



Health-Beneficial Properties Of Organically Grown Stinging Nettle (*Urtica dioica* L.) In The First Year Of Cultivation.

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Introduction

Stinging nettle (*Urtica dioica* L.) is a spontaneous plant very widespread in all temperate regions that is used in many sectors including food. Due to the eco-sustainability of cultivation, the health characteristics and the potential uses of by-products cultivation a complete supply chain, from field production to processing, may be envisaged for stinging nettle.

In this work stinging nettle plants, organically grown in three different Italian farms, were evaluated in terms of biomass production and nutraceutical characteristics.

Materials and Methods

Trials were carried out at three organic farms of the Emilia Romagna region, Italy, located at Tresigallo, Ozzano dell'Emilia and Lizzano in Belvedere during the 2020 growing season. Seeds of stinging nettle were sown in nursery beds at the end of April 2020. After 40 days of growth the plants were transplanted in the experimental fields at a density of 6.66 plants/m². Trials were all rain fed and weed management was carried out either manually or by mechanical hoeing. Plants were harvested in the last week of September 2020 and representative samples of leaf biomass were evaluated for: yield, free (FP), bound (BP) and total polyphenol (TP), flavonoid (FF, BF, TF) compounds; anti-oxidant activities (DPPH and FRAP assays), ascorbic acid, ashes and nitrate. One-way analysis of variance (ANOVA) in conjunction with Tukey's honest significant difference was performed for comparing the three growing locations. Significance between means was determined by least significant difference values for $p < 0.05$. Principal coordinate analysis was applied using Statistica 6.0 software (2001, StatSoft, Tulsa, OK, USA).

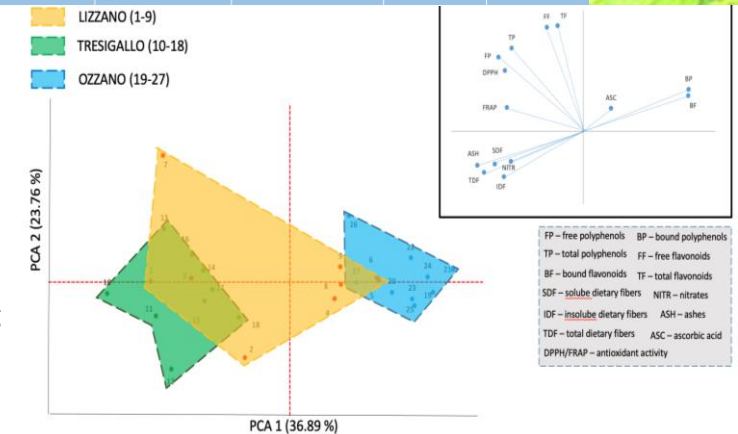


Results

The highest biomass yield was obtained at Tresigallo (3068 kg/ha) whereas at Lizzano (471 kg/ha) and Ozzano (242 kg/ha) yields were much lower, probably due to inadequate weed control during the cropping cycle. No significant differences were observed among locations in the dry matter content. No significant differences were observed among locations for total polyphenol and flavonoid contents. Instead, significant variation in the relative abundance of the polyphenol fractions (free and bound) were observed, with the free fraction accounting for 94.1% (Tresigallo), 87.5% (Lizzano) and 80.1% (Ozzano). Higher contents of free phenolics may reflect plant response to specific abiotic stresses of the growing environment. The highest values of antioxidant activity (FRAP assay) were observed for plants grown at Lizzano and Tresigallo (105.7 and 78.2 mmol/100 g, respectively), which reflected the highest abundance of free polyphenols. On the other hand, plants grown at Ozzano were richer in bound phenolic components (polyphenols and flavonoids) which concur less at the antioxidant activity of the extracts.

| Location | Free Polyphenols | Bound Polyphenols | Free Flavonoids | Bound Flavonoids | DPPH | FRAP |
|------------|------------------|-------------------|-----------------|------------------|----------|----------|
| Lizzano | 340.18 ab | 48.36 b | 315.81 a | 32.41 a | 25.39 ab | 105.69 a |
| Tresigallo | 483.73 a | 30.49 b | 261.64 a | 12.20 b | 39.43 a | 78.20 b |
| Ozzano | 282.76 b | 70.43 a | 276.49 a | 35.05 a | 12.23 b | 38.24 c |
| P | * | *** | ns | *** | *** | *** |

Principal component analysis highlighted that most of Ozzano samples had in common high contents of bound polyphenols and flavonoids. As regards Tresigallo, samples were pooled together based on the high content of dietary fibers, ashes and nitrate. Lizzano samples showed very high variability covering a wider area comprising mostly parameters linked to antioxidant compounds.



This was indicative of how the environmental conditions may affect plant bioactive synthesis.

Conclusions

The preliminary results of the present study showed the possibility of cultivating stinging nettle in Italian organic farming systems. Particularly, the growing location affected the nutraceutical composition of the aerial part of the plants. Additional data coming from two more years of experimentation will give additional insight on the correlation between environmental conditions, agronomic performance and nutraceutical value of organically-grown stinging nettle.

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