Importance of forages on dairy farms – beyond their use as feed

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Advantages of corn silage

- High DM yield
- High digestible energy content
- Uniform forage quality
- Single harvest

Advantages of corn silage

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Advantages of soybean

- Profitable
- Same equipment
- Simplified management
- Rotation benefits

Drawbacks of corn silage and soybean

- Increasing N fertilizer cost
- Pest control costs
- Lower farm energy use efficiency
- Greater risk of
  - Soil erosion
  - Nitrate leaching
  - Nutrient runoff
- Lower soil organic matter


Univ. of Nebraska - Lincoln


Lake Red Rock, IA

NRCS


Lynn Betts NRCS

The average dairy cow produces 8,900 kg of milk

and excretes 98 kg N and 22 kg P yr^{-1}
in 20,600 kg of manure

Manure slurry instead of bedded manure

- Improved efficiencies of transport and application
- Better predictability of N supply
- Lower value for organic matter replacement

Wessuc, Inc.

J. Palsgaard, Merced Co., CA

John Sawyer, Iowa State Univ.

Advantages of perennial forages

- Provide excellent soil protection
- Improve soil organic matter (resilience)
  - Aeration
  - Water holding capacity
  - Nutrient supply
  - Aggregate stability

Annual cropping

3 yr perennial - 3 yr annual

Alejandro La Manna, INIA, Uruguay

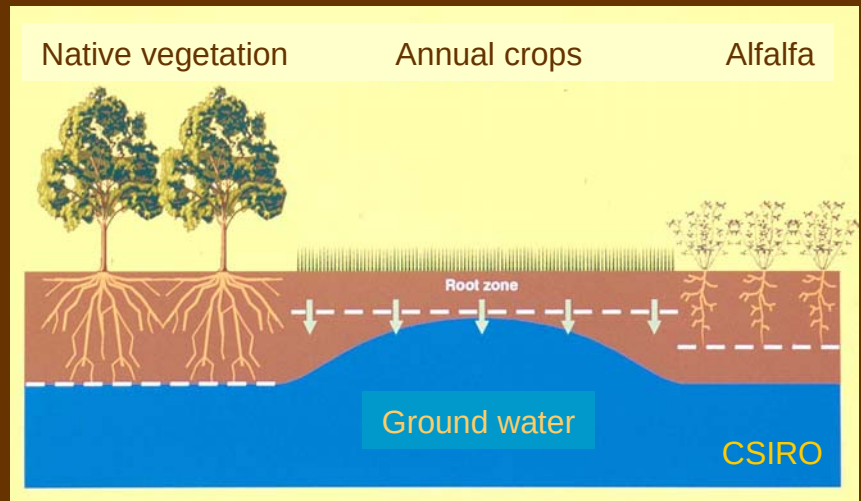
Advantages of perennial forages

- Provide excellent soil protection
- Improve soil organic matter (resilience)
  - Aeration
  - Water holding capacity
  - Nutrient supply
  - Aggregate stability
- High nutrient uptake potential
- Reduce nitrate leaching
- Reduce nutrient runoff
- Lower water tables

Annual cropping

3 yr perennial - 3 yr annual

Alejandro La Manna, INIA, Uruguay



So what roles is that old crop, alfalfa, ready to play on modern dairy farms?

Graber, 1926

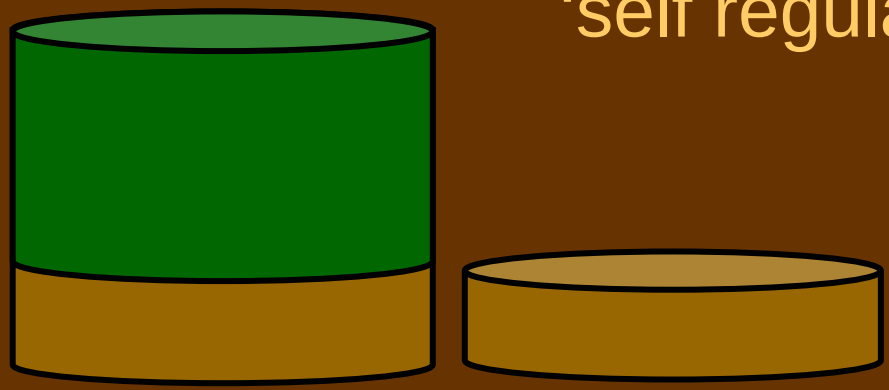
P. Young

N_2 fixation

a *facultative* process

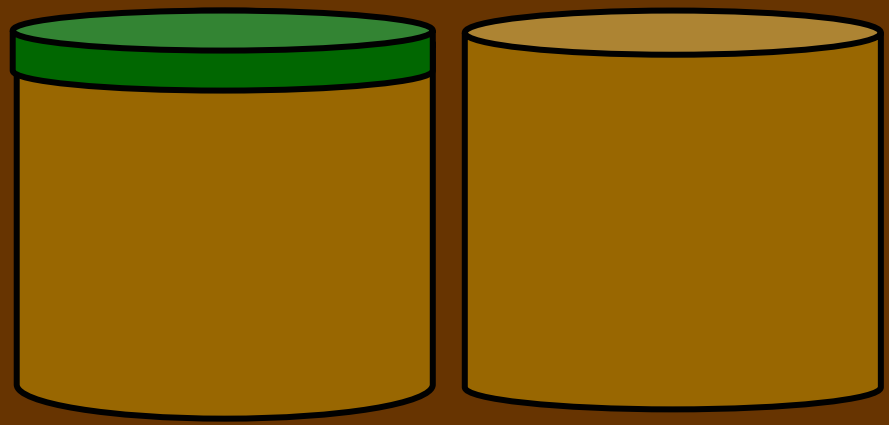
constrained by inorganic N supply

'self regulated' (Ledgard)



Low N

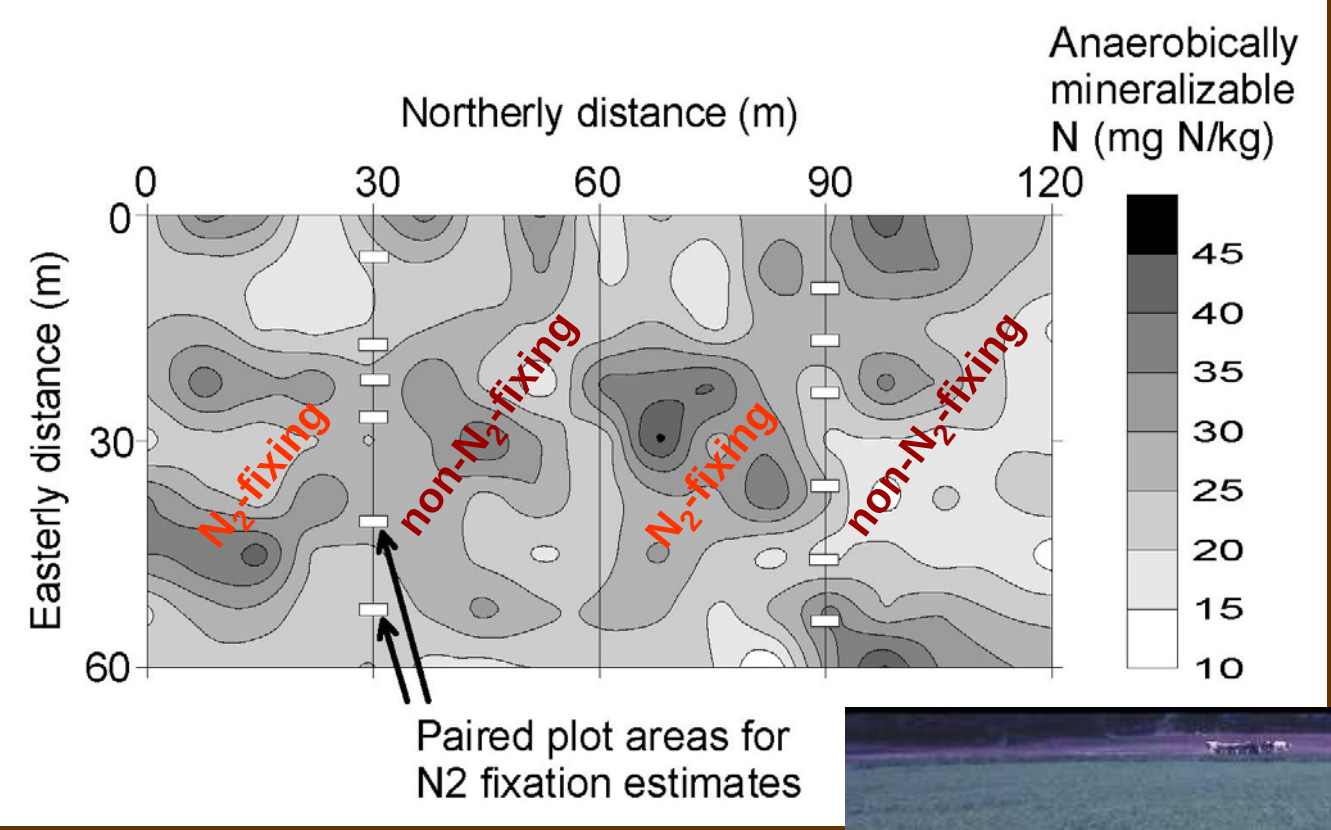
Legume **Grass**



High N

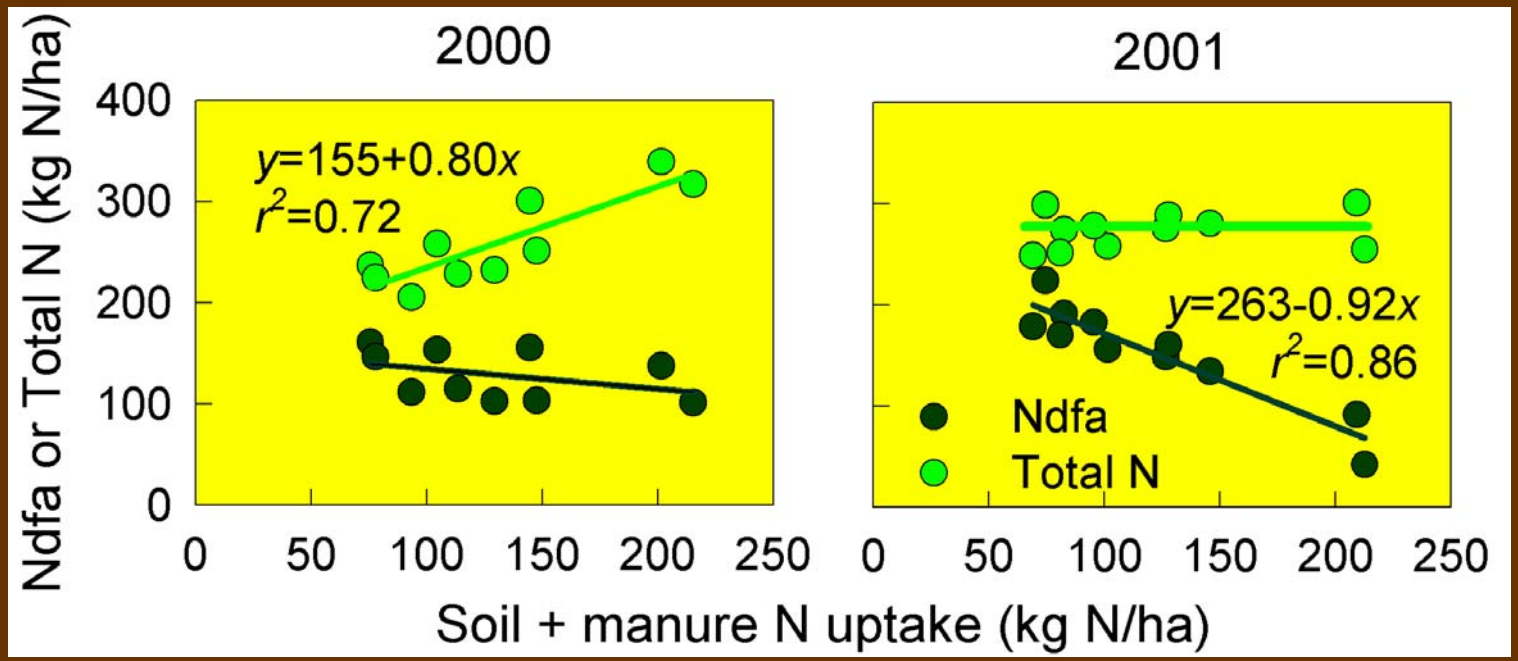
Ledgard, 2001, Plant & Soil, 228:43

Field-scale variability:
Abandoned heifer-feeding yard

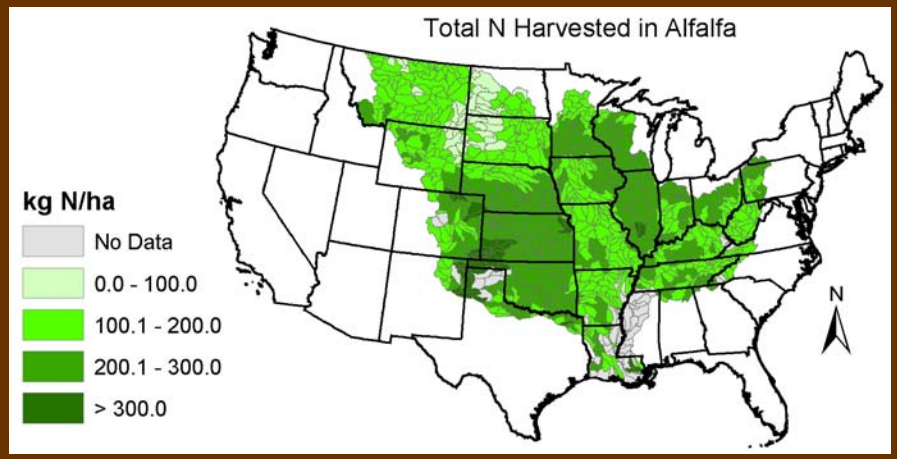

Anaerobically mineralizable N (mg N/kg)
Northerly distance (m)
0
30
60
90
120
Easterly distance (m)
0
30
60
45
40
35
30
25
20
15
10
N2-fixing
non-N2-fixing
N2-fixing
non-N2-fixing
Paired plot areas for N2 fixation estimates

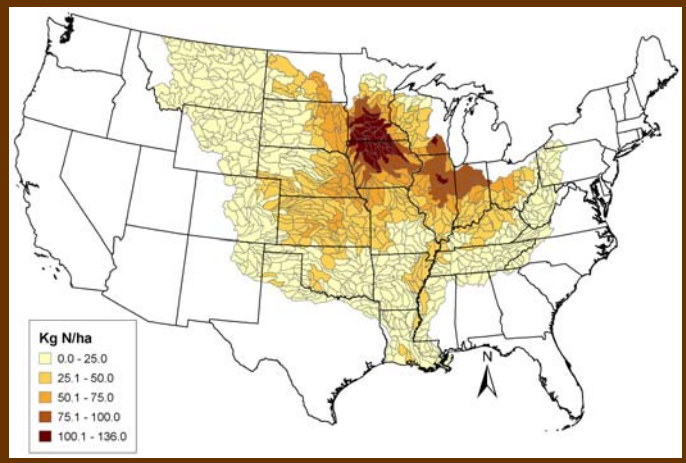

N2-fixing alfalfa
non-N2-fixing alfalfa
N.B. Turyk, 2002

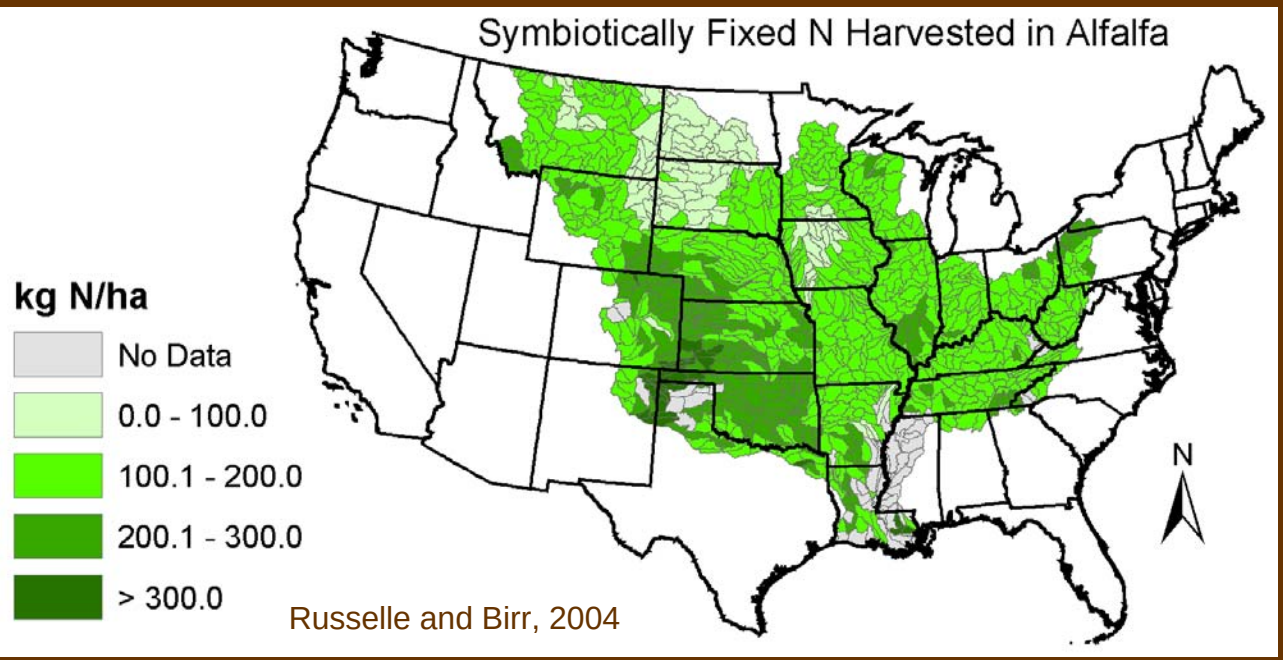
- Yield of N_2 fixing alfalfa > non-N_2-fixing alfalfa
- Yield of N_2 fixing alfalfa less variable than non-N_2-fixing alfalfa
- N_2 fixation provides on-farm buffering capacity for N



Regional scale variability:
How much N does alfalfa fix?







N_2 fixation rates

Alfalfa

45 to 450 kg N ha^{-1}

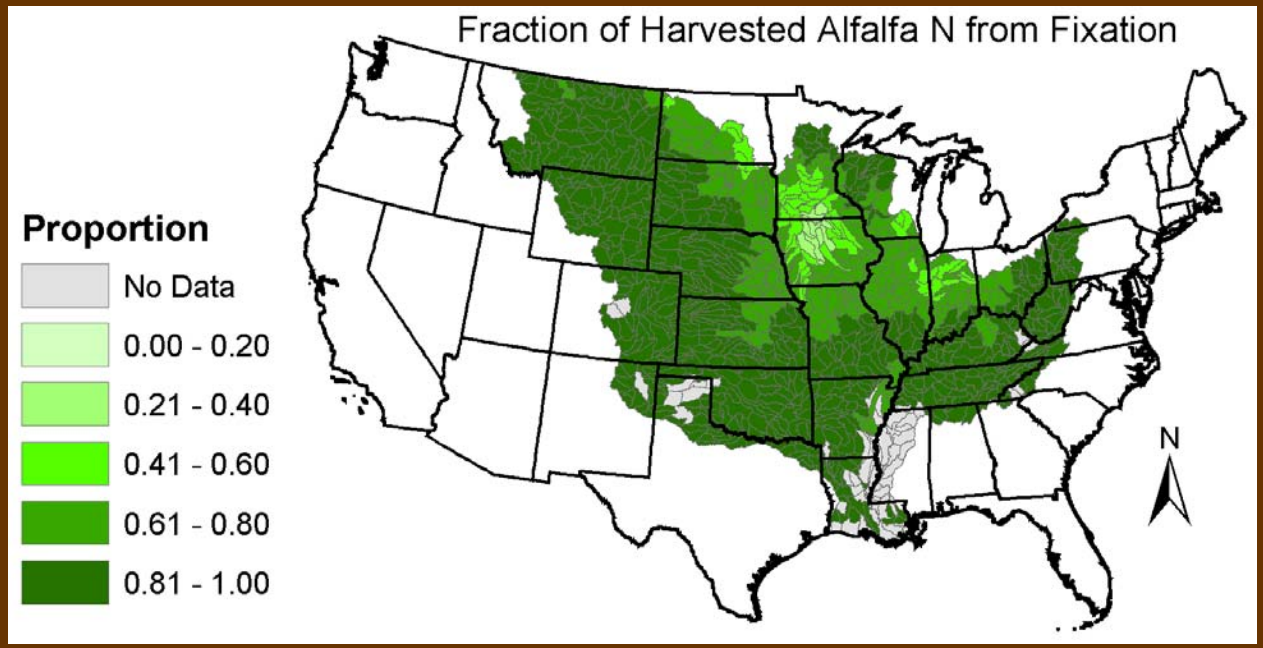
mean=**152** kg N ha^{-1}

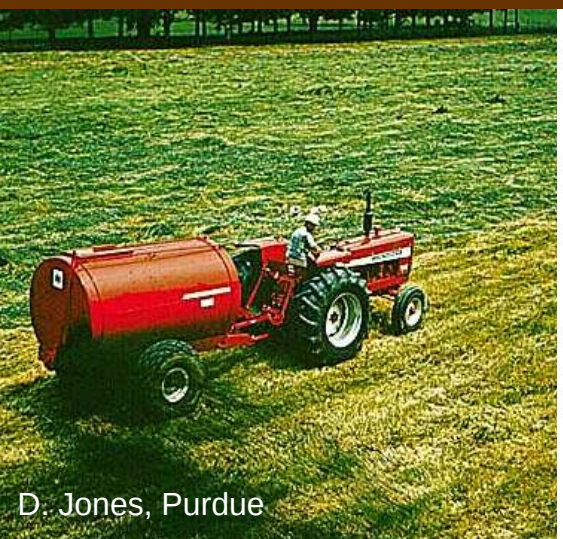
Soybean

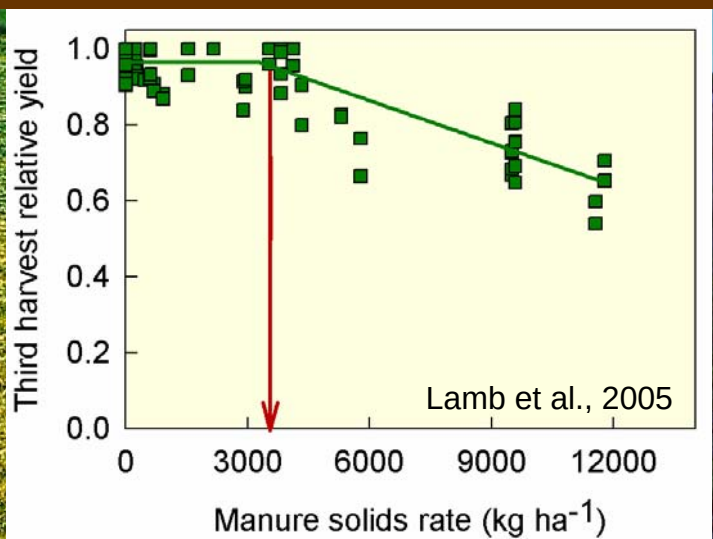
0 to 185 kg N ha^{-1}

mean=**84** kg N ha^{-1}

Alfalfa can help reduce farmers' uncertainty about manure N availability




D. Jones, Purdue




PAMI

Nutrient removal

Crop Watch, Univ. Nebraska

Univ. Arkansas

	Corn silage	Alfalfa silage	
N	10-15	50-60	lb/dry t
P	2- 4	4- 7	lb/dry t
K	10-15	25-60	lb/dry t

Neither crop removes P quickly

Alfalfa is a great crop to remove excess N & K

Nutrient removal

Trelay Seed Co.

Trelay Seed Co.

	Corn silage	Alfalfa silage	
Yield	16.7	6.4	t/a
N	90	150	lb/a
P	22	15	lb/a
K	90	120	lb/a

Yield averages for IL, IA, MN, WI, 2002 (NASS)

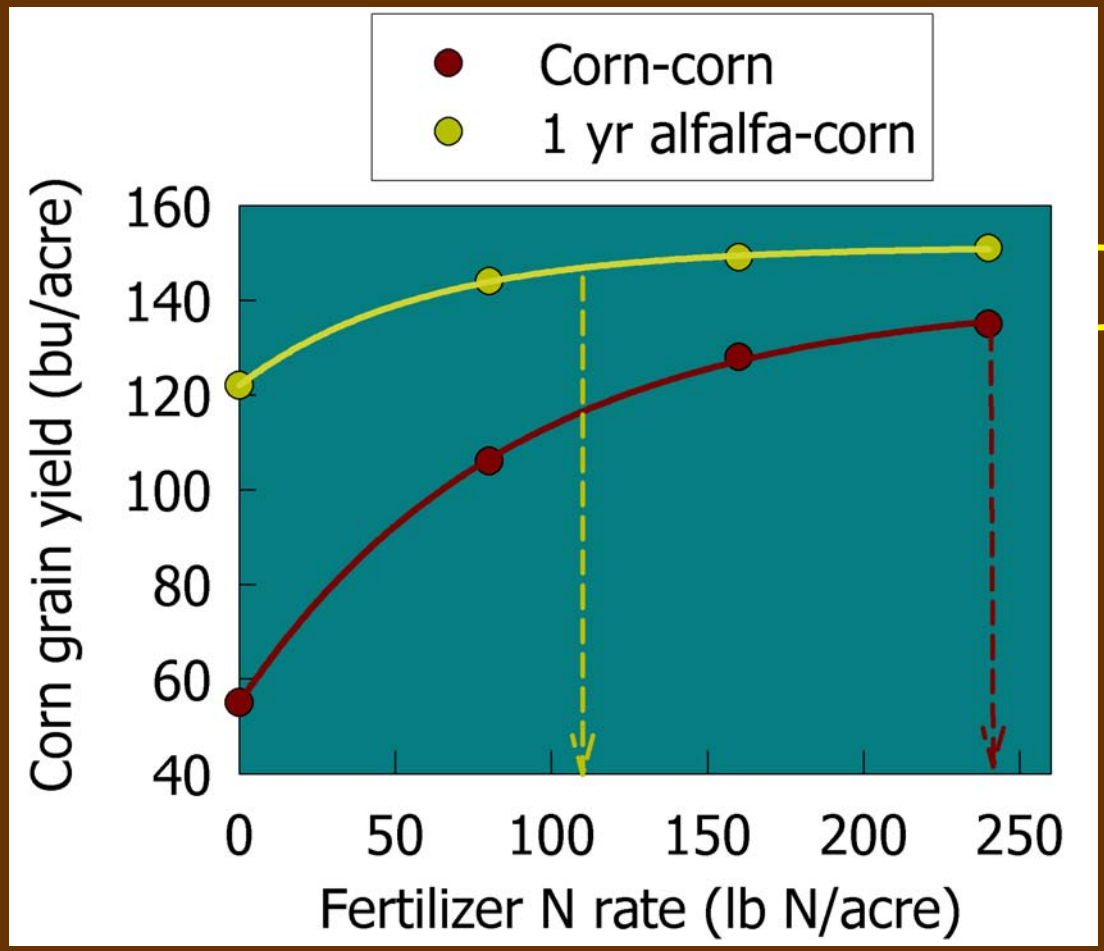
Potential problems with manure on alfalfa

- NH_4^+-K^+ competition – decreased winterhardiness (Joern and Volenec, 1996)
- Excess forage K
  Keep soil K in optimum range
- Manure on foliage can reduce silage fermentation
  Inoculate before ensiling (Wiederholt et al., 2002)
- Disease transmission? *Research required*
- Runoff of dissolved nutrients *Timing, injection*
- Excess N generation

WORST application time is before terminating stand

If stand is poor, apply very low rates

Fertilizer N replacement value and non-N rotation effects



Non-N rotation effect

Yield benefit

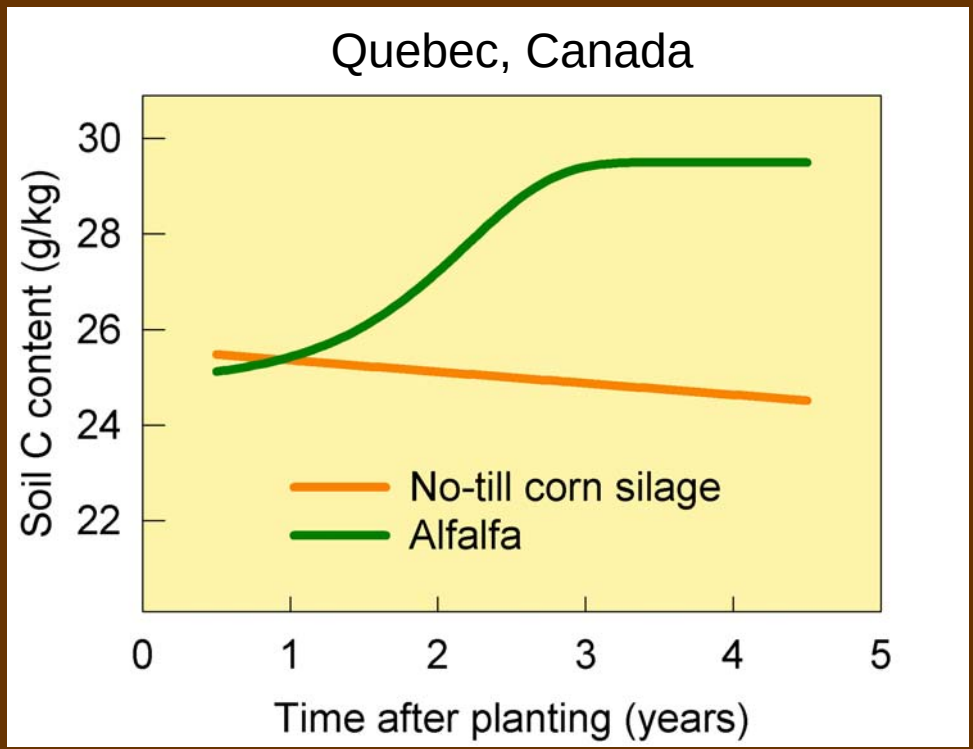
Lower fertilizer N required (2 yr)

No insecticide required (1 yr)

Fertilizer N replacement value

DeWitt, 2002

Fertilizer N replacement value and non-N rotation effects



Angers, 1992

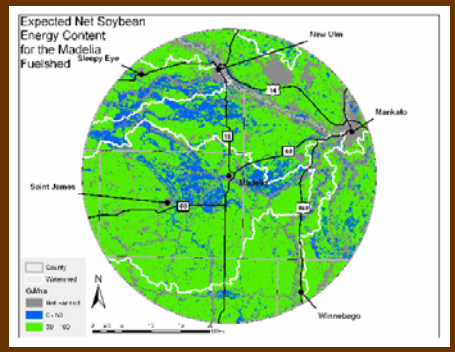
Maximum N benefit after 2 to 3 yrs of alfalfa

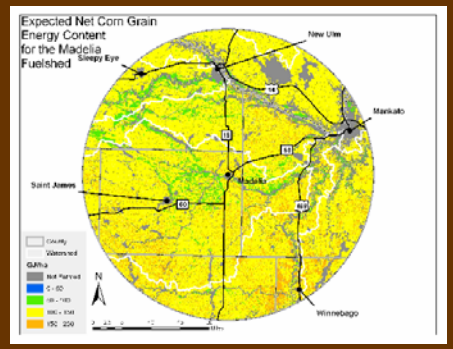
100 to 210 kg N ha^{-1} FNRV

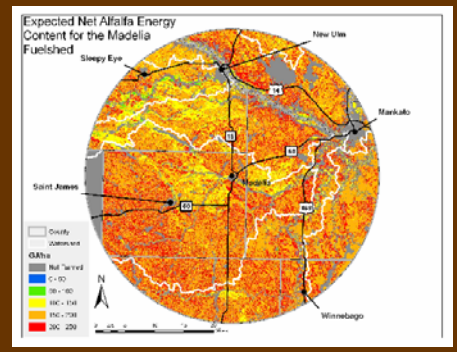
Economic maximum depends on stand, yield, & herbage regrowth

Alfalfa saves energy

- Lower energy input costs than corn
- Much greater net energy yield than corn or soybean



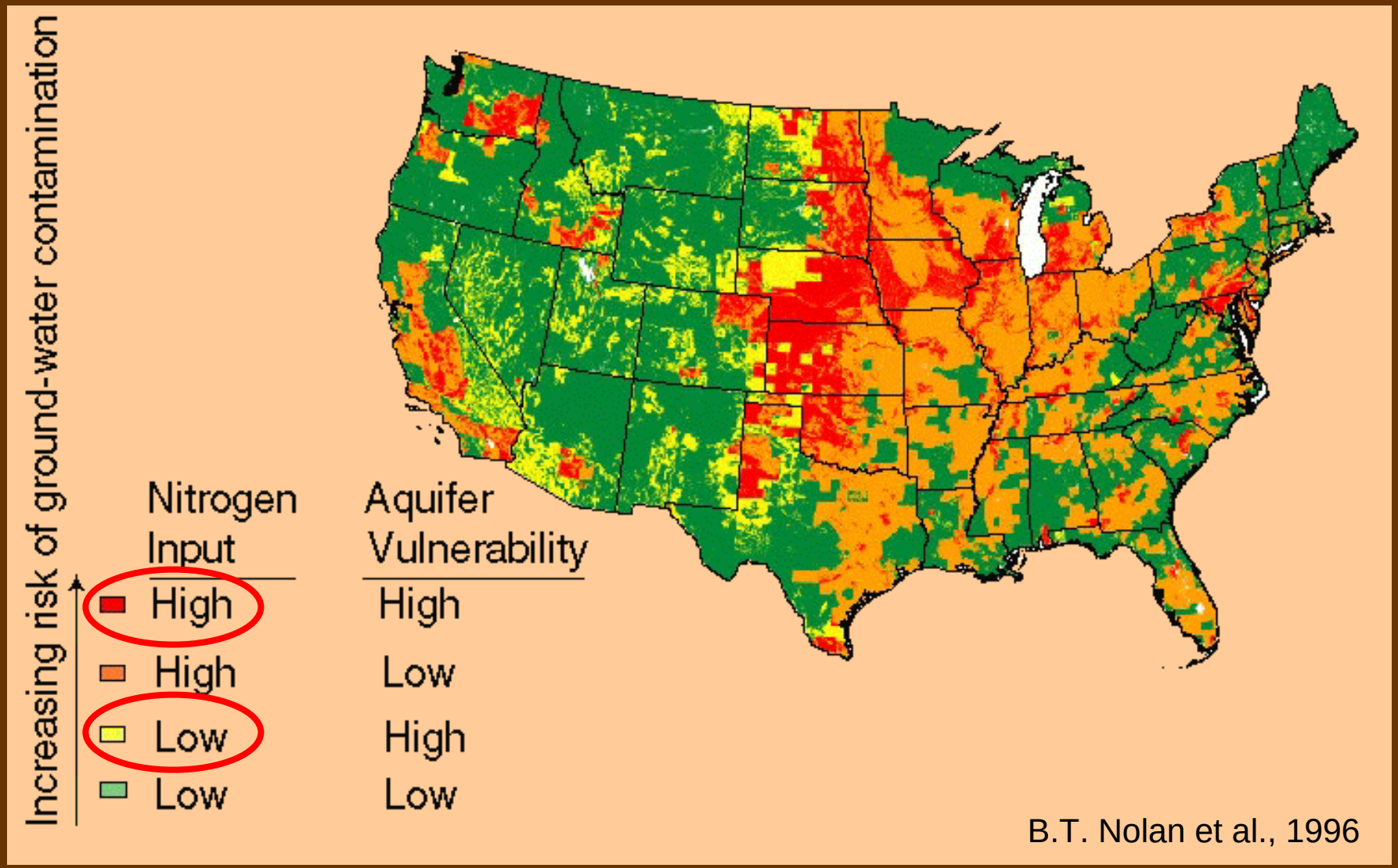




Crop (yield)	Energy Input	Energy Output	Ratio Out : In
	- - - - - - - - MMBTU/a - - - - - - - -		
Corn (180 bu/a)	6.0	59.0	8.8
Soybean (40 bu/a)	2.3	18.3	7.1
Alfalfa (6 t/a)	3.0	78.2	25.0

Russelle et al., 2006

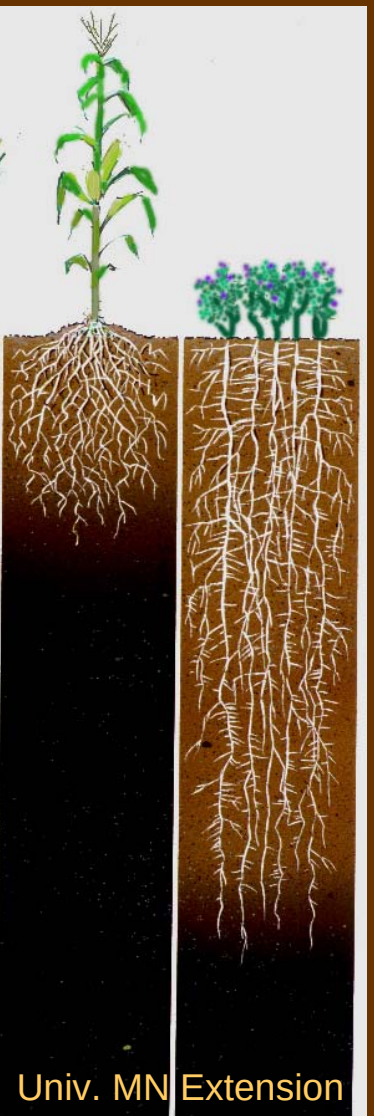
Vulnerable drinking water aquifers

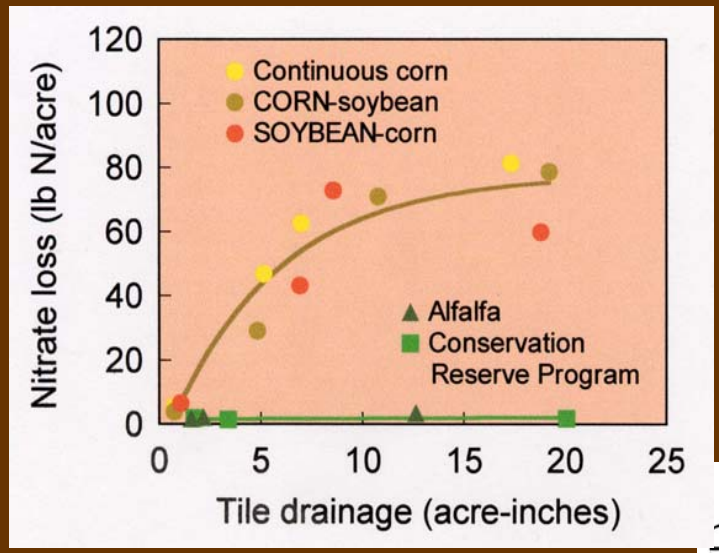


B.T. Nolan et al., 1996

Nitrate leaching can be reduced by:

- Low nitrate concentration in soil solution
- Small flux of solution below the root zone



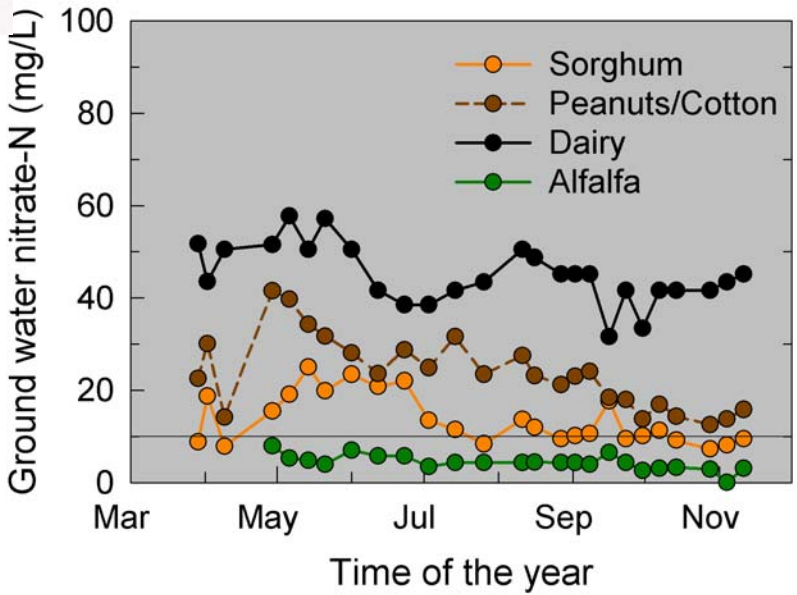


NO_3-N loss from tile drains

Randall et al., 1997

NO_3-N in the Ogallala aquifer

Taylor and Bigbee, 1973



Alfalfa enhances wildlife habitat

Example: Alfalfa in California

> 27% (182 species) of all resident and migratory terrestrial wildlife (mammals, birds, amphibians, and reptiles) use alfalfa for cover, feed, or reproduction

D.H. Putnam

> ~1k species of insects, mites, spiders, and their relatives live in alfalfa fields

Canku Ota

New markets – Value-added processing

Expected arrangements

- AA provides soil tests, seed, harvests & delivers the crop
- Farmer paid per ton DM
  (4 t/a minimum)
- Fresh alfalfa extracted (24 hr)
  - Lutein
  - Green protein concentrate
  - White protein concentrate
- Green alfalfa “fiber” (58% H_2O) may be purchased by farmer

New markets – Value-added processing

MnVAP
Minnesota Valley Alfalfa Producers

MnVAP

Initial plans

- Farmer delivers hay
- Alfalfa separated into leaf and stem fractions
- Stems gasified to produce electricity (75 MW combined cycle)
- Leaves sold as feed

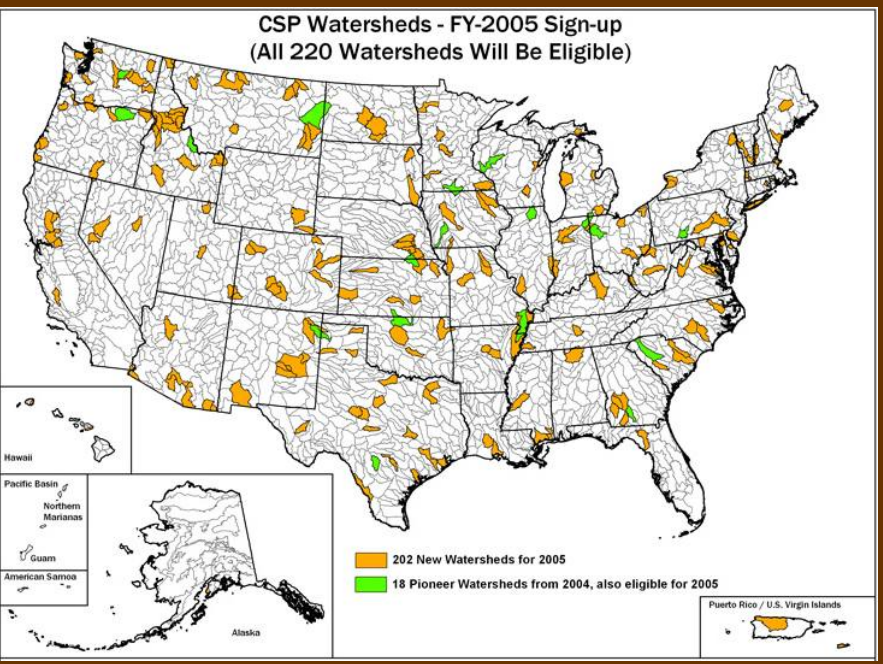
Current situation

- Specialize in feed products

New markets – Support payments

United States Department of Agriculture
Natural Resources Conservation Service

Conservation Security Program
CSP
Self-Assessment

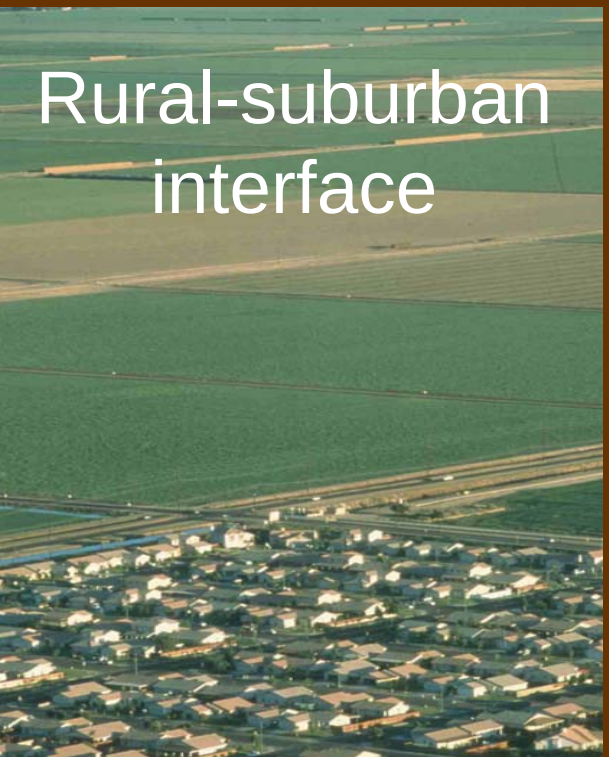


Current situation

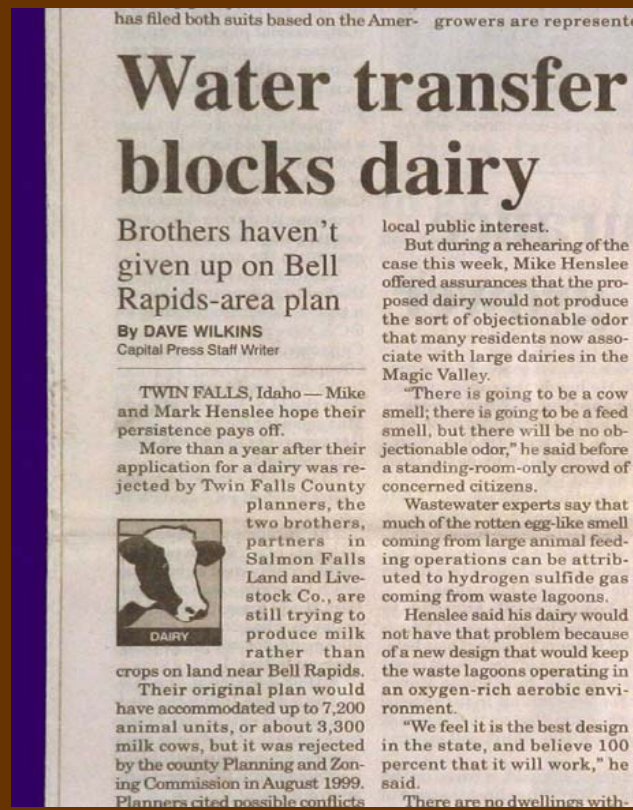
- Selected watersheds
- Working land
- 3 tiers of support
- Eligible practices
  - Use of manure, legumes and other nutrient sources
  - Use of deep rooted, perennial, and/or high residue crops
  - Decrease tillage

The survival of US dairy farming may depend as much on environmental stewardship as on profitability

Ron Nichols, USDA



Dan Putnam



has filed both suits based on the Amer- growers are represent

Water transfer blocks dairy

Brothers haven't given up on Bell Rapids-area plan

By DAVE WILKINS
Capital Press Staff Writer

TWIN FALLS, Idaho — Mike and Mark Henslee hope their persistence pays off.

More than a year after their application for a dairy was rejected by Twin Falls County planners, the two brothers, partners in Salmon Falls Land and Livestock Co., are still trying to produce milk rather than crops on land near Bell Rapids.

Their original plan would have accommodated up to 7,200 animal units, or about 3,300 milk cows, but it was rejected by the county Planning and Zoning Commission in August 1999. Planners cited possible conflicts

DAIRY

local public interest.

But during a rehearing of the case this week, Mike Henslee offered assurances that the proposed dairy would not produce the sort of objectionable odor that many residents now associate with large dairies in the Magic Valley.

"There is going to be a cow smell; there is going to be a feed smell, but there will be no objectionable odor," he said before a standing-room-only crowd of concerned citizens.

Wastewater experts say that much of the rotten egg-like smell coming from large animal feeding operations can be attributed to hydrogen sulfide gas coming from waste lagoons.

Henslee said his dairy would not have that problem because of a new design that would keep the waste lagoons operating in an oxygen-rich aerobic environment.

"We feel it is the best design in the state, and believe 100 percent that it will work," he said.

There are no dwellings with-

Perennial forages provide ecosystem services & other benefits

- Lower N fertilizer and pesticide need
- Reduced runoff
- Less nitrate leaching
- Remediation
- Better soil quality

Ron Nichols, NRCS

Perennial forages provide ecosystem services & other benefits

- Lower N fertilizer and pesticide need
- Reduced runoff
- Less nitrate leaching
- Remediation
- Better soil quality
- Improved air quality
- Better energy balance
- Enhanced wildlife habitat
- New revenue streams
- Improved public image

Ron Nichols, NRCS

Oregon State Univ.

Desirable improvements

- Higher DM yield
- Greater digestible energy
- Greater utilizable protein
- More stable forage quality
- Fewer harvests

Oregon State Univ.

Desirable improvements

- Higher DM yield
- Greater digestible energy
- Greater utilizable protein
- More stable forage quality
- Fewer harvests
- Improved longevity
- Value-added traits
- Salinity tolerance
- Traffic tolerance
- Higher N & P uptake
- Lower K uptake