# ECONOMIC WALK THROUGH A DRY FERTILIZER PLANT

Phil Morrow, Agriliance

There are three simple steps in fertilizer handling.

1. TAKE FERTILIZER IN

2. STORE IT.

3. SEND IT BACK OUT

| ASSUME LABOR COST AT | $ 15.00 | PER HOUR |
|---|---|---|

## Step ONE: IN -- FROM THE DELIVERING VEHICLE TO THE BIN

### A. Annual repairs and maintenance of unloading site -- labor only.

General clean up and maintenance irrespective of level of use.

| | MIN | MAX | TYPICAL | US | THEM |
|---|---|---|---|---|---|
| HRS/YR | 8 | 40 | 20 | | |
| $ | $ 120 | $ 600 | $ 300 | | |

**COST/TON YEAR (Unloading site maintenance)**

| TONS/YR | MIN | MAX | TYPICAL | US | THEM |
|---|---|---|---|---|---|
| | $ 120 | $ 600 | $ 300 | | |
| 3,000 | $ 0.04 | $ 0.20 | $ 0.10 | | |
| 6,000 | $ 0.02 | $ 0.10 | $ 0.05 | | |
| 9,000 | $ 0.01 | $ 0.07 | $ 0.03 | | |
| 12,000 | $ 0.01 | $ 0.05 | $ 0.03 | | |
| 15,000 | $ 0.01 | $ 0.04 | $ 0.02 | | |
| 18,000 | $ 0.01 | $ 0.03 | $ 0.02 | | |
| 21,000 | $ 0.01 | $ 0.03 | $ 0.01 | | |
| 24,000 | $ 0.01 | $ 0.03 | $ 0.01 | | |

| | | |
|---|---|---|
| BEST CASE | $ 0.01 | /ton |
| WORST CASE | $ 0.20 | /ton |

## B. UNLOADING -- labor only.

| | | | MIN | MAX | TYPICAL | | US | THEM |
|---|---|---|---|---|---|---|---|---|
| RAIL | HRS/CAR | | 1 | 6 | 2 | | | |
| | $/CAR | | $ 15 | $ 90 | $ 30 | | | |
| | $/TON | | $ 0.15 | $ 0.90 | $ 0.30 | | | |
| TRUCK | HRS/TRK | | 0 | 1 | 0.33 | | | |
| | $/TRK | | $ - | $15.00 | $ 4.95 | | | |
| | $/TON | | $ - | $ 0.04 | $ 0.01 | | | |

# C: COMBINED: MAINTENANCE + UNLOADING

| | MIN | MAX | TYPICAL | US | THEM |
|---|---|---|---|---|---|
| MAINTAIN | $ 0.01 | $ 0.20 | $ 0.05 | | |
| UNLOAD | $ - | $ 0.90 | $ 0.30 | | |
| | | | | | |
| TOTAL | $ 0.01 | $ 1.10 | $ 0.35 | | |

**At this point we have the fertilizer in the bin and already the range of costs per ton is:**

**$ 0.01 to $ 1.10 probably $ 0.35 /ton**

**Between two 6000 ton departments, the annual bottom line difference between "in" costs could be from**

**$ 60 to $ 6,600 probably $ 2,100**

# STEP TWO: STORE

Next let's look at the "ownership" costs of the plant. We could break out various equipment costs, but using this table, we can find a pretty good estimate yet keep the process reasonably simple.

## A. TOTAL CAPITAL COSTS FOR STORAGE PORTION.

| | | | ESTIMATED ANNUAL "CASH" COSTS TO SUSTAIN INVESTMENT | | | | | |
|---|---|---|---|---|---|---|---|---|
| PLANT | | TTL | 30 | 7.50% | 5.00% | 0.50% | 1.00% | |
| SIZE | $/TON** | INVSTD | YR REPLC | INT | MAINT | INSURE | TAX | TOTAL |
| 1000 | $ 85.00 | $ 85,000 | $ 2,833 | $ 6,375 | $ 4,250 | $ 425 | $ 850 | $ 14,733 |
| 2000 | $ 80.00 | $ 160,000 | $ 5,333 | $ 12,000 | $ 8,000 | $ 800 | $ 1,600 | $ 27,733 |
| 4000 | $ 75.00 | $ 300,000 | $ 10,000 | $ 22,500 | $ 15,000 | $ 1,500 | $ 3,000 | $ 52,000 |
| 8000 | $ 70.00 | $ 560,000 | $ 18,667 | $ 42,000 | $ 28,000 | $ 2,800 | $ 5,600 | $ 97,067 |

***Rough guess at typical construction costs. Actual costs will vary from site to site. The idea here is to get a number on a line and start playing.

# B. PER TON CAPITAL COSTS BASED ON TONS AND TURNS

| | | | | | | US | THEM |
|---|---|---|---|---|---|---|---|
| PLANT SIZE | | 1000 | 2000 | 4000 | 8000 | | |
| ANNUAL COST | | $ 14,733 | $ 27,733 | $ 52,000 | $ 97,067 | | |
| TURNS | 1 | $ 14.73 | $ 13.87 | $ 13.00 | $ 12.13 | | |
| | 2 | $ 7.37 | $ 6.93 | $ 6.50 | $ 6.07 | | |
| | 3 | $ 4.91 | $ 4.62 | $ 4.33 | $ 4.04 | | |
| | 4 | $ 3.68 | $ 3.47 | $ 3.25 | $ 3.03 | | |
| | 5 | $ 2.95 | $ 2.77 | $ 2.60 | $ 2.43 | | |
| | 6 | $ 2.46 | $ 2.31 | $ 2.17 | $ 2.02 | | |

So for "storage", the cost range seems to be from about:

$ 2.02 to $ 14.73 per ton

Using this worksheet about three years ago, we found a range or storage cost from:

$ 2.31 to $ 13.87 per ton

I would guess "typical" is about $ 3.50 per ton

We have now put fertilizer in the bin, paid for the storage space, and and are ready to load out: So far, the range of cost per ton is:

| | MIN | | MAX | | | TYPICAL | |
|---|---|---|---|---|---|---|---|
| Unload | $ 0.01 | to | $ 1.10 | /ton | SAY | $ 0.35 | $/TON |
| Store | $ 2.02 | to | $ 14.73 | /ton | | $ 3.50 | $/TON |
| Total | $ 2.03 | to | $ 15.83 | /ton | | $ 3.85 | $/TON |

We hope you are least convinced that there can be a wide range of cost per ton from one plant to the next.

# STEP THREE: MIXING AND LOAD OUT

| | | | | | | |
|---|---|---|---|---|---|---|
| To keep this simple, let's look at two extremes | | | | | | |
| Plant A -- older mixer and puts out | 4 | 5 | ton loads per hour | | | |
| Plant B -- tower and puts out | 12 | 5 | ton loads per hour | | | |

## A. MIXER AND TOWER LABOR COSTS

| | TON PER LOAD | LOADS PER HOUR | MAN HOURS PER DAY* | TON PER DAY | LABOR RATE | TOTAL LABOR | LABOR PER TON | $ MARGIN TON | $ MARGIN DAY | MARGIN PER $1.00 LABOR |
|---|---|---|---|---|---|---|---|---|---|---|
| MXR | 5 | 4 | 10 | 200 | $ 15.00 | $ 150.00 | $ 0.75 | $ 20.00 | $ 4,000 | $ 26.67 |
| TWR | 5 | 12 | 20 | 600 | $ 15.00 | $ 300.00 | $ 0.50 | $ 20.00 | $ 12,000 | $ 40.00 |
| US | | | | | | | | | | |
| THEM | | | | | | | | | | |

There is a lot of economics crammed into the above table.

First, here is another source of $ 0.25 variation is cost per ton.

**But there is an even more interesting number buried in the table.**

| | | | | |
|---|---|---|---|---|
| At | $ 20.00 | per ton margin the tower produces | $ 12,000 | of margin in a day. |
| | | the mixer produces | $ 4,000 | of margin in a day. |

# B. MIXER and TOWER CAPITAL COSTS

## TOTAL ANNUAL "CAPITAL" COSTS

| SIZE | TOTAL INVSTMNT | LIFE | RPLC | 7.50% INT** | 5.00% MAINT | 0.50% INSURE | 1.00% TAX | TOTAL |
|---|---|---|---|---|---|---|---|---|
| MIXER | $ 25,000 | 10 | $ 2,500 | $ 1,875 | $ 1,250 | $ 125 | $ 250 | *$ 6,000* |
| 90 TON | $ 160,000 | 20 | $ 8,000 | $ 12,000 | $ 8,000 | $ 800 | $ 1,600 | *$ 30,400* |
| 120 TON | $ 180,000 | 20 | $ 9,000 | $ 13,500 | $ 9,000 | $ 900 | $ 1,800 | *$ 34,200* |
| 140 TON | $ 200,000 | 20 | $ 10,000 | $ 15,000 | $ 10,000 | $ 1,000 | $ 2,000 | *$ 38,000* |
| US | | | | | | | | |
| THEM | | | | | | | | |

## "CAPITAL" COST PER TON

| | ANN CST | TNS/YR 2000 | 4000 | 6000 | 8000 | 10000 | 12000 | 14000 |
|---|---|---|---|---|---|---|---|---|
| MIXER | $ 6,000 | $ 3.00 | $ 1.50 | $ 1.00 | $ 0.75 | $ 0.60 | $ 0.50 | $ 0.43 |
| 90 TON | $ 30,400 | $ 15.20 | $ 7.60 | $ 5.07 | $ 3.80 | $ 3.04 | $ 2.53 | $ 2.17 |
| 120 TON | $ 34,200 | $ 17.10 | $ 8.55 | $ 5.70 | $ 4.28 | $ 3.42 | $ 2.85 | $ 2.44 |
| 140 TON | $ 38,000 | $ 19.00 | $ 9.50 | $ 6.33 | $ 4.75 | $ 3.80 | $ 3.17 | $ 2.71 |
| US | | | | | | | | |
| THEM | | | | | | | | |

## "CAPITAL COSTS" of the "Mixer/Tower" probably range from:

$ 1.50 to $ 9.50 per ton SAY $ 4.00

## Comparing towers with mixers can be very misleading.

**On the one hand, mixers are very economical on a per ton basis.**

**On the other hand, mixers are very limited in tons per hour, per day, or per season.**

**Once a plant gets to a certain size, the mixer just can't keep up.**

**With a high market share in a compact area, mixers are very competitive with towers.**

## It is crucial to be "RIGHT SIZED".

| | | | | | |
|---|---|---|---|---|---|
| Say margins are | | $20.00 | /ton | | |

| | | | | |
|---|---|---|---|---|
| With the mixer you can only move | 60 | ton/hour | $ 1,200 | gm/hr. |
| With the tower you can move | 90 | ton/hour | $ 1,800 | gm/hr. |

**In this case the tower gives $ 600 more gross margin/hour.**

**If you have the tower you can give up $ 6.67 per ton and still match the daily gross margin $ generated by the mixer.**

## (Not bright--but you could do it.)

# SUMMARY

Here are four major cost components in a dry fertilizer plant.

The real point is:

The RANGE OF COST FROM ONE PLANT TO THE NEXT.

| | MIN | MAX | TYPICAL | US | THEM |
|---|---|---|---|---|---|
| IN | $ 0.01 | $ 1.10 | $ 0.35 | | |
| STORE | $ 2.02 | $ 14.73 | $ 3.50 | | |
| OUT--LABOR | $ 0.75 | $ 0.50 | $ 0.63 | | |
| OUT--EQUIP | $ 1.50 | $ 9.50 | $ 4.00 | | |
| TOTAL | $ 4.28 | $ 25.83 | $ 8.48 | | |

## SOME CONCLUSIONS AND GUESSES:

| | |
|---|---|
| 1 | There is a very high range in per ton operating costs among dry plants with a low around $ 4.28 and a high around $ 25.83 |
| 2 | $ 5.00 per ton looks doable under really good conditions. |
| 3 | Most plants are probably not much below $9.00 per ton. |
| 4 | It is quite easy to find a $10.00 per ton difference between close neighbors. |
| 5 | A significant portion of through-put costs are in fixed assets. In these cases the per ton costs drop significantly as volume increases. |

**SOME CONCLUSIONS AND GUESSES:**

6 In general we are too inclined to hide behind "pro forma" depreciation rather than budget true replacement costs.

7 In general we are too inclined to focus on "absolute costs" rather than "comparative costs", "return on labor" and "return on capital".

8 In general we are by nature techies and tire kickers and tend to choose our our technology and plant size by personal preference and ego rather than simple economics.

9 If you play with this work sheet you will learn a lot about your businesses.

10 If you want an excel version, e-mail your request to ptmorrow@agriliance.com. Pledge a $10.00 contribution to the charity of your choice, and I will e-mail you the spread sheet.