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PRELIMINARY ASSESSMENT OF ELECTROMAGNETIC FIELD EFFECTS INDUCED BY HIGH AND MEDIUM VOLTAGE POWER LINES ON CARBON ASSIMILATION IN MAIZE AND SUNFLOWER CROPS

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Abstract: The research aimed to develop an experimental model to evaluate the influence of electromagnetic fields generated by medium-voltage (1-35 kV) and high-voltage (35-275 kV) power lines on maize (*Zea mays L.*) and sunflower (*Helianthus annuus L.*) crops. The study was conducted in Dambovita and Iasi counties for high-voltage lines, in Prahova county for medium-voltage lines, and in Călărași county as a control location without electromagnetic influences. The carbon footprint was determined by analyzing the total organic carbon (TOC) content using biological samples collected at the maturity stage from roots, stems, leaves, and fruits/inflorescences. Measurement of electromagnetic field intensity at lateral distances of 30 meters and a height of 2.5 meters revealed maximum values of 5.9 µT for high-voltage lines in Dambovita county, 5.1 µT in Iași, and 0.3 µT for medium-voltage lines in Prahova county. The carbon content analysis in plants indicated that crops assimilate less carbon in areas exposed to high-voltage power lines (maize: 40.46% C (IS), 46.96% C (CL) and sunflower: 41.66% C (DB), 45.69% C (CL) and that medium-voltage lines positively influence carbon assimilation (sunflower: 46.48% C (PH).

• Introduction

In the context of global climate change and the need to reduce greenhouse gas emissions, agriculture plays a crucial role in managing carbon fluxes.

• Material and method

The selected geographical study area was southeastern Romania, including the experimental plots located in Dambovita county (high voltage), Prahova county (medium voltage) and Iași county (high voltage)

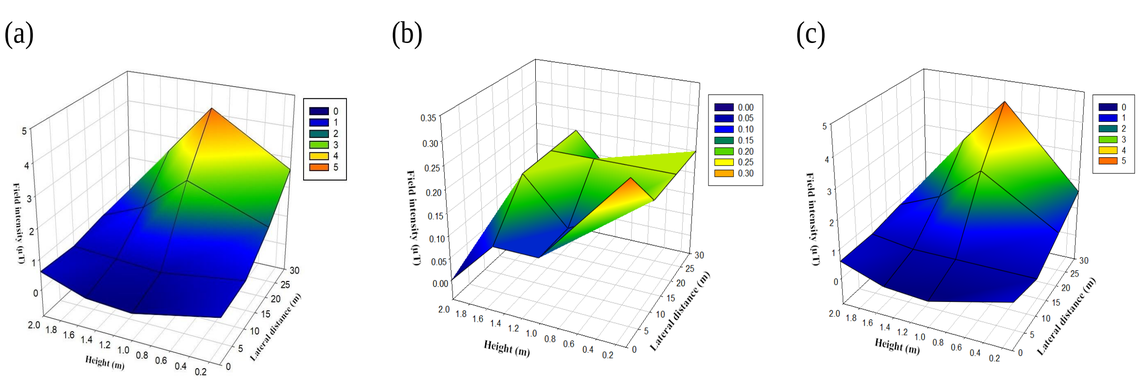
Specific agrotechnical operations for each cultivated plant

Inputs	Agrotechnical Operations	Maize (6000 kg/ha)	Sunflower (3000 kg/ha)
		Carbon [CO_2-eq kg/ha]	
Mechanization	Organic fertilizer application	27	27
	Chemical fertilization	9	9
	Plowing	86	86
	Harrowing	9	9
	Rotary tiller or cultivator use	30	30
	Sowing	13	13
	Rolling	6	6
	Herbicide application	3	3
	Mechanical weeding	28	28
	Phytosanitary treatment 1	19	19
	Tratament fitosanitar 2	19	19
	Mechanized harvesting	81	40
	Crop residue management	13	13
	Transport	97	48
Agrochemicals	Nitrogen	1085	542
	Phosphorus	38	19
	Potassium	39	19
	Fungicides	205	205
	Herbicides	530	530
	Insecticides	443	443
Other inputs	Irrigation, storage, etc.	0.89	0.89
Total		2808.95	2139.46

• Results and discussions

Total organic carbon (TOC) content (%) in plant organs based on crop type and location

	Biomass percentage [%]	Harvested organ	Dambovita county	Prahova county	Calarasi county
SUNFLOWER	13	Root	41.30	47.35	47.02
	35	Stem	41.21	45.49	45.34
	15	Leaf	41.86	47.61	38.71
	37	Capitulum	42.13	46.65	48.37
	100	Total Carbon	41.66	46.48	45.69
MAIZE			Iasi county		Calarasi county
	9	Root	18.58		47.48
	40	Stem	41.93		47.47
	10	Leaf	47.53		45.65
	41	Ear	42.10		46.67
	100	Total Carbon	46.46		46.96

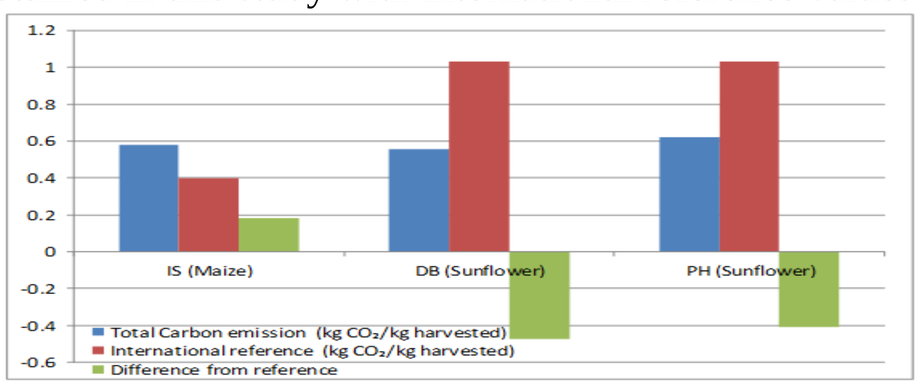


Electromagnetic field intensity in DB (a), PH (b) and IS (c).

Total carbon emissions per kilogram of harvested crop and per crop type compared to international reference values

Field crops	Total Carbon emission (kg CO_2/kg harvested)	International reference (kg CO_2/kg harvested)	Difference from reference
IS (Maize)	0.581	0.4	+ 0.181
DB (Sunflower)	0.555	1.03	- 0.475
PH (Sunflower)	0.623	1.03	- 0.407

Comparison of total carbon emissions by crop type obtained in this study with international reference values



• Conclusions

Long-term monitoring of EMF effects on agricultural crops is essential, as responses vary depending on species, location, and exposure intensity. Adaptive measures may be necessary to optimize yield in EMF-exposed crops.

The determination of carbon content in plants exposed to electromagnetic radiation stands out as a relevant method for assessing its effects, given that the atmospheric concentration of carbon dioxide remains constant, while the variability in soil mineral concentration affects only the total amount of fixed carbon, not the carbon concentration within plant tissues.

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