SZENT ISTVÁN EGYETEM

FACULTY OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES, GÖDÖLLŐ

STIMULANT AND TOXIC EFFECT OF BIOMASS ASH DOSAGE IN POT EXPERIMENT

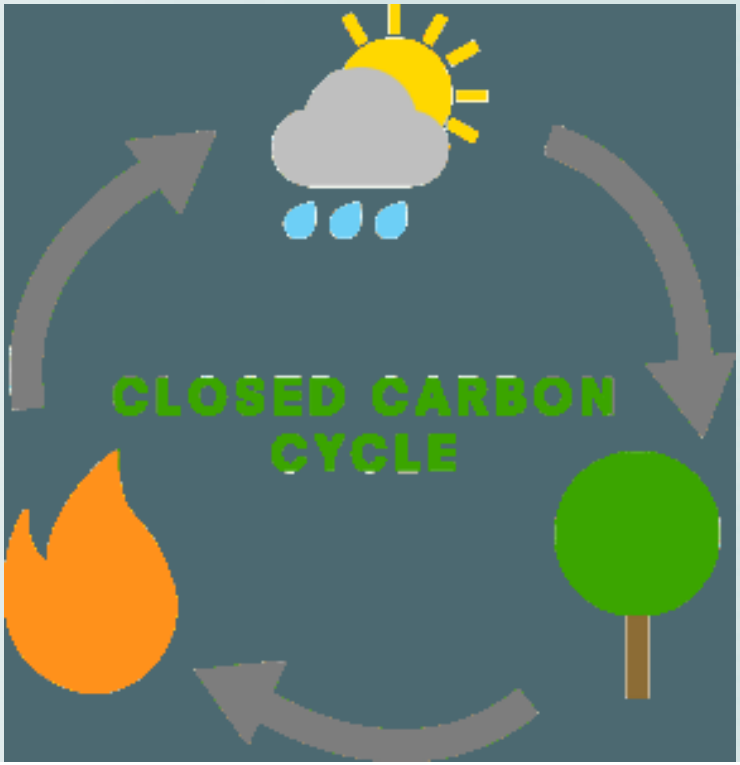
László TOLNER *– István ZIEGLER – György FÜLEKY – Miklós GULYÁS – Gabriella RÉTHÁTI*

SZIE, Institute of Environmental Sciences,
Department of Soil Science and Agricultural Chemistry

tolner.laszlo@mkk.szie.hu

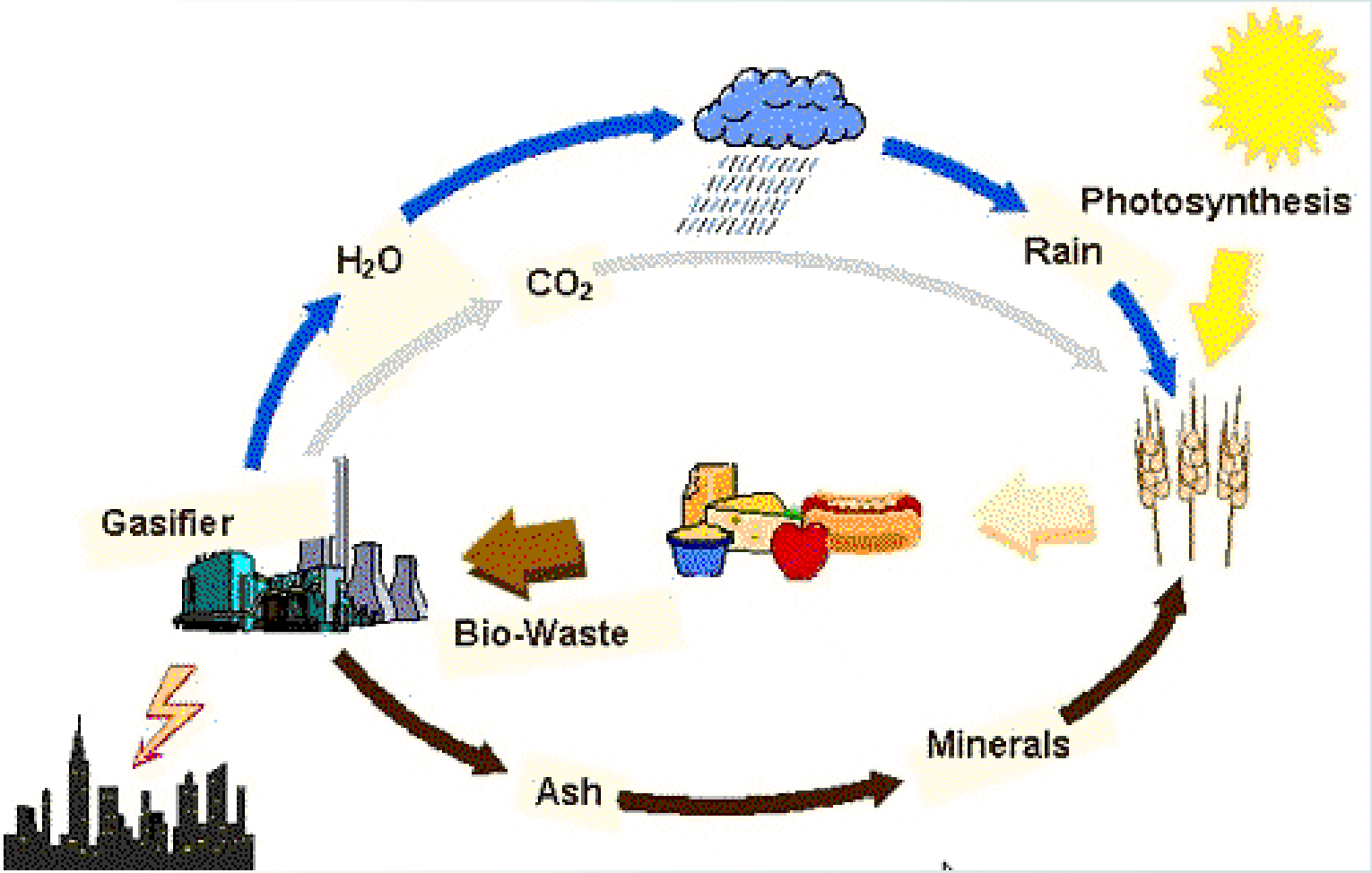
INTRODUCTIONS

- The main energy source on the earth is the sunlight
- The energy of the fress biomass, and fossil fuels originated from the sunlight also
- Burning of carbon-based fuels since the industrial revolution has rapidly increased its concentration in the atmosphere,
  leading to global warming.



- The carbon cycle is a closed system when we use biomass.

- Not only a closed carbon cycle is important
- The other biogeochemical cycles (nutrients) have to be closed also



Results of biomass burning:

AIR

$(C_6H_{10}O_5)_n + 6.O_2 = 6.CO_2 + 5.H_2O$

$R - S - H + O_2 \longrightarrow SO_2$

$R - NH_2 + O_2 \longrightarrow NO_x$ or N_2

$K^+ + O_2 \longrightarrow K_2O + CO_2 \longrightarrow K_2CO_3$

$Ca^{++} + O_2 \longrightarrow CaO + CO_2 \longrightarrow CaCO_3$

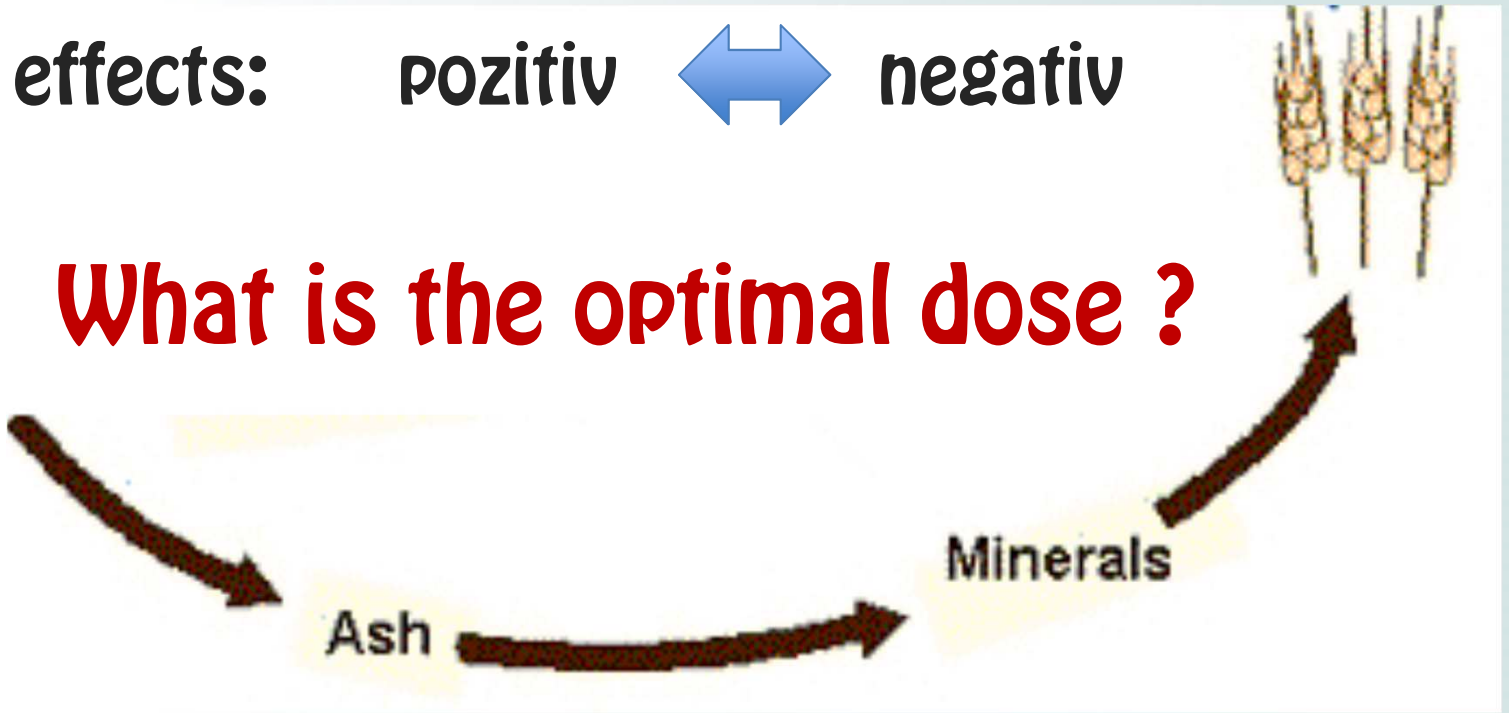
$CaHPO_4$, $Ca_3(PO_4)_2$, M_2O, MO, M_2O_3

ASH

Minerals - nutrients:

- K, Ca, P, microelement compounds are nutrients
- Plant accumulates the toxic microelements too
- Minerals are enriched in ash (ash < 10% biomass)
- Strong basics: KOH, K_2CO_3, $Ca(OH)_2$ in ash

effects: pozitiv ⇔ negativ



MATERIALS AND METHODS

- **Pot experiment** was made
- **Soil:** collected from the first plot of Westsik's crop rotation long-term field experiment.

  It is a loose sandy soil, slightly acid, low in OM.
- **Bioash** originated from Alfen Ltd., Almásfüzitő, chopped wood used by the heating facility.

Chemical properties of soil and bioash:

Sample	pH(KCl)	Humus m m^{-1} %	Ca mg kg^{-1}	P_2O_5 mg kg^{-1}	K_2O mg kg^{-1}
Soil	5.26	0.76	1280	54.3	93.5
Bioash	13.0		116000	1060	4730

MATERIALS AND METHODS

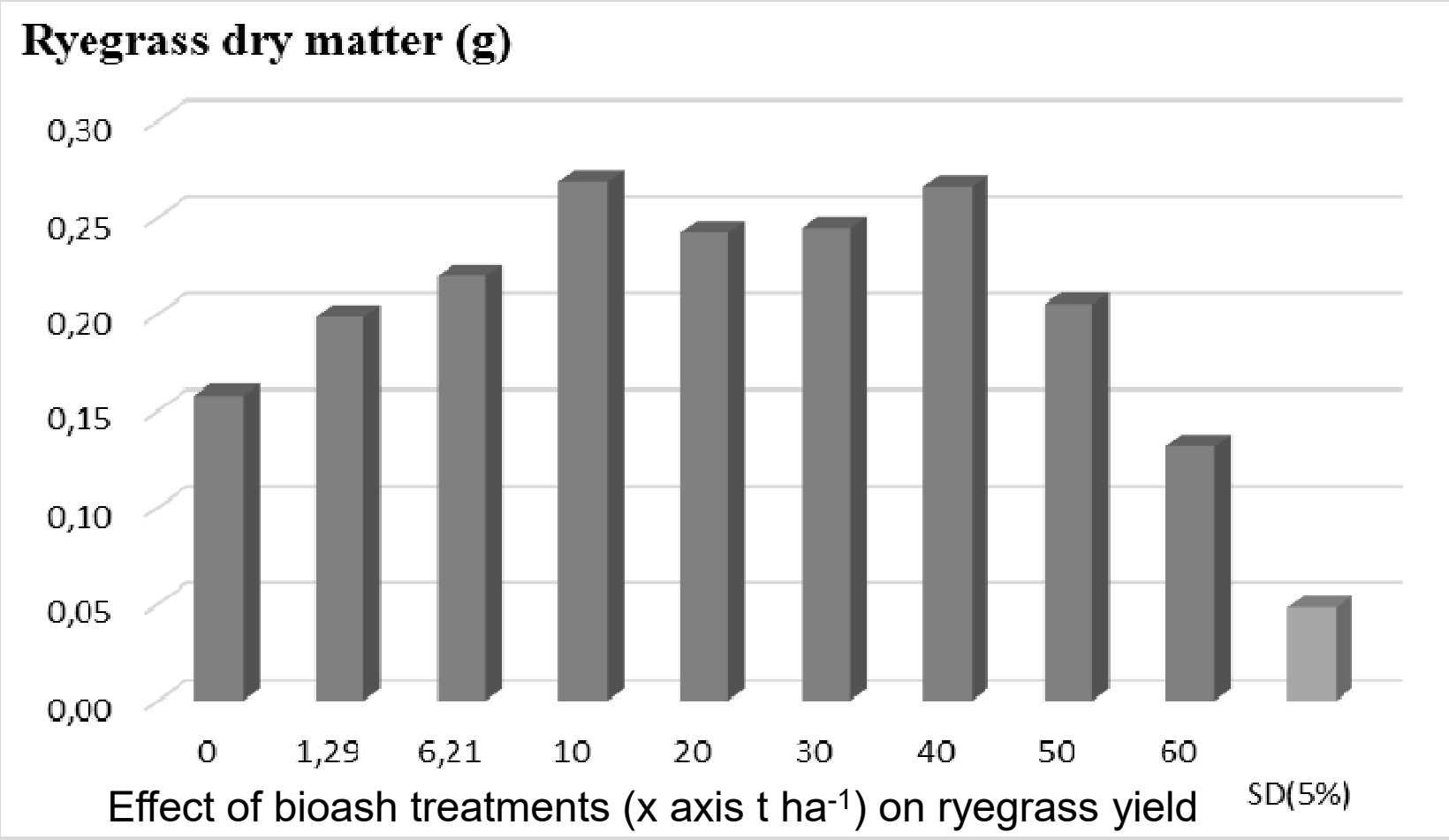
- **Test plants:**
  - ryegrass (*Lolium perenne*),
  - white mustard (*Sinapis alba*)

- Each pot contains 800 g soil.
  - 1 g (550-600 grains) ryegrass or
  - 25 grains of white mustard were seeded to the pots.
  -

- **Ash treatments** (calculated to $t.ha^{-1}$)**:**
  - in ryegrass experiment 0, 1.29, 6.21, 10, 20, 30, 40, 50, 60 $t\ ha^{-1}$,
  - in mustard experiment: 0, 1, 5, 10, 20, 30, 40, 50, 60 $t\ ha^{-1}$

- The treatments were replicated three times

RESULTS



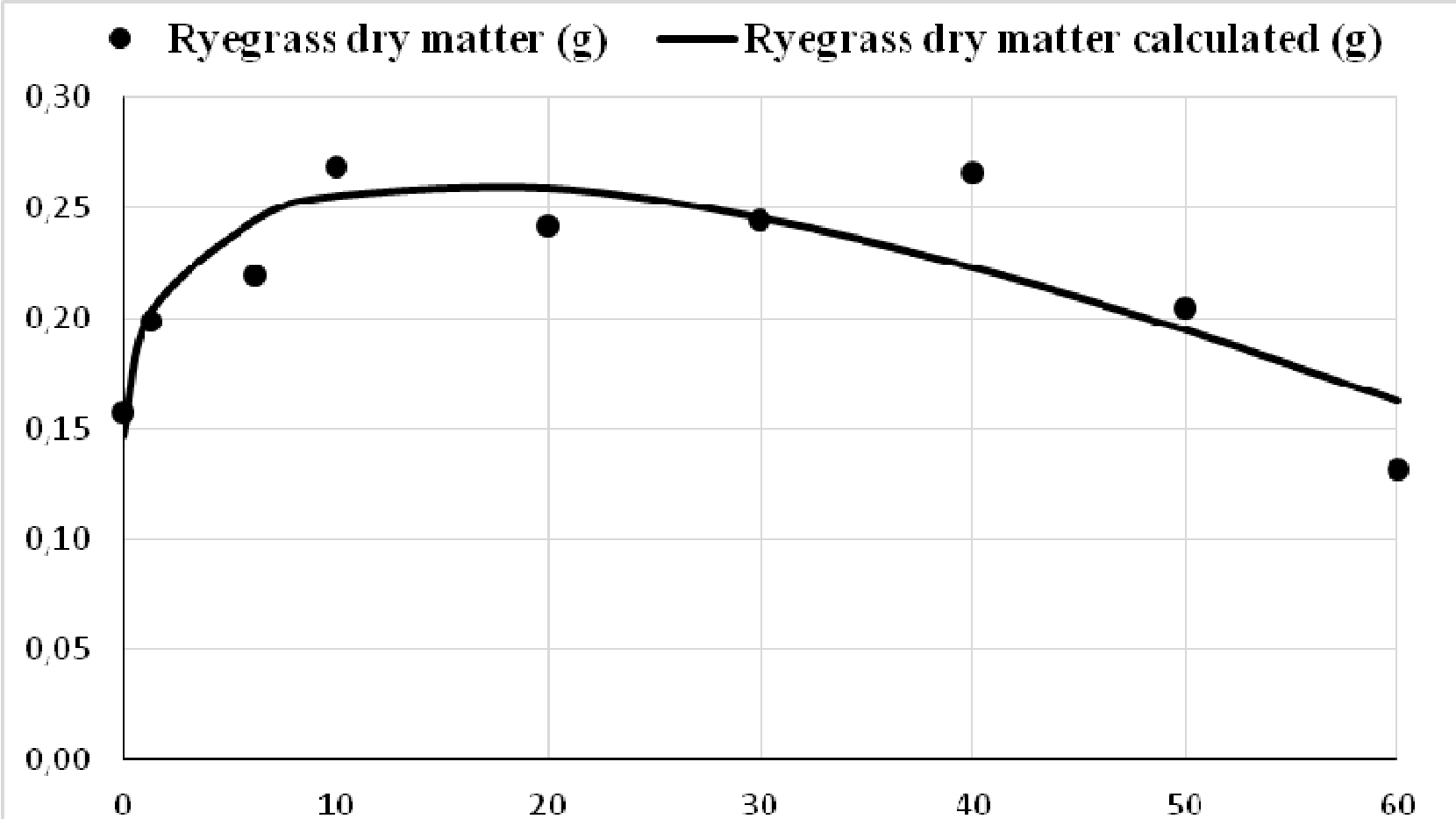
Effect of bioash treatments (x axis t ha^{-1}) on ryegrass yield

Bioash treatments have effect on ryegrass dry matter production ($p<0,1\%$)

The amount of ash dosage till 10 t ha^{-1} increased, 10-40 t ha^{-1} the effect is stagnate, over 40 t ha^{-1} decreasing tendency was measured

RESULTS

What kind of connection can be between the ash treatments and the dry mass production?



Connection between the ash treatments and dry matter production (X axis - bioash (t ha^{-1}).

It is look like an asymmetric maximum function shape curve

RESULTS

We try fitt the next mathematical form of function:

$$y = a * x + b * \sqrt{x} + c$$

Calculation of parameters (a, b, c) made by fitting a curve of second degree after this transformation was used:

$$u = \sqrt{x}$$

The transformed function:

$$y = a * u^2 + b * u + c$$

Representing the dry mass production with this function „u” we got the point around a more symmetrical maximum curve

RESULTS

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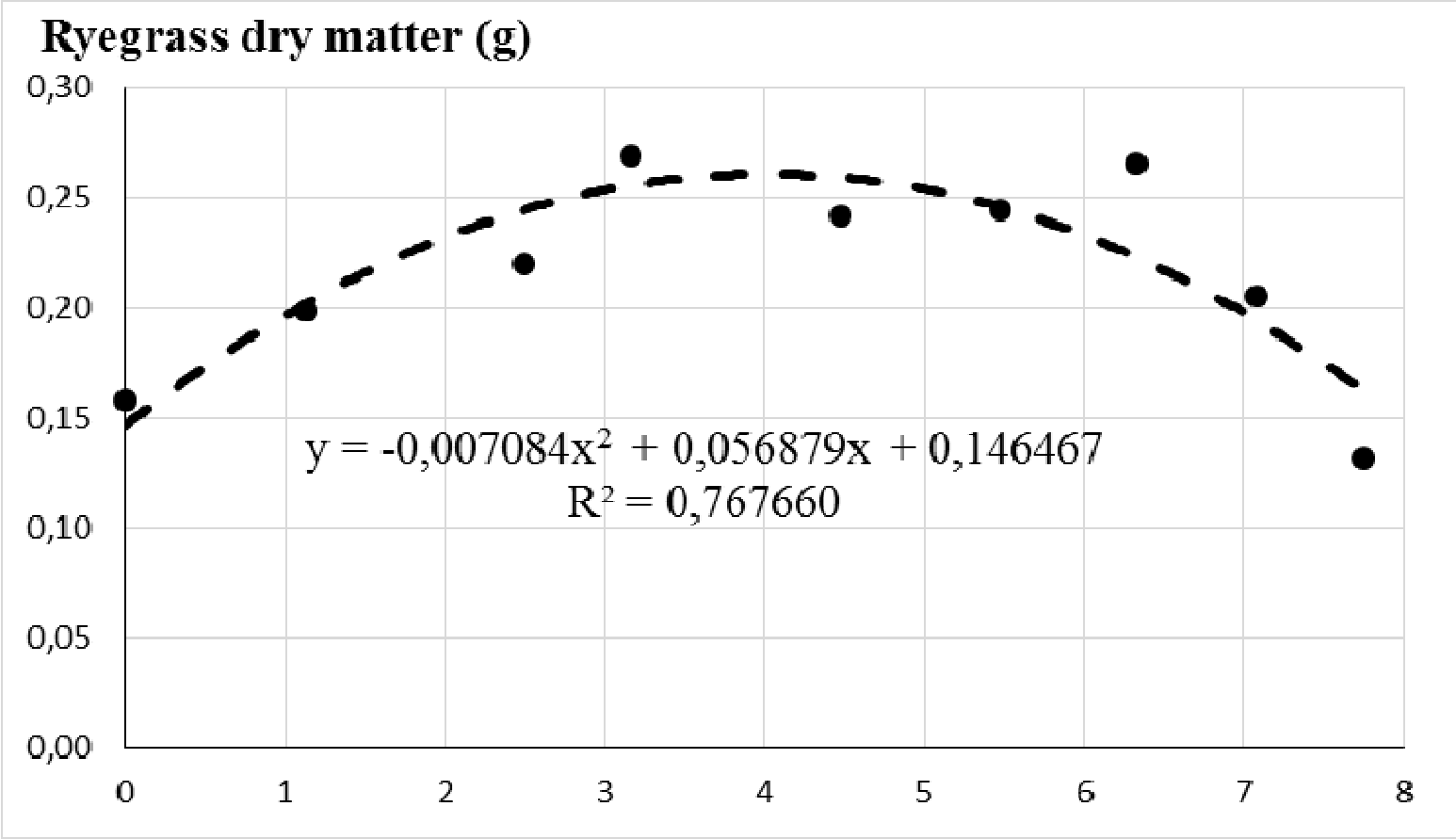


RESULTS

Excel's trend function of second degree we got the curve of function:

$$y = -0{,}007084 * u^2 + 0{,}056879 * u + 0{,}146467$$

Maximum value can be determined by derivation. In maximum value the derivative of function equal zero.

dy/du = -2*0,007084*u_max + 0,056879=0

$\mathbf{u_{max}}$ calculable with the equation. The result is 4.015.

$\mathbf{x_{max}}$ is the square of it = **16.12**.

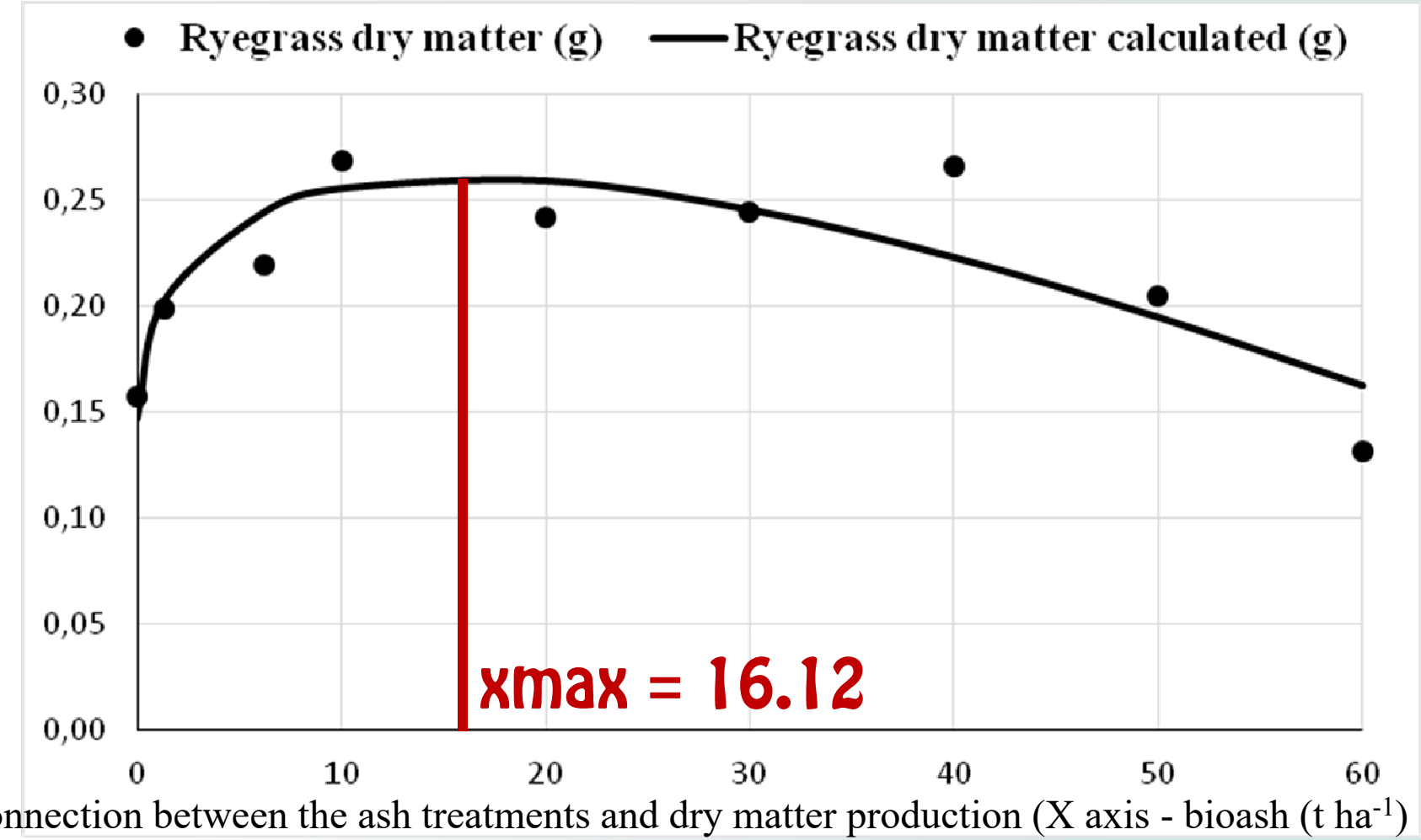
The optimal dosage was 16 t ha^{-1} in case of Ryegrass.

RESULTS

Calculated parameters (a, b, c) help to write the function of curve:

$$y = -0{,}007084 * x + 0{,}056879 * \sqrt{x} + 0{,}146467$$

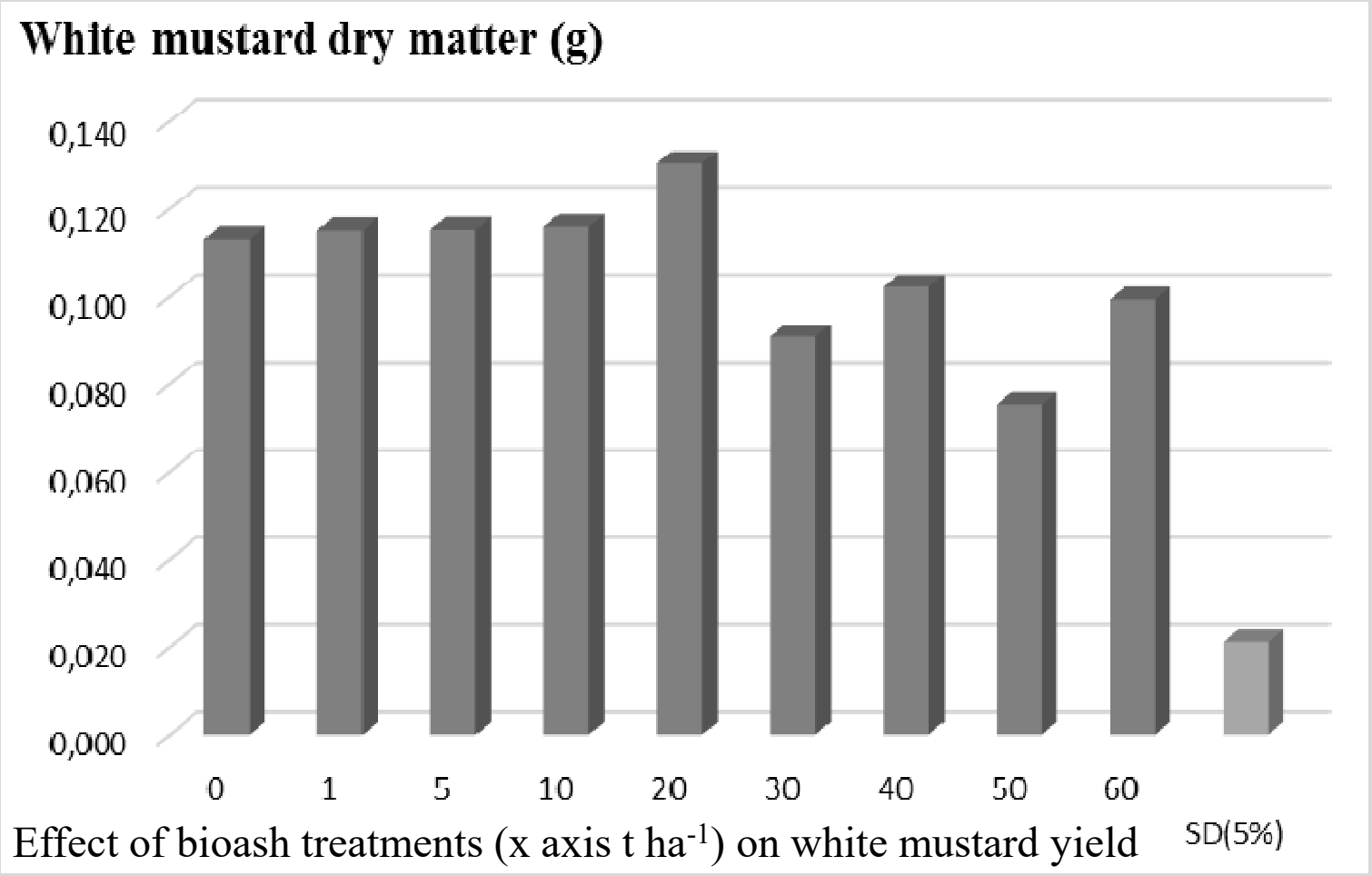
$R^2 = 0{,}7677$



Connection between the ash treatments and dry matter production (X axis - bioash (t ha^{-1})

RESULTS

The effect on white mustard was consolidated



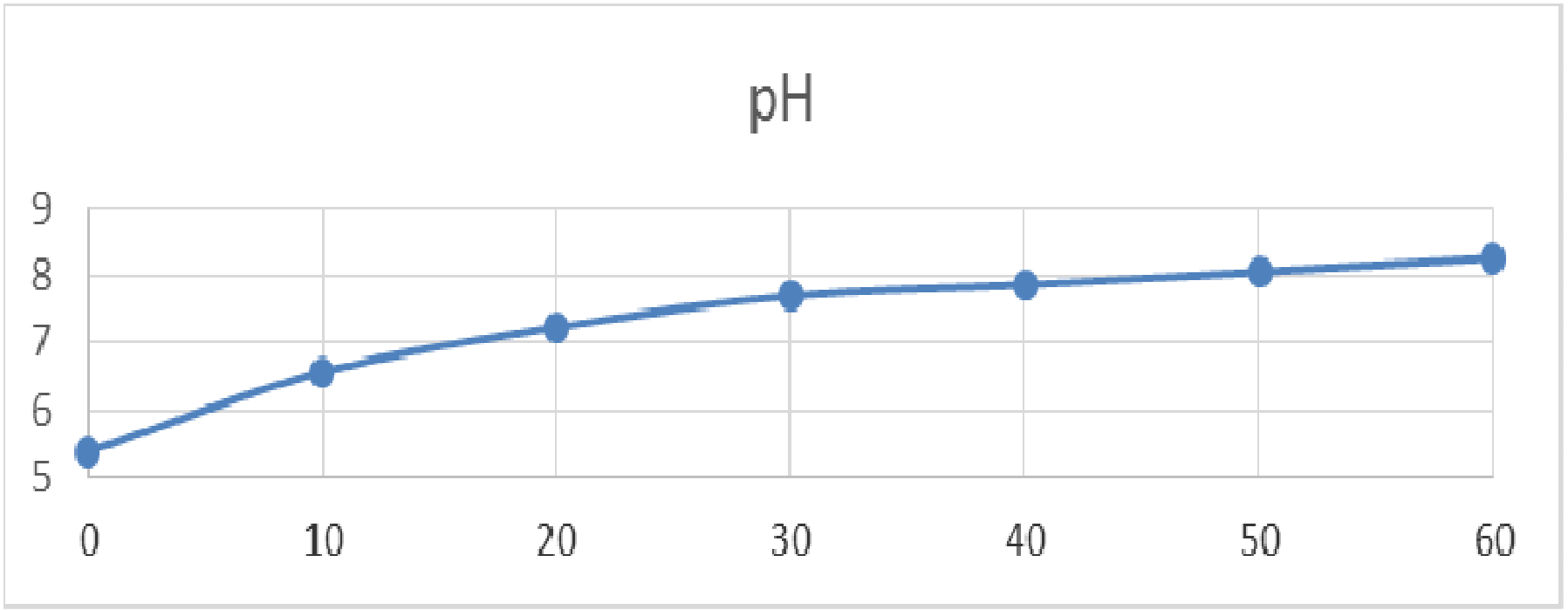
Effect of bioash treatments (x axis t ha^{-1}) on white mustard yield

Bioash has no significant affect below 20 t ha^{-1},
but the higher doses caused considerable decreasing and fluctuation.

Conclusions

- The effect of different biomass ash dosage were investigated in pot experiment on Ryegrass and White mustard.
- The optimal dosage was 16 t ha^{-1} in case of Ryegrass. Significant effect was not found on White mustard below 20 t ha^{-1}.
- The agricultural use of biomass ash in small concentration works as a stimulant but higher concentrations have toxic effect on plants.

Thank you for your attention!


pH
9
8
7
6
5
0
10
20
30
40
50
60