

**T.C.  
ISTANBUL GEDİK UNIVERSITY  
INSTITUTE OF GRADUATE STUDIES**



**THE ECONOMIC IMPORTANCE OF MANAGEMENT USING  
AGRICULTURAL MACHINERY TO RECYCLE AGRICULTURAL WASTE**

**MASTER'S THESIS**

**Zainalabideen Ali Hussein AL-SHAMMARI**

**Engineering Management Department**

**Engineering Management Master in English Program**

**AUGUST 2023**

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**Thesis Advisor: Assoc. Prof. Dr. Utku Canci MATUR**

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LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ MÜDÜRLÜĞÜ

**Master's Thesis Approval Certificate**

Our institute has unanimously accepted the thesis titled “The Economic Importance of Management Using Agricultural Machinery to Recycle Agricultural Waste” authored by Zainalabideen Ali Hussein AL-SHAMMARI, student number (221281019) of the English Master's Program with Thesis in the Engineering Management Department. This acceptance was granted by the jury appointed by our institute's Board of Management on 28/07/2023 as a Master's thesis.

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## **DECLARATION**

I, Zainalabideen Ali Hussein AL-SHAMMARI, do hereby declare that this thesis titled as “The Economic Importance of Management Using Agricultural Machinery to Recycle Agricultural Waste” is original work done by me for the award of the master’s degree in the faculty of Mechatronics Engineering. I also declare that this thesis or any part of it has not been submitted and presented for any other degree or research paper in any other university or institution. (28/07/2023)

Zainalabideen Ali Hussein AL-SHAMMARI



## **DEDICATION**

I begin by thanking and praising Allah for granting me the opportunity to complete this scientific thesis. His guidance and blessings have been instrumental in its accomplishment.

I would like to express my profound gratitude to my supervisor, Assoc. Prof. Dr. Utku Canci MATUR, who provided me with guidance and support throughout this academic journey. Her invaluable insights and continuous encouragement have played a significant role in achieving this milestone.

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Furthermore, I dedicate this scholarly work to my professors and Istanbul Gedik University, who offered me the opportunity to learn and acquire knowledge. This achievement wouldn't have been possible without their support and guidance

## **PREFACE**

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July 2023

Zainalabideen Ali Hussein ALSHAMMARI

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## **ABBREVIATIONS**

|             |                                         |
|-------------|-----------------------------------------|
| <b>AWMS</b> | : Agricultural Waste Management Systems |
| <b>WMP</b>  | : Waste Management Processes            |
| <b>AWM</b>  | : Agricultural Waste Management         |
| <b>ESGW</b> | : Ecological System and Global Warming  |
| <b>DWMS</b> | : Dairy Waste Management Systems        |
| <b>IE</b>   | : Industrial Ecology                    |
| <b>IWM</b>  | : Integrated Waste Management           |
| <b>MRF</b>  | : Materials Recovery Facility           |
| <b>4RS</b>  | : The Four Pillars That Underlie It     |
| <b>SWM</b>  | : Sustainable Waste Management          |
| <b>PV</b>   | : Present Value,                        |
| <b>FV</b>   | : Future Value                          |

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## **THE ECONOMIC IMPORTANCE OF MANAGEMENT USING AGRICULTURAL MACHINERY TO RECYCLE AGRICULTURAL WASTE**

### **ABSTRACT**

The control of agricultural waste and the utilization of contemporary machinery are critical aspects of sustainable development in agricultural economies. This research gives an in-depth comparative analysis of agricultural waste management practices and the mixing of advanced equipment in Iraq and Turkey. Agriculture is a fundamental area in both international locations, contributing drastically to their economies. However, the buildup of agricultural waste poses environmental and financial challenges that necessitate powerful waste control techniques.

This master's thesis delves into the paramount significance of employing agricultural machinery in the control of recycling agricultural waste, thereby exploring its economic implications. The look at makes a speciality of the position of management in enhancing the monetary evaluation of agricultural waste management tasks via the utilization of modern agricultural device. The objective is to envision the financial feasibility of such initiatives and sooner or later promote their inclusion inside the developmental funding agenda of agriculturally ample countries. This initiative goals to draw monetary establishments to invest in agricultural waste management endeavors, thereby elevating them to pivotal newly evolved tasks. The agricultural region's development and the overall country wide economy stand to enjoy the effective usage of agricultural waste as valuable sources.

The thesis underscores the pressing trouble of the copious amount of agricultural waste, the mismanagement of which leads to excessive environmental, health, and financial effects. The confined ownership of agricultural equipment, each by way of the government and the private quarter, compounds the difficulty by means of hindering proper waste recycling efforts. This forces farmers to resort to fallacious disposal strategies, regularly via incineration, leading to a loss of food value, monetary capability, and electricity.

The examine contributes to the sustainable development of the agricultural zone and the financial system with the aid of losing light at the potential of agricultural waste control tasks. The research endeavors to underscore the monetary blessings and environmental effect of right waste management practices, encouraging the adoption of modern agricultural equipment for recycling purposes.

This painting is dedicated to acknowledging the quintessential assist and guidance of my supervisor, in addition to the enduring encouragement of circle of relatives, pals, and each individual who performed a function on this educational adventure.

This looks at investigates the modern-day techniques to agricultural waste management in both Iraq and Turkey, thinking about their effect on renewable electricity manufacturing and natural fertilizer technology. The utilization of contemporary machinery for waste management is explored, that specialize in cutting-edge technologies and modern answers. Through meticulous exam, the

studies identify strengths, weaknesses, and opportunities for enhancement in waste control and machinery usage practices.

The findings of this research offer precious insights for policymakers, researchers, and stakeholders to beautify agricultural practices and decrease the ecological footprint of waste accumulation. The collaboration and knowledge change between Iraq and Turkey play a pivotal position in adopting excellent practices, sharing know-how, and fostering sustainable agricultural improvement.

To cope with the pressing environmental concerns associated with agricultural waste, this takes a look at emphasizes the economic and environmental advantages of efficient waste control. The results underline the importance of using present day agricultural equipment to recycle waste successfully and capitalize on its economic capability. The research indicates that embracing advanced technologies can substantially make a contribution to sustainable agricultural practices and shield herbal sources for destiny generations.

Methodologically, this study employs a complete approach, including literature overview, records series thru surveys and interviews, and the analysis of applicable guidelines and initiatives. Turkey showcases improvements in infrastructure and technological adoption, even as Iraq demonstrates efforts to improve waste control practices in spite of challenges.

In conclusion, this research underscores the pivotal role of agricultural waste management and the usage of contemporary machinery in sustainable improvement. By gaining knowledge of from each other's experiences and taking part internationally, Iraq and Turkey can establish effective waste management techniques that benefit each their agricultural sectors and the surroundings.

**Keywords:** *Agricultural Waste Management, Modern Machinery, Sustainable Development, Environmental Impact, Renewable Energy, Organic Fertilizers, Comparative Analysis, Collaborative Learning.*

## **TARIM MAKİNELERİ KULLANARAK TARIM ATIKLARININ GERİ DÖNÜŞTÜRÜLMESİNİN EKONOMİK ÖNEMİ**

### **ÖZET**

Tarımsal atıkların kontrolü ve çağdaş makinelerin kullanımı, tarım ekonomilerinde sürdürülebilir kalkınmanın kritik yönleridir. Bu araştırma, Irak ve Türkiye'deki tarımsal atık yönetimi uygulamalarının ve gelişmiş ekipmanların karıştırılmasının derinlemesine karşılaştırmalı bir analizini sunmaktadır. Tarım, her iki uluslararası lokasyonda da ekonomilerine büyük ölçüde katkıda bulunan temel bir alandır. Bununla birlikte, tarımsal atıkların birikmesi, güçlü atık kontrol tekniklerini gerektiren çevresel ve finansal zorluklar doğurmaktadır.

Bu yüksek lisans tezi, tarımsal atıkların geri dönüşümünün kontrolünde tarım makinelerinin kullanılmasının büyük önemini araştırmakta ve böylece ekonomik etkilerini araştırmaktadır. Bu bakış, modern tarımsal cihaz kullanımı yoluyla tarımsal atık yönetimi görevlerinin parasal değerlendirmesinin artırılmasında yönetimin konumunu bir uzmanlık alanı haline getirmektedir. Amaç, bu tür girişimlerin finansal fizibilitesini öngörmek ve er ya da geç bunların tarımsal açıdan geniş ülkelerin kalkınma finansmanı gündemine dahil edilmesini teşvik etmektir. Bu girişim, parasal kuruluşları tarımsal atık yönetimi çabalarına yatırım yapmaya çekmeyi ve böylece onları yeni gelişen önemli görevlere yükseltmeyi amaçlamaktadır. Tarımsal bölgenin kalkınması ve ülke genelindeki ekonomi, tarımsal atıkların değerli kaynaklar olarak etkin bir şekilde kullanılmasından yararlanmaktadır.

Tez, kötü yönetimi aşırı çevresel, sağlık ve finansal etkilere yol açan bol miktarda tarımsal atığın acil sorununun altını çiziyor. Her biri hükümet ve özel mahalle aracılığıyla tarımsal ekipmanın sınırlı mülkiyeti, uygun atık geri dönüşüm çabalarını engelleyerek zorluğu daha da artırıyor. Bu, çiftçileri düzenli olarak yakma yoluyla yanlış imha stratejilerine başvurmaya zorlayarak gıda değeri, parasal yetenek ve elektrik kaybına yol açar.

İnceleme, tarımsal atık kontrol görevlerinin potansiyelinde ışık kaybedilmesi yardımı ile tarım bölgesinin ve finansal sistemin sürdürülebilir kalkınmasına katkıda bulunmaktadır. Araştırma, doğru atık yönetimi uygulamalarının parasal nimetlerinin ve çevresel etkisinin altını çizmeye ve geri dönüşüm amacıyla modern tarım ekipmanlarının benimsenmesini teşvik etmeye çalışmaktadır.

Bu resim, bu eğitim macerasında bir işlevi yerine getiren akrabalar, arkadaşlar ve her bireyin sürekli cesaretlendirilmesine ek olarak, amirimin özlü yardımını ve rehberliğini kabul etmeye adanmıştır.

Bu, yenilenebilir elektrik üretimi ve doğal gübre teknolojisi üzerindeki etkilerini düşünerek hem Irak'ta hem de Türkiye'de tarımsal atık yönetimine yönelik günümüz tekniklerini araştırıyor. En son teknolojiler ve modern cevaplar konusunda uzmanlaşmış, atık yönetimi için çağdaş makinelerin kullanımı araştırılmaktadır. Titiz bir inceleme ile çalışmalar, atık kontrolü ve makine kullanım uygulamalarında iyileştirme için güçlü, zayıf yönleri ve fırsatları belirlemektedir.

Bu araştırmanın bulguları, politika yapıcılara, araştırmacılara ve paydaşlara tarımsal uygulamaları güzelleştirmeleri ve atık birikiminin ekolojik ayak izini azaltmaları için değerli bilgiler sunmaktadır. Irak ve Türkiye arasındaki işbirliği ve bilgi değişimi, mükemmel uygulamaların benimsenmesi, bilgi birikiminin paylaşılması ve sürdürülebilir tarımsal kalkınmanın teşvik edilmesinde önemli bir rol oynamaktadır.

Tarımsal atıklarla ilgili acil çevresel kaygılarla başa çıkmak için, bu, verimli atık kontrolünün ekonomik ve çevresel avantajlarını vurgulamaya bakar. Sonuçlar, atıkları başarılı bir şekilde geri dönüştürmek ve ekonomik kapasitesinden yararlanmak için günümüz tarım ekipmanlarının kullanılmasının önemini altını çiziyor. Araştırma, ileri teknolojilerin benimsenmesinin sürdürülebilir tarım uygulamalarına önemli ölçüde katkıda bulunabileceğini ve kader nesiller için bitkisel kaynakları koruyabileceğini gösteriyor.

Metodolojik olarak, bu çalışma literatüre genel bakış, anketler ve görüşmeler yoluyla kayıt serileri ve uygulanabilir kılavuzların ve girişimlerin analizi dahil olmak üzere eksiksiz bir yaklaşım kullanmaktadır. Irak, zorluklara rağmen atık kontrol uygulamalarını iyileştirme çabalarını gösterse de, Türkiye altyapı ve teknolojik benimsemeye iyileştirmeler sergiliyor.

Sonuç olarak, bu araştırma tarımsal atık yönetiminin ve çağdaş makinelerin sürdürülebilir iyileştirmede kullanılmasının önemli rolünün altını çizmektedir. Irak ve Türkiye, birbirlerinin deneyimlerinden bilgi edinerek ve uluslararası alanda yer alarak, her bir tarım sektörüne ve çevresine fayda sağlayan etkili atık yönetimi teknikleri oluşturabilir.

**Anahtar Kelimeler:** *Tarımsal Atık Yönetimi, Modern Makineler, Sürdürülebilir Kalkınma, Çevresel Etki, Yenilenebilir Enerji, Organik Gübreler, Karşılaştırmalı Analiz, İşbirliğine Dayalı Öğrenme*

## 1. INTRODUCTION

The term period “wastes” has spread in current years, and there was a whole lot of communicate approximately it, and seminars and conferences are held to look at it and observe technical traits in its treatment and exploitation. Which is left at the back of at some point of the specific levels that agricultural products go through until it turns into in its form suitable for intake or everlasting use and produced for it., as is the case in wheat straw or flaxseed, or it is referred to as hay if it has no monetary use and consequently it represents a loss of manufacturing as is the case in dead fowl and others Waste can be defined as the a part of the plant that has no longer been exploited economically.

Agricultural waste control structures and method to maximize their usage vary depending on the type of waste and available technology and the motive of recycling this waste among biological methods by using adapting microorganisms to transform those organic waste into products of financial feasibility, mechanical techniques for the production of necessities for homes, golf equipment and industry, chemical techniques for the manufacturing of paper and chemical substances Intermediate, physical techniques consisting of pressing, grinding and capping for ease of use.

That is, it's far the non-economic a part of any plant including logs, thrones, straw, and many others., and it can also be defined as the entirety this is accidentally or secondary produced for the duration of field crop manufacturing approaches, whether in the course of harvest, series or practice for marketing or processing of those vegetation (Raghava and Huang, 2014).

Given what these wastes can do in bridging the food gap for animals, medical studies has reached the opportunity of locating alternative feeds from agricultural field wastes by slicing them and enriching them with a few chemical compounds and generating non-traditional fodders to cover the modern deficit in fodder, especially because the available discipline wastes .

It is possible to allocate a part of it to the manufacture of non-traditional feeds to cover the gap in the current feed. Intensive research has been conducted to select the most appropriate treatments to increase the nutritional value of the agricultural residues that are not currently used for animal feeding, provided that these treatments are easy and affordable for the farmer, while avoiding technology that requires great skills in application, and that it is carried out at appropriate costs and within the reach of the animal breeder in the village, and its implementation does not lead to risks Healthy, whether for the animal that will feed on it or the person who will feed on the milk and meat of these animals Waste management is defined as the process of collecting, transporting, processing, recycling or Landfill waste resulting from human activities in order to reduce its negative impact on Health, environment and natural beauty of the region.

The concept of agricultural waste also considers the waste as the waste, residue, or output resulting from an activity (Rathi, 2006; Zurbriggen, 2002). Garbage of all kinds is waste and all types of waste are waste, and there are several definitions of agricultural waste.

Agricultural waste is generally defined as everything that is produced accidentally or secondary during the production processes of field crops, whether during harvesting or during the preparations for marketing or manufacturing of these crops. It also includes animal and poultry waste before slaughter or during slaughter operations, and during manufacturing and preserving products These are animals and poultry.

Field plant residues are also defined as the parts remaining after harvesting the main crops, Agricultural wastes are by-products within the agricultural production system that must be maximized by converting them into organic fertilizers, fodder, human food, clean energy, or manufacturing them to achieve clean horizontal agriculture, protect the environment from pollution, improve agricultural products and provide employment opportunities in the agricultural sector, thus improving the economic and environmental situation Raising the health and social level in the countryside.

The importance of this study lies in the environmental and economic perspective at the level of the state as a whole, and at the level of individuals for the process of recycling agricultural waste. On the environmental perspective, we find the benefit from recycling agricultural waste in protecting the environment from pollution, with

the possibility of obtaining fully decomposed organic fertilizer that works to increase fertility Soil, increase productivity, and reduce health damage to humans and animals through the disposal of agricultural waste in a safe manner, and on the economic perspective,

the process of recycling waste represents one of the ways to exploit wasted resources and transform them into a useful product of special economic benefit to the farmer and a general economic benefit that contributes to increasing Agricultural national income, as well as employing a number of young people in these projects, which means reducing unemployment, increasing reliance on the local product instead of importing it from abroad, which saves hard currency for the state, and establishing many direct and indirect small industries around this project, including those related to collecting these wastes, including those related to cutting and preparing them, as well as opening wider areas for investment in this vital sector, and expanding investment opportunities This waste is available to domestic investors, and foreign investors, especially with the availability of these wastes in abundance, with the possibility of exporting them abroad in the form of a final product at a competitive price, which contributes to reducing the deficit in the trade balance of the state.

Agricultural extension can contribute to raising farmers' awareness of the technologies for treating agricultural waste and changing negative behaviors in this field, by educating farmers about the importance of optimal use of agricultural waste and how to benefit from it, and how to exploit waste storage places in the field to reduce waste of agricultural land, also educating farmers The environmental damage resulting from the presence and misuse of agricultural waste, whether by burning these wastes or dumping them next to canals and drains, as well as spreading awareness among farmers of how to convert agricultural waste into non-traditional fodder or organic fertilizers or use them in the production of biogas units.

Agricultural guidance can carry out some tasks that help educate farmers on how to benefit from agricultural waste, provide the necessary presses and shredders for compacting and shredding agricultural waste, encourage farmers and the private sector to provide the necessary presses and shredders for the waste recycling process, and encourage NGOs in the villages to benefit from agricultural waste. Preserving the environment from pollution, holding guiding seminars for farmers and providing them with the skills to recycle agricultural waste, and coordinating between media

(Bekchanov, 2017). educational and cultural institutions to spread awareness among rural people of the damages of this problem while exploiting the religious aspect in this matter.

From the above, it can be said that the recycling of agricultural waste is one of the most important issues at the present time in Agricultural country, and this is due to the fact that the accumulation of these waste without use is considered an environmental disaster, the danger of which increases day by day as a result of the development in scientific research, and the increase in crop productivity, which increases the amount of waste, as dealing with Wrong with agricultural waste leads to environmental pollution and waste of resources, through burning waste in the field and the emission of harmful fumes from it, or dumping it in canals and drains.

Agricultural waste can be benefited from and used for many purposes, such as using it to feed animals and thus can bridge the gap in the amount of fodder and reduce the cultivated areas with green fodder and exploit it in the cultivation of strategic crops, as well as using the waste as fertilizer that increases soil fertility, which helps to expand the cultivation of new lands The waste can also be used in the production of biogas, which is a type of clean energy (Gustavson, 2008; Zurbrugg, 2003).

There are many types of agricultural waste such as hay, corn wood, cottonwood, plant thrones, as well as animal waste, and most of these wastes are few in nutrients if they are used in their raw form in animal feeding, so modern technologies must be used to raise the nutritional value of these wastes and from the most important of these techniques are the treatment of waste with urea, injection with ammonia gas, and the addition of molasses to the waste.

For this, the dissemination of this technology must be expanded by raising awareness among individuals of the economic importance of reusing these wastes, and this awareness must be carried out through the various state agencies, including the Agricultural Extension Agency, because it is the most agency entrusted with educating and educating rural individuals, as it is the closest educational device to farmers (Ministry of Environment, 2004). Therefore, the extension system must be supported technically, financially and administratively so that it can bring about behavioral changes among farmers from acquiring knowledge and developing skills,

which leads to changing their tendency towards adopting new technology, thus raising their economic and social level and achieving development goals in society.

There are many types of agricultural waste:

## **1.1 Field Waste**

### **1.1.1 Field residues of plant origin (crop residues)**

They All are weeds that can be introduced by harvesting, gathering or combining field crops or as long as advertising and marketing guidelines. Most of this waste is produced in the field and by farmers. This waste represents by far the largest volume of agricultural waste. When used uncooked in animal feed, and from those wastes “Rice grass, wheat grass, barley, beans, corn, alfalfa, chickpeas, corn stalks, corn stalks, horticultural crops and vegetable throne., Corn stalks, the throne of garden crops and vegetables.

### **1.1.2 Field residues of animal origin (animal waste)**

This is waste when cattle and poultry are on farms or processing plants and includes animal urine (animal manure), brush and poultry manure."

This manure is characterized by a low crude protein content, up to about 20%, although more than half of the material in the manure is non-protein, which limits the use of this manure in poultry feed boundaries, even if they can be used as prey food.

## **1.2 Agricultural Industrial Waste**

It is everything that is produced accidentally or secondary during the processes of preserving or manufacturing agricultural crops for various purposes, whether these crops are plants or animals. These wastes include many types, including:

- 1- Remnants of agricultural manufacturing of plant origin, such as residues of mills and oil extraction factories, remnants of mills and silos, remnants of mills, remnants of the sugar, starch and glucose industries.
- 2- Agricultural industrial waste of animal source, including slaughterhouse and slaughterhouse waste, such as blood powder, bones, horns and hooves, meat powder, feathers, dairy factories and their products such as salty or sweet whey, and fish preservation and processing waste such as fishmeal.

### **1.3 Accidental and Mixed Residues**

Where there is another group of agricultural waste that cannot be included in the field waste or agricultural industrial waste, which is the waste of wholesale markets, kitchens and restaurants, which is a mixture of multiple wastes, the nutritional value of which is not fixed and is subject to many factors (Afrizal, 2016).

Recognizing the extent to which man is misusing the natural resources of the universe, the call for Earth Day emerged in 1971. Since then, the environment has been protected many beliefs and environmental declarations have been created, green events enumerated in many countries and a genuine desire to do that stop property clearance, as well A technology has emerged that knows new vocabulary including, ecosystems and global warming, impact greenhouses, the ozone hollow, waste recycling and frequent intervention This last article includes four pillars that want to consider guilt in recycling the waste on our dangerous planet is based on the use of waste.

### **1.4 4R Golden Rule Which Needs to Be Increased Awareness:**

#### **1.4.1 Reduction**

The idea here is to reduce the amount of raw materials used, thus eliminating waste. They are available through:

Use fewer ingredients. The use of raw materials reduces waste. It reduces the amount of materials used in packaging, such as plastic paper and minerals, and this requires every investor and manufacturer to be environmentally conscious, e.g. in the United States, many liquid soap manufacturers relied on the packaging, so it can be packaged in small bottles called reduction.

#### **1.4.2 Reuse**

This means, for example, to reuse plastic bottles for mineral water, for example, after disinfection, bottles and jars are refilled after use after all, this approach encourages reducing the amount of waste, but requires the general public to be environmentally conscious about how to get rid of their waste, and create a simple sorting system for waste plastic, paper, glass and metal in each before you dispose of japan and united states of america colored trash cans in each county and streets, in order to dispose of

paper waste Green plastic boxes and blue boxes glass and metal, black boxes food waste or so biowaste It is.

### **1.4.3 Recycle**

Recycling is the reuse of waste to produce products Others are of lower quality than the original product.

### **1.4.4 Recovery**

Thermal landfill technology is used in many countries, especially japan for the safe disposal of solid waste, hazardous waste, solid and liquid, and waste hospitals and sludge resulting from sewage and industrial, through burning these wastes under certain operating conditions such as temperature and duration combustion, in order to control emissions and their compliance with environmental laws. these are characterized by the method is to get rid of 71% of the solid materials (visvanathan and trankler, 2003).

And converts them into thermal energy that can act as leaks in mechanical processes or generate steam or electricity. in this course we will teach about waste in terms of the third pillar of management science, especially agricultural waste, which is the recycling of agricultural waste, and we will think about it this course focuses on engineering science which can be used in this project. the concept of recycling initially originated during the first and second world wars, when countries suffered severe shortages of certain basic commodities in some products, such as rubber, and motivates them to store those materials from trash to rafter age if the former is considered, then the cost of raw materials and operating expenses f can help to reduce them.

The following are the most important benefits resulting from recycling agricultural residues: increasing farm income as a result of increasing the productivity of land and decreasing rates -the use of mineral and industrial fertilizers as well as low rates of use chemical pesticides. cut off the life cycle of many insects that remain with agricultural residues in -if stored on the roofs of homes like cotton paper worm. Increasing the productivity and fertility of the land as a result of the use of rich organic fertilizers -with organic, nitrogenous and humid substances.

Establishing some small industries on agricultural residues and thus increasing - income for the farmer from the revenue of these industries such as mushrooms or fodder green and others the study focuses on the importance of the administration's role in increasing the economic evaluation of some agricultural waste management projects using modern agricultural machines to determine the economic feasibility of these projects, with the aim of promoting these projects within the investment map of development projects in agricultural countries that have very large agricultural waste, and attracting financing institutions to invest its money in this field so that agricultural waste management projects are among the most important newly developed projects through which the agricultural sector in particular and the national economy in general can be developed, as agricultural waste represents economic resources and effective alternatives in providing many economic products.

The problem of the study is the large number of agricultural plant waste in general, the failure of which leads to serious environmental, health and economic damage, in addition to the scarcity of agricultural machinery owned by the government and the private sector, which recycles these wastes for later use, which prompts farmers to dispose of them in a wrong and harmful way. in the environment, most of it is through burning, and given the economic importance of agricultural waste, which represents a waste of food value on the one hand and a waste of a product of economic value and great economic benefit, and a waste of energy.

Providing job opportunities for young graduates to establish projects and industries. small on those agricultural remnants. preserving the environment from pollution resulting from the accumulation of those residues through -composting work for each farmer (budgie et al, 2012).

Agricultural residues vary according to the variety of agricultural crops and vary from country to country last, according to the country's production of each agricultural crop. it can be said that the most important of these remains' agriculture in the world in general and in the arab world in particular is a source of for fuel is like cotton and corn, and straw is like wheat straw, and hair and thrones are like a throne beets, tomatoes and potatoes.

This is in addition to the remnants of palm leaves and the remnants of pruning street trees and public squares and parks, and there are other non-wood materials such as hemp and reeds alfa, bamboo, etc., and fruit tree pruning products.

The agricultural waste generated from agricultural crops is estimated at several million tons, which vary between countries and are constantly increasing year after year these agricultural wastes are renewable and environmentally friendly natural resources that can be its use in many areas to obtain several benefits or is a major environmental problem for many of the world's developed and developing countries.

Agricultural residues are defined as residues from the cultivation and processing of raw agricultural products such as fruits, vegetables, meat, poultry, dairy products and crops. They are non-productive products for the production and processing of agricultural products that may contain materials that can benefit humans but whose economic values are lower than the cost of collection, transportation and processing for useful use (eusuf et al, 2011). their composition depends on the system and type of agricultural activities and can be in the form of liquids, dough or solids.

So, the purpose of this thesis is to identify the importance of agricultural waste management and its different types. we will also discuss how to manage agricultural waste in a safe and good way that reduces environmental risks and increases the rate of utilization again, and learn about the methods of managing waste of all kinds, in addition to identifying the benefits resulting from its recycling and the different methods used in the recycling of agricultural waste learn about waste and its different types and annual quantities learn about the different ways to dispose of waste and how to deal with it in a safe way and benefit from it again. also, learn about the benefits of recycling and the different methods used to recycle agricultural waste.

Recycling systems and strategies to maximize the utilization of agricultural wastes vary depending on the type of waste and available technologies and are based on the use of microbial-friendly biomass methods convert these organic wastes into economically viable products. chemical intermediates, physical processes such as pressing for easy handling, grinding and capping, and others for manual purposes etc. and in table 1.1 we order different organic fertilizers according to their sources.

**Table 1.1:** Organic Fertilizer Sources Comparison

| <b>Organic Fertilizer</b> | <b>Fertilizer Source</b> |
|---------------------------|--------------------------|
| Composting                | crop residues            |
| Vermicompost              | earthworms               |
| Dead poultry              | dead poultry             |
| Biogas                    | cattle dung              |
| Non-Traditional Food      | Rice straw               |

Source: (Wackier, 2011)

Advances in biotechnology have led to the adaptation of microorganisms to transform organic compounds and waste into economic 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 microbes to maintain human health and sources of wealth.

**Table 1.2:** Organic Waste Generation Across Agricultural Processes

| <b>Agricultural activities</b>                    | <b>The destruction of the materials</b>              |
|---------------------------------------------------|------------------------------------------------------|
| crop production and harvesting                    | saree, stover                                        |
| Organic Sugar Processing of Fruits and Vegetables | face-cheek-cheek-leaf-tree-clay-seed-pit             |
| Animals that are made                             | organic slurry, pellets, lime mud                    |
| Processing of dairy products                      | Blood and bones, feathers, dung, weeds, and springs  |
| Books made of leather                             | Organic sludge production                            |
| Rice production                                   | Flashing, hair, raw and tanned trim, lime and chrome |
| The production of coconuts                        | Gall, fat, bran, grass, rudder                       |

Source: (Chieng, 2012)

This page reviews the integrated systems for the recycling of agricultural waste by maximizing the role of microorganisms, as the organic waste treatment systems differed according to the purpose of treatment, the degree of demand for the product, the economic feasibility, the extent of farmers' acceptance of technology, the social impact on the future of technology, and the targeted environmental dimension of the systems for recycling this organic waste table1:2 shows the description of agricultural residues by agricultural activity.

The interest in reusing agricultural crop wastes plays a positive role in eliminating these wastes and reducing the percentage of environmental pollution especially on

farms or areas near food are stored in the cannery where this waste is disposed of by improper means.

Due to the increase in population growth, the factories for preserving and freezing vegetables and fruits have become amid a huge population mass, as the surrounding agricultural lands are transformed into facilities and buildings, and the remaining agricultural land is surrounded by a terrible population gathering, which led to the difficulty of getting rid of agricultural waste.

Since almost all these wastes are highly biodegradable substances inhabited by many organisms, such as yeasts, fungi, insects, etc., which are very damaging to the industrial environment therefore, when these wastes are dumped outside the factories, they are even more damaging to the environment as well as the population they are more damaging to the overall health.

Agricultural wastes are vital products of food-making processes in various plants that remain in the fields after obtaining the main product or crop. Some tend to call them agricultural residues, which are of important economic value and sometimes constitute great wealth that is often lost due to lack of exploitation.

Systems and means of recycling agricultural waste vary according to 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 them into organic fertilizers or fodder for animals and using them 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, and thus improving the economic and environmental situation and raising the health and social level.

The proper management of agricultural waste requires dealing with it in a way that guarantees the health of society and the safety of the environment through an integrated system with multiple aspects, components and interconnected links. Therefore, it is necessary to use appropriate and appropriate means for the prevailing conditions, available resources and existing determinants. This means adopting the best options that will meet environmental standards and safety, the lowest possible costs, the highest possible recovery of resources, and compliance with legislation and regulations. For this reason, the ministry of environment worked through its technical

departments in Iraq and Turkey, represented by the departments of agricultural waste management, to implement its work program and seek to prepare instructions for the sound environmental management of agricultural waste, such as instructions for managing agricultural waste of all kinds, to which adherence is the most important mechanism that contributes to solving a number of problems related to agricultural waste management.

Among the objectives of the public policies of the two countries is the preservation of the environment and the optimal economic use of agricultural residues instead of burning them, which leads to an increase in environmental pollution as one of the causes of the massive expansion of land reclamation. exerted at the local and global levels, in the matter of preserving the environment from pollutants resulting from the improper use of agricultural waste.

Agricultural waste management is a manifestation of the development of society to work on the use of its available resources to maximize

Nutritional content and increasing the economic income of the two countries, whether it is managed directly or indirectly. there are many natural and human resources available in Iraq and Turkey, which are considered among the main sources for exploiting this vast wealth of agricultural waste. this study is presented as a contribution to be added to the contributions of others in various fields. it works to adopt mechanisms that achieve a degree of integration at the level of inputs and outputs of agricultural products, its animal and plant branches. please also note that all numerical data included in this study are a reflection of the totality of other studies that have been provided, and the statistical books issued by them, in addition to the reports of the FAO. agriculture (FAO) and derived from the figures, by the working group based on those sources who hope to have expressed the truth of those numbers in order to obtain proposals and conclusions.

systems and means of recycling agricultural waste vary according to 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 them into organic fertilizers or fodder for animals and using them 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, and thus improving the economic and environmental situation and raising the health and social level. the quantities of agricultural waste in iraq for a limited and selected area of iraq's agricultural areas are estimated at 8 million tons (unep, 2013), while in turkey on a limited agricultural area of 17 million tons, which are approximate figures and the actual may be higher than that. as for the actual area, statistics are not available accurate about the quantities left over in the agricultural fields because we still do not consider that an important and priority issue. Iraq and Turkey.



## **2. AGRICULTURAL WASTE TYPES AND METHODS OF DEALING WITH THEM**

Recycling systems and strategies to maximize the utilization of agricultural wastes vary depending on the type of waste and available technologies and are based on the use of microbial-friendly biomass methods convert these organic wastes into economically viable products. chemical intermediates, physical processes such as pressing, grinding and coating for ease of use, and others for crafting and others (henry et al., 2006).

Advances in biotechnology have enabled microorganisms to turn organic matter and waste into economic products while protecting the environment from pollution, and food, food, natural energy, intermediates, and the wastewater process.

Since almost all of these wastes are quick-decomposing organic materials on which many living organisms live, such as yeasts, fungi, insects, and others, which constitutes a severe damage to the environment inside the factories, and when these wastes are disposed of outside the factories, they also constitute more damage to the environment and thus to the general health of the population.

### **2.1 Waste Concept**

The concept of waste in general is summed up in the waste or residue resulting from an activity and there are several definitions of agricultural waste. agricultural waste is defined as everything that is produced secondary through the process of agriculture and the production of field crops, whether resulting from the harvest or from the preparations for marketing or manufacturing of these crops.

Field plant residues are also defined as the components last after harvesting the main crops. Agricultural residues are by means of-merchandise in the agricultural manufacturing machine that need to be maximized by using changing them into organic fertilizers, fodder, human food or smooth strength and manufacturing them to acquire maximum gain, guard the environment from pollutants, enhance the

agricultural machine and offer job possibilities inside the agricultural zone, for you to result in improving the financial and environmental situation and raising fitness and social level.

## **2.2 Types of Waste**

There are several types of waste

### **2.2.1 Field waste**

#### **1. Field residues from agricultural crops**

It is all the waste that is produced during the harvest, and most of these wastes are produced at the field level and by farmers, and this type of waste obtains the largest share of agricultural waste, and this type is poor in protein and nutritional value if and from these wastes “rice straw, wheat straw, barley, beans and lentils, corn stover, corn stalks, and plant thrones.

#### **2. Residues from animal production:**

It is the waste of animals and poultry while they are on the farms, and it includes: (animal dung), blue and poultry litter.

These wastes are characterized by a high percentage of crude protein, reaching about 20%, although more than half of the elements in the waste materials are non-protein materials, which limits the use of these wastes in poultry feed.

### **2.2.2 Waste generated from agricultural industrialization**

It is everything that is produced accidentally or secondary during the operations of preserving and processing agricultural crops for various purposes, whether these crops are plants or animals:

- 1- Vegetable waste: such as waste from mills, oil extraction factories, mill waste, mill waste, sugar, starch and glucose industry waste.
- 2- Agro-industrial waste of animal origin: it includes the remains of slaughterhouses and slaughterhouses, the residues of dairy factories and their products, and the residues of fish preservation and processing.

### **2.2.3 Mixed waste**

There is another group of agricultural waste, which is the waste of wholesale markets, kitchens and restaurants. It is a mixture of the previous waste, the nutritional value of which is not specified and is subject to many factors.

## **2.3 Waste Recycling Concept**

Waste recycling is processes that allow materials to be recovered or reused, such as using them as fuel, extracting minerals and organic matter, treating soils, or re-refining oils.

The recycling of agricultural waste is one of the most important issues at the present time in the world, and this is due to the fact that the accumulation of this waste without use is considered an environmental disaster whose danger increases day after day as a result of the development in scientific research, and the increase in crop productivity (Gunawardana et al, 2009; Basnayake et al, 2007).

which increases the amount of waste, as the wrong handling of agricultural waste It leads to environmental pollution, and waste of resources, through burning waste in the field and the emission of harmful fumes from it, or dumping it in canals and drains.

## **2.4 How to make use of Agricultural Waste**

There are many areas of benefit from agricultural waste, the most important of which are:

### **2.4.1 Non-traditional fodder production field**

The lack of fodder is considered one of the main obstacles to the development and development of animal production, which is one of the main sources of national income in most countries of the world. Scientific research efforts have focused on finding new sources of feed. To overcome this problem, scientific research has tried to maximize the use of agricultural waste by mixing it with some nitrogenous compounds Its use in animal feed as one of the general alternatives to traditional feeding, and this method has resulted in other benefits in addition to providing these feeds. They are called non-traditional feeds because they help reduce environmental

pollution, and thus protect the environment from many diseases transmitted by these wastes.

There are many technologies through which we have been able to convert plant waste into non-traditional feed after adding nutrients to it, namely:

#### 1- Use of liquid nutrients

And it depends on molasses, which is (91%) urea, (2.5%) a mineral source of phosphorous, sulfur, rare mineral salts and vitamin A, D with an amount of water (about 5%) and it is done by heating water and dissolving urea in a known amount of Water and the mixture of mineral salts with vitamins are dissolved in the same way separately, then all are added to 4 tons of raw molasses in the mixing device, and after ten minutes it is transferred to the liquid nutrient storage tank, and its importance is due to the fact that the feed to which this solution is added provides the animal with salt and vitamins.

#### 2- Solid molasses molds

This mold consists of 40-60% molasses, 10-20% urea, and 5-10% table salt, as well as adding chemicals that help freeze the mold to the point of hardness. This technology has nutritional and economic advantages as 20% urea is used, and animal licking Doing it at intervals throughout the day ensures that the animal is supplied with regular small amounts of nutrients.

#### 3- Chop the coarse feed

Where the agricultural residues of dry corn sticks, sorrel, and cane residues are shredded with regular, electric or tractor-operated threshing machines and this makes them more palatable and digestible, and it is possible to replace wheat straw in fattening and dairy rations, and shredding the waste has several benefits, the most important of which is not Exploitation of large areas in the storage of waste, ease of transporting waste, reducing the costs of transporting this waste, increasing the nutritional value, and not wasting field waste.

#### 4- Treating waste with urea solution

In order to carry out the treatment, the field wastes are first shredded by a regular threshing machine, then these wastes are stacked in layers and sprayed with a urea solution that is prepared by dissolving 4 kg of urea in 50 liters of water. With plastic

to prevent the leakage of ammonia resulting from the analysis of urea and leave it completely covered for 2-3 weeks, then lift the cover from the place of taking the processed feed and gradually feed it.

#### 5- Treating waste with ammonia gas

When the waste is injected with it, it leads to an increase in the nutritional value. This is done by arranging straw and straw bales in a pile of 5 tons or 10 tons, then covering the pile with a plastic cover with tight coverage on each side, and injecting ammonia gas, and leaving the pile covered with plastic for 10-14 days in summer and for a period of three weeks in winter, the cover is lifted and straw or straw is left for ventilation for two days.

#### 6- silage

Green fodder is kept away from the air, and it is preserved through fermentation processes, as anaerobic fermentation produces alcohol and acids that increase the acidity of the feed to the point of stopping spoiling agents.

The silage is made by harvesting the crop that will be transformed into silage so that it contains a high percentage of moisture, and cutting the plant with a length of no more than 5 cm, and placing it in the form of layers, each of which is 30 cm thick and 2 m high, then pressed well, and molasses is added to each layer (Gunawardana et al, 2009). At a rate of 15 liters diluted with 15 liters of water per ton, then cover the heap with plastic with weights placed on its surface, and the heap is opened after monthly.

### **2.4.2 The field of organic fertilizer production or what is known as compost**

The trend towards using organic fertilizers was a necessity to reduce the import of chemical fertilizers and the hard currency it costs the state, and most importantly, to reduce the negative effects resulting from the frequent use of chemical fertilizers, as studies have proven their severe harm to human health in addition to the low cost of organic fertilizers as a result of their production of waste.

The method of preparing the organic fertilizer is to determine the area of the heap on the basis that the ton needs an area of 2 x 3 m<sup>2</sup>, then tamping the ground well and then digging a channel around it with a width of 20 cm and a depth of 10 cm. Then the process is repeated with spraying with water and EM1 solution until it reaches a

height of 1.5-2 meters, and then moisturizes the pile once a week in winter, 2-3 times in summer, then flips the pile every 2-3 weeks, and finally leaves the pile for 5 months before use.

#### **2.4.3 Biogas and fertilizer production field**

Biogas technology depends on the fermentation of solid and liquid waste and is based on the treatment of sewage waste, plant and animal farm waste, and garbage in an economical and healthy way to produce methane gas. Biogas is a mixture of methane and carbon dioxide with a group of other gases. It is used directly in cooking, and a cubic meter can occupy a 10-foot refrigerator for 1-2 hours. As for biogas fertilizer, it is created after gas production and is rich in its content of organic matter and major and minor fertilizer elements. It also contains plant hormones, vitamins and growth regulators. It is also free from microbes, larvae, eggs and weed seeds. It is also used as a source for animal and domestic bird wrap because it contains a high percentage of protein materials. Biogas fertilizer consists of two layers, one of which is liquid and the other is solid. Birds, as well as from plant wastes such as corn, cotton, rice straw, vegetable thrones, and greenhouse and forest waste Waste water, as well as from sewage waste, garbage, kitchen waste, massacres, human and water weeds, and Nile roses.

The biogas and fertilizer unit consists of four main parts: a fermenter, a gas complex, a waste feeding basin, an organic fertilizer receiving basin, and these parts are all made of bricks, cement and sand, in addition to polyethylene hoses and iron or plastic pipes. Available daily.

### **2.5 The Role of Agricultural Extension in Making Use of Agricultural Waste**

Agricultural guidance contributes to raising farmers' awareness of the technology for dealing with these wastes and changing negative behaviors in this field, by educating farmers about the importance of optimal use of agricultural waste and how to benefit from it, and how to use waste storage places in the field to reduce agricultural land losses, and farmers' awareness of environmental damage The resulting misuse of agricultural waste, whether by burning these wastes or dumping them next to canals and drains, as well as spreading awareness among farmers how to convert agricultural waste into non-traditional fodder.

Agricultural extension can carry out some tasks that help raise awareness of them, providing the necessary presses and shredders for compacting and shredding the waste, encouraging farmers and the private sector to provide the presses and shredders, as well as encouraging NGOs in the villages to benefit from agricultural waste and preserving the environment from pollution, holding guidance seminars for farmers and providing them With special skills for the recycling of agricultural waste, and coordination between media, educational and cultural institutions to spread awareness among farmers of the damages of this problem.

**Table 2.1:** Characterization of Agricultural Waste According To Agricultural Activity

| <b>The type of plant</b> | <b>The remaining crops</b> | <b>Current state of use</b> | <b>Remaining unused, tons/here</b> |
|--------------------------|----------------------------|-----------------------------|------------------------------------|
| Mecca                    | Dried wood, leaves         | Combustion, grazing         | 15.0                               |
| Wheatgrass for corn      | A dry stick                | Dumping, burning, grazing   | 8.5                                |
| Filled with rice         | Dry grass, bran, bran      | Combustion, grazing         | 5.5                                |
| Spring rice              | Dry grass, bran, bran      | Combustion, grazing         | 4.8                                |
| Cassava fermentation     | A dry stick                | Combustion, grazing         | 3.0                                |
| Sugarcane                | Dried wood, leaves         | Burning coal, used          | 2.5                                |
| Soybean meal             | A dry stick                | Dumping, animal feed        | 3.5                                |

**Source:** (Kumaras, 2009)

From the foregoing, this resulted in the recycling of agricultural waste being the most important issue at the present time, due to the accumulation of waste without use, which is an environmental disaster whose danger increases, and the increase in crop productivity (Goorah et al, 2009), which increases the amount of waste, as the wrong handling of it leads to environmental pollution, through burning Waste in the field and the emission of harmful fumes from it, or dumped in canals.

Agricultural residues can be benefited from and used for many purposes, such as using them to feed animals and thus can bridge the gap in the amount of feed and reduce the cultivated areas with green fodder and exploit them in the cultivation of strategic crops.

There are many types of agricultural waste, such as hay, firewood, plant thrones, and animal dung. Most of these wastes are low in nutrients if they are used in their raw form in animal nutrition, so modern technologies must be used to raise the nutritional value.

Therefore, it is necessary to expand the dissemination of this technology by educating individuals about the economic importance of reusing these wastes, and this awareness must be done through the various state groups, inclusive of the Agricultural Extension Apparatus, due to the fact it's miles the maximum company entrusted with instructing and teaching rural people, as it is the nearest educational device to farmers, so The extension machine have to be supported technically, financially and administratively so that it may bring about a change in farmers by using acquiring knowledge and growing capabilities, which ends up in converting their tendency toward adopting new generation, as a result raising the financial and social degree and accomplishing improvement desires inside the community.

The agricultural waste recycling project is one of the most important sustainable agricultural projects that convert plant and animal waste accumulated in farms into valuable materials for use in other industries. It also provides an opportunity for farmers to increase their income and improve the environment around them.

The project requires good planning, financial investments, and efforts to collect, store, and transform agricultural waste, but it is a good investment. Because of the economic and environmental benefits, it can bring. In addition, local labor can also be employed, which contributes to the creation of new job opportunities and the strengthening of the local economy.

The number of workers required for an agricultural waste recycling project is known based on the size of the project and the technologies used in it. For example, if the project is small in size, it can be run by a small group of 5 to 10 workers. But if the project is large in size, it may need a large team of 20 to 30 workers.

The workers are employed in the project with various skills, including technicians and people engaged in production, loading and unloading, packaging and other work related to the conversion process. It is necessary to train the workers on the use of the equipment and machinery used in the project and on the occupational safety and health procedures related to the conversion process.

For this, it is necessary to expand the dissemination of this technology by educating individuals about the economic importance of reusing these wastes, and this awareness must take place through the various state agencies, including the Agricultural Extension Agency, because it is the agency most entrusted with educating.



### **3. AGRICULTURAL WASTE RECYCLING GUIDE**

#### **3.1 Introduction**

One of the objectives of the country's master policy is to preserve the best environmental and economic benefits instead of burning wasteful agriculture, especially rice grass, which increases environmental pollution in the to the proper waste management in protecting the environment from pollution from scarcity sources (by United Nations, 2015).

It is a method of recycling and utilizing domestic, industrial and agricultural waste to reduce the impact of this waste on the environment and its accumulation this process is carried out by separating waste classification in a resource-based manner and then each product is repeated separately

The concept of recycling originated during the first and second world wars when countries faced severe shortages of basic materials such as rubber, leading to the collection of these materials from trash for re-consumption the role again

Over the years, recycling has become one of the most important methods of waste management. This is due to the environmental impact of this process over the years.

for many years, direct recycling by scrap producers was the dominant recycling method, but in the early 1990s they began to focus on recycling indirect use, i.e., waste materials were created for recycling.

Engineers have learned that taking recycling programs seriously can help reduce raw materials and operating costs, improving their image as a person he is forever guilty of environmental pollution

While some believe that recycling waste is the pinnacle of civilization, after a decade of implementing the concept, many of the countries with the highest recycling rates are beginning to embrace how question the effectiveness of that process and is it the best way to eliminate waste, the costs of restoration have long been recognized as high relative to the benefits and advantages.

The quality of the recycled material is usually lower than that of the primary material, and even if it is not used for the same purpose as the primary material (saifuddin et al., 2008) cost in terms of production exceeds the cost of production which is the main product of its raw material.

So, there is a confusing question! if recycling is an inefficient way to dispose of waste, what is the best way to dispose of it, there is really only one answer in the hands of scientists, because they have to find a new way to dispose of the waste, while simultaneously destroying the renewable resources in it.

Some ideas are already starting to emerge, like using crushed glass in garbage as an alternative to sand on paved streets or efforts to use garbage for clean energy, we observe expect to see many more ideas in the future. since then, environmental outrage has grown, green movements have sprung up in many countries, and many have raised environmental awareness and a real desire to curb pollution tip.

Earth day was called in 1970. there came a generation that knew new terms like: ecosystems, global warming, greenhouse gases, the ozone hole, waste recycling, and mass drought have to atone for the wrongs of our poor planet.

## **3.2 Types Of Agricultural Waste**

### **3.2.1 Straws**

Wheat, corn, bean grass, alfalfa, lentil, chickpea, fenugreek are dry plant residues that arise after studying cereal and legume crops, grass is one of the worst dietary components in a mixed diet , because crops when their grains and seeds are ripe, most of their nutrients are transferred from the leaves and roots and then the tree goes to the leaf f breaking them down most of their nutrients are removed Strawberries have crude high in fiber and low in fat and protein raw crude silica-rich ashes are also moderately abundant and low in calcium and phosphorus and tend to be very unpalatable dairy feeds for cattle ( Zurbrugg, 2002)).

The straw, especially that of the grass crops, loses its aroma, color, taste and luster if stored. for a long time, barley straw has slightly more nutritional value than wheat straw and is more palatable because it is less coarse and firm, as for legumes, its nutritional value varies greatly depending on the proportion for paper with hay.



**Figure 3.1:** Rice Straw as a By-Product of the Rice Crop

**Source:** (Google)

### 3.2.2 Rice straw

Rice straw is used for paper, as bedding for cattle and horses, as fertilizer and organic industrial products as well as for protecting vegetables from frost and also in various fibers for hats and soft furnishings in the production of.

Since most of the grass produced from winter grazing crops is consumed in time in the winter, very little remains in the winter, as their prices rise sharply due to the high demand, when rice grass is available in winter and can be used equally determination and of the n for comparison, we see that they are close to each other, figure 3.1 shows rice husks as a by-product of rice crops comes into existence and experiments with grass-fed rice revealed that the animals first refrained from eating and accepted it, due to lack of familiarity.

He notices some digestive damage that he was afraid of (idris et al, 2004). And the health of the animals has remained good the result of feeding with it did not differ from feeding with wheat straw, while reducing feeding expenses.



**Figure 3.2:** Corn Stover as a by-Product of the Corn Crop

**Source:** (Google)

Since the straw produced from threshing winter crops, most of its quantities are consumed during in the summer, only small quantities remain in the winter, as their prices rise a lot as a result of the increase in the demand for it, while rice straw is available in winter and can be used in animal feed as an alternative of straw with the same decision, and by comparing rice straw to wheat straw in terms of chemical composition and value we find that they are close to each other, and experiments on feeding cattle with rice straw have proven that the animals accepted it after they had refrained from eating it at first due to their lack of familiarity with it. he notices some digestive damage that he was afraid of, and the health of the animals has remained good the result of feeding with it did not differ from feeding with wheat straw, while reducing feeding expenses.

The product of the same year's crop shall be clean and free from mold, provided that it does not exceed its moisture content is less than 12% and foreign matter is less than 4%. Ministerial resolution no. 554 stipulated that of 1984 (legal) that if straw, rice straw and hay are pressed into bales, it will be vegetable or synthetic fibers are used in their bundles, and wires are prohibited for this purpose when issued it does not harm animals (in case of bombing and mixing parts of it with raw rations). the annual production of rice straw is about 3.6 million tons (zurbrugg, 2002). Based on the 2006 census central administration of agricultural extension - ministry of agriculture and land reclamation.

### **3.2.3 Rice straw uses**

- To develop devices for organic chemical recovery.
- Used in biogas production for organic fertilizer and energy.
- It is used as an unconventional feedstock by adding urea and precipitating ammonia.
- Maize seeds that germinate in rice grasslands and are used as dry green fodder for livestock.
- In Western butter production, it is used for human consumption.
- Used as field floor beds in poultry farms.
- Grass can be pressed and sold to paper mills and brick factories.

- Sarsa is used in rations for livestock and building bricks.
- Rice used in furniture and furniture manufacturing.
- Grass-fed grass used in construction.

### 3.2.4 Corn stalks or stover

Similarly, corn stalk, good corn stalk, which is the stalk left after the crop of corn stalks has been gathered, this stalk is usually headless leaves dried) because it is sometimes used for industrial purposes nutritionally deficient organic fertilizers (planitia, 2006) , and fodder was scarce, table 4 shows the management of rice straw in some countries. therefore, it had to be used in livestock as a soft dry coarse material which is a good substitute for hay and rice straw. cut or break if too dry.

**Table 3.1:** Methods of Dealing with Rice Straw in Some Different Countries

| Country                 | beam | fire | Fodder<br>Brush for<br>animal | Mushroom<br>cultivation | fuel<br>for<br>home | coverage<br>flats | industry<br>paper<br>pulp |
|-------------------------|------|------|-------------------------------|-------------------------|---------------------|-------------------|---------------------------|
| Agricultural<br>country |      | •    | •                             | •                       | •                   | •                 |                           |
| Korea                   | •    |      | •                             | •                       |                     | •                 |                           |
| Taiwan                  | •    | •    | •                             | •                       |                     | •                 | •                         |
| India                   |      | •    | •                             |                         | •                   |                   | •                         |
| Pakistan                |      |      | •                             |                         | •                   | •                 |                           |
| China                   |      | •    | •                             | •                       |                     |                   |                           |

**Source:** (Balta, 2009)



**Figure 3.3:** Cottonwood as One of the by-Products of the Cotton Crop

**Source:** (Google)

This can be benefited from the stalks of corn in nutrition, and it still retains a large part of its color green and some succulents (about 35% moisture) by early removing and weighing the corn after approximately 95 days of sowing, after the grains are

completely doused and dried, figure 3.2 corn stover as a by-product of the corn crop instead of leaving the stalks to dry over the chopsticks so that livestock can be fed on part of the green chopsticks and turn its nutritional value. It is usually too dry to require semi-dry silage Heiligenblut as a fertilizer if it is dry.

Standard specifications for good corn stover:

It must be a product of the corn crop of the same year, and it must be dry, acceptable, odorless, and free of substances. Alien, mud and mold, and the moisture content in it should not be more than 13 based on the 2006 census, the amount of corn stover reached 4.5 million dry tons, according to for the latest statistics of the ministry of agriculture.

### **3.2.5 Corn stover is used in the following**

- It is used as animal feed, whether without additives or with additives.
- It is used in making cameras to produce organic fertilizer.
- Used in biogas production for organic fertilizer and energy.
- Used to make building bricks.

### **3.2.6 Cotton stalks**

Cotton has stems and shoots left after harvest, these firewood's are often used as a fuel source and for organic fertilizer figure 3.3 shows cottonwood annual cottonwood production is about 1.6 million tons, according to 2006 census on central administration for agricultural extension - show it. department of agricultural land reclamation.



**Figure 3.4:** The Remaining Residues of Cotton Stalks

Source: (Google)

### **3.2.7 Cottonwood uses**

- Manufacture of particleboard.
- Source of energy (making briquettes used as fuel).
- Unconventional feed for livestock.
- Its use in making organic fertilizers.
- Manufacture of building bricks.
- Obtaining fibers for making ropes after giving firewood.
- Cutting and chopping the cottonwood in the agricultural lands and using it as an organic fertilizer.
- Use of cottonwood in the furniture industry.

### **3.2.8 Bagasse sugar - cane**

It is the one who is left behind after squeezing the reed sticks and uses the suckers a source of fuel in sugar factories, as well as in the manufacture of paper, cellulose, and others the sucker can be used to feed livestock after cutting .standard specifications for reed suckers state: it shall be the product of the same year's crop and shall be free from foreign materials and fermentation and mold, provided that the moisture content in it does not exceed 12%(Shekhar, 2009). and the number of raw cables should not exceed. % 47% and ashes about 4The annual production of bagasse is 5.3 million tons, based on the 2006 Census on Central Administration for Agricultural Extension - Department of Agricultural Land Reclamation.

### **3.2.9 Rice hulls**

It is the outer crust of the barley rice grain, and the rackets produce huge quantities of it annually it receives a great burden in its disposal, and the ferret is used as a source of fuel and for beating bricks, and in making artificial organic fertilizers and insulating panels, and sometimes as a bed for birds, the ferret is poor in its nutritional value, although it can be used to feed livestock, on condition grind it or not to break its sharp needle tips rich in silica so that infections do not occur in the walls of the alimentary canal of animals if they are introduced into their diet in a sound condition, and may resort to treatment ammonia is used as a means to increase its nutritional value by increasing the proportion of nitrogen in it.

The standard specifications of rice lining state: to be the result of hitting the rice crop of the same year, and to be dry and free of substances strange and moldy, provided that the moisture content in it should not exceed 9%, and the ash should not be more than 24%. The percentage of fermentation in feed mixtures should not exceed 15%.

#### **3.2.10 Seed hulls Cotton**

During the processing of cotton feed, the outer shell of the cotton itself is separated and used by breeders as an additive in livestock feed the standard specification for cottonseed husks states: to be produced from the cotton seed crop of the same year and to be free from foreign matter and mold, and it is stipulated that the percentage of raw fibers in it should not exceed 42%, and the percentage of ash in it should not exceed 4%.

#### **3.2.11 Hulls lentil**

A tooth of corn is mixed with the outer kernels of corn. Standard specifications for lentil husks include: Must be dust free, provided that the proportion of crude fibers does not exceed 30% and the ash content does not exceed 6% percent.

#### **3.2.12 Hulls horse bean**

It is the outer husks of the bean seeds mixed with some of the beans. The standard specifications for bean husks state that It shall be free of dust, provided that the proportion of raw fibers in it does not exceed 42%, and ash is not more than 6%

#### **3.2.13 Peanut shells**

It is the outer shells of the pods of peanuts. Table 5 shows the dry quantities of agricultural waste produced annually. the standard specifications for peanut shells stipulate that: it shall be free from mud and mold, provided that the moisture content in it does not exceed 15%, and the raw fibers in it are not more than. 55% and ash over 5%.

From the previous table, it is clear that Total agricultural waste 33.477 million tons The total quantities that are being utilized are 15.594 million tons Quantities that have not been utilized 17,883 million tons The rice straw represents about 25% of it, about 3.6 million tons of the quantities that have not been processed take advantage of them (Nagamuthu et al, 2007).

The burning of agricultural residues has generally caused problems related to agricultural land. significant in this crisis are: a - burning of rice grass and cotton: - since 2007 / due to increase in rice fields, about 1.6 million fedans of rice was not produced during 2006 it is estimated to be about 4 million tonnes per year, due to lack of utilization, including by farmers, where farmers are exposed to heat levels in excess of their needs, causing health damage and adverse environmental impacts have met (unep, 2001).

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**Table 3.2:** The Dry Quantities of Agricultural Waste Produced Annually

| <b>Waste</b>      | <b>Quantity (Million.Dry. Tons/Year)</b> | <b>Notes</b>   |
|-------------------|------------------------------------------|----------------|
| Cotton firewood   | 1.6000                                   | Unused         |
| Rice straw        | 3.600                                    | 70% unused     |
| Corn stover       | 4.500                                    | Feed           |
| Cane bagasse      | 5.030                                    | Unused         |
| Reed thyme        | 1,360                                    | Feed additives |
| Reed straw        | 0.50                                     | Unused         |
| Wheat hay         | 6.900                                    | Feed additives |
| Barley straw      | 0.200                                    | Feed additives |
| Sugar beet        | 0.320                                    | Feed           |
| Tree pruning      | 1.680                                    | Unused         |
| Vegetable waste   | 0.710                                    | Feed           |
| Banana waste      | 1.685                                    | Unused         |
| Bean hay          | 0.35                                     | Feed additives |
| Lentil straw      | 0.012                                    | Feed additives |
| Pea hay           | 0.042                                    | Feed additives |
| Gardens and parks | 1,141                                    | Untapped       |
| Sorghum firewood  | 1.20                                     | Feed           |
| Sesame of wood    | 0.59                                     | Unused         |
| Palm              | 0.86                                     | Unused         |
| Potato of throne  | 0.387                                    | Unused         |
| Tomato of throne  | 1.12                                     | Unused         |
| Total             | 35.477                                   | -              |

**Source:** (Womack et al. 1990)

Cotton plantations also exceeded one million fadas in 2005. most cottonwood contains active bales filled with bollworms and carnations (which serve as fortifications during dormant periods to feed back into the next crop), producing a yield from on farms increases by 20% waste of rice, hay, cotton and other burning agricultural wastes during october and november results in a large amount of waste that can be classified,

Harmful effects of burning agricultural residues above the surface of the agricultural soil, the smoke from burning rice straw waste, cottonwood and other agricultural waste causes the following occurs:

- • Elimination of natural enemies of insects and pests (mosquitoes, predators, etc.).
- • Harms agricultural crops in soil
- • Health diseases (especially chest disease) among farmers and residents of neighboring districts
- • From the fumes produced by the combustion of these agricultural wastes
- • Vehicle collisions during burning of agricultural waste on highways
- • Heat destroys existing vegetable crops and perennial fruits in nearby areas
- • Pollution caused by atmospheric gases (such as carbon dioxide, sulfur, nitrogen, etc.).
- • Heat eliminates field-loving birds
- • Heat causes fire to spread to houses in villages

The harms of burning agricultural residues under the surface of the agricultural soil:

- • Burning of agricultural residues in agricultural land causes a lot of damage, e.g.
- • Death of all organisms that are useful to agricultural land and enhance its fertility.
- • Burning of organic matter through the top layer of agricultural land.
- • Reduced productivity of agricultural land.
- • Conversion of agricultural soil into hard minerals (such as red brick), a.
- • It is similar to the yellow pigment produced by burning raw bricks from agricultural soil in brick kilns |

- • Introduction of carbon dioxide from the atmosphere into agricultural land, and this is cost-effective
- • Depriving plant roots of oxygen, which is essential for respiration and microorganisms, which inhibits proliferation and reproduction, drastically reduces agricultural land productivity.

The method of utilizing agricultural waste by converting it into organic fertilizers is one of the ways that The Agricultural country Ian conditions are suitable for the low percentage of organic matter in the Agricultural country Ian soil, especially in the new land, which represents a large proportion of the cultivated area.

### **3.3 Types of Organic Fertilizers**

Given the importance of organic fertilizers, they can be manufactured from any organic waste (whether vegetable or animal or human) (Shekar, 2009). so, the type and properties of organic fertilizers vary according to the type of organic waste which consists of organic fertilizer.

#### **3.3.1 Municipal fertilizer**

It is what the farms call (the municipal sewage), which is the product of aerobic fermentation of mixed livestock residues. either with soil or rice straw, usually from the barn in which the livestock are raised, and it is a fertilizer good, provided that it is composted and decomposed before using it to fertilize agricultural land.

#### **3.3.2 Industrial organic fertilizer (compost)**

It is a fertilizer that is made in an improved manner than municipal fertilizer, and it is the product of the aerobic fermentation of a mixture of plant waste or animal waste or both together with some additives such as mineral fertilizers and microbial pollinators, which is a very excellent fertilizer for agricultural land.

#### **3.3.3 Poultry manure**

It is a fertilizer resulting from the aerobic fermentation of poultry blue, whether the egg or the chick, and it is a fertilizer excellent, provided that it is composted and decomposed before using it to fertilize agricultural land in order to kill the

pathogens. Diseases, nematodes, and the non-germination of weed seeds so that it is suitable for the plant to benefit from.

#### **3.3.4 Powder fertilizer**

It is an organic fertilizer resulting from the air drying of sludge (sewage) after water separation sanitation is separated from solid materials, as this is done in sewage stations, and it is a fertilizer excellent, rich in nutrients, and because the sludge does not have any treatment except drying it contains all parasites and pathogens, bacterial, fungal and viral as well as a high concentration of heavy elements. therefore, the use of sludge in cultivation is not permitted vegetables or crops that are eaten fresh. but it is only allowed to be used for fertilizing crops which are not eaten fresh (Visvanathan et al, 2004).

There is a long-term plan to treat sewage sludge either by anaerobic or aerobic composting with garbage or agricultural residues in order to eliminate all diseases from parasites and microbes but the content of the compost produced after composting of heavy elements must be taken into account to determine usage rates so that there is no contamination of food or soil with these elements in the long term the use.

#### **3.3.5 Biogas fertilizer**

It is a fertilizer resulting from the anaerobic fermentation of organic waste (whether plant, animal or human) in biogas units, which is an excellent fertilizer for agricultural lands.

#### **3.3.6 Composting garbage**

It is an organic fertilizer resulting from the aerobic fermentation of garbage and waste from streets and homes in villages and cities, it is a good fertilizer.

##### **1. peat moss fertilizer:**

It is an organic fertilizer imported from european countries, and it is the finest, resulting from the aerobic fermentation of leaves forest trees for long years, and it is a fertilizer that is characterized by the power of impregnating a large amount of water, preferably it is used in the production of vegetable seedlings in trays for

greenhouse cultivation, as well as in plant stores ornamental (glaw et al, 2005). which is an excellent fertilizer if it is free of nematodes.

### **3.4 Sources of Organic Fertilizer Production**

Needs of organic fertilizers for agricultural land the total needs of municipal fertilizer per year amount to 211 million m<sup>3</sup> / year, containing the substance the organic matter is about 8%, and this is equivalent to 53 million tons of compost (106 million m<sup>3</sup> of compost) not less than the percentage of organic matter in it is less than 30%, and this is due to the low content of municipal fertilizers from organic matter and fertilizer elements. the current shortage in the needs of organic fertilizers it represents about 40%. the optimum rates for the old organic fertilization are about 20 m<sup>3</sup> / feddan/ year, while the recommendations for reclaimed or sandy lands are about 40 m<sup>3</sup> / feddan / year). the agricultural waste in agricultural country, according to the latest census, is estimated at about 33 million tons annually4 billion, given the organic ingredients it contains - its economic value is between 3-4 billion. and mineral, the use of these agricultural wastes in the production of organic fertilizers can help in reducing the gap caused by the lack of organic fertilizers (unep, 2004).

The Sources of Organic Fertilizer Production:

- • Organic fertilizer produced from animal manure (municipal fertilizer) .
- • Organic vegetables produced from chicken manure (chicken manure).
- • Organic fertilizer production of manure.
- • Production of organic vegetables from treated sewage waste.
- • Production of organic vegetables from agricultural waste

### **3.5 Benefits of Organic Fertilizers**

There are many benefits of organic fertilizers when added to the soil as follows: -

- 1- It is considered a major and continuous store for the fertilizer elements necessary for plant growth, such as nitrogen, phosphorous, potassium, sulfur, calcium, molybdenum, zinc, copper, magnesium,
- 2- Iron, chloride and others.

- 3- It provides soil microbes with food and energy that enables them to decompose organic matter and release nutrients in the easy way for plants.
- 4- Maintaining the biological balance of soil microbes.
- 5- It is considered a basic reformer of the natural and chemical properties of the soil, as the organic matter works on it improving the ground construction in sandy soils and improving ventilation and gas exchange in the ground limestone.
- 6- It increases the exchange capacity of the soil, which increases its ability to retain nutrients and not to lose it with waste water.
- 7- It acts as a soil regulator against rapid changes in acidity, alkalinity, salinity and elements toxic, pesticide residues and chemical pollution.
- 8- Protects the soil surface from erosion by water and wind, and retains the aggregates of soil particles and increases the saturation capacity of the soft water and the kidneys in the soil and increase the wetting of the soil surface
- 9- Maintains soil temperature, moisture, ventilation and permeability, which leads to easy spread of soil. Roots and plant growth.
- 10- Makes the phosphates and the necessary microelements in a more accessible form for absorption by the plants.
- 11- Provide plants with the necessary nutrients on a regular basis throughout its life and according to its needs. Whether they are major or minor items.
- 12- It increases the ability of sandy soils to retain irrigation water by increasing the capacity of soil granules i have to stick together.

### **3.6 Areas of Benefiting from Agricultural Waste**

Organic primary organic crops organic crops are considered as the cornerstone to be conserved to increase the productivity of agricultural land reduces environmental damage due to mineral (drugs) due to excessive use. attention to organic fertilization is considered one of the most important issues in modern agriculture, especially sandy soils, poor organic matter (zurbrugg, 2003) a balanced diet to meet needs role considered as providing essential nutrients for all the plant growth factors, , in addition under conditions of intense irrigation in order to reduce nutrient losses, as

the organic matter is adsorption properties of macro and micro nutrients, . making it easily accessible and permanent in root propagation zone.

Addition of non-dissolving organic matter to the land: adding non-degradable organic matter to the land causes some bad effects on plants developing are as follows: the conversion of dissolved nitrogen (nitrate and ammonia) in the soil into organic nitrogen, causing the occurrence of temporary lack of nitrogen in the soil, which is reflected in the growth of plants. causes an imbalance in the ratio of oxygen to carbon dioxide in the soil air, which: it leads to harmful effects in the soil, such as nitrogen loss as a result of the reverse process take. the number of microbes increases significantly in the presence of non-dissolving organic matter and increases activity (guerrero et al, 2013). which leads to attacking the soil humus. limited aeration conditions resulting from the presence of non-decomposing organic matter led to: microbial extraction of nitrate oxygen, release and loss of nitrogen in the form of single nitrogen or nitrogen oxides. anaerobic conditions and excessive microbial activity of soil microbes lead to the formation of toxic affects the growth of plants.

Reasons for converting plant residues into organic fertilizers outside the soil first every soil contains a special type of humus in which the ratio of carbon to nitrogen varies from soil to another, and this ratio in temperate regions reaches 1:10, and studies indicate that it is from it is more useful for the added waste to contain ratios ranging between (18:1 to 1:20) in order to be there is an opportunity for it to decompose and reach the equilibrium (1:10), which allows to increase its usefulness to the soil. Based on this, the addition of any organic material in which the ratio of carbon to nitrogen differs from what it is existing in the humus of this soil, it is exposed in this case to the activity of microorganisms, which ends by reaching this ratio to its equivalent in soil humus. because of the wide ratio between carbon to nitrogen, in plant residues, which average 1:90, we find that it is difficult to add them directly and stir it with the surface layer of the soil, as this leads to the depletion of the soil content of dissolved nitrogen to decompose in the soil, which affects the nitrogen content of the soil, which decreases gradually and temporarily. in view of the need for soil mastic to build their bodies, as it is not available to them except what the soil contains of dissolved nitrogen, so you get it at the expense of the current crop it shows symptoms of nitrogen deficiency (Kumar and Goel, 2009).

Second one of the reasons that necessitates diverting the waste out of the soil is the loss of nitrogen in particular ammoniacal form by volatilization or by nitrogen alone, or nitrogen oxides, as products of processes the opposite of test that occurs in the soil if the ratio between oxygen and carbon dioxide is disturbed with the ground air, as well as the movement of capillary water in the soil, in addition to the effect of the soil the heat emitted by microbes attacking the added residues.

Third the current methods of cultivation lead to intensification of cultivation and overexploitation of resources, which are caused by the alarming increase in the population with the narrowness of the cultivated area due to the necessity of organic fertilization the plant is outside the soil due to the lack of periods of vacant land between crops, which are required for operations the added waste is decomposed, so that the effects resulting from the use of waste that expands can be avoided carbon to nitrogen.

### **3.7 Compost Concept**

Composting refers to air beam process, and this method is one of the natural treatment of organic waste to produce good organic fertilizer through fermentation organic waste is the conversion of natural organics into soil-like substances and logging etc.). and fertilizer compost is a biologically active substance derived from the decomposition of organic matter by microorganisms under controlled conditions, similar to highly decomposed municipal charcoal, without any odor, as its besides being highly valuable in terms of nitrogen and organic matter, it was free of seed weevils, pathogens and nematodes

The industrial organic fertilizer is one of the important alternatives to fill the deficit in the production of municipal fertilizer. in addition to obtaining a product that is free from weed seeds and pathogens, and thus can be using it in the new lands without transferring problems except the old lands to those interested in organic fertilization in agricultural country have come up with a method for fermenting agricultural plant residues, i. converted to what is known as industrial organic fertilizer. in line with the prevailing agricultural country in conditions from where the use of plant residues, which is broken and cut by threshing machines to increase the surface the type susceptible to decomposition. in addition to helping reduce the volume of waste. foundations are confined Aerobic fermentation increases the moisture content of

these residues. Most of the time, with the availability of nitrogen elements you do the fermentation Phosphorous and potassium are necessary to activate microorganisms.

### **3.7.1 Advantages of using compost**

Compost supplies the plant with all its macro and micro nutrients. both, noting that the release of nutrients from the compost is carried out in large quantities sufficient plant needs throughout the season. compost improves soil texture and helps loosen heavy compacted soils. it improves its aeration and serves to hold loose ground together and increase its holding capacity with moisture. eliminates some plant diseases and harmful insects. (Moghadam et al, 2009) it retains water in sandy soil, protects the environment and reduces soil problems.

It is indispensable for its use in organic cultivation, as it is free from weed seeds and pathogens. diseases that are eliminated by the high heat released during the manufacturing process. compost supplies the soil with millions of microorganisms such as stabilizer microbes. for atmospheric nitrogen and solvent for phosphorous and potassium, which helps to grow crops efficiently high. compost is rich in many hormones, stimulants and growth regulators (Prechthai et al, 2008) as well as many antibiotics that are resistant to fungi and pathogenic bacteria, reducing the use of pesticides. good compost works to chelate toxic heavy metals such as lead and cadmium. and makes it non-absorbable by the roots of plants. maintains the biological balance of soil microbes and increases the number of earthworms. by the soil.

Some important points to keep in mind when making compost:

- Diversity of materials used in the air composting process to contain field crop residues Dry, vegetable and legume residues, animal and poultry production residues.
- The selected land must be compact and level to facilitate the movement of equipment on it.
- When building the tank, it is necessary to carry out the stirring process once a month using the appropriate method for the quantity Composted and its size (manual labor - tractors - organic fertilizer management) and that the percentage of. 1: 1 to 50: carbon to nitrogen between 1:301:50 - %.

- The necessity of adding agricultural clay soil or bentonite mineral (clay) at a ratio of 5As the beneficial microbes need the presence of clay minerals during their decomposition activity to help build the humus and clay complex, where bonds are formed between the clay mineral and the componentorganic.10% mature compost to compost as a source of living organisms
- Must be added necessary for the combustion process.
- It is important that the first layer when building the composter is made of dry agricultural residues, and then alternating layers between wet and dry residues,2 m.
- The width of the cylinder is not more than 3 m and the height is not more than 1.5.

### **3.8 Factors That Affect the Production of Compost**

#### **3.8.1 The volume of waste and the quality of the waste**

The process of crushing and cutting the waste leads to an increase in the decomposition process. this is due to the increase in the surface exposed to decomposing organisms. it also helps to increase the ventilation rate and maintain moisture in addition to the ease of flipping the pile.

it is preferable to be a mixture of difficult to decompose materials with easily degradable substances, in general, organic waste they differ in the proportions they contain of carbon and nitrogen, so green plants are like crop residues vegetables contain a low percentage of carbon and a high percentage of nitrogen, so their decomposition is fast compared to fully ripe materials that take a brown color, such as rice straw, corn stover, wheat straw, cotton wood, etc (Narayana, 2009). which contain a high percentage of carbon and a small percentage of nitrogen its decomposition is slow. it is preferable to shred this waste so that it does not dry out before placing it in the pile.

#### **3.8.2 Ratio of carbon to nitrogen It C/N**

Is considered one of the most important factors that determine the success of the composting process, as microorganisms represent30 parts of carbon in exchange for only one part of nitrogen, so the presence of plant residues1 it requires following a

certain method in composing it as follows: this percentage increases or decreases by more than 30 .1 as in most plant wastes:

In the case of waste whose percentage is more than 301 it is preferable to mix: agricultural, in which the ratio of carbon to nitrogen reaches about 90with nitrogen fertilizers,1 accompanying the composting process is loss in: t - in the case of residues in which the percentage drops below 30nitrogen, and therefore work must be done to mix it with residues in which this percentage expands.1 ammonia and nitrate: in the case of wastes with a ratio of carbon to nitrogen 30it can be released and available in quantities suitable for the use of plants without competition from microbes the soil.

### **3.8.3 Microbial activity**

Microorganisms first begin to represent the available mineral nitrogen and knead to build their bodies and increase their numbers. then these organisms then begin to attack the nitrogen present in the waste in the form of protein where the ammonia is released, and a loss in its quantity may occur due to the high temperature. the heap and the subsequent drop in its temperature, the tastes bacteria begin to oxidize ammonia and form internet art (Zurbrugg, 2003). nitrate is exposed to loss when the heap moisture is increased too much, as it is lost by washing, it may be lost by the process of reversing the taz in case of high humidity and anaerobic pockets and the formation of nitrogen oxides gas, and therefore it is preferable to reduce the moisture of the mature heap when stored.

### **3.8.4 Humidity**

During the fermentation period 60% and can - the moisture of the pile should be maintained between 50identify it by taking samples from inside the pile and pressing them in the palm of the hand, where it is soft like sweat when the right humidity is present, and in this case, the heap temperatures reach about 65 °c72 hours and lasts for two months. to reach a high fermentation efficiency, it must be - after 48maintaining the heat released by reducing the exposed surface of the pile to the outside air so that its width shall be within 3 m, its height not exceeding 2 m, and the length appropriate to the size of the waste. There is a relationship between humidity and aeration, as an increase in humidity of more than 60% reduces the chance of air fermentation unwanted anaerobic products appear.

### 3.8.5 Temperature

In terms of heat, to reach a high efficiency in fermentation, the heat must be maintained. this is done by reducing the exposed surface of the pile to the outside air so that its width does not exceed 3 m and the height is more than 2 m and the length is appropriate for the size of the waste. 70 °C in a period of up to a month, which helps in - the temperature inside the camera reaches 55 eliminate disease-causing microbes and fungi as well as nematodes and weed seeds, as well as the beneficial microorganisms secrete some natural growth regulators and stimulants that are improved quality qualities, as well as many antibiotics that help eliminate pathogenic microorganisms, whether those present in the compost or in the soil, thus be compost plays a major role in biological control of soil pests.

### 3.8.6 Ventilation

Increasing the humidity of more than 60% or doubling the heap leads to a direct drop in the temperature and an increase in it unpleasant odors and the appearance of blue and black colors inside the heap due to the predominance of anaerobic conditions to overcome these conditions, the heap is being flipped daily.

- Good compost properties:
  - It contains the organic matter of histone, which is a storehouse of elements.
  - Free from weed seeds
  - Free from pathogenic organisms such as e.coli and salmonella spp
  - Rich in beneficial microorganisms
  - Free from plant pathogens such as rhizoctonia and fusarium
  - Free from parasites, plant pathogenic insects and nematodes
  - Ph neutral
  - Free from heavy elements
  - The disappearance of plant residues and the lack of recognition of its shape
  - Brown color
  - The acceptable smell is close to the smell of scorched earth

### 3.8.7 Final product quality

- One of the most important tests or determinants of the benefits of supplemental muscle fertilizer may god bless you for the hoped-for

application of agricultural lands, and here are some criteria if we were able to judge the quality of compost organic fertilizers.

- Carbon to nitrogen ratio (c:n ratio): it will make you eat less than 1.21
- The rate of its blood glucose, such as oxygen, will lead to the consumption of less than 111 (mg o./kg vs.hr).
- The germination percentage of the seeds for the test should be more than 10% (usually used). cress or radish seeds.
- The temperature of the mixture does not rise more than 21 °c according to the temperature of the environment surrounding.
- Composted compost must have been left for a period of maturation to not reduce publicly 21 days after the active phase.
- The percentage of reduction of organic matter (vs) must be at least 0.1% .
- And if it does not erode (or fail to bond) i.e. According to the standards of the previous leather, then the mixture it should be left for at least 0 months before adding it to the agricultural soil (guerrero et al, 2013).

### **3.8.8 Benefits of adding compost to the soil**

- Source of organic matter.
- Improves the structural composition of the soil.
- It improves the ability of the soil to hold water.
- Improves root system growth.
- Increases plant resistance to many diseases.
- Reduces the fertilizer needs of the crop.
- Reduces the need to use pesticides.
- Reduces environmental damage by letting organic matter decompose randomly.

### **3.9 Compost Preparation and Processing Machines (Organic Fertilizer)**

Burning the by-products of agricultural crops leads to the emergence of a black cloud that leads to air pollution and human infection with chest allergies, eye and throat infections, and also affects animals by suffering from respiratory suffocation and allergies, causing a decrease in milk production to 20%, and storage of these by-products above the rooftops of farmers' homes lead to many fires and the spread of

rodents and insects, causing the spread of diseases and polluting the environment. thus, the utilization of these by-products is considered an influential factor in keeping the environment clean, especially when benefiting from these wastes in the field of composting and the production of organic fertilizer (compost) because of its many benefits in preserving the environment (Basnayake and Visvanathan, 2014).



**Figure 3.5:** Type of Organic Fertilizer According To Its Sources

Source: (Google)

These outputs are utilized in the field of animal nutrition, the fodder industry, power generation, wood and paper manufacturing, and the production of bio-ethanol and coal.

First: defining compost and its role in preserving the environment.

Definition of compost it is the fertilizer resulting from the decomposition of organic matter by microorganisms in the soil that decompose plant tissues and when fully fermented, it turns into humus, which is a good fertilizer for the soil.

### **3.10 The Benefits of Compost And Its Role In Preserving The Environment**

- Compost is a major and continuous stock of fertilizer elements necessary for plant growth such as nitrogen, phosphorous, potassium, sulfur, calcium, zinc, magnesium, iron, chloride and other important elements.
- It provides soil microbes with food and energy that enables them to decompose organic matter and release nutrients in an easy way to plants.
- Maintains the biological balance of soil microbes.
- It improves the physical and chemical properties of the soil, as the organic matter improves the ground construction in sandy lands and improves ventilation and gas exchange in calcareous lands.

- It increases the exchange capacity of the soil, which increases its ability to retain nutrients and not lose them with waste water.
- It acts as a soil regulator against rapid changes in acidity, alkalinity, salinity, toxic elements, pesticide residues and chemical pollution.
- It protects the surface of the soil from erosion by water and wind, preserving the aggregates of soil particles, increasing the saturation capacity of the soil water and soil kidneys, and increasing the wetting of the soil surface.
- Maintains soil temperature, moisture, ventilation and permeability, which leads to easy spread of roots and plant growth.
- Provides the plant with the necessary nutrients.
- Regularly throughout his life and according to his needs, whether major or minor elements.
- Makes phosphates and the necessary micro-elements more easily absorbed by plants.
- It increases the ability of sandy lands to retain irrigation water by increasing the ability of soil granules to stick together.

#### **3.10.1 Steps to prepare the compost**

The most important steps of compost preparation (production) can be identified as follows:

- The area allocated for the heap is chosen on the basis that the ton occupies about (2 x 3 m) near the source of irrigation water and the ground is tamped well to prevent leaching with digging a channel around it with a width of 20 cm and a depth of 10 cm that ends with a sump collecting leaching so that the heap can be re-sprayed.
- The by-products of agricultural crops (plant residues) are cut into small parts to increase their surface area and increase the effectiveness of microbes on the decomposition of organic compounds.
- The heap is built in successive layers: a layer of agricultural by-products (plant waste) is placed 2-3 m wide and 50-60 cm thick, then a layer of animal waste 10-15 cm thick is placed over it or sprinkled with a mixture of nitrogen and phosphate fertilizers or microbial vaccines and trampled on by workers' feet to compact them and reduce volume. This process is repeated with

alternating layers of waste with water spraying and pressure until all waste is rammed to a height of (1.5-2 meters) and then sprayed from the outside (Hikkaduwa et al, 2015).

- Or the first layer is spread, where it represents 1/10 (one tenth) of the amount of by-products of agricultural crops (plant residues), which are ground and spread out over it with 1/10 of the amount of municipal manure or manure, then spread out 1/10 of the nitrogenous, phosphate and lime activators and rub this layer with tractors or workers. The second layer until the tenth layer is repeated with what was done in the first layer, and the last layer is covered with a layer of 5 cm thickness of municipal compost or soil.
- The heap is then covered and moistened with quantities of water once a week in the winter and two to three times in the summer or whenever necessary, and taking into account that the compost is not dry and not saturated, so that if you take a grip from the heap at a depth of 30 cm from multiple places and press it by hand, the hand is wet Only - this degree of humidity is very necessary for the success of the air beam process and must be maintained until full maturity.
- • Under normal conditions, the temperature of the gates exceeds 50 C after 48:72 hours and rises to 66-70 C and continues for several weeks depending on the type of plant residue, and this level is sufficient to remove it bacteria, nematodes and weeds have all been eliminated spores present in the body.
- The flipping takes place after the sixth week, and it is preferable to flip the heap every two or three weeks at most, so that its surroundings move to the middle and top to the bottom with spraying the biological activator and adjusting the humidity (moisture ratio of 60%) and rebuilding the heap to help mix the ingredients and increase decomposition (Bandara, 2011).
- The heap fermentation period may extend for about 20 weeks for wastes containing a high percentage of lignin such as cottonwood and bagasse.
- The pile can be covered with a cloth or plastic cover to protect it from weather fluctuations, provided that ventilation is allowed and the humidity is not increased so that the pile does not turn into anaerobic conditions.
- Soft fertilizer elements can be added in quantities that help microbial activity.

- The ripening of the compost is indicated by a decrease in the temperature and the disappearance of the smell of ammonia and its transformation to brown.
- After compost is produced, it is sifted and then packed into sacks in preparation for transportation, or it is transported directly to the lands using trailers or transport vehicles without filling it.

### **3.10.2 Factors affecting the decomposition of waste to produce compost**

These factors can be divided into external factors and ground factors as follows external factors include the chemical composition of the waste:

- The ratio of carbon to nitrogen.
- The lignin content of the residues.
- The degree of shredding of vegetable waste.
- The nature of the dominant microbes.
- Ground factors, which include:
  - The temperature.
  - Ventilation. the earth's content of good elements such as (nitrogen - phosphorous - potassium - sulfur).
  - Humidity. The texture and construction of the soil.

### **3.10.3 Agricultural waste shredding machines**

There are two types of agricultural waste shredder

#### **3.10.4 Green waste shredding machines**

It is used for shredding green residues such as alfalfa and green corn sticks. It can also be used to shred rice straw. These machines are divided into:

#### **3.10.5 Stationary green waste shredding machines**

This fixed machine consists of an iron structure on which the shredder is installed, which is a fixed knife and wide and sharp knives mounted on a roller driven by a small motor. the machine may be equipped with a moving mat to direct the waste to be cut to the cutting device and a safety lever to stop the feeding mat or move it in a reverse direction in the event of solid objects heading towards the feeding device,

and the knives cut the waste to the required lengths with the possibility of controlling the cutting lengths by increasing or decreasing the number of knives.



**Figure 3.6:** A Model of a Stationary Green Waste Shredder

Source: (Google)

### 3.10.6 Green waste chopping and slicing machines

They are machines that mow and cut green fodder within one machine. it is divided according to the available power source into a self-powered machine, that is, it has a motor to operate it (figure), or it is a machine that takes its movement from the tractor that take its movement and power from the tractor. it shows how to feed and cut the feed material (corn) and the speed of some different rolls in the machine.



**Figure 3.7:** Automatic Green Waste Harvesting and Shredding Machines and Tractor

Source: (Google)

### 3.10.7 Dry waste shredding machines

This machine is suitable for all types of wood (corn - cotton - palm leaf - reed stalks). The cutting output of this machine is not more than 20 mm and it is also used to cut rice straw as well as dry banana trees. the majority of these machines consist of 9 knives, eight of them installed on a fan and one fixed. the machine has 2 rollers to pull the chopsticks. this machine works fixed by a 60-horsepower tractor, where the

movement of the knives is transmitted by belts and tires (Navaratnam and Joyce, 2016).



**Figure 3.8:** Dry Feed Shredder Takes Power from Tractor Back Shaf

Source: (Google)

### **3.10.8 Compost agitators (organic fertilizers)**

To ensure the efficiency of the compost production process (compost), it is preferable to have a stirring machine to complete the aeration process and to facilitate the addition of water and add bacterial activator if necessary.

### **3.10.9 Self-propelled stirrers**

They are machines that move on both sides of the pile so that the pile is in the middle of it, and there is the turning roller of the machine facing the pile. As the machine moves forward and the roll rotates, the pile is turned over in the same location. Figure shows one of these types. The presented machine has an 80-horsepower engine and a tunnel-shaped structure (Petley,2017). The distance between the two panels is 3 meters, its width is 3.5 meters, and its height is 2.2 meters. It flips 800 linear meters per hour.



**Figure 3.9:** Self-Propelled Compost Agitator

Source: (Google))

### 3.10.10 Tractor-related stirrers

They are machines that move on both sides of the pile so that the pile is in the middle of it and there is the turning roller of the machine facing the pile. as the machine moves forward and the roller rotates, the pile is turned over in the same position. the source of movement for the machine and the turning roller is the rear shaft of the agricultural tractor. figure shows this type of stirring machines.

### 3.10.11 Self-propelled adjacent site stirring machines

They are machines that move on both sides of the pile so that the pile is in the middle of it, then the machine moves the whole pile from its position, lifts it and flips it to the location next to the pile and leaves the main pile site empty. figure illustrates this type of flipping machine.



**Figure 3.10:** Compost Stirring Machines Connected to the Tractor and Power Source

Source: (Google)

### 3.10.12 Stirring equipment on both sides

They are loaders that move on the right side of the pile to turn over half of the pile in its position and then move on the left side of the pile to overturn the other half of the pile in its position as well, thus overturning the whole pile. figure illustrates this type of flipping equipment (bandara, 2008).

### 3.10.13 Giant self-stirring machines

They are giant machines that move on both sides of the pile so that the pile is in the middle, and they have two rolls to turn the compost pile in their position. they are used to overturn large-sized piles. figure shows this type of permutation machine.



**Figure 3.11:** Self-Propelled Compost Stirrers for the Adjacent Site

Source: (Google)

#### 3.10.14 Lift-up stirrers

They are machines that move on both sides of the pile so that the pile is in the middle and are pulled by tractor. They are equipped with a lifting belt to turn the compost pile in its position by lifting it up and then leaving it to fall again on the ground in the same previous location, thus flipping and aerating the pile. figure shows this kind of stirring machine.



**Figure 3.12:** The Machine That Collects the Pile in the Field

Source: (Google)



**Figure 3.13:** Double-Sided Head-Turning Equipment

Source: (Google)

Preparing compost from farm waste (animal and plant waste) as well as from household waste from leftover foods, vegetables, fruits and other biodegradable materials. these organisms breed and set off to spread diseases and epidemics in the ocean (karunarathana et al, 2019).

The process of decomposition of these wastes requires appropriate conditions to help microorganisms complete the process of decomposition as required and quickly, moisture, heat and good ventilation are among the factors required to be provided for these neighborhoods and are important to complete the decomposition process well.

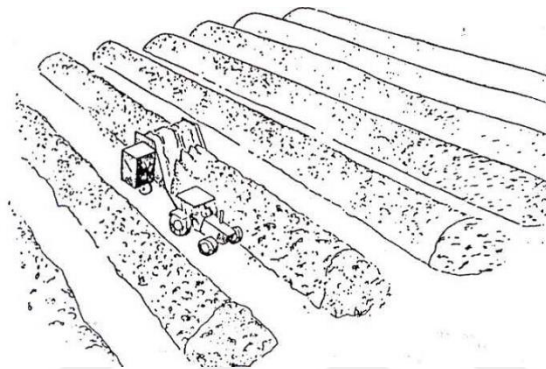


**Figure 3.14:** The Machine That Converts the Heap on Both Sides

Source: (Google)

Raw materials from which organic fertilizers can be manufactured:

Organic fertilizers come from either animal or vegetable sources or a mixture of them. these fertilizers differ in their components and nutrient content according to the type and nature of their source and can be classified into the following:

- Animal waste includes:
  - Bovine waste (solid and liquid substances secreted by the animal
  - poultry waste - horse, sheep and camel waste - bird waste. - bone meal - dried blood - fish meal and liquid fish emulsion).
- Plant residues, including:
  - Crop residues after harvest. Parts and leaves of trees and other plants.
  - Green plants that are grown and turned in the ground, especially leguminous plants.
  - Sabo's (such as bran, husk of rice grains...etc.
  - Molasses (such as sugar cane waste and sugar beet)
  - After extracting the juice. - Sea weeds (coco peat).

- Completely decomposed and heat-treated city waste, such as garbage and sewage waste.
- Factory waste, including

Waste of vegetable oil factories - waste of paper factories - waste of food factories.

In general, organic fertilizers must be fully decomposed and of good specifications before using it in agriculture and not using raw, undissolved and untreated animal waste thermal because it contains many pathogens as well as weed seeds, thus becoming polluted and spreading diseases and insects. therefore, we stress that animal waste should not be used in its nature (raw materials) until after it has been subjected to microbial decomposition and heat treatment (Samarasinha et al, 2015).

### **3.11 Mature Organic Fertilizer Specifications**

The mature organic fertilizer must have a set of important characteristics to determine its quality. there is a law for the circulation of organic fertilizers in every country that defines the specifications of organic fertilizer.

#### **3.11.1 The most important of these specifications**

- The compost is free of unpleasant odors, and this is evidence of proper aerobic treatment.
- The color of the compost is blackish brown, and this is evidence of the formation of humus.
- High level of organic matter and fertilizer elements.
- The ratio of carbon: nitrogen is narrow and according to the law.
- Ph and alkalinity not to exceed 6-8 units.
- The degree of electrical conductivity, preferably less than 10 mm/cm
- The compost is free of pathogenic microbes such as salmonella and shigella.
- The compost is free of heavy metals such as lead, mercury, and others.

#### **3.11.2 Preparation of organic fertilizer**

Preparing compost from farm waste (animal and plant waste) as well as from household waste from leftover foods, vegetables, fruits and other biodegradable materials. These organisms breed and set off to spread diseases and epidemics in the ocean.

The process of decomposition of these wastes requires appropriate conditions to help microorganisms complete the process of decomposition as required and quickly. Humidity, heat and good ventilation are among the factors required to be provided for these neighborhoods and are important to complete the decomposition process well.

### **3.11.3 Specifications of a good fertilizer**

Good compost is subject to certain conditions and specifications that make it usable and highly efficient. These conditions and specifications include the following:

- The fertilizer should be completely decomposed and devoid of or odorless, with a black or dark brown color, free of lumps.
- To be free from pathogens, insects and bush seeds (weeds).
- The fertilizer should be rich in organic matter.
- The salinity of the fertilizer should not exceed 10 mmose/cm (a unit of salinity measurement) as an extract (5:1).
- The pH value should not be more than 7.5 for an extract (5:1).
- The ratio of carbon to nitrogen (C/N ratio) should not be more than 20.
- The percentage of sodium chloride (NaCl) should not exceed 2%.

The use of agricultural machinery to recycle agricultural waste is a growing business, as more and more farms and companies are turning to alternative ways of treating waste products instead of sending them to a landfill. with green waste increasingly being recycled in homes around the world, agriculture is also turning to recycling methods in order to reduce the amount of waste it has to pay to dispose of.

The waste produced by farms and other rural businesses is often very diverse, and it is not easy to recycle it at first. the temptation to collect and pay for it is understandable, but that won't save you any money. strict farm waste laws exist across the uk and other countries in north america and europe, and landfill costs have skyrocketed in the past decade.

With proper recycling equipment and processing machinery, agricultural waste can easily be separated, processed, and sold for a profit. all of the following waste can be treated and recycled using this small mobile recycling equipment:

Green waste such as old trees, branches and hedges can easily be separated and shredded for reuse heaps of used soil or waste can be pulverized from the ground with a cone crusher, and run through trams to provide you with fresh top soil, clean rock useful for landscaping.

Plastic items from your farm, such as rolls of bales, bags of feed, buckets and any type of plastic container can be separated and then easily bundled together for sale with the rapid development of modern agriculture; the shortage of agricultural resources is becoming more and more serious. at the same time, the increase in agricultural residues has contributed to the pollution of rural environments. resource constraints and environmental pollution have challenged the sustainable development of agriculture. sustainable development refers to "not only ensuring the sustainable development of today's economy, but also not depleting future resources and environment.

Agricultural extension can help to increase farmers' awareness on agricultural waste management technologies and change bad practices in this sector, the importance of proper utilization of agricultural waste, availability and transportation waste storage will be used. Similarly, to sensitize farmers about environmental damage due to availability and misuse of agricultural waste, how to convert agricultural waste into non-conventional feed or charcoal organic or producing biogas units by burning or disposing of this waste alongside streams and drains, and for water spills.

On the face of it, the recycling of agricultural waste is one of the most pressing issues in iraq and turkey at the moment, and this is because the unused collection of this waste is environmentally friendly hazardous, more dangerous day Combustion causes environmental pollution, waste and harmful fumes produced, or by discharge into streams or drains.

Agricultural wastes can be used to produce animal feed and many other products, so they can be used in agriculture and crop management to bridge gaps in feed rates and reduce planted areas with green fodder wom. which is one of the types

## **4. ECONOMIC PRINCIPLES FARM MANAGEMENT AND MECHANISMS**

### **4.1 Management Theory**

Every movement directed towards arriving at a suitable theory of management is, in fact, a movement towards reaching a suitable theory of management scientific method in management. and management science is a complex science, because it looks at a group of problems and management learns the characteristic of continuous movement (dynamic) and it is in constant development and change to keep pace with the rise of the scientific, technical and relations level there is no doubt that management is a complex activity with great responsibility (dorney, 2007) and it is also an activity.

That benefits from results reached by other branches as well as from modern technology and mathematical methods, and those methods it is used in management with one goal, which is to help achieve good results in the economy in various fields its branches that it represents, institutions and projects, and in other words, it summarizes that goal, which is represented in securing an increase production and raising the level of its effectiveness, and we can define management as a comprehensive science for all branches to look at inevitability the objectivity of management rules on the one hand, and the way they are applied in the scientific experience of management on the other.

Management theory as a science that deals with management issues it is difficult to define the subject of management theory, but it is possible to identify the cycle of problems that are supposed to be discussed in management theory.

### **4.2 Management Mechanism**

The management mechanism is investigated from two different perspectives, first as an analysis of the management cycle (the tangible link to management), second as an

analysis of the structure of economic systems (the tangible link to individual and collective cooperation and the inevitability of their link).

We can say that management science is nothing but a scientific branch that applies the laws of operations management in the field of economics it is a science that studies the mechanism of management, its influences, the rules and pattern of administrative activity.

Basic law of management completing the work in the best way requires the optimal use of material and human energies and optimal satisfaction for human needs and desires inside and outside the organization, management is an economic and social responsibility.

Management's economic responsibility it is known that management is the completion of work by other people, so it uses the elements of each other material (money, materials, machines) and some of them are human, and the administration chooses the best material and human elements that events are verified and the selected items must be used best.

#### **4.3 Farm Management**

Since agricultural production began to develop from the stage of self-sufficiency to the stage of large production, the science of management began agricultural business has come into being, and the features of its existence go back to ancient historical stages. Science has begun to emerge as a separate science in the early nineteenth century in germany and was for the research and writings of scientists the distinguished germens in their development and progress.

Such as daniel d. tuner, who created the foundations of productive relations, and goltzgoltz then kramer, and in america Spellman w. spillmen in the first quarter of the ninth century ten with a remarkable role that led the ministry of agriculture to recognize the agricultural administration as an independent field of studies agricultural economics and among the first scientists in this science in america, warren g. warren and tiler talar and black black and others

These early leaders were first credited with the use of mathematical methods in management science research farmer as well as E. Heady who also used mathematical methods. Also, the follower of the renaissance of this science In

England, we find that Yong has published some research on this subject, and the establishment of the Institute is also considered The Oxford economist in 1913, the beginning of interest in this science in England.

It is a series of continuous actions and the need arises these behaviors are a result of changes that occur on the farm or in others, and the need to modify operations to suit them with her .it is also defined as the study of ways and means of organizing production elements and applying technical knowledge, experiences and skills in order for the farm to produce the largest possible amount of net income or profits. Farm business management is a type of business management.

If we look atA farm is a business enterprise that is organized and managed for the purpose of obtaining as much as possible net income in the first place and the science of farm management is one of the branches of agricultural economics that It is concerned with organizing and controlling the specialized agricultural operations on the farm as a production unit consisting of Including the general agricultural economic structure.

Farm management as an applied science is based on principles drawn from a range of natural and social sciences and from here it turns out that the science of farm management is a theoretical science and an applied science at the same timethe science of management is concerned with directing the different and specific resources for the different uses that they compete for, in order to achieve the objectives of the production unit, which may include some or all of the following objectives:

- Achieving the highest rates of agricultural plant and animal production.
- Achieving the highest rate of farm income.
- Achieving the highest rate of agricultural growth.
- Achieving family stability above production units and others.

#### **4.4 Characteristics of Management In The Agricultural Field**

Management in the agricultural field is shrouded in some natural and social characteristics that distinguish it from other management in other fields.

#### **4.4.1 The natural characteristics**

- Agricultural production includes live products that require special treatments.
- The climate factor, which is the most unpredictable or uncontrollable natural factor.
- Agricultural diseases and pests, Seasonality.
- The high percentage of fixed costs on the farm and the difficulty of calculating
- The length of agricultural production periods.

#### **4.4.2 The social characteristics**

- This is directly related to the type of production relations prevailing, for example, such relations may prevail
- Small private property
- Medium property
- Big property
- State ownership
- The ownership of the peasants who benefited from the distribution of land.

#### **4.4.3 Objectives of farm management**

It is wrong to consider that the only goal of farm management is to obtain the highest profit. profit may represent the main goal of farm management, but on the profit side, there are other goals that are no less important than achieving profit. of which:

- Enabling the farmer and his family members to obtain a certain standard of living.
- Create a suitable living environment for him and his family.
- Choosing the appropriate production elements and developing how to combine them in a particular production process.
- Efficient management of agricultural work.
- Efficient capital management.
- Choosing the appropriate production projects and selecting the appropriate mix of them.

- Introducing new methods of agricultural work, The difference between the science of agricultural management and the rest of the other agricultural sciences

There is a difference between farm management and other agricultural sciences such as animal production, field crops and soil, for example, that pure agricultural sciences are concerned with the natural relationships (chemical, physical, biological) between production elements and the final product, while farm management is concerned with studying the problem of obtaining the optimal mix of agricultural production elements, which it gives the producer the maximum amount of net income.

Management, after it was in the past an art, today has its principles, so it rose to the ranks of sciences. today, science and administrative art are considered two faiths that complement each other.

#### **4.5 The Functions of Farm Management**

The administrative process, which mainly represents decision-making, passes through five stages:

##### **4.5.1 Planning**

Planning is an essential function of the management process, because it is used in other management works and planning is done for the future. the objectives of planning must be clear, knowing that planning is a dynamic and changing function, meaning that all plans are temporary and subject to change, Characteristics of a good plan:

- The useful plan should be easy, simple and easy to understand.
- The plan must be comprehensive and provide each participant with the advantages that benefit it.
- It should be flexible and adjustable.
- The effective and effective plan must answer the following questions: What is the reason for carrying out these activities, where? And when this plan will be completed, who will carry out this plan.

### **4.5.2 Organization**

It is the division of work into different parts as well as it works to find a state of balance in the project during which the objectives are defined as well as the statement of the means of achieving them, and it is the foundational element in each project.

- Divide the duties into effective units.
- Putting the right people in their right places.
- Determining the powers and responsibilities so that there is no interference in the work.
- Establishing controls in the light of the results.
- And organization is necessary to get the various works to be carried out effectively.

The importance of organization, the importance of organization is due to the fact that it takes: the principle of specialization in production the principle of division of labor includes bearing the risks of the project, in general, the organization provides the competencies related to setting the goal and starting the project.

Such as, determining the type and quantity of production, how to market it, selecting workers, and purchasing production requirements, the following actions for production marketing, areas of innovation and innovation, application of modern production methods contribute to increased production.

### **4.5.3 Motivation**

It is known that planning and organizing are considered ineffective activities unless they have effective leadership and communication, and they also have the ability to provide incentives and their criticism should be constructive. guidance is a day-to-day process that depends on the efficiency of the plan and the organization in question, and the degree of clarity of each one.

### **4.5.4 Control**

It is the fourth function of the management functions, by which we can ensure that the work is finally completed by comparing what has been implemented with what was supposed to be implemented, and it includes setting regulatory standards,

measuring performance, knowing deviations and their causes and working to avoid them.

Stages of the control process.

Therefore, the control process includes two stages, first relates to the renewal of the standards or criteria that you use to measure the actual results of the objectives of the objective plan of the project under consideration, second it relates to evaluating the actual performance of the works that have been completed, and this stage is one of the most important stages of monitoring, censorship features, oversight is not considered a stand-alone authority, but rather a function of management, is not limited to a specific stage of the management process.

Oversight exists at all administrative levels, effective control depends mainly on the extent to which it is accepted and understood by the project workers, the difference between management and organization, the administrative process is mainly represented by decision-making (and the institution cannot carry out its activity to achieve its goals except through management and organization).

It is what is called the administrative functions, and the administrative process is determined by five stages: (planning, organizing, directing, coordination, and controlling). it appears in this sense that organization is one of the management tools, and it must be made clear that organization in farm management affects a major degree in reorganizing the production elements on the farm to achieve a higher level of economic efficiency.

Qualifications that help create a successful management (qualities of a successful manager), the ability to make decisions and analyze problems, constant investigation of new information, the ability to implement decisions and finish business., desire and ability to assume responsibility and take risks.

The ability and experience to perform arithmetic operations and keep farm records, honesty, integrity and integrity at work, desire for rural work., factors affecting the selection of an agricultural project, normal conditions, availability of labor and capital, transportation and transportation, technical level, competition with other commodities and merchandise for agricultural yield, government programs change in demand for agricultural commodities.

#### **4.6 Difficulties That Hinder the Use the Scientific Method in Farm Management**

At the level of developing countries, there are many problems that impede the use of the scientific method in the management of production units, and consequently, the failure of the agricultural sector's performance to achieve its existing goals. These obstacles include the following:

##### **4.6.1 Weakness of agricultural extension programs**

Most developing countries, including Iraq, suffer from the absence or weakness of the role played by the guidance sector. It is known that agricultural extension plays an important and necessary role in modern agriculture, and this sector suffers from a severe shortage of specialists, and consequently the absence of scientific programs for the transformation and application of research results, as well as from the weak financial means of communications and transportation and its inability to reach the various agricultural areas distributed over large geographic area.

##### **4.6.2 The big difference between physical and human development**

Material investments in the agricultural sector in most Arab countries, especially in oil, have reached a degree it is significant on the material level, and for the reasons of rapid agricultural development, which led to the existence of differences between material development, which led to a shortage and shortage of technical cadres (in terms of quality, not number) needed for agricultural development. This fact has repercussions on not enabling production units to achieve their goals.

##### **4.6.3 Lack of technical personnel in the field of agriculture**

Although there are many specialized university colleges and higher institutes in the field of agriculture, it is There is still an urgent need for more attention to graduates and the quality of programs in these institutions in order to live up to the academic and applied level.

##### **4.6.4 Academic division of farm management science**

The branch of knowledge did not find sufficient interest in Arab agriculture until recently. In its division, it was located within the science of agricultural production and one of the branches of agricultural economics, which is from the social sciences. Until the beginning of the sixties, the importance of this branch began to appear at the

local level and took its role as one of the branches of the specialization of agricultural economics to perform his task in finding the advanced cycle in agriculture.

#### **4.6.5 Agriculture is no longer a local craft**

Due to the interaction of human resources with land, water and natural resources in agriculture to follow all products agriculture has given it a wide scope to apply most of the sciences, which led to the description of agriculture as an open industry for scientific improvements, as it is known that these sciences are always evolving and renewable in the world it is necessary that agriculture not be closed, but rather that it is necessary to constantly review the scientific and technological developments in the field the world, but also the study of local markets and global markets and knowledge of the size of supply.

Topics farm managers may face there are other areas besides production efficiencies, workload, project selection and resource mix that a manager must address, the first field he must constantly resist the lack of current information on all fields in agriculture, so he must be aware of all prices related to his work and the change in the costs of production factors. the farm manager must maintain his prevailing technical ability, and he must be persistent in learning new ideas and inventions if he wants to maximize his income.

The second field it is related to the manager's ability to successfully cope with price changes, organizational changes - and political changes. changes in the local market structure such as entering into new marketing and cooperative supply in the region may give an opportunity to increase profits and the most applied change in this category may be market organization which allows making an effort to improve the characteristics of the product, determine the quantity that is put in the market, and search for the best sources of credit.

The third field risk. the risk is partially reflected in the income technologies, and insurance against it can be - regulated or unregulated. Organized insurance, for example, is insurance against fire, or unregulated, such as diversity and specialization.

The fourth field: it includes the problems of short-term economics and production requirements in exchange for long-term requirements.

The fifth field it includes the stability of the resources, the use of them and their price, and how the best combination of the variable resources he owns works with the aim of regulating the profit and income generated by the farm, increasing the production capacity and reducing the unit production costs.

The farm manager must successfully use his decision-making capabilities in at least three areas in order to run his business for a profit, in the field of marketing and in the field of finance.

#### **4.7 The Importance of Farm Management in the Economic Structure**

Farm management is a productive work that is intended to apply scientific assets in agricultural fields to obtain the largest economically possible yield at the lowest costs, and this requires the need to work to raise the efficiency of the two elements of the organization and control, as these two elements are responsible for mobilizing productive resources and controlling their interaction in the process productivity and the extent to which those resources are used. accordingly, we find that the efficiency of the management element is of great importance to use farm productive efficiency, and since the farm administration is responsible for the exploitation of land and capital resources economic exploitation as it is responsible for directing the work element so that we obtain from it the maximum production efficiency it mediates between the use of land and capital, on the one hand, and labor, on the other, to increase efficiency the productivity of this element and therefore it should occupy a decent position as an important element in agricultural production.

Farm management is one of the productive elements that deserve the attention and thought of policy-making bodies through it, agricultural production can be increased in quantity and quality. for example, England and wiles were able to increase the volume of agriculture agricultural production in the year 1957 - 1958 to a level that is about 62% more than the level before 1939, and that is about by improving farm management, or what means raising its level of efficiency by directing the use of available resources.

#### **4.8 Farm Management and Farm Decision Making**

It was previously mentioned that the science of farm management can be defined as the science of making farm decisions in units' production, which is a continuous process, and these decisions can be divided according to divisions different in terms of importance, time and frequency of making these decisions.

Types of farm planning decisions, organizational planning: it includes several things such as the location of the farm and the taxonomic inventory of soil and buildings.

Executive planning: it includes many questions, including how to work on each project how do you use the land.

The importance and repetition of administrative decisions, first: the daily decisions

With many daily routines to be carried out, it is necessary to prioritize which work to do, when, who will do it and how.

Second production cycle decisions here, the farm manager makes decisions that affect the success of his work during one or more production cycles, third: long-term decisions.

The success of the farm manager in the long run depends on the decisions he makes without sufficient and adequate information about the prices of the goods produced in the future and also about the costs of production and thus the size of his profit. here comes the role of the farm management in studying the alternatives available to it in the long run.

Administrative decisions can be defined as creativity in the conduct of administrative activities and it depends on actual knowledge of production conditions and this knowledge is based on the information possessed by the apparatus and the administrative rings on the activities Economic, technological and social phenomena.

The typical administrative decision depends on many conditions including.

A clear definition of the functions of each of the administrative circles, determining the rights of workers and providing them with the necessary information, availability of knowledge and experience of productive leader's classification of administrative decisions.

Administrative decisions in agricultural projects are classified according to many factors, but all forms of classification it is based on key indicators, the most important of which are the degree of comprehensiveness (farm level, production branches). continuity of activity (time period) the agency implementing the decision. the functional nature of the decision. there are three forms that characterize functional relationships in productive projects, it moves from the higher administrative levels to the lower administrative levels.

From the lowest administrative levels to the higher administrative levels. it is achieved within the administrative levels that lie on the same line. areas of decision-making in agricultural business management the farm manager faces several problems that he must make a decision on each of them, and of these decisions are those related to farm science as well as what is related to economic sciences. among these problems of the farm are the following.

The type of crop and its diversity. the area of the land to be cultivated and its limits types of seeds to be used, their quantities, and their sources. how to carry out agricultural operations. the extent of application of technical methods in agriculture. quantity of funds required and sources of obtaining them. the problem of buying or renting land. distribution outlets for agricultural products. the problem of commodity pricing.

And here we note the problems and decisions fall into four groups: agricultural, marketing, financial, individuals. this can be said that those decisions that the farm manager is required to make relate to three main areas: the agricultural sector includes organizational and executive decisions and an administrative field, which is specific to administrative decisions related to financing and agricultural control. as for the third area, it is the marketing field.

which is related to buying and selling decisions. Farm planning operations this concept applies to the farm as an economic project the appropriate farmer that requires making a set of decisions that answer some important questions: what does the farm manager produce how to produce a farm manager.

And taking these decisions on sound foundations that achieve the development and linkage of agricultural resources in a way that leads to reduced agricultural costs to

the minimum possible, and the following is a group of those agricultural organizational and executive decisions.

#### **4.8.1 Farm pattern**

The agricultural loom means the system or structure of the farm in relation to its capacity and the types and amounts of productive resources the types of crops and the agricultural policy followed, and the agricultural pattern differs from one region to another, and it is called on every area in which the natural, economic and social conditions are similar and in which a certain pattern of production prevails pronouncing an area or an area of an agricultural pattern, farm type distractor, farm type

Area, and the area is called in a general agricultural pattern area, if production depends on more than one major agricultural project, each of them contributes less from 50% of the total farm income, the area is called a specialized farming pattern area, and the patterns are determined the farm in light of the economic, social and natural factors prevalent in the different regions.

The most important economic and social factors that determine the agricultural pattern:

Demand and relative prices of agricultural commodities.

Changes in agricultural commodity prices shift farmers from producing one crop to another. There is no doubt that these price changes are linked to the demand for agricultural commodities and are reflected in the development of the agricultural production pattern.

Conditions of agricultural work conditions are taken into account when determining the types of products in the agricultural cycle. for example, when there is an abundance of labor in an area, farmers adopt patterns of production that require the use of greater rates of the labor force, and vice versa if there is a scarcity of labor and a rise in wages. in this the case should choose a farm method that does not require a large amount of labor to be implemented.

Availability of capital agricultural capital resources, whether in the form of machines and fixed equipment or working capital, differ from one region to another and from one farm to another. on the basis of the availability of these elements, we must

choose the appropriate agricultural mode, Other factors such as population density, how easy it is to dispose of products, marketing costs.

Distribution of output and selection of appropriate agricultural operations after determining the types of products that will be produced on the farm in light of the considerations previously discussed, the farm manager must decide how to distribute these products on the land according to their nature and determine the appropriate agricultural cycle.

Assessment of farm supply needs, different quantities and types of different resources can be used to produce any of the agricultural products, and here the role of the farm management emerges, which lies in using its advanced means and estimating the resource quantities that should be allocated to the production activities in consideration with the aim of maximizing the individual farm profit.

Develop a plan for manual and automated work, such a plan aims to estimate the marginal replacement rates for machines and farm work, those rates that achieve the lowest production cost per unit produced. also, the manager must determine the optimum combination between human work and automated work using cost-benefit criteria in order to ensure the achievement of the maximum possible efficiency.

Setting the maintenance and operation program, it includes maintenance, repair and operating expenses. this aspect represents the most important problems of farm management and the most related to the scientific principles of farm management.

Adjusting the timing of agricultural production, the timing of crop production is one of the most important functions of farm management, as the farm manager is faced with a number of alternatives with regard to the element of time as a determining factor for selecting and estimating different farm productive projects over time.

#### **4.8.2 Farm finance**

Farm financing is considered a burden on the farm administration, which demands the provision of funds necessary to carry out productive farm operations in a timely manner. The farm needs enough capital.

#### **4.8.3 Farm control**

Marketing decisions, the farmer may be successful from an agricultural point of view, but he is unsuccessful from an economic point of view on an appropriate price for its products, the amount of the final farm profit depends on many factors, including accuracy and efficiency marketing decisions, the farmer, as a planner, sets his production plan in light of prevailing prices and his expectations the price of the products is taken into account, but in the next stage, which is the stage of maturity and harvesting of these products(crops), the management's attention should be directed to identifying the marketing conditions of crops, and this includes agricultural price movement.

#### **4.8.4 Farms records**

There is no doubt that farms records is of great importance in the scientific management of production units without it, the farm management will not be able to take all kinds of farm decisions efficiently and effectively, as it is necessary for the success of the administration's mission in investing agricultural resources, the optimal investment that achieves the farmer's goal of increasing income and production, increasing the efficiency and exploitation of agricultural resources, and achieving the existence of farm records a group of objectives and advantages.

Assistance in preparing farm including plans seasonal farm plans related to farm production are based on information and data that help in finding accurate improvements and increases the efficiency of the production plan. the farm records provide the information they contain the most accurate data on the state of the farm in terms of soil quality, water, fertilizers, pesticides, their quantities and times farm plan without records will be based on information and averages from different environments and other areas may differ from the conditions of the natural farm and thus the efficiency of the farm plan decreases. and from here there was an important role for farm records in preparing the farm plan.

Assist in the follow-up of the farm plan follow-up on the implementation of implementation is one of the responsibilities of the farm management, which can facilitate its task by the presence of farm records.

Assistance in obtaining farm loans various financial institutions that provide loans to farms require a minimum level of information and data that can be provided through

farm records, such as: income sheet cash flow sheet - farm inventory sheet and other data that make it easier for the farmer to apply for farm loans and support his ability to commitment to the payment programs and the financial obligations arising therefrom.

Assisting in applied scientific research directed at solving agricultural issues the task of scientific research and research centers remains difficult in light of the lack of knowledge of the problems to which it should be directed scientific research in the absence of farm records, and through the information provided by records can know the problems are qualitatively and quantitatively, and from knowing the size of the problems and the damage that these problems cause in income and production, which gives research centers a basis for providing services at the costs required by scientific research from by comparing the damages to the problems and the existence of a solution to the problems experienced by the farm units.

Assisting in determining the farmer's obligations towards taxes and other matters farm records have an important role in determining the net farm income that is subject to taxation and is avoided thus, the farmer changes unfairly with respect to this commitment and this role is necessary and vital in farms in developing and underdeveloped societies alike, and these are examples of the importance of maintaining a minimum level of records farm for scientific management of production units.

There purposes of agricultural records and their uses by achieving the maximum possible profits by increasing production and reducing costs. and achieving farm success depends on how records are used and clarify and display the business that is interested in the farm during a certain period.

Clarify the extent of progress being made on the farm and what can be achieved in the future, Clarify the extent of deviation in the performance of agricultural operations by comparing them with what is specified in the production plan Helps improve the productive efficiency of the resources used, assists in making decisions that are placed in light of risk and uncertainty

Assists in evaluating capital investment in agricultural projects, it helps in analyzing the financial and administrative position of the farm and the farm control so that

deviations can be avoided finance, helps analyze agricultural cost data to reduce costs information required for farm records

The efficiency of decisions made by farm management is often coupled with the quantity the information on which these decisions are based and the rule says that the efficiency increases as the information available increases.



## **5. AGRICULTURAL WASTE IN IRAQ AND TURKEY AND THE AGRICULTURAL MACHINERY USED IN ITS MANAGEMENT**

### **5.1 Introduction**

Agricultural residues are vital by-products of food-making processes in different plants and left in the fields after the main product or crop has been obtained. Some tend to call it agricultural residues, which are of important economic value and sometimes constitute great wealth that is often lost due to lack of exploitation.

There is a long list of these materials, the presence and abundance of which varies in different countries, and perhaps the most important of them are wheat straw, barley straw, rice field residues, rice husks, corn fields residues, corn stalks, sunflower stalks, vegetable crop residues, and others. These wastes, if annual plants, some bushes and pruning products in orchards, forests and trees are added together, will take a more general title, which is called “lignocellulosic materials”, which is an expression of materials that contain in their composition cellulose and lignin other than wood (non-wood) lignocellulosic materials.

Agricultural waste recycling and processes vary according to the type of waste, the methods and techniques available, and the purpose of recycling the primary use is the use of energy or purifying it by converting it into organic manure or animal feed. It helps to protect the environment from pollution, improve agricultural production, and create employment opportunities in rural areas, thus improving economic and environmental conditions and improving health and living standards rise.

The quantities of agricultural waste in the Arab world are estimated at 500 million tons, of which 81% are animal and the rest are vegetable (UNEP, 2010) and agricultural industrial waste is estimated at 14 million tons, which are approximate figures and the actual may be higher. As for Iraq, accurate statistics are not available on the lagging quantities in the agricultural fields because we still do not consider this to be an important matter.

In Iraq, with its environmental diversity and the vastness of its agricultural area, produces millions of tons of these materials annually, and although some of them are benefited from in limited areas, but the most general is not only left unexploited and thus constitutes a waste rather, it is burned on farms and thus is a factor of environmental pollution, leaving its negative impact on the soil (kirkby and fattore, 2006) and on the air and living things.

## **5.2 The Most Important Aspects of The Use of Agricultural Waste In Iraq**

For the purpose of maximizing the depletion of agricultural waste, it is treated by mechanical, biological and chemical methods to be converted into important products needed by man in various fields, thus achieving an important aspect of sustainable use of natural resources. among the most important aspects of the known exploitation of agricultural waste are the following.

### **5.2.1 Compost industry**

It is a natural organic fertilizer resulting from the biodegradation process by microorganisms of plant and animal waste under certain conditions of heat and humidity. compost is known for its great effect in increasing agricultural production as it is a source of nitrogen and a factor in improving soil properties such as increasing the water-retaining capacity of sandy soils, improving the construction and permeability of clay soils, increasing the exchange capacity, improving the ph and converting insoluble elements into soluble, which facilitates their absorption and so on. this type of fertilizer does not contain some chemical elements that have a negative impact on the soil and that chemical fertilizers contain.

### **5.2.2 Energy production**

Methane is produced as a renewable energy source through anaerobic fermentation of solid waste and liquid, including agricultural waste, in an economical, safe and supportive way to protect the environment from pollution. this is 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 gases (-50-

70%) and carbon dioxide (-20-25%) with other gases of -5-10%. (3 pm/ el-shimy, 2010).

### **5.2.3 Animal feed**

Agricultural waste is converted into animal feed after cutting and improving its viability by methods biological, where the residues are treated after softening by evaporation under a certain pressure and temperature, or treat it with urea or ammonia or some acids or bases to increase the protein content in it and improve its digestive properties. residues such as rice straw and cane mulch may also be used as soil for sowing seeds barley, where when the seedlings grow, they are combined as a mixture of fodder for animal feed. waste may be buried green agriculture is compressed underground to make silage, as it is a green fodder that can be provided throughout the year, it has its own advantages in this field.

### **5.2.4 Cellulose and pressed board industries**

These materials can be adopted as a raw material for the production of cellulosic paste, the paper and pulp industry, and the production of composite panels. they contain fibers at rates close to what is contained in tree wood, making them an alternative material for obtaining these fibers, which form the basis of a large number of products. Industries based on cellulose, lignin and other chemical components. in the field of manufacturing boards, the fibers constitute a weight of more than 99% of the weight of the fiberboard, and the minced waste is more than 90% of the weight of the particleboard. several studies and researches have been conducted abroad (Muhammad Yasin et al., 2007, Philip et al., 1993, et al. young Quist 2010) and at home to produce various types of pressed panels and confirmed the validity of most of them and recommended their exploitation in this field, which included papyrus (mafia-al et al., 1987), and reeds (Abd Ali, 1993).

Palm leaf fibers (Abdul Ali and Qadeer, 1996), the stems of the sun flower (Abdul Ali and Qadeer, 1997), the stems of the cotton plant (Abdul Ali and salah al-din Qadir, 2005), and corn stalks (Abdul ali and Nizar Qassemi, 2005). these materials may be used alone or mixed with tree wood to improve certain characteristics of its uses specific mixing ratios determined by the properties of each of the materials used in production (Marie rose et al., 2009).

### **5.2.5 Cultivation on agricultural waste**

This method is used in lands that suffer from soil problems such as severe salinity or injury soil diseases, whether in greenhouses or in the open field. the waste is stacked on the soil as it happens with rice husks where vegetables are grown. also, rice husks, cottonwood or sawdust may be used for the development and production of mushrooms.

### **5.2.6 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 onto these wastes and added to the soil to resist the pathogens inherent in the soil, as happens in the inhibition of the growth of the fungus, phytophthora pythium by compost, and using green fertilizer to inhibit rhizoctonia solan cause of root rot. converting agricultural wastes into organic fertilizers will improve the properties of soil increases growth rates, and because it makes the surrounding medium tend to the basic, it becomes unchanged suitable for the growth of nematodes, in addition to the role of microorganisms on which they are grown in resisting these organisms harmful.

### **5.2.7 Using it for constructive purposes**

The traditional uses of agricultural residues, although they still exist in some developing countries, are It is not of great importance balancing the modern uses in which various advanced techniques are used to be exploited in the structural fields. Agricultural waste and lignocellulosic materials are generally used in many countries to produce cement boards, cement blocks and gypsum boards for use in building walls and ceilings, some of which are heavy-duty and others as insulating boards (Youngquist et al., 1996). These boards - in addition to their low production costs - are It is characterized by its light weight, balanced with traditional building materials, and at the same time it has high insulation qualities, in addition to all this, its alignment with environmental requirements. This is why we see today and in developed countries that entire buildings are produced with these techniques and using agricultural materials.

### 5.2.8 The amount of agricultural waste in Iraq

Iraq, with its environmental diversity and 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, a limited benefit that cannot be considered economic, as happens with the use of straw in the feed for animals, when 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 scientists emphasize its harm to the soil, especially its beneficial life. (And others, 2006, Fatore and Kirkby).

In view of the lack of accurate statistics to inventory the quantities of agricultural residues and other lignocellulosic materials in Iraq, we will provide in the following estimated data, taking into account that they are subject to increase and decrease according to the seasons. Referring to the table, it becomes clear that the areas planted with the main grain crops amount to about ten million dunums, with wheat and barley taking the largest share, and industrial crops up to one hundred thousand dunums, while vegetable crops exceed the cultivated area of one million dunums annually.

In addition to the above, there are vast areas covered with huge quantities of annual plants such as reeds, papyrus, tart, and others, which are also not counted, but some old surveys may be of use in this area. Some foreign companies conducted surveys to inventory the quantities of cane in the southern marshes to complete the studies on its adoption as a raw material for the paper industry in Basra in the sixties of the last century (consult. Sand, 1966).

**Table 5.1:** The Area of Agricultural Land and the Amount of Crops

| Description                                          | Volume (tons) | Year |
|------------------------------------------------------|---------------|------|
| The area planted with wheat                          | 8574          | 2020 |
| Average yield of the total area planted with wheat   | 727.6         | 2020 |
| Wheat production                                     | 6238          | 2020 |
| The area planted with barley                         | 1756          | 2020 |
| Barley production                                    | 511           | 2020 |
| Average yield of the total area planted with yoghurt | 1123.9        | 2019 |
| Rapeseed production                                  | 575           | 2019 |
| The total number of palm trees                       | 17036560      | 2019 |
| Total production quantity                            | 639315        | 2019 |

Source: (Balta, 2020)

At that time, the available and harvestable quantities were estimated at more than one million tons annually, the productivity of one hectare has been estimated between 20 to 30 tons annually, and with the great changes that have taken place in the environmental reality of the region, it is recognized that there are huge quantities of reed and papyrus plants that can be exploited in a way that preserves the ecosystem of the region on the one hand and contributes to revitalizing the economic and social reality For the inhabitants of the marshes on the other hand, this is added to it that the reed plant is not limited to the marsh areas, it grows where there is a measure of water, from the north of Iraq to the south, especially in the middle and south, where it grows densely along the drains and on the sides of irrigation channels and in water bodies Variety.

**Table 5.2:** Statistical Quantity and Production of Vegetable Crops

| <b>Description</b>                                           | <b>Quantity</b>     | <b>Year</b> |
|--------------------------------------------------------------|---------------------|-------------|
| The area planted with cotton                                 | 13,000 dunums       | 2021        |
| Average yield of the total area planted with cotton          | 230.8 (kg/dunum)    | 2021        |
| Production for the cotton crop                               | 3000 tons           | 2021        |
| The area planted with maize                                  | 325,906,000 dunums  | 2021        |
| Average yield of the total area planted with maize           | 1148.8 (kg/dunum)   | 2021        |
| Production of maize crop                                     | 374,400,000 tons    | 2021        |
| The area planted with rye crop                               | 384,926,000 dunums  | 2021        |
| Average yield of the total area planted with rye             | 1097.5 (kg/dunum)   | 2021        |
| Production of rye crop                                       | 422,463,000 tons    | 2021        |
| The area planted with the potato crop                        | 76,673,000 dunums   | 2021        |
| Average yield of the total area planted with the potato crop | 6079.4 (kg/dunum)   | 2021        |
| Production for the potato crop                               | 46,245,510,000 tons | 2021        |

**Source:** (Ferried, 2021)

### 5.3 Quantities That Can Be Exploited from Field and Annual Waste

Studies concerned with estimating the volume and quantities of lingo cellulosic materials depend on the area and productivity of a unit the area or the weight of the crop and the ratio of the weight of the waste to the crop, which is the method adopted in the research to estimate the weights of the lingo cellulosic materials available annually as wastes of fields or annual plants, whose estimates were limited to reeds because there were no surveys to estimate their quantities despite their diversity and abundance. Therefore, the estimates contained in the research represent the minimum

for not including other types of bushes and not including the quantities of paper consumed, which can be recycled at rates that may exceed 75%, as is the case in the netherlands. the table shows that grain crops alone in iraq leave more than 6 million tons of waste, and it is almost entirely usable and exploitable for the production of types of paper and pressed boards.

As for the largest number represented by vegetable crop residues, which exceeds 10 million tons, the waste is very diverse and varies according to its suitability for this industry or that, in addition to being distributed over areas smaller than grain crops, which increases the costs of collecting and delivering them to factories. the outputs of pruning orchids and palm trees, which are close to one million tons annually, are almost all burned. the total estimated quantities, which amount to about twenty million tons annually, are considered in the account of losses, and no part of them has been exploited in the aforementioned fields, with the exception of cane in the paper mill in basra and palm fronds in the compressed wood mill in manuhiri.

**Table 5.3:** Different Field Crops and the Amount of Agricultural Residues Resulting

| Crops       | Production<br>(Ton) | Average Yield<br>(Donum/Kg) |            | Productive/<br>Cultivated<br>% | Productive | Damaged | Cultivated |
|-------------|---------------------|-----------------------------|------------|--------------------------------|------------|---------|------------|
|             |                     | Productive                  | Cultivated |                                |            |         |            |
| Okra        | 59353               | 1350.1                      | 1348.8     | 99.9                           | 43961      | 43      | 44004      |
| Broad Beans | 38605               | 1541.7                      | 1538.3     | 99.8                           | 25040      | 56      | 25096      |
| String Bean | 31064               | 1622.9                      | 1622.8     | 99.9                           | 19141      | 1       | 19142      |
| Eggplants   | 136749              | 3947.6                      | 3940.8     | 99.8                           | 34641      | 60      | 34701      |
| Peas        | 203                 | 1429.6                      | 1429.6     | 100.0                          | 142        | 0       | 142        |
| Carrot      | 3664                | 1859.9                      | 1859.9     | 100.0                          | 1970       | 0       | 1970       |
| Spinach     | 2684                | 1729.4                      | 1729.4     | 100.0                          | 1552       | 0       | 1552       |
| Beans       | 2938                | 1357.0                      | 1365.4     | 99.9                           | 2165       | 1       | 2166       |
| Cabbage     | 5769                | 1778.9                      | 1764.2     | 99.1                           | 3243       | 27      | 3270       |
| Green Onion | 50059               | 2152.8                      | 2152.8     | 100.0                          | 23253      | 0       | 23253      |
| Squash      | 22361               | 2649.4                      | 2640.0     | 99.6                           | 8440       | 30      | 8470       |
| Turnip      | 14492               | 2215.6                      | 2215.6     | 100.0                          | 6541       | 0       | 6541       |
| Lettuce     | 31232               | 1762.0                      | 1758.0     | 99.8                           | 17725      | 41      | 17766      |
| Chard       | 5251                | 1888.8                      | 1880.7     | 99.6                           | 2780       | 12      | 2792       |
| Radish      | 9770                | 2388.2                      | 2387.0     | 99.9                           | 4091       | 2       | 4093       |
| Beetroots   | 5553                | 2068.2                      | 2068.2     | 100.0                          | 2685       | 0       | 2685       |
| Water Melon | 337946              | 3806.4                      | 3803.2     | 99.9                           | 88784      | 75      | 88859      |
| Melon       | 157834              | 3136.9                      | 3133.5     | 99.9                           | 50314      | 56      | 50370      |
| Tomato      | 619543              | 6766.0                      | 6760.2     | 99.9                           | 91567      | 78      | 91645      |

**Source:** (Aarifa 2019)

## **5.4 Agricultural Machinery Used In Agricultural Waste Management**

### **5.4.1 Loader**

It is used to reduce agricultural waste used in producing compostable fillers from production sites to working area by loading onto trailers, and controls large amounts of waste modification of outriggers, figure shows the loader used in agricultural waste sites.



**Figure 5.1:** The Loading Machine Used To Collect Agricultural Waste

Source: (Google)

### **5.4.2 Tractor and trailer**

It is used to transport agricultural waste to production places and also transports the product to the places of consumption, and the shape of the tractors and trailers used in the places of waste and compost.



**Figure 5.2:** Tractor and Trailer Used For Collecting and Transporting Agricultural Waste

Source: (Google)

#### 5.4.3 Stack overturning and cutting machine

This machine is used to grind and stir the compost during its processing, and it is whipped into two types, one of which is self-propelled, and the other is towed behind the tractor. the figure shows the trailer organic fertilizer shredder behind the tractor.



**Figure 5.3:** Stack Overturning and Cutting Machine

Source: (Google)

#### 5.4.4 Coarse waste shredding machine

It is used to chop tree branches and agricultural residues used in the manufacture of Composted organic fertilizer and shows the shape of the coarse waste shredding machine.



**Figure 5.4:** Coarse Waste Shredding Machine

Source: (Google)

The management of agricultural waste in Iraq is scarce because there are many reasons, the most important of which is not adopting a wise policy in the exploitation of these resources. studies and research have proven that there are about 20 million tons annually of lignocellulosic materials in Iraq, at least. only a small part of them is benefited from the absence of studies and statistics that looking in this field even at the level of national statistics, which it makes the picture absent from those

concerned, and also that not adopting projects to exploit these resources means that Iraq will remain an importer of products whose import costs exceed two billion dollars annually. Therefore, the ministry of planning must adopt this issue by forming committees to survey and inventory the available quantities of exploitable lignocellulosic materials and their places of availability. conducting joint studies with the ministry of industry and minerals and the ministry of agriculture to study the feasibility of establishing projects for dough, paper and pressed boards near the places where these raw materials are available. projects, as they have high costs, and there is nothing wrong with establishing joint stock companies through which it is possible to achieve this goal.

Which has multiple economic, social and environmental dimensions. for this, the dissemination of this technology must be expanded by raising awareness among individuals of the economic importance of reusing these wastes, and this awareness must be carried out through the various state agencies, including the agricultural extension agency, because it is the most agency entrusted with educating and educating rural individuals, as it is the closest educational device to farmers. therefore, the extension system must be technically, financially and administratively supported so that it can bring about behavioral changes among farmers from acquiring knowledge and developing skills, which leads to changing their tendency towards adopting new technology, and thus raising their economic and social level and achieving development goals in society. to continue production and compete with the importer.

### **5.5 Agricultural Waste in Turkey and the Machinery Used to Manage It**

Turkey is an agricultural country in the world. Agriculture plays an important role in economic transformation and growth. Despite the direct linkage and economic benefits of transporting parts used for agricultural reasons to various industries for processing, there is no usable or unusable parts of agricultural products for thus agricultural activities generate large amounts of agricultural waste. But unless agricultural residues are valued as soon as possible, there is a significant economic loss. Like the world's population growth, Turkey's population is growing rapidly. Of course, with this population growth comes a need for energy.

However environmental damage due to the emission of greenhouse gases into the atmosphere through the use of fossil fuels, the lack of reserves leads us to look for renewable sources of energy therefore biogas production from organic waste is the sustainable method the research results supported biogas production by anaerobic digestion system method for conversion of various agricultural wastes to energy in different parts of turkey can be fed grinding it back into agricultural land as fertilizer while producing energy from biogas. in this study of agricultural wastes.

The agricultural sector played very important roles in the economic and social development of turkey since then the establishment of the republic not only provides food for the population of the country, but also contributes to national income and employment agricultural sector, which has an important place for the industrial sector as well it meets the need for raw materials in industry. by the way, the agricultural sector is indispensable in terms of exports. because it also contributes to exports directly or indirectly. the agriculture sector is considered more important in turkey. be because turkey is a developing country and the agricultural sector is effective in meeting food needs of people in the strategic sense.

Turkey is known as an agricultural country. Apart from the parts used due to agricultural activities, economic drivers include agricultural culture, which has direct economic value and is exported to industries for processing, and the agricultural products sector types not used or used. Agricultural activities therefore generate large amounts of agricultural waste. Agricultural residues are generated as a result of agricultural activities. Of course, it includes agricultural waste, poultry barns, abattoirs and harvest waste.

Removal of agricultural residues from prior efforts in industries using agricultural inputs is just a classical solution but this should not be seen as a solution because in reality, agriculture of waste is the most powerful and... worthy of the greatest economic benefit to the country. with a circular economy approach, such waste will be covered, the principle of zero waste will be reduced and the public money will be saved another issue is that increasing population leads to energy needs. however, it destroys the environment. emissions of greenhouse gases into the atmosphere due to the use of fossils and deposits. we need to find renewable energy.

## 5.6 The Most Important Aspects of The Use of Agricultural Waste in Turkey

The technologies used for the treatment of agricultural and industrial waste vary according to the quality of the waste, taking into account the following considerations:

The nature of the geographical distribution of waste and the determinants of its collection, which can be manual or automated and transported to manufacturing centers, as well as the seasonality of production

The choice of the technique used in terms of technical terms and ease of application

Taking into account the opinion of the farmer or industrialist during the transfer and application of technology, and comparing with imported technologies that may not be in line with social and environmental conditions, social acceptance of the transfer and application of technology, which needs some time before generalization.

**Table 5.4:** Techniques Used In The Treatment Of Various Agricultural Waste

| Waste                                                                                                                                               | Technology                                                                                        | Use                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Grain waste<br>Alatban<br>Bran                                                                                                                      | Physical/Chemical<br>Granulated center feed                                                       | Reducing the use of concentrated feed used in feeding Herd, formation of fodder stock<br>Included in the concentrated components                                                                                                                                                                                       |
| Olive waste<br>residues pruning<br>residue<br>Olive pepper (peat)                                                                                   | Drying/Crunches<br>Screening /<br>Transactions<br>Physical/Chemical                               | Animal feed during periods of drought is an energy resource with the possibility of use in animal nutrition during periods of drought                                                                                                                                                                                  |
| Agricultural<br>processing waste<br>Orange pepper<br>Tomato pepper<br>Remnants of tree<br>pruning<br>Fermented barley<br>pepper<br>Poultry glaucoma | Silage / Moulds<br>Silage / Moulds<br>Sifting/Jerash<br>Crunches<br>Silage<br>Fermentation/Silage | Feed the meat production center during dry periods Concentrated feed for meat or milk production<br>Concentrated feed for use during periods of drought Use for organic fertilization<br>Incorporation into concentrated feed for meat or milk production A source of biogas, organic fertilizer or feed for ruminants |
| Palm waste<br>Dates are not<br>marketable<br>Dates kernel<br>Palm leaves and so<br>on                                                               | Templates<br>Grinding and<br>preservation in the<br>form of granules and<br>industry              | Formation of fodder stocks for animal nutrition in Oasis areas<br>Domestic concentrated feed not for sheep and goats<br>Wood and paper industry                                                                                                                                                                        |
| Other Waste<br>Prickly pear<br>Lake plants                                                                                                          | Templates<br>Organic fertilization<br>Save in the form of<br>meals                                | Production of meat production feed / organic fertilizer for use in biological agriculture<br>For biological (organic) agriculture and Soil Conservation In addition to concentrated feed, meat production                                                                                                              |

Source: (Araya)

### **5.6.1 Techniques for the production of organic fertilizer**

The disposal of waste at its production sites and its use as organic fertilizer or "compost" is one of the common methods, especially if it is characterized by a high composting value. among the prevailing uses of waste is its application in the soil as a special organic fertilizer for waste whose economic value does not cover the burden of collection and transportation outside the farm.

Among the wastes that can be exploited are palm residues such as grass, and the remains of pruning trees, where they are crushed and fermented, as an organic fertilizer source, especially for vegetable production. this use results in increasing the fertility of the land and mitigating the effect of salinity.

This type of fertilization is used in many regions of turkey, and it can be exploited, especially in biological agriculture, which is developing from year to year due to the increasing demands on foreign markets.

### **5.6.2 Mushroom production**

Mushroom production is among the products that have been developing in recent years with some Countries, including Turkey, this mushroom is mainly grown on agricultural waste that is fermented in a working way Compost. During the fermentation period, several transformations are carried out to become a non-sterile but suitable medium for the growth of a fungus Mushrooms. These transformations are formed by the most insidious types of high-temperature-loving microorganisms. It is done During these transformations, the partial decomposition of organic elements into a suitable medium for the growth of mushroom mycelium provides. He has carbon, Nitrogen and minerals to cover his belongings.

### **5.6.3 The sphere of production of non-traditional feed**

Food insecurity is one of the main obstacles in the development of livestock production, which in this case is considered as one of the main national income in Turkey, scientific research efforts focus on finding alternative food and nurturing diseases affecting humans, animals Plants are also protected There are many technologies that can be adopted to modify plant residues by adding nutrients to unconventional foods.

#### **5.6.4 The use of liquid nutrients**

It is based on molasses, which is a mineral source of (91%) urea, (2,5%) moisture content (about 5%) phosphorus, sulphur, rare mineral salts, vitamins A and D. It is produced by heating water and dissolved in a known volume of urea. Mineral salts mixed with the vitamins are equally added, then the whole is added to 4 tons of unboiled molasses in a mixing machine, transferred after ten minutes to a water storage tank supplied by f nutrients, and we may say half a liter of molasses or usefully equals about half is one kilogram from concentrate feed.

#### **5.6.5 Solid molasses molds**

Molasses jars are manufactured as a useful liquid substitute to facilitate distribution to small livestock breeders. these molds contain 40-60% molasses, 10-20% urea, and 5-10% table salt, as well as chemical additives to help cool the mold to harden this technology has nutritional and economic benefits , as much as 20% urea is used, and throughout the day correcting these dishes provides the animal with a regular supply of micronutrients, and keeps the gut bacteria active.

#### **5.6.6 Coarse feed mincing (mechanical treatment)**

Where agricultural waste is cut from dried chicken stalks, ordinary, electric or tractors are used to make the wheat and cane for delivery, which makes it nice and smooth, and can build wheat grass replacement in fat and dairy feed, and the use of large waste areas accumulation by cutting agricultural waste there are many advantages of not producing, ease of transportation of waste, cost of transportation of this waste decreases, high-value nutrients, waste of field waste

#### **5.6.7 Treatment of residues with urea solution**

For curing, first crush the field residue with a simple crusher, then collect this residue in layers and spray it with urea solution prepared with 4 kg urea in 50 liters of water, and treat it remove sprinkled on 100 kg of grass, grass or firewood, then press treated residues with feet it happens that no ammonia gas leaks, which will be loaded with urea probe and will keep the pile completely covered for 2-3 weeks , then the lid is lifted from feeders processed and slowly incorporated.

#### **5.6.8 Treatment of residues with ammonia gas**

Large quantities of ammonia gas are produced in turkey, increasing the nutritional value of this waste as it is disposed of, and this is done by sorting hay bales in quantities of 5 or 10 tons the pile is covered with a thick cover covering each side - aeration is introduced, the pile is covered with plastic for 10-14 days in summer and for three weeks in winter, the plastic cover is raised and grass or straw is left is aired for two days and the animal is fed.

#### **5.6.9 Silage**

Silage is green fodder that is stored separately from the atmosphere, and is preserved through fermentation processes, including respiration and anaerobic fermentation to produce alcohols and organic acids to increase dietary acidity for removal of spoilage materials, the surface is then securely packed and molasses is added at the rate of 15 liters by adding 15 liters of water to each container, then the piles are covered with plastic in place a load falls on top of the pile, and finally after two months the pile is opened.

#### **5.6.10 The field of organic fertilizer production (compost)**

Trends in fertilizer use required to reduce fertilizer imports, especially phosphate and potash, and strong public investment, and most importantly, it reduces the side effects of everyday medications.

Industrial municipal fertilizers are influenced by plant residues such as fibers, trees, arbors, stems, bananas, grass and phosphorus concentration depending on the nature of the residue on the influence of widespread microorganisms under special conditions such as adequate ventilation, proper moisture, nitrogen. the properties of this charcoal are similar to decomposed urban charcoal, it has higher compost elements and no weed seeds.

The method of organic fertilizer is to determine the area of the pile on the basis of the 2×3m<sup>2</sup> required for one ton, then tamp the soil thoroughly and then surround it with 20 and 10 cm of manure, 60 cm thick on it , then a 10-15 cm thick layer of animal manure is applied, then repeat the process by spraying with water and em1 solution until the height is 1.5-2 m, then once a week at winter, -3 times in winter, in heaps

water, then change the pile every 2-3 weeks, finally leave the pile for 5 months and then use.

#### **5.6.11 The field of biogas and fertilizer production**

Biogas technology is based on the anaerobic fermentation of solid waste and water and the processing of sewage, plant, animal, farm waste and manure in an economical and unhealthy way to produce methane, biogas methane carbon dye. consisting of oxides mixed with many other gases, biogas is a colorless and odorless nontoxic gas that can be used directly for cooking, and can cover a 10-foot cubic meter refrigerator for 1-2,000 hours. as for biogas fertilizer, it is produced after gas production and it is rich in organic matter and elemental content it contains phytohormones, vitamins and growth regulators, and the biogas fertilizer consists of two layers, one liquid and the other solid, and biogas is biogas from animal waste such as cow manure, chicken manure, sheep and goat manure, camel and bird manure. cotton, rice waste, vegetable garden, greenhouse waste and spoiled fruits, as well as sewage and sewage waste, kitchen and kitchen waste and human urine waste and brown arise.

The biogas composting unit consists of four main parts: fermenter, gas collector, waste nutrient pit, organic fertilizer receiver all these parts are made of bricks, cement and sand, as well as polyethylene containers and metal or plastic containers. unit sizes range from 5m<sup>3</sup> – 100m<sup>3</sup> depending on the amount of waste available each day.

#### **5.6.12 Other uses**

- Food production for humans.
- Production of feed for livestock and poultry.
- Dietary protein synthesis.
- Production of biofuels.
- Organic ingredients.
- Paper and paperwork.

## 5.7 The Amount of Agricultural Waste in Turkey

The term agricultural waste is a by-product of the agricultural production process, while some refer to it as “waste” and the latter as “waste”, which is a vocabulary of complete anonymity, as treasure wasted by scientists only its status is appreciated by intelligent people, because it enters many industries like manufacturing of organic fertilizers, food, clean energy etc. recycling also protects the environment from pollution creating employment opportunities for youth, thereby improving the country’s economic situation.

The simplest thing to know is that the money of this treasure will not inadvertently fall into an ungrateful pit; there is a latest estimate of the amount of agricultural waste that we can recycle and recycle, exceeded the current production level in turkey is 184.6 million tons/year, the residue that comes from this category is 62.2 million tons/year. is an agricultural waste, and that wheat and barley crops alone are the source of 60% of agricultural waste.

A study by the department of agriculture and researchers at the agricultural research center found inflation and a lack of use of average agricultural food waste data by provinces, with waste levels ranging from 12% to about a million tone’s 9.2.

The main reason for this was the legal requirement to recycle and dispose of the waste generated by producers. developing countries still use the storage method, while developed countries recycle almost all waste for raw materials and energy. although the amount of work on waste management in turkey has increased, the level of achievement is still not satisfactory.

This is mainly due to the cost of recycling or waste recovery. in order to turn the waste problem into an economic benefit, it is crucial to recycle waste, avoid sending waste to landfills, and manage waste so that it can be sustainable environmentally and economically. this study examined waste management in turkey. in this context, the types and quantities of wastes produced in turkey and their disposal methods were discussed. the present study also provided an overview of commercial waste disposal such as sanitary disposal, composting and recycling in turkey and therefore the aim of the study was to focus future research on waste disposal use of the.

**Table 5.5:** The Amount of Different Agricultural Waste Over Two Years

| Year/Method of Removal     | 2015   |                    | 2017   |                    |
|----------------------------|--------|--------------------|--------|--------------------|
|                            | Plants | Waste Volume (Ton) | Plants | Waste Volume (Ton) |
| Sanitary Earthquake Plants | 123    | 41.261.755         | 122    | 43.825.135         |
| Incinerator Plants         | 5      | 42.872             | 7      | 310.227            |
| waste recycling plant      | 867    | 19.734.241         | 1.568  | 33.023.400         |
| Vegetable Plants           | 5      | 94.079             | 8      | 142.467            |
| co-burning factory         | 36     | 532.643            | 36     | 728.908            |
| Other recycling machines   | 852    | 19.096.879         | 1.526  | 32.224.025         |

Source: (Practical Analysis)

### 5.8 Obstacles And Limitations Facing Optimization Agricultural Residues And Ways To Reduce Their Effects

One of the most important factors for the success of developing methods and technologies to benefit from agricultural residues and agricultural processing is to begin to identify the problems and obstacles facing those uses, whether under traditional methods or those that face the application of advanced technologies in this regard, the most important of these obstacles are the following:

- Technical obstacles: related to the nature and quality of waste, its abundance and how to treat it
- Institutional obstacles: related to the bodies and organizations that are responsible for the use, production and utilization of waste
- Environmental obstacles: related to the effects that are reflected on the environment
- In the case of non-recovery from waste or disposal of pollution resulting from
- Economic constraints: the cost of some technologies is high
- Social obstacles: the difficulty of adopting some technologies by the shrine or investors associated with the mechanism of benefiting from waste

#### 5.8.1 Technical constraints

The waste is generally characterized by its expansion, disappearance of its natural properties and heterogeneity, it is between a dry and moist, fast-fermenting and perishable solid due to its high moisture content and its organic component or liquid in which the concentration of organic matter such as mors rises. Therefore, this

diversity makes it difficult to exploit them in one industry, and they also need equipment before their preparation to be used such as drying, cutting, grinding and fermentation ...etc.

The large size and low density of some wastes, which causes increased costs for their collection and transportation in addition to accumulating in scattered areas between distant farms or factories, sometimes in small quantities, which results in increased costs.

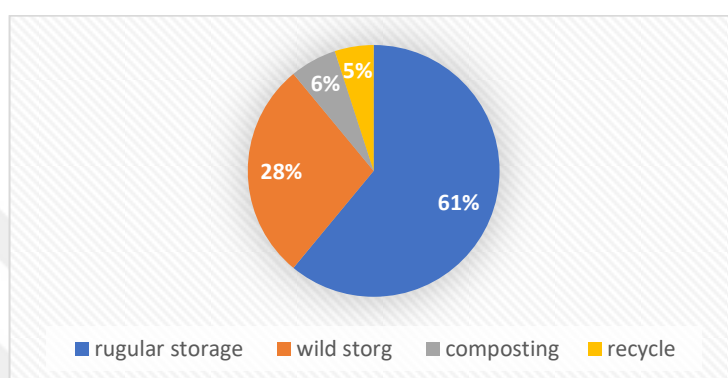


**Figure 5.5:** The Distribution of Waste Disposal Processes in Turkey

**Source:** (Practical analysis

At the time of seasonal agricultural waste production, it is available all year round, and it is the same during one season and when it is available, it is a fast-perishable or changeable crop, especially juicy field waste such as sugar beet (beet), fruit or citrus, grapes and olives from agricultural processing residues, animal production residues, which harms the ability to deal with them other than traditional methods.

Lack of trained technical personnel in the field of preparing information related to waste accounting knowledge of modern technologies used to raise the nutritional value of the dish to be used as for the animal and its fear of uses, or those used to dispose of its waste to prevent environmental pollution in particular, the lack of knowledge and experience of the agricultural guide and the lack of he has information about the technologies of recycling plant and animal creatures farms are not aware of the importance of recycling and using agricultural waste and it is unclear. The final use of waste and the foundations of the trade – off between these alternatives sometimes, weather conditions may hinder the efficiency of collection and storage operations and manufacturing heterogeneity of the qualities of the

residues collected for different crops and within the crop. Single by season production.

### **5.8.2 Institutional and legislative obstacles**

Responsibility for collecting waste or disposing of its coloring should not be transferred to one partying the sense that there is no reliable or measurable institutional reference, formally and technically he took advantage of the waste recently introduced into the araba art gallery, and therefore did not find enough research, application or interest in raising awareness at institutional levels :such as municipalities, local government authorities, shrine organizations and environmental protection associations.

Clack of coordination between public and private sector institutions involved in waste recycling they are often taken into account when planning the creation of agricultural plants where food manufacturing or distribution within a unit for utilization, as a waste treatment unit wet drying, granulation, cubing, pressing, or taking into account the creation of opportunities that encourage the creation of.

Other laboratories that specialize will not lead from existing food industry waste the importance of coordination between the relevant authorities and the role of ministries of agriculture in the araba countries coordination between research centers and institutes interested in research in agricultural production and its improvement characteristics of offal , or those that are engaged in the identification of aspects of waste, and then submission of technical guidance materials and related techniques to the concerned agricultural extension agency.

Deliver it to the farmer lack of sufficient information in the field of benefit and treatment of dilution and limited activity system agricultural guidance system in this area.

### **5.8.3 Environmental restrictions**

The accumulation and decomposition of wet residues leads to the generation and spread of insects, causing in outbreaks of diseases in addition to unpleasant odors air pollution with smoke and carbon dioxide as a result of burning plant residues in the fields some arabidopsis, which may extend to neighboring farms, pastures and

forests, or the smoke that oil plants produce when burning their waste residues. Also, manufacturing residues.

Agricultural and animal products may lead to serious environmental problems recovery from waste represents this for natural resources and its negative effects are reflected when crop residues are not used to feed the animal, the pressure on pastures decreases this leads to overgrazing, degradation of pastures and soil erosion and desertification. Also, the loss of a percentage of plant residues by burning them and not returning to the natural cycle. How organic matter poses a threat to the environment removal of food industry residues, especially liquids resulting from the pressing of olive fruits.

Where it either drains directly into the valley or sewer, or seeps into the groundwater, which leads to pollution due to the content of organic pollutants, the concentration of which ranges from 3 to 12%. The volume of pollutants discharged annually in the mediterranean basin countries it is estimated at about two million cubic meters per year, reflecting the volume of loss and pollution of water.

#### **5.8.4 Economic and social constraints**

The waste of waste without benefiting from it is considered an uneconomical mainstay, part of the inputs that were used to produce the crop reduces the loss of them, and the failure to derive from them in animal nutrition, for example, negatively reflects on the productivity of livestock as a result of receiving less than their food needs, especially in the seasons when the production of azad the utilization of waste in economic activities may face many obstacles other than collection operations, the utilization of waste is economically feasible in the case of transportation, storage and manufacturing, and may limited in the form of a small investment commensurate with the size of the residues due to the nature of the production of waste, which is distributed over regions, farms, and production seasons. Different and in each region, there is a small amount of them the high cost of collection and transportation of waste from the production area to the areas of exploitation and use it may reduce the possibility of their rotation. It may sometimes be preferable to export them abroad.

## **5.9 Difference between Iraq and Turkey in the Management of Agricultural Waste and Used Machinery**

The difference between Iraq and Turkey in the management of agricultural waste is that Turkey follows an integrated approach to the disposal of these wastes in ways that reduce the negative effects on the environment and health, while Iraq lacks an effective infrastructure for solid waste management and relies on uncontrolled landfills or incineration.

Turkey is using options such as anaerobic digestion, fertilization and biofuel production to reuse food waste as a resource. Iraq produces about 30,000 tons of solid waste every day, which is in excess of 1.4 kilograms per capita

The amount of agricultural residues in Iraq and Turkey varies according to the types of crops, animals and regions. According to some sources, the number of agricultural residues in Iraq can be estimated at about 176 million tons of animal manure and 17 million tons of agricultural waste annually. In Turkey, the amount of agricultural residues is about 8 million hectares of agricultural area and 17 billion cubic meters of biogas annually.

### **5.9.1 The methods used in both countries in the management of agricultural waste include**

Reducing the amount of agricultural residues by improving irrigation systems, developing agricultural techniques, reducing the use of fertilizers, implementing prevention and control programs, investment in farms, and increasing environmental awareness and education.

Reuse of agricultural residues in irrigation, fertilization, bioenergy production, thermal decomposition, direct combustion, animal nutrition, and absorption of pollutants, recycling agricultural waste through civil construction and composting operations.

### **5.9.2 Policies and laws related to the management of agricultural waste in both countries include**

In turkey, legislation and policies in the field of waste management have been prepared in line with the eu harmonization process. In this context, the waste

management regulation, which sets out the framework for waste management in turkey, has been implemented taking into account directive 2008/98/ec on waste. Turkey is also a party to the basil convention on the control of transboundary movements of hazardous wastes and their disposal.

In Iraq, the protection and improvement of the environment act no. 27 of 2009 was promulgated, which sets out principles, objectives, policies, procedures and mechanisms for the protection and improvement of the environment and the preservation of ecological balance. The law also contains provisions for the management of waste of all kinds, including agricultural waste, and obliges the generators of such waste to take the necessary measures to avoid pollution or dispose of it in safe ways.

Both countries seek to implement the three-way strategy (reduce, reuse, recycle) to manage agricultural waste in ways that support sustainable agriculture and reduce impact on the environment.

#### **5.9.3 Problems facing these policies and laws are**

Lack of funding and support for municipalities and farmers who bear the main burden of implementing a waste management policy, lack of adequate and appropriate infrastructure for the collection, transportation, storage, treatment and recycling of agricultural waste, weak control and control over the application of laws and regulations related to waste management and the imposition of penalties on violators.

Lack of environmental awareness and education among farmers and consumers about the importance of managing agricultural waste in sustainable ways, the impact of climate change and drought on water resources, agricultural land and crop productivity.

#### **5.9.4 Recommendations to address these problems are**

Increase investment and financing to develop the infrastructure and technology needed to manage agricultural waste in effective and sustainable ways, enhance cooperation and coordination between stakeholders in the public and private sectors and civil society to ensure the implementation and monitoring of policies and laws related to waste management.

Raising environmental awareness and education among farmers and consumers about the importance of managing agricultural waste in ways that preserve natural resources and improve the quality of life, adopting a three-way strategy (reduce, reuse, recycle) to manage agricultural waste in ways that contribute to supporting sustainable agriculture and producing added value from waste, improving the efficiency of water use and agricultural land and developing crop resilience to climate change and drought.

#### 5.9.5 Examples in agricultural waste management are

Using digital and biotechnology to increase the efficiency and productivity of agriculture and reduce the amount of agricultural waste and convert it into energy and value-added products, the use of carbon dot as a catalyst for light to decompose pesticides and agricultural fertilizers that pollute the environment and food, using the biochar cycle as a sustainable strategy for agricultural waste management in integration with traditional composting and irrigation practices.

**Table 5.6:** The Costs of Machines and Equipment used in Iraq and Turkey

| Machine/Equipment    | Price in Iraq        | Price in Turkey     |
|----------------------|----------------------|---------------------|
| Compost turners      | \$10,000 - \$20,000  | \$5,000 - \$15,000  |
| Balers               | \$5,000 - \$10,000   | \$3,000 - \$8,000   |
| Shredders            | \$3,000 - \$6,000    | \$2,000 - \$5,000   |
| Briquetting machines | \$12,000 - \$40,000  | \$10,000 - \$30,000 |
| Biogas digesters     | \$2,000 - \$7,000    | \$1,000 - \$5,000   |
| Tractors             | \$10,000 - \$50,000  | \$8,000 - \$40,000  |
| Harvesters           | \$20,000 - \$100,000 | \$15,000 - \$80,000 |
| Irrigation sprayers  | \$500 - \$2,000      | \$300 - \$1,500     |
| Water pumps          | \$200 - \$1,000      | \$100 - \$800       |

**Source:** (Central Statistics)

#### 5.9.6 Costs and difficulties related to the use of these machines are

The costs of purchasing, installing, maintaining and operating these machines and machines, which may be high for some farmers or municipalities, faculties in obtaining spare parts or qualified experts to repair or modernize these machines and machines in case of malfunction or damage, difficulties in training and qualifying workers or operators to use these machines and machines in a safe and effective manner.

Difficulties in keeping pace with technological developments and innovations in the field of agricultural waste management and the use of the latest available machines and machines, difficulties in adhering to local or international standards, laws and policies related to the management of agricultural residues and the protection of the environment from pollution.

**Table 5.7:** Machines, the Purpose of Their Use and Their Price in Iraq and Turkey

| <b>Machine or equipment</b> | <b>Purpose</b>                                                                                                                                           | <b>Country</b> | <b>Cost (in US dollars)</b> |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------|
| Plow                        | To turn the soil and bury the agricultural waste                                                                                                         | Both countries | 500 - 5,000                 |
| Tractor                     | To pull and carry the agricultural waste                                                                                                                 | Both countries | 10,000 - 100,000            |
| Crusher                     | To cut the agricultural waste into small pieces                                                                                                          | Both countries | 1,000 - 10,000              |
| Blind                       | To dry the agricultural waste and reduce its moisture                                                                                                    | Both countries | 5,000 - 50,000              |
| Presser                     | To press the agricultural waste and form it into blocks or pellets or bars                                                                               | Both countries | 10,000 - 100,000            |
| Biogas generator            | To convert the agricultural waste into biogas and organic fertilizer by anaerobic digestion                                                              | Both countries | 500 - 50,000                |
| Bioelectricity generator    | To generate electricity from biogas or from direct burning of agricultural waste                                                                         | Both countries | 10,000 - 500,000            |
| Bioethanol plant            | To produce bioethanol from hydrolysis of agricultural waste that contains starch or sugar by yeast or enzymes                                            | Turkey         | 100,000 - 1,000,000         |
| Biodiesel plant             | To produce biodiesel from conversion of agricultural waste that contains vegetable oil by transesterification or distillation process                    | Turkey         | 100,000 - 1,000,000         |
| Biohydrogen plant           | To produce biohydrogen from hydrolysis of agricultural waste by water by electrochemical process or water gas shift reaction or steam reforming reaction | Turkey         | 500,000 - 5,000,000         |

Source: (Central Statistics)

## 5.10 Kinds of Relationships between the Cost of Machinery and the Management of Agricultural Waste, Depending on the Perspective and the Context: Here Are Some Possible Relationships

### 5.10.1 From an economic perspective

The cost of machinery is an investment that can generate returns by reducing the environmental and social costs of agricultural waste, such as pollution, greenhouse gas emissions, health risks, and loss of biodiversity. the cost of machinery can also be offset by the revenues from converting agricultural waste into valuable products, such as energy, fertilizer, feed, or biofuels.

The economic perspective of the cost of machinery and the management of agricultural waste is based on the idea that the cost of machinery is an investment that can generate returns by reducing the environmental and social costs of agricultural waste, such as pollution, greenhouse gas emissions, health risks, and loss of biodiversity. the cost of machinery can also be offset by the revenues from converting agricultural waste into valuable products, such as energy, fertilizer, feed, or biofuels.

However, the economic perspective also considers the trade-offs and challenges involved in using machines and equipment for managing agricultural waste. for example, the cost of machinery may depend on the type, quality, and efficiency of the machines and equipment, as well as their availability, accessibility, and maintenance in different regions and markets. the cost of machinery may also affect the adoption and diffusion of innovative and sustainable technologies for managing agricultural waste. moreover, the cost of machinery may be influenced by the policies and regulations that govern the agricultural sector and the waste management sector, such as taxes, subsidies, incentives, standards, or quotas.

Therefore, the economic perspective aims to evaluate the costs and benefits of using machines and equipment for managing agricultural waste from a holistic and systemic point of view. it also seeks to identify the optimal level and allocation of resources for achieving efficient and sustainable outcomes.

The cost of machinery and the management of agricultural waste are two aspects of agricultural production that have environmental implications, especially in the context of global warming and rapid climate change. the cost of machinery refers to the expenses incurred by farmers for purchasing, operating, maintaining, and repairing various types of machines and equipment used for agricultural purposes. the management of agricultural waste refers to the practices and processes adopted by farmers for handling, storing, treating, recycling, or disposing of the waste materials generated by agricultural activities, such as crop residues, animal manure, pesticides, fertilizers, etc.

#### **5.10.2 From a technological perspective**

The cost of machinery is influenced by the type, quality, and efficiency of the machines and equipment used for managing agricultural waste. the cost of machinery

can also vary depending on the availability, accessibility, and maintenance of the machines and equipment in different regions and markets. The cost of machinery can affect the adoption and diffusion of innovative and sustainable technologies for managing agricultural waste.

From a climatic perspective, the cost of machinery is affected by the impacts of global warming and rapid climate change on the agricultural sector. Climate change can alter the patterns and quantities of agricultural waste production and disposal, requiring more or less machines and equipment to cope with the changes. Climate change can also damage or destroy the machines and equipment used for managing agricultural waste, increasing the costs of repair or replacement.

### **5.11 Different Types of Relationships between the Cost of Machinery and the Management of Agricultural Waste, Depending On the Objectives, Methods, and Outcomes of Each Aspect: Some Possible Relationships Are**

#### **5.11.1 Trade-off**

This means that increasing the cost of machinery leads to decreasing the environmental impact of agricultural waste, or vice versa. for example, using more advanced and expensive machines and equipment may reduce the amount or toxicity of agricultural waste produced or emitted, or improve the efficiency and effectiveness of waste treatment or recycling. conversely, using less or cheaper machines and equipment may increase the amount or toxicity of agricultural waste produced or emitted, or reduce the efficiency and effectiveness of waste treatment or recycling.

#### **5.11.2 Some examples of the trade-off relationship are**

Using more advanced and expensive machines and equipment for reducing the amount or toxicity of agricultural waste produced or emitted, such as precision farming tools, sensors, controllers, etc., that can optimize the use of inputs such as water, fertilizer, pesticide, etc. this can prevent or minimize the overuse or misuse of these inputs, and thus reduce the generation of agricultural waste and its negative impacts on the environment.

Using more advanced and expensive machines and equipment for improving the efficiency and effectiveness of waste treatment or recycling, such as anaerobic digesters, gasifiers, pyrolizers, etc., that can convert agricultural waste into biogas, syngas, biochar, etc. this can prevent or minimize the disposal of agricultural waste in landfills, incinerators, or open fields, and thus reduce the emissions of greenhouse gases, odors, pathogens, etc.,

Using less or cheaper machines and equipment for increasing the amount or toxicity of agricultural waste produced or emitted, such as conventional farming tools, pumps, sprayers, etc., that can increase the use of inputs such as water, fertilizer, pesticide, etc. this can cause or exacerbate the overuse or misuse of these inputs, and thus increase the generation of agricultural waste and its negative impacts on the environment.

using less or cheaper machines and equipment for reducing the efficiency and effectiveness of waste treatment or recycling, such as simple composters, boilers, dryers, etc., that can convert agricultural waste into compost, steam, heat, etc.

This can cause or exacerbate the disposal of agricultural waste in landfills, incinerators, or open fields, and thus increase the emissions of greenhouse gases, odors, pathogens, etc.

### **5.11.3 The factors that affect the trade-off relationship between the cost of machinery and the management of agricultural waste are**

The type and size of machinery: different types and sizes of machines and equipment have different costs and environmental impacts. for example, larger and more powerful machines may have higher purchase and operating costs but lower labor and time costs. They may also produce more emissions but reduce soil compaction. Smaller and less powerful machines may have lower purchase and operating costs but higher labor and time costs. They may also produce less emissions but cause more soil compaction.

The type and amount of agricultural waste: different types and amounts of agricultural waste have different environmental impacts and management options. For example, crop residues may have lower toxicity but higher volume than animal manure. They may also be easier to recycle into biofuels but harder to treat into compost. Animal manure may have higher toxicity but lower volume than crop

residues. They may also be easier to treat into biogas but harder to recycle into electricity.

The type and location of farm: different types and locations of farms have different needs and preferences for machines and equipment and agricultural waste management. For example, large-scale and intensive farms may require more advanced and expensive machines and equipment to cope with the high production and waste generation. They may also prefer to recycle agricultural waste into valuable products or resources to increase their income or reduce their costs. small-scale and extensive farms may require less or cheaper machines and equipment to suit their low production and waste generation. they may also prefer to dispose of agricultural waste in a simple or natural way to avoid additional costs or efforts.

**Table 5.8:** Machines, Description, Use and Availability in Iraq and Turkey

| Machine/Equipment    | Description                                                                           | Used in Iraq | Used in Turkey |
|----------------------|---------------------------------------------------------------------------------------|--------------|----------------|
| Compost turners      | Machines that mix and aerate organic materials to produce compost                     | Yes          | Yes            |
| Balers               | Machines that compress and bind agricultural materials into bales                     | Yes          | Yes            |
| Shredders            | Machines that cut and reduce the size of agricultural materials                       | Yes          | Yes            |
| Briquetting machines | Machines that compress and shape agricultural materials into fuel briquettes          | No           | Yes            |
| Biogas digesters     | Devices that convert organic materials into biogas and biofertilizer                  | No           | Yes            |
| Tractors             | Vehicles that provide power and traction to mechanize agricultural tasks              | Yes          | Yes            |
| Harvesters           | Machines that harvest crops such as wheat, corn, rice, etc.                           | Yes          | Yes            |
| Irrigation sprayers  | Devices that spray water or chemicals on crops or soil                                | Yes          | Yes            |
| Water pumps          | Devices that move water from one place to another for irrigation or drainage purposes | Yes          | Yes            |

**Source:** (Central Statistics)

#### **5.11.4 The environmental implications of the trade-off relationship between the cost of machinery and the management of agricultural waste are**

A trade-off between the environmental costs and benefits of the two aspects: the trade-off relationship means that there is a negative correlation between the cost of machinery and the environmental impact or benefit of agricultural waste. this implies

that increasing or decreasing the cost of machinery leads to decreasing or increasing the environmental impact or benefit of agricultural waste, or vice versa.

A trade-off between different environmental goals or indicators: the trade-off relationship means that there is a conflict or compromise between different environmental goals or indicators related to the machines and equipment used for agricultural purposes and the agricultural waste generated or recycled. this implies that improving or worsening one environmental goal or indicator may result in worsening or improving another environmental goal or indicator.

A trade-off between short-term and long-term environmental impacts: the trade-off relationship means that there is a difference or balance between the short-term and long-term environmental impacts of using machines and equipment for agricultural purposes and managing agricultural waste. this implies that achieving or sacrificing short-term environmental benefits may cause or prevent long-term environmental costs, or vice versa.

The synergy relationship between the cost of machinery and the management of agricultural waste means that increasing the cost of machinery leads to increasing the environmental benefit of agricultural waste, or vice versa. this relationship implies that there is a positive correlation between the two aspects, and that investing more in machinery can enhance the value and sustainability of agricultural waste.

#### **5.11.5 Synergy**

This means that increasing the cost of machinery leads to increasing the environmental benefit of agricultural waste, or vice versa. for example, using more advanced and expensive machines and equipment may enable the conversion of agricultural waste into valuable products or resources, such as biofuels, biogas, compost, electricity, etc., or enhance the quality and safety of these products or resources. Conversely, using less or cheaper machines and equipment may limit the conversion of agricultural waste into valuable products or resources, or reduce the quality and safety of these products or resources.

#### **5.11.6 Examples of the synergy relationship are**

Using more advanced and expensive machines and equipment for composting agricultural waste, such as shredders, mixers, turners, screeners, etc., can improve the

quality and quantity of compost produced, which can be used as organic fertilizer or soil conditioner for crops. this can reduce the need for chemical fertilizers and pesticides, and enhance soil health and productivity.

Using more advanced and expensive machines and equipment for converting agricultural waste into bioenergy, such as biogas digesters, gasifiers, pyrolyzers, boilers, turbines, generators, etc., can increase the efficiency and output of bioenergy production, which can be used as renewable fuel or electricity for various purposes. this can reduce the dependence on fossil fuels and greenhouse gas emissions, and contribute to energy security and climate change mitigation.

Using more advanced and expensive machines and equipment for making biomass fuel from agricultural waste, such as pelletizers, briquetters, dryers, etc., can enhance the quality and durability of biomass fuel products, such as pellets, briquettes, rods, etc., which can be used as alternative fuel for heating or cooking. this can reduce the consumption of wood or charcoal, and prevent deforestation and air pollution.

#### **5.11.7 Challenges of implementing the synergy relationship between the cost of machinery and the management of agricultural waste are**

Technical challenges these include the difficulties in selecting, operating, maintaining, and repairing the appropriate machines and equipment for different types of agricultural waste and conversion processes. they also include the challenges in ensuring the quality, safety, and efficiency of the products or resources derived from agricultural waste recycling, such as compost, bioenergy, or biomass fuel.

Economic challenges these include the high initial investment and operating costs of the machines and equipment, which may not be affordable or profitable for small-scale farmers or rural communities. they also include the uncertainties and risks in the market demand and price of the products or resources derived from agricultural waste recycling, which may affect the return on investment and competitiveness.

Environmental challenges these include the potential negative impacts of using machines and equipment on the environment, such as greenhouse gas emissions, water consumption, noise pollution, etc. they also include the potential trade-offs or conflicts between different environmental goals or indicators, such as energy security, climate change mitigation, soil health, biodiversity conservation, etc.

Social challenges these include the lack of awareness, knowledge, skills, and acceptance of the farmers and consumers regarding the benefits and challenges of using machines and equipment for agricultural waste recycling. they also include the lack of institutional support, policy incentives, legal frameworks, and infrastructure for promoting and facilitating the adoption and diffusion of machines and equipment for agricultural waste recycling.

#### **5.11.8 To overcome these challenges, some possible solutions are**

Technical solutions: These include developing and adopting more advanced, efficient, reliable, and adaptable machines and equipment for different types of agricultural waste and conversion processes. They also include improving and standardizing the quality control, certification, and monitoring systems for the products or resources derived from agricultural waste recycling.

Economic solutions: These include providing financial support, subsidies, loans, tax incentives, etc., for reducing the initial investment and operating costs of the machines and equipment. They also include creating and expanding the market opportunities and value chains for the products or resources derived from agricultural waste recycling.

Environmental solutions: These include adopting cleaner production practices, renewable energy sources, water-saving technologies, etc., for reducing the environmental impacts of using machines and equipment. They also include conducting comprehensive environmental assessment and optimization for balancing and integrating different environmental goals or indicators.

Social solutions: These include enhancing the education, training, communication, and participation of the farmers and consumers regarding the benefits and challenges of using machines and equipment for agricultural waste recycling. They also include establishing and strengthening the institutional support, policy frameworks.

#### **5.11.9 The environmental benefits of implementing the synergy relationship between the cost of machinery and the management of agricultural waste are**

Reducing the environmental pollution and risks caused by agricultural waste: By using machines and equipment for recycling agricultural waste into valuable

products or resources, such as compost, bioenergy, or biomass fuel, the amount or toxicity of agricultural waste that is disposed of in landfills, incinerators, or open fields can be reduced. This can prevent or minimize the negative impacts of agricultural waste on air quality, water quality, soil quality, human health, and wildlife.

Enhancing the environmental sustainability and resilience of agricultural production: by using machines and equipment for recycling agricultural waste into valuable products or resources, such as compost, bioenergy, or biomass fuel, the inputs or outputs of agricultural production can be optimized and diversified. this can improve the soil health and fertility, reduce the dependence on fossil fuels and chemical fertilizers and pesticides, increase the renewable energy sources and carbon sequestration, and adapt to the climate change and variability.

Contributing to the environmental goals and indicators of circular economy and bioeconomy: by using machines and equipment for recycling agricultural waste into valuable products or resources, such as compost, bioenergy, or biomass fuel, the principles and practices of circular economy and bioeconomy can be applied and promoted. this can enhance the resource efficiency and productivity, reduce the resource consumption and waste generation, increase the resource recovery and valorization, and create new markets and opportunities for green growth and development.

#### **5.11.10 The economic benefits of implementing the synergy relationship between the cost of machinery and the management of agricultural waste are**

Reducing the production costs and increasing the income of farmers: by using machines and equipment for recycling agricultural waste into valuable products or resources, such as compost, bioenergy, or biomass fuel, the input costs of agricultural production, such as labor, fuel, fertilizer, pesticide, etc., can be reduced. the output value of agricultural production, such as crop yield, quality, price, etc., can be increased. the additional income from selling or using the products or resources derived from agricultural waste recycling can also be generated.

Improving the competitiveness and profitability of agricultural sector: by using machines and equipment for recycling agricultural waste into valuable products or

resources, such as compost, bioenergy, or biomass fuel, the efficiency and productivity of agricultural sector can be improved. the market opportunities and value chains for the products or resources derived from agricultural waste recycling can also be created and expanded. the economic performance and resilience of agricultural sector can also be enhanced.

Contributing to the economic goals and indicators of circular economy and bio economy: by using machines and equipment for recycling agricultural waste into valuable products or resources, such as compost, bioenergy, or biomass fuel, the principles and practices of circular economy and bioeconomy can be applied and promoted. This can increase the resource utilization and conservation, reduce the resource wastage and loss, increase the resource recovery and innovation, and create new jobs and growth for green economy and development.

#### **5.11.11 The social benefits of implementing the synergy relationship between the cost of machinery and the management of agricultural waste are**

Improving the living and working conditions of farmers and rural communities: by using machines and equipment for recycling agricultural waste into valuable products or resources, such as compost, bioenergy, or biomass fuel, the health and safety risks of farmers and rural communities from exposure to agricultural waste can be reduced. the comfort and convenience of farmers and rural communities from using modern machines and equipment can also be increased.

Enhancing the education and skills of farmers and rural communities: by using machines and equipment for recycling agricultural waste into valuable products or resources, such as compost, bioenergy, or biomass fuel, the knowledge and awareness of farmers and rural communities about the benefits and challenges of agricultural waste recycling can be improved. the training and participation of farmers and rural communities in using machines and equipment for agricultural waste recycling can also be enhanced.

Creating new jobs and opportunities for farmers and rural communities: by using machines and equipment for recycling agricultural waste into valuable products or resources, such as compost, bioenergy, or biomass fuel, the employment and income opportunities for farmers and rural communities from producing, selling, or using

these products or resources can be created. the social and economic development and empowerment of farmers and rural communities can also be promoted.

#### **5.11.12 Independence**

This means that there is no significant relationship between the cost of machinery and the environmental impact or benefit of agricultural waste. for example, using more or less advanced or expensive machines and equipment may not affect the amount or toxicity of agricultural waste produced or emitted, or the efficiency or effectiveness of waste treatment or recycling, or the conversion of agricultural waste into valuable products or resources.

### **5.12 The Relationship between the Cost of Machinery and the Management of Agricultural Waste May Vary Depending On Several Factors, Such As**

#### **5.12.1 Type and size of machinery**

Different types and sizes of machines and equipment have different costs and environmental impacts. For example, larger and more powerful machines may have higher purchase and operating costs but lower labor and time costs. They may also produce more emissions but reduce soil compaction. Smaller and less powerful machines may have lower purchase and operating costs but higher labor and time costs. They may also produce less emissions but cause more soil compaction.

#### **5.12.2 Type and amount of agricultural waste**

Different types and amounts of agricultural waste have different environmental impacts and management options. for example, crop residues may have lower toxicity but higher volume than animal manure. they may also be easier to recycle into biofuels but harder to treat into compost. animal manure may have higher toxicity but lower volume than crop residues. they may also be easier to treat into biogas but harder to recycle into electricity.

#### **5.12.3 Type and location of farm**

Different types and locations.

### **5.13 The Relationships between the Cost of Machinery and the Management of Agricultural Waste Are**

The cost of machinery depends on various factors, such as the type, size, capacity, efficiency, and maintenance of the machines. the cost of machinery also varies by region and market conditions.

The management of agricultural waste involves different methods, such as composting, anaerobic digestion, biofuel production, recycling, etc. each method requires different types of machines and has different costs and benefits.

The cost of machinery can affect the profitability and feasibility of agricultural waste management projects. higher costs can discourage farmers and investors from adopting waste management practices, while lower costs can encourage them to do so.

The cost of machinery can also affect the environmental and social impacts of agricultural waste management. lower costs can reduce greenhouse gas emissions, air pollution, water pollution, soil degradation, and waste disposal problems caused by improper waste management. lower costs can also create employment opportunities, income generation, and rural development benefits for farmers and communities.

The cost of machinery can be influenced by global warming and rapid climate change. global warming and climate change can increase the frequency and intensity of extreme weather events, such as droughts, floods, storms, heat waves, etc. these events can damage or destroy the machines and increase the repair and replacement costs. they can also affect the availability and quality of agricultural waste as a feedstock for waste management.

The trade-off relationship between the cost of machinery and the management of agricultural waste means that increasing the cost of machinery leads to decreasing the environmental impact of agricultural waste, or vice versa. this relationship implies that there is a negative correlation between the two aspects, and that investing more in machinery can reduce the environmental pollution and risks of agricultural waste.

## **5.14 Comparing Three Evaluation Methods for Agricultural Waste Management Machines and Equipment**

To evaluate the costs and benefits of using machines and equipment for managing agricultural waste, you can use different methods and tools depending on the scope and purpose of your evaluation. here are some possible methods and tools:

### **5.14.1 Cost-benefit analysis**

This method compares the total costs and benefits of using machines and equipment for managing agricultural waste over a given period of time. it helps to determine whether the benefits outweigh the costs or not, and by how much. it also helps to identify the most cost-effective alternative among different options. to perform a cost-benefit analysis, you need to estimate the direct and indirect costs and benefits of using machines and equipment, such as capital costs, operating costs, maintenance costs, environmental costs, social costs, energy savings, revenue generation, waste reduction, etc. you should also reduce future costs and benefits to their current levels with appropriate discount rates. you can then calculate the net present value (npv), benefits and costs (bcr), intrinsic profitability (irr), or payback period (pp) of machinery and equipment used for farming of the waste management.

### **5.14.2 Life cycle assessment**

This method evaluates the environmental impacts of using machines and equipment for managing agricultural waste throughout their life cycle, from raw material extraction to end-of-life disposal. It helps to identify the environmental hotspots and trade-offs of using machines and equipment, such as greenhouse gas emissions, energy consumption, water consumption, land use, etc. To perform a life cycle assessment, you need to define the functional unit and system boundaries of using machines and equipment for managing agricultural waste. Then you need to collect data on the inputs and outputs of each life cycle stage, such as materials, energy, emissions, wastes, etc. You also need to choose an appropriate impact assessment method to quantify and aggregate the environmental impacts of using machines and equipment. Finally, you can compare the results with other alternatives or benchmarks to identify improvement opportunities.

### **5.14.3 Multi criteria analysis**

This method evaluates the performance of using machines and equipment for managing agricultural waste based on multiple criteria that reflect different aspects of interest or value, such as economic, environmental, social, technical, etc. it helps to incorporate qualitative and quantitative information and stakeholder preferences into the evaluation process. it also helps to deal with uncertainty and complexity of using machines and equipment for managing agricultural waste. to perform a multi-criteria analysis, you need to define the evaluation criteria and indicators of using machines and equipment for managing agricultural waste. then you need to assign weights to each criterion according to their relative importance. you also need to score each alternative based on their performance on each criterion. finally, you can rank the alternatives based on their weighted scores or use a decision rule to select the best alternative.

### **5.15 A Cost-Benefit Analysis of Using Machines and Equipment for Agricultural Waste Management**

An example of how to use cost-benefit analysis to evaluate the costs and benefits of using machines and equipment for managing agricultural waste:

Let's assume that you have two options: option a is to use a biogas generator to convert agricultural waste into biogas and organic fertilizer, and option b is to use a bioelectricity generator to generate electricity from direct burning of agricultural waste. you want to compare the costs and benefits of these two options over a 10-year period. here are the steps you need to follow:

- Step 1: Estimate the direct and indirect costs and benefits of each option. For example, you can use the following table to list the costs and benefits of each option in US dollars per year.

**Table 5.9:** Comparison of Costs and Benefits of Options A and B for a Green Project

| Cost or benefit    | Option A | Option B |
|--------------------|----------|----------|
| Capital cost       | 10,000   | 10,000   |
| Operating cost     | 5,000    | 10,000   |
| Maintenance cost   | 1,000    | 2,000    |
| Environmental cost | 500      | 5,000    |
| Social cost        | 100      | 1,000    |
| Energy saving      | 10,000   | 0        |
| Revenue generation | 15,000   | 20,000   |
| Waste reduction    | 5,000    | 5,000    |

**Source:** (The study)

- Step 2: Discount the future costs and benefits to their present values using an appropriate discount rate. For example, you can use a discount rate of 10% to calculate the present value of each cost and benefit over 10 years. You can use the following formula to calculate the present value:

$$\text{Equation 1 } PV = FV / (1 + r)^n \quad (5.1)$$

PV is the present value,

FV is the future value,

r is the discount rate, and n is the number of years. you can use the following table to show the present value of each cost and benefit for each option.

**Table 5.10:** Cost-Benefit Analysis of Options A and B for Solar Plant

| Cost or benefit    | Option A | Option B |
|--------------------|----------|----------|
| Capital cost       | 10,000   | 20,000   |
| Operating cost     | 30,769   | 61,538   |
| Maintenance cost   | 6,154    | 12,308   |
| Environmental cost | 3,077    | 30,769   |
| Social cost        | 615      | 6,154    |
| Energy saving      | 61,538   | 0        |
| Revenue generation | 92,308   | 123,077  |
| Waste reduction    | 30,769   | 30,769   |

**Source:** (The study)

- Step 3: Calculate the net present value (NPV), benefit-cost ratio (BCR), internal rate of return (IRR), or payback period (PP) of each option. For example, you can use the following formulas to calculate these indicators:

NPV = Sum of present values of benefits - Sum of present values of costs

BCR = Sum of present values of benefits / Sum of present values of costs

IRR = Discount rate that makes NPV equal to zero

PP = Number of years it takes for the cumulative benefits

To equal or exceed the cumulative costs you can use the following table to show the results of these calculations for each option.

**Table 5.11:** The Results of the Financial Indicators for Options “A” And “B” of the Project

| Indicator | Option A  | Option B  |
|-----------|-----------|-----------|
| NPV       | 133,999   | 22,846    |
| BCR       | 3.67      | 1.16      |
| IRR       | 69%       | 14%       |
| PP        | 1.5 years | 4.5 years |

**Source:** (The study)

- Step 4: Interpret the results of the cost-benefit analysis and compare them to your hypothesis. For example, you can write a sentence that summarizes the main finding and provides the relevant statistics. You can also include a table or a figure to illustrate your results. For example:

Based on the cost-benefit analysis, option a is more cost-effective than option b for managing agricultural waste over a 10-year period. option a has a higher npv (\$133,999 vs \$22,846), a higher bcr (3.67 vs 1.16), a higher irr (69% vs 14%), and a shorter pp (1.5 years vs 4.5 years) than option b. the following figure shows the comparison of npv for both options over time.

### 5.16 A Comprehensive List of Environmental Harms from Using Machines and Equipment for Agricultural Waste Management

The harms that occur to the environment from using agricultural machines and equipment for waste management in detail are:

- Using agricultural machines and equipment can increase the water consumption and pollution from agricultural fields. for example, using sprinkler irrigation machines can increase the water use efficiency, but also increase the water salinization and contamination by pesticides and fertilizers.

- Using agricultural machines and equipment can increase the energy consumption and emissions from agricultural fields. for example, using fossil fuel-powered machines can consume non-renewable energy sources and emit greenhouse gases and air pollutants.
- Using agricultural machines and equipment can disturb the natural balance of soil organisms and processes. for example, using excessive tillage machines can destroy the soil aggregates, reduce the organic matter content, and increase the soil erosion.
- Using agricultural machines and equipment can damage or destroy the natural habitats and species. for example, using land clearing machines can remove the native vegetation and wildlife, leading to habitat loss, fragmentation, and invasion by exotic species.
- Using agricultural machines and equipment can affect the availability and quality of agricultural waste as a feedstock for waste management. for example, using drying machines can reduce the moisture content of agricultural waste, but also reduce its biodegradability and calorific value.
- Using agricultural machines and equipment can generate noise pollution that can affect the health and well-being of humans and animals. for example, using tractors, harvesters, shredders, etc. can produce high levels of noise that can cause hearing loss, stress, annoyance, sleep disturbance, and cardiovascular diseases.
- Using agricultural machines and equipment can produce solid waste that can pose disposal and recycling challenges. for example, using plastic mulching machines can create large amounts of plastic waste that can contaminate the soil and water, affect the soil temperature and moisture, and harm the wildlife.
- Using agricultural machines and equipment can introduce invasive species that can disrupt the native ecosystems. for example, using machines that transport seeds, plants, or animals from one region to another can spread pests, diseases, or weeds that can compete with or prey on the local species.
- Using agricultural machines and equipment can alter the landscape and aesthetic values of the rural areas. for example, using large-scale machines that require wide roads or clearings can change the natural scenery and reduce the cultural and recreational values of the countryside.

- Using machinery for the recycling of agricultural waste can consume energy and emit greenhouse gases that contribute to climate change. for example, using composting machines or anaerobic digestion machines can require electricity or fuel to operate, and can also produce carbon dioxide or methane emissions.
- Using machinery for the recycling of agricultural waste can produce solid waste that can pose disposal and recycling challenges. for example, using plastic mulching machines or bioplastic production machines can create large amounts of plastic waste that can contaminate the soil and water, affect the soil temperature and moisture, and harm the wildlife.
- Using machinery for the recycling of agricultural waste can introduce contaminants that can affect the soil and water quality. for example, using pyrolysis machines or biofuel production machines can produce by-products, such as ash or sludge, that can contain heavy metals, persistent organic pollutants, or pathogens that need proper disposal.

### **5.17 Environmental Problems Caused By Using Machines and Equipment for Recycling Agricultural Waste**

Kinds environmental problems are generated when we use machinery for the recycling of agricultural waste:

- Greenhouse gas emissions: Using machines and equipment for recycling agricultural waste may produce greenhouse gases such as carbon dioxide, methane, and nitrous oxide, which contribute to global warming and rapid climate change. These emissions may come from the combustion of fossil fuels to power the machines and equipment, the decomposition or fermentation of organic matter in the waste, or the leakage or venting of biogas or syngas during the conversion processes.
- Water consumption and pollution: Using machines and equipment for recycling agricultural waste may consume and pollute water resources, which affect the availability and quality of water for human and ecological use. Water consumption may occur during the washing, cooling, or diluting of the waste or the products or resources derived from it. Water pollution may occur

due to the discharge of wastewater containing organic matter, nutrients, pathogens, heavy metals, or other contaminants from the recycling processes.

- Noise pollution: Using machines and equipment for recycling agricultural waste may generate noise pollution, which affects the health and well-being of humans and animals. Noise pollution may come from the operation of machines and equipment such as shredders, crushers, mixers, pumps, generators, etc., which produce loud and unpleasant sounds. Noise pollution may cause hearing loss, stress, annoyance, sleep disturbance, or reduced productivity.

### **5.18 Solutions for Reducing Environmental Problems from using Machines and Equipment for Recycling Agricultural Waste**

To reduce or mitigate these environmental problems, some possible solutions are:

- Using renewable energy sources: using renewable energy sources such as solar, wind, hydro, or biomass to power the machines and equipment for recycling agricultural waste can reduce greenhouse gas emissions and fossil fuel consumption. renewable energy sources can also provide electricity or heat for the conversion processes such as composting, anaerobic digestion, gasification, pyrolysis, etc.
- Using water-saving technologies: using water-saving technologies such as drip irrigation, rainwater harvesting, water recycling, or membrane filtration to reduce water consumption and pollution during the recycling of agricultural waste. water-saving technologies can also improve water quality by removing organic matter, nutrients, pathogens, heavy metals, or other contaminants from the wastewater before discharge or reuse.
- Using noise-reducing measures: using noise-reducing measures such as sound insulation, mufflers.
- Greenhouse gas emissions are the release of gases such as carbon dioxide, methane, nitrous oxide, and fluorinated gases into the atmosphere that trap heat and warm the planet. These gases are produced by various human activities, such as burning fossil fuels, agriculture, land use change, and industrial processes. Greenhouse gas emissions are the main cause of global

warming and rapid climate change, which have serious impacts on the environment and human well-being.

#### **5.18.1 The effects of greenhouse gas emissions are**

- Rising temperatures: greenhouse gas emissions increase the greenhouse effect, which is the natural process by which the earth's atmosphere absorbs and re-emits some of the solar radiation that reaches the surface. This keeps the earth's temperature at a level suitable for life. However, too much greenhouse gases in the atmosphere enhance the greenhouse effect and cause the earth's temperature to rise above its natural range. The global average temperature has increased by about 1.1°C since the pre-industrial era, and is projected to rise further if emissions continue to grow.
- Melting ice and rising sea levels: greenhouse gas emissions cause the earth's temperature to rise, which in turn causes ice sheets and glaciers to melt. This adds water to the oceans and increases their volume and thermal expansion. As a result, sea levels rise and threaten coastal areas with flooding, erosion, saltwater intrusion, and displacement of people and ecosystems.
- Changing weather patterns and extreme events: greenhouse gas emissions affect the earth's climate system, which is the complex interaction of the atmosphere, oceans, land, ice, and living organisms that regulate the global temperature and precipitation. Changes in the climate system can alter the frequency, intensity, duration, and location of weather patterns and extreme events such as heat waves, droughts, floods, storms, wildfires, and landslides. These can have negative impacts on agriculture, water resources, health, infrastructure, biodiversity, and human security.
- Using low-carbon energy sources: using low-carbon energy sources such as solar, wind, hydro.
- Water consumption and pollution are the use and degradation of water resources by various human activities, such as agriculture, industry, household, and recreation. Water consumption and pollution can have negative impacts on the environment and human well-being.

#### **5.18.2 Some of the effects of water consumption and pollution are**

- Water scarcity: water consumption and pollution can reduce the availability and accessibility of freshwater for human and ecological use. water scarcity can occur when the demand for water exceeds the supply, or when the quality of water is too low to meet the needs. water scarcity can cause or exacerbate conflicts, poverty, hunger, disease, and migration.
- Waterborne diseases: water consumption and pollution can increase the risk of waterborne diseases, which are caused by pathogens such as bacteria, viruses, protozoa, or parasites that contaminate water sources. waterborne diseases can affect humans and animals through ingestion, contact, or inhalation of contaminated water. waterborne diseases can cause diarrhea, cholera, typhoid, dysentery, hepatitis, and other illnesses.
- Eutrophication: water consumption and pollution can cause eutrophication, which is the excessive growth of algae and aquatic plants due to nutrients such as nitrogen and phosphorus in water bodies. eutrophication can reduce the dissolved oxygen levels in water, which can suffocate fish and other aquatic life. eutrophication can also produce harmful algal blooms that release toxins into water, which can affect humans and animals through drinking, swimming, or fishing.

#### **5.18.3 To reduce or mitigate water consumption and pollution, some possible solutions are**

- Using water-saving technologies: Using water-saving technologies such as drip irrigation, rainwater harvesting, water recycling, or membrane filtration to reduce water consumption and pollution during various human activities. Water-saving technologies can also improve water quality by removing organic matter, nutrients, pathogens, heavy metals, or other contaminants from wastewater before discharge or reuse.
- Using organic farming practices: Using organic farming practices such as crop rotation, mulching.

#### **5.18.4 The other effects of water consumption and pollution are**

- Biodiversity loss: water consumption and pollution can reduce the diversity and abundance of aquatic life, which affects the functioning and resilience of

ecosystems. water consumption and pollution can cause habitat loss, fragmentation, degradation, or invasion by alien species. water consumption and pollution can also threaten endangered or endemic species, such as freshwater dolphins, turtles, fish, and plants.

- Climate change: water consumption and pollution can contribute to climate change, which in turn can exacerbate water scarcity and quality problems. water consumption and pollution can affect the carbon cycle, by releasing greenhouse gases such as carbon dioxide and methane from land use change, agriculture, industry, or wastewater. water consumption and pollution can also affect the water cycle, by altering the evaporation, precipitation, runoff, or infiltration of water.
- Socioeconomic impacts: water consumption and pollution can affect the livelihoods and well-being of people who depend on water resources for various purposes, such as drinking, irrigation, fishing, recreation, or tourism. water consumption and pollution can reduce the availability and quality of water for human use, which can increase the costs and risks of water supply and treatment. water consumption and pollution can also reduce the productivity and value of water-related goods and services, such as crops, fish, energy, or recreation.

#### **5.18.5 To reduce or mitigate water consumption and pollution, some possible solutions are**

- Using integrated water resources management: using integrated water resources management (iwrn) is an approach that considers the social, economic, and environmental aspects of water resources in a holistic way. iwrn aims to balance the competing demands for water among different sectors and stakeholders, while ensuring the sustainability and equity of water use. iwrn involves the participation and collaboration of various actors at different levels of governance.
- Using best management practices: using best management practices (bmps) is a set of techniques or measures that aim to prevent or reduce water consumption and pollution from various sources. bmps include technical, institutional.

### **5.19 Ways to Reduce Environmental Problems from Using Agricultural Machines and Equipment for Waste Management and Their Challenges**

Ways to reduce the environmental problems from using agricultural machines and equipment for waste management are:

- Using water-saving techniques and devices to reduce the water consumption and pollution from irrigation. for example, using drip irrigation machines that deliver water directly to the plant roots, reducing the water loss due to evaporation and leaching.
- Using low-emission machines and equipment that run on renewable energy sources or biofuels to reduce the energy consumption and emissions from fossil fuels. for example, using solar-powered machines or biogas-powered machines that can use agricultural waste as a feedstock for energy production.
- Using minimum tillage or no-till machines and equipment that reduce the soil disturbance and erosion caused by conventional tillage. for example, using direct seeding machines or strip tillage machines that can sow seeds or plant crops without plowing the soil.
- Using integrated pest management techniques and devices that reduce the pesticide use and contamination from agricultural fields. for example, using biological control agents, pheromone traps, or biopesticides that can control pests without harming the beneficial organisms or the environment.
- Using waste-to-energy technologies and devices that can convert agricultural waste into useful products such as biochar, biogas, biofuels, etc. for example, using pyrolysis machines or anaerobic digestion machines that can produce biochar or biogas from agricultural waste, reducing the waste disposal problems and enhancing the soil quality and fertility.
- Using energy-efficient and low-emission machines and equipment that run on renewable energy sources or biofuels to reduce the energy consumption and emissions from fossil fuels. for example, using solar-powered machines or biogas-powered machines that can use agricultural waste as a feedstock for energy production.
- Using biodegradable and recyclable materials and equipment that can reduce the solid waste generation and disposal problems. for example, using bioplastic production machines that can produce bioplastics from agricultural

waste, which can degrade in the soil and water without harming the environment.

- Using proper treatment and disposal methods and equipment for the by-products of the recycling process that can contain contaminants. for example, using ash treatment machines or sludge treatment machines that can remove or stabilize the heavy metals, persistent organic pollutants, or pathogens from the by-products.

#### **5.19.1 The challenges or risks of using these ways are**

- Using water-saving techniques and devices can face technical, economic, and social barriers. For example, using drip irrigation machines can require high initial investment, skilled labor, and maintenance. They can also face water quality issues, such as clogging or salinity.
- Using low-emission machines and equipment can face policy, market, and institutional barriers. For example, using renewable energy sources or biofuels can depend on the availability and affordability of the feedstock, the infrastructure and distribution network, and the incentives and regulations.
- Using minimum tillage or no-till machines and equipment can face agronomic and environmental trade-offs. For example, using minimum tillage machines can reduce soil erosion and fuel consumption, but also increase weed pressure and herbicide use.
- Using integrated pest management techniques and devices can face knowledge and information gaps. For example, using biological control agents or biopesticides can require adequate knowledge and training on the identification, monitoring, and application of these methods.
- Using waste-to-energy technologies and devices can face technical and environmental challenges. For example, using pyrolysis machines or anaerobic digestion machines can require optimal operating conditions, such as temperature, pressure, moisture, etc. They can also produce by-products, such as ash or sludge that need proper disposal.

#### **5.19.2 The benefits of using these ways are**

- Using water-saving techniques and devices can improve the water use efficiency and productivity in agriculture. for example, using drip irrigation

machines can increase the crop yield and quality, reduce the water loss and runoff, and save the fertilizer and energy inputs.

- Using low-emission machines and equipment can mitigate the greenhouse gas emissions and climate change impacts from agriculture. for example, using renewable energy sources or biofuels can reduce the carbon footprint and dependence on fossil fuels, and contribute to the circular economy of biomass.
- Using minimum tillage or no-till machines and equipment can enhance the soil health and fertility by incorporating organic matter and nutrients from agricultural waste. for example, using direct seeding machines or strip tillage machines can improve the soil structure, water retention, and microbial activity.
- Using integrated pest management techniques and devices can reduce the pesticide use and contamination from agricultural fields. for example, using biological control agents, pheromone traps, or biopesticides can control pests without harming the beneficial organisms or the environment.
- Using waste-to-energy technologies and devices can convert agricultural waste into useful products such as biochar, biogas, biofuels, etc. for example, using pyrolysis machines or anaerobic digestion machines can produce biochar or biogas from agricultural waste, reducing the waste disposal problems and enhancing the soil quality and fertility.
- The amount of cost savings by using these ways can vary depending on the type and size of the farm, the local water and energy prices, the availability and quality of the agricultural waste, and the environmental conditions
- Using water-saving techniques and devices can save up to 50% of water use and 30% of energy use for irrigation. this can translate into significant cost savings for farmers who pay for water and electricity or fuel. for example, using drip irrigation machines can save up to \$175 per hectare per year compared to sprinkler irrigation machines.
- Using low-emission machines and equipment can save up to 80% of energy use and emissions for operating the machines. this can translate into significant cost savings for farmers who pay for fossil fuels or carbon taxes. for example, using solar-powered machines or biogas-powered machines can save up to \$200 per hectare per year compared to diesel-powered machines.

- Using minimum tillage or no-till machines and equipment can save up to 60% of fuel use and emissions for tillage operations. This can translate into significant cost savings for farmers who pay for fuel and labor. For example, using direct seeding machines or strip tillage machines can save up to \$100 per hectare per year compared to conventional tillage machines.
- Using integrated pest management techniques and devices can save up to 50% of pesticide use and contamination for pest control. This can translate into significant cost savings for farmers who pay for pesticides and health risks. For example, using biological control agents, pheromone traps, or biopesticides can save up to \$50 per hectare per year compared to chemical pesticides.
- Using waste-to-energy technologies and devices can generate income from selling the products such as biochar, biogas, biofuels, etc. This can offset the costs of waste disposal and management. For example, using pyrolysis machines or anaerobic digestion machines can generate up to \$150 per hectare per year from selling biochar or biogas.

### **5.19.3 Results and methodology**

The problem of the study is the large number of agricultural and plant waste in general, whose failure to use it leads to serious environmental, health and economic damage, in addition to the scarcity of government-owned and private sector machinery, which recycles these wastes in a wrong way, causing them to be destroyed in a wrong way. most of them are burned, and due to the economic importance of agricultural waste, agricultural waste must be recycled using advanced agricultural machinery.

The importance of this study lies in the environmental perspective and the economic perspective at the state level as a whole, and at the level of individuals for the process of recycling agricultural waste, actually at the level of environmental perspective we find the benefit of recycling waste with the possibility of obtaining fully biodegradable organic fertilizer, it works to increase soil fertility, increasing productivity and reducing health damage to humans and animals by just getting rid of agricultural waste in a safe way, and from an economic perspective, the process of recycling waste represents one of the ways exploiting wasted resources and turning

them into a useful product with a special economic benefit that benefits the farm and a general economic benefit it helps in increasing the national agricultural income, as well as employing a number of young people in these projects, which means relying on the local product instead of importing it from abroad, which provides the chinese currency, reduces unemployment, and increases dependence the establishment of many direct and indirect small industries around this project, including the following by collecting these residues, including those related to cutting and preparing them, as well as opening wider areas for investment

In this sector and the expansion of investment opportunities available to inward investors, and the foreign investor in particular with the availability of these with the possibility of exporting them abroad in the form of a finished product at a competitive price, which contributes to reducing the deficit in the country's trade balance.

To achieve the objectives of the study, the descriptive analytical method was used, which focuses on describing the phenomenon under study from during the availability of sufficient and accurate information during a certain period of time in order to obtain practical results and use the methodology, analytical analysis in practical application and conducting the necessary tests for this

#### **5.19.4 Method of data collection**

Theoretical study: books, scientific references, research in periodicals, master's letters and publications of listed companies were relied on applied study:

the study data was compiled from a survey list dedicated to this purpose, as well as direct interviews with many farmers and experts in the field of agricultural waste recycling, and some of those who have conducted previous research in this field.

#### **5.19.5 Statistical methods used in the study**

The statistical program (SPSS) was relied on to test the model: this means that the statistical program (SPSS) was used to test the statistical model that relates the independent variables and the dependent variables in the study.

The statistical program (SPSS) is a software that can perform various statistical analyses, such as descriptive statistics, regression, correlation, hypothesis testing, etc.

A simple regression method was used to determine the nature of the relationship between the two variables: this means that the simple regression method was used to determine the nature of the relationship between two variables, one of them is an independent variable and the other is a dependent variable.

The simple regression method is a statistical technique that finds the best-fitting line for the data and estimates the regression coefficient, the intercept, and the coefficient of determination.

The calculation of repetitions and arithmetic averages was relied on: this means that the calculation of repetitions and arithmetic averages was used to summarize the statistical data. the repetitions are the number of times that a certain value appears in a set of data. the arithmetic average is the sum of the values in a set divided by their number.

Percentages and some other statistical methods were used: this means that the calculation of percentages and some other statistical methods were used to analyze and interpret the data. the percentages are the share of a part from the whole as a ratio to 100. the other statistical methods may include standard deviation, median, range, probability distributions, hypothesis tests, etc.

Collecting data for the study sample and unloading them according to recognized statistical methods that serve the objectives of the study: this means collecting data for the study sample and organizing and arranging and classifying and recording them in a suitable form for analysis.

Collecting data means using appropriate methods to obtain information from a target group. unloading data means organizing and arranging and classifying and recording data in a suitable form for analysis.

the recognized statistical methods are methods that conform to scientific standards and principles accepted statistically. the objectives of the study are goals that are sought to be achieved through conducting.

## 5.20 The Concept of Economic Feasibility Study for Recycling Agricultural Waste

It is intended to achieve a return and profit margin from the recycling of agricultural waste and to indicate the economic importance of this promising sector at the level of Iraq and turkey.

**Table 5.12:** Averages, Coefficient of Variation and Description of Plant Residues Field Paragraphs

| vertebrae                                                                               | little handicap | disabled Average | big handicap | weighted average | standard deviation | Variation coefficient | the description |
|-----------------------------------------------------------------------------------------|-----------------|------------------|--------------|------------------|--------------------|-----------------------|-----------------|
| The lack of availability of shredding and pressing machines to dispose plant waste used | 7               | 31               | 13           | 2.11             | 0.62               | 29%                   | Average         |
| Unavailability of dry fodder storage place                                              | 9               | 29               | 13           | 2.07             | 0.66               | 32%                   | Average         |
| High wages for shredding and baling machines used to recycle plant waste                | 15              | 22               | 14           | 1.98             | 0.76               | 38%                   | Average         |
| market are lower Feed prices in the than the costs of recycling agricultural waste      | 5               | 30               | 16           | 2.21             | 0.61               | 28%                   | Average         |
| Lack of indicative training programs for the recycling of plant waste                   | 15              | 22               | 14           | 1.98             | 0.78               | 39%                   | Average         |

**Source:** (Scientific questionnaires)

**Table 5.13:** Averages, Coefficient Of Variation And Description Of Animal Waste Field Items

| vertebrae                                                                                   | a little | big | medium | weighted average | standard deviation | Variation coefficient | a description disabled |
|---------------------------------------------------------------------------------------------|----------|-----|--------|------------------|--------------------|-----------------------|------------------------|
| the Lack of guidance activities for recycling of animal waste                               | 7        | 23  | 21     | 2.31             | 0.71               | 0.31                  | Average                |
| The difficulty of providing the necessary manpower in the process of recycling animal waste | 11       | 17  | 23     | 2.11             | 0.74               | 0.35                  | Average                |
| Lack of spreaders for organic fertilizers                                                   | 8        | 18  | 25     | 2.20             | 0.69               | 0.31                  | Average                |
| Unavailability of machines for turning piles of animal waste                                | 8        | 23  | 20     | 2.29             | 0.73               | 0.32                  | Average                |
| Unavailability of the necessary places for the burial of animal waste                       | 14       | 16  | 21     | 2.04             | 0.77               | 0.38                  | Average                |

**Source:** (Scientific questionnaires)

### 5.21 Obstacles

The questionnaire was presented to many specialists in the field of agricultural and animal waste management and their opinions were taken. many farmers from different places participated in a random manner to ensure great results. the weighted average was measured on the number of values. the results were viewed as in the attached tables that show the final results of the obstacles that may be faced. farmers face when managing agricultural waste of all kinds.



## 6. CONCLUSIONS AND RECOMMENDATIONS

Agricultural waste is a waste of national resources with huge economic benefits, as agricultural research has shown that agricultural waste using modern agricultural techniques and machinery yields significant economic and economic returns and according to a study according to the agricultural research institute, nothing more than surplus is recycled.

Only 12% of this amount is thrown away, with millions of other tonnes incinerated or dumped into canals and drains! the same study acknowledges the danger of incineration of this waste which poses serious health and environmental problems. noting that recycling agricultural waste is easy, statistically, from a scientific and technological standpoint. even so, millions of tonnes of agricultural waste still pile up in front of us every year, creating mountains of waste that we can only solve by incinerating and turning our backs on all good solutions. al-ahram submitted this file to the agricultural research center affiliated with the ministry of agriculture to understand the research allocation of agricultural waste and to implement the opinions of soil and water environment ministry researchers. whether they eat grains or vegetables or fruits that give people a disproportionate share and leave them behind in harvesting, manufacturing and trading,

Such as roots, maize plant, dates, date palms and textile crops. a third source is animal production that generates waste, whether in the breeding and fattening systems, such as the “waste” of livestock and bird seed (organic water) or parts unsuitable as humans eat from animals such as horned legs.

And animals that die or are killed because they are not fit to be killed, and ironically, these animals that used to be kept by the farmer for the benefit of the land, are now thrown into drains, canals and decompose in garbage for their health reasons and the environment and despite the damage, while producing the best crops, he added that agricultural waste is used sparingly, while farmers and the traditional ones still block millions of tone’s, or are disposed of entirely through combustion and by-products.

The only solution to this waste is to recycle it, the benefit of which is to increase the percentage of organic matter in the soil, an important function of the soil which will increase it because some of the components have a nutrient source, which increases microbial activity and increases soil fertility and reduces the use of chemical fertilizers.

Therefore, it has a great environmental return and also an economic return represented in reducing the cost used in the production of the crop and reducing pollution because mineral fertilizers, regardless of their high degree of purity, contain heavy toxic elements that lead to environmental pollution and also treat various environmental problems such as desertification problems.

Soils of granularity, thus uniformity, are resistant to a variety of erosion factors. he added that huge amount of irrigation water is saved by improving soil water quality by increasing the percentage of organic matter in the soil, improving plant water use efficiency increasing and reducing the amount of water used for crop production. information on national security "liquids". regarding the extent to which all types of agricultural waste will be converted into organic waste, al-jundi pointed out that organic matter can be a corrective or destructive reaction to the chemical composition of the waste, and they a fixed amount follows and measures this as an equivalent of carbon and nitrogen.

Organic is harmful and less than organic matter is beneficial. He said there are different ways to recycle agricultural waste into organic fertilizer, and the method we have in some agricultural countries is "compost", a method based on organic fertilizer production that has been used since the 1980s in the 19th century.

The second area where we use agricultural waste is biogas generation units, but these two processes cannot fully handle millions of tonnes and are therefore inefficient. barriers to agricultural waste recycling are represented in technological and material problems of university. major research institutes are choosing the simplest technologically advanced methods to convert waste into high-value organic coal. as for the economic downturn, this involves setting up specialized infrastructure and advanced factories that cost millions of pounds to transport or collect or build in order to pay for this waste to farmers who are forced not to burn it. as for the organizational aspect, it is represented in interaction with research authorities,

decision makers, farmers and small-scale producers in advertising campaigns urging everyone to manage these wastes in an integrated manner.

This settles the matter completely. he added that laboratory reports revealed that "rice straw", as a by-product of the rice production process, contained the same amount of carbohydrate (70%) as found in the main crop for fatigue under its influence. for their part, the agricultural microbiology research microbial activity unit and the head of agricultural microbiology research at the soil and water environment research institute confirmed that the carbohydrate content of annually burned rice was the same as the carbohydrate content of rice grains want! he explained that we grow 7.1 million tonnes of fedda annually during the paddy season, and the yield per acre is 8.3 tonnes of rice paddy (sirsa) and 8.3 tonnes of paddy straw, which translates to a total paddy yield equal to 5 lakh tonnes of paddy paddy and rice 5 million tons of hay, . that is, the total rice productivity is 5 million tonnes of rice straw, which means that if we have about 6 million tonnes of rice straw per harvest season, we have to recycle 20,000 tonnes of rice straw every day for working days 300 per annum ! he indicated that research efforts are underway to identify a final option to fully utilize all carbohydrates and non-carbohydrates in rice grass, and will not be published until its feasibility is first determined and approved by the ministry.

He explained that current rice grass recycling plants only produce organic fertilizers, and the research the plant does leads to scientific methods that can be used to extract important chemicals from rice grass industries, such as cellulose and pulp paper, and hemolysis of pent xylose sugars for high-value biosynthesis may also have applications in the production of clean gasoline. Similarly, current research is using silica for corneal lenses, as well as electronic fittings, from rice grass.

We are about to finish this research, and it is expected that after presenting it to the ministry, investors from the private sector will participate in order to activate it, especially since studies confirm that recycling rice straw will generate millions of pounds for them on the one hand and will lead to getting rid of the health and environmental pollution problem on the other hand. On the other hand.

Agricultural waste management is one of the most important things to consider in agriculture. agricultural waste management includes several methods, such as landfilling, direct spreading, composting, fermentation, incineration, and recycling.

farmers should follow three main principles for agricultural waste management: reduce, reuse, and recycle.

Agricultural waste management has several benefits for the environment and society. some of the benefits of agricultural waste management include:

- Preventing underutilization of livestock excrement and reckless/random burning of crop residues to ensure food and health security, waste valorization to generate value-added products, farmer's livelihood, job opportunities for youth, and sustainability in agriculture.
- Saving money by purchasing only what is needed and avoiding additional disposal costs.
- Reduced landfill methane emissions and a lower carbon footprint.
- Improved energy and resource management, as well as pollution prevention in the food growing, manufacturing, transporting, and selling processes.
- In addition to these benefits, proper agricultural waste management can also help reduce pollution, conserve resources, prevent damage to ecosystems, and protect human health.

The agricultural microbiology research institute of land, water and environment research indicates that the damage caused by agricultural residues is not limited to burning above the surface of the soil only, but extends these effects if it is burned below the surface of the soil. the natural enemies of intruders and predators, “insects and pests harmful to agricultural crops, also cause health diseases, especially chest diseases.

Whether for farms or residents of neighboring provinces, from the rising smoke that often causes dense fog on agricultural roads that leads to many collisions between cars and also harms it kills vegetable crops and fruit trees, and kills farmer-friendly birds, not to mention causing most of the fires in village homes.and he adds, and if these residues are burned under the surface of the agricultural soil, it will result in many damages as well, including the sound of all living organisms beneficial to the agricultural soil, which increases its fertility, burning the organic matter in the surface layer of the agricultural soil, and reducing the fertility of agricultural lands, or rather converting the soil of agricultural soil into a substance deaf metal "looks like red bricks “in addition to the entry of carbon dioxide from the atmosphere into

the agricultural soil at the expense of the oxygen necessary for the respiration of plant roots and microorganisms in them, which hinders their spread and reproduction, thus reducing the fertility of the soil completely. Expanding the use of waste for energy production, such as gas fuels, ethanol, compressed fuel briquettes, biogas, electricity generation, and the production of chemical compounds such as organic acids, alcohols, enzymes, paper pulp, filters for industrial and agricultural wastewater and activated carbon. the winter crops alone produce about 11871 thousand tons, with a percentage of 35.5% of the total cropped area, which amounts to about 6448 thousand acres, while summer crops produce approximately 5344 thousand tons of waste, representing 46% of the total amount of the cropped area, which amounts to 5925 thousand acres, and this is not the Nile crops that produce 1428 thousand tons of waste, 4.3 percent of an area of 576 thousand acres, in addition to the residues of palm trees and fruitful gardens, which exceed 4761 thousand tons of waste, according to agricultural statistics.

Research conducted at the Institute of Environmental Studies, Food Technology and Environmental Biotechnology, Ain Shams University shows that the main problem we face in this area is the misuse of these wastes in burning and burning grass or traditional processes between when cutting and treating certain chemicals provides possibility of producing non-traditional food, especially from food shortages. Resources are one of the main obstacles to the increase in livestock production and the development of the Institute of Wealth Studies. One of the scientific cases has already been made that this work is about expanding especially farmer's awareness of the damage caused by these weeds on the one hand, and methods, treatments and animal feed modifications on the other side. This relationship should be explored to the limit. He added that the use of this waste by farmers is for animal feed, use as fuel, burning in the field, as fertilizer for winter crops, charcoal and only sold or dumped on other bridges.

Therefore, as the scientific message of the institute explained, some of these behaviors are rational, and others do not comply with the guiding recommendations in disposing of them and using them as feed, and this is largely due to the farmer's lack of awareness of the extent of the danger of the wrong methods in the disposal of waste. There are also other reasons why the farmer does not accept cooperation in the proper disposal of waste, including the difficulty of obtaining supplies and the lack

of capabilities, such as tools for the production of forage “animal nutrition” or the lack of a suitable place to store them. the farmer’s acquisition of knowledge of the method of converting agricultural waste into non-traditional fodder, and defining that we are aware of the waste and the date of its availability, and we have to teach the farmer how to convert it into fodder and how to cut it into pieces and add the components of the bush and “molasses” to the components of the feed, because if this indicative program was implemented, it would be possible to fill the gap of feed instead of importing it. for his part, engineer ahmed hegazy, first undersecretary of the ministry of environment, points out that the uses of agricultural waste are industrially multiple and have a high economic return.

But at the same time, they need material and technological capabilities that are not available to us, pointing out that the ministry of environment has established five factories to recycle rice straw to produce organic fertilizer “cobst “of them are two factories in sharkia governorate and two others in dakahlia governorate and a factory in al-salam city with a capacity of 300,000 tons out of a total of more than 5 million tons of rice straw.

Therefore, what is recycled is really a small amount compared to the total volume, as it shows that only organic fertilizers are made from it. while other industries are of high industrial and economic value, pointing out that the ministry of agriculture produces significant quantities of traditional fodder through the land, water and environment research institute, where these projects are financed by the agricultural research and development support fund from the ministry of agriculture, and hegazy warned of the need to address this tons of waste generated annually through a comprehensive national program in which the private sector participates in its various investments. he also cautioned the need to educate farmers about the value of this waste and its harm it is necessary to establish projects to achieve industrial and economic benefit from this lost wealth and at the same time to contribute to the employment of young graduates.

One of the important recommendations is the use of management and agricultural machinery through specialists because of their great role in raising the economic return significantly, as they will contribute to reducing unemployment rates, raising the economic efficiency of the country, preserving the environment and many other very big advantages so that the importance of this study lies in the environmental

perspective and the economic perspective at the level of the state as a whole, and at the level of individuals for the process of agricultural waste recycling. on the environmental front, we find the benefit from the recycling of agricultural waste in protecting the environment from pollution, with the possibility of obtaining fully decomposed organic fertilizer that works to increase soil fertility, increase productivity, and mitigate damage.

On the economic perspective, the process of recycling waste is one of the ways to exploit the wasted resources and turn them into a useful product of special economic benefit to the farmer and a general economic benefit that contributes to increasing the national agricultural income, as well as employment a number of young people are involved in these projects, which means reducing unemployment and increasing reliance on local products instead of importing them from abroad. it provides hard currency for the state, and the establishment of many direct and indirect small industries around this project, including those related to the collection of these wastes, including those related to cutting and preparing them, as well as opening wider areas for investment in this vital sector.

Expanding banking opportunities for domestic and foreign investors. Especially since this waste is abundant, which can be exported as final products at competitive prices, contributing to the country's balance of trade deficit reducing Growth and formation of black clouds. reducing the use of industrial and chemical fertilizers such as urea, by moving towards organic and pesticide-free crops, for farmers' income due to the flow of soil crops high because of, and the use of mineral and industrial fertilizers decreases It cuts the life span of many manure-dwelling insects, increases soil fertility and yields due to more organic fertilizers use therefore some sub-industries have been established on plant residues and to conserve the environment from pollution caused by the accumulation of garbage and plant and animal waste .

Iraq produces about 9.3 million tons of agricultural waste per year, covering 25% of the country, while Turkey produces about 38.3 million tons of agricultural waste per year, covering 5% of the country

Iraq uses traditional methods to manage agricultural waste such as incineration, burial, use as animal feed or organic fertilizer, while Turkey uses modern methods

such as biogas production, again -fertilizer, bio-bricks, bio-charcoal, and bio-plastics from agriculture use destruction.



## REFERENCES

- Ahmad, Q., & Qazi, J. I.** (2014). Thermophilic fermentations of lignocellulosic substrates and economics of biofuels: Prospects in Pakistan. *International Journal of Energy and Environmental Engineering*.
- Albrecht, B.A., and C.H. Benson.** 2001. Effect of desiccation on compacted natural clays. In *J. of Geotechnical and Geoenvironmental Engineering*.
- Aljibouri, A. K., Turcotte, G., Wu, J., & Cheng, C.** (2015). Ozone pretreatment of humid wheat straw for biofuel production. *Energy Science & Engineering*.
- Attiya, R. A. M.** (2021). The individual and interactive role of arbuscular mycorrhizal fungi and *Trichoderma viride* on growth, protein content, amino acids fractionation, and phosphatases enzyme activities of onion plants amended with fish waste. *ELSEVIER*.
- Attiya, R. A. M. (2021).** The individual and interactive role of arbuscular mycorrhizal fungi and *Trichoderma viride* on growth, protein content, amino acids fractionation, and phosphatases enzyme activities of onion plants amended with fish waste. *ELSEVIER*.
- Azmouti, A. M.** (2003). Performance of Awassi Lambs' Fed Agricultural Waste Silage (Doctoral dissertation).
- Bahers, J. B., & Giacchè, G.** (2019). Towards a metabolic rift analysis: The case of urban agriculture and organic waste management in Rennes (France). *Geoforum*.
- Banerjee, P., Hazra, A., Ghosh, P., Ganguly, A., Murmu, N. C., & Chatterjee, P. K.** (2019). Solid waste management in India: a brief review. *Waste management and resource efficiency*, 1027-1049.
- Banerjee, S., Sen, R., Morone, A., Chakrabarti, T., Pandey, R. & Mudliar, S.** (2012). Improved wet air oxidation pretreatment for enhanced enzymatic hydrolysis of rice husk for bioethanol production. *Dynamic biochemistry, process biotechnology and molecular biology*.
- Bong, C. P., Lim, L. Y., Lee, C. T., Van Fan, Y., & Klemes, J. J.** (2018). The role of smart waste management in smart agriculture. *Chemical Engineering Transactions*.
- Chabuk, A. J.** (2016). Analysis of Landfill Site Selection-Case Studies Al-Hillah and Al-Qasim Qadhaas, Babylon, Iraq (Doctoral dissertation).
- Chaichan, M. T., & Kazem, H. A.** (2018). Generating electricity using photovoltaic solar plants in Iraq (pp. 47-82). Cham, Switzerland: Springer International Publishing.
- Chandel, A.K., E.S. C., Rudravaram, R., Narasu, M.L., Rao, L.V., & Ravindra, P.** (2007). Economics and environmental impact of bioethanol production technologies: an appraisal. *Biotechnology & Molecular Biology Review*, 2(1), 014-032.

- Choudhary, R., Umagiliyage, A. L., Liang, Y., Siddaramu, T., Haddock, J., & Markevicius, G.** (2012). Microwave pretreatment for enzymatic saccharification of sweet sorghum bagasse. *Biomass and Bioenergy*, 39, 218–226. doi:10.1016/j.biombioe.2012.01.006
- Cocozza, C.; Parente, A.; Zaccone, C.; Mininni, C.; Santamaria, P., and Miano, T.** (2011) Chemical, physical and spectroscopic characterization of *Posidonia oceanica* (L.) Del. residues and their possible recycle, *Biomass Bioenergy*, 35 (2), 799-807.
- Cusido, J. A., and Soriano, C.** (2011) Valorization of pellets from municipal WWTP sludge in lightweight clay ceramics, *Waste Manage.*, 31 (6), 1372-1380.
- Dashtban, M., Schraft, H., & Qin, W.** (2009). Fungal bioconversion of lignocellulosic residues; opportunities & perspectives. *International Journal of Biological Sciences*, 5(6), 578–595. doi:10.7150/ijbs.5.578 PMID:19774110
- Demirbaş, A.** (2001). Energy balance, energy sources, energy policy, future developments and energy investments in Turkey. *Energy conversion and Management*, 42(10), 1239-1258.
- Department of Economic and Social Affairs.** (2015). Handbook on The Least Developed Country Category: Inclusion, Graduation and Special Support Measures Second Edition.
- Dhokhikah, Y., & Trihadiningrum, Y.** (2012). Solid waste management in Asian developing countries: challenges and opportunities. *Journal of Applied Environmental and Biological Sciences*, 2(7), 329- 335.
- Dimitriou, I., and Rosenqvist, H.** (2011) Sewage sludge and wastewater fertilisation of Short Rotation Coppice (SRC) for increased bioenergy production-biological and economic potential, *Biomass Bioenergy*, 35 (2), 835-842.
- Dursun, A. Y., and Tepe, O.** (2011) Removal of Chemazol Reactive Red 195 from aqueous solution by dehydrated beet pulp carbon, *J. Hazard. Mater.*, 194, 303-311.
- Eggeman, T., & Elander, R. T.** (2005). Process and economic analysis of pretreatment technologies. *Bioresource Technology*, 96(18), 2019–2025. doi:10.1016/j.biortech.2005.01.017 PMID:16112490
- El-Zawawy, W. K.; Ibrahim, M. M.; Abdel-Fattah, Y. R.; Soliman, N. A., and Mahmoud, M. M.** (2011) Acid and enzyme hydrolysis to convert pretreated lignocellulosic materials into glucose for ethanol production, *Carbohydr. Polym.*, 84 (3), 865-871.
- Etikan, I., Musa, S. A., & Alkassim, R. S.** (2016). Comparison of convenience sampling and purposive sampling. *American journal of theoretical and applied statistics*, 5(1), 1-4.
- Faucher, C., & Bastien, J.** (2006, May). Renewable energy and agriculture: GHG mitigation and waste management strategy. In 2006 IEEE EIC Climate Change Conference (pp. 1-6). IEEE.
- Fernando, R. L. S.** (2019). Solid waste management of local governments in the Western Province of Sri Lanka: An implementation analysis. *Waste management*, 84, 194-203.
- Figueiro, G. G., and Gracioli, L. A.** (2011) Influence of the chemical composition of the substrate in the cultivation of *Pleurotus florida*, *Cienc. Agrotecnol.*, 35 (5), 924-930.

- Gall, H. E.; Sassman, S. A.; Lee, L. S., and Jafvert, C. T.** (2011) Hormone Discharges from a Midwest Tile-Drained Agroecosystem Receiving Animal Wastes, *Environ. Sci. Technol.*, 45 (20), 8755-8764.
- García-Aparicio, M. P., Ballesteros, I., González, A., Oliva, J., Ballesteros, M., & Negro, M.** (2006). Effect of inhibitors released during steam-explosion pretreatment of barley straw on enzymatic hydrolysis. *Applied Biochemistry and Biotechnology*, 129(1-3), 278–288. doi:10.1385/ABAB:129:1:278 PMID:16915647
- Geiser, K.** (2002). Source Reduction: Quantity and Toxicity Part 6B: Toxicity Reduction. In *Handbook of Solid Waste Management* (2nd Edition), edited by George Tchobanoglous and Frank Kreith. New York: McGraw-Hill Companies, Inc.
- Govasmark, E.; Staeb, J.; Holen, B.; Hoornstra, D.; Nesbakk, T., and Salkinoja-Salonen, M.** (2011) Chemical and microbiological hazards associated with recycling of.
- Hamelinck, C. N., Hooijdonk, G. V., & Faaij, A. P.** (2005). Ethanol from lignocellulosic biomass: Techno-economic performance in short-, middle- and long-term. *Biomass and Bioenergy*, 28(4), 384–410. doi:10.1016/j.biombioe.2004.09.002
- Hara, Y.; Furutani, T.; Murakami, A.; Palijon, A. M., and Yokohari, M.** (2011) Current organic waste recycling and the potential for local recycling through urban agriculture in Metro Manila, *Waste Manage. Res.*, 29 (11), 1213-1221.
- Harmsen, P., Huijgen, W., Bermudez, L., & Bakker, R.** (2010). Literature review of physical and chemical pretreatment processes for lignocellulosic biomass (Tech. Rep. 1184). Biosynergy, Wageningen UR Food & Biobased Research.
- Harmsen, P., Huijgen, W., Bermudez, L., & Bakker, R.** (2010). Literature review of physical and chemical pretreatment processes for lignocellulosic biomass (Tech. Rep. 1184). Biosynergy, Wageningen UR Food & Biobased Research.
- Hiskakis, M.; Babou, E., and Briassoulis, D.** (2011) Experimental Processing of Biodegradable Drip Irrigation Systems-Possibilities and Limitations, *J. Polym. Environ.*, 19 (4), 887-907.
- Howard, R., Abotsi, E., Jansen, V. R., & Howard, S.** (2003). Lignocellulose biotechnology: Issues of bioconversion and enzyme production. *African Journal of Biotechnology*, 2(12), 602–619. doi:10.5897/AJB2003.000-1115
- Idris, A., Inanc, B., & Hassan, M. N.** (2004). Overview of waste disposal and landfills/dumps in Asian countries. *Journal of material cycles and waste management*, 6(2), 104-110.
- Iglinski, B.; Iglinska, A.; Kujawski, W.; Buczkowski, R., and Cichosz, M.** (2011) Bioenergy in Poland, *Renewable Sustainable Energy Rev.*, 15(6), 2999-3007.
- Imman, S., Arnthong, J., Laosiripojana, N., & Champreda, V.** (2012). Liquid hot water pretreatment of rice straw for enzymatic hydrolysis. In *Proceedings of the 4th International Conference on Sustainable Energy and Environment: A Paradigm Shift to Low Carbon Society*, Bangkok.
- Ingram, T., Rogalinski, T., Bockemühl, V., Antranikian, G., & Brunner, G.** (2009). Semi-continuous liquid hot water pretreatment of rye straw. *The Journal of Supercritical Fluids*, 48(3), 238–246. doi:10.1016/j.supflu.2008.10.023
- Jaisamut, K., Paulova, L., Patakova, P., Rychtera, M., & Melzoch, K.** (2013). Optimization of alkaline pretreatment of wheat straw to be used as substrate for biofuels production. *Plant, Soil and Environment*, 59(12), 537–542. doi:10.17221/7129-PSE

- Jaisamut, K., Paulova, L., Patakova, P., Rychtera, M., & Melzoch, K.** (2013). Optimization of alkalipretreatment of wheat straw to be used as substrate for biofuels production. *Plant, Soil and Environment*, 59(12), 537–542. doi:10.17221/7129-PSE
- Joshi, B., Bhatt, M. R., Sharma, D., Joshi, J., Malla, R., & Sreerama, L.** (2011). Lignocellulosic ethanol production: Current practices and recent developments. *Biotechnology & Molecular Biology Review*, 6(8), 172–182.
- Khan, D., & Samadder, S. R.** (2014). Municipal solid waste management using Geographical Information System aided methods: A mini-review. *Waste Management & Research*, 32(11), 1049–1062.
- Khorami, M., and Ganjian, E.** (2011) Comparing flexural behaviour of fibre-cement composites reinforced bagasse: Wheat and eucalyptus, *Construction and Building Materials*, 25 (9), 3661–3667.
- Koltermann, A., Kraus, M., Rarbach, M., Reisinger, C., Zavrel, M., & Soltl, Y.** (2014). Cellulosic ethanol from agricultural residues—an advanced biofuel and biobased chemical platform. *JSM Biotechnology Bioengineering*, 2(1), 1024.
- Kumar, P. D., Barrett, D. M., Delwiche, M. J., & Stroeve, P.** (2009). Methods for pretreatment of lignocellulosic biomass for efficient hydrolysis and biofuel production. *Industrial & Engineering Chemistry Research*, 48(8), 3713–3729. doi:10.1021/ie801542g
- Lau, M. W., & Dale, B. E.** (2009). Cellulosic ethanol production from AFEX-treated corn stover using *Saccharomyces cerevisiae* 424A(LNH-ST). *Proceedings of the National Academy of Sciences of the United States of America*, 106(5), 1368–1373. doi:10.1073/pnas.0812364106 PMID:19164763
- Li, C., Wang, L., Chen, Z., Li, Y., Wang, R., Luo, X., & Lu, J.** (2015). Ozonolysis pretreatment of maize stover: The interactive effect of sample particle size and moisture on ozonolysis process. *Bioresource Technology*, 183, 240–247. doi:10.1016/j.biortech.2015.01.042 PMID:25746300
- Li, D., Zheng, Y., & Zhao, W.** (2019). Fault analysis system for agricultural machinery based on big data. *IEEE Access*, 7, 99136–99151
- Logan, T. J., Henry, C. L., Schnoor, J. L., Overcash, M., & McAvoy, D. C.** (1999). An assessment of health and environmental risks of trace elements and toxic organics in land-applied municipal solid waste compost. *Compost Science & Utilization*, 7(3), 38–53.
- Lynd, L., Zyl, W., McBride, J., & Laser, M.** (2005). Consolidated bioprocessing of cellulosic biomass: An update. *Current Opinion in Biotechnology*, 16(5), 577–583. doi:10.1016/j.copbio.2005.08.009 PMID:16154338.
- Menezes, E. G., Do Carmo, J. R., Alves, J. G., Menezes, A. G., Guimaraes, I. C., Queiroz, F., & Pimenta, C. J.** (2014). Optimization of alkaline pretreatment of coffee pulp for production of bioethanol. *Biotechnology Progress*, 30(2), 451–462. doi:10.1002/btpr.1856 PMID:24376222
- Mohanty, B., & Abdullahi, I. I.** (2016). Bioethanol production from lignocellulosic waste—a review. *Biosciences Biotechnology Research Asia*, 13(2), 1153–1161. doi:10.13005/bbra/2146
- Muir, D. C., & Howard, P. H.** (2006). Are there other persistent organic pollutants? A challenge for environmental chemists. *Environmental science & technology*, 40(23), 7157–7166.

- Mussatto, S. I., & Teixeira, J. A.** (2010). Lignocellulose as raw material in fermentation processes. In A. Mendez-Vilas (Ed.), *Current Research, Technology and Education, Topics in Applied Microbiology and Microbial Biotechnology* (pp. 897–907). Badajoz: Formatex Research Center.
- Nakatani, A. S.; Martines, A. M.; Nogueira, M. A.; Fagotti, D. S.L.; Oliveira, A. G.; Bini, D.; Sousa, J. P., and Cardoso, E. J.B. N.** (2011) Changes in the genetic structure of Bacteria and microbial activity in an agricultural soil amended with tannery sludge, *Soil Biol. Biochem.*, 43 (1), 106-114.
- Nawarathna. R. A. G., & Joyce. S.** (2016). Energy from waste: A solution for the garbage crisis at Meethotamulla, Kolonnawa, Sri Lanka. The 5th World Construction Symposium 2016: Greening Environment, Eco Innovations & Entrepreneurship, Colombo, Sri Lanka, 29-31 July 2016.
- Nkwachukwu, O. I., Chidi, N. I., & Charles, K. O.** (2010). Issues of roadside disposal habit of municipal solid waste, environmental impacts and implementation of sound management practices in developing country —Nigeria. *International Journal of Environmental Science and Development*, 1(5), 409-418.
- Nosratabadi, S.** (2022). The Future of Food Supply in the Middle East: Case Studies of Iran, Turkey, and Iraq (Doctoral dissertation, Magyar Agrár-és Élettudományi Egyetem).
- Nwosu-Obieogu, K., Chiemenem, L. I., & Adekunle, K. F.** (2016). Utilization of agricultural waste for bioethanol production- a review. *International Journal of Current Research & Review*, 8(19).
- Ohura, S.; Harada, H.; Biswas, B. K.; Kondo, M.; Ishikawa, S.; Kawakita, H.; Ohto, K., and Inoue, K.** (2011) Phosphorus recovery from secondary effluent and side-stream liquid in a sewage treatment plant using zirconium-loaded saponified orange waste, *J. Mater. Cycles Waste Manage.*, 13 (4), 293-297
- Olofsson, K., Bertilsson, M., & Liden, G.** (2008). A short review on SSF – an interesting process option for ethanol production from lignocellulosic feedstocks. *Biotechnology for Biofuels*, 1(1), 7. doi:10.1186/1754-6834-1-7 PMID:18471273
- Onuki, S., Koziel, J. A., Leeuwen, V. J., Jenks, W. S., Grewell, D., & Cai, L.** (2008). Ethanol production, purification, and analysis techniques: a review. In *Proceedings of the ASABE Annual International Meeting*, Rhode Island.
- Oreb, M., Dietz, H., Farwick, A., & Boles, E.** (2012). Novel strategies to improve co-fermentation of pentoses with D-glucose by recombinant yeast strains in lignocellulosic hydrolysates. *Bioengineered*, 3(6), 347–351. doi:10.4161/bioe.21444 PMID:22892590
- Pandya Swargo, A. H., Onoda, H., & Nagata, K.** (2012). Energy recovery potential and life cycle impact assessment of municipal solid waste management technologies in Asian countries using ELP model. *International Journal of Energy and Environmental Engineering*, 3(1), 28.
- Pereira Bento Casaril, K. B.; Megumi Kasuya, M. C., and Dantas Vanetti, M. C.** (2011) Antimicrobial Activity and Mineral Composition of Shiitake Mushrooms Cultivated on Agricultural Waste, *Braz. Arch. Biol. Technol.*, 54 (5), 991-1002.
- Pimentel, D., & Patzek, T. W.** (2005). Ethanol Production Using Corn, Switch grass and wood; biodiesel production using soybean and sunflower. *Natural Resources Research*, 14(1), 65–76. doi:10.1007/11053-005-4679-8
- Qazi, M. A., Akram, M., Ahmad, N., Artiola, J. F., & Tuller, M.** (2009). Economical and environmental implications of solid waste compost applications to agricultural fields in Punjab, Pakistan. *Waste Management*, 29(9), 2437-2445.

- Qing, Q., Yang, B., & Wyman, C. E.** (2010). Impact of surfactants on pretreatment of corn stover. *Bioresource Technology*, 101(15), 5941–5951. doi:10.1016/j.biortech.2010.03.003 PMID:20304637
- Rashmika, S. T., & Edirisinghe, J. C.** (2016). Factors affecting demand for compost: a case study in Kurunegala. *Journal of Environmental Professionals Sri Lanka*, 5(1), 1-10.
- Ratnavathi, C. V., Suresh, K., Kumar, B. S. V., Pallavi, M., Komala, V. V., & Seetharama, N.** (2010). Study on genotypic variation for ethanol production from sweet sorghum juice. *Biomass and Bioenergy*, 34(7), 947–952. doi:10.1016/j.biombioe.2010.02.002
- Ray, M. J., Leak, D. J., Spanu, P. D., & Murphy, R. J.** (2010). Brown rot fungal early stage decay mechanisms as a biological pretreatment for softwood biomass in biofuel production. *Biomass and Bioenergy*, 34(8), 1257–1262. doi:10.1016/j.biombioe.2010.03.015
- Rigane, M. K.; Michel, J.-C.; Medhioub, K., and Morel, P.** (2011) Evaluation of Compost Maturity, Hydrophysical and Physicochemical Properties: Indicators for Use as a Component of Growing Media, *Compost Sci. Util.*, 19 (4), 226-234.
- Saha, B. C., & Cotta, M. A.** (2007). Enzymatic saccharification and fermentation of alkaline peroxide pretreated rice hulls to ethanol. *Enzyme and Microbial Technology*, 41(4), 528–532. doi:10.1016/j.enzmictec.2007.04.006
- Sanchez, G., Pilcher, L., Roslander, C., Modig, T., Galbe, M., & Liden, G.** (2004). Dilute-acid hydrolysis for fermentation of the bolivian straw material pajabrava. *Bioresource Technology*, 93(3), 249–256. doi:10.1016/j.biortech.2003.11.003 PMID:15062819
- Saveyn, H., & Eder, P.** (2014). End-of-waste criteria for biodegradable waste subjected to biological treatment (compost & digestate): Technical proposals. IPTS: Sevilla, Spain.
- Sinnathamby, V., Paul, J. G., Dasanayaka, S. W. S. B., Gunawardena, S. H. P., & Fernando, S.** (2016). Factors affecting sustainability of municipal solid waste composting projects in Sri Lanka. In *About the 1st International Conference in Technology Management (iNCOTeM 2016)* (p. 98).
- Taherzadeh, M. J., & Karimi, K.** (2008). Pretreatment of lignocellulosic wastes to improve ethanol and biogas production: A review. *International Journal of Molecular Sciences*, 9(9), 1621–1651. doi:10.3390/ijms9091621 PMID:19325822
- Thiviyatharsan, R., Muhilini, J., & Dasinaa, S.** (2016). Estimation and characterization of municipal solid waste generation in Thirukkivil Pradeshiya Sabha, Ampara District. *International Journal of multidisciplinary Studies*, 3(1).
- Travaini, R., Martin-Juarez, J., Lorenzo-Hernando, A., & Bolado-Rodriguez, S.** (2016). Ozonolysis: An advantageous pretreatment for lignocellulosic biomass revisited. *Bioresource Technology*, 199, 2–12. doi:10.1016/j.biortech.2015.08.143 PMID:26409859
- Tuan, T. Q.; Son, N. V.; Dung, H. T. K.; Luong, N. H.; Thuy, B. T.; Anh, N. T. V.; Hoa, N. D., and Hai, N. H.** (2011) Preparation and properties of silver nanoparticles loaded in activated carbon for biological and environmental applications, *J. Hazard. Mater.*, 192 (3), 1321-1329.
- Tutt, M., Kikas, T., Kahr, H., Pointner, M., Kuttner, P., & Olt, J.** (2014). Using steam explosion pretreatment method for bioethanol production from floodplain meadow hay. *Agronomy Research (Tartu)*, 12(2), 417–424.

- UNEP (United Nations Environment Programme)**, 2004. State of Waste Management in South East Asia. Retrieved on 15th October 2019. Available at: <http://www.aseansec.org/files.unep.pdf>.
- United Nations Environment Programme (UNEP)** With a Foreword by Kofi Annan, UN Secretary-General. (2002). Global Environment Outlook 3: past, present and future perspectives. *Environmental Management and Health*, 13(5), 560-561.
- United States Department of Agriculture**. (2009). Colombia: a new ethanol producer on the rise. Economic Research Service: USDA.
- Varga, E., Schmidt, A. S., Reczey, K., & Thomsen, A. B.** (2003). Pretreatment of corn stover using wet oxidation to enhance enzymatic digestibility. *Applied Biochemistry and Biotechnology*, 104(1), 37–50. doi:10.1385/ABAB:104:1:37 PMID:12495204
- Verma, A., Kumar, S., & Jain, P. K.** (2011). Key pretreatment technologies on cellulosic ethanol production. *Journal of Scientific Research*, 55, 57–63.
- Vidal, M., Melgar, J., Lopez, A., & Santoalla, M. C.** (2000). Spatial and temporal hydrochemical changes in groundwater under the contaminating effects of fertilizers and wastewater. *Journal of Environmental Management*, 60(3), 215-225.
- Vidanaarachchi, C. K., Yuen, S. T., & Pilapitiya, S.** (2006). Municipal solid waste management in the Southern Province of Sri Lanka: Problems, issues, and challenges. *Waste Management*, 26 (8), 920-930.
- Walker, G. M.** (2011). Fuel alcohol: Current production and future challenges. *Journal of the Institute of Brewing*, 117(1), 3–22. doi:10.1002/j.2050-0416.2011.tb00438.x
- Wang, Q., & Zhu, S.** (2010). Genetically modified lignocellulosic biomass for improvement of ethanol production. *BioResources*, 5(1), 3–4.
- Wijewardena, J. D. H.** (2005). Improvement of plant nutrient management for better farmer livelihood, food security and environment in Sri Lanka. improving plant nutrient management for better farmer livelihoods. *Food Security and Environmental Sustainability*, Beijing, 73-93.
- Yin, R. K.** (2009). Case study research: Design and methods (applied social research methods). London: SAGE.
- Zheng, Y. I., Pan, Z., & Zhang, R.** (2009). Overview of biomass pretreatment for cellulosic ethanol production. *International Journal of Agricultural and Biological Engineering*, 2(3), 51–68.
- Zimbardo, P. G.** (2012). The enormous silent power of time perspective in our lives and national destinies. Keynote lecture at the 1st International conference of Time perspective, Coimbra, Portugal.
- Zurbrugg, C.** (2002). Urban solid waste management in low-income countries of Asia: How to cope with the garbage crisis. Presented for: Scientific Committee on Problems of the Environment (SCOPE) Urban Solid Waste Management Review Session, Durban, South Africa, 1-13.
- Zurbrugg, C.** (2003). Solid waste management in developing countries. SWM introductory text on [www.sanicon.net](http://www.sanicon.net), 5. Retrieved on 15th March 2020. Available at: [https://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/publikationen/SWM/General\\_Overview/Zurbruegg\\_2002\\_SWM\\_DC.pdf](https://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/publikationen/SWM/General_Overview/Zurbruegg_2002_SWM_DC.pdf).

**Zurbrugg, C., & Drescher, S.** (2002). Markets for Compost—a key factor for success of urban compostingschemes in developing countries. City Matters Magazine, London. Retrieved on 8th April 2019. Available at: [https://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/publikationen/SWM/Market\\_Demand/Zurbruegg\\_2003\\_Key\\_factor.pdf](https://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/publikationen/SWM/Market_Demand/Zurbruegg_2003_Key_factor.pdf).



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