



Ecological foliar fertilizers influence on total phenolic and flavonoid contents and antioxidant activity of *Cynara scolymus* L.

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ECOLOGICAL AGRICULTURE



GLOBAL

- 160 countries, organic farming (FIBL-IFOAM)

-2010, An area of 37 million hectares

(11.30% Austria, 9.70% Switzerland, 7.94% Italy, 6.51% Denmark, 6.30 % Sweden, Uruguay, 5.06% Czech Republic, 4.5% Spain, 3% Argentina, 2,8% Australia, 1,8% China, 1.40% France)

(Source: Willer, 2012; Stoleru, 2013)

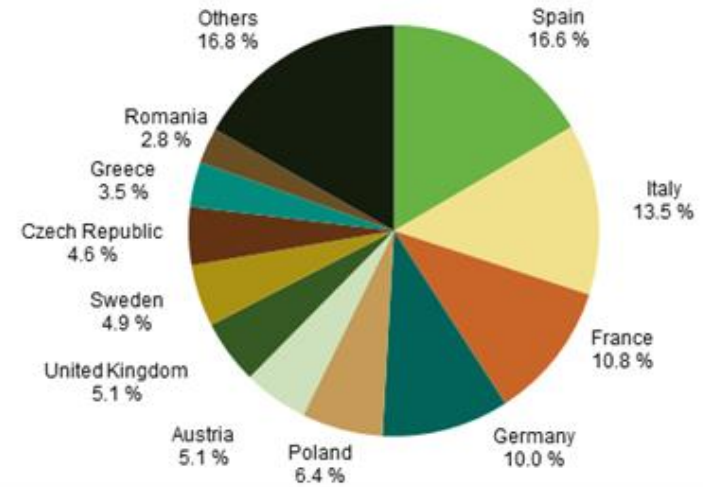


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- dynamic system, with a weighted average **annual growth rate of approximately 20%**.
- in 2012, 288.261 ha certificates, number of certified operators has increased 4.6 times compared to 2006



Share of total organic area fully converted and under conversion, EU-28, 2014 (Eurostat, 2016)

MATERIAL AND METHODS



- **Aime:** analysis of the influence of ecological fertilizers on yield, physiological and biochemical parameters of *Cynara scolymus* L.
- **Plant materials:** seeds of *Cynara scolymus* L., UASVM
- **V1:** control (unfertilized), **V2:** Fylo (0,25%), **V3:** Geolino Plants&Flowers (0,1%), **V4:** Cropmax (0.1%), **V5:** Fitokondi (0.1%).
- Latin square method, randomized design with 3 replications.
- 60 cm – the distance between rows was, 25 cm-between plants
- 3 times fertilization (beginning of the vegetative stage-June 9, during the vegetative stage -July 9, beginning of blooming -August 10).
- Watering was not performed
- November 3, 2015 - harvest





- **Morphometrical assessments:** stem height, number of lateral stems.
- **Physiological measurements:** fresh weight, photosynthesis; chlorophyll fluorescence (Fv/Fm).
- **Biochemical parameters:** assimilatory pigments, total phenolics and flavonoid contents, antioxidant activity (DPPH - 2,2-diphenyl-1-picryl-hydrazyl-hydrate – method)
- **Statistical analysis** by ANOVA and Tukey test



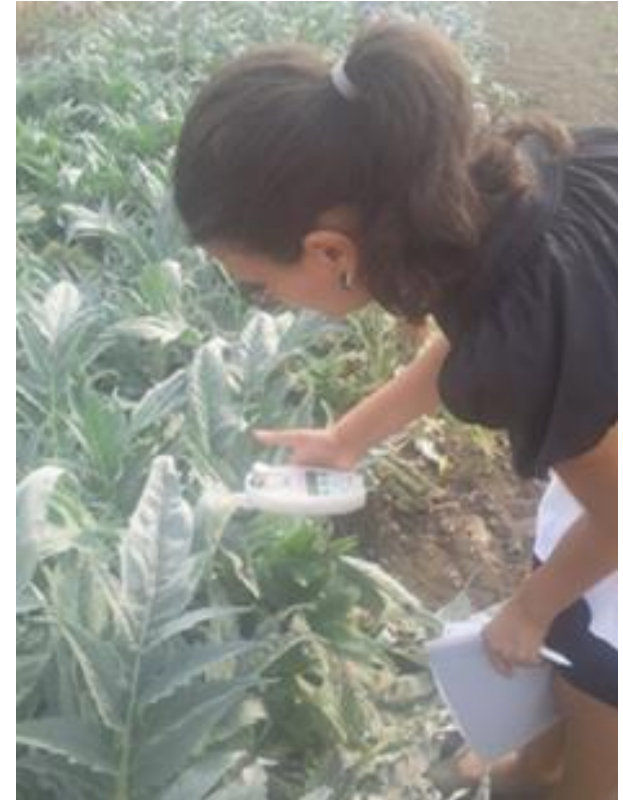
Foliar fertilizer	pH	N%	P%	K%
FYLO	4.37	32.33	1.28	1.04
GEOLINO	4.94	18.72	0.64	7.20
CROPMAX	4.50	0.20	0.40	0.02
FITOKONDI	4.50	0.02	0.01	0.26

They contain also plant growth stimulators: (auxins, cytokinins, gibberellins) - organic acids - vitamins – plant enzymes - trace elements (magnesium, zinc, manganese, copper, bor, calcium, molybdenum, cobalt, nickel)

The influence of ecological fertilizers on the morphometric parameters of artichoke



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The influence of ecological fertilizers on the morphometric parameters of artichoke



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The influence of ecological fertilizers on the morphometric parameters of artichoke



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Treatments/Parameters	No. of nodes	No. of inflorescences	Leaf mass (g)
Control	4.08±0.15	1.33±1.01	110.67±16.54
Fylo	4.56±0.18	2.33±0.33	134.78±20.28
Geolino	4.44±0.24	3±0.67	126.22±19.36
Cropmax	4.89±0.26	1.67±1.11	161.56±19.3
Fitokondi	4.56±0.24	4.11±2.76	175.89±20.82

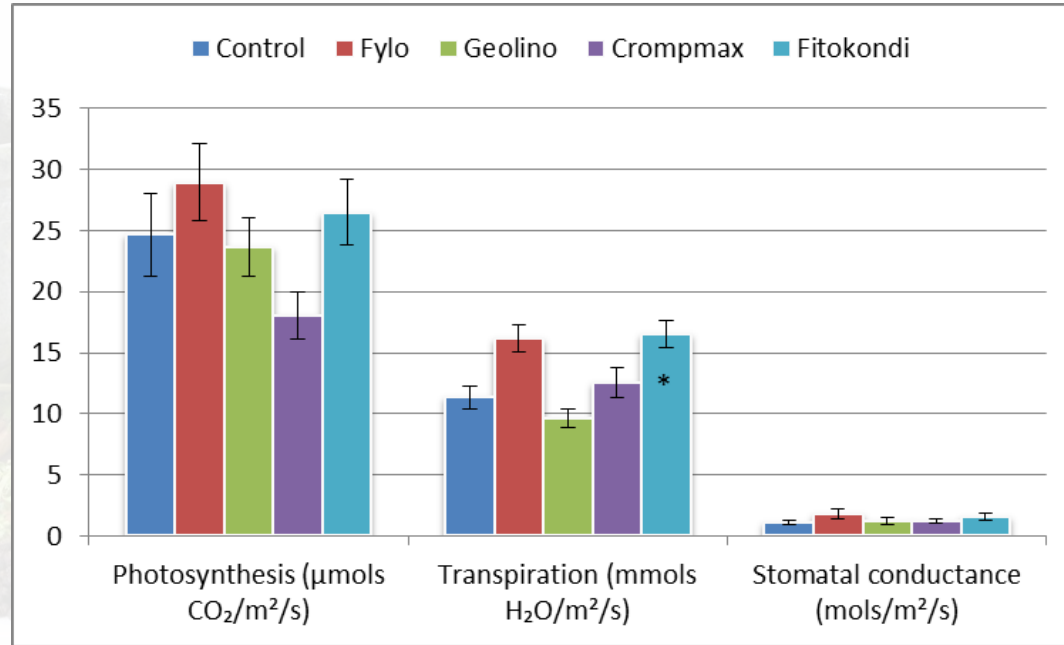
(*-significant differences from control plants at $p < 0.05$)



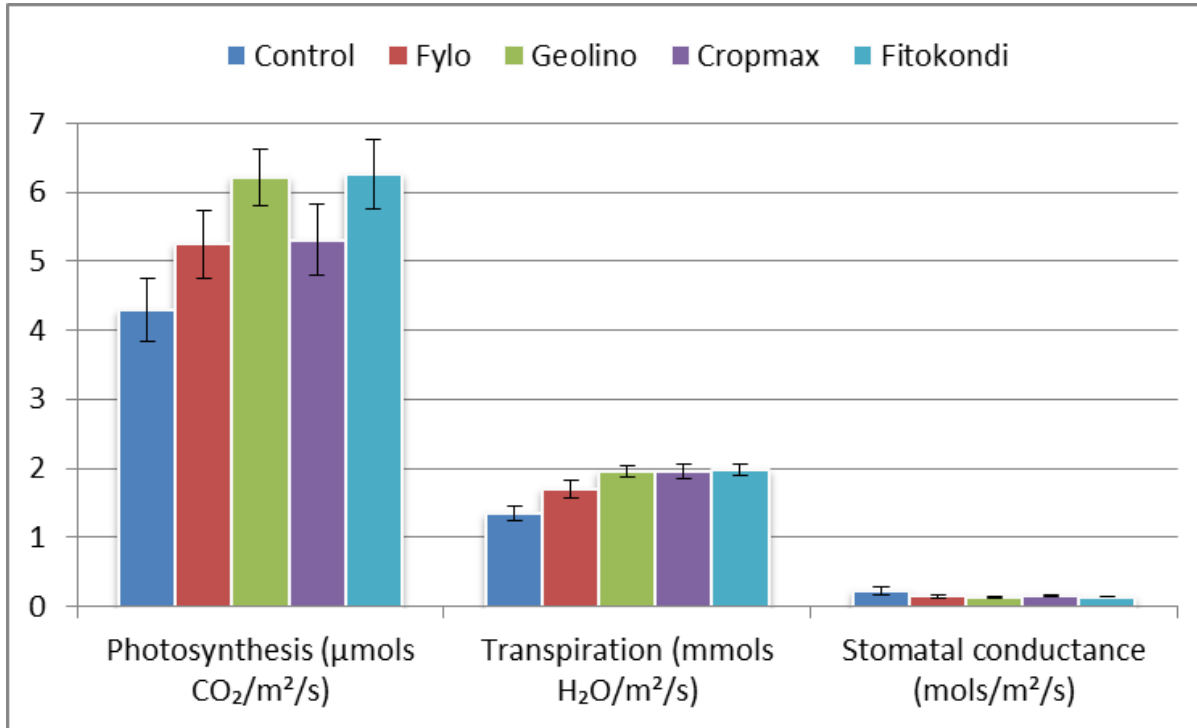
Treatment/ Parameter	Fresh yield kg/ha	Dry yield kg/ha	Dry substances (%)	H ₂ O (%)	Loss on drying
Control	15935.19±2.41	2012.96±0.31	10.61±0.68	86.39±0.68	7.35±0.33
Fylo	16944.44±0.91	2324.07±0.1	13.72±0.64	86.28±0.64	7.29±0.32
Geolino	17925.93±1.12	2231.48±0.09	12.45±0.83	87.55±0.83	8.03±0.52
Cropmax	19962.96±0.9	2611.11±0.14	13.08±0.38	86.92±0.38	7.65±0.23
Fitokondi	18703.7±1.2	2587.96±0.19	13.84±0.56	86.16±0.56	7.23±0.29

Yield of *Cynara scolymus* L. under foliar ecologic fertilization
(*-significant differences from control plants at $p < 0.05$)

The influence of ecological fertilizers on physiological parameters of artichoke



Photosynthesis and transpiration rates and stomatal conductance of *Cynara scolymus* L. plants under foliar ecologic fertilization in August (*-significant differences from control plants at $p < 0.05$)



Photosynthesis and transpiration rates and stomatal conductance of *Cynara scolymus* L. plants under foliar ecologic fertilization in November (*- significant differences from control plants at $p < 0.05$)

Chlorophyll fluorescence parameters of *Cynara scolymus* L. plants under foliar ecologic fertilization, in August



Treatments/Parameters	Control	Fylo	Geolino	Cropmax	Fitokondi
F0	20.67±2.55	28.33±2.18	22.11±1.52	21.11±1.34	20.56±1.74
Fm	151.11±8.61	139.67±7	160±7.28	151.44±5.53	142.11±7.55
Fv	130.44±10.05	111.33±6.97	137.89±6.53	130.33±6.47	121.56±7.97
Fv/Fm	0.86±0.02	0.79±0.02*	0.86±0.01	0.86±0.01	0.85±0.02

(*-significant differences from control plants at $p < 0.05$)

Chlorophyll fluorescence parameters of *Cynara scolymus* L. plants under foliar ecologic fertilization, in November

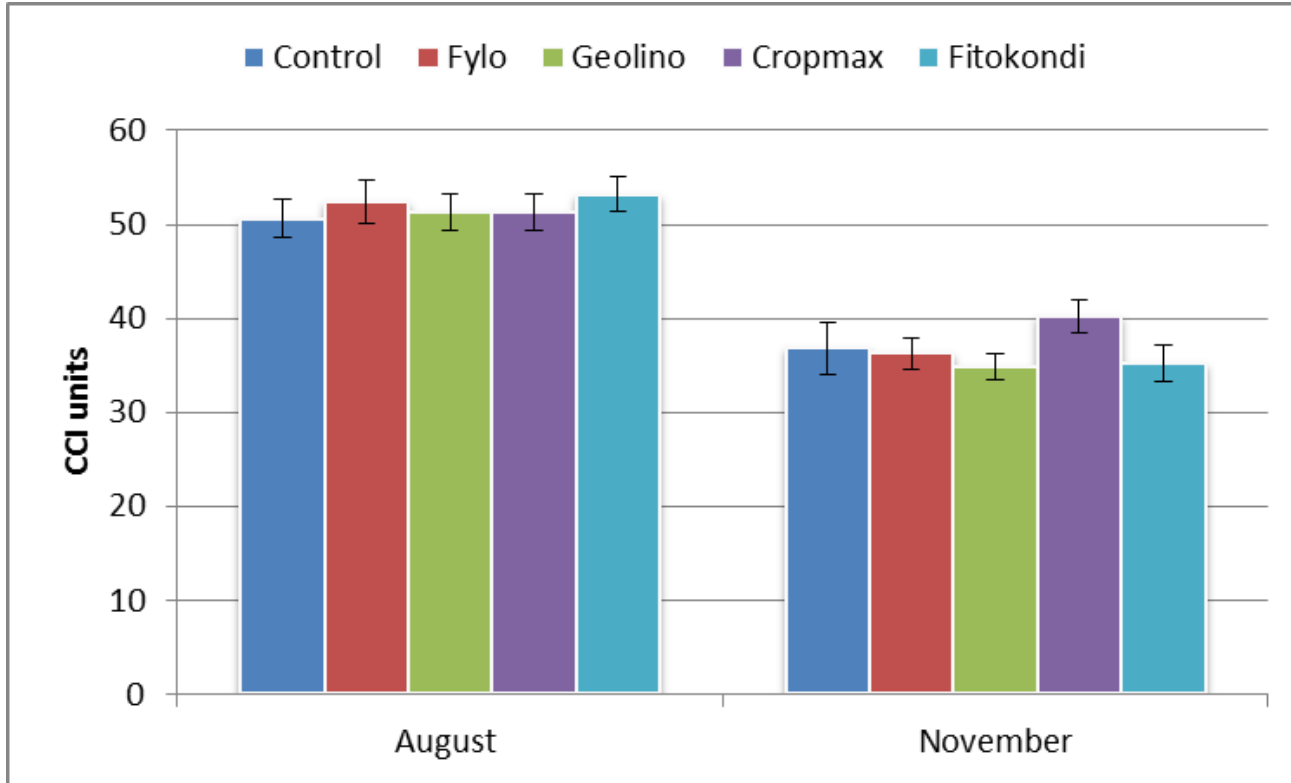


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Treatments/ Parameters	Control	Fylo	Geolino	Cropmax	Fitokondi
F0	19.11±1.18	16.33±1.03	23.56±1.37	22.33±1.52	18.89±1.2
Fm	165.33±5.97	148.22±7.2	132.33±11.09*	136±6.07	128.11±8.79*
Fv	146.22±6.71	131.89±6.79	112.44±5.77*	110±10.26*	109.22±8.22*
Fv/Fm	0.88±0.01	0.89±0.01	0.83±0.01*	0.83±0.01*	0.85±0.01

(*-significant differences from control plants at $p < 0.05$)



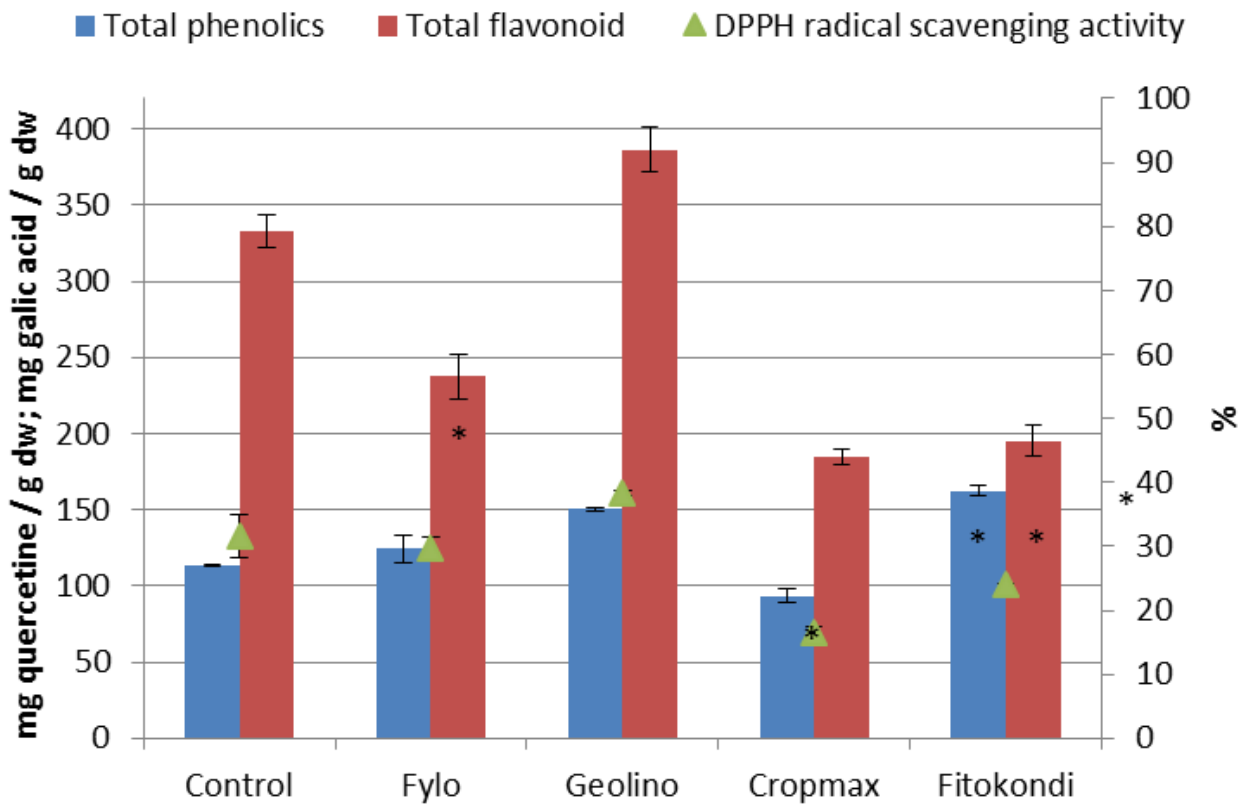
Assimilatory pigments contents in *Cynara scolymus* L. plants under foliar ecologic fertilization (*-significant differences from control plants at $p < 0.05$)

Polyphenolic contents, total flavonoids, antioxidant activity of artichoke under foliar ecologic fertilization



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Total phenolics and flavonoid contents and free radical scavenging activity (%) of *Cynara scolymus* L. plants, 2.5% ethanolic extracts, under foliar ecologic fertilization (*- significant differences from control plants at $p < 0.05$)

CONCLUSION



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- The ecological fertilizers treatments positively influenced the crop of *Cynara scolymus* L.
- Significant increases of the investigated parameters
- Recommended to increase agro productivity of *Cynara scolymus* L.

"Medicus curat, Natura sanat"
"The physician treats, but nature heals." -
Hippocrates





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THANK YOU !