



The Genie

The Genie is an algorithm that models the complexity of soil and crop mineral nutrition and makes precision organic nutritional recommendations for growers.

The model combines several leading agronomic approaches intended to improve crop quality (flavor, aroma, shelf life, and nutritional profile) and grower profitability.

How It Works

Growers or agronomists send in samples of soil, water, and plant tissue to a third party lab to be tested.

Upon receiving the results, I manually enter the data into the model.

The Genie utilizes the following tests to make customized fertility recommendations:

- Standard Soil Test (Mehlich III)
**In 2019 I will be developing a second version for high-pH and Calcareous soils using Olsen-bicarbonate extraction methods*
- Soluble Paste Test
- Irrigation Water Test
- Tissue Test
- Plant Sap Test

The Genie only needs one of these tests to begin making recommendations, but becomes exponentially more helpful the more tests that are used.

Growers also provide the following information to The Genie:

- Crop type
- Farm acreage
- If compost is available and within fertility budget
- If farm is “no-till”
- If soilless media is used
- Any physical nutritional symptoms observed
- Yield goals or estimates

With this data, The Genie provides customized precision nutritional recommendations.



The Recommendations It Provides

The Genie Provides Several “General Notes” such as:

1. Organic Matter: A determination of the sufficiency of organic matter based on soil type, and if low, methods to increase organic matter. Recommendations are based on farm size.
2. Soluble Salts: A determination if soluble salts will be problematic for plant growth, and if so, a simple recommendation to reduce soluble salts.
3. Irrigation Water Determination: A determination of the irrigation water is made, pointing out possible problems such as high alkalinity, sodic, or saline conditions. Depending on the determination, The Genie indicates if irrigation water will cause soil dispersion and inhibition of crop health or if the water needs pH adjustment.
4. Sodium Adsorption Ratio: The SAR is calculated for both water and soil and indicates any permeability hazards.

The Genie Provides “Annual Soil Amendment Recommendations”

Based on three soil test results—the standard test, soluble paste test, and nitrogen test—a full annual organic amendment plan is created.

This amendment calculator goes far beyond other existing calculators **by**:

1. Using *both* a standard soil test *and* a soluble paste test to create more specific recommendations that consider availability of nutrients in solution in addition to acid extracted exchangeable nutrients.
2. Creating recommendations based on *both* the base-cation saturation ratio (BCSR) approach as well as the sufficiency level of available nutrients (SLAN) approach. The computational approach used depends on soil type and total cation exchange capacity.
3. Recommending nitrogen application computed from the crop nitrogen requirement minus the estimated nitrogen release rate of the soil and any cover crop nitrogen additions.
4. Adding the “Replacement Rate” of individual crops.
5. Customizing recommendations based on if the farm is no-till, if compost is within the fertility budget, and if growers are growing in soilless media instead of real topsoil.
6. Recommending biological products for soil nutritional deficiencies (ex: The Genie recommends a phosphorus-solubilizing bacterial product when phosphorus is high on the standard test but has low solubility in solution).
7. Providing recommendations in lbs/acre, lbs/1000 sq ft, and lbs/cubic yard. The Genie explains whether to apply recommended minerals in the spring or fall, why they are being recommended for grower education, and the approximate price per acre of each recommendation.

At this time, The Genie only recommends organic and non-toxic minerals for Annual Amendments.



Example of the logic The Genie uses in determining Dolomitic Lime recommendation:

If Mg deficit is greater than 10%

AND

If Ca deficit is also greater than 10%

AND

pH is less than 6.5

THEN

Dolomite is used to fulfill the lesser of either the Mg deficit or the Ca deficit.

THEN

The remainder of the Ca or Mg deficit is fulfilled by either Ag Lime or Magnesium Sulfate

BUT

Max application limit of lime set based on CEC and organic matter reference table

The Genie Provides “Irrigation Recommendations”

Based on a simple irrigation water test, irrigation recommendations are created. The grower also has the option to set a target pH *or* alkalinity.

The Genie’s Irrigation Recommendations provide:

1. An indicator of which minerals are too high and recommendations of how they can be reduced through filtration or other methods.
2. A recommendation of how much acid should be applied to the water to reach the target pH or alkalinity, and the amount of nutrients in ppm that are added to the irrigation water from the addition of acids to pH the water.
3. Various indications of how irrigation events will influence the soil solution.

The Genie Creates a Soil Solution Model & Mid-Season Fertigation Recommendations

Based on three things—a soluble paste test, a plant sap test, and reported physical plant symptoms—a fertigation fertility plan is created.

The Genie provides:

1. An estimated (non-statistical) likelihood of the plant needing a specific mineral based on the extent to which the three tests and the grower’s observations agree with one another.
2. A recommended quantity of soluble mineral product to apply in fertigation. (The amount of nutrients provided by irrigation water and acid additions to irrigation water are subtracted from the total nutrients needed to provide a more accurate recommendation.)
3. A recommended biological inoculant and humic acid to apply in fertigation.



The Genie Provides “Foliar Recommendations”

The foliar plan is intended as an optional supplement to the fertigation plan. It places greater weight on results from the plant sap test due to the fast turn-around from test to application and real-time nature of the test.

The foliar plan provides recommendations focused specifically on:

1. Minerals difficult to feed via fertigation because of strong probability of soil tie-up (trace minerals in a high pH environment)
2. Minerals that are severely deficient
3. Chelators
4. Biostimulants
5. Biological foliar inoculants

For a real-time walk-through of the tool, please email me at bryantm25@gmail.com
I love sharing it with anyone interested and am *always* open to feedback to improve it.