Nutrient Budget for Fruit and Vegetables Based on Compost and Inorganic Fertilizer

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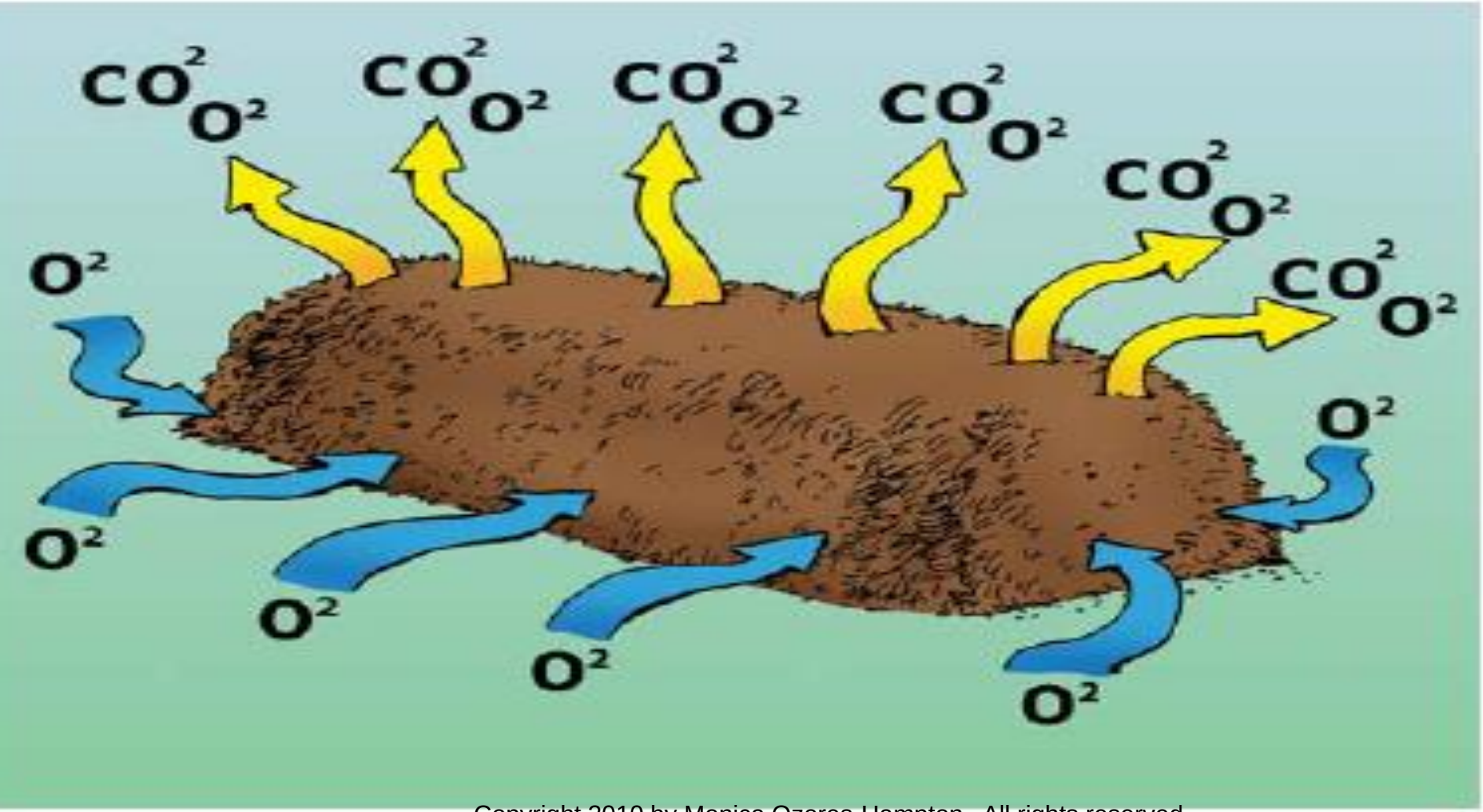
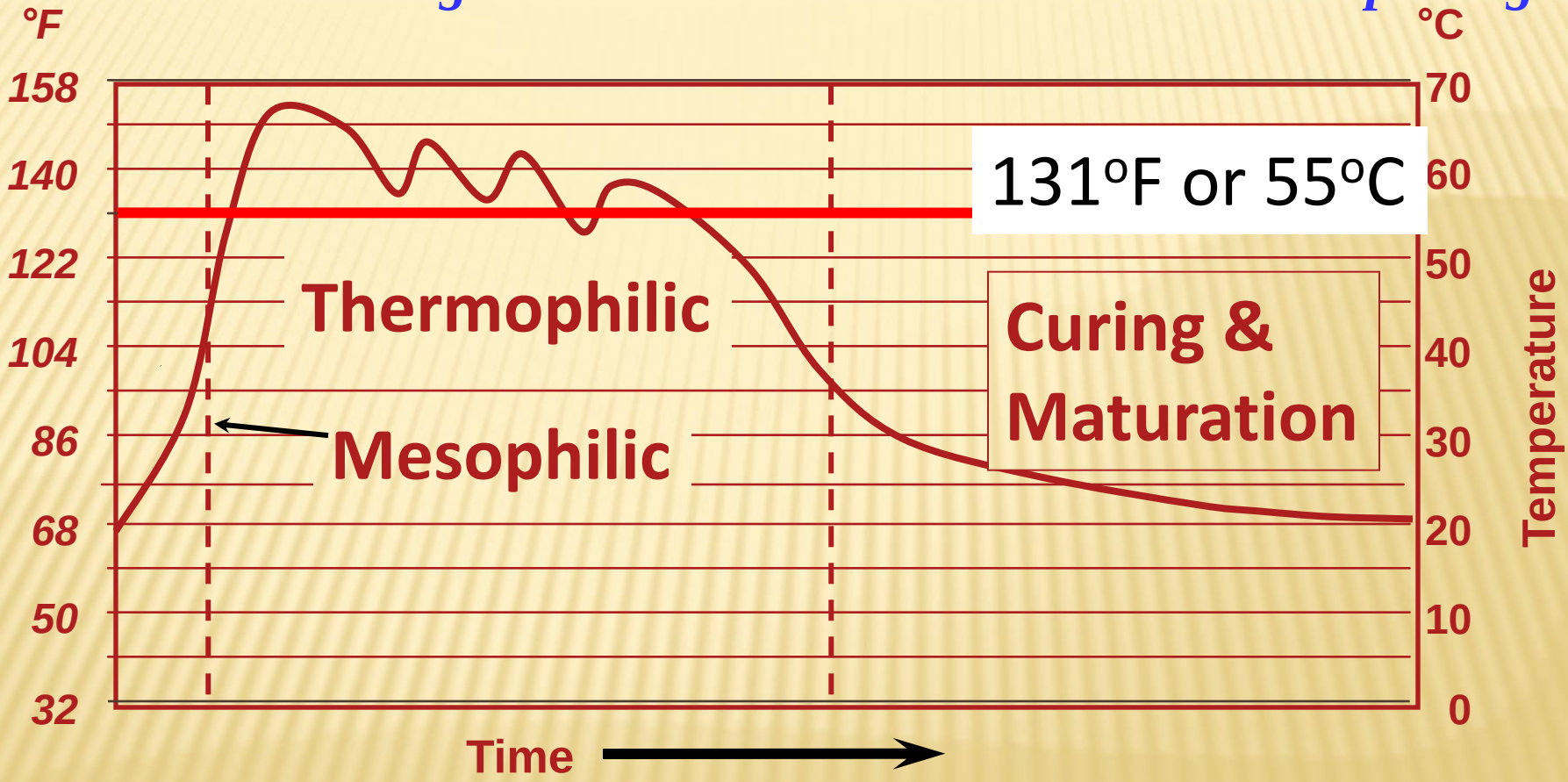
WHAT IS COMPOSTING?

'it's a biological decomposition process where microorganisms convert raw organic materials into relatively stable humus-like materials'



Under USEPA regulation 40 CFR Part 503 windrow composting



Temperatures of 131 °F or 55°C for the first 15 days and turned 5 times will eliminate human and plant pathogen and kill weed seeds

THERMOPHILIC STAGE

- Usually 130-150°F
- Heat should be controlled

PARAMETERS USED TO MONITOR WINDROWS

- Temperature
- Oxygen levels
- Moisture content

Spreading Equipment

QUALITY CONTROL

- Compost is tested in 5,000 ton
  - Test components
    - Carbon to nitrogen ratio
    - Nutrient values
      - N-P-K and minors
      - OM content
    - Maturity
      - Germination test
    - Pathogens
      - Salmonella and E. Coli
    - Microbe diversity

FERTILIZER VS. COMPOST

- A fertilizer is applied specifically to provide known nutrients to a plant.
- Compost is applied to improve or enhance soil characteristics for plant growth, but also may contain required plant nutrients.

FERTILITY PROGRAM: INORGANIC VS. ORGANIC SOURCES

- **Inorganic nutrients:**

  Majority derived from synthetic chemical compounds. Mainly content the vital nutrients of N-P-K that are essential for the plant growth.

  - Easily dissolving in water, fast nutrient release rate, high analysis, low cost per unit of N.
  - Leaching, require energy for manufacturing.

- **Organic nutrients:**

  Derived from animal or vegetable matters. Many of the nutrients present in organic soil amendments must be transformed by soil microorganisms before they can be utilized by crops.

  - Increase soil OM, increased water holding capacity and CEC, recycle nutrients.
  - High cost per unit of N, low analysis and low nutrient release rate (affected by environment), high application rate.

COMPOST SHOULD BE APPLIED TO VEGETABLES BECAUSE:

- Vegetables root zone soil OM concentration usually only 0.5 to 1.5%.
- Availability of non-hazardous organic waste materials is increasing.
- Using organics as nutrient sources can be economically favorable.
- Applying plant nutrients in an organic form may be considered a BMP.
- Benefits such increasing soil quality.

DEVELOPMENT OF NUTRIENT MANAGEMENT PLAN

- We can combined the use of organic and inorganic nutrient sources.
- The goal: increase crop yield, reduce leaching, improve plant nutrient use efficiency and reduce environmental impact.

COMPOST AS AN ORGANIC AMENDMENTS

- **Compost**

  Advantages: soil physical/chemical/biological property ↑, recycle nutrients, leaching↓.

  Disadvantages: cost, availability, spreading equipment, compost quality.

Versus

- **Raw animal manure**

  Advantages: Soil physical/chemical/biological property ↑, recycle nutrients.

  Disadvantages: food safety, availability, odors

COMPOST

Sources	N	P	K	Rate of N Release
	----------(%)----------			
Poultry	1.3-5	3.0	2.0	30
Mushrooms	2.5	1.3	0.9	10
Horse	0.5	0.2	0.4	10
Yard waste	1.0-1.2	0.2-0.3	0.2-1.4	6.0-10
Dairy	1.2-1.5	0.3	0.9	15
Gin trash	1.2-3.8	0.2	1.2	10
Feedlot	1.9-2.2	0.3	0.8	10

NUTRIENT APPLICATION CONSIDERATIONS

To prevent groundwater contamination by nitrate, compost and inorganic fertilizer should be applied at a rate that is equal to or less than the agronomic N-P-K rate for the site.

SETTING UP THE NUTRIENT MANAGEMENT PLAN

Take representative soil sample for moisture and nutrients analysis

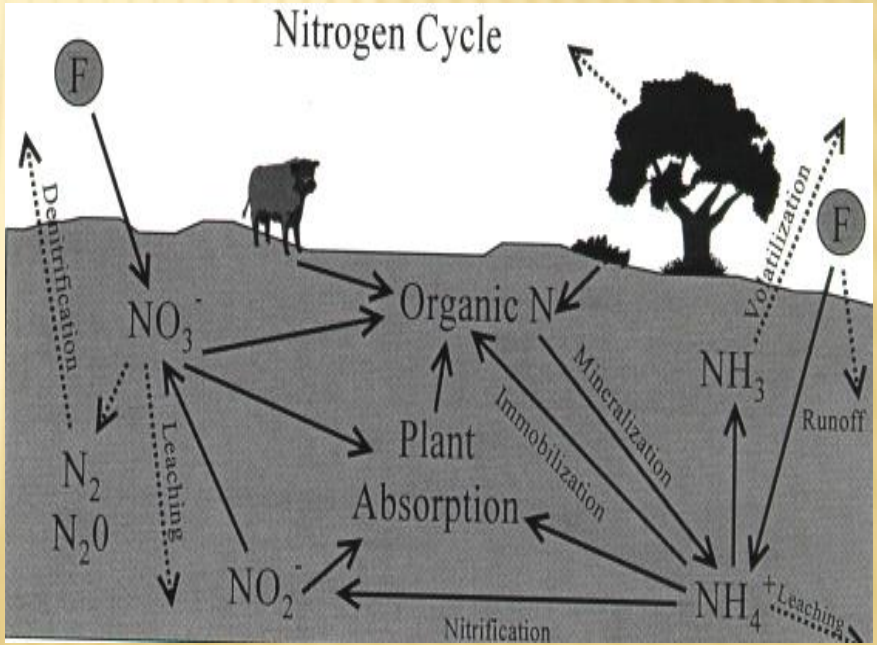
Compare with local crop N-P-K recommendation or agronomic rates

Determine the inorganic fertilizers and compost rate based on moisture, nutrient content and mineralization rate

N-Mineralization

Forms of N: Organic N > 90% and mineral N (NH_4-N, NO_3-N) < 10%

- Critical in determining N application rate.
- Depends on material type, soil, and environmental conditions.
- Decomposition occurs in phases (first-order kinetics). Rapid and slow.



WHAT IS A CROP NUTRIENT BUDGET?

Balance of nutrient entering and leaving the field or area

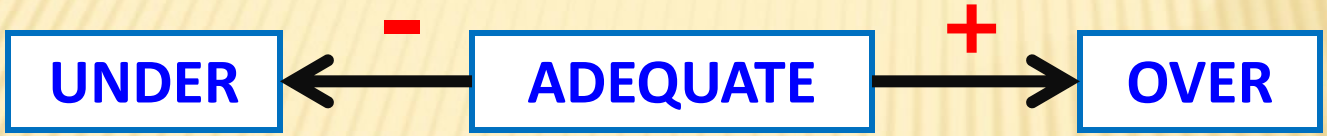
Sources of Nutrients

- N fertilizer
- N in irrigation water
- Residual soil N
- N from cover crops
- N from compost
- Mineralization of soil OM

Losses of nutrients

- Crop removal
- Leaching
- Denitrification
- Volatilization

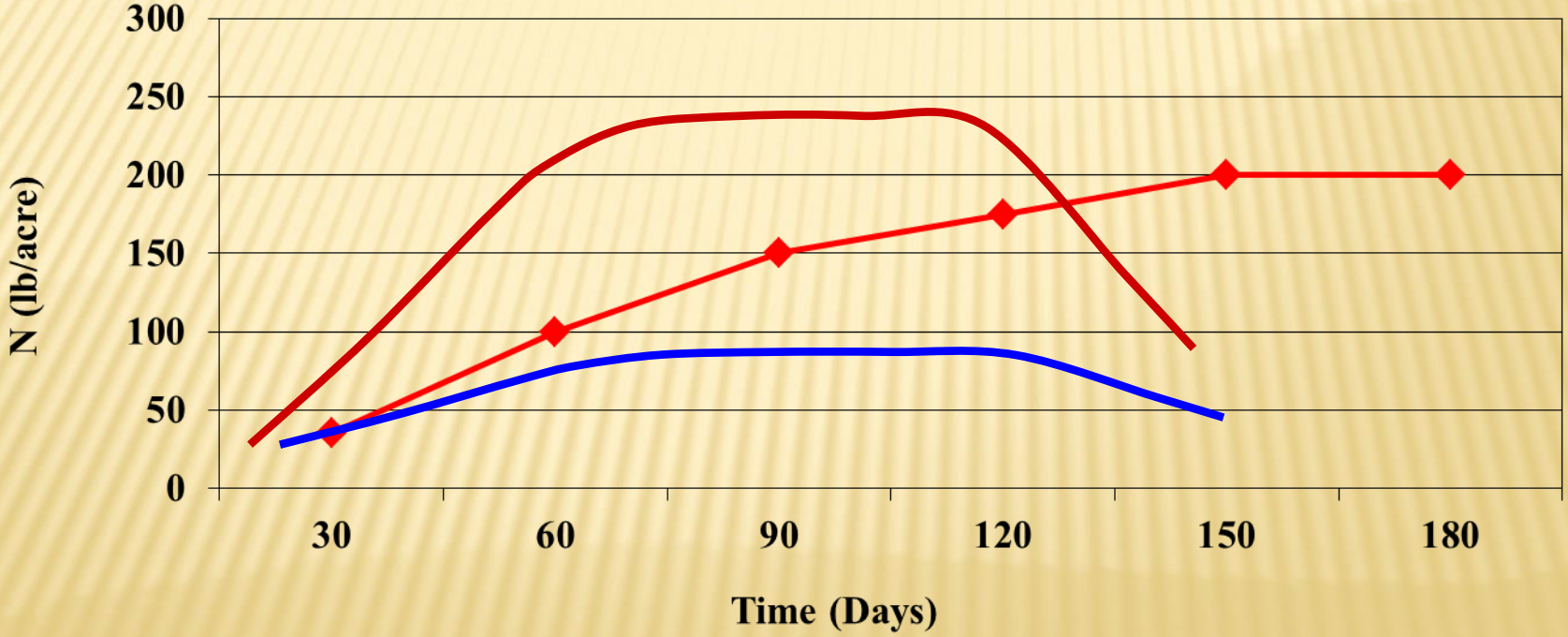
CROP NUTRIENT BUDGET



Reduce crop yield
Reduce crop quality
Deficiency

Inefficient and expensive
Nutrient run off
Ground water pollution
Pest/disease susceptibility
Excess foliage
Reduce vegetable quality

CROP REQUIREMENTS AND N AVAILABILITY



Tomato nutrient requirements in Florida based on 200 lb/acre of N; 100 lb/acre of P_2O_5 and 100 of K_2O lb/acre with a medium soil test levels of P and K.

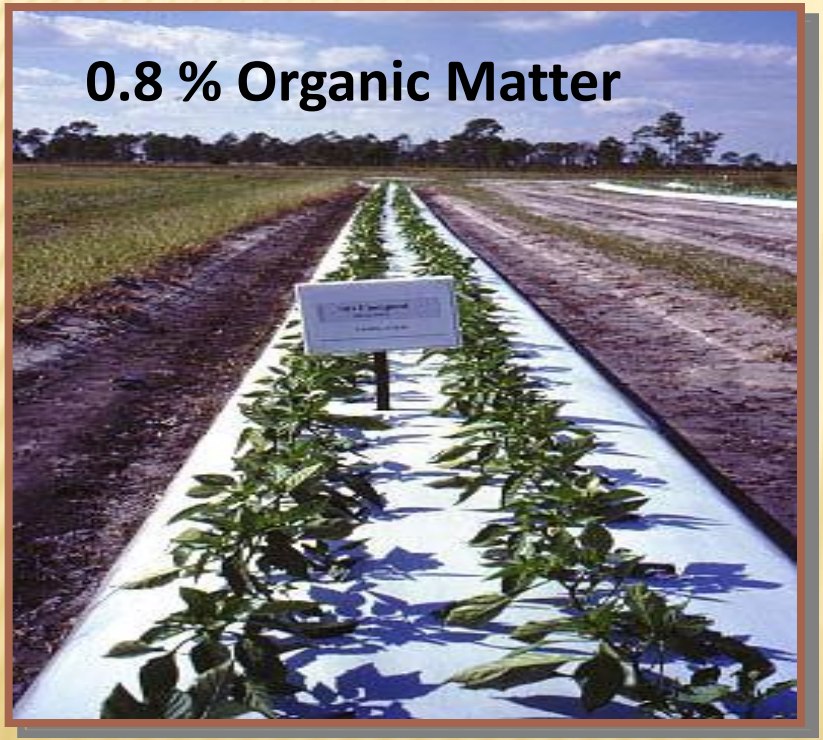
Material Inputs	Application rate (lb/acre dry weight)	N Rate (lb/acre)	N Mineralization Rate (%)	Total (lb NO_3)	Total (lb P_2O_5)	Total (lb K_2O)
---------- Basic Fertility Program ----------						
Poultry manure compost at 5 tons/acre (40% moisture and 3% N, 3% P & 2% K with 70% P and 80% K availability)	6,000	180	10-30	54	288	115
Inorganic Fertilizer	-	-	-	170	-	-

P to P_2O_5 multiply by 2.29
K to K_2O multiple by 1.2

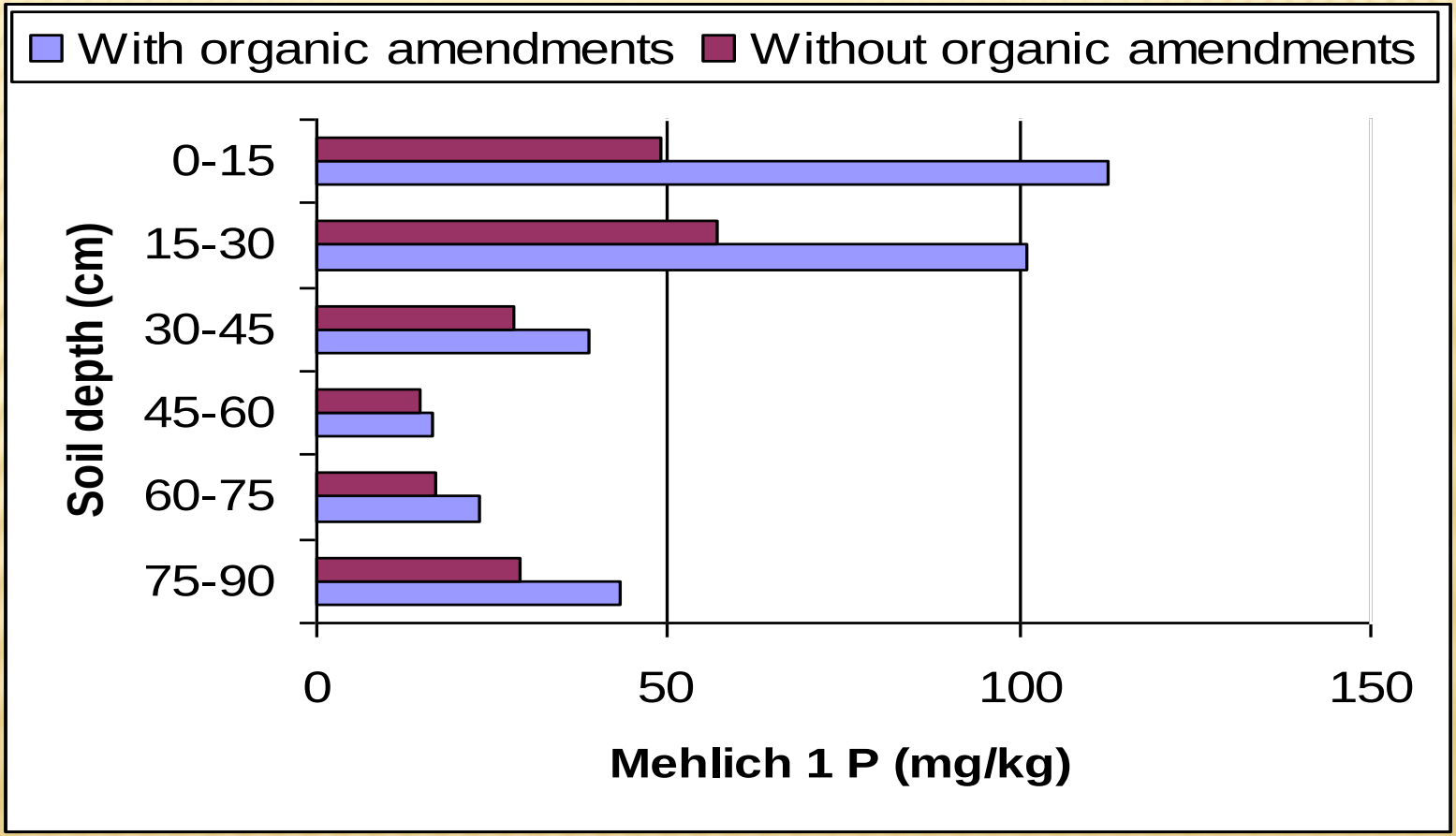

No Organic Amendment


Organic Amendment

Long Term Application of Organic Amendments
10 years



Phosphorous Accumulation in the Soil



CONCLUSIONS

- Compost can improved soil physical, chemical and biological properties.
- N contribution can be low to medium, but P and K may be high to very high, so caution!!!
- Crop nutrient budget can be useful tool to account for nutrient inputs and outputs.