6. Fruchtenicht K., at al (1993) Pflanzenermahrung und Dungung. /In: Faustzahlen fur Landwirtschaft und Gartenbau. Hydro Agri Duhnen GmbH. Landwirtschaftsverlag Munster-Hiltrup, 12, 254-275.
7. Makowski N., Gienapp Ch. (1998) Entscheidungshilfen fur die Rapsbestellung. Neue Landwirtschaft., 7, 54-55.
8. Schroder G. (1992) Raps hat hohe Anspruche. Neue Landwirtschaft., 7, 43-45.
9. Sturm H., at al (1994) Gezielter dungen. Integriert wirtschaftlich, umweltgerecht 3. uberarb. Aufl. Frankfurt: DLG-Verlag, Verlags-Union Agrar. 471.
10. Vošak a kolektiv (2000) Repka. Praha. 321.
11. Жолик Г.А. (2006) Особенности формирования урожая семян ярового и озимого рапса в зависимости от элементов технологии и факторов среды: Монография. Горки, 2006.
12. Интенсивная технология производства рапса (1990) /Под ред. Бурякова Ю.П. Москва.Росагропромиздат. 188.
13. Пилюк Я.Э., Белявский В.М. (1999) Основные пути увеличения производства растительного масла. Проблемы сельскохозяйственного производства в изменяющихся экономических и экологических условиях.- Часть 2. Агрономия.-Смоленск, 12-14.
14. Савенков В.П. (2000) Роль минеральных удобрений в повышении урожайности и качества семян ярового рапса. В кн. Артемов И.В. Научное обеспечение отрасли рапсосеяния и пути реализации биологического потенциала рапса. Липецк, 110-113.
15. Савенков В.П. (2007). Рациональное использование техногенных и биологических средств при возделывании рапса в Центральной России. Автореферат, Воронеж, 2007.
16. Шпаар Д., и др. (1999) Рапс. Минск. 204.
17. Яковчик С.Г. (2006). Особенности формирования и накопления масла и белка в семенах ярового рапса. Рапс: масло, белок, биодизель. Минск, 109-113.

VIDEI DRAUDZĪGU AUDZĒŠANAS TEHNOLOĢIJU OPTIMIZĀCIJA EĻĻAS RAPSIM LATVIJAS AGROEKOLOĢISKAJOS APSTĀKĻOS

Borovko L.

LLU Zemkopības zinātniskajā institūtā Skrīveros velēnu vāji podzolētā mālsmilts augsnē vasaras rapša sējumos veikti izmēģinājumi, kuros uz fosfora P_{70} fona pētīta slāpekļa un kālija mēslojuma devu: ($N_{60}K_{60}$, $N_{80}K_{80}$, $N_{100}K_{100}$, $N_{120}K_{120}$, $N_{140}K_{140}$) kg ha^{-1} ietekme uz sēklu ražu un tās kvalitāti. Izmēģinājumos pārbaudīti sekojoši preparātu maisījumi ar samazinātām devām (0.5 l ha^{-1}): Moddus + Folikūrs, Moddus + Juventus, Cikocels + Folikūrs, Cikocels +Juventus. Maisījumi izsmidzināti augu ziedpumpuru veidošanās fāzē. Trīs gadu lauka izmēģinājumos iegūtie rezultāti rāda, ka NK mēslojums pozitīvi ietekmēja vasaras rapša augšanu un attīstību, sēklu ražu un tās kvalitāti. Vislielāko sēklu ražas pieaugumu – 3.25 t ha^{-1} nodrošināja $N_{120}K_{120}$ deva. NK mēslojuma pielietošana veicināja kopproteīna uzkrāšanos (22-24%), bet koptauku samazināšanos (47-44%) sēklās. Augstāko eļļas iznākumu – 1341 kg ha^{-1} nodrošināja mēslojuma deva $N_{120}K_{120}$. Vidēji trijos gados augšanas regulatoru un fungicīdu maisījumu pielietošanas ietekme uz vasaras rapša sēklu ražu bija būtiska. Salīdzinājumā ar kontroli, ražas pieaugums sastādīja 0.62-0.91 t ha^{-1}. Labākais preparātu maisījums bija Cikocels + Folikūrs, kas nodrošināja 1389 kg ha^{-1} eļļas iznākumu.

EFFICIENCY ESTIMATION OF SOIL DEEP-TILLAGE FOR WINTER WHEAT BY USING PRECISION TECHNOLOGIES OF CROP CULTIVATION

Dinaburga G., Lapins D., Berzins A., Plume A.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001
phone: +371 3005632, e-mail: Dainis.Lapins@llu.lv

Abstract
For the completion of the work the following aim is set: the establishing of soil deep-tillage efficiency in winter wheat industrial areas in conditions of rugged field macro relief using data of the farm management local GIS and soil research. The work was performed at the Latvia University of Agriculture Research and Study farm "Vecauce" from 2005 to 2007. During the research in stationary with GPS established points lightly soil penetration resistance and soil moisture spots were measured to the depth of 50 cm and soil samples were taken to determine its

grading composition in the topsoil. Harvest was detected with combine CLASS LEXION 420 GPS facilities. It was established that deep loosening of soil should be carried out when the penetrometric resistance of soil exceeded 600 kPa cm^{-2}.

Key words: GPS, GIS, soil resistance, soil moisture

Introduction

During recent years several elements of precision agriculture are appearing in the Latvian farms, firstly, the equipment of grain harvesters for the formation of the yield charts, next, the application of the yield chart is connected with the investigation into soil properties (Lapins et al. 2007). This means that the farms should form their own local geographic information system (GIS). Research materials of the soil properties form the basis of the introduction of differentiated, GIS-based resources-saving soil tillage. Already in previous years the research of the possibilities to optimize the measures of soil tillage by using the GPS was conducted in Latvia (Lapins et al. 2006). The aim of the research was to investigate correlations among yield, soil resistance, soil humidity in different meteorological circumstances, as well as to evaluate the efficiency of deep soil tillage for winter wheat in autumn 2005. That would allow for the adjustment of the criteria recommended for implementing site specific soil tillage in the farms.

Materials and Methods

Field trials were carried out at the Research and Study farm “Vecauce” of the Latvia University of Agriculture during the years 2005 to 2007. Winter wheat was investigated in 47 stationary points set up by GPS; the crop rotation was winter wheat after winter wheat. Meteorological conditions were different between the trial years: the average air temperatures were above the long term mean in both trial years, especially in the second part of the year 2006 (Figure 1). The average temperature of July 2006 was 3.5 ºC higher than that observed over the long term. Along with insufficient precipitation this caused rapid ripening and the early harvesting of winter wheat. The total of precipitations was low in both trial years, but during April – August in 2007 it was lower if compared to the same period in 2006 despite a high amount of precipitation in August 2006 (Figure 2).

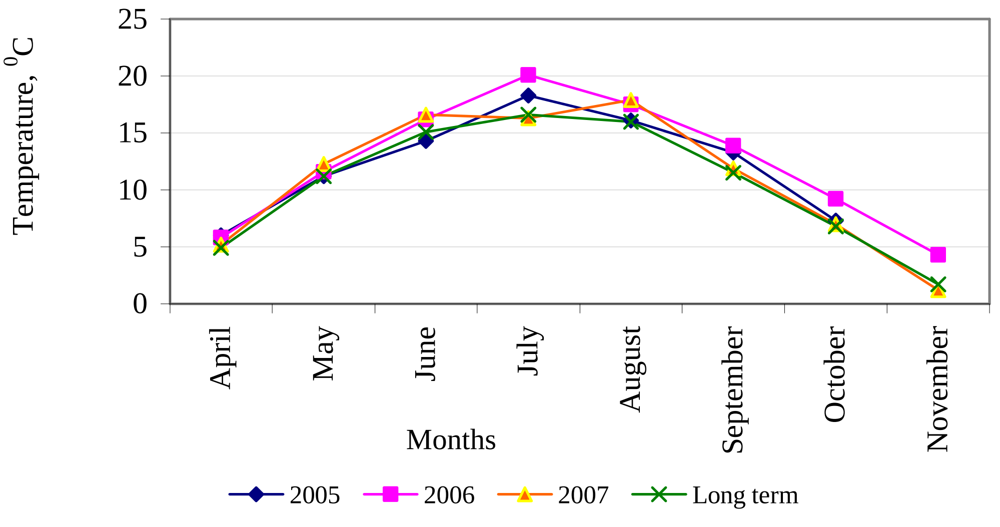

Figure 1. The average day and night air temperatures in the years 2005 – 2007, °C
(In specific year from Metpole in Vecauce, long-term average – from Dobele HMS)

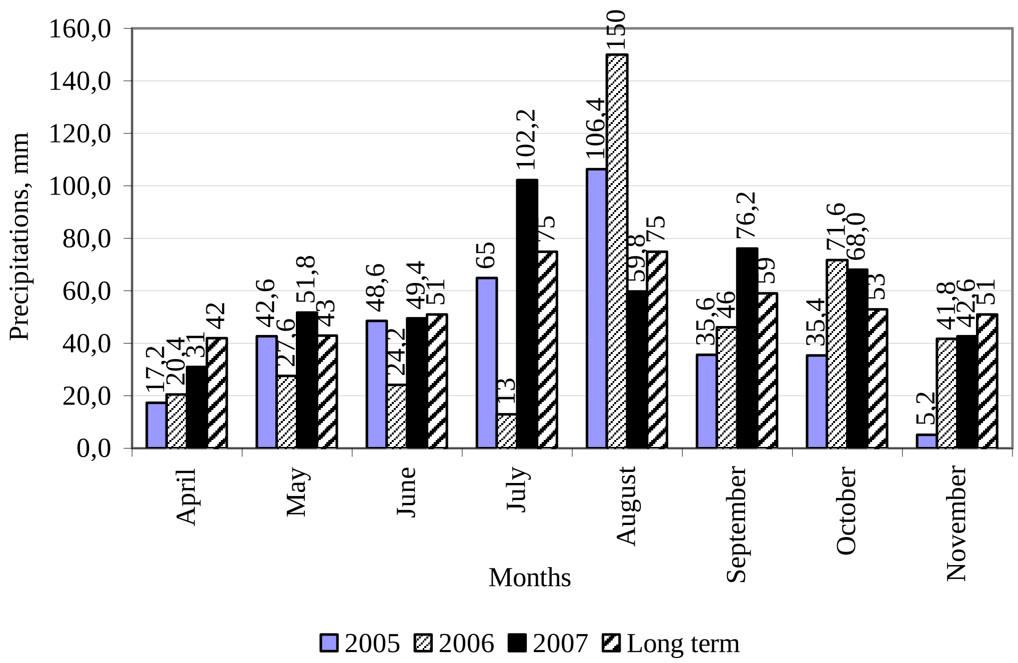

Figure 2. The average amount of precipitation in the years 2005 – 2007, mm
(In specific year from Metpole in Vecauce, long-term average – from Dobele HMS).

Soil characteristics in "Kurpnieki" field: sod podzolic loam soil, humus content 14 - 91 g kg^{-1}, soil reaction pH_{KCL} 6.0 - 7.4, phosphorus content 102 - 394 mg kg^{-1} and potassium content 102 - 333 mg kg^{-1}. Relief – wavy low-land, area with marked mezzo-relief (Figure 3). Field has a closed drainage system.

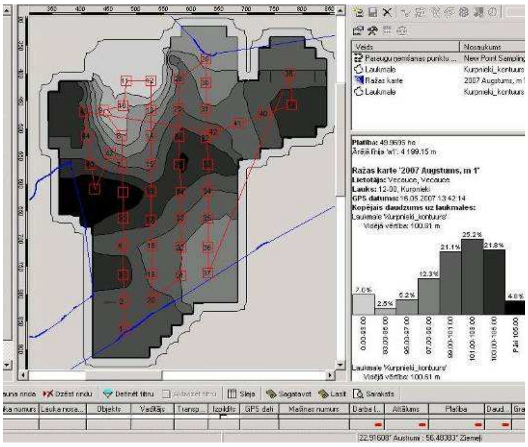

Figure 3. Cartogram of surface altitude in "Kurpnieki" field, m.

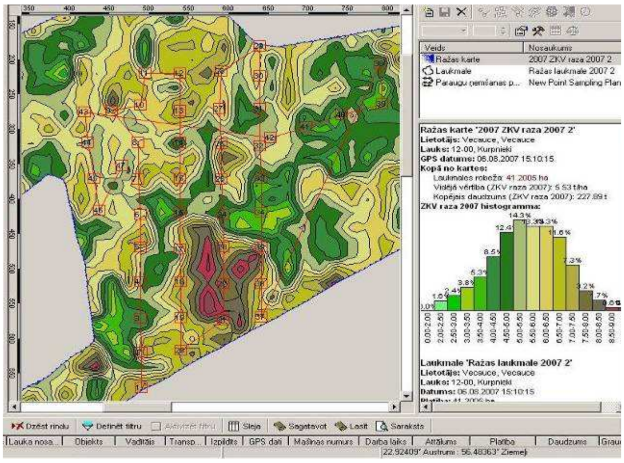

Figure 4. Winter wheat grain yield cartogram of "Kurpnieki" field in year 2007.

Deep soil tillage (until 50 cm) in autumn 2005 was done before the sowing of winter wheat. The same agrotechnology on the entire field was used for growing of winter wheat 'Tarso' and the principle of the single difference was applied at all 47 stationary observation points. For the determination of the point coordinates the GPS receiver Germin iQ 3600 was used. The yield was determined by means of the yield maps developed from the Claas Lexion 420 GPS, and the AGROCOM software was used (Figure 4). The altitude of stationary observation points was determined by using Magelan eXplorist 600. Soil moisture in the arable layer and under it was determined by Eijkelkamp Agrisearch equipment.

Results and Discussions

Winter wheat yields indicated a significant negative effect of on deep soil tillage (Figure 5).

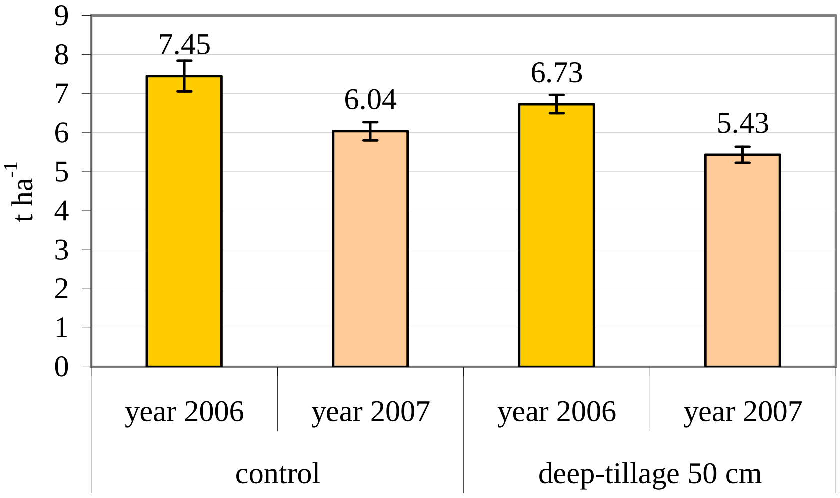

Figure 5. Changes of winter wheat yields after deep soil tillage, t ha $^{-1}$.

A marked negative effect of deep soil tillage was observed in 2006 when there was extremely low precipitation. This was confirmed by the analysis of the results of the effect of soil humidity differences' on the formation of the winter wheat yield (Figure 6). In both trial years the soil humidity was below the optimum which is 25% of the soil capacity.

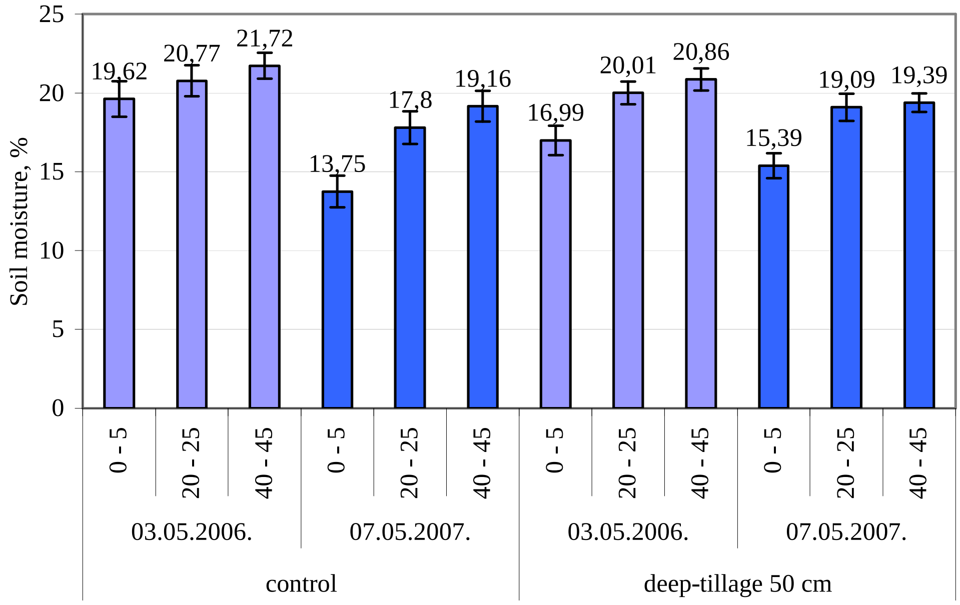

Figure 6. Changes in soil humidity after deep soil tillage.

The evaluation of the indices of soil penetration resistance in the sowing of winter wheat from autumn 2005 until spring 2006 (Figure 7) shows that the soil penetration resistance was significantly higher in the autumn in all soil layers where it was detected. It was significantly lower though in the spring after wintering - only 318 kPa cm^{-2} in a depth of 20 – 30 cm.

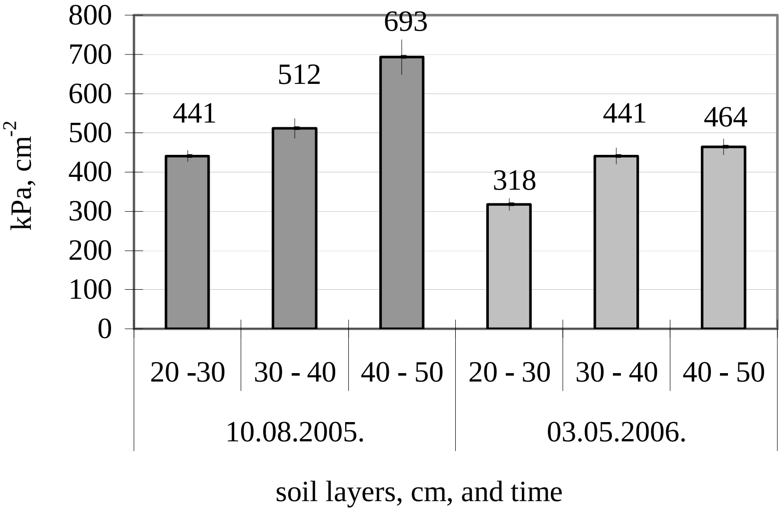

Figure 7. Characterization of the changes of soil penetration resistance (kPa cm $^{-2}$).

It was established that the negative effect of higher sub-soil resistance (above 600 kPa cm^{-2}) on winter wheat yield appeared in the spring.

A evaluation of changes in soil penetration resistance after deep soil tillage in the years 2006 and 2007 confirmed that soil resistance (Figure 8) and humidity are both co-linear factors.

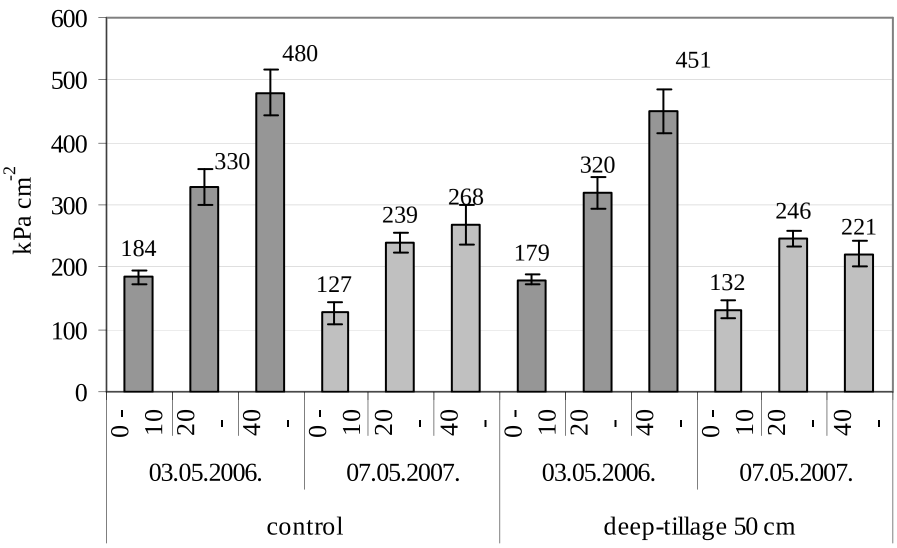

Figure 8. Characterization of the changes of soil penetration resistance (kPa cm^{-2}) after deep soil tillage

Evaluation of winter wheat yields' differences in stationary observation points with different altitudes (meters above the sea level) showed that the yields were higher mainly in the lower areas of the slope (Figure 9).

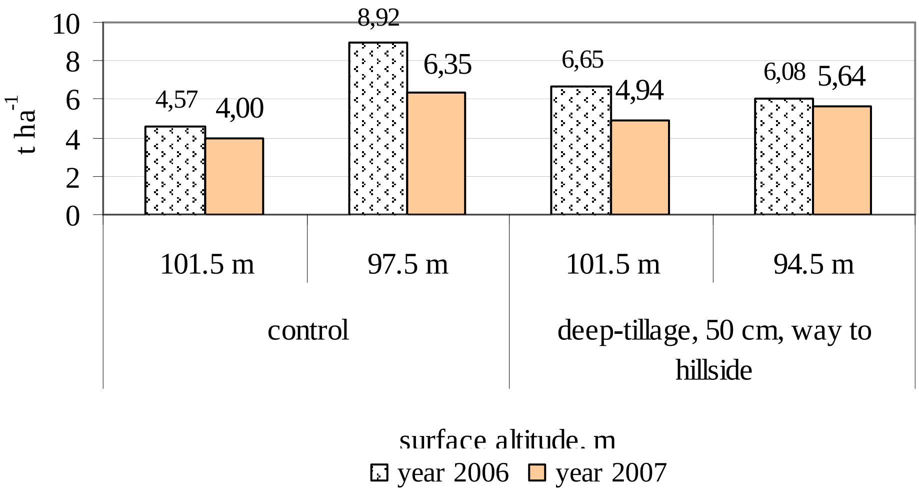

Figure 9. The effect of changes in relief on winter wheat yield

During 2006 (characterized by comparatively low precipitation) this correlation was mostly expressed during the vegetation period of winter wheat in the control treatment. In the points where deep soil tillage was used in 2005 the yield had a tendency to increase. The cause of the yield differences was the increase of soil humidity in the slope in both control and deep tillage variants, with deep tillage in the direction of the slope (Figure 10).

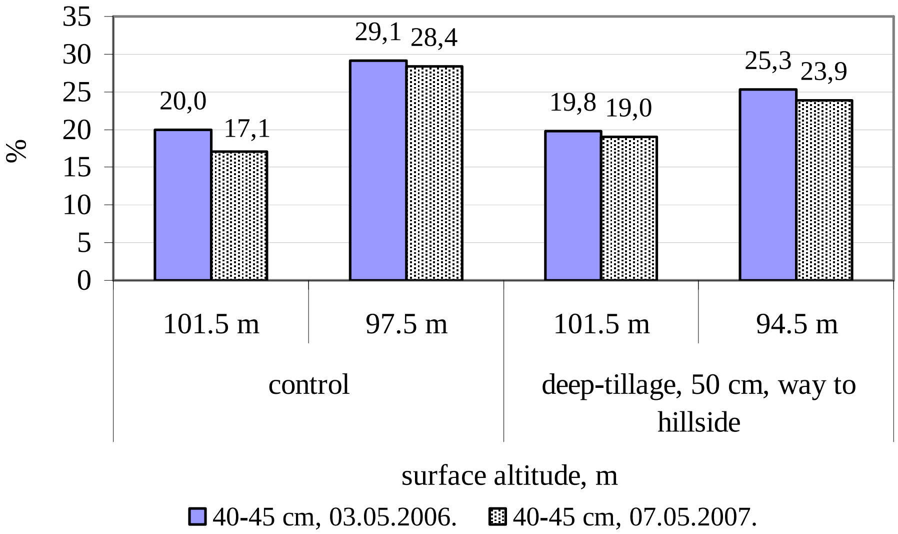

Figure 10. The effect of changes in relief on soil humidity

Soil humidity differences between control and deep tillage variants can be explained by the water flow through the marl of tine of the soil deep tillage equipment. In the lower points of the slope soil humidity (25.3%) was higher than on top of the hill (19.8%) in the same marl (Figure 10). After deep soil tillage across the slope in the comparison points (with altitudes 104 and 101 m above sea level) the soil humidity in spring 2007 were 16.6 and 16.4%, but in the spring of 2007 14.3 and 19.6%.

Conclusions

Deep soil tillage is necessary if the soil penetration resistance exceeds 600 kPa cm^{-2} in depths of 40-50 cm. However, there exists a possibility of a decrease in the winter wheat yield in years with not enough precipitation because of uneven mezzo-relief.

The cause of the decrease in the winter wheat yield after deep soil tillage to the depth of 50 cm was the decrease in the soil humidity in the higher areas of mezzo-relief.
Soil humidity (in % of soil capacity) and soil penetration resistance are mutually co-linear factorial traits.

References

1. Lapins D., Vilde A., Berzins A., Plume A., Dinaburga G. (2007).Criteria For the Site Specific Soil Tillage // Proceedings of the 6th International Scientific Conference Engineering for Rural Development, Jelgava, LLU, 268-275.
2. Lapins D., Vilde A., Berzins A., Plume A., Rucins A. (2006) Investigations in Precision Agriculture in Latvia Studies of Soil Properties and Tillage // Soil Management for Sustainability, Advances in Geoecology 38 / A Cooperating Series of the International Union of Soil Science. – Reiskirchen, Kiel,. 223-232.

AUGSNES DZIĻIRDINĀŠANAS EFEKTIVITĀTES VĒRTĒJUMS ZIEMAS KVIEŠIEM IZMANTOJOT PRECĪZĀS LAUKKOPĪBAS TEHNOLOĢIJAS

Dinaburga G., Lapiņš D., Berziņš A., Plūme A.

Darba mērķis - noteikt augsnes dziļirdināšanas efektivitāti ziemas kviešiem ražošanas platībās neizlīdzināta lauka makroreljefa apstākļos, izmantojot saimniecības lokālās ĢIS un augšņu izpētes datus. Izmēģinājumi iekārtoti SIA LLU MPS „Vecauce". No 2005.- 2007. gadam stacionāros ar GPS noteiktos punktos, veikti augsnes penetrometriskās pretestības un mitruma mērījumi augsnes slāņos līdz 0.50 m dziļumam, noteikts augsnes granulometriskais sastāvs aramkārtā. Raža noteikta izmantojot kombaina CLASS LEXION 420 GPS iespējas. Konstatēts, ka augsnes dziļirdināšana izpildāma, ja augsnes penetrometriskā pretestība pārsniedz 600 kPa cm^{-2}.

THE EFFECT OF NITROGEN NUTRITION ON THE PRODUCTIVITY OF WINTER TRITICALE IN THE SOILS OF CENTRAL LITHUANIA

Janušauskaitė D., Lazauskas S.
Lithuanian Institute of Agriculture, Akademija, Dotnuva, Kėdainiai district, Lithuania, LT-58053
phone:+370 347 37752, e-mail: daiva.janusauskaite@gmail.com

Abstract

During the period 2000–2004 field trials with winter triticale were conducted at the LIA in Dotnuva on a light loam *Endocalcari - Epihypogleyic Cambisol.* The goal of the field trials was to determine the optimal conditions for winter triticale nitrogen nutrition and to estimate nitrogen fertilizer efficacy taking into account mineral nitrogen content in the soil.
Our experimental evidence suggests that nitrogen fertilizers were net effective every year, the regularities of grain yield variation resulting from fertilizer application also differed. A grain yield increase of 19.5–24.0 % was obtained through nitrogen fertilizer application. A rate of N_{90} was found to be optimal for triticale in our trials. Fertilizer efficacy is presented in kilos – averaged data suggest that when winter triticale had received N_{60}, N_{90} and N_{120}, 1 kg of fertilizer nitrogen produced 19.9±7.46 kg, 16.5±6.00 kg and 12.7±5.02 kg of grain, respectively. Additional fertilization of triticale was effective only in the normally wet years.
Having fertilized triticale with N_{90} and N_{120}, in the years conducive to the spread of diseases (2000–2001), a significant yield increase was obtained through fungicide application.

Key words: winter triticale, yield, efficacy of nitrogen fertilizers.

Introduction

Exhibiting a high yield potential, winter triticale is a promising crop. The area currently sown with triticale in Lithuania is steadily increasing and this increase has been determined by the availability