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The study of dependence of profitability in barley production upon economic indicators of agricultural enterprises

Scientific problem. The important task of agricultural production is stable and permanent people's supply with food and increasing the economic efficiency in grain industry. Under all the conditions necessary for the industry's profitability, one of the prior tasks is to improve the efficiency of grain production in agricultural enterprises.

Analysis of recent researches and publications. In scientific research the chief attention is devoted to improving the efficiency in grain industry. It should be noted that to the current economic problems of efficiency in grain-production complex the research papers of such famous Ukrainian scientists as F. Horbonos [1], I. Levytska [5], V. Zhygadlo, O. Sikachyna [3], R. Litnarovych [6], V. Kurgan [4] and others were devoted.

The objective of the article – determination of dependency of barley production profitability from agricultural firms` economic indicators.

Statement of the main results of the study. The efficiency of agricultural production reflects its effectiveness and describes the quality of managing. At the same time it is necessary to distinguish the concept of effect and economic efficiency. Effect means a consequence, the result of production in general or taking certain steps in agriculture. Economic efficiency points to the final result from the usage of production means and human labor, returning the total cost, that is generally defined as the correlation between the results of production and the cost of their gaining [4].

In evaluating the economic efficiency of agricultural farm production one must identify correctly the system of interrelated indicators, those are to reflect impartially its level. To determine the economic efficiency of agricultural enterprises in general we use the system of indicators that should be calculated as follows : the value of gross domestic product (GDP), the value of GDP and pure income, profits, the level of profitability .

One of the main indicators of economic efficiency in production is profitability, that characterizes the income and production profits. It shows the cost results not only of human, but also of materialized labor, the amount of using the production means, the quality of realized production, the level of production organization and its management [1]. Profitability indicators are necessary to evaluate the economic efficiency of management and resource usage.

Analysis of the profitability indicators allows managers and specialists of an agricultural enterprise to determine which products are the most interesting to produce in the farm with the best opportunities to increase profitability of production. The higher production profitability is, the more opportunities there are to carry out scientific and technological progress, comprehensive intensification of agriculture, to solve rural social problems and improve the size of financial stimulating for farm workers according to final results and increasing the production profitability. Therefore, it is the indicator of profitability (the correlation between the pure income and the total production cost in per cents) that stands for the main criterion of evaluating the efficiency of intensive technologies in crop cultivation.

To evaluate the efficiency of grain-feed crops at agricultural formations in Vinnytsia region we have analyzed the main economic indicators for farms, those were grouped according to crop area, yield, gross production, cost of one metric center of grain and the profitability level, as well as their comparing with the similar indicators all over Ukraine with the help of regression analysis.

Regression analysis is a basic statistical method for constructing the mathematical models of objects or phenomena according to experimental data. The main task of regression analysis is obtaining the results of regression options (b_1 ,..., b_m), that would be optimal in some sense [6].

Table 1 shows the indicators of economic efficiency of barley production in 2008-2010, for example the farms of Vinnytsia region were taken, grouped by the level of profitability.

It should be mentioned that during 2008-2010, in Vinnytsia region the number of farms engaged in growing and selling barley decreased. Thus, in the year 2008 among 2111 farms there were 428 of such ones, and in 2010 – only 340 of 2083. Besides, during the previous three years there has been a tendency to reduce the economic efficiency of barley growing in the farms of Vinnitsa region. The evidence to this is the fact that in 2008, only 12,8 % of the grouped farms had the profitability level over 80 % and 25,4 % were non-profit, then in 2010 there were 7,1 and 33,5 % of those, but the lowest indicators of economic efficiency of barley growing was in 2009. That year the general non-profit level of Vinnytsia agricultural enterprises (381 farms) growing the crop was 3,7% , that was due to a decline in the selling price to 73,3 hr. per metric center with the cost level for one metric center of the realized product 76,22 hr. per metric center.

For more impartial analysis of the economic efficiency of barley growing we have made the regression model of depending the profitability level upon other productive and economic indicators in 2008-2010.

$$Y = -34,723s - 0,0006 * x_1 - 0,0603 * x_2 + 2,7421 * x_3 - 0,0296 * x_4 - 173,6261 * x_5 + 174,1446 * x_6 - 174,1022 * x_7 + 0,0494 * x_8$$

there Y is the profitability level of barley growing, %; X_1 is barley produced at one farm, metric center; X_2 is the average crop area, hectare; X_3 is yield, metric center per one hectare; X_4 is the cost of one hectare, hr; X_5 is the cost of one metric center of production, hr; X_6 is the realization price, hr per one metric center; X_7 is the profit got from realization of one metric center of grain, hr; X_8 is the profit obtained from one hectare, hr.

1. Analysis of the efficiency of growing barley at farms in Vinnytsia region, grouped according to the level of profitability (2008-2010)

The groups made upon production profitability,%	The number of farms in groups	Group percentage within the general amount of farms,%	Produced at 1 farm, metric center	Realized at 1 farm, metric center	Average area of 1 farm, hectare	Yield, Metric center per hectare	Grain production cost of 1 metric center, hr.	Costs for 1 hectare of sowing, hr.	Cost of 1 hectare of realized production, hr.	The price of realization, hr. per 1 metric center	The profits got from realization of 1 metric center of grain, hr.	The profit got per 1 hectare, hr.	Profitability, %
1	2	3	4	5	6	7	8	9	10	11	12	13	14
The year 2008													
till -40	15	3,7	3698	3082	176	21,0	127,62	2678	142,90	71,19	-71,71	-1254,45	-50,2
-20	30	7,4	6911	5348	301	23,0	82,17	1889	101,73	73,60	-28,14	-500,47	-27,7
-10	22	5,4	5070	3728	164	30,9	76,20	2358	84,35	72,62	-11,73	-266,96	-13,9
0	36	8,9	4235	3110	140	30,3	66,62	2017	81,08	76,64	-4,44	-98,71	-5,5
10	49	12,1	9170	6545	263	34,8	59,57	2075	72,81	76,10	3,29	81,83	4,5
20	47	11,6	8926	6572	264	33,9	63,14	2138	76,46	88,35	11,89	296,42	15,6

Table 1 continued

30	40	9,9	8563	7140	252	33,9	62,09	2106	71,13	88,08	16,95	479,40	23,8
40	35	8,6	8048	5451	226	35,6	51,33	1830	62,34	84,77	22,43	541,62	36,0
60	55	13,5	9272	5879	225	41,3	48,35	1997	58,79	87,26	28,48	745,73	48,4
80	25	6,2	8789	5413	229	38,4	46,14	1770	53,55	89,97	36,43	860,78	68,0
over 80	52	12,8	9219	5765	228	40,5	43,93	1777	43,43	94,04	50,61	1280,41	116,5
Total	**406**	**100,0**	**7952,98**	**5579**	**230**	**34,5**	**58,1**	**2006**	**69,48**	**84,43**	**14,95**	**362,18**	**21,5**
The year 2009													
till -40	31	8,1	4463	3638	289	15,5	115,65	1788	180,93	68,78	-112,16	-1413,44	-61,99
-20	53	13,9	10539	8584	431	24,4	79,79	1950	101,12	73,57	-27,55	-548,39	-27,2
-10	32	8,4	9174	8210	382	24,0	70,46	1693	80,52	68,72	-11,80	-253,58	-14,7
0	54	14,2	7515	6292	284	26,5	66,81	1771	73,34	70,05	-3,29	-72,99	-4,5
10	63	16,5	7300	6377	268	27,2	63,12	1719	70,68	74,25	3,57	84,92	5,1
20	47	12,3	11434	9717	403	28,3	60,86	1725	67,43	77,04	9,61	231,47	14,3
30	31	8,1	7302	6504	257	28,4	50,55	1437	57,78	72,51	14,73	372,94	25,5
40	28	7,3	9822	11523	304	32,3	51,82	1675	57,24	76,50	19,26	730,58	33,7
60	28	7,3	7063	5095	218	32,4	50,31	1629	50,75	76,24	25,49	595,28	50,2
80	7	1,8	9726	7679	284	34,3	42,04	1440	39,61	68,85	29,24	790,59	73,8
over 80	7	1,8	6216	4716	156	39,9	25,01	998	27,3	65,37	38,07	1152,15	139,5
Total	**381**	**100,0**	**8410**	**7303**	**317**	**26,5**	**65,44**	**1735**	**76,22**	**73,37**	**-2,85**	**-65,59**	**-3,7**
The year 2010													
-40	18	5,3	3030	2456	145	20,9	149,91	3132	191,90	86,66	-105,24	-1782,00	-54,8
-20	26	7,6	4139	4862	180	23,0	113,96	2620	130,07	92,21	-37,86	-1022,82	-29,1
-10	29	8,5	11750	8888	404	29,1	95,56	2780	111,77	96,58	-15,19	-334,26	-13,6
0	41	12,1	3768	4561	193	19,5	103,32	2016	106,02	101,47	-4,54	-107,29	-4,3
10	51	15,0	5924	6210	230	25,8	91,77	2366	94,78	98,82	4,03	108,98	4,3
20	51	15,0	5179	4269	207	25,0	84,43	2112	96,06	109,87	13,81	284,75	14,4
30	37	10,9	5251	5823	222	23,7	76,94	1824	79,86	99,67	19,81	520,64	24,8
40	24	7,1	12053	11686	386	31,2	80,41	2510	84,95	114,07	29,12	881,18	34,3
60	29	8,5	8878	8409	350	25,4	72,14	1830	76,54	115,04	38,49	924,9	50,3
80	10	2,9	6386	5646	231	27,7	75,28	2086	79,98	132,98	53	1298,05	66,3
over 80	24	7,1	6098	5981	186	32,8	58,45	1915	54,13	109,93	55,8	1792,99	103,1
Total	**340**	**100,0**	**6396,8**	**6146**	**246**	**26,0**	**86,96**	**2263**	**94,03**	**104,99**	**10,96**	**274,01**	**11,7**

Source: calculated by the author on the basis of the data of State Statistics Service of Ukraine

2. Standard errors and significance evaluating the (t - criterion) regression coefficients

	a1	a2	a3	a4	a5	a6	a7	a8
St. errors	0,0011	0,0344	0,4257	0,0064	0,0746	0,1625	0,0682	0,003
Evaluation	0,512	1,756	6,441	4,634	2327,950	1071,714	2551,655	14,751

In constructing the regression model we calculated the coefficient of determination, that was R = 0,9599, indicating that the change in the profitability level was caused by the change of the above-given indicators. The Fisher's criterion in this case is F = 35,1883 (table data F = 2,36).

3. Calculation of numerical characteristics

Variable	Average	Median	Variation coefficient, %	Average quadratic deviation	Average error
Y	19,545	14,400	238,060	46,530	8,100
X1	742,273	7302,000	32,862	2438,798	424,540
X2	256,909	231,000	30,146	77,449	13,482
X3	29,118	28,400	21,474	6,253	1,088
X4	1986,424	1915,000	20,975	417,291	72,641
X5	83,677	76,540	42,655	35,692	6,213
X6	86,418	84,770	18,958	16,383	2,852
X7	2,741	11,890	1423,301	39,016	6,792
X8	193,947	284,750	410,009	795,200	138,427

4. Statistical characteristics of the amount distribution

	variable	Min	Max	Asymmetry	Excess
	Y	-61,900	139,500	0,574	0,131
	X1	3030,000	12053,000	0,027	-0,934
	X2	140,000	431,000	0,649	-0,384
	X3	15,500	41,300	0,091	-0,579
	X4	998,000	3132,000	0,547	0,794
	X5	27,300	191,900	1,367	1,960
	X6	65,370	132,980	0,902	0,153
	X7	-112,160	55,800	-1,389	1,862
	X8	-1782,000	1792,990	-0,515	0,074

While calculating the regression model we have built the correlation matrix, that reflects the closeness of connections between the analyzed indicators (tabl. 5).

5. The correlation matrix of depending the economic indicators of barley production in the farms of Vinnytsia region grouped upon the profitability level

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8
Y	0,305	-0,144	0,765	-0,575	-0,819	0,273	0,864	0,923
X_1	1,000	0,799	0,486	-0,224	-0,491	0,002	0,450	0,422
X_2	0,799	1,000	-0,119	-0,104	-0,054	-0,029	0,037	0,015
X_3	0,486	-0,119	1,000	-0,355	-0,787	-0,025	0,709	0,708
X_4	-0,224	-0,104	-0,355	1,000	0,702	0,341	-0,499	-0,540
X_5	-0,491	-0,054	-0,787	0,702	1,000	0,017	-0,908	-0,866
X_6	0,002	-0,029	-0,025	0,341	0,017	1,000	0,404	0,414
X_7	0,450	0,037	0,709	-0,499	-0,908	0,404	1,000	0,966
X_8	0,422	0,015	0,708	-0,540	-0,866	0,414	0,966	1,000

Conclusions. Thus, according to the data in Table 5, the profitability level of barley production in agricultural enterprises correlates closely with income from the sale of one metrical center of grain and yield from one hectare of the planted crop. The correlation coefficients are r = 0,864 and 0,923. There is a strong contrary interrelation between the level of profitability and the cost of one metric center of sold products (r = -0,819) and an average contrary interrelation within the cost of one hectare of planted crops (r = -0,575). The weakest correlation was fixed between the level of profitability and the barley area (r = -0,144), while talking of the barley yield it was stronger (r = 0,765).

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