

The following article and charts were prepared by Dr. Harvey Meredith of the Department of Soil Science, University of Minnesota and made available to Hole Notes by Dr. William P. Martin of the Soil Science Department, University of Minnesota. We wish to express our sincere thanks to these two gentlemen for their kindness in furnishing this very interesting and educational article.

Dr. Martin also enclosed a bulletin, in fact it is a 23-page booklet, entitled "Recommended Chemical Soil Test Procedures for the North Central Region." This region includes Minnesota. A copy of this booklet is available to anyone interested. Contact Dr. John Grava of the Soil Science Staff and the Professor in charge of their Soil Testing Program. We strongly recommend that each Superintendent secure a copy.

FERTILIZER ARITHMETIC
by H. Meredith

Fertilizer is sold on an N-P₂O₅-K₂O basis. Example: The label on a fertilizer bag gives the analysis as 8-16-32. In 100 pounds of material there are 8 pounds of N (nitrogen), 16 pounds available P₂O₅ (phosphorus) and 32 pounds of water soluble K₂O (potassium).

A ton of 8-16-32 would be made up of 20 one hundred pound bags (20 x 100 = 2,000 pounds or one ton). If you want to determine how much N-P₂O₅-K₂O in a ton, multiply each number by 20. In the above fertilizer analysis a ton of 8-16-32 would contain 160 pounds of N, 320 pounds of P₂O₅ (phosphorus) and 640 pounds of K₂O (potassium). If you are buying a single analysis as 34-0-0 you have an easier time of it. If you are buying ammonium nitrate the analysis would be 34-0-0 (N-P₂O₅-K₂O). This means the material is 34 percent N. In 100 pounds of ammonium nitrate there are 34 pounds of N, no phosphorus and no potassium. In one ton there are 680 (34 x 20) pounds of N. If you buy 18-46-0, you have 18 pounds of N (nitrogen), 46 pounds of P₂O₅ (phosphorus) and no potassium per one-hundred pounds. Multiplying by 20 cwt. there would be 360 pounds of N (nitrogen) and 920 pounds of P₂O₅ (phosphorus).

Salesmen often wish to add sophistication to conversions by using the term units instead of pounds. The term unit is used in fertilizer discussions to mean 20 pounds. In a ton of 18-46-0 there are 18 units of N (nitrogen) and 46 units of P₂O₅ (Phosphorus). Since a unit is 20 pounds, multiply units by 20 and we have pounds per ton. In a ton of 18-46-0 there are 360 pounds of N and 920 pounds of P₂O₅ (phosphorus). When we mean pounds per acre we should say pounds per acre. When we discuss price per pound, remember there is a vast difference between price per pound and price per unit. The difference is a factor of 20. Table 3 and 4 are helpful to the understanding of fertilizer analysis and price per pound of plant food.

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A LISTING OF SOME COMMON FERTILIZER GRADES

	<u>Lbs. per 100 Lbs.</u>			<u>Lbs. per ton</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
34-0-0 (ammonium nitrate)	34	0	0	680	0	0
0-46-0 (csp) (Concentrated-super-phosphate)	0	46	0	0	920	0
18-46-0 (DAP) (Di-ammonium-phosphate)	18	46	0	360	920	0
Potash (60% K ₂ O)	0	0	60	0	0	1200
Urea (46% N)	46	0	0	920	0	0
29-14-0	29	14	0	580	280	0
28-0-0 (Liquid)	28	0	0	560	0	0
10-34-0 (Liquid)	10	34	0	200	680	0
82-0-0 (Anhydrous)	82	0	0	1640	0	0
20-0-0 (Aqua-liquid)	20	0	0	400	0	0

Cost of Fertilizer

F.O.B. Plant (March 10, 1975)

	\$/Ton	Cost per lb.		
		<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
18-46-0	240	11.1 ¢	21.8 ¢	-
0-44-0	192	-	21.8	-
34-0-0	162	23.8	-	-
46-0-0	196	21.3	-	-
10-34-0 (liquid)	200	14.6	26.7	-
28-0-0 (liquid)	140	25	-	-
29-14-0	195	23	21.8	-
25-25-0	213	20.8	21.8	-
20-10-0 (liquid)	144	22.6	26.7	-
18-18-0 (liquid)	170	20.5	26.7	-
82-0-0 (anhydrous)	240	14.6	-	-

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FERTILIZER ARITHMETIC (continued from page 3)

During the past 15 years Minnesota has witnessed a phenomenal growth in fertilizer consumption. Total tonnages increased from 236,000 tons in 1960 to 1 million tons in 1974. Nitrogen and potash were used at roughly half the rate of phosphorus in 1960 whereas in 1974 the relative rate of use was 410-268-322 thousand tons for N-P-K, respectively.

SOURCES OF N USED IN MINNESOTA - 1974

<u>Source</u>	<u>%N</u>	<u>Tons</u> (1000)	<u>% of Total N</u>
Anhydrous ammonia	82	279	56
Blends	10 ^{3/}	748	22 ^{3/}
Ammonium nitrate	34	117	9.7
Nitrogen solution	30	90	6.5
Urea	45	40	4.3
Other	25	9.4	0.6 (Includes organics)
Ammonium phosphates	15 ^{3/}	13.6	0.5
Aqua	20	8.7	0.4
Ammonium sulfate	24	4.9	0.3

^{3/} Estimated

Now that you have read this very interesting article and studied the charts you should be in the mood to sell your club, if you have not already done so, on supporting the MGCSA Research Program. Many of the clubs have already sent in their contribution and they are greatly appreciated. However, this is a program that is beneficial to all clubs and their members and we therefore urge 100% support. Have your club make their check payable to the MGCSA and mail it to Keith Scott, Secretary-Treasurer % Oak Ridge Country Club, 700 Highway 18, Hopkins, Minnesota 55343. If you are wondering what amount your club should contribute, a good gauge is 50¢ per member but any amount your club feels they want to contribute will be thankfully accepted.

GREEN CLIPPINGS

With the article on "Fertilizer Arithmetic" we made mention that Dr. Martin enclosed a booklet on Recommended Chemical Soil Test Procedures for the North Central Region and we advised this booklet was available by contacting Dr. John Grava, Department of Soil Science, University of Minnesota, St. Paul, Minnesota 55101. We are listing the contents for your information:

Introduction.....W. C. Dahnke
 (This contains valuable information including some history)
 Soil Sample Preparation.....Kalju Eik, E. L. Hood and J. J. Hanway
 A Standard Soil Scoop for Soil Testing.....T. R. Peck
 Recommended pH and Lime Requirement Tests.....E. O. McLean
 Importance of Soil Extraction Techniques.....John Grava
 Recommended Nitrate-Nitrogen Tests.....P. L. Carlson
 Recommended Phosphorus Soil Tests.....D. Knudsen
 Recommended Potassium Tests.....P. L. Carlson
 Micronutrient Tests.....David A. Whitney

Just a list of the contents indicates the value of the booklet.

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