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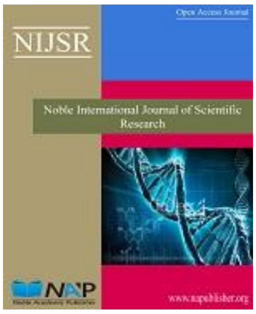

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Climate Smart Agriculture System – As a Review

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Abstract: Smart Climate Agriculture (CSA) is an approach used in agriculture to achieve the highest agricultural productivity of horticultural and field crops while preserving natural resources for future generations and also to minimize greenhouse gas emissions as well as adapting to future climate change. Therefore, the main objective of applying the climate smart farming approach is to improve the farming system in both developing and developed countries. The application of smart climate agriculture at the global level ensures the achievement of several important objectives, including maximizing the use of natural resources and improving the productivity and quality of horticultural crops and field and obtain good fruits safe and healthy and clean the domestic production and export to foreign markets, Climatically minimizes emissions of gases such as carbon dioxide, methane and others and achieves the sustainability of the agro-ecosystem. Climate smart agriculture is an approach aimed at improving the farming system. Therefore, the components of smart agriculture are climatically expressed as traditional conventional agriculture, excluding roads that lead to the depletion of natural resources, as well as avoidance of malpractice practices such as excessive use of chemical pesticides or chemical fertilizers and CSA, good tools and good farming systems that increase productivity and quality without depleting natural resources such as good agricultural practices, biogas and organic systems, which in turn depend on bio-fertilization and To improve the agricultural land and natural resources of the land as well as improve the quality of the final agricultural product.
To conclude, Climate Smart Agriculture is a productive agro-ecosystem which might be very resilient and adaptive to climate change scenarios.

Keywords: Climate Smart Agriculture – Sustainable of Agriculture – Climate Changes.

1. Introduction

Climate change will play an important role in the global farming system. Unfortunately, most climate change scenarios eventually have a negative role on the agricultural system and the scarcity of most crops if temperatures increase from 2 to 4 degrees Celsius. Moreover, emissions will also have a significant impact on the ecosystem. Consequently, innovation and traditional solutions in agriculture have become important to maintain the agricultural system in all its aspects and to achieve food security and food safety at the same time.

Adaptation and mitigating the effects of future climate change must be pursued.

Climate wise agriculture works in this context not only in increasing the productivity and quality of agricultural crops, but also in reducing the emission of greenhouse gases, as well as in adapting and mitigating the effects of climate change. Examples of non-conventional solutions and innovation in agriculture include:

Cultivation of cassava and quinoa crops as a partial substitute for wheat flour

And cassava and quinoa crops are important crops worldwide and are cultivated in many regions of the world to obtain high nutritional value food and enter these crops in their starch and flour extraction industries

And the cassava and quinoa crops of the non-traditional vegetable crops in Egypt so far, although many researches and projects carried out in this field. The cassava and quinoa cultivation is considered one of the innovations and non-traditional solutions to solve the problem of self-sufficiency of wheat flour, where cassava and quinoa flour can be added to wheat flour by 10-20% to manufacture bread loaf and many other pastries the food value is high.

1.1. Climate Changes and Agriculture in Egypt "Case Study"

Climate is the most important point about agricultural productivity, primarily through its effects on temperature and water regimes. For model, the physiographic boundaries of principal biomes are determined by mean annual temperature and soil water regimes. The climate change is therefore expected to alter the biophysical environment of growing crops and to influence biomass productivity and agronomic yields [1] . Positive effects may be associated with the fertilization effects of CO_2 enrichment, increases in the duration of growing seasons in higher latitudes and mountain ecosystems, and possible increase in availability of soil water in regions with an increase in annual precipitation. Each 1°C increase in temperature may lead to a 10-day boost in the growing season in northern Europe and Canada. The CO_2 fertilization effect is real. However, the net positive effect may be moderated by other factors, like the effective rooting depth and nutrient availability. Further, the productivity per unit of available water is expected to rise by 20–40% (van de Geijn and Goudriaan1996).

1.2. Climate Changes and Its Effect on Agriculture

Driven mainly by population and economic growth, total world food consumption is expected to increase more than 50% by 2030 and may double by 2050 [2]. Most of increase about food production in the next decades is expected to occur through further intensification of current cropping systems rather than through opening of new land into agricultural production. Intensification of cropping systems has been a highly successful strategy for increasing food production. The best example is the well-known success of the green revolution, where the adoption of modern varieties, irrigation, fertilizers and agrochemicals resulted in dramatic increases in food production. However, this strategy also resulted in unexpected environmental consequences, one of them being the emissions of GHG into the atmosphere. Therefore, future strategies that promotes further intensification of agriculture should aim at the development of sustainable cropping systems that not only consider increasing food production but that also look at minimizing environmental impact [3].

1.3. Climate Change in Asian countries

Asian countries collectively encompass the world's greatest economic, cultural and ecological diversity. About 60 % of the world's total population lives in these countries, making Asia the most populated continent. The total economic activities of Asia make up about 25 % of the world's GDP[4]. Consequently, the region is facing many environmental and socioeconomic challenges.

Please note here that the variation in climate and geographic features among Asian countries is very large. For example, in China and some parts of India and Pakistan (particularly areas around the Himalayas), winter temperatures are at or below freezing. On other side, South-East Asia and the Pasic islands generally experience temperatures above 25°C throughout the year. Consistent with global temperature trends, Asian countries have also been experiencing a warming trend in recent decades. Climate modeling indicates an increase in temperature in Asia by 0.5-2°C by 2030 and 1-7°C by 2070 and predicts that arid areas of northern Pakistan and India and western China are likely to warm more quickly. In addition, models indicate increasing rainfall during the summer monsoon season and a reduction in winter rainfall and predict that Asia will also be affected by a rise in the global sea level of approximately 3-16 cm by 2030 and 7-50 cm by 2070 [5].

Climate change is resulting in the degradation of land, ecosystems, water and air quality in Asian countries. It is threatening to undermine food security as well as causing health problems. Crop yields are estimated to fall by up to 30 per cent and one billion people may be affected by a water shortage, leading to drought and land degradation by the 2050s [6].Climate change has also resulted in the melting of the Himalayan glaciers, which in the short run has raised the risk of mudslides and erosion. The health impacts primarily consist of epidemics of malaria, dengue, and other vector-borne diseases [7].

Notably, Asia is dealing with increasing cases of natural hazards, such as landslides in the Philippines (2006), extreme weather events in China (2006) including storms, in the east and south, heat and drought in the central and north-eastern regions, and catastrophic in Pakistan (2010 and 2011). The impacts of the disasters include hunger, disease, loss of income and livelihoods, collateral damage to infrastructures, all of which affect the survival and well-being of the population.

1.4. Agriculture as a Solution for Climate Change

The sector of agricultural holds significant mitigation of climate change potential through reductions of GHG emissions and enhancement of agricultural sequestration. In addition, it also has significant role to adapt climate change. Adaptation alone is not sufficient to offset the effects of change of climate, and thus still need to be supplemented by concerted mitigation efforts [8] Mostly, when we implement adaptation measure, we enhance mitigation capacity of particular area such as practicing different land use managements (soil and water conservation measure, manure and fertilizer management) in the agricultural field will help us to sequester substantial amount of carbon in the field and reduce emission of methane and nitrous oxide which are the main GHG emission means. Therefore, the management activities are interrelated and help us to adaptation and mitigation of climate change. Agricultural activities are relatively affordable form of mitigation option, for which many technical options are already readily available FAO [9]. In OA, soil fertility is maintained mainly through farm internal inputs (organic manures, legume production, wide crop rotations etc); energy-demanding synthetic fertilizers and plant protection agents are rejected; and there is less or no use of fossil fuel [OECD [10]]. In relation, improved cropland management (lower use of synthetic fertilizers, reduced tillage etc), Reducing industrial livestock production and improving feeding and grazing land management, Restoration of organic soils and degraded lands to increase soil carbon sinks, Improved water and rice management, Land-use change and agro-forestry, Increasing efficiency in fertilizer production and behavioral changes of food consumers (reducing the meat content) could also be main climate change mitigation measures in agriculture sector Robert, et al. [11]. As earlier mentioned, the agricultural sector has also a potential to adapt to climate change in many areas. Climate change adaptation is a continuous process requiring location-specific response. Adaptation should enable agricultural systems to be more resilient to the consequences of climate change Paul, et al. [12].

1.5. Climate Smart Agriculture

The application of climate smart agriculture will bring many benefits to the agricultural system to improve agricultural horticultural access and access to safe and high value agricultural products and will reduce the agricultural inputs "pesticides and chemical fertilizers" which are a burden on the environment through pollution and reduce emissions Harmful. The use of smart climatic agriculture will bring about an agricultural renaissance and the addition of a large agricultural economy. It is worth noting that the use of a smart agricultural approach to climatic conditions will result in additional economic burdens and will, on the contrary, achieve high economic returns in the short and long term.

The application of climate smart agriculture depends on certain parameters that would eliminate or reduce the maximum greenhouse gas emissions.

The carbon footprint in the simplest definition is to identify "any product" on the amount of emissions emitted during the production process of this product at different stages.

The carbon footprint of agricultural products means the amount of total emissions produced during the production stages starting from tillage, hoeing, irrigation and harvesting. This is very important especially in the field of exporting horticultural crops. These emissions are a successful means of monitoring and identifying carbon footprint, thus enhancing export opportunities for agricultural food products.

1.6. The Future of Farming: Exploring Climate Smart Agriculture

Discover Climate Smart Agriculture and how it could be applied to farming

Climate Smart Agriculture (CSA) offers one possible approach based on three principles:

1. Mitigation of greenhouse gas emissions
2. Adaption to climate change
3. Stable or increased food productivity

Throughout this course we will encourage you to explore these principles and take a critical look at how they could be translated into practice, using the examples of dairy farming and wine production in the EU.

We'll examine the environmental impacts of dairy farming, the challenges farmers are facing as a result of climate change and review some climate smart approaches that might help them become more sustainable. We'll then explore wine production looking at the influence of climate change on growing grapes in Europe, what research is being done and again how we can adapt wine production to climate change.

1.7. Understand the Relationship Between Farming and Climate Change

To help demonstrate the relationship between farming and climate change (and learn how CSA could be applied) we'll touch on global warming and greenhouse gases but also economic and political aspects related to the environment such as: food labeling, funding, policies and regulation.

The issue of climate change is important now and in the near future where climate change is a major concern in many developed and developing countries, especially after the Paris Convention after the climate summit held in Paris, France, in 2015.

For two decades, the world has faced a dual challenge to meet food needs. The rising population has reached 9 billion people in 2050, with a volatile climate dominated by warming. According to FAO estimates, in global agricultural output, although international reports indicate that global agricultural efficiency has doubled over the past six decades, the amount of agricultural land has not increased by more than 10%.

The countries of the developed and developing world have gone too far to find immediate and long-term solutions to their food security, and the challenge has become more complicated by the negative effects of climate change. New strains of agricultural pests need new antiperspirants, the problem of changing rainy season times, Drought and desertification, and pollution of the environment, it was necessary to deal with complex problems can't afford to delay and slowdown, because it is related to the survival and survival of human beings on this simple.

In response to these challenges, many programs, reports, events and strategies have been launched to contain the negative impacts of climate change, namely "on global food security. Among these programs is what is known as 'climate smart agriculture', which means agricultural production capable of increasing yields, Environmental pressures, and at the same time reduce the release of greenhouse gases, or remove them from the atmosphere.

Rice, a staple of daily food for more than three billion people in the world, ranks second in terms of greenhouse gas emissions, as it increases when the soil is fully irrigated, so seasonal irrigation or soil drying Intermittently can limit the formation of methane, and there are many examples of international practices on climate smart farming patterns "in light of the common international concerns created by modern technologies and population explosion

Agriculture is one of the most important areas that are more vulnerable to climate change. To mitigate some of the complex challenges posed by climate change and agriculture (including forests and fisheries), we need to turn to the so-called "Smart Climate" or so-called "Smart Agriculture", that is to say, More efficiently by using less land, water and inputs, in order to produce more food sustainably, together with the need for individuals to be more resilient to changes and shocks.

The use of rural advisory services (RAS), which contribute to the achievement of the so-called "Climate Smart Agriculture" (CSA), is demonstrated by the dissemination of climate information, techniques and information on production practices for climate adaptation Through innovative approaches (eg, plant clinics and participatory videos). However, in many low-income countries, the participation of RAS services is relatively limited in adapting to climate change and mitigation efforts, as well as a reduction in the number of providers who are actually initiating specific programs in this area.

1.8. The Complexities of Climate Change and the Role of CSA

Climate change has a wide-ranging impact (both current and potential) on agriculture and food security. Changes in rainfall patterns, high average temperatures, increased variation in rainfall and temperature, changes in water availability, sea level rise, salinity increase, changes in the frequency and intensity of bad weather all have negative impacts on Agriculture and fisheries sectors. Uncertainties of the effects of climate change, which are related to their timing and severity, coupled with the consequences of many interrelated sectors other than agriculture (health, energy, economy, migration), may result in a very complex challenge.

Of course, achieving these goals requires changes in agricultural behavior, strategies and practices by rural households by improving their access to climate resilience, knowledge and information technologies to increase productivity, inputs, market information and information that contribute to the diversification of sources of income. Organize themselves better for teamwork.

Climate smart agriculture is a new conceptual framework that addresses both the issue of food security and the challenges of climate change. On this basis, agriculture helps translate and increase the impact of sustainable development goals 2030 on agriculture, food security and livelihoods in rural areas. It also contributes to the changes required to improve the capacity of food systems to cope with difficulties in growing cities. Climate smart agriculture supports adapting agricultural sectors to expected climate change and enhancing the capacity of production systems and communities to cope with conditions adverse weather events. Climate wise agricultural practices are identified on the basis of agro-ecological and socio-economic conditions by enhancing resilience and reducing greenhouse gas emissions by providing targeted support to countries to increase productivity, which calls for: - Identification of appropriate systems, practices and technologies. - Establish an enabling institutional structure according to their respective social, economic, environmental and climatic conditions Provide capacity, methodologies and tools to conduct the required assessments and analyzes Small enterprises need to be bypassed to demonstrate the potential of climate smart agriculture. Governments and society are urgently needed to achieve transformational changes which address the interrelated challenges of food security and climate change, and we can no longer distinguish between the future of food security and the future of the environment. Social development is closely linked to climate change, Response ratio.

2. Meteorological

There is a long list of tools based on agro meteorology, which in turn is the key to the application of climate smart agriculture. The most important of these tools are NMHSs, which provide farmers with different levels of detail, a range of weather / climate information (such as real-time weather data - short, medium and long term weather forecasts), the normal climate on the Internet, And expectations. All of which provide the basis for tactical and strategic adaptation, especially when tailored to farmers' needs, including an indicator of usage and results.

2.1. Climate Services

Of course, climate warnings in agriculture mainly contribute to adapting to climate variability and change by stimulating technological innovation, as in the areas of genetics such as adaptation to the latest biotechnology technologies, and agricultural techniques such as tillage, irrigation, weeds management - crop protection, including early warning and decision support systems. In some countries, climate services for agriculture are created through an exchange of views between farmers and mentors / scientists, as farmers' perceptions support the development of key tools such as (rainfall on farmland daily - ecological observations - impact on quantity and quality of crops - seasonal rainfall scenarios).

These services are within the capacity of service providers and farmers adaptability, which includes (early warning in droughts, floods, heat waves and heavy rainfall, with explanations and exchange of views on possible preventive and protection measures). Among the main tools used in the dissemination of agro meteorological information, bulletins, web-based communications, radio, face-to-face talks and meetings, technical seminars. These tools provide end-users (farmers - technical services and support), appropriate climatic information to suit specific needs, as well as supporting the implementation of activities under a different framework of climate smart agriculture.

2.3. Role of Data

Data is always the basis of research, including agronomy. Experimental designs combined with statistical analysis have made considerable progress in understanding the complexity of cropping systems, the so-called large data revolution that has changed many sectors of society. Farmers in developed countries are keen to map high-resolution crops using remote sensing, and automatic climate station networks collect climate data and make it available through real-time web platforms with cloud computing.

In the near future, agriculture is expected to produce more data, thanks to the deployment of unmanned aerial vehicles (UAVs), remote sensing, satellite advancements and the dissemination of the Internet. Here, the role of data in agriculture can be defined as the approach by which technical decisions on farms are adopted or recommended by agro-extension agents by analyzing large amounts of observational data. Farmers' data as crop management, together with weather records and soil data at the field level, are also classified to describe the actual conditions in which the crops grow and the production that has been achieved. In addition to the use of modeling techniques for prospecting, for patterns that report crop response to environmental conditions, and optimal management practices in each context.

2.4. Evaluate the Future of Climate Smart Agriculture

We’ll discuss how to measure the impact of CSA. We’ll look at the barriers for the industry to adopting CSA and how to overcome them. We’ll also explore the critical views on the concept and compare the principles of CSA to other agricultural practices.

There are no special requirements for this course. It will be of particular interest to anyone concerned with modern food production, farming and environmental challenges: this could include farmers or food producers, industry partners, school teachers, or people considering studying agriculture at University.

2.5. Principles of Climate Smart Agriculture

As earlier mentioned CSA has three focal areas *i.e*. sustainably increasing agricultural productivity and incomes, adapting and building resilience to climate change, reducing and/or removing greenhouse gases emissions, where possible. Adapting to climate change is especially important since it ensures food sufficiency. Resilience is defined as the ability of a social system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization [13]. Above all the practices must enhance the natural resource base. Subsequently, the most important point of CSA is the building of soil healthy [14]; [15] through increasing the Soil Organic Matter (SOM) status of the soil [16]. Soil management practices for CSA include; direct seeding under no/reduced-tillage [17], improved protective soil cover through cover crops, crop residues or mulch [18], and crop diversification through rotations [19]; [20] Moreover, integrated soil fertility management, which includes both inorganic and organic sources and considers combining inputs of organic matter *i.e*. mulch, compost, crop residues and green manure with fertilizers to address or prevent macro- and micro-nutrient deficiencies should be carefully considered [21].

2.6. Possible Challenges and Prospects of CSA

There is a lot of skepticism about the ability of CSA to mitigate the effects of climate change by fostering soil resilience and let alone feed communities. This is in spite of the potential benefits of the system especially to the smallholder farmers who bear the brunt of the effects of climate. Most of the farmers are resource poor and their usually own land in marginal areas. According to [22] , there are more than three million smallholder famers owning less than 1.3 hectares in marginal with low yields. CSA would be the most appropriate system for such farmers since it uses locally available resources and does not rely on the use of external inputs [14], Nonetheless, in a review on adapting crops and cropping systems to future climates, [23], highlighted that most recommended adaptations will involve several trade-offs. Such as, [24], points out that, farmers cannot simply cut their existing use of such inputs as fertilizer or pesticides and hope to maintain outputs and neither can they introduce a new productive element into their farming systems, and hope it succeeds. Instead the transition costs arise for several reasons, which include the following;

1) Farmers must first invest in learning about a greater diversity of practices and measures.
2) Farmers need to acquire information and management skills.
3) During the transition and learning period, farmers must experiment more, and incur the costs of making mistakes as well as of acquiring new knowledge and information.
4) New technologies often require more labor.

Moreover, specific policies and interventions for implementing CSA depend on the social and biophysical contexts in which farmers operate, which calls for different solutions for large farms with good market access and high input use, small farms with good market access and high input use, and small farms with low market access and low input use [25]. However, Dobermann and Nelson [25] offered a possible solution to this by suggesting the implementation of the following processes;

1. Diagnosis: which entails understanding the context in which an effort or intervention will be implemented and its links to global agro-ecological knowledge.
2. Contextualized principles: by identifying the right economic, social and ecological principles of relevance to farmers' needs.
3. Getting it right locally: through empowering local communities to improve the performance of the farming system based on agro-ecological principles and local preferences.
4. Scaling and support: by expanding the scope of the effort or intervention (in terms of numbers of people involved and the size of the territory) and create the necessary value chains, services, support systems and self-sustained business models.
5. Evidence: through monitoring and documenting the performance, and learning to enrich the local and global knowledge base to influence policies that will support further implementation.

2.7. Key Recommendations

1. Cultivation of desert areas with crops with a few water needs and bear the conditions of drought and salinity.
2. Intensifying the cultivation of the Jojoba crop in the desert areas and benefiting from them both economically and environmentally.
3. Monitor and reduce greenhouse gas emissions and identify carbon footprint and water footprint for agricultural products.
4. Work on increasing agricultural production and improving its quality through good agricultural practices and climate smart agriculture.
5. Maintaining the ecosystem and biological diversity in agriculture, especially in the modern agricultural areas, the major agricultural projects areas in the new lands, the one million feddan project and the 100 thousand-star project and benefiting from the Chinese experience in this field.
6. To activate cooperation and support the joint activities between the Egyptian and Chinese sides, especially in the field of climate change and agricultural productivity.
7. Develop agricultural development programs that work through expected climate changes and avoid their negative impacts and adaptation
8. Develop mechanisms for the development and establishment of fish farms, taking into account the lack of available water.
9. Coordination between the Egyptian and Chinese sides to establish a database and a regional network for climate change to encourage research, studies and training in this field, with attention to the institutional systems of monitoring and early warning, which helps in formulating future agricultural policies.
10. Increase awareness and adaptation of climate change issues and reduce their expected negative impacts.
11. The need to focus on the factors of climate change affecting one way or another on water resources and agriculture, and monitor these changes and the development of plans and policies on climate change in the planning stages, based on forecasts and forecasts of climate.
12. Expanding the use of modern irrigation technology, which is provided in the quantities of irrigation in the desert and newly reclaimed lands and also in the lands of the valley and the delta and the use of patterns of crops that maximize the productive yield compared to the water unit used.
13. Working on the use of modern technology and remote sensing in the field of climate and agricultural environment.
14. Joint exchange of Chinese and Egyptian experiences in the fields of climate change, agricultural production and combating desertification.

3. Conclusion

From this extensive review, it is concluded that globally, climate change has relationship with agriculture in one or another way. This relationship becomes strong in developing countries because their livelihood depends on agricultural activities and this activities mostly depend on climatic condition, Smart Climate Agriculture is an approach used in agriculture to achieve the highest agricultural productivity of horticultural and field crops while preserving natural resources for future generations and also to minimize greenhouse gas emissions as well as adapting to future climate change. Therefore, the main objective of applying the climate smart farming approach is to improve the farming system in both developing and developed countries.

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