32 Physiological and agronomical aspects of winter wheat fertilization with nitrogen, editors: Fotyma M., Grzebisz W.

Barłóg P., Grzebisz W. Łukowiak R., Cyna K. An analysis of response of four winter cereals to increasing rates of fertilizer nitrogen

Abstract

In the years, 2000 and 2001 four winter crops, rye classical type, rye hybrid type, triticale and wheat cultivated on poor and very good rye soil complexes were evaluated by means of two indices (i) levels of harvested grain yields (ii) optimum nitrogen rates. The first index clearly revealed the advantage of triticale and rye hybrid type over rye classical type and especially wheat. The second index has been evaluated by means of four regression models, quadratic Q, linear-plateau L-P, square root SQR and tanh TG. The Q function has generally overestimated the optimum N rate over the L-P, assumed as the standard nitrogen response function. However, the application of the modified grain yield maximum (GY_{max}), i.e. $GY_{0.95}$ concept allowed to calculate the optimum N rate with much higher accuracy. The other response models, such as the SQR and TG showed much weaker applicability for reliable N optimum estimation.

Key words: winter cereals, N rates, yield response functions, optimum N rates

Barłóg P., Grzebisz W. Winter wheat yielding response to manganese foliar application and fungicide canopy protection

Abstract

One factorial field experiments were carried out in the years 2005-2007 at nine sites strongly differentiated in respect to soil properties and agrotechnical practices. The following treatments were established in order to investigate manganese foliar application with simultaneous fungicide protection on winter wheat health and yield: control; fungicide – beginning of shooting (BBCH30); fungicide – beginning of heading (BBCH50/51); fungicide (30 and 50/51); Mn (30); Mn (50/51); Mn (30 and 50/51); fungicide + Mn (30); fungicide + Mn (50/51); fungicide + Mn (30 and 50/51). Manganese was applied as MnO at the rate of 0.5 kg Mn ha^{-1}. A significant grain yield increase as compared to the control treatment was obtained at two sites, only. The best treatment (on average 50% yield increase) in terms of

plant protection was fungicide application at the stage BBCH30. A simultaneous manganese foliar application along with fungicide increased slightly the efficiency of the treatment. At two sites, the simultaneous application of manganese and fungicide at the stage BBCH50/51 has increased significantly crude protein yield, as compared to the control treatment.

Key words: winter wheat, manganese, fungicide, grain yield, nitrogen content

Fotyma M., Flipiak K. Comparison of several production functions for describing winter wheat response to nitrogen fertilizers

Abstract

In the paper the interpretation of the results of 10 experiments with winter wheat and increasing nitrogen rates by means of 3 production functions is presented. The calculated optimal nitrogen rates decreased as follows : polynomial 2ed order(for maximal yield> polynomial 2ed order(for 95 % of maximal yield) = QUADMOD model > split-lines function. In comparison to polynomial 2ed order for maximal yield, optimal N rates calculated by other functions were by 24 – 42 % lower at the expense of 5-8 % of the yield only. The most recommended production function for interpreting the results of these experiments is polynomial 2ed order for 95 % of maximal yield. Very interesting is also QUADMOD model though its usefulness was limited by inadequate number of 6 nitrogen N rates .

Key words: winter wheat, nitrogen fertilization, production functions, QUAMOD model

Grzebisz W., Łykowski W., Szczepaniak W. Effect of nitrogen rates and plant protection levels on winter wheat grain yielding patterns

Abstract

Grain yield potential of cereal crops depends on degree of limitations imposed both by factors influencing nitrogen supply to growing plants and also those reducing yields such as level of canopy fungicide protection. Both groups of factors, i.e. four N rates and four levels of wheat canopy protection were arranged in experimental design in order to evaluate their effect on grain yields and quality of wheat. Grain yield of variety *Zyta* showed a significant response to interaction of both factors in two of three years of study. Their effects relied on supply of nitrogen, which was limited by external factors, especially by deep drought in 2003

year. Therefore harvested grain yields were significantly influenced by thousand grain weight a yielding element depending on flag leaf ability to keep green area and photosynthetic activity of wheat plant during grain filling period of wheat growth.

Key words: winter wheat, nitrogen rates, level of canopy protection, grain yields

Grzebisz W., Łykowski W., Szczepaniak W., Diatta J. Effect of nitrogen rates and plant protection levels on dry matter management by winter wheat

Abstract

Pattern of dry matter accumulation by the wheat canopy over the growing season is a very useful index of external factors impact. In order to solve this problem field study comprising four N rates and four progressive protection levels of winter wheat has been carried on. The results showed that the general dry matter accumulation pattern following the linear regression model is a prerequisite for high yields of wheat. This model of dry matter accumulation by wheat has been developed by plants well protected against diseases in the growing season, i.e. at the end of tillering and in the middle of shooting (the F-2 level). The yielding role of plant protection at the F2 level relied on sustaining on both higher number of stems and longer photosynthetic activity of leaves. The specific yielding role of plant protection was attributed to plant leaves beneath the second leaf. Their biomass can be used as a useful indicator of the final grain yield of wheat.

Key words: winter wheat, dry matter, nitrogen rates, and fungicide canopy protection

Grzebisz W., Łykowski W., Szczepaniak W., Cyna K. Effect of nitrogen rates and plant protection levels on nitrogen accumulation and remobilization by winter wheat during the graon filling

Abstract

The study on wheat response to increasing supply of fertilizer nitrogen under background of levels of fungicide protection aimed at nitrogen economy in the course of the

growing season, with special attention to grain filling period has been carried on. The general pattern of nitrogen accumulation in the course of the growing season followed the linear regression model and in turn reveals gap between sink capacity of growing grains to absorb nitrogen and its supply from internal and external sources during wheat crop maturation. The most conspicuous physiological function of applied fungicide protection was an increasing ability of wheat plants to increase nitrogen absorption from soil resources during grain filling. These extra amounts of nitrogen taking up by wheat canopies has significantly rendered nitrogen remobilization from leaves below the second leaf (termed as the other leaves – OL) and in turn extended their photosynthetic activity. This phenomenon was a prerequisite for higher grain yields harvested on treatments supplied with high rates of fertilizer nitrogen and well protected against diseases. This hypothesis is corroborated by significantly higher nitrogen yields of the OL at maturity and larger green leaf area of the flag leaf at BBCH 75.

Key words: wheat, nitrogen, anthesis, maturity, remobilization

Pecio A., Fotyma M. Nitrogen fertilization and fungicide application as the elements of winter wheat production

Abstract

In the paper the results of 3 years investigations on interaction of N fertilization and plant protection system in winter wheat production are presented. Wheat was grown after oats on 5 levels on nitrogen fertilizers and under 3 systems of plant protection. The yield parameters and grain baking quality was examined. The prerequisites for high yield of good quality were normal weather conditions and intensive nitrogen fertilization. The parameter deciding upon yield level was the number of grains per ear. The effects of N fertilization and plant protection are of additive character.

Key words : winter wheat, nitrogen fertilization, plant protection systems

Potarzycki J. Influence of nitrogen and magnesium fertilization at the flag leaf stage of winter wheat development on the yield and grain quality

Abstract

The aim of investigations was to determine the effect of winter wheat top-dressing at the flag leaf (BBCH 39) stage with different nitrogen fertilizers (40 kg N*ha^{-1}) and magnesium sulphate. Ammonium nitrate (AN), ammonium sulphate (AS), urea ammonium-nitrate solution (UAN) and calcium nitrate (CN) have been applied in solutions with and without magnesium sulphate. Nitrogen fertilization at the flag leaf stage increased the grain yield on average by 14% and improved the grain quality, but the yield-forming effect was influenced by rainfalls distribution in the growth period. The form of nitrogen fertilizers had a minor effect on grain yield, but the efficiency of different fertilizers depended on weather conditions. The effect of magnesium applied with the third nitrogen rate depended on Mg content in the soil and the type of nitrogen fertilizer. This effect was higher with ammonium sulphate (AS).

Key words: winter wheat, nitrogen, magnesium, fertilization

Potarzycki J. Nitrogen management of winter wheat fertilized with magnesium and nitrogenous fertilizers at the flag leaf stage of growth

Abstract

The aim of the paper was to determine the effect of four nitrogen fertilizers and magnesium applied at the flag leaf stage (BBCH 39) on nitrogen management by winter wheat. The late nitrogen rate, i.e., 40 kg N ha^{-1} was applied at the stage BBCH 39 in the forms of ammonium nitrate (AN), ammonium sulphate (AS), urea ammonium-nitrate solution (UAN) and calcium nitrate (CN). These fertilizers were applied in solutions with and without magnesium. Nitrogen application at BBCH 39 increased nitrogen content in the grain, irrespective of the form of nitrogen fertilizers. The yield of winter wheat grain depended on the nitrogen content in leaves, while the stems decided upon grain quality in respect to nitrogen accumulation. Nitrogen concentration in stems explained in 70-75% the variability of its concentration in the grain. The positive role of magnesium resulted in the stimulation of nitrogen recovery from the late N rate, irrespective of nitrogen fertilizer. Nitrogen recovery from fertilizers applied in solution at top-dressing was higher in the case AN and UAN.

Key words: winter wheat, nitrogen, magnesium

Szczepaniak W. The critical nitrogen concentration (NCC) concept as a tool to evaluate nitrogen nutritional status of winter wheat

Abstract

A well-developed strategy of winter wheat production requires very sophisticated measures to control the crop nitrogen status over the course of the growing season. Currently, the concept of nitrogen critical concentration (NCC) in plant biomass over the course of vegetative growth is of great researcher's attention. The general relationship between plant nitrogen content and dry mass production describes the formula $N_c = a \circ DM^{-b}$ (DM - plant crop dry matter yield, a, b – coefficients). The N_c model for high productive wheat soil has been developed on the basis of three years field experiments consisted of four level of N rates and four progressive levels of canopy fungicide protection. The developed model showed sufficiently high sensitivity, as indicating by the calculated nitrogen nutrition indices (NNIs), to variable nitrogen supply in the course of the studied growing seasons. The developed coefficients "a" and "b" of the N_c equation show great prognostic values with respect to critical ranges of N concentration in wheat canopy in early stages of its growth and N economy over the course of vegetation, respectively.

Key words: critical N concentration model, winter wheat, nitrogen nutrition index (NNI)