7.5%, respectively, which is also consistent with our findings. In a study conducted on 40 soybean genotypes from India, Rathod et al. [33] reported that PA and SA levels ranged from 8.45% to 13.23% and 2.28% to 9.52%, respectively.

The opposite pattern was observed for the content of total unsaturated fatty acids (TUFA): under hydroponic conditions, a gradual increase in TUFA content was noted along with an increase in planting density, which was significant in the case of the densest planting (H90).

The content of TUFA ranged from 85.20% to 85.72%, which is in agreement with the literature data [3, 34].

The content of monounsaturated fatty acids (MUFA) in the oil of "Menua" cultivar ranged from 31.73% to 34.65%, except for the H30 variety, where the lowest content was recorded (28.85%), which was 1.1-1.2 times lower than in others. Palmitoleic acid ranged from 0.05-0.06% regardless of growing medium and planting density.

One of the major ω-9 MUFA is OA. High intake of ω-9 MUFA in the diet has been associated with reduced anger and irritability, pain in patients with inflammatory arthritis [35]. Oils rich in MUFA are considered healthier and have a longer shelf life due to their increased resistance to oxidation [36].

OA content in the "Menua" cultivar seed oil ranged from 28.53% to 34.32% depending on planting density and growing medium. These data are higher than the amount obtained by Anwar et al. (22.6–24.0%) [3], but they are - by the results of Abdelghani et al. (13.3-36.1%) [10] and Choi et al. (14.97-38.74 %) [4].

The content of polyunsaturated fatty acids (PUFA) in the oil of seeds the soybean "Menua" cultivar underwent significant changes depending on the planting density and growing environment. In all variants it ranged from 50.84% to 56.39 %., which is in agreement with data from previous studies [31, 37].

The content of LNA in hydroponics ranged from 4.13% to 5.11%. The maximum content of 5.11% was observed at the lowest planting density (H30), and the minimum content of 4.13% at the 3 times denser planting density (H90). The content of LNA in the H30 variant exceeded other hydroponic variants by 1.1-1.2 times and soil variants by 1.2 times.

The content of LA in all variants ranged from 46.35% to 51.28%, and again the maximum content of 51.28% was observed at H30 variant.

As a conclusion we can maintain that H30 demonstrated better nutritional value due to the higher amount of EFA such as LNA and LA.

Anwar et al. [3] noted that LA and LNA content in soybean oil ranged between 49.03–53.00% and 6.50–8.00%, Abdelghani et al. [10] reported that it ranged between 40.4–63.9% and 3.9–12.8%, and Choi et al. [4] reported that it ranged between 43.22–60.26% and 5.37–12.33%, respectively.

Numerous studies have shown that low ω6:ω3 ratios are generally healthful [38]. In the study by Shostak et al. [37] the ω6:ω3 ratio ranged from 7.5 to 8.2. Butler et al. [39] recorded a dramatically high ratio for high LNA and low LNA varieties: 13.7-16 and 27.9-28.3, respectively. In the study by Anwar et al. [3], this indicator ranged between 6.1-8.1, in the study by Abdelghany et al. [10] it ranged between 3.16-16.4 for 1025 soybean accessions and in the study by Choi et al. [4] it ranged between 3.5-11.2.

In our study ω6:ω3 ratio varied between 10:1 and 11.5:1, depending on the growing medium and planting density.

The H30 variant was the best option as a functional food since the ω6:ω3 ratio was the lowest in this variant and it is in the range of WHO recommendation (5-10)[17].

The variants did not differ in the total content of the 5 main FA (98.84-98.95%), and the total content of the remaining 6 FA did not exceed 1.16% in any variant (Table 3).

In Figure 2 the quantity of 5 main FA is presented per square meter. As can be seen from Figure 2, hydroponics provided the optimal conditions for the accumulation of main FA per square meter. At the same planting densities, growing medium significantly affected the yield of fatty acids obtained per square meter. Thus, in the case of 30 plant/m^2 the quantity LA, LNA, OA, SA and PA obtained from plants per square meter of hydroponics exceeded the soil by 1.7, 1.9, 1.4, 1.4 and 1.6 times, respectively. The difference in the case of 50 plants/m^2 was more noticeable: the amount of LA, LNA, OA, SA and PA obtained per square meter in the soil was inferior to the hydroponic one by 2.9, 2.8, 2.8, 2.7 and 2.8 times, respectively.

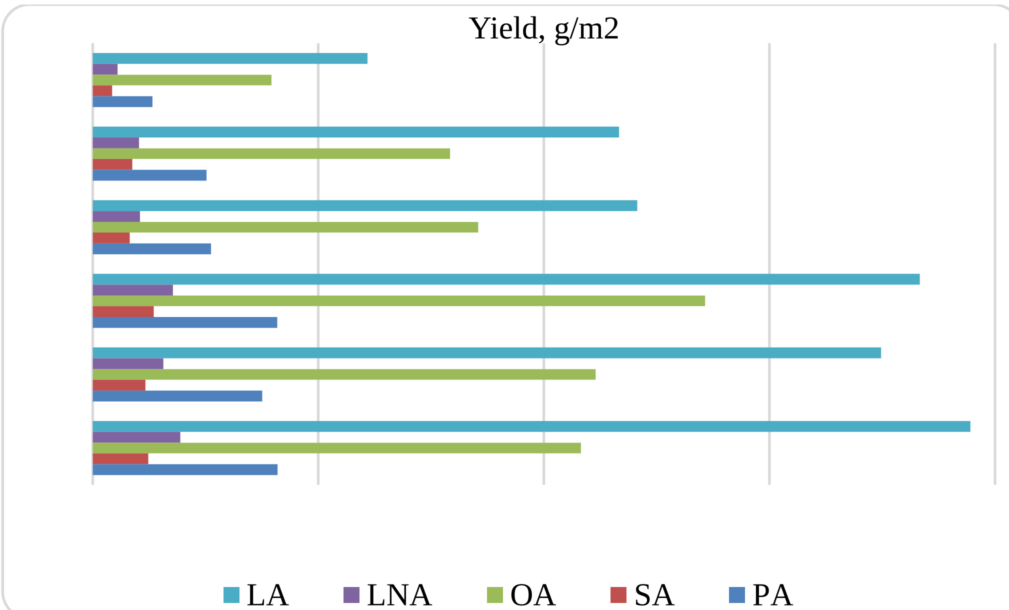

Figure 2. Yield of PA, SA, OA, LNA and LA per square meter

In the densest planting in hydroponics the minimum yield of LA (72.4 g), LNA (6.3), OA (51.3 g), SA (4.9 g) and PA (15.7 g) was obtained per square meter, which is inferior to other hydroponic variants by 1.4-1.6, 1.5-1.8, 1.3-1.6, 1.4-1.7 and 1.4-1.6 times, respectively. In the case of H30 it is possible to obtain a maximum 116.7 g LA and 11.6 g LNA.

CONCLUSION

In the FA composition of the soybean "Menua" cultivar seeds oil, regardless of the growing conditions and planting density, the main FA formed the following descending series: LA>OA>PA>LNA>SA. The same pattern was recorded in other studies [4, 10].

The obtained results (yield, oil content and FA composition) confirm the feasibility of using H30 as a plant-based functional food directed to improve overall health because of the high levels of LNA (5.11%) and the lowest ω6:ω3 ratio (10:1) [17, 40-41].

H70 meets the confectionery industry's needs for high melting point and oxidative stability because it contains high levels of SA (3.41%) and high levels of OA (34.32%), as well as low levels of PUFA (50.84%) [33, 42].

Based on our research, we recommend using H30 as a functional food for daily consumption and H70 for industrial and confectionery purposes.

Authors' Contribution: All authors contributed to this research and wrote this paper.

Abbreviations: GMO: genetically modified organism, FA: fatty acids, EFA: essential fatty acid, TSFA: total saturated fatty acids TUFA: total unsaturated fatty acids, MUFA: monounsaturated fatty acids, PUFA: polyunsaturated fatty acids, PA: palmitic acid, SA: stearic acid, OA: oleic acid, LNA: linolenic acid, LA: linoleic acid.

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