2014 UNL Manure Demonstration Day

Manure vs. Commercial Fertilizer:

Can soil and crops tell the difference?

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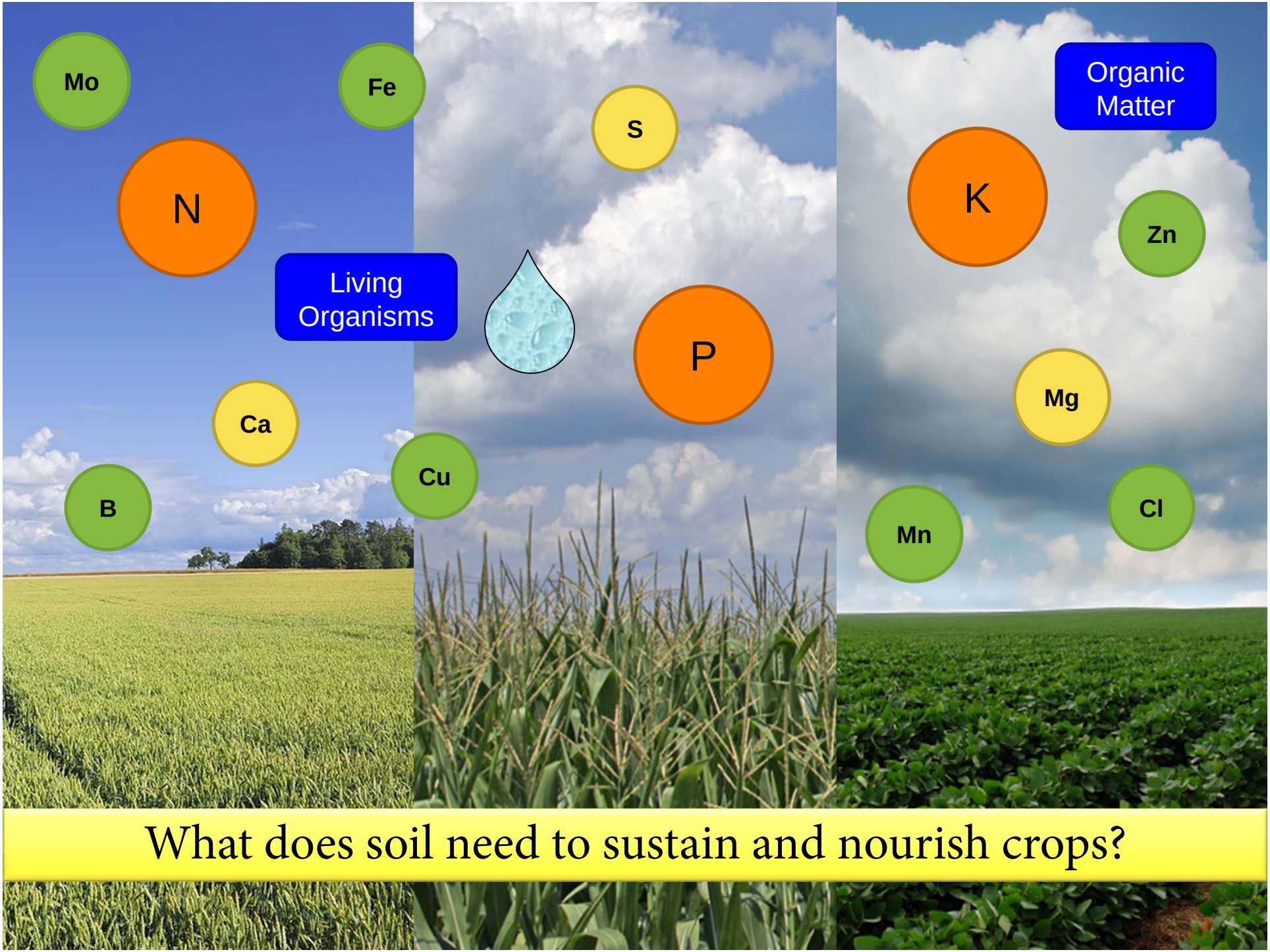
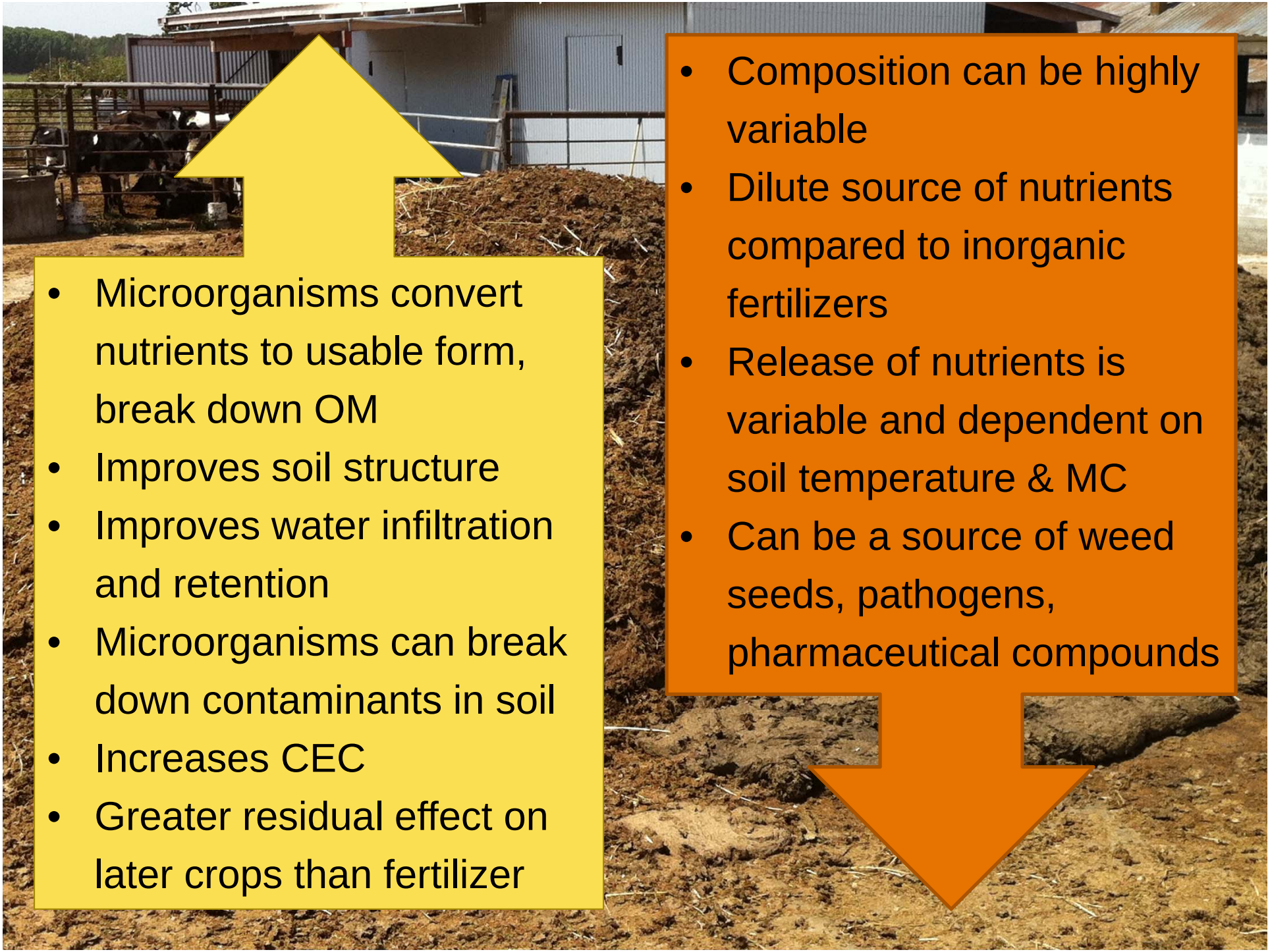
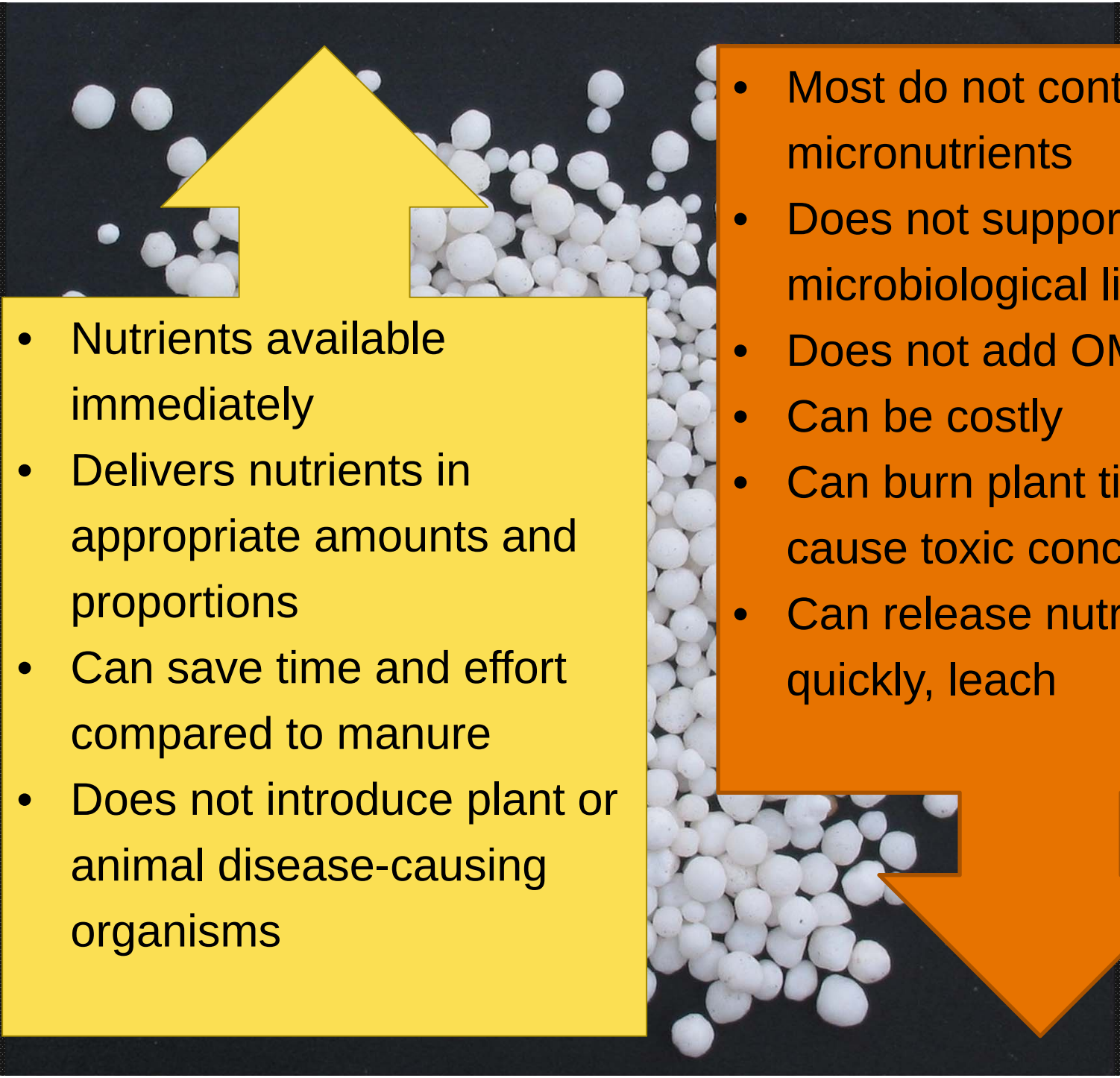


What does soil need to sustain and nourish crops?



- Microorganisms convert nutrients to usable form, break down OM
- Improves soil structure
- Improves water infiltration and retention
- Microorganisms can break down contaminants in soil
- Increases CEC
- Greater residual effect on later crops than fertilizer

- Composition can be highly variable
- Dilute source of nutrients compared to inorganic fertilizers
- Release of nutrients is variable and dependent on soil temperature & MC
- Can be a source of weed seeds, pathogens, pharmaceutical compounds



- Nutrients available immediately
- Delivers nutrients in appropriate amounts and proportions
- Can save time and effort compared to manure
- Does not introduce plant or animal disease-causing organisms

- Most do not contain micronutrients
- Does not support microbiological life in soil
- Does not add OM to soil
- Can be costly
- Can burn plant tissue, cause toxic concen. of salts
- Can release nutrients too quickly, leach

Manure & Fertilizer Effects on Soil Productivity and Quality (Edmeads, 2003)

14 trials, 24 paired comparisons, long-term effects (20-120 years)

Soil Characteristic	Effect	
	Manure	Fertilizer
Organic matter	Greater	
Soil microfauna	Greater	
Topsoil P, K, Ca, Mg	Greater	
Subsoil NO3-N, Ca, Mg	Greater	
Crop production	No difference	No difference
Soil quality		
Runoff and leaching of P and N	Greater	
Bulk density		Greater
Hydraulic conductivity	Greater	
Aggregate stability	Greater	

Does nutrient source affect yield or nutritional value of the plant product?

Effects of Organic and Inorganic Fertilizers on Soil Fertility and Crop Quality – A 32-yr study

(Grandstedt & Kjellenberg, 1997)

Growing conditions:

- Mean annual precipitation = 21”
- Mean annual temperature = 42.8˚ F
- 6 to 8 snow-free months per year
- Fertilizer application rates adjusted to bring about comparable yields

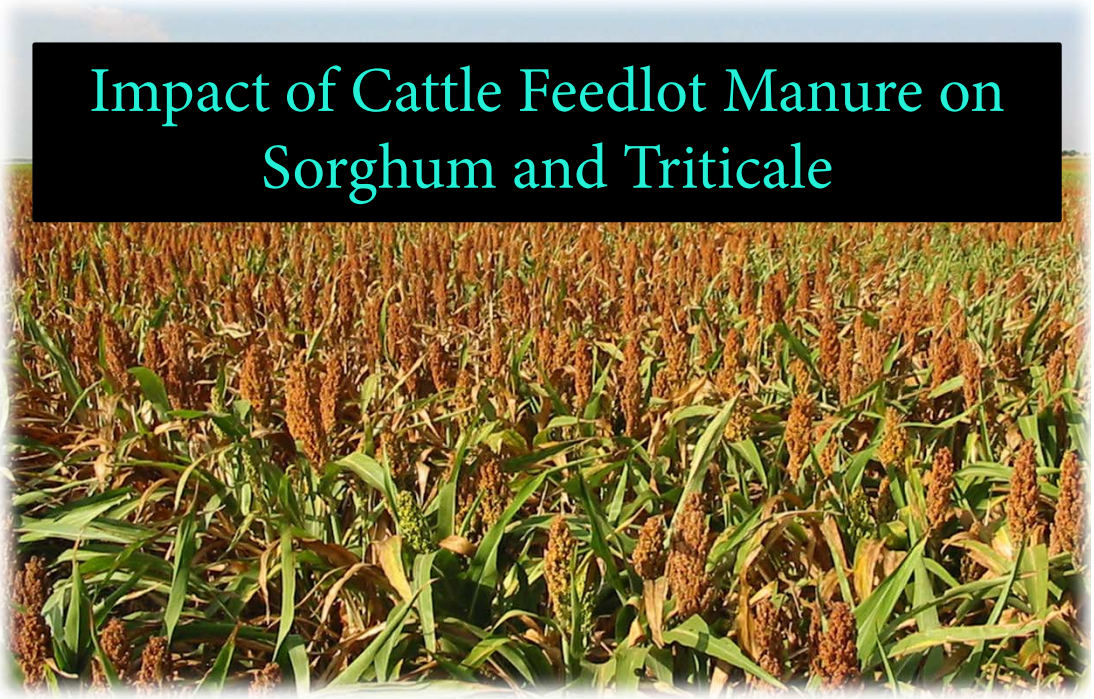
Overview of Findings:

- Crop yield increases were significantly higher under organic treatments
- Lower crude protein content but higher protein quality for potatoes and wheat under organic treatments
- Greater resistance to stressful conditions and decomposition during long-term storage for potatoes under organic treatments
- Higher starch quality under organic treatments
- Higher soil fertility under organic treatments

Impact of Cattle Feedlot Manure on Sorghum and Triticale

	A	B	C
Yr 1	20 t/ha	20 t/ha	60 t/ha
Yr 2	25 t/ha	25 t/ha + N	N
Yr 3	20 t/ha	20 t/ha + N	N

Plus inorganic fertilizer only treatment



Three-year crop DM yield not significant among treatments

Removal of N, P, & S

Inorganic fertilizer > C > B > A

Application of manure at high initial rate vs. annually improved water infiltration

Treatment C maximized yield & nutrient recovery, minimized runoff and dissolved nutrient losses

Klepper *et al.*, 2010

Seed yields

poultry manure (3.97 t/ha) > municipal waste & cow manure (3.78 t/ha) > inorganic fertilizer (3.70 t/ha)

Plant heights

poultry manure (259 cm) > municipal waste & cow manure = inorganic fertilizer (253 cm)

Days to achieve 50% tasseling

Inorganic fertilizer (50 d) < poultry manure (52 d) < municipal waste & cow manure (53 d)

Plant leaf areas did not differ

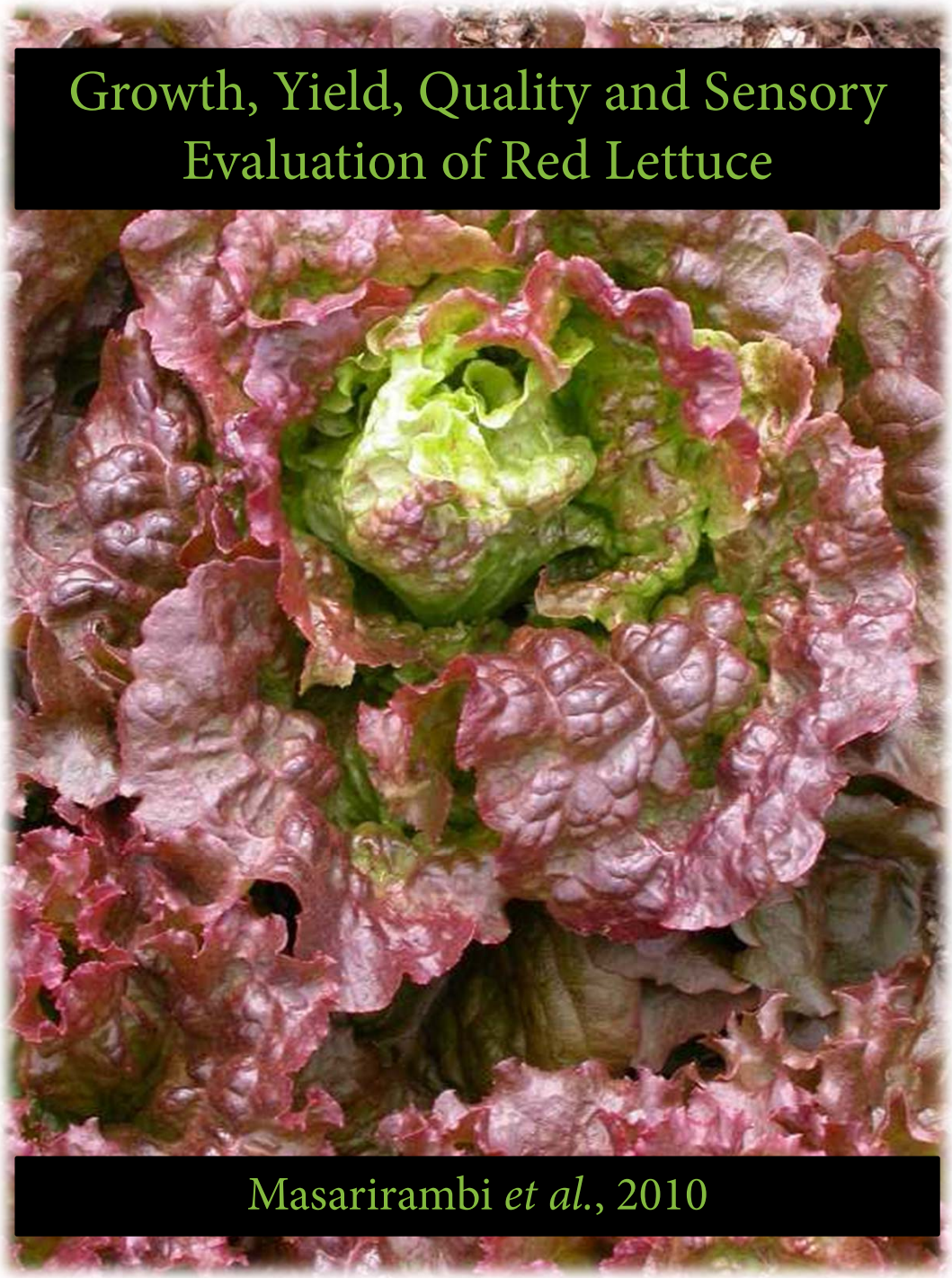
Growth, yield, and nutritional quality significantly affected.

chicken manure > cattle manure > compost > inorganic fertilizer

Compost yielded higher Ca, Fe, Zn (fresh mass)

cattle manure > inorganic fertilizer > chicken manure

No differences in appearance and taste of lettuce among treatments



Manure (30 ton/ha) + 66% of recommended inorganic N-P fertilizer significantly increased total tuber yield

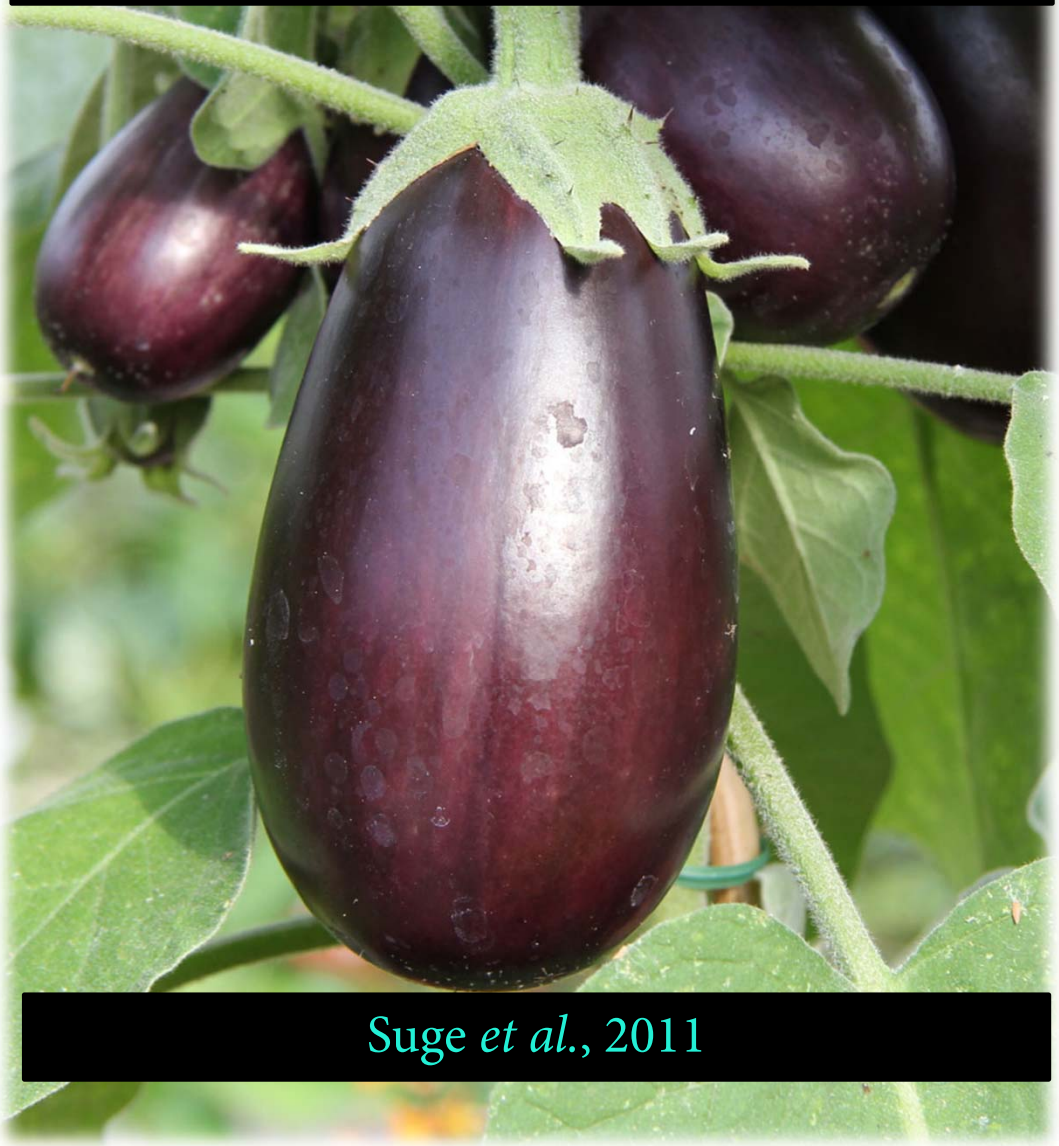
Manure (10 ton/ha) + 66% of recommended inorganic N-P fertilizer
vs.
20 or 30 ton/ha manure and 33% N-P fertilizer recommendation yielded similar results to 100% N-P fertilizer recommendation

Organic vs. Inorganic Fertilizer Effect on Growth, Yield, and Fruit Quality of Eggplant

"Farm yard manure" produced highest plant height and greatest fresh weight of fruit compared to green biomass, compost and inorganic fertilizer.

Eggplants receiving organic amendments, especially manure, were "exceptionally healthy, taller and heavier plants".

Manure and 100% recommended rate of inorganic fertilizer produced greater fruit length and diameter.



Suge *et al.*, 2011

Rono *et al.*, 1996

No significant difference in yields of cabbage or kale among manure and inorganic fertilizer treatments.

Uka *et al.*, 2013

Compared to inorganic fertilizer…

Poultry manure produced greatest plant height, leaf area, and fresh plant weight for okra

Cow manure produced greatest plant dry weight

Parting Thoughts…

Manure is fundamental to sustaining soil in a condition that is highly productive!

In 1907, Theodore Roosevelt said
"the nation that destroys its soil, destroys itself".

"Agriculture is the key to the survival of our species and soil vitality is the key to a productive and beneficial agriculture." – Unknown

Questions?

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