Dynamics of Fluid Fertilizer Production

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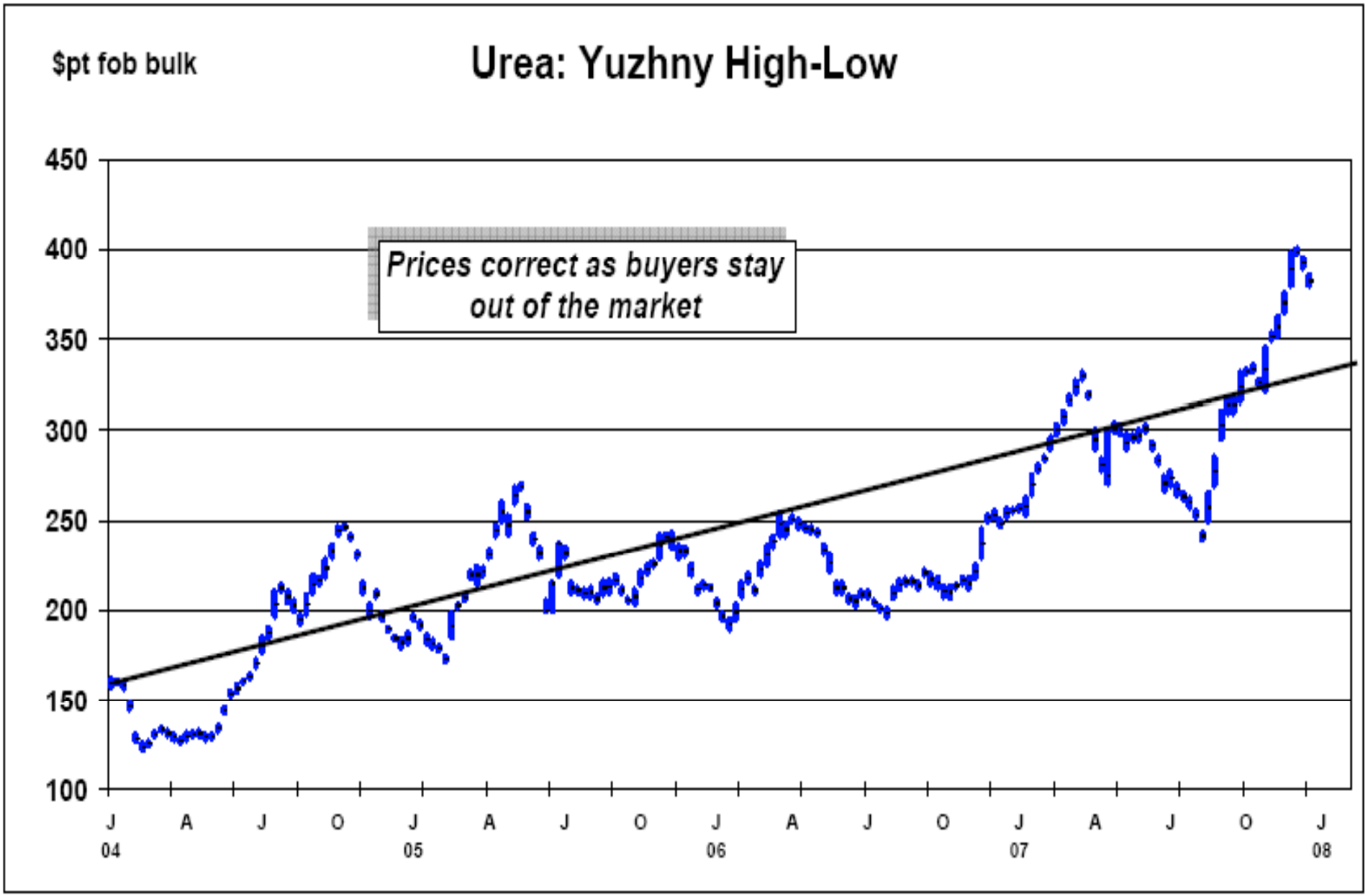
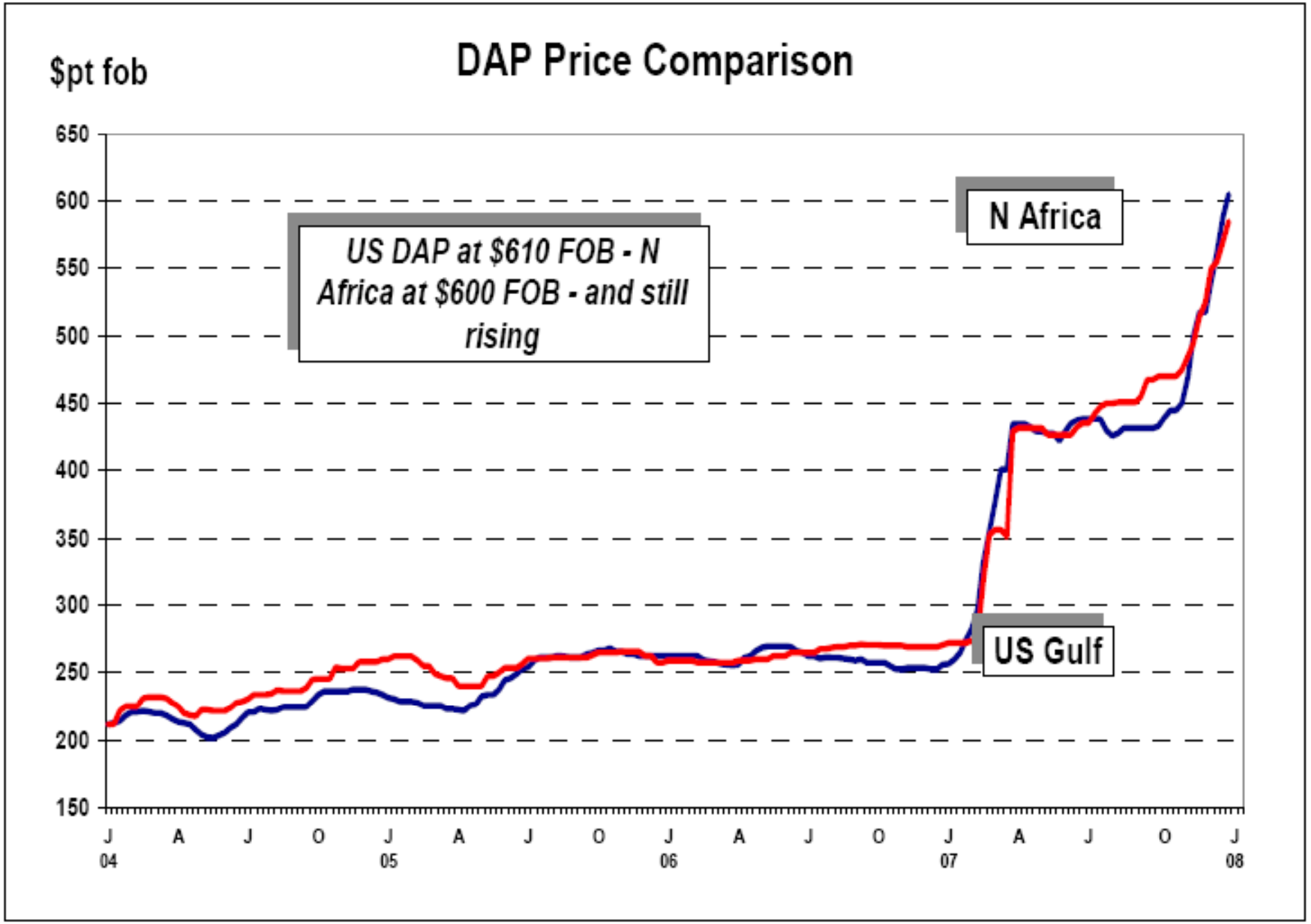

$pt fob bulk
Urea: Yuzhny High-Low
Prices correct as buyers stay out of the market
450
400
350
300
250
200
150
100
J
A
J
O
J
A
J
O
J
A
J
O
J
A
J
O
J
04
05
06
07
08


DAP Price Comparison
$pt fob
650
600
550
500
450
400
350
300
250
200
150
US DAP at $610 FOB - N Africa at $600 FOB - and still rising
N Africa
US Gulf
J
04
A
J
O
J
05
A
J
O
J
06
A
J
O
J
07
A
J
O
J
08

The way it was

- **Converting urea or ammonium nitrate to a solid form is expensive**
- **Verses directly producing UAN**
- **This was the natural advantage of fluid fertilizer production in the US since we produced both here.**

The way it is

- Many ammonia plants in the US closed
- Natural gas is worth more heating homes
- Natural gas is looking for a home internationally
- Nitrogen products will increasingly be imported, mostly as urea
- The natural advantage of fluids is ending

Basic Dynamics

- Most any input with nutrient value can be dissolved in water
- How much water? – salt out or viscosity
- How much energy (heat)?
- Cost of nutrient per acre?
- How much mixing time? (salt out vs. product temperature)

Form-U-Share® Can Help

- Look at many alternative inputs
- Select lowest cost mix subject to
  Grower needs & Technical requirements
- Compute marginal cost of these needs
- Evaluates worth of alternative inputs
- Evaluates high vs. low analysis products
- Stretches your imagination on alternatives

Form-U-Share® Examples

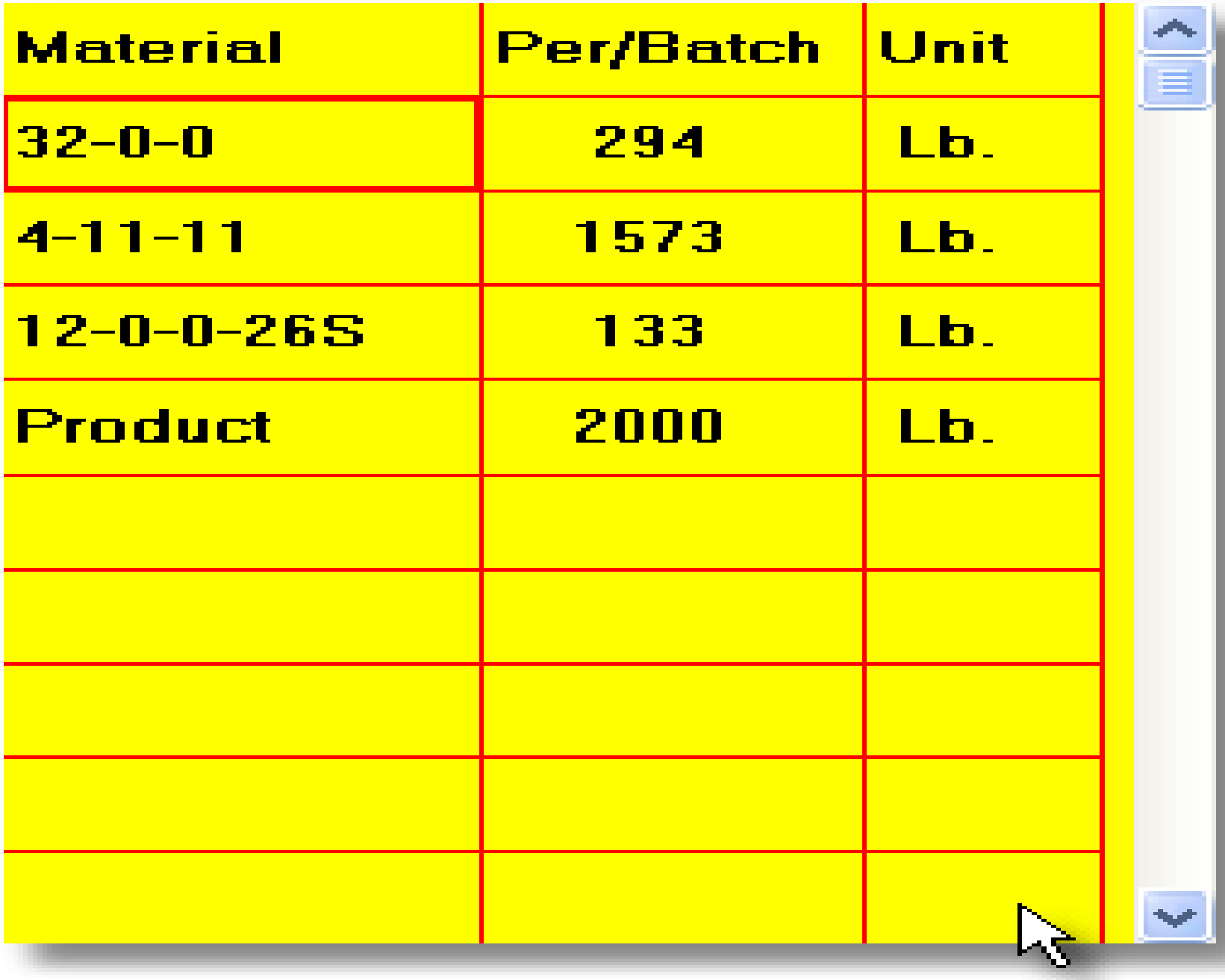
- Cold mixing (32-0-0 10-34-0 4-11-11)
- Salt out temperatures (0-0-62)
- Controlling total water
- Using hot water with urea
- Using ammonium sulfate
- Reacting phosphoric acid
- Reacting sulfuric acid
- Don’t forget suspensions

Cold Mixing Example

- 32-0-0
- 10-34-0
- 4-11-11
- 0-0-12
- 12-0-0-26 S
- 0-0-25-17 S
- Water


Per Acre
Analysis
Nitrogen > 50.00 Lb. 8.65
Phosphate > 50.00 Lb. 8.65
Potash > 50.00 Lb. 8.65
Sulfur > 10.00 Lb. 1.73
Application rate > -- Gal. 9.19
Chlorine < ++ Lb. 6.61
Start
N
P
K
Enter
Load
Calc
Itemize
Grade
Print
Mix
Spread
Bag It
Order
Need
Acres 3.460
Batches 1
Rate 578
Max Lbs. 2000


Mixed Fert $286.60 / Ton $286.59
Spreading 12.11
Mixing Charge 0.00
Applied $298.71 / Ton 298.70
Other 0.00
Total $298.70
3.5 Acres $86.33 / Acre
1.000 Ton 1 Batch
3.5 Acres / Batch Nozzle type - 10
578 Lbs/Acre Tip = 70
53.12 Gal/Acre 120 in.
10 mph.
SaltIndex = 28 31 psi.
Water = 46.3 %
10.9 Lbs/Gal 183.8 Gal

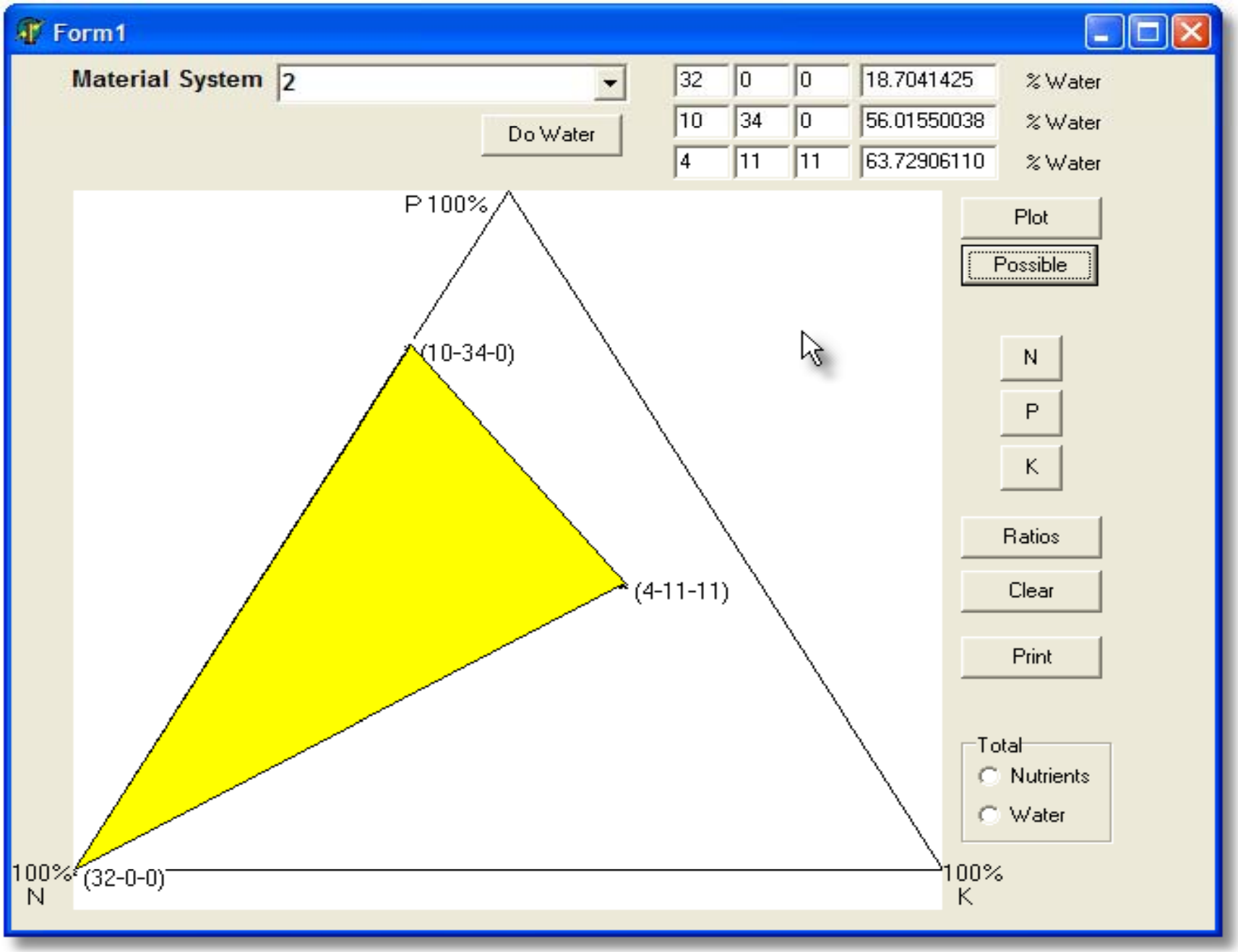

Material
Per/Batch
Unit
32-0-0
294
Lb.
4-11-11
1573
Lb.
12-0-0-26S
133
Lb.
Product
2000
Lb.

Nutrient Values

Nutrient	Rate (Lbs)	Value ($/Lb)	Total ($)
• Nitrogen	50.000	0.625	31.25
• Phosphate	50.000	0.309	15.44
• Potash	50.000	0.373	18.65
• Sulfur	10.000	0.092	0.92
• Total			66.26

Substitution Cost

Material Name	Unit	Cost ($/Unit)	Value ($/Unit)	Difference ($/Unit)
Water	Ton	0.01	0.00	0.01
28-0-0	Ton	355.00	350.00	5.00
30-0-0	Ton	380.00	375.00	5.00
11-37-0	Ton	374.00	366.03	7.97
10-34-0	Ton	335.00	335.00	0.00
0-0-12	Ton	90.00	89.52	0.48
0-0-25-17 S	Ton	315.00	186.50	128.50
12-0-0-26 S	Ton	198.00	150.00	48.00
46-0-0	Ton	495.00	575.00	-80.00
0-0-62	Ton	210.00	262.50	-52.50
21-0-0-24 S	Ton	376.00	462.51	-86.51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Material System
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Do Water
32
0
0
18.7041425
% Water
10
34
0
56.01550038
% Water
4
11
11
63.72906110
% Water
P 100%
(10-34-0)
(4-11-11)
100%
N
(32-0-0)
100%
K
Plot
Possible
N
P
K
Ratios
Clear
Print
Total
Nutrients
Water

Material Systems

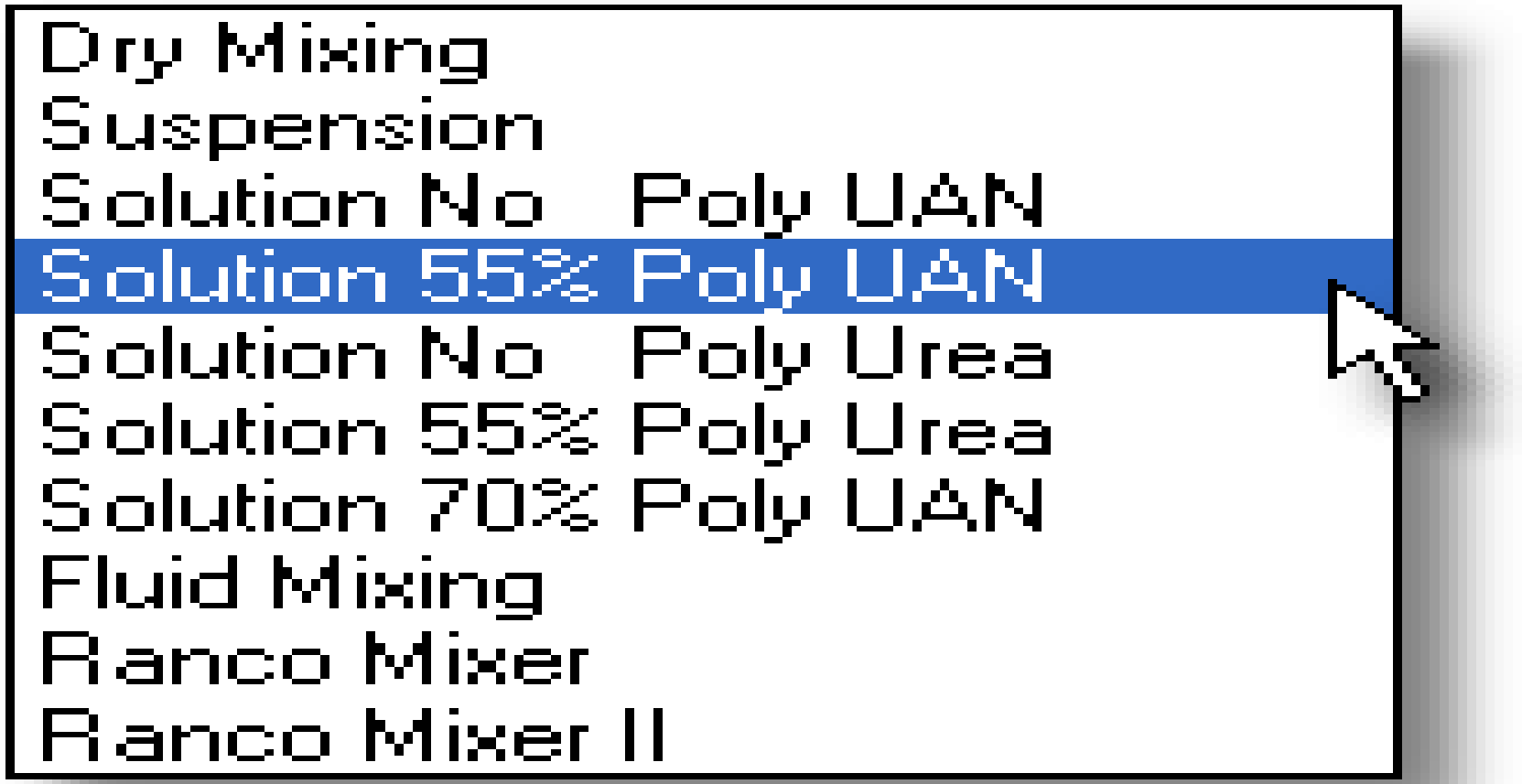
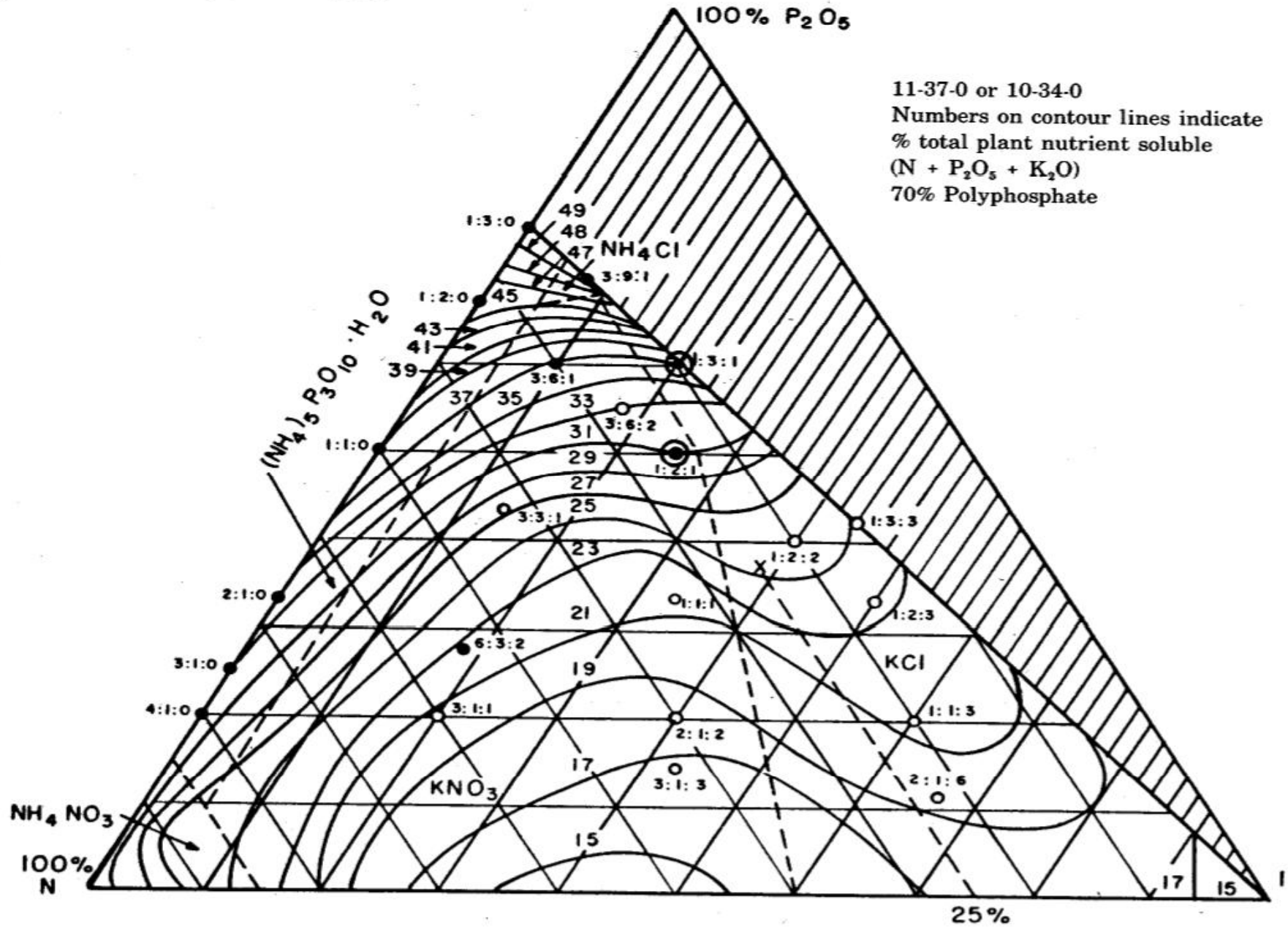
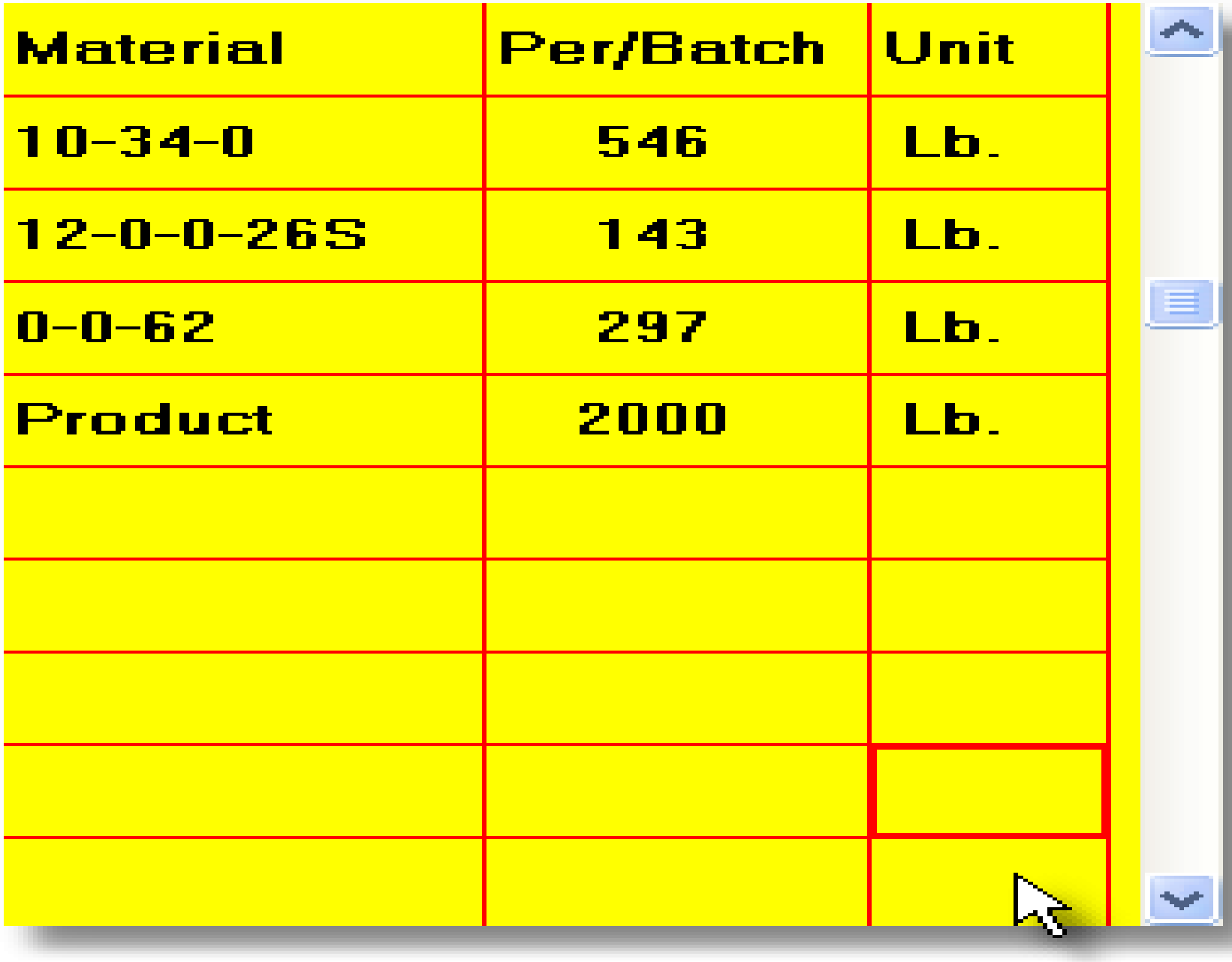


Figure 3.7: System 11-37-0, UAN solution, potassium chloride, water at 32°F.




Mixed Fert $290.66 / Ton $290.66
Spreading 12.98
Mixing Charge 0.00
Applied $303.64 / Ton 303.64
Other 0.00
Total $303.64
3.7 Acres $81.85 / Acre
1.000 Ton 1 Batch
3.7 Acres / Batch
539 Lbs/Acre
50.86 Gal/Acre
SaltIndex = 32
Nozzle type - 10
Tip = 60
120 in.
10 mph.
37 psi.
Water = 50.9 %
10.6 Lbs/Gal
Salt out 55 F
188.7 Gal



Material	Per/Batch	Unit
10-34-0	546	Lb.
12-0-0-26S	143	Lb.
0-0-62	297	Lb.
Product	2000	Lb.


Mixed Fert $241.53 / Ton $241.52
Spreading 10.79
Mixing Charge 0.00
Applied $252.32 / Ton 252.30
Other 0.00
Total $252.30
3.1 Acres $81.86 / Acre
1.000 Ton 1 Batch
3.1 Acres / Batch Nozzle type - 10
649 Lbs/Acre Tip = 80
64.04 Gal/Acre 120 in.
10 mph.
SaltIndex = 34 32 psi.
Water = 59.2 %
10.1 Lbs/Gal 197.4 Gal
Salt out 55 F Product 62 F

Material	Per/Batch	Unit
Hot water	278	Lb.
Water	607	Lb.
32-0-0	295	Lb.
10-34-0	453	Lb.
12-0-0-26S	119	Lb.
0-0-62	247	Lb.
Product	2000	Lb.

Material	Per/Batch	Unit
Hot water	566	Lb.
Water	408	Lb.
10-34-0	454	Lb.
12-0-0-26S	119	Lb.
0-0-62	247	Lb.
46-0-0	206	Lb.
Product	2000	Lb.

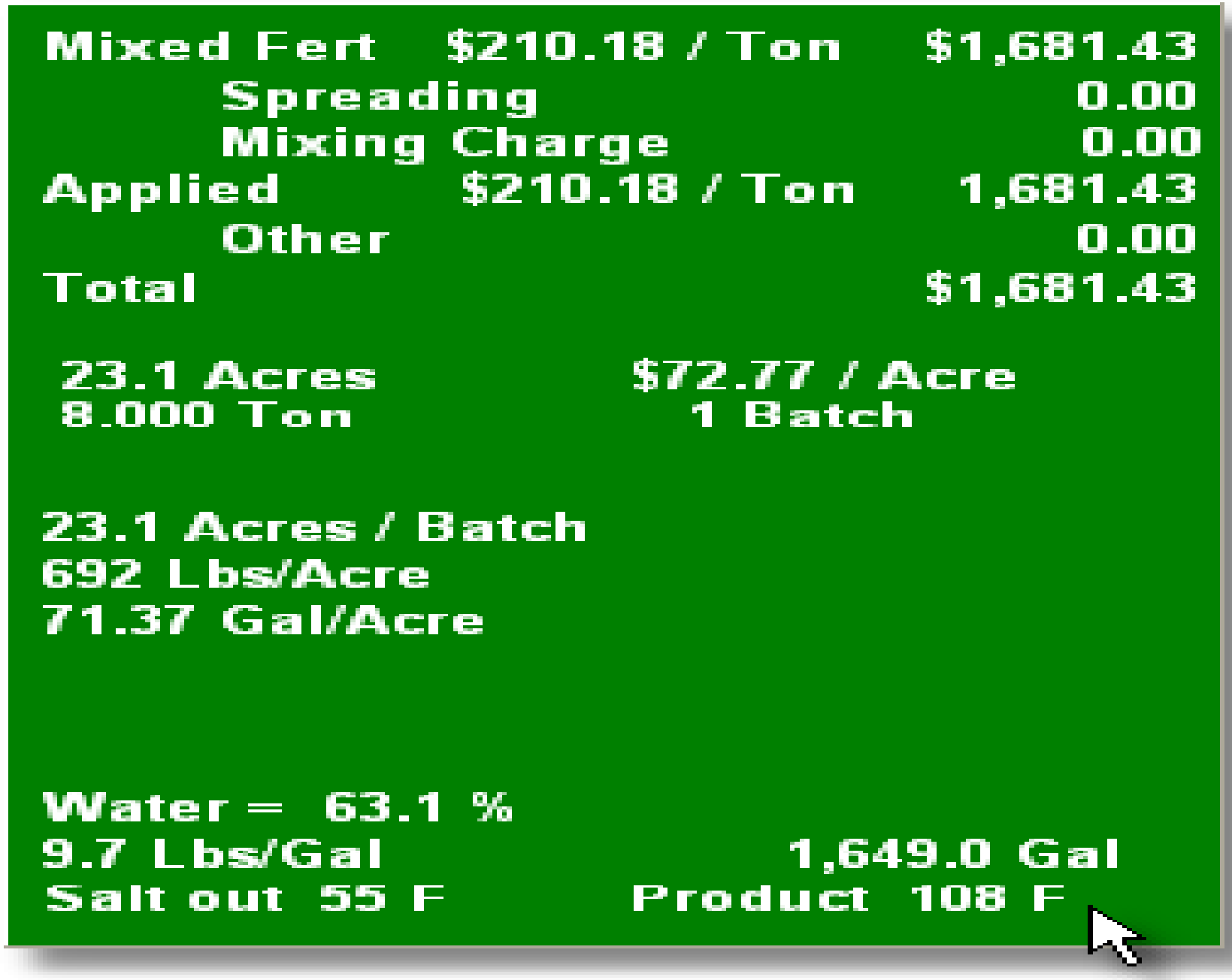
Thermodynamic Balances

- Heat of chemical reaction
- Heat of solution
- Heat capacity
- Temperature of original inputs
- Temperature of hot water
- Temperature of product (mixing time)

Ammonium Phosphate Reactions

(Kg-Cal/mole)

- Monoammonium phosphate
- $NH_3 + H_3PO_4 \rightarrow NH_4H_2PO_4 + Heat$
- (-16.04) L (-306.53) L (-345.38) C (22.81)
  (-339.07) L (16.50)
- Diammonium phosphate
- $2\ NH_3 + H_3PO_4 \rightarrow (NH_4)_2HPO_4 + Heat$
- (2x-16.04) L (-306.53) L (-374.50) C (35.89)

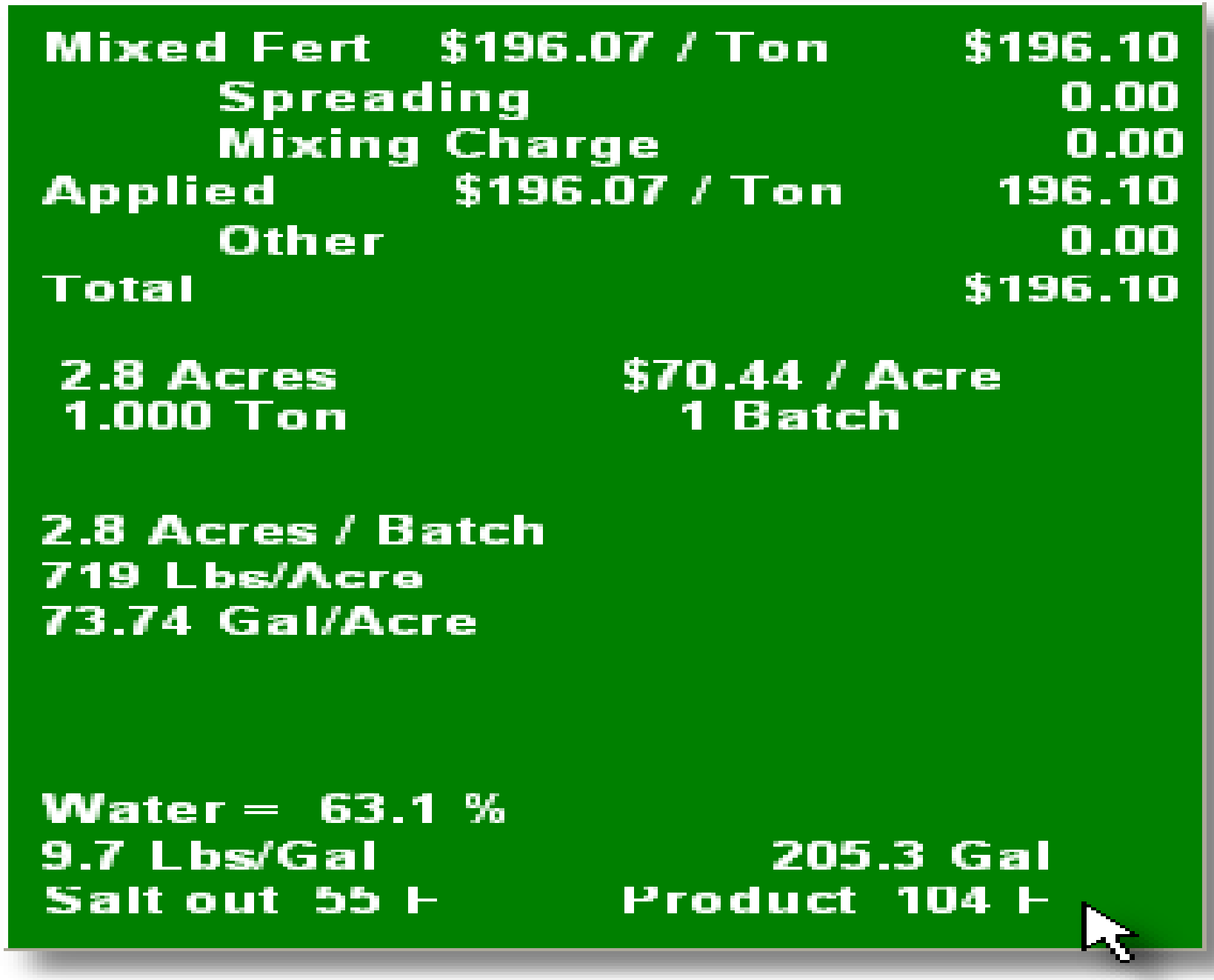

Mixed Fert $210.18 / Ton $1,681.43
Spreading 0.00
Mixing Charge 0.00
Applied $210.18 / Ton 1,681.43
Other 0.00
Total $1,681.43
23.1 Acres $72.77 / Acre
8.000 Ton 1 Batch
23.1 Acres / Batch
692 Lbs/Acre
71.37 Gal/Acre
Water = 63.1 %
9.7 Lbs/Gal 1,649.0 Gal
Salt out 55 F Product 108 F

Material	Per/Batch	Unit
Water	1151	Lb.
0-54-0	267	Lb.
82-0-0	59	Lb.
12-0-0-26 S	111	Lb.
46-0-0	180	Lb.
0-0-62	231	Lb.
Product	2000	Lb.


Mixed Fert $197.22 / Ton $197.25
Spreading 0.00
Mixing Charge 0.00
Applied $197.22 / Ton 197.25
Other 0.00
Total $197.25
2.8 Acres $70.52 / Acre
1.000 Ton 1 Batch
2.8 Acres / Batch
715 Lbs/Acre
74.34 Gal/Acre
Water = 63.1 %
9.6 Lbs/Gal 207.9 Gal
Salt out 55 F Product 153 F

Material	Per/Batch	Unit
Water	1192	Lb.
0-54-0	259	Lb.
H2SO4 93%	87	Lb.
82-0-0	84	Lb.
46-0-0	154	Lb.
0-0-62	224	Lb.
Product	2000	Lb.

Material	Per/Batch	Unit
Water	1198	Lb.
0-54-0	258	Lb.
82-0-0	56	Lb.
21-0-0-24 S	116	Lb.
46-0-0	149	Lb.
0-0-62	223	Lb.
Product	2000	Lb.

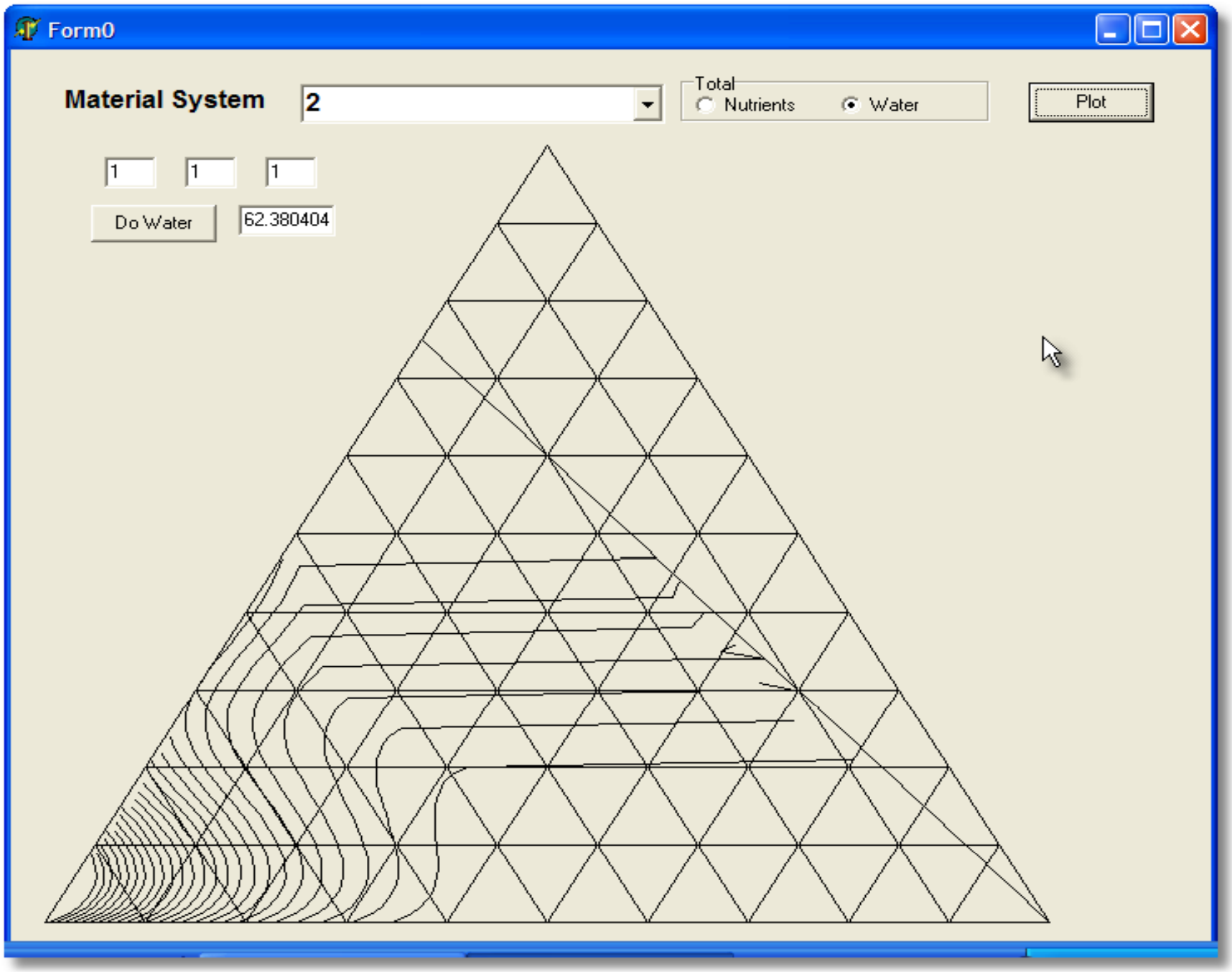

Mixed Fert $196.07 / Ton $196.10
Spreading 0.00
Mixing Charge 0.00
Applied $196.07 / Ton 196.10
Other 0.00
Total $196.10
2.8 Acres $70.44 / Acre
1.000 Ton 1 Batch
2.8 Acres / Batch
719 Lbs/Acre
73.74 Gal/Acre
Water = 63.1 %
9.7 Lbs/Gal 205.3 Gal
Salt out 55 Product 104

Example Summary

- Cold Mix (4-11-11) $86.33 / Acre
- Cold Mix (0-0-62) $81.85 / Acre
- Cold Mix (Hot water) $81.86 / Acre
- Hot Mix (0-54-0) $72.77 / Acre
- Hot Mix (H_2SO_4) $70.52 / Acre
- Hot Mix (21-0-0) $70.44 / Acre

Form-U-Share Edit Data

Mix Name	N	P	K	S	Zn	Watr	Den	Wt
Water	0.00	0.00	0.00	0.00	0.00	100.00	239.50	1.00
32-0-0	32.00	0.00	0.00	0.00	0.00	20.00	180.52	1.00
10-34-0	10.00	34.00	0.00	0.00	0.00	38.00	170.94	1.00
4-11-11	4.00	11.00	11.00	0.00	0.00	51.70	184.69	1.00
0-0-62	0.00	0.00	62.00	0.00	0.00	0.00	120.91	1.00
12-0-0	12.00	0.00	0.00	26.00	0.00	36.00	179.43	1.00
10-0-0	10.00	0.00	0.00	5.00	10.00	60.00	189.38	1.00
Lasso	0.00	0.00	0.00	0.00	0.00	0.00	200.00	1.00
Squadron	0.00	0.00	0.00	0.00	0.00	0.00	200.00	1.00
Product	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.00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Water
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