



ULST Timisoara
Multidisciplinary Conference on Sustainable Development
 21-22 May 2026



AGREEMENT ON REDUCING CHEMICAL HERBICIDE USE IN AGRICULTURE BETWEEN NARDI AND AGROLYNX ZRT

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Abstract: This article is part of an ongoing collaborative project between the National Agricultural Research and Development Institute (NARDI) and AgroLynx Zrt which is centered on the need to reduce the use of chemical herbicides in agriculture while maintaining high crop yields. It adopts a case study approach to explore alternative solutions aimed at reducing or eliminating synthetic herbicide use. Agroecological weed management practices will be compared with conventional chemical herbicide applications under field conditions.

Material and method

Plant material and crop management

- Hybrid:** *Helianthus annuus* L. FD15E27 (NARDI Fundulea)
- Sowing date:** 24 April 2025
Density: 60,000 viable seeds ha⁻¹
Depth: 4–5 cm
- Seed treatment:** fungicides
- Soil preparation:**
 - Autumn ploughing (Oct 2024)
 - Spring discing and harrowing
- Fertilization:**
 - Triple superphosphate: 150 kg ha⁻¹ (before ploughing)
 - Urea: 200 kg ha⁻¹ (early spring)
 - Total: 92 kg N ha⁻¹ and 69 kg P₂O₅ ha⁻¹**
- Irrigation:** 17–18 June 2025
 Drip system, 200 m³ ha⁻¹

Experimental design

Randomized Complete Block Design
 5 replications
 Plot size: 42 m² (4.2 m x 10 m)
 6 rows per plot
 Alley width: 2 m
 Total experimental area: 1302 m²

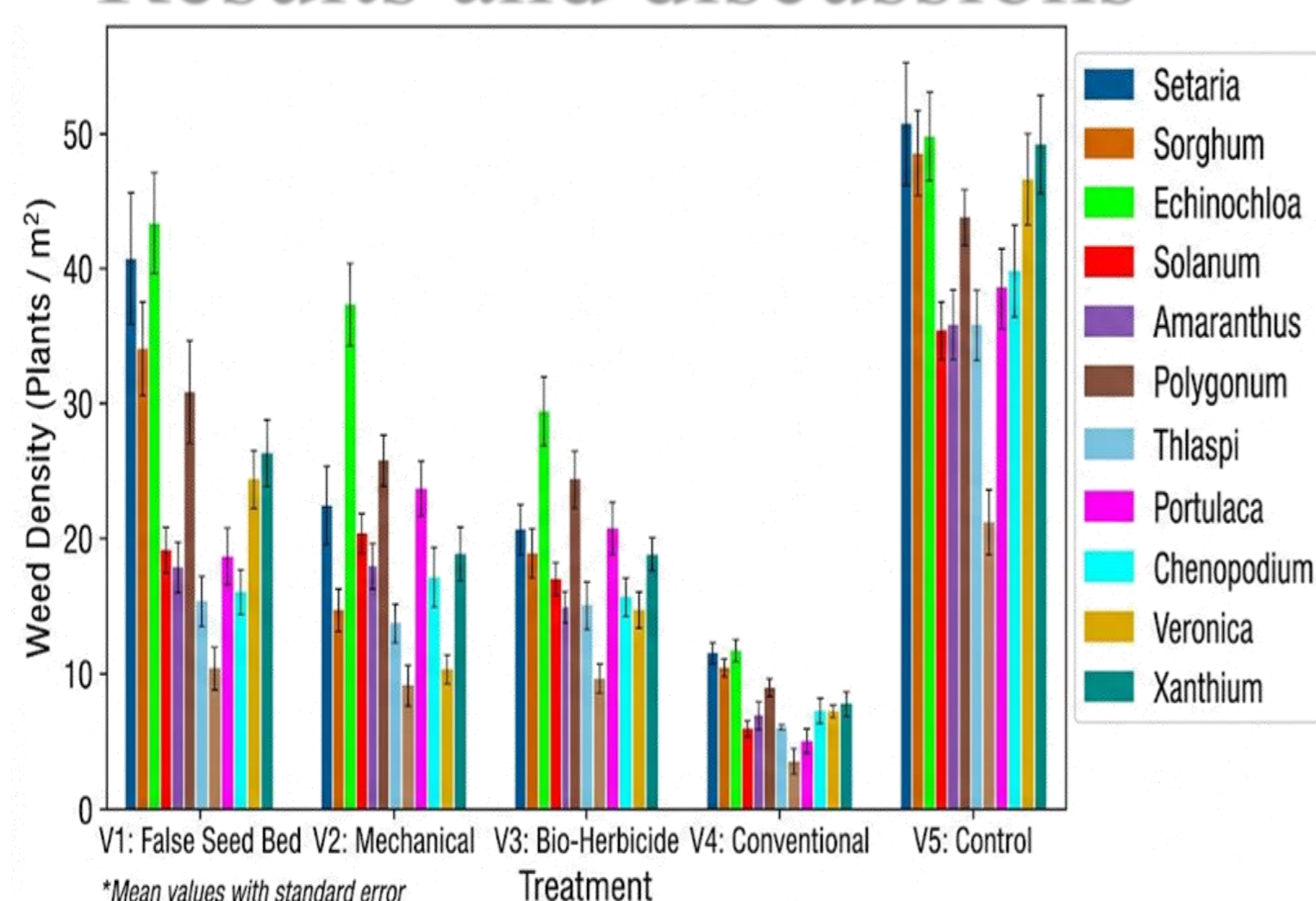
	BLOCK I	BLOCK II	BLOCK III	BLOCK IV	BLOCK V
V1	V3	V5	V2	V4	
V2	V4	V1	V3	V5	
V3	V1	V4	V5	V2	
V4	V5	V2	V1	V3	
V5	V2	V3	V4	V1	

Alley 2 m

Treatments

	V1 FALSE SEEDBED Early soil preparation to stimulate weed germination, followed by destruction of emerged weeds before sowing.
	V2 MECHANICAL TREATMENT Inter-row cultivation during early post-emergence stages (23 May 2025).
	V3 NATURAL HERBICIDE Pre-sowing application of pelargonic acid 20 L ha ⁻¹ (500 g L ⁻¹ a.i.) in 400 L ha ⁻¹ water (5% v/v solution).
	V4 CONVENTIONAL HERBICIDE (ON-FARM PRACTICE) • Pre-emergence: Frontier Forte 0.80 L ha ⁻¹ (24 April 2025) • Post-emergence: Leopard 5 EC 0.75 L ha ⁻¹ (30 May 2025)
	V5 UNTREATED CONTROL No weed control measures, except corrective manual hoeing later in the season.

Results and discussions



Nr.	TREATMENT	QUALITY PARAMETERS			
		HECTOLITER WEIGHT HW (kg/hl)		WEIGHT OF A THOUSAND GRAINS WTG (g)	
		AVERAGE	%	AVERAGE	%
V1	False seed bed	40.9	106.0	74.80	106.80
V2	Mechanical treatment	40.8	105.7	75.09	107.16
V3	Natural Herbicide Treatment (Pelargonic acid)	41.5	107.5	75.44	107.66
V4	Conventional - On-farm Practice	41.0	106.2	75.17	107.27
V5	No treatment (witness)	38.6	100.00	70.07	100.00

• The untreated control (V5) showed the highest weed pressure, indicating strong competitive effects in the absence of control measures.

• Pelargonic acid treatment (V3) providing the most effective early-stage suppression of both monocotyledonous and dicotyledonous species.

• Mechanical (V2) and false seedbed (V1) treatments showed moderate and less consistent control, with some reinfestation later in the season.

• Conventional herbicide treatment (V4) was effective but slightly less consistent than V3.

Analytical methods and instrumentation

SECTION	DESCRIPTION OF ACTIVITY	MONITORED PARAMETERS
PHENOLOGICAL OBSERVATIONS	Monitoring the crop development stages from sowing to maturity.	BBCH scale, Plant height, Number of leaves
MICROBIOME AND SOIL	Soil sampling (5–15 cm depth) for microbiological analyses.	Composition of microbial communities, sampling date
ENVIRONMENTAL MONITORING	Recording of pedoclimatic data using IoT sensors and a weather station.	Air/soil temperature, Humidity, Precipitation, Solar radiation, Water pH
YIELD AND PRODUCTIVITY	Mechanical harvesting and determination of grain quality.	Yield per hectare, Test weight (TW), Thousand kernel weight (TKW), Grain moisture

PRODUCTION PERFORMANCE				
Nr.	TREATMENT	PRODUCTION (kg/ha)	PRODUCTION INCREASE	
			%	kg/ha
V1	False seed bed	2.601	129,40%	591 ↑
V2	Mechanical treatment	2.617	130,19%	607 ↑
V3	Natural Herbicide Treatment (Pelargonic acid)	2.947	146,61%	937 ↑
V4	Conventional - On-farm Practice	2.888	143,68%	878 ↑
V5	No treatment (witness)	2.010	100,00%	0

Conclusions

💡 (V3) – Natural Herbicide Treatment (Pelargonic acid) delivered the best results in both production and quality parameters, outperforming all other treatments. It is a promising, environmentally compatible solution for integrated weed management in sunflower.

All weed management strategies improved sunflower production compared to no treatment.

Pelargonic acid (V3) resulted in the highest increase: 937 kg/ha (146,61%).

Natural herbicide treatment provides an effective and environmentally compatible alternative.

Early application and proper timing are key for maximizing efficiency.

Acknowledgement: This work was supported by a grant of the Ministry of Agriculture and Rural Development, within the ADER Program, project number 2.1.4.