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Effect of Drip Fertigation with Nitrogen on Yield and Nutritive Value of Melon Cultivated on a Very Light Soil

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Abstract: Most species of Cucurbitaceae respond favorably to irrigation, especially when combined with fertilizers. The effect of drip irrigation combined with nitrogen fertigation in melon grown on a very light soil in Central Poland, during 2013–2015, was evaluated. The field experimental design was a split-plot with four replications. Two factors were studied: (1) irrigation treatments applied in two combinations—drip irrigation + broadcast nitrogen fertilization (control), and drip irrigation + fertigation with nitrogen; (2) two cultivars—Melba and Seledyn. The total marketable yield of fruits, weight of a single fruit, and the concentration of dry matter, total sugars, monosaccharides, ascorbic acid, total carotenoids, and polyphenols were evaluated. Tested factors presented a significant effect both on the yield and nutritive value characteristics. Drip irrigation combined with nitrogen fertigation, comparing to the control, notably improved yields and nutritional value of fruits. Seledyn produced better yields than Melba. This study shows that on very light soil, with low water and nutrient retention capacity, melon should be drip-irrigated and nitrogen-fertigated to obtain the best cultivation results.

Keywords: *Cucumis melo* L.; chemical composition; cultivar; drip irrigation; fruit quality

1. Introduction

Melon (*Cucumis melo* L.) belongs taxonomically to the Cucurbitaceae family, which also includes vegetables, such as cucumber, pumpkin, squash, watermelon, and gourds. In many countries around the world, melon fruit is of considerable economic importance. World production of this species in 2018 was estimated at 40 million tons per year. The main melon-producing country is China (12.7 million tons per year), followed by Turkey, Iran, and India (1.8 to 1.2 million tons per year) [1].

There are many cultivars of melon, which differ mainly in shape, color, and taste [2]. Melon fruits are valuable in terms of nutritional and bioactive properties. This species is a very good source of carotenoids (α -, β -carotene, and β -cryptoxanthin), folic acid, pectins, as well as many vitamins (including B group) and minerals (mostly potassium, iron, and magnesium), polyphenols, such as flavonoids and phenolic acids, and fatty acids (including oleic, linoleic, and palmitoleic acids). Melon is a fruit appreciated not only for its taste and dietary qualities, but also its healing properties, thanks to which it is also used in the cosmetics industry [3–6].

In Poland, due to unfavorable climatic conditions, the melon is grown as a non-commercial species. However, the interest in melon cultivation is clearly growing every year. Currently, the Polish National List of Vegetable Plant Varieties includes seven cultivars that are suitable for cultivation in Poland, and their number is systematically growing [7]. This species is photophilous and thermophilic, with a very high water requirement. Melon plants are very sensitive to spring and autumn frosts, which negatively affect growth and development, and thus also the fruit yield [8]. The highest sensitivity of melon plants to water deficit is observed during the fruit setting period [9].

Due to the rising interest in melon growing in Poland, it is necessary to broaden the knowledge about the methods of its cultivation in temperate climatic conditions. Field production of melon largely depends on the thermal conditions and precipitation during the growing season. An important factor in obtaining high- and good-quality crops is ensuring optimal soil moisture during the vegetation period of this species. In Poland, the water requirements of plants from the Cucurbitaceae family are estimated at around 400 mm during the growing season. The main reason for the high water needs of plants belonging to this family is their high fertility and the production of much aboveground mass with a high coefficient of transpiration (as the ratio of the amount of water excreted to the production of dry matter) [10]. It is generally accepted that irrigation significantly affects both the melon yield and the components of the melon yield grown under semi-arid climatic conditions [9,11–13]. Many studies have shown that the field cultivation of melon should be carried out using irrigation treatments [11–16]. It was found that production factors such as water and nutrients (nitrogen, phosphorus, potassium) most often limit the possibility of obtaining a higher yield of melon fruit [17,18]. Drip irrigation combined with fertigation is a good way to increase the efficiency of water use and yield of Cucurbitaceae. It was also found that drip irrigation performed during the cultivation of Cucurbitaceae and other vegetables sensitive to climatic conditions during the growing season clearly increases their nutrient concentration [19,20]. Drip fertigation ensures precise administration of appropriate amounts of nutrients directly to the root zone. Accurate and uniform application of macro- and micronutrients adequately meets the needs of crops during the growing season [21–23].

The objective of this study was to evaluate the effect of drip irrigation combined with nitrogen fertigation on the melon fruit yield and nutritive value characteristics. As a control, drip irrigation combined with broadcast fertilization was used. The total marketable yield of fruits, weight of a single fruit, and the concentration of dry matter, total sugars, monosaccharides, ascorbic acid, total carotenoids, and polyphenols of two melon cultivars (Melba and Seledyn) were evaluated. The experiment was carried out on very light soil in a region of high precipitation deficit; hence, the advisability of irrigation treatments in this area is justified.

2. Materials and Methods

2.1. Field Experiment Description

The field experiment involving the drip fertigation of two melon (*Cucumis melo* L.) cultivars, namely Melba and Seledyn, was conducted in Kruszyn Krajeński near Bydgoszcz 53°04′53″ N, 17°51′52″ E (Central Poland). The area has precipitation deficits, an extremely unfavorable water balance, and high frequency of long periods without rainfall [19,22–29]. The study was carried out in the years 2013–2015. The plants were grown using standard

crop management practices recommended for melon cultivation in Poland. The study was carried out on very light soil with a weak and very weak rye–soil complex. Based on the percentage content of individual granulometric fractions, this soil was classified as sand [30]. The soil of the experimental field contained such fractions as: sand—86.97% (from 2.0 mm to 0.05 mm), silt—12.28% (from 0.05 mm to 0.002 mm), and clay 0.75% (<0.002 mm). The average content of total organic carbon and concentration total nitrogen in the soil was 9.6 g kg^{-1} and 0.9 g kg^{-1} , respectively. The experimental soil was characterized by a low capacity for water retention. The water reserve to 0.6 m depth of soil at field capacity was 72.7 mm, at wilting point 29.1 mm, and the available water 43.6 mm.

The experiment was conducted as a split-plot design with four replications. Two factors were used in the study. The first factor was the drip fertigation with nitrogen applied in two combinations: (1) drip irrigation + broadcast nitrogen fertilization (control); (2) drip irrigation + fertigation with nitrogen. The second factor was two melon cultivars: Melba and Seledyn.

Melon seedlings were transplanted at 0.6 m within rows and 1.6 m between rows. The area of each harvest plot was 12 m^2 and included 15 melon plants, and the whole experimental plot size was 274 m^2 . Before planting the seedlings, cultivating and harrowing were performed. The fertilization consisted of $120:100:150 \text{ kg ha}^{-1}$ of nitrogen: phosphorus: potassium. The fertilization of phosphorus and potassium was carried out every year in early spring. The doses of potassium (potash salt) and phosphorus (superphosphate) fertilization depended on the abundance of these nutrients in the soil, based on the soil analysis carried out each year. Nitrogen fertilization (ammonium nitrate) was applied in three doses of 40 kg N ha^{-1} during the growing season for both variants of fertilization. Fertigation was carried out using a proportional fertilizer dispenser. Drip irrigation and drip fertigation were carried out using the “T-Tape” drip line with a distance of 20 cm between the emitters. The efficiency of a single emitter was 1 l h^{-1} . The distance between the drip lines was 1.6 m. Water from the subsurface well was used for irrigation. The quality and physical and chemical properties of the irrigation water used complied with the quality standards for irrigation water. Drip irrigation was started when the water potential in the soil was close to -40 kPa and finished when the water potential in the soil was close to -10 kPa . The end of irrigation treatments was determined on the basis of soil water potential at field water capacity, measured with a tensiometer. The tensiometers have been installed at every variant of the experiment at the depth of 25 cm. The dates of planting during the particular growing seasons were in the second week of June. Harvesting took place at the physiological stage of fruit ripeness (from the beginning of 3rd week of August till 1st week of September). Ripe fruits were picked progressively as they matured. In the experiment, the total marketable yield of melon fruits (t ha^{-1}) and weight of single melon fruit (kg) were assessed.

2.2. Nutritive Value Assessment

To carry out a nutritional assessment the fresh melon fruits, one fruit from all plants in one plot was cut into a 5 cm wedge and then cut into 1-cm-thick slices. The frozen material was lyophilized (model Alpha 1–4 LDplus, Donserv, Warszawa, Poland), in order to achieve a permanent weight, and then it was ground to a fine powder (the particles were 0.3–0.5 mm in size) and was milled using the ultracentrifuge (Model FW177, Chemland, Stargard, Poland). The ground samples were stored in the dark, in bags, which were placed in desiccators for further analysis.

The total dry matter content of ‘Melba’ and ‘Seledyn’ melon fruits was determined using the drying technique according to the methodology of the Association of Official Analytical Chemists [31].

Carbohydrate analyses were performed according to Talburt and Smith’s [32] procedures. For reducing sugar concentration assessment, one gram of freeze-dried material sample was placed in a 250 mL bottle; 150 mL of distilled water was then added and it was shaken vigorously. One milliliter of the filtrate was mixed with 3 mL of DNP reagent

in a test tube and then heated in a water bath at 95 °C for 6 min. Absorbance of the mixture was measured using a spectrophotometer at a wavelength of 600 nm. The reducing sugar concentration was then estimated using the standard curve of glucose. The total soluble carbohydrate was determined after hydrolysis of sugars. After filtration, 40 mL of the filtrate was taken, and 2 drops of concentrated HCl were added. The samples were warmed in a water bath for 30 min. After cooling, the mixture was neutralized using concentrated NaOH until pH 8.0 was reached. Next, 1 mL of the filtrate was mixed with 3 mL of DNP reagent and the procedure for determining the concentration of reducing sugars was followed. The results were converted to fresh weight taking into account the percentage of dry weight in the fresh matter.

Ascorbic acid reducing sugar concentration was assessed according to Kapur et al. [33]. Ten grams of fresh melon sample was homogenized with 25 mL of 2% oxalic acid solution and quantitatively transferred into a 50 mL volumetric flask and shaken gently to homogenize the solution. Then, it was diluted up to the mark with oxalic acid solution. The obtained solution was then filtered and centrifuged at 4000 rpm for 15 min, after which the supernatant solution was used for spectrophotometric determination (UV-1800, UV Spectrophotometer System, Shimadzu, Kyoto, Japan) of ascorbic acid concentration. Ascorbic acid is oxidized to dehydroascorbic acid by adding bromine water. After this, L—dehydroascorbic acid reacts with 2,4—DNPH and produces an osazone, which, treated with 85% H₂SO₄, forms a red-colored solution. A typical calibration plot was made and used to determine the concentration of ascorbic acid in the investigated samples.

Total carotenoids in melon samples were extracted by procedures described by Herrero-Martinez et al. [34]. Ten grams of lyophilized melon was blended with 100 mL saturated anhydrous sodium carbonate and mixed with a mechanical blender. Ten grams of the mixture was transferred into a centrifuge tube, 20 mL tetrahydrofuran was added, and it was mixed for 2 min under cold water. The mixture was centrifuged at 5000 rpm for 5 min and the supernatant was collected. Extraction was performed by adding 15 mL dichloromethane and 15 mL of 10% w/v NaCl into the supernatant and shaking it for 2 min. The extraction was repeated twice; the organic layer was collected and evaporated under nitrogen steam. The residue was kept at −20 °C, reconstituted with 5 mL dichloromethane, and diluted (1/40-fold) with dichloromethane prior UV measurements (Shimadzu UV-1800, UV-Vis spectral photometer system, Japan). Detection was performed at 450 nm according to the procedure reported in the Polish Standard [35]. Standard β-carotene for identification was prepared in dichloromethane to obtain 4 µg mL^{−1}.

Total phenolic reducing sugar concentration was determined using the Folin–Ciocalteu reagent (Sigma-Aldrich, Darmstadt, Germany) according to the method of Singleton and Orthofer [36]. A volume of 0.5 mL of Folin–Ciocalteu reagent previously diluted with distilled water (1:10) was mixed with 0.1 mL of each sample. The solution was allowed to stand for 5 min at 25 °C before adding 1.7 mL of sodium carbonate solution (20%). Then, 10 mL of distilled water was added to the mixture, and the absorbance was measured at λ = 735 nm after 20 min of incubation with agitation at room temperature. Results were expressed in mg of gallic acid equivalents (GAE) per kg of fresh sample.

2.3. Statistical Analysis

All the experimental data were tested for differences by two-way ANOVA using of Statistica® 13.1 package. The significance of differences (LSD—lowest significant difference) was evaluated using the Tukey multiple confidence intervals for the significance level of $p = 0.05$.

2.4. Weather Conditions

The average air temperature in Kruszyn Krajeński in the vegetation period, i.e., from 1 April to 30 September in the years 2013–2015, was 14.9 °C and was 0.3 °C higher than the mean for the long-term period 1986–2015 (Table 1). The warmest month of the growing season in 2013–2015 was July, with a mean temperature of 19.6 °C (0.8 °C above the mean

for long-term period). In 2014, the highest average air temperature (15.4 °C) was recorded, which was 0.8 °C higher compared to the mean for the long-term period.

Table 1. Average air temperature (°C) data during the vegetation period of Melba and Seledyn melon cultivars in the years 2013–2015.

Study Years	Months of Vegetation Period						Mean
	IV	V	VI	VII	VIII	IX	
2013	7.0	14.2	17.4	18.9	18.1	10.7	14.4
2014	9.9	13.3	16.0	21.5	17.2	14.4	15.4
2015	7.5	12.4	15.7	18.5	20.9	13.8	14.8
Mean for 2013–2015	8.1	13.3	16.4	19.6	18.7	10.0	14.9
Mean for long-term period 1986–2015	8.1	13.3	16.3	18.8	18.0	13.1	14.6

The mean sum of precipitation in Kruszyn Krajeński in the period from 1 April to 30 September, for the years 2013–2015, amounted to 279.2 mm and was 31.4 mm lower than the mean for the long-term period 1986–2015 (Table 2). The highest precipitation during the vegetation period occurred in 2013 and amounted to 354.3 mm (43.7 mm above the mean for the long-term period). In the 2015 growing season, the lowest total precipitation was recorded, amounting to 193.3 mm, and was 117.3 mm below the mean for the long-term period. The mean precipitation in April, June, July, and August in 2013–2015 was lower than the mean for the long-term period. The highest monthly precipitation (91.7 mm in May and 79.0 mm in July) was noted in the growing season of 2013.

Table 2. Precipitation (mm) data during the vegetation period of Melba and Seledyn melon cultivars in the years 2013–2015.

Study Years	Months of Vegetation Period						Sum
	IV	V	VI	VII	VIII	IX	
2013	13.6	91.7	49.3	79.0	56.6	64.1	354.3
2014	40.7	65.7	44.9	55.4	57.3	25.9	289.9
2015	15.6	21.6	33.0	50.4	20.3	52.4	193.3
Mean for 2013–2015	23.3	59.7	42.4	61.6	44.7	47.5	279.2
Mean for long-term period 1986–2015	26.9	50.2	54.9	71.4	59.7	47.5	310.6

2.5. Irrigation Water Rates

The seasonal irrigation water rates used in the growing of Melba and Seledyn melon cultivars were inversely proportional to rainfall amount during the irrigation period. Relationship between precipitation (mm) and seasonal irrigation water rates (mm) of Melba and Seledyn melon cultivars in June–August in the years 2013–2015 is shown in Figure 1. The melon irrigation period, mean for 2013–2015, began on 13 June and ended on 4 August and lasted for an average of 53 days. The shortest irrigation period, only 11 days, was carried out in 2013. On average, in 2013–2015, during the irrigation period, 14 single waterings took place. The average seasonal dose, in the years 2013–2015, was 142.2 mm and ranged from 104.5 mm in 2013 to 169.0 mm in 2014. Both experimental treatments received the same amount of irrigation water.

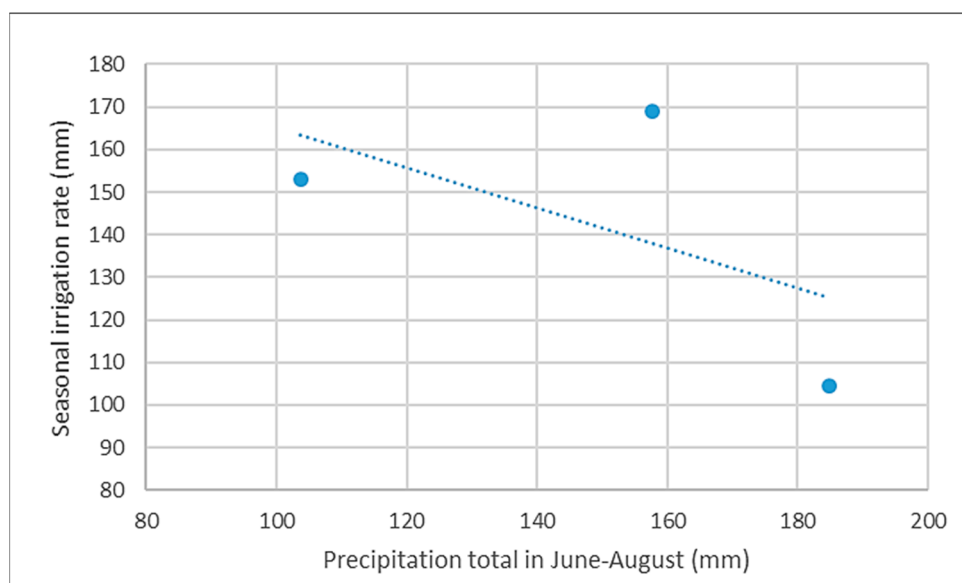


Figure 1. Relationship between precipitation (mm) and seasonal irrigation water rates (mm) of Melba and Seledyn melon cultivars in June–August in the years 2013–2015.

3. Results and Discussion

In the control field (the drip irrigation combined with broadcast nitrogen fertilization), the mean total marketable melon yield in the years 2013–2015 was 26.38 t ha^{-1} and 32.69 t ha^{-1} for Melba and Seledyn cultivars, respectively (Table 3). On average, for the two studied melon cultivars, the highest marketable fruit yield was recorded in 2014. With the drip irrigation and broadcast nitrogen fertilization, the marketable yield was 34.95 t ha^{-1} , and in the field with the drip irrigation and fertigation with nitrogen, the yield of fruits was 39.85 t ha^{-1} . The lowest values of this parameter were recorded in 2015, when the marketable yield was 19.96 t ha^{-1} and 22.68 t ha^{-1} , respectively, for the control and for drip irrigation combined with nitrogen fertigation. Compared to the control, the liquid fertigation significantly increased the fruit yield of Melba and Seledyn cultivars by 12.5% and 13.6%, respectively. There was no significant interaction between irrigation treatment and cultivars.

Table 3. Influence of drip fertigation on the total marketable yield of fruits (t ha^{-1}) of Melba and Seledyn melon cultivars in the years 2013–2015.

Irrigation Treatment	Cultivar	Years of Study			Mean for 2013–2015
		2013	2014	2015	
Drip irrigation + broadcast nitrogen fertilization (control)	Melba	32.47	31.62	15.04	26.38
	Seledyn	34.92	38.27	24.89	32.69
	Mean	33.70	34.95	19.96	29.54
Drip irrigation + nitrogen fertigation	Melba	35.37	35.66	18.01	29.68
	Seledyn	39.95	44.04	27.36	37.12
	Mean	37.66	39.85	22.68	33.40
LSD _{0.05} for irrigation treatment ¹		2.182	4.624	1.828	1.902
LSD _{0.05} for cultivar		1.913	2.380	2.053	2.198
Interaction		n.s.	n.s.	n.s.	n.s.

¹ LSD = the lowest significant difference (Tukey's confidence half-interval) at $p < 0.05$; n.s.—not significant at $p < 0.05$.

Some studies have previously confirmed the beneficial effect of irrigation combined with fertilization on the development of plants of the Cucurbitaceae family during cultivation on light soils. The marketable yield of watermelon grown on light soil in Central Poland under the influence of irrigation combined with nitrogen fertilization increased

by an average of 21% [23]. In addition, in the cultivation of watermelon performed in semi-arid regions of Brazil, on the sandy soil with low retention capacity of water and low nutrient levels, the authors reported a significant effect of irrigation and nitrogen fertigation on the plant growth, increasing the yield by 64% [37]. In the study presented in this paper, the marketable yield of melon fruits was comparable to the yields obtained in research performed in other soil and climate conditions in other regions of the world. In a study carried out in Turkey, the yield of melon ranged from 18.0 t ha⁻¹ to 32.4 t ha⁻¹ depending on the irrigation method [38], and from 8.2 t ha⁻¹ to 43.8 t ha⁻¹ depending on the year of research and the type of irrigation system [39]. In an experiment carried out under field conditions with furrow irrigation in Northwest China, near to the Tengger desert, the yield of melon ranged from 19.6 t ha⁻¹ to 27.8 t ha⁻¹ [40]. In research performed in Northern Jordan, melon fruit yields ranged from 15.6 t ha⁻¹ to 23.5 t ha⁻¹ depending on irrigation quantity [41]. In other studies carried out in Turkey, different irrigation systems and nitrogen levels affected the fruit yield of melon [42]. In the above research, by analyzing different levels of melon irrigation and fertilization, positive effects of combining nitrogen fertilization at a dose 60 kg N ha⁻¹ and drip irrigation were observed. As a result of these experiments, the fruit yield of melon was 59.77 t ha⁻¹.

In the present study, a significant influence of the cultivar on the marketable yield of melon fruit was also noticed. The marketable yield of fruits of the Seledyn cultivar was higher by 24.5% compared to the Melba cultivar. Significant relationships between the yield characteristics and the cultivar of watermelon have already been observed in previous studies, the purpose of which was to compare the effects of irrigation and fertilization on the fruit yield [23,43,44].

The increase in the marketable yield of melon fruits results primarily from a significant increase in the single fruit weight. The lowest total marketable yield of fruits and weight of a single fruit was obtained in 2015 (Tables 3 and 4). According to meteorological data, 2015 was very dry. The total rainfall in the period from April to September was only 193.3 mm (62% of the mean for the long-term period 1986–2015). The average air temperatures during the growing season in April, May, June, and July were lower than the mean for the long-term period, 1986–2015, by 0.6 °C, 0.9 °C, 0.6 °C, and 0.3 °C, respectively (Table 1). Water deficits negatively affect the development of the melon, as it is a photophilous and thermophilic species, with a very high water requirement [8,9]. The melon plants of the Seledyn cultivar produced fruits of significantly greater weight than the plants of the Melba cultivar (Table 4). The use of drip fertigation with nitrogen significantly increased the average melon fruit weight of both the Melba cultivar by 0.12 kg (average fruit weight 0.76 kg) and the Seledyn cultivar by 0.19 kg (average fruit weight 1.15 kg). There was no significant interaction between irrigation treatment and cultivar. Melba is an early cultivar with an average weight of one fruit ranging from 0.5 kg to 0.7 kg [8]. In turn, the Seledyn cultivar is one of the very early ones with fruit larger than Melba, weighing up to 1.4 kg. For comparison, in the study carried out in Turkey, depending on the irrigation method, the weight of melon fruit ranged from 0.8 kg to 1.2 kg [38].

The nutritive values of melons are presented in the Table 5. The content of dry matter, total sugars, monosaccharides, ascorbic acid, total carotenoids, and polyphenols depended on both studied factors: drip irrigation and the cultivar. Drip irrigation combined with nitrogen fertigation significantly increased the concentration of studied components in relation to the control: for dry matter, by 1.7 points on average, total sugars by 14.1 points, monosaccharides by 17.3 points, ascorbic acid by 10.4 points, total carotenoids by 4.5 points, and total polyphenols by 10.8 points. In the study published by Ouzounidou et al. [45], melon fruit concentrated up to 5.1 g 100 g⁻¹ fresh weight of monosaccharides and from 0.8 g 100 g⁻¹ fresh weight to 4.0 g 100 g⁻¹ fresh weight of saccharose (total sugars). In the present experiment, similar results were obtained if we converted our figures into g 100 g⁻¹ fresh weight; the levels of total carbohydrates and monosaccharides in the edible parts of melon were significantly affected by the cultivar and irrigation treatments. Seledyn contained significantly more dry matter, total sugars, and monosaccharides than Melba. In

the studies presented by Wichrowska et al. [46], irrigation also had a positive effect on the concentration of reducing sugars and vitamin C in Cucurbitaceae, as in the present study. Melba contained significantly more ascorbic acid, total carotenoids, and polyphenols than Seledyn. Ouzounidou et al. [45] reported that the L-ascorbic acid concentration of melon fruit ranged from 13 mg 100 g⁻¹ fresh weight to 28 mg 100 g⁻¹ fresh weight. Substantially lower concentrations of this acid, in the range of 8 mg 100 g⁻¹ fresh weight to 13 mg 100 g⁻¹ fresh weight, were noted by Lin et al. [47]. The results of ascorbic acid concentration in the presented studies ranged between 14.5 mg 100 g⁻¹ fresh weight and 20.3 mg 100 g⁻¹ fresh weight and depended also on the irrigation treatment. Moreover, irrigation with fertilization increased the concentration of nutrients also in *Cucurbita maxima* Duch. [22].

Table 4. Influence of drip fertigation on the single fruit weight (kg) of Melba and Seledyn melon cultivars in the years 2013–2015.

Irrigation Treatment	Cultivar	Year of Study			Mean for 2013–2015
		2013	2014	2015	
Drip irrigation + broadcast nitrogen fertilization (control)	Melba	0.55	0.87	0.50	0.64
	Seledyn	0.93	1.26	0.69	0.96
	Mean	0.74	1.06	0.59	0.80
Drip irrigation + nitrogen fertigation	Melba	0.79	0.94	0.56	0.76
	Seledyn	1.17	1.39	0.89	1.15
	Mean	0.98	1.17	0.73	0.96
LSD _{0.05} for irrigation treatment ¹		0.175	0.100	0.109	0.133
LSD _{0.05} for cultivar		0.199	0.168	0.096	0.134
Interaction		n.s.	n.s.	n.s.	n.s.

¹ LSD = the lowest significant difference (Tukey's confidence half-interval) at $p < 0.05$; n.s.—not significant at $p < 0.05$.

Table 5. Influence of drip fertigation on the selected components of nutritive value of Melba and Seledyn melon cultivars (mean for the years 2013–2015).

Irrigation Treatment (I)	Cultivar (I)	Dry Matter (%)	Total Sugar (g kg ⁻¹ FM)	Monosaccharides (g kg ⁻¹ FM)	Ascorbic Acid (mg kg ⁻¹ FM)	Total Carotenoids (mg kg ⁻¹ FM)	Total Polyphenols (mg GAE kg ⁻¹ FM)
Drip irrigation + broadcast nitrogen fertilization (control)	Melba	7.75	38.47	25.50	182.47	248.13	58.50
	Seledyn	8.54	73.53	57.53	144.67	88.50	52.23
	Mean	8.15	56.00	41.52	163.57	168.32	55.37
Drip irrigation + nitrogen fertigation	Melba	7.95	45.80	36.47	202.80	256.37	62.80
	Seledyn	8.63	84.53	63.97	162.27	96.27	61.27
	Mean	8.29	65.17	50.22	182.54	176.32	62.04
Mean	Melba	7.85	42.14	30.99	192.64	252.25	60.65
	Seledyn	8.59	79.03	60.75	153.47	92.39	56.75
Mean		8.22	60.58	45.87	173.05	172.32	58.70
LSD _{0.05} for irrigation treatment (I) ¹		0.076	2.050	0.745	3.867	3.462	1.926
LSD _{0.05} for cultivar (II)		0.321	0.967	0.953	2.501	2.028	0.895
LSD _{0.05} for interaction (I/II)		n.s.	2.226	1.187	n.s.	n.s.	2.086

¹ LSD = the lowest significant difference (Tukey's confidence half-interval) at $p < 0.05$; n.s.—not significant at $p < 0.05$.

4. Conclusions

The results of this study indicate that on loose sandy soil with low water capacity and nutrients, melon plants should be drip-fertigated with nitrogen, in order to obtain the best effects. As compared to the control (drip irrigation combined with nitrogen fertilization), the fertigation supplying nitrogen to the plants, used during the cultivation of two melon cultivars, Melba and Seledyn, on a loose sandy soil in Central Poland, significantly increased the total marketable fruit yield by 12.5% for Melba and by 13.6% for Seledyn. Compared to the control, drip fertigation also increased the weight of single fruits by 0.12 kg for Melba and by 0.19 kg for Seledyn. Drip irrigation combined with nitrogen fertigation significantly and positively influenced nutritive value, affecting the

increase in dry matter, total sugars, monosaccharides, ascorbic acid, total carotenoids, and polyphenols. Melba contained significantly more ascorbic acid, total carotenoids, and polyphenols than Seledyn, while Seledyn contained significantly more dry matter, total sugars, and monosaccharides.

Our studies fill a gap in the existing scientific literature and show that on a very light soil in a region with very low precipitation within Central Europe (Central Poland), the use of drip irrigation and nitrogen fertigation is effective for the cultivation of melon.

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