These are accumulated and the sum is displayed at the bottom of the table. As X varies from 2 through 40 the profits grow to a peak value of $4.40 at X equal to 8 and then decline modestly.

Accumulations from August 16 through December 31 also shown at the bottom of Table 1 are all negative regardless of the value of X.

Accumulations from January 1 through July 7 grow from large negative values when X is 2 to large positive values as X is increased.

The number of times a particular decision rule called for a position change is also indicated in a row at the bottom of the table.

Interpretation of The Simulation

Figure 2 illustrates the implications of this simulation for the seasonal character of the corn market.

Beginning with the summer period, the optimum results under conditions of X equal to 8 suggest the character of the corn market to be that it is trending either sharply higher or lower during this period. Since only 8 days breathing room is required, it suggests that the market is very directional and that if it reverses its trend it tends to follow through in the new direction and easily recovers the costs of moving across the 8-day high low range.

We suggest that this phenomenon is the result of summer corn and soybean belt weather patterns having some degree of stability to them. Dry or rainy weather tends to persist. The droughts of 1980 and 1983, for example, were the result of a high pressure ridge that remained over the eastern and some portion of the western corn belt through the July and August period.

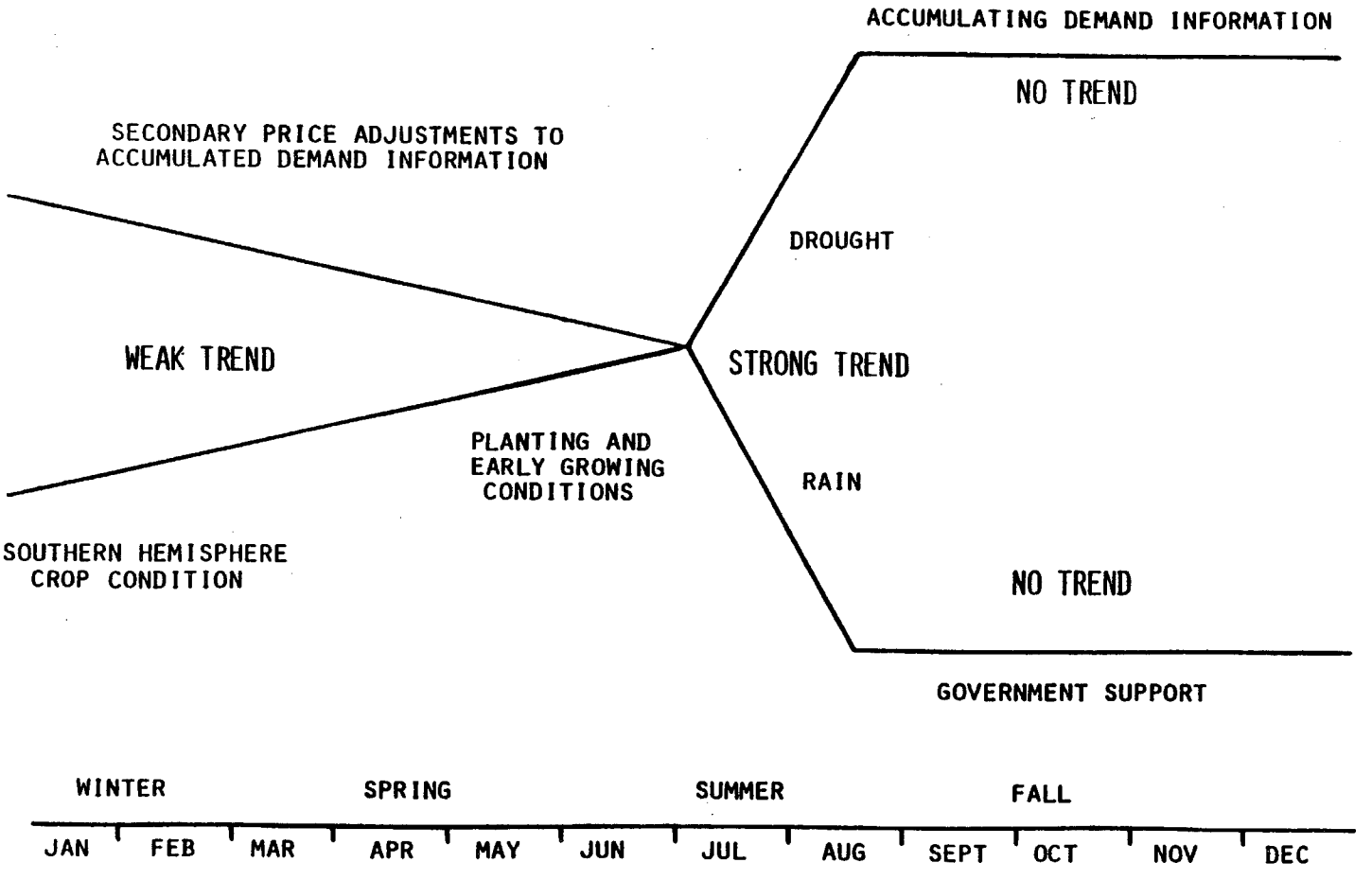
It is interesting that this analytical technique allows us to pinpoint the beginning and ending dates of what is apparently the weather influence on the corn market. It seems to begin in earnest on about July 8, give or take a few days. These data suggest that it typically ends about August 15.

According to this simulation, the character of the corn market changes to a sideways pattern after August 15. The large losses result from failure of the market to follow through when it reverses position, thereby tending to buy at higher prices and sell at lower prices as the market moves sideways throughout the fall period.

Under conditions of the high prices that follow a drought, we suggest that the corn market demonstrates a sideways character because it has reverted to a demand orientation, that is, it needs to find a price that will limit the next year's demand to available supplies. It takes time for demand information to accumulate. The market moves sideways while it waits.

FIGURE 2.

CORN MARKET
SEASONAL TREND CHARACTERISTICS



Under conditions of low prices following a favorable growing season, the corn market tends to move sideways as it is supported by the loan rate.

During the January 1 through July 7 period, the character of the corn market as revealed by these simulations seems to be that of weak trends, that is, directional but with significant oscillation about the general trend. If X is less than 10, the accumulated profits of this period tend to be negative. But if X is set at 35 or 40, accumulated profits are substantial. Our interpretation is that weak trends exist that are exploited in the simulation if enough breathing room is allowed. If not, the short-term oscillation of the market creates overwhelming losses as the X day high and low range is repeatedly crossed. By keeping X large, these losses are avoided and the longer term slower trend creates profits.

Typical market moving events in the January 1 through July 7 period that are significant but unlikely to be as strong in July and August weather include: southern hemisphere weather and crop conditions and northern hemisphere crop planting and early growing conditions. Also, by this time the demand information that the market waited for in the fall has accumulated to the degree that it is possible to make secondary price adjustments. If prices were initially too high and too much demand has been curtailed, then prices will adjust lower. This is typically the case is short crop years.

In Appendix I are December corn charts for the years 1966 through 1988. A visual impression can be formed by scanning these charts that tends to confirm the schematic just described. In particular, 1983 is a perfect example with weak trends in the spring, strong trends in the summer, and a sideways market in the fall.

The Simulation Against Soybean Futures Data

Simulations against soybean data were conducted in exactly the same manner as has been described for corn. The results are presented in Table 2.

The soybean data covered the period 1973 through 1983 inclusive. For the period March 1 through October 31, the November futures contract was used. For the period November 1 through December 31, the January futures contract was used. For the period January 1 through February 28, the March futures contract was used.

The seasonal dynamics of the soybean market appear to be almost identical to those of corn. The one exception is that the beginning of the weather influence seems to appear about one week earlier.

In Appendix II are November soybean charts for the years 1966 through 1988.

Table 2.

SOYBEAN SIMULATION
1972 Through 1983
Cents/Bushel

X Day Rule:		2	3	4	5	6	7	8	9	10	15	20	25	30	35	50
January	1	32	-17	-38	-19	-16	-26	-19	-18	-52	-180	-165	-155	58	74	-26
	2	-39	-41	26	66	80	77	77	77	39	5	121	140	66	86	151
	3	93	137	138	131	157	144	135	134	131	123	121	63	129	127	117
	4	-158	-113	-111	-46	-55	-72	-62	-4	36	34	26	8	33	31	-11
February	1	-2	76	23	-38	-18	-5	-55	-82	-51	-23	-23	-29	-14	-25	6
	2	-42	-92	-82	15	31	-41	-4	59	56	74	84	80	126	126	168
	3	116	190	185	170	164	160	199	214	211	171	165	141	157	163	169
	4	166	110	50	61	52	52	29	23	23	59	60	49	51	20	10
March	1	-38	-26	9	33	33	19	70	70	64	64	77	77	49	19	47
	2	-123	-39	-52	-50	-58	-18	-81	-96	-92	-20	-14	-14	-14	-14	-84
	3	-34	-37	-39	-39	21	7	9	2	54	-18	-49	-51	-51	-58	-57
	4	-27	-54	-54	16	36	28	62	87	102	27	85	74	50	50	22
April	1	15	61	78	57	48	44	42	35	27	94	88	58	94	85	103
	2	-75	-34	-67	-58	-68	-34	-40	-76	-29	-80	-62	-62	-58	-58	-56
	3	-69	-4	-13	-53	-84	-94	-107	-114	-54	-7	29	-26	42	42	31
	4	-114	-34	-99	-24	-40	-45	-98	-86	-93	-172	-136	-115	-115	-132	-2
May	1	-22	-12	3	-1	29	31	25	47	50	31	41	-6	1	16	-14
	2	-94	-34	-11	-55	-19	-48	-54	-53	-34	-9	9	-20	16	-21	6
	3	2	39	-12	56	55	29	-37	-63	-50	-50	81	90	66	66	73
	4	116	111	177	178	177	169	188	182	182	145	199	168	171	171	180
June	1	27	97	69	10	-1	-6	-10	-8	5	16	16	4	15	15	27
	2	204	117	173	115	102	82	55	20	57	9	-15	-52	-27	-27	-27
	3	45	-144	-41	-51	-136	-149	-136	-149	-96	53	24	70	34	16	6
	4	84	125	1	-58	-129	-207	-101	-122	-60	-45	-51	-38	-28	-28	-56
July	1	292	271	171	169	146	90	42	22	2	131	211	110	105	107	165
	2	36	163	114	58	-17	128	139	134	141	42	-17	-17	199	178	128
	3	198	147	160	192	204	177	314	314	252	160	67	133	186	186	182
	4	9	-178	71	28	68	267	236	236	259	347	317	234	219	213	168
August	1	-10	-50	60	106	105	-30	-51	34	109	32	24	9	40	40	116
	2	269	200	114	163	199	375	352	270	301	182	182	147	112	100	189
	3	-2	-16	-60	-20	23	28	-20	-84	-79	-120	-255	-227	-166	-171	-115
	4	-179	-277	-131	99	39	5	15	-33	1	118	72	23	-33	-33	-83
September	1	-2	62	83	43	94	94	128	144	130	98	130	139	50	4	75
	2	64	62	20	-25	-62	-157	-174	-196	-114	-104	-121	-162	-213	-33	-119
	3	-32	-81	-133	-107	-161	20	42	-3	-60	-77	-23	41	-3	-11	64
	4	127	120	56	109	89	143	105	81	61	47	52	-108	-210	-25	39
October	1	116	136	101	28	-2	-8	-52	-10	-1	-21	105	124	124	-16	-45
	2	61	29	47	20	-27	-93	-104	-54	-90	-110	-86	-28	-28	50	106
	3	88	47	78	98	9	19	-10	13	-4	53	84	104	114	116	-29
	4	-55	-69	39	14	69	94	92	103	93	43	6	-64	44	32	-13
November	1	-34	84	59	40	-11	-44	-52	-81	-54	-45	-90	-90	11	-56	-58
	2	116	144	115	41	61	37	3	-101	-65	130	96	93	16	-11	-16
	3	85	114	87	129	116	102	77	60	54	70	167	133	-48	-48	-48
	4	-75	-147	-186	-131	-140	-160	-174	-180	-176	-129	-126	-126	-129	-58	-65
December	1	59	26	51	8	9	-19	-30	5	106	-8	63	78	103	20	-30
	2	81	77	70	60	121	107	65	71	81	46	146	120	132	132	155
	3	-46	-3	-70	-81	-86	-32	-41	-82	-88	-94	-50	-50	-57	-57	-71
	4	10	-22	-19	-32	9	-24	40	52	57	83	42	42	72	82	81
Jan 1 - Jun 4:		63	384	312	415	361	97	87	80	426	299	709	454	850	742	782
Jul 1 - Aug 2:		793	554	690	715	704	1007	1031	1008	1063	893	784	617	861	823	947
Aug 3 - Dec 4:		382	287	208	293	150	112	-89	-295	-148	-19	212	42	-221	-85	-172
Total:		1239	1225	1210	1423	1216	1216	1029	794	1341	1173	1705	1113	1491	1481	1557

Note: All numbers rounded to the nearest cent.

A Simulation Against Wheat Futures Data

Similar simulations were conducted against a Chicago wheat data base. The strong seasonal characteristics found here in corn and soybeans are not apparent in wheat. Perhaps this is because wheat is grown over a much larger region in the U.S. and the world, for that matter. A single regional weather event, though important, is not capable of the supply side impact that seems to be the case in corn and soybeans.

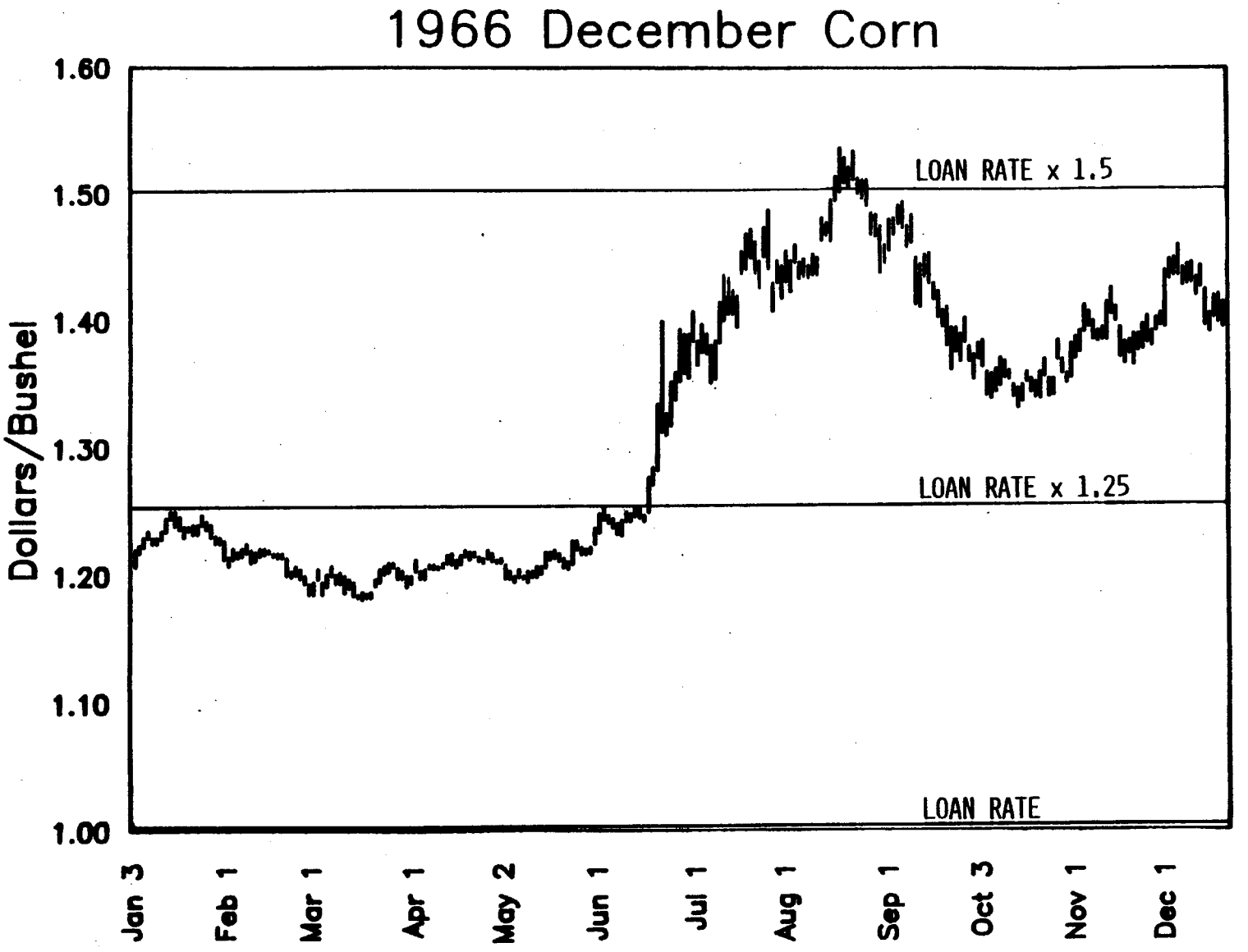
Management Implications for Farmers

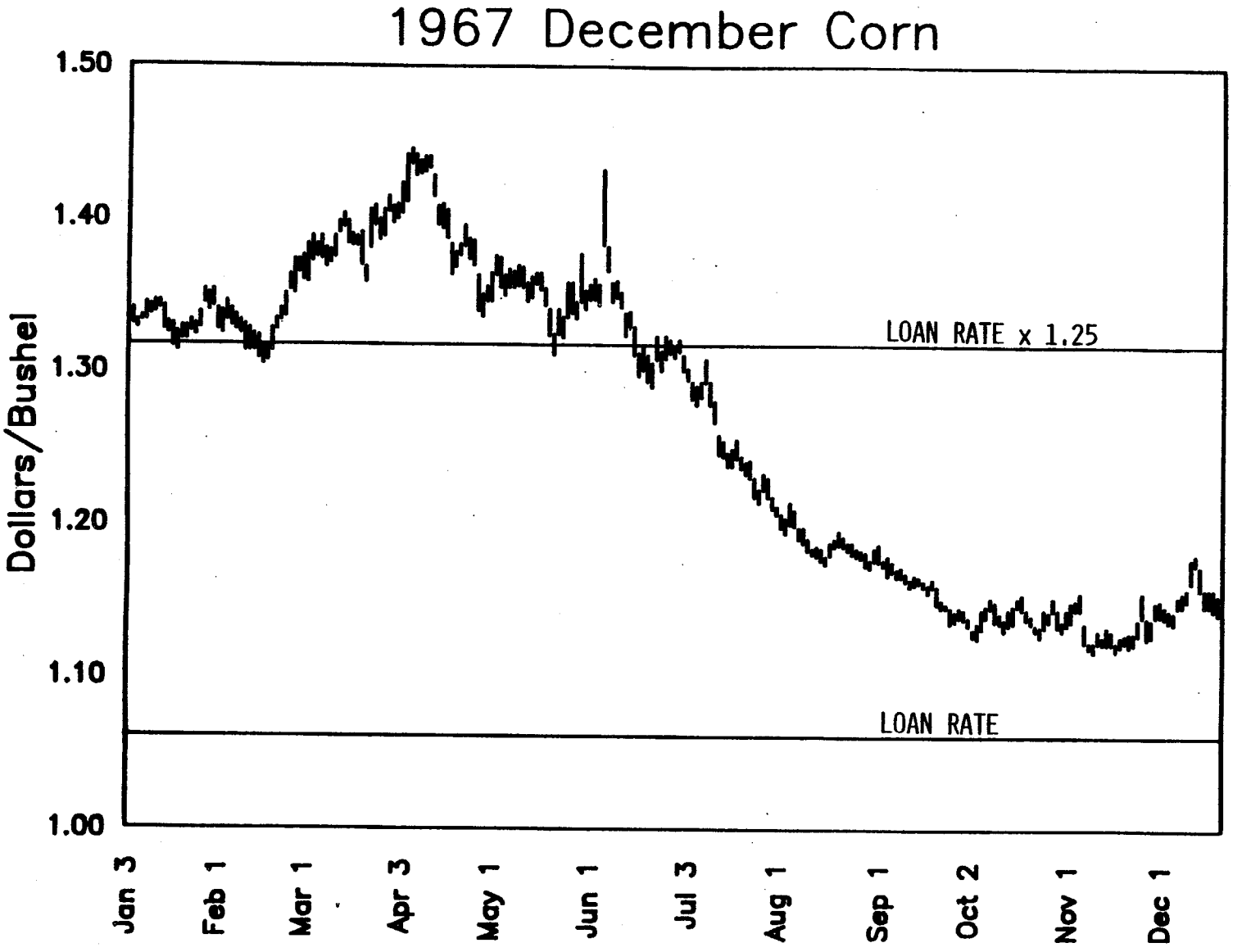
The characteristics of the corn and soybean markets as revealed in this study suggest that there are substantial market timing advantages to be gained by farmers who monitor market trends and employ trend following strategies. Specifically this research suggests that during the July through August 15 period aggressive trend following strategies would be in order for timing sales or ownership of corn and soybean production. A more conservative trend following strategy would be in order for the January through June period, while no advantages to trend following management strategies are likely in the fall in the long run.

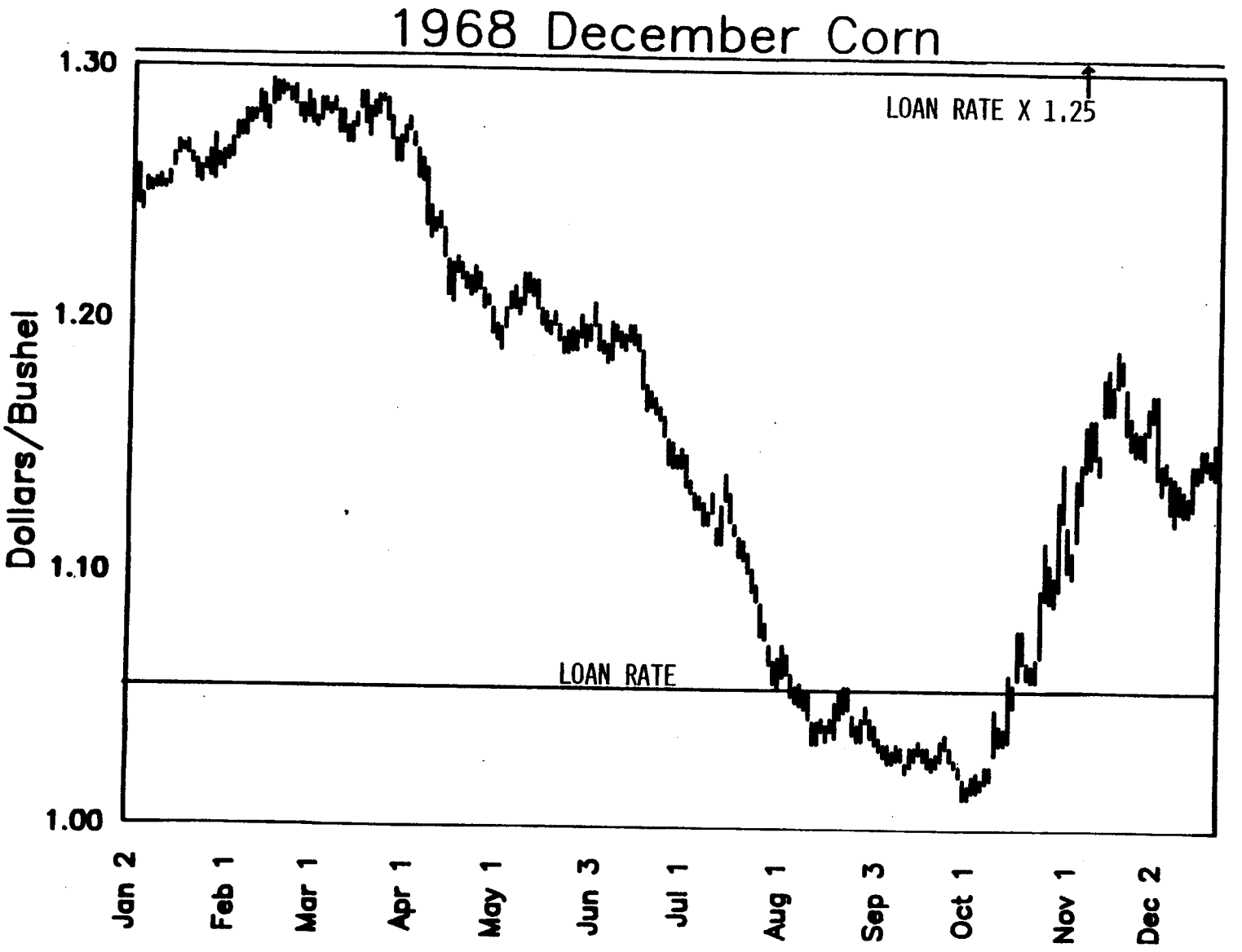
Conclusion

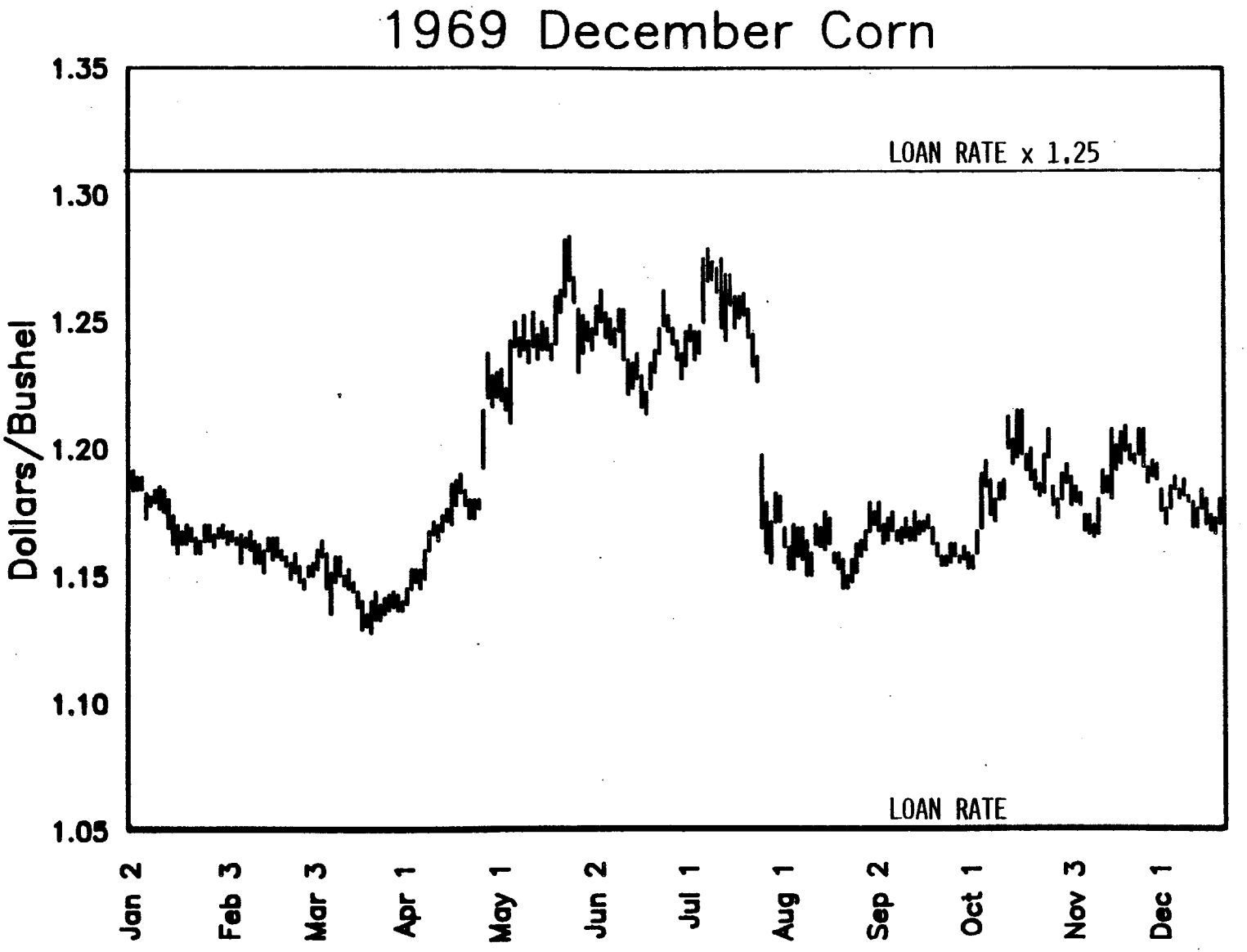
The corn and soybean crop is grown in a relatively concentrated region, the corn and soybean belts. The U.S. weather patterns in this region tend to be stable in the July and August period. The corn and soybean market, therefore, tends to trend sharply higher or lower during this period depending upon the nature of the weather. After about August 15, the nature of the corn and soybean market reverts to a demand orientation if supplies have been curtailed by drought or to the supporting features of the government program if it has rained. In both cases, the market tends to oscillate sideways. From January through June, the corn and soybean markets tend to exhibit weak trends under conditions of more oscillation than is present during the July-August period. Marketing management techniques that exploit these characteristics would involve aggressive trend following strategies in the July through August 15 period and conservative trend following strategies in the January 1 through early June period.

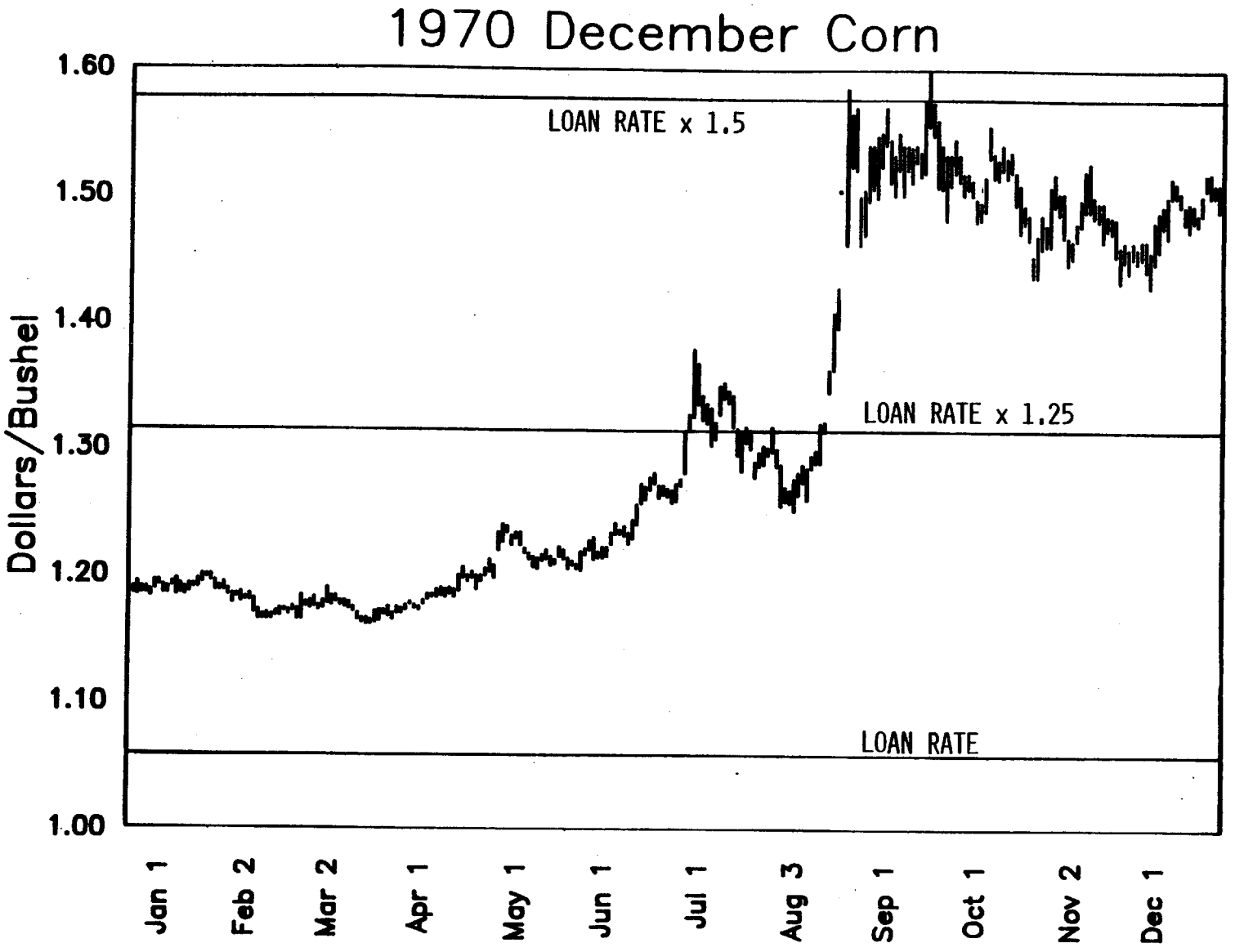
APPENDIX I

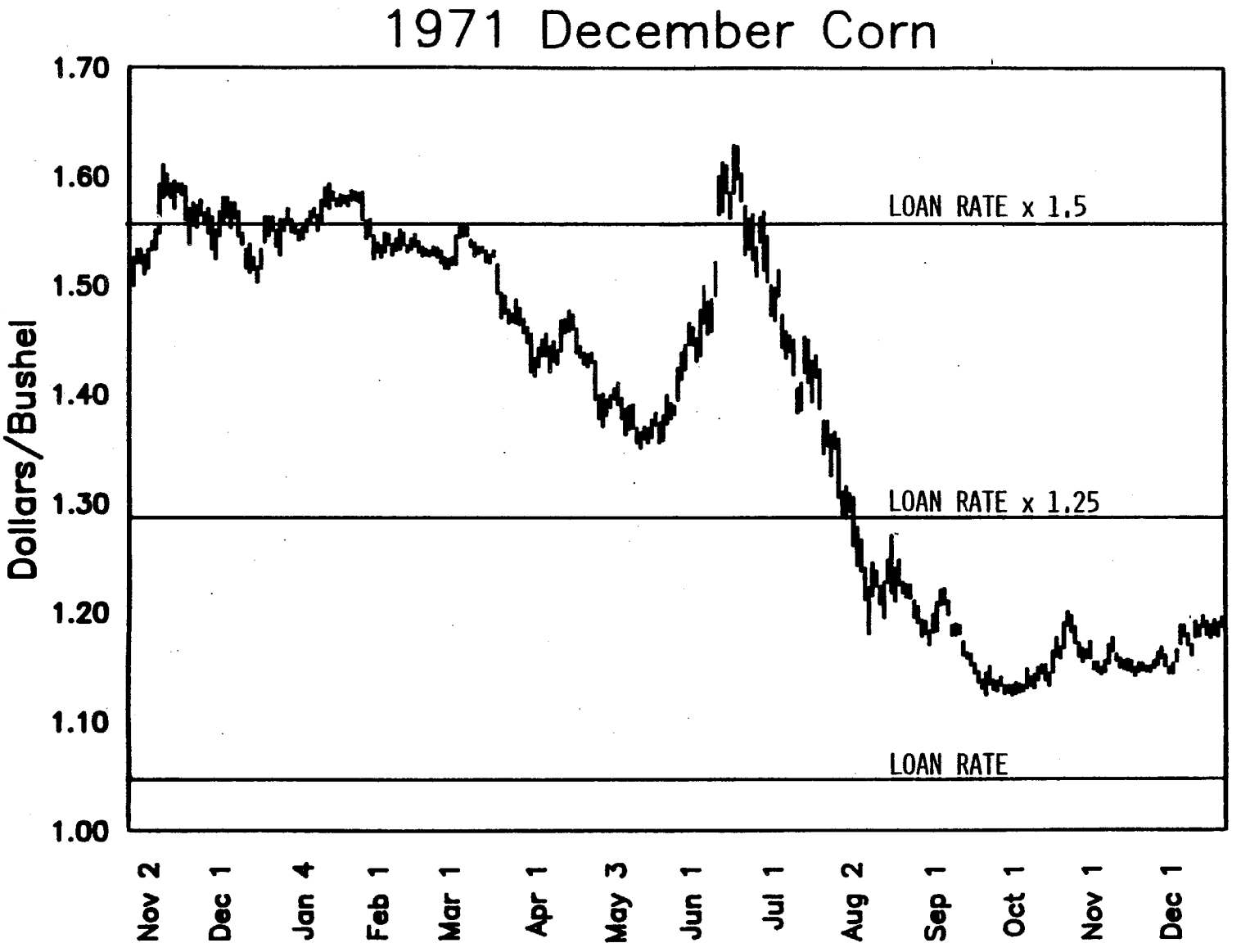

1966 December Corn
Dollars/Bushel
1.60
1.50
1.40
1.30
1.20
1.10
1.00
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Jan 3
Feb 1
Mar 1
Apr 1
May 2
Jun 1
Jul 1
Aug 1
Sep 1
Oct 3
Nov 1
Dec 1

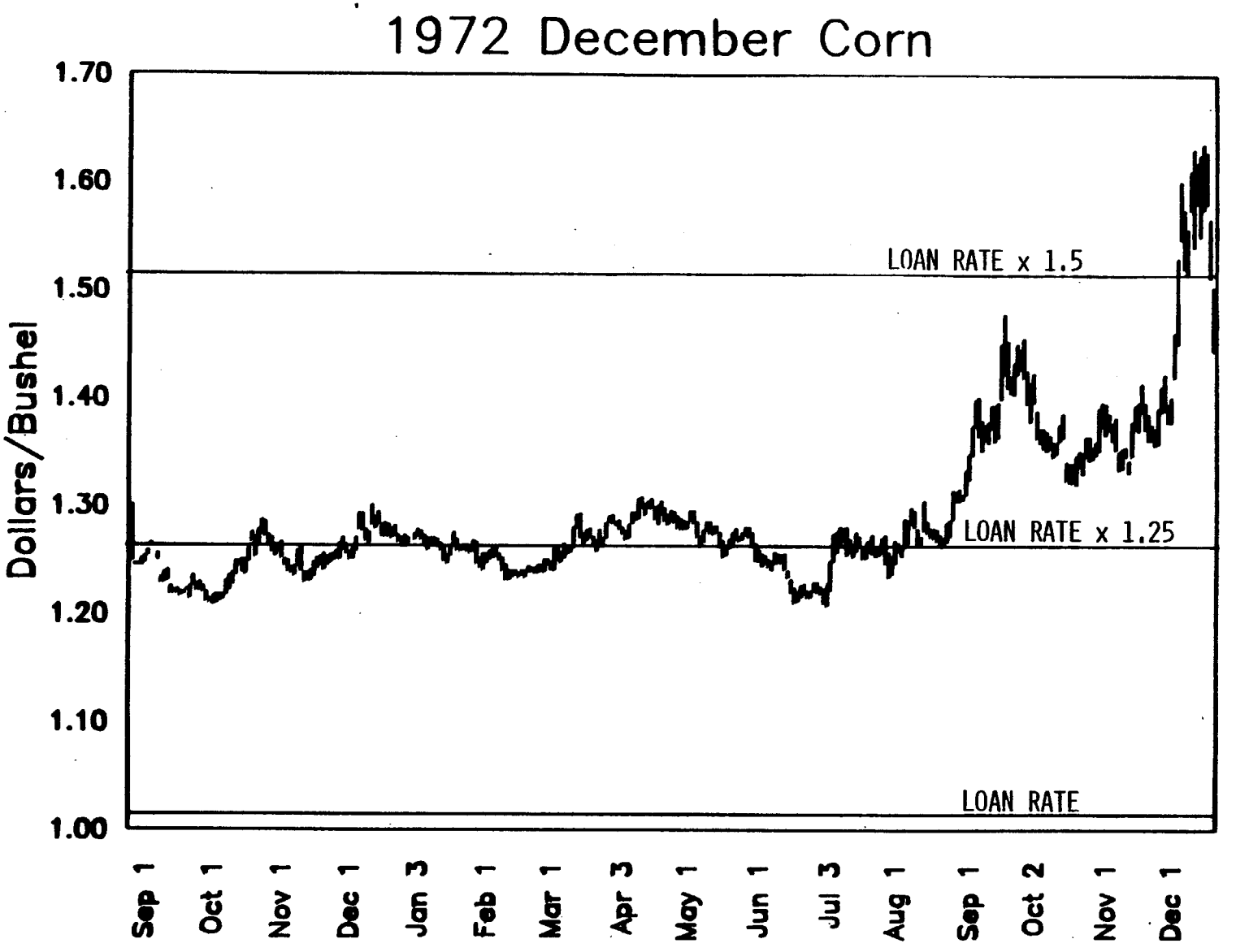

1967 December Corn
1.50
1.40
1.30
1.20
1.10
1.00
Dollars/Bushel
LOAN RATE x 1.25
LOAN RATE
Jan 3
Feb 1
Mar 1
Apr 3
May 1
Jun 1
Jul 3
Aug 1
Sep 1
Oct 2
Nov 1
Dec 1

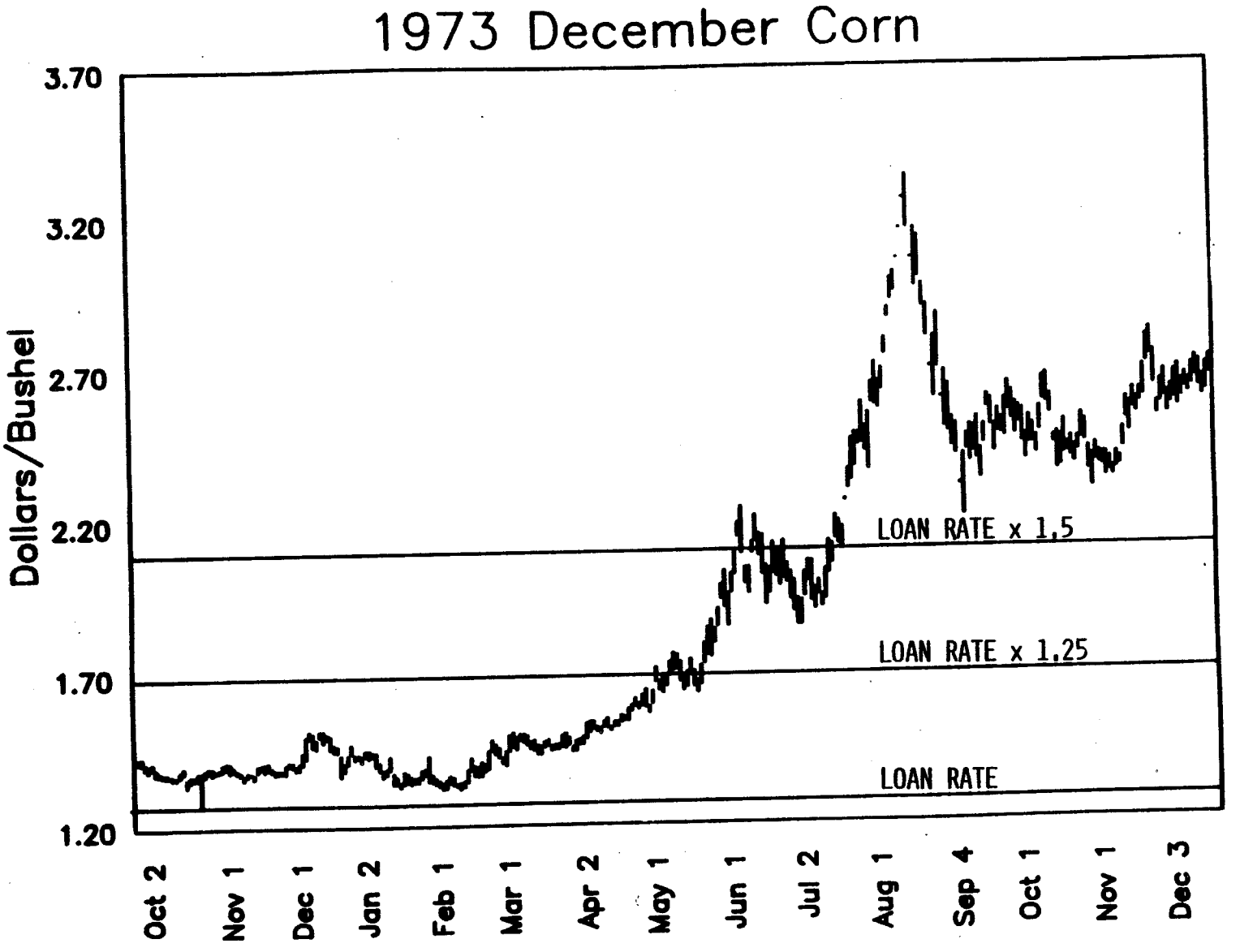

1968 December Corn
1.30
1.20
1.10
1.00
Dollars/Bushel
LOAN RATE X 1.25
LOAN RATE
Jan 2
Feb 1
Mar 1
Apr 1
May 1
Jun 3
Jul 1
Aug 1
Sep 3
Oct 1
Nov 1
Dec 2

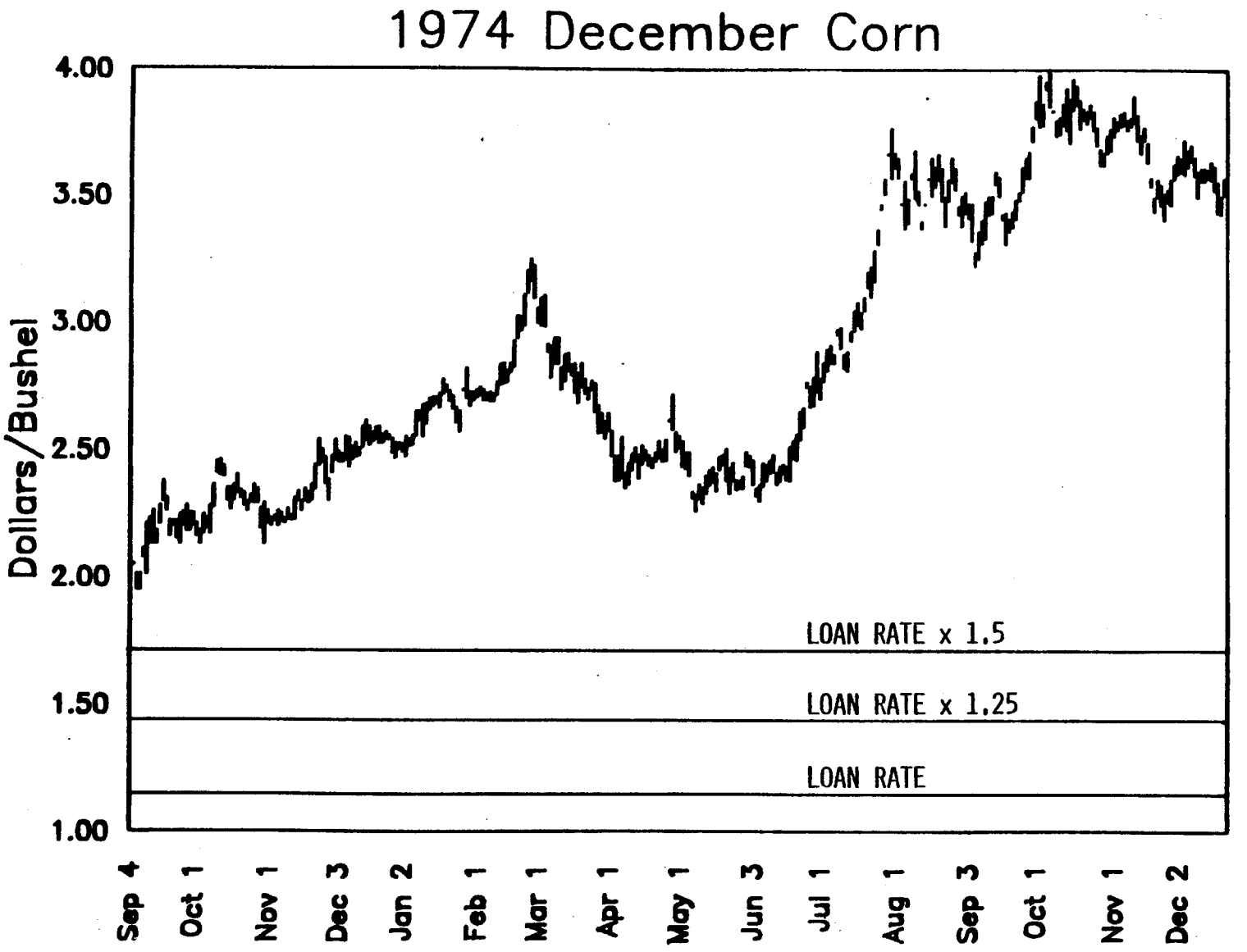

1969 December Corn
Dollars/Bushel
1.35
1.30
1.25
1.20
1.15
1.10
1.05
LOAN RATE x 1.25
LOAN RATE
Jan 2
Feb 3
Mar 3
Apr 1
May 1
Jun 2
Jul 1
Aug 1
Sep 2
Oct 1
Nov 3
Dec 1

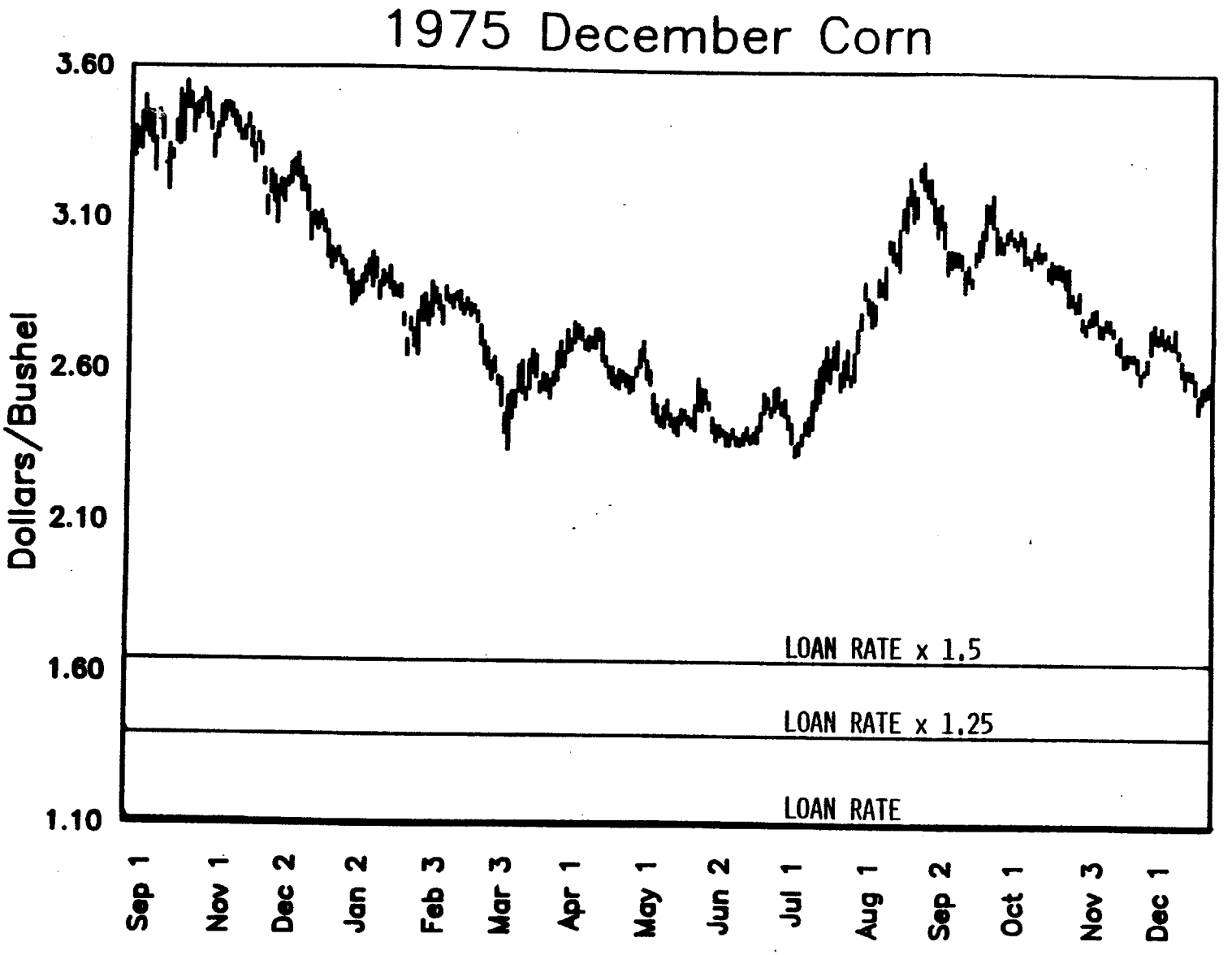

1970 December Corn
Dollars/Bushel
1.60
1.50
1.40
1.30
1.20
1.10
1.00
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Jan 1
Feb 2
Mar 2
Apr 1
May 1
Jun 1
Jul 1
Aug 3
Sep 1
Oct 1
Nov 2
Dec 1

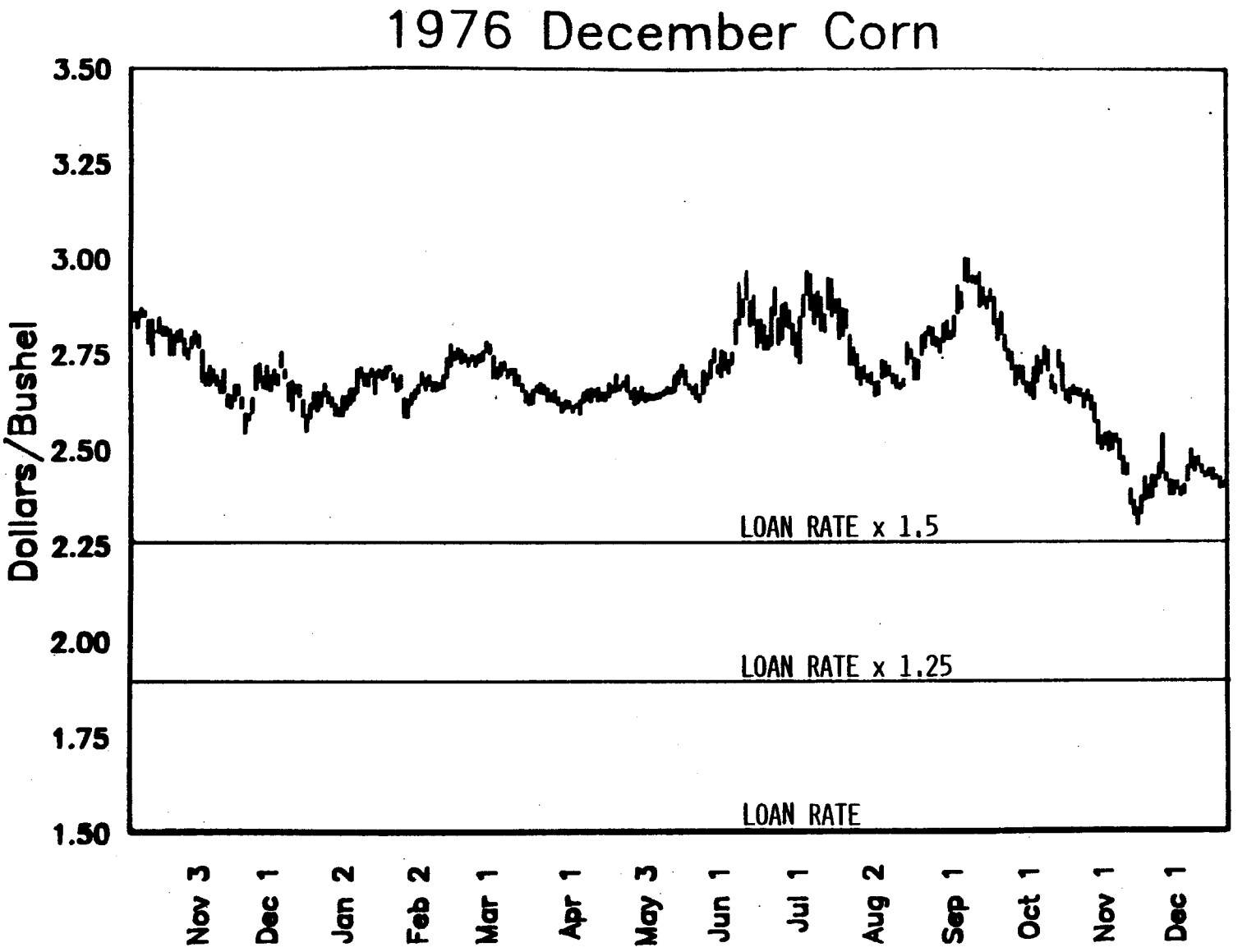

1971 December Corn
Dollars/Bushel
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Nov 2
Dec 1
Jan 4
Feb 1
Mar 1
Apr 1
May 3
Jun 1
Jul 1
Aug 2
Sep 1
Oct 1
Nov 1
Dec 1

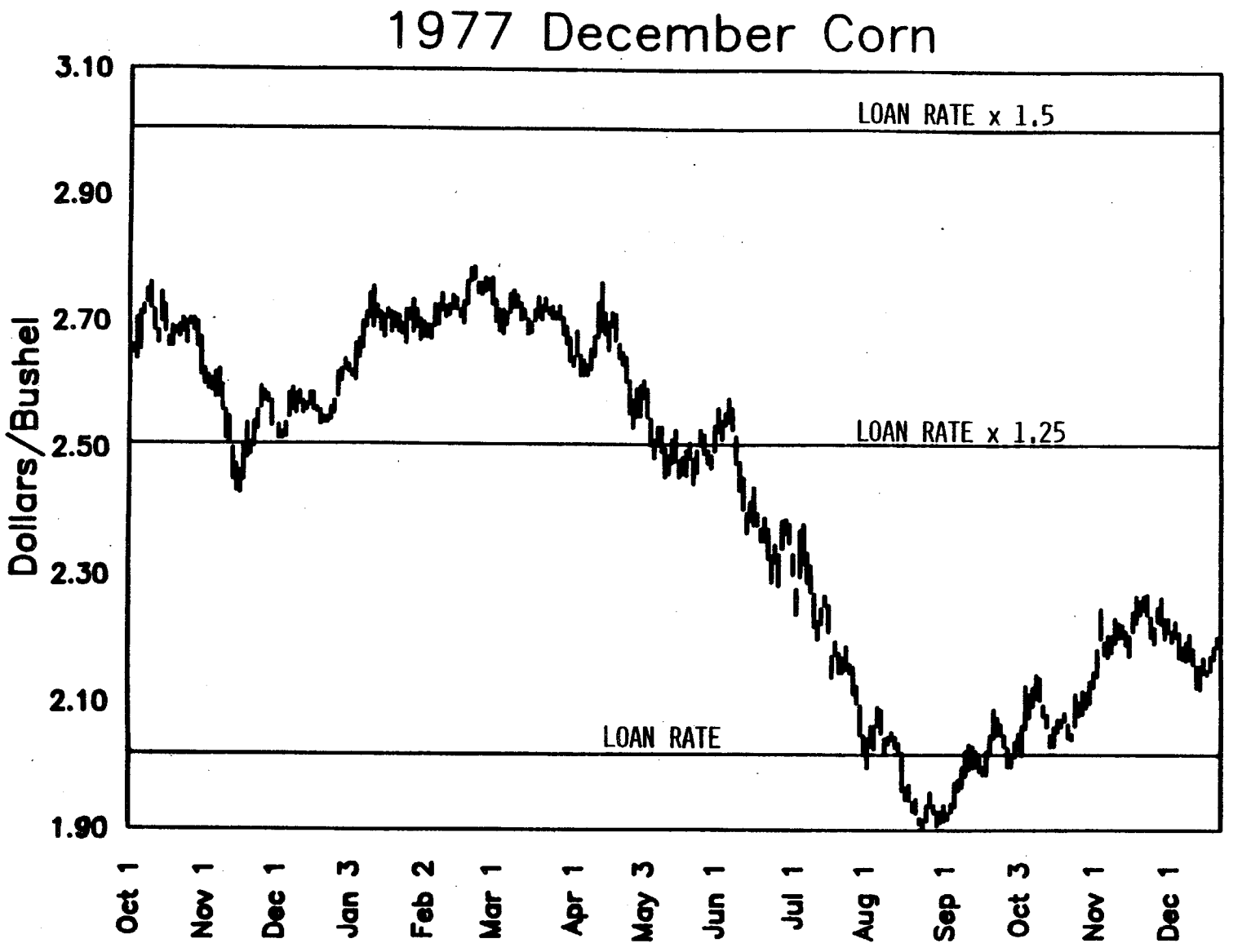

1972 December Corn
Dollars/Bushel
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Sep 1
Oct 1
Nov 1
Dec 1
Jan 3
Feb 1
Mar 1
Apr 3
May 1
Jun 1
Jul 3
Aug 1
Sep 1
Oct 2
Nov 1
Dec 1

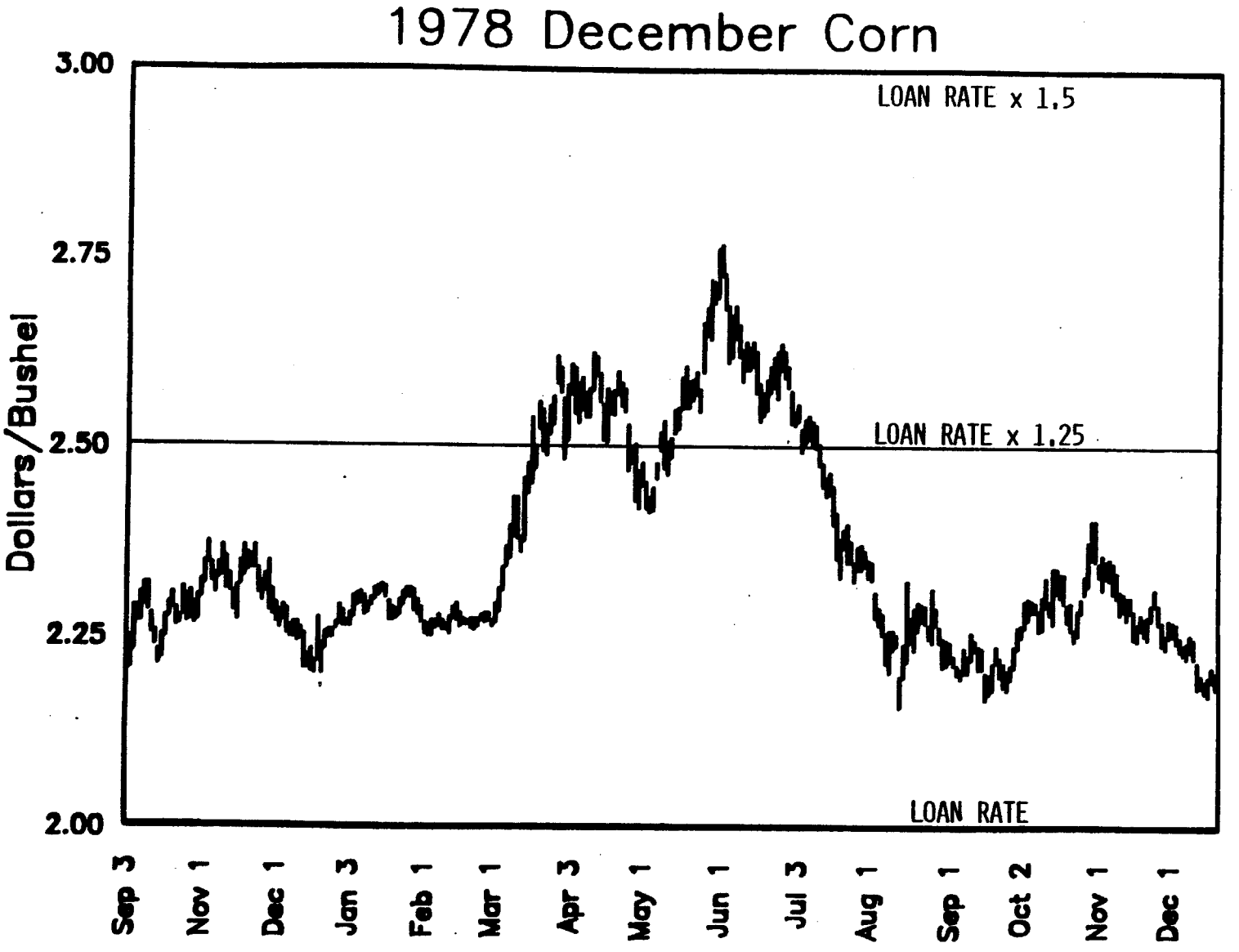

1973 December Corn
Dollars/Bushel
3.70
3.20
2.70
2.20
1.70
1.20
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Oct 2
Nov 1
Dec 1
Jan 2
Feb 1
Mar 1
Apr 2
May 1
Jun 1
Jul 2
Aug 1
Sep 4
Oct 1
Nov 1
Dec 3

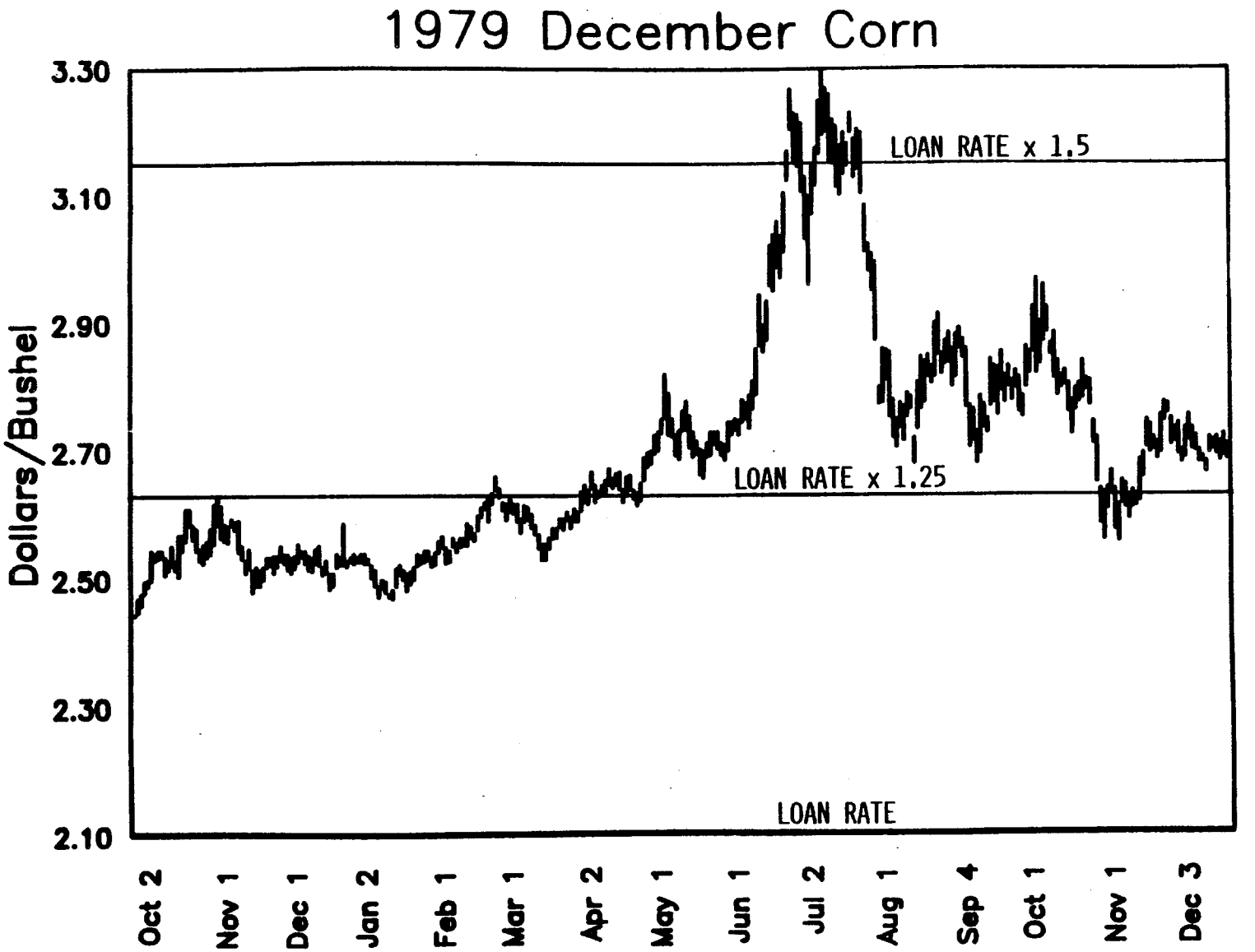

1974 December Corn
Dollars/Bushel
4.00
3.50
3.00
2.50
2.00
1.50
1.00
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Sep 4
Oct 1
Nov 1
Dec 3
Jan 2
Feb 1
Mar 1
Apr 1
May 1
Jun 3
Jul 1
Aug 1
Sep 3
Oct 1
Nov 1
Dec 2

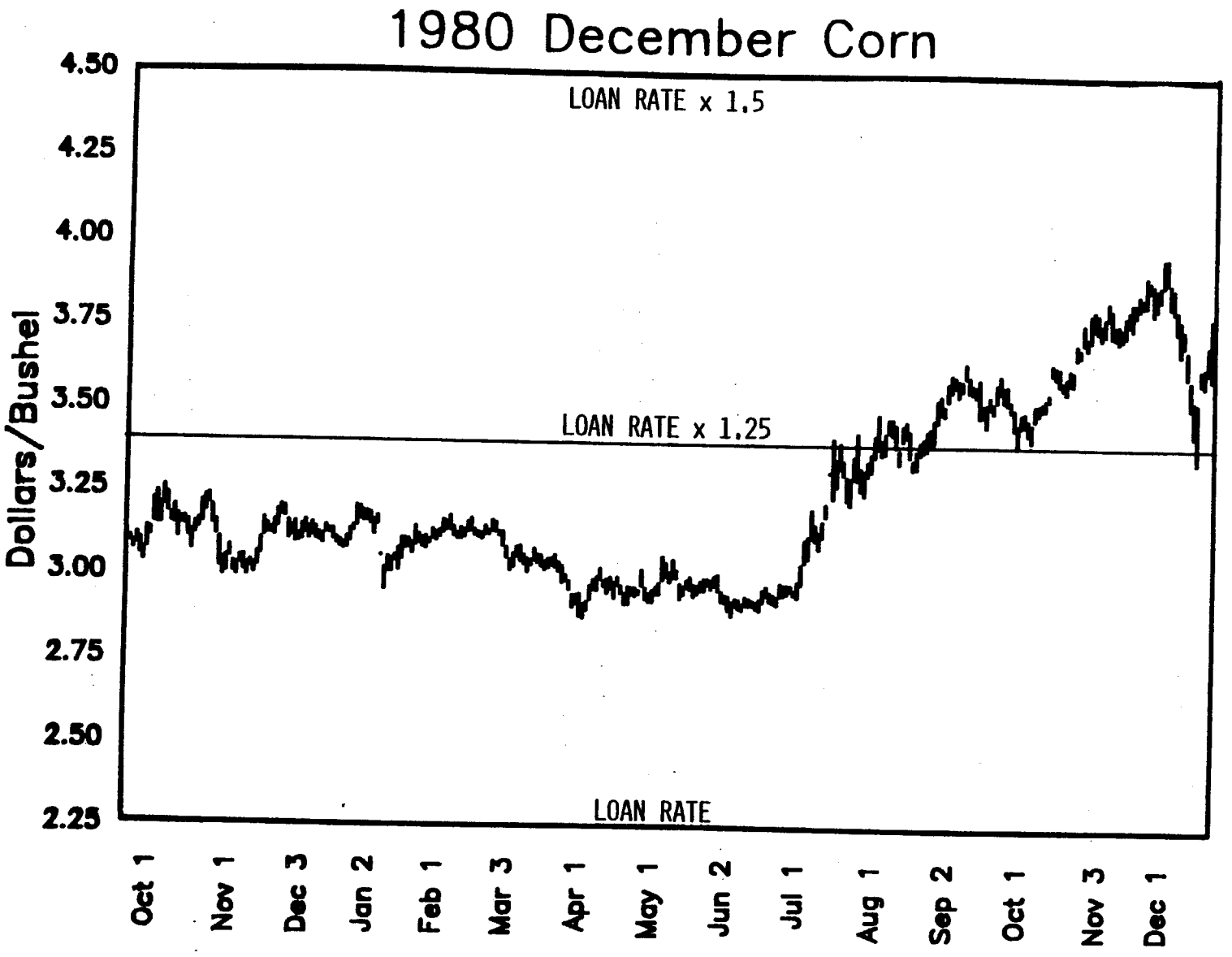

1975 December Corn
3.60
3.10
2.60
2.10
1.60
1.10
Dollars/Bushel
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Sep 1
Nov 1
Dec 2
Jan 2
Feb 3
Mar 3
Apr 1
May 1
Jun 2
Jul 1
Aug 1
Sep 2
Oct 1
Nov 3
Dec 1

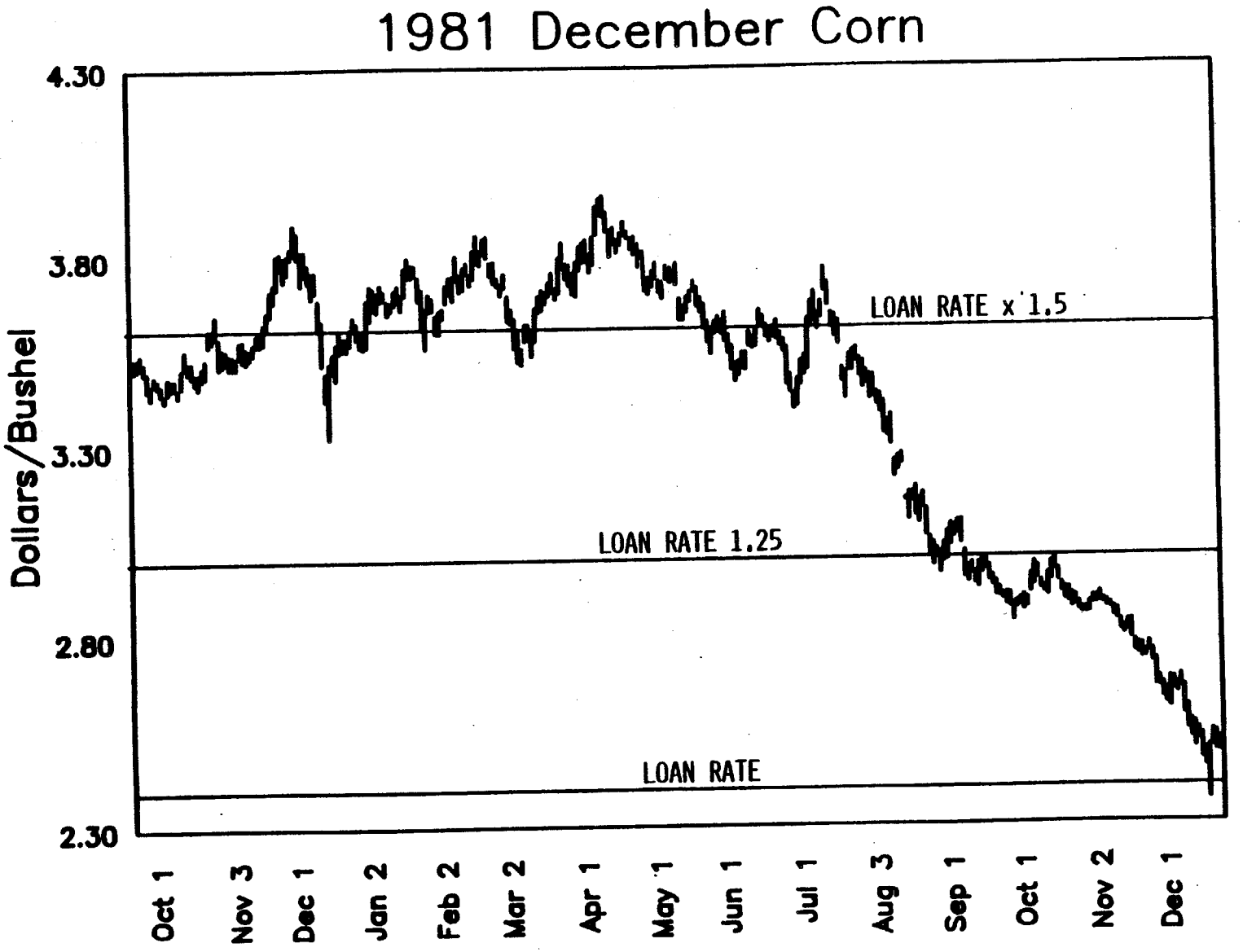

1976 December Corn
Dollars/Bushel
3.50
3.25
3.00
2.75
2.50
2.25
2.00
1.75
1.50
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Nov 3
Dec 1
Jan 2
Feb 2
Mar 1
Apr 1
May 3
Jun 1
Jul 1
Aug 2
Sep 1
Oct 1
Nov 1
Dec 1

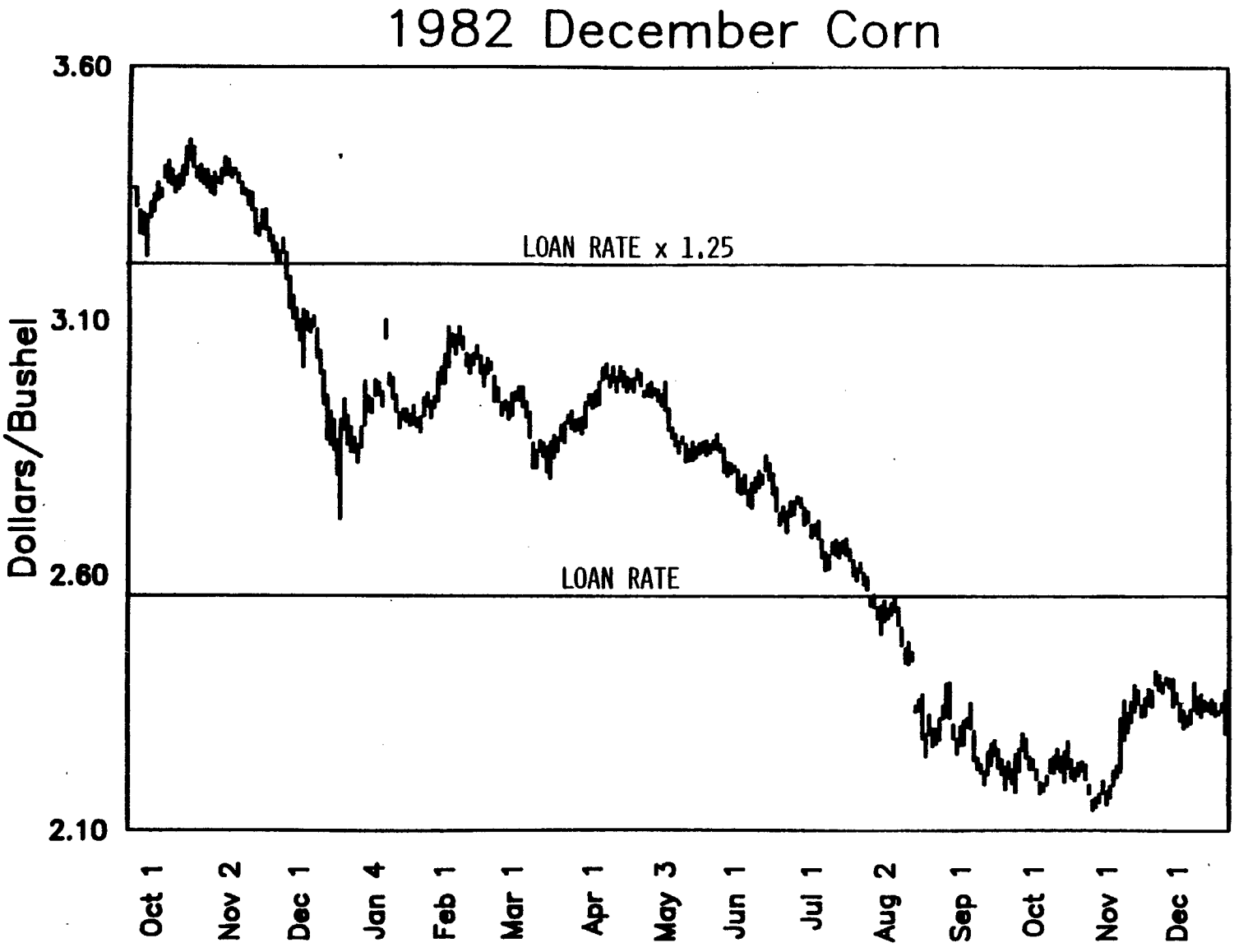

1977 December Corn
3.10
2.90
2.70
2.50
2.30
2.10
1.90
Dollars/Bushel
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Oct 1
Nov 1
Dec 1
Jan 3
Feb 2
Mar 1
Apr 1
May 3
Jun 1
Jul 1
Aug 1
Sep 1
Oct 3
Nov 1
Dec 1

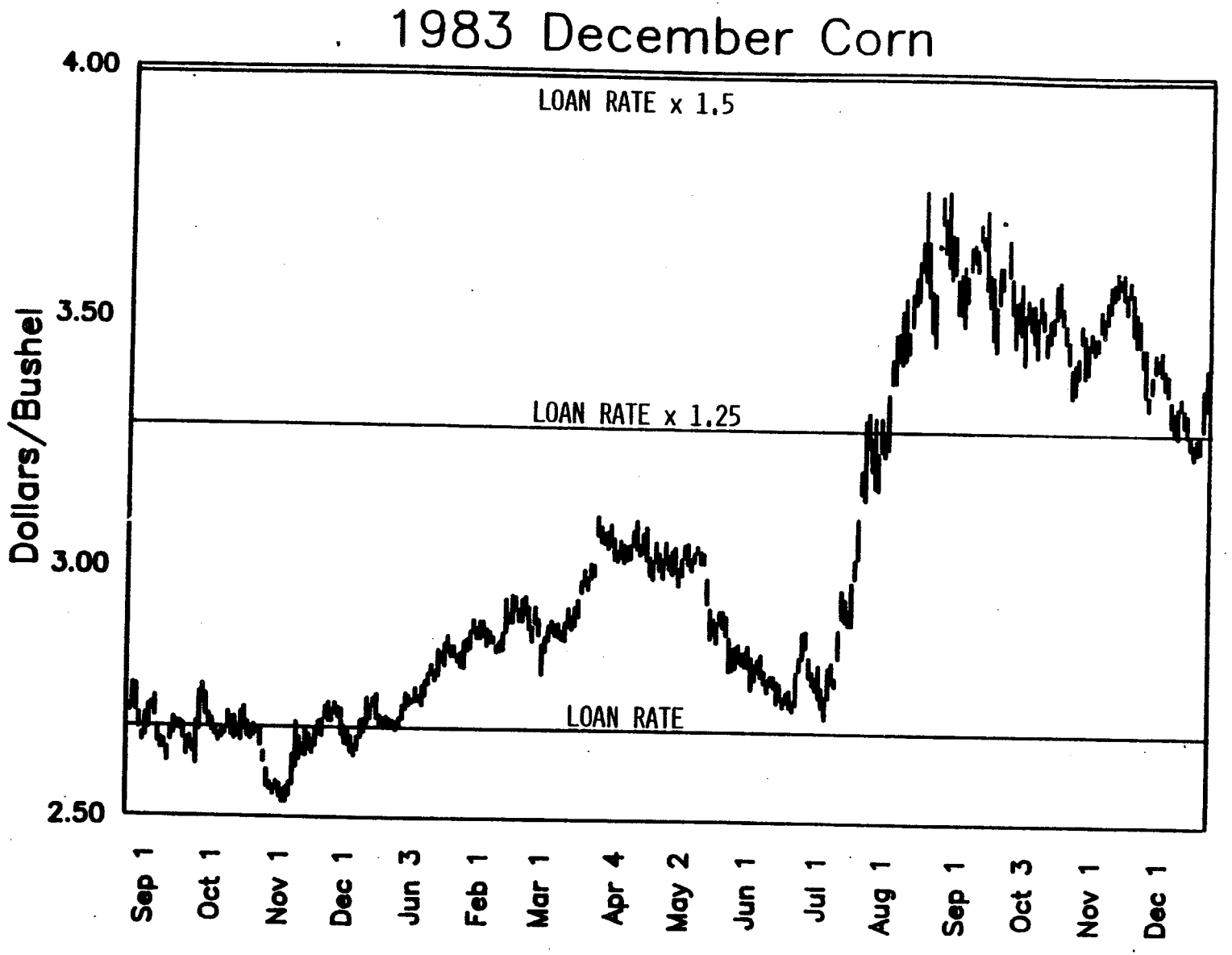

1978 December Corn
3.00
2.75
2.50
2.25
2.00
Dollars/Bushel
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Sep 3
Nov 1
Dec 1
Jan 3
Feb 1
Mar 1
Apr 3
May 1
Jun 1
Jul 3
Aug 1
Sep 1
Oct 2
Nov 1
Dec 1

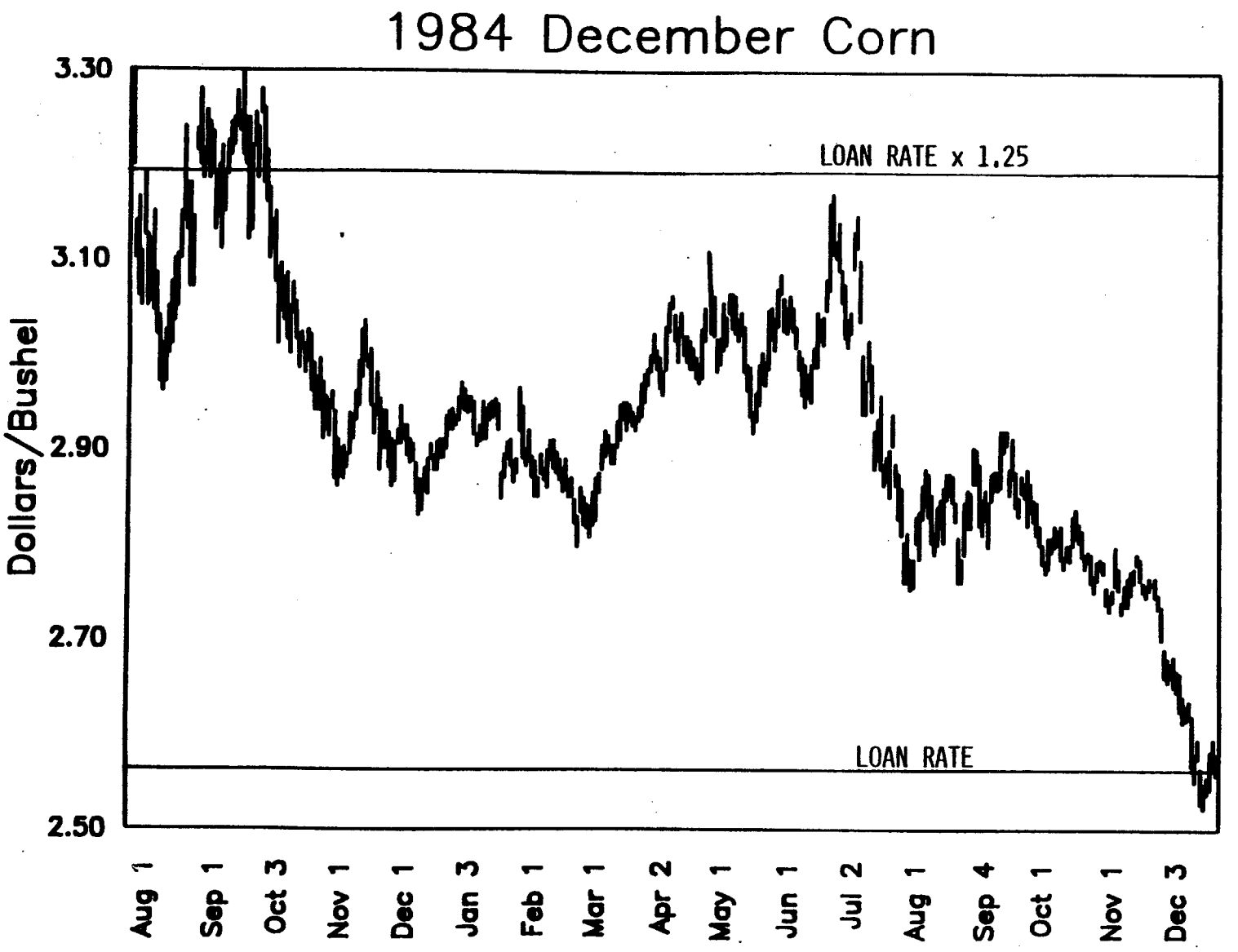

1979 December Corn
3.30
3.10
2.90
2.70
2.50
2.30
2.10
Dollars/Bushel
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Oct 2
Nov 1
Dec 1
Jan 2
Feb 1
Mar 1
Apr 2
May 1
Jun 1
Jul 2
Aug 1
Sep 4
Oct 1
Nov 1
Dec 3

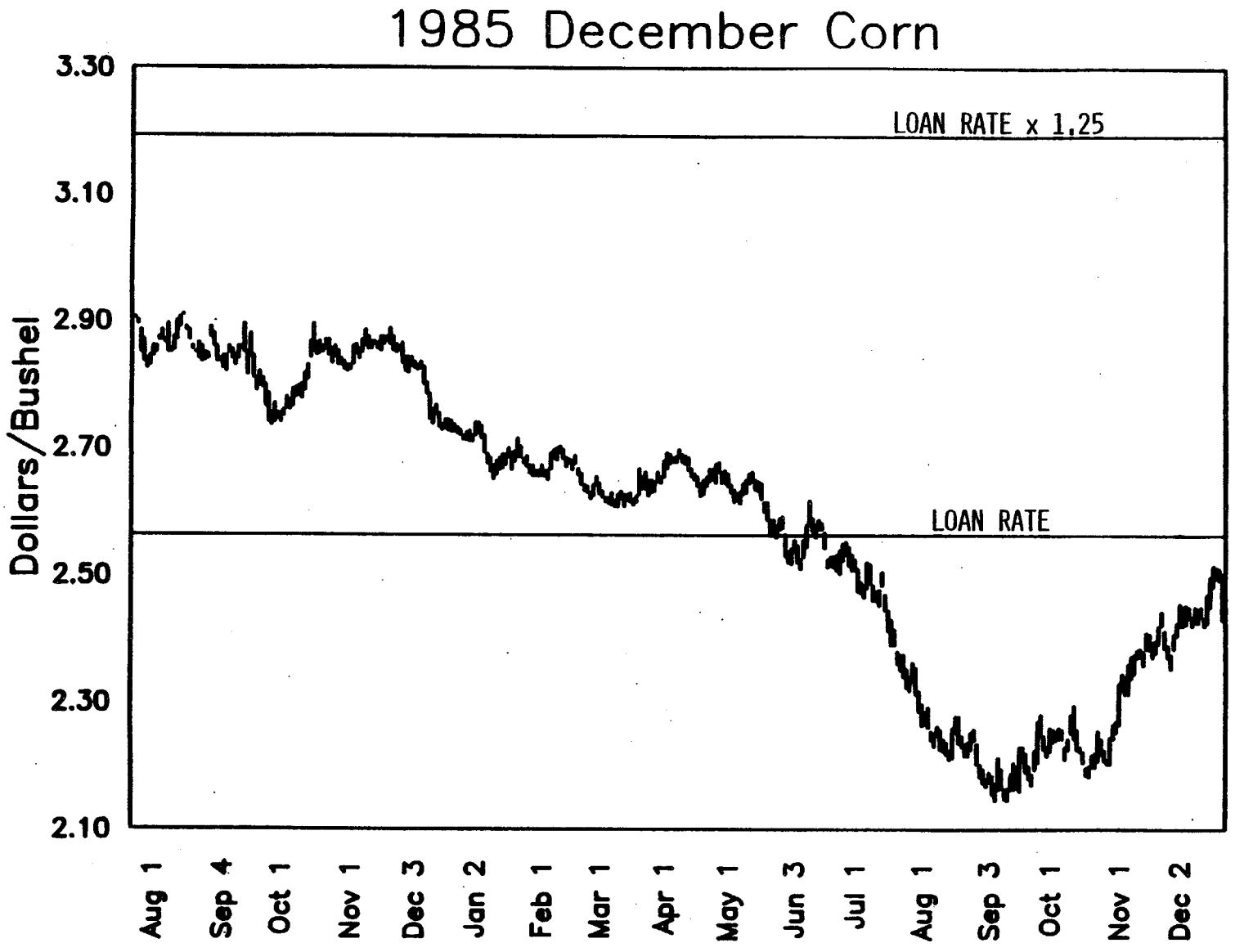

1980 December Corn
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Dollars/Bushel
4.50
4.25
4.00
3.75
3.50
3.25
3.00
2.75
2.50
2.25
Oct 1
Nov 1
Dec 3
Jan 2
Feb 1
Mar 3
Apr 1
May 1
Jun 2
Jul 1
Aug 1
Sep 2
Oct 1
Nov 3
Dec 1

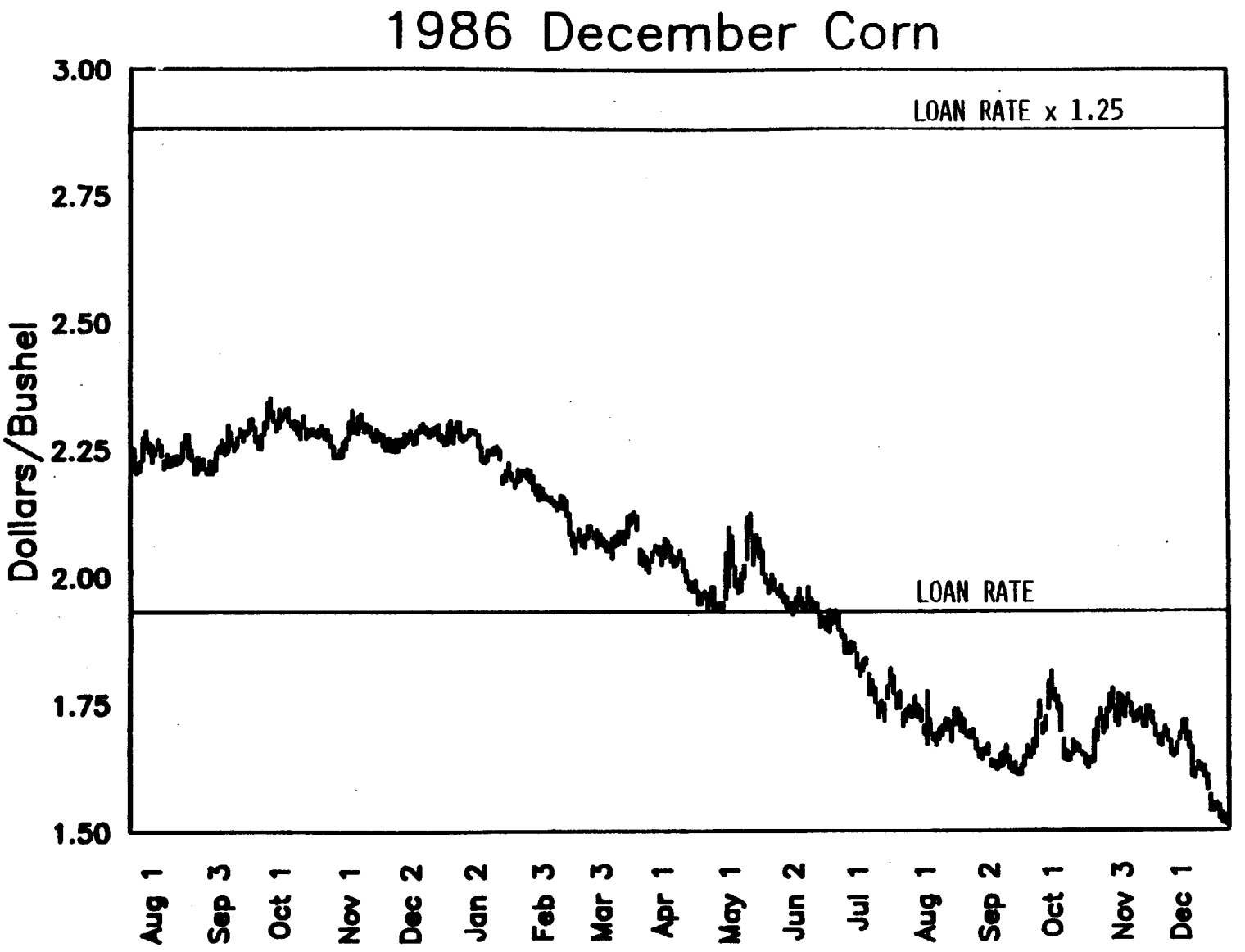

1981 December Corn
4.30
3.80
3.30
2.80
2.30
Dollars/Bushel
LOAN RATE x 1.5
LOAN RATE 1.25
LOAN RATE
Oct 1
Nov 3
Dec 1
Jan 2
Feb 2
Mar 2
Apr 1
May 1
Jun 1
Jul 1
Aug 3
Sep 1
Oct 1
Nov 2
Dec 1

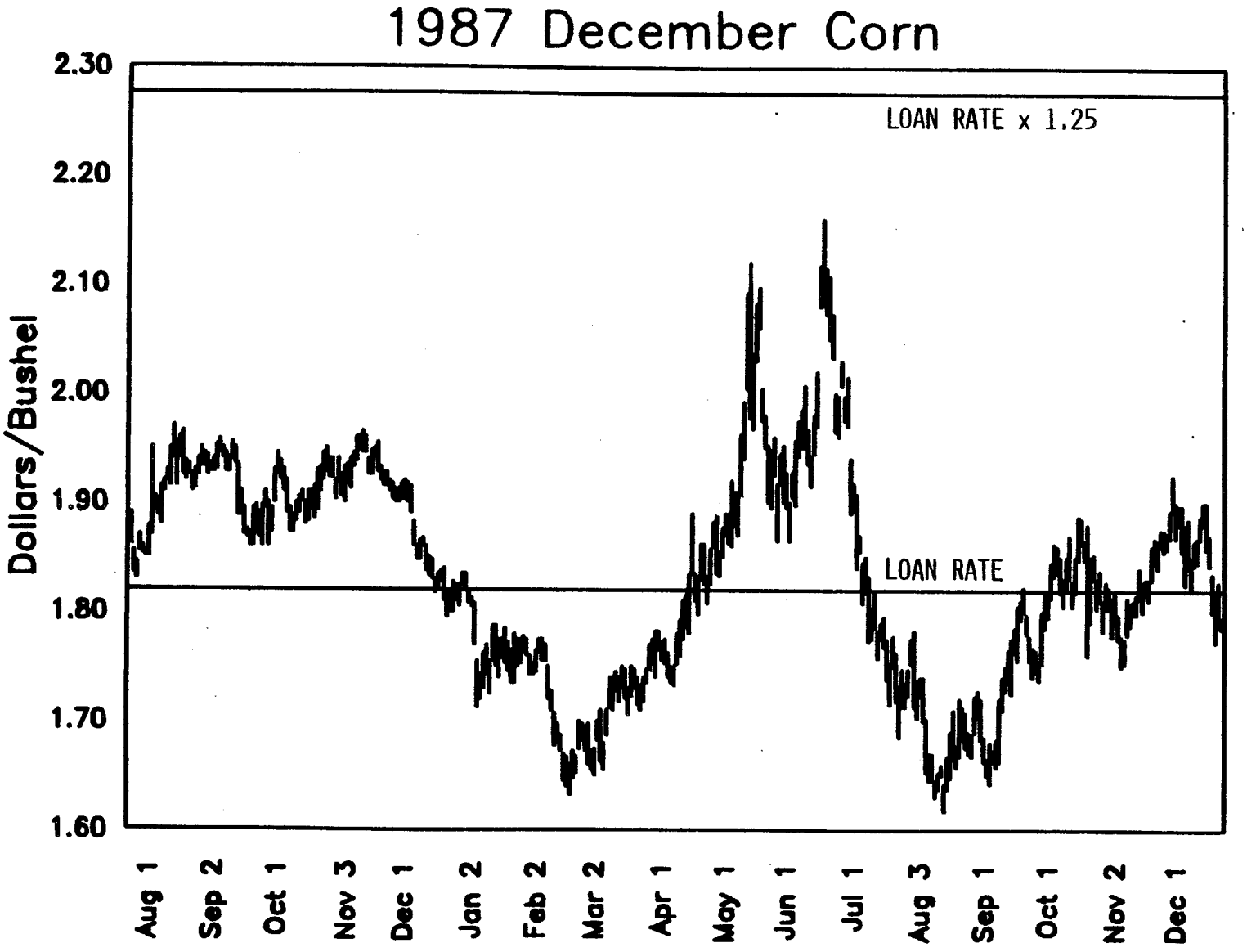

1982 December Corn
3.60
3.10
2.60
2.10
Dollars/Bushel
LOAN RATE x 1.25
LOAN RATE
Oct 1
Nov 2
Dec 1
Jan 4
Feb 1
Mar 1
Apr 1
May 3
Jun 1
Jul 1
Aug 2
Sep 1
Oct 1
Nov 1
Dec 1

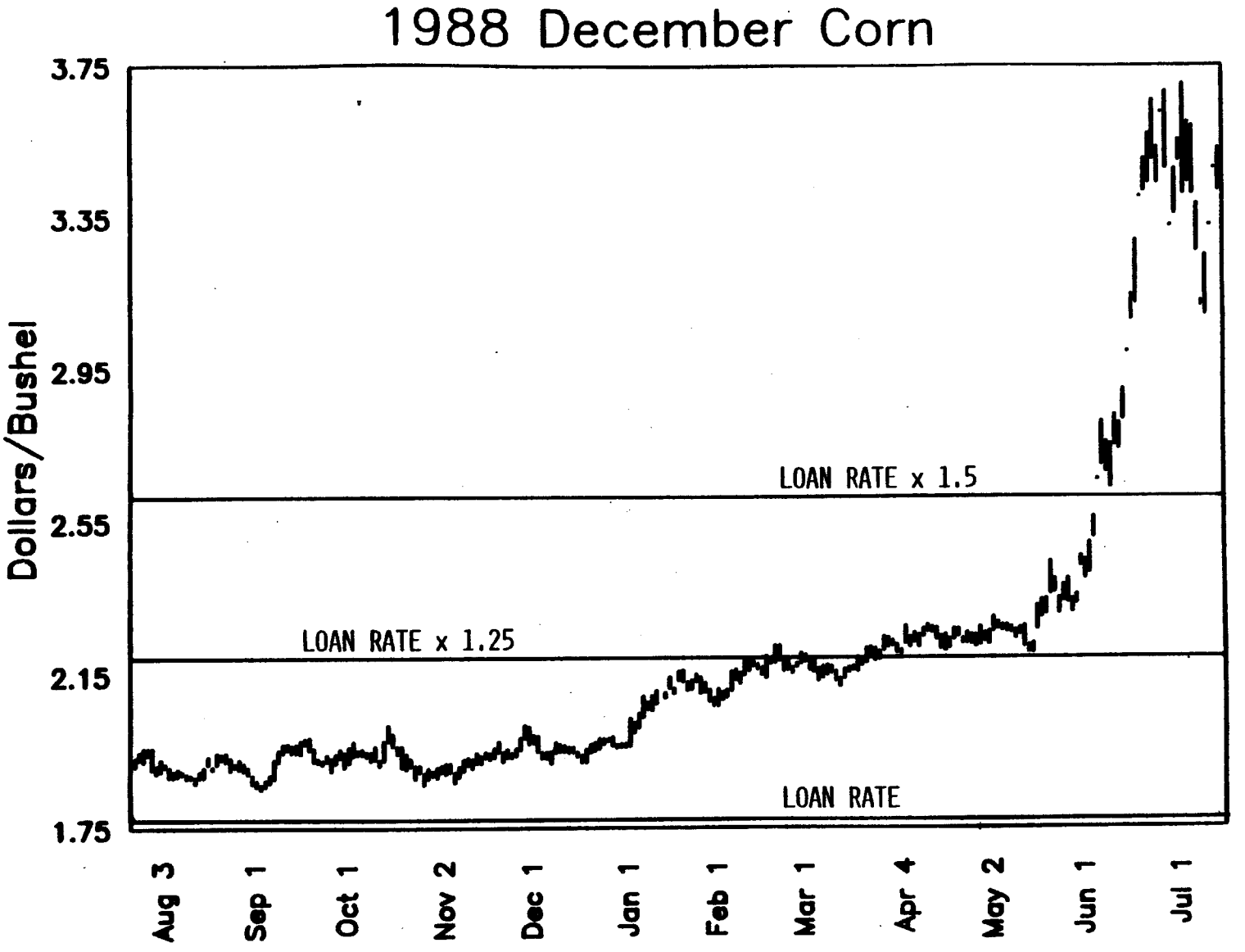

1983 December Corn
4.00
3.50
3.00
2.50
Dollars/Bushel
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Sep 1
Oct 1
Nov 1
Dec 1
Jun 3
Feb 1
Mar 1
Apr 4
May 2
Jun 1
Jul 1
Aug 1
Sep 1
Oct 3
Nov 1
Dec 1


1984 December Corn
3.30
3.10
2.90
2.70
2.50
Dollars/Bushel
LOAN RATE x 1.25
LOAN RATE
Aug 1
Sep 1
Oct 3
Nov 1
Dec 1
Jan 3
Feb 1
Mar 1
Apr 2
May 1
Jun 1
Jul 2
Aug 1
Sep 4
Oct 1
Nov 1
Dec 3

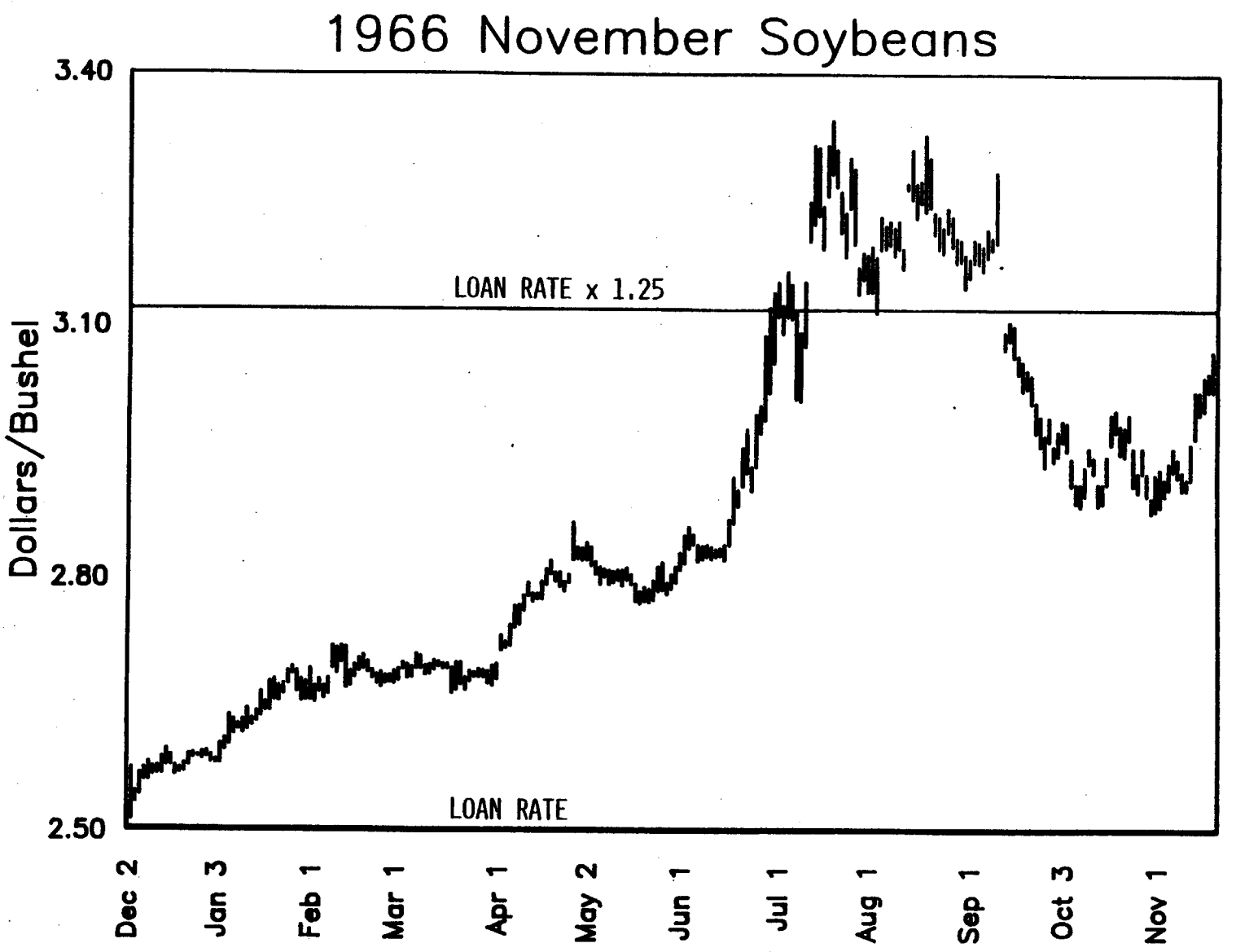

1985 December Corn
3.30
3.10
2.90
2.70
2.50
2.30
2.10
Dollars/Bushel
LOAN RATE x 1.25
LOAN RATE
Aug 1
Sep 4
Oct 1
Nov 1
Dec 3
Jan 2
Feb 1
Mar 1
Apr 1
May 1
Jun 3
Jul 1
Aug 1
Sep 3
Oct 1
Nov 1
Dec 2

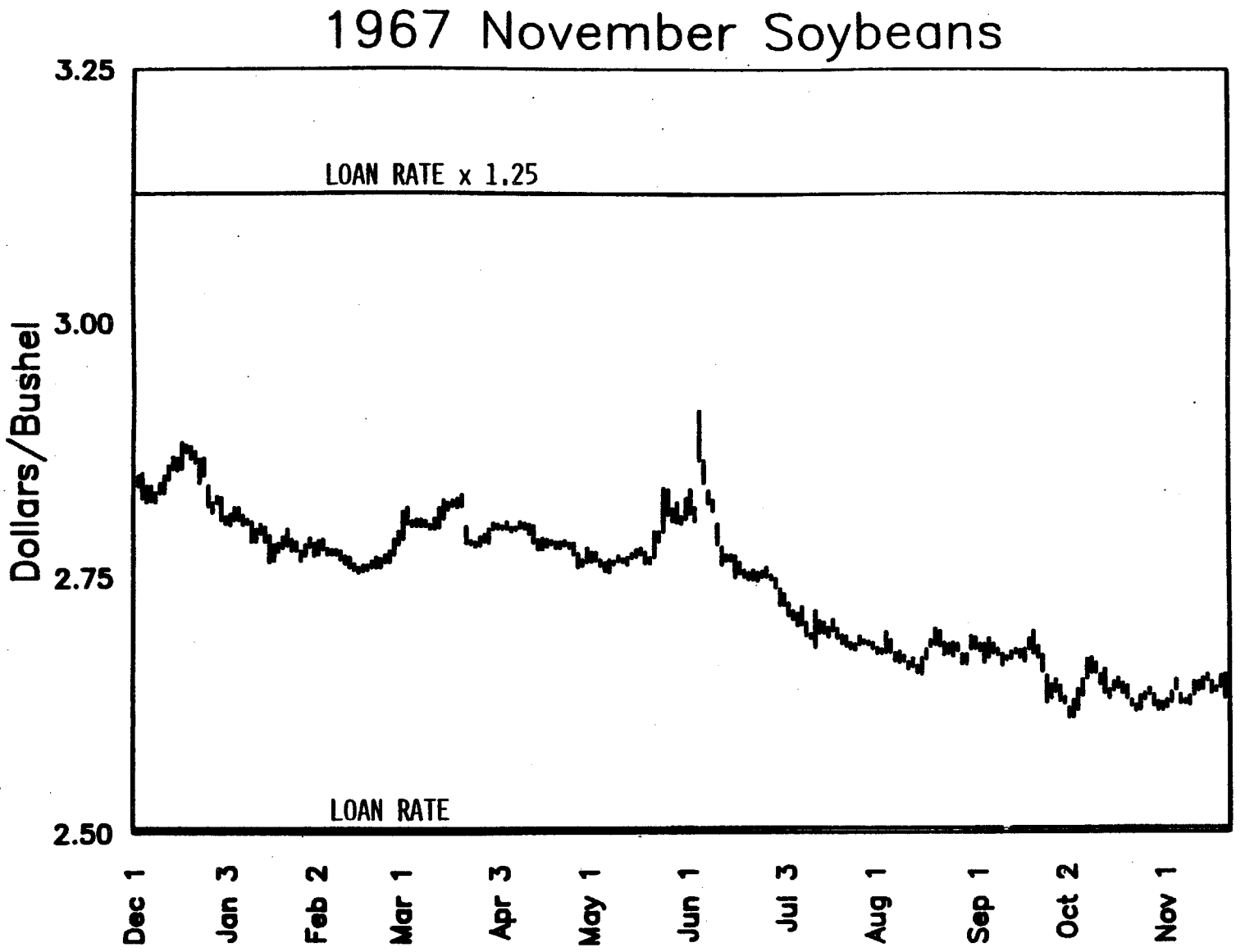

1986 December Corn
3.00
2.75
2.50
2.25
2.00
1.75
1.50
Dollars/Bushel
LOAN RATE x 1.25
LOAN RATE
Aug 1
Sep 3
Oct 1
Nov 1
Dec 2
Jan 2
Feb 3
Mar 3
Apr 1
May 1
Jun 2
Jul 1
Aug 1
Sep 2
Oct 1
Nov 3
Dec 1

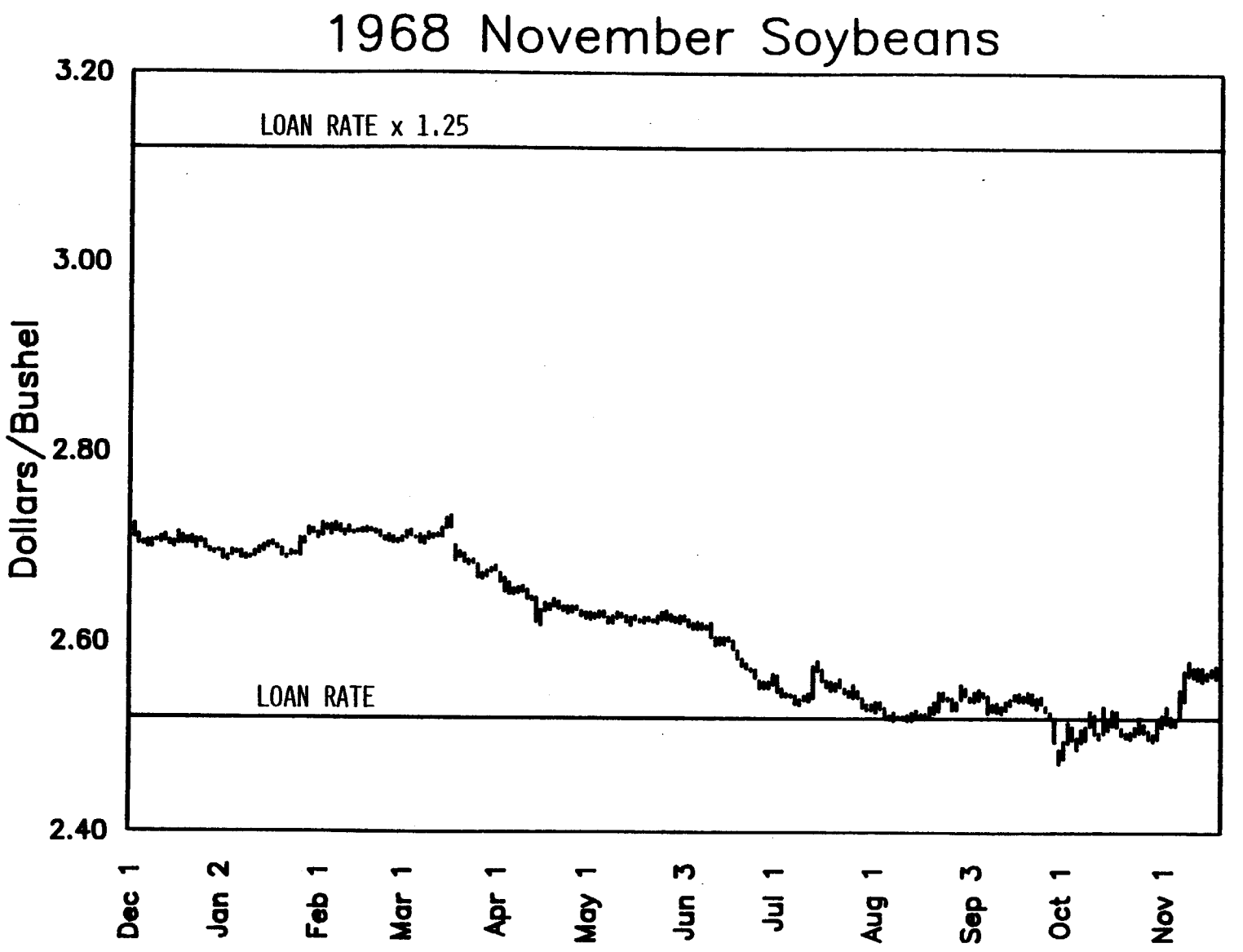

1987 December Corn
LOAN RATE x 1.25
LOAN RATE
Dollars/Bushel
2.30
2.20
2.10
2.00
1.90
1.80
1.70
1.60
Aug 1
Sep 2
Oct 1
Nov 3
Dec 1
Jan 2
Feb 2
Mar 2
Apr 1
May 1
Jun 1
Jul 1
Aug 3
Sep 1
Oct 1
Nov 2
Dec 1

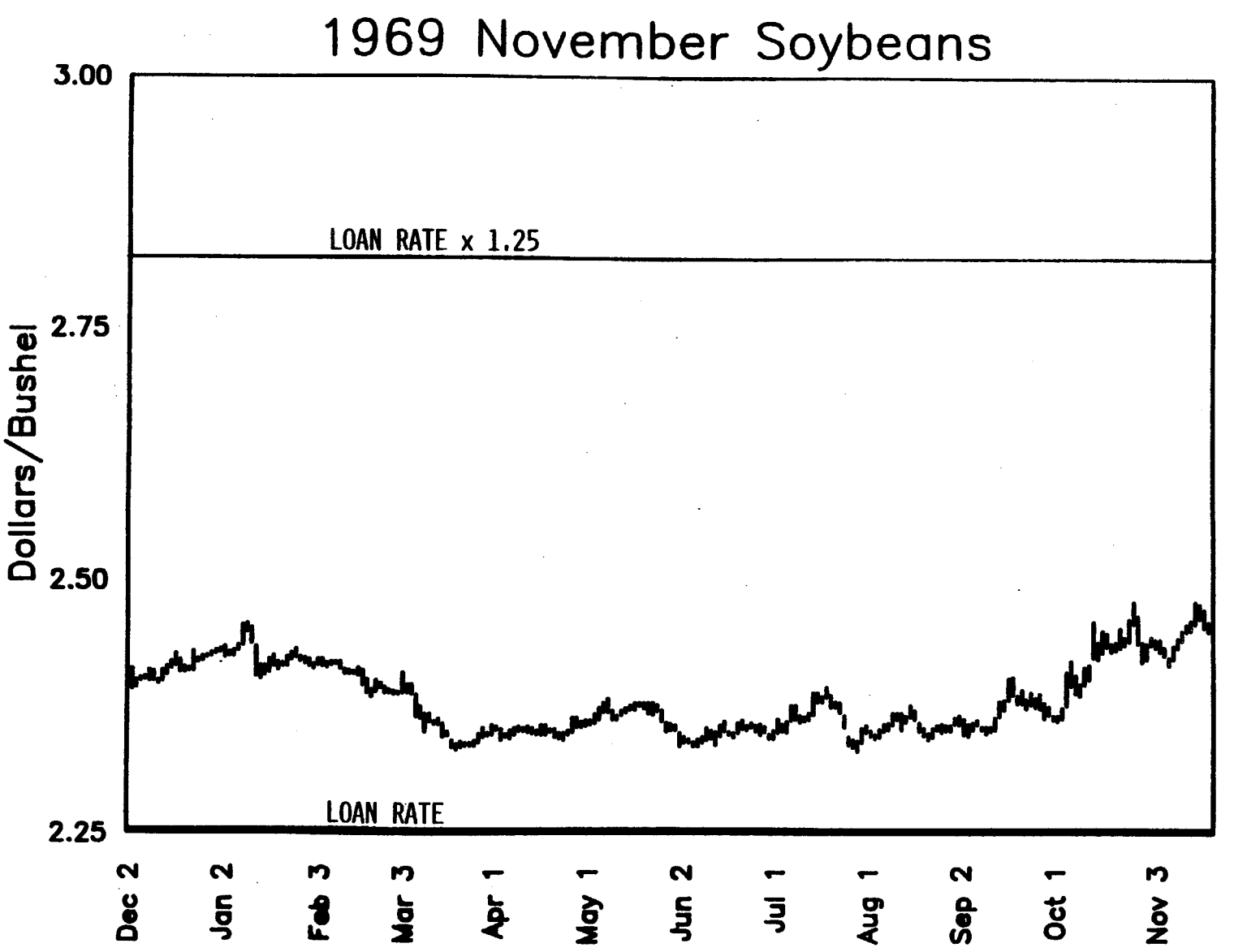

1988 December Corn
Dollars/Bushel
3.75
3.35
2.95
2.55
2.15
1.75
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Aug 3
Sep 1
Oct 1
Nov 2
Dec 1
Jan 1
Feb 1
Mar 1
Apr 4
May 2
Jun 1
Jul 1

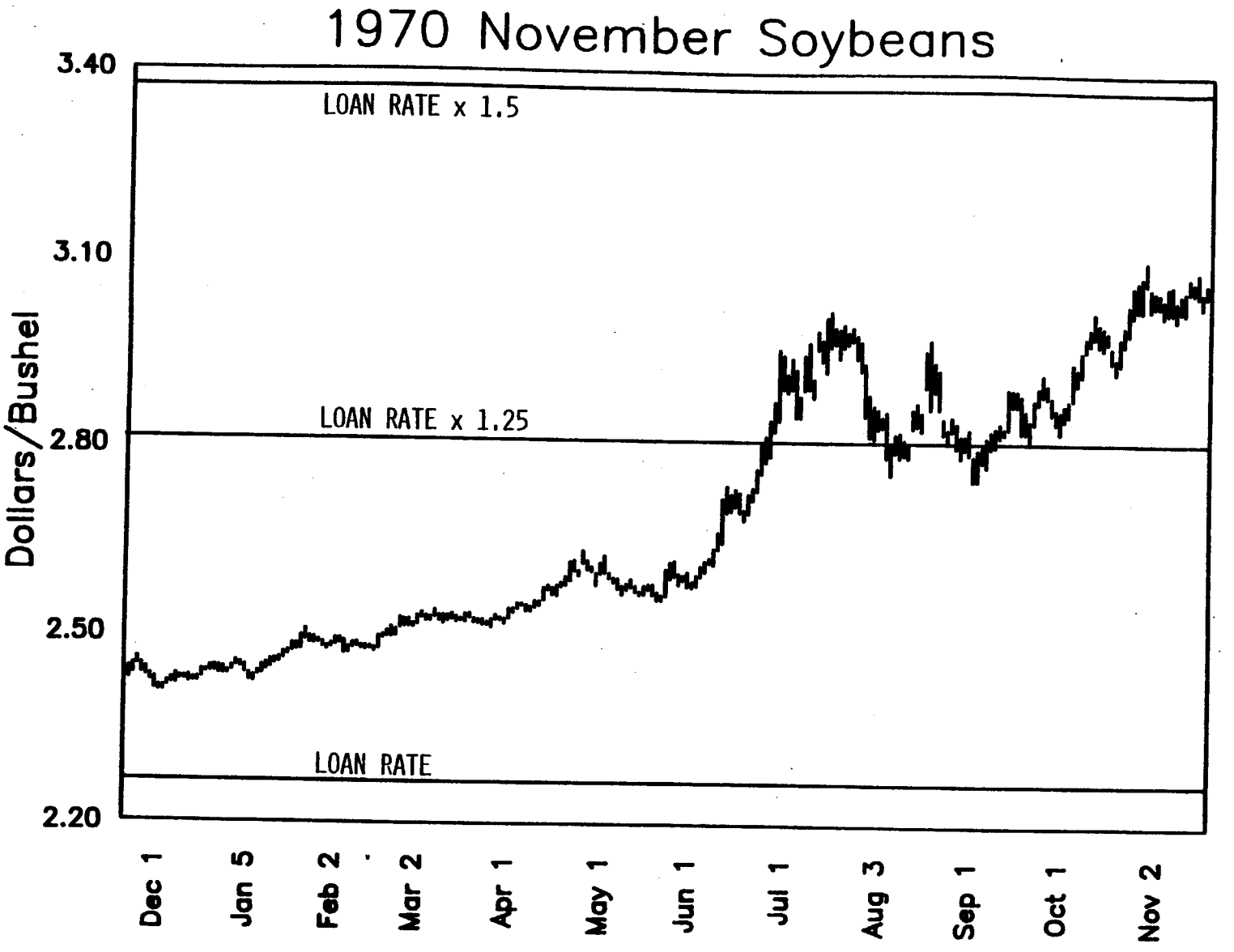
APPENDIX II

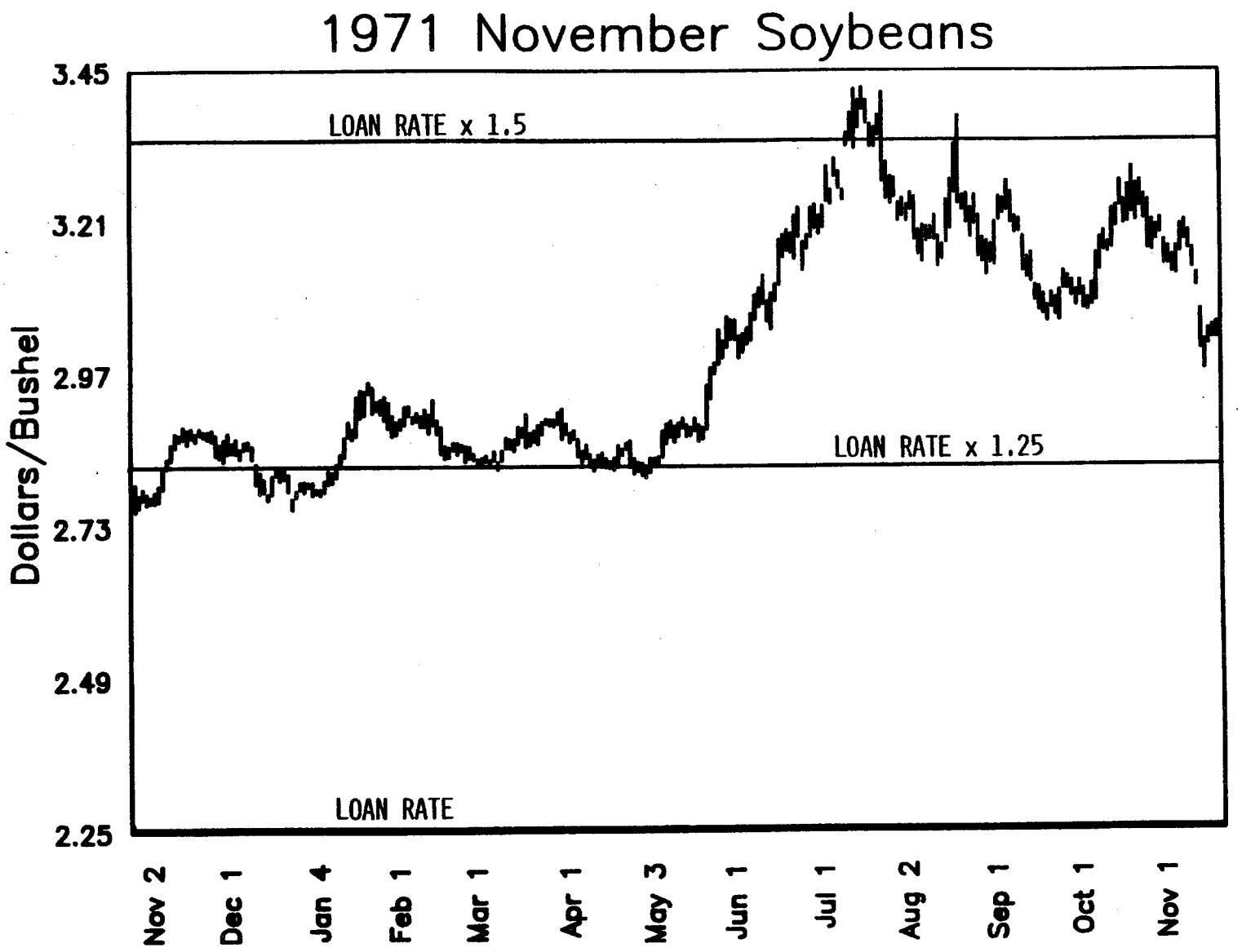

1966 November Soybeans
3.40
3.10
2.80
2.50
Dollars/Bushel
LOAN RATE x 1.25
LOAN RATE
Dec 2
Jan 3
Feb 1
Mar 1
Apr 1
May 2
Jun 1
Jul 1
Aug 1
Sep 1
Oct 3
Nov 1

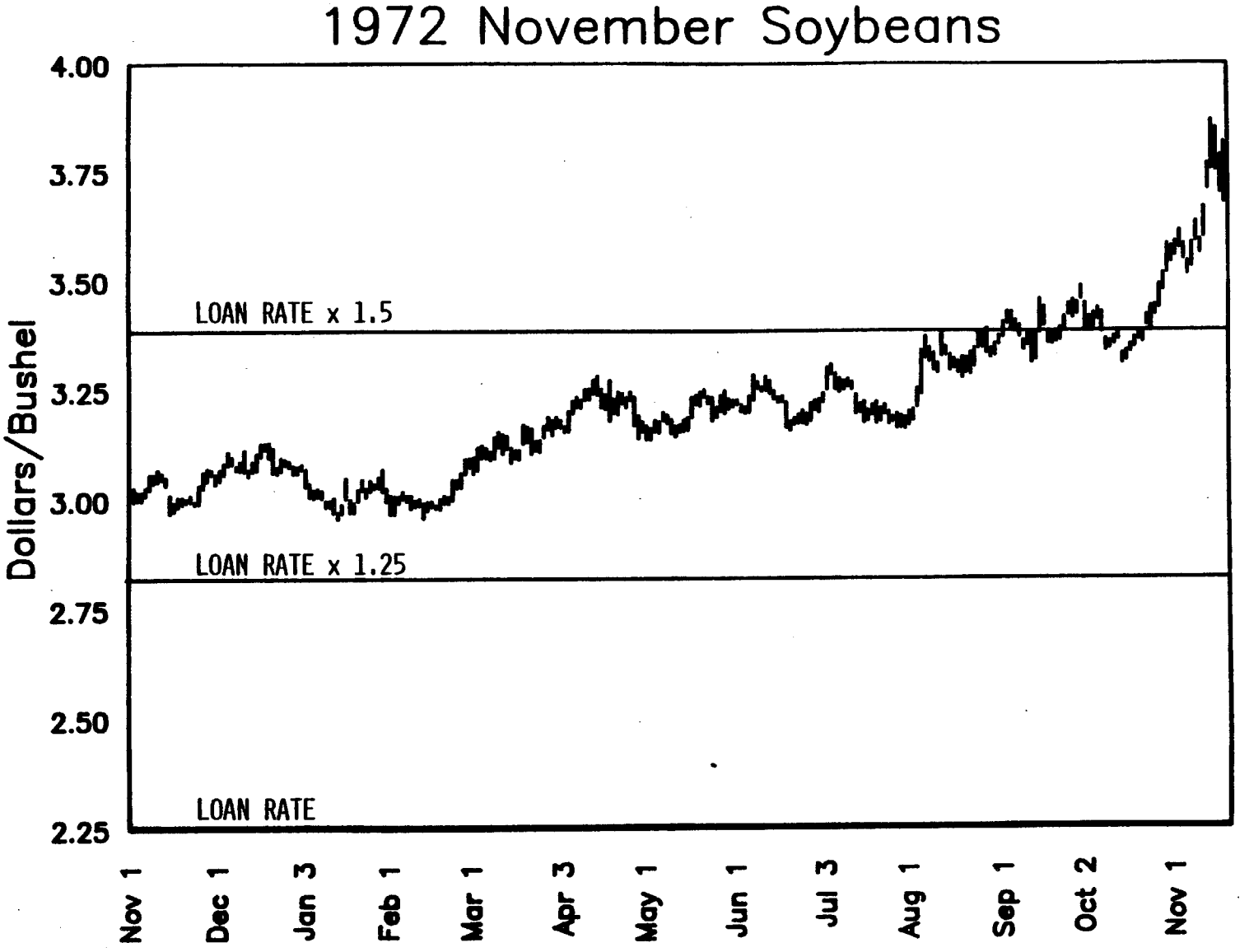

1967 November Soybeans
3.25
LOAN RATE x 1.25
3.00
2.75
LOAN RATE
2.50
Dollars/Bushel
Dec 1
Jan 3
Feb 2
Mar 1
Apr 3
May 1
Jun 1
Jul 3
Aug 1
Sep 1
Oct 2
Nov 1

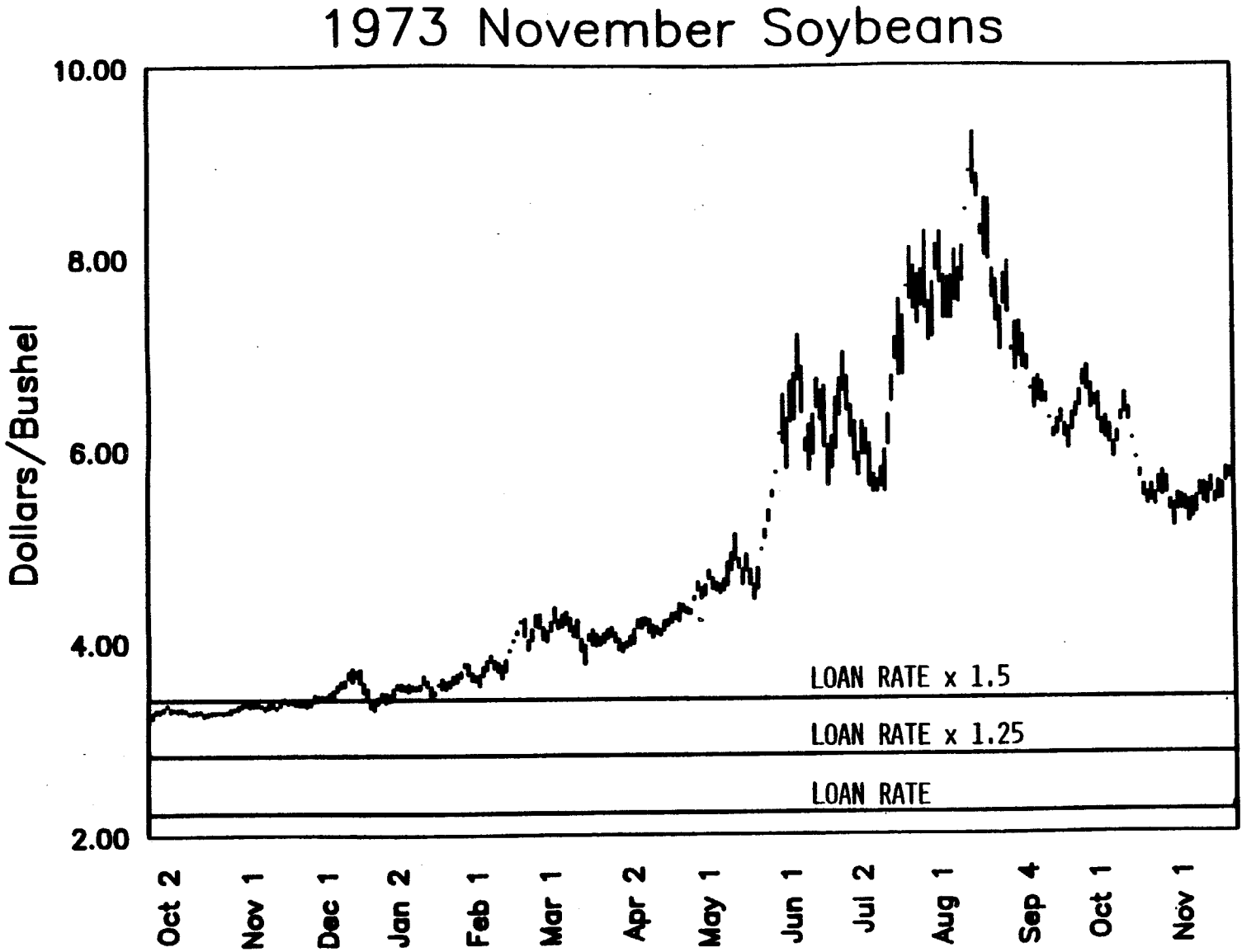

1968 November Soybeans
3.20
3.00
2.80
2.60
2.40
Dollars/Bushel
LOAN RATE x 1.25
LOAN RATE
Dec 1
Jan 2
Feb 1
Mar 1
Apr 1
May 1
Jun 3
Jul 1
Aug 1
Sep 3
Oct 1
Nov 1

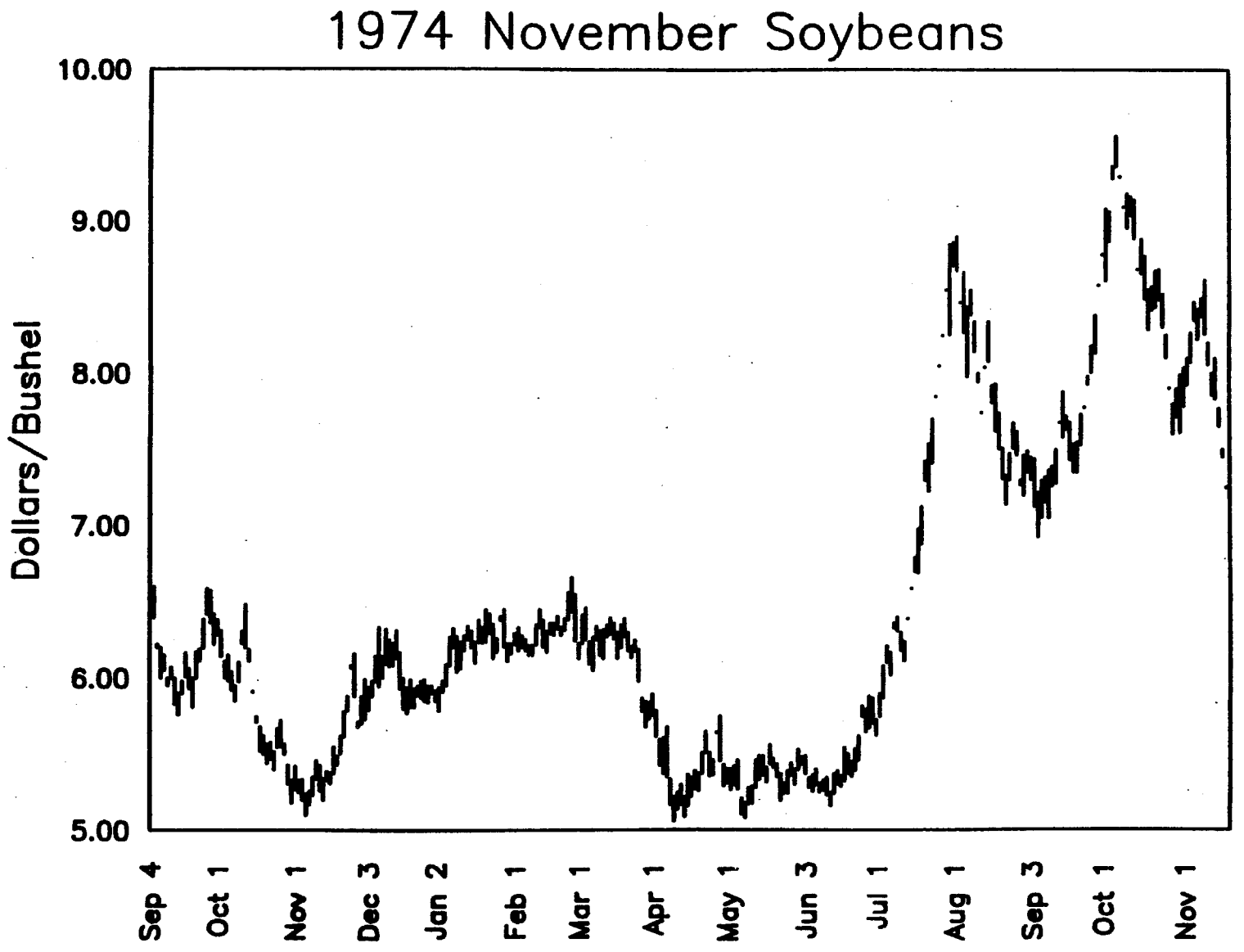

1969 November Soybeans
3.00
2.75
2.50
2.25
Dollars/Bushel
LOAN RATE x 1.25
LOAN RATE
Dec 2
Jan 2
Feb 3
Mar 3
Apr 1
May 1
Jun 2
Jul 1
Aug 1
Sep 2
Oct 1
Nov 3

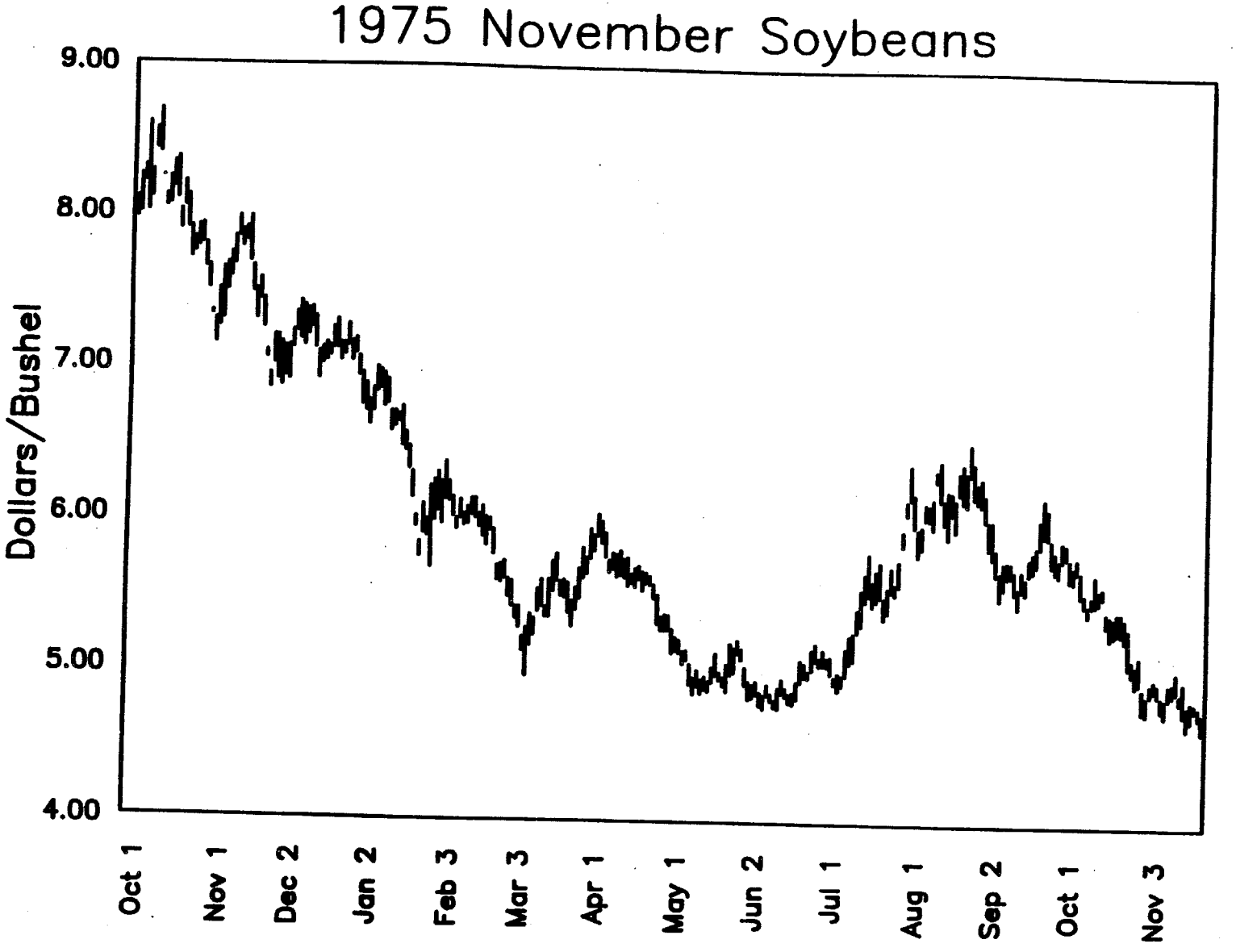

1970 November Soybeans
3.40
3.10
2.80
2.50
2.20
Dollars/Bushel
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Dec 1
Jan 5
Feb 2
Mar 2
Apr 1
May 1
Jun 1
Jul 1
Aug 3
Sep 1
Oct 1
Nov 2

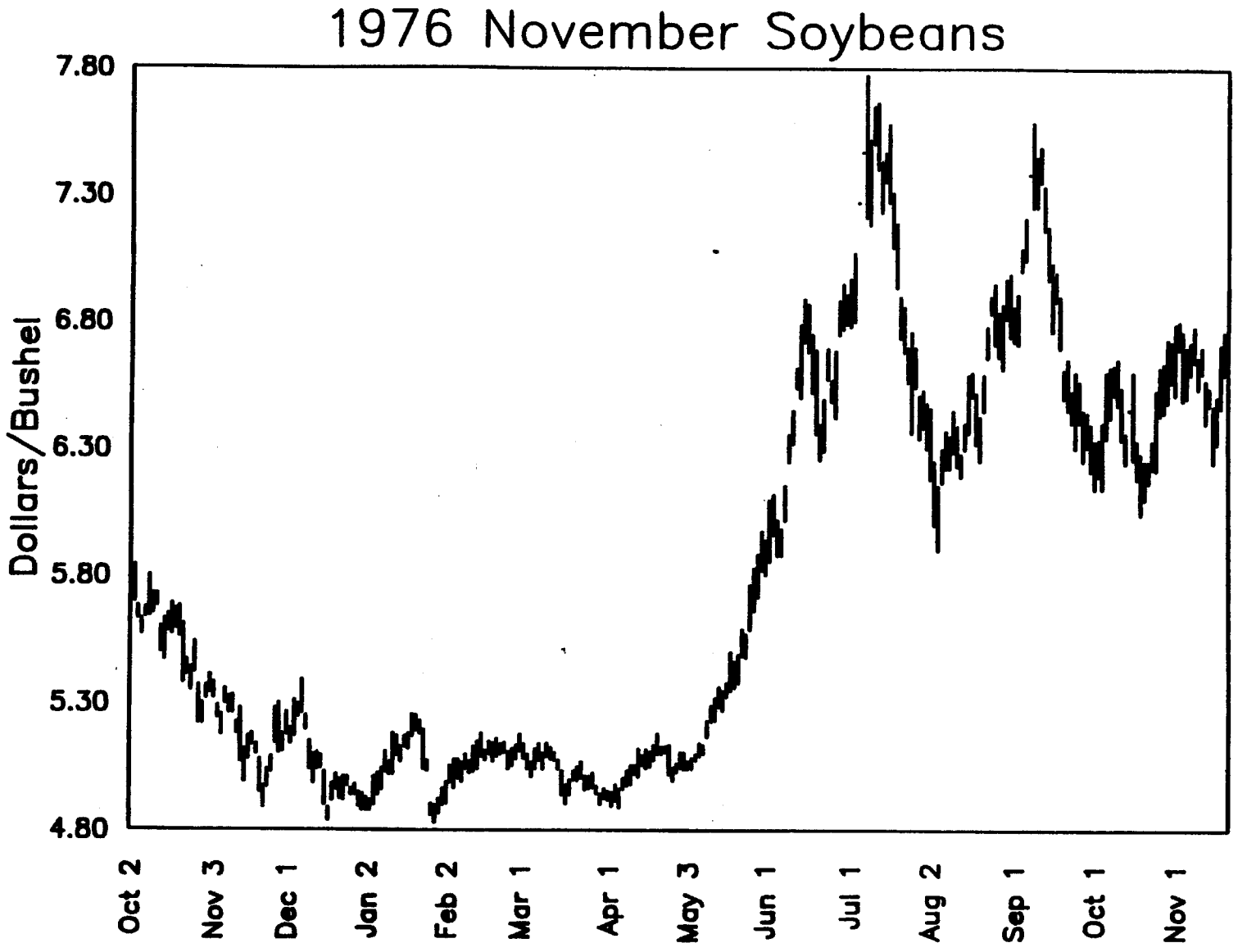

1971 November Soybeans
3.45
3.21
2.97
2.73
2.49
2.25
Dollars/Bushel
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Nov 2
Dec 1
Jan 4
Feb 1
Mar 1
Apr 1
May 3
Jun 1
Jul 1
Aug 2
Sep 1
Oct 1
Nov 1

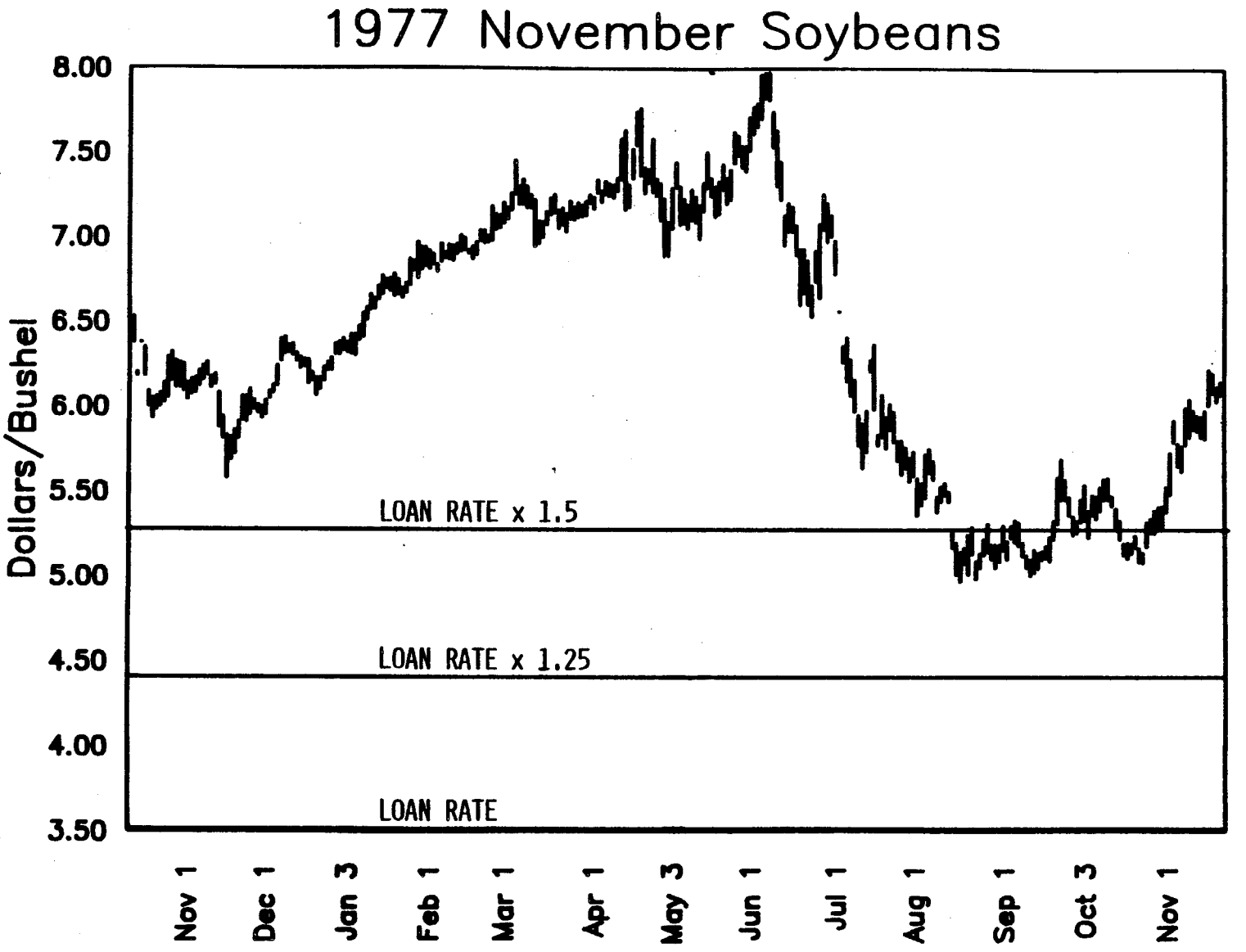

1972 November Soybeans
4.00
3.75
3.50
3.25
3.00
2.75
2.50
2.25
Dollars/Bushel
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Nov 1
Dec 1
Jan 3
Feb 1
Mar 1
Apr 3
May 1
Jun 1
Jul 3
Aug 1
Sep 1
Oct 2
Nov 1

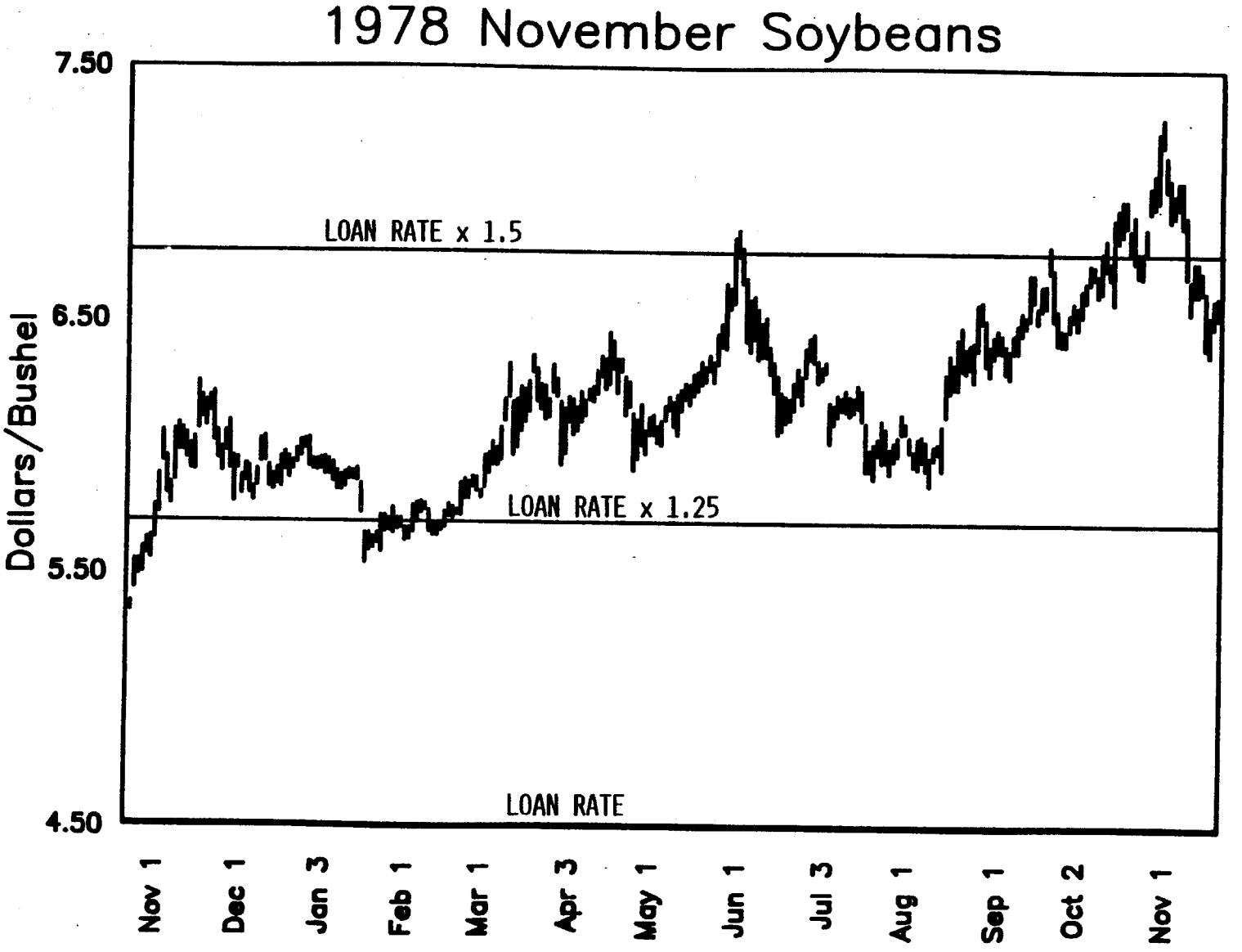

1973 November Soybeans
10.00
8.00
6.00
4.00
2.00
Dollars/Bushel
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Oct 2
Nov 1
Dec 1
Jan 2
Feb 1
Mar 1
Apr 2
May 1
Jun 1
Jul 2
Aug 1
Sep 4
Oct 1
Nov 1

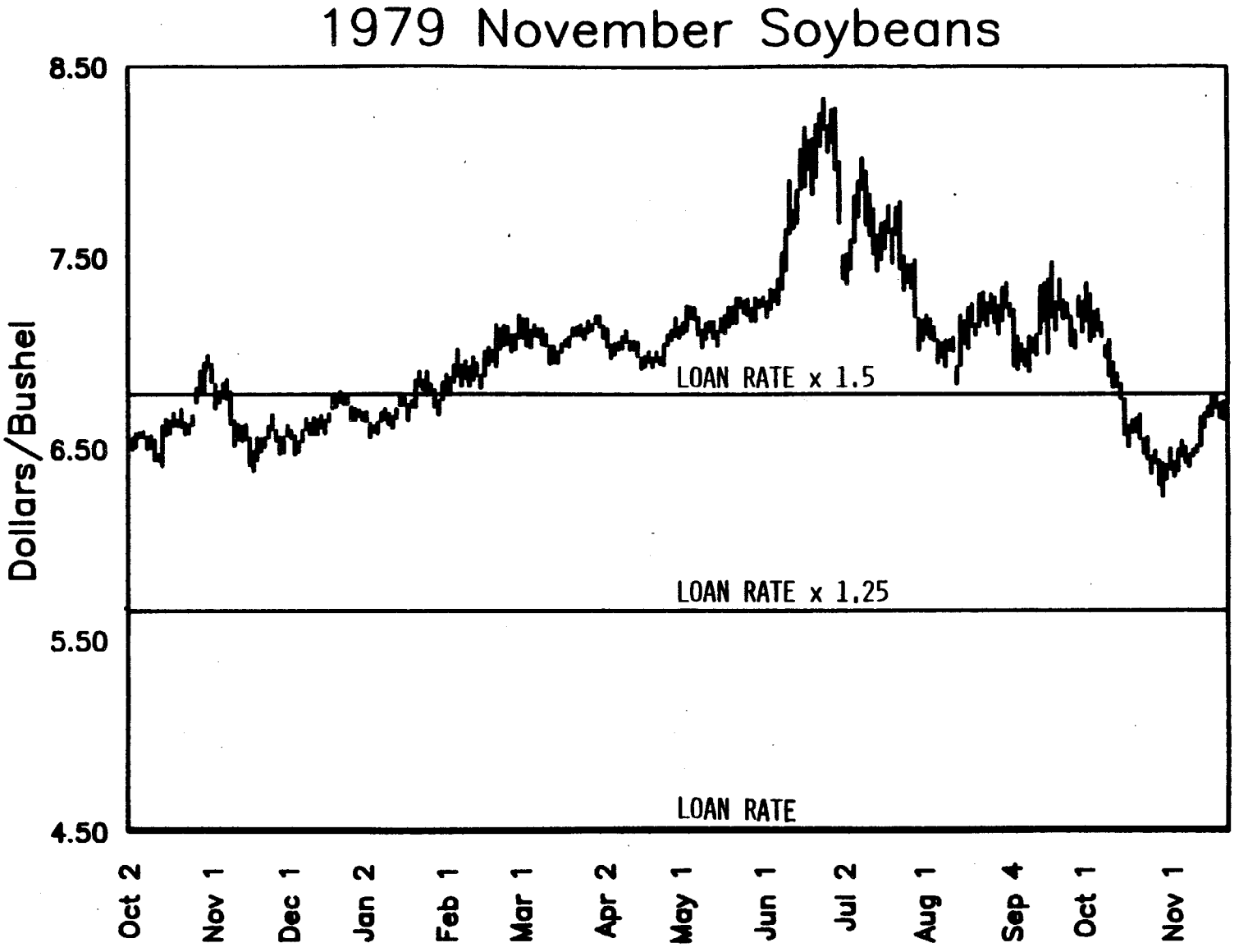

1974 November Soybeans
10.00
9.00
8.00
7.00
6.00
5.00
Dollars/Bushel
Sep 4
Oct 1
Nov 1
Dec 3
Jan 2
Feb 1
Mar 1
Apr 1
May 1
Jun 3
Jul 1
Aug 1
Sep 3
Oct 1
Nov 1

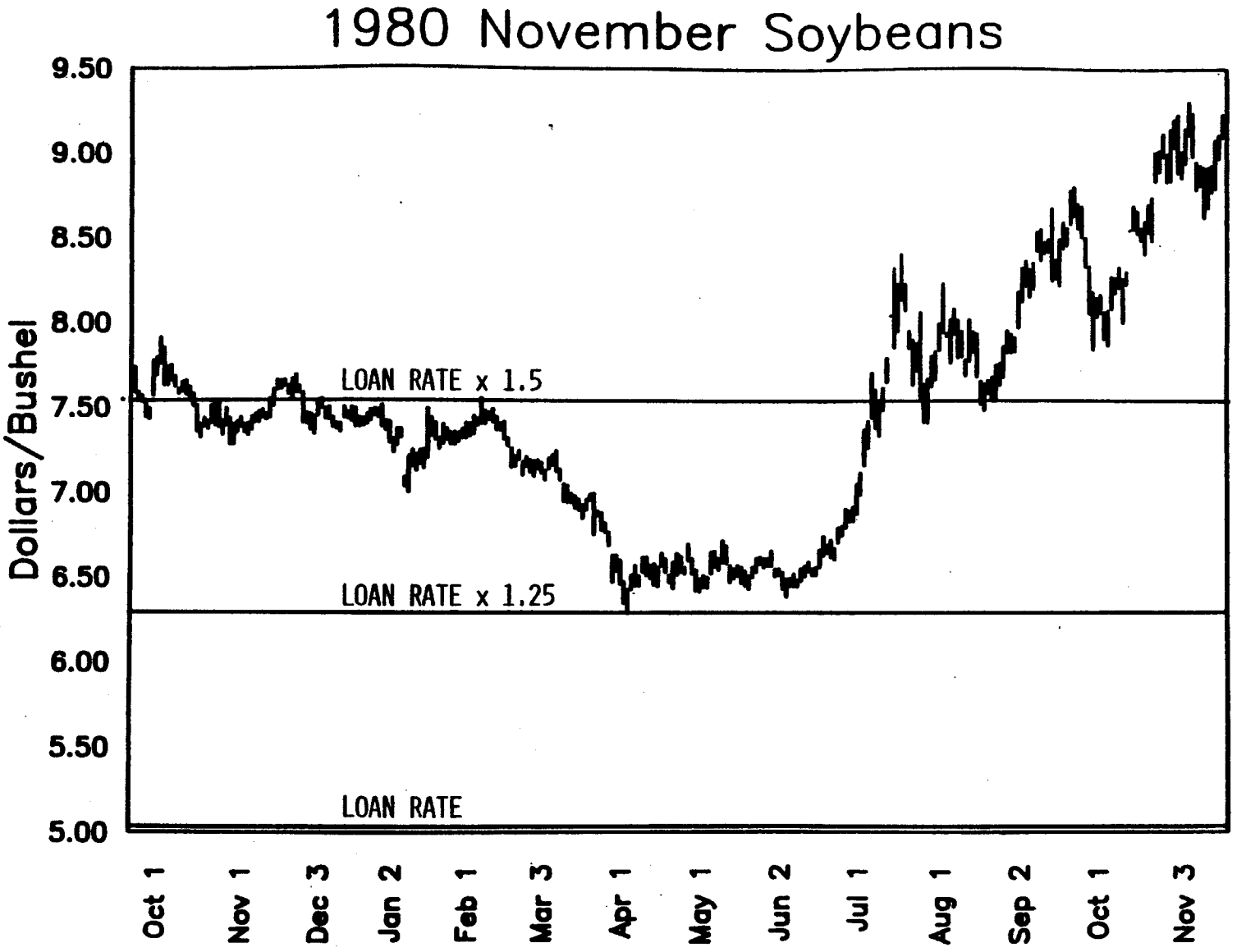

1975 November Soybeans
9.00
8.00
7.00
6.00
5.00
4.00
Dollars/Bushel
Oct 1
Nov 1
Dec 2
Jan 2
Feb 3
Mar 3
Apr 1
May 1
Jun 2
Jul 1
Aug 1
Sep 2
Oct 1
Nov 3

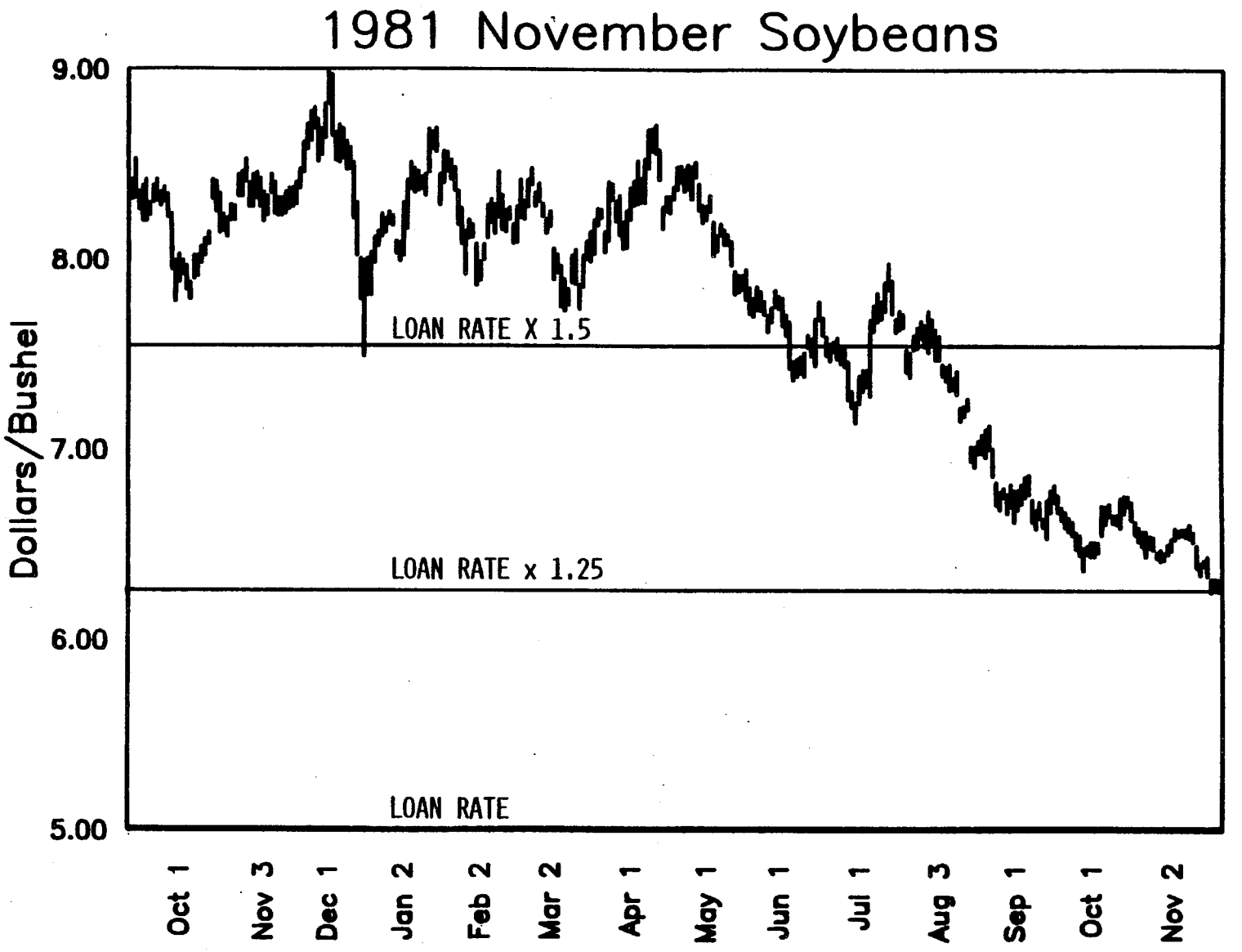

1976 November Soybeans
Dollars/Bushel
7.80
7.30
6.80
6.30
5.80
5.30
4.80
Oct 2
Nov 3
Dec 1
Jan 2
Feb 2
Mar 1
Apr 1
May 3
Jun 1
Jul 1
Aug 2
Sep 1
Oct 1
Nov 1

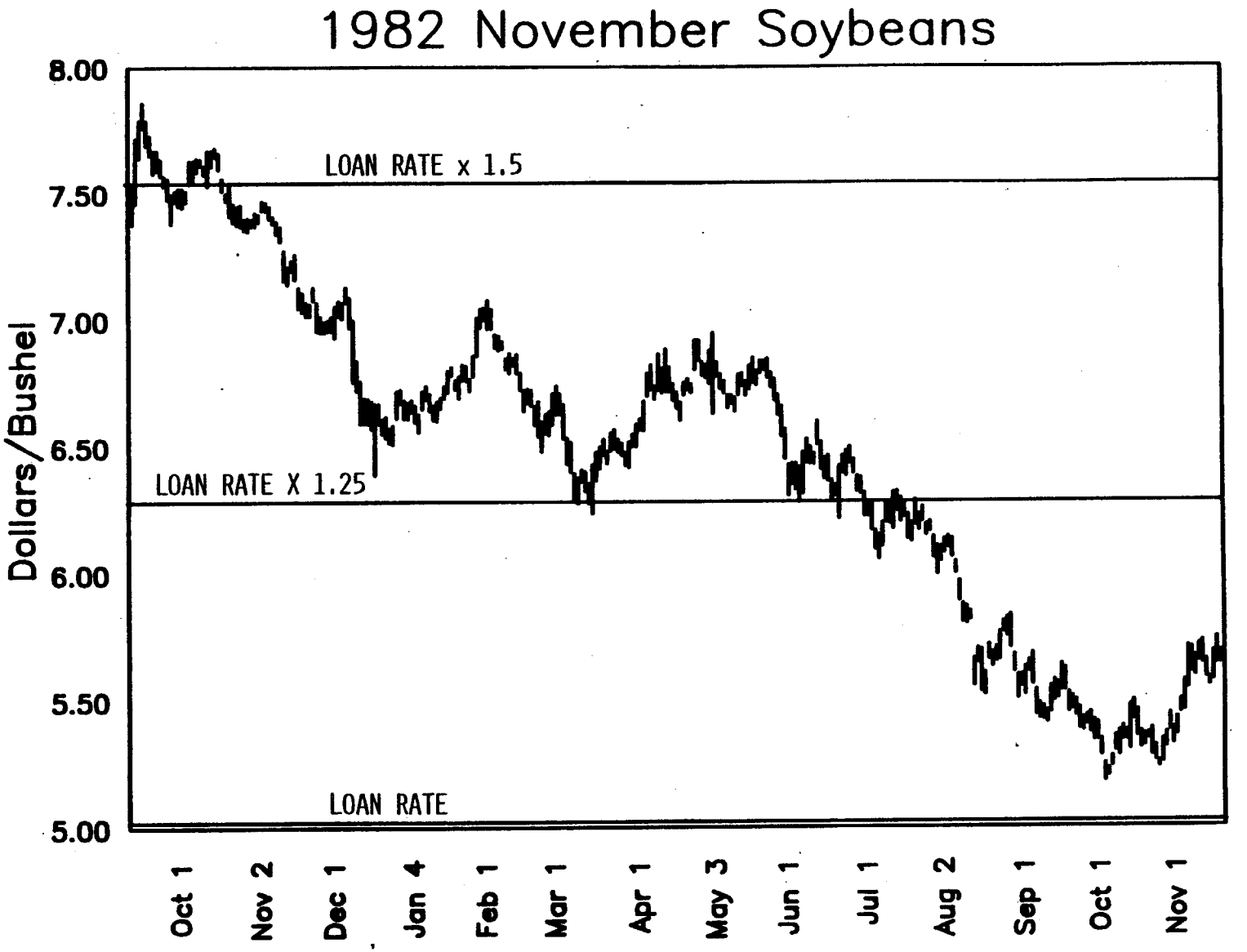

1977 November Soybeans
8.00
7.50
7.00
6.50
6.00
5.50
5.00
4.50
4.00
3.50
Dollars/Bushel
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Nov 1
Dec 1
Jan 3
Feb 1
Mar 1
Apr 1
May 3
Jun 1
Jul 1
Aug 1
Sep 1
Oct 3
Nov 1

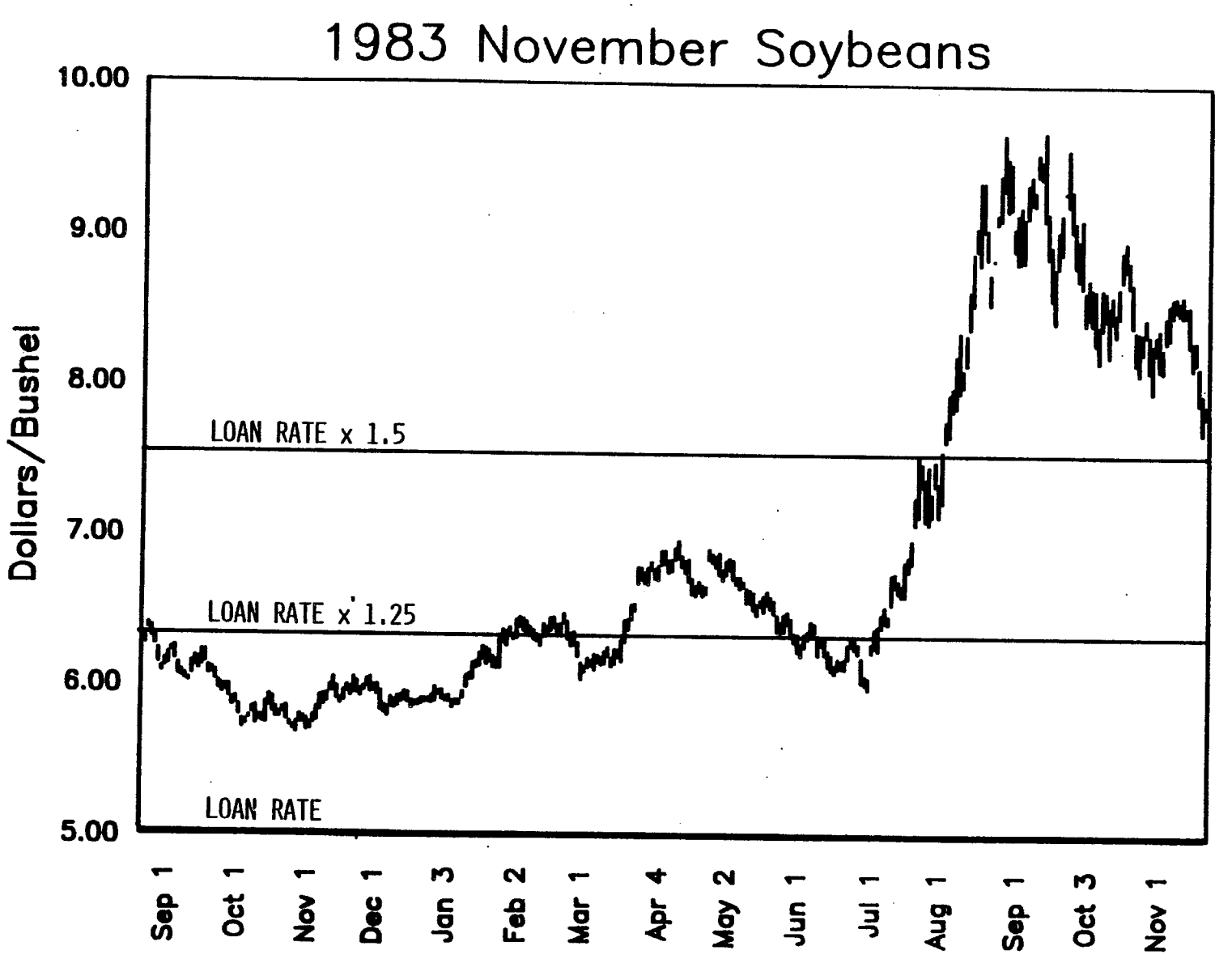

1978 November Soybeans
7.50
6.50
5.50
4.50
Dollars/Bushel
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Nov 1
Dec 1
Jan 3
Feb 1
Mar 1
Apr 3
May 1
Jun 1
Jul 3
Aug 1
Sep 1
Oct 2
Nov 1

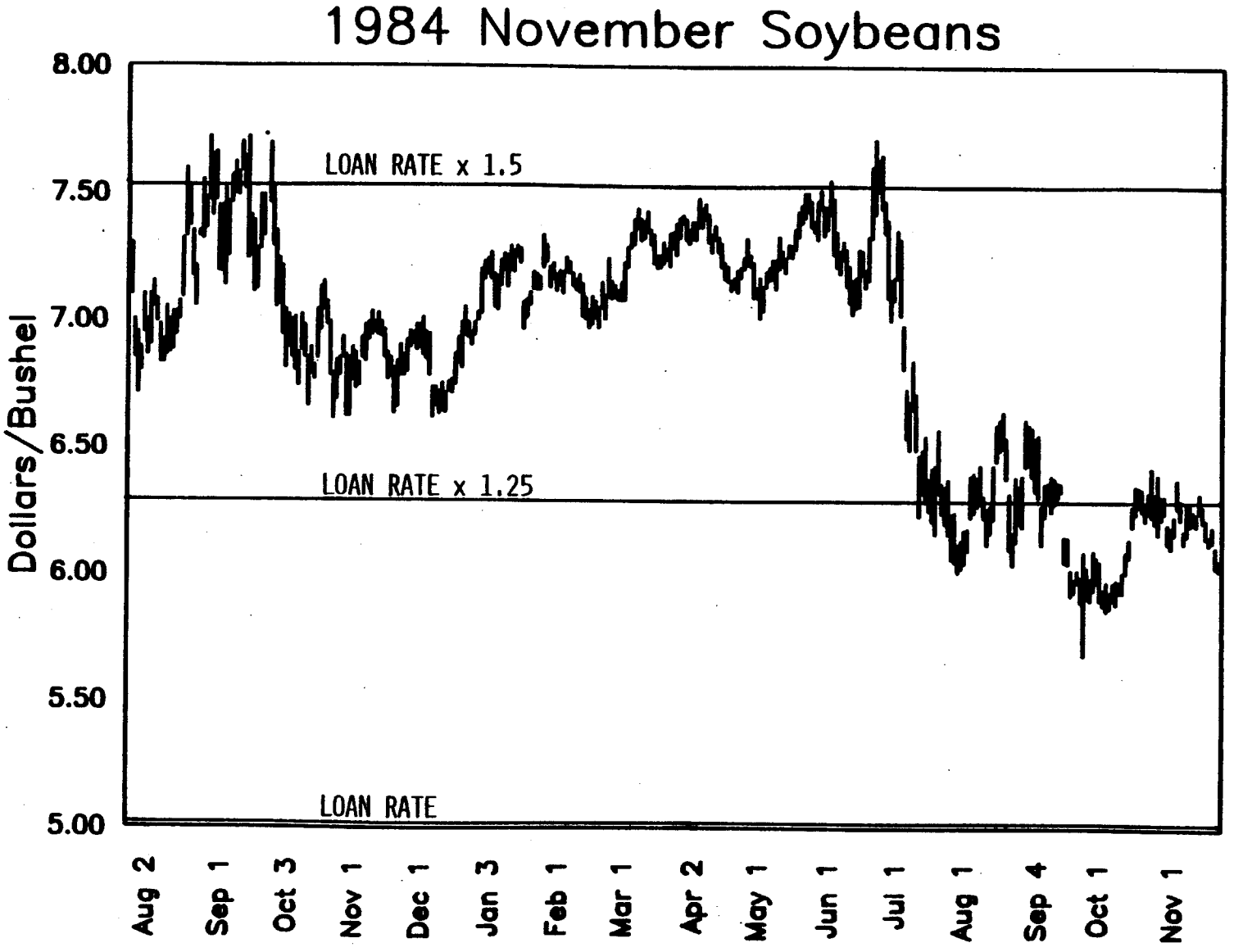

1979 November Soybeans
8.50
7.50
6.50
5.50
4.50
Dollars/Bushel
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Oct 2
Nov 1
Dec 1
Jan 2
Feb 1
Mar 1
Apr 2
May 1
Jun 1
Jul 2
Aug 1
Sep 4
Oct 1
Nov 1

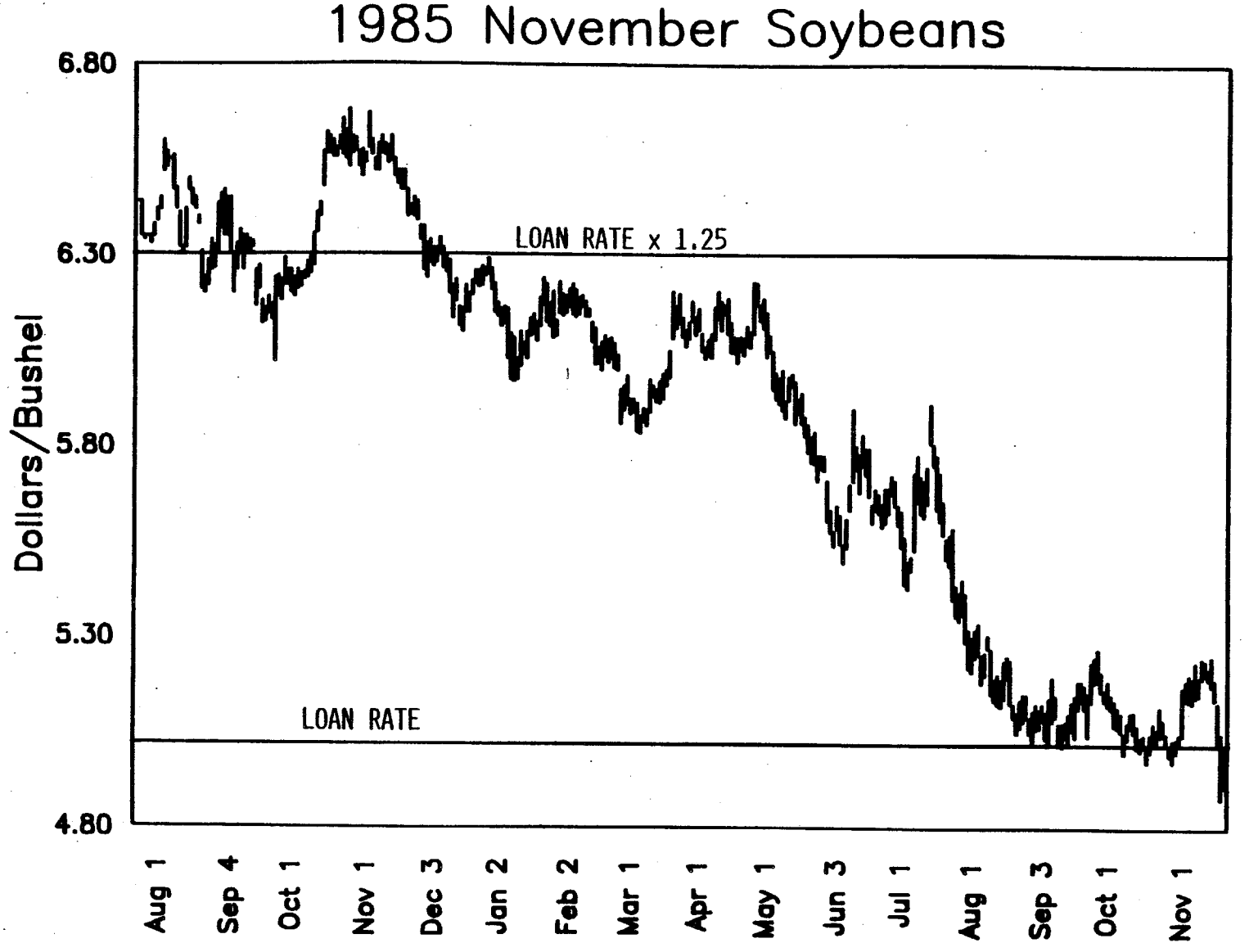

1980 November Soybeans
Dollars/Bushel
9.50
9.00
8.50
8.00
7.50
7.00
6.50
6.00
5.50
5.00
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Oct 1
Nov 1
Dec 3
Jan 2
Feb 1
Mar 3
Apr 1
May 1
Jun 2
Jul 1
Aug 1
Sep 2
Oct 1
Nov 3

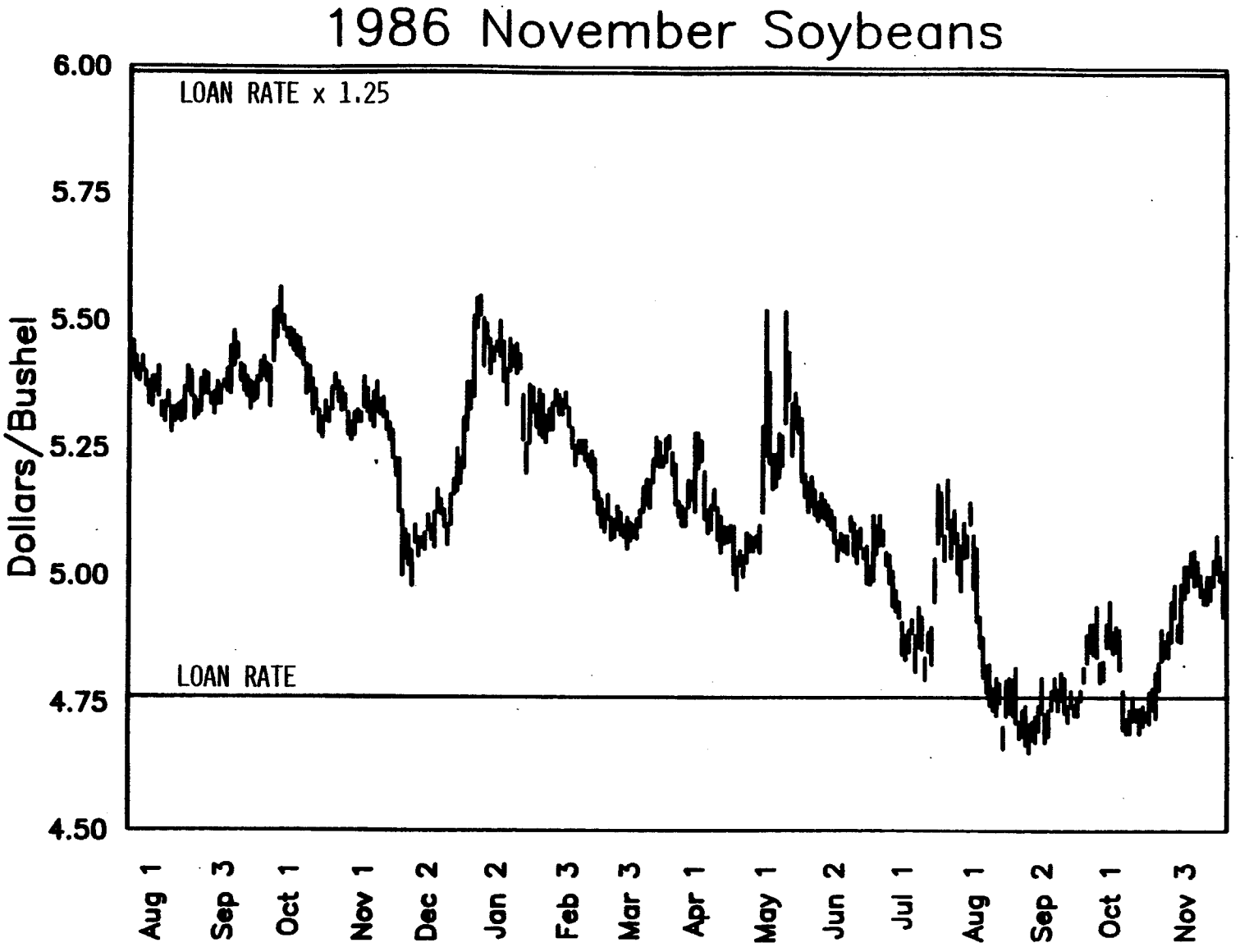

1981 November Soybeans
9.00
8.00
7.00
6.00
5.00
Dollars/Bushel
LOAN RATE X 1.5
LOAN RATE x 1.25
LOAN RATE
Oct 1
Nov 3
Dec 1
Jan 2
Feb 2
Mar 2
Apr 1
May 1
Jun 1
Jul 1
Aug 3
Sep 1
Oct 1
Nov 2

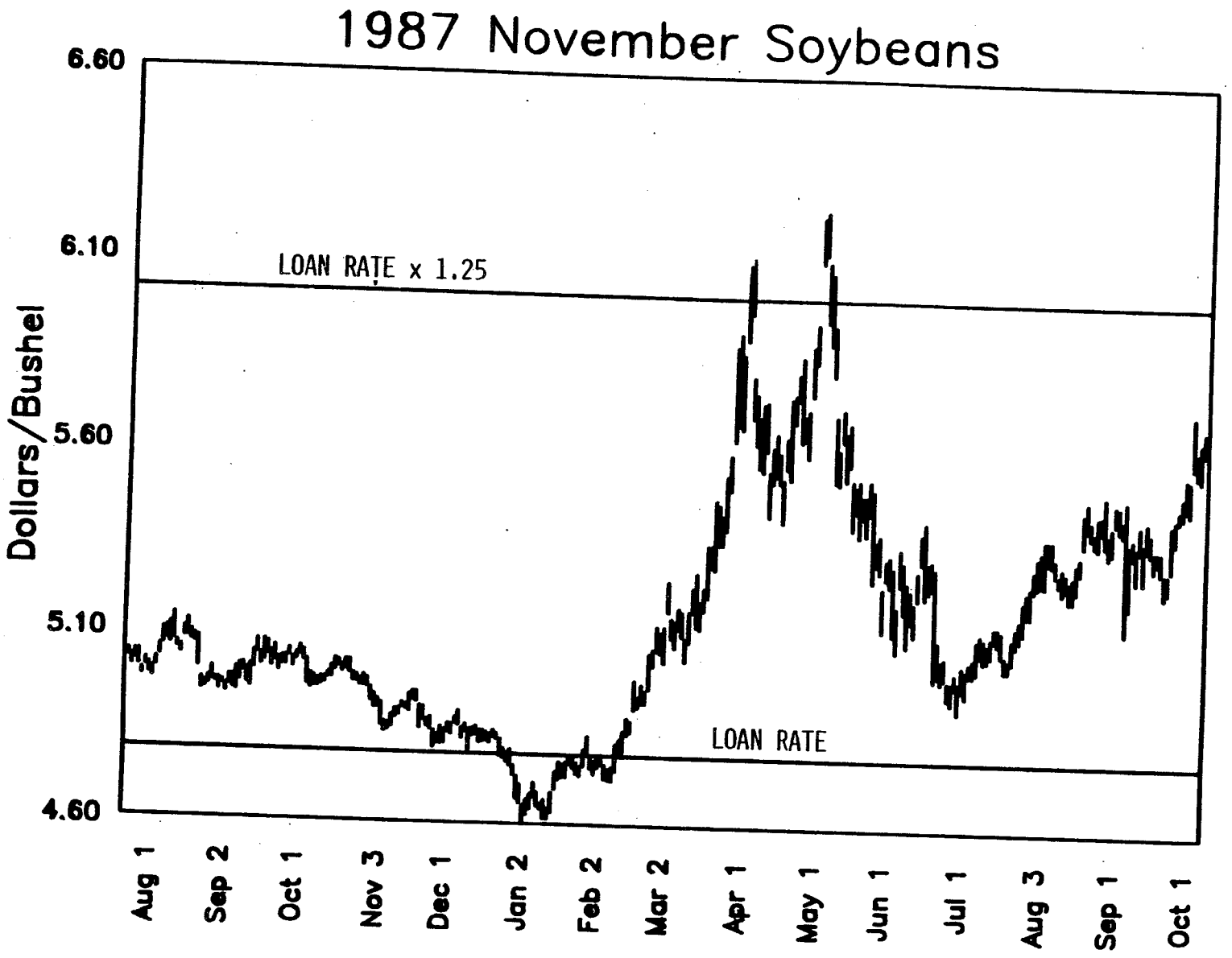

1982 November Soybeans
8.00
7.50
7.00
6.50
6.00
5.50
5.00
Dollars/Bushel
LOAN RATE x 1.5
LOAN RATE X 1.25
LOAN RATE
Oct 1
Nov 2
Dec 1
Jan 4
Feb 1
Mar 1
Apr 1
May 3
Jun 1
Jul 1
Aug 2
Sep 1
Oct 1
Nov 1

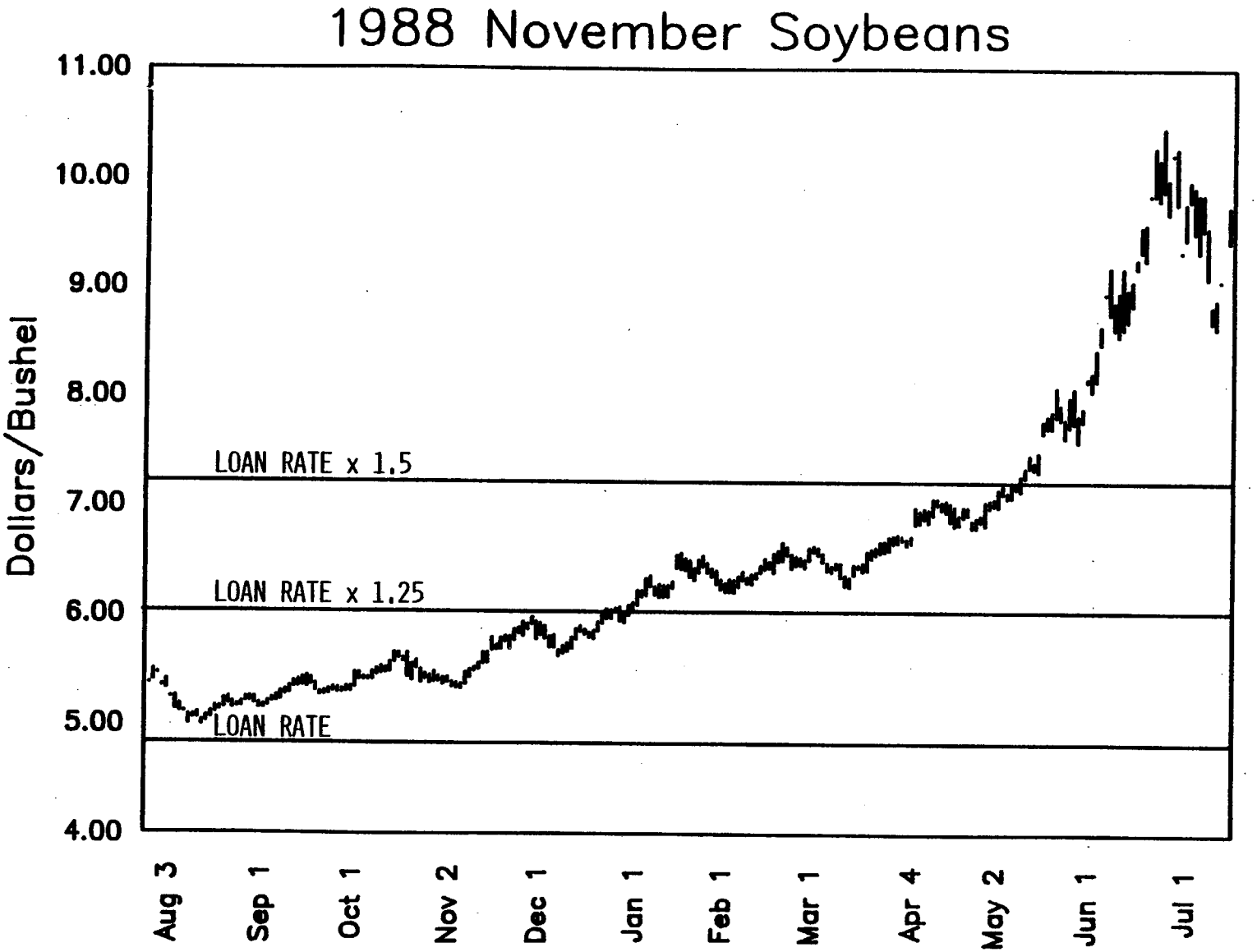

1983 November Soybeans
10.00
9.00
8.00
7.00
6.00
5.00
Dollars/Bushel
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Sep 1
Oct 1
Nov 1
Dec 1
Jan 3
Feb 2
Mar 1
Apr 4
May 2
Jun 1
Jul 1
Aug 1
Sep 1
Oct 3
Nov 1


1984 November Soybeans
8.00
7.50
7.00
6.50
6.00
5.50
5.00
Dollars/Bushel
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Aug 2
Sep 1
Oct 3
Nov 1
Dec 1
Jan 3
Feb 1
Mar 1
Apr 2
May 1
Jun 1
Jul 1
Aug 1
Sep 4
Oct 1
Nov 1


1985 November Soybeans
6.80
6.30
5.80
5.30
4.80
Dollars/Bushel
LOAN RATE x 1.25
LOAN RATE
Aug 1
Sep 4
Oct 1
Nov 1
Dec 3
Jan 2
Feb 2
Mar 1
Apr 1
May 1
Jun 3
Jul 1
Aug 1
Sep 3
Oct 1
Nov 1


1986 November Soybeans
LOAN RATE x 1.25
LOAN RATE
Dollars/Bushel
6.00
5.75
5.50
5.25
5.00
4.75
4.50
Aug 1
Sep 3
Oct 1
Nov 1
Dec 2
Jan 2
Feb 3
Mar 3
Apr 1
May 1
Jun 2
Jul 1
Aug 1
Sep 2
Oct 1
Nov 3


1987 November Soybeans
6.60
6.10
5.60
5.10
4.60
Dollars/Bushel
LOAN RATE x 1.25
LOAN RATE
Aug 1
Sep 2
Oct 1
Nov 3
Dec 1
Jan 2
Feb 2
Mar 2
Apr 1
May 1
Jun 1
Jul 1
Aug 3
Sep 1
Oct 1


1988 November Soybeans
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
Dollars/Bushel
LOAN RATE x 1.5
LOAN RATE x 1.25
LOAN RATE
Aug 3
Sep 1
Oct 1
Nov 2
Dec 1
Jan 1
Feb 1
Mar 1
Apr 4
May 2
Jun 1
Jul 1