



Forage Legumes in Wisconsin

Some history and current status

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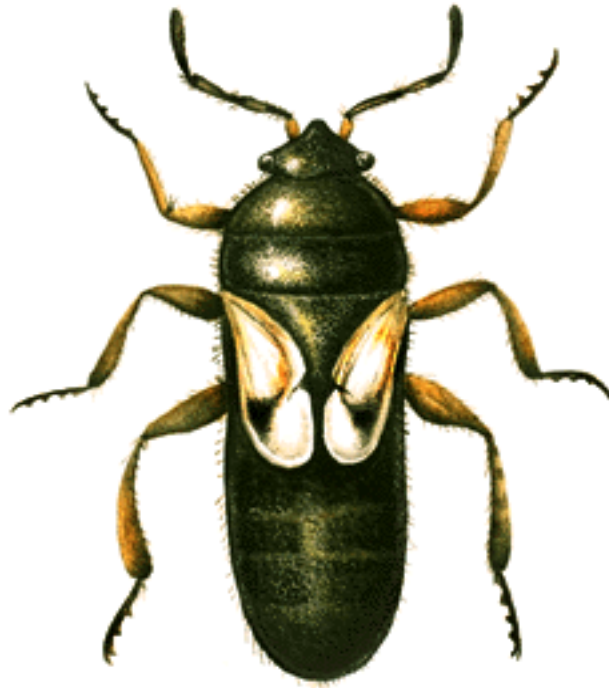
Wisconsin was top wheat producing state in 1850's and 1860's.

“America's Breadbasket”



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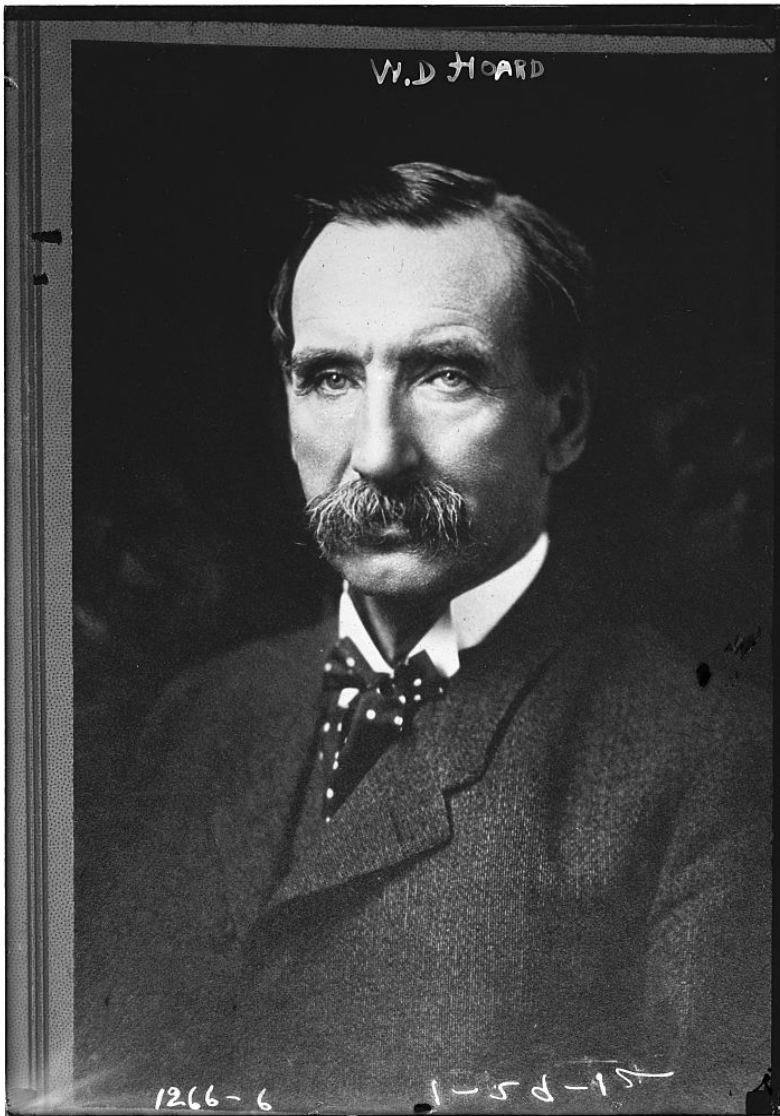


Chinch Bug in 1870's
(*Blissus leucopterus*)



“Men of large vision who saw the necessity of the change from the plow to the cow stepped forward with an idea for a new kind of agriculture.”

By 1899 more than 90% of Wisconsin farms had dairy cows and there were more than 1000 cheese factories in the state.



William Dempster Hoard
“the apostle of the dairy cow”

1872

Led the "seven wise men" in founding the Wisconsin Dairymen's Association

1885

Founded Hoard's Dairyman, "a journal devoted to dairy farming"

1888

Elected the 16th Governor of Wisconsin

1891

Began intensive promotion of alfalfa

1899

Purchased a 193-acre dairy farm to "keep feet on the ground"

1908-1911

President of University of Wisconsin Board of Regents

W.D. Hoard, in his various leadership roles, advocated for:

- Single purpose cow; competitive railroad freight rates for transport of dairy product; disease inspection and control; farm record keeping for continuous herd improvement; University of Wisconsin research in support of dairy development including animal and plant breeding, milk quality, soil fertility, agricultural engineering; University dairy training programs
- His promotion of alfalfa as a forage crop for hay and haylage was key to development of the budding dairy industry in the state

Hoard gave credit for the rapid transformation in Wisconsin Agriculture to:

- Leaders with vision
- Innovative farmers
- Research and education

Sweet clover

(Melilotus officinalis and M. alba)

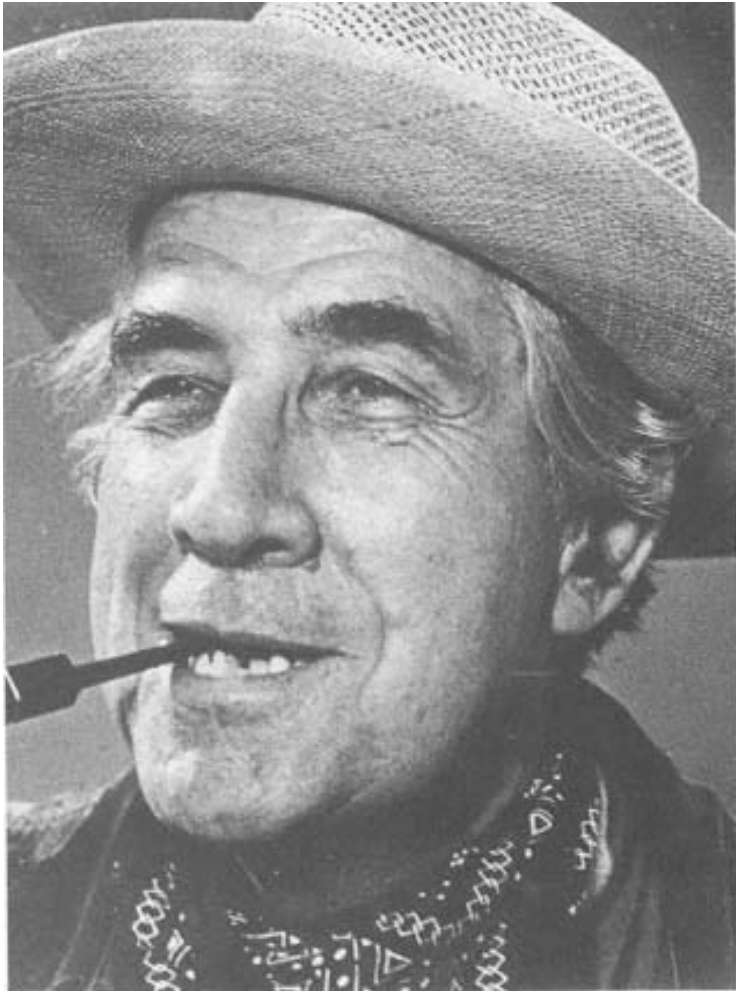
Gained importance as a forage crop after 1900 but use declined rapidly after 1940 as a result of invasion by sweet clover weevil

“Sweet clover disease” in cattle eating moldy sweet clover hay was documented in North Dakota and Canada in 1921

It was concluded that fresh sweet clover did not contain the causative agent for this disease and that a byproduct of spoilage must be involved

Coumarin is bitter and implicated in low palatability. W.K. Smith and R.A. Brink crossed *M. alba* with *M. dentata* and selected for low coumarin concentrations



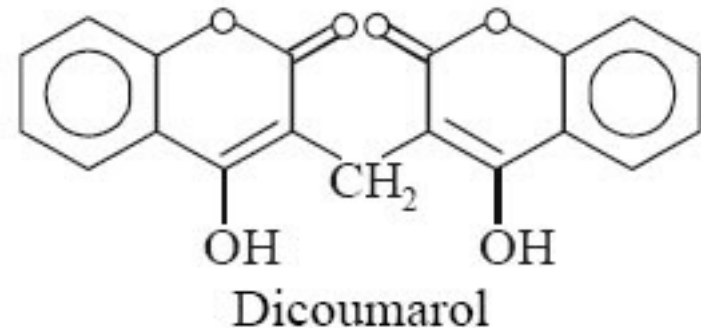


Karl Paul Link

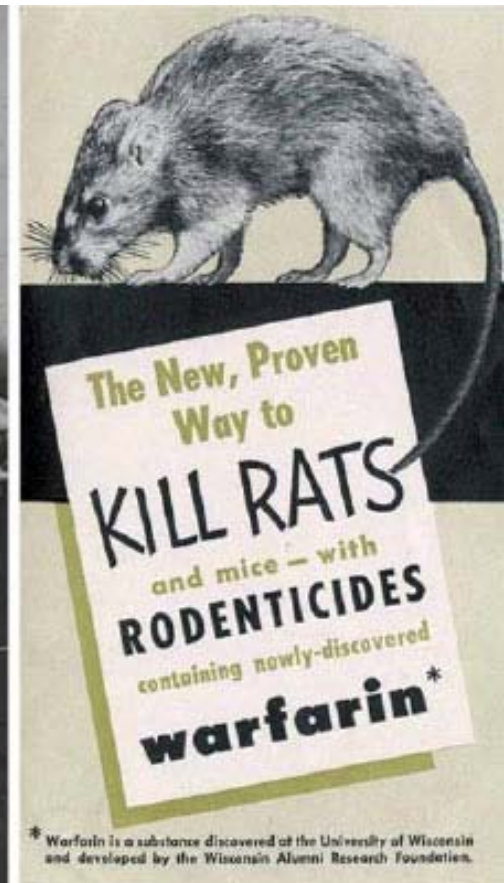
Farmer Ed Carlson drove 190 miles through a blizzard to Karl Link's lab in December 1933 with a dead heifer, a milk can full of blood that wouldn't clot, and a pile of moldy sweet clover hay.

Link's team isolated the hemorrhagic agent in 1939 and synthesized the compound in 1940.

They confirmed that coumarin is converted to a toxic compound called dicoumarol during spoilage. In the animal, dicoumarol interferes with vitamin K, which is needed for the development of prothrombin clotting factors.



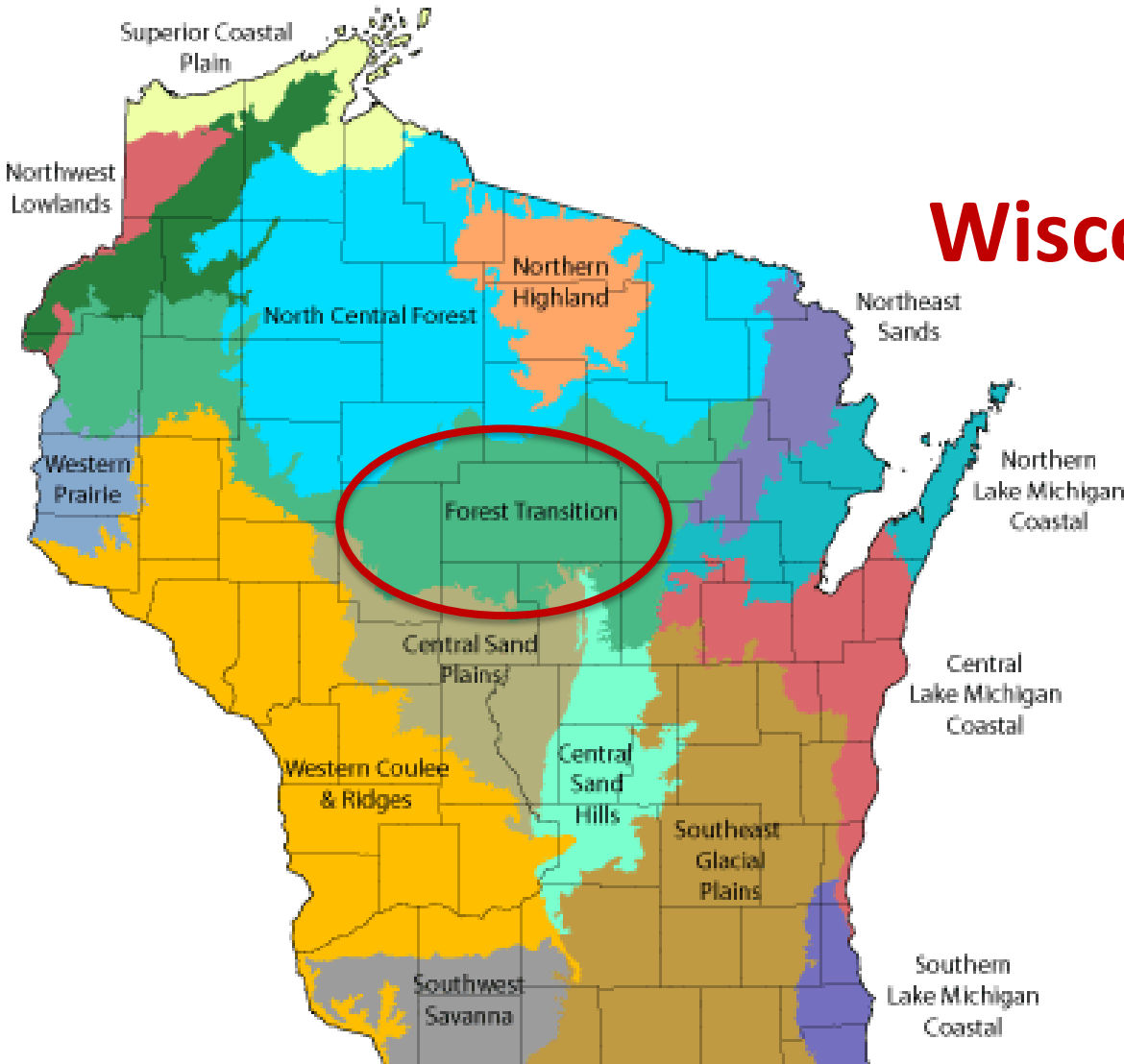
Of Rats and Men: Warfarin was promoted as rat poison in 1948 and approved as anticoagulant medication in 1954. Becomes world famous in 1955 when President Eisenhower was prescribed the drug.



Red clover (*Trifolium pratense*)



Wisconsin's clover belt



“Clover is listed as the greatest of all forage plants for the dairy cow, and here it grows not only abundantly but with a luxurious extravagance that is beyond the belief of any man who ever gave this section close study.”

John F. Lamont, Annual Report of the Wisconsin Dairymen's Association, 1905.

“Probably about 2 million acres of red clover in WI in 1920”

Wisconsin Farmer

“125,000 acres of red clover seed in WI in 1919”

American Seedsman



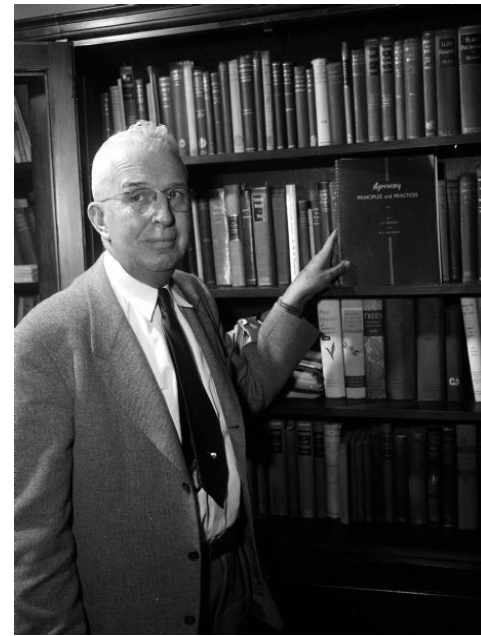
William K. Smith

‘Lakeland’ released by Wisconsin Agric.
Experiment Station and USDA, 1959

“Lakeland Top Clover Variety
Grown in State” replacing ‘common’
Appleton Post-Crescent, February 11, 1966



Alfalfa (*Medicago sativa*)

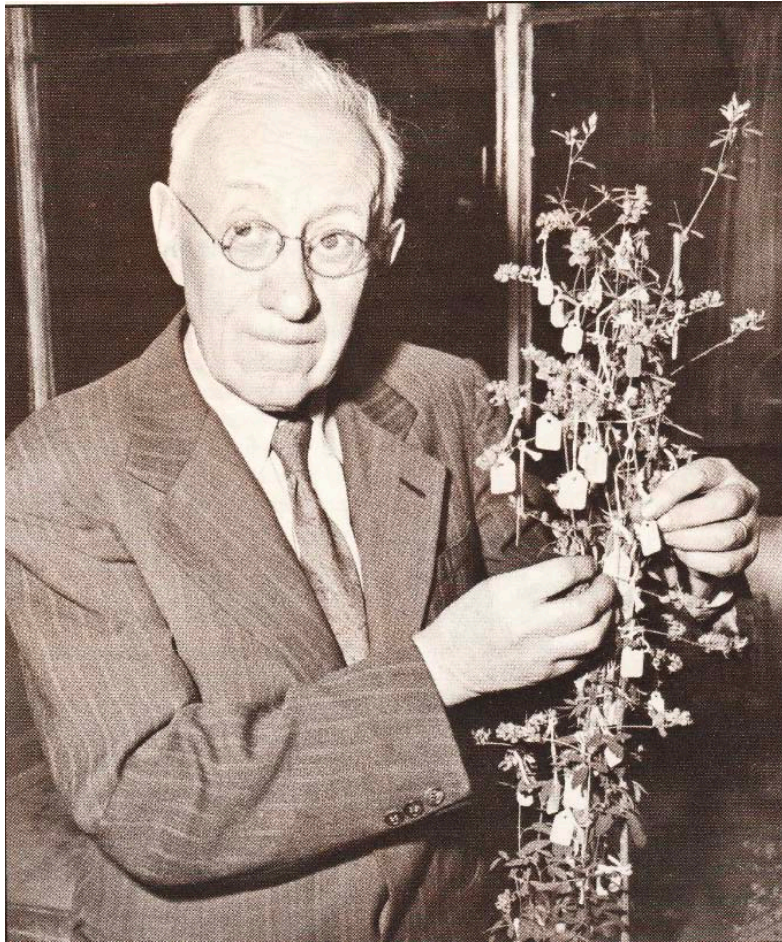


Laurence F. Graber
“Mister Alfalfa”

- Larry Graber joined the Agronomy Department in 1910 and was assigned the task by R.A. Moore to increase alfalfa acreage in the state
- Established the “Alfalfa Order” in 1911 with 1350 members
- Research was the first in the nation on physiology and management of alfalfa



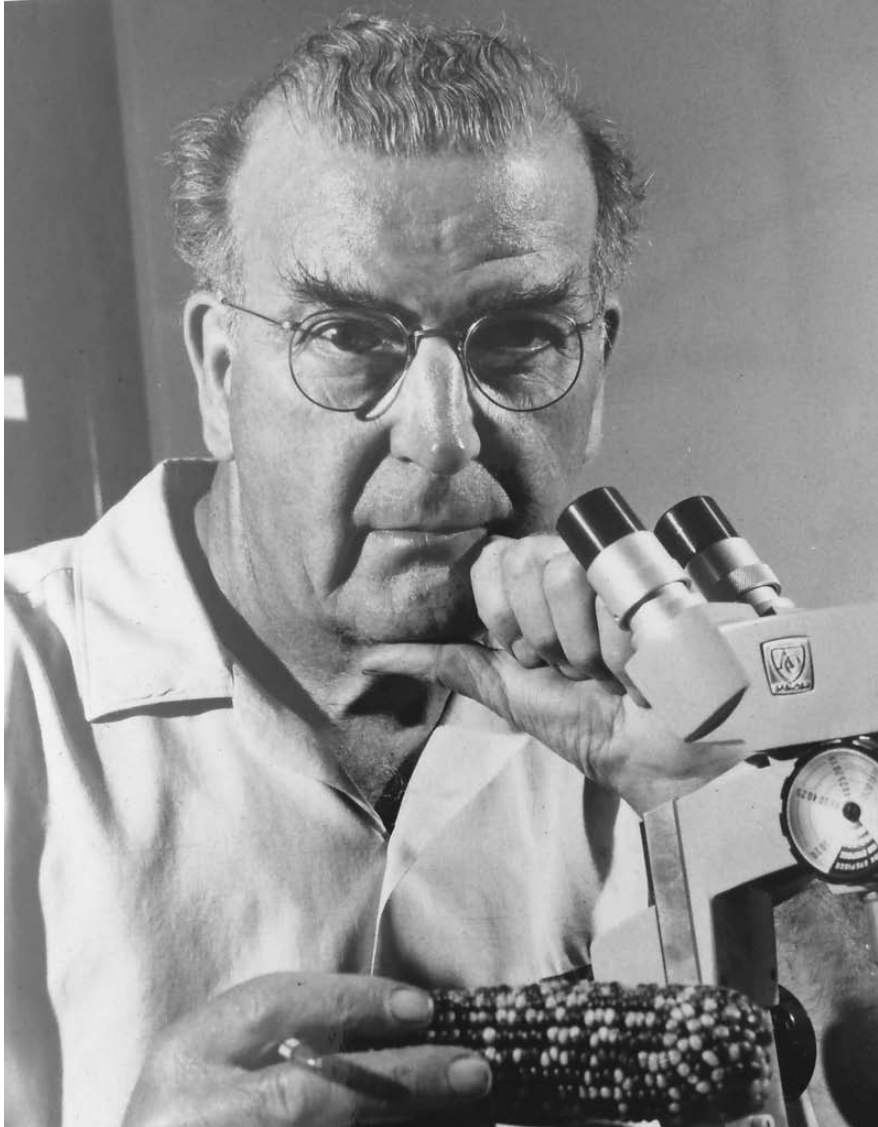
Coronation of "Queen Alfalfa" in 1926



Frederick R. Jones



- Identified bacterial wilt as a factor in alfalfa winter injury in 1926
- Developed screening techniques for this disease that are still used



Royal Alexander Brink

Initiated an alfalfa breeding program, with collaborators L.F. Graber and F.R. Jones in 1926

Goal was to develop winter hardy and bacterial wilt resistant alfalfa

Released 'Vernal' alfalfa in 1953

Exceptional winter hardiness *and* resistance to bacterial wilt

Slogan: *You can plow Vernal when you want to not when you have to!*

Helped boost alfalfa acreage in Wisconsin to 3 million acres by 1966

Today Vernal is in the ancestry of more than 1000 varieties



Emil Truog

- Developed tests to rapidly identify soil nutrient limitations
- Developed tests for soil pH and lime requirements to adjust pH
- Related visual symptoms to specific nutrient deficiencies



Classic K deficiency symptoms in alfalfa



Helige-Truog Combination Soil Tester

German bacteriologists Friedrich Nobbe and Lorenz Hiltner patented the use of pure cultures of bacteria to support nitrogen fixation in legumes and called this product “Nitragin”. After 3 years of marketing the product in USA, the German-American Nitragin Co. was established in Milwaukee in 1912.

FOREIGN OFFICES:
 WESSEND-ROEDL, GERMANY
 LONDON, ENGLAND
 RIO DE JANEIRO, BRAZIL
 VALPARAISO, CHILE
 MEXICO CITY, MEXICO
 MELBOURNE, AUSTRALIA
 CALCUTTA, INDIA

GOLD MEDAL, ST. LOUIS, 1904.
 CABLE ADDRESS
 NITRAGIN
 A. B. C. CODE

German-American "Nitragin" Co.
 MANUFACTURERS OF
 "NITRAGIN"
 (TRADE MARK REG. NO. 32212)

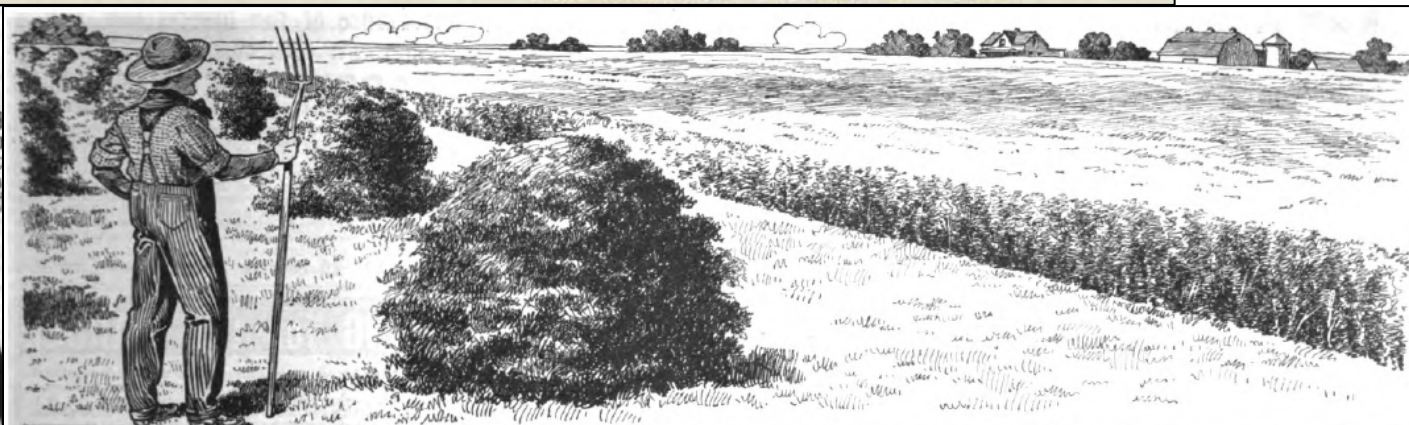
The Nobbe-Hiltner Improved Soil Inoculator

Milwaukee, Wis. Feb. 26th 1912.

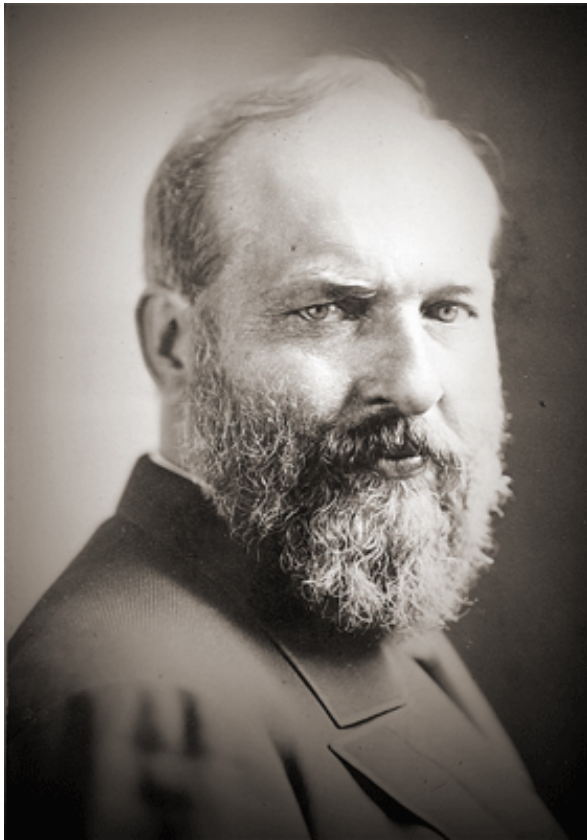
COW PEAS NOT INOCULATED vs. COW PEAS INOCULATED WITH "NITRAGIN"

- ALFALFA - NOT INOCULATED vs. INOCULATED WITH "NITRAGIN"

Old Farms Made New
 or
 How to improve the soil—enlarge the yield in crops and increase the value of your farm by using
NITRAGIN
 The Nobbe-Hiltner Improved Soil Inoculator



Let Us Tell You How You Can Raise Alfalfa Successfully

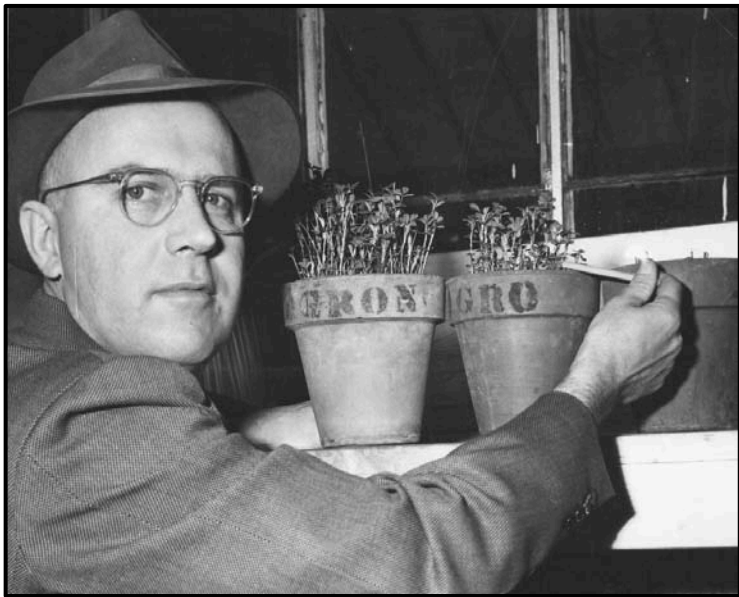


Franklin Hiram King
Agricultural Physics

Perfected and promoted the cylindrical silo

Wrote a bulletin on "The Construction and Filling of Silos"





Dale Smith

Developed principles of forage crop management based on physiology

Shifted farmers from two harvest to three harvest alfalfa system to increase yield and nutritive value



Dwayne Rohweder

Promoted understanding of forage quality and developed relative feed value (RFV) index

Crop acreage, production and value in Wisconsin in 2014.

	Acreage	Production	Value
	(million acres)	(million tons ¹)	(billion dollars)
All hay and haylage	2.6	9.6	1.5
[Alfalfa hay and haylage]	[2.2]	[8.5]	[1.4]
[other hay and haylage]	[0.4]	[1.1]	[0.1]
Pasture	1.7	-	-
Corn silage	0.8	6.2	0.5
Corn grain	3.1	-	1.8
Soybean	1.8	-	0.8

¹Production adjusted to dry matter basis

Source NASS 2014

Alfalfa acreage and production in six highest production states.

	Acreage				Production		
	2013	2014	2015		2013	2014	2015
	(1,000 acres)				(1,000 tons)		
Wisconsin	2,000	2,200	2,150		5,766	8,455	7,685
South Dakota	1,820	1,920	1,930		3,909	4,431	4,309
Minnesota	1,185	1,360	1,350		3,386	4,249	4,098
Idaho	1,135	1,120	1,030		4,658	4,706	4,581
California	865	850	815		6,136	5,960	5,660
Michigan	840	850	890		2,789	2,961	3,220

Source NASS 2016

Recent Developments that Will Have Impact:

Reduced lignin alfalfa

Downregulation of Caffeic Acid 3-*O*-Methyltransferase and Caffeoyl CoA 3-*O*-Methyltransferase in Transgenic Alfalfa: Impacts on Lignin Structure and Implications for the Biosynthesis of G and S Lignin

Dianjing Guo, Fang Chen, Kentaro Inoue, Jack W. Blount, and Richard A. Dixon*
Plant Biology Division, Samuel Roberts Noble Foundation, Ardmore, Oklahoma 73401

The Plant Cell, Vol. 13, 73–88, January 2001

Tannins in alfalfa and white clover

Expression of the R2R3-MYB Transcription Factor TaMYB14 from *Trifolium arvense* Activates Proanthocyanidin Biosynthesis in the Legumes *Trifolium repens* and *Medicago sativa*

Kerry R. Hancock, Vern Collette, Karl Fraser, Margaret Greig, Hong Xue, Kim Richardson, Chris Jones and Susanne Rasmussen*
AgResearch, Ltd., Palmerston North 4442, New Zealand

Plant Physiology, Vol. 159, 1204-1220, July 2012