ABSTRACT

The book is structured in two directions which aime:

PART I: National and international knowledge level of the achievements in the field (Chapters I, II, III, IV).

PART II: Own contribution (Chapters V, VI, VII and VIII).

I thought the soil must be further studyed as it is the main work in agriculture, its physical characteristics, soil texture, soil types encountered in everyday practice, soil structure, soil density, their influences on soil's main works , plowing.

Also there have been presented the mechanical characteristics of soil composition and plasticity, adhesion and extern friction, penetration and hardness, soil resistance at the agricultural work and the influence of his work on the soil physical and chemical traits, continuously checking the influence of these traits on to plowing quality, reduce energy consumption in this paper.

These elements have been structured in **Chapter I "The soil, the main object of labor in agriculture."**

In **Chapter II "Plowing, the main soil job"** was revealed the goal of the plowing, tillage requirements, the relationship between swath width and its depth, classificating plowing by taking into account the speed of the unit (tractor + plug) and adaptating the plowing based on the optimal time. It also shows its quality of work and energy indices which are determined at the field work.

In **Chapter III "The plow – the main equipment for plowing"** presents the current state of construction of plows, their classification, components and forces acting on the plow's mouldboard during field work, the distribution of working bodies and deepen the study on the moldboard which is the main responsible for achieving quality tillage, also the main responsible in terms of energy consumption in this plowing thesis (according to some authors 30-50% of fuel consumption due to moldboard plowing, and other authors such as consumption can reach up to 60, even 70%).

Given this has been established as the main line of research - mouldboard research, innovative technical solutions will be proposed amending its constructive function in order to increase quality and reduce energy consumption at plowing, as well as its subsequent work. Also, research will focus on other active organs of the plow that directly or indirectly contribute to the goal we have set and which has been presented (furrower, plow blade, jointer, extension wing moldboard etc).

In next in **"History on the creation and evolution of the plow"** presents the history of the emergence and development of the plow worldwide and the history of the emergence and development of the plow in our country.

Here it is stated that the plow dates from the earliest times of human existence, the oldest agricultural tool. He appeared on the historical stage of transition of human society from nomadic life to the sedentary agriculture appears.

In primitive society (Stone Age) have been used as tools to scrach the ground, stems of trees or sharp sticks. Initially these tools were powered by people.

Prototypes of plows, improperly so called, were discovered in the Stone Age (about 6000 BC). The oldest documents that show the evidence of plows pulled by animals, dating from the third millennium BC and come from Mesopotamia and Egypt.

The process of improvement of the primitive plow has been very slow. The iron mouldboard was invented in the first millennium BC

A considerable advance in plow construction is considered the application, in the eighth century AD, the boards lying tilted to a forward direction, and this is the first prototype of the moldboard. This plug was invented in Bavaria.

In **Chapter IV "Used in the creation of new plows with mouldboard"** (part of my contribution) to propose another way of research and technical creation, taking into account the principle that no matter the method for research used, but more important are the result of research objectives and achieve those objectives.

It proposes the use of divergent thinking to generate a wealth of innovative technical solutions, despite a convergent thinking to generate unique technical solution or few technical solutions, perhaps a blend of divergent and convergent thinking which may give an innovative solution to outstanding problems of current technique. It will be addressed critical, with a specialist eye, on the global solutions with scientific and technical creative eye, as alleged by *Prof. M.W. Thring in England*: "Why is it this way, no another way could be more effective? ".

It is also is better to make some effort to avoid psychological barriers, using new methods of synthesis of information, ideas chart, morphological matrix. Hence the research on two main directions.

Analysis of the latest technical solutions available worldwide through analysis of published works, professional magazines, scientific communications, essays, reviews, catalogs business, because, according to some authors, they comprise about 50% of the latest information on the global scale.

Through this research, according to Prof. ing.Vitalie Belous, thematic materials research over the past 10-15 years is more than sufficient, without neglecting the investigation of earlier work, current solutions can bring a new effective approach, according to the directions of global perspective.

Research by patent. For creative researcher in the technical and beyond, according to Prof. ing.Vitalie Belous, research through patents is the principal form of research, because often innovative constructive solutions occur 2-5 years earlier than in articles specialist, booklets, monographs, but a combination of this research as presented above can only bring positive results on the technical solutions proposed as a result of research.

It has been completed a research report from the Library of the State Office for Inventions and Trademarks Bucharest, where it was found that if the engines, for example, exist in the past five years more than 300 patents, in the field who has the main theme the mouldboard of the plow there are, after the year 1927, 10 patents for inventions, which shows that this piece, high energy, has been poorly studied. Since the volume is not very large, research will take into account all these patents.

As has been suggested that the results of research proposals for innovative technical solutions that will materialize in stores patents have been highlighted and use creative methods and techniques of individual technique (intuitive methods, heuristics and logical-combination methods), and group methods and techniques (brainstorming, Synectics, Philips 66, Panel discussion, 6-3-5 method, Frisco method, Delphi method, chains of association, general heuristic method).

Since developing the thesis must be a result of individual research, group methods and techniques have only been mentioned, but will go further and use the innovative technical solutions generate only individual research methods (creation) and intuitive techniques (psychological): consonance association, analogy, evocation, extrapolation, empathy, inversion techniques and technical creative-intuitive logic (input-output technique, equipment lists Osborn, interrogative technique, heuristic approaches) deducative logical techniques (mixing, morphological research by matrix - *F. Zwiki* matrix, flat space matrix, generalized object method - a method developed by *Prof.V.Belous* in Iasi).

In **Second parte "My own contribution"**, in **Chapter V "The goal nd the objectives attended in the doctorate thesis"** highlighted the goal of this dissertation startind from the fact

the plowing is the main work of the soil, work that is hard and expresive, using almost 70 % from the total energy used in soil worte, **the goal of plowing is the rotate of the soil, the chopping of the furrow, the loosening and mixing of the soil, the destroying of the weeds and the covering with vegetal remains**.

The main objective attended was the conception, the projection, the execution and the experimenting of some plows which which technical solutions desiged bz the writer whicle could help growing the quality of the plowing work and fuel economy and even to the works after this one.

Another important objective is the practical inspection of some technical solutions made and optimized by computer.

There will be inspected some quality indices and energerical indices and considering them there will be established the optimal type of plow, there will be made some conclusions.

In **Chapter VI "The optimization the constructiv solutions for making the plows to increase the quality of the plowing and the reduction of fuel consume".**

There will be establish new technical solutions bydouble assembly of the technical elements, new to the world from the speciality inventions paterns and the catalogs of most important section firms.

Using the analogy of consonance and extrapolation was done the assembly of triangular knives at the bottom of the moldboard to the top of its, technical solution covered by a patent deposit, notified at OSIM Bucharest. A/00008/8.01.2007, which was made practically at the Department of Agricultural Mechanization of Veterinary Medicine, Iasi, the deposit is presented in this paper.

Was observed in the field tests carried out at Research Station for Agricultural Development in Podu-Iloaiei increasing fineness of the soil, but also a wear to the triangular knife.

Using change - improvement - developing and making use of bionics methods (extrapolation techniques from the animal or plant kingdom to the technical "kingdom"), taking into account self sharpening of the rodent teeth, the knives were modified to self sharpening knives , which is the subject of a patent, which is presented also in full in this paper (A0001-1.5.2009).

Given the patent DE 3318159 A1 - Patent Germany 1983, the inventor Hans Wacker who claimed that an absolute novelty in the world, making a plow blades made of strips (strips), which has the advantage of obtaining high soil grinding work pieces show the disadvantage of instability on the job, using the analogy, extrapolation, bionics, modification, improvement, development, proposed installation of blades welded to the moldboard with selfsharpening active

surface from the bottom toward the encompassing its superior benefits and the moldboard strip also gives additional advantages:

- increase the soil crumbling;
- increase stability while working bands;
- the possible use of the moldboard plow on medium and heavy soils.

This paper, presented in the thesis, the subject of patent filing OSIM notified and registered under no. A00062/6.04.2009.

Further, taking account of this work, but also the technical solution proposed by Benno Graβner patent no. DE 3323791A1 Germany in 1985, which proposes to amend the mouldboard's chest (previous contour moldboard is convex in front) in order to decrease the drag of the moldboard on the job, to reduce the tensile strength slippage of the tractor and plow, but with consider the strip blades, should be the next technical solution: making a band with its convex moldboard breasted front wing moldboard is made of pieces, plus the following items which they claimed in the patent filing submitted OSIM and notified no. A/00247 / 20.03.2009:

- moldboard surface is mounted by welding selfsharpening odds with the bottom to the top;
- moldboard chest is amended by practicing a bit with autoascuțire;
- furrower edged out by autoascuțire.

This technical solution was proposed and is under patent, using the research techniques (creative) analogy, extrapolation, bionics, modification, improvement and development.

There were three technical solutions proposed, as follows:

- adding in front of the mouldboard 4 long knives;
- replacement wing moldboard extension cord with three radial blades plowing to improve quality (degree

of fineness of the soil) and reduce energy consumption and paper work to show it;

- replacement wing moldboard extension cord with three parallel knives, plowing to improve quality (degree of fineness of the soil) and reducing energy consumption and paper work to show it.

These technical solutions that can be subject to deposits to obtain patents or subject to scientific work, we have used in practical experiments.

Also in this section has been enhanced and applied research logical advantages, in particular those deriving from research morphological matrix of F. Zwiki. This method has the advantage that it generates a lot of innovative solutions by logical biasamblarea attributes (elements) provided technical innovations in the world state of the art, but has the disadvantage that it requires a huge volume of work from the researcher.

From the two applications presented in this chapter results:

• 10 x 50 biassembly possible, so 500 technical solutions;

• 25 x 25 = 625 possible new technical solutions. For the researcher is a large job to write the 1125 solution

and then analyze each one of them.

For maximum advantage and to remove the disadvantages during the research the idea came (great Romanian scholar Stephen Odobleja would have said "light") to extrapolate these disadvantages in the computer design that make this computer work, researchers still having its own interpretation and evaluation of results.

To materialize this idea actually worked in several stages (steps).

Step 1: types were presented (variations) possible mouldboards, according to current standards.

Step 2: moldboard type assigned to each one of the combined index: eg:

Cu- universal moldboard

Cc- cylindrical moldboard,

Ce- helical moldboard,

....

Cds- special purpose moldboard (total 10 types).

Step 3: to prepare a table containing the attributes (elements) of the technical innovations of the state of the art world literature, scientific papers, catalogs, companies, inventions, including technical solutions observed in the Agricultural Mechanization Department of Veterinary Medicine, Science, as well as their technical solutions. Attribute technical = technical innovations, the claim rendered synthetically. Was assigned to each technical attribute one factor K: K1, K2, K3, ... , K50.

Step 4: To run a flow chart to make biasamblările CiKn form where

i = 1, 2, ... , 10

n = 1, 2, ... 50 or form KMK where

m = 1, 2, 3, ... 25

l = 26, 27, ... , 50

It was introduced in the scheme to include all logical instruction biassembly F. Zwiki morphological matrix.

Step 5: To list all the texts biassembly CiKn form ordered CuK30 = cultural form mouldboard (Universal) - Cu - made of strips (strips) - K30 -

Step 6: preparation of a computer program in Pascal language to execute these works .

After running the program, presented in full in this chapter has listed two computer

applications, one with 500 technical solutions and other having 625 technical solutions, which is very important because now the program can generate technical solutions in any field where data is inserted necessary.

In this chapter we proceeded to **optimize technical solutions automatically generated by computer** through a computer program in three steps, after determining the criteria for optimization, based on the 1125 technical solutions, **as the first step** has been acquired 110 technical solutions, **as The second** step 26 technical solutions, and after **the third step** four technical solutions, which are subject to optimization.

In **Chapter VII "Material and method"** is showed the fact that the experiments were conducted in two steps as follows:

a) Step I. Here werw field experiments of the plow models created by writer (V_2, V_3, V_4 compared with V_1 – witness).

b) Step II. Here werw experiments of the plow models resulted by double assembly of the new technical solutions worldwide and the optimization of them (V6m, V7m compared V5n – witness).

After that, in the some chapter are presented quality indices and energetical determinants in the experiment (the chopping grade, the soil loosening grade, the fuel usage per hour, the slipping of the wheelds drive).

Also, there is a presentation of **the conditions where were made the slep I and slep II experiments** the writer and the plow types created by the computer.

In **Chapter VIII "Experimental Tests conducted"** to determine its quality plowing and energy indices, which will be considered when research in the production of technical solutions proposed in this thesis. It then presents experimental investigations carried out. Experiments were conducted in Podu-Iloaiei ARDS in Iasi.

The research conducted at the first experience we used four experimental variants:

• March plots were rectangular look of the resort sola No.9, P1, P2, P3, with dimensions of 20 x 70 m area and each 1000 square meters, with the unit consisting of tractor and plow 650m U-PP-3-30M, unmodified (version V1 - March) whilst maintaining constant working speed v = 4.61 km / h, working depth of 25 cm and width work of 90 cm. They determined its quality (degree of fineness of the soil, raising its level) and energy indices (fuel consumption zone, tensile strength, spin);

• were kept constant working speed, working width, depth work, and experimental plots were plowed P4, P5, P6 with the same size with plow PP-3-30M which were mounted moldboard modified sudându knives on them is triangular (version V2). Indices were determined by qualitative and energetic indices;

• March plots were plowed under the same conditions as PP-3-30M plow in front of each body which were mounted four long knives (variant V3). Quality indices were determined and energetic experimental plots P7, P8, P9;

• Working under the same conditions to be replaced every three furrows strip wing moldboard with radial blades (v4 version). Quality indices were determined and energy plots P10, P11, P12.

• In **variant V2** to V1 version - witness obtained a 0.88% increase in the hourly consumption of diesel and 0.83% of slip tractor, while the degree of fineness of the soil increased by 6.5 %, and the degree of soil aeration decreased by 6.4%, showing improving the quality of plowing them.

• The **V3 version** is found, compared to variant V1 - witness an increase in slip tractor with 1.29%, the tensile strength of the plow with 0.94% and fuel consumption by 2.25% zone, thereby increasing insignificant, but to obtain a decrease in the degree of soil loosening by 10.4% and an increase in the grinding of the soil with 20.04%, which means a significant improvement in the quality of plowing.

• The **V4 variant** was found, compared to variant V1 - control, increasing the tractor wheels slip to 0.60%, the tensile strength of the plow by 0.33% and the hourly fuel consumption 1.18% in 9.34% with the increasing degree of grinding of soil and 8.68% decrease by raising awareness of it.

In the last part of this chapter presents two practical verification of technical solutions: moldboard of 4 lanes - and moldboard **V6m version** of 4 lanes with four selfsharpening knives which were mounted fromthe bottom to the top - **V7m version**. These two solutions have resulted as follows: using the computer, starting from 50 technical solutions have been generated automatically 1125 technical solutions, through a program in Pascal language, one of them tuning your PC, were obtained in three stages, 4 technical solutions. Of the four technical solutions results in 1125, we chose two that were made and then tested.

The **variant V6m** observed compared to the variant V5n - witness a decline in hourly fuel consumption 9.04% 6.31% tractor with a slip, and tensile strength of the plow to 7.07%, also degree of fineness of the soil increased by 10.16%, so this option determines improve the quality of plowing.

The variant is **found V7m** compared to variant V5n - witness a reduction in fuel consumption of 6.85% zone, tensile strength decreased with the plow and reduce slip 3.48% to 4.08% tractor. Regarding the degree of fineness of the soil, it is an increase of 16.9% compared to variant V5n - control.

Chapter IX "Conclusion" contains the main issues determining the best experimental

variants. In the first experiments (experimental variants V1 - control, V2, V3, V4) the best results on the quality of work performed were obtained in variant V3 (in front of each body were long knives mounted 4 furrow that cuts vertically, resulting in more slices of the swath).

The second experience (versions V5n experimental - control, V6m, V7m) best results in terms of quality work has won V7m version (the mouldboards made of four bands that each have four selfsharpening blades mounted). Considering the results obtained in the two experiments established that the best choice for V3 and quality of work performed are V7m, topping first variant V3.