CONTROLLED RELEASE FERTILIZERS AND THEIR NUTRIENT RELEASE

J. B. SARTAIN

FERTILIZER INDUSTRY HISTORY

- CONTROLLED-RELEASE MATERIALS ACCOUNTED FOR 1.7% OF THE US FERTILIZER MARKET IN 1993

- ANNUAL GROWTH IN US CONSUMPTION IN CONTROLLED-RELEASE MATERIALS HAS BEEN APPROXIMATELY 4% FOR PAST 6 YRS

- MOST OF THE DEVELOPMENT AND USE OF CONTROLLED-RELEASE HAS INVOLVED NITROGEN BASED MATERIALS

FERTILIZER INDUSTRY HISTORY

- CONTROLLED-RELEASE PRODUCTS ARE USED MOSTLY IN THE NON-FARM OR SPECIALITY MARKET
- NURSERIES, HOME LAWNS, RECRECATIONAL AREAS AND GOLF COURSES
- SOME USED IN HIGH CASH VALUE VEGETABLES, AND CITRUS
- IN JAPAN SOME ARE USED IN RICE PRODUCTION

SELECTED CONTROLLED RELEASE MATERIALS AND THEIR PROPERTIES

Nitroform

- Urea formaldehyde
- Insoluble organic
- 38% N ; 65-71% WIN
- Biological N release
  - rate influenced by soil temperature

Nutralene

- Methylene Urea
- 40% N - 36% WIN
- Biological N release
- More rapidly available than UF
- Not as adversely influenced by cool temperatures

Sulfur Coated Urea

- 32-38% N
- Release depends upon
  - thickness of sulfur coating
  - biological
  - soil environment
    - temperature
    - pH
- Cool season response-erratic
- Coating fragile

Polymer/Sulfur-Coated Urea

- Hybrid between
  - Sulfur (first and main coat material)
  - Polymer (Secondary coat)
- Controlled release fertilizer produced at a lower cost
- Release mechanism is a combination of:
  - Diffusion, dominated by the polymer coating
  - Capillary, once in contact with the sulfur coat.

Polyon

- 40 - 44% N
- Polyurethane coated urea
- N release influenced by
  - coating thickness
  - diffusion rate
  - soil temperature
- good for both warm and cool season
- Coating is abrasive resistant

Trikote

- 42 % N
- Urea coated with a polymer
- N release by diffusion
- Coating thickness important
- Release faster than Polyon

IBDU

- 31-90% WIN
- N released by hydrolysis
- Relatively unaffected by
  - temperature
  - pH
- Particle size important
- Excellent cool season response

CoRon

- 28% N Solution
- Polymethylene ureas and amine modified polymethylene ureas
- N release dependent upon microbial action

N-Sure

- 30% N
- Ring structured Triazones may contain methylene diurea
- N release by microbial action
- Response very similar to CoRon


NITRO 30 (LIQUID)
TOTAL - N 30%
SOLUBILITY 100%
METHYLENE UREA

NITAMIN

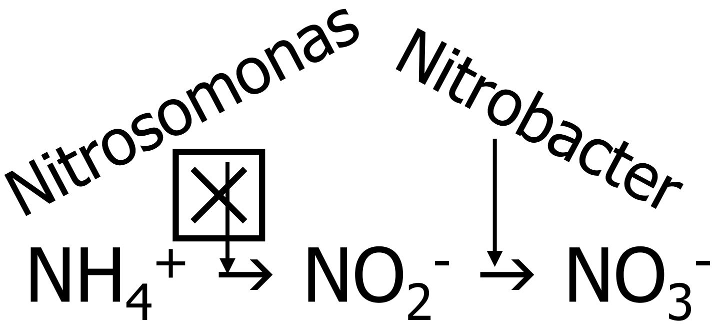
SOLUTION/SOLID CONTAINING 30% N

A MIXTURE OF TRIAZONE, METHYLENE UREAS AND UREA

CONTAINS 30% UREA – READILY AVAI

RELEASE BIOLOGICALLY

Nitrification Inhibitors



- Nitrate is leached easier than ammonium-N
- Fall application for plant uptake in the next growing season (mid-western)
- Some nitrification inhibitors include:
  - Nitrapyrin (N-Serve)
  - Dicyandiamide (DCD)
  - NBPT((N(N-butyl)-triphosphoric triamide)

N- Serve	DCD

N- Serve

- Inhibits action of nitrosomonas
- Applied with NH3 extending NH4+ life time in soil
- Not beneficial in Florida turfgrass
- Affected at high vapor pressure and high temperature.

DCD

- 66 % N
- Used as nitrification inhibitor and N source
- More used in Europe
- Inconsistent results in Florida’s potato production area
- General class inhibitor – kills everything

NITROGEN STABILIZED MATERIALS

UFLEXX - UREA + AGROTAIN

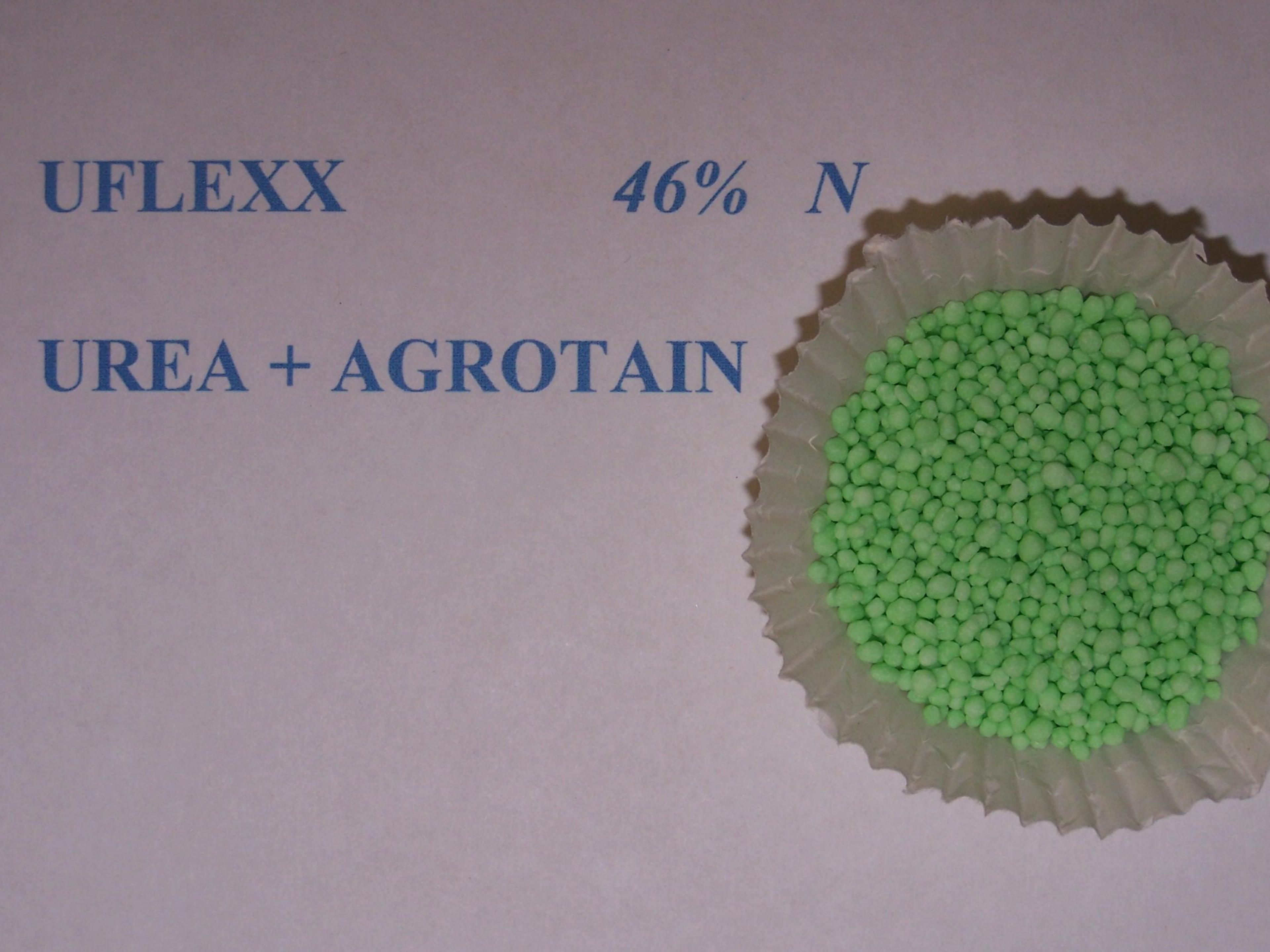
UMAXX - UREA + 2 X AGROTAIN

BOTH PRODUCTS CONTAIN 46% N

AGROTAIN = NBPT + DCD

UMAXX 47% N

UREA + AGROTAIN


UFLEXX 46% N
UREA + AGROTAIN

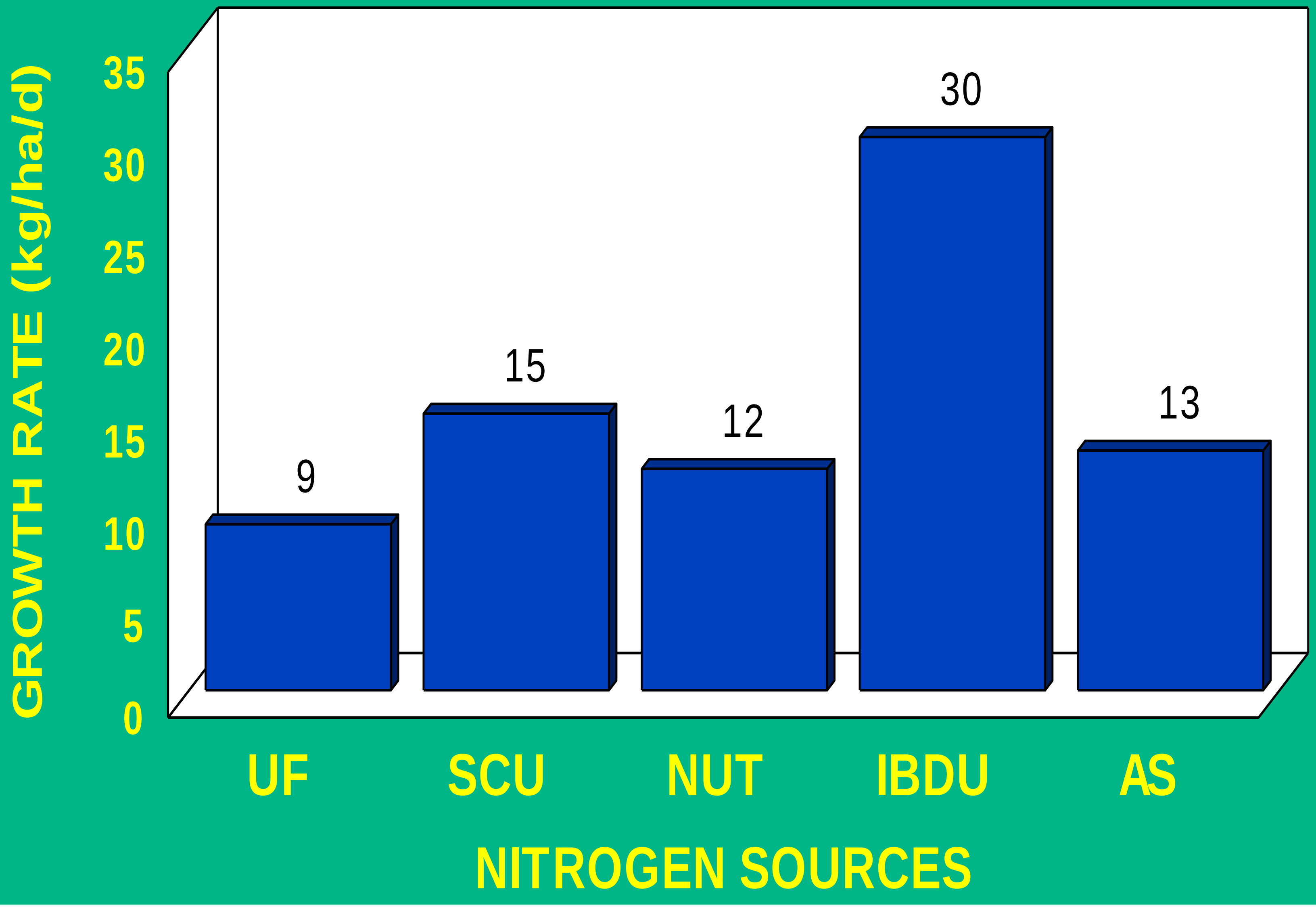
SOME REASONS FOR USING CONTROLLED RELEASE NITROGEN PRODUCTS

GREATER EFFICIENCY OF APPLIED N

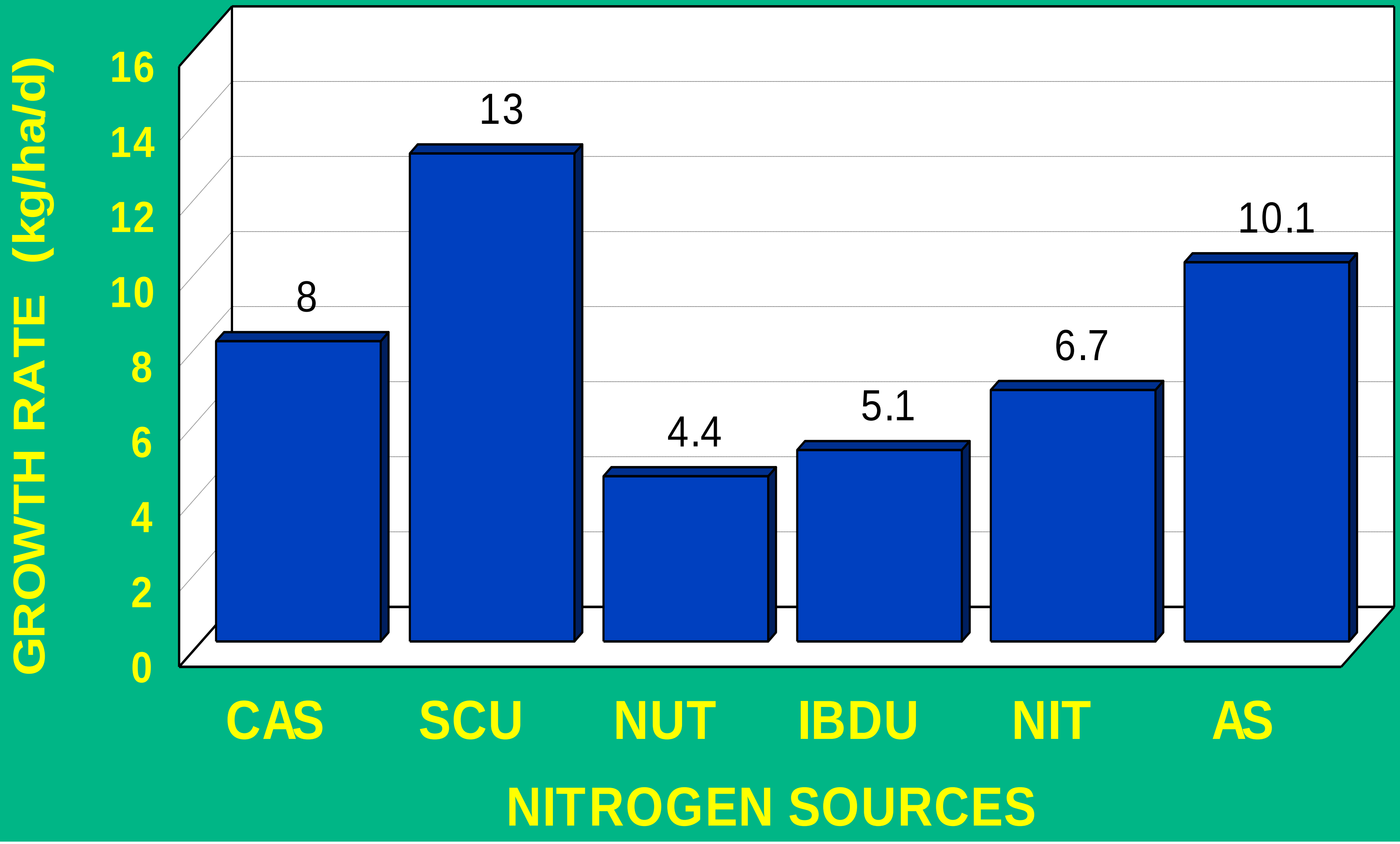
MORE UNIFORM LONG TERM GROWTH

LESS LOSS OF N DUE TO LEACHING

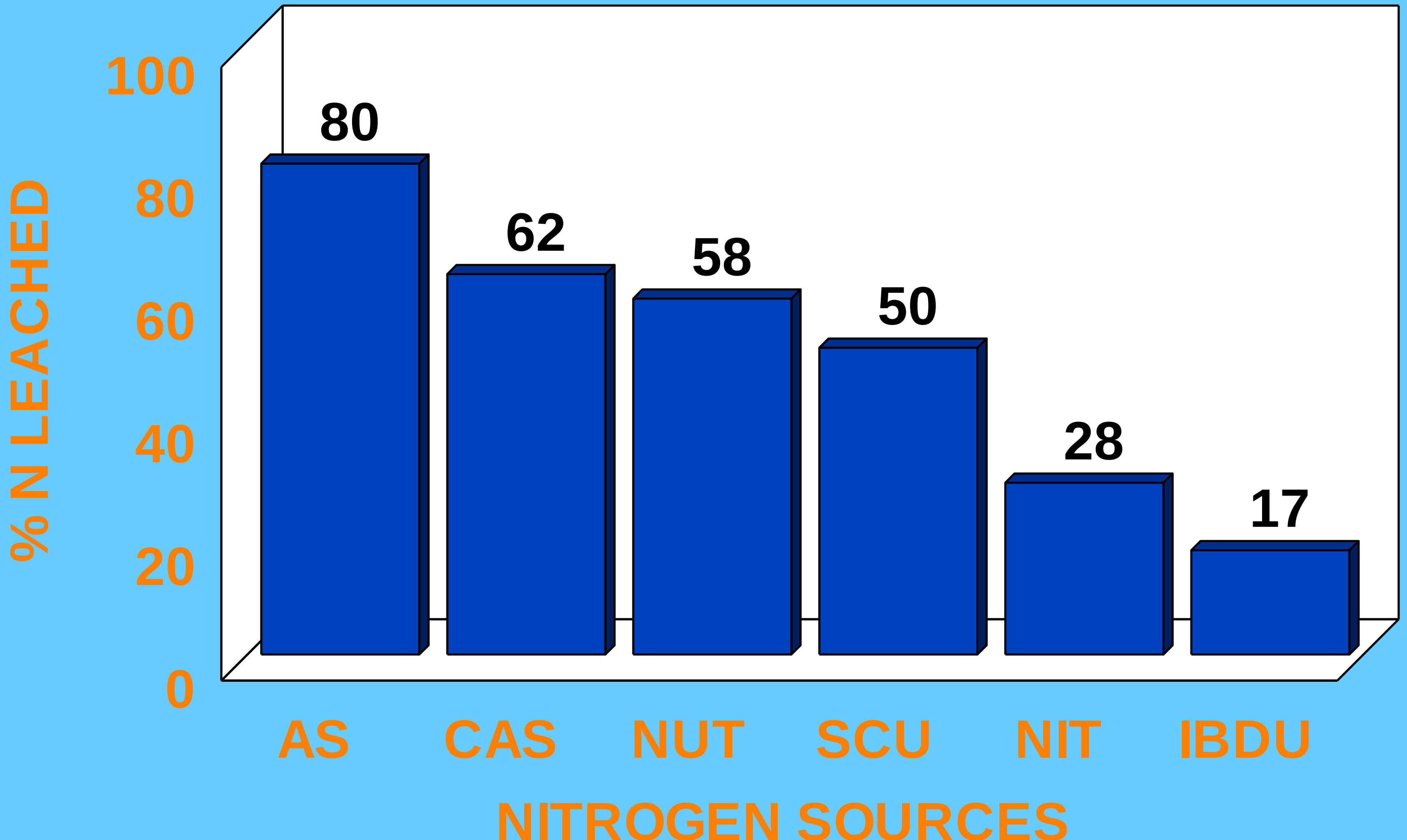
EFFECT OF N SOURCE ON GROWTH OF RYEGRASS



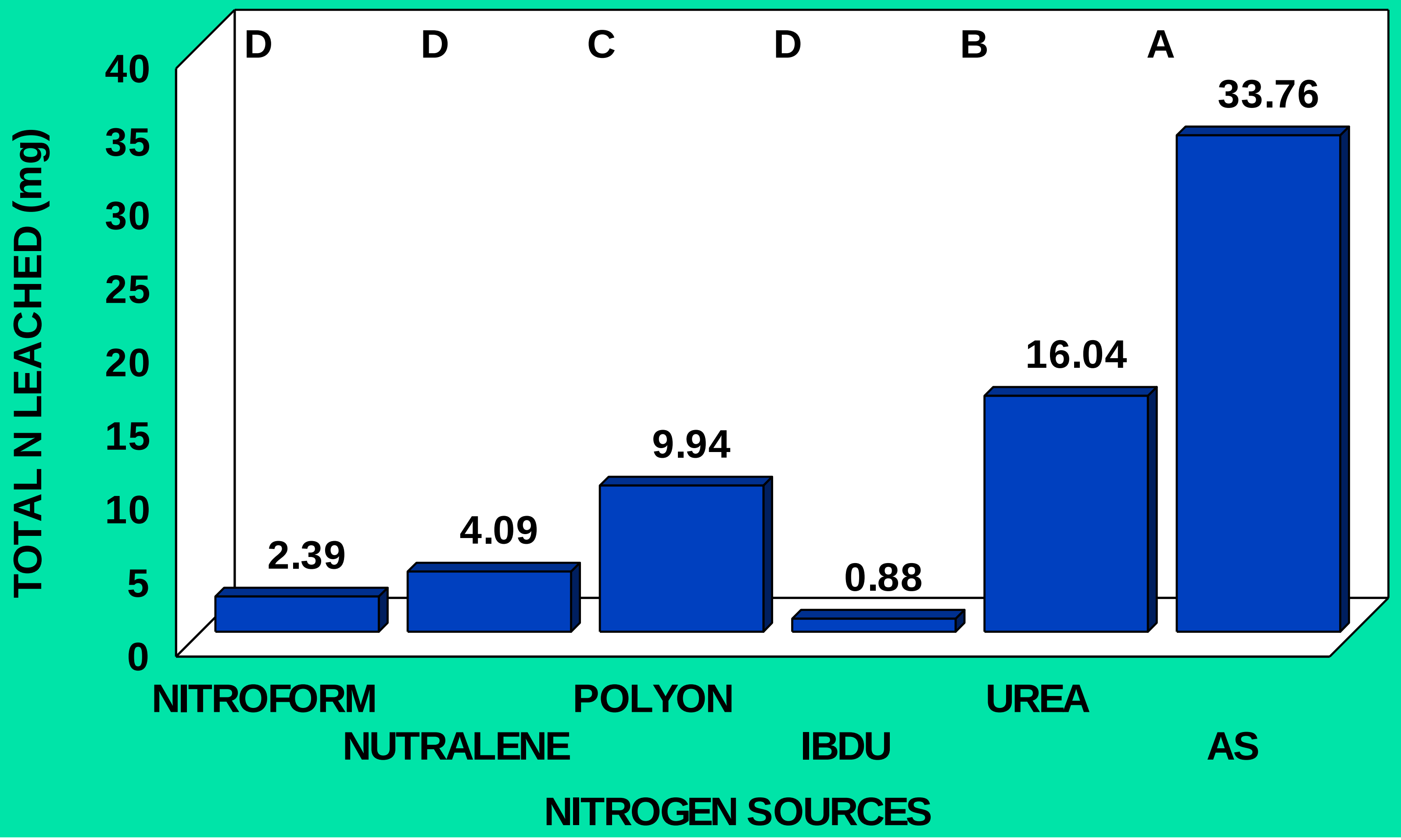
EFFECT OF N SOURCE ON GROWTH OF TIFWAY BERMUDA



LEACHING N LOSS FROM SLOW-RELEASE N SOURCES



EFFECT OF N SOURCE ON TOTAL N LEACHED



ESTIMATING RELEASE PROPERTIES OF SLOW-RELEASE FERTILIZER MATERIALS

OBJECTIVES

1. ESTABLISH N RELEASE CURVES FOR CRN SOURCES

2. DEVELOP LABORATORY PROCEDURES FOR EXTRACTING N FROM CRN SOURCES

3. ESTABLISH A RELATIONSHIP BETWEEN RELEASE CURVES AND EXTRACTION PROCEDURES

4. PREDICT N RELEASE BASED ON EXTRACTION

PERCENT N RELEASED OVER TIME FOR SELECTED CRN MATERIALS

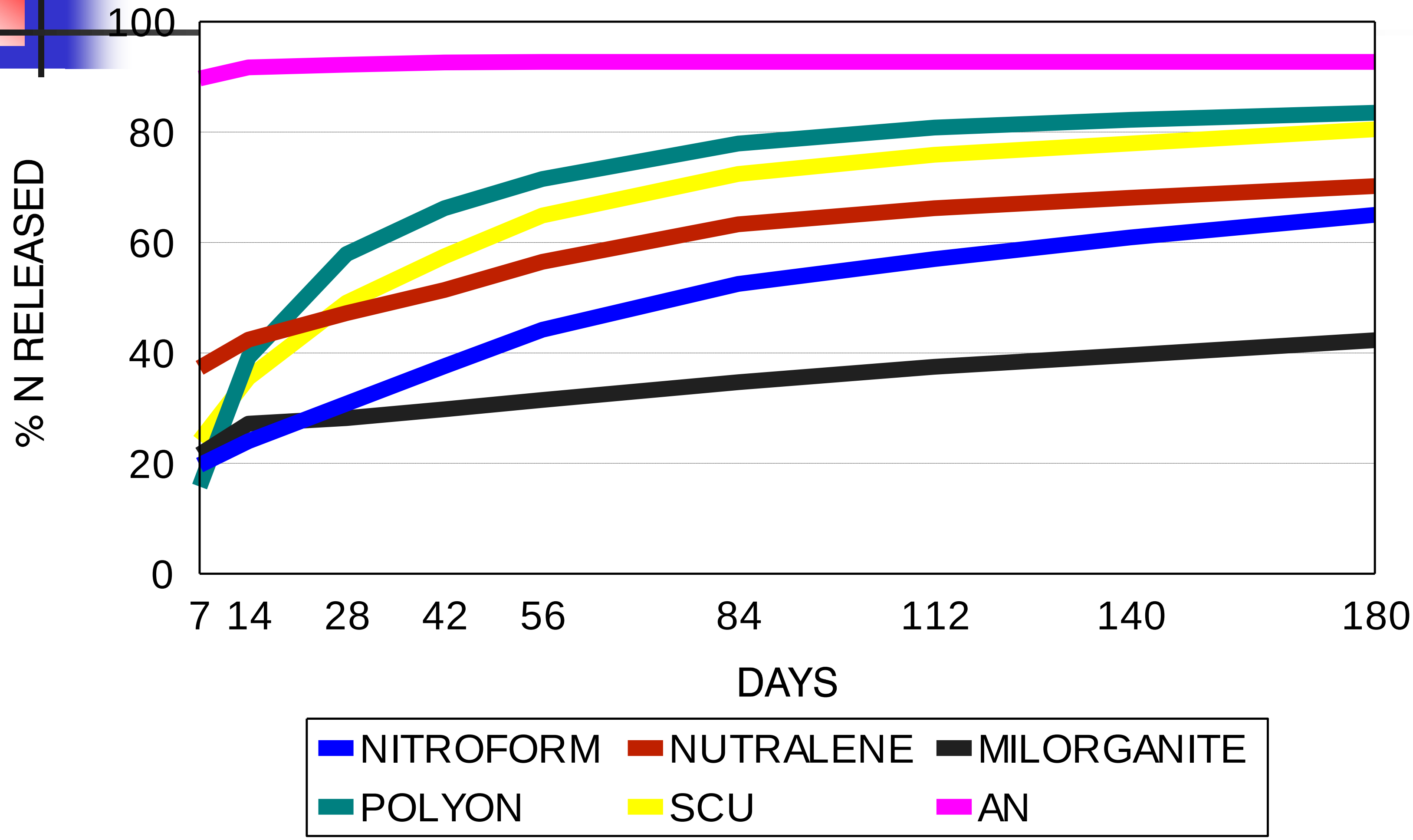
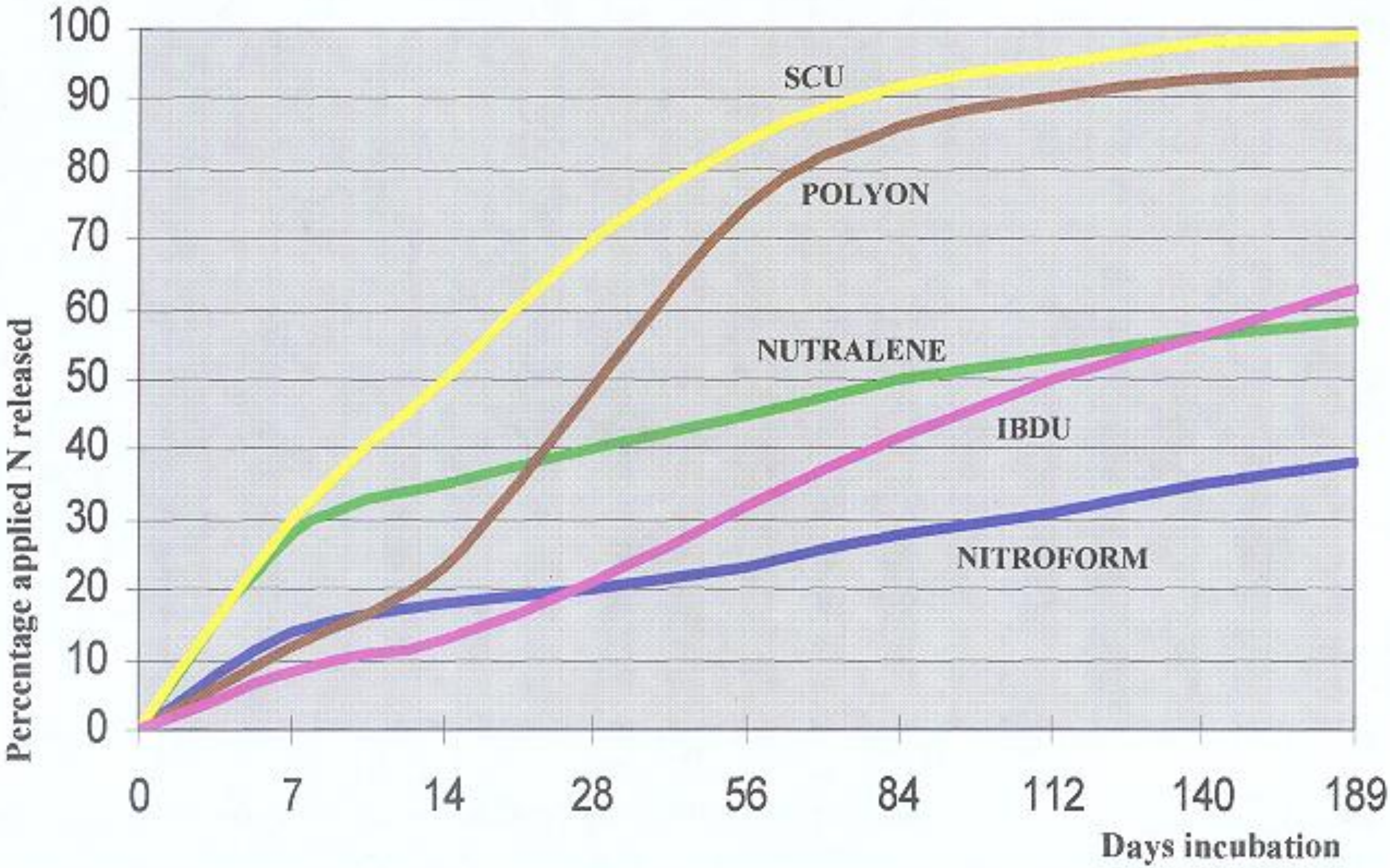
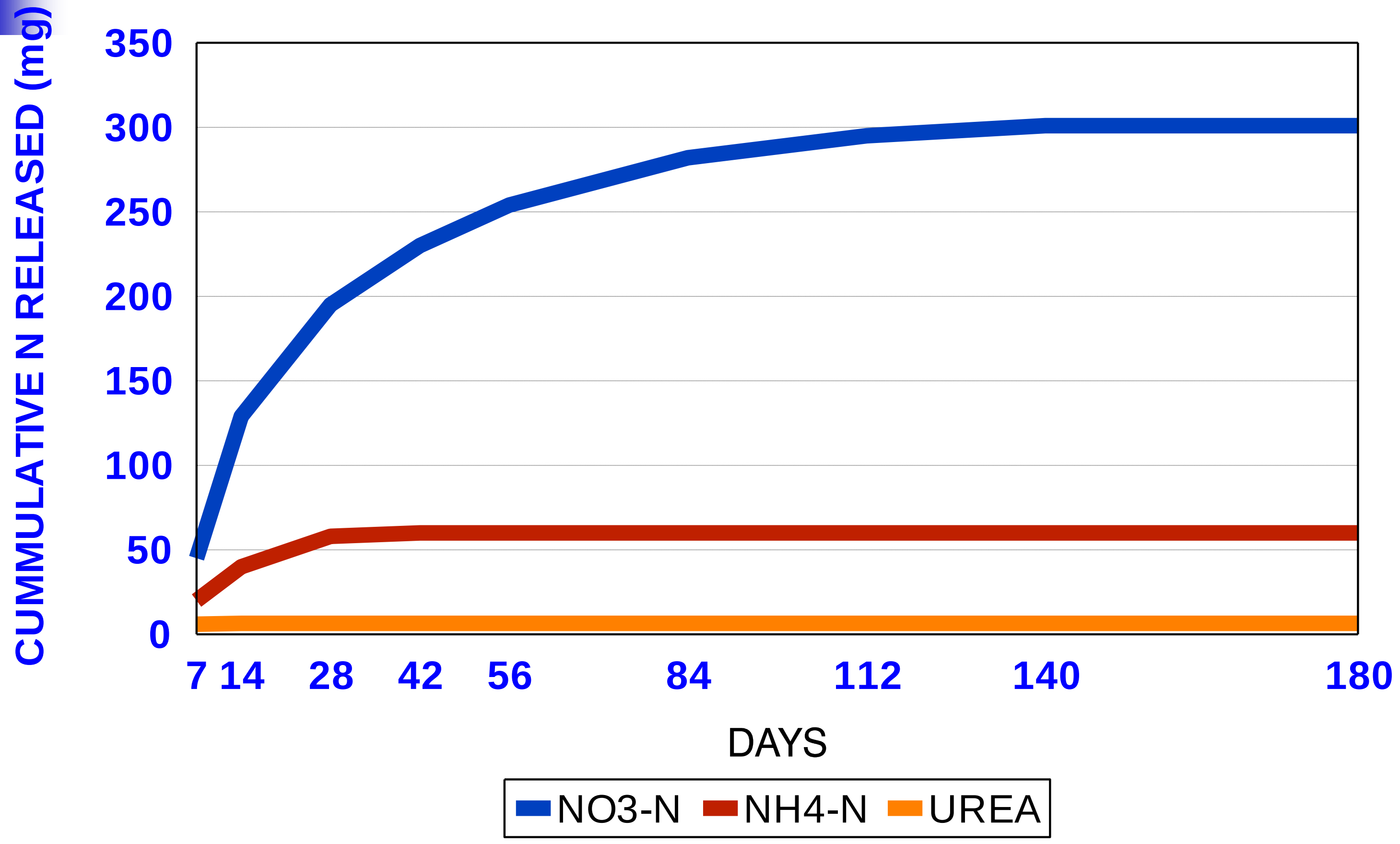


Figure 5. Percentage of applied N released from selected nitrogen sources over 189 day soil incubation



TOTAL N RELEASED FROM POLYON BY FORM OVER TIME



Mean % N released from selected N sources over 182 day incubation period

N Source	7	14	28	56	84	112	140	182
	---------------% of applied N released---------------							
Nitroform	14	18	20	23	28	31	35	38
Nutralene	28	35	40	45	50	53	56	58
Polyon	12	23	49	75	86	90	93	94
SCU	30	50	70	84	92	95	98	99
IBDU	8	13	21	32	42	50	56	63
Osmocote	19	25	35	55	72	81	88	94
20-2-20	37	39	41	45	48	50	52	54

SUMMARY

- NUTRIENT RELEASE IS INFLUENCED BY ENVIRONMENTAL CONDITIONS

- CONTROLLED RELEASE MATERIALS RELEASE N AT DIFFERENT RATES

- INITIAL AND LONG TERM RELEASE OF N SIGNIFICANTLY DIFFERENT BASED ON CONTROLLED RELEASE SOURCE