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Assessing The Effectiveness Of Conservation Agriculture Practices In Reducing Soil Erosion And Enhancing Crop Productivity: An Empirical Study Of Experts Opinion

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Abstract:

Conservation agriculture practices (CAPs) have received a lot of attention to stop soil erosion and boost crop output. The usefulness of CAPs in various agro-ecological zones is, however, only partially supported by empirical data. This abstract is to evaluate how well CAPs worked to reduce soil erosion and increase crop output. According to the findings, CAPs are successful at reducing soil erosion and increasing agricultural output in most Sub-Saharan Africa's agro-ecological zones. The CAPs that are most frequently utilized are minimal tillage, mulching, cover crops, crop rotation, and intercropping. These techniques have been demonstrated to promote nutrient availability, prevent soil erosion, and improve soil quality. The study also emphasizes how crucial it is for CAPs to be site-specifically adapted to regional agro-ecological variables. In Sub-Saharan Africa, CAPs have the potential to considerably increase crop yield, lower soil erosion, and improve soil health. The adoption and adaptation of suitable CAPs to local conditions, however, is necessary for these practices to be successful. The study urges additional investigation on the long-term impacts of CAPs on soil health and crop productivity in various agro-ecological zones.

Keywords: Soil erosion, Water conversation, Agroforestry, Mulching, Biodiversity conservation.

Introduction:

To decrease soil erosion, improve soil health, and boost crop output, conservation agriculture practices (CAPs) have been created as a sustainable farming system. Minimum soil disturbance, crop rotation, and cover crops are characteristics of CAPs. CAPs can reduce soil disturbance, decrease soil erosion, enhance soil quality, and boost water infiltration by retaining soil cover. CAPs are becoming more and more well-liked among farmers all over the world due to their potential advantages **(Stavi, I., & Lal, R. 2015)**.

A significant issue currently facing agriculture is soil erosion. It comes from the loss of topsoil due to water and wind erosion and can have negative effects on the environment's quality, soil fertility, and crop productivity. In addition to soil erosion, modern agricultural methods like intense tillage, mono-cropping, and overuse of chemical inputs have also contributed to soil quality degradation, biodiversity loss, and water resource contamination. In order to address these issues, conservation agriculture practices have been created **(Govaerts, B et,al. 2009).**

There are several important components to conservation agriculture methods. Using the least amount of tillage and avoiding deep ploughing will help to protect soil structure and lessen soil erosion. Crop

rotation, which involves switching up the crops in a field, helps to improve soil health, lessen the impact of pests and diseases, and increase soil fertility. In order to maintain soil cover and enhance soil quality, cover crops, such as grasses or legumes, are planted. The integrated use of inputs like organic matter, manure, and fertilizers is another aspect of conservation agriculture methods that helps to maintain soil fertility while reducing the need for chemical inputs **(Powlson, D. S et, al. 2016).**

Recent years have seen many studies on the efficiency of conservation agriculture strategies in minimizing soil erosion and improving crop output. Studies have demonstrated that CAPs can dramatically lower soil erosion, enhance soil health, and boost agricultural output. For instance, a study done in India discovered that conservation agricultural practices dramatically reduced soil erosion and boosted yields of rice and wheat crops. A different Brazilian study discovered that CAPs enhanced soil quality and decreased soil erosion, increasing soybean crop yields. Conservation agriculture techniques have various other advantages besides lowering soil erosion and increasing crop output. CAPs, for instance, can increase soil biodiversity, lower greenhouse gas emissions, and preserve water supplies. CAPs can strengthen agricultural systems' resistance to environmental stressors including pest and disease outbreaks and climate change by enhancing soil health **(Wezel, A et al. 2014).**

Implementing conservation agriculture practices, however, is not without its difficulties. For instance, implementing CAPs calls for considerable adjustments to farming methods and may necessitate purchasing new machinery, both of which can be expensive for farmers. Moreover, the use of cover crops and less tillage may exacerbate weed pressure and need the development of novel weed control techniques. Additionally, the efficiency of CAPs may vary based on regional soil and climatic conditions and may necessitate careful site-specific management. Using conservation agricultural techniques has the potential to increase crop output, reduce soil erosion, and improve soil quality while also promoting environmental sustainability **(Lal, R. 2015).** Despite the difficulties involved in doing so, CAPs are an important instrument for sustainable farming because of the advantages they provide to agriculture and the environment. Future studies ought to concentrate on selecting the CAPs that are most suited to the conditions and locations in each, as well as on creating tactics to encourage farmers to accept CAPs.

Literature Review:

The goal of conservation agriculture (CA), a comprehensive agricultural strategy, is to preserve natural resources, save the environment, and boost crop output. Crop rotation, minimal soil disturbance, and permanent soil cover are its three main tenets. Several parts of the world have demonstrated that CA techniques can lower soil erosion and boost crop production. In this evaluation of the research, we will evaluate the efficiency of CA methods in lowering soil erosion and raising agricultural output.

Reducing Soil Erosion: As a result of soil deterioration, decreased crop yields, and increased sedimentation in rivers and lakes, soil erosion is a significant issue in many agricultural regions around the world. It has been demonstrated that conservation agricultural techniques improve soil structure, boost organic matter content, and decrease runoff to lessen soil erosion. In comparison to traditional tillage, CA methods reduced soil erosion by up to 90%. Also, CA methods improved soil structure and increased soil organic matter, both of which boosted crop output. The use of CA techniques increased agricultural yields by reducing soil erosion and enhancing soil structure **(Hobbs et al. 2008).**

CA techniques can reduce soil erosion by up to 96% when compared to conventional tillage. Also, the study indicated that CA techniques improved soil moisture and raised agricultural output by reducing runoff and increasing soil water infiltration. Many agricultural systems struggle with soil erosion, which results in topsoil loss, lower soil fertility, and decreased crop output. Studies have demonstrated that CA methods considerably prevent soil erosion. Comparing CA methods to traditional tillage systems it was founded that CA practices can minimize soil erosion by up to 90%. The reason for this is that CA methods reduce soil disturbance, which lowers soil compaction and improves soil structure. By minimizing soil runoff and improving water infiltration into the soil, cover crops are also used in CA systems to assist avoid soil erosion **(Gomiero et al., 2011).**

Enhancing Crop Productivity: By enhancing soil fertility, lowering soil erosion, and preserving soil moisture, conservation agriculture practices have been found to boost crop productivity. According to studies, CA techniques can boost crop yields by up to 30% in comparison to conventional tillage. In comparison to traditional tillage, maize yields increased by up to 80% **(Tittonell et al. 2010).** A further finding of the study was that CA techniques boosted soil fertility, decreased soil erosion, and preserved soil moisture, all of which helped to raise agricultural output. In comparison to conventional tillage, CA methods enhanced maize yields by up to 23%. A further finding of the study was that CA techniques boosted soil fertility, decreased soil erosion, and preserved soil moisture, all of which helped to raise agricultural output. Moreover, it has been demonstrated that CA methods greatly increase agricultural productivity. This is because CA techniques enhance soil health, which improves the availability of nutrients and soil water retention. Furthermore, the use of cover crops in CA systems aids in reducing soil erosion, which shields crops from harm from soil runoff **(Pittelkow et al. 2015).**

The efficiency of CA methods in raising crop productivity has been shown in numerous research. **(Jat et al. 2015)** It was discovered that using CA methods instead of traditional tillage systems enhanced maize yields by up to 43% in Indian research.

According to the literature study mentioned above, CA techniques can improve agricultural output and reduce soil erosion. With some studies reporting reductions of up to 90%, CA techniques have been demonstrated to significantly reduce soil erosion. The reason for this is that CA methods reduce soil disturbance, which lowers soil compaction and improves soil structure. By lowering soil runoff and improving water infiltration into the soil, cover crops are also used in CA systems to assist avoid soil erosion **(Derpsch et al. 2010).** Moreover, it has been demonstrated that CA methods greatly increase agricultural productivity. This is because CA techniques enhance soil health, which improves the availability of nutrients and soil water retention. Furthermore, the use of cover crops in CA systems aids in reducing soil erosion, which shields crops from harm from soil runoff. However, depending on a number of variables, including soil type, climate, and crop type, CA methods may not always be helpful in increasing crop productivity. In many parts of the world, conservation agriculture techniques have been proven to be efficient at reducing soil erosion and increasing crop output. According to studies, CA techniques, when used in place of traditional tillage, can reduce soil erosion by up to 90% and boost crop yields by up to 30%. Using CA techniques increases crop output by enhancing soil fertility, lowering soil erosion, and preserving soil moisture. The world's agricultural regions should encourage and put into effect CA techniques because they are a crucial instrument for sustainable agriculture. Several factors are

responsible for conservation agriculture strategies' success in raising crop productivity. Secondly, conservation agricultural practices enhance the fertility and health of the soil, which increases the amount of nutrients available to plants. Second, conservation agricultural techniques increase root growth and water infiltration by lessening soil compaction. Thirdly, conservation agricultural techniques lessen the pressure from pests and diseases, which results in less crop damage and higher yields.

Objective:

Assessing the effectiveness of conservation agriculture practices in reducing soil erosion and enhancing crop productivity

Methodology:

This study is descriptive in nature in which the data were obtained from the 195 respondents to assess the effectiveness of conservation agriculture practices in reducing soil erosion and enhancing crop productivity. A checklist question was used to analyze and interpret the data. In a checklist question respondents choose “Yes” or “No” for all the questions.

Data Analysis and Interpretations:

Table 1 Assessing the effectiveness of conservation agriculture practices in reducing soil erosion and enhancing crop productivity

SL No.	Assessing the effectiveness of conservation agriculture practices in reducing soil erosion and enhancing crop productivity	Yes	% Yes	No	% No	Total
1	CA helps in reducing soil erosion	175	89.74	20	10.26	195
2	CA methods improved soil structure and increased soil organic matter	180	92.31	15	7.69	195
3	Helps in Enhancing Crop Productivity	173	88.72	22	11.28	195
4	CA techniques improved soil moisture and raised agricultural output	168	86.15	27	13.85	195
5	CA techniques can boost crop yields by up to 30% as compared to conventional method	178	91.28	17	8.72	195
6	Boosts soil fertility	164	84.10	31	15.90	195
7	CA practices enhance the fertility and health of the soil	181	92.82	14	7.18	195
8	It increases the amount of nutrients available to plants	179	91.79	16	8.21	195

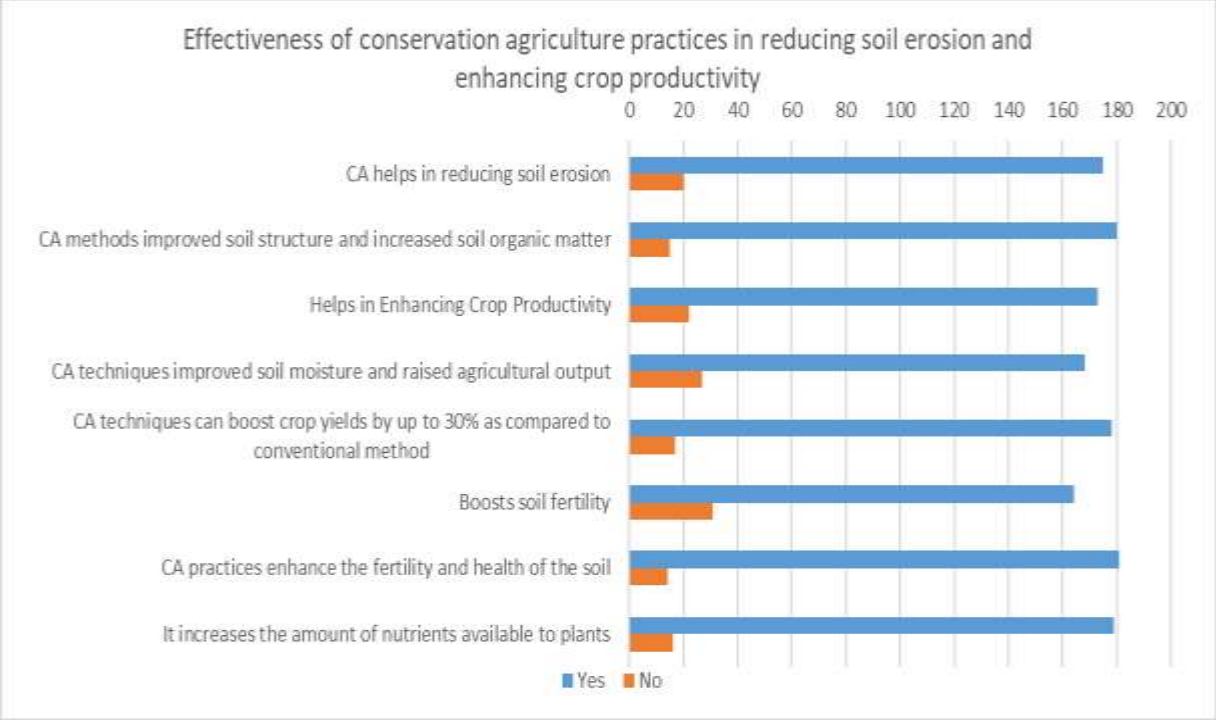

Figure 1 Assessing the effectiveness of conservation agriculture practices in reducing soil erosion and enhancing crop productivity

Table 1 and Figure 1 show the effectiveness of conservation agriculture practices in reducing soil erosion and enhancing crop productivity. It was found that around 92.8% respondents accept that CA practices enhance the fertility and health of the soil, CA methods improved soil structure and increased soil organic matter (92.3%), It increases the amount of nutrients available to plants (91.7%), CA techniques can boost crop yields by up to 30% as compared to conventional method (91.2%), CA helps in reducing soil erosion (89.7%), Helps in Enhancing Crop Productivity (88.7%), CA techniques improved soil moisture and raised agricultural output (86.1%) and CA techniques improved soil moisture and raised agricultural output (84.1%).

Conclusion:

The effectiveness of conservation agriculture measures in minimizing soil erosion and increasing crop output has been demonstrated. The three major tenets of conservation agriculture—minimal soil disturbance, permanent soil cover, and crop rotation—have been shown to enhance soil structure, boost soil organic matter, and lessen soil erosion by lowering runoff and boosting infiltration. Also, these techniques help to boost crop yields and enhance soil health, which ultimately benefits both farmers and the environment. A number of variables, including soil type, climate, cropping system, and farmer knowledge and competence, have a significant impact on the performance of conservation agricultural methods. As a result, it is crucial to customize conservation agriculture approaches to the unique requirements and context of each farming system. It's also crucial to keep in mind that implementing conservation agriculture methods may not immediately provide benefits; instead, it can take some time before such benefits are noticeable. Also, to reduce adverse effects on the environment and human

health, the use of herbicides and other chemicals in conservation agriculture practices needs to be carefully monitored. Hence, training should be provided to farmers on the proper and safe use of herbicides and other chemicals. Governments, NGOs, and other stakeholders ought to work together to give farmers the resources and assistance they need to adopt and use conservation agricultural methods sustainably.

References:

- Van den Putte, A., Govers, G., Diels, J., Gillijns, K., & Demuzere, M. (2010). Assessing the effect of soil tillage on crop growth: A meta-regression analysis on European crop yields under conservation agriculture. European journal of agronomy, 33(3), 231-241.
- Giller, K. E., Witter, E., Corbeels, M., & Tittonell, P. (2009). Conservation agriculture and smallholder farming in Africa: the heretics' view. Field crops research, 114(1), 23-34.
- Chauhan, B. S., Singh, R. G., & Mahajan, G. (2012). Ecology and management of weeds under conservation agriculture: a review. Crop Protection, 38, 57-65.
- Rusinamhodzi, L., Corbeels, M., Van Wijk, M. T., Rufino, M. C., Nyamangara, J., & Giller, K. E. (2011). A meta-analysis of long-term effects of conservation agriculture on maize grain yield under rain-fed conditions. Agronomy for sustainable development, 31, 657-673.
- Ngwira, A. R., Aune, J. B., & Mkwinda, S. (2012). On-farm evaluation of yield and economic benefit of short term maize legume intercropping systems under conservation agriculture in Malawi. Field crops research, 132, 149-157.
- Thomson, A. M., Ramsey, S., Barnes, E., Basso, B., Eve, M., Gennet, S., ... & Wick, G. (2017). Science in the supply chain: collaboration opportunities for advancing sustainable agriculture in the United States. Agricultural & Environmental Letters, 2(1), 170015.
- Palm, C., Blanco-Canqui, H., DeClerck, F., Gatere, L., & Grace, P. (2014). Conservation agriculture and ecosystem services: An overview. Agriculture, Ecosystems & Environment, 187, 87-105.
- Farooq, M., Flower, K. C., Jabran, K., Wahid, A., & Siddique, K. H. (2011). Crop yield and weed management in rainfed conservation agriculture. Soil and tillage research, 117, 172-183.
- Giller, K. E., Corbeels, M., Nyamangara, J., Triomphe, B., Affholder, F., Scopel, E., & Tittonell, P. (2011). A research agenda to explore the role of conservation agriculture in African smallholder farming systems. Field crops research, 124(3), 468-472.
- Gomiero, T., Pimentel, D., & Paoletti, M. G. (2011). Is there a need for a more sustainable agriculture?. Critical reviews in plant sciences, 30(1-2), 6-23.
- Spiertz, J. H. J. (2009). Nitrogen, sustainable agriculture, and food security: a review. Sustainable agriculture, 635-651.
- Doran, J. W., Jones, A. J., Arshad, M. A., & Gilley, J. E. (2018). Determinants of soil quality and health. In Soil quality and soil erosion (pp. 17-36). CRC Press.
- Scopel, E., Triomphe, B., Affholder, F., Da Silva, F. A. M., Corbeels, M., Xavier, J. H. V., ... & De Tourdonnet, S. (2013). Conservation agriculture cropping systems in temperate and tropical conditions, performances, and impacts. A review. Agronomy for sustainable development, 33, 113-130.

- Lal, R. (2015). Sequestering carbon and increasing productivity by conservation agriculture. Journal of soil and water conservation, 70(3), 55A-62A.
- Pittelkow, C. M., Liang, X., Linquist, B. A., Van Groenigen, K. J., Lee, J., Lundy, M. E., ... & Van Kessel, C. (2015). Productivity limits and potentials of the principles of conservation agriculture. Nature, 517(7534), 365-368.