

Supplement

S1. Effect of foliar sodium selenate and selenocystin supply on wax accumulation at the surface of bean seeds, Uliasha cv (0.26 mM solution)

Plants of Uliasha cv. were grown at the experimental fields of Federal Scientific Vegetable Center (55°39.51' N, 37°12.23' E), in a loam sod podzolic soil having the following soil characteristics: pH 6.8, 2.05% organic matter, 1.32 mg-eq 100 g⁻¹ hydrolytic acidity, 18.5 mg kg⁻¹ mineral nitrogen, 21.3 mg kg⁻¹ ammonium nitrogen, sum of absorbed bases as much as 93.6%, 402 mg kg⁻¹ mobile phosphorous, 198 mg kg⁻¹ exchangeable potassium. The foliar biofortification of plants was performed twice during the vegetation period at 10-day interval using 0.26 mM solutions of sodium selenate and selenocystin. After harvest, seeds were kept at room temperature during a month.

The determination of wax was done on 10 randomly chosen seeds after hexane extraction (20 °C, 24 hours). The wax content of bean seed surface was assessed spectrophotometrically by Unico 2804 UV spectrophotometer (Dayton, NJ, USA), using the absorption value of bean seed hexane extracts at 260 nm [1]. As an external standard, 0.02% paraffin solution in hexane was used. The results were expressed as mg of paraffin equivalent per g of dry weight (mg PE g⁻¹ d.w.).

S2. Determination of potato peel, pulp antioxidant status.

The determination of total polyphenols (TP) was performed via extraction of 0.5 g dry peel, pulp homogenates with 20 mL of 70% ethanol/water (7:3, v/v) at 80 °C for 1 h. The mixture was cooled down and quantitatively transferred to a volumetric flask, and the volume was adjusted to 25 mL. The mixture was filtered through filter paper, and 1 mL of the resulting solution was transferred to a 25 mL volumetric flask, to which 2.5 mL of saturated Na₂CO₃ solution and 0.25 mL of diluted (1:1) Folin–Ciocalteu reagent (AppliChem Panceae, Darmstadt, Germany) were added. The volume was brought to 25 mL with distilled water. One hour later the solutions were analyzed on a spectrophotometer (Unico 2804 UV, Suite E Dayton, NJ, USA), and the concentration of polyphenols was calculated according to the absorption of the reaction mixture at 730 nm. As an external standard, 0.02% gallic acid (w/w) (Sigma-Aldrich, St. Louis, USA) was used. The results were expressed as mg of Gallic Acid Equivalent per g of dry weight (mg GAE g⁻¹ d.w.).

Antioxidant Activity (AOA) The antioxidant activity of the samples was assessed using a redox titration method via titration of 0.01 N KMnO₄ (analytical grade, Chimmed, Moscow, Russia) solution with ethanolic/water extracts of dry samples [2], produced as described above. The reduction of KMnO₄ to colorless Mn²⁺ in this process reflects the quantity of antioxidants dissolvable in 70% ethanol/water (7:3, v/v). The values were expressed in mg Gallic Acid Equivalents (mg GAE g⁻¹ d.w.).

S3. Determination of betalain pigments in beet peel and pulp

Six cultivars of beet (Dobrinia, Bordo, Gaspadina, Lubava and Marusia) were grown at the experimental fields of Federal Scientific Vegetable Center (55°39.51' N, 37°12.23' E). After harvest, roots were washed with fresh water to remove soil particles. Betalain pigments were determined in fresh beet peel and pulp before and after 6 months root storage according to Golubkina et al. [2]. Water extracts of peel and pulp were subjected to spectrophotometer. Betalain pigments content was assessed using light absorption values at 535 nm and 485 nm, and the following formula:

Betacyanins, (mg g⁻¹) = (D₅₃₅ V 550 d):60000 a;

$$\text{Betaxanthins (mg g}^{-1}\text{)} = (\text{D}_{485} \text{ V } 408 \text{ d}):48000 \text{ a,}$$
 Where D_{535} -light absorption of betacyanin at 535 nm;
 D_{485} - light absorption of betaxanthin at 485 nm;
 V- volume of extracts, mL;
 550 and 408 –molecular mass of betanin and vulgaxanthin respectively, g M^{-1} ;
 d- dilution;
 60000 and 48000 - extinction of betanin and vulgaxanthin respectively;
 a - sample mass, g

S4. Radish antioxidant activity

Eighteen radish cultivars were grown in greenhouse at the Federal Scientific Vegetable Center. After harvest, leaves were detached and roots were washed with fresh water to remove soil particles. Peel and pulp were separated, cut into small pieces and dried at 80 °C to constant weight. Homogenized dry samples were used for the determination of AOA using titration method as described in S2 section according to Golubkina et al. [2].

Table S1. Total antioxidant activity of peel and pulp of radish

Cultivar	Peel	pulp	Peel/pulp
Variant	37.6 d	19.5 ab	1.93
Vella	53.7 ab	20.0 a	2.69
Merkado	58.1 a	19.3 ab	3.01
Teplichny Gribovsky	53.1 abc	20.6 a	2.58
Sonata	52.4 bc	20.6 a	2.54
Record	42.5 c	15.9 d	2.67
Cardinal	51.9 bc	19.3 a	2.69
Aria	49.9 c	18.0 bc	2.77
Feya	43.7 cd	16.9bc	2.59
Mokhovsky	23.2 e	10.8 e	2.15
Margo	49.3 c	19.5 ab	2.53
Mavr	51.4 bc	17.0 c	3.02
Zarya	52.4 bc	19.5 ab	2.69
Sofit	47.9 c	20.2 a	2.40
Mechta	55.0 abc	18.5 bc	2.97
Miff	47.0 c	17.2 bc	2.73
Karmelita	39.6 d	14.9 d	2.66
Karmen	64.9 a	21.9 a	2.96

Along each line, values with the same letters do not differ statistically according to Duncan test at $p < 0.05$

S5 Effect of water stress on lipids accumulation in inner and outer scales of *A. cepa*

An investigation was carried out on 4 cultivars of *A. cepa* (selection of Federal Scientific Vegetable Center): Myachkovski, Globus, Zolotie kupola, Zolotnichol) at the experimental fields of Federal Scientific Vegetable Center (55°39.51'N, 37°12.23'E) and in Amur region of Russia (50°19'09" N, 127°44'12" E). A randomized complete block design was used with three replicates. Onion was grown on sod-podzolic clay-loam soil, pH 6.8, 2.1% organic matter, 1.1 $\text{g}\cdot\text{kg}^{-1}$ N, 0.045 $\text{g}\cdot\text{kg}^{-1}$ P_2O_5 , 0.357 $\text{g}\cdot\text{kg}^{-1}$ K_2O , spaced 80 x 70 cm (Moscow region) and on meadow-chernozem and alluvial soil of the Amur region with pH 5.3, 3.8% organic matter, hydrolytic acidity 2.5 $\text{mg}\cdot\text{eq}100 \text{ g}^{-1}$, total N 0.02-0.35%, exchangeable K 162 mg Kg^{-1} , mobile P 65 mg Kg^{-1} .

The mean month temperature and precipitation values are reported in Table S5-1.

Table S2. Mean month temperature and precipitation values in Amur and Moscow regions in 2021.

	Amur region		Moscow region	
	Temperature °C	Precipitation mm	Temperature °C	Precipitation mm
May	11.9	58	17.1	143
June	20.2	49	22.2	95.9
July	22.2	162	23.9	103.7
August	19.9	153	23.8	52.7

Determination of lipids content

About 0.1 g of dry homogenized inner and outer scales of *A. cepa* were mixed with 10 mL of hexane and left at room temperature for 24 hours. Lipids concentration was determined spectrophotometrically using light absorption value at 260 nm. As an external standard, 0.02% paraffin solution in hexane was used. The results were expressed as mg of paraffin equivalent per g of dry weight (mg PE g⁻¹ d.w).

References

- 1 Iqbal, S.; Younas, U.; Chan, K.W.; Zia-Ul-Haq, M.; Ismail, M. Chemical composition of *Artemisia annua* L. leaves and antioxidant potential of extracts as a function of extraction solvents. *Molecules* **2012**, *17*, 6020–6032.
2. Golubkina, N.A.; Kekina, H.G.; Molchanova, A.V.; Antoshkina, M.S.; Nadezhkin, S.M.; Soldatenko, A.V. *Plants Antioxidants and Methods of Their Determination*; Infra-M: Moscow, Russia, 2020; pp. 155–164; doi 10.12737/1045420 (In Russ.).