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Effect of boron fertilization on seed yield of white clover

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Introduction One of the preconditions of widespread utilisation of white clover in grassland management is the availability on the market of seeds of valuable cultivars (Woodfield *et al.*, 2004). However, there are many problems in the process of the reproduction of white clover cultivars resulting in low seed yields obtained on plantations. Therefore, further technology improvement of white clover cultivation for seeds is a necessity. One of the factors stimulating the seed potentials of white clover is fertilization and from among microelements, appropriate levels of soil boron appears to be essential for the production of seeds of good quality (Marshall *et al.*, 1991). The aim of the study was to evaluate the effects of boron fertilization on seed yield and selected morphological and biological features of white clover.

Materials and methods During 2002-2004, in Brody (52°26'N, 16°18'E) an experiment was set up in a plot block-design with four replicates (plot size 15.5 m (10 m) to evaluate the effect of boron fertilization on the seed yield and its components of white clover of Polish cv. Wota. The experiment was situated on Albic Luvisols soils (pH_{KCl}-5.3, N_t-0.82%, P₂O₅-130 mg/kg, K₂O-149 mg/kg, Mg-75 mg/kg, B-0.2 mg/kg). White clover seeds were sown in the summer of 2002 in pure sowing. Standard technology of cultivation of this species for seeds was employed. Fertiliser was applied in autumn each year at a rate of: P₂O₅-60 kg/ha, K₂O-60 kg/ha. Additionally, the dose of boron in the amount of 2 kg/ha was applied in the first decade of April and was administered in the form of spray using for this purpose a Bormax (boron ethanolamine) preparation containing 11% boron soluble in water. The yearly mean temperature and total precipitation for 2002, 2003 and 2004 was 9.7, 9.3, 9.1 °C and 750.5, 410.0, 584.7 mm, respectively. The effects of boron fertilization were evaluated on the basis of biological and morphological features of white clover. Inflorescences density was determined using fixed quadrat method. Before harvest the plant material was sampled and biometrical analyses of inflorescences were performed. Seed yield was measured on an area of 15.5 m² using plot harvester. Tests of the main effects were performed by F-tests. Means were separated by the LSD and were declared different at the $P < 0.05$ level.

Results Following the foliar application of boron, the seed yield of white clover plants increased both in the first and second years of utilisation by 20.0% and 24.4%, respectively. Boron was found to determine the vitality of white clover plants which resulted in the development of a greater number of inflorescences calculated per unit of area, especially in the second year of cultivation for seeds by 26.7%. The important role, from the physiological point of view, of this microelement in the process of growth and development of white clover plants in its cultivation for seeds is further confirmed by the development in the inflorescences of clover of a greater number of pods as well as a greater number of seeds in pods. The observed better setting of seeds in pods, in comparison with the control, by 9.5 to 18.8%, depending on the year of utilisation, was probably the effect of the role of boron in facilitating pollen tube elongation, which is essential for syngamy and the resulting seed set and development to occur.

Table 1 Effect of boron fertilization on seed yield and its components of white clover in two years of harvest.

Year after sowing	1 st	2 nd	LSD _{0.05}	1 st	2 nd	LSD _{0.05}
Boron fertilization (kg/ha)	0	2		0	2	
No. of inflorescences per m ²	745	758	ns	626	793	42.3
No. of pods per inflorescence	86.1	92.2	4.36	60.8	62.3	ns
No. of seeds per pod	2.1	2.3	0.16	1.6	1.9	0.18
Seed yield (kg/ha)	358.3	429.9	38.99	162.0	201.2	34.62
1000 seeds weight (g)	0.736	0.730	ns	0.733	0.735	ns

Conclusions The foliar additional feeding of white clover plants in early spring by boron exerted a positive influence on the number of heads per unit of area, number of pods per head and the number of seeds per pod. The advantageous inflorescence structure on surfaces fertilised by boron increased the seed yields by 20.0 to 24.4% in comparison with the control treatment.

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