THE USE OF BOTTOM-ASH COAL-CINDER AS A COMPONENT OF GROWING MEDIA

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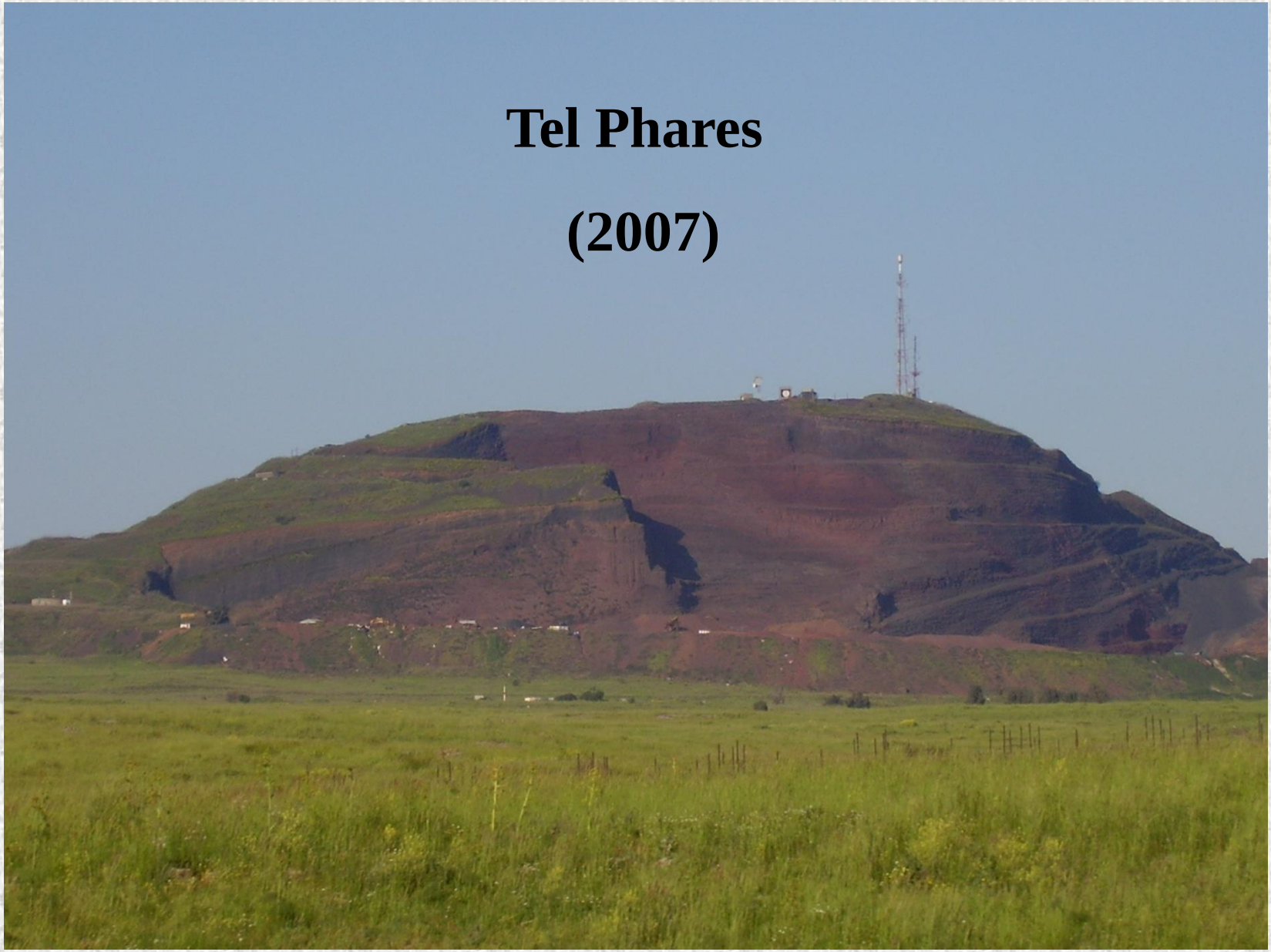

Tel Phares
(2007)

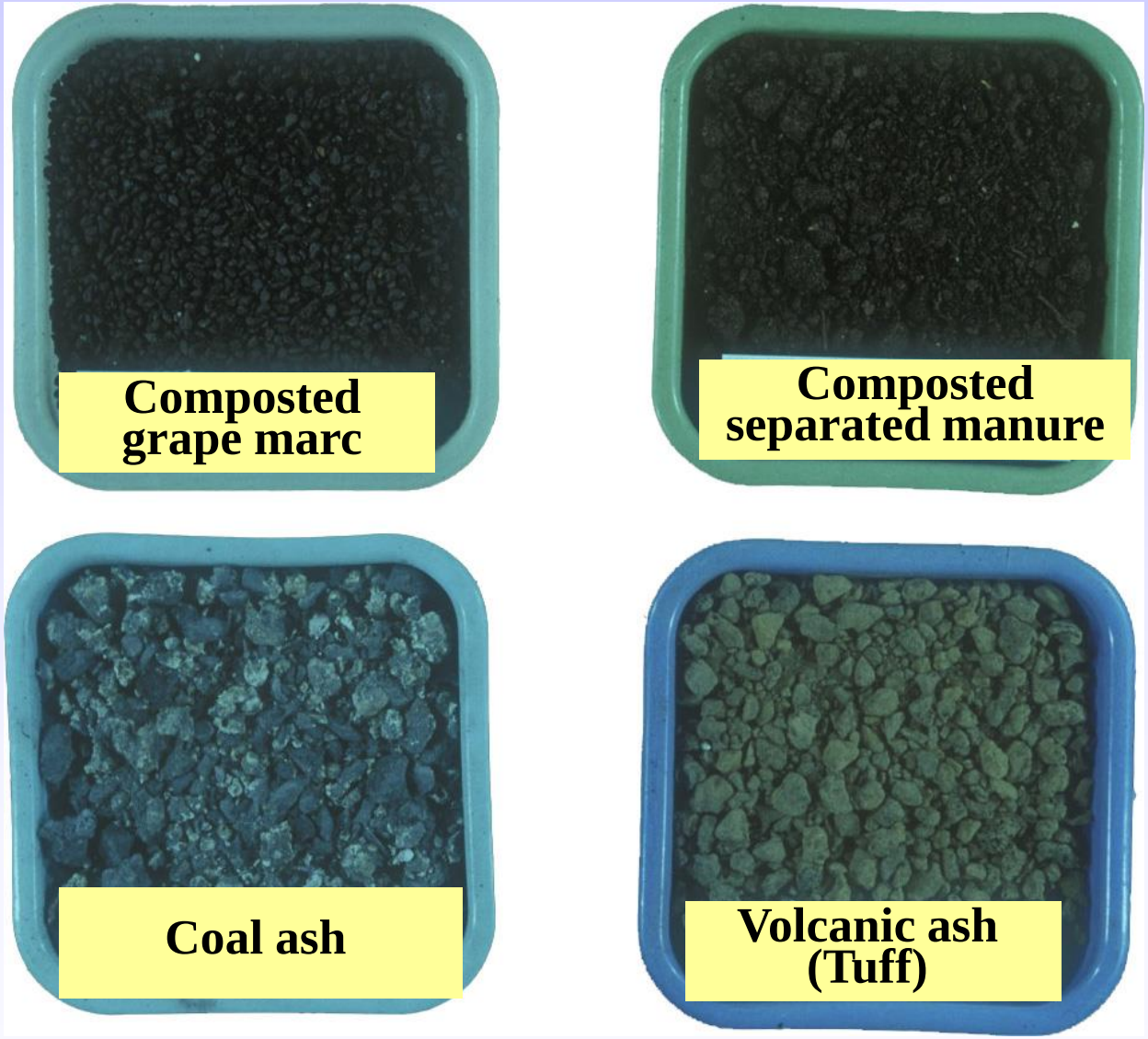
Sieving and separating bottom coal cinder (Ashklon)

Sieving and separating bottom coal cinder (Ashklon)

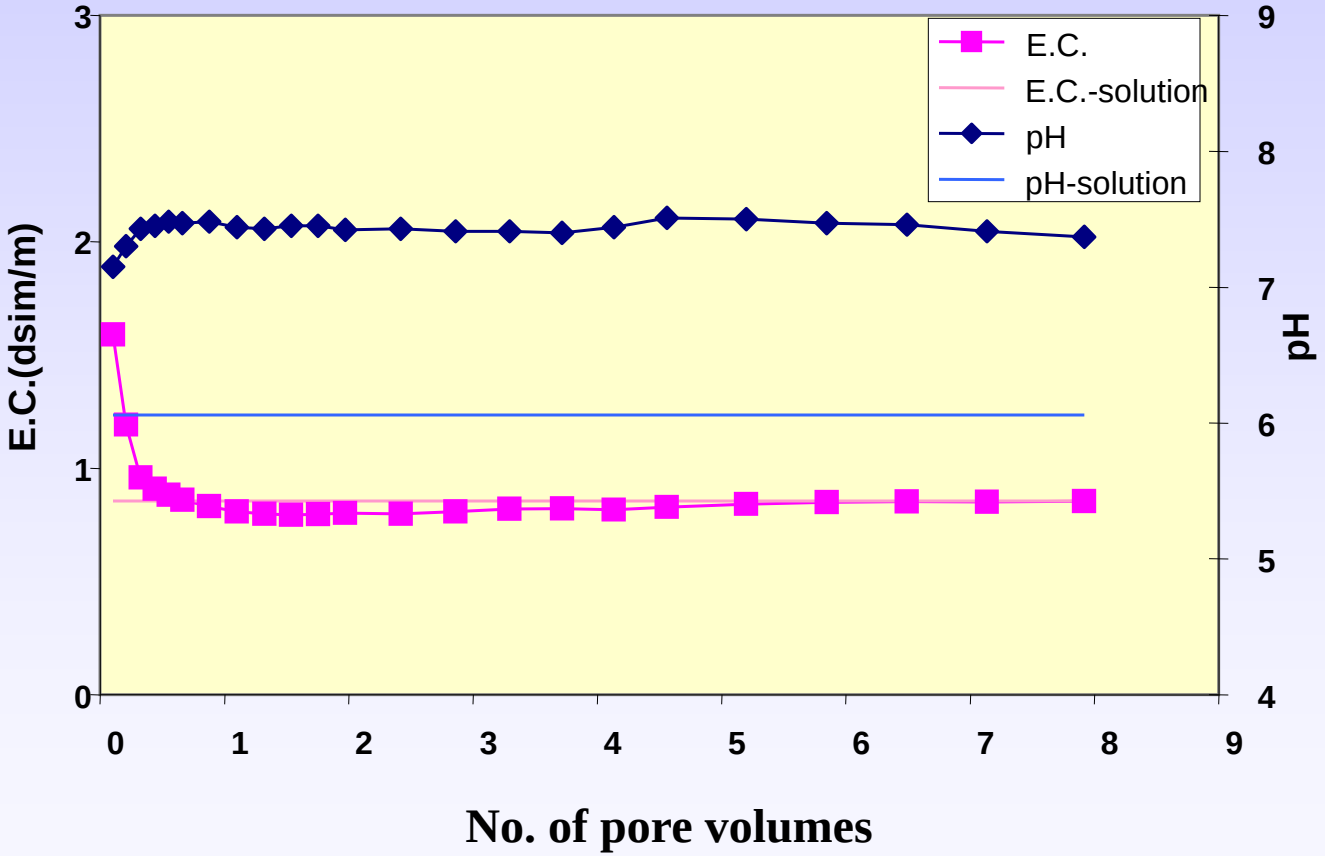
Aims of research

- **Chemical and physical characterization of coal cinder from power plants (and industry).**
- **Evaluation of the chemical and physical properties of bottom coal cinder in light of its potential use as a container medium.**
- **Evaluation as above for coal cinder mixtures with composts.**

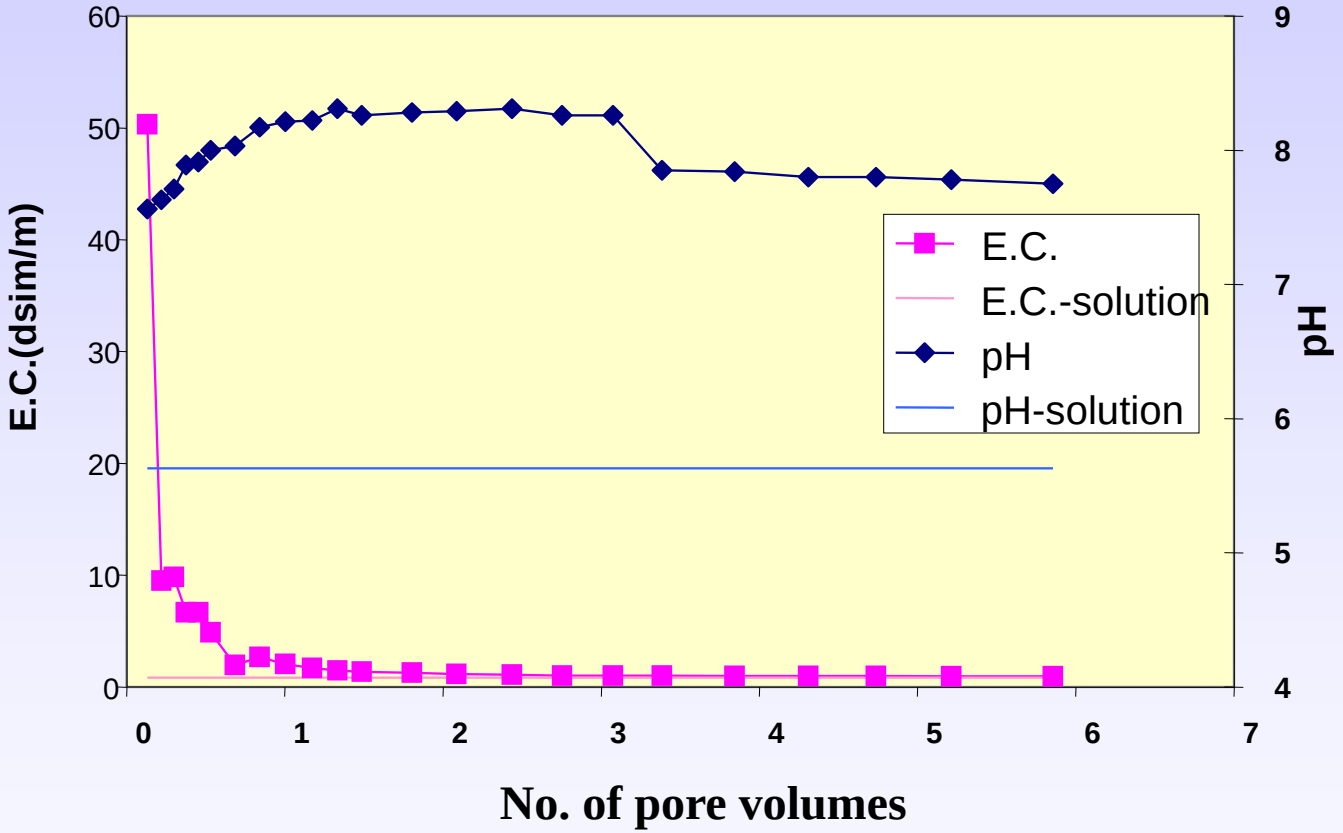
Tested materials



Leaching volcanic ash size fraction 0-8 mm with nutrient solution containing (mg $^{L-1}$): N-90 ; P-17 ; K-130 ;pH-5.6 ; E.C.-0.84 dsim/m ;



Leaching of coal cinder size fraction 1.18-9.5 mm with nutrient solution containing (mg L^{-1}): N-90 ; P-17 ; K-130 ;pH-5.6 ; E.C.-0.84 dsim/m ;



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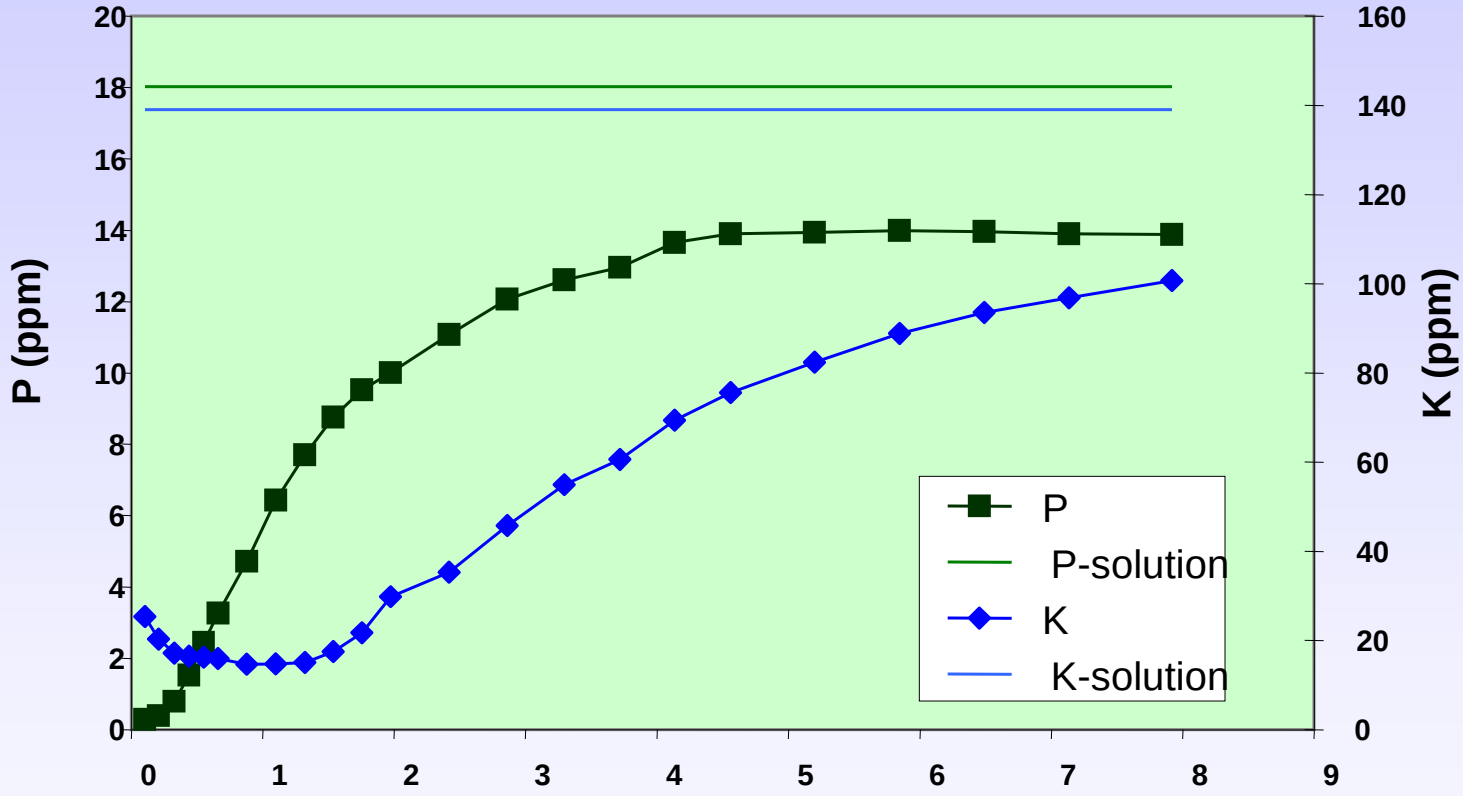
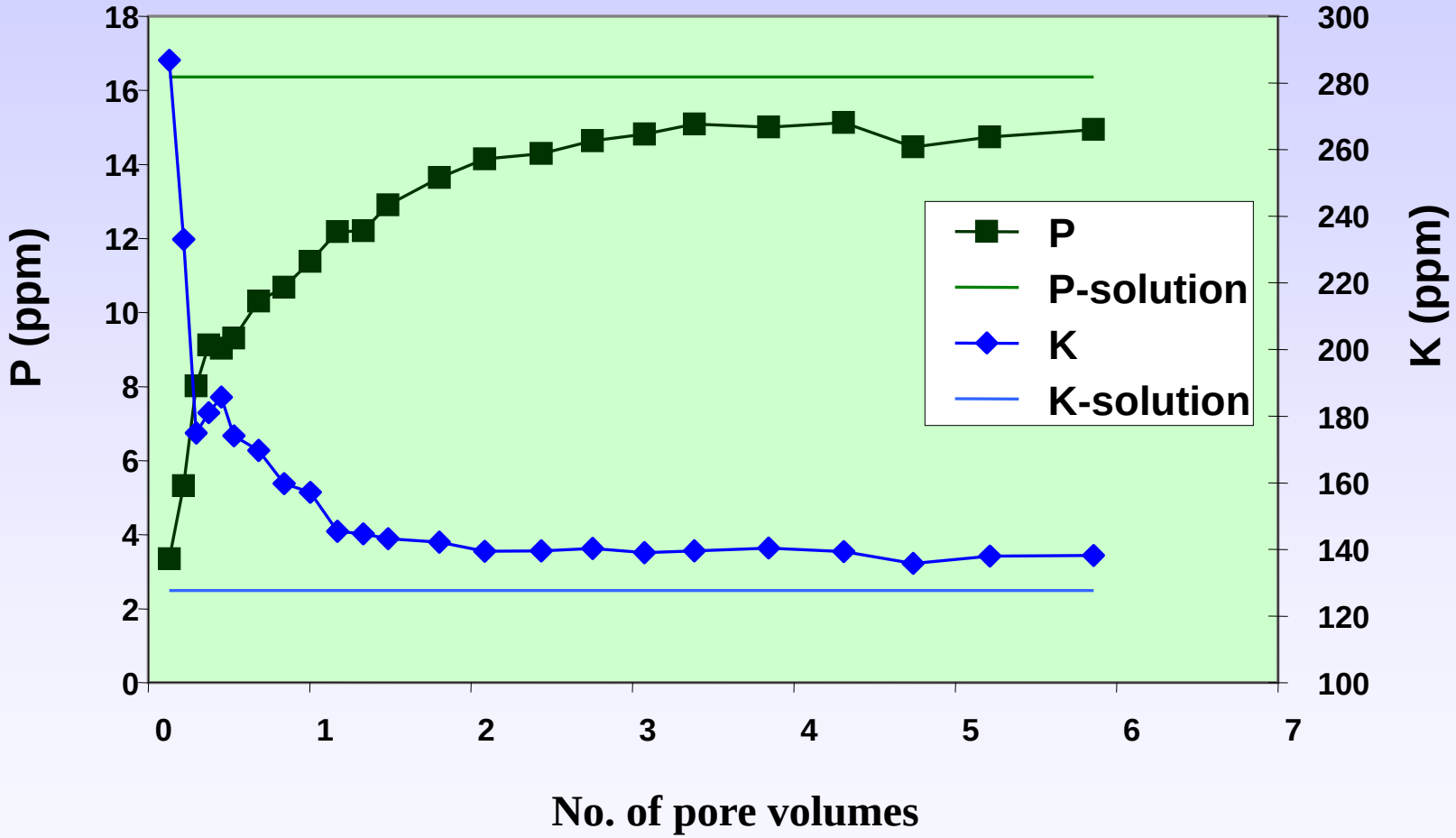
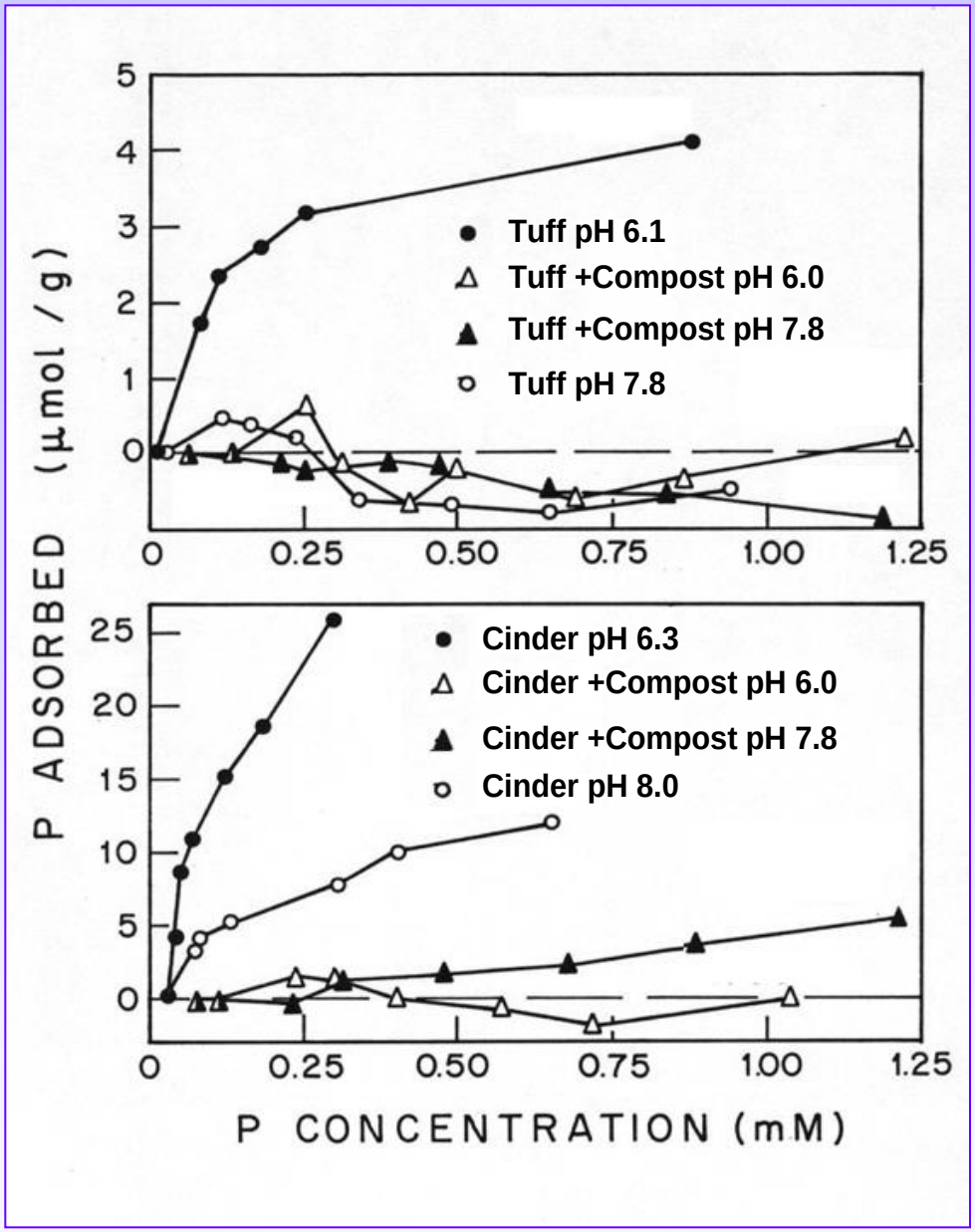


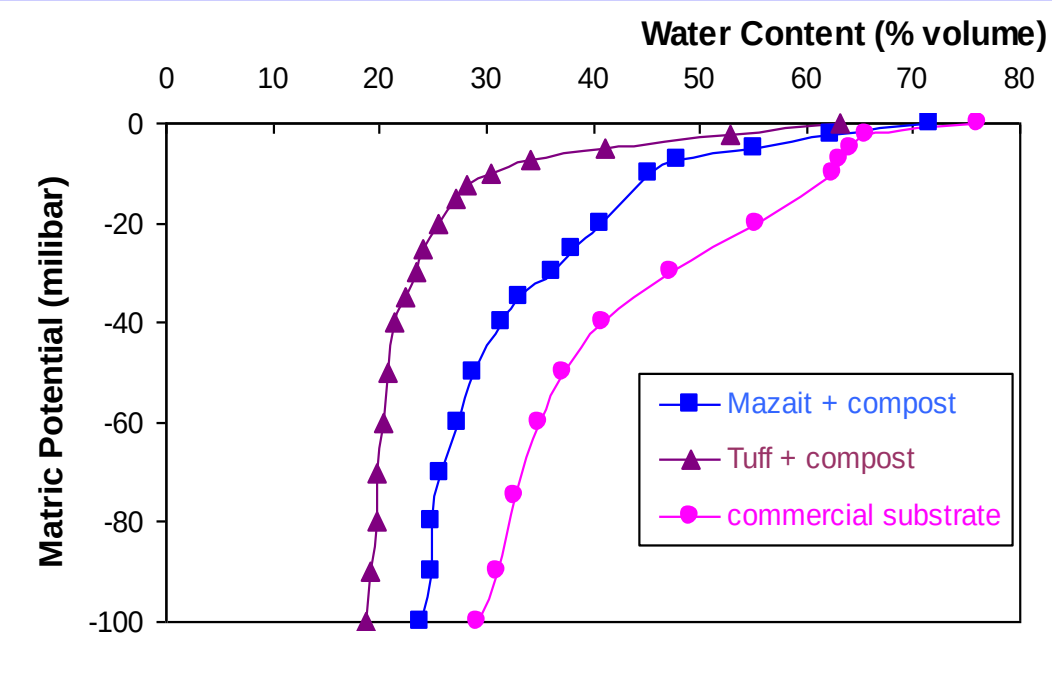
No. of pore volumes

Leaching of coal cinder size fraction 1.18-9.5 mm with nutrient solution containing (mg L^{-1}):
N-90 ; P-17 ; K-130 ;pH-5.6 ; E.C.-0.84 dsim/m ;





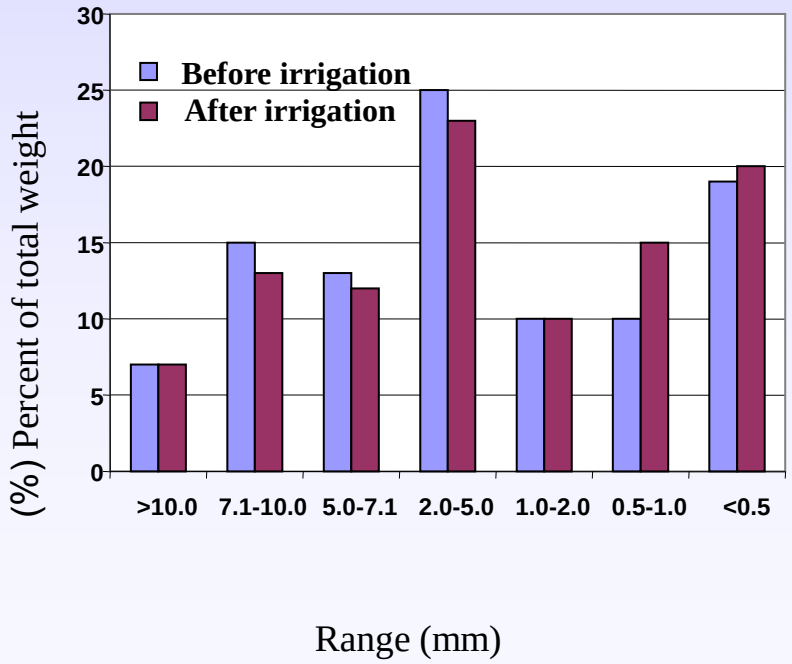
Sorption isotherms of phosphorus on volcanic ash (tuff) and on coal cinder and their mixtures with composts (two pHs : ~6; ~8).



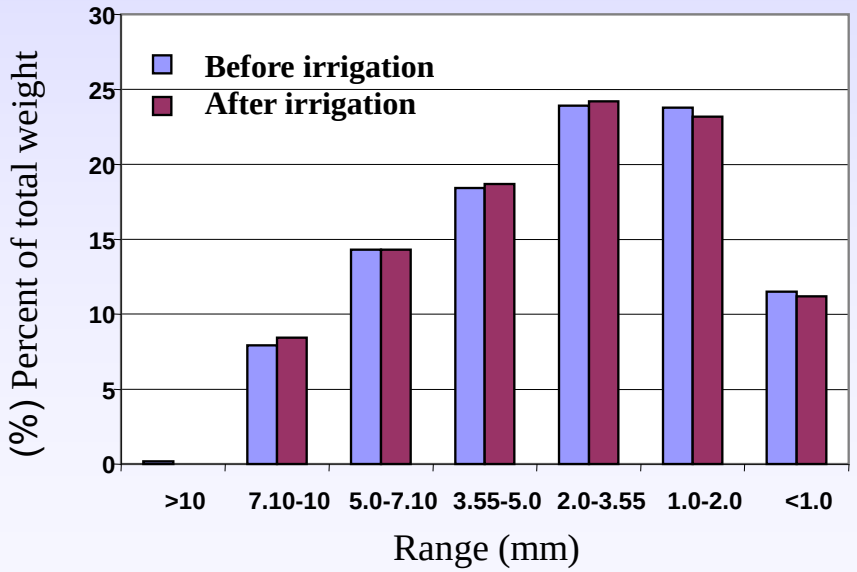
Substrate	Air content 0-10 milibar	Easily available water 10-50 milibar	Water buffering capacity 50-100 milibar
Mazait + compost	26	17	5
Tuff + compost	33	10	2
Commercial substrate	14	25	8
Ideal substrate	20-30	20-30	4-10

Particle size distribution of volcanic ash and coal cinder following a prolonged irrigation regime

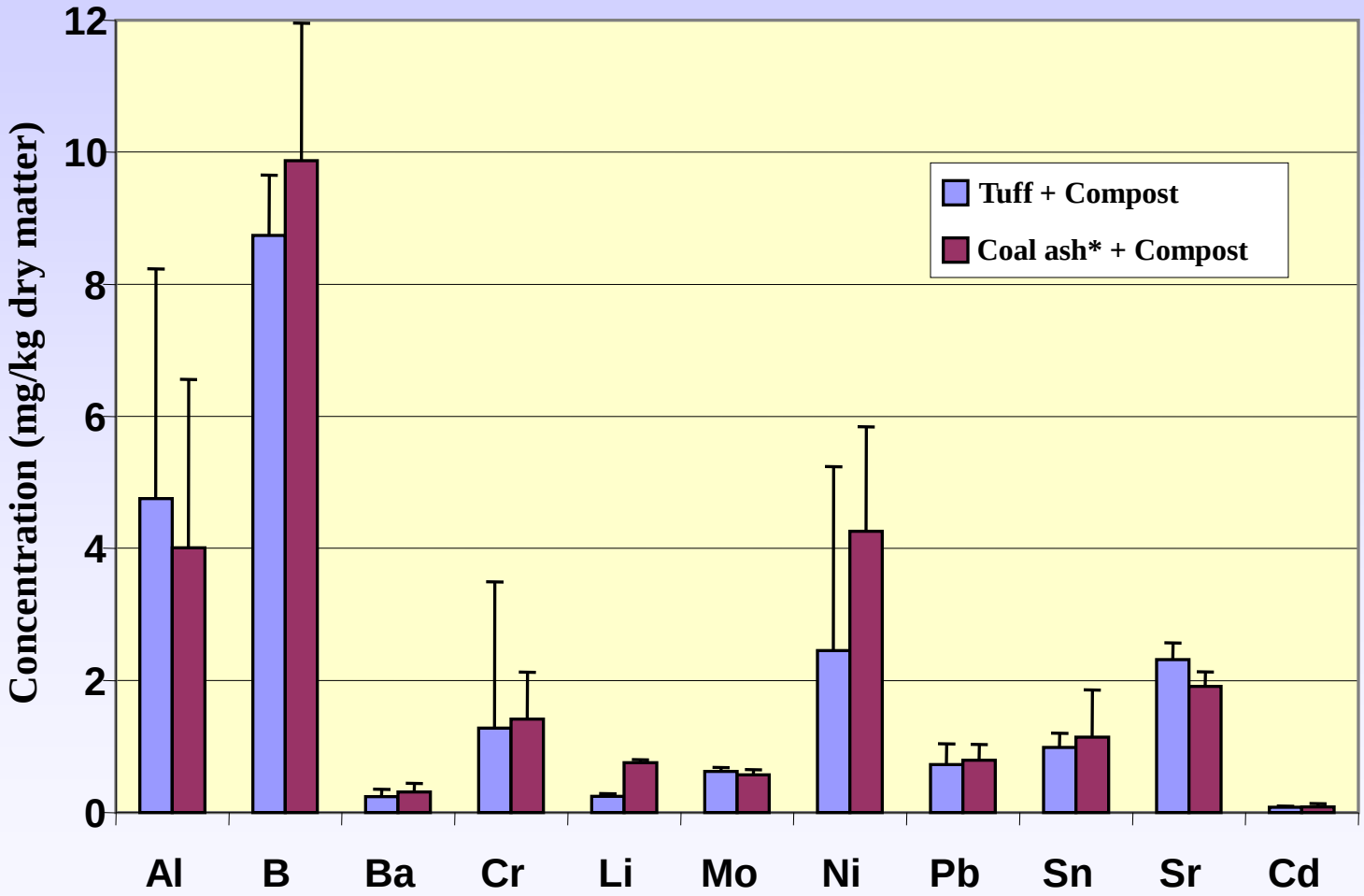
Particle size distribution of tuff (size 0-8 mm) before and after irrigation



Particle size distribution of coal cinder (size 1.18-9.5 mm) before and after irrigation



Trace elements concentration in tomato fruits



*(power plant coal ash)

Trace elements concentration in pepper fruits (mg/kg dry matter)

Element	coal ash + compost	Tuff + Compost
Cd	0.40	0.38
Co	1.2	2.0
Cr	0.5	0.4
Mo	0.7	0.7
Ni	1.1	1.1
Pb	*L.D.B	*L.D.B

B.D.L – Below Detection Limit*

***industrial coal ash**

Trace elements concentration in melon fruits (mg/kg dry matter)

Element	coal ash + compost	Tuff + Compost
Cd	0.19	0.35
Co	0.7	0.9
Cr	2.7	2.2
Mo	0.6	0.9
Ni	0.6	1.9
Pb	0.08	0.09

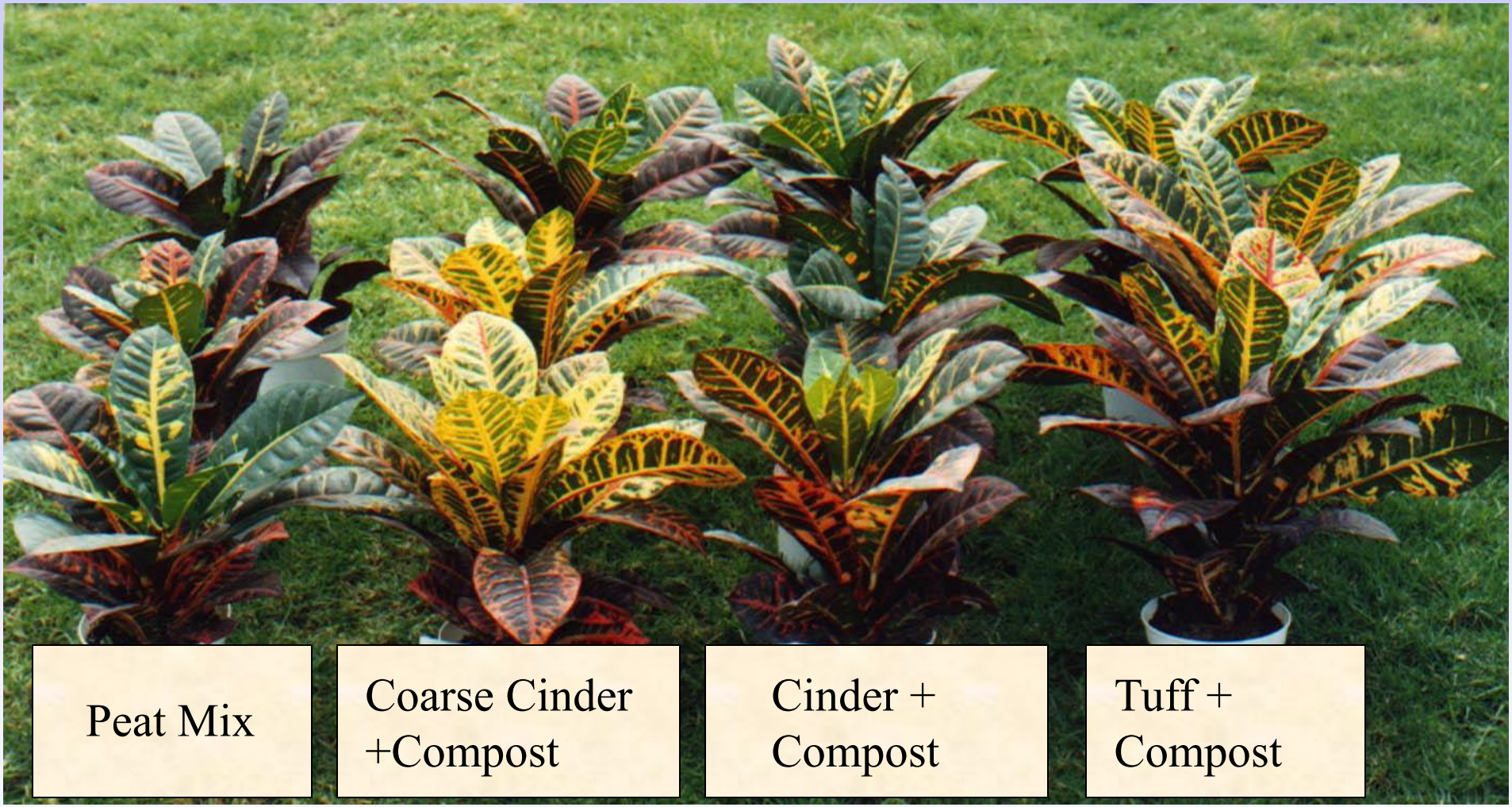
*industrial coal ash

Concentrations of radionuclides in agricultural produce

- **Aim**: To measure radionuclides levels in produce grown on coal and volcanic ash, and to compare these to health standards.
- Tested: ^{40}K, ^{226}Ra, ^{232}Th

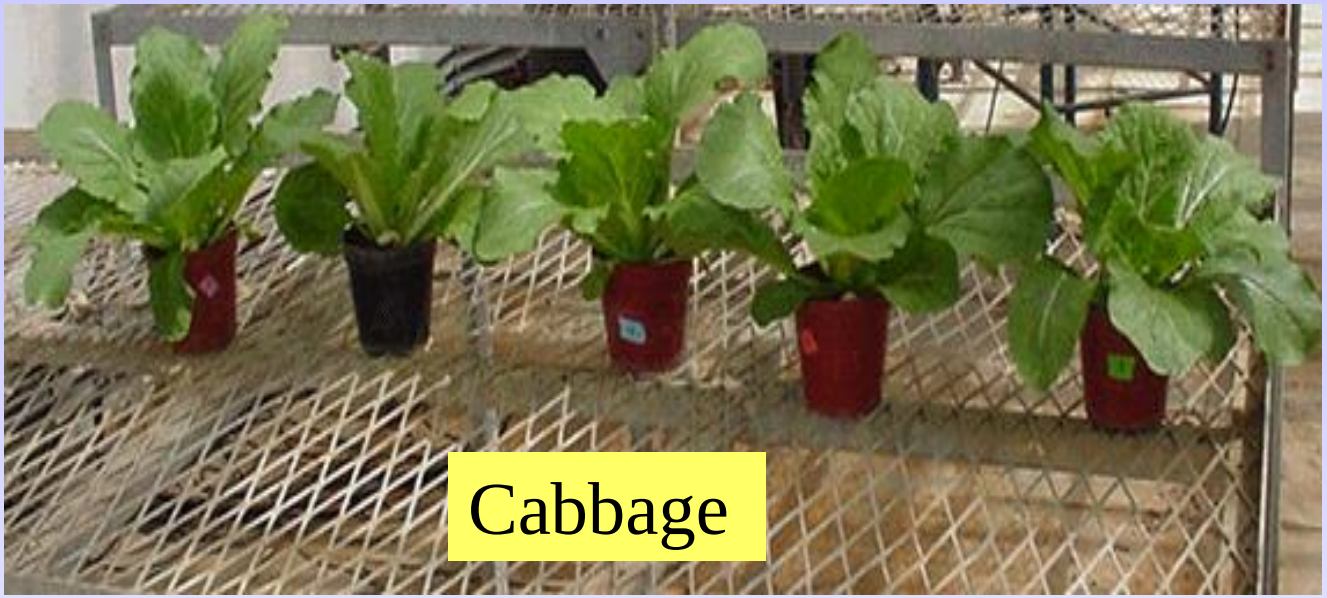
- **Results**: No significant differences were found in radionuclides concentration between produce grown on volcanic and coal ash.

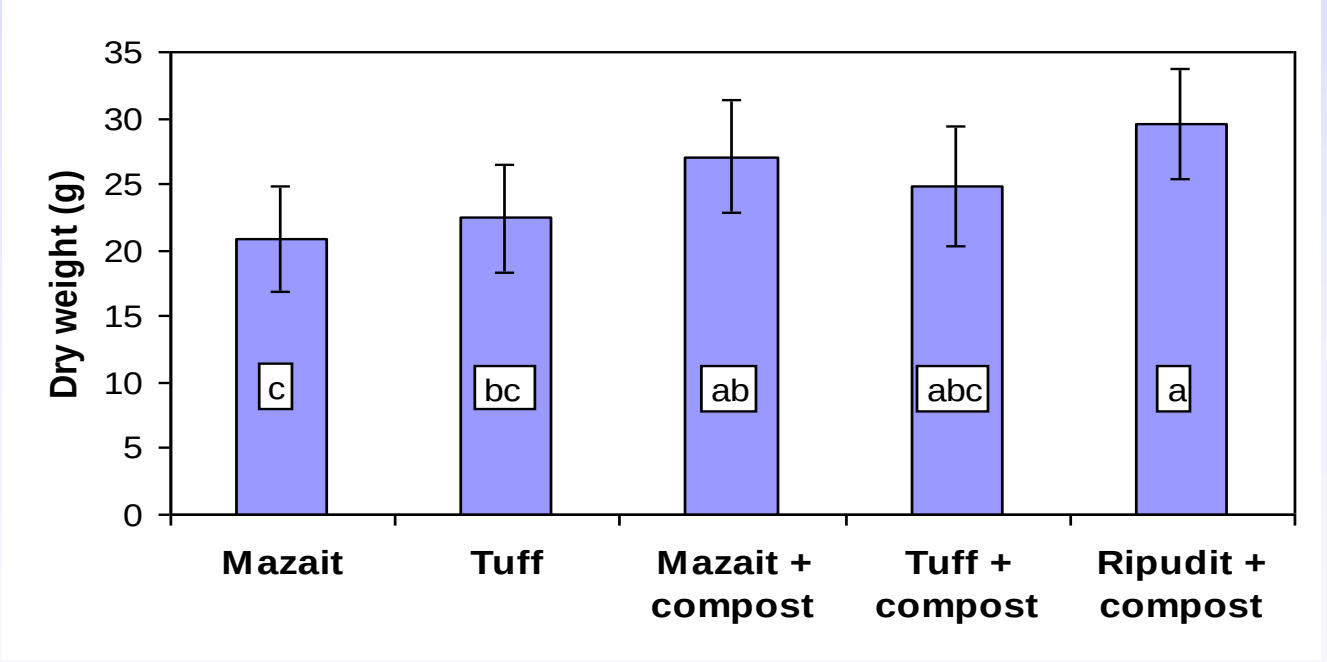
- **Conclusions**: Coal and volcanic ash are safe container media for fod crop production



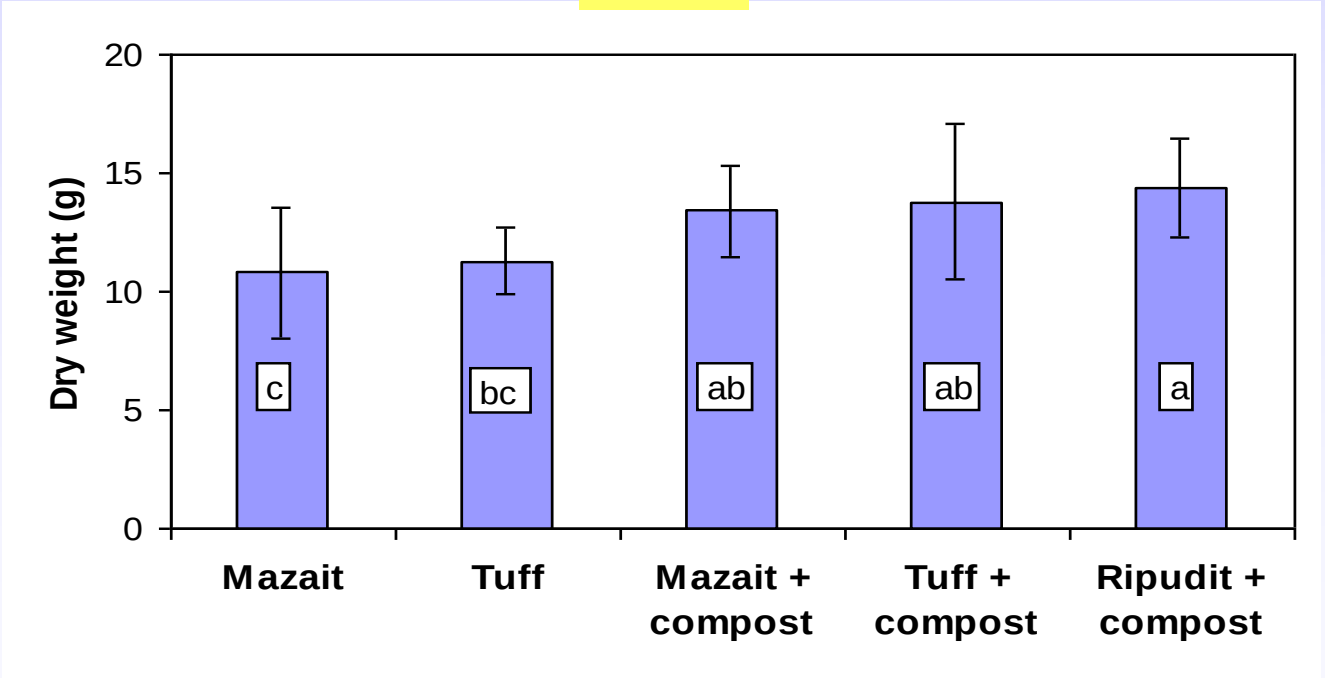
Croton plants grown on a commercial peat mix and on a mixture of coal cinder or tuff with compost (grape marc:separated manure- 1:1)

Gerbera grown on a mixture of coal ash and compost in a commercial greenhouse

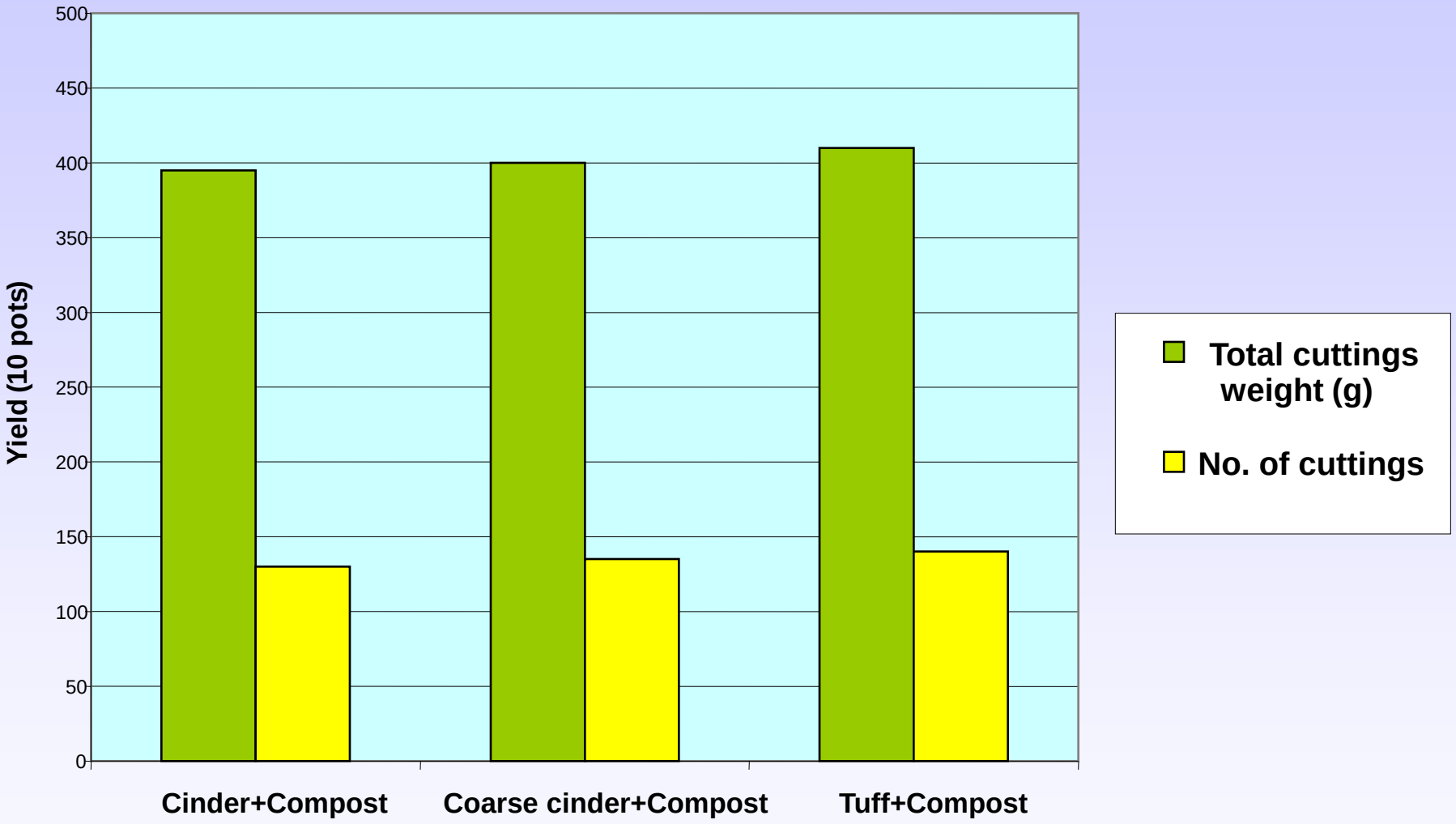

Cabbage


Dry weight (g)
35
30
25
20
15
10
5
0
c
bc
ab
abc
a
Mazait
Tuff
Mazait + compost
Tuff + compost
Ripudit + compost

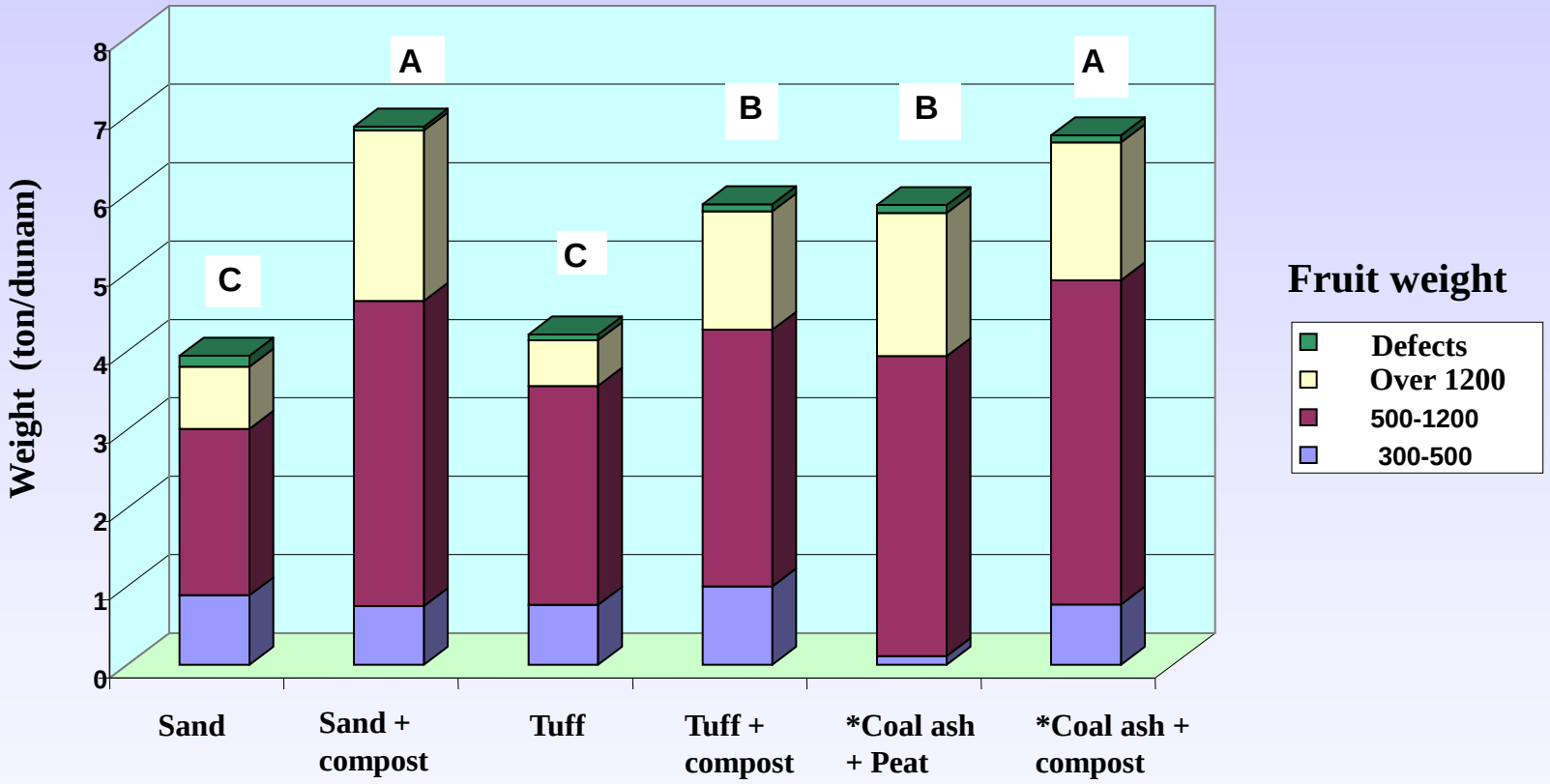
Basil


Dry weight (g)
20
15
10
5
0
c
bc
ab
ab
a
Mazait
Tuff
Mazait + compost
Tuff + compost
Ripudit + compost

Carnation Yield



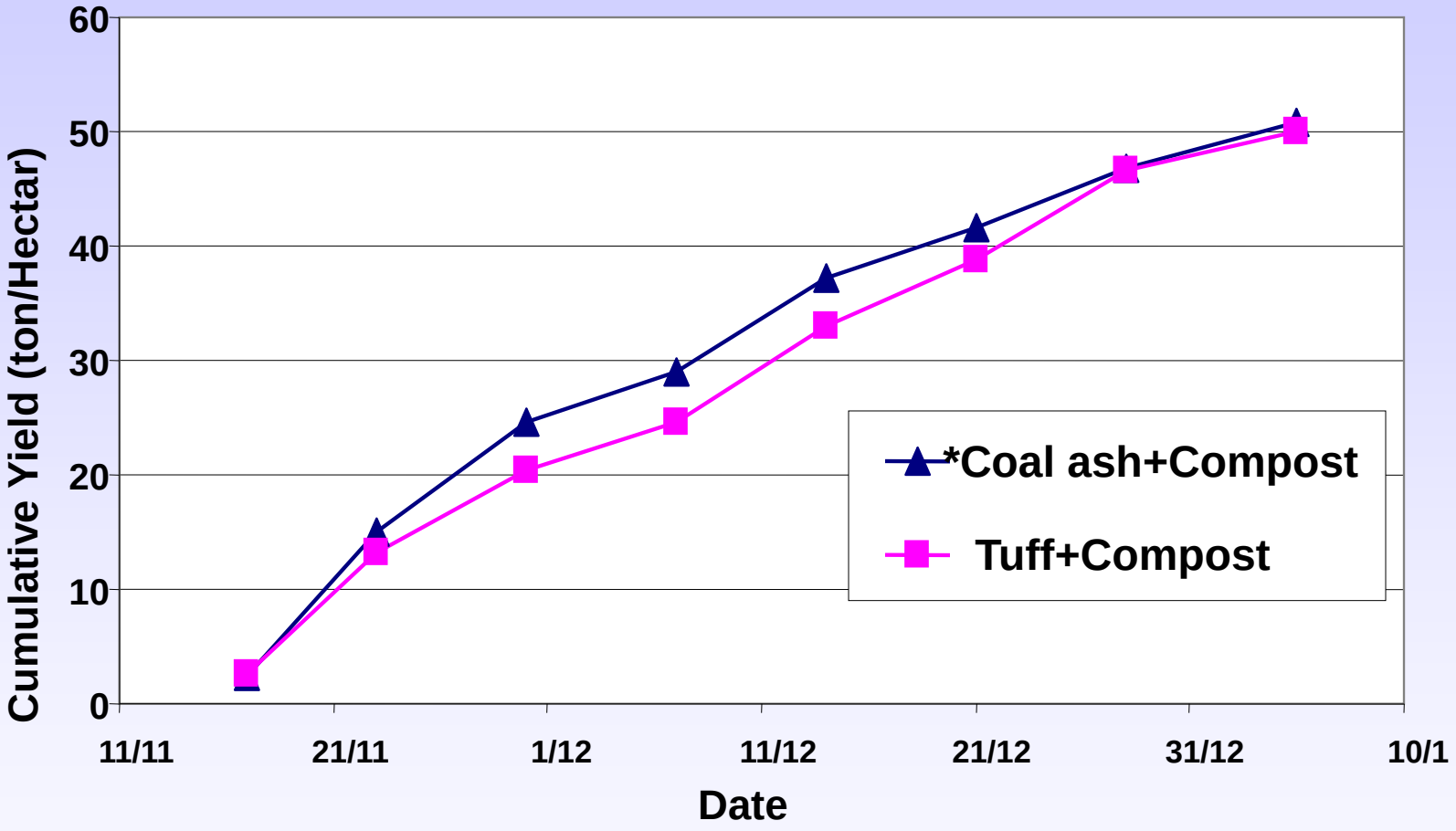
Melons yields – grown on different media in Chatzeva (Arava region)



*industrial coal ash

Bottom coal cinder plus compost (70%:30%) 8th year of cropping – Jordan Valley

Cumulative yield of cherry tomatoes grown on coal cinder or volcanic ash mixed with compost (a commercial greenhouse in the Jordan vally)



*(power plant coal ash)

Pepper growth in coal cinder (Pharan, Arava region).
Trench padded with agricultural cloth permeable to water filled with coal cinder+compost (3:1 v/v)

Advantages: overcoming lack of soil, reduced water consumption due to limited root zone and optimal water suction level.

Pepper plants at Tsofar (Arava)
Right- soil planted
Left- coal cinder + 20% compost

Protea Plants (ash/soil)

Mature oak tree transplanting into coal cinder plus 30% compost

ממוצע צימוח

	אפר +קומפוסט	ביקורת	מובהקות
צימוח לגובה (ס"מ')	29.0	26.0	אין
צימוח לצדדים (ס"מ)	56.0	34.5	יש
צימוח צידי מרבי (ס"מ)	68.0	47.0	יש

השתילה בתערובת אפר פחם וקומפוסט הביאה לצימוח צעיר רב יותר - בעיקר לרוחב.

Oak root growth

שורשונים בתערובת אפר+קומפוסט

מעבר שורשים מתערובת האפר+קומפוסט לקרקע המקומית

Summary and conclusions

Chemical analyses:

- pH of the leachate ranges from 7-8.
- Levels of potentially toxic elements (including B) are low (below “critical” levels).
- Excessive salts – are easily leachable.
- P is removed from the solution for sometime. Organic matter prevents P removal.
- No K fixation was found.

Physical analyses:

- No degradation of particles during a lengthy leaching period.
- Water retention curves exhibit low water holding capacity. It can however be enhanced by compost additions.

Summary and conclusions

- Compost additions also result in:
  # Enhanced plant growth.
  # Improved buffer capacity.
  # Suppressiveness to soil borne diseases.
- The recommended level of compost addition is 25-40% (v/v).
- Plant growth experiments in commercial and experimental greenhouses show that mixtures of coal cinder with composts support plant productivity at least to the level obtained in volcanic ash grown plants.


THANK YOU
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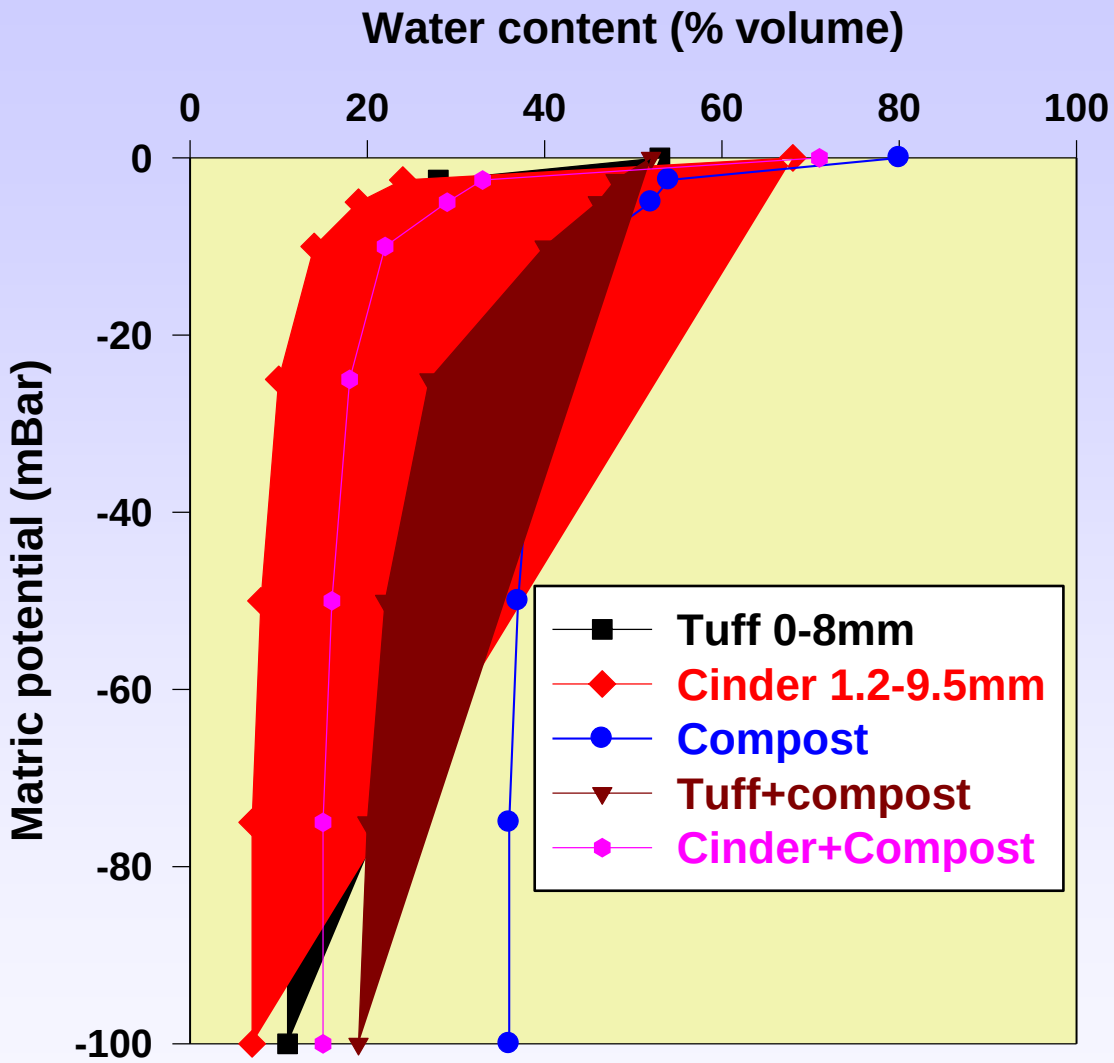
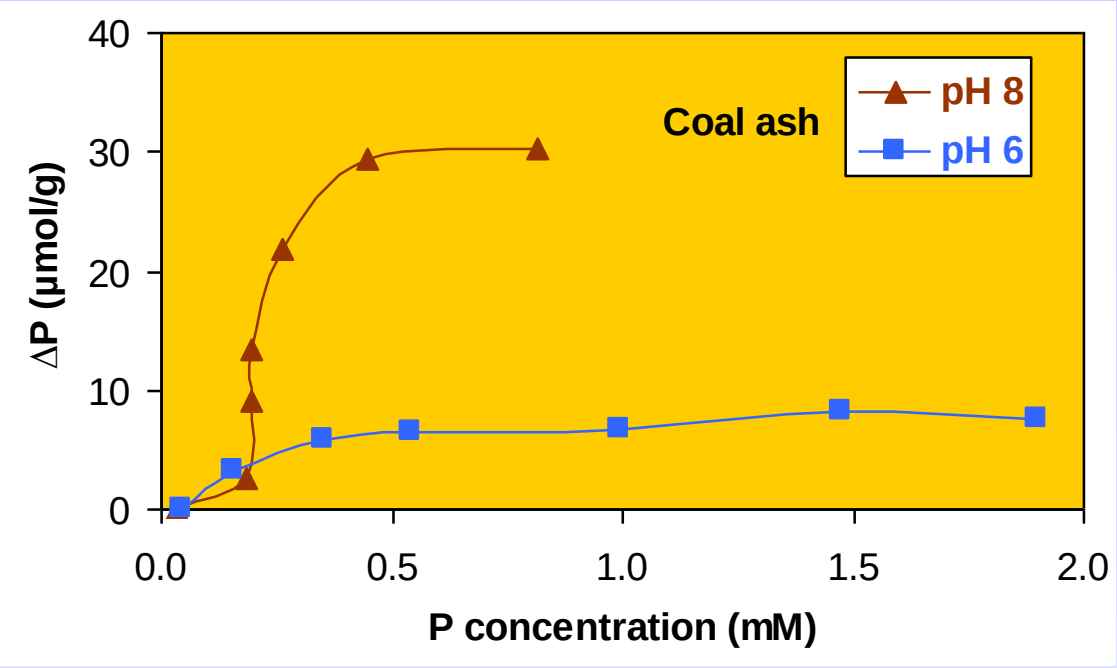
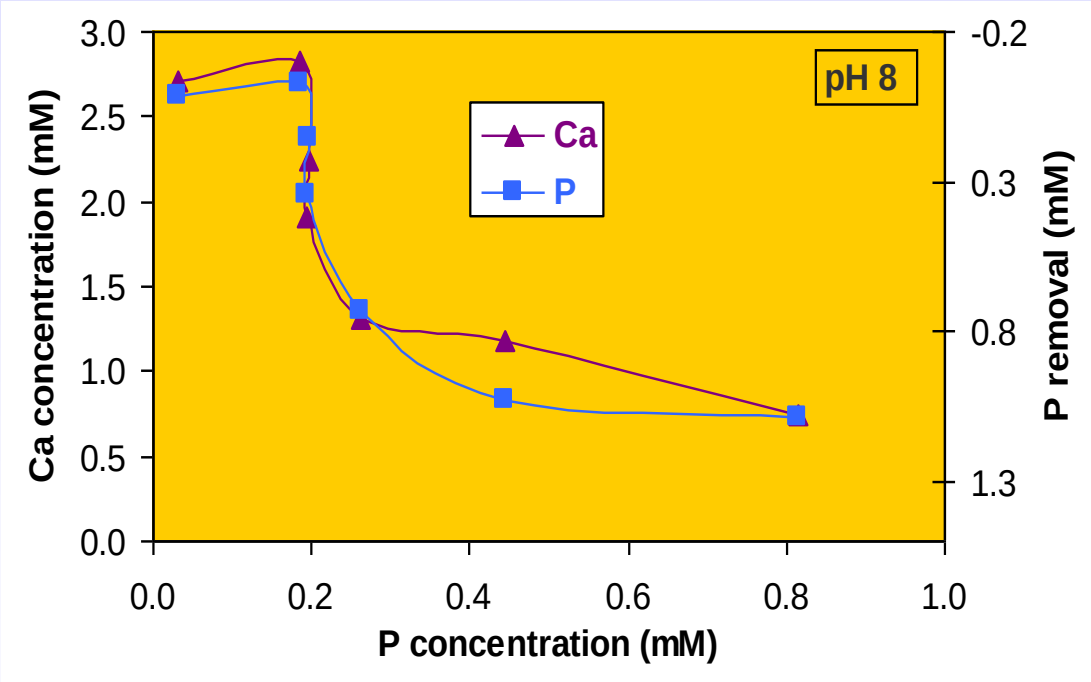
האפר המנופה


Water content (% volume)
0
20
40
60
80
100
Matric potential (mBar)
0
-20
-40
-60
-80
-100
Tuff 0-8mm
Cinder 1.2-9.5mm
Compost
Tuff+compost
Cinder+Compost

Removal of P from the solution coal ash (8 reaction days)

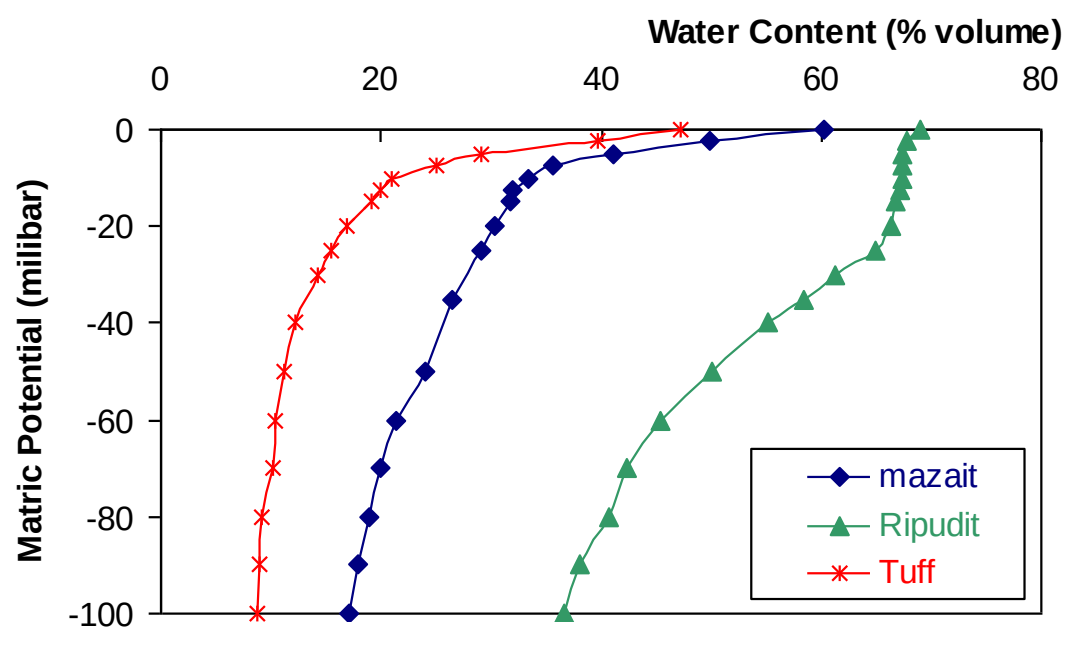




Precipitation of calcium phosphate coal ash (8 reaction days)

Coal Cinder (Matsait) + compost

Tuff + compost



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Tuff	26	10	2
Ripudit	2	17	22
Ideal substrate	20-30	20-30	4-10