3(28) Physiological and agrotechnical principles of spring barley fertilization , Editor, Grzebisz W.

Przygocka-Cyna,K., Grzebisz,W. Yield and technological quality of malting barley in response to elemental sulphur application, p. 5

Abstract

The main yielding attributes of malting barley, i.e. grain yield and grain technological quality are sensitive to effects of external growth conditions, for example water stress. Research procedures conducted according to the concept of balanced plant crops fertilization allow finding a nutrient, which can be used as an instrument improving yielding use efficiency of nitrogen. In the present study, sulphur was used to correct nitrogen use efficiency. The conducted study showed, that both total and technological yields of malting barley responded to the interaction of year and S rates. The applied S fertilization affected plants growth in two main growth phases, i.e. vegetative and generative due to increasing number of developed ears and correcting weight of individual grains. Plants fertilized with S produced more than 720 ears per m2, which number was sufficient to achieve total grain yield of 5.3 t·ha-1. During grain filling, barley plants well supplied with S had increased their TGW up to 40 g, which in turn decreased N grain concentration. Thus, only S-sufficient barley plants were able to overcome, at least partly, negative effects of external conditions on their nitrogen economy, resulted in higher yields of grain and its technological quality.

Key words: malting barley, elemental sulphur, grain yield, technological yield

Przygocka-Cyna,K., Grzebisz,W. Dry matter accumulation and remobilization during grain filling of malting barley in response to elemental sulphur application, p.18

Abstract

Total grain yield of malting barley and its technological parameters are the main yielding characteristics, but both are strongly dependent on external growth factors. Sulphur is known as an element, which can significantly improve the N plant crop economy. The effective, but at the same time reliable evaluation of the yielding role of S needs a special research tool. In the present study, the growth analysis methods were used to evaluate the effect of S fertilization on dry matter accumulation and remobilization by malting barley during grain filling period. It was found, that dry matter yield of ears was affected by both dry matter

sources, but in accordance to S supply. Dry matter yield of ears of barley plants fertilized only with N (the control treatment), generally depended on the pre-anthesis dry matter resources. Plants fertilized also with S were however much more depended on current dry matter assimilation. Dry matter accumulation rate measured at anthesis, expressing its maximum rate, can be used as the parameter evaluating the final dry matter yield of ears.

Key words: malt barley, elemental sulphur, grain filling, dry matter, remobilization

Przygocka-Cyna,K.,Grzebisz,W. Nitrogen accumulation by barley plants and its economy during grain filling in response to elemental sulphur application,p. 29

Abstract

Nitrogen concentration in malting barley grain at maturity is for growers the main factor affecting profitability of this crop production. However, potential success in malting barley production depends on two physiological traits (i) amount of nitrogen accumulation in the pre-anthesis vegetation (ii) nitrogen partitioning among organs during grain filling. In the present study, the growth analysis was applied to explain the effect of elemental sulphur on these two physiological barley characteristics. Basing on the obtained results, malting barley nitrogen economics was described using three parameters: (i) the maximum rate of nitrogen accumulation, which occurred at heading, i.e. 3-4 weeks before plants reached the highest values of the CdmAR (ii) net nitrogen accumulation, which extended up to anthesis (iii) the net losses of nitrogen, which were substantial during grain filling. The main yielding effect of elemental sulphur application revealed via (i) higher amounts of N accumulation at anthesis and (ii) much lower post-anthesis N losses. Thus, plants well supplied with S were able to accumulate higher amount of dry matter during grain filling period of barley growth, causing in turn the dilution effect of nitrogen in grain.

Key words: malting barley, grain filling, nitrogen uptake, nitrogen remobilization

Przygocka-Cyna,K.,Grzebisz,W. Sulphur accumulation by barley plants and its economy during grain filling in response to elemental sulphur application , p. 40

Abstract

The most strategies of malting barley fertilization with nitrogen consist in decreasing fertilizer N rate in order to keep the qualitative standards. This assumption is only in part true. The production strategy of malting barley should also comprise tools allowing increasing

physiological utility of nitrogen taken up by plants. In the present study it was assumed, that sulphur applied in the elemental form is able to fulfill this yielding gap. It was found, that barley plants response to applied sulphur in two growth stages. The first one has been brought into light at stage, when flag leaf is just visible (BBA-37). This period of barley growth was decisive for the number of developed tillers, which depends on access to nitrogen and in turn is responsible for the potential number of physiological sinks (grains per plant). The second period of barley plants sensitivity to S availability occurred during grain filling. At milking stage of barley growth, plants well supplied with S doubled their S content in comparison to anthesis, whereas S-deficient increased its content only by 50%. Consequently S-sufficient barley plants were able to produce higher dry matter yield and decrease N concentration in grains. This phenomenon known as "N dilution effect" stresses the effect of S supply during grain filling on C economy ofbarley plants.

Key words: malting barley, elemental sulphur, S accumulation, grain filling, S remobilization

Fotyma,E.,Fotyma,M.,Filipiak,K. Application of model QUADMOD for interpretation the results of experiments with spring barley nitrogen fertilization , p. 52

Abstract

In the paper the description of the model QUADMOD and its application to optimise nitrogen rates for spring barley is presented. The parameters of the model can be approximated by means of simple statistical method based on discontinuous (two-straight lines) production function. All QUADMOD parameters calculated from the results of 12 field experiments with spring barley N fertilization showed substantial variability and therefore can not be treated as standard values in fertilizer recommendations.

Key words: QUADMOD model, nitrogen fertilization, spring barley

Górski,D., Grzebisz,W., Gaj,R. Effect of variety, nitrogen rate and fertilizer type on the yield and its structure and canopy architecture of malting barley, p. 61

Abstract

A three-factorial field trial was undertaken during the consecutive years 1999- 2001 in the surroundings of Znin, on the Kujawy Region. The following factors were investigated: (i) two malting barley varieties Brenda and Rudzik, (ii) four nitrogen rates: 0; 30; 60; 90 kg N ha-1 and (iii) three types of mineral fertilizers: ammonium salpeter (AS), calcium ammonium

salpeter (CAN), nitrophoska (NPK). Results revealed that barley grain yield depended on the number of ears per area unit (1m2), basically. The optimal nitrogen rate for recording barley grain characterised by high technological quality was estimated to amount for 30 kg N·ha-1, at productive tillering of 2.0.

Key words: spring barley, components of yield structure, stand structure

Górski,D., Grzebisz,W., Gaj,R. Effect of variety, nitrogen rate and fertilizer type on accumulation of biomass by malting barley , p. 70

Abstract

The formation of biomass and its structure was estimated for the period before and after blooming in a field trial, where two varieties of malting barley have been tested under conditions of differentiated nitrogen fertilization. Plant biomass was determined at the following growth stages (according to the Zadoks scale): EC 31/31, EC 50/51 and EC 92. Nitrogen fertilization has significantly shaped the magnitude of the biomass, irrespective of years, whereas the yield was a function of the formed biomass. Results show that about 87% of the grain matter originated from assimilates accumulated after blooming.

Key words: biomass, spring barley, nitrogen

Górski,D., Grzebisz,W., Gaj,R. Effect of variety, nitrogen rate and fertilizer type on nitrogen management by plants of malting barley . p.77

Abstract

During the three consecutive years vegetative years i.e. 2000 - 2002 a threefactorial field trial was carried out at Żnin on the Kujawy Region. The following experimental factors were considered: (1) two malting barley varieties (2) four mineral nitrogen rates (3) three types of mineral fertilizers. Cropping of malting barley requires an elaboration of fertilizing strategy in order to enable nitrogen uptake during the vegetative growth stage (up to the blooming stage). Results have shown that the size of nitrogen pool taken up by malting barley was determined mainly by the level of nitrogen fertilization. An increase of nitrogen rate up to 90 kg N·ha-1 induced a simultaneous increase of its accumulation in the separate plants organs (i.e. leaves, stems, ears and grains) and from the start up to the end of the vegetation, as well.

Keywords: nitrogen uptake, protein, translocation coefficient

Górski,D., Grzebisz,W., Gaj,R. Effect of variety, nitrogen rate and fertilizer type on mineral nitrogen balance in the field of malting barley ,p. 85

Abstract

A field trial with malting barley was carried out at Żnin on the Kujawy Region. The following factors were tested i.e. two spring barley varieties, four nitrogen rates and three mineral fertilizers. The content of mineral nitrogen was determined at the following dates: at spring before sowing of barley and at three given growth stages: EC 30/31, EC 50/51 and EC 92. Soil samples were collected from the topsoil (0-30 cm) and subsoil (31 – 60 cm). Nitrogen fertilization increased the rate of mineralization processes in the soil, and consequently led to an increase of the amounts of nitrogen available for plants. High content of mineral nitrogen in the soil has stimulated its uptake by plants, particularly at the vegetative growth. The increase of nitrogen uptake induced high grain yield. The content of mineral nitrogen forms in the soils was determined by the rate of its uptake from the soil.

Key words: mineralized nitrogen, nitrogen balance, priming effect,

Pecio,Al. Verification of the universality of critical nitrogen dilution curve for spring malting barley cultivars . p. 95

Abstract

On the base of field experiment conducted in the years 2001-2003 at the Grabow Experimental Station of the Institute of Soil Science and Plant Cultivation in Pulawy nitrogen dilution curves were evaluated for 4 selected cultivars of spring malting barley. The parameters of these curves did not differ significantly and were similar to parameters obtained in previous study with cultivar Rudzik. Therefore the common dilution curve for spring barley was proposed in the form of the following equation: Ncrit=3.12·DM-0.33. The results support the hypothesis on the universality of the dilution curve for all C3 crops set by Greenwood et al. [1990].

Key words: spring barley, malting cultivars, nitrogen dilution curve

Pecio, Al. Stability of QUADMOD model parameters for cultivars of malting spring barley , p. 105

Abstract

In the paper parameters of QUADMOD model for spring malting barley cultivars were estimated on the base of field experiments carried on in the years 1998-2003. This model

enables optimization of nitrogen fertilization by means of parameters derived from the relationships between N uptake and N rate and between grain yield and N uptake. Statistical analysis showed that QUADMOD parameters did not differ significantly between tested barley cultivars. However these parameters showed high variability depending on climatic conditions and should not be generalized. Average optimal nitrogen rate was 55 kg N·ha-1 by which the yield of about 5,2 t.ha-1 grain can be achieved with nitrogen concentration of about 2,1%, adequate for malting barley.
Key words: QUADMOD model, nitrogen fertilization, malting barley.