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STUDIES AND RESEARCHES REGARDING THE DETERMINATION GEOMETRICAL PARAMETERS AND CONSTRUCTIVE - FUNCTIONAL PARAMETERS OF THE WORKING SURFACE OF THE LAMELLAR MOULDBOARD USE AT MODERN PLOUGHS

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ABSTRACT:

At present the great majority of the ploughs producers all around the world (Rabe – Werk, Lemken, Eberhardt, Vogel & Noot, Krone, Frost, Landsberg, Regent, Pöttinger, Kuhn – Huard, Gregorie – Besson, Nardi, Kverneland, John Deere, Case, Masseey Ferguson) offer about the classical mouldboards also lamellar mouldboards. The last once weren't introduced in the endowment of the native ploughs until present, although they appeared for the first time as early as the year 1900.

This paper presents the studies and researches effected by the authors with a view to determination of the α, β and γ geometrical parameters of the prototype native variants and a German variant (Lemken) and of the variation of these parameters depending on the z height. They are also presented the researches affected regarding the positioning of the straight and curved lamellas within the framework of experimental body of the ploughs and the geometrical specific features of the lamellas' sections of the studied mouldboards.

KEY WORDS:

lamellar mouldboard, body of a plough, geometrical parameters

1. INTRODUCTION

The newest ploughs engineering's achieved by the producing companies with impressive achievements in this field, both on European and international plan, represents the quintessence of all the best that the engineering technique could create in the field. They possess a different adaptation capacity at the new working technology of the soil. The adopted technical solutions are capable to offer a great degree of adaptability to the soil categories, the state of the ground, the covering degree with plants remainders and the potential of the power basis.

In the current stage of development of the conception as concerns the high technical ness ploughs engineering, the great majority of the ploughs producer companies from the whole world, affairs to these equipments a very diversificated work kit, among which the lamellar mouldboards.

The experiment shows that the lamellar mouldboards utilisation for certain soils presents the following advantages:

- the furrow's processing effect ensures a better repartion of the elements which contribute to the soil to keeping the soil's fullness;
- they outrun more easily the rigid obstacles raised during the working time;
- they don't get stuck on soils with humidity excess, what recommends them priority in such situations;
- they work better that classical mouldboards the soils with humidity deficit at working speeds included between 10 – 11 km/h;
- strength force at tractive of the ploughs equipped with such mouldboards is with 20 – 30% more reduced then in the case of ploughs equipped with classical mouldboards.

In the context of presence of these advantages, for many agricultural areas from the West Field's territory, at the fundamental work of the soil, the ploughs equipped with such mouldboards proved their whole efficiency, especially for extreme situations of humidity excess or humidity deficit.

2. MATERIALS AND METHODS

The determination of the structures of those three types of the studied body of a plough with lamellar mouldboards, respectively the tracing of the curves and α and β characteristic angles and γ generatrix with the coordinates help and the establishing of the variation of their size on the working surface of the mouldboard were achieved in the Soil Working Agricultural Machinery Laboratory as part of U.P.Timişoara, with the coordinate (coordinate table).

The graphic plotting of α and β curves, γ generatrix and angles α = f(z), β = f(z) and γ = f(z) was achieved on a computer INTEL PII DESHUTES 350 MHz, using "EXCEL 2000" and "WORD 2000" programmes.

3. RESULTS AND DEBATES

From the study done on the mouldboard with straight lamellas (the native prototype variant) resulted the following variations of the α, β and γ geometrical parameters on the height of the mouldboard: $\alpha = 14^{o}...118^{o}$; $\beta = 21^{o}...101^{o}$; $\gamma = 41^{o}...43^{o}$. Therefore it results that the mouldboard with straight lamellas of native origin is of universal type (cultural).

From the study done on the lamellar mouldboards, the Lemken variant, resulted the following variations of the α, β and γ geometrical parameters of the mouldboard: $\alpha = 12^{o}...110^{o}$; $\beta = 18^{o}...120^{o}$; γ =

$18^{o}...25^{o}$. Therefore it results that the mouldboard is combined type, that is:

- the α angle seized between $12^{o}...110^{o}$ corresponds to a cylindrical type mouldboard, which grants a pronounced breaking up degree to the Lemken lamellar mouldboard;
- the β angle seized between $18^{o}...120^{o}$ corresponds to a half - helicoid or helicoid type mouldboard, which grants a pronounced overthrow degree to the Lemken lamellar mouldboard;
- the γ angle seized between $18^{o}...25^{o}$ corresponds to a mouldboard for high working speed, which leads us to the conclusion that the Lemken mouldboard can work at speeds of over 7 kilometre per hour.

From the study done on the mouldboard with curve lamellas - the native prototype variant - resulted the following variations of the α, β and γ geometrical parameters on the height of the mouldboards: $\alpha = 18^{o}... 105^{o}$; $\beta = 18^{o}...108^{o}$; $\gamma = 40^{o}...48^{o}$. Therefore results that the mouldboard with curve lamellas of native origin is of universal type (cultural).

Also from the study effected on the geometrical parameters results the following results:

1. the breadth of the lamellas is different from a type of mouldboard to another, depending on the type of the soil.
2. the thickness of the lamellas of the Lemken mouldboard (δ = 10 mm) is different from the thickness of the lamellas of the native mouldboard (δ = 7 mm), which make the Lemken mouldboards to have a longer length of life.
3. nr. 1 and nr. 2 lamellas of the Lemken mouldboard are inverted, which make these have a double length of life, comparative to nr. 1 and nr. 2 lamellas of the mouldboard with straight lamellas, native variant;
4. the lengths of the lamellas are different, depending on the type of the mouldboard, respectively the type of the soil, which is going to work on.

The mouldboards with straight lamellas, respectively with curve lamellas, the native variants, were achieved by cutting up of some classical mouldboards, fact that led to the loss of the materials qualities from which they were made;

The lamellas of the Lemken mouldboards were individual achieved in die fact that leads to a unquestionable superiority of these by comparison with the native ones, cutting up.

From the effected studies about the positioning of the lamellas given the soils' surface it results obvious conclusion that the lamellas of the German mouldboard are positioned given the soils' surface at a much bigger height than the lamellas of the prototype native mouldboards.

Figure 1 presents the positioning of the straight lamellas in the frame of the Lemken experimental body of a plough. Figure 2 presents the positioning of the curve lamellas in the frame of the native experimental body of a plough number two. Figure 3 presents the positioning of the

straight lamellas in the frame of the native experimental body of a plough number one.

In figures 4,5 and 6 are presented the curves α, β and γ for the Lemken mouldboard with straight lamellas. In figures 10, 11 and 12 are presented the curves α, β and γ for the native mouldboard (prototype) with curve lamellas. In figures 16, 17 and 18 are presented the curves α, β and γ for the native mouldboard (prototype) with straight lamellas.

In figures 7, 8 and 9, the angles $\alpha = f(z)$, $\beta = f(z)$ and $\gamma = f(z)$ for Lemken mouldboard with straight lamellas are graphic presented. In figures 13, 14 and 15 the angles $\alpha = f(z)$, $\beta = f(z)$ and $\gamma = f(z)$ for the native mouldboard (prototype) with curve lamellas are graphic presented. In figures 19, 20 and 21 the angles $\alpha = f(z)$, $\beta = f(z)$ and $\gamma = f(z)$ for the native mouldboard (prototype) with straight lamellas are graphic presented.

In the table 1, 2 and 3 are presented samples with the coordinates experimental determined in the laboratory for the plotting of the curves α, β and γ in the case of the Lemken mouldboard with straight lamellas.

Table 1

The coordinates	Curves α – LEMKEN body of a plough (Germania) – Mouldboard with straight lamellas																			
	Curve α_1													Curve α_n	Curve α_{27}						
	1	2	3	4	5	6	7	8	9	10	11	12	13	…	1	2	3	4	5	6	7
X	10	29	69	127	209	261	289	325	349	364	371	382	390	…	1250	1246	1246	1242	1243	1241	1241
Y	845	845	845	845	845	845	845	845	845	845	845	845	845	…	175	175	175	175	175	175	175
Z	8	26	40	59	84	97	111	349	169	198	227	254	274	…	291	301	312	324	336	347	354

Table 2

The coordinates	Curves β – LEMKEN body of a plough (Germania) – Mouldboard with straight lamellas										
	Curve β_1					Curve β_n	Curve β_{34}				
	1	2	3	4	5	…	1	2	3	4	5
X	33	33	33	33	33	…	1244	1244	1244	1244	1244
Y	817	829	842	855	863	…	180	175	171	170	165
Z	0	19	28	37	43	…	286	300	314	324	338

Table 3

The coordinates	Curves γ – LEMKEN body of a plough (Germania) – Mouldboard with straight lamellas																					
	Curve γ_1																	Curve γ_n	Curve γ_{26}			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	…	1	2	3	
X	20	38	63	251	280	302	324	349	368	388	410	425	437	450	463	475	486	…	693	709	729	
Y	830	808	798	664	635	614	592	568	549	530	510	495	485	470	460	448	435	…	570	556	539	
Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	…	544	544	544	

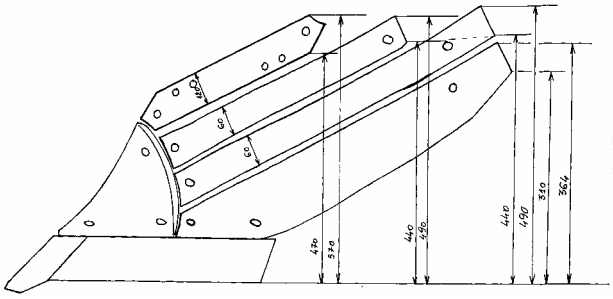


Figure 1

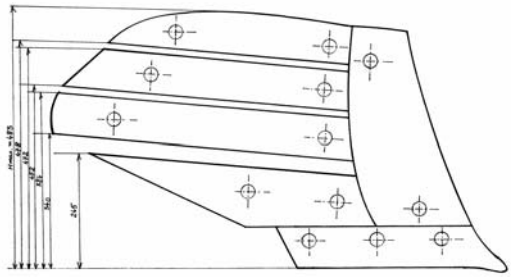


Figure 2

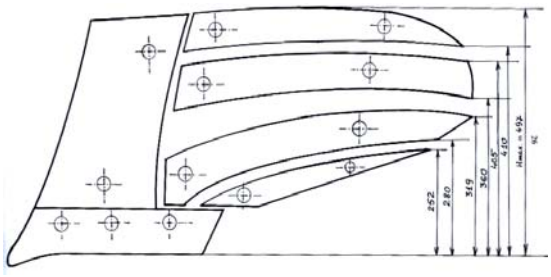
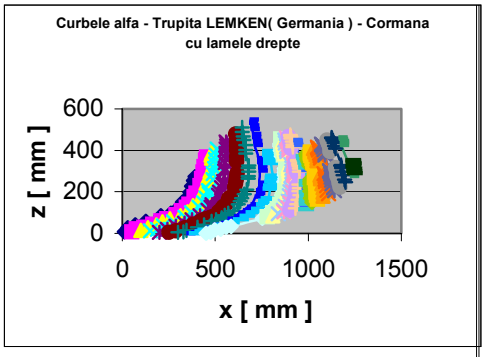


Figure 3



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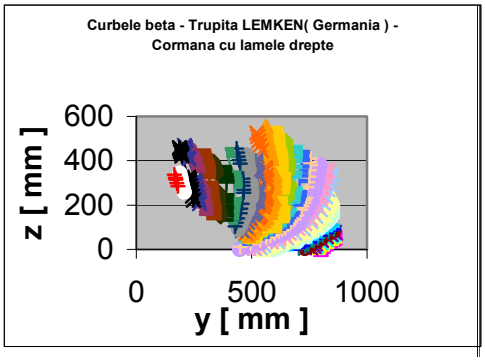

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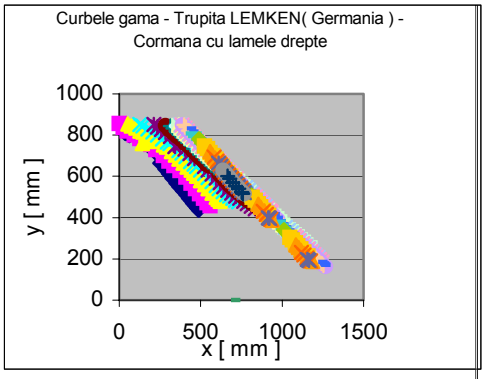

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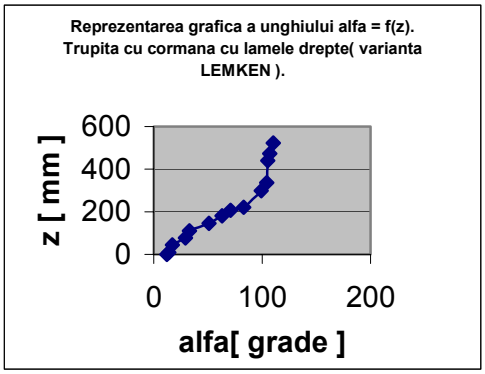

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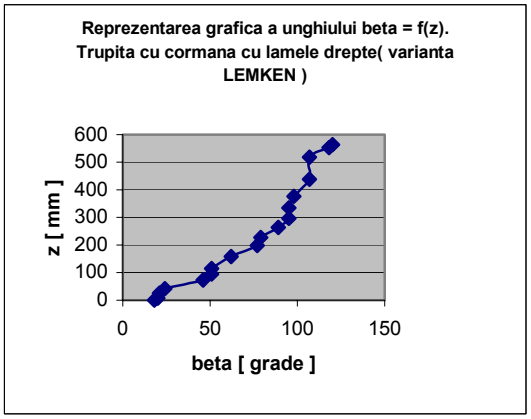

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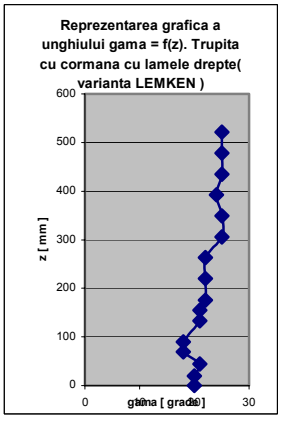

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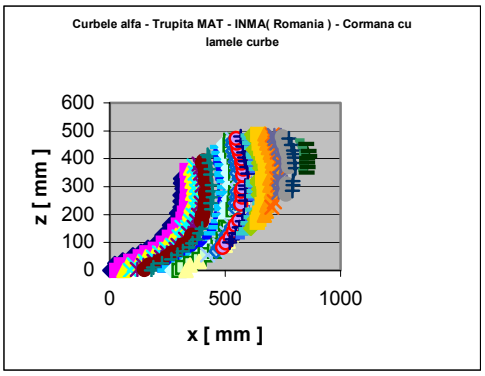

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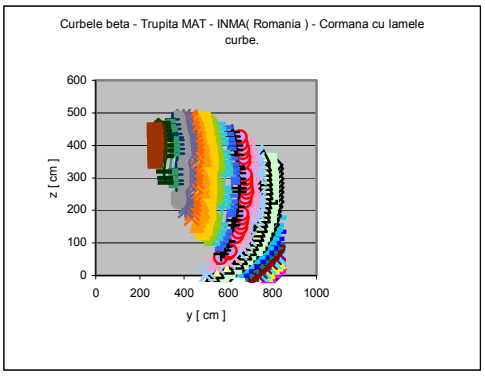

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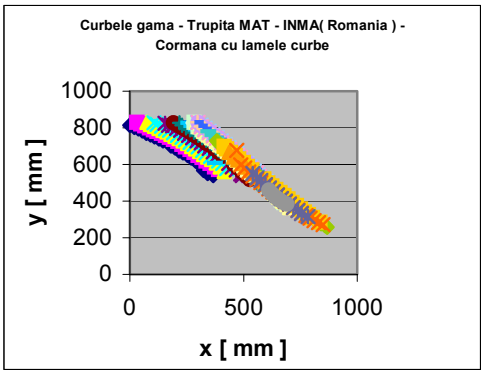

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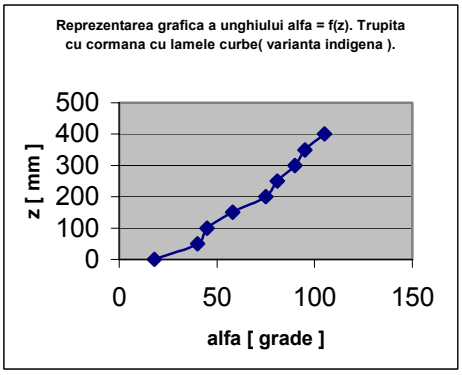

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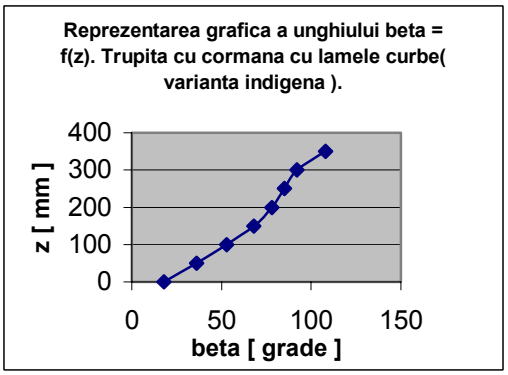

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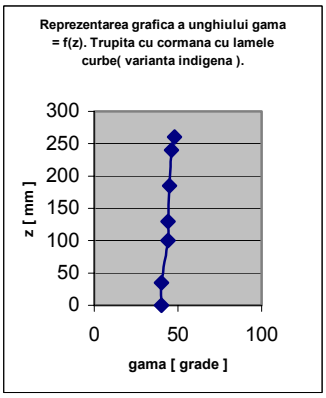

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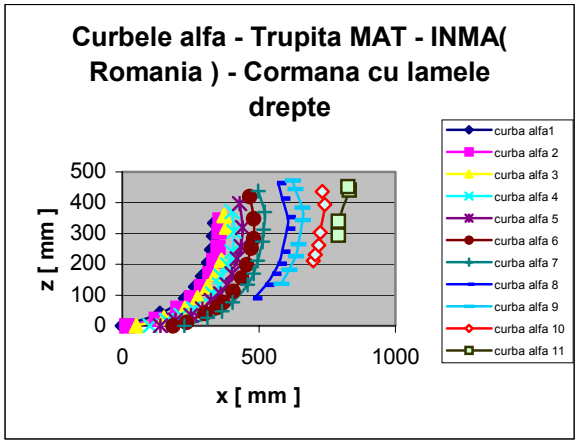

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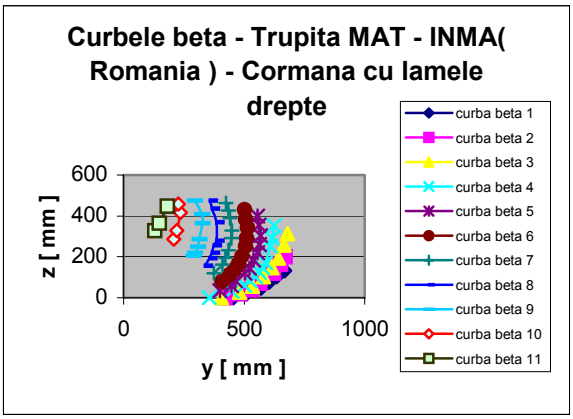

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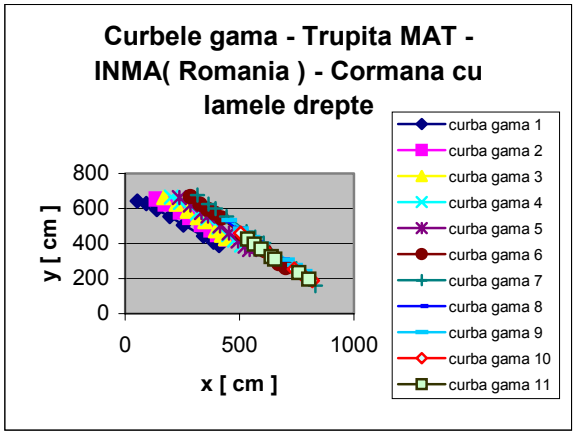

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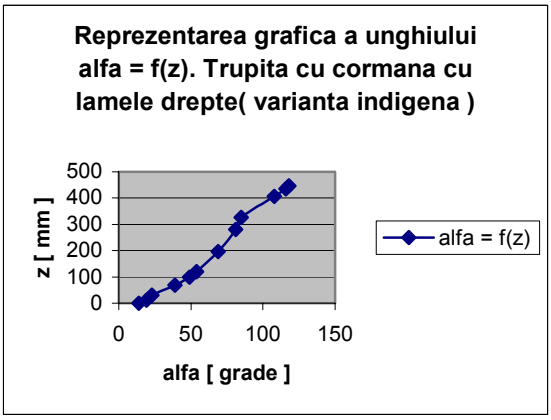

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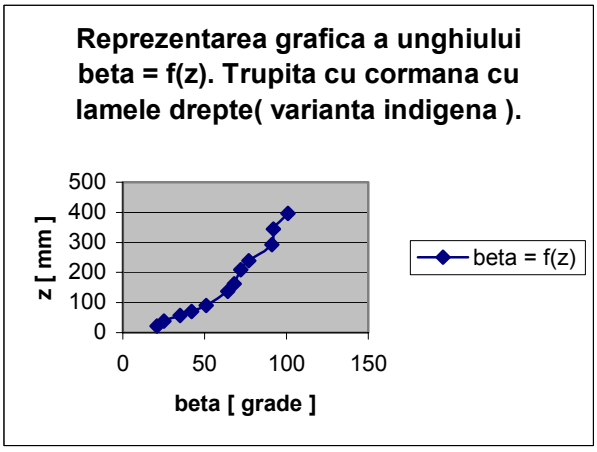

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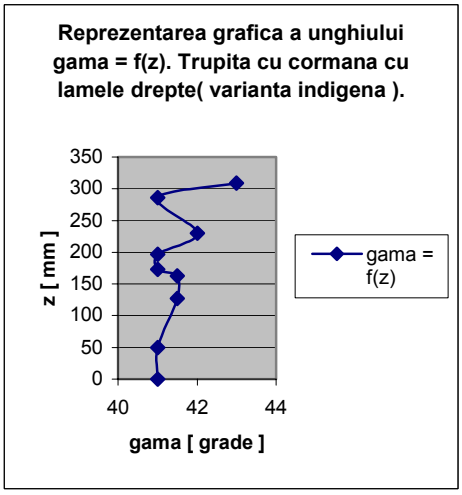

Figure 21

Conclusions

- The utilization of lamellas mouldboards is advantageously for all technical, technological and power purposes.
- The advantages presents previously made that in the current stage all of the impressive ploughs design concerns to achieve equipped variants exclusively only with lamellar mouldboards or to deliver this types of mouldboards as an optional equipment.
- The pedological map of Romania praises important diversifications of soil category for all the country areas, which justify the granting of the proper attention to this variant of mouldboards. The presence of this variant of mouldboards in the ploughs endowment which work in Romania imposed in the same measure in all the country areas and especially in the areas with soils type "marshy ground".
- The researches effected by the authors finalized for the first time in our country, the geometrical specific feature of three types of lamellar mouldboards, from which two were native and one was from abroad (the mouldboard of the Lemken German company).
- From the thorough studies effected by the authors on the evolution directions and boundaries of the parameters which characterize this geometry for a big number of lamellar mouldboards, it is finally praised the fact that the performance variants have different evolution rules of the characteristic angles from those of the complete mouldboard. This fact permits them to achieve ploughing at enlarged speeds and with much superior technological performances to those achieved with usual mouldboards (classic).

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