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An Economic Study of Rice Waste Usage to Produce the Organic Fertilizers and Non- traditional Fodder in Beheira Governorate, Egypt

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ABSTRACT

Usually the farmer gets rid of crop residues by burning, which causes pollution to the environment and the smoke rises and forms what is known as the black cloud. Therefore, the search Aims to Studying the current situation of agricultural waste in Egypt, studying the current situation of the number of farm animals and the fodder balance in Beheira Governorate, and Studying measuring the economic impact of using rice waste in the production of organic fertilizers and non-traditional fodder in Beheira Governorate. The research had taken a study sample of agricultural waste users (rice straw) in Beheira Governorate during February 2021 to August 2021. Through team of researchers from Agricultural Economics Research Institute, the random sample included 120 farmer from Damanhour Center, 60 farmer of the traditional feed users and 60 farmer of the modernized feed users represented in urea-treated rice straw to show the efficiency of using this type of feed. Where both descriptive and quantitative methods were used through the use of simple regression analysis to estimate the growth rates of some of the variables included in the research. In addition to some economic and efficiency Indicators. The research also relied on published and unpublished secondary data related to the research topic from its various sources. The research reached several results, the most important of which are: The average daily yield of milk for each of the local cows, mixed cows, and buffaloes in the case of feeding on the traditional ration was about 35.5, 56.6 and 59.5 pounds per head, respectively. And in the case of using urea-treated rice straw, it amounted to about 36.1, 58.2, and 64.4 pounds per head, respectively, with an increase of about 0.6, 1.5, 4.9 pounds per head, respectively. And some Conclusion like: Its needs to expand in uses of agricultural waste in the production of non-traditional feed contributes to reducing the animal feed gap, especially concentrated feed in the field of dairy cattle production. Activating the role of NGOs working in the field of agriculture, especially projects funded by the Social Fund and micro-projects funded by special funds in the governorates.

Introduction

Agricultural waste is a wealth that must be saved, such after the harvest process the burning crop waste is a waste of renewable energy, that effects on chemicaland organic components of agricultural soil, which negatively affects the soil natural properties, in addition to reducing the microbial content of the surface layer of the soil[(3)]. The general policy of the state aims at the optimal use of agricultural waste and preserving the environment from pollution, especially the waste of the rice crop, which may cause the black cloud in the month of September and October of each year. The most part this waste maybe not to use [(2)]. It has been possible to maximize the use of it at the present time by converting it into several forms, including organic fertilizers (compost), non-traditional fodder, and the production of food and energy from them. It is also included in many industries, such as: papermaking, particleboard, and other uses that help get rid of them and create added value to advancing agricultural and economic development [(1)].

Research problem

The steady increase in population numbers and the growing demand for providing safe food for humans and animals in most countries of the world led to the adoption of policies based on agricultural crop intensification, in addition to the horizontal expansion of the agricultural area with the trend towards food processing. It is what results in a huge increase in agricultural, plant and animal waste, and the risks and environmental damage that may result from these wastes leads to a disruption of the environmental balance and the public health of community members [(5)].Therefore, the use of agricultural waste, especially from the rice crop, in the production of organic fertilizers contributes to improving the properties of agricultural soils and increasing its productivity, in addition to using them in the production of non-traditional fodders that may reduce the deficit in the animal feed balance and maximize the benefit from it, and reduce the percentage of environmental pollution resulting from burning these

wastes. This necessitated studying the current situation of agricultural waste resulting from rice cultivation, as well as measuring the economic impact of its use in agriculture and the expansion of livestock development in Egypt.

Research aims

The research mainly aims to study the current situation of agricultural waste from field crops, especially rice, during the period (2005-2019) and how to benefit from them in the field of organic fertilizer production in agriculture. And in the field of animal production for the production of non-traditional fodder in Beheira Governorate, for a field study for the agricultural season 2020/2021 by studying the following sub-objectives:

First target: Studying the current situation of agricultural waste in Egypt
Second target: Studying the current situation of the number of farm animals and the fodder balance in Beheira Governorate.
Third target: Studying measuring the economic impact of using rice waste in the production of organic fertilizers and non-traditional fodder in Beheira Governorate.

Materials and methods

Study area

Beheira Governorate is one of the governorates that are interested in rice cultivation, Damanhour Center is one of the important agricultural centers in Damanhour Governorate, but is considered the capital of that governorate. The agricultural sample villages were selected from this center due to its diversity of agriculture and animal production

Sampling method and size

A stratified random sample was collected by personal interview method from 120 observations, 60 farmer of the traditional feed users and 60 farmer of the modernized feed users represented in urea-treated rice straw.

Data sources and methodology:

Both descriptive and quantitative methods were used by using simple regression analysis to estimate growth rates for some of the variables included in the research. As well as, the use some of economic indicators and efficiency criteria to show the using efficiency of this type feed. The research relied on published and unpublished secondary data that related to the research topic from its various sources. In addition to the primary data obtained from a random sample of some livestock farms in Beheira Governorate, through the questionnaire collected by personal interview method from 120 observations, accordingly, a stratified random sample was selected in Damanhour Center for 60 holders of the traditional feeding method, and 60 holders of the newly developed feeding method represented by urea-treated rice straw.

Data Analysis

The data was analyzed by using descriptive econometric methods using functions and some arithmetic methods

Results and Discussion

The current situation of agricultural waste in egypt

Groups of field crops: By reviewing the area and quantity of agricultural waste from groups of field crops grown in Egypt during the period (2005-2019) as shown in Tables 1, 2. the following is shown:

Cereal group: The area of cereal group waste ranged between a minimum of about 653.6 thousand feddan in 2007 and a maximum of about 7.33 million feddan in 2013 with an annual average of about 6.95 million feddan, while the amount of grain group waste ranged between a minimum of about 17.31 million ton year 2010, and a maximum of about 20.05 million ton in 2019 with an annual average of about 18.43 million ton. By estimating the equations of the general trend of the area and quantity of agricultural waste from the grain group, it was found that the amount of agricultural waste from the group of grain has taken a general increasing trend and statistically significant at a level of significance of 0.05 with an annual growth rate of about 0.5% By an annual increase of about 92.1 thousand ton, while the statistical significance of the area of agricultural waste from the grain group was not established at different levels of significance.

Table 1. The area and quantity of agricultural waste from groups of crops grown in Egypt during the period (2005-2019).
Area= 1000 feddan* , Quantity 1000 ton

Years	Cereal crop		Legumes crop		Sugar crop		Oil crop		Fiber crop		Total crop	
	Area	Quantity	Area	Quantity	Area	Quantity	Area	Quantity	Area	Quantity	Area	Quantity
2005	6853.9	18274	55.8	74.4	167.3	687	266.5	368.6	656.6	1264	8000.2	20667.6
2006	6749.7	18019	52.3	69.4	186.4	616	258.9	369.7	536.4	1033	7783.7	20107.3
2007	6537.6	17389	242.0	394.9	248.3	621	275.9	420.4	574.6	1120	7878.4	19945.4
2008	7001.3	18604	191.1	312.3	257.7	644	252.5	413.6	312.7	610	8015.2	20583.8
2009	6961	18406	227.1	389.8	264.6	1041	307.3	472.9	284.4	512	8044.4	20821.7
2010	6540	17309	213.5	365.7	385.7	1557	302.0	475.6	402.2	734	7843.4	20441.1
2011	6657.9	17433	155.7	260.1	361.9	1467	282.3	461.2	520.1	975	7977.9	20595.9
2012	7176.3	19122	109.6	183.1	423.8	1720	241.1	389.7	333.4	642	8284.1	22056.4
2013	7327.8	19059	113.7	190.4	460.5	1872	245.0	413.9	286.7	559	8433.6	22094
2014	7296.4	19000	102.8	172.1	507.7	2067	243.0	426.5	369.2	701	8519.2	22366.6
2015	7204.4	18681	90.2	152.7	554.9	2263	276.9	489.6	240.9	440	8367.3	22026.2
2016	7204.4	18404	66.5	112.5	557.6	2279	270.0	469.8	131.7	221	8230.1	21485.9

2017	6950.5	17855	131.5	229.9	523.4	2129	264.7	460.1	216.9	385	8087	21058.5
2018	6767.3	18803	92.8	202.7	492.7	1986	260.2	510.0	335.9	621	7948.9	22122.3
2019	7089.2	20050	75.7	174.3	605.3	2640	264.4	527.8	239.4	467	8273.9	23859.2
Average	6954.5	18427.0	128.0	219.0	399.8	1572.6	267.4	444.6	362.7	685.6	8112.5	21348.8

feddan = 4200 m^2

***Source**: Compiled and calculated from: the Directorate of Agriculture in Beheira, statistics Department, and unpublished data.*

Legume group: The area of legume group waste ranged between a minimum of about 52.3 thousand feddan in 2006 and a maximum of about 242 thousand feddan in 2007 with an annual average of about 128 thousand feddan, while the amount of legumes waste ranged between a minimum of about 69.4 thousand ton in the year 2006 and a maximum of about 394.9 thousand ton in 2007, with an annual average of about 219 thousand ton. By estimating the equations of the general trend of the area and quantity of agricultural waste from the group of legumes, the statistical significance of each of them was not proven at different levels of significance.

Sugars group: The area of sugars group waste ranged between a minimum of about 167.3 thousand feddan in 2005 and a maximum of about 605.3 thousand feddan in 2019 with an annual average of about 399.8 thousand feddan, while the amount of sugars waste ranged between a minimum of about 616 thousand ton in 2006 and a maximum of about 2.64 million ton in 2019 with an annual average of about 1.57 million ton. By estimating the equations of the general trend of the area and quantity of agricultural waste from the group of sugars, it was found that there was a general trend increasing and statistically significant at a significant level of 0.01 with an annual growth rate of about 8.8%, 11% with an annual increase of about 35.2 thousand feddan, 173 thousand ton for each, respectively.

Table 2. General trend equations of the area and quantity of agricultural waste from crops groups grown in Egypt during the period (2005-2019).

Crop	Item	Unit	The Equation	R^2	F	Growth rate %
Cereal crops	Quantity	1000 ton	$\ln \hat{Y}_i = 9.78 + 0.005\ T_i$	0.27	4.71*	0.5
Sugar crop	Area	1000 feddan	$\ln \hat{Y}_i = 5.21 + 0.088\ T_i$	0.89	102.42**	8.8
	Quantity	1000 ton	$\ln \hat{Y}_i = 6.36 + 0.110\ T_i$	0.85	72.91**	11
Oil crop	Quantity	1000 ton	$\ln \hat{Y}_i = 5.94 + 0.019 T_i$	0.56	16.23**	1.9
Fiber crop	Area	1000 feddan	$\ln \hat{Y}_i = 6.37 - 0.070\ T_i$	0.53	14.83**	-.70
	Quantity	1000 ton	$\ln \hat{Y}_i = 7.03 - 0.073\ T_i$	0.52	13.99**	-7.3
Gross total	Area	1000feddan	$\ln \hat{Y}_i = 8.97 + 0.003\ T_i$	0.29	5.38**	0.3
	Quantity	1000 ton	$\ln \hat{Y}_i = 9.90 + 0.009\ T_i$	0.63	22.39**	0.9

*** Significance at 0.01 level.* * Significance at 0.05level.* ***Source**: Calculated from Table1.*

Oils group: The area of oil group waste ranged between a minimum of about 241.1 thousand feddan in 2012 and a maximum of about 307.3 thousand feddan in 2009 with an annual average of about 267.4 thousand feddan, while the amount of oil waste ranged between a minimum of about 368.6 thousand ton year 2005 and a maximum of about.527.8 thousand ton in 2019 with an annual average of about 444.6 thousand ton. By estimating the equations of the general trend of the amount of agricultural waste from the group of oils, it was found that there is a general trend increasing and statistically significant at a significant level of 0.01 with an annual growth rate of about 1.9%, with an annual increase of about 8.4 thousand ton. While the statistical significance of the area of waste of the group of oils was not proven at the different levels of significance

Fiber group: The area of the fiber group waste ranged between a minimum of about 131.7 thousand feddan in 2016 and a maximum of about 656.6 thousand feddan in 2005 with an annual average of about 362.7 thousand feddan, while the amount of fiber group waste ranged between a minimum of about 221.0 thousand ton In 2016, a maximum of about 1.264 million ton was reached in 2005, with an annual average of about 685.6 thousand ton. By estimating equations, the general time makes the area and quantity of agricultural waste from the fiber group the presence of a general decreasing and statistically significant trend at a significant level of 0.01, an annual form of about 7%, an annual decrease of 7.3%, amounting to about 25.4 thousand feddan, 50 ton for each, respectively.

Total groups of field crops: The total area of agricultural waste for groups of field crops ranged between a minimum of about 7.78 million feddan in 2006 and a maximum of about 8.52 million feddan in 2014 with an annual average of about 8.11 million feddan, while the amount of agricultural waste of groups of field crops ranged between minimum of about 19.95 million ton in 2007 and a maximum of about 23.86 million ton in 2019, with an annual average of about 21.35 million ton. By estimating the equations of the general time trend for the total area and quantity of agricultural waste from groups of field crops, it was found that there was a general increasing and statistically significant trend at a significant level of 0.01 with an annual growth rate of about 0.3%, 0.9% with an annual increase of about 24.3 thousand feddan, 192.1 thousand ton for each, respectively.

The relative importance of rice crop waste in Egypt: by reviewing the relative importance of rice waste from grain group waste and the total waste during the period (2005-2019) as shown in Table 3. it was found that the rice area ranged between a minimum of about 850 thousand feddan per year 2018 and a maximum of about 1.77 million feddan in 2008, with an annual average of about 1.38 million feddan, while the amount of waste generated ranged between a minimum of about 1.87 million ton in 2018, and a maximum of about 3.89 million ton, with an annual average of about 3.00 million ton. By estimating the equations of the general time trend of the area and quantity of rice waste in Egypt during the period (2005-2019), it was found that it takes a

general decreasing and statistically significant trend at a significant level of 0.05 with an annual decrease rate of about 2.4%, 2.4% and an annual decrease of about 33.02 thousand feddan, 72.1 thousand ton each, respectively.

The relative importance of the rice area of the grain group area ranged between a minimum of about 12.56% in 2018 and a maximum of about 25.54% in 2007 with an annual average of about 19.81%, while the amount of rice crop waste from the amount of grain group waste ranged between a minimum of about 9.95 % in 2018 and a maximum of about 21.61% in 2007, with an annual average of about 16.33%. While, the relative importance of the rice area in the total area of field crops showed that it ranged between a minimum of about 10.69% in 2018 and a maximum of about 22.08% in 2008 with an annual average of about 16.98%, while the relative importance of the amount of rice waste from the total amount of waste of field crop groups ranged Between a minimum of about 8.45% in 2018 and a maximum of about 18.92%, with an annual average of about 14.14%.

Chemical analysis of rice waste: By reviewing the chemical analysis of rice crop waste for the production of bioenergy and organic fertilizers as shown in Table 5. it was found that the moisture content was about 13%, and the organic matter and organic carbon amounted to about 42.19%, 47.67% for each The ratio of nitrogen, phosphorous and potassium was about 0.612%, 0.34%, 0.517% for each of them, respectively, while the ratio of carbon: nitrogen was 78:1, while the ratio of hemicelluloses was about 19%-27%, the percentage of cellulose was about 32%-47%, and the percentage of lignin, carbohydrates and protein was about 5-24%, 5-36%, 2-4% for each of them, respectively, while the percentage of fats and waxes was about 1%, while The percentage of fiber and ash is about 40%, and 12.5% for each of them, respectively. This means that the content of rice straw is rich in organic matter and carbohydrates, which raise the properties of the soil and thus increase productivity.

Table 3. The relative importance of rice waste from the waste of the grain group and the total waste during the period (2005-2019)

Years	Rice		The relative importance of rice waste of the grains group		The relative importance of rice waste from the total waste	
	Area 1000 feddan	Waste quantity 1000 ton	Area (%)	Quantity (%)	Area (%)	Quantity (%)
2005	1460	3212.0	21.30	17.58	18.25	15.54
2006	1590	3545.7	23.56	19.68	20.43	17.63
2007	1670	3757.5	25.54	21.61	21.20	18.84
2008	1770	3894.0	25.28	20.93	22.08	18.92
2009	1370	2918.1	19.68	15.85	17.03	14.01
2010	1090	2321.7	16.67	13.41	13.90	11.36
2011	1410	3003.3	21.18	17.23	17.67	14.58
2012	1470	3160.5	20.48	16.53	17.74	14.33
2013	1420	3053.0	19.38	16.02	16.84	13.82
2014	1360	2924.0	18.64	15.39	15.96	13.07
2015	1220	2623.0	16.93	14.04	14.58	11.91
2016	1350	2902.5	18.74	15.77	16.40	13.51
2017	1310	2816.5	18.85	15.77	16.20	13.37
2018	850	1870.0	12.56	9.95	10.69	8.45
2019	1300	3055.0	18.34	15.24	15.71	12.80
Mean	1376	3003.8	19.81	16.33	16.98	14.14

***Source**: compiled and calculated*

1- Ministry of Agriculture, Economic Affairs Sector, Central Administration of Agricultural Economy, Agricultural Statistics Bulletin, Cairo, miscellaneous issues.

2- Ministry of Agriculture, Economic Affairs Sector, Central Administration of Agricultural Economy, Bulletin of Costs and Net Return, Cairo, miscellaneous issues.

Table 4. General trend equations of rice waste area and quantity in Egypt during the period (2005-2019)

Item	Unit	The Equation	R^2	F	Growth rate %
Area	1000 feddan	$\hat{Y}_i = 7.1 - 0.024\ T_i$	0.38	7.82*	-2.4
Waste quantity	1000 ton	$\hat{Y}_i = 8.18 - 0.024\ T_i$	0.34	6.67*	-2.4

** Significance at 0.05 level.*

Source: Calculated from Table 3.

Table 5. Chemical analysis of rice waste.

Characteristic	Percentage	Characteristic	Percentage
Moisture	13	Cellulose	47 – 32
Organic matter	82.19	Lignin	24- 5
Organic carbon	47.67	Carbohydrates	36.5
Nitrogen	0.612	Protein	4-2
Phosphorous	0.34	Fat and wax	1
Potassium	0.517	Fiber	40
C : N	1: 78	Ash	12.5
Hemicelluloses	27 – 19	-	-

***Source**: Ministry of Agriculture and Land Reclamation, Agricultural Development Program, Project for Biological Analysis of Agricultural Waste to Compost, 2016*

The importance of the agricultural waste of rice in the Behaira governorate: By reviewing the area of the rice crop cultivated in the Behaira governorate during the period (2005-2019) as shown in Tables6, 7. it was found that the area of the rice crop ranged between a minimum of about 116.4 thousand feddan. In 2018, a maximum of about 247.9 thousand feddan in 2007 with an annual average of about 188.4 thousand feddan, while the amount of rice crop waste in Beheira Governorate ranged between a minimum of about 269.2 thousand ton in 2018 and a maximum of about 551.6 thousand ton in 2007 with an annual average of about 421.7 thousand ton. By reviewing the relative importance of the area and quantity of rice waste in Beheira Governorate for Egypt, it was found that the relative importance of the area ranged between a minimum of about 12.32% on 2016 and a maximum of about 14.96% in 2011 with an annual average of about 13.7%. The relative importance of the amount of waste relative to the amount of rice waste in Egypt ranged between a minimum of about 12.75% in 2016 and a maximum of about 15.62% in 2011 with an annual average of about 14%.

By reviewing the relative importance of the area and quantity of rice waste in Behaira governorate for the group of grains, it was found that the relative importance of the area ranged between a minimum of about 1.72% in 2018 and a maximum of about 3.79% in 2007 with an annual average of about 2.7%. The relative importance of the amount of waste relative to the amount of waste from the grain group in Egypt ranged between a minimum of about 1.43% in 2018 and a maximum of about 3.17% in 2007, with an annual average of about 2.3%. By estimating the equations of the general trend of the area and quantity of rice waste in Beheira Governorate during the period (2005-2019) as shown in Table 7. it was found that it takes a general decreasing and statistically significant trend at a significant level of 0.01 with an annual decreasing rate of about 2.8%, 2.5% and by the amount of decrease Annually, it amounted to about 5.27 thousand feddan, and 10.54 thousand ton each, respectively.

Table 6. The relative importance of rice area and waste quantity in Beheira Governorate and its percentage of the grain group during the period (2005-2019).

Years	Beheira Governorate		Rice waste relative importance of Egyptian rice		Rice waste relative importance of the grains group	
	Rice area 1000 feddan	Waste quantity 1000 ton	Area (%)	Waste quantity	Area (%)	Waste quantity
2005	195.8	435.6	13.41	13.56	2.86	2.38
2006	216.2	481.0	13.60	13.57	3.20	2.67
2007	247.9	551.6	14.84	14.68	3.79	3.17
2008	232.9	518.3	13.16	13.31	3.33	2.79
2009	200.2	445.5	14.62	15.27	2.88	2.42
2010	154.8	344.5	14.20	14.84	2.37	1.99
2011	210.9	469.2	14.96	15.62	3.17	2.69
2012	199.9	444.8	13.60	14.07	2.79	2.33
2013	188.8	420.1	13.30	13.76	2.58	2.20
2014	176.7	393.2	12.99	13.45	2.42	2.07
2015	162.6	361.7	13.32	13.79	2.26	1.94
2016	166.3	370.0	12.32	12.75	2.31	2.01
2017	164.1	365.1	12.53	12.96	2.36	2.04
2018	116.4	269.2	13.70	14.40	1.72	1.43
2019	192.1	456.3	14.78	14.94	2.71	2.28
Mean	188.4	421.7	13.7	14.0	2.7	2.3

***Source**: compiled and calculated*

1- Ministry of Agriculture, Economic Affairs Sector, Central Administration of Agricultural Economy, Agricultural Statistics Bulletin, Cairo, miscellaneous issues.

2- Ministry of Agriculture, Economic Affairs Sector, Central Administration of Agricultural Economy, Bulletin of Costs and Net Return, Cairo, miscellaneous issues.

Table 7. General trend equations office area and waste quantity in Buhaira Governorate during the period (2005-2019)

Item	Unit	The Equation	R^2	F	Growth rate %
Area	1000 feddan	$Ln\hat{Y}_i = 5.44 - 0.028\ T_i$	0.44	10.09**	-2.8
Waste quantity	1000 ton	$Ln\hat{Y}_i = 6.23 - 0.025\ T_i$	0.38	8.08**	-2.5

*** Significance at 0.01Source: Calculated from Table 6.*

The current situation of the number of farm animals and the fodder balance in beheira governorate

The current situation of the number of heads of farm animals in Beheira Governorate: It was shown from the development of the numbers of heads of farm animals in Egypt during the period (2005-2019), which is shown in Tables8, 9.show the following: The number of cows ranged between a minimum of about 334 1000 head in 2019 and a maximum of about 750,000 head in 2009 with an annual average of 610 thousand head of cows. The number of buffaloes ranged between a minimum of about 124,000 heads in 2019 and a maximum of about 578,000 heads in 2007, with an annual average of 423,000 heads. The number of sheep ranged between a minimum of about 224 thousand heads in 2019 and a maximum of about 740 thousand heads in 2011, with an annual

average of 534,000 heads of sheep. While the number of goats ranged between a minimum of about 54 thousand head in 2019 and a maximum of 402 thousand head in 2011, with an annual average of 310 thousand head of goats.

While the number of camels ranged between a minimum of about 3 thousand heads in 2019 and a maximum of about 7 thousand heads in 2011, with an annual average of 6 thousand heads of camels. By estimating the equation of the general temporal trend of the numbers of cows, buffalo and sheep during the period (2005-2019), it was found that there is a general statistically significant decreasing trend at a significant level of 0.01 with an annual decreasing rate of about 3.8%, 5.1%, 6% with an annual decrease rate of about 23.2 thousand heads, 21.6 thousand heads, 32 thousand heads each, respectively. While by estimating the equation of the general temporal trend of the number of camels, it was found that there is a general statistically significant decreasing trend at a significant level of 0.05, with an annual rate of decrease of about 3.8%, with an annual decrease rate of about 200 heads.

Table 8. Evolution of farm animals numbers at Beheira Governorate During the period 2005-2019

(1000 heads)

Years	Cows	Buffaloes	Sheep	Goats	Camels
2005	672	441	571	288	7
2006	690	448	588	293	7
2007	709	578	725	371	7
2008	724	485	729	393	7
2009	750	512	730	395	7
2010	742	495	732	401	6
2011	712	489	740	402	7
2012	429	425	410	279	3
2013	660	411	441	268	4
2014	576	419	414	272	5
2015	537	384	442	290	6
2016	579	360	450	297	6
2017	499	384	365	362	5
2018	537	384	442	290	6
2019	334	124	224	54	3
Mean	610	423	534	310	6

Source: *Compiled and calculated from: Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Central Administration of Agricultural Economy, Livestock Statistics Bulletin, miscellaneous issues.*

Table 9. General trend equations of the development of the animal heads numbers in Beheira Governorate during the period (2005-2019)

Item	Equations	R^2	**F**	**Growth rate (%)**
Cows	$\text{Ln } \hat{Y}_i = 6.69 - 0.038\ T_i$	0.54	15.36**	-3.8
Buffaloes	$\text{Ln } \hat{Y}_i = 6.41 - 0.051\ T_i$	0.43	9.73**	5.1
Sheep	$\text{Ln } \hat{Y}_i = 6.71 - 0.060\ T_i$	0.61	20.67**	-6.0
Goats	$\text{Ln } \hat{Y}_i = 2.01 - 0.038\ T_i$	0.32	6.17*	-3.8

*** Significant at level 0.01 .* * Significant at level 0.05 .Source: It was collected and calculated from the data in Table 8.*

Feed balance in Beheira Governorate: It was found from the estimate of animal units, needs and feed balance in Beheira Governorate during the period (2005-2019) as shown in Tables 10,11.that the number of animal units ranged between a minimum of about 555,000 animal units. In 2019, a maximum of about 1.61 million animal units in 2007, with an annual average of about 1.34 million animal units, and the needs of green fodder ranged between a minimum of about 3.41 million ton in 2012, while the minimum amount of hay and concentrated feed reached about 444, and 738.2 thousand Ton in 2019 for each of them, respectively and a maximum of about 5.36, 1.29, 2.14 million ton in 2007, with an annual average of about 4.47, 1.07, 1.79 million ton.

It is evident from the availability of fodder in the Behaira governorate that the availability of green fodder ranged between a minimum of about 5.29 million ton in 2015 and a maximum of about 55.03 million ton in 2017 with an annual average of about 15.83 million ton, while the available of straw ranged between a minimum It reached about 1.88 million ton in 2010, and a maximum of about 2.69 million ton in 2019 and an annual average of about 2.09 million ton.

While the availability of concentrated feed ranged between a minimum of about 37 thousand ton in 2007 and a maximum of about 136 thousand ton in 2015, with an annual average of about 71 thousand ton. By estimating the equations of the general time trend available from the available data, it was found that there was an increasing and statistically significant general trend at a significant level of 0.05, with an annual growth rate of about 1.2%, with an annual increase of about 25.05 thousand ton, while the statistical significance was not established for each of the number of animal units, available from green fodder and concentrated feed at different levels of significance as shown in Table 11.

Table 10. Farm animal forage needs*, available ones and the balance of feed in Beheira Governorate during the period (2005-2019) (1000 ton)

Years	Units animal number (1000 Unit)	Forage needs			Feed available			balance of feed		
		Green Fodder	Straw	Concentrated feed	Green Fodder	Straw	Concentrated feed	Green Fodder	Straw	Concentrated feed
2005	1378	4589	1102	1833	7421	2021	76	2832	1078	1757-
2006	1399	4659	1119	1861	7260	2006	57	2601	887	1804-
2007	1609	5358	1287	2140	8260	2027	37	2902	740	2103-
2008	1509	5025	1207	2007	7721	2111	59	2696	904	1948-
2009	1569	5225	1255	2087	7091	1996	78	1866	741	2009-
2010	1539	5125	1231	2047	5967	1880	82	842	649	1965-
2011	1502	5002	1202	1998	6127	1996	61	1125	794	1937-
2012	1023	3407	818	1361	6002	2059	60	2596	1241	1300-
2013	1240	4129	992	1649	6001	1931	79	1871	939	1571-
2014	1192	3969	954	1585	5967	1904	134	1996	950	1452-
2015	1155	3846	924	1536	5289	2024	136	1442	1100	1401-
2016	1540	5128	1232	2048	51752	2005	43	46624	773	2005-
2017	1408	4689	1126	1873	55031	2028	47	50342	902	1826-
2018	1519	5058	1215	2020	52110	2642	47	47052	1427	1973-
2019	555	1831.5	444	738.15	5421	2685	65	3589.5	2241	673.15-
Mean	1342	4469	1074	1786	15828	2088	71	11358	1024	1715-

** Cow or horse = 1 animal unit, buffalo = 1.25 animal unit, goat = 0.07 animal unit, sheep = 0.1 animal unit, camel or mule = 0.75 animal unit, donkey = 0.5 animal unit,*

*** The needs of an animal unit are estimated at about 3.33 ton of green fodder, 0.8 ton of hay, 1.33 ton of concentrated feed per year.*

***Source**: 1. Ahmed Kamal Abu Raya, Animal and Poultry Nutrition, Modern Scientific Foundations, Diets and Fodder, Dar Al Maaref, second edition, Cairo, 1969 (1).*

2. Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Central Administration of Agricultural Economy, Livestock Statistics Bulletin, miscellaneous issues.

By reviewing the feed balance in Beheira Governorate, as shown in Table 10. it is clear that the green fodder balance ranged between a minimum of about 842 thousand ton in 2010 and a maximum of about 50.34 million ton in 2017, with an annual average of about 11.36 million ton, while the feed balance ranged of milk between a minimum of about 649 thousand ton in 2010, and a maximum of about 2.24 million ton in 2019 and an annual average of about 1.02 million ton.

While the decrease in the balance of concentrated feed ranged between a minimum of about 673.15 thousand ton in 2019 and a maximum of about 2.1 million ton in 2007, with an annual average of about 1.72 million ton.

By estimating the equations of the general trend of the balance of green fodder and hay in Beheira Governorate, it was found that there was a general increasing and statistically significant trend at a significant level of 0.05, with an annual growth rate of about 16.5%, 3.7%, with an annual increase of about 1.78 million ton, 37.9 thousand ton for each of them, respectively, While the statistical significance of the feed balance of concentrated feed was not proven at the different levels of morale as shown in Table 11.

Measuring the economic impact of using rice waste in the production of organic fertilizers and non-traditional fodder in Beheira governorate.

Using rice waste in the production of organic fertilizer (compost): The quality of compost depends on the nature of the raw materials from which the compost piles are built. The mixture of plant and animal wastes, which should have a ratio of C/N Ratio at the beginning of building the pile, revolves around 30:1 as shown in Table 11.Fertilizers elements are often found in organic fertilizers in an insoluble form. After being added to the soil, it is exposed to microbial activity, causing it to turn into a soluble form suitable for plant uptake. Studies that dealt with the mineralization of fertilizer elements with organic fertilizer indicate that 40% of the nitrogen, phosphorous and potassium elements are facilitated during the first year, 30% in the second year, and 20% in the third year.

An addition to organic fertilizer is considered essential for most crops, not only for its content of sadistic elements, but for its effect in raising the organic content of the soil, and the consequent increase in the vital activity of microorganisms in the soil, which fixes the nitrogen of the atmosphere and secretes growth regulators that directly effect on cultivated crop.

Table 11. General trend equations of farm animals annual feed needs, the available ones and the feed balance in Beheira Governorate (2005-2019) (1000 ton)

Item	Equations	R^2	F. Ratio	Growth rate
Straw available	$Ln\hat{Y}_i = 7.54 + 0.012\ T_i$	0.28	4.99*	1.2
Green fodder balance	$Ln\hat{Y}_i = 6.93 + 0.165\ T_i$	0.29	5.39*	16.5
Straw balance	$Ln\hat{Y}_i = 6.58 + 0.037\ T_i$	0.29	5.25*	3.7

** Significant at the 0.05 .level of significance. Source: It was collected and calculated from the data in Table 10.*

Table 12. Chemical analysis of crop waste with a ratio of C/N between 1: 30 to 1: 100

Plant waste	C%	N%	C/N	OM%	Ash%	P%	K%
Pepper stalk	53.5	0.95	56:1	92.28	7.72	0.03	2.24
Onion haulm	43.9	0.77	57:1	75.62	24.4	0.3	1.17
Vegetables	43.9	0.77	57:1	75.6	24.4	0.3	1.17
Barley straw	46.3	0.66	70:1	79.7	20.3	0.11	2.11
Olive prune	54.9	0.78	70:1	94.6	5.38	0.19	0.98
Sunflower stalk	50.8	0.67	76:1	87.50	12.50	0.24	1.14
Denaiba straw	50.4	0.65	77:1	86.8	13.2	0.67	0.3
Corn straw	50.3	0.61	83:1	86.8	13.2	0.38	1.2
Cotton stalk	54.2	0.64	85:1	93.4	6.59	0.45	0.35
Wheat straw	47.0	0.54	87:1	81	19.1	0.19	1.25
Sugar cane bagasse	54.7	0.59	93:1	94.3	5.74	0.07	0.34
Rice straw	48.0	0.50	96:1	82.8	17.2	0.31	0.89

***Source**: Ministry of Agriculture and Land Reclamation, Agricultural Development Program, Biological Analysis of Agricultural Waste Project*

The economic impact of compost production: It is clear from the data of Table 13. that the total costs of producing compost from rice straw resulting from the cultivation of an feddan of rice crop amounted to about 1190 pounds, including each of the value of rice straw, where an feddan produces an average of 2.5 ton of straw at a value of about 400 pounds, representing about 33.6% of the total costs, followed by the cost of human labor, the value of renting the pile floor, and automated work with a value of about 180, 160, 150 pounds, representing about 15.13%, 13.45%, 12.61% of the total costs for each of them, respectively. Then the cost of municipal fertilizers, additives and activators, and transportation at a value of about 137.5, 125, 37.5 pounds, representing about 11.55%, 10.5%, 3.15% of the total costs for each of them, respectively. The amount of compost produced from the heap is estimated at about 3.5 ton (70% of the weight of the inputs), with a value of about 1750 pounds, meaning that the net return achieved from the heap amounted to about 560 pounds, in addition to the net return from the main crop, achieving an increase in the income of rice farms. The ratio of revenues to costs amounted to about 1.47, meaning that the return on the spent pound amounted to about 0.47 pounds, during the period of work of the heap, which ranges from 3-4 months, and the added value from the production of a feddan of straw as a secondary product amounted to about 1087.5 pounds.

The economic impact of using rice waste in the production of non-traditional feeds: The economic impact of using urea-treated rice straw in feeding milk cattle with the research sample can be measured through the following:

Costs of manufacturing a ton of urea-treated rice straw: It is clear from the data in Table 14. that the total costs of manufacturing urea-treated rice straw for the average quantities of straw manufactured by the sample farmers (3.4 ton per farm) amounted to about 1125.16 pounds, while the cost of Manufacturing a ton of urea-treated rice straw about 326.9 pounds, the price of a ton of rice straw represents a percentage of about 57.02%, while the cost of plastic represents a percentage of 16.4%, while the price of urea, the cost of human labor, represents a percentage of about 15.67%, 10.89% of Total manufacturing costs per ton of rice straw respectively.

Table 13. The economic impact of compost production from rice straw resulting from the cultivation of a feddan of rice in 2019/2020

Item	Unit	Quantity	Unit Price	Value	% of total cost
Pile floor rent	M^2	20	2	160	13.45
Rice straw	Ton	2.5	160	400	33.61
Organic fertilizer	M^3	2.5	55	137.5	11.55
Automation	Hour	1.5	100	150	12.61
Labor	Man/day	2	90	180	15.13
Transfer	Pound/ton	2.5	15	37.5	3.15
Additives and activators	Kg.	50	2.5	125	10.5
Total costs	Pound, %			1190	100
Compost value	Ton, pound	3.5	500	1750	
Net return	Pound			560	
Benefit/cost	Ratio			1.47	
The pound Return	Pound			0.47	
Value Added*	Pound			1087.5	

** Value added = value of production - value of production inputs*

Source: Estimated according to the agricultural extension data in Abu Homs Center on the compost piles implemented in the villages of the center during the 2019/2020 agricultural season.

Table 14. Average of manufacturing costs Items per ton of rice straw treated with urea in the research sample.

Item	Unit	Labor (Man/day)	Plastics (m^2)	Straw (ton)	Urea (kg.)	Total cost (Pound)
Quantity, number		3.5	36.4	3.4	67.8	
Unit price	Pound	35	7.0	1.7	2.6	
Value	Pound	122.5	184.8	641.58	176.28	1125.16
Ton cost	Pound	35.71	52.41	187.41	51.41	326.9
% of total cost		10.89	16.42	57.02	15.67	100.00

Source: *The results of the research questionnaire were calculated from the data*

The effect of using rice straw treated with urea on the average daily ration costs for a head of dairy cattle in the research sample: It is clear from the data in Table 15. that the average total costs of the daily ration of milk cattle in the case of using the traditional ration amounted to about 19.9, 27.2 and 28.5 pounds for municipal cows, mixed cows and buffaloes, respectively, while the daily ration costs for the head in the case of using urea-treated rice straw amounted to about 19.1, 23.5 and 24.6 pounds, respectively. Which means achieving a reduction in the costs of the daily feed for the head as a result of the use of rice straw treated with urea, amounting to about 0.8, 3.7, 3.9 pounds per head for each of the municipal cows, mixed cows and buffaloes, respectively, with a decrease in the costs of the daily ration amounted to about 4%, 13.6%, 13.7% on the arrangement. The decrease in the cost of the daily ration after using treated rice straw is due to the fact that farmers reduced the used quantities of alfalfa and concentrated feed and replaced them with low-cost urea-treated straw.

The effect of using rice straw treated with urea on the average daily head of dairy cattle: From the results of the research sample, it was found that the average daily head of dairy cattle in the case of feeding on the traditional ration was about 7.1, 11.33, 8.5 kg/day for municipal cows, mixed cows and buffaloes, respectively, while the share of the cost per kilogram of the cost of the daily ration Typical are about 2.8, 2.4, and 3.35 pounds/kg for domestic cows, crossbreeds, and buffaloes, respectively. While the average daily yield in the case of feeding on rice straw treated with urea was about 7.22, 11.63, 9.2 kg/day, while the share of the cost per kilogram of the cost of the daily ration treated with urea was about 2.65, 2., 2.67 pounds / kg for municipal cows, mixed cows, and buffaloes, respectively, with a daily increase of 0.12, 0.3, 0.7 kg / day, with an increase of about 1.7 %, 2.6%, 8.2% for each of them in the same order. As for the average daily return of dairy cattle in the case of feeding on the traditional diet, it amounted to about 35.5, 56.6, 59.5 pounds per head for each of the municipal cows, mixed cows, and buffaloes, respectively. . While the average yield of feeding on urea-treated rice straw amounted to about 36.1, 58.2, and 64.4 pounds per head, respectively, with an increase of about 0.6, 1.5, 4.9 pounds, representing about 1.7%, 2.6%, and 8.2%of the average daily head yield without using treated rice straw for domestic cattle, crossbreed cattle, and buffalo, respectively.

Table 15. The economic impact of using urea-treated rice straw on the average daily ration costs per kilogram of milk product and the total additional returns to the head of dairy cattle in the research sample

Items			local cows	Hybrid cows	Buffaloes
Fodder kind	Traditional	Fodder cost (L.E.)	19.9	27.2	28.5
		Production average	7.1	11.33	8.5
		Average cost of 1 liter of milk	2.8	2.4	3.35
	Straw treated with urea	Fodder cost (L.E.)	19.1	23.5	24.6
		Production average	7.22	11.63	9.2
		Average cost of 1 liter of milk	2.65	2.02	2.67
Fodder cost	Cost deducted		0.8	3.7	3.9
	Deduction Percent (%)		4.0	13.6	13.7
Milk increase	Wight increase		0.12	0.3	0.7
	Increasing percent		1.7	2.6	8.2
Revenue of milk	Milk price		5	5	7
	Using traditional fodder		35.5	56.65	59.5
	Using straw treated with urea		36.1	58.15	64.4
Invested pound interest		Amount of increasing	0.6	1.5	4.9
		Increasing prevent	1.7	2.6	8.2
Added value of an animal production			1.4	5.2	8.8

Source*: It was collected and calculated from the data of the research sample.*

Conclusion

The results showed that the total additional returns (total additional benefits) that were achieved as a result of using urea-treated rice straw in the ration of milk cattle amounted to about 1.4, 5.2, and 8.8 pounds per head for each of the municipal cows, mixed

cows and buffaloes, respectively. These additional returns are due to two factors, the first of which is the increase in the return due to the increase in the average productivity of the head of milk, and the second is the savings in feeding costs for the head.

Recommendations

From the results abovethe research recommends some recommendations as the following

The necessity of expanding the use of agricultural waste in the production of non-traditional feeds that contributes to reducing the animal feed gap, especially concentrated feed in the field of dairy cattle production.

Activating the role of non-governorate organizations (NGOs) working in the field of agriculture, especially projects funded by the Social Fund and micro-projects funded by special funds in the governorates to train and qualify natural cadres working in the field of agricultural production to produce nontraditional fodder, compost, silage, biogas, product paper from rice straw,wood particle from firewood and other secondary products extracted from waste in order to preserve the local environment on side, on other side adding an economic return to farmers by making maximum use of these wastes.

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