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The impact of macroelements and microelements on the size of starch granules in potatoes

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The objective of the study was to determine the responses of the analyzed potato cultivars to soil and foliar fertilization and the resulting differences in the size of starch granules.

The study was co-financed by the Ministry of Science and Higher Education in 2008-2011 (research project No. N N310 307334).

The experimental factors were as follows:

- **Soil NPK fertilization at two rates:**
  A – 280 kg ha^{-1} (80 N, 80 P, 120 K);
  B – 420 kg ha^{-1} (120 N, 144 P, 156 K), 120 kg N ha^{-1} was split-applied before planting (80 kg N ha^{-1}) and before row closure (80 kg N ha^{-1}).

- **Foliar application of the following fertilizers:**
  a – Basfoliar 2-4-6 (8 dm ha^{-1})
  b – ADOB Mn (4 dm ha^{-1})
  c – Solubor DF (2 dm ha^{-1})
  d – ADOB Mn + Solubor DF (2 + 1 dm ha^{-1})
  e – ADOB Mn + Basfoliar 12-4-6 (2 + 4 dm ha^{-1})
  f – Basfoliar 12-4-6 + Solubor DF(4 + 1 dm ha^{-1})
  g – Basfoliar 12-4-6 + ADOB Mn + Solubor DF (2.7 + 1.3 + 0.7 dm ha^{-1})
  h – control treatment - no foliar fertilization

The size of starch granules was determined with the use of a laser particle size analyzer, in cooperation with the Department of Agricultural Technology and Food Storage of the Wrocław University of Environmental and Life Sciences (Lin et al. 2005, Chang et al. 2006, Lu et al. 2008).

The results were processed statistically by analysis of variance. Differences between treatments were determined by Duncan's test at a significance level of p=0.05. All analyses were performed in the STATISTICA® software package.

Table 1. The effect of soil and foliar fertilization rates on the size of starch granules

Experimental factors		Grain size fractions (%)		
		<20 µm	40. µm	>40µm
* A	a	9.80	31.04	59.15
	b	10.21	31.25	58.54
	c	10.14	32.08	57.78
	d	10.66	33.28	56.06
	e	11.02	33.39	55.60
	f	10.18	32.89	56.93
	g	11.02	32.72	56.26
h (control)		9.91	31.84	58.25
Mean		10.37	32.31	57.32
* B	a	12.67	33.84	53.49
	b	11.50	34.67	53.83
	c	10.83	34.33	54.83
	d	11.22	34.62	54.16
	e	10.83	33.20	55.97
	f	11.53	34.12	54.35
	g	10.75	33.83	55.42
h (control)		12.86	34.57	52.57
Mean		11.52	34.15	54.33
LSD (α = 0.05) for:				
soil fertilization		0.72	0.78	1.28
foliar fertilization		n.s.	n.s.	n.s.

The results have been published in a study entitled "T*he effects of varied soil and foliar mineral fertilization levels in the production of high-starch potatoes*" Bogucka B., Cwalina-Ambroziak B., Zięba T. 2010 Pol. J. Natur. Sc., Vol 25(3): 215-228

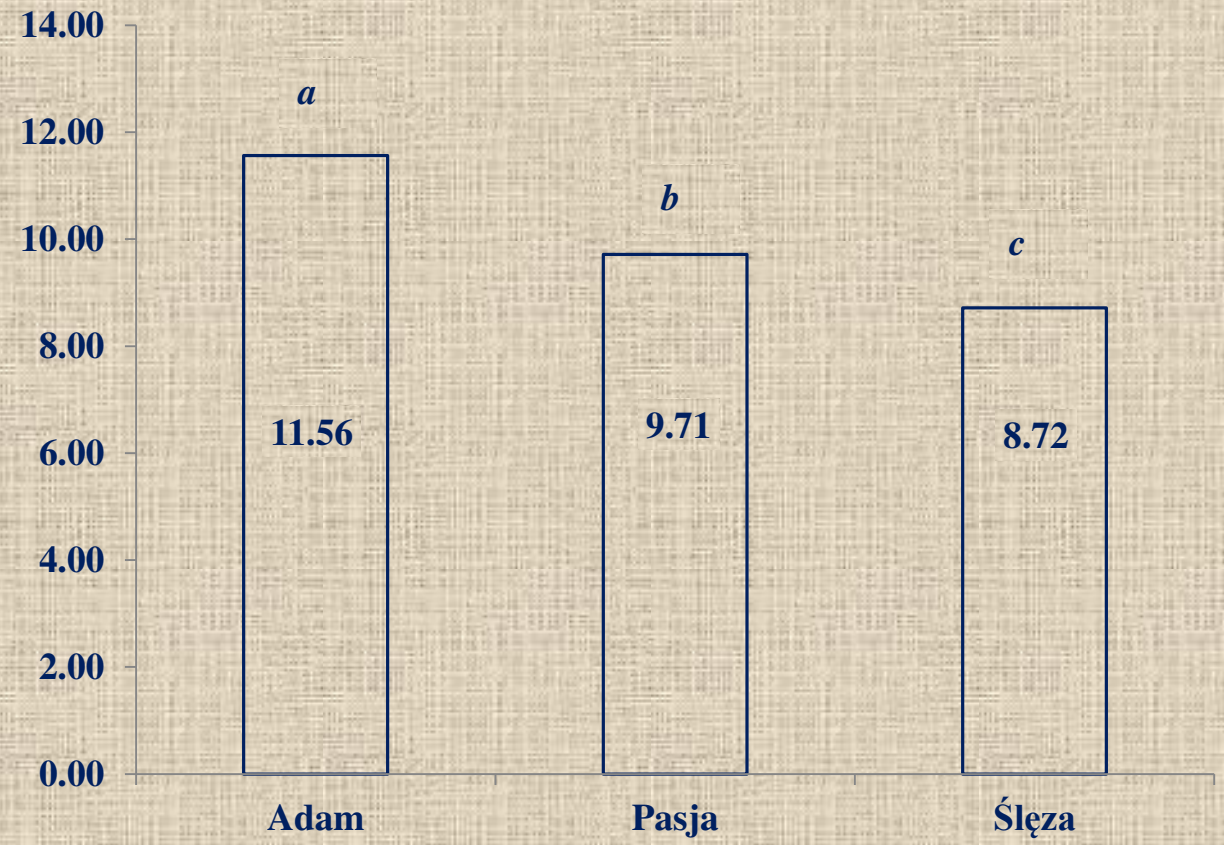


Figure 1. Effect of cultivar on starch grains size <20 µm (%)(α = 0.05)

a .b. c. – values marked with the same letter do not differ significantly at p=0.05

*Pasja Pomorska = Pasja

The results have been published in a study entitled "*Effect of different mineral fertilization technologies on the size of starch granules in potato*" in the Starch/Stärke 2014, 66, 1–6 (www.starch-journal.com).

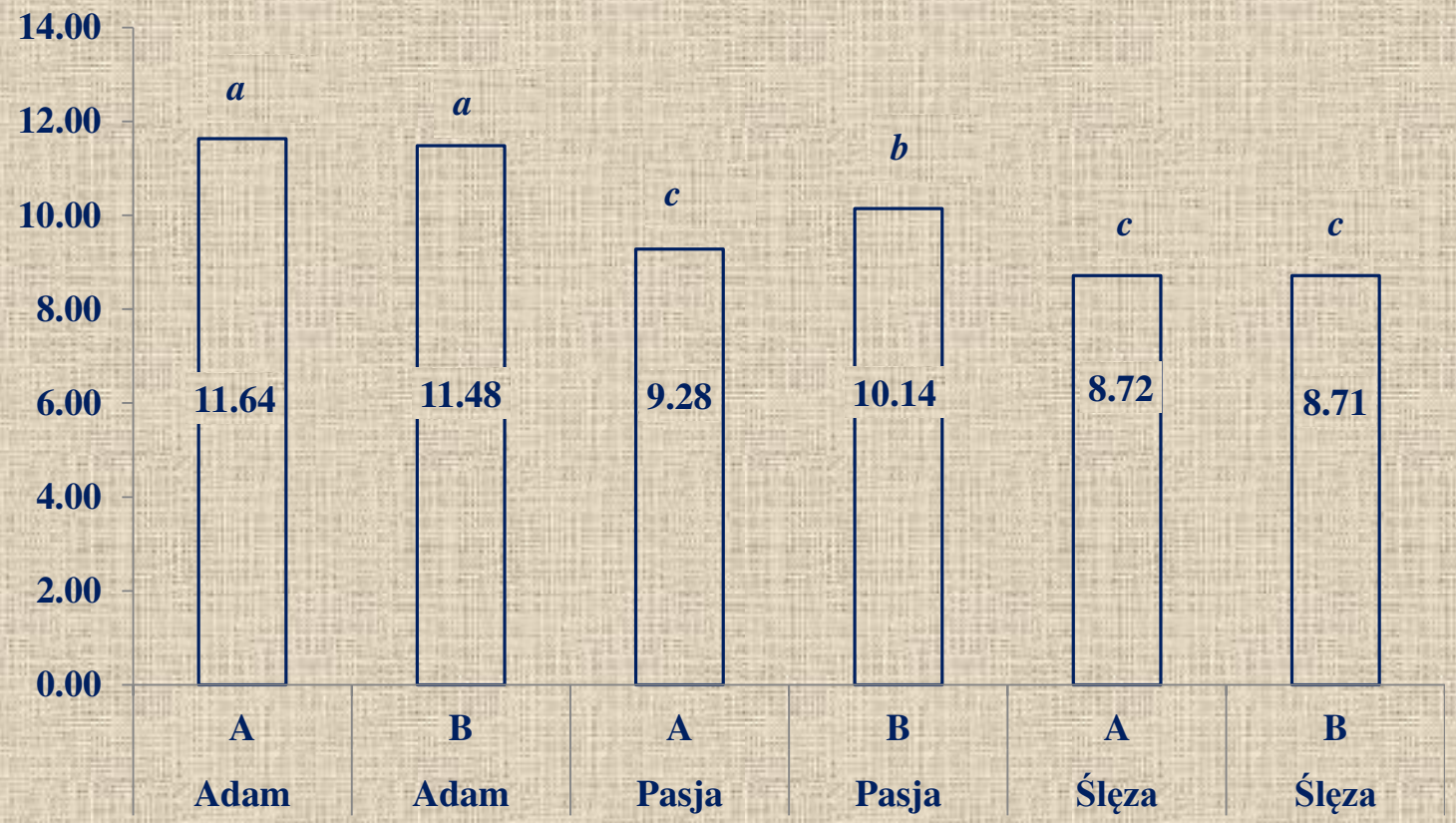


Figure 2. Effect of cultivar and different soil fertilization rates on starch grains size <20 µm (%)(α = 0.05)

A – 280 kg/ha NPK (80 N, 80 P, 120 K); B – 420 kg/ha NPK (120 N, 144 P, 156 K).

a .b. c. – values marked with the same letter do not differ significantly at p=0.05

The results have been published in a study entitled "*Effect of different mineral fertilization technologies on the size of starch granules in potato*" in the Starch/Stärke 2014, 66, 1–6 (www.starch-journal.com).

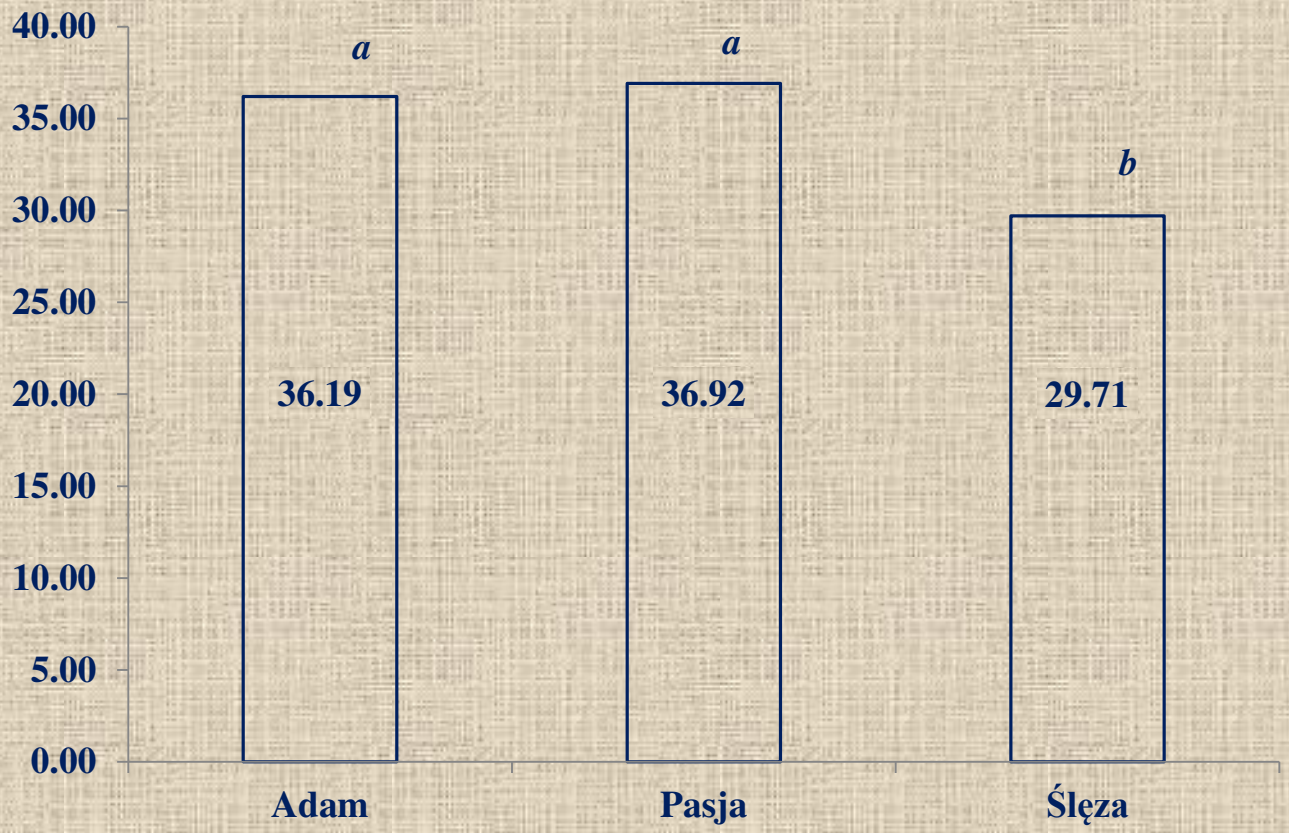


Figure 3. Effect of cultivar on starch grains size 20 - 40µm (%)(α = 0.05)

a .b. – values marked with the same letter do not differ significantly at p=0.05

*Pasja Pomorska = Pasja

The results have been published in a study entitled "*Effect of different mineral fertilization technologies on the size of starch granules in potato*" in the Starch/Stärke 2014, 66, 1–6 (www.starch-journal.com).

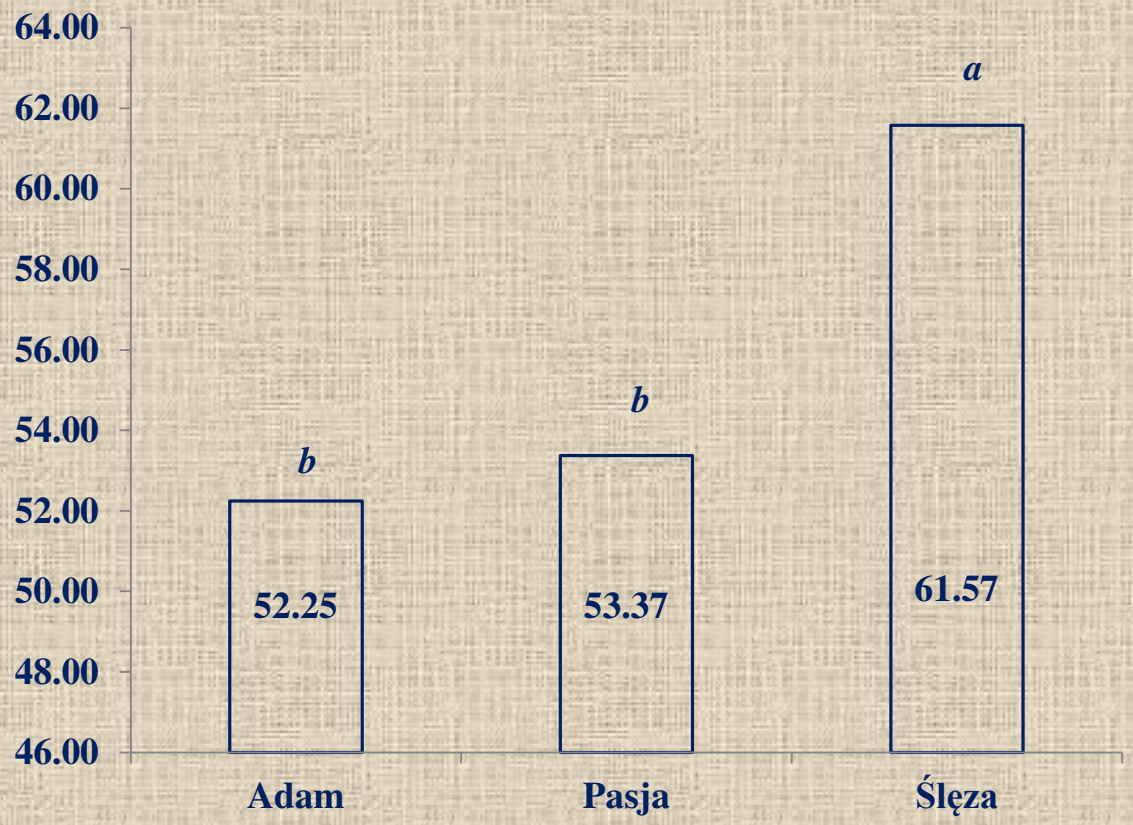


Figure 4. Effect of cultivar on starch grains size >40µm (%)(α = 0.05)

a .b. – values marked with the same letter do not differ significantly at p=0.05

*Pasja Pomorska = Pasja

The results have been published in a study entitled "*Effect of different mineral fertilization technologies on the size of starch granules in potato*" in the Starch/Stärke 2014, 66, 1–6 (www.starch-journal.com).

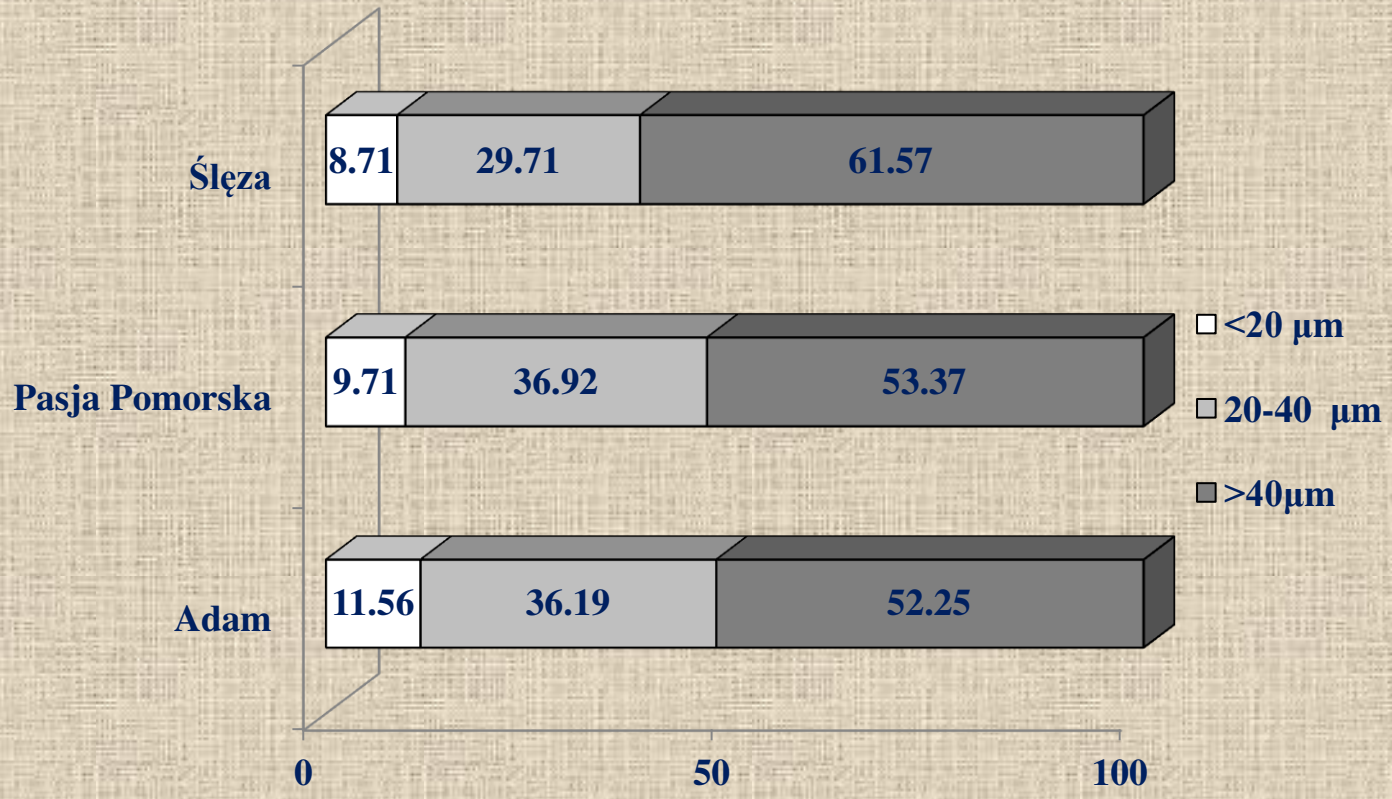


Figure 5. Starch grain fractions in three potato cultivars (%)(α = 0.05)

The results have been published in a study entitled "*Effect of different mineral fertilization technologies on the size of starch granules in potato*" in the Starch/Stärke 2014, 66, 1–6 (www.starch-journal.com).

CONCLUSIONS

- **The percentage of large starch granules is mostly a varietal trait.**

- **In the discussed study, there was a predominance of large starch grains measuring more than 40 µm in diameter. The late maturing potato cultivar was characterized by the highest, and the medium-early maturing cultivar – by the lowest number of starch granules.**

- **An increase in macronutrient levels had a negative effect on the size distribution of starch granules.**

- **Further research is necessary to deepen our knowledge about the influence of agricultural treatments, in particular the supply of macronutrients and micronutrients, on the size of starch granules in potato tubers.**