It was for the fourth time that the Department of Machinery Exploitation and Management in Agricultural Engineering of the Faculty of Production Engineering, University of Life Sciences in Lublin and Walloon Agricultural Research Centre in Gembloux, Belgium organized International Scientific Symposium “Farm Machinery and Process Management in Sustainable Agriculture”

The following proceedings contain 35 reviewed abstracts presented at the symposium in November 2009 in Lublin, Poland. The symposium reviewed the latest achievements and progress in the management and production methods used in sustainable agriculture. The proceedings are a healthy balanced between papers of the theoretical nature and those concerned with different practical issues. The contributions prove a great progress made in all aspects of sustainable agriculture.
IV International Scientific Symposium

FARM MACHINERY
AND PROCESS MANAGEMENT
IN SUSTAINABLE AGRICULTURE

Symposium Proceedings

Edited by
Bruno Huyghebaert, Edmund Lorencowicz, Jacek Uziak

Published by
Department of Machinery Exploitation
and Management in Agricultural Engineering
University of Life Sciences in Lublin, POLAND

Lublin, Poland 2009
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Walloon Agricultural Research Centre, Gembloux, BELGIUM

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ISBN 83-922409-4-4

The cover page photo has been adopted from web portal Heroturko (www.heroturko.us)

All papers are published on the responsibility of authors and after the positive reviewing by the Symposium Organizing Committee.

Printed by: Reprographic Centre, University of Life Sciences in Lublin
The organizers wish to acknowledge with thanks the sponsorship and support of

Rector
of the University of Life Sciences in Lublin

Marszałek Województwa Lubelskiego
Marshal of Lubelskie

Agencja Rynku Rolnego Oddział Lublin
Agricultural Market Agency Lublin Branch

Company
“Zakłady Azotowe Puławy SA”

Farmers Journal
“Rolniczy Przegląd Techniczny”
## CONTENTS

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>7</td>
</tr>
<tr>
<td>Investments of agricultural farms on lower Silesia in the context of Common Agricultural Policy</td>
<td>9</td>
</tr>
<tr>
<td>Tomasz Berbeka</td>
<td></td>
</tr>
<tr>
<td>Estimation of capability of sugar beet production in Lubelskie voivodeship</td>
<td>13</td>
</tr>
<tr>
<td>Małgorzata Bzowska-Bakalarz, Katarzyna Gil</td>
<td></td>
</tr>
<tr>
<td>The direction of agricultural production and use of information sources on farms of Małopolska</td>
<td>15</td>
</tr>
<tr>
<td>Michał Cupiał</td>
<td></td>
</tr>
<tr>
<td>Use of remote sensing by environmental protected manure utilization</td>
<td>17</td>
</tr>
<tr>
<td>László Fenyvesi, Szilvia Késmárki-Gally Erdeiné</td>
<td></td>
</tr>
<tr>
<td>Employment and changes of size of chosen agricultural farms in Lubelskie province</td>
<td>21</td>
</tr>
<tr>
<td>Jarosław Figurski, Edmund Lorencowicz</td>
<td></td>
</tr>
<tr>
<td>Effect of inorganic amendments on ryegrass crop in a sandy soil</td>
<td>23</td>
</tr>
<tr>
<td>Fran Gjoka, Enkeleida Beqiraj, Pashk Leka, Lush Susaj</td>
<td></td>
</tr>
<tr>
<td>Effect of inorganic amendments on soil chemical properties and yield of ryegrass in sandy soil</td>
<td>25</td>
</tr>
<tr>
<td>Fran Gjoka, Enkeleida Beqiraj, Pashk Leka, Lush Susaj</td>
<td></td>
</tr>
<tr>
<td>Investigations on the equipment of agricultural farms in technical facilities from the point of view of Poland’s integration with the European Union</td>
<td>29</td>
</tr>
<tr>
<td>Zenon Grześ</td>
<td></td>
</tr>
<tr>
<td>Framework Directive on sustainable use of pesticides – analyse and consequences regarding Sprayer Inspection</td>
<td>33</td>
</tr>
<tr>
<td>Bruno Huyghebaert</td>
<td></td>
</tr>
<tr>
<td>Repeatability and intra-lab reproducibility of the nozzles spray pattern measurement</td>
<td>35</td>
</tr>
<tr>
<td>Bruno Huyghebaert, Viviane Planchon</td>
<td></td>
</tr>
<tr>
<td>Economic effectiveness of foliar plant growth stimulators in motherwort (leonurus cardiaca l.)</td>
<td>37</td>
</tr>
<tr>
<td>Anna Kiełtyka-Dadasiewicz, Dariusz Kusz, Stanisław Zając</td>
<td></td>
</tr>
<tr>
<td>Black locust (robinia pseudoacacia l.) Cultivations for energy purposes in the aspect of sustainable agriculture</td>
<td>41</td>
</tr>
<tr>
<td>Artur Kraszkiewicz</td>
<td></td>
</tr>
<tr>
<td>Current value and wear of agricultural machinery</td>
<td>43</td>
</tr>
<tr>
<td>Edmund Lorencowicz, Jacek Uziak</td>
<td></td>
</tr>
<tr>
<td>Machine utilization costs in different branches of plant production considering the level of mechanization</td>
<td>45</td>
</tr>
<tr>
<td>László Magó</td>
<td></td>
</tr>
<tr>
<td>Current status of biological and conventional plant protection products registration in Poland</td>
<td>49</td>
</tr>
<tr>
<td>Ewa Matyjaszczyk</td>
<td></td>
</tr>
<tr>
<td>Tractor tests: analysis of the results accumulated over the 10 last years</td>
<td>51</td>
</tr>
<tr>
<td>Olivier Miserque, Jean Bruart</td>
<td></td>
</tr>
<tr>
<td>Study of the performances of different nozzles types for spraying liquid fertilizer on wheat</td>
<td>53</td>
</tr>
<tr>
<td>Olivier Mostade, Françoise Vancutsem, Bruno Huyghebaert, Gaëtan Dubois, Sèbastien Pekel</td>
<td></td>
</tr>
<tr>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>The market of second-hand tractors and combine harvesters</td>
<td>55</td>
</tr>
<tr>
<td><strong>Aleksander Muzalewski</strong></td>
<td></td>
</tr>
<tr>
<td>An evaluation of quality properties of plant biomass briquettes</td>
<td>57</td>
</tr>
<tr>
<td><strong>Ignacy Niedziółka, Andrzej Żuchniarz</strong></td>
<td></td>
</tr>
<tr>
<td>Effectiveness of fighting the bean (<strong>uromyces phaseoli</strong>)’s rust in field cultivation using standard and large drop nozzles</td>
<td>59</td>
</tr>
<tr>
<td><strong>Stanislaw Parafiniuk, Marek Kopacki</strong></td>
<td></td>
</tr>
<tr>
<td>The influence of technical equipment on sustainability of agricultural production with different production trends in chosen farms</td>
<td>61</td>
</tr>
<tr>
<td><strong>Agnieszka Prusak, Sylwester Tabor</strong></td>
<td></td>
</tr>
<tr>
<td>Evaluation of baling press and integrated baler wrapper work exploitation</td>
<td>65</td>
</tr>
<tr>
<td><strong>Artur Przywara, Magdalena Kachel-Jakubowska, Janusz Nowak</strong></td>
<td></td>
</tr>
<tr>
<td>Assessment energy consumption pattern in a sample of Walloon farms</td>
<td>69</td>
</tr>
<tr>
<td><strong>Fabienne Rabier, Sandrine Dufourny, Didier Stilmant</strong></td>
<td></td>
</tr>
<tr>
<td>Review of the methods of application of biocidal products in Belgium</td>
<td>73</td>
</tr>
<tr>
<td><strong>Fabienne Rabier, Bruno Huygebaert, Stéphanie Noel</strong></td>
<td></td>
</tr>
<tr>
<td>Plant protection risk assessment as ecological education factor</td>
<td>77</td>
</tr>
<tr>
<td><strong>Józef Sawa, Bruno Huygebaert</strong></td>
<td></td>
</tr>
<tr>
<td>SWAT model as a tool for catchment management</td>
<td>79</td>
</tr>
<tr>
<td><strong>Maria Śmietanka, Damian Śliwiński</strong></td>
<td></td>
</tr>
<tr>
<td>Efficiency of layouts in greenhouse tomato cultivation in the years 2004-2007</td>
<td>83</td>
</tr>
<tr>
<td><strong>Marek Stachowiak</strong></td>
<td></td>
</tr>
<tr>
<td>The level of application of EU funds by agricultural farm size and production type</td>
<td>85</td>
</tr>
<tr>
<td><strong>Anna Szeląg-Sikora</strong></td>
<td></td>
</tr>
<tr>
<td>Annual utilization as a criterion of form use choice of combine harvester</td>
<td>87</td>
</tr>
<tr>
<td><strong>Tomasz Szuk</strong></td>
<td></td>
</tr>
<tr>
<td>The two methods of sweet maize kernel removing from the cob costs’ assessment.</td>
<td>89</td>
</tr>
<tr>
<td><strong>Mariusz Szymańek, Edmund Lorencowicz</strong></td>
<td></td>
</tr>
<tr>
<td>Pest/diseases signalization as an element of sustainable agriculture</td>
<td>91</td>
</tr>
<tr>
<td><strong>Anna Tratwal, Felicyta Walczak</strong></td>
<td></td>
</tr>
<tr>
<td>Effects of the use of EU funds by agricultural holdings on the example of selected programmes</td>
<td>93</td>
</tr>
<tr>
<td><strong>Zbigniew Wasąg</strong></td>
<td></td>
</tr>
<tr>
<td>Evaluation of the development of semi-subsistence holdings in years 2005–2008</td>
<td>95</td>
</tr>
<tr>
<td><strong>Zbigniew Wasąg, Joanna Tarasińska</strong></td>
<td></td>
</tr>
<tr>
<td>Comparison of the coefficients $r^2$, d and W used for verification of correctness of mathematical models on basis of experimental data</td>
<td>97</td>
</tr>
<tr>
<td><strong>Mirosława Wesołowska-Janczarek, Andrzej Kornacki</strong></td>
<td></td>
</tr>
<tr>
<td>Technological and ecological modernization of selected family farms</td>
<td>99</td>
</tr>
<tr>
<td><strong>Zdzisław Wójcicki</strong></td>
<td></td>
</tr>
<tr>
<td>Soil contact pressure resulting from loaded agricultural tyres</td>
<td>103</td>
</tr>
<tr>
<td><strong>Paulina A. Misiewicz, T.E. Richards, K. Blackburn, M.J. Hann, R.J. Godwin</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Keywords index</strong></td>
<td>105</td>
</tr>
<tr>
<td><strong>Authors index</strong></td>
<td>107</td>
</tr>
</tbody>
</table>
INTRODUCTION

Sustainable agriculture is not a fashion which will change when a new season comes; it is also not a dream idea of researchers with no practical value - it is a reasonable possibility for our development. It is in fact the only realistic chance to meet the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable agriculture integrates three main goals: environmental health, economic profitability, and social and economic equity. A variety of idea, policies and practices have contributed to these goals. Sustainable agriculture put emphasis on system perspective which envisions an integrated system which covers not only individual farm, as part of the local ecosystem, but also communities affected by this farming system both locally and globally. Such vision allows for larger and more systematic examination of the consequences of farming practices on both human communities and the environment.

People in many different capacities have shared this vision and contributed to it. A system perspective dictates interdisciplinary approach in research which requires input from various disciplines. It is the aspiration of the Organizing Committee that the 4th International Scientific Symposium on “Farm Machinery and Process Management in sustainable Agriculture” will be a forum for international researchers to exchange ideas and experiences on main themes of this year symposium, namely: Economy, Energy, Environment, Evaluation and Equipment. As making the transition to sustainable agriculture is a process we are convinced that the Symposium will make its own unique contribution to strengthen the sustainable agriculture community.

Once again the Symposium is the result of a successful and rewarding collaboration between the Lublin University of Life Sciences and the Walloon Agricultural Research Centre.

The Symposium would not have been a success with the moral and financial help given by sponsoring institutions. Their continuous encouragement and is support is gratefully acknowledged.

The Organizing Committee
INVESTMENTS OF AGRICULTURAL FARMS ON LOWER SILESIA IN THE CONTEXT OF COMMON AGRICULTURAL POLICY FINANCING POSSIBILITIES

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Keywords: agricultural farm, investment, financial support of UE

Introduction
Integration of Poland in EU caused plenty of adaptation processes in the whole national economy and also in the Agriculture. Constitutional transformations in this area affect the agrarian structure of farms, and first of all, improvement of farm area structure. Relatively large crumbling of Polish agriculture in comparison to the other Member States, obsolete machines and the progressive processes of land concentration in national producers extorted investments in fixed assets. The new possibilities of funding, with co-financing from EU and assumption of national agriculture by the system of direct payments, pushed the farmers to give a greater interest in the modernization of their farms.

Methods
The study aims at to evaluate the support scale for the investment in agricultural Lower Silesian farms of the EU support programmes. In 2008 the information in the chosen farms in the area of Lower Silesia relating to their supports in the existing instruments of the Common Agricultural Policy was collected. Database from ARiMR and MRWiR was also used in the analysis. The study used descriptive and comparable methods [Kopeć 1983].

Results
The first programme for agriculture and country areas was the pre-accession SAPARD. This instrument prepared 10 candidate countries to the membership in EU [Rowiński 2008]. The centres for farms modernization were guaranteed in 50% of investments costs. The amount of 1,084 million Euro was spent of the total budget where 708.2 million Euro came from EU budget and 235.8 million Euro from the national budget. ”Investments in agricultural farms” in Poland within action no. 2
- were realized the payment of the sum of 588,511,151 PLN with 12,929 applications.

The SPO „Agriculture” was the continuation programme of the previous SAPARD. The payments were realized from Section of Orientation EFOGR, implemented in 2004-2006, and the realization of the payment had to take place till the end of 2008, however became prolonged to 30.06.2009. This Programme is one of the two co-financed from UE budget and supporting development of agriculture and rural areas in first years of integration. The budget designed on SPO “Agriculture” carried out 1,784 million Euro with 1192.69 million Euro (67%) coming from EU, however the national support carried out 591.31 million Euro (33%). The great value of the budget had 2 actions: “Investments in agricultural farms” (33.85% of total budget) and “Improvement of processing and marketing of farm products”, which was co-financed from UE (27.27%). Remaining actions did not cross 10% share and were co-financed from UE from the range of 0.31 % to 10.9 %.

The results of questionnaire investigations conducted in 40 individual farms are presented in Table 1 below.

Table 1. Investments in agricultural farms

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<th>Specification</th>
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<td>1.00-9.99</td>
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<td>The building, repair, modernization of buildings to agricultural production and storage and stores of agricultural products</td>
<td>3R</td>
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<tr>
<td>Purchase or installation of machines, devices, equipment or tools to agricultural production, storage, storing, the preparation of agricultural products to the sale</td>
<td>3R</td>
</tr>
<tr>
<td>Purchase of agricultural land</td>
<td>2R</td>
</tr>
<tr>
<td>Purchase of buildings</td>
<td>2R</td>
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<tr>
<td>Planting of orchards and perennial plantations, including exclusively purchase of qualified plant material, equipment</td>
<td>1I</td>
</tr>
<tr>
<td>Pastures equipment: fencing, the building, barns for animals, purchase and the installation of devices to watering the animals and building of water lines</td>
<td>1I</td>
</tr>
<tr>
<td>Purchase of breed animals</td>
<td>1I</td>
</tr>
<tr>
<td>Building, the purchase and the installation of devices to land irrigation</td>
<td>1I</td>
</tr>
<tr>
<td>Purchase, installation and the building of devices serving the environments protection and higher hygienic standards of agricultural products</td>
<td>1I</td>
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R-realization  I-Intention
The highest interest among the investments was noted in the case of building, improvement, modernization of buildings, storage and storing of agriculture production. Almost 55% of investigated farms used or were going to use EU financial support. The high level of needs was noted for purchase of machines and installation for agricultural products, storage, storing, and preparation of agricultural products for sale. Over 25% of farms under investigation were co-financed within EU budget and almost 8% of them were going to use such finance in years 2009-2010.

Recapitulation

In Lower Silesia, according to ARiMR database, by the end of July 2009 there were 801 application within action “Modernization of agricultural farms PROW 2007-2013” of the sum of 137,861,767 PLN in the face of 558 application and 94,539,155 PLN in the campaign of 2007 year. Investments in fixed assets were pleased the large interest among farmers on the reports of financial envelope and the number of farms in studied population. The research confirmed that modernization was still the high need and the investments arrangements of farmers did not always meet with possibilities of financial support from EU.

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ESTIMATION OF CAPABILITY OF SUGAR BEET PRODUCTION IN LUBELSKIE VOIVODESHIP

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Keywords: sugar beet, sugar market

Introduction

White beet campaign of 2008/2009 in Poland was a period in which mechanisms of regulation of union sugar market was implemented. Production of sugar has been limited to 366 879 tons; only nineteen of twenty nine sugar factories has been in operation. Poland turned from significant exporter into importer [Mucha 2009, Świtlicki 2009]. It is noticeable that Poland still occupies the third place in the EU when it comes to production of sugar and Lubelskie voivodeship is a significant supplier of raw material used for its production. Acreage reduction of sugar beet production intended to the sugar industry makes possible to develop alternative use in other branches of industry. Keeping this valuable plant in the crops rotation improves the soil structure and the yield of the after-crop that facilitates the cultivation according to the rules of the balanced farming.

Methods

The research was performed in the area of Lubelskie voivodeship. Sources of data were interviews with workers of departments responsible for raw material in three sugar factories and farmers who cultivated sugar beet in this region. The data which was taken into account was the area of sugar beet cultivation before and after the reform of union sugar market. The results obtained were compared with the data received from National Union of Sugar Producers and National Union of Planters of Sugar Beet which enabled presentation of productive capability according to situation in Poland an in the EU.

Results

Area of sugar beet cultivation in Lubelskie voivodeship has decreased since the introduction of the reform of the union sugar market from 45 186 hectares in 2005 to 29 966 hectares in 2008 [BDR GUS]. Great
acreage dedicated for cultivation of the plant is divided among many producers (about 9,000) who, on average, allot 3 hectares for cultivation of sugar beet. The large number of growers and land crumbling trammel the technical development of the sugar beet production.

Due to many errors committed in the cultivation and the use of old machines, the national yield of sugar beet in 2008 decreased strongly in Poland [Mucha 2009, information gathered in sugar factories in Krasnystaw, Werbkowice, Strzyżów]. Production results achieved are strongly related to favorable natural conditions for agriculture in Lubelskie voivodeship for which average value of valuation of agricultural production space is 74.1 points (average for Poland is 66.6 points) [Witek 1994]. The information gathered enabled juxtaposition of producers request for raw material (with taking into account its quality) with productive possibilities of planters.

References


THE DIRECTION OF AGRICULTURAL PRODUCTION AND USE OF INFORMATION SOURCES ON FARMS OF MAŁOPOLSKA

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Keywords: information, agricultural production, information sources, farm

In the present situation the farmer is becoming more a manager than a technologist or engineer. In a smaller extent, using existing skills, knowledge complemented supported agriculture, and increasing the capacity of management and marketing. To reach good results in the market, it must continuously gain information necessary to interpret them correctly and respond to them. Tests were carried out in 40 farms located in two regions characterized by different specifications of production. Half of the surveyed facilities located in the district Miechów are typical farms, resulting in plant and animal production (group I). The second part specializes in vegetable farming located in the municipality Igołomia-Wawrzeńczyce (group II). The aim of this study was to determine differences that exist in the use of information sources in the holdings of such different production direction.

Although the holding of the two investigated regions were similarly equipped with a storage media (for example, over 80% have a computer, more than half had access to the Internet), noted the differences in their use for agricultural production on the farm.

The Internet is used to obtain information used in managing the farm in 35% of farms in the district Miechów (group I) and 45% of respondents vegetable farms (group II). Inverse proportion exists with the use of agricultural advisers. In this case, 50% of farmers in group I at 25% in group II use their assistance.

TV is used for 90% of objects in group I and 65% in group II, radio 20% (group I) and 5% (group II). Professional press is read in 30% of farmers (in both groups).

During the study, farmers in both regions have identified the frequency with which they wish to receive certain types of information. Respondents also gave information they would like to receive daily, weekly, monthly and irregularly.
USE OF REMOTE SENSING BY ENVIRONMENTAL PROTECTED MANURE UTILIZATION

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Keyword: plant feeding, remote sensing, soil features

Introduction

By the conservation tillage we have to cover the replacement of the available nutrients removed by the harvesting. The nitrogen and microorganism source should be ensured by the suitable spreading of the organic fertilizer, in our case the slurry. It is necessary to know the internal content features of the slurry and the site specific features of the soil and the harvested vegetation.

Methods

The accurate quantitative definition of the color characteristics is possible by the application of the hyperspectral remote sensing method. Our objective is to develop a method to define the content characteristics of the soil. The AISA DUAL hyperspectral sensor operates in the range of 400-2500 nm wavelength and has a high. The density deviation shows the changing of the reflection and can be seen as a picture. The changing of the reflectance can be shown at any point of the recorded object in the function of the spectrum (Fig. 1.).

Fig. 1. Illustration for the hyperspectral aerial remote sensing (Specim Ltd.)
The recorded crude pictures can be radiometrically corrected and georectified by using special software called Cali-Geo. Photographs were made from the B 22 field in Bábolna (Hungary). First time the field was bare in April 2006 then it was covered in August. The yield evolution was measured on the different color characteristics by the use of GPS. The slurry injecting was made by a “Detk 1013 SD” tank truck. We applied the RDS RATEMASTER 20 control unit for control. The instrument displays information e.g. slurry quantity (m³/h), injected volume flow (1/s), speed (km/h), total spreaded quantity (m³).

Results
The different color characteristics have been determined by using the pictures taken. The greatest connection was found between the measured humus content of the soil and the red color values on the picture of the field. There is also a strong connection between the yield and the green color values of the pictures. According to the soil examinations the phosphorus and potassium content was very good, the nitrogen content was only moderate. In this case the nitrogen content is determinant in the soil-plant system (Németh, 2006), so in the first year we focused the nitrogen balance, soil state changes and the disintegration.

Conclusion
With the invented equipment and method we were able to successfully solve the side specific fertilizing with slurry and to start experiments to decompose of the lignocelluloses content materials, which are left on the soil surface. The site specific distribution of the soil and plant features was defined by the application of a modern remote sensing method for the conservation tillage. There is a significant connection between the integral optical characteristics, the color values and the contents of the soil and plant leaves. By using the hyperspectral remote sensing method, the color values can be calculated to a high level of accuracy and the spatial distribution can also be determined. The results can be easily used for controlling precision operations, because these ones are collected in a spatial IT system. The shown method could be simplified in the future and make more precise by using
the data of yield-measurement at harvest (Késmárki-Szücs, 2007; Magó-Jakovác, 2005).

Acknowledgements

This piece of work was carried out with the support of Hungarian Scientific Research Fund (OTKA).

References


EMPLOYMENT AND CHANGES OF SIZE OF CHOSEN AGRICULTURAL FARMS IN LUBELSKIE PROVINCE

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Keywords: employment, European Size Unit, Annual Work Unit

Introduction

One of the basic problems which Polish agriculture struggles with is the over employment. In 2006 over 21% of Polish working force was employed in agriculture but the participation in the gross domestic product from this group was only 4.25% [GUS 2009]. This phenomenon was more pronounced in the south-east Poland than in other regions. It causes limitations in the process of improving the agrarian structure and technological progress. Farmers are not able to achieve satisfactory financial results; their farms are not competitive [Strategia… 2005]. It is the reason to try to define the relationship between the employment in the chosen group of agricultural farms of Lubelskie province and the parameters describing their economic strength.

Material and methods

Research has been carried out on a group of the chosen farms situated in the area of Lubelskie province. Total of 123 farms were qualified for research. Many factors were defined, e.g. area of farms, the technical equipment, economic size of farms. The results were collected in database Access and Excel spreadsheet [Lorencowicz, Kocira 2004]. Questions concerned the number of people working in each farm, the number of hours of work executed in farms and outside of them. As a result it was possible to determine the Annual Work Units (AWU). AWU defines the number of employees in farm and one unit of AWU is equal to 2120 hours of work carried in farm (which is equivalent to one full regular position). The results of research were compared with calculated economic size of farms.

Results

The average utilized agricultural area (UAA) has increased, in the analyzed group of farms, from 11.23 ha in 2001 to 13.32 ha in 2006. The
biggest growth was recorded in group of farms with UAA less than 5 ha. Changes in structure of the economic size of farms were also observed. The growth of the ”very small” farms (less than 4 ESU) - from the first and the second class of the economic size of farms (according to European Union nomenclature) - was recorded in 2006. In 2006 there were four farms more (10.0%) in this group in comparison to 2001 year. However, there were four farms less (42.9%) in the group of farms of 16 to 40 ESU units. One farm with more than 100 ESU was recorded in year 2006, whereas there was no a single farm of that size in year 2001. The number of people employed has fallen in farms under consideration insignificantly. The average result for 2001 year was 5.95 person per farm, it has fallen after five years to 5.12. In year 2001 each employed person spent about 3,894 hours on work in farm, and 3,255 hours in 2006. It has been reflected in the average number of AWUs. The number of AWU units has fallen in comparison to 2001 year by about 20%.

On the basis of the results it is possible to define changes in the area structure of farms of Lubelskie province. Economic strength of farms is reducing; farmers have shifted to production which does not require large work output. The investigations proved the growth of the number of the smallest farms and decrease of employment.

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EFFECT OF INORGANIC AMENDMENTS ON RYEGRASS CROP IN A SANDY SOIL

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Keywords: dry matter yield, NPK fertilizer, nutrient uptake, zeolitic material

Abstract

The effect of natural zeolite (Stilbite-Stellerite) and NPK fertilizers application on ryegrass crop was studied in a pot-culture experiment in the glass-house of Agricultural University of Tirana, Albania using a sandy soil (Haplik arenosol). Results showed that application of zeolite and NPK fertilizers resulted in a significant increase in the shoot and roots yield of ryegrass compared to control. Interaction effect of zeolite x NPK fertilizers on crop yields and nutrient content and uptake by ryegrass is significant. The highest yields were recorded in the treatment receiving 6 q zeolite ha⁻¹ and NPK fertilizers. As regards nutrient content, the lowest total content of K, Ca and Fe in shoot of ryegrass was observed under treatment with NPK fertilizers, and of P, Cu and Zn under treatment with 5% zeolite, 12 q zeolite ha⁻¹+NPK and 6 q zeolite ha⁻¹+NPK, respectively, while the highest total content of P, K, Fe and Zn in shoot was observed under direct application of zeolite at 6 q ha⁻¹, 12 q ha⁻¹ and 5% and together application of zeolite at 12 q ha⁻¹ with NPK. The uptake of nutrients by plants was also influenced almost in the similar pattern by the various treatments. Among the various treatments, application of the zeolite at 6 q ha⁻¹ together with NPK was found to be the best treatment in increasing the dry matter yield and in enhancing the uptake of nutrients by ryegrass.

Introduction

The zeolites help control the release of plants nutrients in agricultural systems [2]. However, little is known about the effect of zeolite application on yield and nutrition of crops in sandy soil. These soils are generally low in humus, nutrients and structure stability. This paper deals with the effect of natural zeolite and NPK fertilizers on dry matter yield and nutrient concentration and uptake by ryegrass grown in a sandy soil.

Materials and methods

The experiment was laid out in randomized block design with the four replications and seven treatments: (i) control, (ii) NPK, (iii) 6 q zeolite ha⁻¹, (iv) 12 q zeolite ha⁻¹, (v) 6 q zeolite ha⁻¹+NPK, (vi) 12 q zeolite ha⁻¹+NPK, and (vii) zeolite at 5 % (w/w basis). NPK fertilizers were applied at a recommended dose of 148:75:60 kg ha⁻¹ active substance. Ryegrass was used as the test crop. Plant samples were analyzed for total P, K, Ca, Mn, Cu, Zn, and Fe by standard methods. The data were analyzed by ANOVA. The LSD test at p<0.05 was used for mean separation.
Results and discussion

Application of zeolite and NPK resulted in a significantly increase in the shoot and roots yield of ryegrass compared to control. The highest shoot yield (4.29 g pot\(^{-1}\)) was recorded in the treatment receiving 6 q zeolite ha\(^{-1}\)+NPK. Zeolite applied directly (12 q ha\(^{-1}\) and 5 % of soil weight) or together with NPK increased significantly the yield of roots over control, but not over NPK except application of 6 q zeolite ha\(^{-1}\)+NPK giving the highest root yield (2.08 g pot\(^{-1}\)). Zeolite leads to a more efficient use of NK fertilizers by reducing their rates for the same yield, by prolonging their activity or finally, by producing higher yields [4]. Substantial increases were noticed in the content and uptake of nutrients in shoot due to application of zeolite and NPK. Zeolite at 6 q ha\(^{-1}\), 12 q ha\(^{-1}\) and 5% and zeolite at 12 q ha\(^{-1}\)+NPK recorded the highest P, K, Fe and Zn content and uptake of these nutrients of ryegrass shoot. The highest content of Cu and Mn in shoot was observed in control and this may be due to the rate of selectivity for cations Zn\(^{2+}\)<Cu\(^{2+}\)<Pb\(^{2+}\) of the zeolite used [1]. Also, zeolites display different affinities for cations and form the theoretical basis of their cation selectivity sequence [3]. The highest content of Mn in control may be due to high binding capacity of Fe-Mn oxides and aluminosilicates for metals. These effects were assumed to be related to immobilization of metals due to formation of insoluble metal-organic complexes and increased CEC [5].

Conclusion

From the results it could be concluded that the zeolite functioned as a good regulator of plant nutrition in sandy soil amended with NPK fertilizers. Application of natural zeolite at 6 q*ha\(^{-1}\) together with NPK fertilizers at 148:75:60 kg ha\(^{-1}\) was the best treatment in increasing dry matter yield of ryegrass and in enhancing the uptake of nutrients by ryegrass.

Literature

EFFECT OF INORGANIC AMENDMENTS ON SOIL CHEMICAL PROPERTIES AND YIELD OF RYEGRASS IN SANDY SOIL

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Keywords: natural zeolite, NPK fertilizer, nutrient status, problem soil

Abstract

The present research was aimed to study the effect of natural zeolite and inorganic fertilizers applied alone or in combination on soil chemical properties and yield of ryegrass crop in sandy soil. A pot culture experiment was conducted in the glass-house of Agricultural University of Tirana (Albania), using a sandy soil (Haplik arenosol) and zeolitic material (Stilbite-Stellerite) from Munella area (Central Mirdita) and NPK fertilizers. Generally, all treatments decreased soil fertility parameters, except cation exchange capacity. A significant decrease in humus, N, P, Ca, Fe and Zn losses due to combined application of zeolite and NPK fertilizers was generally observed, resulting in more of these nutrients in the soil solution for the plant roots. The different treatments increased the yield of ryegrass crop significantly over control. The 6 q zeolite ha⁻¹ + NPK treatment was found superior over other treatments in increasing yield of ryegrass. The results of the study indicate that zeolitic rocks may be a potential source of amendment for application to sandy soil in improving soil chemical properties and in turn increase in yield of crops. Zeolite at 6 q ha⁻¹+NPK was most significant in increasing crop yield and in maintaining and improving soil properties and nutrient status in soil.

Introduction

Sandy soils in Albania occupy 13 000 ha or around 2% of the agricultural land area. One mean to improve these soils is utilization of the different amendments, including zeolite. The information on influence of zeolite on properties of sandy soil and crop yield is scanty, while in Albania is missing. This study was undertaken to find out the effect of natural zeolite and NPK fertilizers on soil chemical properties and ryegrass yield in sandy soil.

Materials and methods

The experiment was carried out in a randomized block design with seven treatments replicated four times. The treatments consist of control, NPK, 6 q zeolite ha⁻¹, 12 q zeolite ha⁻¹, 6 q zeolite ha⁻¹+NPK, 12 q zeolite ha⁻¹+NPK, zeolite at 5 % (w/w basis). A recommended dose of NPK at 148, 75 and 60 kg ha⁻¹ active substance was applied to each pot. Ryegrass
was used as a test crop. Soil samples were analyzed for pH, humus, total N, CEC, available P and exchangeable K, total Cu, Zn, Mn, Fe and Ca and texture by standard methods. The data were analyzed by ANOVA. The LSD test at p<0.05 was used for mean separation.

Results and discussion

All treatments decreased soil fertility parameters, except CEC where, however, only application of zeolite at 5% by soil weight had significant effect. Significant lower content was observed for N in NPK, 6 q zeolite ha\(^{-1}\), 12 q zeolite ha\(^{-1}\) treatments; humus, P and K in all treatments; and Cu in NPK, 6 q zeolite ha\(^{-1}\)+NPK, 5% zeolite treatments, Fe in 5% zeolite treatment, Zn and Ca in all treatments; and higher CEC value in 5% zeolite treatment due to direct effect of zeolite on nitrogen capture, storage and release [1], mineralization of biogenic substances by microorganisms [2], solubilization of phosphate minerals [5,4] and phosphorous uptake by plants [3], and on soil CEC. The lowest values of N (0.05%), Zn (46.0 mg kg\(^{-1}\)), Mn (0.06 mg kg\(^{-1}\)), and Ca (2.93 mg kg\(^{-1}\)), were recorded in NPK treatment, Cu (25.6 mg kg\(^{-1}\)) and Fe (3.08 mg kg\(^{-1}\)) in 5% zeolite treatment, P (0.67 mg 100g\(^{-1}\)) and K (4.00 mg 100g\(^{-1}\)) in 6 q zeolite ha\(^{-1}\) treatment. The highest value of CEC (15.55 me 100 g\(^{-1}\)) was noted in 5% zeolite treatment. Effect of zeolite on CEC could be related to its mineralogical composition. The different treatments increased the ryegrass crop yield significantly over control. The 6 q zeolite ha\(^{-1}\)+NPK treatment was found superior over other treatments in increasing yield of ryegrass on sandy soil.

Conclusion

From the results it could be concluded that zeolitic rocks may be a potential source of amendment for application to sandy soil in improving soil chemical properties and in turn increase in yield of crops. Zeolite at 6 q ha\(^{-1}\)+NPK was most significant in increasing crop yields and in maintaining and improving soil properties and nutrient status in soil.
Literature


INVESTIGATIONS ON THE EQUIPMENT OF AGRICULTURAL FARMS IN TECHNICAL FACILITIES FROM THE POINT OF VIEW OF POLAND’S INTEGRATION WITH THE EUROPEAN UNION

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Keywords: structural transformations, technical means, agricultural machines, structure of equipment, support instruments

Introduction

Structural transformations in agriculture, including sustainable development of rural areas, are among the most important challenges facing Polish agriculture. With reference to agricultural technique, one of the basic tasks is to complete the process of technical reconstruction of agriculture. Considerable dynamics of this process could be observed during the period directly before and after Poland’s accession to the European Union when a significant increase in the demand for agricultural machinery was recorded. This was caused by possibilities of utilisation of financial resources for agricultural support, including investment in farm mechanisation.

The main objective of this research project was to assess the state of technical equipment of agricultural farms from the point of view of Poland’s integration with the European Union. In addition, the author also assessed the participation of instruments of agricultural support in the purchase process of agricultural machines.

Methods

The investigations were conducted in 2008 on farms situated in the region of Wielkopolska. Studies were carried out on the total of 16 farms with areas ranging from 12 to 160 ha.

Experimental farms were selected on purpose because such choice ensured obtaining the most comprehensive information. The required information was obtained applying the method of standard interview on the basis of questionnaires (Rzeszowska 2009).
Results

The mean area of the examined farms amounted to 66.28 ha and six of the experimental farms increased their area, on average, by 9.58 ha after 2004. Dual-purpose farms were dominant (71%) in which two branches of agricultural production – plant and animal could be distinguished. Using the developed set of information as the basis, current equipment structures of the examined farms in technical means was determined. In addition, the participation of instruments for agricultural support in the process of farm technical modernisation was assessed (Figs. 1 and 2).

Figure 1. Equipment structure of the examined agricultural farms in agricultural mechanisation facilities (Source: Own investigations)
Figure 2. Structure of expenditure for the purchase of agricultural machines in the examined farms - after year 2002 (Source: Own investigations)

Discussion

From the point of view of market economy, the experimental agricultural farms belonged to commodity and farmer’s farmsteads (Fereniec 1999). The structure of technical equipment of the examined farms was dominated by machines for transfer and transport, cultivation machines as well as agricultural tractors (Fig. 1). The performed detailed analysis of the obtained research results revealed increasingly wider application of modern agricultural machines of high labour efficiency. In the case of the examined farms, such machines included: agricultural tractors with horse-power exceeding 75 kW, trailers with the capacity ranging from 8 to 10 t, telescope loading machines, reversible ploughs, cultivation aggregators, roll balers etc.

The observed increased numbers of various agricultural machines should be attributed to the use of various instruments of the financial support system of Polish agriculture (Szumski 2007). In the case of the examined farms, levels of support instruments in expenditures on agricultural machine purchases after 2002 amounted to 61% (Fig. 2). In years 2004 – 2006, the support system that farmers used most frequently was the Sector Operational Program (SOP). The proportion of this program in total
expenditures incurred in connection with the purchase of machined in the examined farms amounted to 38%.

References
FRAMEWORK DIRECTIVE ON SUSTAINABLE USE OF PESTICIDES – ANALYSE AND CONSEQUENCES REGARDING SPRAYER INSPECTION

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Key words: Framework Directive, sustainable use, pesticides, sprayer, inspection

Introduction

The Thematic Strategy on the sustainable use of pesticides was adopted in 2006 by the European Commission, together with a proposal for a Framework Directive on the sustainable use of pesticides (FWD). It aims to fill the current legislative gap regarding the use-phase of pesticides at EU level through setting minimum rules for the use of pesticides in the Community, so as to reduce risks to human health and the environment from the use of pesticides.


The Article 8 of the FWD requests the inspection of all the pesticides application equipments (PAE) at regular interval. The Member States (MS) have now to implement this request taking into consideration their experiences and situation in the past. Nevertheless, the stakes are considerable and the MS should analyse and determine the consequences of the FWD requirements on the Sprayer Inspection.

Framework Directive on Sustainable Use of Pesticides

The purpose of this Directive is to establish a legislative framework which: contributes to the reduction of impacts of plant protection products on human health and the environment; aims to achieve a more sustainable use of plant protection products; promotes a significant overall reduction in risks and hazards of using plant protection products consistent with necessary crop protection.

The Sustainable Use Directive is a part of the package of measures (including the replacement for the pesticides authorisation Directive 914/414, the revision of the Machine Directive 2006/42/EC and a new
statistics Regulation), which will make up the Community’s Thematic Strategy for Pesticides.

The Directive will establish a framework, which will promote the ‘best practice’ in the storage, use and disposal of pesticides, and their packaging. Key features include: the establishment of national action plans; compulsory testing of spray machinery and certification of spray operators, distributors and advisors; a ban (subject to derogations) on aerial spraying; special measures to protect the aquatic environment, public spaces and special conservation areas; minimising the risk of pollution through handling, storage and disposal; and the promotion of Integrated Pest Management (IPM). Progress will be measured through the use of ‘risk indicators’.

**Article 8 of the FWD- Sprayer Inspection**

The Article 8 of the FWD stipulates that MS must assure that PPE is inspected at least once within 7 years, at the latest, following the implementation of the FWD, and that the inspection intervals are shortened from 5 to 3 years at the most after 2020.

The scope of the Article 8 is large since it concerns all the PPE including the sprayer of all types, the powder applicator, the fogger … On the other hand, the MS may derogate from the inspection certain type of PPE following a risk assessment for Human Health and Environment and an assessment of scale of use.

For the moment, standards for inspection of pesticide application equipment already exist for field crop sprayer and air-assisted sprayers for bush and tree crops (EN 13790-1 and 2). However standards are needed for all pesticide application equipment used by professionals in order to comply with the FWD. CEN has been mandated to develop rapidly new standards on PPE inspection.

**Conclusions**

The FWD on sustainable use of pesticides introduces new rules concerning PPE inspection. As the deadline is short, the MS have to develop rapidly National Action Plan to implement them.

**References**


REPEATABILITY AND INTRA-LAB REPRODUCIBILITY OF THE NOZZLES SPRAY PATTERN MEASUREMENT

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Keywords: Framework Directive, sustainable use, pesticides, sprayer, inspection

Introduction

Since October 2004, the Spraying Technique Laboratory of the CRA-W has been accredited ISO 17 025 for the nozzle spray pattern measurement (Certificate BELAC 266-T). The measurement protocol is based on the International Standard ISO 5682 – 1/2/3. The nozzles spray pattern is measured with a patternator answering to the requirements of the Standards. The spray pattern results are expressed in a statistical parameter: the Coefficient of Variation (CV).

In order to validate the precision of the measurement, the protocol used by the Laboratory has been validated. Therefore the repeatability and intra-laboratory reproducibility of the protocol for the nozzle spray pattern have been determined.

Method

The trials follow the laboratory protocol and fulfil the ISO 5682-1 and ISO 5682-2 requirements. The spray distributions of 2 sets (Albuz API11003 and Albuz API11004) of 24 nozzles for several setting’s conditions have been measured. The offset angle is between 5° and 7°; the nozzles’ spacing is 50 cm. As the positioning and the setting of the nozzles have a high influence on the spray distribution, it has been the same for each trial.

The main factors of variability retained for the experiment are the time period, the human factor, the spraying pressure and the boom height. All these factors can affect the main variable of this experience being the coefficient of variation (CV) is expressed in percentage:

\[ CV = \frac{S}{\bar{x}} \times 100, \]

where, S is the standard deviation and \( \bar{x} \) the average of the water level in the vessels of the patternator.

The same trials were done from 2002 to 2006.
Results

The repeatability and intra-lab reproducibility were determined each year from 2002 to 2006. It is interesting to compare the results obtained by the same laboratory at different times.

Table 1. CRA-W’s results from 2002 to 2006

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005 (1)</th>
<th>2005 (2)</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of operators</td>
<td>3</td>
<td>4</td>
<td>7</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Number of measurements</td>
<td>142</td>
<td>192</td>
<td>112</td>
<td>48</td>
<td>48</td>
<td>48</td>
</tr>
<tr>
<td>Mean-(m) (%)</td>
<td>7.17</td>
<td>7.49</td>
<td>7.22</td>
<td>7.50</td>
<td>7.47</td>
<td>7.56</td>
</tr>
<tr>
<td>Standard deviation-(\sigma) (%)</td>
<td>1.46</td>
<td>2.02</td>
<td>1.84</td>
<td>2.51</td>
<td>2.41</td>
<td>2.61</td>
</tr>
<tr>
<td>Repeatability – r (%)</td>
<td>1.00</td>
<td>0.36</td>
<td>0.41</td>
<td>0.28</td>
<td>0.33</td>
<td>0.39</td>
</tr>
<tr>
<td>Reproducibility - R (%)</td>
<td>1.23</td>
<td>0.44</td>
<td>1.28</td>
<td>0.78</td>
<td>1.31</td>
<td>1.41</td>
</tr>
</tbody>
</table>

The first validation of the protocol developed by CRA-W to measure the nozzle spray pattern has been realised in 2002. At this time, the repeatability (r) reached 1.00% and the reproducibility (R) reached 1.23%. These results were considered as unsatisfying and the protocol was changed to decrease the variability of the measurements. Therefore one accepted the maximum amplitude between the CVs from two repetitions of 0.5% (in true CV value). This procedure allows us to improve the repeatability and to keep it under 0.5%, as it is shown by the results obtained afterwards.

This positive effect is not so evident for the reproducibility. Except for 2003 and 2005(1), the reproducibility ranged from 1.00 to 1.50%.

Conclusions

Determining the accuracy of the nozzles spray pattern measurement is not easy since reference material doesn’t exist. Then a laboratory developing a protocol of nozzles spray pattern measurement can hardly define the trueness of its measurements. The repeatability and the reproducibility (precision) can be determined via intra-lab trials. Even the variability of the mean value and the repeatability are reduced, it is difficult to decrease the reproducibility under 1.00%.

References

ECONOMIC EFFECTIVENESS OF FOLIAR PLANT GROWTH STIMULATORS IN MOTHERWORT (LEONURUS CARDIACA L.)

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Keywords: economic effectiveness, plant growth stimulators, motherwort

Introduction

Foliar application of plant growth stimulators is a method of intensified plant production often used to obtain an elevated yield of high quality. Often the real choice of preparation was to dictate economic calculation. This study analyses the economic effectiveness of foliar application of plant growth stimulators (Atonik Al, Bioalgeen S90, Biotrissol T) to a motherwort (Leonurus cardiaca L.) culture. Motherwort is a perennial medicinal plant, demonstrates sedative and soporific properties, recommended in cases of excessive excitability and cardiovascular neurosis [Mścisz and Gorecki 1997].

Methods

Calculation of economic effectiveness for research on plant growth stimulators is based on results of field experiment performed in 2001-2004 [Kieltyka-Dadasiewicz and Berbeć 2007]. The plant was cultivated as recommended for the species [Załęcki et. al. 1994]. New plantations were established every year, with continued measurements over 2-year-old (2002-2004) and 3-year-old plants (2003-2004). Plant growth stimulator was applied in solutions as per producer recommendations: 0.2% Atonik, 0.5% Biotrissol and 0.5% Bio-algeen in 400 litres per hectare for each spraying. Application occurred twice for 1-year old plants and three times for 2 and 3 year old plants. A control cultivation of motherwort was not sprayed. Harvest occurred once in the first year and twice in the second and third years.

Marginal effectiveness ratio of inputs was used for evaluation of economic effectiveness for each plant growth stimulator (Atonik, Biotrissol and Bioalgeen). This method measures the production effects of the last units of global inputs. Economic effectiveness with reference to increment of production results (zł) and increment of inputs (zł) was evaluated according to equation [Kusz 2006]:
\[ E_k = \frac{\Delta E}{\Delta N} \]

where:
- \( E_k \) – the marginal effectiveness ratio
- \( \Delta E \) – increment of production results (zł)
- \( \Delta N \) – increment of inputs (zł)

For calculated of increment of production results set prices of motherwort herbs in 2009 year at 4500 zł∙t⁻¹ level was accepted. Only variable inputs for evaluation increment of inputs were taken into consideration, whereas constant inputs for respective objects were disregarded. Inputs taken into consideration included plant growth stimulator price, costs of spraying plants and additional herb drying fees. The 2009 price level was used for calculation.

**Results**

The highest increase in yield of motherwort herbs was observed for Bio-algeen. The lowest observed was Atonik, independent of plant age and experiment year (table 1).

<table>
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<tbody>
<tr>
<td></td>
<td>( Y )</td>
<td>( \Delta Y )</td>
<td>( E_k )</td>
</tr>
<tr>
<td>Biotrissol</td>
<td>3.13</td>
<td>1.00</td>
<td>3.40</td>
</tr>
<tr>
<td>Bioalgeen</td>
<td>4.40</td>
<td>2.28</td>
<td>3.96</td>
</tr>
<tr>
<td>Atonik</td>
<td>3.05</td>
<td>0.92</td>
<td>3.37</td>
</tr>
</tbody>
</table>

\( E_k \) – The marginal effectiveness ratio
\( Y \) – Yields (t)
\( \Delta Y \) – Increment of yields relative to control objects (t)

Additionally, marginal effectiveness ratio was the highest for Bioalgeen and lowest for Atonik. The largest economical and yield effects for cultivation of motherwort were obtained using Bio-algeen growth stimulator.
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BLACK LOCUST (ROBINIA PSEUDOACACIA L.)
CULTIVATIONS FOR ENERGY PURPOSES IN THE ASPECT
OF SUSTAINABLE AGRICULTURE

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Keywords: biomass energy, black locust, sustainable agriculture

According to the principles of sustainable development, the modern agriculture should, apart from accomplishing production and economic goals, achieve ecological goals, protecting natural environment from contaminations and hazards of various kinds caused by agricultural activity [Kukuła and Krasowicz 2006; Muller 2009].

A growing need for energy, together with tightened requirements concerning environmental protection in the energy sector, leads to an increasing use of ecological (renewable) energy sources, mainly biomass. There is a risk that the growing area of the crops for energy purposes will lead to the competition for agricultural production space. Another threat for the environment caused by the desire to gain the maximum profit may be intensive cultivation of energy crops, often in a monoculture (most often willows) [Kukuła and Krasowicz 2006, Muller 2009].

The purpose of the present study is to present the possibilities of cultivation of black locust for energy purposes in degraded and devastated areas with unfavourable management conditions, in relation to the features of sustainable agriculture.

As an energy crop, black locust draws attention because of its biological features. They include fast growth, low habitat requirements, relatively small sensitivity to atmosphere pollution, and easiness of cultivation [Bender et al. 1985]. Besides, black locust wood has very good physical properties, which determine its energetic usefulness. High density and low moisture of the wood directly after cutting as well as high combustion temperature comparing to an oak wood are noteworthy [Kraszkiewicz 2007].

Sustainable agriculture is oriented at using land resources in a way that does not destroy their natural sources, but makes it possible to satisfy the basic needs of successive generations of producers and consumers [Smagacz 2000]. Biological features of black locust enable a successful use of this species in land improvement of degraded and devastated areas [Bender et al. 1985]. The cultivation of black locust is possible in the
areas not used because of their unfavourable technical and ecological conditions, or the ones which should not be used in agriculture from the perspective of good agricultural practice (protection of soil and water resources). It particularly concerns uplands or plateaux threatened with water erosion. What is more, the species enables rational management of the post-industrial wastelands and e.g. areas after local aggregate mining, waste stockyards [Bender et al. 1985; Kraszkiewicz 2007]. According to Bender et al. [1985], land improvement plantations of black locust are latent wastelands due to low economic use of the species’ wood. Using black locust wood for energy purposes may quickly enhance the productivity of the improved lands.

According to Kukuła and Krasowicz [2006], food self-sufficiency can be achieved through excluding from cultivation the weakest arable areas and 30-50% of weak soils, together with an increasing the level of agrotechnology and agrarian culture in relation to other soils as well as decreasing the area of uncultivated land on good and medium soils. By using the excluded areas for energy crops, it is possible to decrease the competition for agricultural production space.

Black locust energy crops located in the areas which cannot be used for cultivating other plants may be an alternative for gaining a precious energy resource, at the same time bringing measurable ecological benefits.

It would be purposeful to expand the scope of the studies concerning profitability of setting up and cultivating a plantation of black locust on different forms of uncultivated land to obtain middle-size wood, and, taking account of its expansive character, with a special consideration of methods and costs of its elimination.

References
CURRENT VALUE AND WEAR OF AGRICULTURAL MACHINERY

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Keywords: current value, selling price, machine wear

Introduction

During exploitation agricultural machines and tractors undergo both technological and economical wear. It means that their current market value is related not only to its quality but also to the technological improvements. It is the reason that technical means of agricultural production have similar reduction of their market values.

Materials and Methods

The material for this study consisted of the data regarding prices of new and used tractors on the Polish market and also used tractors, combine harvesters and other agricultural machines on the German market. The information was assembled in a database of more than 1400 records with data about the type and model of the machine, the year of production, total number of work hours (tractor hours or combine hours) and the price. The records were verified, sorted and statistically analysed. For tractors and combine harvesters additional parameters, like age and annual hours, as well as price calculated per 1 kW of power and per 1 m of the operating width, were determined. The relationships between the price and such parameters as work hours, engine power, working width and utilization (in hours) were displayed in tabular and graphical form.

The aim of the study was to establish the relationship between the wear of the tractors and agricultural machines and their market resale price.

Results

The results indicated similarities between the loss of values for the tractors in Poland and Germany. The loss of the value depended on the age as the total tractor hours. In Germany, the price for the tractors varied between €4,500 and €160,000, with the average price of €31,500. The prices for tractors older than 15 years were above €20,000 whereas
younger tractors had more differentiate prices between €20,000 and €160,000. There was a significant relation between the market price and the age of the tractors, and this relation was non-linear. The price of the tractor calculated per the unit of power (€/1 kW) decreased with the age from ca 600 to 100 Euro per kW. For Polish market, the current market value, calculated as a percentage of the purchase price, decreased with the age of the tractor non-linearly reaching 20% for 15-year and older.

The price of the second-hand combine harvesters in Germany was moderately related with both the age and the total hours of the machine. The lowest prices were for machines older than 15 years and total hours above 2,000. There was a significant relationship between the value of the combine harvester, calculated per unit of power, and its age. In case of the oldest machines under consideration the above value was from ca 900 to less than 100 €/1 kW.

Similar relationships were noted for other machines.

Conclusions

The analysis performed indicated relationships between: the current market value and the age, number of hours and power of tractors and machines. The relationship between the current value and the age and the number of hours confirmed the non-linear relation with rapid loss of the value in the first years of the use and asymptotic change reaching ca 5% of the purchase price at the age of 20 and more. Similar relationships were established more than 50 years ago by Scheafer-Kehnert [1963] and confirmed later by Culpin [1975]. Such tendency is constant [Theunissen 2002, Witney 1988] and proves significant effect of the economical wear on the market value of the machine of complicated structure such as tractors and self-propelled machines, among others.

Literature

MACHINE UTILIZATION COSTS IN DIFFERENT BRANCHES OF PLANT PRODUCTION CONSIDERING THE LEVEL OF MECHANISATION

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Keywords: mechanisation of small and medium sized farms, machine fleet planning, machine utilisation, low cost machine fleet, machine investment and usage cost

Introduction

In the present study we have tried to offer a general guideline considering a general crop plan and production technology characteristic of several branches with an overview of the composition of machine stock from the use of the lowest cost level to the highest technical level machinery, the machine demand and the utilization level of those together with investment and utilization costs which may serve as a basis and may open further research perspectives for the reduction of machine utilization costs both for the producers and for the professional organizations.

Method - The crop growing branches surveyed

The surveys can be conducted by modelling the machine working processes of agricultural production. In the case of field crop production a crop plan including cereal plants for human consumption, maize for animal breeding and for energy production purposes and oil seeds – as sunflower and the nowadays very popular crucifer - appropriate for human consumption and energy production as well and reflecting the special features of production in Hungary has been applied. Our calculations have been based on a crop plan including cereal plants, sweet corn, onion and root vegetables in case of field vegetable growing while in case of plantation cultivation the data of a vine growing farm have been taken into account. Depending on farm size the proportion of the crop area of the individual plants has been stipulated in view of the agronomical and production technological conditions.

Results - The analysis of machine utilization costs subject to farm size

Figure 1 shows the lower and upper limit of machine utilization costs, resp. the most probable range of machine utilization costs of the different branches subject to farm size taking the application of low technical level
power- and working machines as well as the expensive power machines representing the most modern technology into account. In general terms we can say that the low level of utilization by the small size farms generates the dominance of fixed costs. Due to this fact the substantial differences between the amortization costs of cheap and expensive machines are also reflected in the cost of utilization. By medium size farms this tendency is already more moderate. By large farm sizes where the variable costs predominate in the cost structure of machine utilization owing to the notable shift-hour performance and the specific costs of fuel and wage costs are more favourable due to the fact that the machines are of a higher technical level and able to work more efficiently and with a better area performance the difference between the utilization costs of the cheap and the expensive power machines reduces, in some cases to the minimum.

Considering the above we can come to the conclusion that the variability of machine utilization cost tapers with the growth of farm size. In case of plantation cultivation where labour tasks are fulfilled by one or two nearby maximally utilized power machines by large farm size and machine harvesting is done by pulled harvester the cost interval gets quite narrow. Contrary to the above the maximal utilization of the self-propelled grain combine used in field crop producing and field vegetable growing farms can hardly be ensured even in case of large farm sizes and the high level of the operational costs of same tempers the “slimming” of the cost interval.

It can be stated that by the more working time demanding branches in case of large-scale farming the costs of machine utilization are less dependent on the technical and cost level of the appliances used and the machine costs assignable to the given area size and labour quantity can be determined more precisely.
Conclusion

It can well be demonstrated by the presented examples of the branches of plant production that while the investment of an own machine is not economical by small-scale production including the least machine labour per hectare demanding grains and oilseeds due to the low level of machine utilization already under 18 ha, the farm size limit of non-economical machine utilization is lower in case of field vegetable growing and plantation cultivation where the specific labour demand per unit of area is higher and the level of machine costs is already from 6-10 ha farm size on acceptable due to the better machine utilization. Furthermore, the capacity of the machines assigned to the crop growing technologies applied in the latter branch is lower, their purchase price is mainly lower and this effects the machine cost level of small-scale farming in a more favourable way than the phenomena experienced in field crop production.

It can be stated here as well that one who intends to operate an own machine stock under the above mentioned size limits has to face a specific investment cost five to ten times higher than the acceptable cost level. If, however, one is forced to do that due to some production–technological pressure one has to try to decrease the specific costs of
machine utilization by increasing machine utilization in order to keep the costs at an acceptable level.
The aim of our research work and the exposition of its results are the professional support of the machine investment decisions and the machine utilization practice of the different size farms promoting hereby the creation of the conditions of fruitful farming and rational machine investment decisions.

References

CURRENT STATUS OF BIOLOGICAL AND CONVENTIONAL PLANT PROTECTION PRODUCTS REGISTRATION IN POLAND

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Keywords: registration, plant protection products, effects of EU accession

Introduction
Since European Union accession on the 01.05.2004 the number of plant protection products (PPP) placed on the Polish market has significantly decreased. The main reason was implementation of the rules of the Directive 91/414 to the Polish law and withdrawal of numerous active substrances from use in EU plant protection, due to the review carried out by European Commission. The paper presents detailed information concerning the current status of PPPs registration in Poland with particular regard to the biological means of crop protection.

Material and methods
The official list of plant protection products placed on the Polish market published by Polish Ministry of Agriculture and Rural Development as well as Polish legal acts regarding plant protection were analyzed and discussed. The data for the 30.04.2009 (5 years after EU accession) were considered.

Results
At present there is 806 plant protection products placed on the Polish market. The biggest group – 286 products are herbicides (over 35% of all PPPs placed on the market) followed by fungicides - 257 (over 31%). The group zoocides with 153 products registered (about 19% of all PPPs) includes insecticides – 113 products (14% of all PPPs) and relatively small number of nematicides (4), molusccocides (7), rodenticides (14) and acaricides (15). The most complex and the least numerous with 110 products (over 13%) is the last group “others”. To this group belong

1 http://www.bip.minrol.gov.pl/DesktopDefault.aspx?TabOrgId=647&LangId=0
pheromones and attractants (15), repellents (14), bactericides (5), growth regulators (49) and resistance stimulators (5).

The placement of biological plant protection products on the Polish market is governed by completely different rules depending on the group they belong to: chiefly, whether they are micro or macro organisms. Microorganisms and viruses undergo a very strict, costly and time consuming registration procedure, more or less uniform for all EU countries. Placing products belonging to this group on the Polish market requires a very significant financial and time-consuming investment. The rules regarding macro organisms registration are established in EU on the member state level. In Poland, at present there is a complete lack of regulation, which means that macro organisms used in biological control can be imported and used in Poland without any supervision. However, the list of biological products registered under the old regulations in the number of 25 can still be used as a guide to inform on the safety and efficacy of some products.
TRACTOR TESTS: ANALYSIS OF THE RESULTS ACCUMULATED OVER THE 10 LAST YEARS

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Keyword: tractor, consumption, power, engine

Introduction

The Agricultural Engineering Department of the CRA-W produces, on users’ demand, power and consumption measurements from agricultural and forest tractors. The tractor tests are acquired on a fixed test bench with simultaneous fuel consumption measurements and possibly with certain exhaust gases analysis. On one hand, thanks to this objective measure, it is easily possible to verify if the developed power is conforming, on the other hand judging the fuel consumption level. This last point, obtained a more pronounced importance with the increase of diesel prices. Presented here, is an analysis of results accumulated over the last 10 years. These observations are compared with the ones we executed in 1992, whilst a synthesis analysis similar to the tests of tractors. Comparison measures between fuels (fossil fuels or renewable fuels) and influences on certain accessories have equally been materialized.

Results

The observation of the tested tractor distribution shows a dominance of group models (John Deere (38%), AGCO (25%) and CNH (22%)). The average age of tested tractors is relatively low and their total average life span is 1500 hours with observations varying from 3 to 9600 hours. The average annual use is between 500 to 700 hours/year and only the tractors of less than 60 kW portray a less high usage of just more than 300 hours per year. These descriptive data from the tested tractor park are relatively similar to the ones obtained from the previous analysis executed in 1992. However, the average pto power establishes today at 104.3 kW as it was only 66kW in 1992 – an increase of nearly 60% in a bit less than 15 years. Currently, along the tested tractors, less than 9% show real power inferior to 95% of the initial power, whereas in 1992 nearly 40% of tested tractors produced an insufficient amount of power. These engines, quite often,
have a mechanical problem and have a greater specific consumption level than their initial value. A good amount between them, then undergo an investigation in order to obtain correct values, when possible. More than 39% of tractors have normal power. Just over 29% have a power superior to 5 to 15% of the norm and more than 22% are beyond this threshold. In 1992, these two values were 17.1 and 7.2%. Recently, a number of tested tractors have been equipped of an accessory modifying the injection management and increasing the power.

The average specific consumption level measured at the nominal rate has been established at 257.6 g/kWh and is practically identical to the one referenced at 254.4 g/kWh. The average power increase hasn’t had any repercussions on the specific motor consumption. More than half of the tested tractors present a specific consumption level conforming to its initial value, this result is better than the one previously obtained where there were barely 34% of tractors with normal consumption levels. The proportion of tractors with elevated specific consumption levels get to 30%. Some specific tests with tractors have displayed an influence from the type of fuel (gasoil, biodiesel, vegetal oil ...), generally to the advantage of the fossil fuels in specific consumption term. A specific consumption development equally observes itself according to the category of anti-pollution norms at which the motor responds.

Conclusion

In a period of just over 15 years, the performance state in terms of power and consumption of the tractors has significantly evolved. From a situation of nearly 40%, without delivering the referenced power, currently only 9% of tested tractors fall into this category. Conversely, the percentage of tractors with power clearly superior to the referenced power has tripled to attain 22%. This caused a few incidences on the specific consumption of tractors that remain noticeably equivalent to the reference and equally to the average values recorded in 1992. This should not however cover the increase of specific consumptions registered after the application of anti-pollution norms.

References


STUDY OF THE PERFORMANCES OF DIFFERENT NOZZLES TYPES FOR SPRAYING LIQUID FERTILIZER ON WHEAT

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Keywords: liquid fertilizer, nozzles, image analysis, spraying fertilizer

Summary
Trials on liquid fertilizer application on wheat were conducted with different models of spray nozzles. The main objective of the trials was to compare the burning effect of nitrogen application on the last leaf according to the application techniques: solid fertilizer (reference), pure liquid nitrogen applied with flat fan nozzle, wide angle flat fan nozzle, air induction flat fan nozzle and stream jet fertilizer nozzle.

The solid fertilizer application achieves superior yield relative to an application of liquid nitrogen. The application of liquid nitrogen on wet vegetation provides higher levels of leaf burning from an application on dry vegetation.

Methods
The trials allowed to compare the application of pure nitrogen with different types of nozzles (see Fig. 1) on wet vegetation (morning dew) and dry vegetation (sunlight), in reference to the application of nitrogen in solid form. The tests were carried out at the fraction of last leaf on wheat at 90 unitN without dilution.

The analysis focused on the percentage of blight on the first and second leaf having a direct impact on crop yield. The image analysis was used to quantify the proportion of necrotic leaf.

Results and discussions
There is a significant difference between the applications of the last fraction of nitrogen under solid or liquid form. The yields are higher for solid application (see Fig. 1). Burnings are often encountered when applying liquid nitrogen and reduces the yield potential of the plant. When applying on dry vegetation, only the stream jet fertilizer nozzle (SJ7-03) allows to obtain yields equivalent to those obtained by solid form.
The levels of burnings (see Fig. 2) were determined by image analysis. This technique unfortunately does not easily differentiate between burnings from liquid nitrogen application and parasitic necrosis. This explains the low burning rate observed for the solid application.

Application on wet vegetation has generally higher levels of burns from an application on dry vegetation. The most important contact area on wet leaf associated with differentiated open stomata are two explanatory causes of the phenomenon.
THE MARKET OF SECOND-HAND TRACTORS AND COMBINE HARVESTERS

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Keywords: market, second-hand machinery, tractors, combine harvesters, farms, age, power

Introduction

The purchases of second-hand agricultural machines give the farmers possibility: to increase the level of mechanization, to utilize quite modern as well as efficient and powerful machines and tractors, to modernize machinery resources without significant capital cost. The purpose of this paper is both to estimate the Polish market of second-hand tractors and combine harvesters and also to present this issue on the example of 54 investigated farms.

Methods

The analysis is based on data of Central Statistical Office (GUS) and own market investigations. Data concerning tractors and combine harvesters (resources and investments) on 54 investigated farms (size 9.7-150 ha) were collected in 2009 year in the project NCBiR-IBMER (N R 12 0043 06).

Results

Within a period of 1993-2008 supplies of second-hand tractors amounted 26% of the total market of these agricultural vehicles. In the years 2001 and 2002 the share of used tractors in total market exceeded even 50-60% in numbers. Due to improvement of income conditions on farms in next years (accession to EU) the share of second-hand tractors in the total market diminished to about 25%.

Table 1. Supplies of new and second-hand tractors, thousands

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<tbody>
<tr>
<td>Total</td>
<td>94.6</td>
<td>11.2</td>
<td>9.8</td>
<td>12.1</td>
<td>14.1</td>
<td>13.5</td>
<td>13.2</td>
<td>18.4</td>
<td>22.0</td>
<td>22.5</td>
<td>231.5</td>
<td>136.9</td>
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<tr>
<td>- new</td>
<td>78.4</td>
<td>7.7</td>
<td>4.5</td>
<td>4.6</td>
<td>7.5</td>
<td>10.0</td>
<td>9.9</td>
<td>13.4</td>
<td>16.6</td>
<td>17.7</td>
<td>170.3</td>
<td>91.9</td>
</tr>
<tr>
<td>- second-hand (import)</td>
<td>16.2</td>
<td>3.5</td>
<td>5.3</td>
<td>7.5</td>
<td>6.6</td>
<td>3.6</td>
<td>3.4</td>
<td>5.0</td>
<td>4.8</td>
<td>61.2</td>
<td>45.0</td>
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<tr>
<td>%</td>
<td>17</td>
<td>31</td>
<td>54</td>
<td>62</td>
<td>47</td>
<td>26</td>
<td>27</td>
<td>25</td>
<td>21</td>
<td>26</td>
<td>33</td>
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</table>
Within a period 1993-2008 the total supplies of grain harvesters achieved 66.7 thousand pieces. A majority of these combines was delivered to Poland as used ones (86%). Most of them were imported from Germany (72%). The import of second-hand combines clearly decreases from year to year.

Table 2. Supplies of new and second-hand combine harvesters, thousands

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<tbody>
<tr>
<td>Total</td>
<td>34.35</td>
<td>3.83</td>
<td>5.78</td>
<td>7.53</td>
<td>4.26</td>
<td>2.11</td>
<td>2.41</td>
<td>2.12</td>
<td>1.99</td>
<td>2.37</td>
<td>66.73</td>
<td>32.39</td>
</tr>
<tr>
<td>- new</td>
<td>3.89</td>
<td>0.23</td>
<td>0.43</td>
<td>0.61</td>
<td>0.45</td>
<td>0.36</td>
<td>0.64</td>
<td>0.60</td>
<td>0.84</td>
<td>1.26</td>
<td>9.30</td>
<td>5.41</td>
</tr>
<tr>
<td>- second-hand (import)</td>
<td>30.46</td>
<td>3.60</td>
<td>5.35</td>
<td>6.92</td>
<td>3.81</td>
<td>1.70</td>
<td>1.78</td>
<td>1.51</td>
<td>1.15</td>
<td>1.11</td>
<td>57.38</td>
<td>26.92</td>
</tr>
<tr>
<td>%</td>
<td>89</td>
<td>94</td>
<td>93</td>
<td>92</td>
<td>90</td>
<td>80</td>
<td>74</td>
<td>71</td>
<td>58</td>
<td>47</td>
<td>86</td>
<td>83</td>
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</table>

Investigated 54 farms have 154 tractors with average power of 50 kW and average age 19.4 years. Among them within a period 2000-2009 farmers have bought 49 tractors, of that 28 new ones with average power 76.5 kW and 21 used ones with average power of 66.9 kW. In 2009 the age of above mentioned purchased second-hand tractors average 16.1 years.

Combine harvesters are present on 36 farms with average power of 90 kW and age 22.1 years. Within a period 2000-2009 farmers have bought 14 combines, of that 3 new ones with power 170-270 kW (average 76.5 kW) and 11 second-hand combine harvesters with power 51.5-110.3 kW (average 77.9 kW). In 2009 year above second-hand combines were 24.1 years old (20-35 years).

**Discussion**

Presented data show that a purchase of second-hand machines still plays an important role on Polish market of mechanization means. Decrease of supplies of second-hand tractors and combine harvesters observed in last period was mainly caused by both EU subvention (development programs) and by relatively high saturation of Polish agriculture with above mentioned mechanization means.

**References**

GUS 2009. Produkcja wyrobów przemysłowych w 2008 r.
AN EVALUATION OF QUALITY PROPERTIES OF PLANT BIOMASS BRIQUETTES

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Keywords: plant biomass, briquettes, quality properties

Objects and materials
The examined briquettes were produced in two types of press: a screw and a piston one. The following raw materials were used for the briquettes produced in the screw briquetting machine: fodder maize straw, *sida hermaphrodita*, cereal straw and meadow hay. The comparative materials for the briquettes produced in the piston briquetting machine were: chamomile straw, fodder maize straw as well as stems of *silphium* and *sida hermaphrodita*. The following working parameters were applied for the screw briquetting machine: the compacting chamber temperature 200; 225 and 250°C, briquetting efficiency approximately 60 kg·h\(^{-1}\), moisture of the raw materials 10%. For the piston briquetting machine the moisture parameter was the same but the briquetting efficiency was approximately 400 kg·h\(^{-1}\). Besides, in the piston briquetting machine there was no possibility of controlling the compacting chamber temperature.

Methods
The measurements of the kinetic strength of the briquettes were taken on a test stand consisting of a cuboid drum sized 300×300×460 mm with the walls of net mesh 10×10 mm. The drum’s rotational speed was 15 rpm, testing time 5 min, and average sample mass 1000 g. The compression strength was determined using the Centor Easy dynamometer, equipped with a force sensor of the 50 kg maximum pressure. The sensor’s tip was a flat disc of 35 mm in diameter. The briquettes, placed between the sensor’s tip fixed on the movable part of the stand and the plate, were subjected to pressing. The sensor recorded the value of pressure force exerted on the examined briquette. The obtained values of density as well as of static and kinetic strength were statistically analysed on the basis of variance analysis as well as Tukey’s test, at the trust interval of 95% using the STATISTICA 6.0 programme.
**Results**

During the analysis of the influence of the compaction chamber temperature in the screw briquetting machine, independently of the kind of applied material, it was observed that the density of the obtained briquettes increased significantly with the growth of temperature from 200 to 250°C and it ranged from 450 to 850 kg·m$^{-3}$. For the piston briquetting machine the density of the obtained briquettes ranged from 475 kg·m$^{-3}$ for *sida hermaphrodita* to 850 kg·m$^{-3}$ for chamomile straw. The coefficient of the briquettes’ strength ranged from 0.1 to 0.9 depending on the type of the working unit, temperature in the compaction chamber and the applied raw material. The value of compressing stresses causing a briquette’s damage for the assumed compaction chamber temperatures: 200; 225 and 250°C reached 0.12; 0.26 and 0.46 MPa, respectively.

**Conclusions**

During tests on the kinetic strength, stratification was observed both in the briquettes obtained in the screw unit and the ones from the piston machine. When the briquettes obtained from the different tested raw materials were compared it could be noticed that, independently of the compaction chamber temperature, the briquettes obtained from fodder maize straw showed the highest strength. For all the briquettes obtained in the screw working unit it was found out that their average density increased with an increase of compaction chamber temperature. Higher kinetic and static strength values in the briquettes were also recorded when the compaction chamber temperature grew.
EFFECTIVENESS OF FIGHTING THE BEAN'S (UROMYCES PHASEOLI) RUST IN FIELD CULTIVATION USING STANDARD AND LARGE DROP NOZZLES

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Keywords: runner bean, standard and large drop nozzles, fungicides railway track protection

Runner bean (Phaseolus coccineus L.) is an important leguminous plant in agriculture. Unfortunately, varied factors limit the development of this crop. One of the most important among them in the last years, is the rust. This pathogen causes a considerable weakness of the assimilation apparatus and then decrease crops. In that respect it is important to find more effective methods of bean protection using fungicides by spraying under good and difficult atmospheric conditions.

This investigation was conducted in years: 2007-2009 in RZD Czesławice. The experience assumed the method of random blocks in 4 repetitions sowing the bean of brand Blanka. Spraying was done using two kinds of nozzles; standard 110 03 (Marian Mikołajczak) and large drop nozzles ID 120 03 C (Lechler). The seven following combinations of plant protection product and spraying technique were applied: I - control without spraying; II - spraying the Dithane (the s.and. the mankozeb), the standard sprayer RS – MM; III - spraying the Dithane, large drop nozzles ID; IV - spraying the Sumilex (the procymidon), sprayer the RS – MM; V - spraying the Sumilex sprayer ID; VI - spraying the Amistar (the azoksystrobina), the sprayer RS – MM; VII - spraying the Amistar, sprayer ID. Every 14 days, the application of plant protection product has been conducted. During the whole period of vegetation, the plants health has been evaluated. From every parcels, 25 plants have been defined and the rust infestation has been determined according to a 5 points scale score (0-4). Based on this observation the index of infestation (%) has been evaluated. The results was analysed statistically using Duncana's test by level of significance p = 0.05.
Table 1. Rust infestation (*Uromyces the phaseoli*) of brand Blanka according to the spraying technique and the applied plant protection product

<table>
<thead>
<tr>
<th>Protection</th>
<th>Infection index (%)</th>
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<tr>
<td></td>
<td>2007</td>
<td>2008</td>
<td>2009</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>62,0</td>
<td>94,6</td>
<td>70,2</td>
<td></td>
</tr>
<tr>
<td>Dithane RS-MM</td>
<td>52,5</td>
<td>87,6</td>
<td>55,3</td>
<td></td>
</tr>
<tr>
<td>Dithane ID</td>
<td>50,3</td>
<td>87,9</td>
<td>53,8</td>
<td></td>
</tr>
<tr>
<td>Sumilex RS-MM</td>
<td>46,3</td>
<td>95,0</td>
<td>67,5</td>
<td></td>
</tr>
<tr>
<td>Sumilex ID</td>
<td>50,2</td>
<td>92,9</td>
<td>61,3</td>
<td></td>
</tr>
<tr>
<td>Amistar RS-MM</td>
<td>3,0</td>
<td>51,3</td>
<td>10,0</td>
<td></td>
</tr>
<tr>
<td>Amistar ID</td>
<td>2,5</td>
<td>55,3</td>
<td>12,5</td>
<td></td>
</tr>
</tbody>
</table>

Investigations showed, that fungicides application influenced the plants' well-being. The best results were obtained when one applies Amistar independently of the spraying techniques.
THE INFLUENCE OF TECHNICAL EQUIPMENT ON SUSTAINABILITY OF AGRICULTURAL PRODUCTION WITH DIFFERENT PRODUCTION TRENDS IN CHOSEN FARMS

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Keywords: sustainable agricultural production, production trend, mechanization

Introduction
Rational agriculture mechanization gives harmonization of production, social and ecological aims, which are significant for sustainable agriculture. It gives opportunity to improve effectiveness of production expenditures, personnel work comfort and respect for natural environment. There are many different direct and indirect competitions between agriculture mechanization, economics, natural environment and social effects in the country and in agriculture. They should be considered in analysis and selection of production system and technology [Pawlak 2008].

Methods
The aim of work was evaluation of the effects of technical equipment on sustainability of agricultural production with different production trends. The scope of the work included an intentional selection of farms fulfilling the requirements concerning the minimal area, technical equipment and diversification of the production. The research was conducted as direct survey in 50 farms from southern Poland in 2008.

To define the level of sustainability of agricultural production in economic, social and ecologic aspect there were calculated inter alia following measures: agricultural income per 1 fulltime worker, workload, balance of organic substances renewing, NPP balance. [Sawa 2008]. Technical equipment was characterized in three different trends of production with methods which are used in Institute of Agricultural Engineering and Informatics in Krakow [Tabor 2006].

Results
Out of 50 farms, 25 were aimed at plant production, 7 at animal and 18 were mixed production. Highest average arable land area had animal
producing farm (11.57 ha) but 66% of it was grasslands. Average livestock fluctuated between 0.62 do 1.62 livestock units per hectare. In animal producing farms there were achieved twice as big value of direct surplus and goods production comparing with other trends. The highest reproduced value of technical equipment was in plant, lowest was in animal producing farms (Table 1).

<table>
<thead>
<tr>
<th>Specification</th>
<th>Average</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reproduced value</td>
<td>29.20</td>
<td>15.13</td>
<td>12.77</td>
<td>65.67</td>
</tr>
<tr>
<td>Trucks</td>
<td>2.01</td>
<td>6.28</td>
<td>0.00</td>
<td>30.19</td>
</tr>
<tr>
<td>Tractors</td>
<td>12.77</td>
<td>8.77</td>
<td>2.82</td>
<td>39.60</td>
</tr>
<tr>
<td>Self-propelled machines</td>
<td>4.01</td>
<td>7.07</td>
<td>0.00</td>
<td>22.75</td>
</tr>
<tr>
<td>Other</td>
<td>10.40</td>
<td>8.23</td>
<td>3.38</td>
<td>40.56</td>
</tr>
<tr>
<td>Mechanization costs</td>
<td>16.05</td>
<td>13.42</td>
<td>2.96</td>
<td>48.56</td>
</tr>
<tr>
<td>Technical equipment index</td>
<td>0.45</td>
<td>0.45</td>
<td>0.03</td>
<td>1.81</td>
</tr>
<tr>
<td>Reproduced value</td>
<td>20.80</td>
<td>11.23</td>
<td>9.06</td>
<td>34.90</td>
</tr>
<tr>
<td>Trucks</td>
<td>1.11</td>
<td>2.95</td>
<td>0.00</td>
<td>7.80</td>
</tr>
<tr>
<td>Tractors</td>
<td>9.96</td>
<td>7.88</td>
<td>0.00</td>
<td>23.30</td>
</tr>
<tr>
<td>Self-propelled machines</td>
<td>0.69</td>
<td>1.83</td>
<td>0.00</td>
<td>4.83</td>
</tr>
<tr>
<td>Other</td>
<td>9.04</td>
<td>6.38</td>
<td>2.61</td>
<td>19.34</td>
</tr>
<tr>
<td>Mechanization costs</td>
<td>13.09</td>
<td>10.39</td>
<td>4.09</td>
<td>31.58</td>
</tr>
<tr>
<td>Technical equipment index</td>
<td>0.16</td>
<td>0.07</td>
<td>0.08</td>
<td>0.30</td>
</tr>
<tr>
<td>Reproduced value</td>
<td>26.19</td>
<td>18.30</td>
<td>10.43</td>
<td>91.37</td>
</tr>
<tr>
<td>Trucks</td>
<td>1.50</td>
<td>3.63</td>
<td>0.00</td>
<td>11.21</td>
</tr>
<tr>
<td>Tractors</td>
<td>9.26</td>
<td>8.23</td>
<td>2.80</td>
<td>30.67</td>
</tr>
<tr>
<td>Self-propelled machines</td>
<td>4.37</td>
<td>7.89</td>
<td>0.00</td>
<td>29.50</td>
</tr>
<tr>
<td>Other</td>
<td>11.06</td>
<td>12.72</td>
<td>3.77</td>
<td>60.70</td>
</tr>
<tr>
<td>Mechanization costs</td>
<td>17.17</td>
<td>12.41</td>
<td>4.10</td>
<td>45.06</td>
</tr>
<tr>
<td>Technical equipment index</td>
<td>0.14</td>
<td>0.12</td>
<td>0.03</td>
<td>0.47</td>
</tr>
</tbody>
</table>

It was determined by the fact that in researched animals producing farms many technological actions were hand’s made. It resulted by growing of workload (average 866 working hours per person) and low mechanization
costs. The lowest economic results were achieved by farms with mixed production trend. They had higher mechanization costs with lowest goods production.

None of the researched groups of farms has achieved sustainability of production in all aspects. Plant and mixed trends producers haven’t fulfilled requirements of purchasing-power parity for agriculture producers and animal producers had too high level of livestock in relative to its land area. It has caused too high nitrogen fertilizing.

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EVALUATION OF BALING PRESS
AND INTEGRATED BALER WRAPPER WORK EXPLOITATION

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Summary: The objective of this work was the evaluation of two kinds of machines used for harvesting of hay, straw, and green forage. The study showed that the integrated baler wrapper is more efficient than set of baling press and baler wrapper.

Key words: machines operation, efficiency, baling press

Introduction

The correct and effective work of machines depends on direct control and their set up as well as knowledge of their working conditions and use [Kuczewski 1980]. In the modern agriculture, the organization of mechanized process of production is significant. Application of correct technology in agricultural production processes in view of aggregation of different machines is crucial and it is done in order to achieve continuity of work and the best use of the equipment to decrease the number of machines and workers, as well as to obtain the lowest cost of executed work.

Progress in cultivation and agricultural science related to fodder and cereal crop make possible to obtain a satisfying yield of straw, hay, or green forage. Such condition fits ideally legal regulation concerning environmental protection which requires reduction of emission of harmful gases by burning of fossil fuels. Straw as a biofuel becomes an interesting object of numerous research studies, e.g. the boiler houses using bales of straws or briquette as fuel [Balsami 1998; Denisiuk 2000; Dybiec 2003; Jackowska 2004].

The specialization and the size of the farm is one of the basic conditions concerning the machine fleet. The assurance of the correct quality of straw, which satisfies expectation of numerous buyers, is tied with strict compliance with agrotechnical term, as well as weather conditions during harvesting. The above can be achieved by the newest technologies which are based on using cylindrical or rectangular bales [Miłosz 1997; Olszewski 1980]. There are two basic groups of harvesting technologies of hay and straw. In the first group, the material is in loose form on trailers. In this group, the most operations are manual [Sęk 1978]. The second group is based on pressing material to rectangular or
cylindrical bales (with variable, fixed, or hybrid working chamber) and is characterized by high efficiency and mobility [Gieroba 1993].

The aim of the study

The aim of the study was evaluation of harvesting machines of hay, straw, and green forage. Research included measurement of active time for two types of machine for package of hay in the form of cylindrical bales.

Material and methods

The study of operation of machines for silage of hay, straw, and green forage in cylindrical bales was carried out according to the obligatory normative documents by Institute for Buildings, Mechanization, and Electrification of Agriculture in Warsaw, Poland. According to recommendations included in those materials, the structure of active time for particular researched machines was determined.

There were two types of machine used in the research. The first machine was baling press "Sipma Z-279/1" furnished with 1.8 m pick-up together with the wrapping machine "Mascar 3100". The second machine was integrated baler wrapper "Taarup Bio+" furnished with 2.1 m pick-up, rotor, and fourteen knives with individual knife protection.

The first-cut green forage contained different levels of dry matter (about 12%).

Results and discussion

Table 1 presents the results of the study. The total measured active time for the assembly of the press and the wrapping machine was 110 seconds, whereas in the case of integrated baler wrapper - 52 seconds.

Table 1. List of parameters for aggregates in field conditions

<table>
<thead>
<tr>
<th>Variant Machine</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension of the baling chamber</td>
<td>Width [m]</td>
<td>1.20</td>
</tr>
<tr>
<td></td>
<td>Diameter [m]</td>
<td>1.20</td>
</tr>
<tr>
<td>Dimension of the baler wrapper</td>
<td>Width [m]</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Diameter [m]</td>
<td>-</td>
</tr>
<tr>
<td>Average time of bale formation [sec.]</td>
<td>90</td>
<td>-</td>
</tr>
<tr>
<td>Average time of bale wrapping [sec.]</td>
<td>-</td>
<td>20 *</td>
</tr>
<tr>
<td>Total time [sec.]</td>
<td>110</td>
<td>52</td>
</tr>
</tbody>
</table>

* Wrapping of bale 2 layers of foils half of width imposing
Conclusions

From among two sets tested, integrated baler wrapper is more efficient than an assembly of the press and the wrapping machine. That has been proved for one cycle that is for the formation of bales and winding foil. It is more time-consuming to do most of works by using separated machines. In the case of integrated baler wrapper, the active time for formation and wrapping of the bale was half in comparison with the aggregate of hay baler and wrapping machine. The use of one machine is more efficient than integrated set of machines in respect to saving of fuel and working time.

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ASSESSMENT OF ENERGY CONSUMPTION PATTERN IN THE SAMPLE OF WALLOON FARMS

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Keywords: energy, consumption, direct and indirect energy, Walloon farm, energy efficiency

Introduction

Farming systems have to face, like all other companies, energy prices increase, and consequently the production costs. In this way, it is important to analyse energy consumption patterns in Walloon farms in order to identify the leeway of progress and to give advices to farmers on the ways to improve their energy efficiency. To reach such a target, the project OPTENERGES (Optimizing the energy efficiency of livestock farms and reducing their greenhouse gas emissions), covering French Lorraine, Luxembourg and Walloon Region is conducted since the end of 2008. This work synthesized first results obtained in this project and in an approach performed by the VALBIOM (Walloon Biomass Use Association).

Material and method

Energy assessments were made in 15 Walloon farms using a specific tool called Planete (Solago, 2007). All direct energies are taking into account (fuel, electricity, lubricant, etc) as well as all indirect energy needed to manufacture, transport and recycle all inputs purchased (animal food, fertilizer, pesticides, etc). The results are expressed as litre of fuel equivalent (LFE), 1 LFE = 35.8 MJ = 0.88 litre of fuel.

PLANETE tool is specific to farming systems, its main goals are:
- to quantify all non renewable energies used in the farm;
- to know the share of the different energy origin and forms (direct, indirect, etc) within the farm;
- to compare farms between them in order to underline technical itineraries allowing to reduce energy consumption and to give individual advised to the farms followed up.
Results and discussion

Table 1. Annual consumption (litre of fuel equivalent – LFE year)

<table>
<thead>
<tr>
<th></th>
<th>Mean ± standard deviation of the mean</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil and by-product</td>
<td>19 902 ± 5 301</td>
<td>7 414</td>
<td>89 003</td>
</tr>
<tr>
<td>Electricity</td>
<td>2 940 ± 599</td>
<td>215</td>
<td>8 569</td>
</tr>
<tr>
<td>Other energy sources (lubricant, grease…)</td>
<td>55 ± 46</td>
<td>0</td>
<td>700</td>
</tr>
<tr>
<td>Animal food</td>
<td>7 118 ± 2 450</td>
<td>0</td>
<td>36 430</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>22 179 ± 6 062</td>
<td>7 182</td>
<td>102 440</td>
</tr>
<tr>
<td>Other (pesticides, seeds, young animals…)</td>
<td>6 170 ± 1 660</td>
<td>2 307</td>
<td>28 571</td>
</tr>
<tr>
<td>Farm equipment and buildings</td>
<td>4 956 ± 1 112</td>
<td>696</td>
<td>17 676</td>
</tr>
<tr>
<td>Total</td>
<td>63 379 ± 13 102</td>
<td>30 959</td>
<td>239 222</td>
</tr>
</tbody>
</table>

Results (Table 1) show a great variability among farms with a total energy expenditure varying between 30 959 and 239 222 LFE in a year. The energy consumed by each item varies also a lot in our sample because the energy used in a farm depends strongly from the farm’s type and its main production. The direct energy (electricity and oil), fertilizer and animal food represent, altogether, 83% (between 75 and 90%) of the total energy expenditure per year.

Table 2. Energy consumption depending on the farm’s types

<table>
<thead>
<tr>
<th></th>
<th>Mean ± std</th>
<th>Crop farms</th>
<th>Dairy farms</th>
<th>Beef farms</th>
<th>Beef + dairy farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total energy consumption LFE/ha</td>
<td>444±25</td>
<td>902±194</td>
<td>746±44</td>
<td>1432±666</td>
<td></td>
</tr>
<tr>
<td>Total energy consumption LFE/1000 litre of milk</td>
<td>/</td>
<td>169±36</td>
<td>/</td>
<td>477±193</td>
<td></td>
</tr>
<tr>
<td>Total energy consumption LFE/100 kg weight living animal</td>
<td>/</td>
<td>/</td>
<td>212±21</td>
<td>255±35</td>
<td></td>
</tr>
</tbody>
</table>

In order to identify improvement way, within farm type (crop, dairy, beef and dairy + beef farms) variations were analysed. With an average consumption of 444 [373-496] LFE/ha, crop farms are the smaller energy consumer group. At the opposite, dairy/beef farms of our sample have reached a consumption level of 1432 [766-2098] LFE/ha. It is observed that farms with breeding activities are less efficient in an energetic point of view (energy contain in the products/energy of inputs), with a ratio of 3.75 in average for all breeding farms against 10.6 for crop farms.

In average, the total energy expenditure is 169±36 LFE/1000 litre of milk in our sample of dairy farms. The beef farms have consumed 212±21 LFE to produce 100 kg weight of living animal.
For all types of farms, the most important and variable items are fertilizer and oil/by-products. For dairy and beef farms, the part animal food represents also an important fraction of the energy consumption (14 and 20% respectively). Electricity can also be an important part of the total energy consumption, especially for farms that are producing milk due to the milking machine and the milk tank.

Conclusions
Energy consumption assessment is a tool allowing to farmers to compare their situation with other farms and to assess the possibilities of saving energy. This first energy consumption assessment performs in Walloon farming systems have confirmed the important variability that exists among farm’s types but also within a same farm’s type. This pre-study has shown that fuel, electricity, fertilizer and animal food represent, in average, 83 [74-90] % of the total energy consumption. The observed variability within each farm’s type is also important; this implies that improvements are possible, in the Walloon context. They will be studied during the OPTENERGES project, sharing, in this way, French and Luxembourg expertise. However, the results presented in this paper aren’t representative of the variety of farm’s systems existing in Wallonia as the number of farms analysed remains too small. So, this number has to be increased. It is foresee that assessment will be done on 50 Walloon breeding farms. On this bigger sample, the way of reducing energy consumption as the impact of their setting up on the energy efficiency will be studied.

Acknowledgements
This study was supported by the Walloon Region and the European Union (FEDER fund) in the context of the OPTENERGES project financed in the INTERREG IV program “Wallonia – Luxembourg – French Lorrain area”. The authors would also like to thank farmers for their availability.

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REVIEW OF THE APPLICATION METHODS OF BIOCIDAL PRODUCTS IN BELGIUM

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Keywords: biocidal products, method of application, equipment of application, inventory

Introduction

Biocides are “Active substances and preparations containing one or more active substances, put up in the form in which they are supplied to the user, intended to destroy, deter, render harmless, prevent the action of, or otherwise exert a controlling effect on any harmful organism by chemical or biological mean” (Directive 98/8/CE). The biocides are characterized by a very wide scope of application and cover a vast spectrum of human activities in the non agricultural field. More than 600 biocides are approved in Belgium; they are classified in 23 categories. The forms in which the biocides are presented are also very diverse (liquid, powder, aerosol sprayer, bait…). This great diversity implies a large number of application methods.

To be put on the market, a biocide has to obtain an authorization coming from the Belgium authorities. The approval form must contain a technical part in which the method of application of biocide, as well as the description of the equipment used, must be specified. Nevertheless, these data are often very brief and do not allow the administration to assess the feasibility of the treatment. The overall purpose of this study was to give a description of the biocides application techniques and to provide tools to the agents in charge of the evaluation of new biocidal products. The inventory of the techniques of application was limited to 3 types of biocides (wood preservatives, rodenticides and insecticides-acaricides). They form together about half of the approved product in Belgium and are certainly the biocides which raise the most questions.

Material and method

The inventory was made from the list of authorized biocides in Belgium and the technical parts of the authorization acts (SPF, 2008). In addition, enquiries were made to professional’s users of biocides and retailers of
equipment of application. A database (Access) was built to gather all information about the methods and equipments of application.

Inventory

*Wood preservative (PT 8)*

The wood preservative is set aside for giving an additional durability to a wood which is not durable enough for its utilization. A total of 54 wood preservatives are authorized on the Belgium’s market, they are made of 13 different active substances. All formulations are liquid formulations, products ready to use represent 76% of the available wood preservatives. Seven (7) methods of application are used to applied wood preservatives. The different equipments used for the application of wood preservatives are listed in the Table 1.

Table 1. Equipment of application

<table>
<thead>
<tr>
<th>Equipment of application</th>
<th>Method of application</th>
<th>User</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paint brush or brush</td>
<td>Brush treatment</td>
<td>Amateur/professional</td>
</tr>
<tr>
<td>Syringe</td>
<td>Injection</td>
<td>Amateur</td>
</tr>
<tr>
<td>Injection devices</td>
<td>Injection</td>
<td>Professional</td>
</tr>
<tr>
<td>Sprayers</td>
<td>Spraying</td>
<td>Professional/amateur</td>
</tr>
<tr>
<td>Spraying tunnel</td>
<td>Spraying</td>
<td>Professional</td>
</tr>
<tr>
<td>Double vacuum system</td>
<td>Impregnation double vacuum process</td>
<td>Professional</td>
</tr>
<tr>
<td>Pressure/vacuum system</td>
<td>Impregnation pressure/vacuum process</td>
<td>Professional</td>
</tr>
<tr>
<td>Pot for dipping</td>
<td>Dipping</td>
<td>Amateur</td>
</tr>
<tr>
<td>Dipping vat</td>
<td>Dipping</td>
<td>Professional</td>
</tr>
</tbody>
</table>

*Rodenticides PT14*

Product-type 14 is defined as Rodenticides. A total of 58 products are authorized in Belgium. Baits ready for use represent 93% of the authorized products. Almost all PT14 have an anticoagulant action. Nine (9) actives substances are used. The methods of application are presented in Table 2.

Table 2. Method of application for PT14

<table>
<thead>
<tr>
<th>Method of application</th>
<th>Number of products</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct laying of bait and direct laying of bait in wet conditions</td>
<td>54</td>
<td>92</td>
</tr>
<tr>
<td>Gasification</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Fumigation with gas generating product</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Gel injection</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
The equipments which can be used for the application of rodenticides are: bait box, gel gun, mousetrap and duster.

**Insecticides, acaricides, products used against the arthropods**

*PT18*

The variability of the targets and application sites involve a great range of application’s methods. A total of 204 products are authorized; they contain 40 different active substances. The products available on the market can be liquid, solid or gas. The methods of application are: aerosol, spraying, direct deposit of bait, powder application, vapour releasing by heating, diffusion, treatment with anti parasite collar, shampoo application, fogging, fumigation and spot application.

**Acknowledgements**

This study was supported by the Federal Public Service-Health, Food Chain Safety and Environment.

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SPF (Service Public Fédéral). Autorizations acts for biocidal 316 products (PT 8, 14 and 18), 2008.
PLANT PROTECTION RISK ASSESSMENT AS ECOLOGICAL EDUCATION FACTOR

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Key words: risk of pesticide application, risk factors, ecological education

Summary. Risk assessment of the plant protection applications has been performed taking into account variable natural and operational factors, but keeping constant technical and technological factor. The Risk assessment for the Environment performed during study follows the protocol developed by Spungoli and Vieri [1998]. It has been shown that having a technically efficient sprayer alone does not ensure high quality of treatment or low risk for the Environment. The user’s skill and education takes a great part in order to decrease the risk for the environment of the plant protection applications.

CONCLUSIONS

The high risk of plant protection applications has an economic dimension and exerts a complex effect on the process of agricultural production. This influence determines an ability of a farm to realize the process of agricultural production according to the principles established in the Code of Good Plant Protection Practice as part of Agricultural Sustainable project. The consequences of which can include changeable possibilities of producers taking advantage of different forms of subsidies for agriculture within, the so-called, agricultural-environmental programs. The indicated importance of each individual factor in shaping the risk level, while applying pesticides, including the role of the operator’s skills and responsibility, are the starting point to acknowledge the issue of education of agricultural producers in the sphere of both theoretical and practical principles of performing plant protection treatments (ecological education).

The aim of the study is to assess the degree of risk in performing a plant protection treatment with an efficient agricultural sprayer (Table 1) used in two different kinds of conditions (Fig. 1). The environmental impact analysis presented by Spugnoli P. and Vieri M. [Spugnoli and Vieri, 1998]¹ was used to make the Risk assessment. The method distinguishes and assesses Risk factors (natural, technical and technological, exploitation ones) and such risk objects as operator, people and animals in
the area of the treatment, air, water reservoirs, neighbour cultivations, spraying quality.

Table 1. Technical characterization of the sprayer considered in the assessment of the risk level of plant protection treatment

<table>
<thead>
<tr>
<th>Specification</th>
<th>Measurement units</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tank capacity</td>
<td>dm³</td>
<td>400</td>
</tr>
<tr>
<td>Working boom width</td>
<td>m</td>
<td>12</td>
</tr>
<tr>
<td>Scale of vertical regulation of the field boom</td>
<td>m</td>
<td>0.3-2</td>
</tr>
<tr>
<td>Number of a field boom sections</td>
<td>pieces</td>
<td>3</td>
</tr>
<tr>
<td>Spacing of nozzles</td>
<td>m</td>
<td>0.5</td>
</tr>
<tr>
<td>Maximum working pressure</td>
<td>MPa</td>
<td>0.4</td>
</tr>
<tr>
<td>Intensity of liquid outflow per minute</td>
<td>dm³</td>
<td>107</td>
</tr>
<tr>
<td>Type of sprayer pump</td>
<td></td>
<td>COMET BT 105</td>
</tr>
</tbody>
</table>

Sprayer fulfils the requirements binding at the diagnostic stations

Fig. 1. Area of risk factors in different conditions of the plant protection

SWAT MODEL AS A TOOL FOR CATCHMENT MANAGEMENT

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Keywords: SWAT, modelling, agriculture pollution, catchment management

Introduction

Agricultural modelling is still not as popular in Poland as in other European countries. The development of modelling can bring many profits. To prove such benefits there is a Polish-Norwegian project supported by the Norwegian Financial Mechanism. Within the project, the research team is developing a tool, which enables easy assessment of catchments condition depending on different environmental situations.

Methods

The SWAT model was chosen for the project – this is an acronym for Soil and Water Assessment Tool. It is a physically-based continuous-event, hydrology model developed to predict the impact of land management practices on water, sediment, and agricultural chemical yields in large, complex watersheds with varying soils, land use, and management conditions over long periods of time (Neitsch et al. 2002). The schema of the model functionality is shown on the figure 1.

![SWAT model schema](image)
The research site is located in central Poland, includes part of Zgłowiączka river catchment and has 125.3 km². Because of high soil fertility this land is first and foremost the agricultural land.

Results

The problem of modelling small catchments is the availability of data in proper resolution and accuracy. SWAT model requires a great amount of data; meteorological data, (in day step) soil data, land management data, topographic data, and hydrologic data. These were compiled and analyzed with GIS. To supply reliable answers, the developed models must be fed with correct and exact data. On the catchments of upper Zgłowiączka inhabitant activities has negative impact on environment. Part of these activities, including intensive agriculture, causes high concentrations of nutrients in surface waters. The most dangerous is random inflow of waste water or sewage to the river. It is hard to evaluate scale of the problem and to evaluate the final impact on water quality. Large problem in calibration of the model is lack of local data, short time of time series or long period of time between subsequent measurements. All the above mentioned facts explain limited confidence for final results. However we believe that SWAT even in this situation is powerful tool for testing different scenarios of water management. SWAT is physically based model which makes it more resistant on “noise” than empirical models.

Discussion

The unquestionable advantage of modeling is speed in obtaining results. Thanks to this speed modeling is important tool for testing several strategies of catchments management. Water Framework Directive is one of the most difficult to fulfil. This project focuses on supporting administration and self-governmental organization in implementation of effective strategies of catchments management based on a modelling approach. This method enables analysis of trends and early warning system against excessive pollution load.

References


EFFICIENCY OF LAYOUTS IN GREENHOUSE TOMATO CULTIVATION IN THE YEARS 2004 - 2007

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Key words: efficiency, layout, productivity, tomato, greenhouse

Introduction

The improvement of profitability in horticultural production can be achieved by the increase in the efficiency of layouts provided. One of the measures regarding this efficiency can be the standard partial productivity expressed by a quotient involving incomes from particular economic activity divided by costs of particular production factor applied in this activity. This statement is in agreement with generally accepted formula of average efficiency expressed by the relation between the effect obtained and the layout involved. In the conditions of market economy rationalized layouts have become an unavoidable necessity and, therefore, the knowledge about productivity of particular production factors is crucial as far as estimation of their destined level of consumption. The aim of this work is to estimate the standard partial productivity of layouts in greenhouse tomato cultivation in the years 2004-2007.

Methods

The subject of the investigation was chosen according to a purposeful method - possibly the largest production area of a greenhouse and tomato cultivation, as well as maintaining records of management events, according to generally accepted rules, were the criteria of selection. Primary materials were collected on the basis of interviews with the employees of the examined object and plotting the data regarding object accountancy and master file of particular production departments on the unit of measure of the author’s work.

In their further processing there were applied simple and added calculations (Dobija 2007, Sobota 2003). As far as costs division was concerned, there were used in accounting analysis of III order. Standard partial productivity was calculated on the basis of the formula proposed by Stabryła (2002).
Results and summary

Investigations were conducted in the region of Lower Silesia, in horticultural production plant featuring the area of about 23-29 ha cultivated plants under covers, with vegetables as prevailing type in organization structure, out of which tomato occupied about 54-63 %. Tomato cultivation was conducted in a prolonged cycle Mean partial productivity of layouts ranged from 1.06 (2004) – 1.45 (2007). The highest productivity in summary cost groups characterized human labor (social insurance and other benefits 16.49 in 2004 – 21.54 in 2005 and salaries and wages 4.41 – 5.76 respectively), amortization (17.69 in 2004 up to. 22.73 in 2006), energy and materials consumption 1.83 (2004) – 2.56 (2007). Among energy and materials consumed the most productive proved to be fuel consumption (about 395-675), spare parts and building materials (about 303-572), application of carbon dioxide to plant nutrition (about 41-234), seeds (about 101-164), media for vegetable cultivation (about 38-71), electric energy (about 54-66), pesticides (about 39-64), fertilizers (about 30-32), while heat energy featured relatively low productivity index (about 3-4). Presented order - pattern of productivity factors results from their contribution to costs structure, as well as from specificity of greenhouse tomato cultivation in our country – highly energy consuming, which is connected with Polish climate conditions, as well as plant growing period. Significantly higher productivity, e.g. of plant nutrition with carbon dioxide and plant protection chemicals than that of fertilization points to the fact that layouts gone to those activities require special attention.

References

THE LEVEL OF APPLICATION OF EU FUNDS BY AGRICULTURAL FARM SIZE AND PRODUCTION TYPE

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Key words: farm, direct surplus, European Size Unit (ESU)

Upon entering the EU, we note a variety of changes in our farming. The criteria of accessing the agricultural funds verify the potential of Polish farms, while at the same time influencing their change. The agrarian structure is systematically changing with the number of farms decreasing and the leasing of lands increasing. The effects of specifically applying subsidies are also seen in the modernization of farms, among them agricultural machines and inventory buildings.

The study estimated the economic size of the farms studied, taking into account EU subsidies in the context of direct payments (funded from the European Guaranteed Fund). The study also analyzed the level of application of other funds to farm modernization. The study took into account the type of agricultural production based on EU farm classification standards. In classifying the study groups, the study also took into account the size of the subsidies granted. The study’s subject included 147 farms located in Southern Poland. One of the main criteria used to qualify a farm for the study was the level of application of EU funds available. Farms accepted for the study were ones that did not limit themselves to only the direct subsidies.

Among the farms under consideration, the smallest subset, almost 11%, consisted of farms focused on livestock production. The remaining two groups, those specializing in both livestock and produce production and those specializing only in produce production, were of comparable count in the study (table 1).

The economic size of the studied farms is described by the European Size Units (ESU), with the average of the group being 25 ESU’s. The described economic sizes were in accordance with the sizing naming conventions. Within the three production type groups, the economic size group that dominated was the medium-large group, which ranged from...
50.0% to 29.9% of the farms within the three study groups (with this economic group compromising 34% of the entire study group). The modernization of mechanical technology was found to be among the farmers the most popular form of utilizing the EU funds (with the dominance of purchasing tractors, machines and tools). Besides investments in technology, the respondents also decided to modernize inventory buildings in the context of “Meeting EU Agricultural Standards.”

Table 1. General characterization of the studied farms

<table>
<thead>
<tr>
<th>Description</th>
<th>Average</th>
<th>Agricultural Production Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Produce</td>
</tr>
<tr>
<td>No. of Farms</td>
<td></td>
<td>67</td>
</tr>
<tr>
<td>Agricultural Land Area</td>
<td>24.5</td>
<td>32.4</td>
</tr>
<tr>
<td>ESU Count</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>Farms within the size classification</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Very Small</td>
<td>5.4</td>
<td>13.4</td>
</tr>
<tr>
<td>Small</td>
<td>14.3</td>
<td>14.9</td>
</tr>
<tr>
<td>Medium Small</td>
<td>31.3</td>
<td>23.9</td>
</tr>
<tr>
<td>Medium Large</td>
<td>34.0</td>
<td>29.9</td>
</tr>
<tr>
<td>Large</td>
<td>12.3</td>
<td>13.4</td>
</tr>
<tr>
<td>Very Large</td>
<td>2.7</td>
<td>4.5</td>
</tr>
</tbody>
</table>

The results allow to conclude that the type of agricultural production may be the determining factor in the value of the subsidies (which also forms the basis for describing the economic size) and the degree to which the funds were used.
ANNUAL UTILIZATION AS THE CRITERION OF FORM USE CHOICE OF COMBINE HARVESTER

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Key words: mechanization, services, yearly utilization, combine harvester

Introduction

Appointments in mechanization equipment of individual farms in Poland are characterized by high level of diversity. It concerns the quantity as well as types, age, quality and technical condition of owned machines and equipment [Pawlak 2005]. Relatively small surface of average farm, simplified sowing structure, non-intensive farming, low level of inter-neighbor’s services, but oversized number often technically and technologically obsolete machines, affects low yearly utilization of owned equipment. Such situation generates high cost of mechanization that brings up level of total production costs and reduces the level of income [Karwowski 2005, Muzalewski 2002]. Therefore, the problem of form use choice seems to be the most important with regard to high value machines. The aim of this elaboration was taken numerical consideration connected to alternatives of using mechanization services versus purchase new or second hand equipment on the example of combine harvesters.

Methods

The research, having a simulation character, was based on norms and normatives of work management in plant production and combine harvesters most often exploited in individual agricultural farms and also prices of mechanization services, theoretical and practical knowledge of the author.

There was equivalents of average represented combines in individual groups following mark and models: A - Bizon Z056; B - Bizon Z058; C - 56 new TC Mech New Holland, D - John Deere 1450 CWS. The unit costs of exploitation in various yearly utilization were counted. Moreover points of limitary service price in work hours and harvest acreage were established (Fig. 1).

On the mechanization database comes from 96 Lower Silesian agricultural farms were created 4 typological groups of grain harvesters.
Results

The research confirmed that for the purchase of new combine harvester the minimum acreage of cereals and other similar plants must be assured: Group A – 133 ha; Group B – 140 ha; Group C – 168 ha; Group D – 202 ha.

Limitary acreages were compared to accurate plant surface in farms. Only in fours objects this numbers were over about 25% In the compartment from 4% to 59%. In three cases the farms owned combines from A group and in one case from C group. In 47 remaining objects the harvest acreage were lower than counted limitary acreage – average about 57%, in the compartment from 1% to 92%. This farm shouldn’t purchase in any case new harvesters. The best solution for this farms is using outside services. In the case of limitary services the farms should consider purchase of second hand combine harvesters to the highest price: 65000 PLN for groups A and B and 125000 PLN for D group.

Fig. 1. The influence of annual utilization of selected types combine harvesters per unit exploitation costs

References

COST ASSESSMENT OF SWEET MAIZE KERNEL REMOVAL FROM THE COB

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Keywords: sweet corn, cutting, threshing, freezing, cost

The costs of cutting and threshing methods in sweet maize kernel harvest for consumption purposes have been compared. The cobs for the tests have been harvested in milk-maturity stage while their moisture was about 74%. The cobs had been frozen in liquid nitrogen steam before the threshing in order to enable kernel separation from moisture maize cobs.

Calculations showed that, for established technical, technological and organisational conditions, threshing-method was more expensive than cutting-method. It is due to the high cost of liquid nitrogen. There are some additional advantages in this method that should be considered, although they are hard to be calculated precisely. These advantages are:
1. The increase, by about 30%, of kernel yield caused by the growth in sweet maize cobs yield which quality perform the standards of separating (threshing) machines and level of kernels recovery.
2. The possibility of sweet maize cobs earlier harvesting, which results in better quality.
3. The maize cobs are partially disintegrated in the cutting method.
4. There are no utilization costs since there is no need to use technological (processed) water.
5. The use of much more efficient machines, which working-parts do not wear as quickly as cutter working-parts (blades).
6. Reduction of seasonal labour picks due to the shift of frozen cobs threshing.

The above benefits prove that, in specified conditions, threshing-method is more cost-effective in comparison to cutting-method.
PEST/DISEASES SIGNALIZATION AS AN ELEMENT OF SUSTAINABLE AGRICULTURE

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Keywords: pest/disease signalization, monitoring, sustainable agriculture

Introduction

Nowadays, one of the most crucial elements of plant protection is efficient monitoring of pests and diseases occurring on agricultural plants. Providing accurate signalization and advisory service, one has to remember that in terms of first appearance of pests/diseases and their developmental stages the significant differences can sometimes reach 3 weeks between different regions of the country. Within voivodeship regions these differences reach 2 weeks, and about 1 week within the county. Moreover, a few days differences of pests or diseases appearance can be observed between plantations that are distributed in close localization. The main purpose of regional signalization is determining the optimal time of chemical control on specific plantation which gives opportunity to reduce the costs, number of chemical treatments and subsequently reducing the risk of environmental pollution.

Methods

Taking into consideration the demand of producers for accurate information regarding optimal chemical treatments terms and determination of the effectiveness of their performance, since 2005, the Plant Protection Institute has been providing the regional monitoring of pests and diseases from the beginning of March through the end of vegetation seasons (in cereals end of June, for potatoes and sugar beets end of September) and detailed field observations are done every week. Information regarding the agrophages (pest/diseases) occurrence and harmfulness are collected according to the methods. Methods were published by the Department of Methods of Forecasting and Pest Registration, Plant Protection Institute (1-5).

The main aims of field observations consist of the time of the treatment performance, determination if the treatment is economically profitable and an identification of which chemical product should be used. In case of agrophages that must be controlled in a specific developmental stage (e.g. Oulema spp.) the need of chemical treatment is determined by signaling.
The other pest and diseases monitoring till threshold (the moment of chemical treatment) is provided for as long as pest/disease can be danger to the crop. The results are published on the Institutes’ website (www.ior.poznan.pl) under “Sygnalizacja Agrofagów” (Pests/diseases signalization). As well as the information about first appearance and next developmental stages, the above website also provides information on the pests and diseases biology too. Such information helps the producers estimate their individual situations on the field.

**Results and discussion**

Since vegetation season 2005 field, observations have been concentrated on: – powdery mildew, rust, septoria diseases, cereal leaf beetles, saddle gall midges and aphids in cereals, late blight and Colorado potato beetle in potatoes, alternaria leaf spot, dry-rot of cabbage, sclerotinia disease, stem mining weevil, cabbage stem-weevil, rape blossom beetle on winter rape plants, cercospora leaf spot, aphids, cutworms and beet fly on sugar beets, European corn borer on maize. Observations are provided at 12 places (6voivodeships. Thanks to information service the producers estimate their individual situations on the field – especially producers whose plantations are located near by observations points. Moreover service can be used as the education service – there are many information about observation methods, agrophages thresholds, pest/disease biology. On the base of obtained results in the future information about pest/diseases biology together with meteorological conditions decision support systems can be work out.

**References**

EFFECTS OF THE USE OF EU FUNDS BY AGRICULTURAL HOLDINGS ON THE EXAMPLE OF SELECTED PROGRAMMES

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Keywords: farms, modernisation, material effects

Introduction

The increase in the competitiveness of Polish agriculture, which results from modernisation of agricultural production, is generally connected with the higher consumption of production resources, modernisation of machinery, and the adaptation of the production area to new agrotechnical requirements. Investment needs in relation to aims have been several times higher and diversified in groups of holdings that differed with respect to their economic size and location [SPO 2004]. Financial support for the modernisation of agricultural holdings is aimed to increase their efficiency by means of a better use of production aids [PROW 2007]. It includes the improvement of their efficiency and competitiveness, adjustment of the scope, scale and quality of production to the needs of the market, improvement of the conditions in which livestock is kept, environmental protection and safety at work.

Methods

The study uses statistical data from the Agency for Restructuring and Modernisation of Agriculture, based on investment applications filed in the Biłgoraj county. The study was performed within the Sectoral Operational Programme (SPO) – “Investments in Agricultural Holdings” (IGR) and Rural Development Programme (PROW 2007–2013) – “Modernisation of agricultural holdings” (MGR).

Results and discussion

The quantitative system within Investment in Agricultural Holdings (SPO) and Modernisation of Agricultural Holdings (campaign 2007) included “buildings and structures” (construction or alterations involving modernisation) at 11.8 and 9.5%, respectively. But the largest item was the “Purchase of machines, machinery or tools for agricultural production, including software”, 75.8 and 73.7%, respectively. Similar results for the analysed agricultural holdings within SAPARD and SPO programmes were achieved by Czubak [2008]. He observed that support was mostly used to supplement or exchange agricultural equipment. In comparison, in
the whole country a slightly better result, 82.0%, was achieved within Investments in Agricultural Holdings (SPO) and other undertakings were at a similar level. The opportunity to use EU funds enabled 1/3 holdings to purchase machinery in recent years. [Czarnocki et al. 2008]. The possibility to finance only machines younger than 5 years old can, in the future, lead to the rejuvenation of the machinery. The rate at which holdings are equipped in south-east Poland is generally good. [Lorencowicz 2003]. A major item in the studied county within Modernisation of Agricultural Holdings (campaign 2007) and also the „purchase or construction of elements of technical infrastructure that influence directly the conditions of agricultural activity” – 11.6%. The highest qualified costs (86.5%) in Investments in Agricultural Holdings (SPO) were noticed in relation to the purchase of machines and equipment. Qualified costs in relation to Complete costs in the Modernisation of Agricultural Holdings (campaign 2007) constituted 65.6%, and their decrease in relation to Investments in Agricultural Holdings (SPO) can mean that farmers buy more and more new machines.

Conclusions

Undertakings financed with public funds were mostly used to increase the scale of production, to improve the area structure of agricultural holdings and to improve or to implement new production technologies. Investments realized in Poland within Modernisation of Agricultural Holdings (campaign 2007) were aimed mainly at lowering production costs in agricultural holdings (machines and appliances for agricultural production and for the preparation of fodder – over 90% of public funds), improving the quality of goods (machines and equipment for initial production, storage or storing as well as preparing for the sale of agricultural products), as well as environmental protection.

References

Sektorowy Program Operacyjny „Restrukturyzacja i modernizacja sektora żywnościowego oraz rozwój obszarów wiejskich”. 2004. MRiRW.
EVALUATION OF THE DEVELOPMENT OF SEMI-SUBSISTENCE HOLDINGS IN YEARS 2005–2008

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Keywords: semi-subsistence holdings, financial support, material effects

Introduction
The study analysed the development of semi-subsistence holdings participating in the Rural Development Plan (PROW–2006). “Support for Semi-Subsistence Holdings” involved the payment of a bonus in the amount equivalent to €1250 a year over a period of five years [PROW 2004]. The assistance was aimed at holdings whose economic size was between 2 to 4 ESU. Farmers were obliged to attach to the application a development plan of the semi-subsistence holding, in which they promised to implement one of several undertakings (indirect goals).

Methods
The study involved applications for financial support within the “Support for Semi-Subsistence Holdings” (PROW-2004) filed with the Agency for Restructuring and Modernisation of Agriculture in the Biłgoraj County. It presents empirical data from completed undertakings and compares it to the rate of equipping holdings with technical machinery in the first and final year (after the implementation of the planned project).

Results and discussion
The Rural Development Plan for years 2004-2006 in Poland provided for 73 thousand beneficiaries, whereas the actual number was over two times higher (116 thousand). In the Biłgoraj County there are 1339 holdings that participate in the five-year programme (campaign 2005) and their number is higher than the mean for one county in the Lubelskie Voivodeship (904) and in the whole country (369). The possession of major equipment by holdings in the years 2005–2008 within Support for Semi-Subsistence Holdings reflects the rate of equipping holdings with technical machinery and the effects of their participation in the support programme. It has been found that the purchase of the most commonly used machines:
agricultural tractors and trailers was only 18.0% and 38.8%, respectively, which can indicate holding saturation. It is confirmed by Kusz [2009], who estimates that in years 1996–1999 machines and technical appliances played a major role in the structure of investment expenditure, whereas since 2000 it has been possible to notice more investment in buildings and structures. Within the implementation of agro-technical activities, one can notice a tendency to replace machines and tools of low efficiency with tools and machines that ensure a much higher efficiency [Kowalik, Grześ 2006]. The number of tractors in the final year increased from 0.7 to 0.9 pieces/holding (by 29%). Muzalewski [2004] in the years 1992–1999 noted a lower increase from 2.19 to 2.63 pieces/holding. (by 20%), which can reflect lack of financial support from EU funds in that period. In the studied county, however, there has been noted a multi-fold increase in soil millers (125.3%), tractor loaders (275.0%), cultivation units (139.6%), tobacco planters (116.7%), forage harvesters (500.0%) and beetroot (200.0%) and currant combine harvesters (600.0%). Relatively low results were noted with corn combine harvesters (51.4%) and potato harvesters (41.0%). A considerable majority of semi-subsistence holdings have an area from 6 to 7 ha (33.2%), from 4 to 6 (28.9%) and from 7 to 9 ha (17.8%). Within Support for Semi-Subsistence Holdings in the country, from the list of undertakings (indirect goals) that the applicants could choose from, the purchase of agricultural machinery was the most common choice, together with the purchase of livestock or the purchase or lease of arable land.

Conclusions

Financial support for small holdings contributed to increasing their investment possibilities, and so it facilitated their achievement of economic sustainability. Support for small holdings gives them a chance of modernisation, and thus to improve their profitability. It makes it possible for them to adapt to EU standards with respect to production hygiene, animal welfare and the protection of the environment.

References

COMPARISON OF THE COEFFICIENTS $R^2$, $D$ AND $W$ USED FOR VERIFICATION OF CORRECTNESS OF MATHEMATICAL MODELS ON BASIS OF EXPERIMENTAL DATA

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Keywords: verification of correctness of mathematical model, coefficient of determination $R^2$, coefficient of adaptation $d$, coefficient of relative level of residual $W$

Abstract

Scientists from agricultural engineering often use mathematical models to describe different processes and phenomena. Systematic of such processes can be found in the books of Pabis (1985) and Powierża (1997). Very important issue of the research is verifying created models with experimental data. It takes the form of comparing the results from empirical research with model predictions. Here arises a problem what methods should we apply to compare this data. In the literature the following coefficients of goodness of fit are used for verification of correctness of a mathematical models: coefficient of determination $R^2$ (Makuć, Urbanek 2004), coefficient of convergence $\varphi^2$ (Makuć, Urbanek 2004), relative factor of structure similarity $Z$ (Makuć, Urbanek 2004), rate of adaptation $d$ (Kornacki, Wesołowska-Janczarek 2008), Mallows factor $C_p$ (Mallows 1973), coefficient RMS (Białobrzeski 2006), coefficient of relative level of residual $W$ (Nowak 2002) and others.

In this paper the attention was focused on three coefficients: $R^2$, $d$ and $W$. The problem, if these coefficients give consistent conclusions on goodness of fit of a mathematical model to experimental data was examined. Research was conducted by the computer simulation method, using four types of functions: polynomial, logarithmic function, exponential function and power function. Two different distributions of independent variable $x$: normal and uniform were taken into account. Moreover three ranges of values of $x$ were considered. In normal distribution $N(\mu, \sigma^2)$ we assume $\sigma = 1, 5$ and $10$ and in uniform distribution $J(a,b)$ we consider ranges $(a,b)$ on length $6, 30$ and $60$. Each combination was repeated four times.
Based on all 96 examples we conclude when considered coefficients give consistent or inconsistent results about goodness of fit of the mathematical model to experimental data.

References


TECHNOLOGICAL AND ECOLOGICAL MODERNIZATION OF SELECTED FAMILY FARMS

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Key words: ecological modernization, family farm, technological transformations

Summary. Information has been presented about assumption and realization by IBMER and agricultural universities three-year development project concerning the implementation of technological progress and ecological transformations till 2015, carried out on 55 selected family farms in different regions of Poland.

The Ministry of Science and Higher Education took a positive attitude towards the suggestion of a team of specialists from IBMER and Agricultural Universities concerning the financial support of a three-year project “Technological and Ecological Modernization of Selected Family Farms”. The project, headed by Professor Zdzisław Wójcicki, started in April 2009 on the basis of the agreement between IBMER and the National Center of Research and Development dated 19 August, 2009 No. N R 12 0043 06/2009.

The project stipulates research and implementation of technological transformations and ecological changes till the year 2015 in 50 commercial family farms of arable land between 10 to 16 ha in different regions of the country. At present, the cooperation between researchers and the owners of selected farms takes place in the total of 55 objects.

Specialists from the University of Life Sciences in Lublin (Professor Józef Sawa and others) investigate 9 farms, from University of Podlasie in Siedlce (Krzysztof Kapela, Sc.D. and others) - 4 farms, from the University of Agriculture in Kraków (Sylwester Tabor, Sc.D. and others) - 8 farms, and from the University of Life Sciences in Poznań (Karol Wajszczuk, Sc.D.) - 7 farms. Experts from the departments in Poznań – Strzyszyn (7 farms), Gdańsk (2 farms), Tylicz near Krynica Górska (4 farms) and in Warsaw (14 farms), who work under the direct supervision of Aleksander Muzalewski, Sc.D., realize the project at IBMER.

Apart from organizing the project, preparing the methodology and selecting the farms for analysis, the program covers the following:

- working out a project (plan) of a farm set-up as well as mechanizing and investing in the farm (business plan) for each
farm at the end of 2015 in comparison to the initial state at the end of 2008
- for each farm, preparing a description of the equipment and evaluation of activity in 2009 and next in 2010
- preparing a collective specification of the results obtained in 2009 and 2010 and comparing them with the assumptions of the modernization project until 2015
- evaluation of the scientific-technological progress taking place in selected objects and preparing 10 future models of family farms rationally adjusted to a given area group and a given agricultural region in Poland.

By comparing the present state and the obtained results with the development assumed in the project (plan) prepared together with the owner and concerning modernization by 2015, we will be able to study the conditions of agricultural progress and to realign the introduction of new technologies of plant and animal production on the basis of new machine aggregates used individually, collectively or in the sphere of services by local contractors.

Research and implementation activity will make it possible not only to work out and evaluate the prognoses till and after 2015, but also to study retrospectively and evaluate the activity of the selected farm in the period before and after Poland’s accession in the European Union (2004) and even for the whole period after the political transformation (1989). This follows that the majority of the examined objects have cooperated with experts from IBMER and Universities of Agriculture since 1990, taking part in the realization of few research projects of KBN (State Committee for Scientific Research) conducted according to the methods of technical and economic field studies and collective studies that are similar to the present ones (although less developed).

Realization of developmental and implementation activity is assumed to produce significant production, energy, ecological and economic effects due to the use of new machine sets, modernized buildings and objects and new organization of the activity of a medium-sized agricultural farm which will be a commercial family farm.

Utilitarian advantages following from the developmental project for a broader group of investigated farms are seen in spreading the results of activity of 50 farms, recommending new techniques and technologies and publishing a catalogue of 10 models of future family farms (enterprises). Our developmental project coordinated by IBMER is realized according to the principle of copyright co-ownership of (field) resources collected
by particular research stations. Results of field and other studies are juxtaposed and stored in electronic form and will be (are) made accessible on request of each cooperating research institution and each member of a team conducting field studies in selected farms. Thus, a large database will be created to be also used in research activity of cognitive character.

It can be assumed that a side effect, which will be important to a researcher, of realizing the developmental project will be the possibility of preparing research dissertations, promotion papers, monographs, books and other publications that will have the character of creative work. Within a year, some research scientists from a team of more than 25 persons conducting field developmental activity in selected farms will be able to present at scientific symposia and conferences the initial results of their scientific and implementation output from the sphere of management of technology and processes in sustained agriculture.
SOIL CONTACT PRESSURE
RESULTING FROM LOADED AGRICULTURAL TYRES

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Keywords: agricultural tyre, carcass stiffness, contact pressure, inflation pressure, soil compaction

Abstract
Introducing loads onto the soil via machinery tyres increases soil density, producing compaction and damage to the soil-water-air-plant system. Over the last years, farm machinery has increased substantially in weight increasing the loads on soil and exacerbating compaction problems. Compacted soils, therefore, require effective management strategies to return them to an optimum physical condition improving quality and yield of crops, and also to reduce the risk of further compaction and the likelihood of erosion.

Tyre contact pressure is often used as an indicator of the potential for a machine to cause compaction. There is no agreed standard for determining the contact pressure of loaded agricultural tyres and there is little information available which allows comparison between tyres in terms of the soil pressure created. The aim of this paper is to report on the development of a method to estimate tyre contact pressure and the findings of this research.

This paper presents the results of an investigation into the contact pressures obtained when a tyre was loaded on a soil surface. For these tests a novel method employing a piezo-resistive pressure mapping system was used. It involved burying pressure sensors in the soil and loading them with a range of agricultural tyres. This method allowed an accurate measurement of the mean soil pressure and pressure distribution across the contact area.

The results obtained in this investigation indicate non-uniform pressure distribution across the contact patch. The results also gave an understanding of the influence of tyre inflation pressure and load on the resulting contact pressure. Further, tyre carcass stiffness was assessed which contributed to a better understanding of soil damage due to compaction.
<table>
<thead>
<tr>
<th>KEYWORDS INDEX</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>age</td>
<td>55</td>
</tr>
<tr>
<td>agricultural farm</td>
<td>9</td>
</tr>
<tr>
<td>agricultural machines</td>
<td>29</td>
</tr>
<tr>
<td>agricultural production</td>
<td>15</td>
</tr>
<tr>
<td>agricultural tyre</td>
<td>103</td>
</tr>
<tr>
<td>agriculture pollution</td>
<td>7</td>
</tr>
<tr>
<td>Annual Work Unit</td>
<td>21</td>
</tr>
<tr>
<td>baling press</td>
<td>6</td>
</tr>
<tr>
<td>biocidal products</td>
<td>7</td>
</tr>
<tr>
<td>biomass energy</td>
<td>4</td>
</tr>
<tr>
<td>black locust</td>
<td>4</td>
</tr>
<tr>
<td>briquettes</td>
<td>5</td>
</tr>
<tr>
<td>carcass stiffness</td>
<td>103</td>
</tr>
<tr>
<td>catchment management</td>
<td>8</td>
</tr>
<tr>
<td>coefficient of adaptation d</td>
<td>9</td>
</tr>
<tr>
<td>coefficient of determination $R^2$</td>
<td>9</td>
</tr>
<tr>
<td>coefficient of relative level of residual W</td>
<td>9</td>
</tr>
<tr>
<td>combine harvester</td>
<td>55</td>
</tr>
<tr>
<td>consumption</td>
<td>69</td>
</tr>
<tr>
<td>contact pressure</td>
<td>103</td>
</tr>
<tr>
<td>cost</td>
<td>8</td>
</tr>
<tr>
<td>current value</td>
<td>4</td>
</tr>
<tr>
<td>cutting</td>
<td>8</td>
</tr>
<tr>
<td>direct and indirect energy</td>
<td>69</td>
</tr>
<tr>
<td>direct surplus</td>
<td>8</td>
</tr>
<tr>
<td>dry matter yield</td>
<td>2</td>
</tr>
<tr>
<td>ecological education</td>
<td>7</td>
</tr>
<tr>
<td>ecological modernization</td>
<td>9</td>
</tr>
<tr>
<td>economic effectiveness</td>
<td>3</td>
</tr>
<tr>
<td>effects of EU accession</td>
<td>4</td>
</tr>
<tr>
<td>efficiency</td>
<td>65</td>
</tr>
<tr>
<td>employment</td>
<td>1</td>
</tr>
<tr>
<td>energy</td>
<td>6</td>
</tr>
<tr>
<td>energy efficiency</td>
<td>6</td>
</tr>
<tr>
<td>engine</td>
<td>5</td>
</tr>
<tr>
<td>equipment of application</td>
<td>7</td>
</tr>
<tr>
<td>Europen Size Unit (ESU)</td>
<td>21</td>
</tr>
<tr>
<td>family farm</td>
<td>9</td>
</tr>
<tr>
<td>farm</td>
<td>15</td>
</tr>
<tr>
<td>farms</td>
<td>93</td>
</tr>
<tr>
<td>financial support</td>
<td>6</td>
</tr>
<tr>
<td>financial support of UE</td>
<td>9</td>
</tr>
<tr>
<td>Framework Directive</td>
<td>33</td>
</tr>
<tr>
<td>freezing</td>
<td>89</td>
</tr>
<tr>
<td>fungicides railway track protection</td>
<td>59</td>
</tr>
<tr>
<td>greenhouse</td>
<td>83</td>
</tr>
<tr>
<td>image analysis</td>
<td>53</td>
</tr>
<tr>
<td>inflation pressure</td>
<td>103</td>
</tr>
<tr>
<td>information</td>
<td>3</td>
</tr>
<tr>
<td>information sources</td>
<td>1</td>
</tr>
<tr>
<td>inspection</td>
<td>33</td>
</tr>
<tr>
<td>inventory</td>
<td>7</td>
</tr>
<tr>
<td>investment</td>
<td>9</td>
</tr>
<tr>
<td>layout</td>
<td>8</td>
</tr>
<tr>
<td>liquid fertilizer</td>
<td>4</td>
</tr>
<tr>
<td>low cost machine fleet</td>
<td>45</td>
</tr>
<tr>
<td>machine fleet planning</td>
<td>45</td>
</tr>
<tr>
<td>machine investment and usage cost</td>
<td>45</td>
</tr>
<tr>
<td>machine utilisation</td>
<td>45</td>
</tr>
<tr>
<td>machine wear</td>
<td>43</td>
</tr>
<tr>
<td>machines operation</td>
<td>65</td>
</tr>
<tr>
<td>market</td>
<td>5</td>
</tr>
<tr>
<td>material effect</td>
<td>93</td>
</tr>
<tr>
<td>mechanisation of small and medium sized farms</td>
<td>45</td>
</tr>
<tr>
<td>mechanization</td>
<td>61</td>
</tr>
<tr>
<td>method of application</td>
<td>73</td>
</tr>
<tr>
<td>modelling</td>
<td>7</td>
</tr>
<tr>
<td>modernisation</td>
<td>9</td>
</tr>
<tr>
<td>monitoring</td>
<td>1</td>
</tr>
<tr>
<td>motherwort</td>
<td>3</td>
</tr>
<tr>
<td>natural zeolite</td>
<td>2</td>
</tr>
<tr>
<td>nozzles</td>
<td>5</td>
</tr>
<tr>
<td>NPK fertilizer</td>
<td>23</td>
</tr>
<tr>
<td>nutrient status</td>
<td>2</td>
</tr>
<tr>
<td>nutrient uptake</td>
<td>2</td>
</tr>
<tr>
<td>pest/disease signalization</td>
<td>91</td>
</tr>
<tr>
<td>pesticides</td>
<td>33</td>
</tr>
<tr>
<td>plant biomass</td>
<td>57</td>
</tr>
<tr>
<td>plant feeding</td>
<td>1</td>
</tr>
<tr>
<td>plant growth stimulators</td>
<td>37</td>
</tr>
<tr>
<td>plant protection products</td>
<td>49</td>
</tr>
<tr>
<td>power</td>
<td>51</td>
</tr>
<tr>
<td>problem soil</td>
<td>2</td>
</tr>
<tr>
<td>production trend</td>
<td>61</td>
</tr>
<tr>
<td>productivity</td>
<td>83</td>
</tr>
<tr>
<td>quality properties</td>
<td>57</td>
</tr>
</tbody>
</table>
registration 49
remote sensing 17
risk factors 77
risk of pesticide application 77
runner bean 59
second-hand machinery 55
selling price 43
semi-subsistence holdings 95
services 87
soil compaction 103
soil features 17
sprayer 33, 35
spraying fertilizer 53
standard and large drop nozzles 59
structural transformations 29
structure of equipment 29
sugar beet 13
sugar market 13
support instruments 29
sustainable agricultural production 61
sustainable agriculture 41, 91
sustainable use 33, 35
SWAT 79
sweet corn 89
technical means 29
technological transformations 99
threshing 89
tomato 83
tractor 51
tractors 55
verification of correctness of mathematical model 97
Walloon farm 69
yearly utilization 87
zeolitic material 23
AUTHORS INDEX

Beqiraj Enkeleida 23, 25
Berbeka Tomasz 9
Blackburn K. 103
Bruart Jean 51
Bzowska-Bakalarz Małgorzata 13
Cupia ł Michał 15
Dubois Gaë tan 53
Dufourny Sandrine 69
Fenyvesi László 17
Figurski Jarosław 21
Gil Katarzyna 13
Gjoka Fran 23, 25
Godwin R.J. 103
Grześ Zenon 29
Hann M.J. 103
Huyghebaert Bruno 33, 35, 53, 73, 77
Kachel-Jakubowska Magdalena 65
Késmárki-Gally Erdeiné Szilvia 17
Kiełtyka-Dadasiewicz Anna 37
Kopacki Marek 59
Kornacki Andrzej 97
Kraszkiewicz Artur 41
Kusz Dariusz 37
Leka Pashk 23, 25
Lorencowicz Edmund 21, 43, 89
Magó László 45
Matyjaszczyk Ewa 49
Miserque Olivier 51
Misiewicz Paulina A. 103
Mostade Olivier 53
Muzalewski Aleksander 55
Niedziółka Ignacy 57
Noel Stephanie 73
Nowak Janusz 65
Parafiniuk Stanisław 59
Pekel Sébastien 53
Plan chon Viviane 35
Prusak Agnieszka 61
Przywara Artur 65
Rabier Fabienne 69, 73
Richards T.E. 103
Sawa Józef 77
Śliwiński Damian 79
Śmietanka Maria 79
Stachowiak Marek 83
Stilmant Didier 69
Susaj Lush 23, 25
Szeląg –Sikora Anna 85
Szuk Tomasz 87
Szymanek Mariusz 89
Tabor Sylwester 61
Tarasińska Joanna 95
Tratwał Anna 91
Uziak Jacek 43
Vancutsem Françoise 53
Walczak Felicyta 91
Węglicki Zdzisław 93, 95
Wesołowska-Janczarek Miroslawa 97
Zając Stanisław 37
Zuchniarz Andrzej 57
It was for the fourth time that the Department of Machinery Exploitation and Management in Agricultural Engineering of the Faculty of Production Engineering, University of Life Sciences in Lublin and Walloon Agricultural Research Centre in Gembloux, Belgium organized International Scientific Symposium “Farm Machinery and Process Management in Sustainable Agriculture”

The following proceedings contain 35 reviewed abstracts presented at the symposium in November 2009 in Lublin, Poland. The symposium reviewed the latest achievements and progress in the management and production methods used in sustainable agriculture. The proceedings are a healthy balanced between papers of the theoretical nature and those concerned with different practical issues. The contributions prove a great progress made in all aspects of sustainable agriculture.