

CONTROLLED RELEASE TECHNOLOGIES

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INTRODUCTION

■ SLOW AND CONTROLLED RELEASE NITROGEN FERTILIZERS DERIVED FROM UREA

- SOLIDS

- LIQUIDS

COATED PRODUCTS

■ SULFUR COATED UREA

- Poly S[®] (Scotts)
- XCU[®] (Agrium)

■ RESIN COATINGS

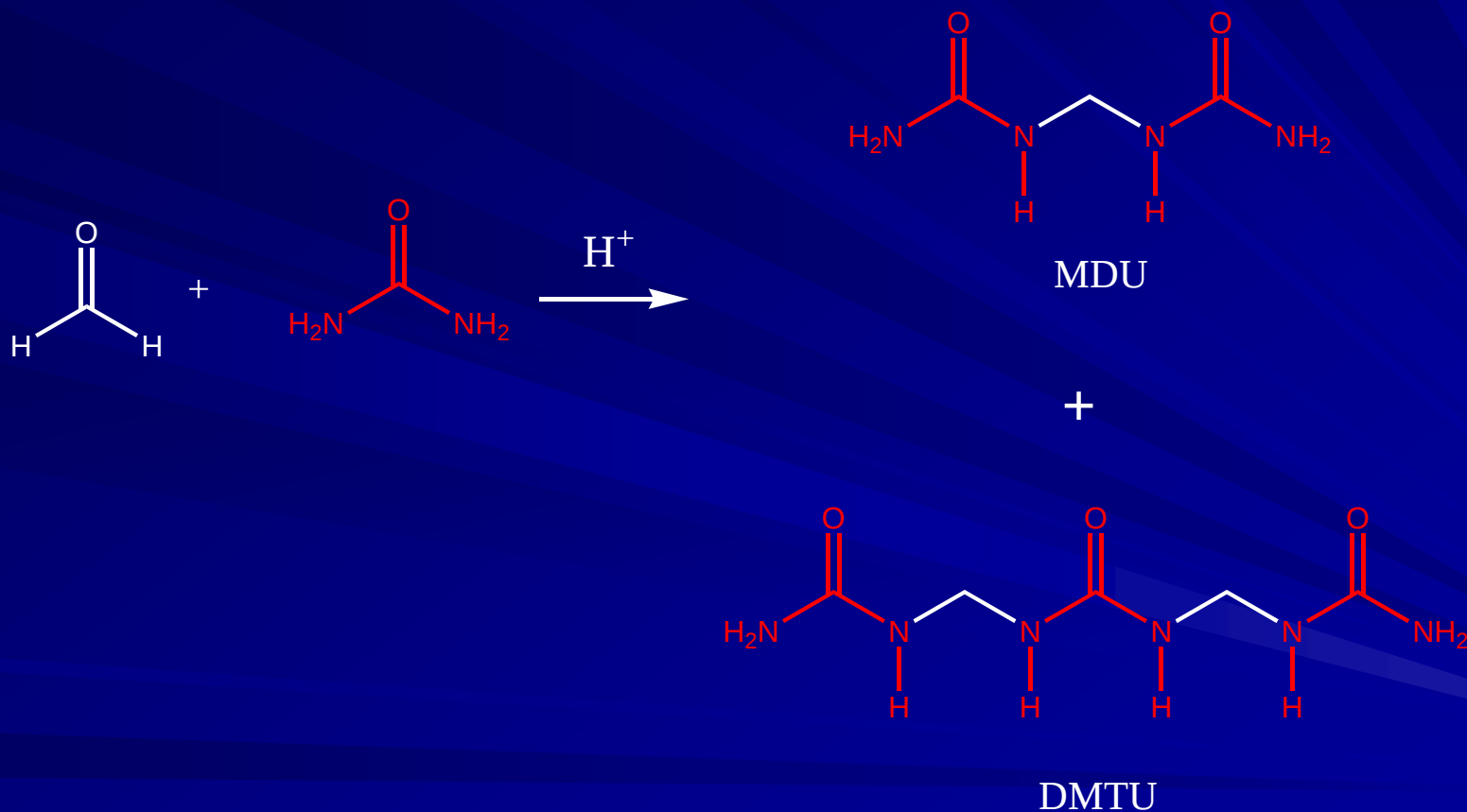
- Polyon[®] (Agrium)
- ESN[®] (Agrium)
- Duration[®] (Agrium)
- Osmocoat[®] (Scotts)

SOLID UREAFORMS

- TURFBUILDER® 41-0-0 (Scotts)
- NITROFORM® 38-0-0 (Nu-Gro America Corp.)
- NUTRALENE® 40-0-0 (Nu-Gro America Corp.)
- UF-38® (Morral Companies~SROF)
- MU-40® (Morral Companies~SROF)
- Meth-Ex 40® (Lebanon Seaboard)

UREAFORM CHEMISTRY

ACID CATALYSIS



SOLIDS

From Urea and Higher Aldehydes

■ IBDU

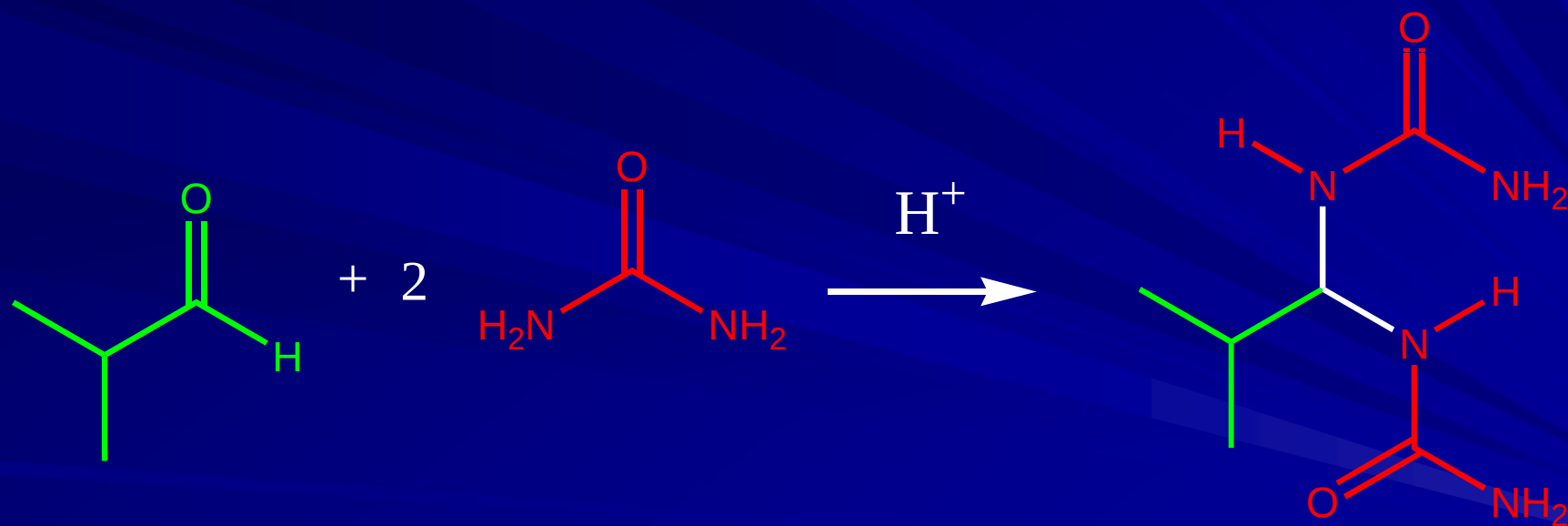
- Par-Ex[®] (Lebanon Seaboard)
- IB Nitrogen[®] (Nu-Gro)

■ CDU

- Chisso, Corp

ISOBUTYLIDENEDIUREA

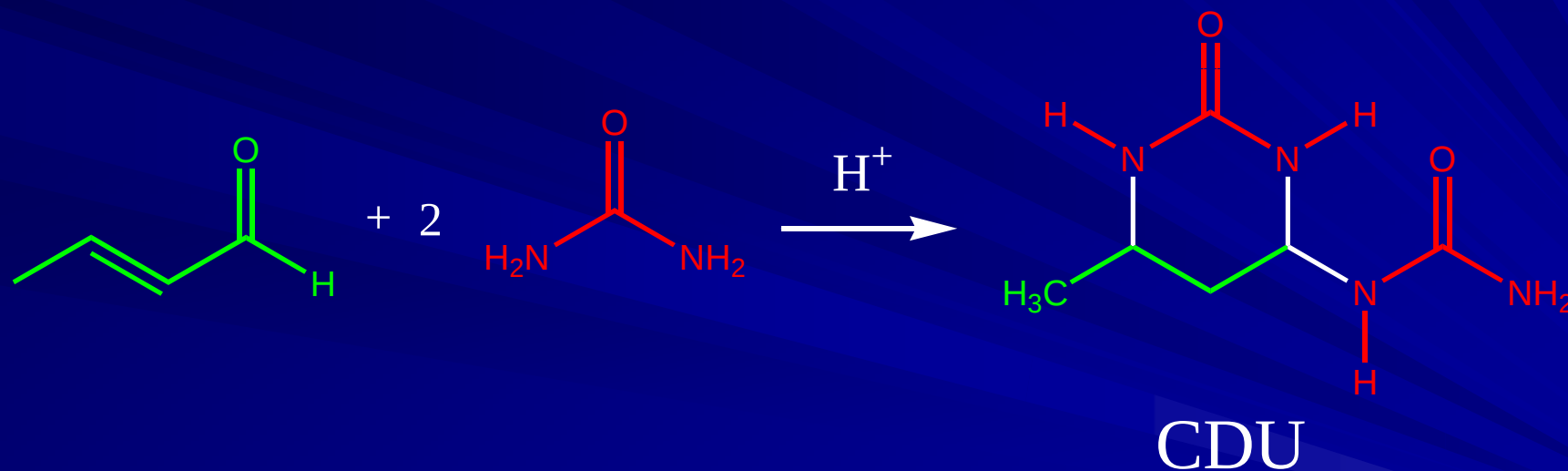
32% N



IBDU

CROTONYLIDENEDIUREA

33% N



CLEAR LIQUID UREAFORM PRODUCTS

■ MORRAL COMPANIES

- NBN-30®

■ TESSENDERLO KERLEY

- NSURE® 28-0-0
- Formolene® Plus

■ GEORGIA PACIFIC

- N-Fusion® 22-0-0
- Nitamin® 30-0-0

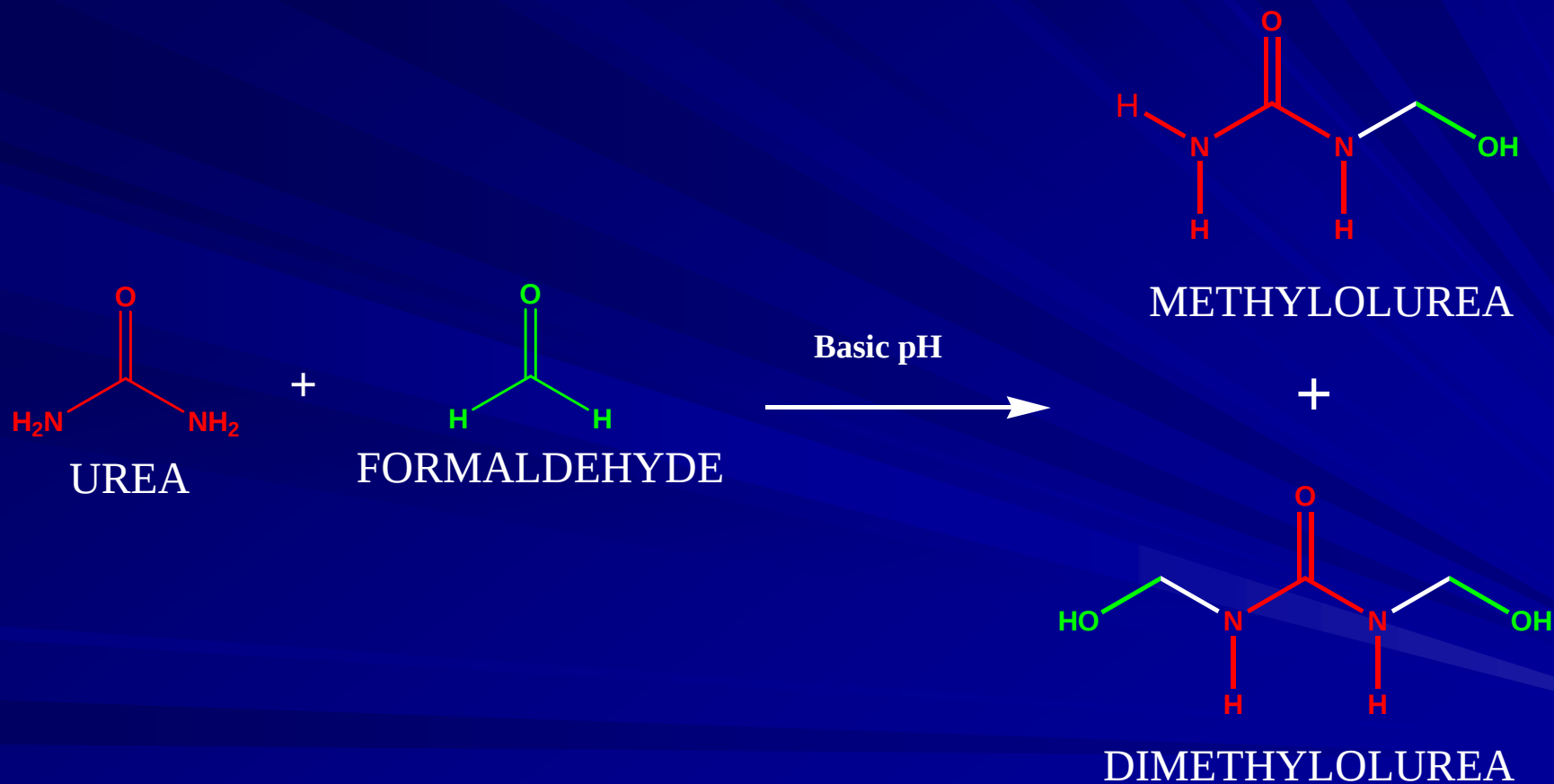
■ HELENA

- CoRoN® 28-0-0

■ GROWTH PRODUCTS

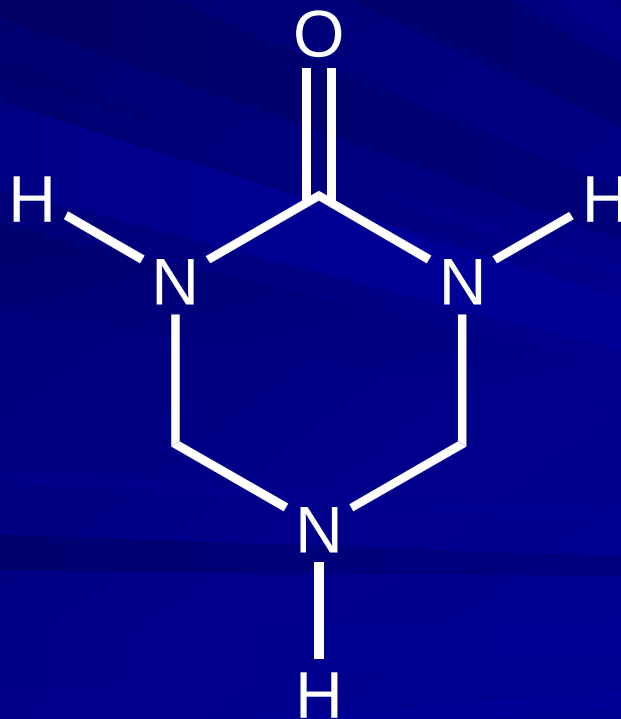
- Nitro 30® SRN

UREAFORM COMPONENTS BASE CATALYSIS

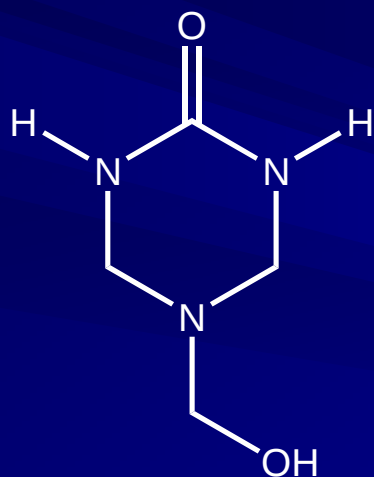


TRIAZONE

- First proposed by Ed Hawkins (U. S. Patent 4,554,005) 1985.



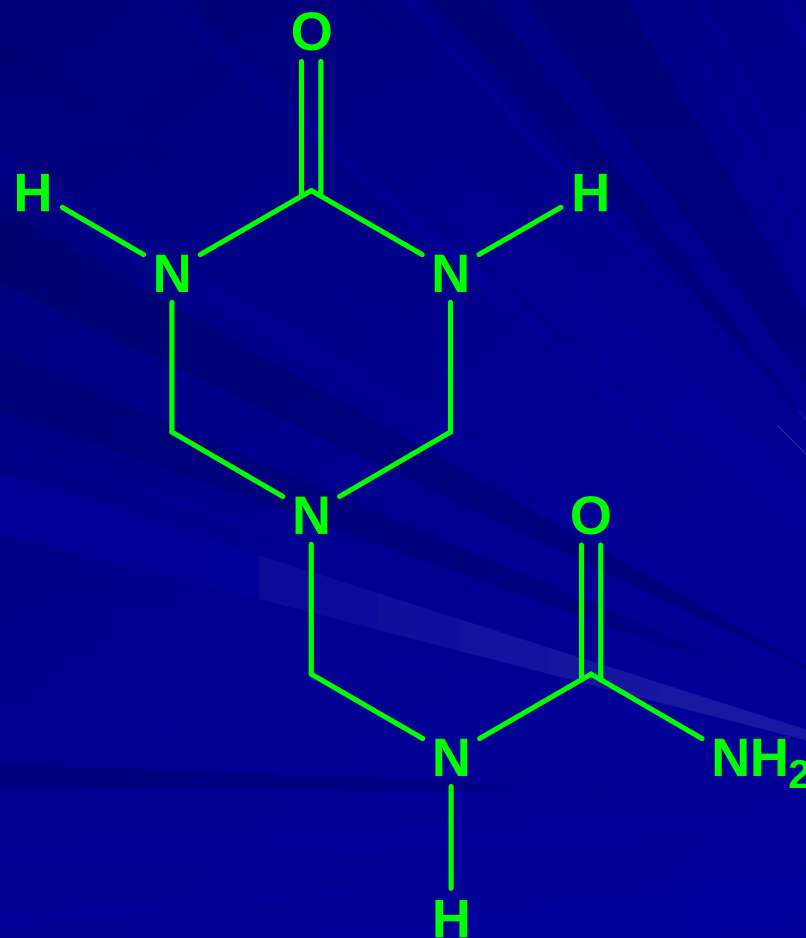
OTHER PROPOSED TRIAZONE STRUCTURAL FORMULAS



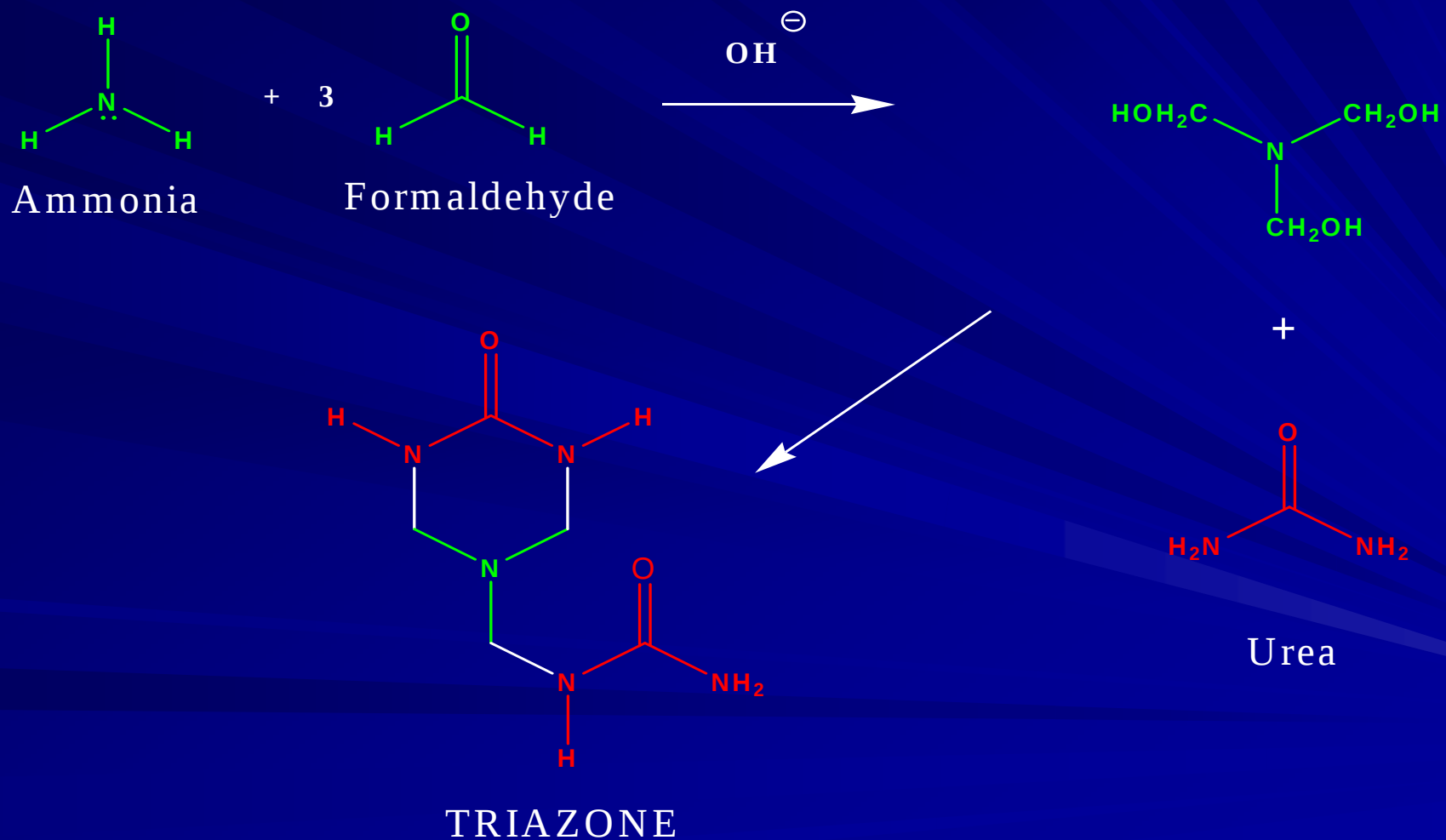
CHEMICAL STRUCTURE

TRIAZONE

- The triazone molecule shown (40% N) was isolated from Morral Companies NBN-30®.
- The structural formula was elucidated using NMR and MS data.
- T. P. Murray, 204th ACS National Meeting, August 27, 1992. Division of Fertilizer and Soil Chemistry.



TRIAZONE CHEMISTRY



ADVANTAGES OF UREAFORM FERTILIZERS

- CONTROLLED RELEASE OF NITROGEN
- FOLIAR BURN PROTECTION
- SEEDLING INJURY PROTECTION

BURN POTENTIAL

- SALT INDEX - An index that relates the extent to which a given amount of various fertilizers increase the osmotic pressure of the soil solution. (Rader, 1943). Modern determinations are made using conductivity (Jackson, 1958).
- OSMOLALITY – Osmolality (mm/Kg) determined for 3% nitrogen solutions and correlated to leaf burn. (Murray, Darrah, Clapp, Communications in Soil Science and Plant Analysis, 38: 337-346, 2007)

SALT INDEX

- The “Salt Index” is used to compare the increase in osmotic pressure for 45 fertilizer materials against the same weight of sodium nitrate.
- The “Salt Index” is useful only for comparing one fertilizer with another and was never meant to correlate to leaf burn or seedling injury.

OSMOLALITY

- Determined using a Vapor Pressure Osmometer.
- Determinations made using dilute solutions.
- Nitrogen fertilizers diluted to 3 % N.
- Osmolality reported in mmol/Kg

OSMOLALITY VALUES

Fertilizer Components

COMPOUND	%N	Osmolality mmol Kg ⁻¹ (3% N)
UREA	46	1018
IBDU	32	40
Ammonium Nitrate	35	1804
UAN	28	1439

OSMOLALITY VALUES

Solid Ureaform Components

COMPOUND	%N	Osmolality mmol Kg ⁻¹ (3% N)
Methylenediurea	42	298
Dimethylenetriurea	41	129
Triazone Concentrate	36	270

OSMOLALITY VALUES

DRY SLOW RELEASE PRODUCTS	%N	Osmolality mmol Kg ⁻¹ (3% N)
UF-38 [®] (Morral)	38	303
MU-40 [®] (Morral)	40	321
NITROFORM [®] (Nu-Gro)	38	220
NUTRALENE [®] (Nu-Gro)	40	312
TURFBUILDER [®] (Scotts)	41	557

OSMOLALITY VALUES

Liquid Ureaform Components

COMPOUND	%N	Osmolality mmol Kg ⁻¹ (3% N)
Monomethylolurea	31	906
Dimethylolurea	23	825
Dimethylolmethylenediurea	29	542
Triazone Concentrate	36	270

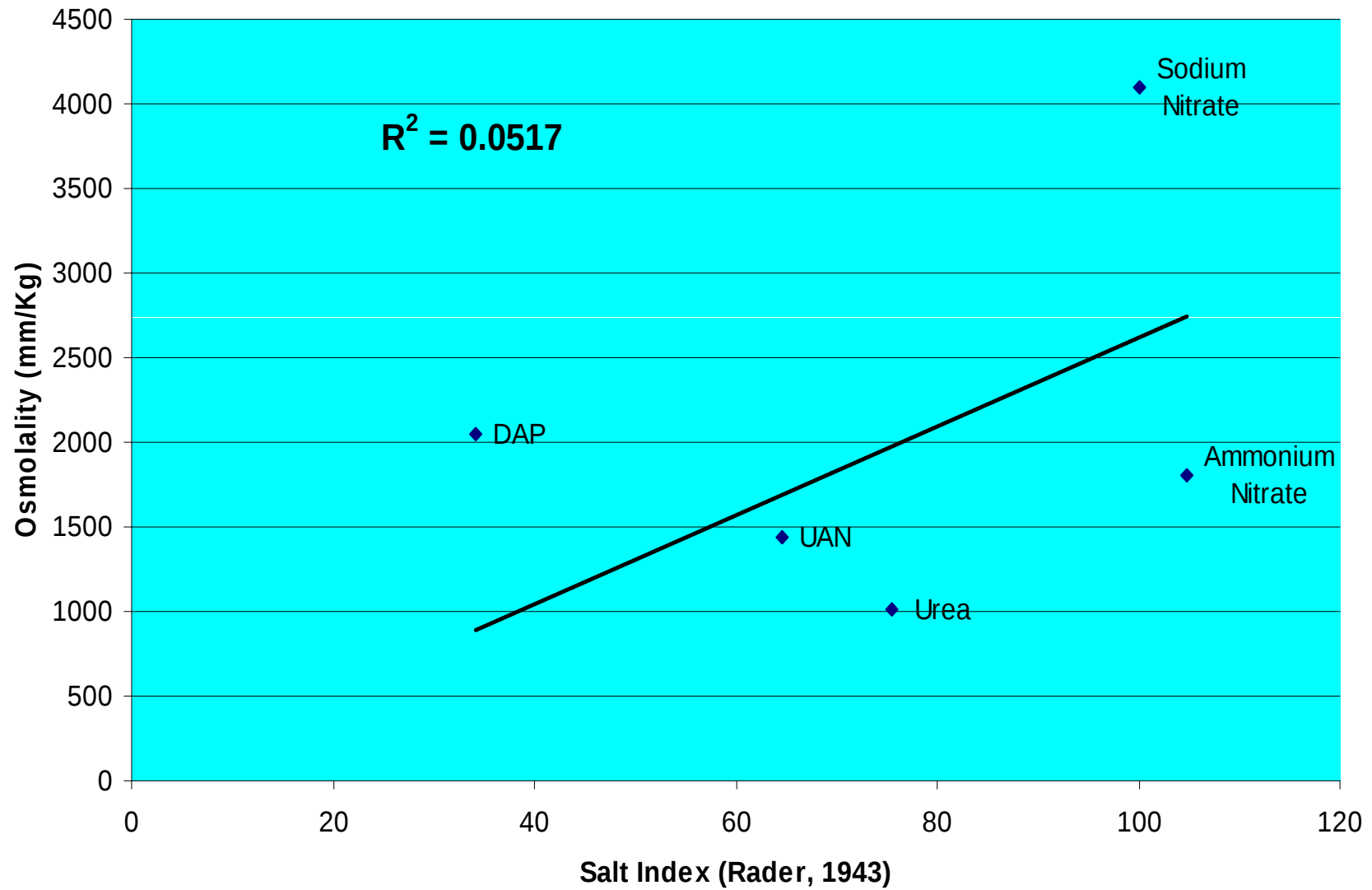
OSMOLALITY VALUES

LIQUID CONTROLLED RELEASE PRODUCTS	%N	Osmolality mmol Kg ⁻¹ (3% N)
NBN [®] (Morral)	30	698
N-SURE [®] (TKI)	28	513
CoRoN [®] (Helena)	28	685
FORMOLENE [®] (TKI)	30	745
NITAMIN [®] (Georgia Pacific)	30	634
NFUSION [®] (Georgia Pacific)	22	399
NITRO 30 [®] (Growth Product)	30	796

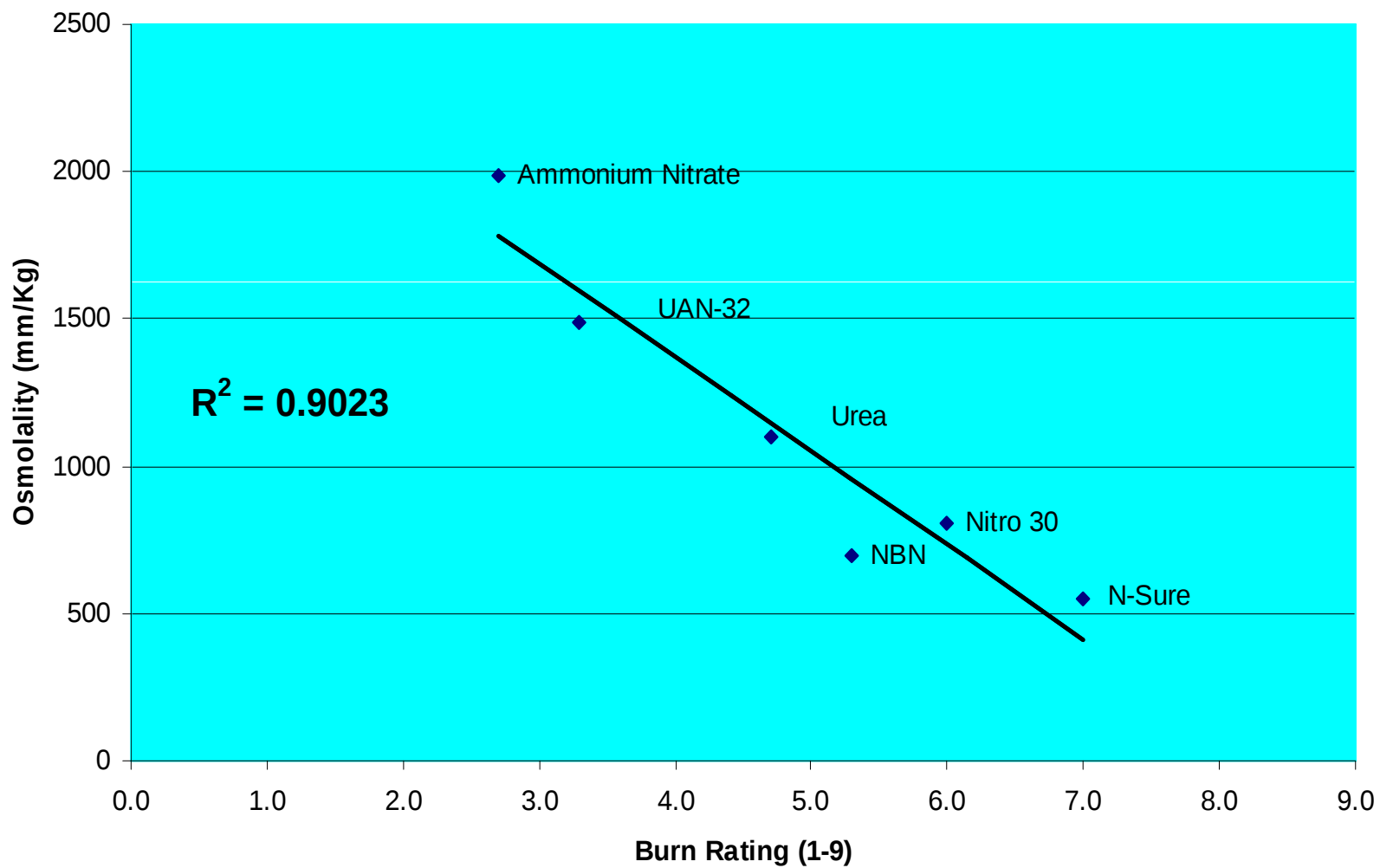
Osmolality and Salt Index

COMPOUND	%N	Salt Index	Osmolality mmol Kg ⁻¹ (3% N)
Sodium Nitrate	16	100.0	4092
Ammonium Nitrate	35	104.7	1804
UAN	28	64.6	1439
Ammonium Sulfate	21	69.0	2314
DAP	18	34.2	2054

Osmolality vs Salt Index



Osmolality vs Leaf burn Tall Fescue



NITRIFICATION INHIBITORS

- DCD (Dicyandiamide).
 - GUARDIAN[®] (Conklin)
 - GUARDIAN DL[®] (Conklin)
- Nitrapyrin (2-chloro-6-(trichloromethyl)-pyridine). N-Serve[®] (Dow Agrosciences)
- DMPP (3,4-Dimethylpyrazone phosphate).
 - ENTEC[®] (K+S Nitrogen)

UREASE INHIBITORS

- Agrotain N-(n-butyl)-triphosphoric triamide (NBPT)

ACKNOWLEDGMENT

- MORRAL COMPANIES

- UNIVERSITY OF NORTH ALABAMA