

THE CONSEQUENCES OF SOIL MINING FROM POTASSIUM STOCK

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Abstract

In the paper the results of laboratory investigations on the content of different pools of potassium in strongly differentiated soils are presented. The soil samples originate from the long-term experiments with potassium fertilization carried on in nine Central-Eastern European Countries. Soil samples were collected from two treatments, without and with potassium fertilization and from two soil layers 0-25 cm and 25-50 cm. The analysis concern the immediately available, readily available, slowly available and two operational forms of structural potassium. The factor which influenced the most the content of all pools, except immediately available one, of potassium was soil texture. The changes in the content of structural potassium matches perfectly well the offtake of this element in the control treatment. In the long-term experiments the balance between different pools of potassium is established independently of fertilizers application.

Key words: long-term fertilization experiments, potassium pools, potassium Balance

THE EFFECT OF SOIL AND FOLIAR SULPHUR APPLICATION ON WINTER WHEAT YIELD AND SOIL PROPERTIES

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Abstract

In the years 2009-2010 the effect of sulphur fertilization on the yield and chemical composition of winter wheat was researched in a field experiment carried on in the South-West region of Poland. Elemental sulphur was applied through soil and foliar application. Two doses of sulphur 40 kg S·ha⁻¹ and 80 kg S·ha⁻¹ in the form of Wigor 90 fertilizer including 90% of elemental sulphur have been applied to the soil in the autumn. The foliar fertilization consisted of two doses of elemental sulphur 5 dm³·ha⁻¹ and 10 dm³·ha⁻¹ applied at the visible flag leaf stage (37 BBCH). The soil applied sulphur significantly increased grain yield and the content of this element in above-ground parts plants at the growth stages 39 BBCH and 59 BBCH in comparison with the yield from the control field. The straw yield also increased with a dose of 80 kg S·ha⁻¹ applied to the soil and after foliar fertilization when the dose of 10 dm³ Sulphur·ha⁻¹ was used. Fertilizing with elemental sulphur significantly increased the overall sulphur content during the wheat vegetation 39 BBCH phase when the highest doses were used and during the 59 BBCH phase when a several doses were applied. However, no significant differences in the content of this element in the final yield (grain and straw) were found. Elemental sulphur applied to soil in two doses significantly lowered the soil reaction and increased the sulphate content in comparison to the control.

Key words: sulphur fertilisation, winter wheat, sulphur in plants, sulphur in soil

EFFECT OF COMPOST PRODUCED BY THE GWDA METHOD AND PRP SOL ON THE YIELD OF WINTER WHEAT AND SOIL PROPERTIES

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Abstract

In 2008–2009, a field experiment has been carried on at Agricultural Experimental Station in Lipnik on the soil qualified as class IVa and good rye complex showing neutral reaction, high

content of available phosphorus and medium content of available potassium and magnesium. The aim of the study was to determine the effect of compost produced from municipal sewage sludge by the GWDA method supplemented by soil improver PRP SOL on the yield and quality of winter wheat grain and on soil properties. Compost was applied in the doses including 100, 200 and 300 kg N·ha⁻¹ and soil improver in the dose of 150 kg·ha⁻¹. Compost and soil improver significantly increased grain yield. The total cadmium, copper and zinc contents in soil decreased under influence of compost independently of soil improver application

Key words: sewage sludge compost, soil improver, winter wheat, heavy metals in soil.

EFFECT OF COMPOST FROM THE SPENT MUSHROOM SUBSTRATE ON MAIZE YIELD AND SOIL FERTILITY

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Abstract

The three-year field experiment on a soil classified as stagnic luvisol examined the effect of raw and composted spent mushroom substrate on maize yield and soil properties (pH, Hh, CEC, TB, BS and content of available forms of P, K and Mg). Six fertilizer treatments and a control one, in four replications each was used in the experiment. The fertilizer treatments include: spent mushroom substrate, spent mushroom substrate composted with straw, spent mushroom substrate composted with sewage sludge, farmyard and mineral fertilization. All fertilizers were applied in three doses, corresponding to 100, 200 and 300 kg N · ha⁻¹. In the experiment for three years a maize of the KB1902 variety was cultivated. The test plant was grown for silage.

The investigations shown that fertilization with spent mushroom substrates and composts made of this substrate increased yields of maize as compared to the control treatment. These fertilizers have also favourable effect on the soil chemical properties in terms of raising soil pH and increasing the contents of available forms of P, K and Mg. and improving the sorption properties of the soil. Among the studied fertilizers compost made from spent mushroom substrate and sewage sludge showed the best impact on yield of maize and improving the soil chemical properties.

keywords: spent mushroom substrate, compost, fertilization, soil

SOIL PROPERTIES UNDER CROP ROTATION AND PLANTATION OF NORTHERN Highbush BLUEBERRY DEPENDING ON LONG-TERM FERTILIZATION

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Abstract

The study was based on the long-term fertilization experiments carried on since the year 1923 at the Experimental Station in Skierniewice. The main objective was to assess soil structure and soil water retention with regard to different fertilizer treatments applied to cereal-root crop rotation and the permanent plantation of Northern highbush blueberry (*Vaccinium corymbosum*). The soil in rotation was cultivated by ploughing while under the plantation was not cultivated at all. Since 1923, nitrogen has been applied to both fields in the form of ammonium sulphate.

The measure of soil structure was the stability of the aggregates selected into two fractions, 3-1 and 1-0.5 mm by dry and wet sieving method. Soil under the permanent plantation showed the best structure. In the arable crop rotation, full fertilization only, including manure, NPK and liming improved considerably this soil characteristic. Soil water retention, particularly measured at the water potential -10 and -33 kPa was significantly higher under the permanent plantation. Soil structure alike, the highest water retention capacity characterized the treatment with the full fertilization. Very strong relationships between soil structure and water retention has been established.

Key words: fertilization, liming, soil structure, soil water retention

THE EFFECT OF INCREASING DOSES OF MEAT-AND-BONE MEAL ON THE YIELD AND MACRONUTRIENT CONTENT OF TIMOTHY GRASS (PHLEUM PRATENSE L.)

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Abstract

The effect of three increasing doses of meat-and-bone meal on the growth rate, yield and macronutrient content of timothy grass (*Phleum pratense* L.) was studied during a two-year pot experiment carried on in 2005–2006. Meat-and-bone meal was applied in a doses 0.25, 0.5 and 1.0% per 10 kg soil at the beginning of the experiment in 2005. The increasing doses of the meal contributed to a gradual decrease of the grass dry matter yield, particularly in the first year of study. The highest (1%) dose of the meal proved to be too high for timothy grass due to limiting the seed sprouting and young plant withering. Timothy grass fertilized with higher doses of meat-andbone meal was characterized by the optimum content of nitrogen, magnesium and calcium, high concentrations of phosphorus and sodium, and excess accumulation of potassium in the biomass.

Key words: timothy grass, macronutrients, meat-and-bone meal.

THE EFFECT OF SOIL FERTILIZATION WITH PHOSPHORUS ON THE CONTENT OF SELENIUM IN WHITE MUSTARD PLANTS (*Sinapsis alba* L.)

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Abstract

In the pot experiment, the impact of phosphorus fertilization on the yield and the content of selenium in mustard plants were investigated. The soil substrate was slightly acidic (pH KCl 6,3) sandy loam showing average content of available phosphorus (55 mg P .kg⁻¹) and a low content of selenium (143 µg.kg⁻¹). Soil has been enriched with selenium, using an aqueous Na₂SeO₃ solution in a dose of 240 µgSe. kg⁻¹. Phosphorus was introduced in triple superphosphate in doses of: 0, 0,08, 0,12, 0,16 and 0,24 g P. kg⁻¹ of soil. The testing plant, grown twice in the same season was white mustard variety “Claudia”. The lowest dose of phosphorus fertilizer increased significantly the selenium content in the above-ground parts of mustard. However, the following doses decreased almost proportionally the content of this element. At the highest level of phosphorus fertilization, the selenium content was much lower than in the control plants. The ratio Se:P narrowed with the consecutive phosphorus doses, i.e. the accumulation of selenium declined in mustard plants well supplied with phosphorus.

Key words: phosphorus, selenium, white mustard

Effect of different long-term organic and mineral fertilization systems on productivity of crops GROWN ON LIGHT SOIL

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Abstract

The study dealt with yields of crops obtained in a permanent static field experiment established in the year 1973 at Tomaszkowo near Olsztyn. Three fertilization systems have been compared, organic (farmyard manure, slurry), mineral (NPK) and mixed organic and mineral (slurry + PK, manure + PK). Two rates of slurry were tested, rate I balanced according to N content with FYM and mineral fertilizers and rate II balanced according to carbon content with FYM. Additional mineral fertilization (P and K) was applied in a dose equal to half of a rate applied in NPK fertilizers. Slurry in rate II produced the highest cereal unit yield, nearly two-fold higher than in control treatment. The yield of potato tuber in the NPK treatment exceeded, however, that in the treatment with natural fertilizers. For potato additional PK fertilization proved to be the most effective in combination with slurry in rate, I. Spring barley, winter wheat, winter rape, rye and maize responded better to the application of slurry in rate II than to the treatments with slurry in rate, I, FYM or NPK. The most effective was 1 kg of nitrogen originated from the slurry in rate, I and NPK. It was slightly less effective in FYM and two-times less effective than nitrogen in the slurry applied at rate II.

Key words: long term fertilization, farmyard manure, slurry, NPK fertilization

INFLUENCE OF DIFFERENT FERTILIZATION SYSTEMS AND LIMING ON POTATO TUBER YIELD AND YIELD STRUCTURE

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Abstract

The aim of the study has been to evaluate the influence of long-term application of three fertilization systems on the volume and structure of potato tuber yield. The first system was based on natural fertilizers, farmyard manure (FYM) and slurry, both from a swine farm; the second one included natural fertilizers supplemented by PK fertilizers in half the dose of these elements in the NPK treatment and the third one consisted exclusively of NPK mineral fertilizers. The control treatment was unfertilized. The experiment consists of two series, without liming and with liming under winter wheat preceding potato in the crop rotation. In the paper, the results obtained in the fifth rotation cycle are presented. Significantly increased tuber yield appeared under all fertilization systems. Slurry supplemented by PK fertilizers increased the yield of potato tubers in comparison to FYM alone or FYM with PK fertilizers. The highest yield was achieved in the treatment with slurry rate II (balanced in terms of the amount of organic carbon introduced to soil in farmyard manure), supplemented by PK fertilizers. Liming increased the tuber yield by 2.9 Mg·ha⁻¹ in all fertilization treatments except FYM+PK. On average, marketable tubers made up about 90% of the total potato yield. The highest yield of marketable tubers was found in the treatment with slurry rate I (balanced in terms of the amount of total N introduced to soil in farmyard manure)+PK. Liming had some effect on calcium accumulation in potato tubers and on the process of tuber formation, increasing the total number of tubers.

Key words: slurry, farmyard manure (FYM), potato yield, potato yield structure

THE EFFECT OF LONG-TERM FARMYARD MANURE STORAGE DIRECTLY ON THE GROUND ON THE POLLUTION OF SOIL AND WATER BY MINERAL FORMS OF NITROGEN

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Abstract

In the period from autumn 2007 to autumn 2009, the impact of farmyard manure heaps situated directly on sandy soil on soil and ground water pollution with mineral forms of nitrogen has been investigated. This method of manure storage results in the highly pollution of the soil profile up to 90 cm and the ground water with nitrate and ammonium nitrogen. Hence such method of manure storage must not be continued for a longer period of time.

Key words: cattle farmyard manure, FYM storage, soil and groundwater pollution, nitrate nitrogen, ammonia nitrogen

NITROGEN IN ATMOSPHERIC DEPOSITION

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Abstract

The global input of inorganic nitrogen with the atmospheric depositions on Earth surface has increased three fold since 1860, and currently it is comparable to the amount in mineral fertilizers. Moreover, this assessment does not include the load of the organic nitrogen which equals about 25% of the total deposited element. The evaluation of the total atmospheric nitrogen input is often limited to the wet deposition, comprising rain, snow and hailstones. Meanwhile, nitrogen compounds fall in dry deposition as well. Dry deposition includes sorption of gaseous nitrogen compounds and gravitational settle down of particulate matters containing nitrogen, also precipitations of dew, fog and cloud drops, though water is involved here. The inorganic nitrogen concentrations in dew water collected in Europe were in the range 1,6–7,3 mg N·dm⁻³, in fog water in the range 5,6–50,7 mg N·dm⁻³, and in cloud water 3,8–8,1 mg N·dm⁻³. The load of nitrogen in fog depositions in Chech mountains achieved 17 kg N·ha·y⁻¹, and in cloud droplets depositions in Mid-Wales 7,8 kg N·ha·y⁻¹. The global nitrogen fluxes in atmospheric depositions consisted from 46, ·10⁶ t N·y⁻¹ in dry forms and 46,3·10⁶ t N·y⁻¹ in rains and snows. The amount of reactive nitrogen in wet deposition in Poland is usually supposed to be 17 kg N·ha⁻¹·y⁻¹. Assuming that similar amount falls in dry deposition than the total load would amount to 34 kg N·ha⁻¹·y⁻¹, or 1,060·10³ t N deposited on the territory of Poland. This amount is equal to the nitrogen consumption with mineral fertilizers. To that 25% should be added in the form of organic nitrogen compounds, which raise the total nitrogen input to 42 kg N·ha⁻¹·y⁻¹.

Key words: Atmospheric nitrogen, wet and dry deposition, dew, fog, cloud droplets, organic nitrogen