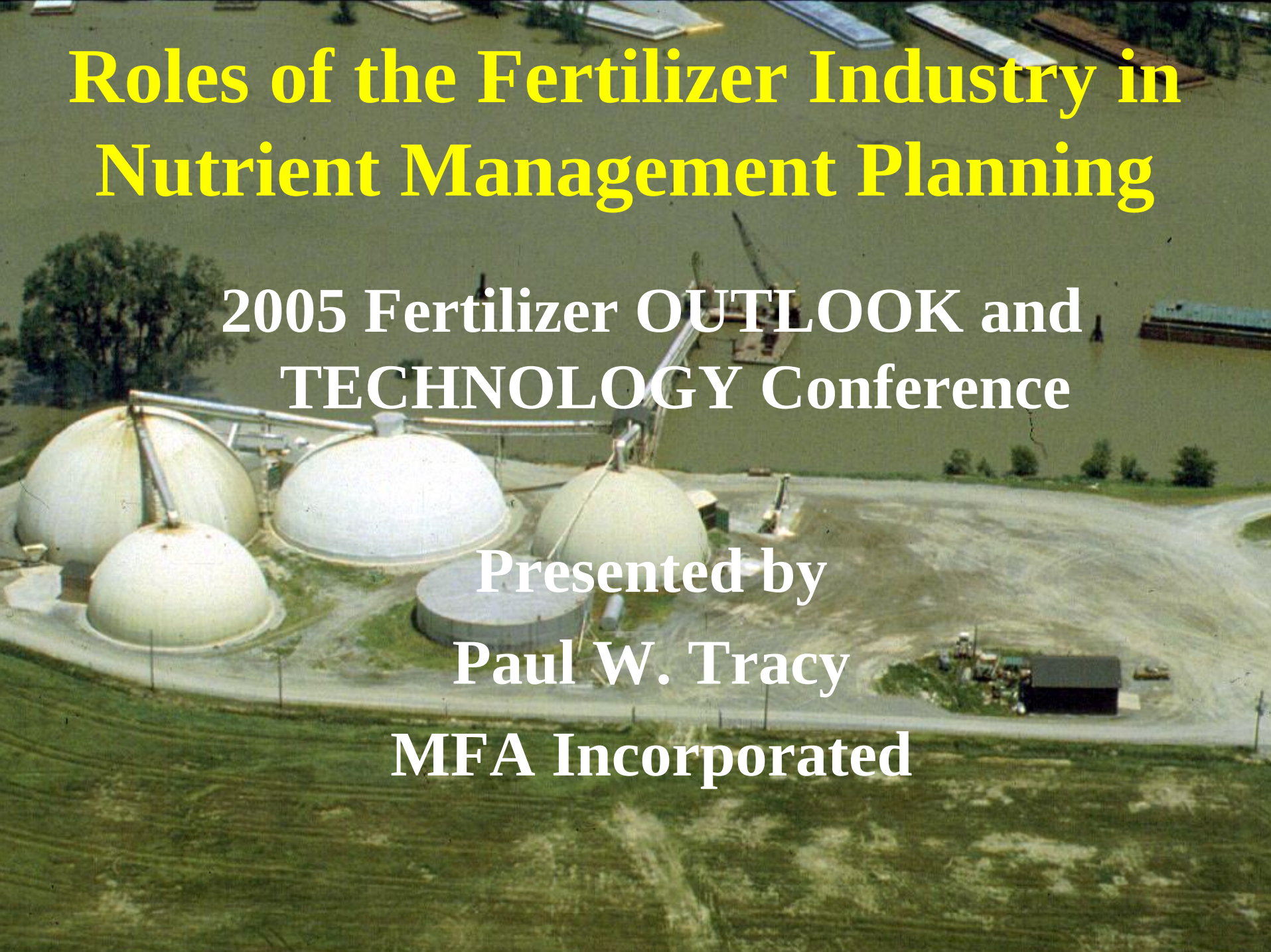


# Roles of the Fertilizer Industry in Nutrient Management Planning

## 2005 Fertilizer OUTLOOK and TECHNOLOGY Conference


**Presented by**

**Paul W. Tracy**

**MFA Incorporated**

# Material Collected for Presentation from:

**MFA, Incorporated**

**Potash & Phosphate Institute**

**USDA NRCS**

**American Society of Agronomy**

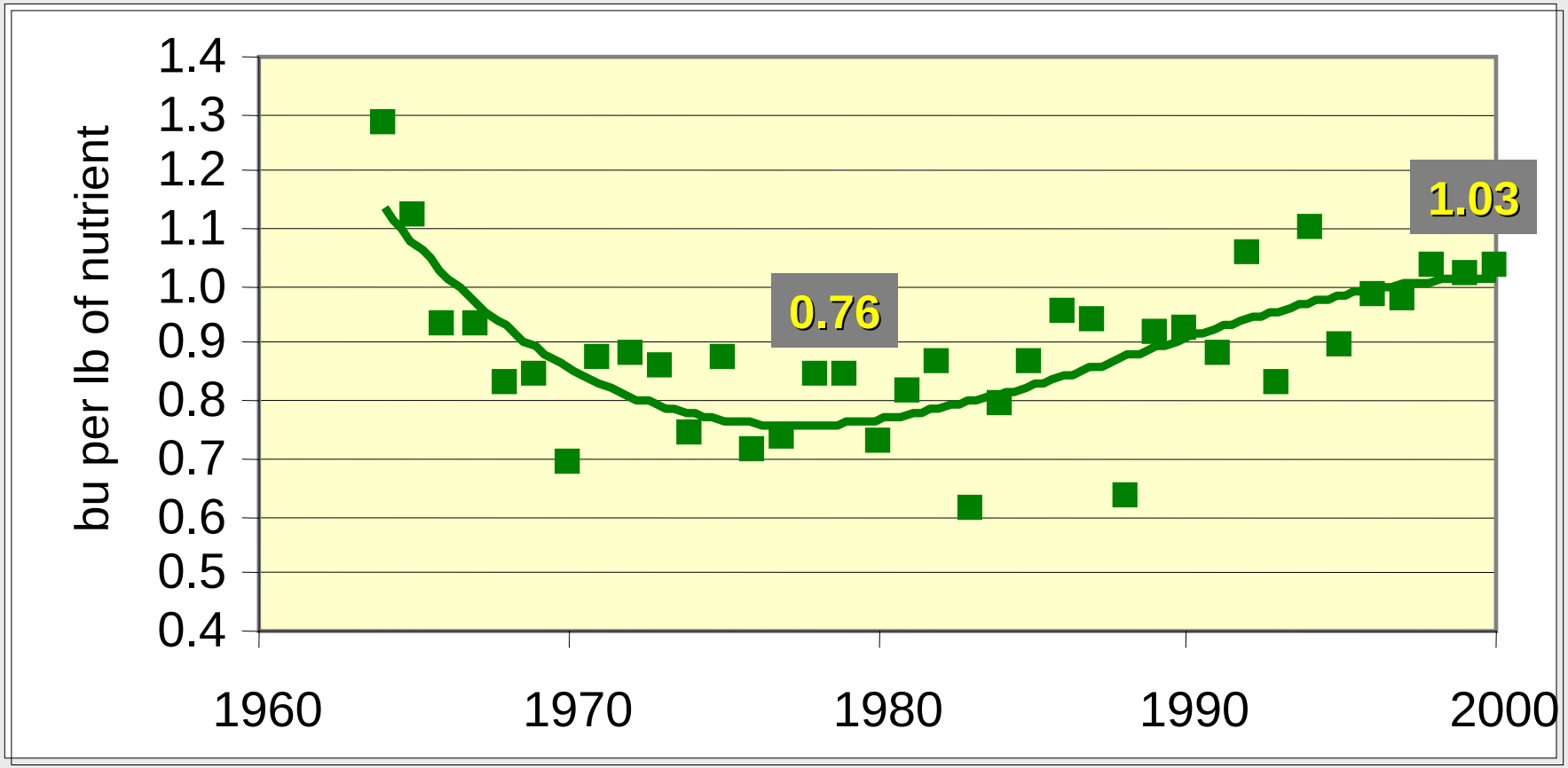
# Levels of Nutrient Management

**International/National:** Manufacturers, Distributors, Transportation, Global Balances – **Mega Scale**

**Regional/Local:** Distributors, Retailers, Regional Cooperatives, Corporate Farms – **Macro Scale**

**Farm/Field/Subfield:** Individual farming operations, landowners, cash renters, etc. – **Micro Scale**

# Corn Grain Produced in the U.S. Per Unit of Fertilizer N Used, 1964-2000. - PPI




**Since 1980:**

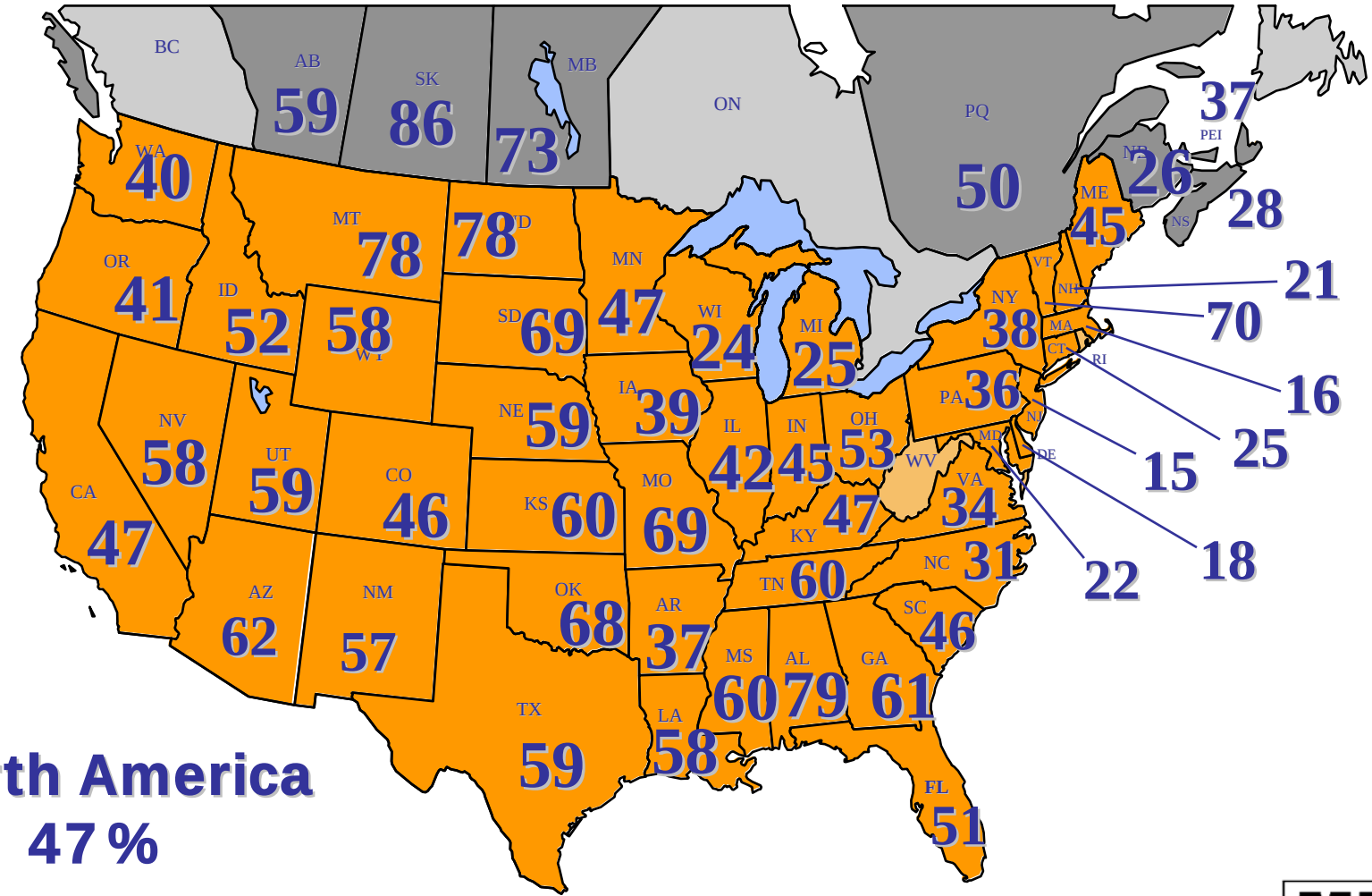
**35% increase in N efficiency**

**40% increase in corn yields**

***More will be expected***

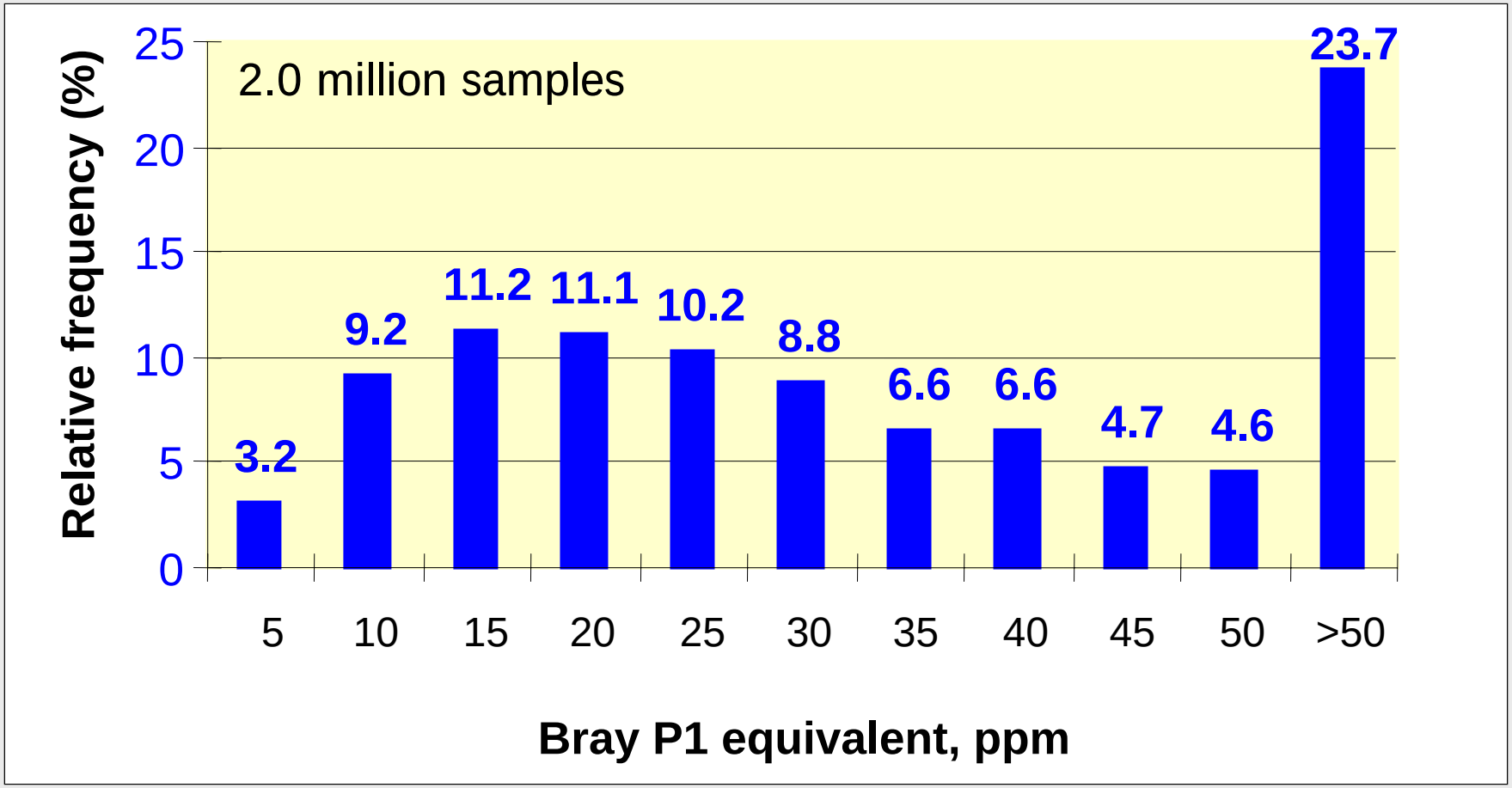
MFA AGRI SERVICES

# Percent of Soils Testing Medium or Lower in P in 2001 - PPI




**North America**
**47 %**

# Soil Test P Relative Frequency Distribution for North America in 2001 - PPI




Median P = 28 ppm

MFA AGRI SERVICES

# Partial P budgets for North America (average of 1998-2000) - PPI

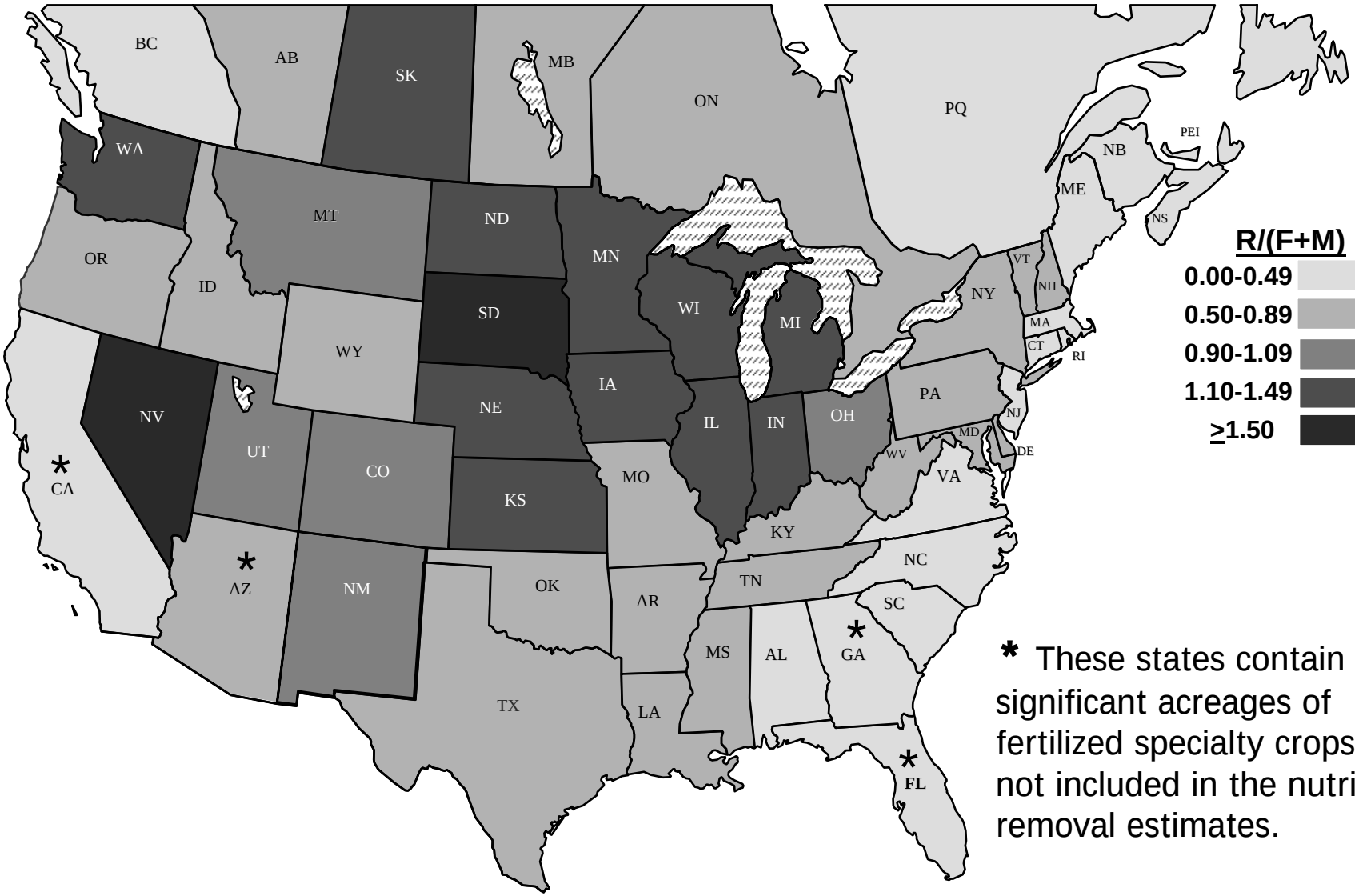
| Region | Crop Removal | Applied Fertilizer | Recov. Manure* | Balance** | Removal/use ratio | |
|---|---|---|---|---|---|---|
| | | | | | Fertilizer | Fert+Man |
| | ---------- $P_2O_5$, billion pounds ---------- | | | | | |
| North America | 13.0 | 10.3 | 4.0 | +1.3 | 1.27 | 0.91 |
| U.S. | 11.1 | 8.8 | 3.3 | +0.9 | 1.27 | 0.92 |
| Canada | 1.9 | 1.5 | 0.7 | +0.4 | 1.23 | 0.84 |
| 6 corn states | 5.1 | 3.0 | 0.9 | -1.3 | 1.70 | 1.33 |
| | | | | | | |
| Iowa | 1.26 | 0.62 | 0.23 | -0.41 | 2.03 | 1.47 |
| Kansas | 0.67 | 0.43 | 0.15 | -0.09 | 1.56 | 1.16 |
| North Carolina | 0.12 | 0.21 | 0.25 | +0.34 | 0.56 | 0.25 |

* Recoverable manure nutrients, Kellogg et al., (USDA-NRCS), 2000.

** Fertilizer+manure-removal.

MFA AGRI SERVICES

# Ratio of P Removal by Common Crops to Fertilizer Applied Plus Recoverable Manure - PPI



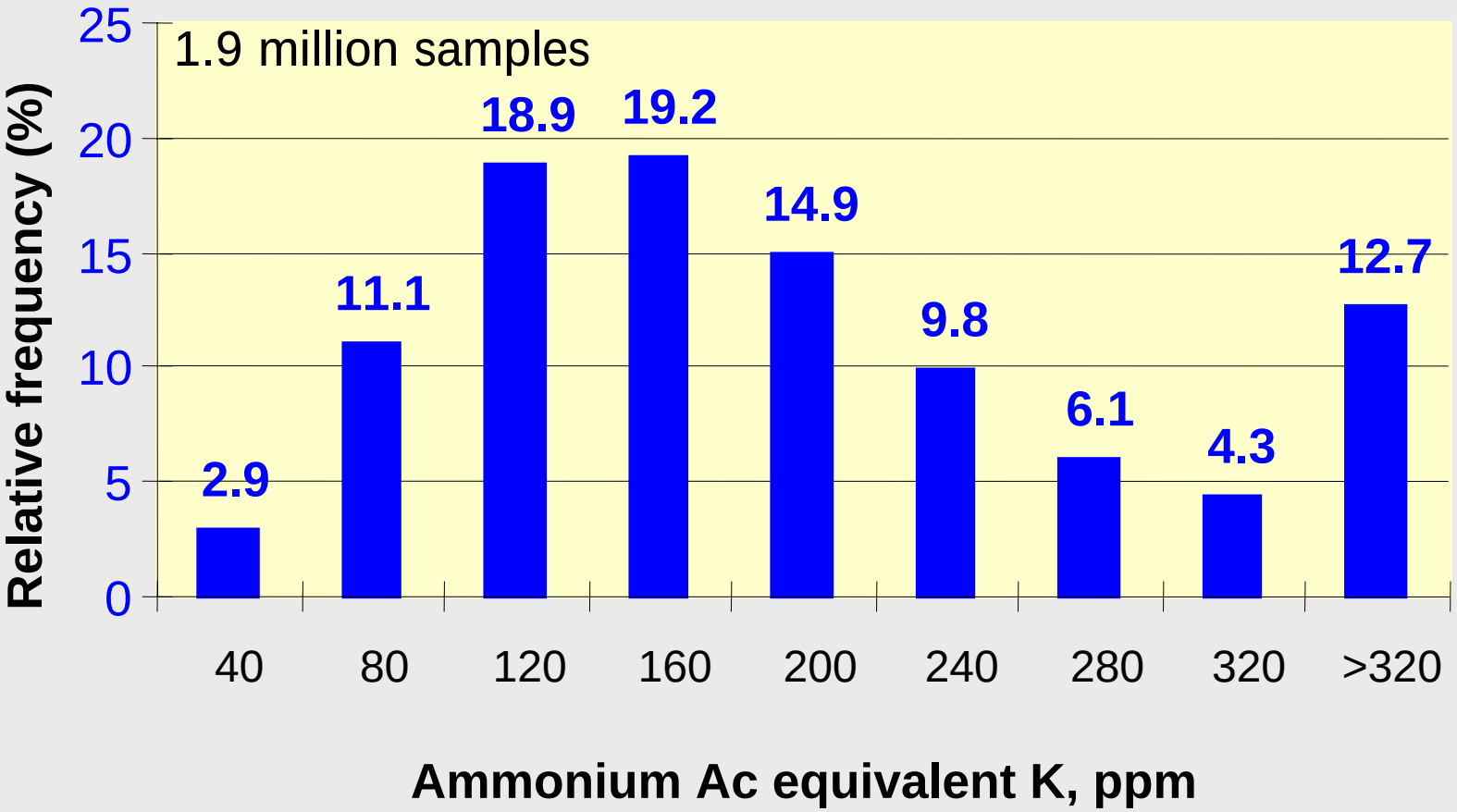

* These states contain significant acreages of fertilized specialty crops not included in the nutrient removal estimates.

# An Acre of Corn, 1970 to 2000 - PPI

| | | 1970 | 1980 | 1990 | 2000 |
|---|---|---|---|---|---|
| Yield | bu/A | 72 | 91 | 119 | 137 |
| P2O5 removal | lb/A | 32 | 40 | 52 | 60 |
| P2O5 rate | lb/A | 64 | 57 | 51 | 47 |
| Applied-removed | lb/A | 32 | 17 | -1 | -13 |
| Eroded P2O5 | lb/A | 6 | 4 | 3 | 2 |
| Manure P2O5 | lb/A | 5 | 5 | 5 | 5 |
| **Soil test P*** | **ppm** | **12(L)** | **22(H)** | **27(H)** | **24(H)** |

**IA median**

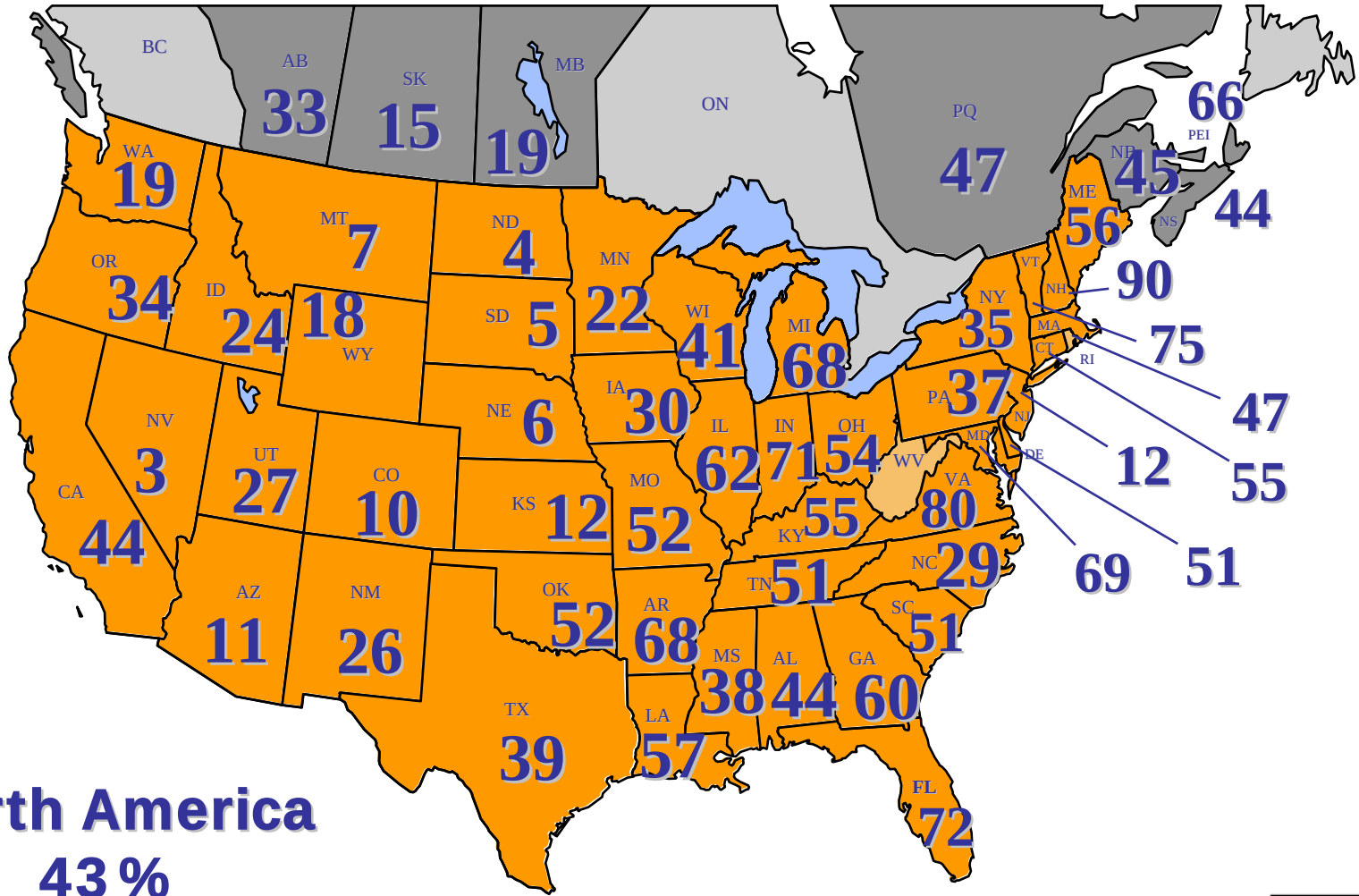
# Soil Test K Relative Frequency Distribution for North America in 2001 - PPI




Median K = 155 ppm

MFA AGRI SERVICES

# Percent of Soils Testing Medium or Lower in K in 2001 - PPI




**North America**
**43 %**

MFA AGRI SERVICES

# Partial K budgets for North America (average of 1998-2000) - PPI

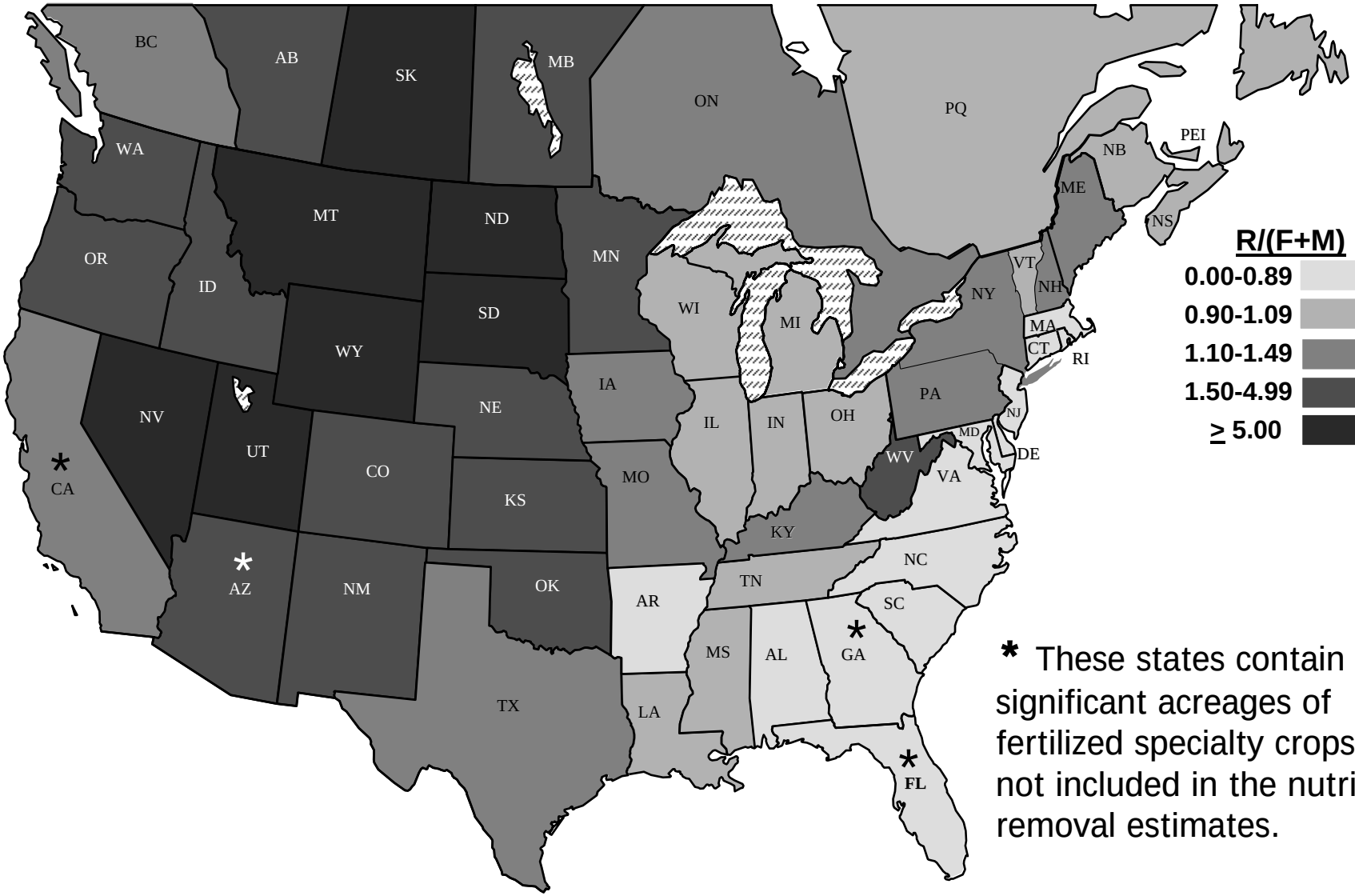
| Region | Crop Removal | Applied Fertilizer | Recov. Manure* | Balance** | Removal to use ratio | |
|---|---|---|---|---|---|---|
| | | | | | Fertilizer | Fert+Man |
| | ---------- $K_2O$, billion pounds ---------- | | | | | |
| North America | 21.0 | 10.9 | 4.5 | -5.6 | 1.92 | 1.36 |
| U.S. | 18.3 | 10.1 | 3.8 | -4.4 | 1.81 | 1.32 |
| Canada | 2.6 | 0.8 | 0.7 | -1.1 | 3.36 | 1.77 |
| 6 corn states | 6.6 | 4.1 | 1.0 | -1.5 | 1.62 | 1.29 |
| | | | | | | |
| Iowa | 1.56 | 0.88 | 0.29 | -0.39 | 1.77 | 1.33 |
| Kansas | 0.86 | 0.11 | 0.19 | -0.55 | 7.60 | 2.80 |
| North Carolina | 0.23 | 0.39 | 0.24 | +0.40 | 0.57 | 0.36 |

* Recoverable manure nutrients, Kellogg et al., (USDA-NRCS), 2000.

** Fertilizer+manure-removal.

MFA AGRI SERVICES

# Ratio of K Removal by Common Crops to Fertilizer Applied Plus Recoverable Manure - PPI



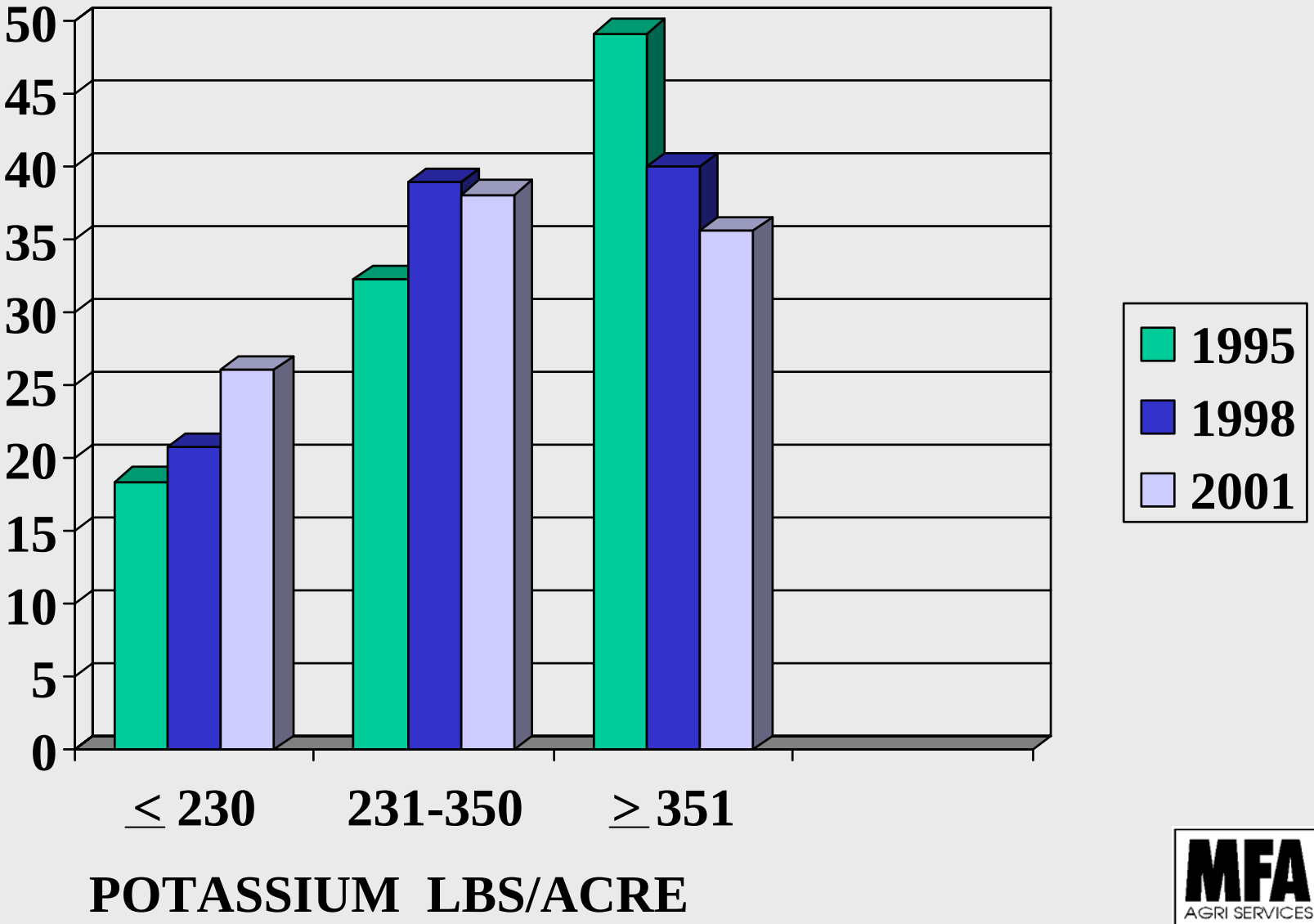

* These states contain significant acreages of fertilized specialty crops not included in the nutrient removal estimates.

# 8 YEARS OF MFA COMPOSTIE SAMPLES POTASSIUM vs PPI

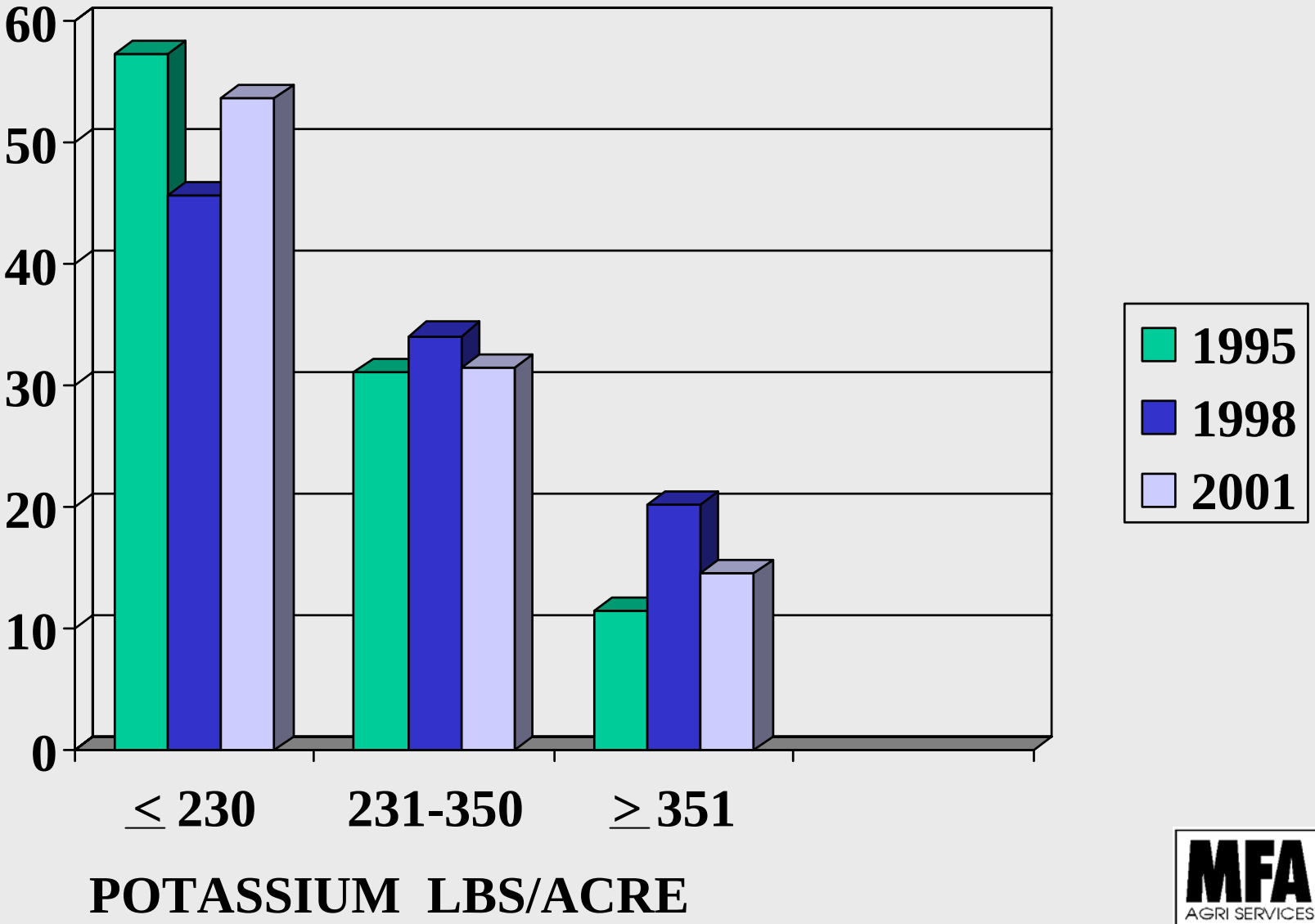
**K in lbs/acre**

| | ≤ 230 | 231-350 | ≥ 351 |
|---|---|---|---|
| **MFA % Samples** | **34.0** | **35.5** | **30.4** |
| **PPI % Samples** | **37.0** | **28.0** | **35.0** |

# REGION 3 % K OVER 3 SOIL TESTING YEARS



# REGION 4 % K OVER 3 SOIL TESTING YEARS



# What is Nutrient Management Planning?

## NRCS Definition:

**“Managing the amount, source, placement, form, and timing of application of nutrients and soil amendments to ensure adequate soil fertility for plant production and to minimize the potential for environmental damage”.**

Missouri NRCS CPS&S Code 590, May 2001

MFA AGRI SERVICES

# What is Nutrient Management Planning?

## MFA Definition:

**“Systems level crop, animal and land use nutrient management designed to ensure economic, environmental and social sustainability of our land resources.**

**Paul Tracy – October, 2004**

**With quality materials, transportation, storage, blending, application and fertilizer inspection control programs, the industry has already developed a high quality nutrient management system**

AGRI SERVICES

**Since comprehensive nutrient management planning includes manure, by-product and other waste-based nutrients, can/should the fertilizer industry become involved in the process?**

MFA AGRI SERVICES


In many cases we already are: Several fertilizer retailers and manufactures also play important roles in animal agriculture or other nutrient-based by-product industries

MFA AGRI SERVICES

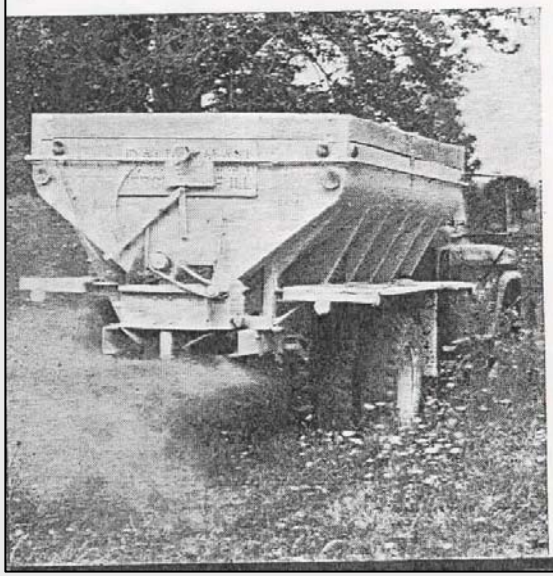
# Farm Journal, 1960



TRY *Ray Dankenbring, Poultry Editor*

## NEW POULTRY INCOME

*—sell the manure*



■ When you can take a by-product like poultry manure, pellet it, package it, and sell it for $80 a ton, you can look for more farmers to try it.

And that's just what is happening. When egg and broiler prices got down below the cost of production last year, some poultrymen discovered that manure was the only part of their business showing a profit!

Some were selling it in bulk for $10 a ton. Others were running dry manure through a hammermill into paper bags and selling it for $40 to $60 a ton.

Now the latest idea is to pellet the manure, neatly package it, and sell it as a retail store item for as much as $80 a ton!

University of Delaware scientist W. H. Mitchell discovered that it's a simple trick to run broiler manure through a regular feed-pelleting machine.

He says you get pellets that are easy to handle and practically dust-free (see photo).

"There's no drying-out cost either," says agricultural engineer Howard Hoyt. "The forced air used during the pelleting process dries out most of the moisture."

Delmarva Poultry Industries Inc. sells test-marketing pelleted-broiler-litter at $40 to $45 a ton, wholesale to stores, as a soil conditioner in the lawn and garden market.

Several Delaware nurseries and farm stores are offering the pellets for sale, mostly in 25 and 50-lb. bags. Usually a 25-lb. bag sells for $1.15 ($92 a ton) and the 50-lb. for $2.00 ($80 a ton). A few stores charge more.

At the Eastern States Farmer's Exchange service center in Newark, Del., manager Harry Pierce is selling two different sizes of pellets: 3/16 inch, small enough for regular lawn fertilizer spreaders; and 3/8 inch, used mostly around shrubbery. "Interest is picking up fast," says Pierce. "At first, the manure pellets were just a curiosity—but now the word is getting around, and sales are going up."

A ton of dry manure, properly handled is equivalent to a ton of 5-3-2 commercial fertilizer, says Herbert C. Jordan, Extension poultryman at Pennsylvania State University.

Furthermore, Jordan figures that chickens produce a ton of the dry manure for every two tons of feed they eat. So if a laying hen eats 100 pounds of feed in a year (enough to produce 20 dozen eggs), she produces 50 pounds of dry manure. *That would be $2 worth per hen, if you sold it at the retail rate!*

Jordan figures more conservatively that you can add 1½ cents per pound to broiler returns and 26 cents per laying hen by selling the manure. He's figuring it at the wholesale level ($5 to $15 a ton), which most poultrymen would use. End

**Incorporating manure into the fertilizer industry is not a new concept – Article describes processed litter in 1960**

**$43.20 cost at source, $40 nutrient value at field?**

MFA AGRI SERVICES

# e.g. Swine Manure Value "as received" (MWPS-18)

**Total N Value = $15.00/1000 gallons**

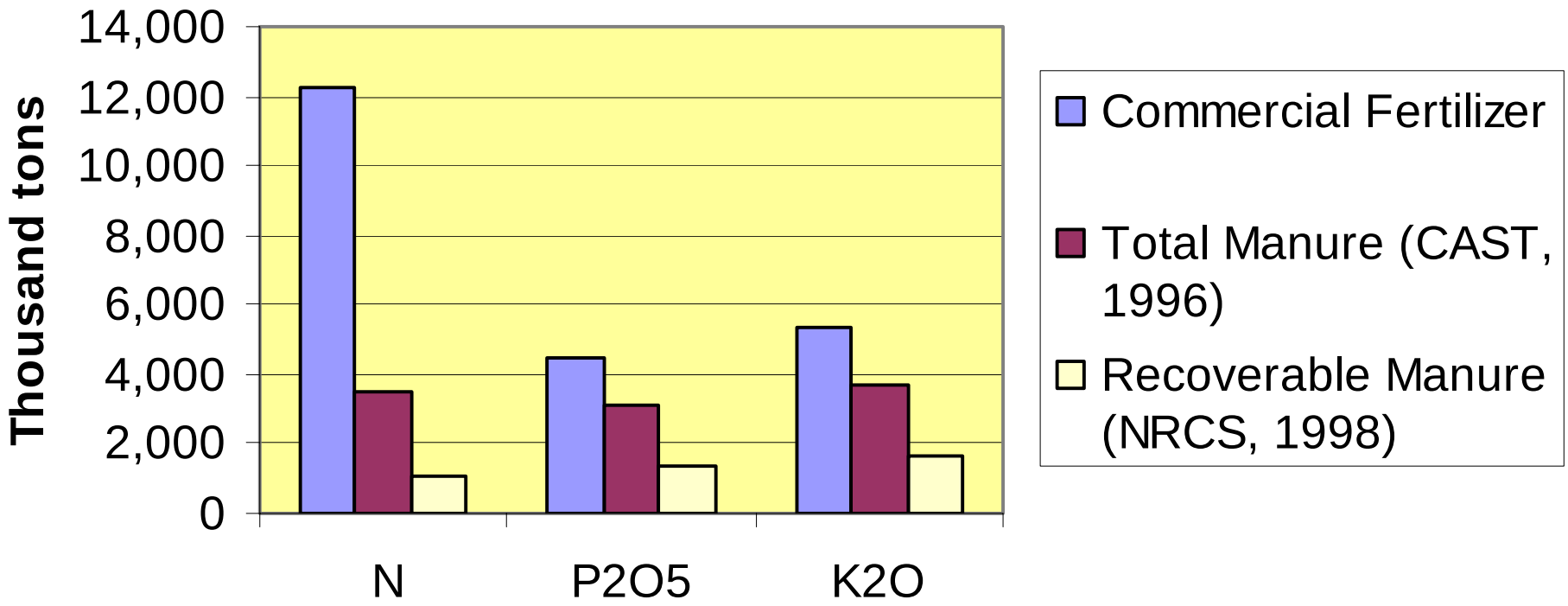
**P2O5 Value = $ 8.40/1000 gallons**

**K20 Value = $ 6.8/1000 gallons**

Based upon $0.30/lb N, $0.24/lb P2O5 and $0.17/lb K2O - 2004

MFA AGRI SERVICES

# Manure Nutrients Relative to Commercial Fertilizer Use in the U.S.




**Tom Bruulsema, PPI, 1998**

MFA AGRI SERVICES

# Potential Commercial Fertilizer Replacement with Manure Nutrients

| Nutrients/ Regions | Atlantic | West North Central | West South Central | U.S. Total |
|---|---|---|---|---|
| | | % replacement | | |
| N | 32 | 11 | 22 | 14 |
| P205 | 150 | 24 | 141 | 42 |
| K20 | 120 | 55 | 452 | 59 |

**Integrated Animal Waste Management Council for Agriculture Science and Technology - Report 128**

MFA AGRI SERVICES

# Illinois P Budgets, 1982-1996

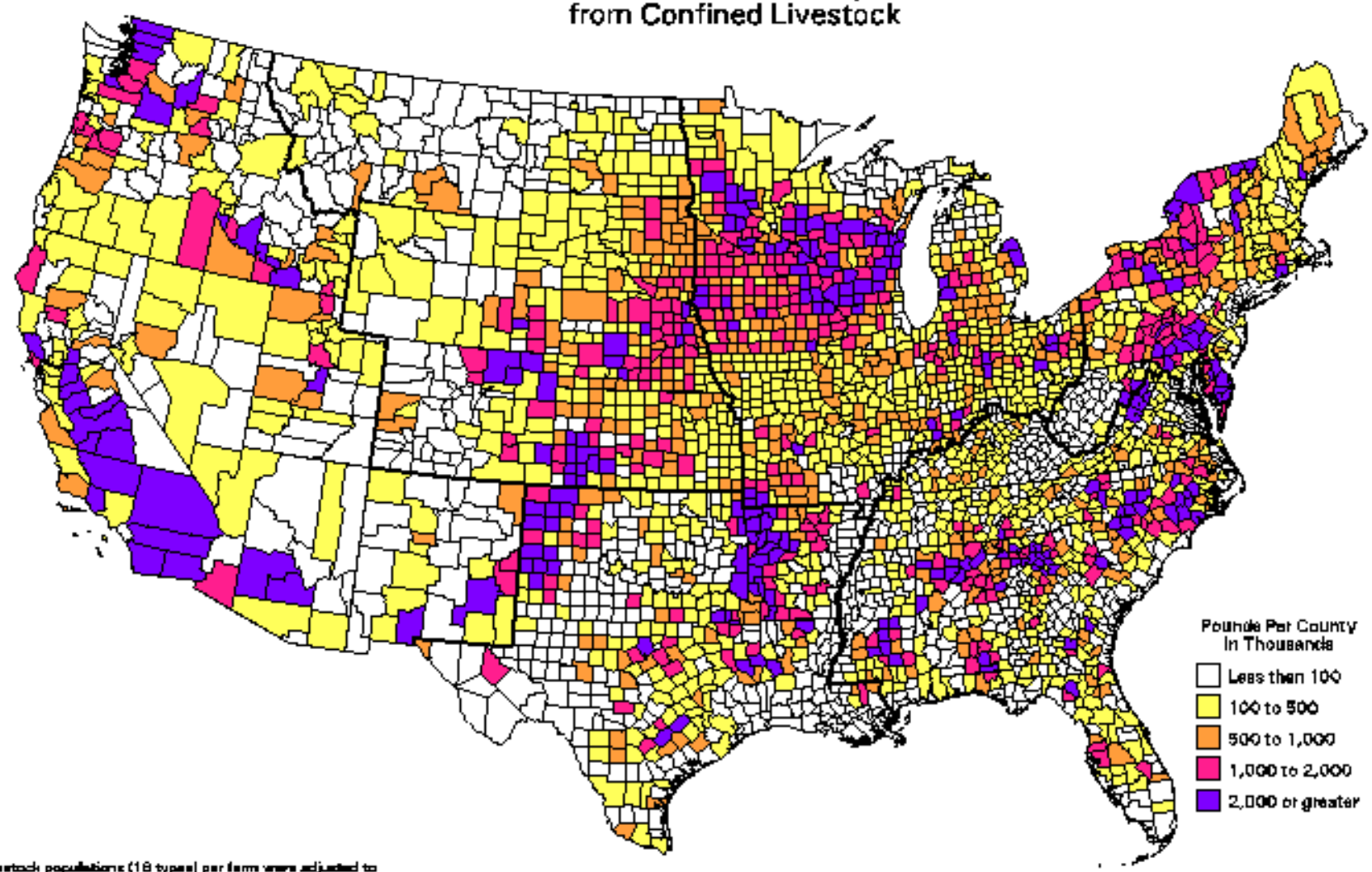
| | Removal | | Inputs | | | |
|---|---|---|---|---|---|---|
| Years | Crop | Animal* | Fertilizer | Manure | Human | Removal/ Inputs |
| | ----------tons, thousands---------- | | | | | % |
| 82-86 | 517 | 8 | 466 | 112 | 16 | 88 |
| 87-91 | 498 | 8 | 385 | 106 | 16 | 100 |
| 92-96 | 574 | 8 | 381 | 101 | 16 | 117 |

*Meat, eggs & milk

Hoeft, University of Illinois

MFA AGRI SERVICES

# Map 1: Estimated Manure Nitrogen Production from Confined Livestock



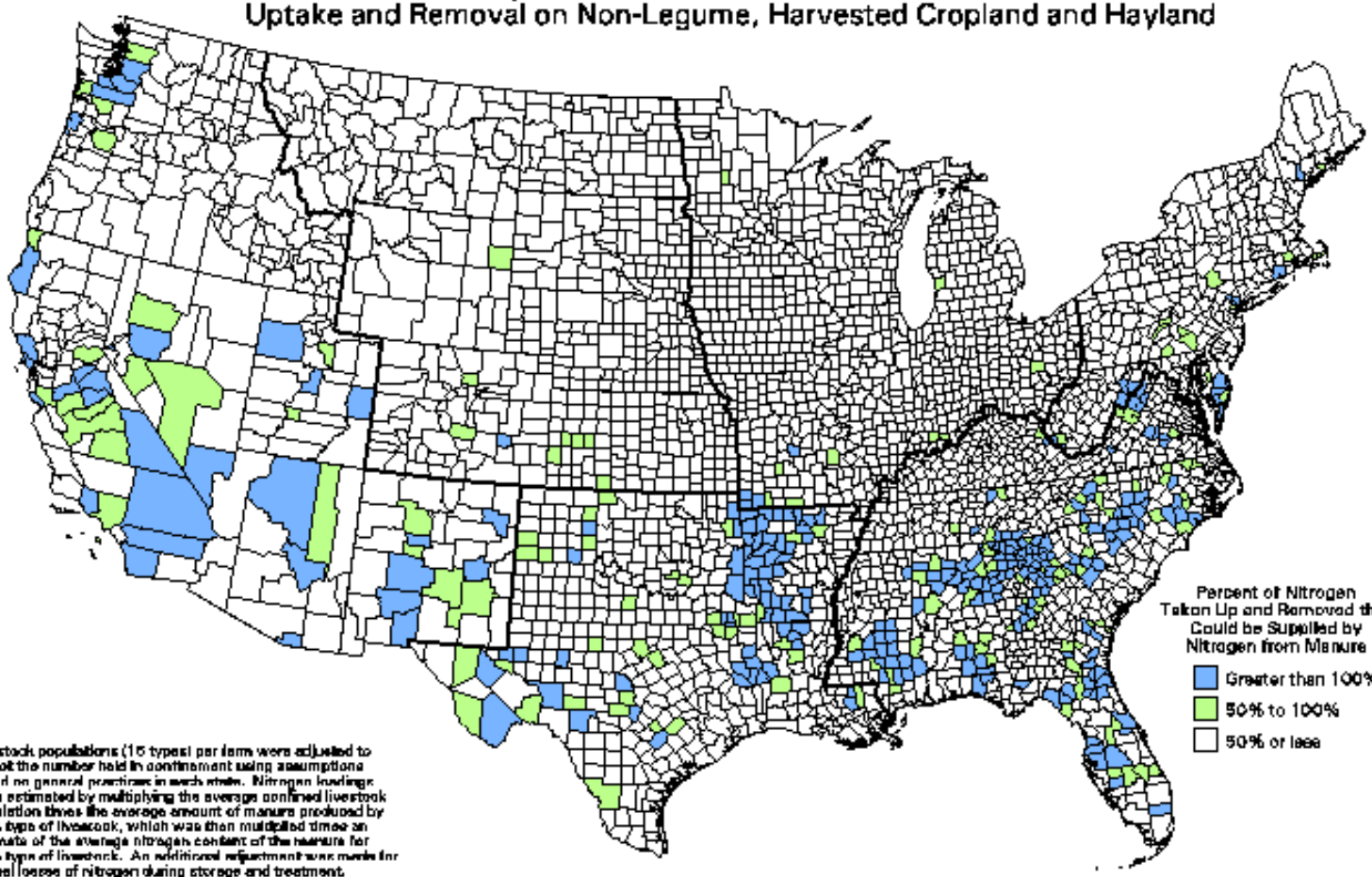

Livestock populations (18 types) per farm were adjusted to reflect the number held in confinement using assumptions based on general practices in each state. Nitrogen loadings were estimated by multiplying the average confined livestock population times the average amount of manure produced by each type of livestock, which was then multiplied times an estimate of the average nitrogen content of the manure for each type of livestock. An additional adjustment was made for typical losses of nitrogen during storage and treatment.

Data Source: Census of Agriculture, 1992. This analysis has only been run for the contiguous 48 states. Alaska, Hawaii, Puerto Rico, U.S. Virgin Islands, and Pacific Basin data were not incorporated in the study.

U.S. Department of Agriculture
Natural Resources Conservation Service
Resource Assessment and Strategic Planning Division
Washington D.C. November 1997 Map ID: 2420

USDA

# Map 2: Potential for Nitrogen Available from Animal Manure to Meet or Exceed Plant Uptake and Removal on Non-Legume, Harvested Cropland and Hayland



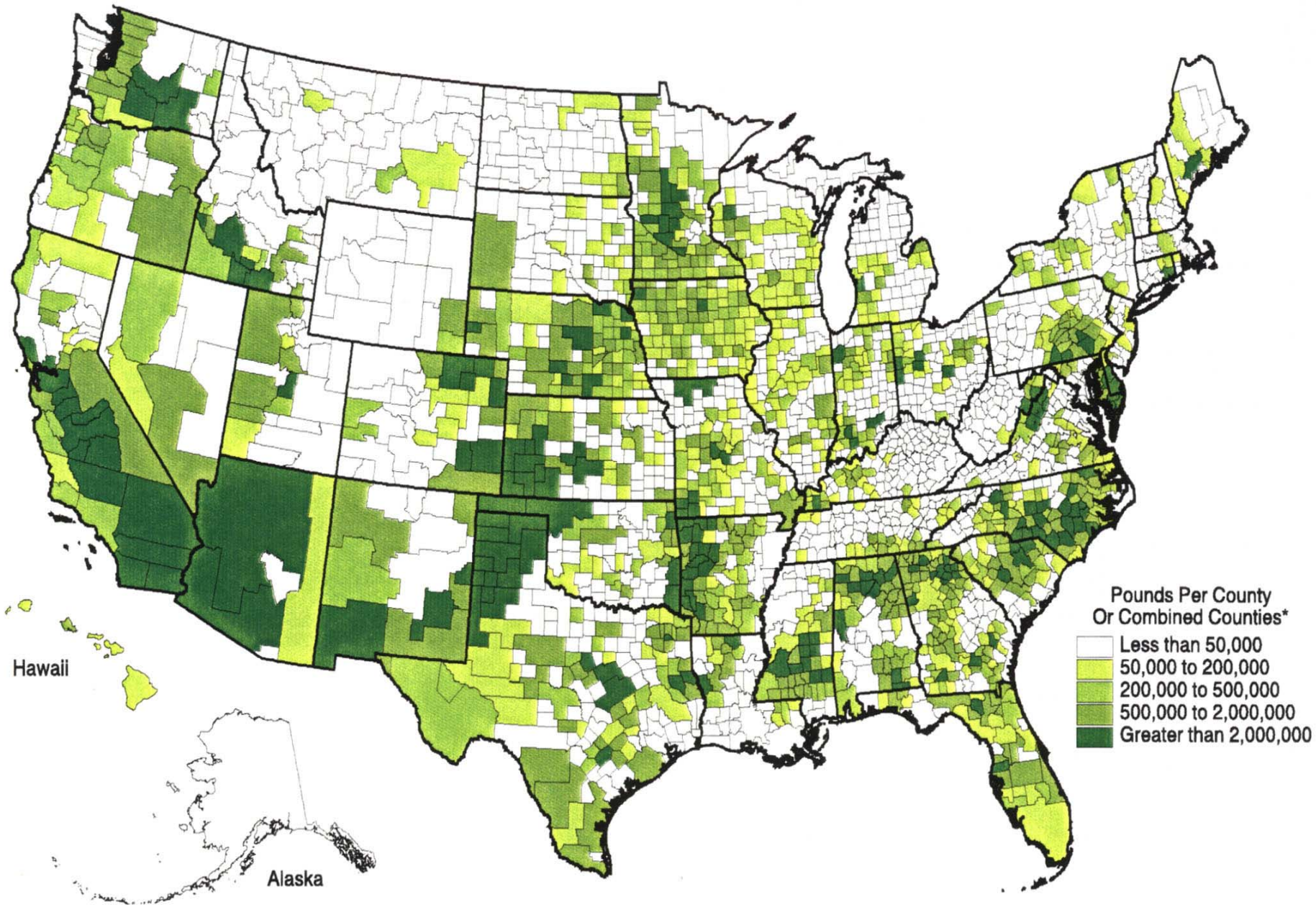

Livestock populations (15 types) per farm were adjusted to reflect the number held in confinement using assumptions based on general practices in each state. Nitrogen loadings were estimated by multiplying the average confined livestock population times the average amount of manure produced by each type of livestock, which was then multiplied times an estimate of the average nitrogen content of the manure for each type of livestock. An additional adjustment was made for typical losses of nitrogen during storage and treatment. Nitrogen uptake and removal were estimated using yield data and estimates of the percent nitrogen content in the harvestable portion of the crop. The ratio of nitrogen available in manure to the amount that could be taken up and removed by crops grown in the county is shown in the map. It was assumed that all cropland, hayland, and pastureland in the county were available for manure utilization. No adjustment was made for application of commercial fertilizer.

Data Source: Census of Agriculture, 1992. This analysis has only been run for the contiguous 48 states. Alaska, Hawaii, Puerto Rico, U.S. Virgin Islands, and Pacific Basin data were not incorporated in the study. Citrus, Vegetable, and Nut Crops have been excluded from this analysis.

U.S. Department of Agriculture
Natural Resources Conservation Service
Resource Assessment and Strategic Planning Division
Washington D.C. November 1997 Map ID: 2406

USDA

**Map 28** Excess manure nitrogen assuming no export of manure from farm, 1997



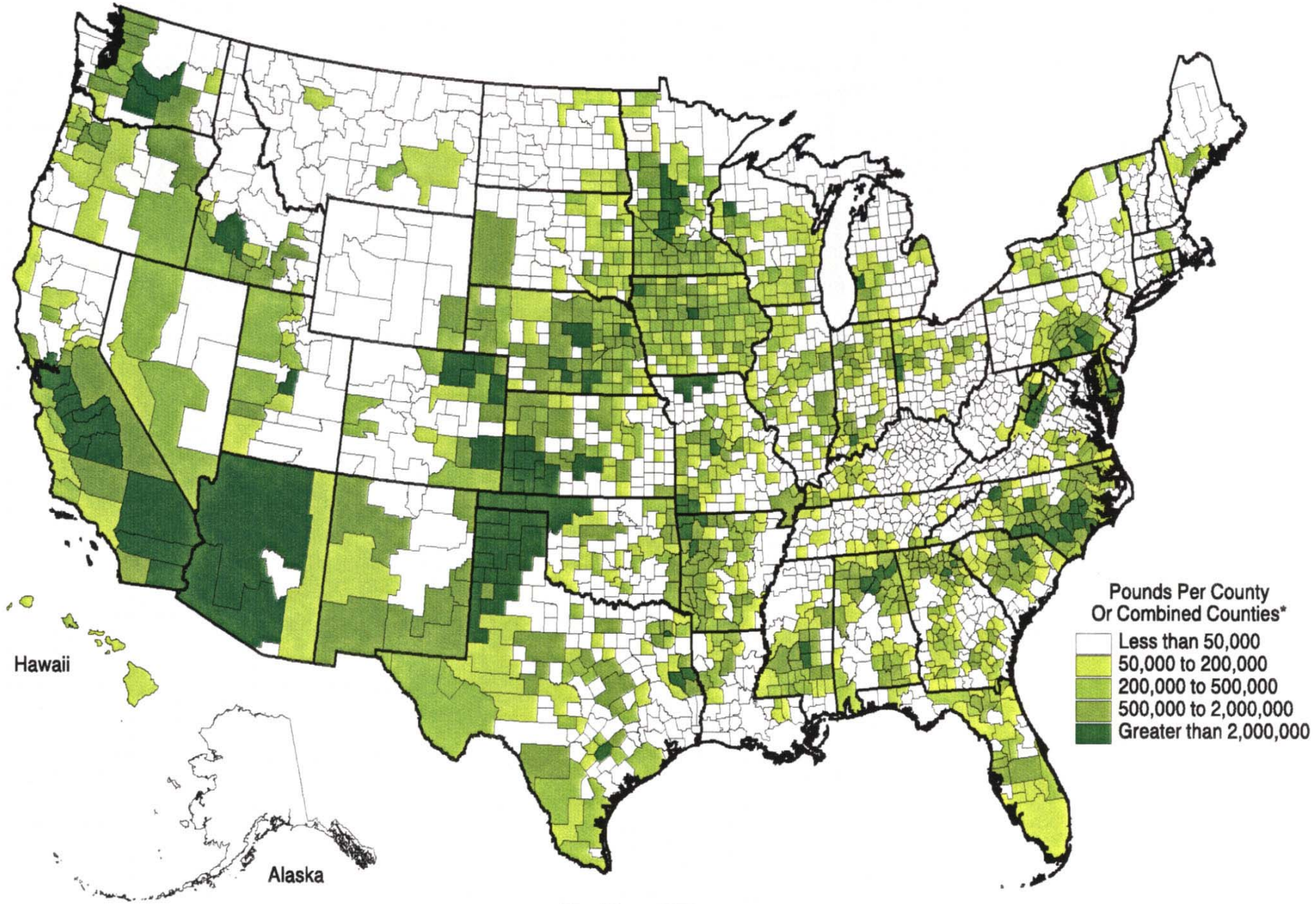

Map ID: m5436

*Some counties are combined to meet disclosure criteria.

# Manure P vs. Crop Land P Use

< 25%
25 - 50%
50 - 100%
>100%

**Map 30** Excess manure phosphorus assuming no export of manure from farm, 1997

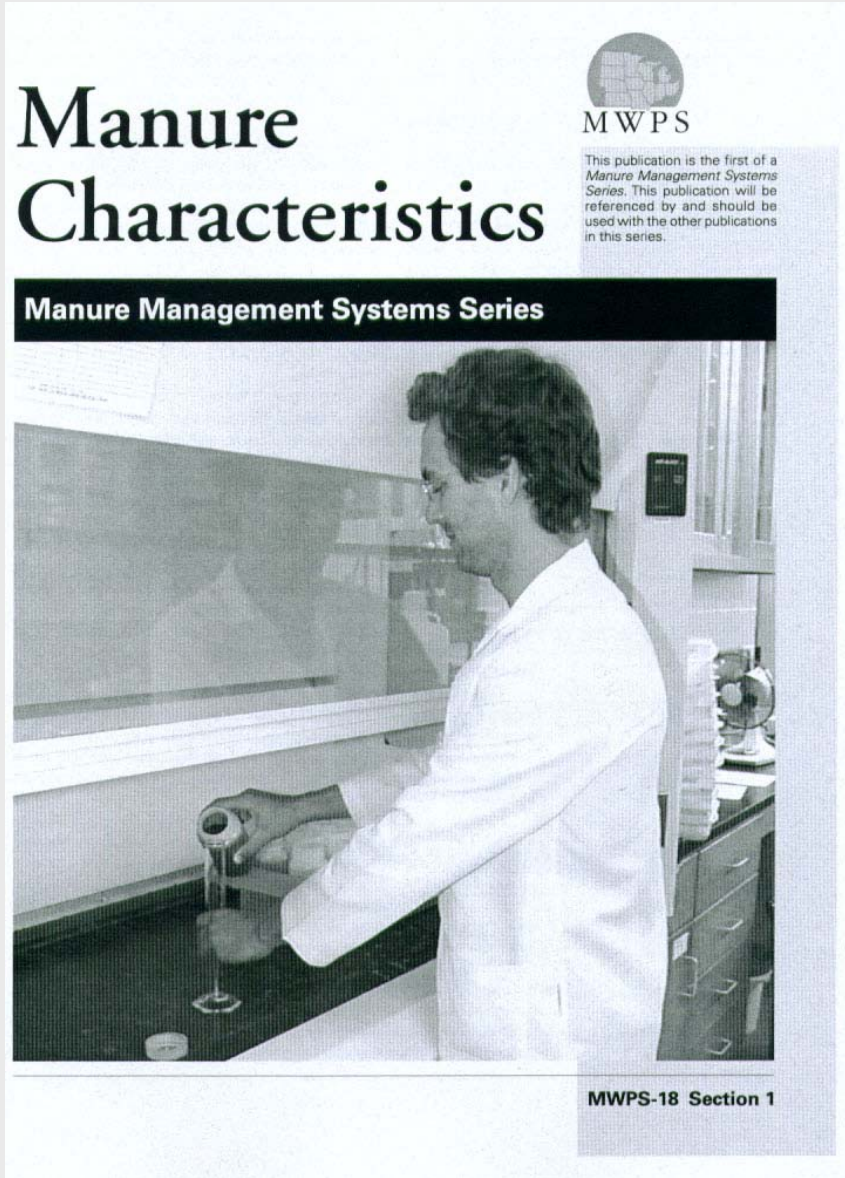



Map ID: m5438

*Some counties are combined to meet disclosure criteria.

# Manure and other waste-based nutrients require different management compared to commercial fertilizers

**“Manure Characteristics” from the Manure Management Systems Series: MWPS-18, Section 1**



# Federal Nutrient Management Plans

NRCS


Univ. Ext.

TSP/CCA Ag. Retailer

# Certified Crop Adviser Brief Summary

**Administrative Agent: American Society of Agronomy**

**Voluntary Program: Proactive, Non-Regulatory**

**Boards: International + 37 State/Regional/Provincial**

**Requirements: Must pass 2 exams (local/international), education + crop advising experience, 2 references, code of ethics, proficiency in 4 competency areas (SW, IPM, CP, CN)**

**Continuing Education: 40 hours every two years. Minimum of 5 hours for each competency area.**

MFA AGRI SERVICES

# CCA Testing Procedure Results

| Education Level | Percent Passing |
|---|---|
| < High School | 35 |
| High School | 57 |
| < B.S. | 69 |
| B.S. | 81 |
| M.S | 89 |
| Ph. D. | 89 |

# MFA's early (1995) CCA Class

MFA AGRI SERVICES

# American Society of Agronomy CCA Program Participation – October 2004

**International = 14, 819**

**Missouri = 400+**

**MFA Incorporated = 116**

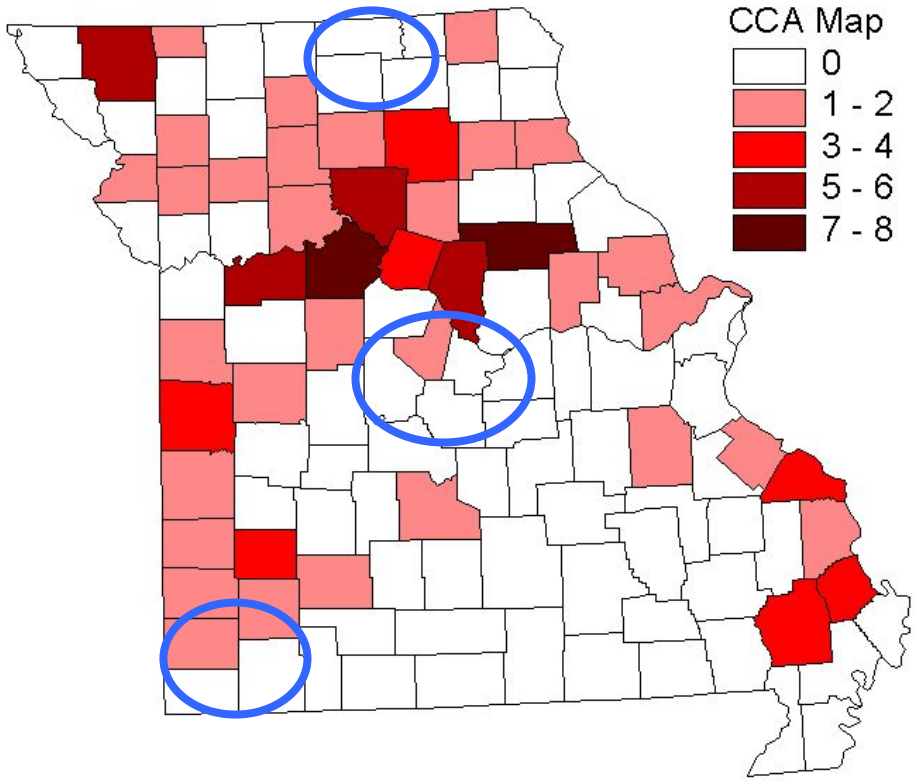
# CCA Employment Breakdown

## (Doane Agricultural Services – 2004)

| | |
|---|---|
| **Agricultural Retailers** | **64%** |
| **Agriculture Manufacturers** | **15%** |
| **Total Agricultural Industry** | **79%** |
| **Farm Managers/Independents** | **12%** |
| **Custom Applicators/Government** | **9%** |

MFA AGRI SERVICES

# Number of MFA CCA's per County in Missouri - 2003




**Areas of Highest CAFO Manure Production**

MFA AGRI SERVICES

## Missouri Environmental Quality Incentives Program (EQIP)
## Glacial Till Region Scoring Worksheet - FY03

**Field Office:** **Date:**

**Applicant(s):**

**Address:**

**Farm Number:** **Tract Number:** **Acres in Application:**

**LRF:** **New Farmer:** **Livestock Operation:** **if yes, type:**

| *Complete this scoring worksheet for each concern below. Score each tract on a separate scoring worksheet. Award points for practices planned to receive cost share and/or incentive payments. The final score will be the cumulative score of the three resource concern areas and the Special Emphasis Area.* | Percent Planned | Available Points | Points Awarded | |
|---|---|---|---|---|
| **Special Emphasis/Water Quality Areas - 20 point maximum** | | | | |
| (1) Offered acres are in the watershed of a 303d list stream. EQIP planned practice(s) must address the water quality concern in the watershed area identified. | | 10 | | A |
| OR Offered acres are in the watershed of a public drinking water supply reservoir. | | 5 | | |
| (2) Percent of unbuffered perennial or intermittent streams, wetlands, sinkholes, or permanent waterbodies planned for buffers. | | % X 8 | | B |
| (3) Planned well plugging of all abandoned well(s) on offered acres. | | 2 | | C |
| **Sub Total (A + B + C) =** | | **20** | | D |
| **Livestock Concerns - 70 point maximum** | | | | |
| (4) Planned improvements made to an existing animal waste management system - such as implementing a waste utilization plan, installing manure transfer pipe, installing roofing over existing facilities, adding a composter to a facility, adding solid separation, adding a flush system or similar improvements, closing or converting an existing animal waste facility. Also planned improvements to address air quality such as animal waste digestors and/or farmstead windbreaks designed to control odors. | | 35 | | E |
| OR Planned conversion of an existing confined livestock operation to a grass based livestock production operation. | | 35 | | |
| OR Planned replacement of an inadequate or failing animal waste system or planned installation of a system on an existing operation for collection, storage and/or treatment of animal waste. | | | | |
| a. Planned 0-50% expansion. | | 35 | | |
| b. Planned 51%-100% expansion. | | 25 | | |
| c. Planned >100% of expansion. | | 15 | | |
| OR Planned installation of a new animal waste system for collection, storage, treatment for a new livestock operation and/or enterprise. | | 10 | | |
| (5) Planned new prescribed grazing system: | | | | F |
| a. 8 or more paddocks | | 25 | | |
| b. 4-7 paddocks | | 18 | | |
| OR Existing prescribed grazing system with plans to increase paddocks by 4 or more new paddocks. | | 10 | | |
| (6) Plan to convert a minimum of 20% of existing cool season pasture and/or hayland acres to native warm season grasses. | | 6 | | G |
| (7) Plan to improve a minimum of 30% of existing pasture acres by interseeding legumes. | | 4 | | H |
| **Sub Total (E + F + G +H) =** | | **70** | | I |

# Federally Subsidized Nutrient Management Programs:

**Limited Access, Vary by location, Reward poor past land stewardship, discriminates against many of the early innovators. Early contracts have discriminated against industry/CCA (est. < 5% of contracts to industry)**

MFA AGRI SERVICES

# Nutrient Management Plan

**Name:** **Field:** **Date:**

## Nutrient Management Plan Checklist

- ❑ Field map attached
- ❑ Recent soil test information
- ❑ Soil test history attached
- ❑ TMDL issues addressed, if applicable
- ❑ Manure Management Plan attached, if needed
- ❑ Nutrient application rates within guidelines
- ❑ No conflicts with rest of Conservation Plan
- ❑ Estimated erosion loss calculated
- ❑ P Index calculated, if needed
- ❑ Leaching Index determined
- ❑ Suggested Best Management Practices identified
- ❑ Environmental Risks Identified
- ❑ Certified Advisor/Planner signature
- ❑ Producer Signature

### Environmental Risk Assessment

| Y | N | |
|---|---|---|
| ❑ | ❑ | P TMDL Area |
| ❑ | ❑ | N TMDL Area |
| ❑ | ❑ | P Soil Test Greater Than 50 ppm Bray1/Mehlich III |
| ❑ | ❑ | Irrigated Field |
| ❑ | ❑ | Adjacent to Homes, Buildings, etc. |
| ❑ | ❑ | Shallow Water Tables (less than 10' deep) |
| ❑ | ❑ | Water Well in Field |
| ❑ | ❑ | Wellhead Setback |
| ❑ | ❑ | Stream Setbacks |
| ❑ | ❑ | Adjacent to Intermittent/Perennial Stream (<300') |
| ❑ | ❑ | Flood Frequency Class (Occasional or Greater) |
| ❑ | ❑ | Buffer Strips Present |
| ❑ | ❑ | Sheet/Rill Erosion Concerns |
| ❑ | ❑ | Gully Erosion Concerns |
| ❑ | ❑ | Stream Bank Erosion Concerns |
| ❑ | ❑ | Other Environmental Concerns (detail below) |

### Producer Long-Term Nutrient Objectives:

### Overall Conservation Plan Objectives:

### Environmental Management Indicators:

**RUSLE Soil Erosion:** _____ ton/acre
**P Index:** _____ (if needed)

**Leaching Index:** High Medium Low

**Manure Application:** (circle one)
None
Incorporated days after application
Unincorporated
Subsurface Injected
Irrigation System
Other

### Map:

N ↑

| Certified Nutrient Planner | Date | Producer | Date |
|---|---|---|---|
| | | | |

K-STATE PM-47

USDA NRCS Natural Resources Conservation Service Kansas

**Kansas State University Agricultural Experiment Station and Cooperative Extension Service**

**There are many standard NMP forms available**

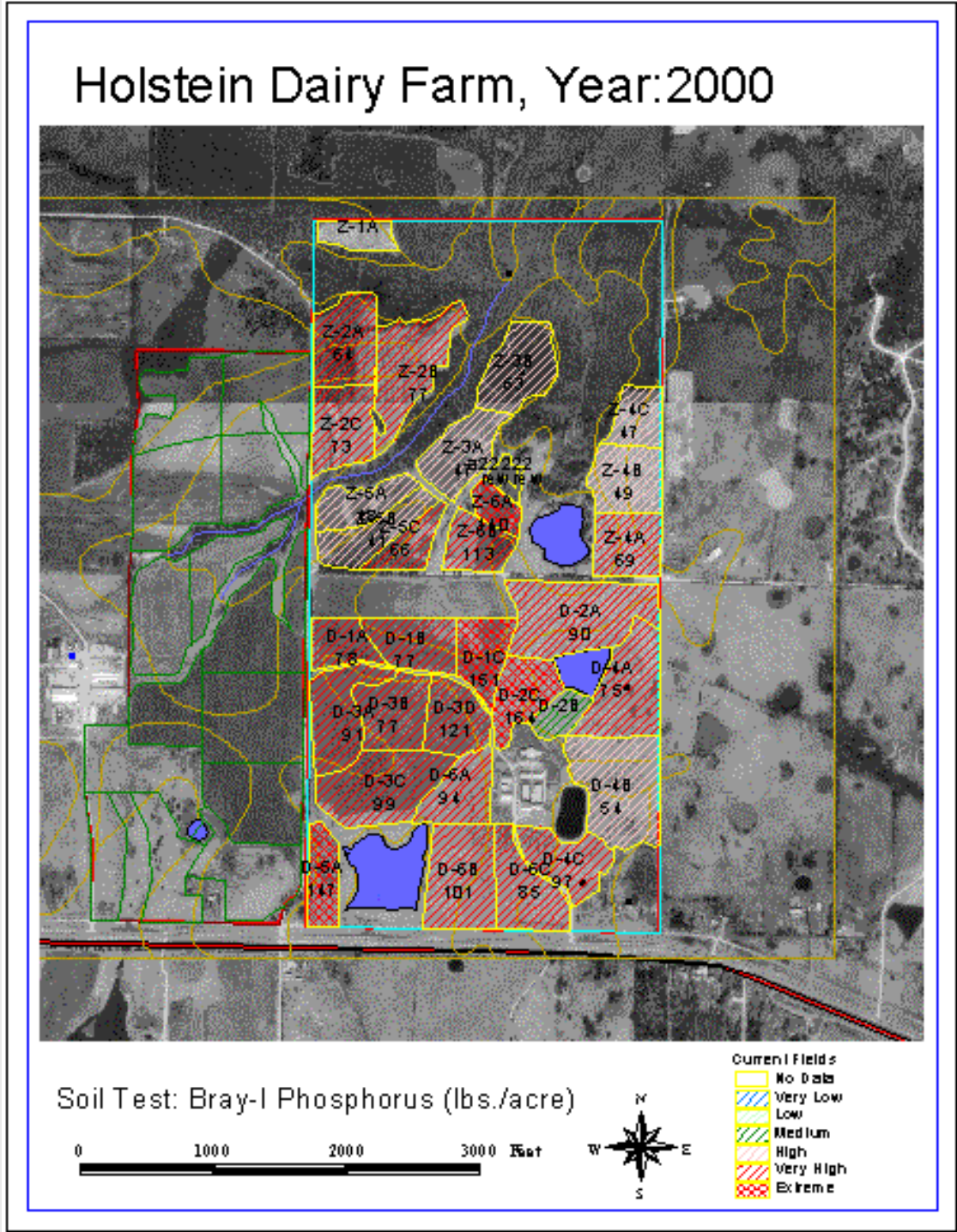
MFA AGRI SERVICES

# Manure Management Planner – Version 0.19


MFA AGRI SERVICES

# Spatial Nutrient Management Planner (SNMP)

**John Lory**
**University of Missouri**



# MFA Precision Agriculture Programs

# Precision Ag. Components of CNMP

**VRT technology**

**Yield Mapping**

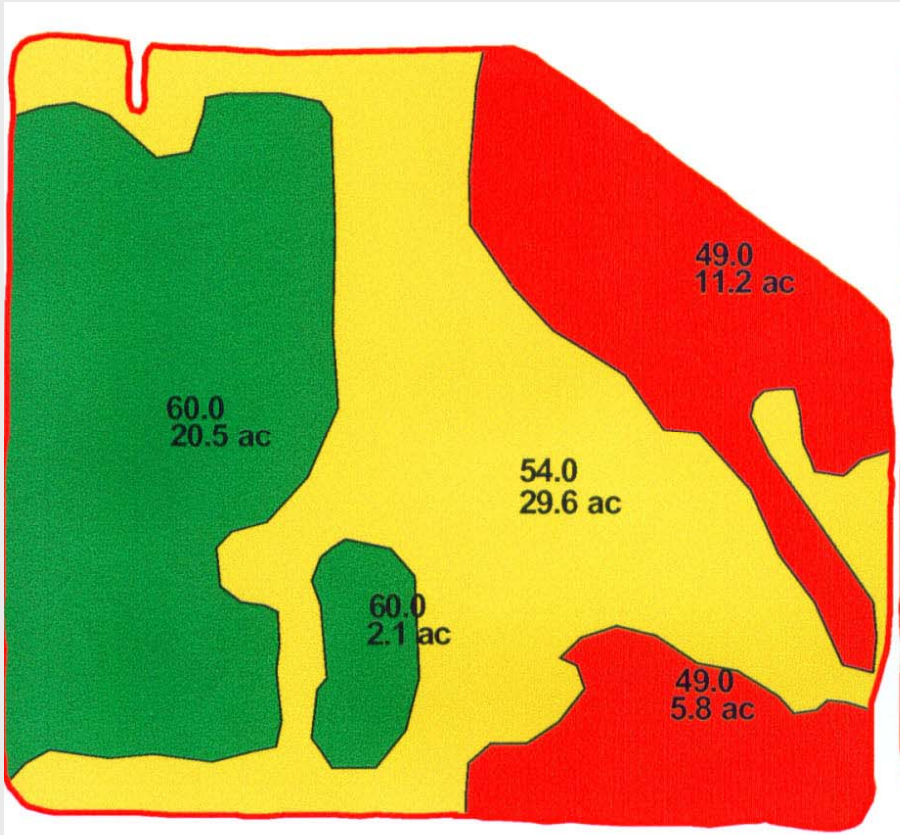
**Management Zone Delineation**

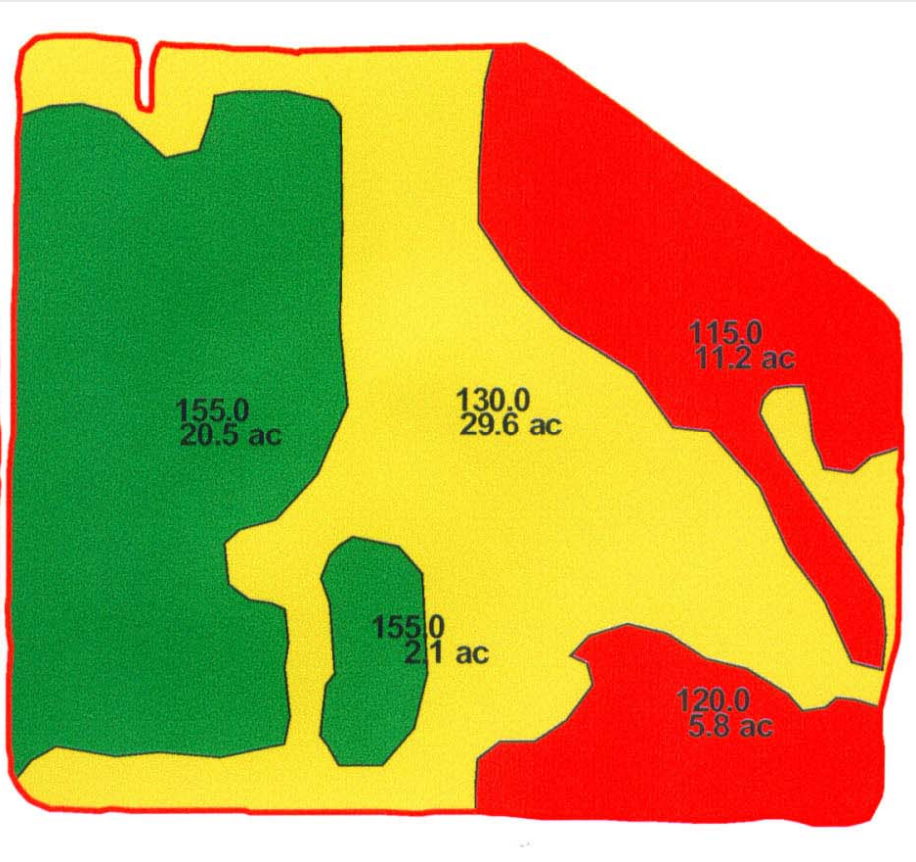
**Improved Crop and Field Scouting**

**Record Keeping & Trend Analysis**

**Improved Sub-Field, Field, and Farm Environmental Stewardship and Defendable Documentation**

# Multi-Year Management Zones




**Soybean** **Corn**

MFA AGRI SERVICES

**We must develop value-added products, services and fee-based support programs before nutrient management planning becomes a viable component of the current fertilizer industry**

MFA AGRI SERVICES

# Summary

**The fertilizer industry is playing the major role in overall nutrient management, and should/will increase its role in manure/waste nutrient management.**

**We have the personnel, equipment, transportation, credibility, land owner contact, and overall infrastructure to succeed.**

**To be successful at the retail level, nutrient management programs must be value-added, with fee-based agronomic technical support**

**A seamless multi-tiered system that addresses modified, non-modified and alternative uses for waste products in combination with fertilizers is needed**

MFA AGRI SERVICES


Any Questions?
Photo: John Deere