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TABLE OF CONTENTS

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ISSN: 2582 – 7022

Agrospheres:e-Newsletter, (2021) *2*(3), 1-2

Agrospheres: e-Newsletter

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Need of Breeding Programmes in Wheat Crop

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INTRODUCTION

Wheat (*Triticum aestivum*L.) belonging to the family *Poaceae* earlier known as *Gramineae* of tribe *Triticeae* is the most important cereal crop and staple food for nearly 35% of the world population. Wheat, which is the leading grain crop of temperate regions, is grown almost across the world. India has the largest area under wheat cultivation and second largest producer after China in the world. It is the second most important food crop of India after rice, both in terms of area and production. It covers 32 per cent of the world's total acreage under cereal crops. It is grown in an area of 30.23 million ha in India and 2.57 million ha in Haryana with a production of 93.50 and 11.36 million tones, respectively (Anonymous, 2016). Around 80 per cent of total wheat production comes from North West Plain Zone (NWPZ) of India. Due to its wide adaptability, it can be grown under different agro-climatic conditions between 11°N to 35°S latitudes, 72°E to 92°W longitude and from sea level to very high elevations. Although it is cultivated under a wide range of climatic conditions but most extensive production of wheat is in areas where the winters are cool and the summers comparatively hot. Wheat is used for preparation of food like bread, pasta, macaroni, noodles, etc., due to its taste, unique baking qualities and long shelf life.

Genetic diversity is essential to meet the diversified goals of plant breeding such as breeding for increasing yield, wider adaptation, desirable quality, pest and disease resistance. The source of genetic variation is essential for the next breeding stages. If variation is present in the tactical gene pool, the materials can be used directly to develop competitive varieties. Genetic diversity is the basis for launching an efficient breeding programme that aimed for the improvement of wheat productivity.

Wheat breeding through hybridization also requires the selection of diverse genotypes, irrespective of whether the product is a pure line or a hybrid variety. Bread wheat (*Triticum aestivum*) evolved through two polyploidization events between *Triticum urartu* (AA genome) and an *Aegilopsspeltoides*-related species (BB genome), forming *Triticum turgidum* ssp. diccocoides, and between *Triticum turgidum* ssp. durum (AABB genome) and *Aegilopstauschii* (DD genome), forming the modern hexaploid bread wheat (AABBDD) genome (Feldman et al.,1995; & Huang et al., 2002).

Food grain production in recent years has not kept pace with growth in population and demand that has lead to price rise, which is a serious threat to food security in India and other developing countries. There is an urgent need to increase the production of food grain to combat this adverse situation *vis-a-vis* to ensure food availability in India. Grain yield is an important trait as it measures the economic productivity in wheat. Morpho-physiological characteristics of the plant greatly influence the breeding progress since the grain yield depends upon different morphological and physiological traits. The impact of variation in seed vigour on both total and marketable yield differs between species and the specific production practices and market requirements of the crop. The major impacts of variation in seed vigour manifest through a negative direct effect on seedling emergence and therefore an indirect effect on yield (Tekrony & Egli, 1991; & Finch-Savage, 1995). For this purpose the genotypes with suitable plant type are needed to be selected from a diverse gene pool for their future use as parents in hybridization programme. Grain yield is the end product of interaction of many factors known as yield contributing components and is a complex trait. Effective selection programme depends on the existing genetic variability available in the breeding material for studying genetic divergence in crop plants.

Wheat yield is mainly influenced by three yield components *viz.*, tillers per unit area, grains per spike and kernel mass (weight). The vegetative period may also affect grain yield. Grain growth rate (GGR) is a trait with substantial genetic potential to increase wheat yield. It is defined as a period between flowering (anthesis in the middle spike) and physiological maturity (yellowing of peduncle). Different genotypes interact differently with prevailing temperature, which forms the basis for difference in the expression of potential traits, which may contribute to high temperature stress tolerance in specific wheat genotypes (Tripathi & Chaudhary, 2007). Phenotypic and genotypic coefficients of variations, heritability and genetic advance have been used to assess the magnitude of variance in wheat breeding material. Since the correlation coefficients generally show linear relationships among independent variables that may not sufficiently describe the association when a clear cause-effect relationship is required between the variables. Therefore, the direct and indirect effects between yield and yield components should be known in breeding programs (Albayrak et al., 2003). Path coefficients analysis partitioned the correlation coefficient into direct and indirect effects on yield. Therefore, this technique provides a critical examination of specific factors producing a given correlation and can be successfully employed in formulating a selection strategy.

A well known fact is that the highly vigorous seed performs better under wide range of environmental conditions, particularly stress conditions. For genetic amelioration of wheat crop, precise information on the nature and degree of genetic diversity helps in making choice of desirable parents in crossing programme. Study of its genetic variability and correlation is pre-requisite since variability in crop plants provides an opportunity for selecting desirable genotypes. Correlation on the other hand gives an idea about various associations existing between yield and other characters. Another goal for wheat breeding is quality improvement which includes milling characters, gluten content, amylase content and fibre as well as protein quality. So, these are the reason due to which we do wheat breeding.

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How to Identify Aluminium (Al) Toxicity in Acid Soils

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INTRODUCTION

Aluminium (Al) toxicity is a serious constraint to crop production in many regions around the world. Approximately 84 per cent of the soils in the North Eastern Hill (NEH) region of India are acidic in reaction, having toxicity of aluminium. The first step is, therefore to identify the problem. Should we use exchangeable (KCl-extractable) Al, Al-saturation percentage, or soil-solution Al concentration (or activity of the various Al species)?

Aluminium is not an essential element for either plants or animals. Most of the farmers have heard that too much aluminium (Al) can be harmful to plants. However, many may not be aware that there are multiple forms of Al in the soil and most of them are not directly harmful to plants. There are also multiple methods of testing the soil for these various forms of Al and several different ways to use these soil test results. Therefore, farmer should understand how Al can affect crop plants.

Available Aluminium

This test determines the amount of the "available" or easily soluble Al (Al^{+3}). Farmers can use this result to evaluate the potential of Al toxicity to their crop. This is not a routine test and must be specifically requested.

Mehlich 3-Al

It is extracted with the same chemical solution that is used in determining many plant nutrients. Mehlich (M)-3 is a stronger extracting solution than used for available Al, so the results are much larger values. The M 3-Al result has no relationship to “available Al”.

Aluminium toxicity

Excess soluble/available aluminium (Al^{+3}) is toxic to plants and causes multiple other problems. Some of the more important problems include:

ISSN: 2582 - 7022

1. Direct toxicity, primarily seen as stunted roots
2. Reduces the availability of phosphorus (P), through the formation of Al-P compounds
3. Reduces the availability of sulphur (S), through the formation of Al-S compounds
4. Reduces the availability of other nutrient cations through competitive interaction

The primary damage caused by excess Al^{+3} is damage to plant roots. Diagnosing this type of damage requires that farmer inspect the root systems of their crops or other plants. Of course, when plants have damaged root systems, many other above-ground symptoms are likely to appear. One of the most common will be P-deficiency. However, since Al-toxicity occurs in strongly acid soils, plants may also exhibit deficiency symptoms of calcium (Ca), magnesium (Mg), or other nutrients. There might be symptoms of manganese (Mn) toxicity, which is common when the soil pH is too low. Finally, poor root development reduces the plants ability to absorb water. Plant problems that damage the roots are difficult to diagnose with leaf analysis. This is because the uptake of these toxins is somewhat self-limiting, due to the root damage that they cause. This is most common with Al and copper (Cu) toxicities. Very little Al^{+3} in the soil solution is required to cause damage to most plants. Since Al is the most abundant element in the soil, but the soluble Al^{+3} is the toxic form, we need to know how much Al^{+3} is present in the soil and what controls its availability to plants. The availability of Al^{+3} is not completely understood, but certain soil factors are known to have a significant effect.

1. The total amount of Al present in a particular soil type
2. The soil pH
3. The types and amounts of clay in the soil
4. Soil organic matter

The soil pH is probably the single most important management factor controlling the amount of Al^{+3} in the soil solution. Soluble Al is present in the soil when the pH begins to drop below pH 6.0. However, it is inconsequential in the vast majority of soils until the pH drops below pH 5.5. Even then, it is rarely a problem until the soil pH drops below pH 5.0. However, the amount of soluble Al increases dramatically in nearly all soils as the soil pH drops below pH 5.0. In these extremely acid soils, only those species adapted to acid soils (such as pineapples, tea, coffee, and acid-loving ornamentals) or the few crop species bred to tolerate high soil Al levels can be expected to do well.

Acid sub-soil

Some soils have extremely acid sub-soils. These soils present special problems. While normal lime applications and tillage will easily correct the topsoil, lime is not mobile enough to have a significant or quick effect on subsoil acidity. When tillage is not an option, acid sub-soils become more of a problem to deal with. Lime that is surface applied or applied with only shallow incorporation affects only the top couple of inches of soil, or however deep the shallow incorporation was. If lime cannot be incorporated throughout the rooting zone of the upcoming crop, then another approach must be taken. Gypsum ($CaSO_4$) is the best solution to reduce the toxic effects of sub-soil Al^{+3} in these situations. Gypsum is not a liming agent, because it cannot neutralize acid. However, the excess Ca applied with the gypsum is a competitive cation to the toxic Al^{+3} and causes the Al^{+3} to be leached into greater soil depths (assuming enough water passes through the subsoil). Neither the lime nor the gypsum is an instant solution to excess Al^{+3}. Depending on the nature and particle size of lime, it could require up to 18 months for the lime to completely react and neutralize the acid soil. Gypsum could work faster, depending on how fast it can be leached through the subsoil.

In brief, soils differ in the amount of potentially soluble Al. Some soils can contain different amounts and types of clay, and different amounts of organic matter (OM). Different clay types can affect both the potential amounts of Al available to go into solution, as well as the amount of Al^{+3} that can be "fixed" or tied-up, after it is formed. Certain compounds in soil OM have the ability to form Al-chelates which are unavailable to plants, thus removing some of the Al^{+3} from the soil solution. All of this simply means that some farmers will have more or less difficult time in reducing the amount of Al^{+3} in their soils.

Soil aluminium saturation

Since Al^{+3} is a soluble cation, it can be evaluated by percent saturation of the soil CEC, in the same way as the major nutrient cations. Like these other cations, Al^{+3} is held on the negative sites of clay and OM (adsorbed). This adsorbed Al^{+3} is called exchangeable Al. Some of the exchangeable Al^{+3} is released into the soil solution. This "free" Al^{+3} in solution is the form that damages plants. However, the adsorbed Al^{+3} provide a ready source of additional Al^{+3} to recharge the soil solution. Like the nutrient cations, the percent of the soil CEC that is occupied by exchangeable Al^{+3} is called the percent Al saturation and it is an indicator of the reserve Al^{+3} that must be counteracted if toxicity is to be reduced or eliminated. When the exchangeable Al (per cent saturation) is greater than 60 per cent, there is a large increase in the soil solution Al^{+3}. This and previous information illustrate how both methods of evaluating soil Al have a value, and may be needed. However, these give us somewhat different information, and finally:

- Do not use Mehlich 3-Al to evaluate potential Al toxicity. It is only used to convert Mehlich 3-P into Morgan-P.
- When the soil is more acidic (pH is below 5.0), soluble Al is almost certainly a problem.
- When the soil pH is increased to be (between 5.0 and 5.5), soluble Al likely a small problem.
- When the soil pH is (5.5 and 6.0), soluble Al is not likely to be a significant problem.
- When the soil pH is above 6.0, soluble Al is almost certainly not a problem.
- Lime is the solution to excess soluble Al in the topsoil.
- Gypsum may be needed to correct excess soluble Al in the sub-soil.

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Role of Olive Oil in Bone Health

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INTRODUCTION

Olive (*Olea europaea*) is commonly called as evergreen tree or golden tree belongs to the family Oleaceae. It is native to the Mediterranean, Asia and Africa, but now found around the world and it is largely produced in Spain, Italy and Greece. Olives are one of the most extensively cultivated fruit crops in the world and it is characterized by small size, squat shape, oblong opposite leaves with white flowers. (Tagliaferri et al., 2014). Olive oil is considered as healthy oil because of its high content of monounsaturated fatty acid (mainly oleic acid), polyphenols (oleuropein), vitamin E and vitamin K. These nutrients can acts as bone protective agents and helps to reduce osteoporosis in postmenopausal women. A trending Mediterranean diet includes olive oil which is beneficial in the protection of chronic diseases, especially for bone health (Liu et al., 2014).

Diaz-Curiel et al. (2020) conducted a study on effects of virgin olive oil on bone health in ovariectomized rats. Total 48, 6-month-old female wistar rats weighing 320 g were divided into 4 groups 1) SHAM-simulated intervention (n = 12), 2) OVX-ovariectomized (n = 12), 3) OVX + 100 (n = 12), ovariectomized and treated with VOO (100 µL/day by oral gavage) 4) OVX + 200 (n = 12) ovariectomized and treated with Virgin olive oil (VOO)-(200 µL/day by oral gavage), all over 3 months. Results revealed that after 3 months of VOO treatment, although FBMD (femoral bone mineral density) and LBMD (lumbar bone mineral density) were not affected whereas the bone quality was improved. The elasticity of bone and fractal dimension (complexity of bone) were more similar to healthy bone.

Roncero- Martin et al. (2018) assessed the association of olive oil intake and bone density parameters in Spanish women.

Results revealed that there was significantly increased in volumetric bone mineral density (vBMD) (mg/cm3) ($p < 0.01$) in the group with a higher intake of olive oil (>18.32 g/day) compared to low intake of olive oil (<18.32 g/day). Spanish women dietary intake of olive oil was positively associated with total, trabecular and cortical BMD (bone mineral density).

Mazzanti et al. (2015) carried out a study on effect of one year dietary supplementation with vitaminized virgin olive oil (VitVOO) on markers of bone turnover and oxidative stress in healthy post-menopausal women. Results found that one year oral supplementation with VitVOO are able to counteract bone loss by reducing both ucOC (under carboxylated osteocalcin) concentration and UCR (ratio between serum under carboxylated osteocalcin to serum carboxylated osteocalcin) and increasing the T-score values. Compared to VOO (Placebo), VitVOO in the diet of post-menopausal women represents a proper tool for bone protection and a useful strategy against oxidative stress.

Liu et al. (2014) conducted study on olive oil in the prevention and treatment of osteoporosis after artificial menopause. Results showed that EVOO (Extra virgin olive oil) significantly increased BMD and decreased phosphatase, alkaline phosphatase (ALP), IL-6, MDA (Malondialdehyde), and nitrate levels in mice. However, it had no significant effect on the Ca^{2+} level. In clinical follow-up, EVOO also improved patient BMD levels on L3, L4 and left femoral neck. Olive oil not only improved serum bone indicators in castrated rats, but also prevent bone loss in patients.

Tagliaferri et al. (2014) investigated the effect of olive oil and vitamin D synergetic effect to prevent bone loss in mice. Mice were randomly divided into six groups (n=12). At 8 weeks of age, 4 groups of mice were bilaterally ovariectomized (OVX) and 2 batches were sham-operated (SH). Two supplementary OVX groups were given either refined or virgin olive oil fortified with vitamin D3, to assess the possible synergistic effects with another liposoluble nutrient (Vit-D3). Results revealed that virgin olive oil fortified with vitamin D3 is able to counteract the bone loss and improved bone remodeling and bone mineral density in mice.

Saleh and Saleh, (2011) evaluated the protective effects of olive oil supplementation against osteoporosis in ovariectomized (OVX) rats. Results found that OVX-rats showed a significant decrease in plasma calcium levels and a significant increase in plasma ALP, MDA and nitrates levels. These changes were reduced by olive oil supplementation in the Olive-OVX rats. Light microscopic examination of the tibia in Olive-OVX rats, cortical bone thickness (CBT) and the trabecular bone thickness (TBT) were markedly improved as compared to the OVX group. Thus, olive oil effectively mitigated ovariectomy-induced osteoporosis in rats and it may be a promising effect for the treatment of postmenopausal osteoporosis.

CONCLUSION

Olive oil which is rich in MUFA and polyphenols helps to enhance the calcium deposition and bone mineral density. Different experimental models have demonstrated that virgin olive oil and its phenolic compounds may favor bone density maintenance. Moreover, the bioactive component of olive oil- oleuropein is of great importance in the protection of cardiovascular disease, cancers and also sin bone health (osteoporosis). Hence, olive oil particularly virgin olive oil is a potential source for the management of bone health and osteoporosis in women.

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Mahua Seed Decorticator- Make Life Easy for Tribal People

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INTRODUCTION

Madhuca longifolia, commonly known as mahua belongs to Sapotaceae family, which is extensively growed in central and southern parts of India. A dry deciduous tree, mahua, is largely concentrated in forest ranges of Madhya Pradesh, Jharkhand, Chhattisgarh, Odisha, Maharashtra and Bihar. This survival tree has economic, cultural and geographical importance and dominates farm economy, as it is an important source of livelihoods to forest dwellers. The annual production of seed in the country is around 0.50 million tons (Gupta et. al., 2013). Tribal communities such as Gond and Baiga tribes in Madhya Pradesh collect mahua flowers, fruits, seeds and leaves during February to April months for their economic importance. The mahua seeds, generally ellipsoidal shaped, measuring from 1.5–2.0 cm in length and from 1.3–1.6 cm across, are valued for their quantity of fat (upto 50%). Commercially known as mahua butter or mowrah butter, it has many edible and medicinal applications. The removal of rind from mahua seed manually is laborious and time consuming.

People are removed rind form seed by heavy stone and there are not used any machine to remove rind from seed. To overcome this problem of tribal people 'Patalkot Tribe Solutions LLP' is developed a machine, Mahua Seed Decorticator (manual cum power operated) which can be easily removed rind form seeds. A mahua seed decorticator was developed based on physical and mechanical properties of mahua seed. A decorticator is a machine for stipping the skin off bark, wood, nuts, grain, plant sheller etc. in preparation for further processing. The developed machine is designed to run by manpower (manually operated) or power operated (1 hp electric ac motor) which can be suitable for rural areas.


Picture1 and 2: Peoples are involved removing rind from seed manually.

This decorticator is used to decorticate mahua seed to get kernels. These kernels are processed for extraction of oil. This machine is very useful for rural people, farmers and small-scale industries for post harvest processing of mahua seeds. The unit cost of machine is 6000/- (manually).

Design consideration

The mechanics of mahua seed decorticator include compression, shearing and impact force. The developed machine utilizes the principle of shearing force. The following factors were considered in the design of the mahua seed decorticator.

i. Materials of adequate strength and stability were used for fabrication (i.e. mild steel).
ii. The machine was designed to have a maximum capacity of 40 kg of Mahua seed hour with motor operation and 20 kg per hour with manually operation so that machine could be affordable for small scale farmers and micro-industries.
iii. The materials that are available locally were used in fabrication of the components.

The machine was conceived as an easy-to-adjust, easy-to-dismantle and easy-to-fabricate device. Consideration was given to the cost of items and materials for fabrication with the ultimate aim of utilizing the cheapest available materials, yet satisfying all strength requirements.

Technical Description

- The machine is put on and made to run, before loading with the seed so as to ensure that all the component of the machine are properly fixed (if not properly fixed, there will be noise as a result of vibration).

Mahua seeds are fed manually into open hopper. Due to the vibration of the machine, the seeds gravitate down the slanted sheet to the opening into the decorticating chamber.

- In the decorticating chamber, the rotating embossed perforated drum rotates, which compress the mahua seeds against an attached stationary embossed concave perforated plate.
- The rotating drum is powered by 1 hp ac electric motor or manually. This compression force helps the frangible seed coat to crack.
- Due to continuous rotating action, the blades create impact and shearing force inside chamber, which caused the cracked the seed coat to break and detached from the kernel.

Picture 3: Mahua Seed Decorticator

- The clearance between the drum and concave plate are adjustable to suit the axial dimension of the seed in order to ensure efficient cracking and detachment of seed coat in a single pass. The machine has single chute.
- The efficiency of machine is reported 88% with 4-5% seed brokens.

CONCLUSION

Mahua seed is one of the important tree born oil seed. It is mainly processed for extraction of its oil. A manual cum power operated mahua seed decorticator was designed, constructed and tested. The tests carried out on the machine indicate a fairly satisfactory performance. It should be possible to improve the performance of the machine, especially with respect to throughput and percentage of completely decorticated seeds, with further modification and testing.

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Role of Big Data Analytics in Agriculture and Aquafarming System

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INTRODUCTION

A vast data set beyond the ability of the commonly used software tools to analyse, manage and process the data within a lapsed time is termed as big data. In the recent trend the software tools became more powerful so the definition of big data also changed; today, depending on the nature and mix of the data, a set of data is considered big if it contains a few petabytes to many zettabytes of data.

Gartner IT Glossary, defined Big Data as high-volume, variety and/or high-velocity information that demands innovative forms of cost-effective information processing that enable enhanced insight, decision making, and process automation.

Broadly big data is made up of 3 V's, which are as follows:

- **Volume:** Large amounts of petabytes to zettabytes sized data.
- **Velocity:** Data streaming at a very great speed and shorter time to act based on these data streams.
- **Variety:** Data come from different data sources such as internal and external data sources. More importantly, data can come in various formats such as, structured data as a database table, semi-structured data such as XML data, unstructured data such as text, images, video streams, audio statement, and more.

A way towards smart farming

With the building blocks of the initial successes of the first Green Revolution in the 1960s, now it is high time for a new revolution in Agriculture, which is urgently needed for sustainable and significant growth in worldwide agricultural production. To achieve this, we need novel sustainable solutions to reduce the environmental footprint of farming and big data analytics.

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Big Data analysis enables organizations to analyze various data sources for improved insights, which can help improve the forecasting and operational efficiency and lead to enhanced and timely decision making. These technologies, in turn, will help broaden the analytics and predictive options leading to better outcomes.

The Smart Farming concept brings alongside the management cycle as a cyber-physical system. Such a system controls the farm system, which integrates the smart devices connected to the Internet. Smart devices extend the conventional tools (e.g., rain gauge, tractor, etc.). Such extensions add autonomous context-awareness by all kinds of sensors, built-in intelligence, capable of executing autonomous actions (Wolfert et al., 2017). Human intervention is always involved in the smart farming process but at a higher intelligence level, and most of the operational activities are carried on by machines thus, cyber-physical cycle becomes almost autonomous.

Proposed multidisciplinary model for Smart Agriculture in India –

The proposed architecture of the interdisciplinary model, as shown in figure 1, consists of the five modules:

1) Sensor Kit Module
2) Mobile App Module
3) Agro Cloud Module
4) Big-Data Mining, Analysis, and Knowledge Building Engine Module
5) Government and Agro Banks User Interface

Sensor Kit module is portable Internet of Things (IoT) device with soil and environment sensors. Mobile App module provides an interface to the users. Agro Cloud Module consists of storage, Big-Data mining, analysis, and knowledge building engine and application module to communicate with the users. Government and Agro Banks user interface are a web interface for information related to agricultural schemes and loans (Channe et al., 2015).

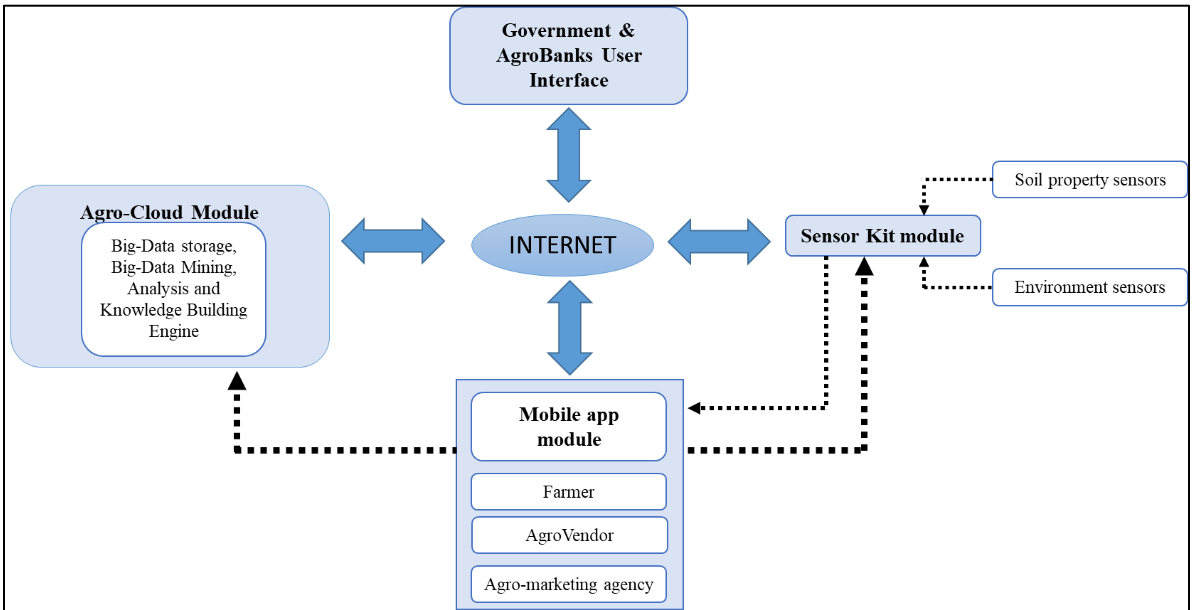

Figure 1. The proposed architecture of multidisciplinary Smart Agriculture model

Big data in fisheries

For a long time, the fish farms' performance was depended on the fish farmers' intuition and the basic conventional technologies and data tools. Due to this fundamental approach, there may often have been times where strategic knowledge may have been squandered or specific patterns in the raw data not identified.

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As a direct consequence of these practices, the aquaculture industry is hampered in making optimal strategic decisions due to this lack of appropriate informed knowledge. With the recent technological advancements in cloud computing infrastructures and the availability of big datasets in the aquaculture industry, coupled with advances in modern data analytics methods, this is no longer the case. By using data analytics algorithms on datasets stored in the cloud, a backup of initial conventional intuitive decisions can be paired up with the computational model results. This can provide the industry with better decision-making tools that will further lead to increased proficiency, a better return for the farmers, and an environmental benefit through a more sustainable approach to the Aquaculture industry.

A way towards Aqua Smart farming

The main problem companies facing today is that they cannot interpret the data they capture, nor can they contemplate alternative uses for their data. So, if they were able to interpret and understand the data, they would be able to considerably improve the production in terms of food conversion ratio (FCR), cost, mortality, diseases, environmental impact, etc. Thus, the Aqua Smart project aimed to bring significant and open data analytics as a service to the aquaculture industry (Sarraipa, et al., 2016). The prime goal of the Aqua Smart project was to create a cloud-based platform to assist aquaculture managers in their decision-making process with the basics of machine learning and data mining techniques. With such platform's help, the fish farmers will have a better understanding of their farm and thus will be able to make more accurate estimations on the fish's growth (Marcelino-Jesus et al., 2018).

It allows companies to analyse production data between samplings providing them with visualisations to show new insights into what is happening on the farm. Thus, Aqua Smart aims to radically enhance the innovation capacity within the aquaculture sector by helping companies to transform the large volumes of heterogeneous captured data into knowledge through identification and analysis of this production data and subsequently using this harvested knowledge to improve performance (Sarraipa, et al., 2016).

Challenges

Privacy and security concerns regarding data sharing are some of the most significant challenges (Van't Spijker, 2014). Usually, the companies are afraid that data can fall into the wrong hands (e.g., of competitors) (Gilpin, 2015). Therefore, easy flow of technological advancements and reliable access to Big Data and building trust with farmers should be a starting point in developing applications (Van't Spijker, 2014).

CONCLUSION

In this fast-evolving era, new technological inventions are needed to enhance production sustainably. Big data analytics has been introduced as a boon to the worldwide agricultural and aquaculture farming systems. Day by day, technological advancements contribute to enhanced data production, which can be easily uploaded and analysed with the help of cloud computing and big data analytics tools. The Smart agriculture project and Aqua Smart project's main objective is to acquire new skills, knowledge, and data analytics experiences suitable for improved production efficiencies. The privacy and security concerns form the biggest challenge for the Big data analytics system. Thus, a solid and reliable open-source platform should be introduced for gaining the trust and widespread adaptability of the big data technologies.

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Importance of Seed Treatment in Field Crops

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INTRODUCTION

Seed treatments provide farmers with an economical and environmentally sound means by providing protection for the seed and seedlings against disease and insect pressure from the moment they are planted. There are hundreds of pathogens and insects that can damage or even kill the seed or seedlings before they even have a chance to develop, which can negatively influence the crop's progress throughout the growing season and have a major impact on the yield. Seed treatment results in stronger and more uniform stands, healthier plants and higher crop yields. The yield of crops can be increased by seed treatment and the losses due to pest diseases outbreaks in crops can be reduced by 10 to 15 percent.

What is a seed treatment?
Seed treatments are defined as the precise application of chemical or biological substances to seeds or vegetative propagation materials (bulbs, corms, or tubers) to control disease causing microorganisms, insects, or other pests. Commonly used seed treatments are insecticides, fungicides and bactericides.

Categories of seed treatments

Seed treatments categories for crop disease management incorporate 1) Seed protection, 2) Seed disinfestation, and 3) Seed disinfection. Seed protection could be a biological, chemical, physiological or combination treatment planned to protect the seed and seedling from pathogenic microorganism within the soil. Seed disinfestation treatments are outlined moreover to control spores and other structures of pathogens on the surface of seeds. Seed disinfection treatments look for eliminate pathogens that have penetrated into living cells of the seed, infected it and have become established. Agro-chemical mixtures also may be supportive in disinfection. The treatment should control the pathogen, but ideally should not affect the embryo or emergence potential of seed.

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Benefits of seed treatment

Seed treatments play a critical role in agriculture and the production of healthy crops. Because very small quantities of active-ingredients of pesticides is applied to non-target sites, or to non-target organisms. Seed treatment selectively control pests; thus, they are not harmful to beneficial organisms. Their safe and targeted use provides an efficient use of pesticides and reduces the amount of chemicals. However, the benefits of seed treatments can be short-lived, or the efficacy of seed treatments can be low if pest pressure is extremely high.

Chemical seed treatment for major field crops

Chemical (fungicide and bactericide) seed treatments help control soil-borne and seed-borne pathogens that cause seed decay, seedling blight, root rot and seed-borne diseases. Control of these diseases may result in better stands, more vigorous seedlings, and increased yields. Always keep in mind that while treating seed, first treat with fungicide, then with pesticide chemicals and finally biofertilizer culture. This sequence of seed treatment is of great importance while doing seed treatment. Following seed treatments details are as per the pesticide label claim approved by Central Insecticides Board Registration Committee (CIBRC), Faridabad (Haryana) for their commercial use in the country.

Crops	Diseases	Fungicides	Application Rate (per kg of seed)
Cotton	Root rot, bacterial blight	Carboxin 37.5% + Thiram 37.5% WS	3.5 g
	Seedling disease	Fluxapyroxad 333 g/l FS	1.5 ml
	Seedborne disease	Thiram 75% WS	3 g
	Angular leaf spot	Carboxin 75% WP	2- 2.5 g
Groundnut	Collar rot	Thiram 75% WS	
	Collar rot, seed rot, root rot, stem rot	Carboxin 37.5% + Thiram 37.5% WS	3 g
	Seed and seedling rot	Penflufen 13.28% + Trifloxystrobin 13.28% FS	1 ml
	Stem rot	Thiophanate Methyl 450g/l + Pyraclostrobin 50g/l FS	2- 2.5 g
	Collar rot, stem rot	Tebuconazole 2 % DS	1 g
	Collar rot, dry root rot, tikka leaf spot	Carbendazim 25%+ Mancozeb 50% WS	3 g
Maize	Downy mildew	Metalaxyl 35% WS	7 g
	Seedling blight	Thiram 75% WS	3 g
	Seed rot, seedling blight	Carbendazim 25% + Mancozeb 50% WS	3 g
Mustard	White rust	Metalaxyl 35% WS	6 g
Pearl millet	Downy mildew	Metalaxyl 35% WS	6 g
Pigeonpea	Seed rot, root rot, stem rot, fusarium wilt	Carboxin 37.5% + Thiram 37.5% WS	4 g
Chickpea	Dry root rot, collar rot	Carbendazim 25% + Mancozeb 50% WS	3 g
Black gram	Root rot, collar rot	Carbendazim 25% + Mancozeb 50% WS	3 g
Paddy (Rice)	Brown Spot, seedling blast, sheath blight	Carbendazim 25% + Mancozeb 50% WS	3 g
	Blast, sheath blight, aerial phase	Carbendazim 50% WP	2 g
	Bacterial leaf blight	Streptomycin Sulphate 90% + Tetracycline Hydrochloride 10% SP	40 ppm solution (before sowing soak seeds for 12 hours)
Sorghum	Downy mildew	Metalaxyl 35% WS	6 g
	Grain smut	Sulphur 80% WP	3-4 g
		Carbendazim 50% WP	2 g
	Seedling blight, loose smut	Thiram 75% WS	3-4 g
	Anthracnose	Fluxapyroxad 333 g/l FS	1 ml
Soybean	Collar rot, charcoal rot and other seedling diseases	Carboxin 37.5% + Thiram 37.5% WS	3 g
	Rhizoctonia root rot	Fluxapyroxad 333 g/l FS	1 ml
	Seed and seedling rot	Penflufen 13.28% + Trifloxystrobin 13.28% FS	1 ml
	Seedling rot	Thiophanate Methyl 450g/l + Pyraclostrobin 50g/l FS	2- 2.5 g
	Root rot, collar rot	Carbendazim 25% + Mancozeb 50% WS	3 g
Sunflower	Downy mildew	Metalaxyl 35% WS	6 g
Wheat	Bunt, flag smut, loose smut	Carboxin 75% WP	2-2.5 g
		Tebuconazole 2% DS	1 g
		Thiram 75% WS	3 g
	Loose smut	Triticonazole 80 g/l + Pyraclostrobin 40 g/l FS	1 g
		Carboxin 37.5% + Thiram 37.5% WS	3 g
		Carboxin 75% WP	2.5 g
		Tebuconazole 2% DS	1 g
		Tebuconazole 5.36% FS	0.28 g
		Carbendazim 50% WP	2 g
	Loose smut, seedborne and soilborne disease	Carbendazim 25% + Mancozeb 50% WS	3 g

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Seed treatment not only to kill fungi and pests but also to provide higher yields of the crop. Thus, seed treatments should be considered as tools in an integrated pest management plan.

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Biochar: Future of Agriculture

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INTRODUCTION

The amount of carbon in the soil is a direct indication of good quality of soil. Higher carbon stocks have a direct correlation with increased agricultural yields through improved soil health. In the current scenario of climate change and global warming, much of carbon in atmosphere has to be sequestrated into soil carbon pool so that increasing CO2 in the atmosphere and resulting warming could be reduced. The use of biochar can be a simple yet powerful tool to combat climate change by sequestering much of atmospheric carbon into soil as well as providing an opportunity for the processing of agricultural and other waste into useful clean energy.

What is Biochar?

Biochar is a solid material obtained from the carbonisation of biomass. Biochar is produced through a process known as pyrolysis, means thermal decomposition of organic material (i.e. wood chips etc, crop waste and manure) under limited supply of oxygen (02), and at relatively low temperatures (<700°C). This process often mirrors the production of charcoal, which is perhaps the most ancient industrial technology developed by humankind. However, it distinguishes itself from charcoal and similar materials by the fact that biochar is produced with the intent to be applied to soil as a means to improve soil health, to filter and retain nutrients from percolating soil water, and to provide carbon storage. Due to the molecular structure of biochar, it is in a more stable form than the original carbon (i.e. plant biomass, manure, etc.) both chemically and biologically. As a result, it is more difficult to breakdown biochar in the soil, resulting in a product that can remain stable in the soil for hundreds to thousands of years. One of the great things about producing biochar through the process of pyrolysis is the fact that the main by-product is a gas, known as syngas which is a form of bio energy waiting to be used.

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It is easily captured and can be used to produce heat and power, to generate electricity as well as power the pyrolysis machine in the process, making the machine largely sufficient.

Application in Agriculture

The potential benefits that biochar offers for farming includes:

1. Improved soil fertility and crop yields
2. Increased fertilizer use efficiency
3. Improved water retention, aeration and soil tilth
4. Higher cation exchange capacity and less nutrient runoff
5. Clean and efficient biomass energy production from crop residues and forest debris
6. Combined heat, power, and refrigeration opportunities from pyrolysis
7. Leads to net sequestration of carbon from the atmosphere to the soil thereby increasing soil organic carbon (SOC)
8. Greater on-farm profitability
9. Can be financed through carbon markets and carbon offsets
10. Decreased nitrous oxide and methane emissions from soils
11. Provides powerful tool for reversing desertification
12. Provides alternative for slash-andburn agriculture
13. Can work as component of reforestation and aforestation efforts
14. Can produce electricity, bio-oils, and/or hydrogen fuels
15. Can use wide variety of feedstock including crop residues such as wheat
16. Acts as a liming agent to reduce acidity of soils
17. Carbon sequestration by the natural process of photosynthesis
18. Net production of energy in form of bio energy

Environmental Impact of Biochar

- Biochar can be a simple yet powerful tool to combat climate change. Biochar sequestration is considered carbon negative as it results in a net decrease in atmospheric carbon dioxide over centuries or millennia time scales.
- It can make a big difference in the fossil fuel emissions worldwide and act as a major player in the global carbon market with its robust, clean and simple production technology. As organic materials decay, greenhouse gases, such as carbon dioxide and methane (which is 21 times more potent as a greenhouse gas than CO_2), are released into the atmosphere.
- Instead of allowing the organic matter to decompose and emit CO_2, pyrolysis can be used to sequester the carbon and remove circulating CO_2 from the atmosphere and store it in virtually permanent soil carbon pools, making it a carbon-negative process. By charring the organic material, much of the carbon becomes “fixed" into a more stable form, and when the resulting biochar is applied to soils, the carbon is effectively sequestered.
- It is estimated that use of this method to “tie up" carbon has the potential to reduce current global carbon emissions by as much as 10 percent.
- The use of pyrolysis also provides anopportunity for the processing of agricultural residues, wood wastes and municipal solid waste into useful clean energy. Although some organic matter is necessary for agricultural soil to maintain its productivity, much of the agricultural waste can be turned directly into biochar, bio-oil, and syngas.
- Biochar can also provide an extremely powerful means of reversing desertification. In most semi-arid and desert climates the soil is nearly void of soil organic carbon (SOC), and thus has the potential to absorb massive quantities of carbon. Generally, the amount of carbon in the soil is a direct indication of soil quality: the greater the amount of SOC, the higher quality the soil.

- Higher carbon stocks have a direct correlation with increased agricultural yields, higher plant moisture absorption, improved soil tilth, and higher levels of soil biological activity.

Best Management Practices for Biochar Soil Application

The particle size distribution of biochar materials will vary widely depending on the feedstock and the pyrolysis technique used to produce the biochar. With small particles, it is important to apply biochar in ways that minimize loss due to wind or water erosion.

Some best management practices are enlisted below to avoid these losses:

- Apply biochar under the right weather conditions when winds are mild. It varies according to general weather conditions and time of day. It may also be helpful to apply biochar during mild rain conditions where light rain will dampen biochar dust and hold it on the soil surface until it can be tilled in.
- Apply moisture to biochar. Water can be applied directly to the biochar, or it can be mixed with moist manure.
- Produce a biochar formulation by pelleting, prilling, and mixing biochar with other types of amendments such as manures or composts. Different biochar formulations will be bestsuited to different application methods, and very fine biochar may be desirable in certain cases, for example when applying as slurry, by itself or mixed with manure.

Size of Biochar Particles

Ideal particle sizes to improve soil moisture retention have not yet been determined. Handling and applying the biochar will also impact the decision of what particle size is best.

Biochar can be finely divided and can be applied to soil as it is, provided care is taken to minimize wind losses. If particle size must be reduced (for example from biochar made from old pallets or larger pieces of wood), it can be hand crushed inside bags using a large pestle. Small amounts can also be crushed by driving over the material with a roller pulled by a tractor. For crushing larger amounts of biochar materials, hammer mills can be used, as well as compost shredders.

Best management practices include moistening the material before crushing it to reduce dust created during the process, and/or crushing the biochar inside closed bags.

Application Rate of Biochar

- Recommended application rates for any soil amendment must be based on extensive field testing, soil types and crops. Also, biochar materials can differ widely in their characteristics, thus the nature of a specific biochar material (e.g. pH, ash content) also influences application rate.
- Application rates of 5-50 tonnes of biochar per hectare (0.5 - 5 kg/m2), with appropriate nutrient management results in better yield of crops. Most biochar materials are not substitutes for fertilizer, so adding biochar without necessary amounts of nitrogen (N) and other nutrients cannot be expected to provide improvements to crop yield.

Frequency of Application

- Due to its recalcitrance to decomposition in soil, single applications of biochar can provide beneficial effects over several growing seasons in the field. Therefore, biochar does not need to be applied with each crop, as is usually the case for manures, compost, and synthetic fertilizers.
- Depending on the target application rate, the availability of the biochar supply, and the soil management system, biochar amendments can be applied in increments. However, it is believed that beneficial effects of applying biochar to soil improve with time, and this may need to be taken into consideration when splitting applications over time.

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Methods of Biochar Application under Conventional Field Crop Systems

- **Broadcast and incorporate**: Broadcasting can be done by hand on small scales or on larger scales by using lime/solid manure spreaders or broadcast seeders. Moistened biochar materials may be better suited to application with manure spreaders than lime spreaders. Incorporation can be achieved using any ploughing method at any scale, including hand hoes, animal draft ploughs, disc harrows, chisels, rotary hoes, etc.
- Mould board ploughing is not recommended as it is unlikely to mix the biochar into the soil and may result in deep biochar layers.
- **Traditional banding**: Banding of seeds and fertilizers is a routine operation in mechanized agriculture, and involves applying an amendment in a narrow band, usually using equipment that cuts the soil open, without disturbing the entire soil surface. Banding allows biochar to be placed inside the soil while minimizing soil disturbance, making it possible to apply biochar after crop establishment. However, the amounts of biochar that can be applied in this way are lower than those which can be achieved by broadcast applications. When working by hand, biochar can be applied in furrows opened using a hoe and closed after applying biochar.
- **Mixing biochar with other solid amendments**: Mixing biochar with other soil amendments such as manure, compost or lime before soi application can improve efficiency by reducing the number of field operations required.
- Since biochar has been shown to sorb nutrients and protect them against leaching, mixing with biochar may improve the efficiency of manure or other amendment application.
- **Mixing biochar with liquid manures**: Biochar can also be mixed with liquid manures and applied as Fine biochars will likely be best suited to this type of application using existing application equipment, and dust problems associated with these would be addressed. Biochar could also be mixed with manure in holding ponds and could potentially reduce gaseous nitrogen losses as it does when applied to soil.

Formulated Biochar Products

Since biochar itself cannot be considered a source of nutrients (unless it has a high ash content), there is interest in blending it with other materials such as synthetic fertilizers, compost and manures to enhance its value as a soil amendment.

Adding biochar to sewage sludge or poultry manure during composting has been shown to reduce N losses and themobility of some heavy metals was also reduced in sewage sludge compost with biochar. It is also believed that adding biochar to composts and manures can reduce odors.

Another organic fertilizer made by Japan as bokashi, that is a fertilizer combining “effective" microbes, molasses, biochar, bran, and animal manure with water, and incubating under anaerobic or partially anaerobic conditions. Rice hull biochar is often used due to the availability of rice hulls in many regions. However, great care must be exercised while carbonizing rice hulls, as high process temperatures can lead to the production of carcinogenic compounds.

Potential Health Issues of Biochar Application

- Health risks from biochar relate to possible soil and thus food contamination, and to the effects of breathing in small biochar particles. Contamination can come either from contaminated biomass or from the pyrolysis process. For example, trees absorb heavy metals and other air pollutants and when wood is burnt or pyrolysed, those become concentrated in the ash, which forms part of the biochar.

- The ash retained after burning wood from forests well away from any sources of pollution contained so many heavy metals that some of it should have qualified as toxic waste. Depending on the pyrolysis temperature and the original biomass, there is a risk of particles called Polycyclic
- Aromatic Hydrocarbons (PAHs) forming, some of which are known to cause cancer and birth defects. All of this can be avoided by testing different batches of biochar before they are used. Breathing in small charcoal particles can cause 'black lung disease' or pneumoconiosis.
- Furthermore, breathing in ash residues from charred rice husks is linked to a
- risk of the lung disease silicosis. Both are potentially fatal lung diseases. These risks can be significantly reduced if people who handle and apply biochar wear adequate masks.

CONCLUSION

Biochar has a both positive as well as negative impact on crop growth, yield and human health. This technology involves a large biomass demand for production as well as fine biochar particles are causing severe health hazards thus, it is critical that we address this issue with caution. However, application of biochar to damaged soils of low fertility seems promising and has a high potential for mitigating climate change and helping to raise soil fertility but not a silver bullet to improve nutrient economy in farming, or to increase crop yields. We need to investigate and utilize it to reduce our emissions and sustain soils, but we cannot rely on it for solving our emerging problems.

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Biodegradable Packaging from Agro-Waste

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INTRODUCTION

Agriculture based industries produce a vast amount of agro-waste from various agricultural activities. One-third of the total food produced globally per year for consumption remains unutilized and therefore wasted as stated by Food and Agricultural Organization (FAO). Food waste is one of the arduous tasks the world is facing currently. Major food losses occur during the post-harvest stage. Fruits and vegetables contribute to a significant amount of waste. As stated by the FAO, 20-30% of fruits and vegetables are disposed of as waste during post-harvest handling and processing operations. Agriculture waste include field residues such as stems, stalks, leaves, seedpods, and process residues like husks, seeds, roots, bagasse, molasses. Waste from food processing units consists of organic residues such as fruit seeds, citrus peels, potato peels, coconut shells, wheat straw, rice husks, pomace, etc. These wastes are commonly disposed of at landfill sites or employed in preparing compost. Due to the varied composition of cellulose, hemicelluloses, proteins, lipids, these wastes serve as a raw material for the production of biodegradable and sustainable packaging material.

Need for Biodegradable Packaging

Packaging waste adds to a major portion of solid waste and has raised environmental concerns over the years. Development of biodegradable packaging materials from natural bases such as agro-waste is the need of hour. Utilization of agro-waste is an economical and effective step taken for development of sustainable and eco-friendly, biodegradable packaging materials. Using Biodegradable packaging minimizes waste and lessens the environmental consequences of using petro-chemical based synthetic packaging materials.

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Biodegradable films can easily disintegrate into the environment by natural factors such as microbes (bacteria, fungi, etc) or abiotic components of the ecosystem thus has least impact on the environment and ecosystem.

Biodegradable packaging

Biodegradable packaging options include biopolymers and bioplastics. Biopolymers are the polymers derived from natural sources which are sustainable, biodegradable, non-toxic, non-carcinogenic, and non-immunogenic. Proteins (casein, soy, whey) and polysaccharides (cellulose, starch, chitin) are two major classes of food biopolymers. Bioplastics are made from different sources such as plant oil, cellulose, corn starch, potato starch, sugarcane, hemp, etc. Biodegradable films have certain obstructions that are associated with low gas barrier properties, high solubility, and low mechanical strength for packaging purpose. To overcome this problem, biodegradable composite films for food packaging are being developed by incorporation of nano-particles to improve the efficiency of packaging materials.

Bio-polymers from agro waste

Bio-polymers are derived from biomass by-products. They are obtained from renewable sources. Biodegradable polymers of agricultural origin (Figure 1) with lipids, plant-based proteins- zein, soy, pea, gluten, and polysaccharides- starch, chitosan, sodium alginate, pectin, gums, and lignocelluloses (straws and wood) are emerging.

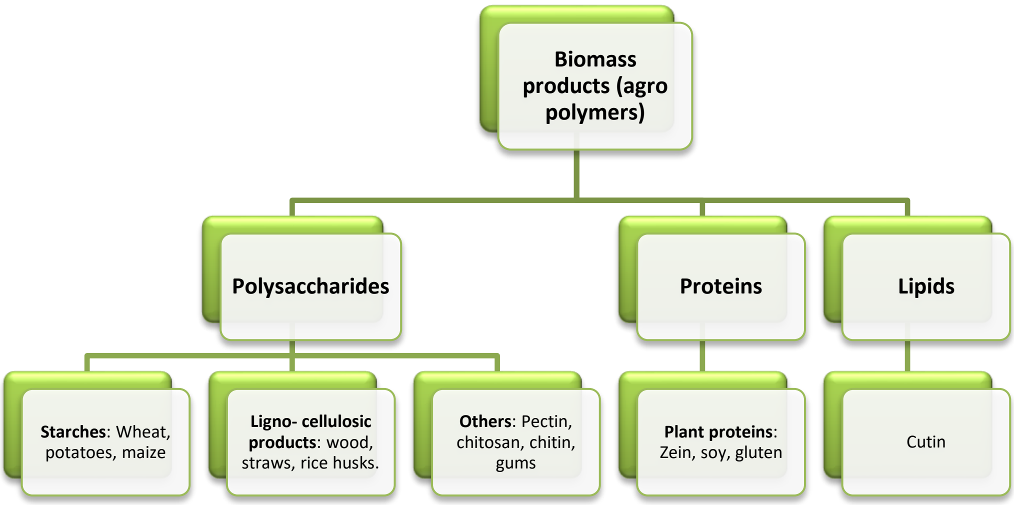

Figure 1: Main polymers of agricultural origin from renewable resources

Applications of Agro-waste for development of Biodegradable Packaging

Starch which is mainly extracted from cassava, potato peels, rice husk, wheat bran, is rich in amylose, exhibit thermoplastic property that could be used in development of packaging material. These can be easily obtained from agriculture waste at zero cost. Corn starch-based biocomposites added with rice husk and walnut shell were effective in enhancing the physical, mechanical, and thermal properties of biocomposites and could be of advantage as a sustainable packaging material (Singh et al., 2019).

Pectin, extracted from citrus peels and by-products of juice processing has diverse functionalities in sustainable packaging applications. It is the most pliable polysaccharides suitable for the formation of an effective biomaterial film due to its biodegradability, biocompatibility, and non-toxicity (Nisar et al., 2018). Pectin films act as a good oxygen barrier and have decent hardness and adhesiveness properties

(Bermúdez-Oria et al., 2017). Packaging films formed with coconut water and lime peel extract possessing antioxidant properties have shown potential to extend shelf-life of food products with an improved water barrier property, and scale down the use of synthetic packaging material (Rodsamran & Sothornvit, 2019).

Among the plant proteins, soy- protein isolate is a fine alternative to develop new bio-based packaging materials. Soy protein isolate (SPI), obtained from soybean oil processing industry has excellent gelling, emulsifying ability, and strong water and oil holding capacity. SPI-based films usually show lower oxygen permeability as compared to films based on synthetic polymers, starch, hemicelluloses, and pectin (Nishinari et al., 2014).

Cellulose from agro-waste such as rice straw, wheat hull, wood chips, wood pulp, maize stalk, sorghum waste, is used as raw material for the formation of biodegradable film packaging. It is the most abundant polysaccharide biopolymer available worldwide. Multiple hydroxyl groups of cellulose in cellulosic materials can be modified either partially or wholly on treating with numerous chemicals to produce a variety of end products stated as cellulose derivatives (Israel et al., 2008). Cellulose Nanocrystals (CNCs) and cellulose nanofibers (CNFs) are non-toxic, biodegradable, have high strength and barrier protection. CNCs and Corn zein are utilized for the preparation of oxygen and water vapor barrier biocomposite films (Ben Shalom et al., 2021).

Plant cutin is the main element (80% w/w) of the skin fraction of tomato pomace. Cutin extracted from tomato waste is a non-toxic, compostable, waterproof, UV-blocking, amorphous, insoluble, and infusible lipid-based polymer made of esterified C16 and C18 hydroxy acids (Domínguez et al., 2011).

CONCLUSION

Food industry has seen significant advances in the packaging sector. One of which is the use of bio-polymers prepared from agro-waste for packaging applications. Food waste that generally ends up in landfills and causes environmental damage, can be transformed into biodegradable packaging material. Bio-based packaging could serve as an alternative to synthetic packaging materials. Use of agro-waste as raw materials for developing biodegradable packaging can be economical and contribute to recycling of waste and to a sustainable eco-friendly environment.

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Managing Crop Residue for Enhancing Nutrient Availability of Soil

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INTRODUCTION

Crop residues have multiple uses on agricultural and allied sectors. Rice-wheat is the founder cropping system of Indo-Gangetic Plains (IGP) of South Asia which support food and energy source of a millions. Burning and/or removal of crop residue are not economical rather than endanger to ecosystem functions.

A multiple problems are faced by crop growers on managing residues at time of harvesting to proceed for next crop. However, by adopting some useful interventions, a sizeable quantity of primary plant nutrients can be supplemented in soil without sacrificing the economic return of targeted crop. Crop residues are organic vegetative crop materials offer sustainable and ecologically sound alternatives for meeting the nutrient requirements of crops. These resources are facing increasingly competing uses, including soil and water conservation, livestock feed, industrial uses (e.g. papermaking fiber) and most recently, as feed stocks for cellulosic ethanol production (Blanco-Canqui et al., 2009).

Rice-wheat is a major crop rotation in the Indo Gangetic Plains (IGP) of South Asia, spread over 13.5 million ha in Bangladesh, India, Nepal and Pakistan (Ladha et al., 2000). Burning of rice residues is cost-effective and the predominant method of disposal in areas under combined harvesting in the IGP. However, disposal of crop residues by burning is often criticized for accelerating losses of soil organic matter (SOM) and nutrients, increasing C emissions, causing intense air pollution, and reducing soil microbial activity (Kumar & Goh, 2000). The gaseous emissions from burning of rice straw are 70.0, 7.0, 0.7, 2.09 and 20.25% of CO_2, CO, CH_4, N_2O and others.

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Oppositely, decomposition of crop residues releases about 55-70% of the C to the atmosphere as CO2, 5-15% is incorporated into microbial biomass, and the remaining C (15-40%) is partially stabilized in soil as new humus (Stott & Martin, 1989).

Problem for incorporation of crop residues

Crop residues have been incorporated immediately before planting the next crop, grain yields were lower than where residues are removed or burned, resulting in N immobilization, a problem that is attributable to the slow rates of residue decay.

In rice-wheat cropping systems, too, management of rice straw, rather than wheat straw, is a serious problem, because there is very little turn-around time between rice harvest and wheat sowing. Other potential problems of residue incorporation just before rice transplanting include accumulation of phenolic acids in soil and increased CH_4 emission under flooded conditions (Grace et al., 2003).

In this case, the timing of incorporation of crop residues is more important than the amount. Compared with the traditional method of wet incorporation shortly before planting of the next rice crop, the potential benefits of shallow incorporation shortly after crop harvest include accelerated aerobic decomposition of crop residues (about 50% of the C within 30-40 d), leading to increase N availability, and reduced CH_4 emissions. Early incorporation also allows additional time for phenol degradation to occur under aerobic conditions, thereby avoiding any adverse effect on germinating seeds and seedlings.

Management aspect of crop residues for better cultivation

Time of incorporation had a large effect on the decomposition of rice residue during the fallow phase. Differences in decomposition rates of crop residues were positively correlated with crop N content. It is generally accepted that residues with low N content or a high C:N ratio decompose more slowly than those with a low C:N ratio or high N content. However, De Haan (1977) found no relationship between percentage of N in added plant residue and the rate of decomposition. The rate of plant residue breakdown depends on the relative proportion of biochemical composition such as lignin, hemicellulose and polyphenol. Many workers have found that increasing lignin concentration reduces the decomposition rate and nutrient release from plant residues.

Yadvinder-Singh et al. (2004) reported that at wheat seeding, the mass loss of rice residue was 51% for a 40-day decomposition period, compared with 35% for a 20-day decomposition treatment and 25% for a 10-day decomposition treatment. The amount of mass loss remained significantly higher for the 40-day decomposition period compared to the 10-day or 20-day period up to 72 days after seeding of wheat. At the end of the study, no significant difference, however, was noted among the three treatments. And also noted that substantial immobilization of fertilizer N with incorporation at 10 days after fertilizer application in treatments in which rice straw incorporation at 10 days after fertilizer application in treatments in which rice straw was incorporated at 0 and 10 days before application of fertilizer compared to the no-straw treatment.

The magnitude of immobilized N was influenced by the decomposition period of rice straw prior to fertilizer application. Interestingly, immobilization of N in the treatment where fertilizer N was applied concurrently with straw incorporation (0 day) always remained lower than the treatment without straw. These data clearly demonstrated that incorporation of rice straw at 20 d or more before wheat sowing will minimize any adverse effects on crop growth due to N immobilization after straw incorporation. The results from the decomposition and N mineralization studies suggested that rice residue is likely to have little adverse effects on N availability in the soil when it is allowed to decompose under aerobic conditions for at least 10 days before sowing of the next upland crop. The rice and wheat productivity is not adversely affected when rice residue is incorporated for at least 10 d and preferably 20 d before the establishment of the succeeding crop.

In other studies, application of rice and wheat straw (with C:P ratio >300) caused immobilization of P during the first 15 days and then progressively increased the available P content in soil from the 30th day onward (Mukherjee et al., 1995). Mishra et al. (2001) reported that during the decomposition of rice straw, P content increased from 0.10 to 0.195% with time.

About 22.5 and 59.4%, of the total P present in rice straw was released within 5 and 23 weeks, respectively, after its incorporation into the soil. Verma and Mathur (1990) found that incorporation of rice straw along with cellulolytic microorganisms and rock phosphate at 15 days before wheat sowing resulted in a significant increase in wheat yield over recommended fertilizer management practices. Potassium is not bound in any organic compound in the plant material, and thus its release does not involve microorganisms. Rice straw contains about 65% of total K in water-soluble form and it is readily released in the soil upon incorporation. Release of K from rice straw occurred at a faster rate, and within 10 days after incorporation. Available soil K contents increased from 50 mg K kg'^{1} in the untreated control to 66 mg K kg'^{1} in straw-amended treatments.

CONCLUSION

Crop residues are not a waste. Because of serious environmental effects, crop residue burning is not desirable. Rice residue is likely to have little adverse effects on N availability in the soil when it is allowed to decompose under aerobic conditions for at least 10 days before sowing of the next upland crop. But, rice and wheat productivity is not adversely affected when rice residue is incorporated for at least 10 d and preferably 20 d before the establishment of the succeeding crop.

Available P content in the soil increases after 30 days of incorporation of straw into the soil. Release of K from the rice straw occurs quickly after incorporation into the soil.

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Women Role in the Agriculture Development

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INTRODUCTION

Pakistan's population is growing at a very high rate, and quite a number of the population is contributed immediately or not directly with agriculture sectors for his or her survival. The agriculture zone is gambling a crucial position in decreasing poverty and acts as a source of increase inside the countries in which it's miles a primary source of livelihood for the terrible. It gives uncooked materials to industries and additionally serves as a marketplace of its product thereby it contributes loads to the countrywide earnings. It has been envisioned that greater than fifty percent of the arena food production has been completed by women. Due to their crucial role within the large international food production, women are considered as the assets of expertise for cultivating, processing as well as retaining regionally tailored nutritious crop sorts. Due to having such kind of expertise, women can be recognized as the innovation leaders for sustainable development in agriculture sectors and can play their role more effectively. Women are visible in nearly every section of agricultural improvement but a lot of these activities are not described as "economically lively employment" in Pakistan although they're vital to the well-being of rural households and an essential element for our residing. Women's multi-dimensional roles in agriculture want to be diagnosed. Pakistan is a male-dominated society wherein women are with them in each discipline as a substitute in a few regions they carry out better than men but they may be deprived to get admission to effective assets and vast livelihood incomes. Women contribute a lot to agriculture but their contribution to agriculture is not favored. Unfortunately, no matter their wealth of expertise and capability, they are disregarded with the aid of coverage makers, frequently not being acknowledged as "productive" farmers.

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Their farm services are often unpaid or under-valued and that they tend to be debarred from decision-making. They are negatively tormented by traditional patterns and economic rules. They face more constraints than males. They have neither ownership nor management over resources. Furthermore, in many agricultural chores, women outnumber men in the hard work pressure. Hence, this text describes the role of women in the agricultural improvement of the United States and additionally defines the fundamental

Major Roles Played by Women in Agriculture

Women make essential contributions to agriculture and rural financial sports in all growing country areas. Their roles range extensively amongst and within regions and are changing unexpectedly in many components of the arena in which financial and social forces are transforming the agriculture quarter. Women work in agriculture as farmers on their account, as unpaid people on the circle of relatives' farms, and as paid or unpaid worker's on other farms and agricultural organizations'. They are involved in both crop and cattle production at subsistence and commercial stages. They produce meals and cash crops and control combined agricultural operations regularly concerning vegetation, cattle, and fish farming. All of these women are taken into consideration as part of the agricultural labor force. In farm animals' management, they proportion responsibility with men and their kids for the care of animals, and particular species and types of hobby are more related to women than men. For instance, women often have a distinguished function in coping with hen and dairy animals and in worrying for different animals which can be housed and fed inside the domicile. They are extra typically occupied in subsistence and industrial fishing from small boats and canoes in coastal or inland waters. Moreover, women contribute to each the formal and informal forestry sectors in many widespread methods. They play roles in agroforestry, watershed control, tree development, and woodland safety and conservation.

<u>Constrains development process</u>

Major Constraints faced by Women in Agriculture

Women are facing the constrain of gender hole, they are considered simply for "help" and that's why they're now not allowed to take part in any decision making. Secondly, land possession issues, because of the lack of land rights, female farmers are not capable to make use of the livelihood belongings that come from land possession. Moreover, they'll earn a decrease salary.

Developing Innovative abilities in Women through Extension

Innovation development could be prime to enhancing rural productiveness, employability, and profits-earning opportunities, enhancing food safety, and selling environmentally sustainable rural improvement and livelihoods. Despite lady farmers' essential role in agriculture and other rural sports, better limitations in training and schooling restrict their participation in greater productive and remunerative paintings, carry out managerial and leadership roles and participate fully in the improvement in their groups. Targeted movement is needed to dismantle these limitations. Education and training are essential additives of any method to enhance agricultural and non-farm productiveness and pull households out of poverty. Learning about improved manufacturing technologies and techniques, new merchandise and markets, business and existence abilities (consisting of fitness control, selection-making, self-confidence, or struggle control) could make a huge distinction. Skills improvement is especially crucial to lady's farmers who're much more likely to be contributing own family employees, subsistence farmers or domestic-based totally micro-marketers inside the casual area, or performing low-paid, unskilled work as seasonal workers. Women farmers often have one-of-a-kind education desires than men, linked to their domestic work and care duties, in addition to gender-based totally divisions of exertions for dealing with or task unique tasks in the crop, livestock, forestry or fish production and processing and their packing responsibility.

Restrictions

Males' prejudices towards women, Women's Domestic Violence, getting access to career training, Lack of or total lack of education ignorance of modern agricultural methods poor health and malnutrition low ability and low paying activities, The move to the countryside, A preference for men over women in terms of land ownership.

CONCLUSION

Women have been engaged themselves in agricultural and allied sports because a long time, however nevertheless their hard work has long gone neglected and unrewarded. They manage each aspect of farm work but still aren't taken into consideration as farmers. Women contributed their share (agriculture) in the shape of hard work, energy, and their treasured time. Approximately Seventy percentage of worldwide negative are ladies and the most important issues they face are peculiar social, cultural, instructional, political, and allied problems. Without organizing gender equality, the improvement of a country could not take place. Providing due recognition to women's work as well as get entry to education, extension services, statistics, land, credit facilities, resources, present-day technologies, and different applicable agricultural innovations will trap many girls to agricultural productions and will help to lessen poverty amongst lady farmers.

Recommendations

- The Pakistani government should devise an integrated framework to assist women in all aspects of agriculture, including financial services, land reforms, and tax reforms.
- Develop the extension system to meet the needs of female farmers, with plans in place to teach them how to use modern equipment in their farming practices to increase production.
- Rural agro-based small-scale enterprises should be promoted by policy changes to help in the diversification of agricultural resources and the production of jobs for the women of Pakistan. Women should be taught how to process and preserve different fruits, vegetables, and livestock products so that they can add value to the economy.

For the framework to be revised, data on gender must be collected.


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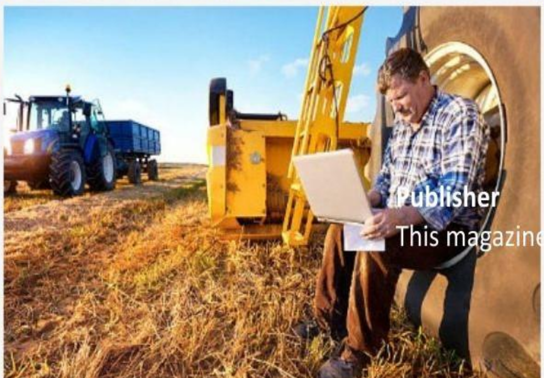


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