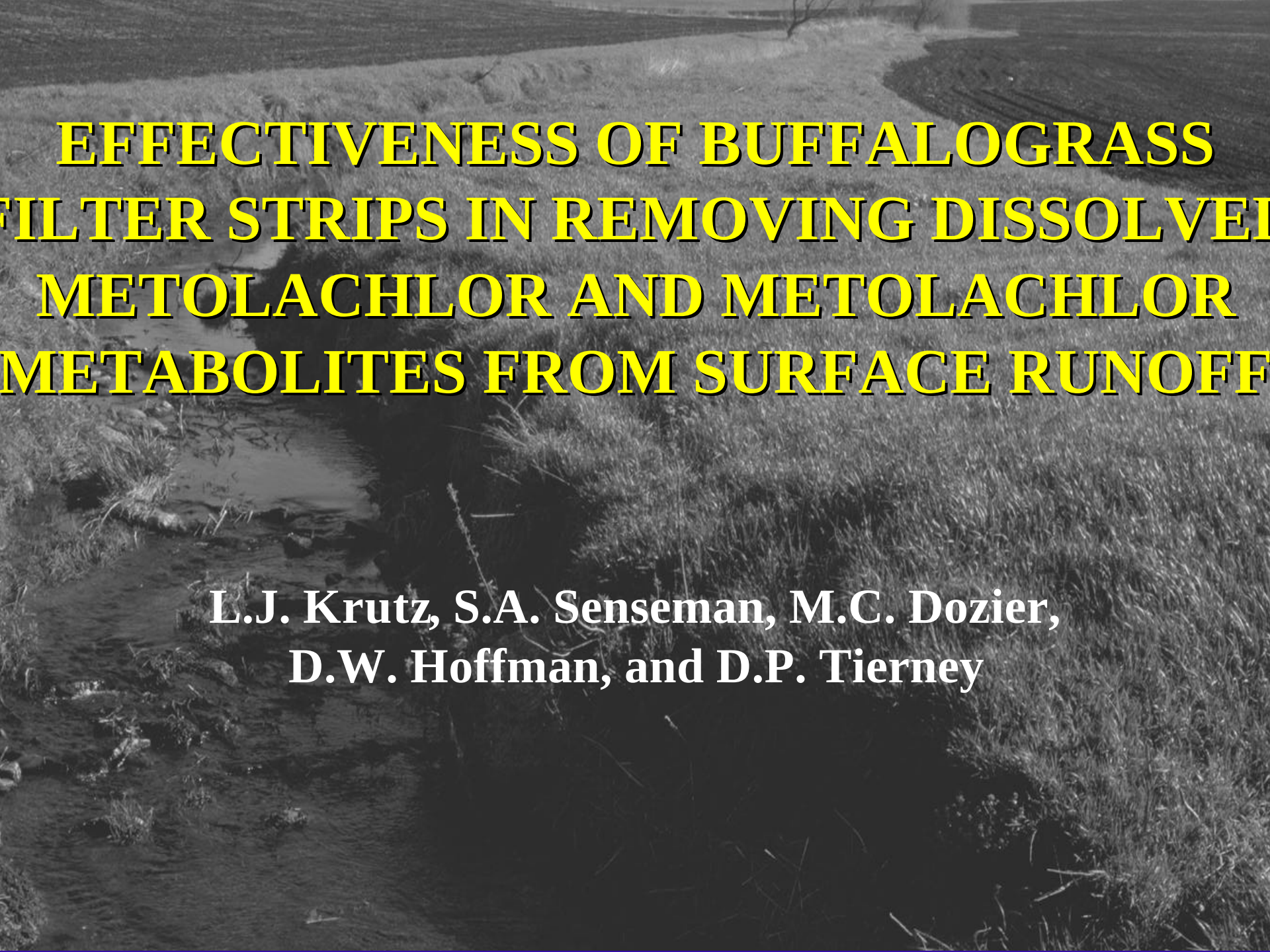

EFFECTIVENESS OF BUFFALOGRASS FILTER STRIPS IN REMOVING DISSOLVED METOLACHLOR AND METOLACHLOR METABOLITES FROM SURFACE RUNOFF

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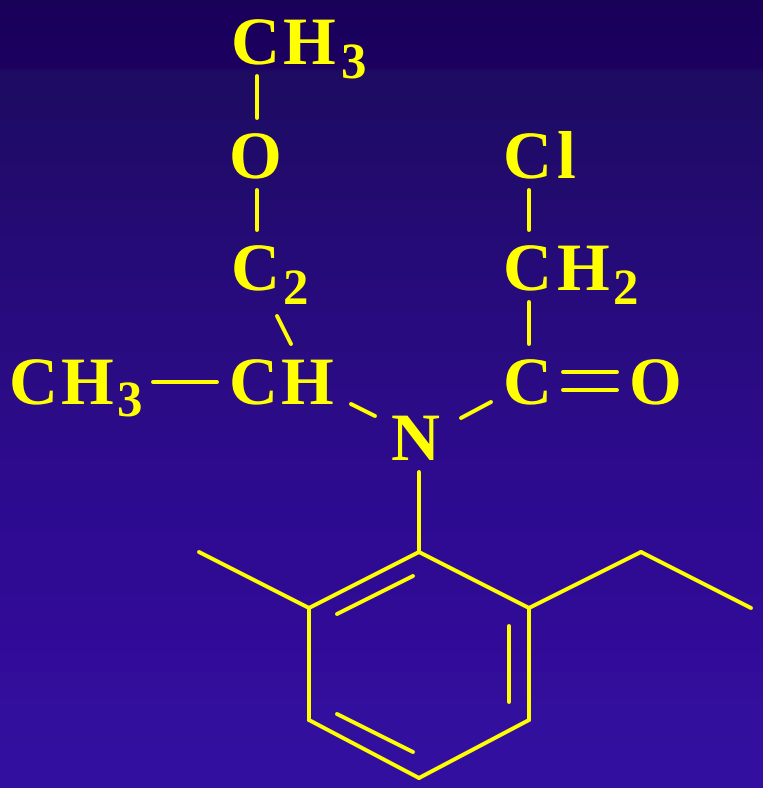
Introduction

- Metolachlor - chloroacetamide herbicide.
- Used for weed control in corn and sorghum.
- Detected in ground and surface waters (Goolsby et al. 1994).
- Degrades rapidly in soil $T_{1/2}$ = 15-30 days.



Metolachlor

Metolachlor Metabolites

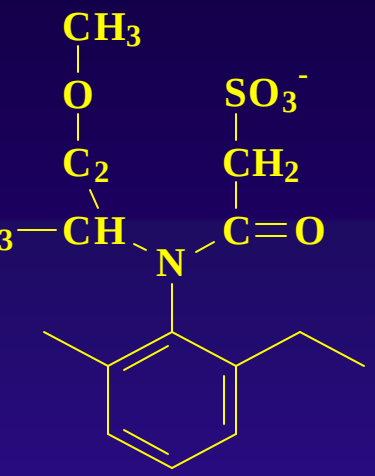
Detected in surface and ground water (Kolpin et al. 2000).

Higher frequency (Baker et al. 1993).

Higher concentrations (Kolpin et al. 1996).

> 80% mass chloroacetamide compounds in ground and surface wate
onsisted of the sulfonic and oxanilic acid degredates (Kalkhoff et al.
998).

Metolachlor OA and ESA

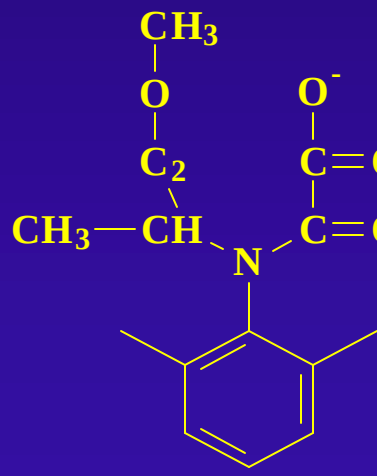


ESA

- Transformations are biologically mediated.
- Detoxification pathways from plants and so microorganisms via glutathione conjugation (Field e al. 1996).

Ionic metabolites that are highly water-soluble Phillips et al. 1999).

Adsorption and desorption processes differ among etolachlor and metolachlor metabolites (Novak et al. 000).



OA

Vegetative Filter Strips

Suspended solids

Inorganic compounds

Organic compounds

- Infiltration
- Adsorption

Dillaha et al. 1989 / Barfield et al. 1998

Hypothesis

The effectiveness of a buffalograss filter strip i
etaining dissolved metolachlor, metolachlor ESA
nd metolachlor OA will be compound specific.

Objective

Construct a mass balance whereby the trappin
fficiency (T_E), mass adsorbed (M_{ads}), and mas
nfiltrated (M_{inf}), can be compared amon
netolachlor, OA, and ESA.

Materials and Methods

Soil Data

Surface layer characteristics of Houston Black Clay (fine, smectitic, thermic Udic Haplusterts)[a].

lope	sand	silt	clay	OM	pH	CEC[b]
		%				
-5	9	33	58	2.4	7.1	61.6

Information taken from Soil Interpretation Lab Data Reports from the Texas State oil Office of the USDA-NRCS.

milliequivalents 100 g^{-1}

Field Descriptions

- Nurse tank
- Pump
- Applicator
- Buffalograss plot
- Sample collection
- Data logger

Nurse Tank

- Application (0.12 ug mL^{-1})
  - Metolachlor
  - OA
  - ESA
- Hoffman et al. 1995

Application Device

- Wolfe et al. 2000
- Sheet flow
- Easy field calibration
- 750 L hr^{-1}

Sample Collection and Analysis

1 x 3 m buffalograss plots

Irrigated to saturation

5-min intervals

Solid Phase Extraction (SPE)

HPLC-PDA

Runoff Volume Collected

- Pressure transducer
- Data logger
- 1-min interval
- Volume = $\Pi\ r^2\ h$

Equations

- Trapping efficiency (T_E)

$$T_E = M_i - M_o / M_i$$

$$M_i = \Sigma\, q_i\, C_i\, d_t$$

$$M_o = \Sigma\, q_o\, C_o\, d_t$$

- Mass balance

$$M_i - M_o = M_{inf} + M_{as}$$

Barfield et al. 1998

Equations

- Mass infiltrated (M_{inf})

$$M_{inf} = V_{inf}\, C_{avg}$$

$$V_{inf} = V_i - V_o$$

- Mass adsorbed (M_{ads})

$$M_{ads} = M_i - M_o - M_{inf}$$

Statistics

RCB

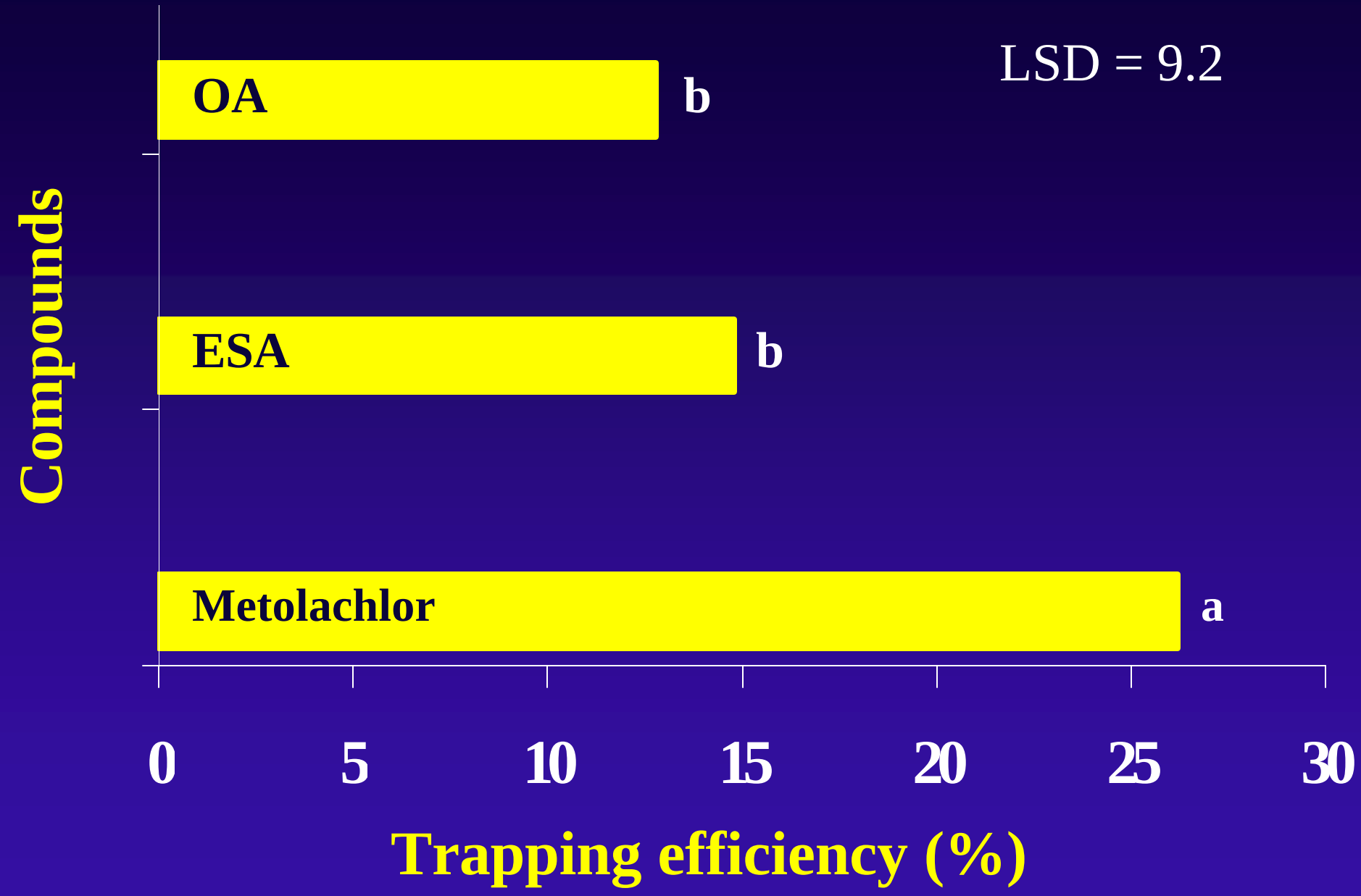
Five replications

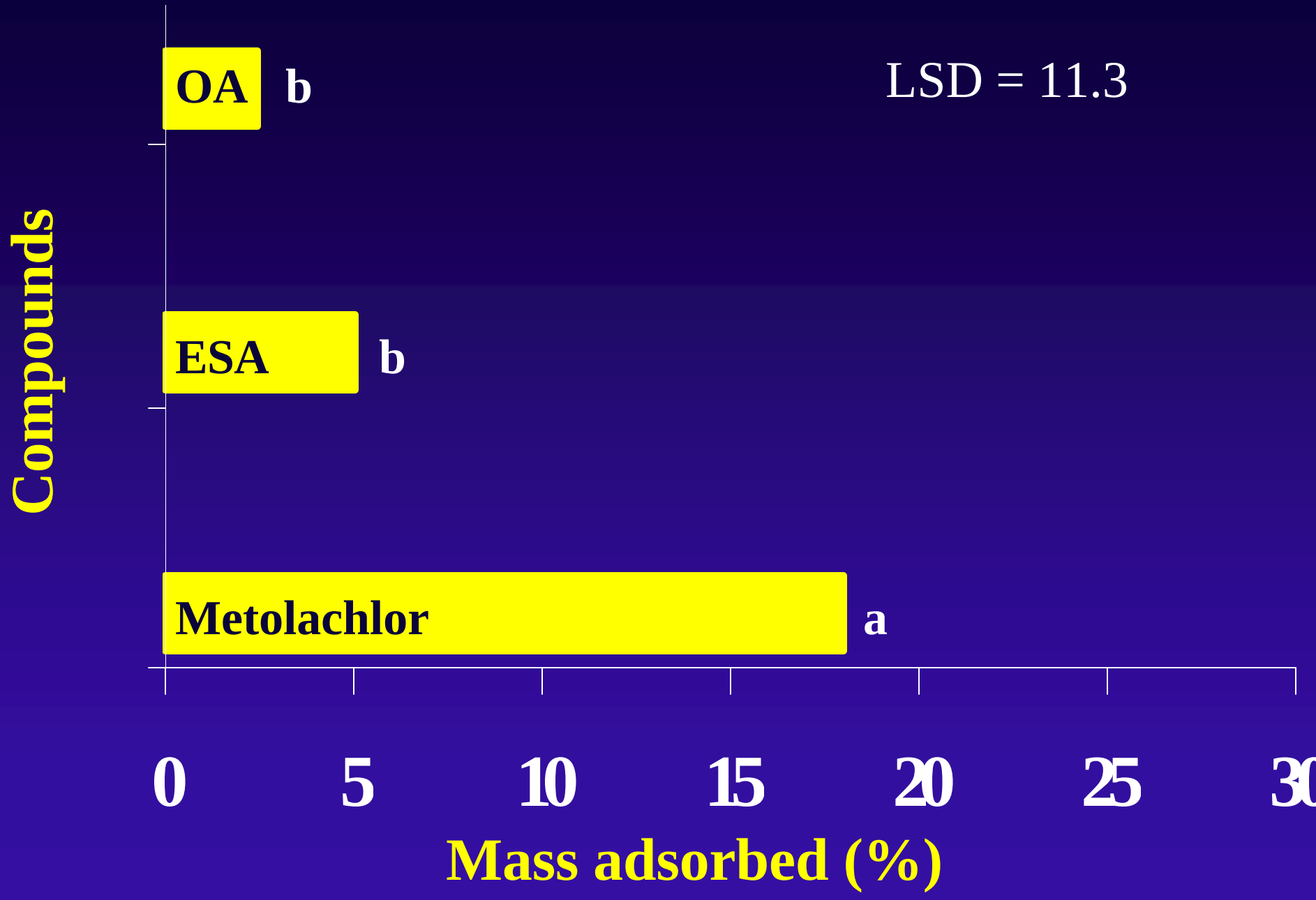
Treatment means subjected to analysis of variance

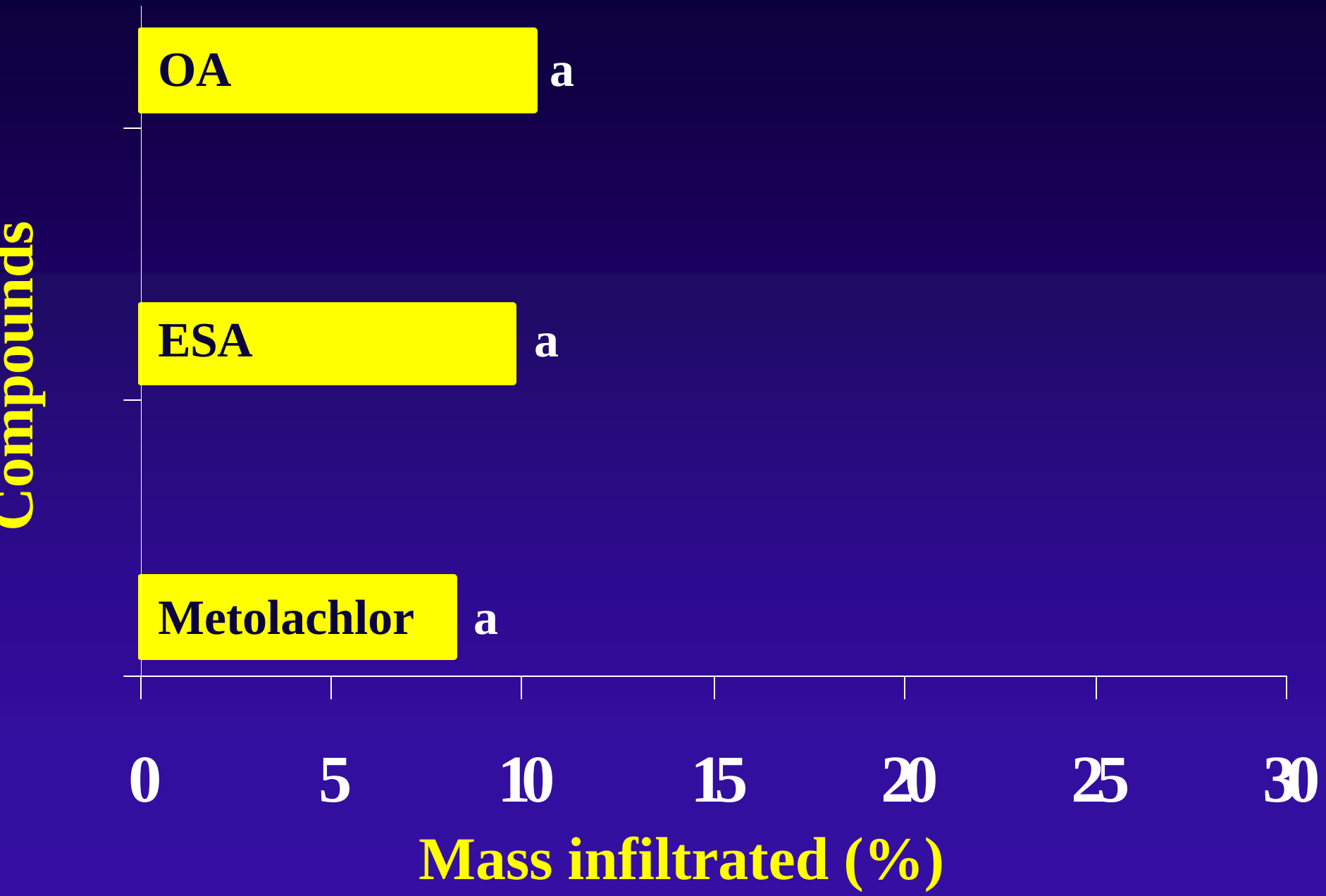
- T_E
- M_{ads}
- M_{inf}

Means separated by Fisher's LSD


Results and Discussion


LSD = 9.2
OA
b
ESA
b
Metolachlor
a
Compounds
0
5
10
15
20
25
30
Trapping efficiency (%)


LSD = 11.3
OA
b
ESA
b
Metolachlor
a
Compounds
0
5
10
15
20
25
30
Mass adsorbed (%)


OA
a
ESA
a
Metolachlor
a
Compounds
0
5
10
15
20
25
30
Mass infiltrated (%)

Conclusions

- Retention was compound dependent.
- Trapping efficiency data indicated that metolachlor wa preferentially retained within the strip when compared to th metabolites.
- Metolachlor adsorption was significantly greater than metabolite adsorption and likely attributed to the differences i trapping efficiency among compounds.
- Even under saturated conditions, infiltration played an important role in compound retention.

Future Research

Infiltration

- aeration
- tillage

Adsorption

- vegetation
- PAM
- zeolites