

Observations of Fertilizer Absorption of Atmospheric Water

Risk to Water Absorption and Caking

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Factors

Environmental

- RH at storage and during transfer
- Condensation at rapid temperature change

Fertilizer Physical Quality

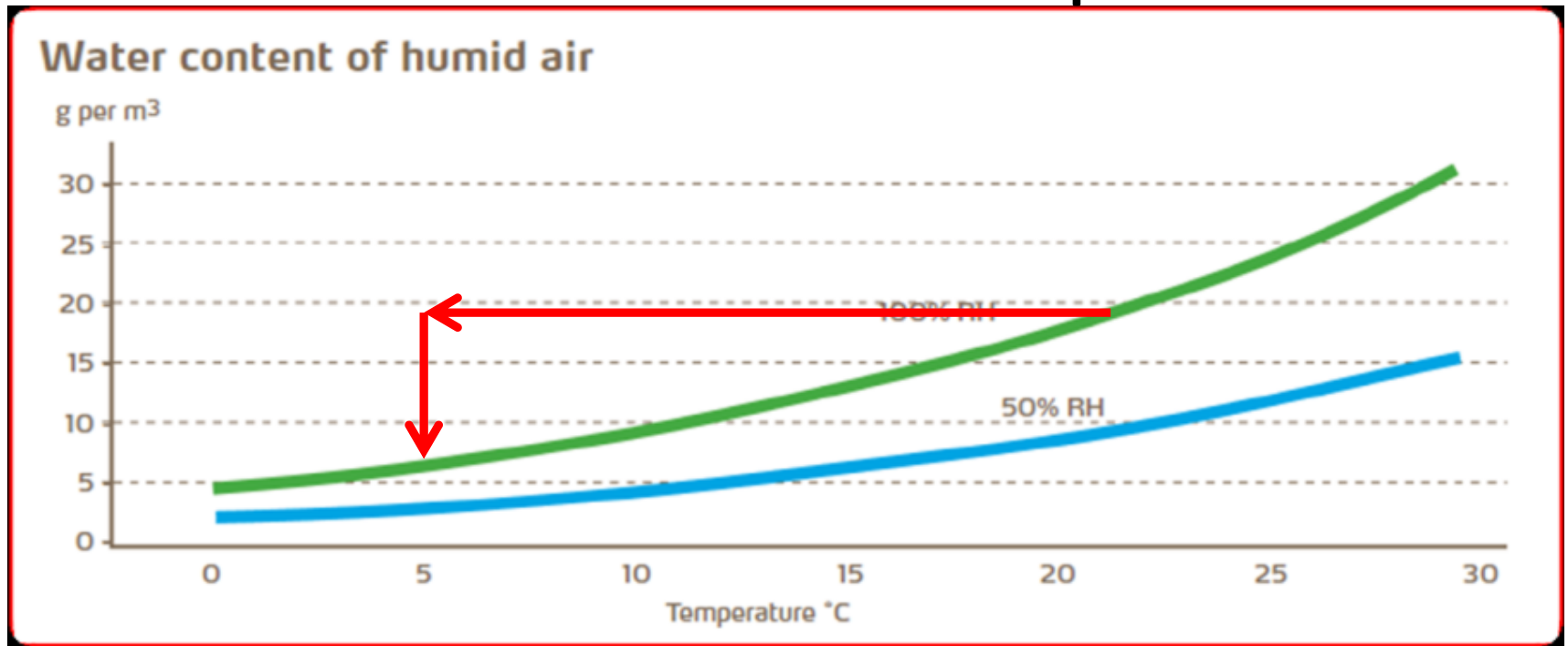
- Fertilizer type
- Fertilizer Blends
- Fertilizer Quality (prilled? dust? oil?)
- Specialty fertilizer (ESN?? AMS vs elemental S?)

Relative humidity = water retained by air at given temperature. Warm air can retain more water. Warming air will absorb water, cooling air will deposit water.

'Critical Relative Humidity' = RH above which a fertilizer will begin to absorb moisture. Each fertilizer or blend will have a unique CRH

Try to keep RH well below 50% at all times.

Condensation is an added problem.

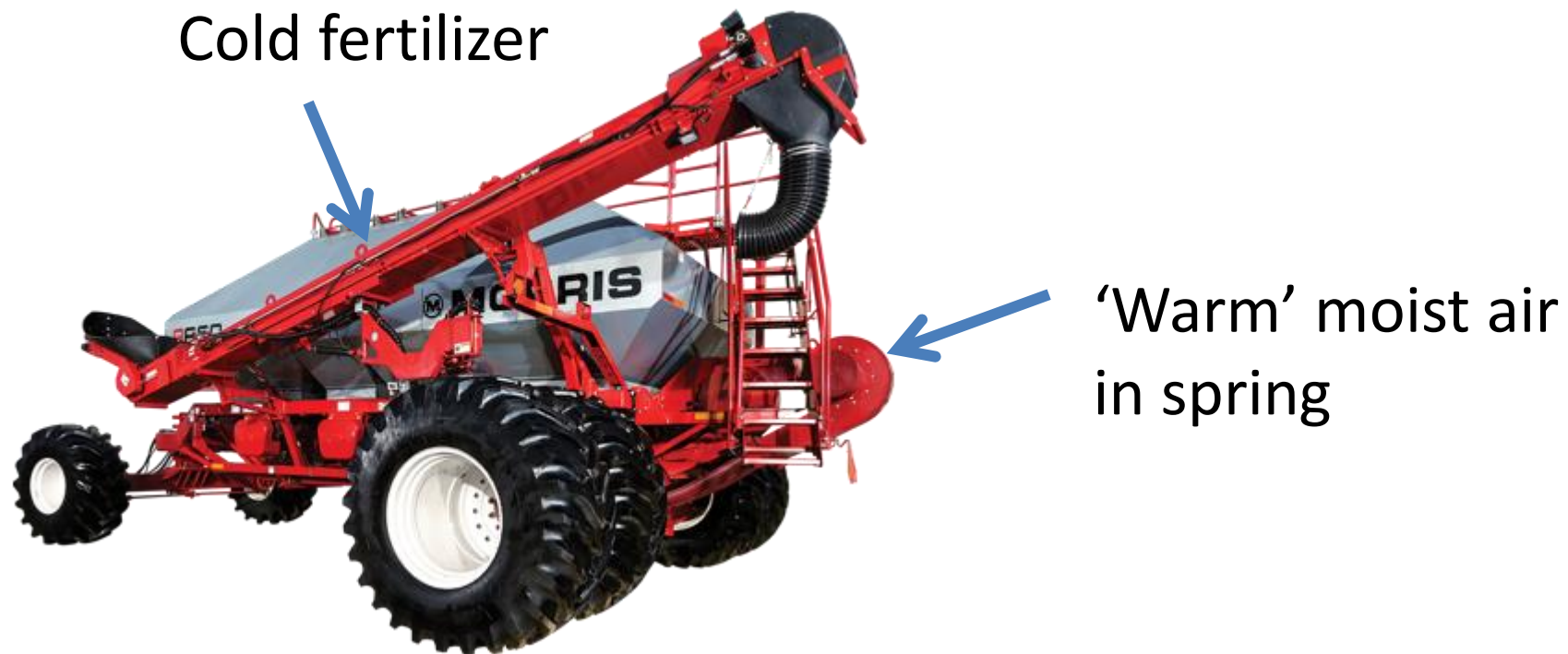


If air is rapidly cooled, moisture will condense.

If very warm fertilizer rapidly contacts cold air, condensation may occur

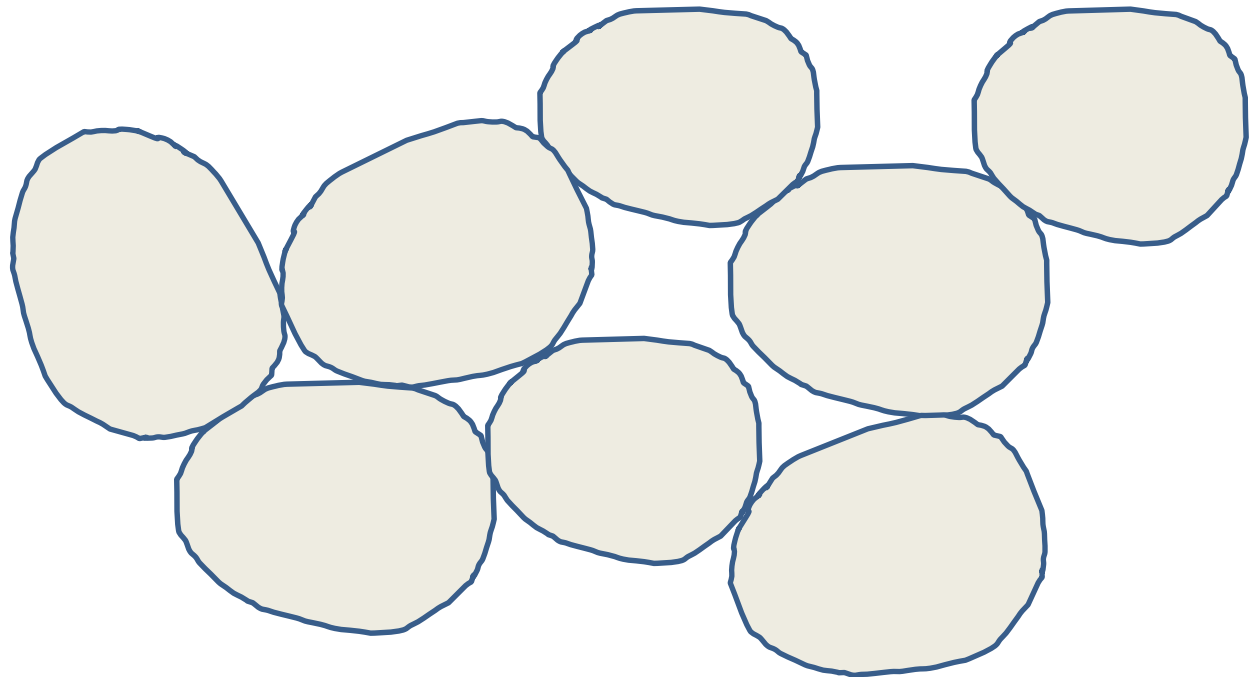
If warm air rapidly contacts cold fertilizer, condensation may occur

Where does warm air hit cold fertilizer?

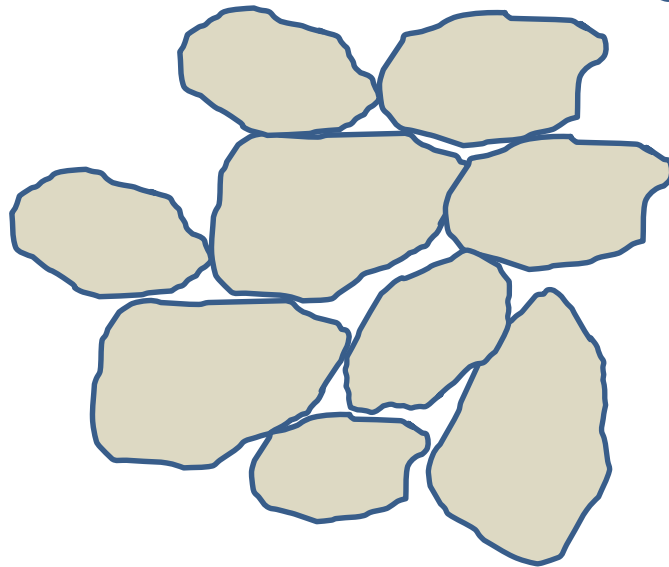


Condensation in tank, then deposition in rollers, augers, lines and manifolds

Physical Factors



Prills do not reduce ability to absorb water but they do reduce risk to form crystalline bridges = 'Caking'





Crystal bridges between fertilizer particles can cause 'caking'

So.....how to measure fertilizer absorption of atmospheric air? A \$50 lab.



Trials: Blends that represent 80N-25P₂O₅-15K₂O-15S in plastic cups
In a closed plastic tub with 1" of water to provide 75% humidity at 20C.

Products used in two trials:

Blend Trials

Urea prills (46-0-0)

MAP granules (11-52-0)

Potash granules (0-0-62)

Ammonium sulphate prills (20-0-0-24)

Product trials

ESN (44-0-0)

Tiger Combo (12-0-0-50)

MES15 (13-33-0-15)

Ammonium sulphate (21-0-0-24) from multiple sources

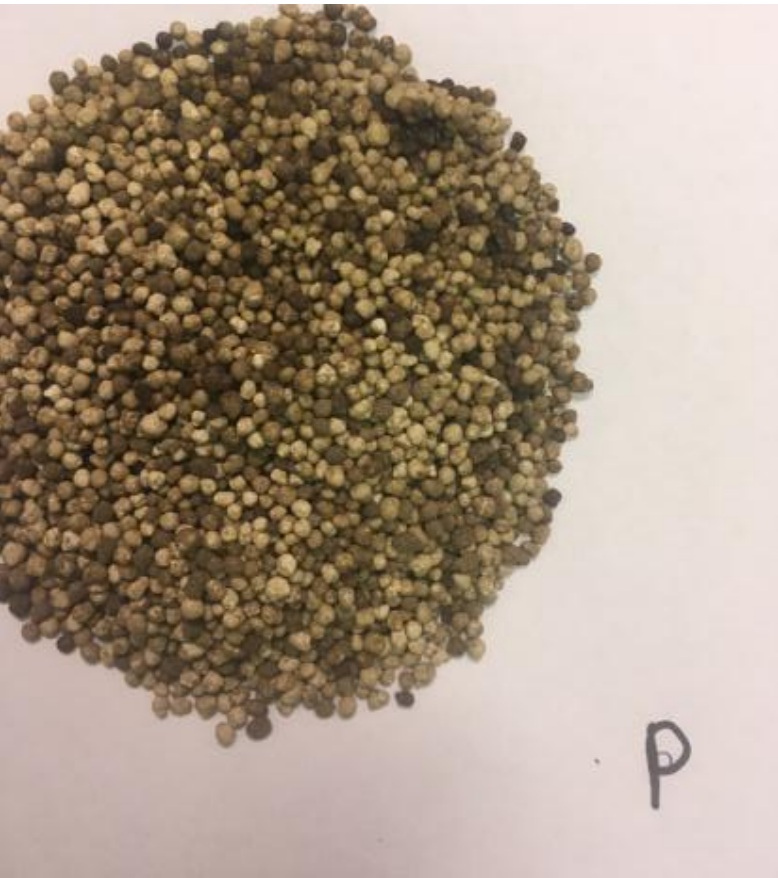
Fertilizer Blends based on 80N-25P₂O₅-15K₂O-15S

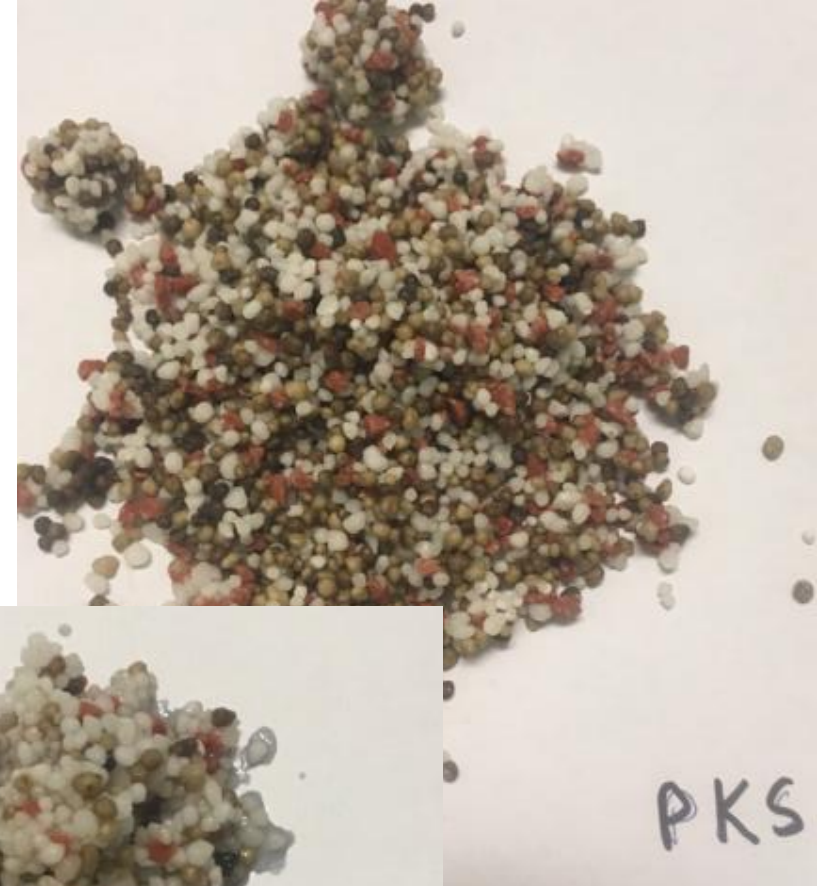
Conditions: 70%RH at 21 C. Initial Weight 200 grams.

Trial 1: Individual fertilizers and Blends

55 days

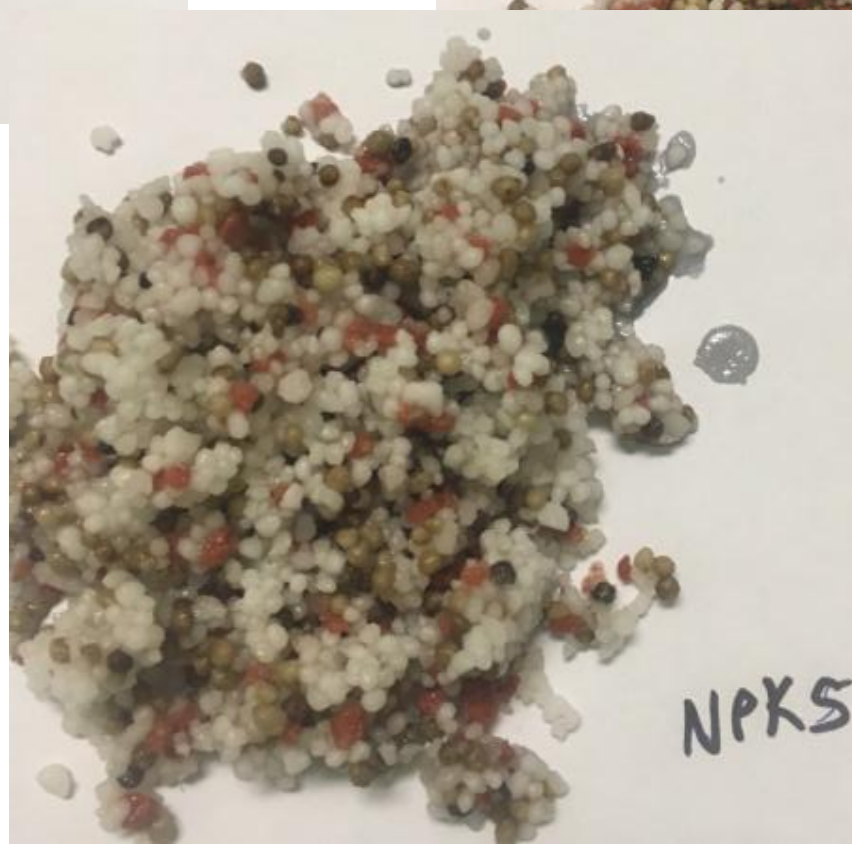
No caking in 11-52-0, slight caking in 0-0-62





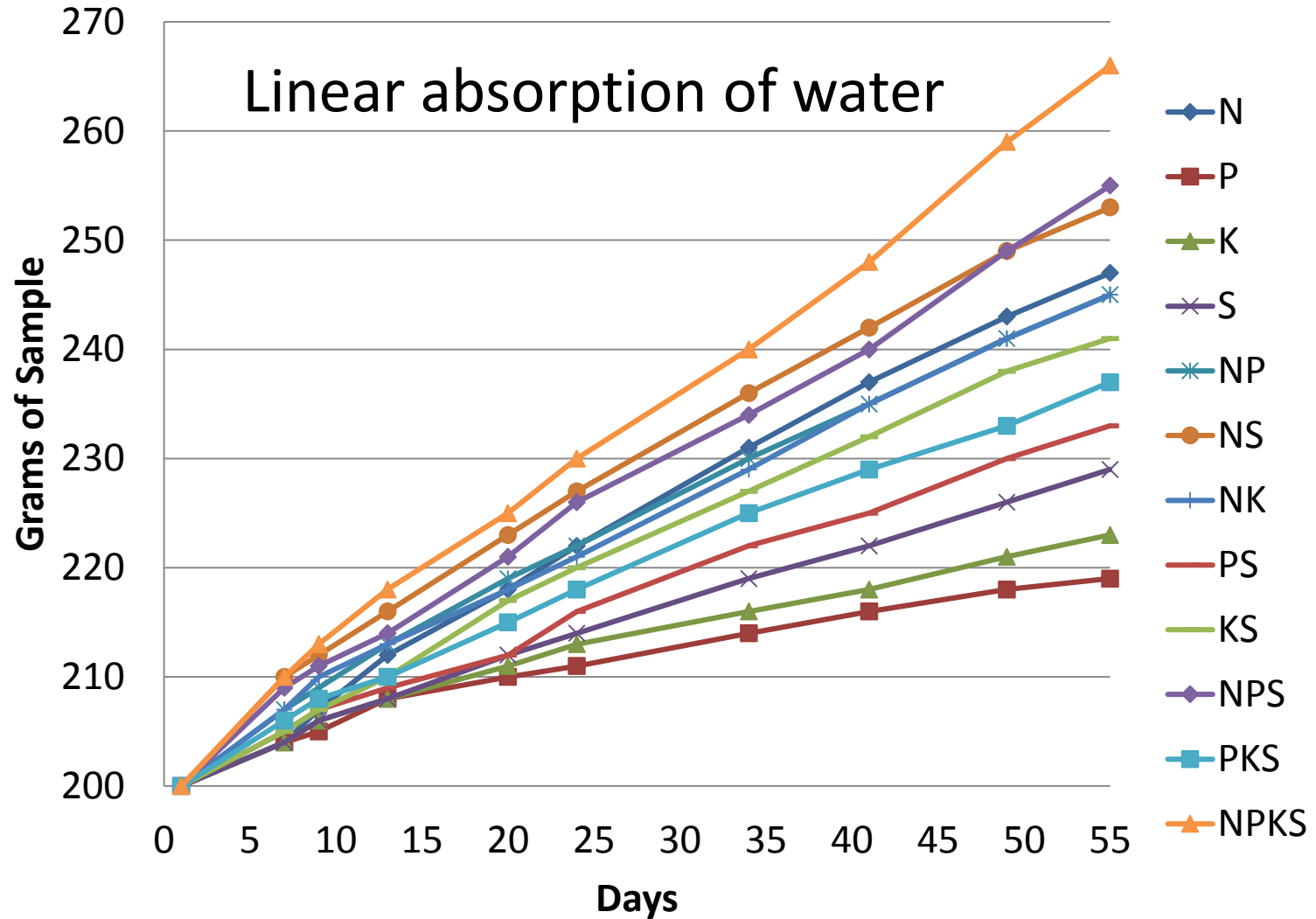
PKS

3-4x Fertilizer Blends:
severe water
absorption with loss
of prill structure –
caked only when
dried under low
humidity



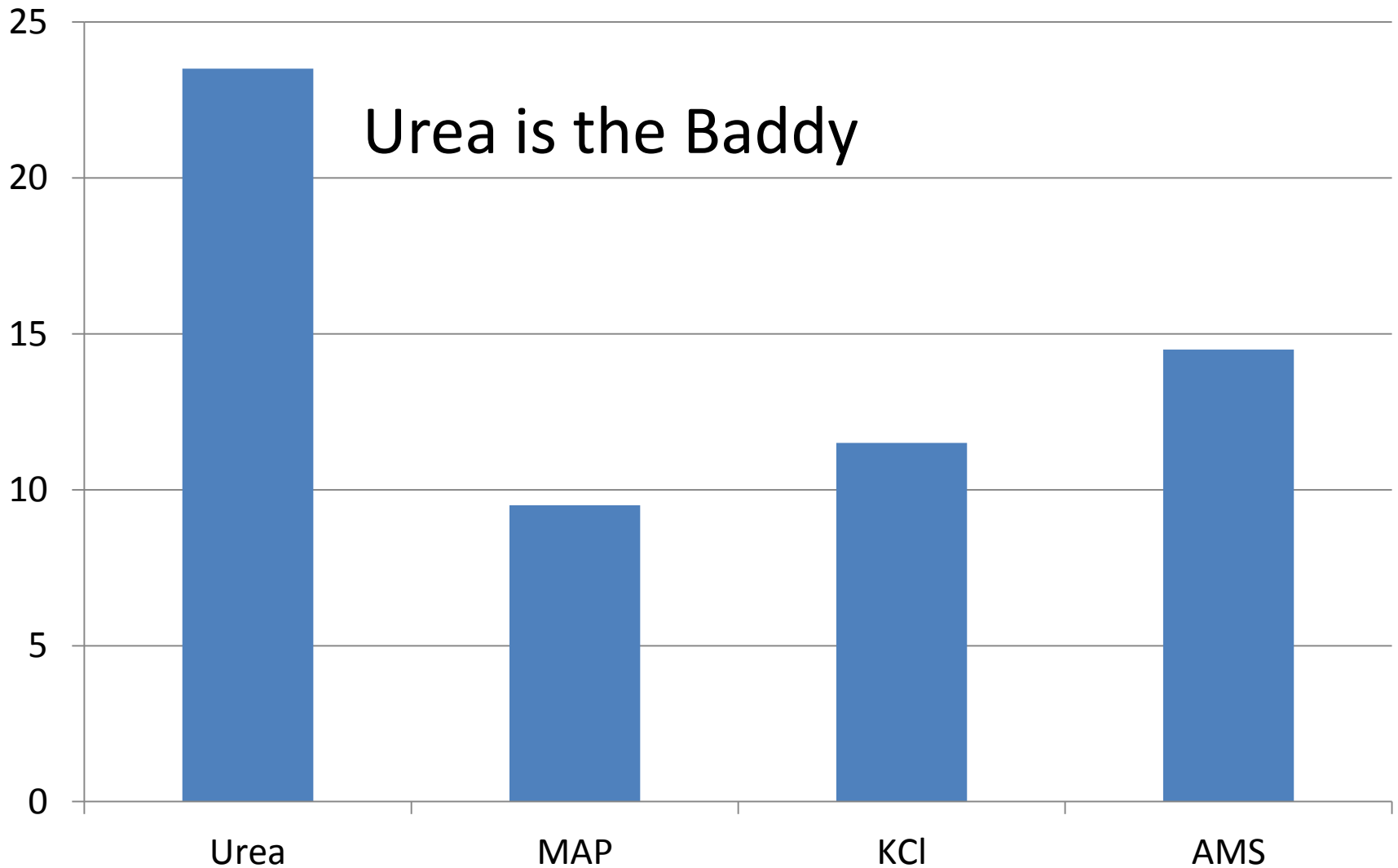
NPKS

Absorption of Water by Fertilizer Blends



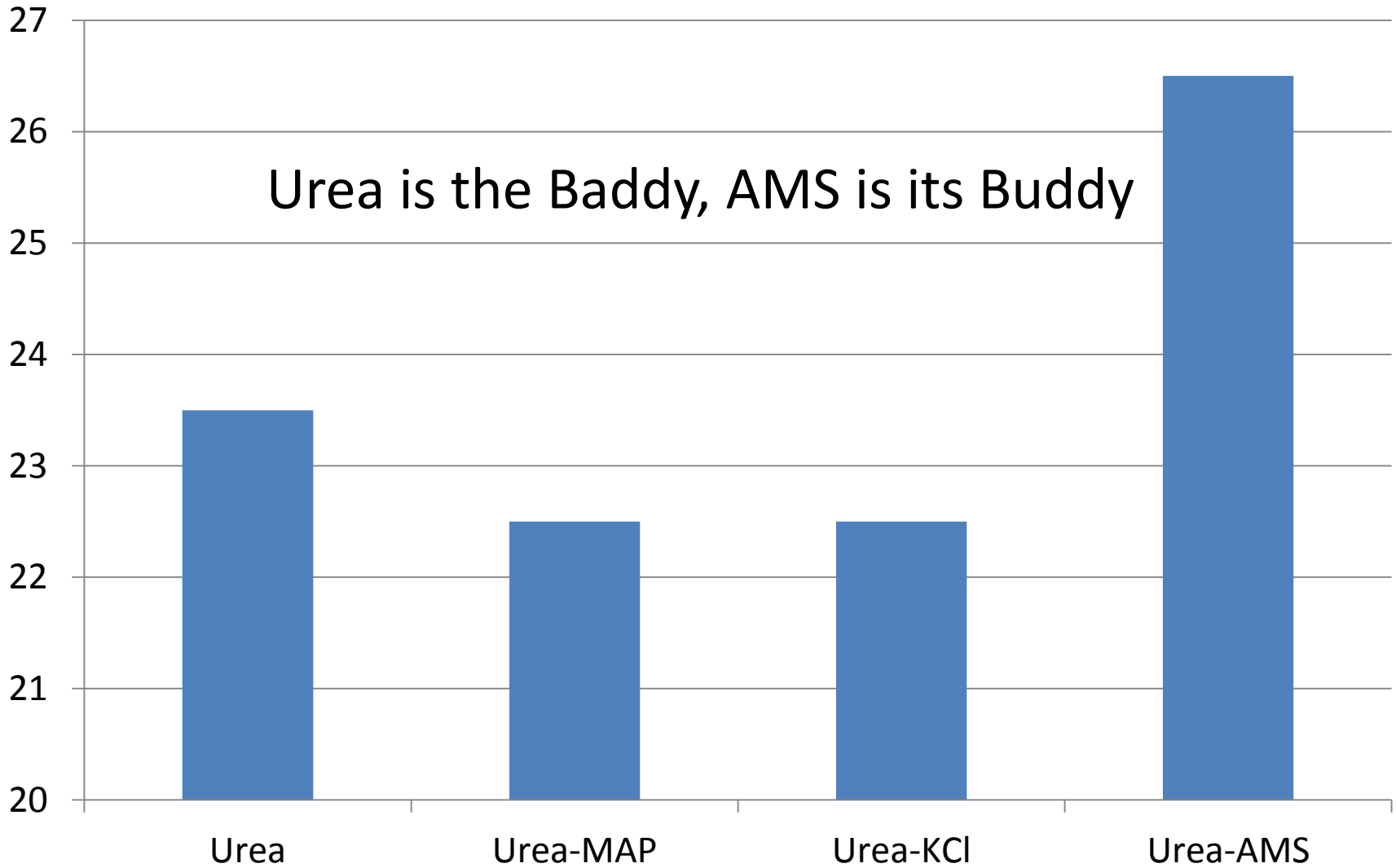
Fertilizer Blend based on 80N-25P₂O₅-15K₂O-15S
Conditions: 70%RH at 21 C. Initial Weight 200 grams.

Absorption of Atmospheric Water by Primary Fertilizers



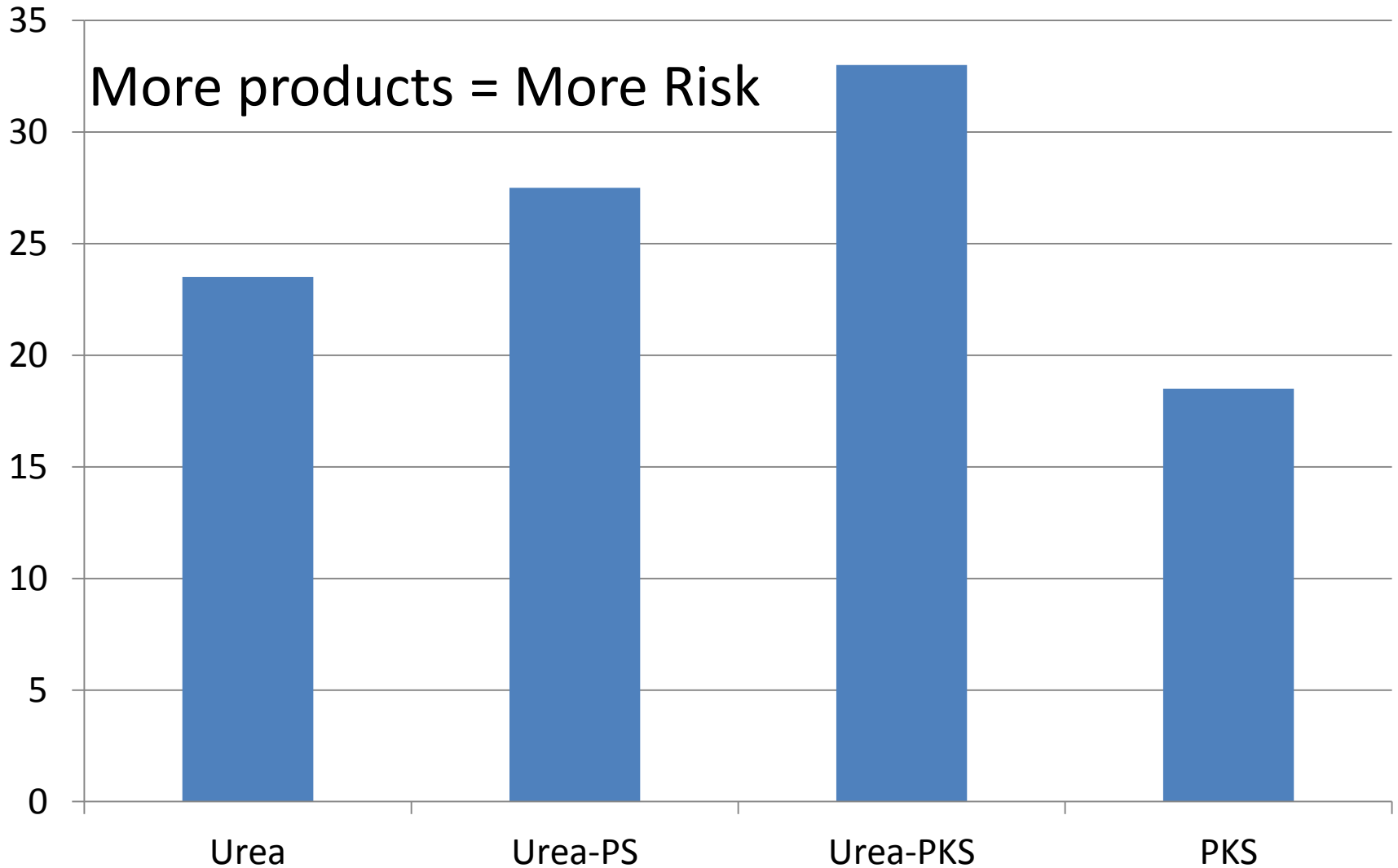
% weight gain of water after 55 days at 70% RH, 21C

Absorption of Atmospheric Water by Urea Blends



% weight gain of water after 55 days at 70% RH, 21C

Absorption of Atmospheric Water by Multinutrient Blends



% weight of water vs 200 gram initial weight after 55 days at 70% RH, 21C

NPKS Blend had severe water absorption

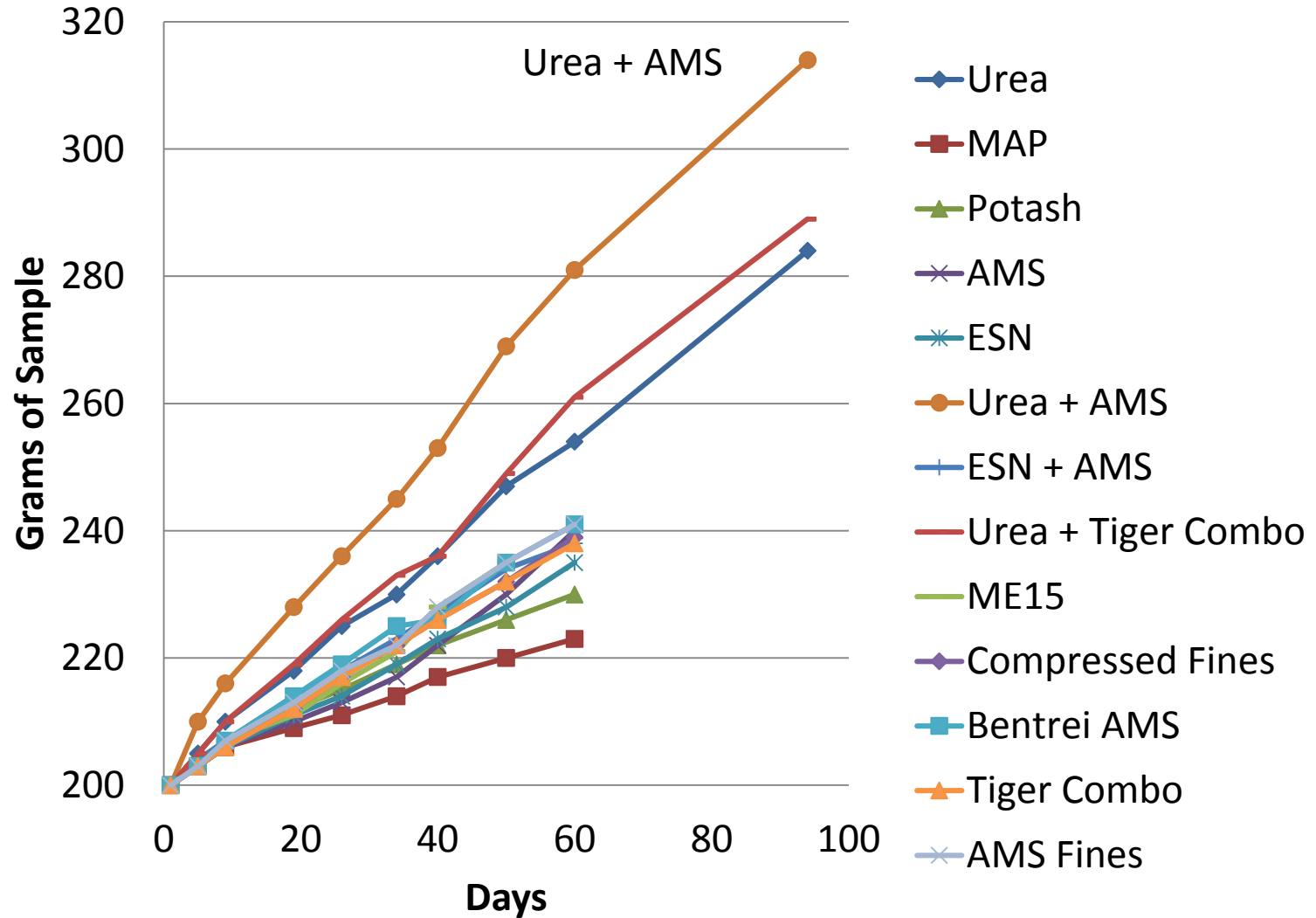


Trial 2: Fertilizer Product Comparison

(up to) 100 days

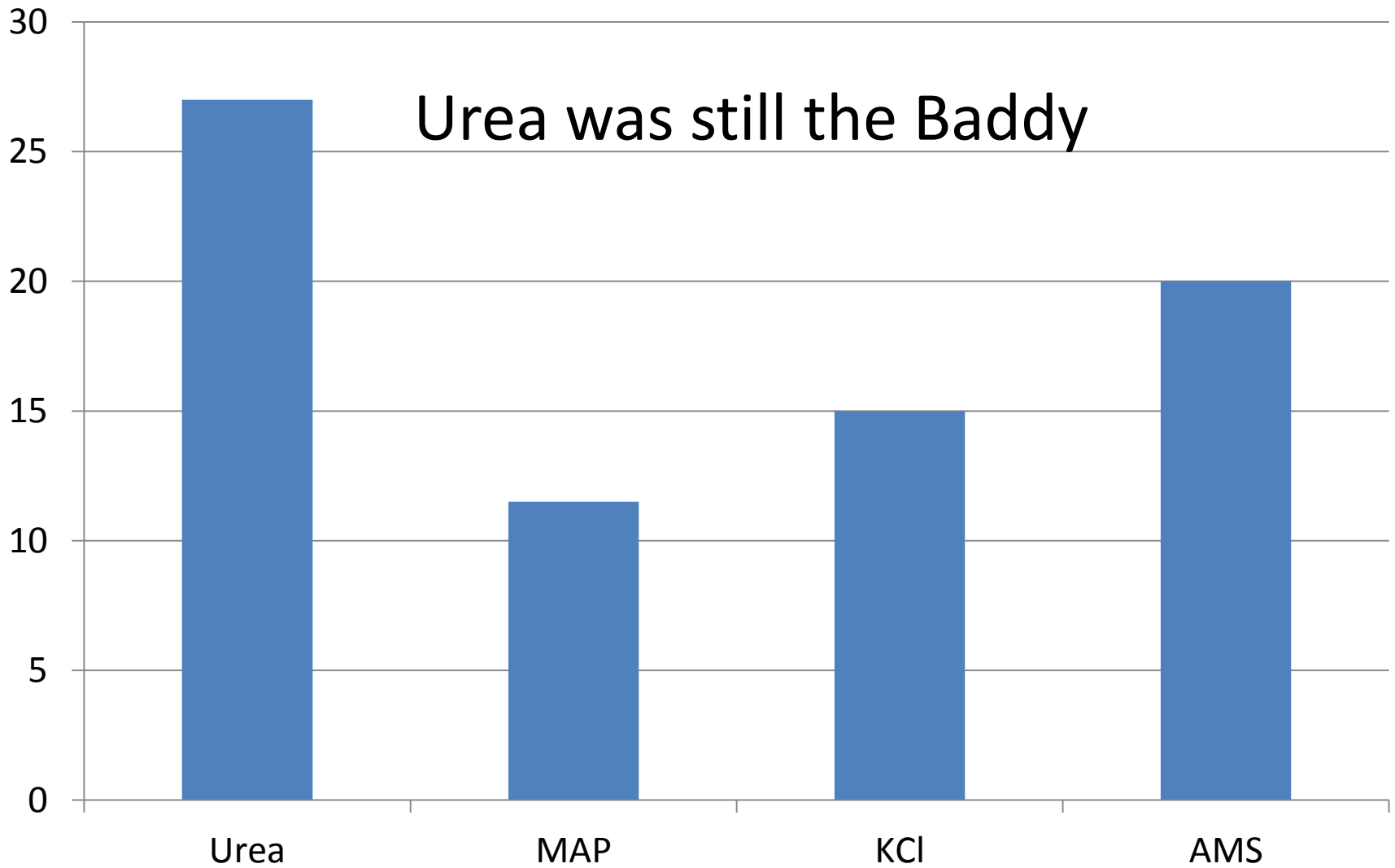
Primary goal to compare AMS products and specialty products such as ESN, ME15 and Tiger Combo

Absorption of Water by Fertilizer Products



Fertilizer Blend based on 80N-25P₂O₅-15K₂O-15S
Conditions: 70%RH at 21 C. Initial Weight 200 grams.

Absorption of Atmospheric Water by Individual Fertilizers



% weight gain of water after 60 days at 70% RH, 21C



Yes, that is free water....

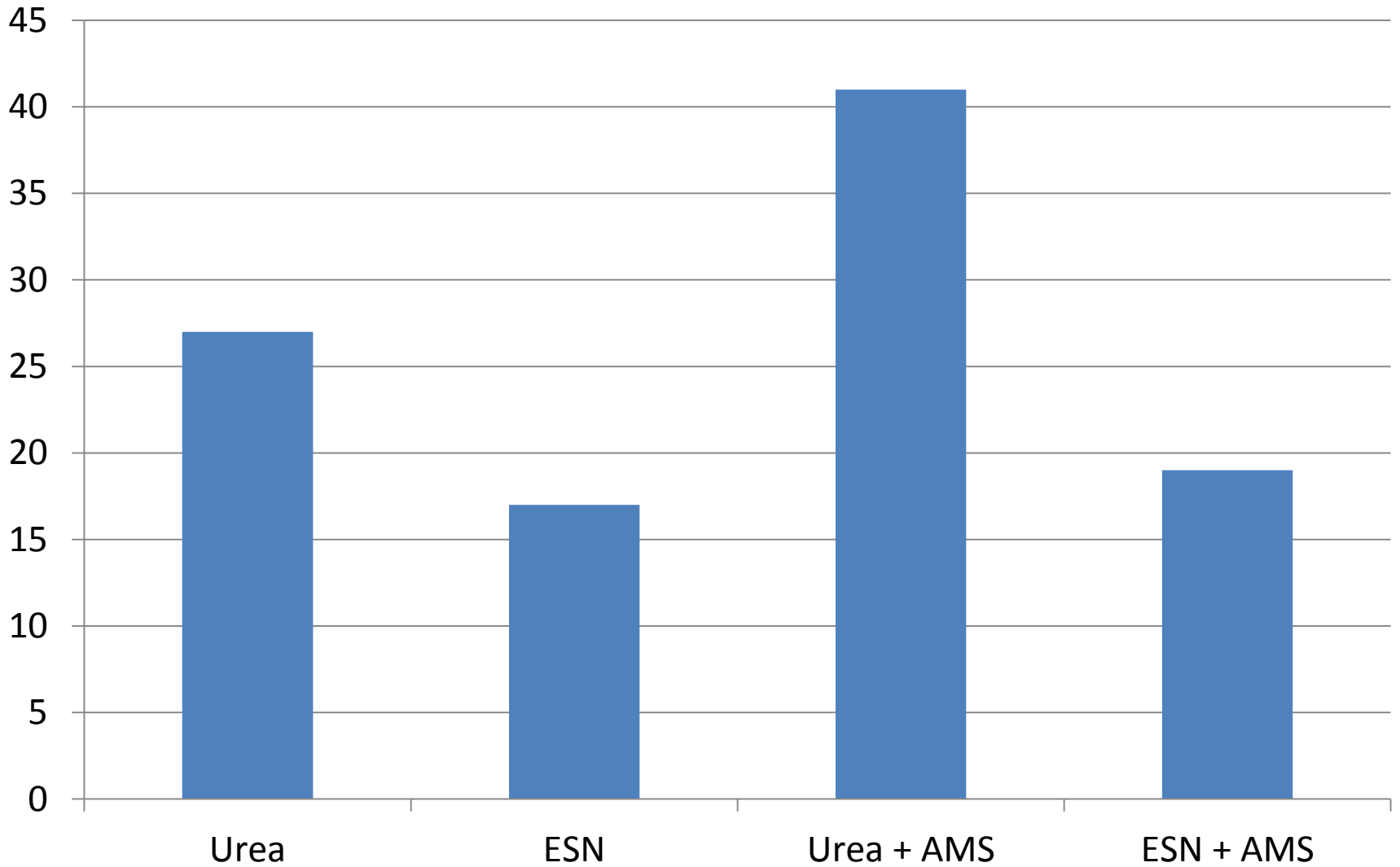
Urea

At 100 days



MAP

ESN Absorbs Atmospheric Water Slower than Urea



% weight gain of water after 60 days at 70% RH, 21C

ESN



Urea



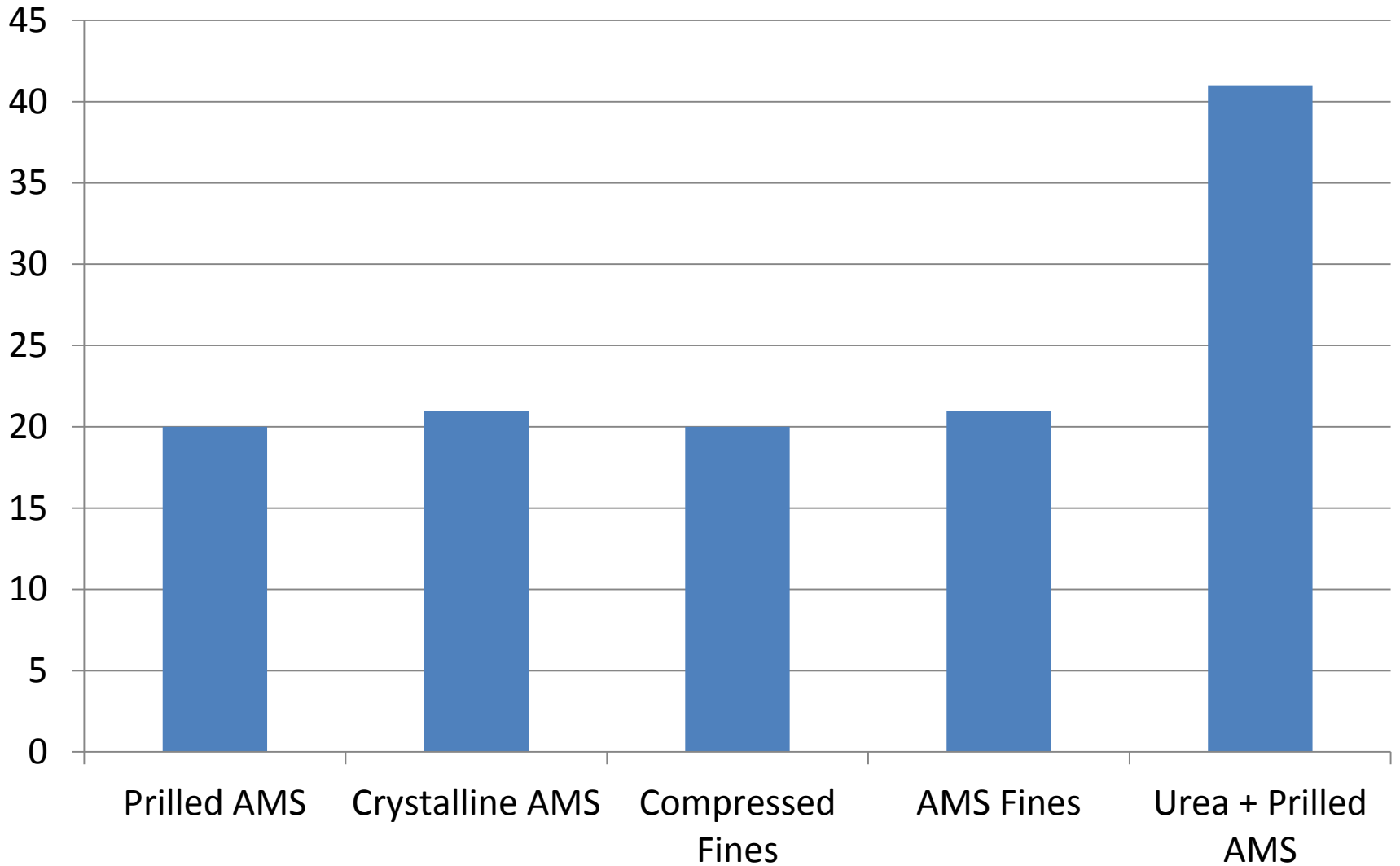
Urea + AMS



ESN + AMS

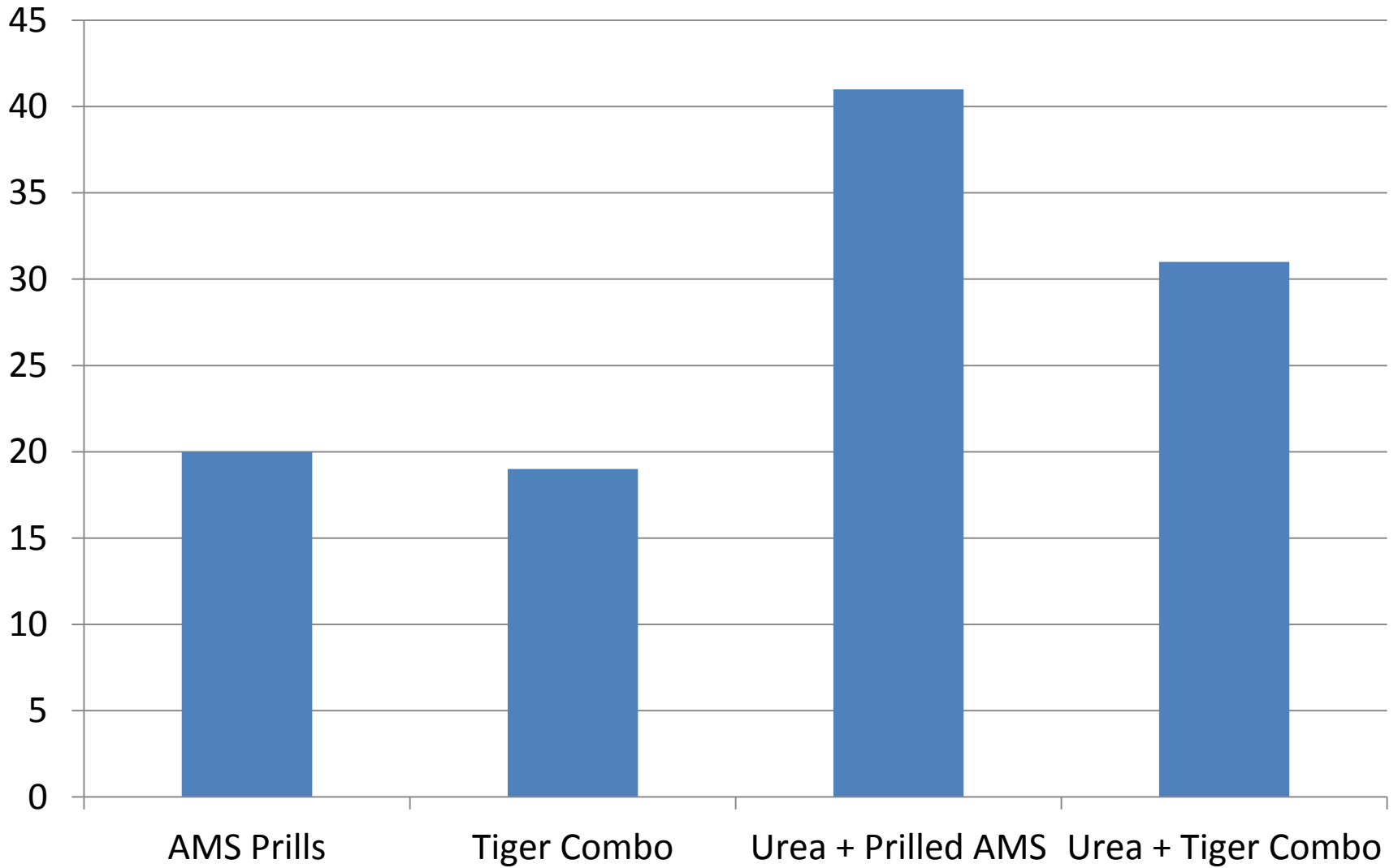


AMS Fertilizers Absorb Atmospheric Water at Same Rate



% weight gain of water after 55 days at 70% RH, 21C

Absorption of Atmospheric Water by S Sources



% weight gain of water after 55 days at 70% RH, 21C

Tiger Combo is 60% AMS and 40% 'Tiger 90' (12-0-0-50)



Urea + AMS Prills



Urea + Tiger combo

Overall

- Avoid high humidity (CRH....try to keep RH under 50%)
- Avoid condensation – rapid changes in temperature
- Physical quality is important but not as important as CRH
- Urea and blends with urea have a higher risk
- Communicate with farmers when there is risk and approach solutions with thought to risk factors in mind