Article

Observations on the Productivity of Breeding Specimens of *Urtica dioica* L. from European Russian Ecotopes in Comparison with the Breeding Variety under Field Crop Conditions

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Abstract: Nettle is most often studied as a spinning plant, as a source of biochemicals and environmentally safe fungicides. Major studies are mostly conducted on natural samples and plant populations. Prospects for the use of plant biological resources of stinging nettle (*Urtica dioica* L.) from the Cretaceous south of the Central Russian Upland to create cultivars for a wide range of applications are considered. The aim of the study is to investigate the productivity of fresh weight and its biochemical composition in the variety of stinging nettle Avicenna, created on the basis of the initial material selected in the Belgorod region of Russia and patented in 2019, and new promising cultivars UD 32/06 and UD 12/16. The experiments were carried out by the split plot method with full randomization in four replicates. The cultivars UD 32/06 and UD 12/16 reliably surpass the Avicenna cultivar in the collection of fresh mass weight by 16.6–22.7% and 23.1 to 27.8%, dry weight by 11.4–28.7% and 1.9–32.7%, and seeds by 19.7–32.0% and 23.2–40.0% accordingly. Analysis of variance showed a significant effect of the factor “Cultivar” on the productive traits “Fresh weight yield” (strength influence 87.2%), “Dry weight yield” (strength influence 43.9%), and “Seed yield” ($h^2x = 61.6\%$). The content of crude protein in dry weight of the Avicenna and new varieties is 21.1–24.2%, crude fat: 2.5–4.2%, fiber: 12.0–14.8%. High content of ascorbic acid, calcium, phosphorus, iron, and zinc were observed in all material tested. It is concluded that the biological resources of the wild-growing forms of *Urtica dioica* L. from the European south of Russia are a valuable source material for obtaining varieties, and varieties with high productivity of the aboveground mass and stable seed productivity. The obtained research results prove the usefulness of nettle cultivation.

Keywords: *Urtica dioica* L.; breeding; local biodiversity; field cultivation

1. Introduction

Sustainable agriculture in crop and livestock production serves the rational use of the possessed resources of soil, water, and air. Special attention should be paid to the development and functioning of the natural engineering sectors, where the economic growth is limited by the rational use of natural resources and environmental protection [1]. Due to the increasing air pollution and climate change, agents approved for use in organic agriculture in both crop and livestock production are sought. These can be substances of plant origin, among others, which can be obtained both from natural habitats and from targeted

crops. The species and different parts of the plant in use that are obtained from natural habitats include, among others, field horsetail (*Equisetum arvense* L.), herb; sea buckthorn (*Hippophae rhamnoides* L.), fruit; St. John's wort (*Hypericum perforatum* L.), herb; common hellebore (*Pteridium aquilinum* L.), leaves; serpentine knotweed (*Polygonum aviculare* L.), herb; broad-leaved plantain (*Plantago major* L.), herb; red clover (*Trifolium pratense* L.); and flower, nettle (*Urtica dioica* L.), leaves and roots [2]. Some of these are suitable for agricultural crops.

Stinging nettle is one such multi-purpose plant. It can be used to produce new, high-quality agricultural raw materials for the dyeing, textile, and energy sectors, as well as in agriculture [3–6] and in broadly understood environmental protection, including rehabilitation of areas contaminated with lead arsenate [7]. Research [2] on the possibility of using innovative botanical extracts as biostimulants for plant growth and development to improve nutritional value showed beneficial effects of foliar application of botanical extracts from *Urtica dioica* L. on growth and development of model vegetable (cabbage) seedlings. Chitosan, horsetail (*Equisetum arvense* L.), and nettle (*Urtica dioica* L.) have also been shown to be effective in protecting against fungal pathogens and controlling grapevine trunk disease (GTD) [8,9].

Phytofungicides based on nettle chitosans are proposed to be used as an alternative to synthetic antibiotics [10,11]. Their advantages are easy biodegradability, environmental friendliness, and low toxicity [9,12,13]. Antibiotics in poultry feeding have a negative influence on biogas yield from poultry manure [14].

The use of renewable bioresources for extract production is particularly important in sustainable agricultural systems [15]. In addition, 14-day aqueous extract of nettle is valuable for fertilizer purposes due to its high content of nitrogen, phosphorus, calcium, magnesium, and iron and promotes plant growth [16,17]. Short-term nettle extract (24 h), in addition to being used for fertilizer purposes, can be used as a repellent against insects [18,19]. Nettle is harvested both from natural habitats and from cultivation. In order to protect biodiversity and prevent overexploitation of this species and, at the same time, to improve its properties, new, more valuable cultivars are being sought (through genetic modification). In previous years, work was undertaken to introduce common nettle into agricultural cultivation [7,20].

Stinging nettle (*Urtica dioica* L.) is a common plant that grows throughout the temperate regions of Europe, Asia, and North America. It is highly variable in morphological characteristics and probably represents a number of subspecies [20]. It was found that, in Europe, the tetraploid cytotype is predominantly widespread at 87%, and the diploid forms are about 13%. Most diploid forms are confined to natural and almost natural habitats, while tetraploid forms tend to inhabit synanthropic areas [21]. In some parts of Europe, wild nettle species grow exclusively in moist or wet, very fertile habitats on sunny sites [22]. Nettle grows readily in moist forests and meadows, in pastures, and in periodically flooded areas, but it is primarily known as a nitrophilous weed accompanying human habitats.

All morphological parts of nettle (stem, leaves, roots, and seeds) are utilized to produce many added-value natural products by exploiting all the plant parts. Common nettle (*Urtica dioica* L.) is a valuable herbal plant and can be used for feed purposes as a feed additive for livestock, especially poultry [23–27]. Selective breeding of *U. dioica* clones for high-fiber and fiber content and high seed productivity is being conducted [28].

All over the world, there is an active search for an equivalent replacement of artificial medicines with herbal products, the so-called phytobiotics [29–32].

Components obtained from the following species are actively involved in production: *Origanum vulgare*, *Rosmarinus officinalis*, *Tussilago farfara*, *Plantago major*, *Chelidonium majus*, *Matricaria matricarioides*, *Achillea millefolium*, *Urtica dioica*, and others in various combinations [33].

Today, we evaluate these plants by their biochemical composition, the content of macronutrients (lipids, proteins, and carbohydrates) in them, as well as minerals, such as potassium (K), phosphorus (P), magnesium (Mg), calcium (Ca), iron (Fe), and zinc (Zn) [34].

The inclusion of nettle in the diet of poultry allows not only replenishment of the need for basic microelements (especially iron), 19–21% of protein, and 55–75% of vitamins, but also to save 30% in feed. The nutrient availability of nettle flour to poultry is close to that of green grass. Nettle flour contains over 24% protein, 5% fat, and 18.5% fiber; 1 g of nettle flour contains (mcg): carotenoids—150–250, vitamin E—25, riboflavin—12, ascorbic acid—1000 mg, vitamin K—25 mg, a high content of iron, as well as formic, pantothenic acid, ferulic, parocumaric, p-coumaric, and other organic acids [35,36].

This represents a potential hazard due to the possible accumulation of heavy metals and other potentially hazardous substances.

The use of raw nettle on an industrial scale for the needs of poultry has long been limited by the lack of local varieties of this valuable forage crop [37]. Breeding work with this valuable crop, both in the world and in Russia, is poorly conducted. Several varieties have been created and introduced into cultivation in Germany (*Urimed*, *Saluica*), and the Panacea variety was registered in Belarus in 2002 [38].

Work on the study of the biological resources of *U. dioica* L. in the European south of Russia (geographically in the south of the Central Russian Upland) began in 2002. The region possesses vast biological and genetic plant resources of various valuable species of the families *Lamiaceae*, *Fabaceae*, *Asteraceae*, *Urticaceae*, and others [38,39].

The concept of the formation in the south of the Central Russian Upland of a secondary anthropogenic microgenetic center for the formation of individual synanthropic plant species has been developed. Active work is underway to mobilize the genetic resources of wild relatives of cultivated plants of the Cretaceous South of Russia in the breeding process to obtain highly productive forms of forage crops for various purposes, including wild populations of *U. dioica* L. [40–42].

In 2018, the first variety of stinging nettle *Avicenna* was patented in Russia, created on the basis of the source material obtained in the gully–ravine complexes of the Belgorod region of Russia [43,44]. Work continues on the creation of new varieties of the valuable forage crop of dioecious nettle based on local breeding material [43]. The studies of the forms, samples, and ecotypes of nettle, both collected in the wild and obtained by selection using methods of hybridization, individual family selection, the polycross method and recurrent selection, are constantly being studied.

The aim of this research is to study the two created breeding populations, which were obtained by the method of biotypic selection, and compare them with the breeding variety.

2. Materials and Methods

2.1. Plant Material

In the experiments of the study, two (2) potential populations of stinging nettle were studied, obtained as a result of seed propagation of clones selected in different ecotopes of the Cretaceous south of the Central Russian Upland (Figure 1).

The commercial variety *Avicenna* was used as the standard (st) (Table 1).

Table 1. List of genotypes of stinging nettle used in the study.

№	Type/Cultivar	Genealogy	Geographical Co-Ordinates
1	Breeding variety <i>Avicenna</i>	Patent № RUS 10668 [43]	
2	Savage class UD 32/06	Gully–ravine complex with chalk outcrops Valuisky district, Belgorod region, Russia	50.287098 N 38.324434 E
3	Savage class UD 12/06	Floodplain of the Seversky Donets River, Belgorodsky District, Belgorod Region, Russia	50.638359 N 36.647003 E

The studied populations were preliminarily tested in a collection nursery and outperformed the selection variety Avicenna in yield.

Figure 1. Initial populations of nettle in places of natural growth in the Belgorod region of Russia (photo by V.I. Cherniavskih).

2.2. Test Setting and Experimental Conditions

The experimental site for the field experiment was kindly provided by the director of the seed-breeding enterprise S.A. Mavrodin (Dragunskoye village, Belgorodsky district, Belgorod region, Russia, FE “Mavrodin S.A.” 50.657654 N, 36.381310 E (Table 2, Figure 2)).

Table 2. Characteristics of the soil.

Parameter	Description
Soil	typical black soil (typical black soil)
Humus (according to Tyurin), %	4.9
pH soil	6.8
P ₂ O ₅ , mg·kg ^{−1}	120
K ₂ O, mg·kg ^{−1}	180
Average annual rainfall, mm	553
Average annual temperature, °C	+6.3
Frost-free period, months	8–9
Height above sea level, m	181

The content of mobile compounds of phosphorus (P₂O₅) and potassium (K₂O) in the soil was determined by extracting them from the soil with a solution of acetic acid with a concentration of 0.5 mol·(dm³)^{−1} at a soil-to-solution ratio of 1:25 and subsequent determination of phosphorus in the form of a blue phosphorus–molybdenum complex on a photoelectric colorimeter and potassium on a flame photometer (Soils. Determination of mobile compounds of phosphorus and potassium by Chiricov method modified by CINA O (GOST 26204-91)) [31].

Figure 2. Experienced plots of stinging nettle (photo by V.I. Cherniavskih).

The determination of soil pH was carried out by extracting exchangeable cations, nitrates, and mobile sulfur from the soil with a solution of potassium chloride with a concentration of $1 \text{ mol} \times (\text{dm}^3)^{-1}$ (1 N) at a soil-to-solution ratio of 1:25 with potentiometric determination of soil pH using a glass electrode. The identification of the humus content in the soil was carried out by the oxidation of organic matter with a solution of potassium dichromate in sulfuric acid and the subsequent determination of trivalent chromium, which is equivalent to the content of organic matter on a photoelectrocalorimeter (Soils. Methods for determination of organic matter GOST 26213-91).

The experiments were carried out in 2018–2020 by the split plot method with full randomization in 4 replicates on two-row plots. The size of the accounting plots of the first order (variety samples) was $6 \text{ m} \times 0.3 \text{ m}$ and the size of the plots of the second order (accounting for seeds and accounting for fresh weight) was $3 \text{ m} \times 0.45 \text{ m}$. Sowing was carried out with seeds in the spring of 2017 at the rate of 500 seeds per 1 running meter with a manual seeder to a depth of 1 cm. In the course of the growing season of the first year, the destruction of unwanted vegetation by agrotechnical methods and loosening of row spacings were carried out. In the fall of 2017, before the onset of frost, the grass was cut down. No mineral or natural fertilizer was applied to the crop and no pesticides were used. Accounting for fresh weight yield was carried out in the phase of full flowering (75% of open flowers) and accounting for seed yield was carried out in the phase of full maturation (75% of ripe seeds).

The study of morphological characters was carried out in accordance with test guidelines for DUS testing of *Urtica dioica* L. [44,45]. Each test was carried out on 30 plants in each of 4 replicates (a total of 120 plants of each variety): the length of the stem was measured by the main stem from the base to the top of the inflorescence; to determine the length and width, the leaves were taken in the middle part of the main stem and the width was measured in its widest part; the length of the female inflorescence was measured on the main stem in the fruiting phase from the topmost branch to the top of the topmost spikelet; foliage was taken as the ratio of the mass of leaves to the mass of a plant without leaves.

The mass fraction of nitrogen, crude protein, crude fiber, crude fat, crude ash, copper, manganese, iron, zinc, calcium, phosphorus, ascorbic acid (vitamin C), and carotene were determined. The combined samples of nettle fresh mass, weighing from 0.4 to 0.5 kg, were crushed into segments 1–3 cm long. An average sample was isolated from the combined sample, the mass of which, after drying, was at least 100 g. All the samples were dried (with the exception of samples for determination of vitamin C.) in a drying cabinet at a temperature of 60–65 °C to an air-dry state. The air-dry sample was milled and sieved through a sieve, and then all chemical analyses were carried out according to standard methods described in [31].

The determination of the content of crude ash, as well as macro- and microelements, was carried out after burning the plant sample and subsequent calcination at a temperature of 525 ± 25 °C with the standard methods described in [31].

2.2.1. Method for Determination of Mass Fraction of Nitrogen and Crude Protein

Determination of nitrogen and protein by the Kjeldahl method was carried out according to the protocol: Feeds, compound feeds, feed raw materials. Determination of mass fraction of nitrogen and calculation of mass fraction of crude protein by the method (GOST ISO 5983-2-2016, <https://docs.cntd.ru/document/120014057>, accessed on 30 October 2021). Sample weight was 1.000 ± 0.001 g. Ashing was carried out for 60 min with sulfuric acid (H_2SO_4) with a mass fraction of at least 98%, not containing nitrogen ($P_{20} = 1.84 \text{ g} \cdot \text{cm}^{-3}$) 12 cm^3 per sample, and Kjeldahl catalyst tablets containing 3.5 g of potassium sulfate and 0.4 g of copper (II) sulfate pentahydrate per tablet. Distillation was completed in a distillation apparatus with 30 cm^3 of a concentrated solution of boric acid $\text{H}_3\text{BO}_3 = 40.0 \text{ g} \cdot \text{dm}^{-3}$ and 50 cm^3 of sodium hydroxide solution (NaOH) with a mass fraction of 40%. Colorimetric titration was carried out with hydrochloric acid solution, $c(\text{HCl}) = 0.1000 \text{ mol} \cdot \text{dm}^{-3}$. The mass fraction of crude protein was calculated as $N \times 6.25$. Results are expressed as percentage (%) in dry weight (DW), % in DW.

2.2.2. Method for Determination of the Mass Fraction of Crude Fiber

Determination of the fiber content was carried out according to Henneberg and Shtoman. The protocol was: Feeds. Methods for determination of crude fiber content with intermediate filtration (GOST 31675-2012, <https://mooml.com/d/gosty/37190/>, accessed on 30 October 2021).

The mass of a crushed air-dry sample of a plant sample is 2.000 ± 0.001 g. Reagents: sulfuric acid of molar concentration with $(1/2\text{H}_2\text{SO}_4) = 0.255 \pm 0.005 \text{ mol dm}^{-3}$; potassium hydroxide of molar concentration with $(\text{KOH}) = 0.230 \pm 0.005 \text{ mol dm}^{-3}$; sand, sequentially sifted through sieves with aperture size of 0.160 and 0.125 mm; petroleum ether. Samples were boiled with sulfuric acid solution 30 ± 1 min and titrated with a Komovsky pump. These were washed with distilled water with a temperature of 95 °C– 100 °C, degreased with acetone, and boiled with potassium hydroxide solution for 30 ± 1 min. Then, they were washed with distilled water at a temperature of 95 °C– 100 °C and filtered. The suction filter with the residue was dried for 3 h at a temperature of 130 ± 2 °C, cooled in a desiccator, and then were weighed and placed for 3 h in a muffle furnace at 550 ± 20 °C to ash the residue. The Nutsch filter cooled in a desiccator was weighed again with the residue. Weighing was carried out with an accuracy of ± 0.001 g. The results are expressed in percent (%) in dry weight (DW).

2.2.3. Method for Determination of Mass Fraction of Crude Fat

The determination of the mass fraction of crude fat was determined from the fat-free residue in a Soxhlet apparatus in accordance with the protocol: Feeds, mixed feeds, feed raw material. Methods for determining the raw fat content (GOST 13496.15-2016, <https://docs.cntd.ru/document/1200140598>, accessed on 30 October 2021). Extraction of crude fat from the sample was carried out with petroleum ether (fraction 40 – 70 °C) in a Soxhlet apparatus. Then, the solvent was removed and the defatted residue was weighed and the fat mass fraction was calculated. Results are expressed as percentage (%) in dry weight (DW), % in DW.

2.2.4. Method for Determination of Mass Fraction of Crude Ash

The essence of the method is to determine the mass of the residue after combustion and subsequent calcination of the sample. Ashing the organic matter of the analyzed sample by calcining and weighing the resulting residue was carried out in accordance with the protocol: Feeds, compound feeds. Method for determination of crude ash (GOST 32933-2014 (ISO 5984: 2002), <https://docs.cntd.ru/document/1200114230>, accessed on

30 October 2021). The sample weight was 5.000 ± 0.001 g. Ashing was carried out at a temperature of 550°C for 5 h.

Results are expressed as percentage (%) in dry weight (DW), % in DW.

2.2.5. Method of Copper Determination

The determination of the copper content was carried out photometrically with lead diethyldithiocarbamate in accordance with the protocol: Vegetable feeds. Methods for determination of copper (GOST 27995-88, <https://docs.cntd.ru/document/1200024376>, accessed on 30 October 2021). Sample weight was 2.00 ± 0.02 g. Preparation of a solution of lead diethyldithiocarbamate in carbon tetrachloride was as follows: 0.664 g of sodium diethyldithiocarbamate was placed in a separating funnel with a capacity of 2000 cm^3 , 1 dm^3 of carbon tetrachloride was added, and 0.486 g of nitric acid in 100 cm^3 of lead was added and dissolved in lead within 5 min. The extracts were photometrically measured against carbon tetrachloride at a wavelength of 436 nm. Results are expressed in milligrams per kilogram dry weight of plants (DW), $\text{mg}\cdot\text{kg}^{-1}$ DW.

2.2.6. Method of Manganese Determination

Determination of manganese content was carried out by photometric periodate method in accordance with the protocol: Vegetable feeds. Methods for determination of manganese (GOST 27997-88, <https://docs.cntd.ru/document/1200024378>, accessed on 30 October 2021). Sample weight was 2.00 ± 0.02 g. Ashing of the plant sample was carried out in a standard way in a muffle furnace at $525 \pm 25^\circ\text{C}$. Manganese was oxidized with periodate to a colored permanganate ion, and the optical densities of the analyzed solutions and reference solutions with a known concentration of manganese at a wavelength of 536 nm were compared. The results are expressed in milligrams per kilogram dry weight of plants (DW), $\text{mg}\cdot\text{kg}^{-1}$ DW.

2.2.7. Method of Iron Determination

A photometric method for the determination of iron with ortho-phenanthroline was used. The optical density of the orange-red complex compound of ferrous iron with ortho-phenanthroline, formed in ash solutions and reference solutions with a known iron concentration, was determined in accordance with the protocol: Vegetable feeds. Methods for determination of iron (GOST 27998-88, <https://docs.cntd.ru/document/1200024379>, accessed on 30 October 2021). The weight of a plant sample for ashing was 2.00 ± 0.02 g. Ashing was carried out according to a standard technique in a muffle furnace at $525 \pm 25^\circ\text{C}$. Iron was reduced to a bivalent state with hydroxylamine. The optical density of the solutions was measured in a cuvette with a translucent layer 10 mm thick relative to the first reference solution, which did not contain iron, at a wavelength of 510 nm. The results are expressed in milligrams per kilogram dry weight of plants (DW), $\text{mg}\cdot\text{kg}^{-1}$ DW.

2.2.8. Method of Zinc Determination

A photometric method for the determination of iron with dithizone was used. We compared the optical density of a complex compound of zinc with dithizone, extracted with carbon tetrachloride from a solution of ash and reference solutions with a known zinc concentration in accordance with the protocol: Vegetable feeds. Methods for determination of iron (GOST 27998-88, <https://docs.cntd.ru/document/1200024379>, accessed on 30 October 2021). The weight of a plant sample for ashing was 2.00 ± 0.02 g. Ashing was carried out according to a standard technique in a muffle furnace at $525 \pm 25^\circ\text{C}$. The extracts were photometrically measured against the first zinc-free reference solution at a wavelength of 538 nm. Results are expressed in milligrams per kilogram dry weight of plants (DW), $\text{mg}\cdot\text{kg}^{-1}$ DW.

2.2.9. Method of the Mass Fraction of Calcium Determination

Calcium was determined by the flame photometric method in accordance with the protocol: Fodder, mixed fodder and mixed fodder raw material. Methods for determination of calcium—GOST 26570-95 (<https://docs.cntd.ru/document/1200024365>, accessed on 30 October 2021). An air-acetylene gas mixture was used for photometry. The intensity of calcium radiation in a gas-air flame was compared when the test solutions and reference solutions were introduced into it. To eliminate the influence of interfering elements in the hydrochloric acid solution, a magnesium salt was used. The mass of the plant mass for ashing was 2.000 ± 0.001 g. The results are expressed as percentage (%) in dry weight (DW), % in DW.

2.2.10. Method of the Mass Fraction of Phosphorus Determination

The phosphorus content was determined by a photometric method in accordance with the protocol GOST 26657-97 (<https://docs.cntd.ru/document/1200024370>, accessed on 30 October 2021). The plant sample was mineralized by dry ashing with the formation of orthophosphoric acid salts and subsequent photometric determination of phosphorus in the form of a heteropoly acid. The size of the plant sample for ashing was 2.000 ± 0.001 g. Ashing was carried out in a standard way in a muffle furnace at a temperature of 525 ± 25 °C. Ash solutions were prepared using 5 cm³ of a nitric acid solution and 15 cm³ of a coloring solution (a mixture of equal amounts of nitric acid, ammonium vanadium meta, and ammonium molybdate). Photometry was carried out in cuvettes with a translucent layer thickness of 5 mm using a blue light filter with a maximum light transmission in the region of 465 nm.

2.2.11. Method of Moisture Content Determination

Determination of dry weight was carried out by drying to constant weight at a temperature of 105 ± 2 °C.

2.2.12. Method of Vitamin C Determination

A photometric method in accordance with the protocol: Products of fruits and vegetables processing, Methods for determination of vitamin C (GOST 24556-89, <https://docs.cntd.ru/document/1200022765>, accessed on 30 October 2021) was used. The weight of a plant sample was 10.00 ± 0.01 g. The extraction solution was hydrochloric acid with a mass fraction of 2%. Reduction of sodium 2,6-dichlorophenolindophenolate with ascorbic acid was carried out by extraction with an organic solvent amyl acetate with photometry of an organic extract at a wavelength of 500 nm.

2.2.13. Method of the Carotene Determination

Carotene was isolated from the plant mass by extraction with gasoline (petroleum solvent) according to the protocol: Forage. Methods for determining carotin, GOST 13496.17-95 (<https://docs.cntd.ru/document/1200024339>, accessed on 30 October 2021), and gasoline (petroleum solvent) nefras-S 50/170 according to GOST 8505-80 (<https://docs.cntd.ru/document/1200003655>, accessed on 30 October 2021). The color intensity of the extract was measured by photometry using a photoelectric calorimeter with a blue filter and a light transmission of 450 nm.

2.3. Statistical Processing

The obtained data on the main elements of productivity were analyzed by the method of analysis of variance (ANOVA), with the calculation of $LSD_{0.05}$ for the probability level ($p = 0.05$), the sum of squares of deviations (D), variance (s^2), and the strength of the influence of organized factors on the effective trait taking into account the number of degrees of freedom ($n - 1$). The data on the mass fraction of protein, fiber, fat, ash, phosphorus, calcium, trace elements, vitamin C, and carotene were processed using the formula for calculating the standard error (SE) by assessing the reliability of the difference

between the means between the selection samples and the standard using the Student's *t*-test at the probability level $p = 0.05$.

3. Results

To obtain large volumes of raw nettle, which can later be used as feed additives or for the production of phytobiotics, it is necessary to create varieties with a high yield of the aboveground mass. Therefore, in this experiment, important indicators of the quality of varieties were determined (Table 3). In terms of green mass yield, the new cultivars UD 32/06 and UD 12/16 significantly exceeded the Avicenna cultivar during three years of testing by 16.6–22.7% and 23.1–27.8%.

The dry weight yield, which depends on the dry weight content in plant tissues, reflects the direction of metabolic processes and the ability of individuals to adapt to the conditions of the ecotope. In terms of dry weight yield, the sample UD 32/06 also showed a significant excess over the standard during three years of testing, the most significant being in 2019 and 2020 by 20.5 and 28.7%. Sample UD 12/16 in the first year of dry weight yield testing was at the standard level, but, in subsequent years, it also exceeded the standard by 26.9 and 32.7%.

For the widespread introduction of new varieties of nettle into agricultural production in Russia, it is necessary to expand the areas occupied by this valuable crop. Seed growing of dioecious nettle is a complex technological process, at the initial stages requiring a high number of seeds for setting up nurseries for breeding new varieties. Consequently, the yield of seeds and the mass of 1000 seeds are important breeding traits that are used to select stinging nettle.

In terms of seed yield, the new varieties UD 32/06 and UD 12/16 significantly exceeded the variety Avicenna during three years of testing, increasing their productivity gradually over the years by 19.7, 23.7, and 32.0% and 23.2, 28.0, and 40.0%, respectively.

Cultivars UD 32/06 and UD 12/16 also have a higher weight of 1000 seeds, in comparison to Avicenna cultivar.

The results of analysis of variance for the weight of 1000 seeds, yield of green mass, dry weight, and seed yield are shown in Table 4.

For all the studied performance indicators of the main elements of productivity, significant differences were established in the studies ($p < 0.05$).

The different influence of organized factors has been established, both on the yield of the aboveground mass and on the formation of seed productivity. The factor *cultivar* has the maximum effect on the productive attribute *green mass yield* ($h^2x = 87.2\%$). The share of the influence of the factor *conditions of the year*, which also includes the age of individuals of the studied varieties of nettle, does not exceed 11.3%, with a minimum share of the influence of random factors ($h^2x = 1.5\%$). At the same time, the effective indicator *dry weight yield* equally depends on the conditions of the year and the variety ($h^2x = 44.3$ and 43.9% accordingly).

The productive characteristics *seed yield* and weight of 1000 seeds, which comprehensively describe the formation of seed productivity, are most influenced by the factor *cultivar* ($h^2x = 61.6$ and 60.1% accordingly), but, at the same time, the share of the influence of the factor *conditions of the year* on the formation of effective traits of seed productivity is also quite high ($h^2x = 33.8$ and 31.8% accordingly).

Table 3. Indicators of the main elements of productivity of the aboveground mass and seeds of varieties of stinging nettle in 2018–2020.

Cultivar	2018	2019	2020
Green mass yield, kg·m ⁻²			
Avicenna (st)	2.634	2.874	2.779
UD 32/06	3.072	3.400	3.411
UD 12/16	3.366	3.539	3.519
¹ LSD _{0.05}	0.129	0.388	0.327
Ff	92.7	9.3	17.1
F _{0.05}	5.1	5.1	5.1
Dry weight yield, kg·m ⁻²			
Avicenna (st)	0.613	0.683	0.642
UD 32/06	0.683	0.823	0.826
UD 12/16	0.642	0.867	0.852
¹ LSD _{0.05}	0.044	0.115	0.106
Ff	65.1	8.0	13.5
F _{0.05}	5.1	5.1	5.1
Seed yield, g·m ⁻²			
Avicenna (st)	8.85	9.45	10.00
UD 32/06	10.60	11.69	13.20
UD 12/16	10.90	12.10	14.00
¹ LSD _{0.05}	0.37	0.45	0.92
Ff	99.4	113.4	61.1
F _{0.05}	5.1	5.1	5.1
Weight of 1000 seeds, g			
Avicenna (st)	0.186	0.199	0.210
UD 32/06	0.206	0.210	0.233
UD 12/16	0.229	0.218	0.238
¹ LSD _{0.05}	0.005	0.006	0.007
Ff	185.4	25.9	50.2
F _{0.05}	5.1	5.1	5.1

¹LSD_{0.05}—least significant difference; Ff—Fisher’s calculated criterion for the experiment; F_{0.05}—the value of the F-Fisher fit criterion for the significance level of the estimated 5%.

Table 4. The results of analysis of variance of the main elements of productivity of varieties of stinging nettle, on average, in 2018–2020.

Effective Feature	Source of Variation	D	n – 1	s ²	F _f	F _{st0.05}	h ² x
Green mass yield	Cumulative	0.944	8				100.0
	Conditions of the year	0.107	2				11.3
	Cultivar	0.823	2	0.411	117.1	6.9	87.2
	Random	0.014	4	0.004			1.5
Dry weight yield	Cumulative	0.085	8				100.0
	Conditions of the year	0.038	2				44.3
	Cultivar	0.037	2	0.019	7.4	6.9	43.9
	Random	0.010	4	0.002			11.8
Seed yield	Cumulative	23.4	8				100.0
	Conditions of the year	7.9	2				33.8
	Cultivar	14.4	2	7.2	26.8	6.9	61.6
	Random	1.1	4	0.3			4.6
Weight of 1000 seeds	Cumulative	0.0023	8				100.0
	Conditions of the year	0.0007	2				31.8
	Cultivar	0.0014	2	6.84 × 10 ⁻⁴	14.8	6.9	60.1
	Random	0.0002	4	4.6186 × 10 ⁻⁵			8.1

D—sum of squares of deviations (deviant); s²—dispersion; n – 1—the number of degrees of freedom; h²x—the strength influence on the effective sign. Ff—Fischer’s design criterion for experiment; F_{0.05}—Fisher’s F-test value for the significance level of the estimated 5%.

The formation of high yields of the aboveground phytomass depends, first of all, on the morphological characteristics of the aboveground parts of the studied varieties (height, number, size of leaves, etc.), since they determine the formation of the photosynthetically active leaf area.

In addition, breeding work with such a poorly selected crop as stinging nettle requires an assessment of morphological characteristics, because they are the phenotypic characteristic of accessions when evaluated for distinctness, uniformity, and stability.

The results of the assessment of individual morphological breeding characteristics of the variety of specimens of stinging nettle are presented in Table 5 and Figures 3–6.

Table 5. Morphological breeding characteristics of varieties of stinging nettle in 2018–2020.

Cultivar	2018	2019	2020
Foliage, %			
Avicenna (st)	35.25 ± 7.38	30.45 ± 6.05	32.25 ± 4.88
UD 32/06	38.63 ± 4.94	33.30 ± 5.15	35.23 ± 5.73
UD 12/16	53.93 ± 2.79	40.63 ± 2.83	48.90 ± 5.05
The ratio of the length and width of the leaf			
Avicenna (st)	1.76 ± 0.08	1.82 ± 0.09	1.98 ± 0.13
UD 32/06	1.91 ± 0.12	2.15 ± 0.08	2.25 ± 0.07
UD 12/16	1.60 ± 0.11	1.83 ± 0.07	1.90 ± 0.05

Figure 3. Stem length of varieties of stinging nettle, on average, in 2018–2020.

Figure 4. Leaf length of varieties of stinging nettle, on average, in 2018–2020.

Figure 5. Leaf width of varieties of stinging nettle, on average, in 2018–2020.

Figure 6. Length of female inflorescence of varieties of stinging nettle, on average, in 2018–2020.

The cultivar UD 12/16 differed from the specimens of the *Avicenna* cultivar (standard) in the length of the stems, the cultivars of which were lower in years by 25.4, 24.6, and 24.1%, accordingly. Individuals of cultivar UD 32/06 tended to decrease in height, but only in 2018 were they significantly lower than the standard.

In terms of foliage, cultivar UD 12/16 significantly exceeded both the standard and cultivar 32/06 for three years by 51.6–52.9% and 38.8–39.6%, accordingly. Individuals of the cultivar UD 32/06 had a tendency to an increase in the degree of leafiness in comparison with the standard, but did not significantly exceed it.

In terms of leaf length and width, individuals of two promising cultivars UD 32/06 and UD 12/16 significantly exceeded the standard. In particular, by the length of the sheet: by 23.3–35.3% and 44.2–60.8%; and in width: by 14.0–14.3% and 59.8–60.4%, respectively. However, in terms of the ratio of leaf length and width, all cultivars were actually at the standard level during three years of research. The exception was individuals of the variety UD 32/06, in which, in 2019, the indicator was significantly higher than the standard by 18.1%.

For the formation of high seed productivity, an important indicator is the length of the female inflorescence. In promising cultivars UD 32/06 and UD 12/16, the length of the female inflorescences significantly exceeded the size of the inflorescences of the *Avicenna* variety: in 2018—by 274% and 357%; in 2019—by 158% and 216%; and in 2020—203% and 267%.

As a result of analysis of variance, significant differences ($p < 0.05$) were established for all studied effective morphological characters (Table 6).

It was found that the main influence on the formation of morphological traits responsible for aboveground productivity is exerted by the organized factor *cultivar*, that is, these traits are determined by the selection and genetic characteristics of the obtained forms of stinging nettle.

The share of the influence of the factor *cultivar* varies from 55.6% for the effective indicator *ratio of length and width of the sheet* to 99.97% for the indicator *width of the leaf*. At the same time, the share of the influence of the factor *conditions of the year* on the formation of such effective morphological features as *leaf width* and *stem length* does not exceed 0.02–1.4%. The maximum influence of the factor *conditions of the year* was set for the indicator *ratio of leaf length and width*—40.6%.

The factor *cultivar* also influences the formation of the indicator *length of female inflorescence* as much as possible in comparison with *conditions of the year* ($h^2x = 89.3$ and 8.7% accordingly).

Since our research is aimed at obtaining new forms of stinging nettle with high aboveground productivity, an important element of breeding work is the search and creation of forms that will maintain, with a high yield of green mass and dry weight, indicators of the content of nutrients, vitamins, and macro- and microelements at the level standard, *Avicenna*, or exceed it.

As a result of research, new forms of stinging nettle were obtained with a high yield of green mass and dry weight, and the content of nutrients (Figures 7–9), vitamins, macro- and microelements (Figures 10–18) at the level standard, *Avicenna*, or exceeding it.

Table 6. The results of analysis of variance of morphological breeding traits of varieties of stinging nettle, on average, in 2018–2020.

Productive Feature	Source of Variation	D	n – 1	s ²	F _f	F _{st0.05}	h ² x
Stem length	Cumulative	2816.9	8				100.0
	Conditions of the year	39.9	2				1.4
	Cultivar	2770.3	2	1385.2	826.3	6.9	98.3
	Random	6.7	4	1.7			0.2
Foliage	Cumulative	502.3	8				100.0
	Conditions of the year	91.5	2				18.2
	Cultivar	385.8	2	192.9	30.8	6.9	76.8
	Random	25.0	4	6.3			5.0
Leaf length	Cumulative	49.8	8				100.0
	Conditions of the year	6.5	2				13.0
	Cultivar	42.3	2	21.2	84.6	6.9	85.0
	Random	1.0	4	0.2			2.0
Leaf width	Cumulative	16.942	8				100.00
	Conditions of the year	0.004	2				0.02
	Cultivar	16.937	2	8.468	30548.3	6.9	99.97
	Random	0.001	4	0.0003			0.01
The ratio of the length and width of the leaf	Cumulative	0.311	8				100.0
	Conditions of the year	0.126	2				40.6
	Cultivar	0.173	2	0.086	29.0	6.9	55.6
	Random	0.012	4	0.003			3.8
Length of female inflorescence	Cumulative	1665.0	8				100.0
	Conditions of the year	145.0	2				8.7
	Cultivar	1487.1	2	743.6	90.6	6.9	89.3
	Random	32.8	4	8.2			2.0

D—sum of squares of deviations (deviant); s²—dispersion; n – 1—the number of degrees of freedom; h²x—the strength influence on the effective sign. F_f—Fischer’s design criterion for experiment; F_{st0.05}—Fisher’s F-test value for the significance level of the estimated 5%.

Figure 7. The content of crude protein in varieties of stinging nettle, on average, in 2018–2020.

Figure 8. The content of crude fat in varieties of stinging nettle, on average, in 2018–2020.

Figure 9. The content of crude fiber in varieties of stinging nettle, on average, in 2018–2020.

Figure 10. The content of crude ash in varieties of stinging nettle, on average, in 2018–2020.

Figure 11. The content of carotene in varieties of stinging nettle, on average, in 2018–2020.

Figure 12. The content of vitamin C in varieties of stinging nettle, on average, in 2018–2020.

Figure 13. The content of calcium in varieties of stinging nettle, on average, in 2018–2020.

Figure 14. The content of phosphorus in varieties of stinging nettle, on average, in 2018–2020.

Figure 15. The content of iron in varieties of stinging nettle, on average, in 2018–2020.

Figure 16. The content of zinc in varieties of stinging nettle, on average, in 2018–2020.

Figure 17. The content of manganese in varieties of stinging nettle, on average, in 2018–2020.

Figure 18. The content of copper in varieties of stinging nettle, on average, in 2018–2020.

Protein and fat are vital macronutrients that determine the growth, development, and reproductive functions of living organisms. Protein is one of the key indicators of the quality of the aboveground plant mass. The indicator *crude protein* characterizes the total amount of nitrogenous substances, which, in plant tissues, are represented by proteins, free amino acids and amides, nucleic acids, nitrogenous bases, and mineral forms of nitrogen. In the fraction of crude protein, proteins usually account for 60–70% of the total amount of nitrogen, and nonprotein nitrogenous compounds 30–40% (Figure 7).

The groups of substances that are called *crude fat* include, in addition to the actual fat, wax, chlorophyll, resins, dyes, organic acids, phosphatides, sterols, and other compounds that largely determine the energy value of plant materials.

The content of crude protein in dry weight in the Avicenna cultivar did not differ significantly from new cultivars and varied within the range of 21.1–24.2% (crude fat: 2.5–4.2% (Figure 8)).

The main, by weight, but most difficult to assimilate organic matter of plants is carbohydrate fiber. *Crude fiber* is the most difficult to assimilate organic matter of plants. It is usually defined in phytomass and includes a fraction of lignin, which can reduce the nutritional value of the feed. The level of fiber in the standard and cultivars did not exceed 12.0–14.8%.

The pigment content in the cultivars remained fairly stable at the level of 377.3–431.3 $\mu\text{g}\cdot\text{g}^{-1}$ DW. There was a positive tendency towards an increase in the carotene content in the UD 32/06 cultivar by 4.2–6.4% in relation to the standard.

An important indicator of the antioxidant activity of nettle tissues is also the level of ascorbic acid (vitamin C). In our experiments, the content of ascorbic acid in the phytomass of nettle was 182–238.2 $\mu\text{g}\cdot\text{g}^{-1}$. At the same time, the variety UD 32/06 in 2018 and 2020 yielded to the standard for this indicator by 21.8 and 9.7%, and the variety UD 12/16 was at the level of the variety Avicenna.

Calcium, phosphorus, iron, zinc, copper, and manganese are essential minerals in poultry nutrition. Up to 99% of calcium in the body of birds is contained mainly in the bone tissue in the form of phosphate salts. Iron is part of hemoglobin; copper, zinc, iron, and manganese are part of the most important redox enzymes that regulate plastic and energy metabolism. Moreover, all macro- and microelements are closely related to each other in the regulation of metabolic processes: phosphorus ensures the absorption of calcium; manganese is involved in the regulation of phosphorus–calcium metabolism, etc. Their deficiency reduces protein metabolism and causes a number of nutritional diseases—rickets, muscular dystrophy, reduces egg production; copper deficiency causes indigestion; lack of iron causes anemia; zinc deficiency leads to edema and dermatitis; lack of manganese leads to disruption of endocrine functions, etc. [46].

In the studied varieties, the content of calcium was 0.723–0.840%, phosphorus: 0.412–0.474%, iron: 323.6–355.8 $\text{mg}\cdot\text{kg}^{-1}$ DW, zinc: 23.7–34.8 $\text{mg}\cdot\text{kg}^{-1}$ DW, copper: 3.8–5.4 $\text{mg}\cdot\text{kg}^{-1}$ DW, and manganese: 42.4–54.2 $\text{mg}\cdot\text{kg}^{-1}$ DW (Figures 13–18).

Analysis of variance of the content of the main nutrients in the aboveground mass of varieties of stinging nettle made it possible to establish that significant differences ($p < 0.05$) were established only for such effective traits characterizing the nutritional value of the forage mass as *crude fat*, *crude fiber*, *carotene*, *calcium*, *phosphorus*, and *iron* (Table 7).

Table 7. Results of analysis of variance for the content of the main nutrients in the aboveground mass of varieties of stinging nettle, on average, in 2018–2020.

Productive Feature	Source of Variation	D	n – 1	s ²	F _f	F _{st0.05}	h ² x
Crude protein	Cumulative	10.56	8				100.0
	Conditions of the year	9.62	2				91.1
	Cultivar	0.55	2	0.27	2.8	6.9	5.2
	Random	0.39	4	0.10			3.7
Crude fat	Cumulative	4.05	8				100.0
	Conditions of the year	0.11	2				2.7
	Cultivar	3.93	2	1.96	196.5	6.9	97.1
	Random	0.01	4	0.01			0.2
Crude fiber	Cumulative	8.14	8				100.0
	Conditions of the year	5.13	2				63.0
	Cultivar	2.77	2	1.38	22.5	6.9	34.0
	Random	0.25	4	0.06			3.0
Vitamin C	Cumulative	2393.4	8				100.0
	Conditions of the year	144.9	2				6.1
	Cultivar	1274.8	2	637.4	2.6	6.9	53.3
	Random	973.7	4	243.4			40.7

Table 7. Cont.

Productive Feature	Source of Variation	D	n – 1	s ²	F _f	F _{st0.05}	h ² x
Carotene	Cumulative	3385.7	8				100.0
	Conditions of the year	2707.1	2				80.0
	Cultivar	542.0	2	271.0	7.9	6.9	16.0
	Random	136.6	4	34.1			4.0
Crude ash	Cumulative	5.27	8				100.0
	Conditions of the year	3.40	2				64.5
	Cultivar	1.32	2	0.66	4.8	6.9	25.1
	Random	0.55	4	0.14			10.4
Calcium	Cumulative	0.020	8				100.0
	Conditions of the year	0.002	2				8.5
	Cultivar	0.018	2	0.009	116.4	6.9	90.0
	Random	3.1×10^{-4}	4	7.64×10^{-5}			1.5
Phosphorus	Cumulative	0.004	8				100.0
	Conditions of the year	0.003	2				83.8
	Cultivar	4.58×10^{-4}	2	2.29×10^{-4}	7.9	6.9	12.9
	Random	1.15×10^{-4}	4	2.88×10^{-5}			3.3
Iron	Cumulative	1160.5	8				100.0
	Conditions of the year	23.8	2				2.1
	Cultivar	1114.3	2	557.1	99.6	6.9	96.0
	Random	22.4	4	5.6			1.9
Zinc	Cumulative	135.4	8				100.0
	Conditions of the year	113.1	2				83.5
	Cultivar	5.7	2	2.8	0.7	9.1	4.2
	Random	16.7	4	4.2			12.3
Copper	Cumulative	4.20	8				100.0
	Conditions of the year	2.38	2				56.8
	Cultivar	0.44	2	0.22	0.6	9.1	10.5
	Random	1.37	4	0.34			32.7
Manganese	Cumulative	354.0	8				100.0
	Conditions of the year	244.1	2				69.0
	Cultivar	7.5	2	3.8	0.14	9.1	2.1
	Random	102.3	4	25.6			28.9

D—sum of squares of deviations (deviant); s²—dispersion; n – 1—the number of degrees of freedom; h²x—the strength influence on the effective sign. F_f—Fischer's design criterion for experiment; F_{st0.05}—Fisher's F-test value for the significance level of the estimated 5%.

Assessment of the share of the influence of individual organized factors on the formation of qualitative indicators of the aboveground mass of stinging nettle was different.

The share of the influence of the factor *cultivar* on the resultant signs of the quality of the aboveground mass of nettle varies from h²x = 2.1% to h²x = 97.1% and increases in the order: manganese, zinc, crude protein, copper, phosphorus, carotene, crude ash, vitamin C, crude fiber, calcium, iron, crude fat.

The share of the influence of the factor *conditions of the year* on the resultant signs of the quality of the aboveground mass of nettle varies from h²x = 2.1% to h²x = 91.1% and increases in the order: iron, crude fat, vitamin C, calcium, copper, crude fiber, crude ash, zinc, phosphorus, manganese, carotene, crude protein.

4. Discussion

Despite its many advantages, nettle is still an underestimated plant source of many valuable substances. The value of nettle is determined by the level of biologically active substances in its tissues. These are substances that are actively involved in the physiological regulation of the plant organism. They are responsible for plant immunity, resistance

to a number of unfavorable environmental factors (drought, temperature changes, soil salinity, or acidification), improve seed setting, etc. They also play an important role in the life of animal organisms, because they are part of enzymes. Most biologically active substances are not produced by organisms of animals and poultry, but come exclusively with plant foods.

Carotene is one of the most widespread biologically active substances in plant tissues. In plants, this pigment is necessary for the processes of photosynthesis and reproduction, and for the implementation of redox reactions. Carotene in the body of a bird is a precursor of vitamin A, a deficiency of which leads to visual impairment, a decrease in reproductive functions, etc. This study confirmed the results of other researchers [46,47] and show that processed nettle is rich in carotene, calcium, iron, protein, zinc, and manganese, which were found in all varieties of common nettle tested.

Much research is being conducted on the possibilities of transforming a common weed into a useful plant with a wide range of applications. The properties of nettle make it used in functional foods, dietary supplements [46], and pharmacological preparations; it shows activity against both Gram-positive and Gram-negative bacteria. The antimicrobial activity of active compounds contained in nettle makes it possible to use this valuable plant in food and feed preparations [46–49].

The effectiveness and final profitability of nettle cultivation can be decisively influenced by the original soil and climatic conditions, but, in the end, also by the quantity of the yield and the quality of the final product. This quality is reflected in the content of protein, fat, fiber, and vitamins (C, K, D) and minerals: K, P, Mg, Ca, Fe, Zn.

Crude fiber, which is usually determined in phytomass, includes a fraction of lignin, which can reduce the nutritional value of feed [38,50].

An increase in fiber content usually leads to a decrease in the content of digestible forms of carbohydrates (mono-, oligo-, and polysaccharides, primarily starch), as well as protein compounds. The level of fiber in the standard and cultivars did not exceed 12.0–14.8%.

The dry weight yield depends on both the genotype [44,51] and the growing conditions and time of harvesting the aboveground mass of nettles [2,52–54]. According to the literature, nettle yields range from 6–15 t·ha^{−1}, which depends on the level of fertilization, agronomic treatments, soil type (nutrient abundance), and nettle clones [55]. In this study, dry weight yield for Avicenna, UD 32/06, and UD 12/16 varieties ranged from 6.13 to 6.42 t·ha^{−1}, 6.83 to 8.26 and 6.42 t·ha^{−1}, respectively. This research was conducted in the territory of the continental climate zone on soils rich in humus and with annual precipitation over 500 mm, but no fertilizers were used.

Virgilio et al. 2014 [5] obtained even twice lower yields, namely 3 t·ha^{−1} dry weight yield at low inputs, with a maximum result of 12 t·ha^{−1}. However, Jankauskienė and Gruzdevienė [55] obtained similar and more than twice higher yields, depending on sowing width and similar soil phosphorus and potassium abundance, with additional N:P:K 16:16:16 fertilization at 200 kg·ha^{−1} [55]. According to them, cultivated nettle at a sowing width of 60 × 100 cm had yields two to three times higher than from nettle from wild habitats. The level of fiber in standard and cultivar samples in our study did not exceed 14.8%, while, in studies of German cultivar selectors, e.g., Bredemann cultivar, conducted to obtain the highest possible fiber content, it ranged from 5 to 17% [55].

Analyses of composition and bioactive compounds in Nepalese nettle showed crude protein of 33.8%, crude fiber of 9.1%, crude fat of 3.6%, total ash of 16.2%, and carbohydrate of 37.4% [56]. In our study, these amounts were, respectively, crude protein from 21.1% (Avicenna) to 24.2% (UD 12/16), crude fat from 2.5% (Avicenna) to 4.4% (UD 12/16), crude fiber from 12.0% (Avicenna) to 14.8% (UD 12/16), total ash from 15.0% (Avicenna) to 17.6% (UD 32/06). The values obtained were similar to the results of other authors' studies.

Nencu I. et al. (2015) found low carotenoid content and, in our study, the carotene content was stable enough at 377.3–431.3 µg·g^{−1} [57].

The chemical composition, amounts of biologically active substances, and changes in antioxidant activity during the growing season of wild common nettle (*Urtica dioica* L.) depending on the harvest date were investigated by Paulauskienė et al. (2021) [53]. Total ascorbic acid content (AAC) in fresh weight in nettle leaves ranged from 8.17 mg·100 g⁻¹ in April to 0.58 mg·100 g⁻¹ in September. The values reported in the literature were from 16.00 to 112.80 mg·100 g⁻¹ of fresh weight or oven-dried to 238 mg·100 g⁻¹, which may have been affected by the weather during the growing season [2,5,58,59]. In this study, the AAC in nettle leaves ranged from 182.3 (UD 32/06) to 238.2 (UD 12/16) µg·g⁻¹ DW. Thus, these results are similar to those obtained by the cited authors.

5. Conclusions

1. The research results prove the usefulness of nettle cultivation. By choosing the right variety, satisfactory productivity, i.e., nutrient, mineral, and vitamin content, is possible to obtain.
2. The research results obtained in our study show the advantages of the modified nettle cultivars over the Avicenna cultivar.
3. Avicenna cultivar and new cultivars of stinging nettle UD 32/06 and UD 12/16, obtained from the source material collected in the Cretaceous south of the Central Russian Upland, by their nutritional properties, can become the basis for obtaining phytobiotics for the poultry industry.
4. Biological resources of wild forms of *U. dioica* L. from the European south of Russia are a valuable source material for obtaining varieties with high productivity of above-ground mass and stable seed productivity. They provide a high-quality dry weight yield at the level of 0.613–0.683 kg·m⁻² and seed productivity of 8.85–10.00 g·m⁻².
5. The share of the influence of the genotype of nettle varieties on the quality of the above-ground mass is significantly higher than the influence of the conditions of the year (the accounted strength influence was from 91.1 to 97.1%). This indicates the crucial importance of breeding methods for improving the quality of nettle raw materials.

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