STUDY ON THE DYNAMICS OF AN AGGREGATE FOR DIRECT SEEDING OF MAIZE IN STUBBLE

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Abstract. *Direct tillage, as an agricultural technology, minimizes soil processing, loosening it only on a narrow strip, in which the seeds are introduced, while also having to find the optimal conditions for germination and development. When certain conditions are met (the presence of agricultural aggregates with direct sowing machines in unprocessed soil and herbicides capable of keeping the soil clean throughout the entire crop's vegetation along with functional irrigation systems), direct tillage is starting to become an important method of saving energy while also conserving soil's production capacity, both being essential elements for a durable agriculture. The present paper presents a dynamic study of a direct tillage aggregate used for maize crop sowing, starting with the implementation of a theoretical model and completed with the acquisition of data values regarding the forces that occur during works. The results obtained from experimental study may constitute elements of analysis of the correlation that exists between the forces that occur during direct seeding work for maize crops and energy consumption associated with immediate implications on production obtained per unit of area.*

Key words: *direct sowing, forces, moments, fuel consumption*

INTRODUCTION

As a consequence of the small ratio between the production costs and the delivery prices of agricultural products , more and more farmers are beginning to resort to different methods of soil works which aim to reduce workforce ,machines and fuel costs, while also producing more crops in a shorter amount of time. Observations drawn as a result of scientific research in the field, indicate the fact that an agricultural production increase of 1% requires an increase of energy consumption under the form of fuel, of 2,5%. Another conclusion shows that for the usage of agricultural machines it is required energy consumption two times higher than the one needed for their manufacture.

MATERIAL AND METHODS

This paper presents the results of the research conducted in order to determine the dynamics of the direct sowing aggregate .

The object of experimental research was the aggregate which consisted of the direct seeding machine Massey Ferguson MF 354 TSB and the tractor U-650 M.

The experimental device used for the dynamics' and energetics' study in working conditions ,of the direct sowing aggregate was carried out according to the scheme presented in the figures 1.

The direct sowing machine Massey Ferguson MF 354 TSB was designed for precision seeding in unworked fields of hoeing plants crops, because it can simultaneously take care of the seeding and the management of solid mineral fertilizers and herbicides.

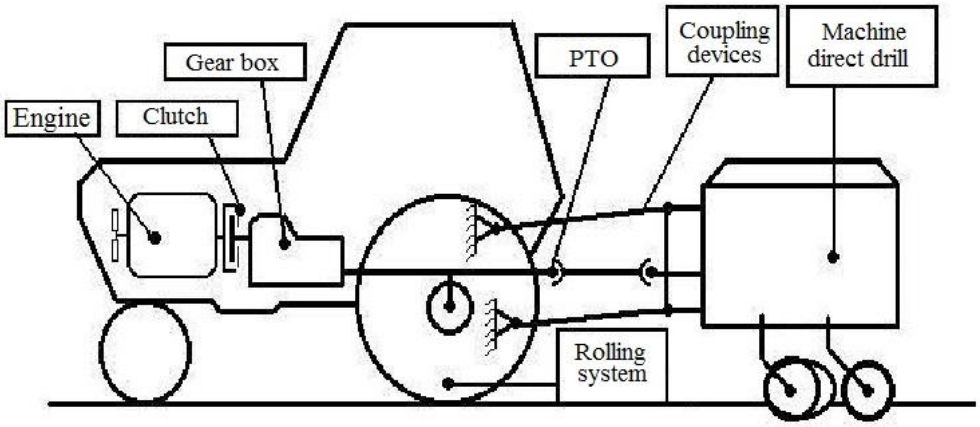

Fig.1 Physical model of directly sowing agregate

RESULTS AND DISCUSSION

For the studied aggregate ,the measurements which were tracked during the experimental research and which influence in terms of dynamics and energetics the execution of direct seeding work are the following :

- The traction power between the tractor and the direct seeding machine
- The downforce between the connection couple tractor – direct seeding machine
- The torque transmitted to the machine through the PTO shaft

During the conducted experimental research, there were determined (through measurements) and analyzed the basic parameters characterizing in terms of dynamics and energetics the tractor-direct sowing machine system.

- The thrust between the tractor and the working machine (direct sowing machine)
- The downforce between the connection couple tractor – working machine
- The torque transmitted through the PTO shift

For each of the two samples ,the variation graphs of the parameters studied at different gears ,have the shape of the ones presented in the figures 2-5.

In table 1 there are presented the values recorded at the trials of the tractor U-650 M-direct sowing machine Massey –Ferguson MF-543 aggregate .

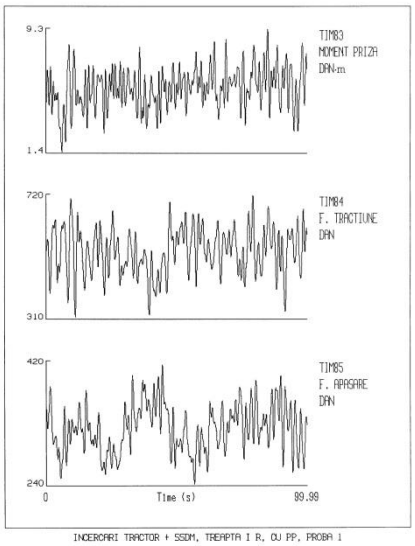

Fig. 2. Graphs recorded after processing the data for sample 1,gear I_R

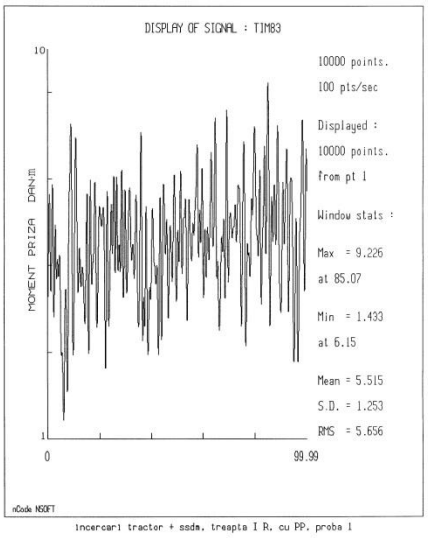

Fig. 3. Graph recorded for the moment variation resistance for the PTO – sample 1, gear I_R

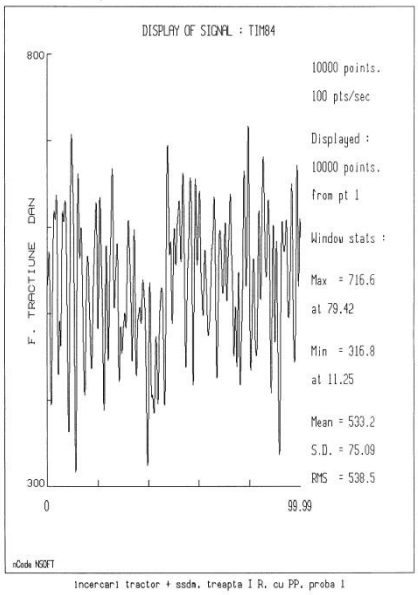

Fig. 4. Graph recorded for the variation of the traction power – sample 1, gear I_R

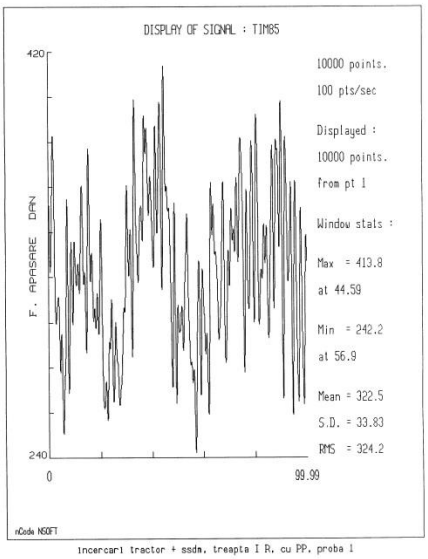

Fig. 5. Graph recorded for the variation of the downforce – sample 1, gear I_R

Table 1

Results of traction tests of direct sowing unit U-650 M + Massey-Ferguson MF 534

No.	No.of the trial	Speed level	PTO	Traction force (daN)			Pressure force (daN)			Resistance moment to the power plug axis (daNm)			Fuel consumption (l/ha)
				Min	Max	Med	Min	Max	Med	Min	Max	Med	
1	1	I R	OFF	274,8	663,6	447,2	99,56	418,3	183,4	-	-	-	4,04
2	2	I R	OFF	193,7	666,2	469,4	289,5	444,2	346,5	-	-	-	4,08
3	1	I R	ON	316,8	716,6	533,2	242,2	413,8	322,5	1,4	9,2	5,5	4,21
4	2	I R	ON	325,9	738,3	531,7	223,4	391,7	324,3	0,7	13,3	7,2	4,71
5	1	II L	OFF	245,0	622,1	430,2	85,4	352,4	198,0	-	-	-	5,80
6	2	II L	OFF	257,4	671,9	469,5	157,8	410,2	285,5	-	-	-	6,00
7	1	II L	ON	273,0	693,8	527,6	229,8	367,4	285,0	-0,3	3,1	1,3	6,03
8	2	II L	ON	320,2	643,7	498,4	267,2	412,6	322,5	0,1	6,3	3,5	5,83
9	1	II R	ON	242,7	812,6	537,0	186,7	424,2	311,4	0	8,4	4,3	3,19
10	2	II R	ON	284,1	766,9	521,5	230,2	415,8	319,0	0,36	13,9	7,2	2,95
11	1	III L	ON	261,9	679,6	469,1	192,5	467,0	326,4	-4,7	13,8	3,1	2,98
12	2	III L	ON	305,4	721,1	498,4	276,5	437,4	343,1	-1,5	14,3	3,1	3,28
13	1	III R	ON	115,3	901,3	507,3	192,2	514,2	357,4	-3,2	13,4	4,3	2,39
14	2	III R	ON	110,1	1027	529,7	146,9	508,0	353,9	-2,9	16,0	6,0	2,45
15	1	IV L	ON	117,6	876,2	505,3	305,8	526,9	391,0	-0,3	17,2	7,9	2,75
16	2	IV L	ON	211,7	782,7	543,0	288,7	467,6	370,3	-3,9	22,1	8,3	2,62

CONCLUSIONS

Following the processing and analysis of the data achieved during our experimental research, we were able to develop a series of conclusions, the most important of them being presented synthetically as following:

- The average traction power Ft med has values of 469,1 daN in gear III L (sample 2) and 530,0 daN in gear IV L (sample 2);
- The average pressure force Fa med increases from 285,0 daN in gear II L (sample 1) up to the maximal value of 391,0 daN in gear IV L (sample 1);
- The moment resistant to the power take-off shaft Map med is between 1,3 daNm in gear II L (sample 1) and 8,3 daNm in gear IV L (sample 2).

The values of the resistant moment to the PTO shaft are low regardless of the used gear because only the direct sowing machine's ventilator is hydrostatically powered from the tractor's PTO and the energy required is reduced.

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