

THE OPTIMIZATION OF AGRICULTURAL HOLDINGS SIZE, USING THEIR SIZE CLASSES

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Abstract: *The purpose of the study is to statistically determine the optimal size of holdings that lead to an average production as high as possible, inducing in this case an optimal profit per surface unit (in fact major desire of every agricultural enterprise). The study starts from observations concerning the average production class size in some crops (wheat, corn, oil plants, fodder plants, potatoes).*

Key words: *Optimal dimension, agricultural holding, agricultural production*

INTRODUCTION

In practice it is noted that farms that have a small area as well as very large ones are not economically viable. This is due to the fact that generally small areas are adequate for subsistence farms or so-called "weekend farmers" who generally do not use than traditional technical elements or outdated.

The same phenomenon is observed in the case where the holding has a considerable expanse, which prevents the entrepreneur to effectively manage all production factors they might have, which leads to negative consequences which will be reflected in the decrease of average production.

The aim of the study is to determine statistically which is the optimal size of farms that lead to an average as high as possible, inducing in this case an optimal profit per unit area (in fact the desire of every major agricultural enterprise).

MATERIALS AND METHODS

Data obtained from the Agricultural Department Timis for the years 2007-2009 regarding the average production, by size class in some cultures, are centralized in the table below.

For each of these data sets we will determine a mathematical relationship of regression function type, linear and parabolic relative to the average size of the size classes of agricultural holdings.

Definitely at a glance on values, indicating adequate model of them as the parable. However to confirm that the parabola shape the process in a superior way of the regression line for each case will be calculated also the correlation coefficient r^2 .

Table 1

Average production by size class in the period 2007-2009

- kg./ha -

Nr. crt.	Specification	Size class			
		0-20 ha	20-50 ha	50-200 ha	Over 200 ha
2007					
1	Wheat	2560	2710	2916	3010
2	Corn	2916	3210	3581	3924
3	Oil plants	1198	1250	1361	1391
4	Forage plants	11268	12100	13280	15537
5	Potatoes	9833	10235	11932	12690
2008					
1	Wheat	3405	3451	3536	3646
2	Corn	3249	3620	3710	3901
3	Oil plants	1626	1713	1814	1836
4	Forage plants	17649	18051	19235	19495
5	Potatoes	11868	12051	12127	12195
2009					
1	Wheat	2747	2907	2956	3150
2	Corn	3647	3890	3918	3991
3	Oil plants	1331	1395	1456	1476
4	Forage plants	15360	16980	20037	22771
5	Potatoes	13440	16021	16238	16362

Source: Agricultural Department Timis

We also calculated the coefficients a, b and c, followed by determining which is the optimal size. The calculations were repeated for each of the three agricultural years studied. Final data are centralized in Table 8

RESEARCH RESULTS

The average dimension for each culture will be established by calculating the average values for years 2007, 2008 and 2009.

Table 2

Statistic data for agricultural year 2007

Average size of classes ha	Wheat	Corn	Oil plants	Forage plants	Potatoes
	Kg./ha				
10	2560	2916	1198	11268	9833
35	2710	3210	1250	12100	10235
125	2916	3581	1361	13280	11932
300	3010	3924	1391	15537	12690

Source: Agricultural Department Timis

Table 3

Statistical analysis of the corresponding data of the agricultural year 2007

Agricultural culture	Regression model	Correlation coefficient, r^2	Regression coefficient function			Optimal size ha
			a	b	- c	
Potatoes	Linear	0,884	10027,6	9,7435		-
Potatoes	Parabolic	0,997	9515,02	25,1253	-0,0484	259,5589
Wheat	Linear	0,823	2634,49	1,4001		-
Wheat	Parabolic	0,986	2542,54	4,1590	-0,0087	239,023
Forage plants	Linear	0,987	11398,1	14,0269		-
Forage plants	Parabolic	0,992	11240,1	18,7677	-0,0149	629,7886
Oil plants	Linear	0,803	1226,96	0,6217		-
Oil plants	Parabolic	0,999	1181,66	1,9807	-0,0043	230,314
Corn	Linear	0,908	3033,63	3,1840		-
Corn	Parabolic	0,985	2897,38	7,2722	-0,0129	281,8682

Source: Own calculations

Table 4

Statistic data for 2008

Average size ha	Wheat	Corn	Oil plants	Forage plants	Potatoes
	Kg./ha				
10	3405	3249	1626	17649	11868
35	3451	3620	1713	18051	12051
125	3536	3710	1814	19235	12127
300	3646	3901	1836	19495	12195

Source: Agricultural Department Timis

Tabel 5

Statistical analysis of the corresponding data of the agricultural year 2008

Agricultural culture	Regression model	Correlation coefficient r^2	Regression coefficient function			Optimal size ha
			a	b	- c	
Potatoes	Linear	0,701	11954,6	0,8994	-	-
Potatoes	Parabolic	0,870	11889,6	2,8481	-0,0061	233,4508
Wheat	Linear	0,973	3415,98	0,7959	-	-
Wheat	Parabolic	0,997	3397,71	1,3440	-0,0017	395,2941
Forage plants	Linear	0,799	17890,5	6,1020	-	-
Forage plants	Parabolic	0,973	17440,3	19,6124	-0,0425	230,7341
Oil plants	Linear	0,727	1673,29	0,6294	-	-
Oil plants	Parabolic	0,974	1619,15	2,2540	-0,0051	220,9804
Corn	Linear	0,831	3411,37	1,7755	-	-
Corn	Parabolic	0,974	3311,70	4,7662	-0,0094	253,5213

Source: Own calculations

Tabel 6

Statistic data for agricultural year 2009

Average size ha	Wheat	Corn	Oil plants	Forage plants	Potatoes
	Kg./ha				
10	2747	3647	1331	15360	13440
35	2907	3890	1395	16980	16021
125	2956	3918	1456	20037	16238
300	3150	3991	1476	22771	16362

Source: Agricultural Department Timis

Tabel 7

Statistical analysis of the corresponding data of the agricultural year 2009

Agricultural culture	Regression model	Correlation coefficient r^2	Regression coefficient function			Optimal size ha
			a	b	- c	
Potatoes	Linear	0,388	14739,9	6,5987	-	-
Potatoes	Parabolic	0,460	13926,8	30,9962	-0,0768	201,7982
Wheat	Linear	0,896	2799,35	1,1970	-	-
Wheat	Parabolic	0,911	2776,48	1,8834	-0,0022	428,0455
Forage plants	Linear	0,937	15938,5	24,2423	-	-
Forage plants	Parabolic	0,997	15035,5	51,3396	-0,0853	300,9355
Oil plants	Linear	0,736	1364,25	0,4276	-	-
Oil plants	Parabolic	0,959	1329,55	1,4689	-0,0033	222,5606
Corn	Linear	0,580	3759,81	0,8654	-	-
Corn	Parabolic	0,736	3693,66	2,8502	-0,0062	229,8548

Source: Own calculations

In conclusion, most cases show a superior correlation coefficient for the regression parabola, aspect that indicates that this is an exact model of the studied phenomenon rather than the regression line. These issues reveals that farms with a small size, but also very large ones leads to production average inferior to holdings having medium size .

In agreement with data presented above, the optimal values are listed in the table below (except oil plant culture for 2009 where are noted inconsistencies in the statistical data values which were ignored).

Table 8

Optimal dimension of agricultural holdings

Agricultural culture	Year /Optimal dimension (ha)		
	2007	2008	2009
Potatoes	259,5589	233,4508	201,7982
Wheat	239,023	395,2941	428,0455
Forage plants	629,7886	230,7341	300,9355
Oil plants	230,314	220,9804	222,5606
corn	281,8682	253,5213	229,8548

Source: Own calculations

CONCLUSIONS

- At potato crop were obtained optimal values of the average area between 209.0845 and 306.119 hectares;
- For wheat crop were recorded optimal values between 239.023 and 428.0455 hectares;
- In forage plants was obtained optimum value between 300.9355 and 629.79 ha;
- From oily plants the optimum size is 220.9805 and 230.314 ha;
- For corn crop optimal value is between 198.4965 and 215.4895 hectares.

According to the optimum size obtained, we make the following recommendations for average crop at the studied area:

- at potatoes we recommend the area between 200-300 ha;
- at wheat, between 200 – 400 ha;
- at forage plants between 300 – 600 ha;
- oil plants, is recommended a surface of 200 ha;
- at corn crop between 100 și 200 ha.

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