OPEN ACCESS

Haya: The Saudi Journal of Life Sciences
Abbreviated Key Title: Haya Saudi J Life Sci
ISSN 2415-623X (Print) |ISSN 2415-6221 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Review Article

Current Scenario, Recent Advances in Developing the Systems of Agroforestry and its Sustainable Impact on Agriculture Development

Amir Shahzad[1], Shah Wali Amir[1], Romail Aslam[1], Arslan Arshad[1], Ziafat Ali[1], Afifa Zahid[1], Raees Ahmad[1], Ayesha Saddiqa[2*]

[1]Department of Forestry and Range Management, University of Agriculture Faisalabad, Pakistan
[2]National Institute of Food Science and Technology, Faculty of Food, Nutrition and Home Science, University of Agriculture Faisalabad, Pakistan

DOI: 10.36348/sjls.2021.v06i12.004 | **Received:** 07.11.2021 | **Accepted:** 12.12.2021 | **Published:** 17.12.2021

***Corresponding author:** Ayesha Saddiqa

Abstract

Agroforestry helpful for maintaining the environmental a balance between soil and degradation of hazardous chemicals. Different ecological factors also playing important role in agricultural forestry. Agroforestry has multidimensional approaches for growing the new varieties of plants, cross breeding, and genetic exchange by developing the new varieties of trees. Agroforestry also playing important role in recycling of waste water through efficient treatment water plants. Cacao agroforestry systems are wieldy important in order to grow the specific number of pants growing the different varieties. Consuming of cacao at the optimum level can help with issues such as depression, stress, blood pressure and heart health. Sometimes, nature of soils able to regenerate into new trees. Poorly drained soils, excessive water or insufficient moisture can cause stunted growth and plant decline. Agroforestry strategies such as taungya system and silvopastoral system are reliable for growing the trees. Biofuel for large production of energy in industrials and commercial level by conserving the sustainable development.

Keywords: Insufficient moisture, Agroforestry, taungya system, sustainable development.

INTRODUCTION

Diversity of agriculture fields in the modern era leads to development of innovations in agroforestry that playing an important role in the cleaning of environmental pollution by targeting the toxic chemicals in the form of nickel, chromium, cadmium and arsenic. These metals increase the accumulations of other waste causing chemicals [1, 2]. Agroforestry can be maintaining the environmental a balance between soil and degradation of hazardous chemicals through fertilization, irrigation, pruning, and thinning. Tree formation with advances in the form of planting strategies that combined and actively managed to optimize the positive biophysical interactions. Different ecological factors also playing important role in agricultural forestry. Trees are regularly coppiced and the cuttings are applied as mulch to the soil. This strategy helpful for plating the new tree growth by reducing weeds in order to maintain the soil moisture [3-5].

Different efforts have been made in order to achieve the high level of agroforestry through sustainable agricultural practices. It can be helpful for addressing the climate changes through establishing a series of goals of soil conservation. Agroforestry as major targeting the environmental and biological pollution can reduce degradation of human modified lands through creating the solutions to complex barriers to adoption [6, 7].

Agroforestry has multidimensional approaches for growing the new varieties of plants, cross breeding, and genetic exchange by developing the new varieties of trees. It can increase the environmental, economic, and social benefits through green management system that allows the new green farming. There are different gaps in the literature as sustainable development growing but the impact of human activities on trees degradation lacking [8, 9]. While on the other hand, strategies for agroforestry involving the carbon sequestration have been designed for reducing the erosion of soil. It also acting as effective role in global carbon sequestration, involved in carbon capture and the long-term storage of atmospheric carbon dioxide. Agroforestry also playing important role in recycling of

waste water through efficient treatment water plants. Nutrient leaching and soil erosion through impending effect of tree roots and stems can cause the destruction of agricultural processing of tress. By implanting the new tress, nutrients balance can be improved that can increase the agricultural productivity [10, 11].

Table-1: Shows the principles of agroforestry and different parameters

Agroforestry	Role	Parameters	Significance
Agricultural systems	Used for the crop farming, and forests playing important role in maintain the environmental balance between the soils and different types bacteria.	Environmental balance, ecological chain between organisms, flow of food to the natural ecosystem for increasing the soil fertility	Many of the planting trees have positive impact on the human health as they can supply and filter air in order to reduce the number of chemicals pollutants in the environment.
Agroforestry systems	Important role in the cleaning of environmental pollution by targeting the toxic chemicals in the form	nickel, chromium, cadmium and arsenic	maintaining the environmental a balance between soil and degradation of hazardous chemicals
Soil conservation and trees	Also playing important role in recycling of waste water through efficient treatment water plants.	Water balance nutrients balance and food chain, ecological factors	Nutrient leaching and soil erosion through impending effect of tree roots and stems can cause the destruction of agricultural processing of tress

Recent approaches in agroforestry

Agroforestry also controlled the growth of lethal worms by establishing the relationship among different organisms. Agroforestry controlled the effects of spray drift reduction and runoff mitigation that can cause the wind speed, boom height, distance to susceptible vegetation and spray particle size [9]. Various types of microbial agents have been used in order to control the attack of pests in the growing parts of crops. Agroforestry emphasizes on the strategies in acute toxicity leading to pollinator mortality deleterious effects on growth and health. Agroforestry practices are major reselection's of controlling the disaffect pollinators by affecting the various exposure pathways. These also infused on the risk of pesticides to pollinators due to releases of harmful chemicals in the form of liquid or solid form [1, 7, 12].

Sustainable agricultural development framework of agroforestry systems is the evolutionary step to establish the value of agroforestry tools at the farm scale. Farmers usually follow the patterns of traditional farming that can cause the loss of ultimate products and goals in the available areas. It identifies the benefits of farming by adopting strategies that protect or enhance natural capital. Different farmer's can get the valuable information about growing of tress in the available soils. While on other hand, agribusiness lenders are showing increasing interest in using natural capital approaches developing the natural capital. These strategies can reduced the risk assessments by increasing the rate of farming with vegetate soil growth by interaction among different farmers [1, 6, 7, 13].

Resource islands and fertility of land can be maintained through the vegetation of trees and bushes. These can improve the air quality by filtering dust as well as toxic pollutants in the form of carbon dioxide by increasing the rate of oxygen. These agroforestry measures can reduced the chances of flooding incoming from different areas. Different factors affected the microenvironment such as composition of the trees that planting in the specific areas, solid density creation of positive feedbacks. Soil productivity that is main factor for dertnination of agroforestry in the specific regions can be reflected in the growth of forest vegetation or the volume of organic matter produced on a site [14, 15].

Cacao agroforestry systems are wieldy important in order to grow the specific number of pants as these can have roots that can reach beyond 2 m depth. Cacao trees with different properties that distinguish them from other tress such as erect and smooth trunk with pale brownish color, almost white. These posses the long roots that expended the area the growing areas with maximum benefits for growing the other varieties of plants. These trees poses the shallower root activity in the soil compared with fruit shade trees. It's densely packed with iron, magnesium and antioxidants. These nutrients make them ideal plant for the human health as many of other plants not posses the such character's in harsh areas [16, 17].

Consuming of cacao has lots of agroforestry benefits for the farmers and workers in the agricultural sectors. Consuming of cacao at the optimum level can help with issues such as depression, stress, blood pressure and heart health. It contains the serotonin that acts as stimulator helpful to improves the mood and decreases stress. So, it is widely used for the treatment of depression. The extracts of the cacao contains several antioxidants in the form of polyphenols. Their name is due to relaxation of brain cells as they comprised of

phenylethylalanine is a natural antidepressant that works with the dopamine in your brain[18-20].

Some of the trees are useful for fixing the right amount of nitrogen for the organisms in the food chains. This nitrogen can be move through in order to survival of the organisms. Growing nitrogen-fixing trees have been playing important rile to increase crop yields. These also regulate the water efficiency of plants under the phenomenon of transpiratation. Water efficiency is reducing water wastage by measuring the amount of water required for a particular purpose and the amount of water used or delivered. These changes for the plant growth helpful to combat the environmental stress due to climate change in arid and semi-arid regions. While on the other hand, agroforestry systems also control the growth of plants by controlling the drought stress[12,19]. In that case, prolonged droughts agroforestry systems in those regions. The mechanism of trees in which different parts of planting trees conserve water under drought conditions, plants may close the stomata in their leaves to limit transpiration and thereby conserve water. Many factors also affecting the opening and closing of stomata through different rates of transpiration. Any factor that limits the plant growth can be restricted under the agroforestry systems that maintain the environmental balance and regulate the flow of water, minerals and ions by conserving the agricultural product. Minerals and water balance can be affected by increasing the concentrations of water use in the specific lands. Limit use of water can prolong the grow of trees by inhibit their growth than the normal growth under the different soils while on the other hand, excess use of water can disrupt the grow of trees by inhibit their growth factors than the normal growth under the different soils. So the systems of agroforestry can be applied in order to conserve the optimum yields [21, 22].

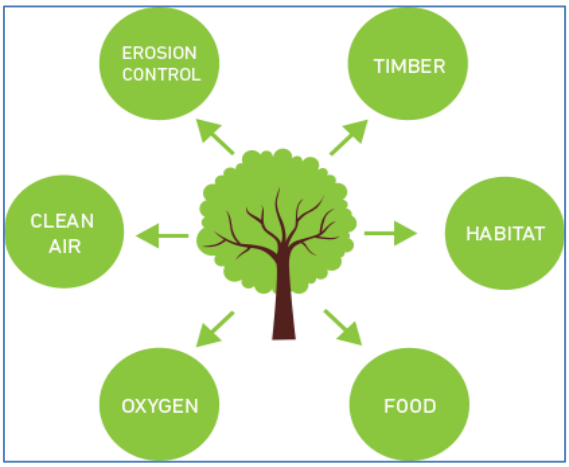

Fig-1: Shows the benefits of agroforestry in the environment

Agroforestry systems can be applied to different fields in order to improve the adverse climate changes and reducing the risks of chemical pollutants in the environment that causes serious health pommels through the food crops. Thus, agroforestry systems are helpful for planting and management of trees. Trees can be grown in the agricultural conservation through different strategies. Sometimes, nature of soils able to regenerate into new trees [18-20]. Often, a deciduous tree that has been cut will re-sprout in multiple places around the edge of the stump or from the roots. This can be used in order to prevent the young trees formation so that incoming trees can be grow for indefinite periods of time. Sometimes chemical agents can accelerate the process of seed growth following the root to access water underground. Many of the trees can be used as source of food sources in the form of different varieties that can positive reflection of agricultural landscapes. Through agroforestry systems, growth of trees can be reflected in two ways. Optimum use of water and chemicals can promote the growth of trees in the appropriate manner under the different conditions of growing soils. While on the other hand, excess use of water and chemicals can inhibited the growth of trees in the dough and salinity under the different conditions of growing soils. Thus, different agricultural farming systems of agroforestry can be adopted in right ways in order to get the desired yield in the available area. In the process of seed germination, water is absorbed by the embryo, which results in the rehydration and expansion of the cells. Mostly, environmental conditions can inhibited the growth of trees but they also provide the sources of carbon that can clean the environment through reducing the chemical pollutants and waste products [11, 15, 22, 23].

Different advances in the agroforestry as the revolutionized in the fine-tune the technology, assess its productivity and efficiency relative to traditional farmer practice and determine farmer. Irrigation water supply augmentation and management for the planting trees can be made more practical to the fields applications in the form of easier method as drainage of some biofertilizers that can be applied to the soils can cause the deficiency of minerals and nutrients. It can accuse the stunt growth of the young tissue of the plants [1, 17, 19, 21]. Poorly drained soils, excessive water or insufficient moisture can cause stunted growth and plant decline. As it leads to the successful development of agricultural systems of land farming as it provides the fertile soil and nectary nutrients that can be promoted by plant promoting bacteria. Sometimes stunting growth of a plant disease that results in dwarfing and loss of vigor. It can be maintained through agroforestry strategies such as taungya system in which different strategies of planting of arable crops at early stages of forest establishment. It can increase the yield of crops with high quality and desired products for the famers. While on the other hand, silvopastoral system are those that combine tree growing with the production of livestock. These agroforestry systems can act as main source of shelter for animals in order to precede them from the attack of infectious diseases. Due to problems

existing in the agricultural farming, agroforestry is the ideal solution for understanding of the indigenous system of different crops [1, 19, 24, 25].

Agroforestry has improved the environmental conservation through cleaning the environment by advanced planting strategies that ultimately leads to the economic development in rural areas. Trees conserve water and reduce soil erosion. Agroforestry systems help to combat the rigorous changes in the ecological environments such as carbon storage and nutrient cycling. Agroforestry systems are helpful for removal of air pollutants as air diffuse inside the leaf, gases diffuse into intercellular spaces and may be absorbed by water films that can helpful to save energy[26-30].

CONCLUSION

As the different agricultural systems are used for thecrop farming, and forests playing important role in maintain the environmental balance between the soil and different type's bacteria that promotes the growth of plants. Agroforestry systems overall marinating the environmental balance, ecological chain between organisms, flow of food to the natural ecosystem for increasing the soil fertility. Many of the planting trees have positive impact on the human health as they can supply and filter air in order to reduce the number of chemicals pollutants in the environment. Trees can use as biofuel for large production of energy in industrials and commercial level by conserving the sustainable development.

REFERENCES

1. Zomer, R. J., Neufeldt, H., Xu, J., Ahrends, A., Bossio, D., Trabucco, A., & Wang, M. (2016). Global Tree Cover and Biomass Carbon on Agricultural Land: The contribution of agroforestry to global and national carbon budgets. *Scientific reports*, *6*(1), 1-12.
2. World Bank. (2020). Climate-Smart Agriculture Implementation Brief: A Summary of Insights and Upscaling Opportunities through the Africa Climate Business Plan.
3. Zhongming, Z., Wangqiang, Z., & Wei, L. (2019). Climate Change and Land.
4. Schroth, G., & Harvey, C. A. (2007). Biodiversity conservation in cocoa production landscapes: an overview. *Biodiversity and Conservation*, *16*(8), 2237-2244.
5. Coe, Richard, Fergus Sinclair, and Edmundo Barrios. "Scaling up agroforestry requires research 'in'rather than 'for'development." *Current Opinion in Environmental Sustainability* 6 (2014): 73-77.
6. Willemen, L., Nangendo, G., Belnap, J., Bolashvili, N., Denboba, M. A., Douterlungne, D., ... & Hahn, T. (2018). Decision support to address land degradation and support restoration of degraded land. In *The IPBES assessment report on land degradation and restoration* (pp. 591-648). Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.
7. Smith, J., Pearce, B. D., & Wolfe, M. S. (2013). Reconciling productivity with protection of the environment: Is temperate agroforestry the answer?. *Renewable Agriculture and Food Systems*, *28*(1), 80-92.
8. Udawatta, R. P., & Jose, S. (2012). Agroforestry strategies to sequester carbon in temperate North America. *Agroforestry Systems*, *86*(2), 225-242.
9. Holzmueller, E. J., & Jose, S. (2012). Biomass production for biofuels using agroforestry: potential for the North Central Region of the United States. *Agroforestry Systems*, *85*(2), 305-314.
10. Stanley, J., Preetha, G., & Stanley. (2016). *Pesticide toxicity to non-target organisms* (pp. 99-152).
11. Potts, S. G., Imperatriz-Fonseca, V., Ngo, H. T., Biesmeijer, J. C., Breeze, T. D., Dicks, L. V., ... & Vanbergen, A. J. (2016). *The assessment report on pollinators, pollination and food production: summary for policymakers*. Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.
12. Young, A., & International Council for Research in Agroforestry. (1989). Agroforestry for soil conservation.
13. National Australia Bank. Natural Value. Available online: https://www.nab.com.au/about-us/corporate-responsibility/environment/natural-value (accessed on 20 June 2018).
14. Dijkstra, F. A. (2003). Calcium mineralization in the forest floor and surface soil beneath different tree species in the northeastern US. *Forest Ecology and Management*, *175*(1-3), 185-194.
15. Reich, P. B., Oleksyn, J., Modrzynski, J., Mrozinski, P., Hobbie, S. E., Eissenstat, D. M., ... & Tjoelker, M. G. (2005). Linking litter calcium, earthworms and soil properties: a common garden test with 14 tree species. *Ecology letters*, *8*(8), 811-818.
16. Moser, G., Leuschner, C., Hertel, D., Ho¨lscher, D., Ko¨hler, M., Leitner, D., Michalzik, B., Prihastanti, E., Tjitrosemito, S., & Schwendenmann, L. (2010). Response of cocoa trees (Theobroma cacao) to a 13-month desiccation period in Sulawesi, Indonesia. Agroforestry Systems, *79*, 171–187
17. Buresh, R.J., Rowe, E.C., Livesley, S.J., Cadisch, G., & Mafongoya, P. (2004). Opportunities for capture of deep soil nutrients. Below-ground Interactions in Tropical Agroecosystems (eds M. van Noordwijk, G. Cadisch & C.K. Ong), pp. 109–123. CABI Publishing, Wallingford.
18. Cassano, C. R., Silva, R. M., Mariano-Neto, E., Schroth, G., & Faria, D. (2016). Bat and bird exclusion but not shade cover influence arthropod abundance and cocoa leaf consumption in agroforestry landscape in northeast

Brazil. *Agriculture, Ecosystems & Environment*, *232*, 247-253.
19. Jagoret, P., Kwesseu, J., Messie, C., Michel-Dounias, I., & Malézieux, E. (2014). Farmers' assessment of the use value of agrobiodiversity in complex cocoa agroforestry systems in central Cameroon. *Agroforestry systems*, *88*(6), 983-1000.
20. Somarriba, E., Orozco Aguilar, L., Cerda Bustillos, R., López Sampson, A., & Cook, J. (2018). Analysis and design of the shade canopy of cocoa-based agroforestry systems. *Achieving sustainable cultivation of cocoa*.
21. de Leeuw, J. (2014). Treesilience: An assessment of the resilience provided by trees in the drylands of Eastern Africa Edited. *Nairobi, Kenya: World Agroforestry Center (ICRAF)*.
22. Hadgu, K. M., Rossing, W. A., Kooistra, L., & van Bruggen, A. H. (2009). Spatial variation in biodiversity, soil degradation and productivity in agricultural landscapes in the highlands of Tigray, northern Ethiopia. *Food Security*, *1*(1), 83-97.
23. Guyassa, E., Raj, A. J., Gidey, K., & Tadesse, A. (2014). Domestication of indigenous fruit and fodder trees/shrubs in dryland agroforestry and its implication on food security. *Int J Ecosyst*, *4*(2), 83-88.
24. Amonum, J. I., Babalola, F. D., & Agera, S. I. N. (2009). Agroforestry systems in Nigeria: Review of concepts and practices. *Journal of Research in Forestry, Wildlife and Environment*, *1*(1), 18-30.
25. Montambault, J. R., & Alavalapati, J. R. (2005). Socioeconomic research in agroforestry: a decade in review. *Agroforestry systems*, *65*(2), 151-161.
26. Montambault, J. R., & Alavalapati, J. R. (2005). Socioeconomic research in agroforestry: a decade in review. *Agroforestry systems*, *65*(2), 151-161.
27. Brewbaker, J. L. (1987). Leucaena: a multipurpose tree genus for tropical agroforestry. *Agroforestry: a decade of development*, 289-323.
28. Fischer, A., & Vasseur, L. (2000). The crisis in shifting cultivation practices and the promise of agroforestry: a review of the Panamanian experience. *Biodiversity & Conservation*, *9*(6), 739-756.
29. Jihad, A. N., & Lestari, L. D. (2021). An Overview and Future Outlook of Indonesian Agroforestry: a Bibliographic and Literature Review. In *E3S Web of Conferences* (Vol. 305, p. 07002). EDP Sciences.
30. Scherr, S. J. (1991). On-farm research: the challenges of agroforestry. *Agroforestry Systems*, *15*(2), 95-110.