Kronika

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Modern Agriculture and Water Quality
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Inaugural address on the occasion of the opening of the academic year of the Faculty of Land Reclamation and Environmental Engineering, Warsaw Agricultural University, held on 2 October, 1995.

Good morning, ladies and gentlemen. I am pleased and honored to be able to speak with you today, as you begin your University studies. What I will try to do today, is to give you a few ideas of some of the opportunities and challenges that you will be able to work on, during your careers. I will discuss some interactions between modern agricultural practices and water quality. I will use examples from the USA, only to illustrate the types of scientific and engineering problems, that you will learn how to approach, during your studies. The particular problems that you face in Poland will be different, but these discussed today will illustrate the concepts.

Modern agricultural practices in the USA have brought us many improvements, in the lives of farmers and all citizens. But they have also presented us with new problems or challenges, that we as scientists and engineers have needed to address. Let me first discuss a few of the improvements that have occurred in agriculture during the last 40 years. Human labour is less arduous now than it was in the past. Our farmers still work very hard, physically and mentally, but their labor is not as arduous as in the past, and we would consider that to be a benefit. Our system gives us dependable, high crop yields. Certainly the yields vary from year to year based on weather conditions, but overall we can count on good crop yields. In general now we have less soil erosion than we did 40 years ago, so we are conserving the soil resource base for future generations. In general we also have less animal manure in streams

now than we did in the past. And finally, we tend to have more efficient production units than previously.

Along with the improvements, however, there have also been some new challenges or problems that have developed. Soil compaction has increased in many fields, due to large farm equipment and loss of soil organic matter. In many soils, the organic matter content and overall soil quality has declined. In some areas of the country, we find nutrients and pesticides in surface water or ground water. The increased specialization of our farmers has some advantages and disadvantages-increased specialization means that a farmer can become a real expert in one or two areas. But it may also mean that he loses the flexibility to change quickly into a different crop or system, for example, if the market conditions change.

So my main point is, there are always tradeoffs to consider. Each new practice brings advantages and disadvantages with it. As scientists and engineers, part of our job is to analyze the system in terms of costs/benefits, and to try to develop practices that improve the overall system while minimizing negative impacts.

As an example of some of these tradeoffs, I will consider water quality. There are four main categories of agricultural pollutants in water: sediment, bacteria, nutrients, and pesticides. Sediment originates from soil erosion, and it is still the major agricultural pollutant of surface water in many areas. Bacteria can also be a pollutant of surface waters, and may originate from animal manures, for example. Nutrients such as nitrate may pollute both ground and surface waters. Phosphorus, however, is generally a pollutant in surface water only, since it is bound by soil particles as it leaches through the soil profile. Pesticides may move into ground or surface waters, depending on the pesticide chemical properties. Now we will look at each of these four categories, and give examples of how water quality has improved and also where we have some new problems.

Sediment—We have several major factors that have caused surface water quality to improve with respect to sediment, and several factors that may cause water quality to decline. No-till and other conservation tillage practices have greatly reduced soil erosion, and therefore less sediment is entering streams. This has been one of the major improvements in surface water quality in many agricultural areas. No-till is a system that uses a metal cutting blade to open a narrow slot in the soil, in which the seeds are planted without plowing or disturbing the rest of the soil. Crop residues from the previous crop remain on the soil surface, and protect the soil surface from the erosive effects of intense rainstorms. In some parts of the country, contour strip-cropping, terraces, and other conservation structures and practices have reduced soil erosion. On the other hand, the larger field sizes we have now, and the loss of windbreaks or fencerows, may increase wind or water erosion in some areas. Having fewer hay crops in the rotation, and a general loss of soil organic matter after

years of intensive cultivation, may also increase water runoff and soil erosion.

Bacteria–In general, we have fewer livestock animals that are free to graze directly in or near streams and ponds. This means less manure input to the surface water, and therefore less bacteria from the animals. The water runoff from feedlots is generally controlled so that it does not enter streams directly, again giving us an improvement in surface water quality. However, the high animal density produces large volumes of manure for disposal in small areas. Then manure is often viewed more as a problem for disposal rather than as a nutrient benefit to be used wisely.

Nutrients–Lower soil erosion rates also mean lower losses of nutrients that are bound to sediments (phosphorus, for example). So surface water quality has generally improved with respect to phosphorus inputs from agriculture. The use of inorganic N fertilizers provides a more predictable supply of nitrogen to crops, than does the use of legumes and manures alone. Thus the nitrogen supply can be better matched with crop requirements, providing another opportunity to improve water quality. However, the more intensive use of fertilizers and animal manures can lead to excess nitrate leaching to ground water.

Pesticides–Pesticides help prevent crop losses from pests (insects, weeds, disease), and therefore more dependable crop production occurs from year to year. The more consistent yields result in more complete use of other agricultural inputs such as fertilizers. A major water quality benefit of herbicide use, is that it reduces the need for excessive tillage to control weeds. Soil erosion is decreased and surface water quality is improved with respect to sediment. One potential disadvantage is that mobile pesticides may move by runoff or leaching into surface or ground waters. Leaching losses are generally most important on sandy soils.

This briefly summarizes some of the changes that have occurred over the past 40 years, with water quality and agriculture in the USA. I now will focus more directly, on some of the challenges that you will face during your careers.

Many interesting and important challenges await you in your career. During your lifetime, agriculture and the rural environment in Poland will undergo rapid, dramatic change. Because of this rapid change, you will need to continually learn new things. Your university studies are a good beginning, but are not the end of your education. This lifelong learning may include formal courses and workshops, reading, and self-study.

I encourage you to learn from others, both personally and professionally. Education now is international, and we can all learn much from each other. I am currently in Poland for 8 months sabbatical leave, to learn some things here that I cannot learn in the USA. Take advantage of opportunities to improve your language skills or to study or travel in other countries. Be creative in your thinking. Dont just take an agricultural system di-

rectly from some other country. Learn from the successes and failures of other countries, and then help develop a new and better way for Poland. Agriculture, and culture, is always evolving, and we all need to learn from today and from history.

Let me just list a few of the changes and challenges that will be opportunities for you in the future. Poland will most probably have larger farms and fewer farmers than you do now. This can mean greater production efficiency and lower food prices in the shops. It also means that new agricultural processing industries, or other rural businesses will be needed, to provide greater employment opportunities. Water supply and wastewater treatment in rural areas is a large and important need in Poland, and many of you will find challenging work in this area. Resource recovery is an area where all countries need some new and creative efforts, so we can do a better job of recycling, composting, and reusing waste materials. I think you have a real opportunity in Poland in the area of ecology, to better integrate agriculture and the natural environment. With some creative thinking, you can avoid some of the problems that have developed in some of our intensive agricultural systems in the USA.

I will end with a few final words of encouragement and challenge to you. I encourage you to be bold, courageous, and creative in your thinking. Use your talent and opportunities, to serve your country and to help improve life during this period of rapid change. Use your time at the University to learn new skills, and to begin to develop a new vision for yourself and for your country. This will require your hard work and personal committment. Your studies and jobs will be enjoyable but will also require your committment, but it is worth the effort. You will be faced with tremendous changes and opportunities in your lifetime, and each of you can contribute something to your countrys transformation. Poland is a crossroads of a new Europe, and agriculture is a crucial piece of Poland's growth during this transition. These are really exciting and challenging times in Poland, and you can look forward with much hope and anticipation.

I wish you all the best as you begin your studies at this University!

Dziękuję.

Streszczenie

Współczesne rolnictwo wielkoobszarowe w USA przyczyniło się do istotnej poprawy życia całego społeczeństwa. W szczególności praca rolników stała się lżejsza, a poziom ich życia zaczął odpowiadać standardowi reszty społeczeństwa. Stan rolnictwa w USA zapewnia powszechny dostęp do taniej i zdrowej żywności. Jednocześnie należy podkreślić, że współczesne rolnictwo niesie ze sobą liczne zagrożenia, które w poważnym stopniu decydują o jakości środowiska. Do najważniejszych z nich należy zaliczyć:

- zanieczyszczenia wód powierzchniowych i gruntowych różnego ro-

dzajami związkami chemicznymi (nawozy, herbicydy, pestycydy),
- nadmierne wyczerpywanie zasobów i ich nieodnawianie,
- zmniejszenie naturalnej produktywności gleb przez erozję, zagęszczenie i utratę substancji organicznych,
- utratę genetycznej różnorodności uprawianych i naturalnie egzystujących roślin i zwierząt hodowlanych,
- traktowanie rolnictwa jako fabryki, a nie jako kierowanego ekosystemu.

Należy podkreślić, że w USA poczyniono znaczne postępy w przeciwdziałaniu erozji gleby oraz zanieczyszczeniu rzek i jezior. Wyzwaniem dla współczesnego pokolenia jest tworzenie rolnictwa jako zrównoważonego układu przyrodniczo-techniczno-ekonomicznego. Inżynierowie kształtujący środowisko wiejskie, szczególnie w Polsce, muszą się liczyć z koniecznością daleko idących przemian. Przemiany te muszą w szczególności odpowiadać światowej koncepcji zrównoważonego rozwoju. Koncepcja ta podkreśla ścisłą zależność pomiędzy wzrostem ekonomicznym i szeroko rozumianą ochroną środowiska. Zatem muszą zdawać sobie Państwo sprawę że niezbędna jest ciągła poprawa sytuacji w zakresie zaopatrzenia w wodę i oczyszczania ścieków, poszukiwanie lepszych sposobów odzyskiwania surowców i ponownego ich użycia, postęp w technologii uprawy gleby oraz nawożenia.

W szczególnej sytuacji jest Polska, stoi bowiem w przededniu przystąpienia do wielkiej organizacji gospodarczej jaką jest Unia Europejska. Z tego względu konieczne są również działania o charakterze restrukturalizacyjnym.

Kultura amerykańska, a w tym rolnictwo są w ciągłym rozwoju. Mam zatem nadzieję, że będziecie Państwo uczyć się na naszych błędach, korzystając z naszych doświadczeń i tworzyć nowe, lepsze drogi rozwoju dla swego kraju.

Wykorzystajcie czas spędzony na tej Uczelni, aby posiąść nowe umiejętności i rozpocząć tworzenie nowej wizji dla swojego kraju i siebie samych. Czeka Was okres wytężonej pracy i trudnych decyzji, które w efekcie prowadzą do rozwoju kraju i indywidualnej satysfakcji.