SOIL/PLNT_SCI 4313 : SEMESTER PROJECT

> SITE CHARACTERIZATION

[ROLLINS FARM]

- Haymond silt loam
  - + 0-3% slopes
  - + frequently floods
  - + well draining
  - + restrictive layer at 80 inches
  - + 2.20% OM
  - + bulk density = 1.43 g/cm^3

4R's
right form
right time
right rate
right place

> NUTRIENT MANAGEMENT PLAN

Using closest county w/ info...

2023 - 166.3
2022 - N/A
2021 - 178.1
2020 - 168.7
2019 - 131.1

AVERAGE = 161.05 lbs/acre

C : N : P : S
100 10 1 0.1

CROP SELECTION: CORN

-NITROGEN CALCULATION

$$\frac{161.05 \text{ lbs}}{1 \text{ acre}} \mid \frac{1.2 \text{ lbs N}}{1 \text{ lbs}} \mid \frac{193.26 \text{ lbs N}}{1 \text{ acre}}$$

ORGANIC N CALCULATION

based on top 12" of soil

BD = 1.43 g/cm³

OM = 2.20%

1 acre = 43560 ft² x 1 ft depth = 43560 ft³

$$\frac{43560\ ft^3}{1\ acre} \mid \frac{28316.8\ cm^3}{1\ ft^3} \mid \frac{1.43\ g}{1\ cm^3} \mid \frac{1763876125\ g\ dry\ soil}{1\ acre}$$

or

1.76×10^9 g dry soil / 1 acre

OM = 52% SOC

0.022 OM x 0.52 = 0.01144 SOC → 1.144% SOC

0.01144 SOC / 10 = 0.001144 SON → 0.1144% SON

$$\frac{1.76 \times 10^9\ g\ dry\ soil}{1\ acre} \mid \frac{1\ kg}{1000\ g} \mid \frac{0.001144\ ^{SON}}{1\ g\ dry\ s} \mid \frac{2013.44\ kg\ SON}{1\ acre}$$

MINERALIZATION

$$\frac{2013.44\ kg\ SON}{1\ acre} \mid 0.02 \mid \frac{40.27\ kg\ plant\ available\ N}{1\ acre}$$

2% MINERALIZATION RATE

USE EFFICIENCY AND TOTAL POUNDS NEEDED

65% N use efficiency of application
- Since this is an agricultural site most farmer friendly/ equipment friendly N fertilizer would be UREA (46-0-0)

TOTAL NEEDED = 193.26 lbs N / 1 acre
MINERALIZED = 40.27 kg plant available N / 1 acre

40.27 kg pa N	2.20 lbs	88.59 lbs N
1 acre	1 kg	1 acre

193.26 lbs N/ 1 acre - 88.59 lbs N / acre
= 104.67 lbs N / acre

$\frac{104.67}{65} = \frac{x}{100}$ x = 161.03 lbs N / acre needed @ 65 use efficiency

161.03 lbs N	100 lbs urea	350.07 lbs urea
1 acre	46 lbs N	1 acre

DROUGHT YEAR

2012 YIELD = 33.4 bu/acre

33.4 bu	1.2 lbs N	40.08 lbN
1 acre	1 bu	1 acre

40.08 lbs N/ acre - 88.59 lbs N/ acre = -48.51 lbN / acre

all of the 350.57 lbs urea would have been an overapplication

- PHOSPHORUS CALCULATION

ORGANIC P CALCULATION

1.76×10^9 g dry soil / 1 acre → 1.76×10^6 kg dry soil / 1 acre
1.144% SOC

0.01144 SOC / 100 = 0.0001144 SOP → 0.001144% SOP

$\frac{1.76 \times 10^9 \text{ g dry soil}}{1 \text{ acre}}$	$\frac{1 \text{ kg}}{1000 \text{ g}}$	$\frac{0.0001144 \text{ SOP}}{1 \text{ g dry soil}}$	$\frac{201.34 \text{ kg SOP}}{1 \text{ acre}}$

MINERALIZATION

$\frac{201.34 \text{ kg SOP}}{1 \text{ acre}}$	0.02	$\frac{4.03 \text{ kg plant available / solution P}}{1 \text{ acre}}$

2% mineralization assumption

SOIL TEST P

30 mg P / kg soil

$\frac{30 \text{ mg P}}{1 \text{ kg soil}}$	$\frac{1.76 \times 10^6 \text{ kg ds}}{1 \text{ acre}}$	$\frac{2.205 \times 10^{-6} \text{ lbs}}{1 \text{ mg}}$	$\frac{116.42 \text{ lbs P}}{1 \text{ acre}}$

* assumed 0.45 lbs P_2O_5 removal per bushel *
FERTILIZER CHOICE: 10-34-0 (ammonium polyphosphate)

$\frac{161.05 \text{ bu}}{1 \text{ acre}}$	$\frac{0.45 \text{ lbs } P_2O_5}{1 \text{ bu}}$	$\frac{72.47 \text{ lbs } P_2O_5}{1 \text{ acre}}$

* 15% P use efficiency of application *

$P = P_2O_5 / 2.29$

$2.29\,P = P_2O_5$

TOTAL NEEDED = 72.47 lbs P_2O_5 / 1 acre

MINERALIZED = 4.03 kg plant available / solution P / 1 acre

SOIL TEST = 116.42 lbs P / 1 acre

4.03 kg soil P / 1 acre	2.20 lbs / 1 kg	2.29	20.30 lbs P_2O_5 / 1 acre

116.42 lbs P / 1 acre	2.29	266.60 lbs P_2O_5 / 1 acre

PRESENT = 266.60 lbs P_2O_5 + 20.30 lbs P_2O_5

= 286.90 lbs P_2O_5 / 1 acre

NEEDED = 72.47 lbs P_2O_5 / acre

$\frac{72.47}{15} = \frac{x}{100} = 483.13$ lbs P_2O_5 / acre

* needed @ 15% use efficiency *

483.13 lbs P_2O_5 / acre − 286.90 lbs P_2O_5 / acre

= 196.23 lbs P_2O_5 / acre

196.23 lbs P_2O_5 / 1 acre	100 lbs APP / 34 lbs P_2O_5	577.11 lbs APP / 1 acre

NONE NEEDED 286.9 > 72.47

> INTEGRATED MANAGEMENT PLAN

$P = P_2O_5 / 2.29$

RECALCULATE P

2022 YIELD = 46.6 bu/acre soybeans (USDA NASS)
Soy needs ... 0.4 lbs P / bu (Iowa State)

46.6 bu	0.4 lbs P	2.29 lb P_2O_5	42.69 lbs P_2O_5
1 acre	1 bu	1 lb P	1 acre

PRESENT = 266.90 lbs P_2O_5
CORN = 72.47 lbs P_2O_5
SOY = 42.69 lbs P_2O_5

NO ADDITIONAL P_2O_5 / P FERT NEEDED

NEW N VALUE

N NEEDED = 104.67 lbs N / acre
CORN N NEEDED = 161.03 lbs N / acre @ 65% UEP
UREA NEEDED = 350.07 lbs / acre

SOY FIXED = 40 lbs N / acre
COVER CROP = 60% residual

161.03 lbs N/acre − 104.67 lbs N/acre = 56.36 lbs N/acre residual

53.36 lbs N/acre (residual) × 0.60 = 33.82 lbs N/acre

161.03 lbs N/acre − 40 lbs N/acre − 33.82 lbs N/acre = 87.21 lbs N/acre

87.21 lbs N	100 lbs urea	189 lbs Urea
1 acre	46 lbs N	1 acre