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RGV Small Acreage

SAP-003

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FARMERS & RANCHERS EDUCATION COMMITTEE

TEXAS A&M AGRILIFE EXTENSION

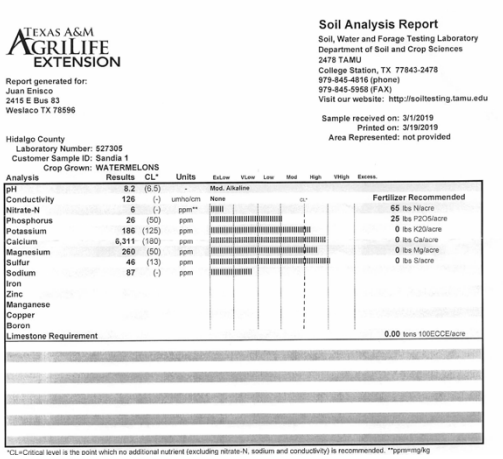
Calculating Fertilization Rates

The crops can optimize production if the fertility level in the soil is adequate. The main factors that determine the soil fertility are organic matter (including the soil micro-organisms), the soil texture, soil structure, soil depth and the soil fertility, the soil capacity to store fertilizer (adsorption capacity), and the toxicity elements in the soil. The best step in determining the fertility of the soil is to conduct a soil analysis to determine fertilizer needs for a given crop.

The objective of this paper is 1) to determine the fertilizer rate N_2, P_2O_5 and K_2O needed for a crop, based in a soil analysis report. 2) To determine the fertilization cost N_2, P_2O_5 and K_2O for a given crop.

Determining the fertilizer rate

3. The soil analysis will determine the fertilizer requirements for a given crop. For the example in Figure 1, the fertilizer required for watermelons is 65 lbs/ac of N_2, 25 lbs/ac P_2O_5 and 0 lbs/ac K_2O.



TEXAS A&M AGRILIFE EXTENSION

Soil Analysis Report
Soil, Water and Forage Testing Laboratory
Department of Soil and Crop Sciences
2478 TAMU
College Station, TX 77843-2478
979-845-4816 (phone)
979-845-5958 (FAX)
Visit our website: http://soiltesting.tamu.edu

Sample received on: 3/1/2019
Printed on: 3/19/2019
Area Represented: not provided

Report generated for:
Juan Enisco
2415 E Bus 83
Weslaco TX 78596

Hidalgo County
Laboratory Number: 527305
Customer Sample ID: Sandia 1
Crop Grown: WATERMELONS

Analysis	Results	CL*	Units
pH	8.2	(6.5)	-
Conductivity	126	(-)	um/cm
Nitrate-N	6	(-)	ppm**
Phosphorus	26	(50)	ppm
Potassium	186	(125)	ppm
Calcium	6,311	(180)	ppm
Magnesium	260	(50)	ppm
Sulfur	46	(13)	ppm
Sodium	87	(-)	ppm
Iron			
Zinc			
Manganese			
Copper			
Boron			
Limestone Requirement			

Mod. Alkaline
None

Fertilizer Recommended
65 lbs N/acre
25 lbs P2O5/acre
0 lbs K2O/acre
0 lbs Ca/acre
0 lbs Mg/acre
0 lbs S/acre
0.00 tons 100ECCE/acre

*CL=Critical level is the point which no additional nutrient (excluding nitrate-N, sodium and conductivity) is recommended. **ppm=mg/kg

Figure 1. Fertilizer recommendation from a soil analysis report.

1. The commercial fertilizer that will be used are **Urea and ammonium nitrate UAN32 for nitrogen and 4-29-2 for phosphorus mix**. The UAN 32 has 32% by weight of nitrogen, in which one-fourth of the nitrogen is ammonia, one-fourth is nitrate and one-half is urea, the rest are other ingredients. The phosphorus fertilizer mix 4-29-2, means that the fertilizer has 4% by weight of Nitrogen, 29% by weight of phosphorus, and 2% by weight of potassium, the rest are other ingredients.

2. To calculate the amount of fertilizer required, it is necessary to know the density (lb/gal) of each fertilizer type, which is generally provided by the fertilizer company, as it is shown the following table:

Fertilizer	Density
N32 (32-00-00)	11.04 lb/gal
P_2O_5 (4-29-2)	11.9 lb/gal

Example: Calculate the rate of fertilizer required for 1 acre using the soil analysis report of Figure 1.

For phosphorus:

P_2O_5 (4-29-2) *Density* $11.9\ lb/gal$

Step 1. We obtain the proportion of the phosphorus fertilizer (4-29-2) required to meet the recommendation of 25 lbs/ac required by the soil analysis, using the mathematical rule of three, a method of having three numbers to help calculate the unknown, to solve the proportion:

$$100\ lb\ of\ fertilizer - 29\ lb\ of\ P/acre$$
$$x - 25\ lb\ of\ P\ required/acre$$
$$x = \frac{(100 * 25\ lb/acre)}{29\ lb/acre}$$
$$x = 86.27\ lb\ \ of\ fertilizer\ (4 - 29 - 2)$$

Step 2. Once we obtain the amount of fertilizer required, the fertilizer density will be used to obtain the fertilization rate required per acre of this liquid fertilizer.

$$1gal - 11.9\ lb$$
$$x - 86.27\ lb$$
$$x = \frac{(1\ gal * 86.27\ lb)}{11.9\ lb}$$
$$x = 7.25\ \frac{gallons}{acre}\ of\ (4 - 29 - 2)$$

For Nitrogen.

N32 (32-00-00) *Density* $11.04\ lb/gal$

Step 1. We will calculate the amount of nitrogen that is applied indirectly with the fertilizer 4-29-2.

$$100 - 4\ (N)$$
$$86.27 - x$$
$$x = \frac{(86.27 * 4\ (N))}{100}$$
$$x = 3.45\ lb\ (N)$$

Step 2. We subtract the nitrogen contained in the fertilizer 4-29-2, to the fertilizer required by the soil analysis which is 65 lbs/ac.

$$N = 65\ lb - 3.45\ lb$$
$$N = 61.55\ lb$$

Step 3. The rate required by the soil analysis was adjusted, to estimate the N fertilizer required from the UAN32 fertilizer, using the rule of three.

$$100 - 32\ lb\ N$$
$$x - 61.55\ lb\ N$$
$$x = \frac{(100 * 61.55\ lb\ N)}{32\ lb\ N}$$
$$x = 192.3\ lb\ of\ UAN32$$

Step 4. To determine the amount of liquid fertilizer required, we use the density of UAN 32:

$$1gal - 11.04lb$$
$$x - 192.34\ lb$$
$$x = \frac{(1gal * 192.34\ lb)}{11.04\ lb}$$
$$x = 17.42\ \frac{gallons}{acre}\ of\ UAN32$$

Determination of fertilization costs

Sometimes, it is necessary to determine the most economical source of N-P-K fertilizer and the cost per unit of nitrogen, phosphorus and potassium.

Example: Considering the following fertilizer costs, calculate the cost per unit of N-P-K of the formula recommended by the soil analysis:

Fertilizer	Cost
N32 (32-00-00)	$\$275/Ton$
P_2O_5 (4-29-2)	$\$3.10/gal$

To obtain the cost per unit of N-P-K fertilizer, we use the following procedure:

Step 1: Estimate the cost of P per unit of the fertilizer (4-29-2), we consider that 1 gallon of water weighs 8.35 lbs.

$$\$3.10\ -8.35\ lbs\ (1\text{Gal})$$
$$x - \quad 1\ lb$$
$$x = \frac{(\$3.10 * 1lb)}{8.35\ lb}$$
$$x = \$0.37/lb\ of\ \mathbf{P2O5}$$

Step 2: For Nitrogen N_2 (32-00-00)

There are 2000 lbs in 1 ton. Therefore: $275/2000 lbs = $0.1375 /lb of N_2

Step 3: Then we calculate the cost per unit N-P-K of fertilizer **4-29-2:**

$$4 + 29 + 2 = 35$$

$$\frac{4}{35} = 0.1142 * \$0.37 = \$0.042/lb\ \text{of N}$$

$$\frac{29}{35} = 0.8286 * \$0.37 = \$0.31/lb\ \text{of P}$$

$$\frac{2}{35} = 0.0571 * \$0.37 = \$0.02/lb\ of\ K$$

Step 4. From the soil analysis, it is required to apply the formula 65-25-0. Considering that the fertilizer 4-29-2, has other compositions besides phosphorus.

The cost per unit of P_2O_5 per acre of the fertilizer 4-29-2 is:

$$P_2O_5 = \frac{\$0.31}{lb} * 25 \frac{lb}{acre} = \$7.75/acre$$

Step 5. To obtain the cost of Nitrogen por acre, we use the same methodology, we include the nitrogen contained in the 4-29-2 fertilizer.

For N_2

$$4 - 29 - 2$$
$$32 - 00 - 00$$
$$- - - - - - - - - -$$
$$36 - 00 - 00 \ \ units\ of\ N$$

Then:

$$\frac{4}{36} = 0.1111\% * \frac{\$0.042}{lb} = \$0.0046/lb$$
$$\frac{32}{36} = 0.8888\% * \frac{\$0.1375}{lb} = \$0.1222/lb$$

Total cost per unit of Nitrogen ($0.0046+0.1222= $0.1268/b)

The total cost per unit of nitrogen N_2 is:

$$N_2 = \frac{\$0.1268}{lb} * 65 \frac{lb}{acre} = \$8.24/acre$$

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