



Effect of chosen agronomic factors on the yield and raw material quality of three populations of greater plantain (*Plantago major* L.)

INTRODUCTION

Greater plantain (*Plantago major* L.) is a herbaceous perennial plant commonly occurring all over the world. In Poland it grows in meadows, pastures, arable fields, roadsides, and wastelands. Numerous authors report that greater plantain protects the environment against the pollutions released in the reaction of fuel with oxygen during the work of car engines (Samuelsen 1998; Shepeleva et al. 2008).

Medicinal properties of greater plantain have been known for ages. The raw materials used in phytotherapy are leaves or herb of this species collected from spring to autumn. The most important biologically active compounds in these raw materials are iridoid glycosides, flavonoids, phenylpropanoid glycosides, and mucilages. Extracts from leaves or herb of great plantain have been used in the folk medicine in the inflammations of upper respiratory tract, bronchi, stomach and intestines, as well as in the case of wounds and abscesses (Samuelsen 1998, Beara et al. 2009).

Nowadays the main species of *Plantago* used medicinally is ribwort plantain (*P. lanceolata*). It is collected both from natural sites and from the plantations. Greater plantain is collected in smaller amounts and only from the wild. It has been observed that the natural resources of this species decrease, mainly because of the human activity (house and industrial building, chemisation of agriculture, etc.). Plantations of the selected populations of this species may be the source of more uniform raw material preferred by the phytopharmaceutical industry.

The aim of this study was to determine the effect of the chosen agrotechnical parameters on the yielding and accumulation of biologically active compounds in the aboveground parts of plants representing three populations of greater plantain.

MATERIALS AND METHODS

Plant material

The object of the study were 3 populations of greater plantain (*Plantago major* L.) originating from the natural sites in Poland (1 – Elsnerów, N 52°16.766' E 21°04.980'; 2 – Krzywda, N 51°50.156' E 22°07.232'; 3 – Antonowo, N 52°44.736' E 21°57.280') and maintained in the *ex situ* collection at the experimental field of the Department of Vegetable and Medicinal Plants, Warsaw University of Life Sciences – SGGW. The seeds were sown in two dates: spring (April) and late spring (June). Sowing rate was 3 kg/ha, and row distance 30 cm. The raw material (aboveground parts of the plants) was harvested at the vegetative stage of plant development (second decade of July/first decade of August), at the stage of full blooming (first decade of August/second decade of August), and at the stage of seed maturity (second decade of September/third decade of September). The plant material was dried in the drying chamber at 45°C. The yield of air-dry aboveground organs was determined.

Chemical analyses

In the air-dry raw materials the content of iridoid glycosides, phenolic acids and flavonoids was determined. The above mentioned compounds were determined spectrophotometrically (using UV-1700 PharmaSpec spectrophotometer, Shimadzu), according to the methods described in the Polish Pharmacopoeia (Farmakopea Polska VIII, 2008). All analyses were made in 3 replications.

Statistical evaluation of the results

The results were subjected to statistical evaluation using ANOVA 3 programme and Tukey's test at the significance level = 0.05



Population Elsnerów: 1 – on natural site, 2 – on experimental field

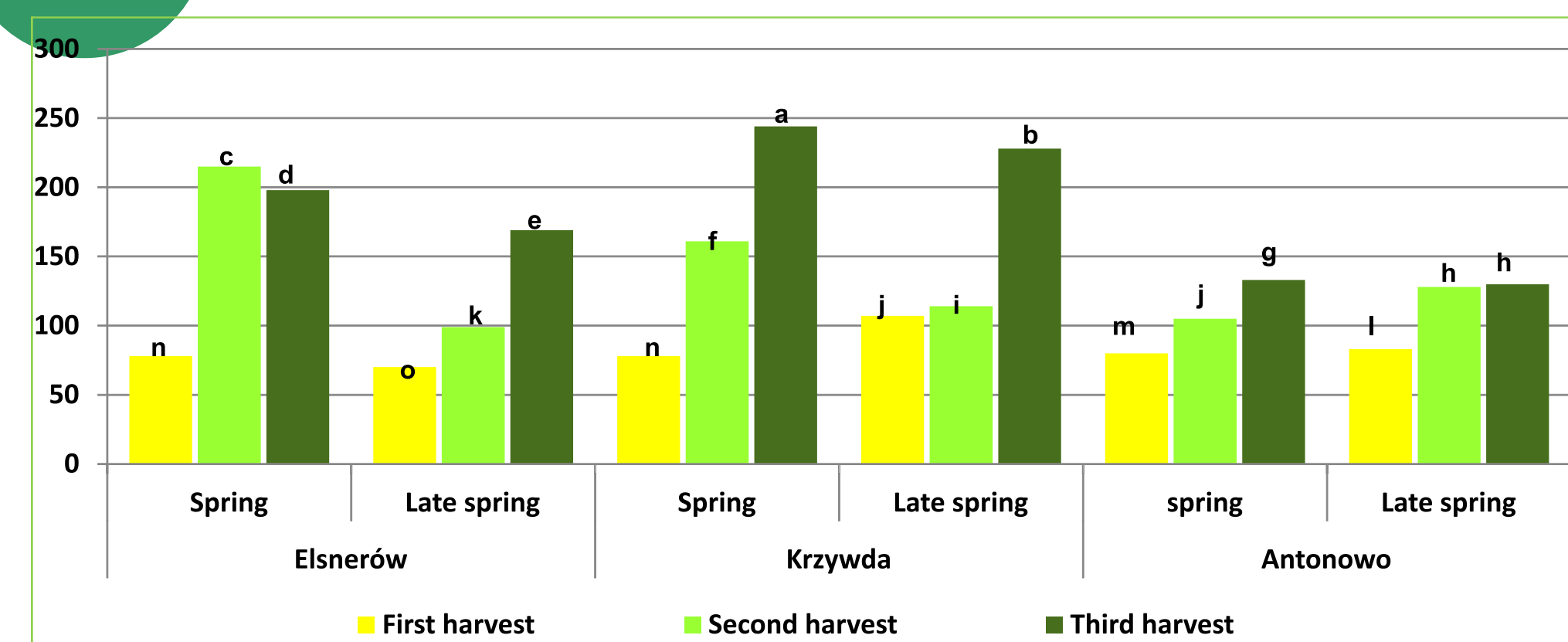
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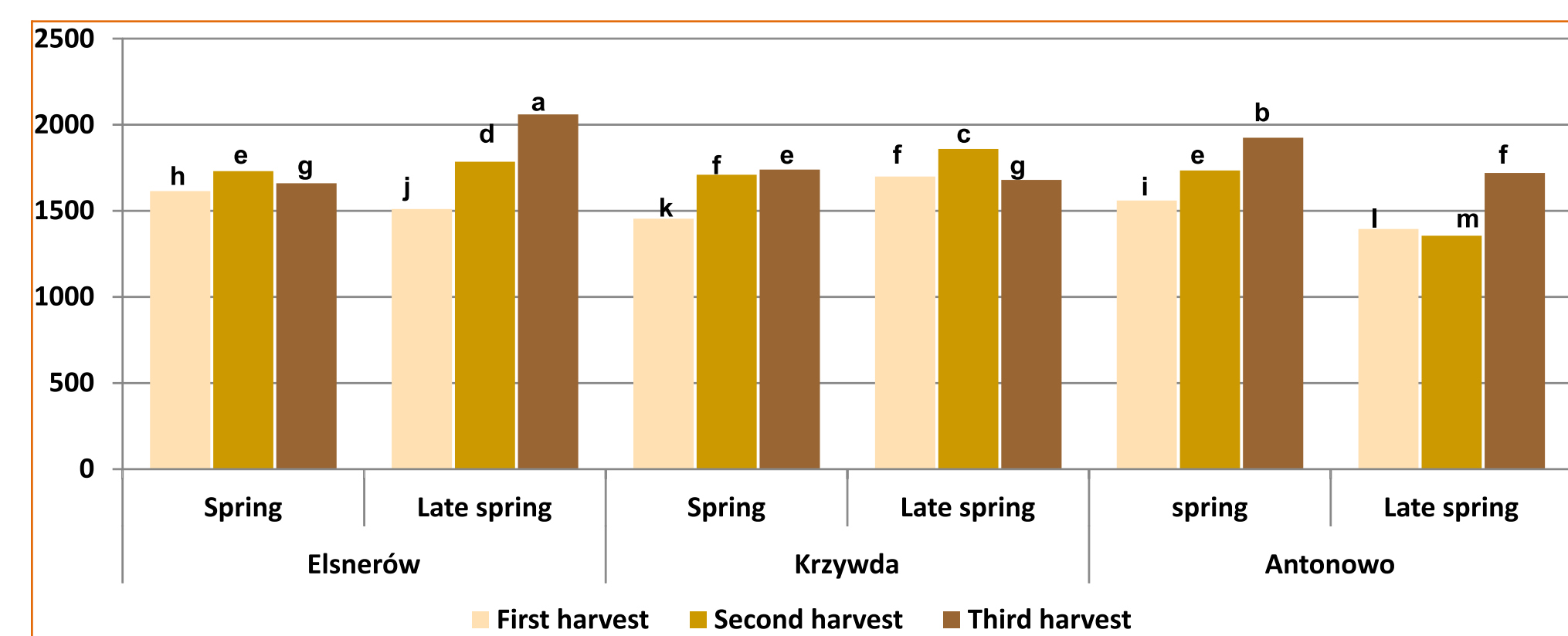
CONCLUSION

- The obtained results show intraspecific variability of *Plantago major* in respect of herb yield and the content of biologically active compounds (iridoid glycosides and phenolic acids) in this raw material.
- The time of plantation establishing (seed sowing) and the time of plant harvesting determine the yield of greater plantain herb.
 - Spring sowing allows to obtain higher yield of herb in comparison to late spring sowing.
 - Late harvesting (at the stage of seed maturity) is the way to increase the yield of the raw material.
- The content of biologically active compounds in the herb of greater plantain is also affected by the above- mentioned agrotechnical factors.
 - The herb harvested from the plantation established in spring is characterised by higher content of iridoid glycosides, but lower content of phenolic acids, and flavonoids in comparison with the raw material originating from the plantation established by late spring sowing
 - The highest content of iridoid glycosides is characteristic for the herb harvested at the stage of seed maturity.
 - Herb collected at the stage of plant blooming is characterised by the highest content of phenolic acids.

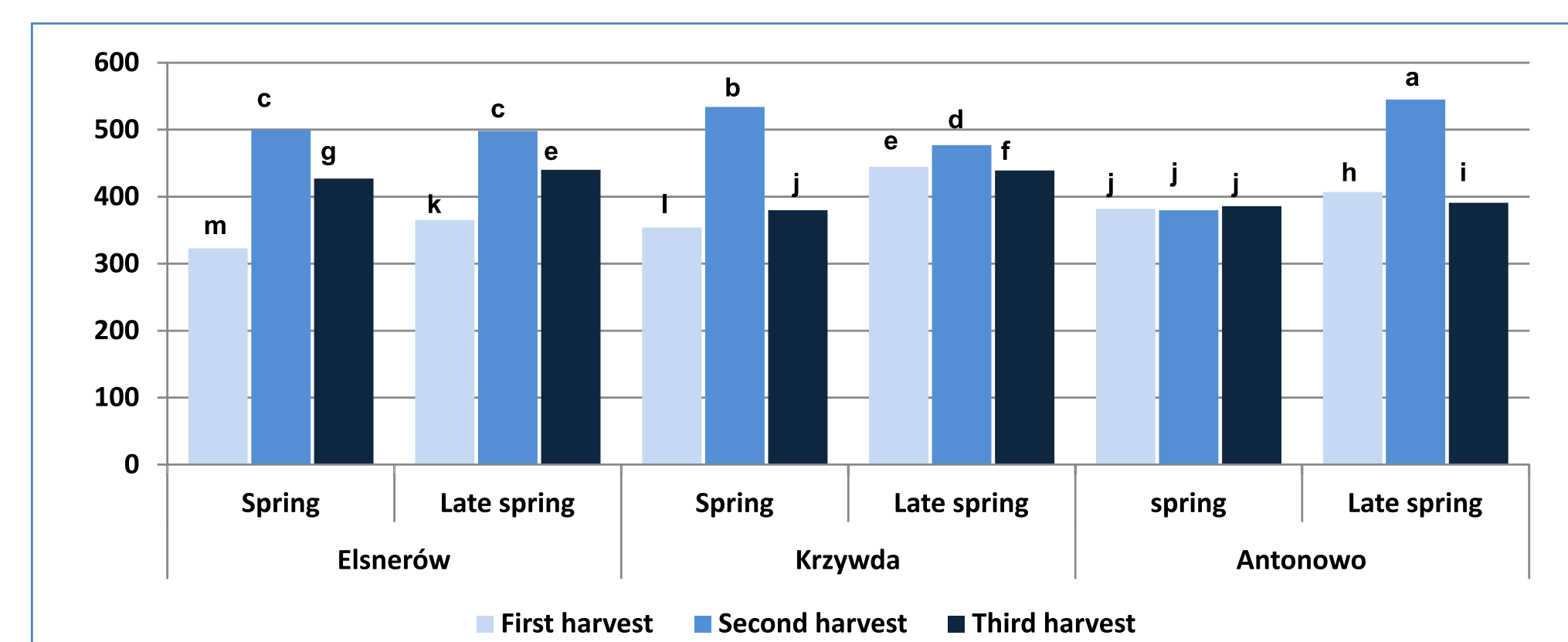
RESULTS



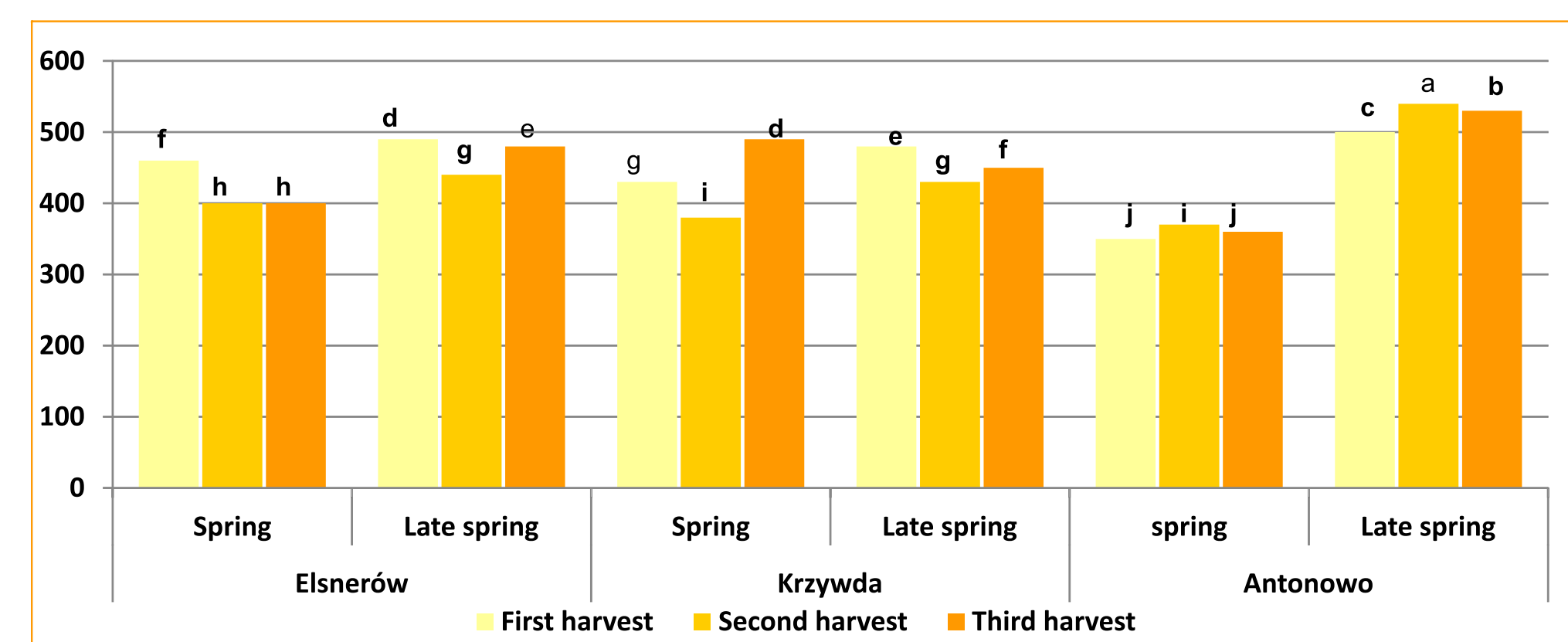
Effect of the time of plantation establishment and harvest on the yield of air-dry herb (g/m²)



Effect of the time of plantation establishment and harvest on the content of iridoid glycosides in air-dry herb (mg/100g)



Effect of the time of plantation establishment and harvest on the content of polyphenolic acids in air-dry herb (mg/100g)



Effect of the time of plantation establishment and harvest on the content of flavonoids in air-dry herb (mg/100g)



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