PROGRESS REPORT ON THE EFFECT OF NITROGEN ON YIELD, SUCROSE CONTENT AND PURITY OF SUGAR BEETS

By: G. E. Nichol 1/

This report summarizes work done during the past three years in cooperation with Dr. F. W. Snyder of the U. S. Department of Agriculture and M. G. Frakes of the Michigan Sugar Company, and work done in 1964 in cooperation with Dr. J. F. Davis and Wm. Judy of the Soil Science Department of Michigan State University. Analysis of samples was made at the Michigan Sugar Laboratory with the cooperation of M. G. Frakes and staff.

A few years ago we were promoting the use of higher applications of Nitrogen as a means of getting higher yields and larger acre returns from the sugar beet crop. Farmers responded very well to the notion that Nitrogen would result in higher yields of sugar beets. Graph "A" attached shows the progression in Nitrogen use from 1952 to the present time.

Sugar content of beets has generally declined during this period of years as has extraction of sugar per ton.

At the suggestion of Dr. Snyder, we initiated a cooperative nitrogen study in 1962. Commercial fields were selected for this study in both the Monitor area and the Michigan Sugar Company area. These fields were already blocked and thinned. Nitrogen applications were superimposed over the fertilizer which had already been applied to the beets. Thus, total Nitrogen rates varied considerably from field to field. Sampling started on August 20, and continued at 10 day intervals until October 10. Sucrose tests were made on the beets on each sampling date. The effect of Nitrogen on sucrose content of the beets is shown in the attached Graphs "B" and "C".

After reviewing these tests, it was felt that more uniform stands were necessary to achieve reliable experimental results and that rates of Nitrogen should be controlled more precisely. Nitrogen experiments in 1963 were designed to correct the mistakes made the previous year. Fields were selected where the basic application of Nitrogen was about 40 pounds per acre and where beet rows ran perpendicular to the tile lines. Thinning was controlled carefully in order to get stands which were uniform. Nitrogen in the form of ammonium Nitrate was spread on the surface of the soil after thinning at rates which resulted in total applications of Nitrogen of 40, 80, 120, 160 and 200 pounds per acre. These tests were conducted on three farms in the Monitor area. In 1963, beet analysis consisted of measuring sucrose as well as clear juice purity by the method of Carruthers and Oldfield. Results of the three tests followed the same trend and are grouped together for comparison. Note that the 160 and 200 pound rate are not included. In one test these plots were infested with sugar beet nematode. In another, presence of a sandy subsoil made

1/ Research Supervisor
Monitor Sugar Divn.

comparison questionable. Results of these tests are shown on Chart"D" which is attached.

We concluded that 1963 must have been an unusual year because results did not agree with what we thought they should have been.

Three more Nitrogen tests were conducted in the Monitor District in 1964. These tests were done as carefully as we know how to do such work.

Rates in all tests started at 30 pounds total Nitrogen per acre and increased in 30 pound increments to top rates of near 200 pounds per acre. Nitrogen was applied in the form of ammonium Nitrate spread on the soil surface after thinning. Thinning was done with extreme care to obtain uniform stands of beets.

Samples were harvested from the Walraven test on two dates prior to the regular test. These samples showed the same trend as is shown in the final harvest summary.

Results of these Nitrogen tests are summarized in the three Tables "E", "F" and "G" which are attached.

Additional tests on clear juice have been made by Dr. Synder to measure Amino Nitrogen, Potassium and Sodium. These impurity values are shown in the attached Table "H".

A comparison of the Amino Nitrogen values in these two tests indicates that the Walraven field already had a high level of Nitrogen in the soil, as compared to the Appold field. This probably explains why we obtained a moderate yield response to Nitrogen on the Appold field, but not in the Walraven field.

These results point out the need for a soil test which will indicate the Nitrogen supplying power of a given field.

Further testing work will be conducted in 1965.

TABLE E

SUMMARY OF 1964 N TESTS

Appold - Harvest 10-12-64 - 3 Replications

Total N/A*	Beets 100' Row	Tons Per Acre**	% Sugar	% C.J.P.	Recoverable Sugar/Acre
30	87	20.26	16.27	94.59	5,855
60	87	22.50	16.20	93.85	6,318
90	86	23.06	15.82	93.54	6,342
120	88	20.72	15.15	93.21	5,408
150	87	22.78	15.07	93.46	5,923
190	86	21.66	14.12	91.79	5,090

* 30# at planting. Balance side dressed.
** Corrected for estimated 8% tare.

TABLE F

SUMMARY OF 1964 N TESTS

Walraven - Harvest 10-20-64 - 3 Replications

Total N/A*	Beets 100' Row	Tons Per Acre**	% Sugar	% C.J.P.	Recoverable Sugar/Acre
30	94	25.58	17.17	94.59	7,802
60	93	24.92	16.73	93.87	7,302
90	94	24.83	16.45	92.71	6,977
120	92	25.48	16.70	92.82	7,287
150	93	25.02	15.62	91.02	6,405
190	97	25.39	15.68	91.45	6,601
230	89	25.76	14.62	89.79	5,976

* 30# at planting. Balance side dressed.
** After 5% tare.

TABLE G

N TEST

Harvested 10-8-64 - 24 Replications

TOTAL N	YIELD	% SUCROSE	C.J.P.	RECOVERABLE SUGAR/ACRE
30	23.49	17.66	93.09	7,152
60	23.20	17.11	92.91	6,795
90	22.35	16.62	92.57	6,325
120	23.90	16.25	91.30	6,315
150	22.75	15.58	90.78	5,771
180	23.64	15.29	90.37	5,813

TABLE H

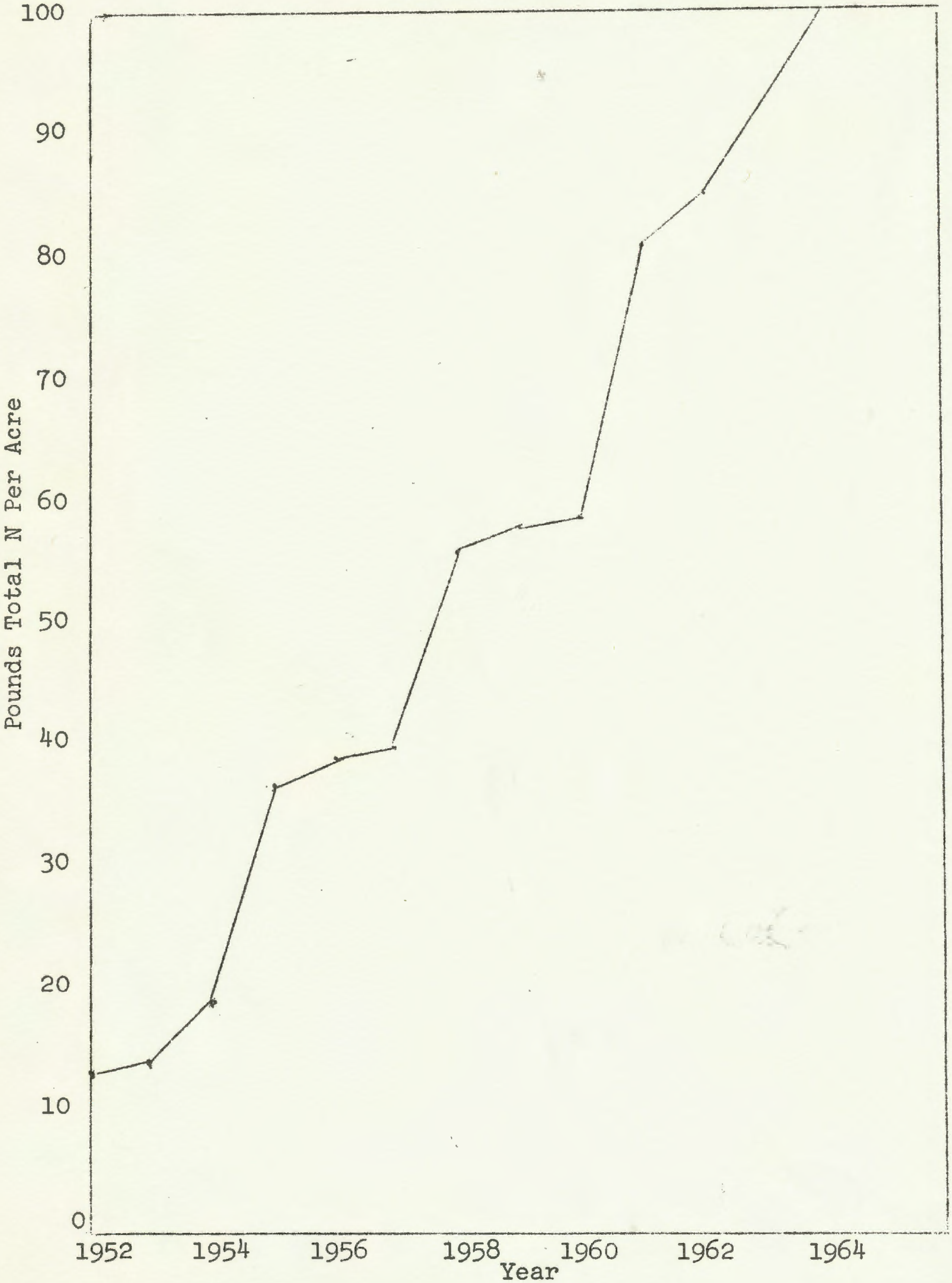
IMPURITY VALUES - N TESTS 1964
Appold and Walraven Farms

TOTAL N	FIELD*	C.J.P.	AMINO N	K	Na	BETAINE	TOTAL
30	A	94.59	1,157	2,470	260	957	4,844
	W	94.59	2,376	2,317	106	1,577	6,376
60	A	93.85	1,600	2,709	377	925	5,611
	W	93.87	2,831	2,478	106	1,443	6,858
90	A	93.54	1,666	2,975	473	941	6,055
	W	92.71	3,713	2,760	131	1,596	8,200
120	A	93.21	1,599	3,063	479	1,137	6,278
	W	92.82	3,254	2,694	182	1,803	7,933
150	A	93.46	2,431	2,713	589	905	6,638
	W	91.02	5,197	3,254	207	1,837	10,495
190	A	91.97	2,742	3,551	719	1,163	8,175
	W	91.45	4,584	2,922	228	1,902	9,636
230	W	89.79	5,985	3,457	309	2,122	11,873

*A - Appold Farm
W - Walraven Farm

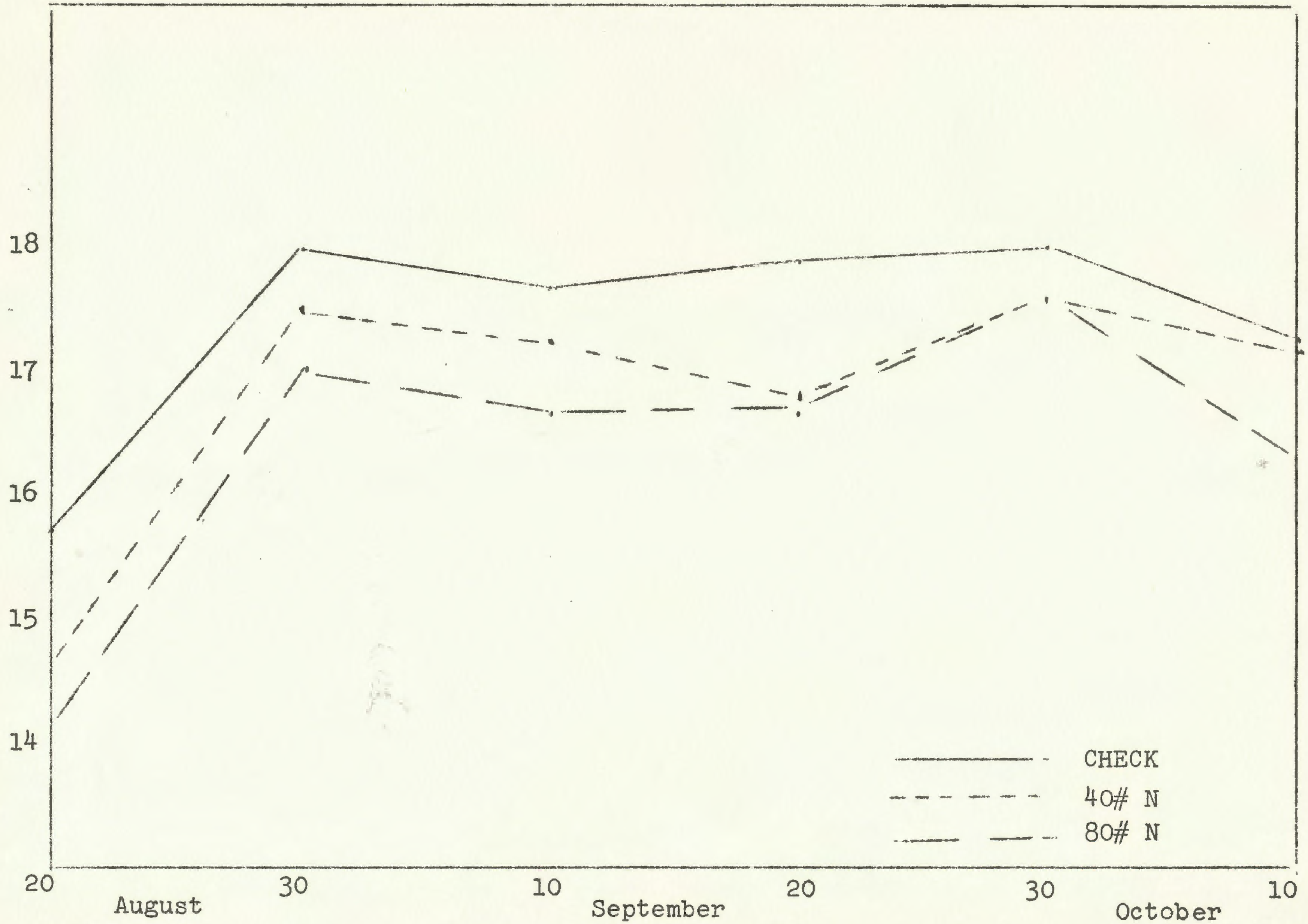
GRAPH "A"

Average Rate of N on Commercial Fields
MONITOR SUGAR



GRAPH "B"

Sugar Tests 1962 - Average of 3 Growers
MONITOR AREA



GRAPH "C"

Sugar Tests - 1962 - MICHIGAN SUGAR
Average of 4 Growers - Unionville Area

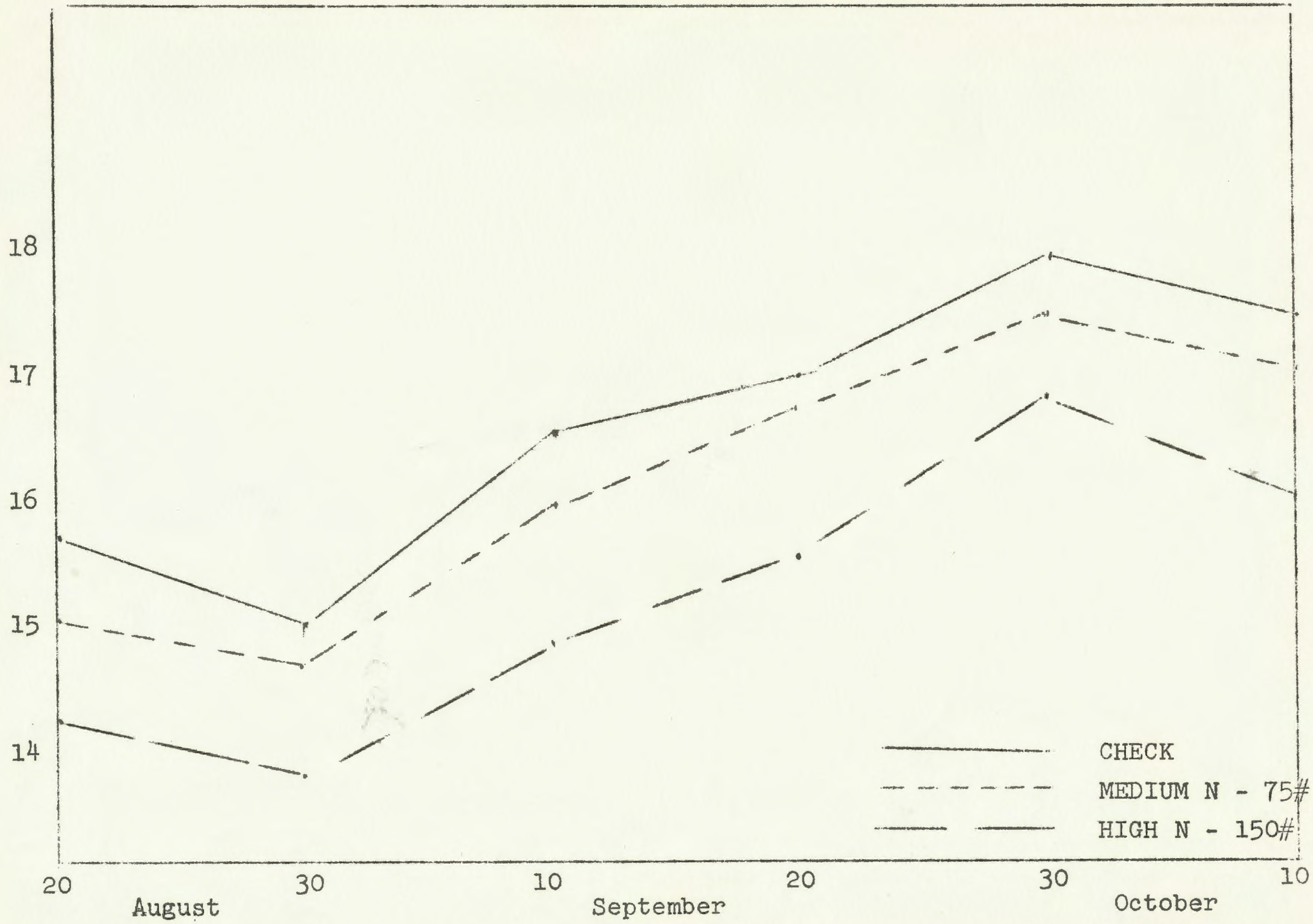


CHART "D"

NITROGEN STUDY - MONITOR 1963
Frank, Fischer, Hardy - 40-80-120# N