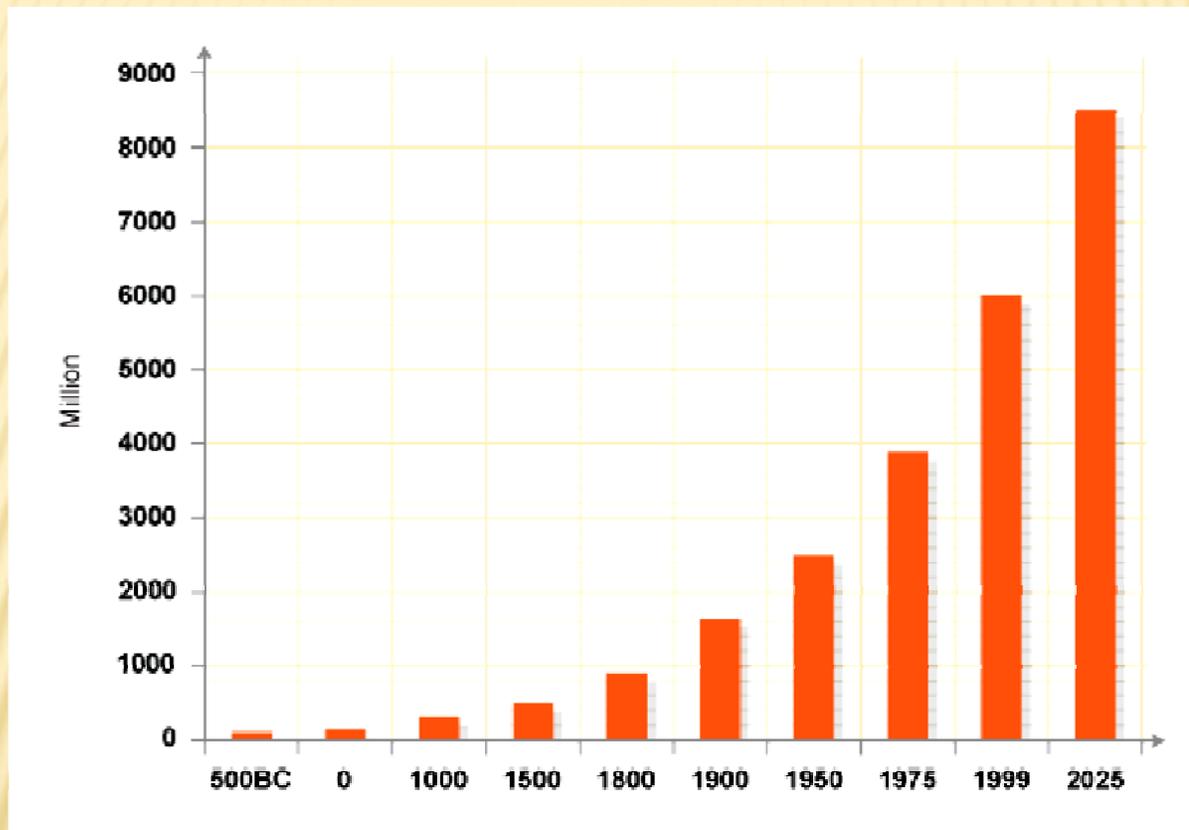


Climate, CO₂ and Food Security: An Overview of Research Efforts.



FOOD SECURITY: POPULATION.



Today 200,000+ people will be added to the global population.
All will want their share of food, water and energy.

Food security and resource management: Green revolution as paradigm.

Since the start of the green revolution, the global population has more than doubled, as has the number of available calories. We have been successful in adding people because the green revolution provided the necessary food.



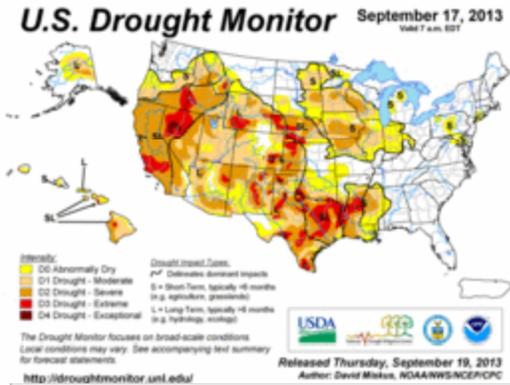
Water

Energy

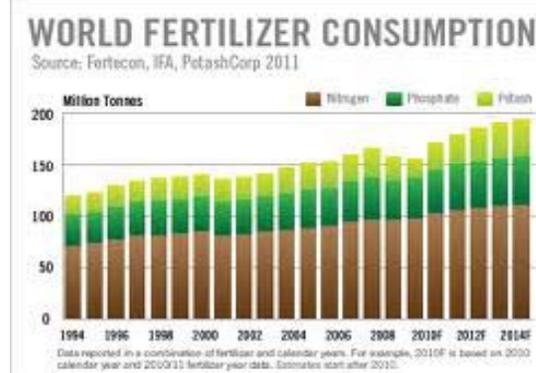
Arable Land

Climate Change and Food Security.

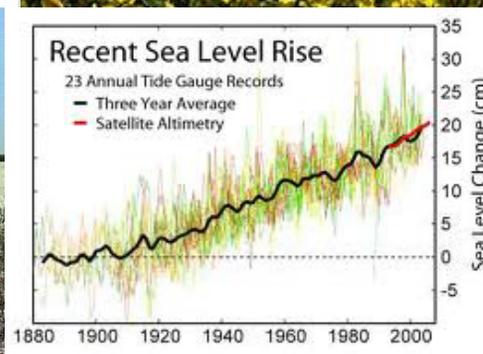
Water



Energy



Land



But wait, there's more!

Food Quality



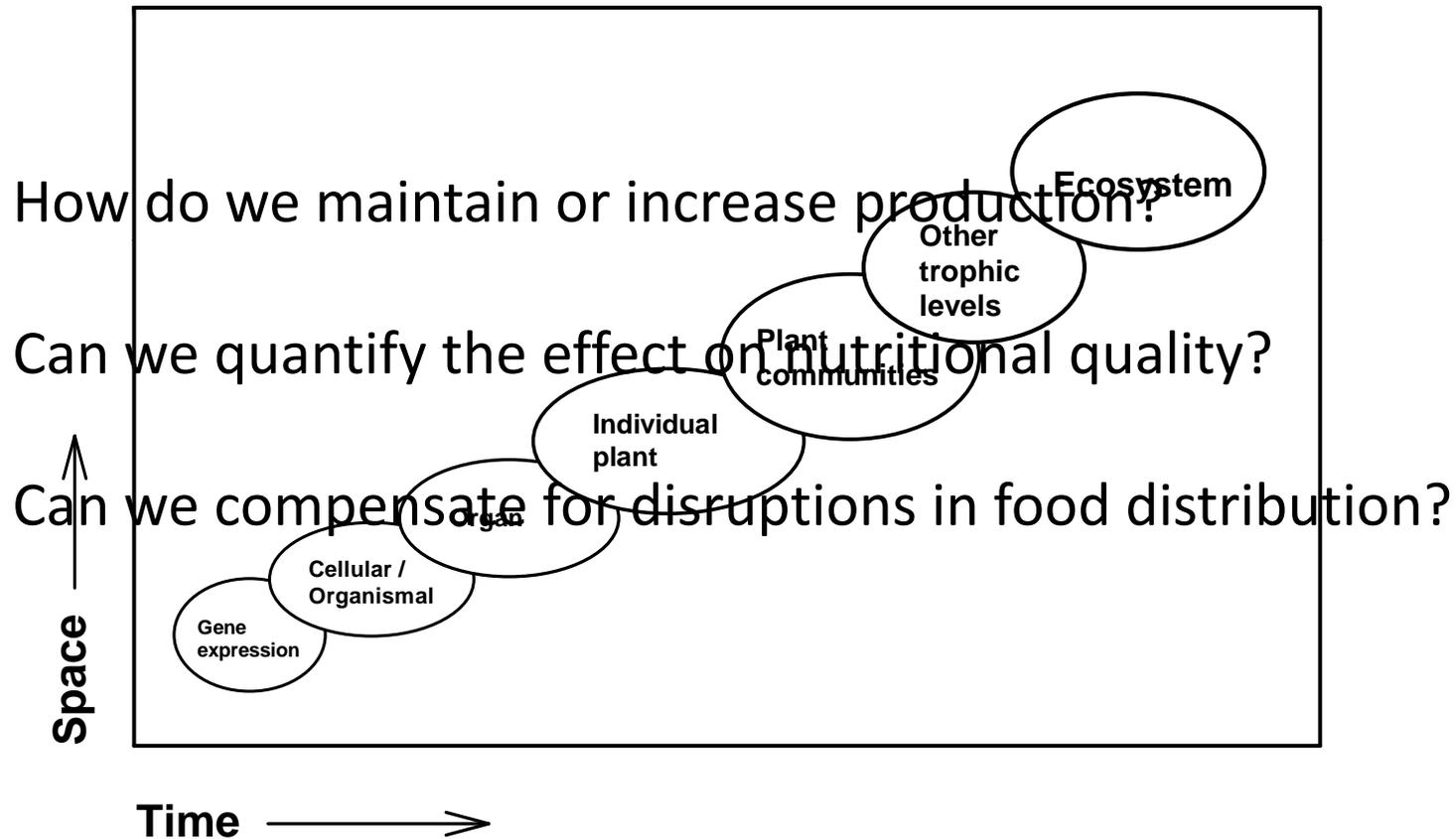
Pests



Food
Distribution

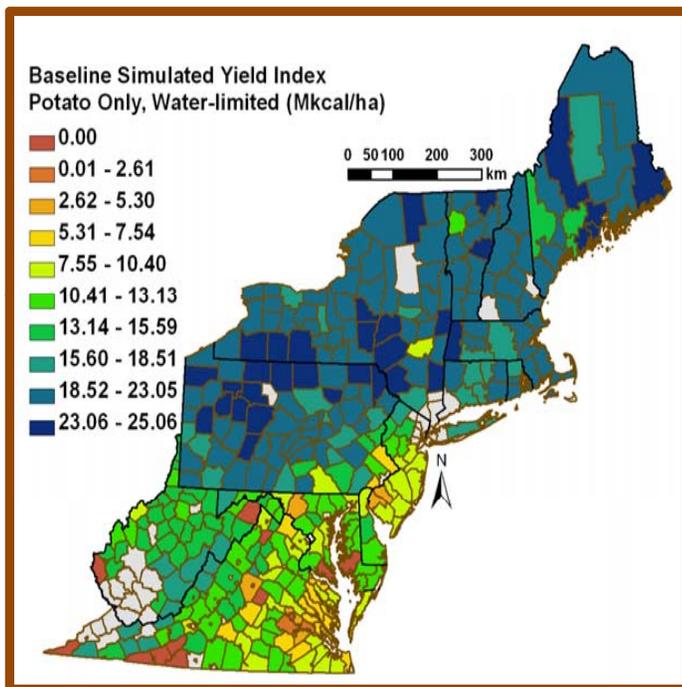


Food Security: Production, Distribution and Quality:



Climate Change & Food Production: Adaptation

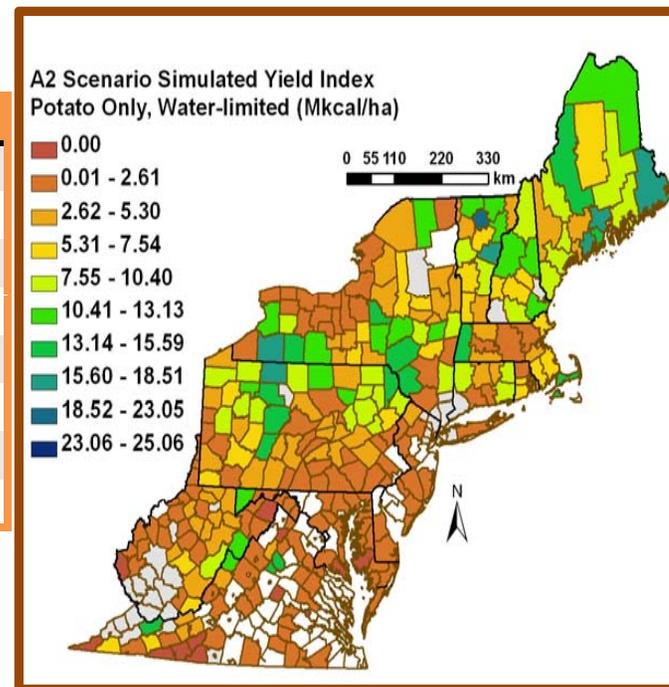
Current Climate



Change in Yield per State

State	Change	State	Change
ME	-35%	PA	-39%
VT	-27%	NJ	-79%
RI	-43%	MD	-77%
NH	-28%	DE	-88%
MA	-51%	WV	-44%
CT	-46%	VA	-76%
NY	-43%		

Future Climate

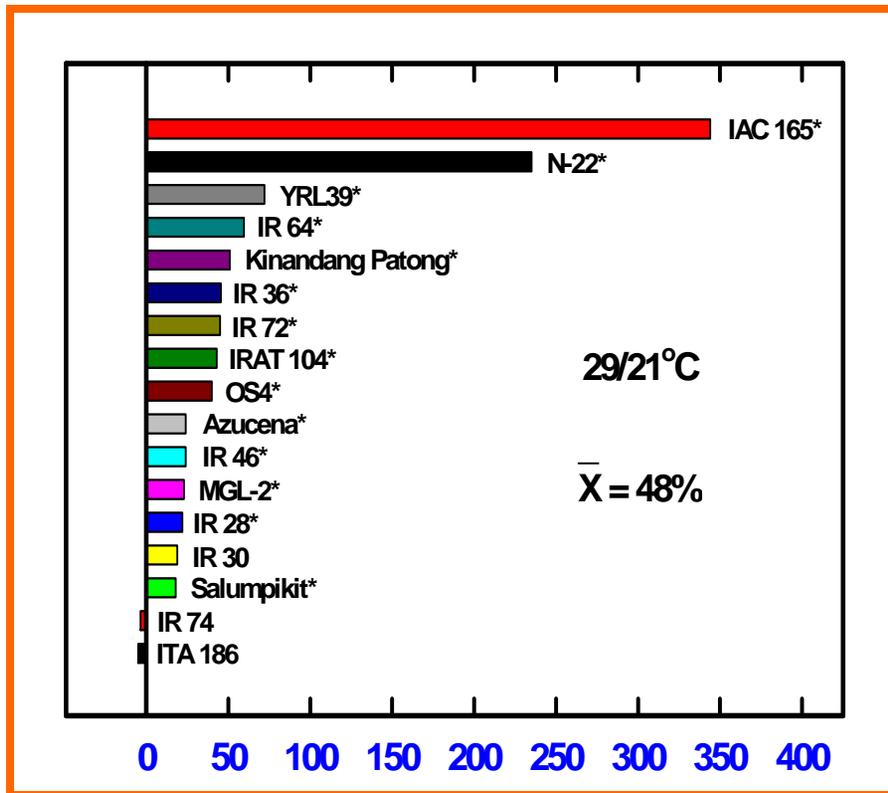


- Climate change has a more significant effect on yield in the southeast states by the coast (potato is a cool season crop!)
- Simulations study possible adaptation approaches by adding irrigation or modifying the planting and harvesting dates
- For example, providing irrigation was found to alleviate some of the temperature stress in most of the states shown above.

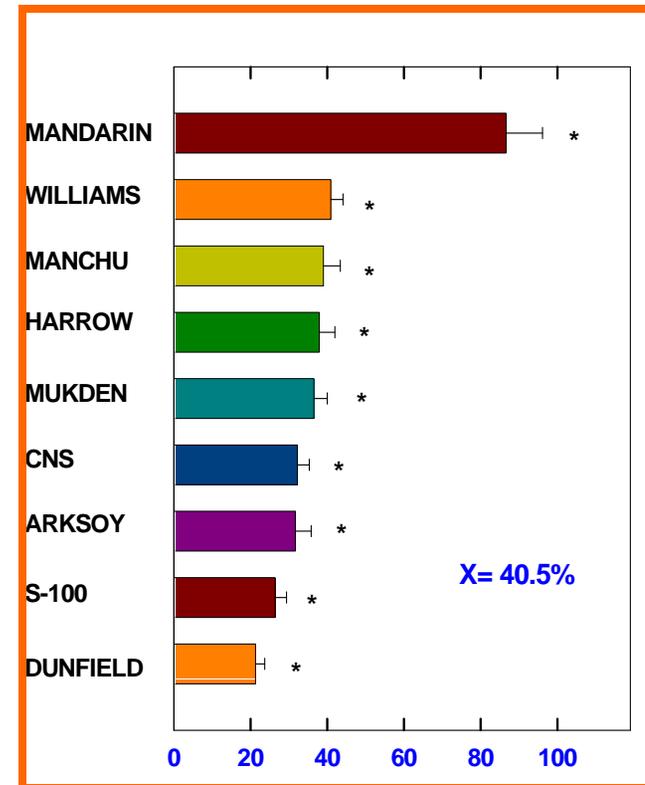
Production.

Carbon dioxide, in addition to being the primary greenhouse gas, is also the source of carbon for plant growth. Given this, can we begin to select for differential CO₂ responses within a crop?

How much yield potential is there among crop lines to rising CO₂ levels?

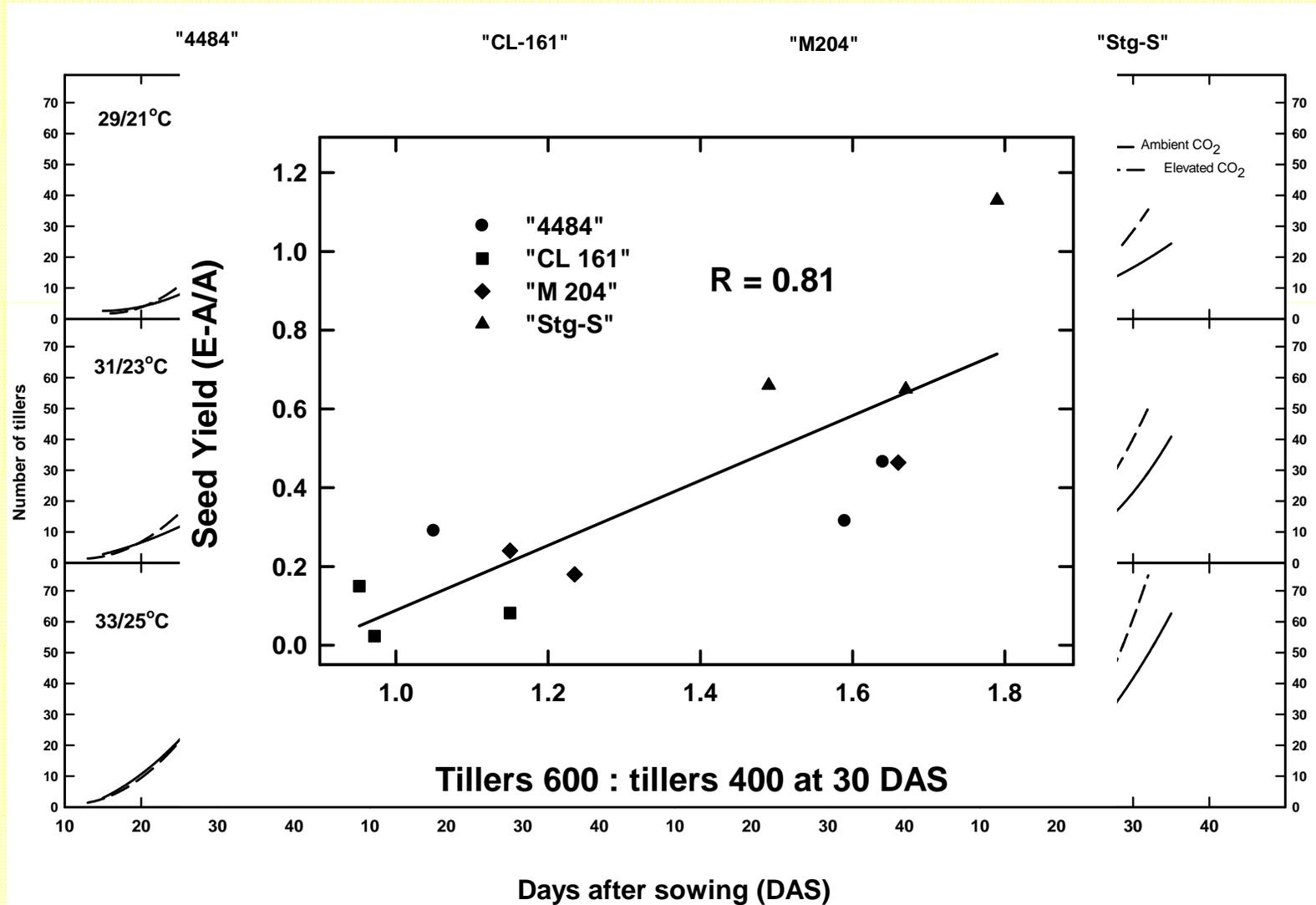


Rice

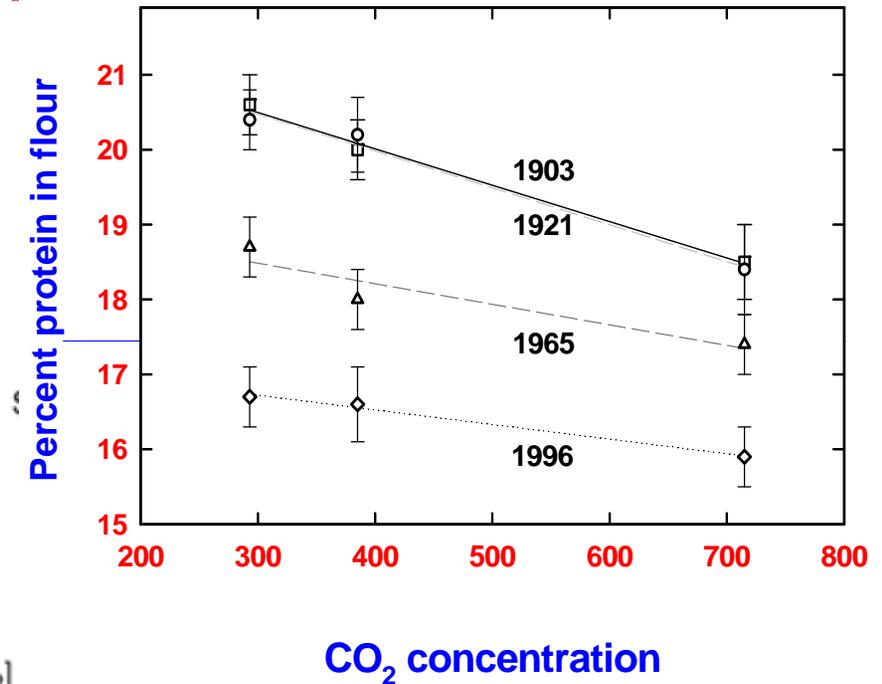
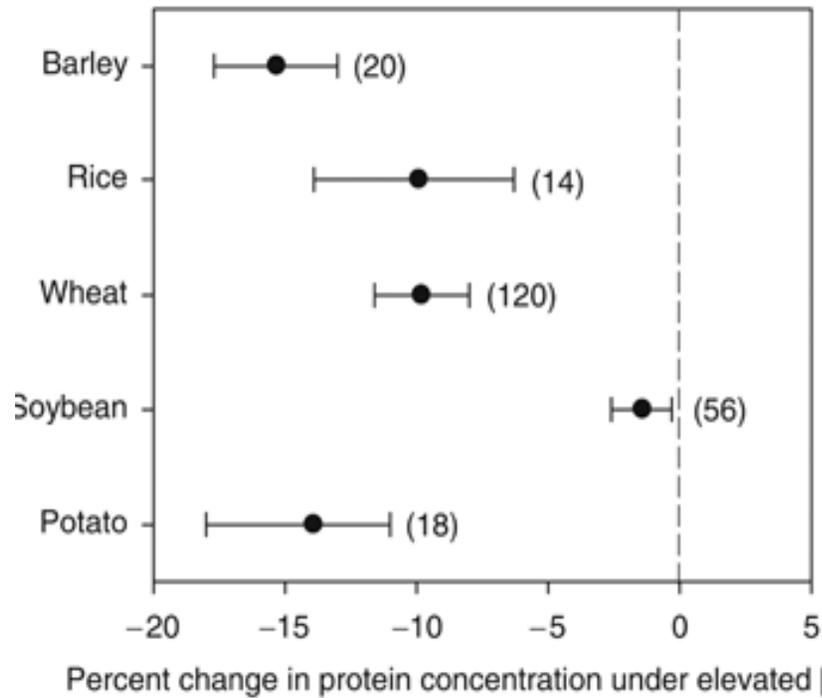


Soybean

CO₂ and temperature



Quality / Human Nutrition



- █ Palmitic acid
- █ Stearic acid
- █ Vaccinic acid
- █ Oleic acid
- █ Omega-6 acid
- █ Omega-3 acid

Nutritional Variation impacts on human health are lacking.

Beneficials, nutrition and CO₂.

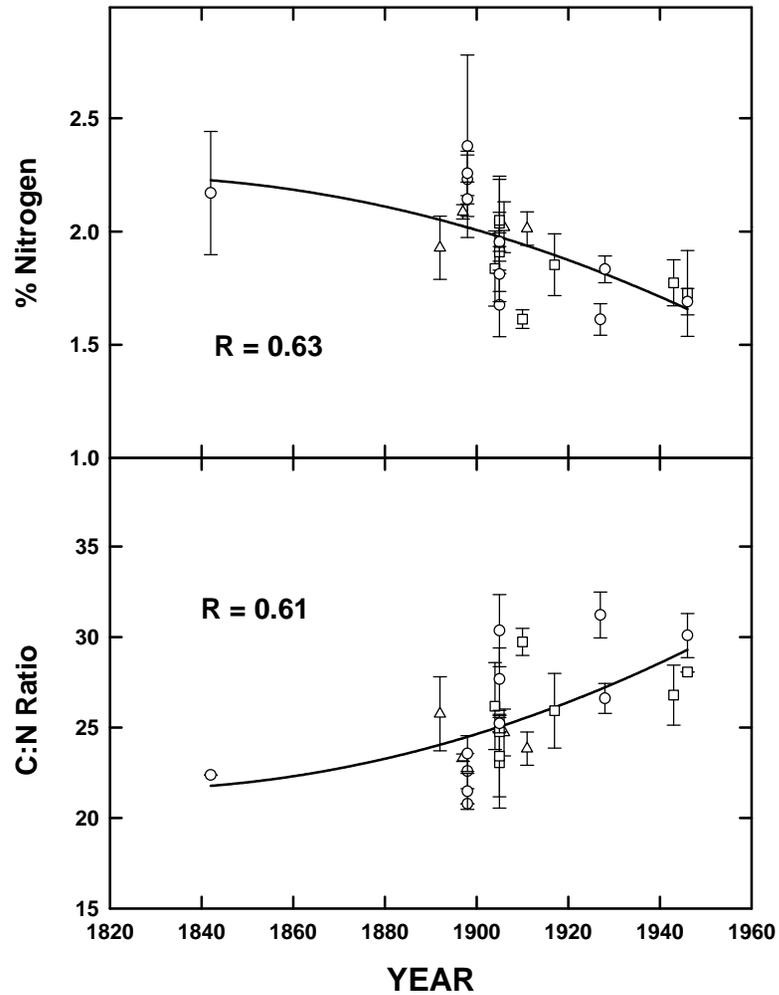
If rising CO₂ reduces protein concentration for human consumption could it also reduce the protein in pollen, with subsequent consequences for pollinators?



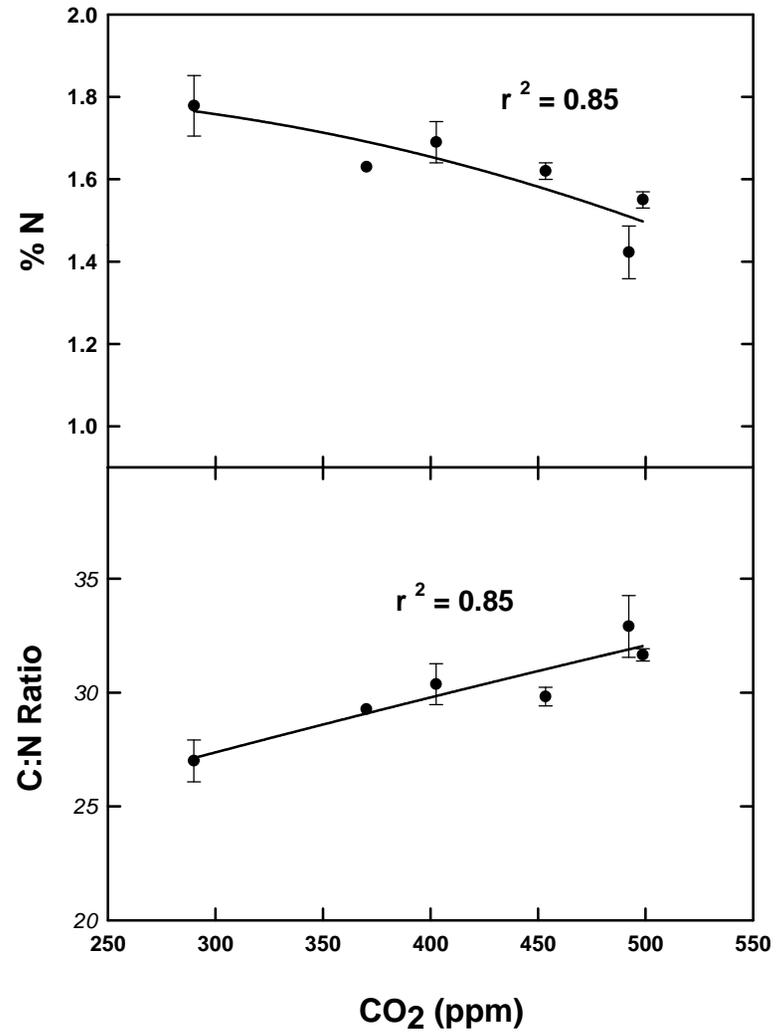
Focus on goldenrod, particularly *Solidago canadensis*, (most prevalent species of goldenrod) as last source of pollen before winter, and an obvious factor in food supply for overwintering.

Nutritional Quality

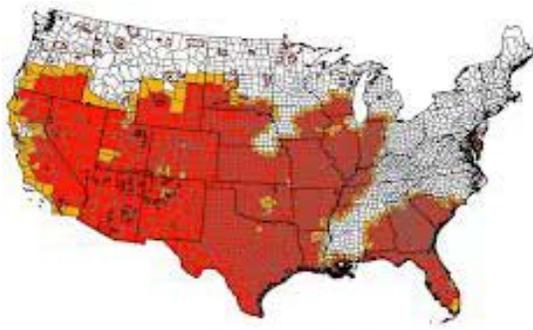
**Solidago canadensis
(Herbarium)**



**Solidago canadensis
(Texas Monolith)**



Distribution



2012

Secretarial Drought Designations as of July 31, 2012



USDA FSA
2012 Farm Income Agency
Production, Emergency and Compliance Division
Washington, DC
July 31, 2012

10/2/12/2012



Traffic jam

Two industry and waterways groups estimate that low water in Mississippi shipping channels will result in these commodity losses over December and January:

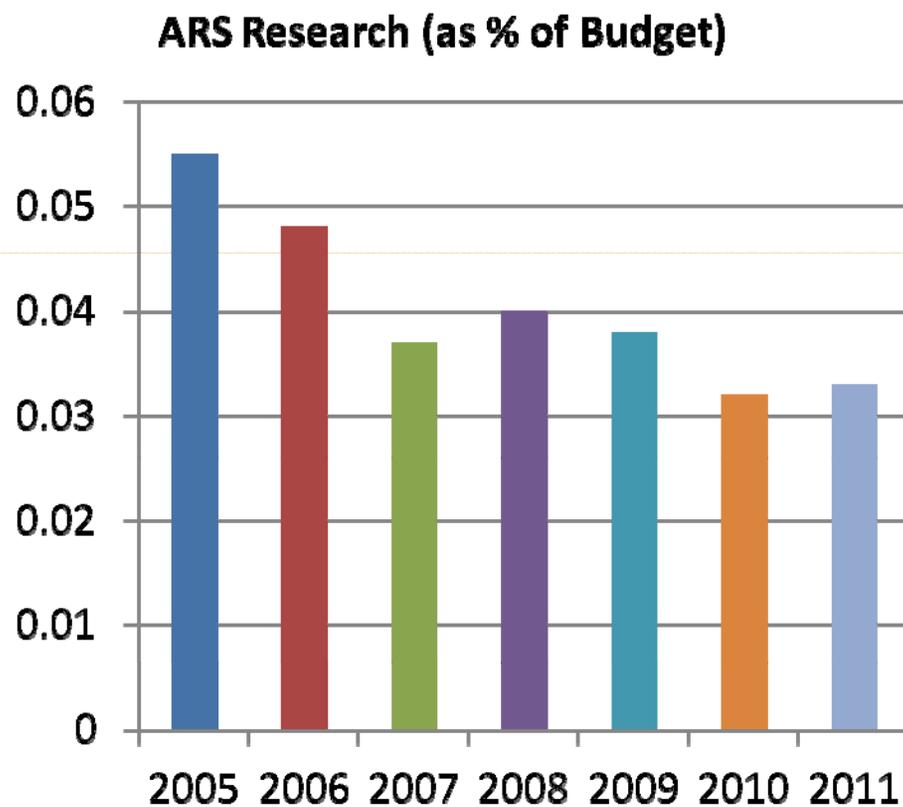
Agricultural	\$2.3 bil.
Chemical	\$1.8 bil.
Petroleum	\$1.3 bil.
Crude oil	\$534 mil.
Coal	\$192 mil.

Sources: Waterways Council Inc.,
American Waterways Operators THE WASHINGTON POST

...and the greatest challenge.

1960-1979	Grew 3.2%
1980-1989	Flat
1990-1999	Grew 0.6%
2000-2009	Decreased 0.2%

Source: USDA ERS



HUGE challenges, must pool our resources.