Soil Test to Fertilizer Blend Worksheet Name: _____

Using the below table of fertilizer prices and analysis, the NDSU soil guidelines, and the attached soil tests, numbered 1 – 2 complete the following questions.

Name	Analysis	Price per Ton	$/lb
Urea	46 – 0 – 0	$380	.19
MAP (Monoammonium phosphate)	11 – 52 – 0	$545	.2725
AMS (Ammonium sulfate)	21 – 0 – 0 – 24 (S)	$340	.17
Potash	0 – 0 – 60	$385	.1925

For Soil Test 1:

1. Looking at soil test one:
    a. How much nitrogen is in the soil
    b. How much nitrogen do you need to add for 160 bushels
    c. What phosphorus test was used?
    d. How much P2O5 do you need to add for 160 bushels?
    e. How much K20 do you need to add for 160 bushels?
    f. How much sulfur do you need to add for 160 bushels?

2. Using the NDSU guide, how much nitrogen would you have to add to get 160 bushel yield. How does this compare to the Agvise number? NOTE: The technique use in class only works if the numbers are linearly related. NDSU guide is

3. Using the NDSU guide, how much P2O5 would you have to add to get 160 bushel yield. How does this compare to the Agvise number?

4. Using the above four fertilizers, design a blend for one acre with a yield goal of 160 pounds.
    a. How much of the above fertilizers do you use? Use AGVISE N P K S
    b. What is your cost per acre
    c. What is the new analysis of your blend?

5. Given the same soil test numbers and the NDSU guide, design a blend for soybeans with a yield potential of 50 bushels.
    a. How much of the above fertilizers do you use?
    b. What is your cost per acre
    c. Does analysis of your blend change?

For Soil Test 1:

6. Looking at soil test one:
    a. How much nitrogen is in the soil
    b. How much nitrogen do you need to add for 170 bushels
    c. How much P2O5 do you need to add for 170 bushels?
    d. How much K20 do you need to add for 170 bushels?
    e. How much sulfur do you need to add for 170 bushels?

7. Using the NDSU guide, how much nitrogen would you have to add to get 170 bushel yield. How does this compare to the Agvise number?

8. Using the NDSU guide, how much P2O5 would you have to add to get 170 bushel yield. How does this compare to the Agvise number?

9. Using the above four fertilizers, design a blend for one acre with a yield goal of 160 pounds.
    a. How much of the above fertilizers do you use? Use AGVISE
    b. What is your cost per acre
    c. What is the new analysis of your blend?

10. Given the same soil test numbers and the NDSU guide, design a blend for alfalfa with a 6 ton yield.
    a. How much of the above fertilizers do you use?
    b. What is your cost per acre

For Soil Test 2:

11. Looking at soil test two:
    a. How much nitrogen is in the soil
    b. How much nitrogen do you need to add for 180 bushels
    c. How much P2O5 do you need to add for 180 bushels?
    d. How much K20 do you need to add for 180 bushels?
    e. How much sulfur do you need to add for 180 bushels?

12. Using the NDSU guide, how much nitrogen would you have to add to get 180 bushel yield. How does this compare to the Agvise number?

13. Using the NDSU guide, how much K2O would you have to add to get 180 bushel yield. How does this compare to the Agvise number?

14. Using the above four fertilizers, design a blend for one acre with a yield goal of 180 pounds. Assume you bump your Sulfur from 0lbs to 10 lbs per acre.
    a. How much of the above fertilizers do you use? USE AGVISE
    b. What is your cost per acre
    c. What is the new analysis of your blend?

15. Given the same soil test numbers and the NDSU guide, design a blend for soybeans with a yield potential of 30 bushels. How much of the above fertilizers do you use?

For Soil Test 2:

16. Looking at soil test two:
    a. How much nitrogen is in the soil
    b. How much nitrogen do you need to add for 160 bushels
    c. How much P2O5 do you need to add for 160 bushels?
    d. How much K20 do you need to add for 160 bushels?
    e. How much sulfur do you need to add for 160 bushels?

17. Using the above four fertilizers, design a blend for one acre with a yield goal of 160 pounds. Assume you bump your Sulfur up to 15 lbs per acre. USE AGVISE
    a. How much of the above fertilizers do you use?
    b. What is your cost per acre
    c. What is the new analysis of your blend?
    d. How much cheaper would the blend be if you included no phosphorus potassium or sulfur?

No Salt Issues

NDSU EXTENSION SERVICE

Nutrient In The Soil		Interpretation
0-6"	19 lb/ac	
Olsen	9 ppm	
	189 ppm	
0-6"	6 lb/ac	
0-6"	18 lb/ac	
	2.6 ppm	
	0.61 ppm	
	6.4 ppm	
	3.3 ppm	
	0.59 ppm	
	685 ppm	
	2600 ppm	
	74 ppm	
	3.6 %	
	0.2 %	
0-6"	0.33 mmho/cm	

1st Crop Choice		
Corn-Grain		
YIELD GOAL		
150 Bu		
SUGGESTED GUIDELINES		
Band		
LB/ACRE		APPLICATION
N	154	
P_2O_5	52	Band *
K_2O	10	Band (2x2) *
Cl		Not Available
S	5	Band (Trial)
B	0	
Zn	2	Band
Fe	0	
Mn	0	
Cu	0	
Mg	0	
Lime		

2nd Crop Choice		
Corn-Grain		
YIELD GOAL		
170 Bu		
SUGGESTED GUIDELINES		
Band		
LB/ACRE		APPLICATION
N	168	
P_2O_5	55	Band *
K_2O	10	Band (2x2) *
Cl		Not Available
S	5	Band (Trial)
B	0	
Zn	2	Band
Fe	0	
Mn	0	
Cu	0	
Mg	0	
Lime		

3rd Crop Choice		
Corn-Grain		
YIELD GOAL		
180 Bu		
SUGGESTED GUIDELINES		
Band		
LB/ACRE		APPLICATION
N	178	
P_2O_5	59	Band *
K_2O	10	Band (2x2) *
Cl		Not Available
S	5	Band (Trial)
B	0	
Zn	2	Band
Fe	0	
Mn	0	
Cu	0	
Mg	0	
Lime		

Soil pH	Buffer pH	Cation Exchange Capacity	% Base Saturation (Typical Range)				
			% Ca	% Mg	% K	% Na	% H
7.2		21.2 meq	61.4	34.8	2.3	1.5	

No Issues

Sample a highly productive area in the field so you know what a "good" soil sample looks like. Then sample a salt affected area separately so you can compare the soil tests.

Composite sampling across an entire field where parts of it are salt-affected is no longer useful for making management decisions.

Soil Test Examples provided by AGVISE LABORATORIES

Saline Soil

NDSU EXTENSION SERVICE

(2)

Nutrient In The Soil		Interpretation
Nitrate	0-6" 81 lb/ac	
Phosphorus	Olsen 43 ppm	
Potassium	203 ppm	
Chloride	0-6" 395 lb/ac	
Sulfur	0-6" 120 +lb/ac	
Boron	2.9 ppm	
Zinc	0.37 ppm	
Iron	4.1 ppm	
Manganese	2.5 ppm	
Copper	0.77 ppm	
Magnesium	2553 ppm	
Calcium	6652 ppm	
Sodium	70 ppm	
Org Matter	3.5 %	
Carbonate (CCE)	2.6 %	
Salinity (EC $_e$)	0-6" 4.03 mmho/cm	

1st Crop Choice		
Corn-Grain		
YIELD GOAL		
160 BU		
SUGGESTED GUIDELINES		
Band		
LB/ACRE		APPLICATION
N	81	
P_2O_5	15	Band (2x2) *
K_2O	10	Band (2x2) *
Cl		Not Available
S	0	
B	0	
Zn	5	Band
Fe	1	Band
Mn	0	
Cu	0	
Mg	0	
Lime		

2nd Crop Choice		
Corn-Grain		
YIELD GOAL		
170 BU		
SUGGESTED GUIDELINES		
Band		
LB/ACRE		APPLICATION
N	93	
P_2O_5	15	Band (2x2) *
K_2O	10	Band (2x2) *
Cl		Not Available
S	0	
B	0	
Zn	5	Band
Fe	1	Band
Mn	0	
Cu	0	
Mg	0	
Lime		

3rd Crop Choice		
Corn-Grain		
YIELD GOAL		
180 BU		
SUGGESTED GUIDELINES		
Band		
LB/ACRE		APPLICATION
N	105	
P_2O_5	15	Band (2x2) *
K_2O	10	Band (2x2) *
Cl		Not Available
S	0	
B	0	
Zn	5	Band
Fe	1	Band
Mn	0	
Cu	0	
Mg	0	
Lime		

Soil pH	Buffer pH	Cation Exchange Capacity	% Base Saturation (Typical Range)				
			% Ca	% Mg	% K	% Na	% H
8.1		65.4 meq	66.2	32.6	0.8	0.5	

Issues with the Soil

Saline soils inhibit/reduce germination and also put crops into drought stress

Often occurs: along ditch, seep, in areas with high water table

Saline areas may grow in size if not actively managed

Management Options

EC_e 0.3 – 2: grow whatever, but be aware if EC approaches a value of 2

EC_e 2 – 4: ditching, use more salt-tolerant crops, cover for longer, mulch, do not till, tiling

EC_e 4+: kochia management, perennial species, ditching, tiling, do not till

soybean, corn, grow anything — Yield Loss (1.5/1.7)

EC_e = 0 → EC_e = 2

increasing salinity

oats wheat rye sugarbeet canola sunflower safflower barley

EC_e = 2 → EC_e = 4

increasing salinity

lambsquarters mustard foxtail barley kochia

EC_e = 4 → EC_e = 10

increasing salinity

1. A 19 lbs

B. 154 lbs

C. Olsen

D. 52 lbs

E. 10 lbs

F. 5 lbs

2. $\frac{150}{180} = \frac{160}{x}$ ← Yield goal / ← lbs fertilizer

$160 \times 180 = 150x$

$28800 = 150x$

$192 = x$ lbs N - NDSU

$154 + 19 = 173$ lbs N - Agvise

3. $\frac{42}{150} = \frac{x}{160}$

$6720 = 150x$

$x = 44.8$ NDSU

52 Agvise

$\frac{.28 \text{ lb } P_2O_5}{1 \text{ bu}} \times 160 \text{ bu}$

4. 154 - 52 - 10 - 5 ← pounds per acre

Work Right to left

Nitrogen Tally

154 lbs

In AMS - 4.41

149.59

In Map - 11

138.59

or

139

Fert #1 - 21-0-0-24-AMS

x .24% = 5 lbs S

21 pounds AMS

Nitrogen in - 21 pounds x .21 = 4.41 lbs N

Fert #2 Potash - 0-0-60

x .60% = 10 lbs K_2O

x = 17 lbs Potash

9.

A.

Fert #3 MAP 11-52-0

x .52% = 52 lbs P_2O_5

x = 100 lbs MAP

Nitrogen 100 x .11 = 11 lbs N

Fert #4 - Urea 46-0-0

x .46% = 139 lbs N

x = 302 lbs UREA

4. continued

B. Ams $\frac{\text{lbs}}{21} \times \frac{\$/16}{.17} = \$3.57$

Potash $17 \times .1925 = \$3.2725$

MAP $100 \times .2725 = \$27.25$

UREA $302 \times .19 = \$57.38$

$\$91.4725$

C.

Fert	lbs	Analysis
AMS	21	21-0-0-24
Potash	17	0-0-60
MAP	100	11-52-0
UREA	302	46-0-0
	440 lbs	

(from #A)

N	P	K	S
4.41	—	—	5
—	—	10	—
11	52	—	—
139	—	—	—
154	52	10	5

$\frac{154}{440}$ $\frac{52}{440}$ $\frac{10}{440}$ $\frac{5}{440}$

.35 .12 .02 .01

35 - 12 - 2 - 1

5.

P	lbs Needed	K
11 lbs		0

MAP 11-52-0

A. $x \cdot 52\% = 11$

22 lbs MAP

B. $22 \text{ lbs} \times \$5/16 = \$6.00$

C. Nope

6. A 19 lbs

B 166

C. 55

D 10

E 5

7. Yield $\frac{150}{180} = \frac{170}{x}$

Nitrogen

$150 \cdot 170 = 180x$

$25500 = 180x$

142 lbs

8. P_2O_5 $\frac{42}{150} = \frac{x}{170}$

Yield

$150x = 42 \cdot 170$

$150x = 7140$

48 lbs

9. A. lbs 166 55 10 5
N P K S

Fert #1 AMS 21-0-0-24

x .24% = 5 lbs

21 lbs AMS

Nitrogen 21 lbs x .21 = 4.41 lbs N

Fert #2 0-0-60 potash

x .60% = 10 lbs

17 lbs Potash

Fert #3 MAP 11-52-0

x .52% = 55

x = 106 lbs MAP

Nitrogen 106 lbs x 11% = 11.66 lbs

Fert #4 Urea 46-0-0

x .46% = 150 lbs

x = 326 lbs Urea

Nitrogen Tally

Nitrogen in

166 lbs

AMS → 4.41 lbs

149.59

MAP → - 11.66

149.93 - N

150 lbs N

9. B.

	lbs	$/16	= $
AMS	21	.17	$3.57
Potash	17	.1925	$3.2725
MAP	106	.2725	$28.885
UREA	326	.19	$62
			$97.7275

9. C

Fert	lbs	Analysis
AMS	21	21-0-0-24
Pot.	17	0-0-60
MAP	106	11-52-0
UREA	326	46-0-0
	470	

N	P	K	S
4.41	—	—	5
—	—	10	—
11.66	55	—	—
150	—	—	—
166	55	10	5

$\frac{166}{470}$ $\frac{55}{470}$ $\frac{10}{470}$ $\frac{5}{470}$

.35 .12 .02 .01

35 - 12 - 2 - 1

10. lbs 45 - 0

P_2O_5 K_2O

A. x · 52% = 45

MAP
11-52-0

87 lbs MAP

B. 87 lbs × .2725 = $23.58

11. A 81 lbs

B 105 lbs

C 15 lbs

D 10 lbs

E 0 lbs

12. Yield $\frac{150}{\text{Fert } 180} = \frac{180}{x}$

$180 \cdot 180 = 150x$

$32400 = 150x$

216 lbs vs 186 lbs Agvise

(13) 0 vs 10 Agvise

	N	P	K	S
14. A.	105	15	10	10

Fert #1 AMS 21-0-0-24

$x \cdot 24\% = 10$

$x = 42$ lbs Ams

Nitrogen $42 \times .21 = \sim 8.82$ lbs

Fert #2 Potash 0-0-60

$x \cdot 60\% = 10$

$x = \sim 17$ lbs Potash

Fert #3 Map 11-52-0

$x \cdot 52\% = 15$

$x = \sim 29$ lbs MAP

Nitrogen $29 \times .11 = 3.19$

Fert #4 Urea 46-0-0

$x \cdot 46\% = 93$

$x = \sim 202$ lbs Urea

Nitrogen Tally

105

Ams → - 8.82

96.18 lbs

- 3.19

~93 lbs

14. B

Fert	lbs	$/16	= $
AMS	42	.17	7.14
Potash	17	.1925	3.2725
MAP	29	.2725	7.9025
UREA	202	.19	38.38
			$56.695

C.

Fert	lbs	Analysis	N	P	K	S
AMS	42	21-0-0-24	8.82	—	—	10
Potash	17	0-0-60	—	—	10	—
MAP	29	11-52-0	3.19	15	—	—
UREA	202	46-0-0	93	—	—	—
	290		105	15	10	10

$\frac{105}{290}$ $\frac{15}{290}$ $\frac{10}{290}$ twice ←

.36 .05 .03 .03

35 - 5 - 3 - 3

15. Add Zero - NDSU

16. A 81 lbs
B 81 lbs
C 15 16
D 10 16
E. 0 16s

17. A. 81 • 15 • 10 • 15 ← lbs

Fert #1 AMS 21-0-0-24

$x \cdot .24\% = 15$

$x = 62.5$ lbs AMS

Nitrogen = 62.5 lbs x .21 = 13.125 lbs N

Fert #2 Potash 0-0-60

$x \cdot .6\% = 10$

X ~ 17 lbs Potash

Fert #3 11-52-0 - MAP

$x \cdot .52\% = 15$ lbs

$x = 28.846$ lb MAP

~29 lbs MAP

Nitrogen = 29 lbs x 11% = 3.19 lbs N

Fert #4 Urea 46-0-0

$x \cdot 46\% = 65$

x ~ 142 lbs Urea

Nitrogen Tally

81

AMS - 13.125

67.875

- 3.19

64.685

~

65 lbs

17. B.

Fertilizer	lbs	$/16	$
AMS	62.5	.17	10.625
Potash	17	.1925	3.2725
MAP	29	.2725	7.9025
Urea	142	.19	-26.98
Totals			$48.78/acre

17. C

Fert.	lbs	Analysis	N	P	K	S
AMS	62.5	21-0-0-24	13.125	—	—	15
Potash	17	0-0-60	—	—	10	—
MAP	29	11-52-0	3.19	15	—	—
UREA	157	46-0-0	65	—	—	—
	265.5		81	15	10	15

81	15	10	15
265.5	265.5	265.5	265.5
.31	.06	.04	.06

31-6-4-6

17. D. cost 1

$48.78 / acre

cost 2

81 lbs from UREA - 46-0-0

x .46% = 81

~177 lbs x $.19/lb

$33.63 / 1 acre

48.78 - 33.63

$15.15