EVOLUTION OF CONCEPTIONS REGARDING PRODUCTION CAPACITY OF ARABLE FIELDS IN GERMANY & RUSSIA

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Abstract

This paper will present the evolution of conceptions regarding qualitative evaluation and production capacity of arable lands, focusing on the first two countries that initiated extensive studies concerning soil characterization. Although the research had an economic purpose: in the process of land fertility determination and classification the appraisal system is introduced for a better determination of taxes, an ecological approach developed which promoted land fertility appreciation according to its intrinsic traits. Some of these traits are: thickness of plough surface and underground, absorption capacity, humidity and thermic properties, cultural status, homogeneity of particles, richness in nutritive substances, being suitable for various cultures, amelioration status and production results.

Key words: appraisal system, arable land, economic, fertility, soil classes.

INTRODUCTION

The need for finding an operable system for arable land classification, is very old and it made the object of laborious research for a great deal of specialists, both in economy and finance and especially in the field of soil science and ecology. Being a stringent economical necessity on a certain level of society growth, qualitative evaluation of arable lands expressed itself as a specific preoccupation ever since the XVIII century in those states where agriculture was more developed, then in all European countries during the XIX century, especially in the first half of the XX century.

As time passed, two main research tendency emerged, which are represented in some countries even today: the "economistic" tendency which recommends that soil fertility to be determined in relationship with the productions obtained on the surface unit and depending on the average economical results and on the "naturalist' or "economic" tendency, which recommends the appreciation of land fertility in connection with the intrinsic characteristics of soil and natural factors favors which influence growth and fruit bearing of plants.

The dispute between these two movements lasted until the sixth decade of the XX century when in almost all the world the ecological parametric method was accredited, the only one capable in securing a virtual objectivity in classification operations of lands.

MATERIAL AND METHOD

In Germany, the qualitative evaluation of arable lands realized itself firstly without executing or the existence of a previous soil drilling and without the elements that characterize soil to be cartographically expressed. The main purpose of appraisal was establishing a value necessary for a most accurately tax distribution. To this purpose, means of research were subordinated while elements of study regarding natural conditions which led to calculation or appreciating appraisal numbers were much time neglected.

Research concerned with economic categorizing of arable lands belongs to H. Niklas, who mentions that land fertility was determined in XVII Prusia the way which the seed sowed was multiplying. The same author claimed that at the end of the XVIII century there was in Saxony a land taxation system according to the characteristics of soil.

In 1805 I.F. Meyer (quoted by Teaci, 1980) uses for the first time the term "soil appraisal" with the purpose of fertility classes classification. This operation was realizing at time depending on the textual making of soil and the plants that soil was able to support. Works of A. Thaer end the economic conception regarding appraisals in Germany. He introduces 2 investigation courses for arable land`s quality establishing concept: "appraisal" connected to soil quality, and "taxation" connected to economical results specifying that the two directions need to be joined in order to characterize the "physical and economic" land. For the first time Thaer reflects the quality of lands in a table jotting down soils with numbers between 1 and 100 points and arranging them in 10 fertility classes as showed: class I and class II – wheat soils; class III and class IV –barley soils; class VII and class IX –rye soils.

Except the economical aspect Thaer concludes that soil must be characterized also from a practical point of view stating the following elements: name of soil, usage and crop, deepness of soil and its underground, its place in relationship with main means of communication. Thaer`s followers kept his broad views regarding appraisals developing in particular the aspect of physical characteristics study.

RESULTS AND DISSCUSIONS

In 1820 Birnbaum (quoted by Teaci, 1980) elaborates an appraisal system and soil classification in 10 distinct fertility classes based on a number of 11 characteristics of soil, each characteristic receiving 10 points at its optimal status and 1 point at its minimal status. These characteristics were: thickness of plough surface and underground, absorption capacity, humidity and thermic properties, cultural status, homogeneity status of particles, richness in nutritive substances, being suitable for various

cultures, amelioration status. He challenges the net income classification method, showing that at the realization of it not just land contributes but also the manner in which management is done.

W. Klopp (1871) is the first researcher in the field of soil which made an appraisal system based on the chemical characteristics of soil. Pleading in favor of this system he proves that these characteristics have great stability and can build objective criteria for appraisals. It is important to mention that V.V. Dokuceaev in his works regarding the land appraisals in gubernia Nijni-Novgorod refers to the method proposed by Klopp and simulates the characteristics of an ideal soil, according to his principles, a soil that will serve as a comparison term as it follows: clayey minerals 10-20% sandy quartz 10-15%, calcium carbonates 3-5%, magnesium carbonates 0,5-1,5%, changeable bases 8-20%, total change capacity 50-100 me for 100 grams of soil and humus percentage 3,5%. This is the model Dokuceaev proposes as class I cultural soil.

In 1876 W. Detmer returns to the arable lands classification according to net income, improving the old method of quality appreciation connected to multiplication of seeded sowed capacity, considering that this way the capacity of lands to secure greater or smaller crops will be better emphasized. In the case of wheat crops, the author was pointing out through the 200kg/ha seed necessary, the possibility of differentiating according to the obtained production after the following relations: class I 3000 kg: 200 kg = 15 points, class IV 1800 kg : 200 kg = 9 points, class VIII 400 kg : 200 kg = 2 points. G. Krafft (1876) quoted by D. Teaci (1965) takes over and improves Birnbaum`s method foreseeing isolation and checking the influence of natural environment factors, and establishing their value. In a 100 points system he proposes a notification system as it follows: texture - 25 points, soil deepness -10 points, nature of underground -15 points, humus content -5 points, landscape (slope) -5 points, resistance to work -10 points, state of culturalisation –fertilization -10 points.

After the year 1900 conceptions about qualitative classification of lands are multiplying and most of the researchers go for the pedogenetic approach. F. Aereboe (1928) claims that land classification has to start from knowing the characteristics of soil and underground as well as climate conditions. He is one of the few who showed that appraisal must be done for every stand alone usage.

In 1934 in Germany a law was adopted saying that all classification (appraisal) systems of lands must be renewed and standardized after one single system. Principles of the german appraisal system which is in effect and after which cadastral classification appraisal works for all arable surfaces were made in both german countries: DRG -1956 and FRG -1964, as well as in Austria are based on the following principles: appraisal is made

according to natural environment factor`s characteristics; lands classify distinctively for arable and lawns.

Groups of factors taken into consideration were the following: surface geology and lithology (deluvial parental, wind, fluviatile rocks, and hard alterated rocks), texture and evolution status of soil. Giving a great deal of importance to the lithological factor, in the german classification system it can be explained that in this geographical area where the climacteric differences are relatively slim, soil traits were especially determined by characteristics of the parental fabric which endured despite all the bioclimateric influence exerted upon them.

A special place in this system, was taken by the soil evolution status "zustandsstufe" according to which, a soil has a youth period, a maturity period and an older period. Conceived by W. Rothkegel (1950) as an evolution process which secures in the first phase a soil fertility growth through bioaccumulation processes, whereas in the second evolution phase a domination through degradation processes; the system was used in making the german appraisal system, without stating some parametric criteria.

The appraisal method was improved all the time, and completed through confrontations with land owners and connected to the results obtained in the reference lots network and model farms. Critically analyzing H. Arens`s (1960) method, he considers that the previous did not had strong criteria, therefore, for arable lands the author established 8 textual classes and one for peat, 5 geological sources of parental rocks and 7 evolution stages. With this in mind, the separation of over 200 soil classes was possible, which eventually was reduced to 8 and assessed in value with points between 0 and 100.

For grazing and ordinary meadow vegetation fields categorizing in quality classes was much simpler made using four textual classes and 3 evolution stages, eliminating the parental rocks in favor for climacteric and hydrogeological characteristics. For an accurate determination of an evolution stage there were taken into consideration a series of criteria that referred to intrinsic traits of soil such as: humus content, reaction, deepness, etc. without precise boundaries to be given.

As a result of the german appraisal works maps and classification records were created for all arable lands on a 1:3600 -1:5000 scale and then systematization works for administrative units. In former DRG appraisal works executed after this method since 1956 were utilized in many areas like planning, organizing and financing the agricultural production. In parallel, works of synthesis were elaborated: W. Kasch (1953) elaborated, based on large scale appraisal works, a map of the DRG appraisal soils on a 1:500.000 scale.

Since in the german conception no references to appraisals on crops are made, Kasch provides some advice concerning culture plants for which soils from a certain class can be used: -class I –over 80 points, with very good soils for culture plants; -class II -65-80 points, the same as above; -class III -50-65 points, with good soils for wheat and beet; -class IV -35-50 points, with middle favorable soils, for wheat and rye; -class V -25-35 points, with mediocre soils for rye, potatoes, and oat; -class VI -18-25 points, with weak favorable soils, for rye and potatoes; -class VII under 18 points with very weak favorable soils, for rye;

-class VIII with unproductive soils, usually for mire.

Without any doubt, for concluding the appraisal operations on a national level, tremendous efforts have been made. R. Matz (1956) pointed out that for these operations 440 appraisal specialists over 10 years time were used, which researched 104.000.000 soil profiles and surveys. For land quality determination, 100.000 model parcels were chosen for thoroughly study and comparison, and over 40.000 meetings and conferences with land owners have been organized. Costs of such an endeavor reached over 50 million DM at the date.

The cambric chernozem was considered a standard for Germany, a soil situated on plain fields in unvaryingly climacteric conditions, characterized by an average 8°C temperature and a multi annual average rainfall of 600 mm.

Defining the "standard" type (homogenous ecological micro district) was made through indicators such as: solification rocks, soil evolution stages, and appraisal numbers. Later on, (E. Vojahn -1961, H. Bannorth -1963, W. Kasch -1963) mention that appraising a certain land surface through one number is insufficient and it is necessary for every homogenous ecological territory to be characterized as detailed as possible in order for the technician to find as much information in relationship which to orient its practical options.

The development of Russian genetic pedology is in close relationship with the beginning of the appraisal works executed by V.V. Dokuceaev and his collaborators during 1880-1885, in gubernia Niji-Novgorod. Concerning soil appraisal, V.V. Dokuceaev states his point: "before everything it is necessary to make a research of natural abilities of soil, based on its geological, physical and chemical characteristics; this half of work needs to be done by a pedologist" after which Dokuceaev mentions "it is necessary to move to a minute agro economical research, these researches need to be done in a tight correlation with the natural conditions; this part of appraisal works will be executed by statistical experts".

This means that Dokuceaev distinguishes two main aspects in appraisal works, aspects that even today are recognized as components of

study operations for economic appraisal of lands. For soil appraisal V.V. Dokuceaev and N.M. Sibirtev made a series of concrete proposals of land appreciation connected with intrinsic characteristics of soils, proposals that resemble a lot with those of Klopp`s, conceiving a series of schemes, with standard soils, on appraisal value levels. In his qualitative land classification works, Dokuceaev used 8 classes and usually operates with 3 basic cultures.

Table 1

Cereal production in relationship with fertility classes in gurbenia Nijni-Novgorod 1882

	Fertility class and crop in puds per desetine							
Plant	I	II	III	IV	V	VI	VII	VIII
Rye	74	70	64	56	47	43	37	34
Wheat	49	44	43	38	38	31	29	28
Oat	-	-	-	-	59-48	45	40	32

Recalculating these productions, figures of 1200-4500kg/ha cereals, are obtained which shows the production difference from simple to "three times", exactly how it happens today of course on another much higher production level. If under theoretical development of pedology as a science Dokuceaev`s conception represented a qualitative jump of capital importance, in the field of appraisal methods, he proposed simple methods, a lot of times similar to the ones in the german school of that era especially resembling Klopp`s. The most important aspect in Dokuceaev`s concepts about appraisals is the recommendation that when elaborating qualitative evaluation methods to have a tight collaboration between concrete manifestation of every environmental factors` traits and the productions that are obtained on various fields. A tight co-operation between naturalists and economists in order to obtain verifiable data in practice, is also recommended.

After Dokuceaev`s death ideas regarding arable fields appraisal in Russia disappeared gradually, but the one that contributed to the definitive abandon of appraisal works in the former Soviet Union was W.R. Williams who claimed that "in the actual stage, soil appraisal lost any meaning for production". This pseudo-scientific conception was formed in the same period (1930-1940) when soviet agrarian economists brought the idea of land differentiate rent disparition, and when nobody was dealing with land quality studies from a economic point of view in Russia any more (F. T. Gavriliuc, 1963).

A revive of arable land appraisal in the Soviet Union owes a great deal to Ceremuschin (1958-1963) who, studying the process of appraisal works realization in former DRG proposed a much simpler economic method for qualitative evaluation of arable lands based on economic results that

production units obtain. Due to Ceremuschin`s proposal the old disputes between the two conceptions economical and ecological were resumed.

In opposition, the followers of ecopedological conception (N.A. Blagodivov -1952, 1954; F.T. Gavriliuc -1963; A.G. Medvedev) foresaw the execution of soil appraisal works based on their intrinsic properties and landshaft characteristics taken as a whole. In every union republic or even for some greater regions an entire range of methodologies were elaborated. Working principles are different from case to case, but the pedologic current still dominates which try to objectivize the work procedures.

Therefore, Blagodivov elaborated in 1954 a vast scheme for soils in northwestern Russia scheme based on a highly developed legend which includes land appraisals for a number of 11 cultures. Moreover, the author tried a concrete expression of the appraisal point in kg product/point available then in the socio-political conditions at the date.

Table 2

Value of appraisal point expressed in kg/point for various crops

Crop	Medium agrotechnic	Superior agrotechnic
	Kg/point	Kg/point
Cereals	20	32
Clover, hay	40	55
Potatoes	220	320
Sugar beet	300	450

Based on the production data from experimental parcels F.T. Gavriliuc (1963) correlated crops with some indicators that characterizes soil (humus, deepness, etc) observing that crops (rye) from the testimonial variants differ from the most fertile soils (precaucazian cernosioms) to the most weaker soils (stagnic luvisoils in the nearby of Moscow) from simple to three times (700-2500kg), data considered fundamental for soil`s natural fertilizing characterization.

A.G. Medvedev (1964, quoted by Teaci 1980) propose for Belarus an appraisal scheme based on the legend of grouped soils according to texture, a scheme close to the german one, in which lithological constitution is replaced with the genetical type of soil.

CONCLUSIONS

The schemes proposed by Russian pedologists which deal with appraisal problems are conceived as closed schemes. However, the authors foresee a future step in which operation with open schemes, taking as a provisory standard, medium productions or other medium elements that are

considered with 100 points value. Unfortunately, between the economists and pedology researchers there is still an insufficient collaboration, because of the concept that claimed up to now that making appraisals based on data regarding natural conditions is a “mechanized” procedure which has no economic ground.

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