Advances in Social Sciences Research Journal – Vol. 12, No. 07
Publication Date: August 01, 2025
DOI:10.14738/assrj.1207.19173.
Al-Thamir, S. N. K. (2025). Recycling Agricultural Waste in Iraq and Ways to Benefit from it Economically. *Advances in Social Sciences Research Journal*, 12(07). 401-410.

Recycling Agricultural Waste in Iraq and Ways to Benefit from it Economically

Samira Nema Kamil Al-Thamir
University of Al-Qasim Green, College of Agriculture, Iraq

ABSTRACT

The research was conducted with the aim of shedding light on the volume of annual waste and the large losses that occur as a result of wasting enormous national wealth, most of which are neglected or burned as a result of not adopting a wise policy in the exploitation of these resources. The quantities of lignocellulosic materials were estimated for the agricultural wastes of the most important crops, as well as the orchards and reeds being the most important and widespread annual plants, The approved national and international data were adopted in calculating the per capita consumption rate of cellulosic industries and compressed boards, and then Iraq's need in the light of international rates, The research proved that there are about (20) million tons annually of lignocellulosic materials in Iraq, at the least estimates, of which only a small part is used, The results of the research indicated that Iraq's annual consumption of paper exceeds (2) million tons, and its consumption of compressed boards is more than one million tons, based on global consumption rates, The results also showed that the annual costs of importing paper (calculated on the basis of the global consumption rate) exceed (1.5) billion dollars, and these combined with other products can exceed the costs of importing (2.5) billion dollars. The research came out with a set of conclusions and recommendations to the concerned authorities to adopt various projects. To exploit these forgotten resources in places provided by beginners with grain crop residues.

Keywords: Agricultural waste, Lignocellulosic materials, Pulp and Paper, Composite Panels.

INTRODUCTION

Agricultural residues are vital products of food-making processes in various plants that remain in the fields after obtaining the main product or crop. Agricultural waste is considered a heavy burden on the environment, especially since the improper disposal of these waste reflects wrong practices represented in wasting a valuable productive element that is available in the agricultural lands cultivated by the farmer. Moreover, may contribute to increasing soil fertility and entering into new and valuable industries if used properly **[11]**

A lot of agricultural production is characterized by a large number of by-products, most of which are considered agricultural waste there is a long list of these materials, the presence and abundance of which varies in different countries. Perhaps the most important of them are wheat straw, barley straw, rice field residues, rice husks, corn field residues, corn stalks, Sunflower stalks, vegetable crop waste, and others.

These wastes, if annual plants, some bushes, and pruning products in orchards, forests, and trees are added to them all together, they will take a more comprehensive title, which is what is called "lignocellulosic materials," which is an expression of materials that contain cellulose and lignin in their composition other than tree wood (Non-wood lignocellulosic materials).

There are various systems and means of recycling agricultural waste to maximize its utilization, depending on the type of this waste, the available methods and technologies, and the purpose of recycling. One of the most important aspects of exploitation is converting it into organic fertilizers, fodder for animals, or producing paper and using it in the production of clean energy. Which contributes to achieving clean agriculture, protecting the environment from pollution, improving agricultural products, providing employment opportunities in the countryside. Thus improving the economic and environmental situation and raising the level of health and social **[7].**

Progress in biotechnology has led to the adaptation of microorganisms to convert compounds and organic waste into economical products. While preserving the environment from pollution, as well as exploiting the ability of these microorganisms in the production of food, fodder, bioenergy, intermediate compounds and wastewater purification, in addition to resisting the negative impact. These microorganisms have the delicate sense to preserve human health and sources of wealth.

The quantities of agricultural waste in the Arab world are estimated at about 500 million tons, of which 81% are animal and the remainder are plant **[15],** They are approximate numbers and the actual may be higher. As for Iraq, there are no accurate statistics on the amounts left in the agricultural fields because we still do not consider that important. Iraq, with its environmental diversity and the capacity of its agricultural area, produces millions of tons of these materials annually, and although some of them are used in limited areas, they are not only left unexploited, which would be a waste of wealth **[8].**

One of the important matters for the settlement of organic agriculture in Iraq is the conversion of organic waste and agricultural by-products into organic fertilizers. because Iraq is located in semi-arid areas, where there is scarcity of rain, lack of vegetation cover, high temperature, as well as an intensive farming system, and therefore there is a lack of organic matter and natural bio fertilizers to preserve Soil fertility and rational use of chemical fertilizers.

Research Problem

The problem of the research is that the large number of plant agricultural wastes in general and as a result of not benefiting from them by recycling these wastes, which leads farmers to dispose of them in a wrong and harmful way to the environment, most of them by burning,. And this leads to serious environmental, health and economic damages on the one hand and waste of a valuable resource, Economic value and great economic benefit.

Search Goal

The research aims to shed light on the issue of agricultural waste recycling because it is one of the vital topics of great importance, and to try to find ways to exploit these lost resources in ways that achieve environmental, economic and social goals.

Data Sources

The primary data was relied on from its sources through field research and personal interviews with owners of farms that produce different crops in several regions of the country, as well as using official statistics from government sources.

Research Method

To achieve the objectives of the study, the analytical descriptive approach was used, which focuses on describing the phenomenon under study through the availability of sufficient and accurate information during a certain period of time in order to obtain practical results.

RESULTS AND DISCUSSIONS

The Most Important Aspects of Benefiting from Agricultural Waste

For maximizing the utilization of agricultural waste, it is treated by mechanical, biological and chemical methods to be converted into important products needed by man in various fields. Through this, an important aspect of the sustainable use of natural resources is achieved. Among the most important known aspects of exploitation of agricultural waste are the following:

Compost Industry:

It is a natural organic fertilizer resulting from the process of biodegradation by microorganisms of plant and animal waste under certain conditions of temperature and humidity. Compost is known for its significant impact on increasing agricultural production as it is a source of nitrogen and a factor in improving soil properties such as increasing the ability of sandy soils to retain water, improving the construction of clay soils and increasing their permeability. Exchange capacity, improve PH, and convert insoluble elements into soluble, which facilitates absorption, and so on. This type of fertilizer does not contain some of the chemical elements that have a negative effect on the soil, which are contained in chemical fertilizers **[16]**

Energy Production:

Where methane is produced as a renewable source of energy through anaerobic fermentation of solid and liquid waste, including agricultural waste, in an economical, safe and supportive way to protect the environment from pollution. This type of exploitation would contribute to the rationalization of energy consumption from its traditional sources, and provide protection for biomass from direct burning. Methane is included in the production of biogas, which is a mixture of methane (50-70) and carbon dioxide (20-25) with other gases (5-10%). It is a non-toxic gas and there are no risks from its use. Its calorific value is (3170-6625) kcal/m3 **[5].**

Animal Feed:

Agricultural waste is converted into fodder for animals after cutting it and improving its suitability by biological methods. The waste is treated after softening by evaporation under a certain pressure and temperature, or it is treated with urea, ammonia, or some acids or bases, in order to increase the percentage of protein in it and improve its digestive properties. Residues such as rice straw and cane sawdust may also be used as a ground for scattering barley seeds, whereby when the seedlings grow; they are combined as a fodder mixture to feed the animals. The green agricultural waste may be buried under pressure under the surface of the earth to make silage, as it is green fodder that can be provided throughout the year and has its own advantages in this field **[6].**

URL: http://dx.doi.org/10.14738/assrj.1207.19173

Cellulosic Industries and Pressed Boards:
These materials can be adopted as a raw material for the production of cellulosic pulp. and paper industry (Pulp and Paper) and the production of composite panels (Composite Panels), that they contain fibers at rates close to what is contained in tree wood makes it an alternative material for it in obtaining these fibers.

Which constitute a basis material for a huge number of industries based on cellulose, lignin and other chemical components, and in the field of board industry, fibers constitute a weight of more than 99% of the weight of the fiber board.

The minced waste accounts for more than 90% of the weight of the particleboard. Many studies and researches have been conducted to produce various types of Pressed boards and confirmed the validity of most of them and recommended their use in this field, which included papyrus, reeds, palm fronds, sun flower stems, cotton plant stems **[1]** and corn stalks **[2].**

These materials may be used alone or mixed with tree wood to improve certain characteristics for specific uses with mixing ratios determined by the properties of each material used in production **[12].**

Farming on Agricultural Waste:
This method is used in lands that suffer from soil problems such as severe salinity or infection with soil diseases, whether in greenhouses or in the open field. Residues are stacked on the soil, as happens with rice husks, where vegetables are grown on them. Rice husks, cotton firewood, or sawdust may also be used to grow and produce mushrooms (mushrooms).

The Use of Agricultural Residues in the Control of Plant Diseases:
This is applied by direct use by mixing it with the soil or after converting it into organic fertilizers or (compost). Some beneficial microorganisms are loaded on these residues and added to the soil to combat the pathogens lurking in the soil, as happens in inhibiting the growth of the fungus (Phytophthosa Pythium) by compost. and the use of green fertilizers to inhibit the fungus (Rhizoctonia solani), which causes root rot. The conversion of agricultural residues into organic fertilizers would improve soil properties and increase growth rates, and as it makes the medium surrounding the soil tend to be alkaline, it becomes unsuitable for the growth of nematodes, in addition to the role of microorganisms that grow on it in resisting these harmful organisms. The growth of nematodes, in addition to the role of microorganisms that grow on it in resisting these harmful organisms **[9].**

Use for Construction Purposes:
The traditional uses of agricultural waste, although they still exist in some developing countries, do not constitute a great importance compared to the modern uses, in which various and advanced techniques are used to exploit them in the construction fields.

Agricultural waste and lignocellulosic materials are used in general in many countries to produce cement boards, cement blocks, and gypsum boards for use in the walls and ceilings of buildings, some of which are load-bearing and others as insulating boards**.** These boards, in addition to their low production costs, are characterized by their light weight. A balance with traditional building materials while at the same time having high insulating qualities, in

addition to all of this being compatible with environmental requirements. That is why we see today, and in developed countries, that entire buildings are produced using these technologies and using agricultural materials **[4].**

The Volume of Agricultural Waste in Iraq:

Iraq, with its environmental diversity and the capacity of its arable area, produces millions of tons of grain crops, vegetable crops, and industrial crops. Some of these crops benefit from the remnants of their fields, with limited benefit that cannot be considered economic, as happens with the use of hay in the fodder for animals, or most of it is left and burned in the fields. This burning process is not recommended. In addition to its environmental impact in polluting the air, soil science specialists emphasize its harm to the soil, especially to its beneficial organisms **[14]**.

In view of the lack of accurate statistics to count the quantities of agricultural waste and other lignocellulosic materials in Iraq, we will provide the following estimated data, taking into account that it is subject to increase and decrease according to the seasons.

Table (1) shows that the areas cultivated with the main grain crops during the period 2021-2022 amount to about ten million dunums, of which wheat and barley take the largest share, and industrial crops about one hundred thousand dunums. As for vegetable crops, the cultivated area exceeds one million dunums annually **[10].**

In addition, to the aforementioned, there are vast areas covered with huge quantities of annual plants such as Reeds, Papyrus, Tartaea (Schanginia), and others. Which are also not counted, but some old surveys may be of benefit in this field, and some foreign companies have conducted surveys to limit the quantities of reeds in the southern marshes to complete Studies on its adoption as a raw material for the paper industry in Basra in the sixties of the last century.

At the time, the available quantities that could be harvested annually were estimated at more than one million tons annually, and the productivity of one hectare was estimated between (20-30) tons annually, and with the great changes that took place in the environmental reality of the region, it is recognized that there are huge quantities of reed plants. and papyrus can be exploited in a way that preserves the ecosystem of the region on the one hand and contributes to the revitalization of the economic and social reality of the inhabitants of the marshes on the other**.**

In addition, the reed plant is not limited to the marshlands, as it grows when water is available, from northern Iraq to its south, especially in the center and south, where it grows abundantly along drains and on the sides of irrigation canals and in various water bodies. Various other jungles**.**

Table (1) Iraq's production of cereals and important industrial crops for the years 2021-2022

Crop	Area (100 dunam)		Production (100 tons)	
	2021	2022	2021	2022
Wheat	36264	55332	17003	27488
Barley	15620	40231	50515	11372

URL: http://dx.doi.org/10.14738/assrj.1207.19173

Rice	2196	1919	1731	1558
Yellow Corn	4562	4678	2381	2667
White Corn	971	684	347	512
Millet	114	124	20	23
Sesame	299	525	45	133
Cotton	530	823	239	453
Sunflower	168	227	52	75
Vegetable Crops	11526	10432	34424	33396

Source: Ministry of Planning, Central Statistical Organization (2023), Crop and Vegetable Synthesis Report.

Size and Quantities of Agricultural Waste that can be Exploited:

For the purpose of estimating the weights of the lignocellulosic materials available annually as residues of the fields, the estimation of the volume and quantities of lignocellulosic materials was relied on the area and productivity per unit area or on the weight of the crop and the ratio of the weight of the residue to the crop **[13].**

Table (2) shows that grain crops alone in Iraq are left behind, more than (6) million tons of waste in addition to paper waste, which is also considered one of the most important wastes of raw lignocellulosic materials that can be used,. where it can be used and exploited to produce types of paper, and compressed boards, the estimates contained in the research did not include all annual plants due to the lack of surveys to estimate their quantities despite their diversity and abundance in Iraq of dates **[3]**.

Table (2) Calculating the estimated quantities of the most important raw lignocellulosic materials that can be exploited in Iraq

Crop	Crop weight main (ton)	Raw material weight / crop weight	Material weight rate raw/crop weight	Total amount of the substance raw (ton)
Wheat	2224600	2-1	1.5	3336900
Barley	819400	2-1	1.5	1229100
Rice	164500	2-1* 4-2 **	4.5	740250
Corn	295400	2-1* 4-2 **	4.5	329300
Sunflower	6400	5-2	3.5	22400
Cotton	34600	0.25 -0.35	0.3	11070
Sesame	8900	5-2	3.5	31150
Millet	2200	2-1	1.5	3300
Reeds	1500000	1	1	1500000
Palm	566830	0.5 -0.3	0.4	2400000
Fruit Trees	600000	1	1	600000
Vegetable Crops	3391000	5-1	3	10173000
		Round paper		500000
		Total		19716470

* Weight of the stem and leaves, ** Weight of peels and calves

Source: The table is from the researcher's work

Table No. (2) shows that vegetable crop waste is considered the highest among waste, which exceeds (10 million tons), and these waste varies according to the diversity of vegetable crops. It increases the costs of collecting and delivering them to factories, and the outputs of pruning fruit orchards and palm tree pruning, which are close to one million tons annually, are almost all burned.

Table No. (2) also shows that the waste that was calculated, which amounts to about (20 million tons) annually in the waste account, and no part of it was exploited in the areas referred to in the table above, except for cane in the paper factory in Basra and palm fronds in the compressed wood factory in Manathira. The two projects failed and the two factories were closed because of the political and economic conditions that Iraq went through.

Estimating the Current and Future Market Needs in Iraq:

Iraq imports all its needs of paper, chipboard and other wood products from various countries of the world. And since it is not possible to count the annual import quantities due to the multiplicity of importers and the fact that the old official statistics of the General Establishment for Trading in Construction Materials do not represent the volume of current consumption due to the increase in consumption that has occurred in recent years. Therefore, in order to reach reasonable estimates of the national needs of these materials, we adopted consumption rates per capita in the world as a basis for calculating the annual consumption quantities of the main products that the market needs now and in the future, as shown in Table No. (3).

Table (3): The consumption rates of the Iraqi market are estimated according to the global consumption rates

Product	The global average annual per capita consumption	The volume of Iraq's consumption according to The global average (tons / (m^3	Weight of the required raw material (tons)	Unit price (Ton/m^3) dollars	Total consumption Cost (1,000) Dollars
Cellulosic dough	30 kg	3475000	990000	750	742500
Printing paper and cardboard	60 kg	4950000	1980000	850	1683000
Brown paper	10 kg	825000	330000	300	99000
Fiberboard (MDF)	0.0093 m^3	594000	297000	300	89100
Particle board	0.0133 m^3	643500	429000	200	85800

Source: The table is from the researcher's work

Table No. (3) shows the calculation of the approximate weights of the required raw material by multiplying it by the factor (2.5) for pulp and paper, and the factor (2) for (MDF) panels, and using the factor (1.5) to convert cubic meters of particle boards into the corresponding tons of material raw.

Table No. (3) shows that the total weight of the required raw material does not exceed ten million tons, which constitutes almost half the weight of the annual available quantities mentioned in Table (2). Paper and paperboards constituted the largest volume due to the large volume of per capita consumption (60) kg of these materials. Although global consumption

URL: http://dx.doi.org/10.14738/assrj.1207.19173

varies greatly according to countries, so that it is less than (10) kg in some, it is more than (300) kg in others, and since Iraq is witnessing a good development and movement, we find that the number referred to is not considered large, but may be little in near future. As for the panels, in both its fibrous and particleboard parts, the global average is also not far from the actual need of the country, due to the general tendency to use home and office furniture, etc., and the entire factory is made of these panels.

The Cost of Imports of These Products

The prices of one unit (ton or cubic meter) differ, of course, from one country to another and from one product to another so the price was adopted by calculating the approximate rate of a number of producers in different locations, so the sources were not referred to because they are too many and they are available today on the Internet. The volume of annual consumption for Iraq was calculated based on its population (42) million people, and from the global unit price, the total costs of consumption were calculated for each product separately.

Printing paper and cardboard constituted a number that exceeds (1.5) billion dollars annually, and if the cost of consuming dough is added to it (given that its uses exceed much the paper industry), the figure will exceed (2) billion dollars, which is a large number that should not be overlooked with the possibility of making,. This industry is patriotic with national raw materials and Iraqi manpower.

The Iraqi consumer has shifted from using traditional furniture produced from solid wood to modern furniture produced from composite panels, due to the large difference in prices in favor of the second; in addition to that it is often produced with designs and specifications that suit the modern needs of homes or offices, and others.

Table (2) shows that the volume of consumption received from (for MDF fiber boards and particle boards), which is about (700) thousand cubic meters, is less than the actual need of the country because there are types of synthetic boards that we did not mention in the research because they are less important, on the one hand. The developmental reality and the large housing projects Iraq is witnessing come from the other side. These projects, which will be implemented according to modern construction methods, will require a huge amount of these panels, which can be produced entirely from agricultural waste.

Conclusions

From the research results, the following conclusions can be drawn*:*

1. The land of Iraq abounds in huge quantities of untapped raw materials that can be converted into products of economic value*.*
2. Half of the available lignocellulosic materials annually is almost enough to meet the country's needs of paper products and compressed boards*.*
3. The current consumption of the Iraqi individual does not represent the true picture of consumption at the global level due to the conditions the country experienced, and it is expected to grow a lot*.*
4. The absence of studies and statistics that look into this field, even at the level of national statistics, which makes the picture absent from those concerned*.*
5. The exploitation of agricultural waste will provide additional income for the farmer, helping him to continue production and compete with the importer*.*

6. The failure to adopt projects to exploit these resources means that Iraq will remain an importer of products whose import costs exceed two billion dollars annually.

Recommendations

In light of the obtained research results, the following can be recommended*:*

1. That the Ministry of Planning adopt this issue by forming committees to survey and inventory the available quantities of exploitable lignocellulosic materials and their locations*.*
2. Conducting joint studies with the Ministry of Industry and Minerals and the Ministry of Agriculture to study the feasibility of establishing pulp, paper and compressed board projects near the places where these raw materials are available*.*
3. We suggest that the beginning be with the remnants of grain crops due to their abundant quantities and the ease of collection operations, given that they are grown in large areas*.*
4. The state should take it upon itself to set up these projects because they have high costs, and there is nothing wrong with establishing joint-stock companies through which this goal with multiple economic, social and environmental dimensions can be achieved.

References

Abd Ali, Basem Abbas, and Al-Daini, Nizar Qasim (2005), Exploitation of maize waste (Kawalah) in the manufacture of particleboards. Journal of Agriculture Al-Rafidain 33 (2), pp. 56-61, Iraq.

bd Ali, Bassem Abbas and Qadir, Salahuddin (2005), Recycling Cotton Stalks to Produce Particle Boards for Furniture, Ziraat Al Rafidain Journal 33 (1), pp. 67-77, Iraq.

Al Koaik, F. N. , A. I. Khalil, T. Alqumajan. (2011), Performance evaluation of a static composting system using date palm residues, Midd. East Jour. Of Scien. Res. 7 (6) : 972 – 983.

Al-Shaer, Duha (2018) Recycling techniques in building materials as a tool for environmental protection and achieving sustainability in hot regions, Fayoum University Journal, Volume (1), Issue (2), page 43.

Al-Shimy, Samir Ahmed (2011), Biogas production and how to benefit from it, Land, Water and Environment Research Institute, Agricultural Research Center.
http://www.mazra٢a.net/vb/showthread.php?t٧٨٨٠=&page.١=

Attiyah, Ahmed Nader, Saleh Al-Sayed Saada, and Mahmoud Suleiman Sultan (2012) Benefiting from agricultural waste on the farm of the Faculty of Agriculture, Mansoura University, by converting it into organic fertilizers and animal feed, Mansoura University Journal, Volume (3) Issue (11), Egypt, p. 1831.

Hanna, Nashaat Nazim Nicola, (2015), The Economics of Recycling Agricultural Residues for Some Field Crops in Kafr ElSheikh Governorate, an unpublished master thesis, Institute of Environmental Studies and Research, Abin Shams University, Egypt, p. 7.

Kirkby C. A. and Alison Fattore, (2006), Effect of Rice Stubble Burning on Soil Health. A report for the Rural Industries Research and Development Corporation, RIRDC Publication No..5, p.195.

Madah, Ahmed (2018), The Possibility of Economic Exploitation of Plant Agricultural Residues in Syria, Al-Furat University Journal, Basic Sciences Series, Issue 32, Syria, pp. 154-173.

Ministry of Planning, Central Statistical Organization (2023), Agricultural Statistics Area, Crop and Production (2021-2022) Mohamed ,Abeer Arafa Othman (2016), The economic benefits of recycling agricultural waste in Egypt, a case study in Assiut Governorate, an unpublished master's thesis, Faculty of Agriculture, Assiut University, Egypt, p. 5.

Rose Marie Garay, Francisco MacDonald, María Luisa Acevedo, Beatriz Calderón, and Jaime E. Araya (2009). Particleboard made with crop residues mixed with wood from Pinus radiate. Bio Resources 4(4), 1396 – 1408 - 1396.

Rosillo Calle (2007). The biomass assessment handbook.

URL: http://dx.doi.org/10.14738/assrj.1207.19173

Saqr, Ibrahim (2014), Muhammed Abd al-Qadir, Rula Ziyadah, and Muhammed Qarjouli. An economic study on the utilization of agricultural production residues as fodder for the development of livestock in the Arab countries, Jordan, Tunisia, Algeria, Saudi Arabia, Iraq, and Morocco. The Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD), p.193 http://www.scribd.com/doc/٤٧٤٤٨١٨٣/٥٠٤٠٩٢٩٢-The-Biomass-Assessment

United Nations Economic and Social Council UNEP (2010): Regional implementation report on the five areas presented to the United Nations Commission on Sustainable Development at its 18th session, draft regional report for the Arab region.

Zaidan, Ali, Muhammad Manhal Al-Zoubi and Mays Dib (2017) The effect of different levels of dry biogas fertilizer and tobacco compost on the growth and productivity of regular potatoes grown in Tartous Governorate, Tishreen University Journal for Research and Scientific Studies - Biological Sciences Series, Volume (40), Issue (5), Syria, p. 245.