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Virginia Department of Conservation & Recreation

Commercial Fertilizer

References

- Mid-Atlantic Nutrient Management Handbook
  - Chapter 8: Commercial Fertilizers

Commercial Fertilizer

- Nitrogen
- Phosphorous
- Potassium
- (Sulfur)
- (Lime)

Nitrogen

- Inorganic N fertilizers are produced by fixing N from the atmosphere
  - Natural gas as the energy source

Nitrogen Fertilizers

- Urea [$CO(NH_2)_2$]:
  - Fertilizer grade: 46-0-0
  - Soluble, readily available source of N
  - Dry fertilizer product
  - Produced by reacting ammonia (NH_3) with carbon dioxide under pressure at an elevated temperature
  - Contains the highest percentage of N of all dry fertilizers
- Ammonium nitrate (NH_4NO_3):
  - Fertilizer grade: 34-0-0
  - Soluble, readily available source of N; non volatile and non leeching
  - Dry fertilizer product
- Ammonium sulfate [$(NH_4)_2SO_4$]:
  - Fertilizer grade: 21-0-0-24S
  - Contains 24% sulfur
  - Soluble, readily available source of N and S
- Non-pressure nitrogen solutions:
  - Fertilizer grade: ranges from 28-0-0 to 32-0-0
  - Soluble, readily available source of N
  - Liquid fertilizer product that does not require pressure for storage
  - Usually referred to as UAN (Urea Ammonium Nitrate)
- Aqua ammonia (NH_4OH):
  - Fertilizer grade: 20-0-0 (most common)
  - Density of 20-0-0 is 7.60 lbs/gal at 60°F
  - Produced by dissolving NH_3 gas in water

Phosphorous

- Ingredient for producing phosphorus (P) fertilizers is rock phosphate
  - Comes from the mineral apatite, a calcium
- Most conventional P fertilizers are made by reacting rock phosphate with:
  - Sulfuric acid to create superphosphate (20%)
  - Phosphoric acid to create triple superphosopate (46%)

Phosphorus Fertilizer

- Diammonium phosphate [$(NH_4)_2HPO_4$]:
  - Fertilizer grade: 18-46-0
  - Soluble, readily available source of P and N
  - Dry fertilizer product
- Monoammonium phosphate ($NH_4H_2PO_4$):
  - Fertilizer grade: 11-52-0
  - Soluble, readily available source of P and N
- Ammonium polyphosphate [$(NH_4)n+2PnO_3n+1$]:
  - Fertilizer grade: 10-34-0 or 11-37-0
  - Soluble, readily available source of P and N
  - Liquid fertilizer product
- Concentrated (Triple) superphosphate [$Ca(H_2PO_4)2•H_2O$]:
  - Fertilizer grade: 0-46-0
  - Soluble, readily available source of P
  - Dry fertilizer product

Potassium

- Term “potash”
  - Comes from an early production technique where potassium was leached from wood ashes and concentrated by evaporating the leachate in large iron pots (“pot-ash”)
- Potash is a potassium-rich salt that is mined from underground deposits formed from evaporated sea beds millions of years ago
- **Elemental potassium is K
- **Potash is K_2O

Potassium Fertilizer

- Potassium chloride (Muriate of Potash) (KCl):
  - Most abundantly used form of potassium fertilizer
  - Contains 60-63% K_2O
  - Water soluble source of K
- Potassium sulfate (K_2SO_4):
  - Contains 50-53% K_2O, 18% S, and no more than 2.5% Cl
- Potassium-magnesium sulfate (sul-po-mag) (K_2SO_4•$2MgSO_4$):
  - Contains about 22% K_2O, 11% Mg, 22% S, and no more than 2.5% Cl
  - Along with the K, this product is a good source of Mg and S
- Potassium nitrate (KNO_3):
  - Contains about 44% K2O and 13% N

Fertilizer Analysis

- Expressed as **PERCENTAGES**
  - N = % nitrogen
  - P = % phosphorus
  - K = % potassium (potash)
  - S = % Sulphur
- N-P-K-S

Fertilizer Materials

- 4 Categories, 2 Types
  - Granular
    - Dry Bulk Blend
    - Ammoniated Dry Granular
  - Liquid
    - Clear Liquid Solution
    - Liquid Suspension

Dry Bulk Blends

- A blend is made by mixing two or more fertilizer materials
  - Particles of nitrogen, phosphate, potash, limestone filler, and some secondary nutrients and micronutrients Produced by blending various dry materials
- Custom blending to meet exact nutrient needs of the crop

Dry Bulk Blends

- Important to match particle size and density
- Reduces segregation during transport to the field
- Larger particle and less dense materials tend to move to the top of the load
- Similar particles improve uniformity during application
  - more dense particles throw farther

Dry Bulk Blends

- Common dry nitrogen (N) materials
  - ammonium sulfate 21-0-0-24
  - UREA 46-0-0
- Common Dry Phosphate (P) materials
  - Diammonium phosphate (DAP) 18-46-0
  - concentrated (triple) superphosphate 0-46-0
- Common Dry Potassium (K) materials
  - muriatic of potash (potash) 0-0-60
  - potassium-magnesium sulfate 22-22-11
    - (sul-po-mag or k-mag)

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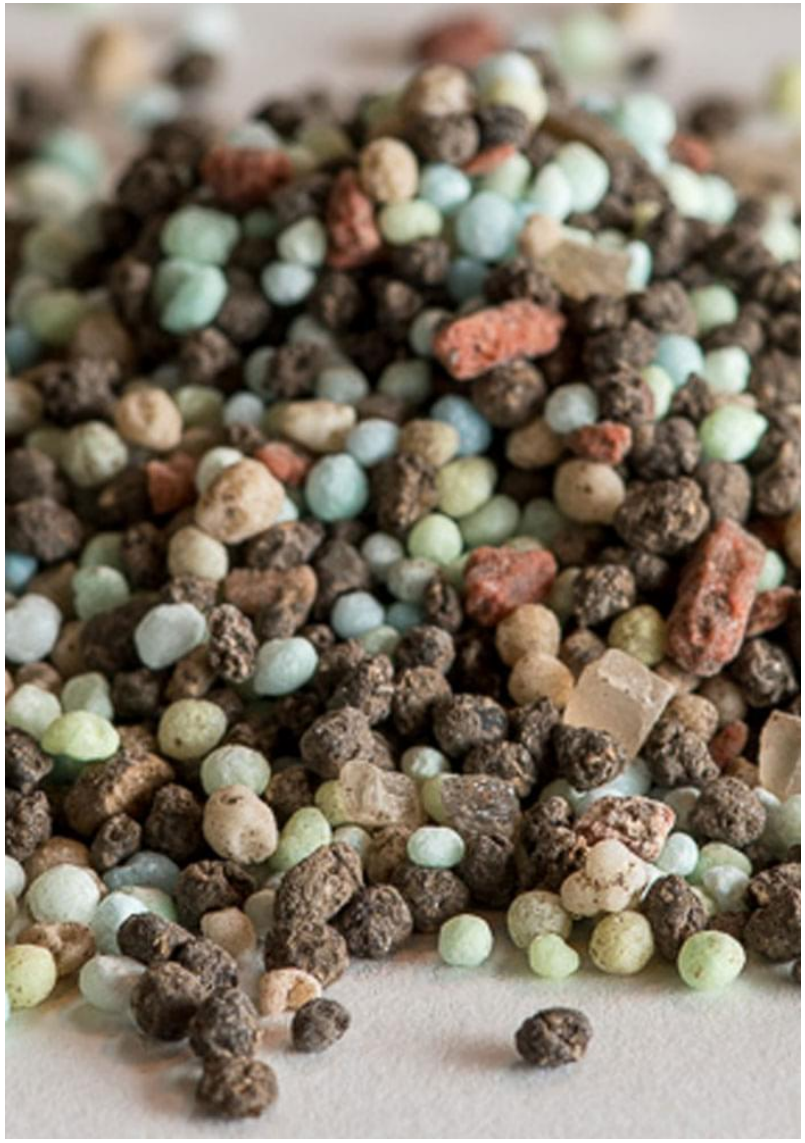


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Ammoniated Dry Granular

- In ammoniated fertilizers materials supplying N, P, K, etc.. are chemically combined into one solid granule
  - The granules' size, shape and density are closely controlled so that each granule has consistent percentages of each nutrient.
- Ammoniated fertilizer distribution breakdown is not possible because the nutrients are chemically combined, resulting in a consistent application


Green-Gro
QUALITY
FERTILIZER
10-10-10
GUARANTEED ANALYSIS
CAUTION: KEEP OUT OF REACH OF CHILDREN AND PETS
(SEE BACK PANEL FOR ADDITIONAL CAUTIONS)

Bulk Blended vs Ammoniated

- Ammoniated
  - Chemically manufactured for homogenous blended of N-P-K in each granule
  - Better for lower analysis (banding along rows)

- Bulk Blends
  - Mixed together physically; segregate during transportation, handling and application, resulting in uneven distribution in the field
  - Can be mixed on site to meet specific recommendations
  - Higher analysis
  - Less manufacturing costs

Clear Liquids

- Cold mix process
  - Start 10-34-0 base
  - commonly used as a starter
  - additional nitrogen or potash sources may be added for a complete fertilizer

Clear Liquids

- Hot mix process
  - aqua ammonia reacted with phosphoric acid
    - (generates considerable heat)
  - water (filler), potash, and additional nitrogen added to mix

Clear Liquids

- Hot mix process
  - common liquid materials
    - aqua ammonia 20-0-0
    - phosphoric acid
    - water
    - potash 0-0-60
    - 28%-32% UAN nitrogen solution
    - micronutrients


2 X 2.5 GAL
(2 X 9.46 L)
30-0-0
60%SRN
PLANT FOOD

Liquid Suspension

- High analysis with clear liquids is limited
  - Clay provides a surface for the fertilizer salts to form on
- Nutrients are held in “suspension”
  - Suspensions allow for less material per acre (higher analysis)
- Flexibility
  - Allows for more acres per load
- Agitation necessary to prevent settling of clay

Macro Nutrients

- N
- P
- K

Sub Macro Nutrients

- Mg
- Ca
- S

Micro Nutrients

- Fe
- Mn
- Zn
- Cu
- B
- Co
- Mo


200
150
100

Advantages of Granular and Liquid

- Liquid
  - Ease of handling and application (once set up)
  - Ease of blending
  - Uniformity of application
  - Starter and in-season application
  - Blend with crop protection products
- Granular
  - Cheaper in bulk
  - Easier to store (does not “settle out” over time or “salt out” in cold weather)
  - More efficient for heavy pre-plant applications
  - Slow-release options (polymer-coated urea)

Disadvantages

- Spatial:
  - distance from plant roots to fertilizer nutrients
  - less mobile nutrients (phosphorus) can't get closer than the individual granule containing them
  - in liquid form more mobile in the soil water solution
- Salt content
  - granular fertilizers can be "hot"
  - roots can steer away from a band of granular fertilizer that contains high levels of nitrogen and potassium
- Consistency
  - nutrient content is identical in every drop of liquid fertilizer
  - granular have individual nutrient components in each granule
- Equipment
  - cost of converting equipment to handle liquid fertilizer can be $$

TerraGator

RoGator

Nurse Trucks

Tender Trucks and Trailers

Dry Truck

Sidedress