Effect of Boron Fertilization on Seed Yield of White Clover

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Key words : white clover , seed production , boron , fertilization

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% , P_2O_5-130 mg/kg , K_2O-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 : P_2O_5-60 kg/ha , K_2O-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 ℃ 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 quadrate 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 m^2 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	1st		$LSD_{0.05}$	2nd		$LSD_{0.05}$
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 .

References

Marshall , A .H . , Khrbeet , H .K . , Hides , D .H . , 1991 . Influence of boron on the reproductive growth of white clover (*Trifolium repens* L .) cultivars . *Annals of Applied Biology* 119 , 541-548 .

Woodfield , D .R . , Jahufer , M .Z .Z . , Ford , J .L . , Van Hanja , N . , Johnston , D . , Van Kruijssen , L . , Caradus , J .R . , 2004 . Breeding white clover (*Trifolium repens* L .) for Europe : successes and challenges . *Grassland Science in Europe* 9 , 392-394 .