The estimation of productivity and yield of linseed (*Linum usitatissimum* L.) using the growth analysis

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Abstract

In three year field experiments (2001 – 2003) the growth, yield and productivity of 8 flax cultivars were compared. Cultivars ‘AC Linora’, ‘Flanders’, ‘Linola™ 947’, ‘Norlin’ and ‘Omega’ were obtained from Canada, ‘Barbara’ and ‘Hungarian Gold’ from Hungary and ‘Opal’ from Poland. Apart from the estimation of the yield of aboveground parts dry matter and seed yield the determinations of the primary index value of growth analysis were done and on their basis the indices LAI, LAD, RGR, CGR and HI were calculated.

The obtained yield results of the examined flax cultivars show significant genotypic – environmental relationships pertaining to the dynamics of dry matter accumulation and the amount of seed yield. Meteorological conditions in the successive years significantly influenced the particular phases of growth and development of cultivars and the factor which increased the amount of dry matter was the air temperature during the period of plant emergence – budding. During the vegetative season with a large amount of rainfall the average seed yield was about 40 % lower than compared with a year of average precipitation and a warm second part of the second period of flax vegetation. Among the analyzed cultivars a stable yield in all the years was characteristic for cultivars ‘Flanders’, ‘Barbara’ and ‘AC Linora’ (that cultivar, however, during a wet year yielded at a low level). The assimilation leaf surface of the linseed quickly increased during the period from budding to flowering and the accumulation of dry matter of the aboveground parts lasted up to the green maturity. In the successive years of the experiment there were observed significant (linear or logarithmic regressions) relationship between the yield of dry matter and the indices of growth analysis. The biggest values of the CGR indicator were observed for the period from budding to flowering. The maintaining of a high CGR value after plant flowering in the year with a favourable course of climatic parameters was beneficial for a better yield of all flax cultivars. The low values of the RGR index after flowering of cultivar ‘Hungarian Gold’ and ‘Opal’ strictly corresponded to their low yield of seed and straw biomass.

List of abbreviations: DM, dry matter; LA, leaf area; DS, development stage; GDD, Growth Degree Days; P, rainfall; K, Sielianinow hydrothermal index; CSR, Cumulative Solar Global Irradiation; LAI, Leaf Area Index; HI, Harvest Index; LAD, Leaf Area Duration; RGR, Relative Growth Ratio; CGR, Crop Growth Ratio.

Introduction

Today linseed is treated in Europe as an alternative oil plant whose cultivation area systematically increases due to relatively low cost of cultivation and subsidies to the area of cultivation in some countries of the European Union countries (Zając 2004, Casa *et al.* 1999). The present production of linseed
Material and methods

Experimental details

One-factor experiment was conducted in the years 2000–2003 at the Experimental Station Prusy, 18 km north-east of Cracow. The experiment was performed by the method of randomized blocks in 4 replications and the size of a block was 10 m². Annual parts of the experiment were set up on degraded black soil formed from loess and classified as a very good wheat complex of the first evaluation class. As far as the granulometric characteristic is concerned the soil was classified as common silt. The soil contained 1.18 % organic C and 0.169 % of total N. The soil pH varied from 6.0 to 6.2. The pre-sowing mineral fertilization was done in the amount of 30 kg was nitrogen in the form of ammonium nitrate, 48 kg P₂O₅ and 72 kg K₂O. However, in the phase of stem extension mainly 30 kg N per 1 ha was used in the same form as earlier.

Plant material

Eight cultivars of linseed were investigated, out of which ‘AC Linora’, ‘Flanders’, ‘Linola™ 947’, ‘Norlin’, and ‘Omega’ were from Canada, two cultivars ‘Barbara’ and ‘Hungarian Gold’ from Hungary and ‘Opal’ from Poland. Sowing of cultivars (600 seeds per 1 m²) was done using sowing machine in rows of 15 cm apart. The dates of sowing in 2001, 2002 and 2003 were 13, 17 and 16 April and harvest was done on the 21st, 8th and 10th October, respectively. After emergence, depending on the year of vegetation, one or two treatments of flea control were performed with the help of Karate 025EC in the amount of 0.3 dm³ ha⁻¹. At the phase of stem extension monocotyledonous and dicotyledonous weeds in the field were controlled using herbicides Chiesel 75 WG and Targa Super 0.25 EC. Harvest was done with the help of a harvester in the second or third decade of August after an earlier desiccation using the preparation Reglone in the dose of 4 dm³ ha⁻¹ in 300 dm³ of water.

Measurements

Climatic data (air temperature, solar radiation, the amount of precipitation) were obtained from a local meteorological station. On the basis of measure-