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Farmer's Knowledge And Perception And How It Influences Conservation Agriculture (CA) Adoption In The Bawku Municipality.

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This paper should be cited as Abu et.al (2022)

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ABSTRACT

Farmer's knowledge is critical in studying Conservation Agriculture (CA) practices as an alternative to conventional farming methods. The study was conducted with the main objective of exploring farmers' knowledge and perception about CA and how it influences CA adoption. The study used an interpretivism qualitative research philosophical approach and a case study design. The research methods used for data collection was interviews guides and field observations. The data analysis was using content analysis. The interviews were transcribed into text boxes and the content was analysed accordingly. The study was conducted in the Bawku Municipality of Ghana. The results of the study revealed that farmers' knowledge and source of it, Farmers' worldviews and cosmovision, farmers' perceptions about CA, crop residues retention and issues of spirituality influences CA adoption in the Bawku Municipality. The study concluded that indeed, Farmers' indigenous knowledge, perceptions and source of knowledge influence the adoption of CA in the Bawku Municipality. It recommends that Promoters, practitioners, researchers and other relevant bodies should make good use of relevant farmers' knowledge, perceptions and experiences in other to increase CA adoption in the study area.

KEYWORDS: Conservation Agriculture, knowledge, perception, cosmovision, spirituality.

1.0 INTRODUCTION.

Africans have a worldview, which means a coherent body of knowledge that covers all aspects of the world of a people. It is a mindset/map that peoples use to orient, posit, and explain their world, and from which they act or refuse to act. And establish for themselves an expectation/motivation and a vision for the future. With this mindset, there is a hierarchy between divine beings, spiritual beings, ancestors and natural forces. The sacred character of natural resources. The cyclic notion of time, Powers of ancestral spirits. Use of magical powers

both in negative and positive terms. In the African reality, one can observe a dual system of beliefs and knowledge: traditional and modern. They co-exist and each of them goes with specific values and this often leads to different decision-making" (Millar et al., 2006, p. 76)

1.1 Explanatory notes on terminology

Worldview on the other hand are beliefs are assumptions that have not been verified and tested by the scientific process but are held by an individual or a community of believers. The source of belief can be revelations or teaching by spiritual leaders, ancient texts, or supernatural experiences.

It is this belief in an ancestral spirit and worldview that explains the indigenous knowledge system.

Perception, on the other hand, is the ability to see, hear, or become aware of something through the senses. It also refers to how something is regarded, understood, interpreted to be true by the senses.

The main objective of the study was to explore the indigenous farmers' knowledge and perception of Conservation Agriculture (CA) practices and how it influences conservation agriculture (CA) adoption in the Bawku Municipality, Ghana.

Farmers' knowledge refers to the assumptions, concepts and interpretations of information acquired by individuals or groups. Knowledge is understood here as to how people give meaning to phenomena and translate them into action. Knowledge production then is a process that links information with meaning, values and action that cannot be reduced to a set of 'objectively' validated information. Knowledge is inextricably linked to the social, environmental and institutional contexts. Knowledge can be the result of a certain tradition, it can be confined to a certain locality, be linked to indigenous people, to a certain continent or have a global character (hence the possible labels as traditional, local, indigenous, African, global knowledge).

Again, the indigenous knowledge system is enshrined in the culture which is an in-separatable phenomenon from the traditional African religion, and science of the people and hence African science.

Science is the body of knowledge and its classification under a theoretical framework, which itself is tested in observation or supported by its logic. It includes the complex of producing knowledge and information with its assumptions, general principles, theories and methodologies about a range of phenomena on which a specific community has reached consensus. The knowledge acquired is always limited and subject to modification in the light of new data and information. In a society where a particular science is accepted and used, there is a professional community of practitioners of knowledge governed by some social and methodological norms.

Adopting these definitions allows to stating that, besides the academically established science, there are many other 'sciences' referring to numerous 'knowledges' from different cultures, worldviews and beliefs systems that are co-existing. Every form of knowledge – including the one produced by natural, quantitative and quantitative science is socially constructed.

This means that knowledge cannot exist separate from the process of its construction. What makes a certain form of knowledge more disseminated than others is concerning its degree of meaningfulness either for people in the same community where the said knowledge is generated or due to the degree of instrumentalisation by powerful elites within different societies or historical periods. 'Truth' is not so much determined by objectivity, but by 'inter-subjective validation' (Millar, 2006).

It is clear from the above discussion that the belief in the existence of ancestral spirit is linked to the traditional/ indigenous knowledge system and the knowledge system is equally linked to indigenous science and cosmovision.

Within the Moshi-Dagbambas group of people, they have a proverb (yam pinla yeni) which is translated to mean knowledge or charity begins at home. This statement may sound basic but it

generally explains why learning, knowledge and science begin at home that is 'within' the community and expands outside to other communities until it reaches the global level.

CA is defined as a set of agricultural technologies, which includes; minimum soil disturbance, zero tillage, permanent soil cover, diversified crop rotations, and integrated weed management (Reicosky and Saxton, 2007; Hobbs et al., 2008; Friedrich et al., 2012). Aimed at reverting the many negative effects of conventional farming practices such as soil erosion (Strauss and Klaghofer, 2001; Van- den Putte et al., 2010; Rodriguez et al. 2017), soil organic matter (SOM) decline (Luo et al. 2010), water loss, soil physical degradation, and fuel use (Baker et al., 2002; FAO, 2008).

Conservation agriculture (CA) serves as an alternative to conventional farming practice.

Adoption is the spontaneous and autonomous diffusion of CA practices from Farmer-to-farmer. In the case of Farmer-to-farmer, diffusion and adoption relate to the long-term use after the knowledge of CA had been spread through farmers' networks (Rogers, 1995).

2.0 Literature Review.

The research review literature on the worldview and cosmovision of Africans and how it influences the adoption of agriculture technology and innovations.

2.1 Worldviews and belief system.

Millar et al. (2006) in his work with the COMPASS provided four different worldviews and beliefs system as discussed below.

African worldviews and Belief systems

Traditional African ways of thinking and reasoning differ in many respects from the dominant international approach. Despite generations of western influence, the decisions about agriculture, health and nature management are still heavily based on the concepts of African traditions. At the village level the spiritual leaders, although often not clearly observed by outsiders, are quite

influential. Nowadays, thinking amongst Africans ranges from traditional to modern, but in many cases, both systems of thinking can be observed parallel to each other. Traditional worldviews and traditional institutions play an important role.

The Europe (Conventional/Enlightening) worldview and beliefs system. Measuring and the use of the five senses is knowing; Rational logic; Materialism; Mechanistic, Self-interest of individual or group as organizing principle. (Postmodernity): Uncertainty, diversity, chaos and self-regulation, holism, synergy rather than generic principles and universal science or values (such as human rights, democracy, good governance). (Trans-disciplinarity and Co-evolution of sciences): Compas wants to provide a platform for inter-scientific dialogue that can contribute to a co-evolution of sciences. In this process, each science involved is stimulated to evolve (to develop and improve their methods and theories) based on their own dynamics as well as on the basis of interaction with other systems of knowing.

2.2 Rural people's knowledge/indigenous knowledge and CA

These two nomenclatures are used interchangeably**.** Indigenous knowledge (IK) refers to the accumulation of experiences and the sharing or passing down of information from one generation to the next within a society (Wang, 1982; CIKARD, 1988; Mundy and Compton, 1995) cited in Millar (2018).

For others rural people's knowledge (RPK) is identified as that which emerges from the interaction amongst individuals/groups and between individuals/groups and their environment, resulting in a product which has been formed and transformed by the society itself (Chambers, 1983; Chambers & Jiggings, 1987; Chambers, 1990) cited in Millar (2018).

Rhodes and Bebbington (1988) observe that farmers' experimentations resulted from actions related to curiosity, the need to solve problems and to adapt to situations. A very brief explanation of the various types of experiments as identified by Rhoades and Babington is as follows:

Curiosity experiment: the driving force for this type of response to innovations is the farmer`s own curiosity and quest for additional knowledge as a result of some skills which he has acquired or encountered or an idea he/she just wants to try out.

Problems solving experiments: problems solving in the rural farmer`s experiment and innovations results when he or she encounters a situation out of the normal, different from that which he/she is used to in the enterprise. The situation might include factors resulting from responses to "external change" such as population pressure on land where agricultural land is scarce, reduction in yield or a diseased situation, Climatic variation as reflected in a decrease in rainfall or moisture-holding capacities of soil also result in innovativeness.

Adaptive experiments: no matter the form or source of an idea, farmers, if left on their own, would always modify somewhat, what they have to do in using the idea. Besides modifications, reinvention is part of the farmer's adaptation to innovations. During the conscious process of adapting, they may come across some idea that existed at some time in the past but have died out or have been abandoned due to lack of use. The process of curiosity or problem-solving normally give rise to addictiveness in the use of innovations.

Social/peer pressure experiment: In addition to the three types of situation that results in innovativeness mentioned above, Millar (1992; 2018) also identified a set of examples that do not fit into the earlier categories of Rhodes and Bebbington. This is the type of innovation Ithat has resulted from social pressure or peer pressure. It is unique in the sense that it goes beyond agronomic factors of innovation to combine with social-culture, religious or spiritual factors of experiment discussed in various degrees. For farmers to adopt a new set of agricultural technology they, first of all, try it in their field several times to see results before fully adopting or rejecting that particular technology, therefore if a new agricultural technology or innovation is not applicable/appropriate in the location environment is likely to be rejected.

The diffusion of the Innovations Model is regarded as one of the most useful tools for assessing how innovations diffuse through a social system. Millars' Constellations of Cosmovisions Model walks us into the worldview and life-world of smallholder farmers, enabling us to make meaning of how this helps them organize their food systems.

2.3 Rural people knowledge (RPK), research and experiment, in adoption and diffusion of conservation agricultural practice in northern Ghana

Rural people's knowledge and endogenous knowledge will be used here interchangeably. RPK knowledge or endogenous knowledge; is a form of knowledge and science originating Ifrom indigenous cultures, whiles its evolution may be enhanced by inter-science dialogues and co-evolution with other science (Wang. 1982; CIKARD, 1988; Mundy and Compton, 1995) cited in Millar & Abazaami (2018). Indigenous knowledge and science, are knowledge and science developed and used in indigenous, traditional and local people as well as ancient or classical sciences available in written or classical form (chambers, 1983; 1990; chambers and Jiggins, 1987). Knowledge and sciences: these are knowledge and sciences developed within traditional societies and mostly transferred from generation to generation in non-written forms (Millar & Abazaami, 2018). Endogenous research is research being carried out by indigenous and local knowledge communities using indigenous ways of learning, transdisciplinary methods and co-learning with other sciences, aiming to develop endogenous science (Millar & Abazaami). RPK and Smallholder farmers' knowledge are essential in their research and experiment leading to new technologies development, innovativeness, adoption/adaption and Diffusion of new or essential existing ideas (Millar & Abazaami, 2018) in Agricultural food productivity in Northern Ghana with much emphasis on conservation Agricultural practice in mind. The smallholder farmer is a researcher who sometimes follows processes identical to formal research procedures in addition to following his/her own "logical" processes, these allow the mapping out of courses

for intervention processes (Millar, 2018) which, if carefully harnessed provides a rich blend for sustainable agricultural development. Endogenous Development provides one of the approaches that draw on the richness of farmer knowledge's and scientific knowledge with the view to arriving at a blend that enhances synergic, (Millar, 2006; 2018, p.33) "farmer's experimentation: an alternative logic". Richards (1985), in his essay on Africa indigenous Agricultural Revolutions, argues that successful rural development depends on inventive self-reliance, which enables smallholder farmers to make changes that are potential of benefit to them in particular, and to society in general. This seems a reasonable starting point for the re-orientation of efforts of an interventionist. The point is not to deny intervention but to change the power relationships between the intervened and the farmer through processes that would enable the farmer to dictate the pace, if not define the rules. Roder (1990), elaborately describes the traditional use of nutrient inputs by a small farmer in Bhutan. Farmers had skills in using fodder to produce manure, litter from the forest as bedding for livestock and later for manure Iand its transportation, ash from fuel-wood as fertilizer, leaf mould from the forest as organic matter for crops and so on. Skills and techniques amongst small farmers in the area of soil (Millar, 1992), and water conservation in Mali have been described by Kassague, Dolo and Ponsion (1996). This includes the use of mounds, terraces, stone lines, bonds or low walls, square basins and planting-holes, direct seeding of the local millet called 'Zaa' in Mampruli in Northern and some part of Upper East Region Here, ingenuity is exemplified. (Millar, 2018, p.50-61), "farmer's experimentation: an alternative logic". From the analysis above farmers are not passive "takers" (consumers) or adaptors of innovations of agricultural technologies that enter their "life-world", but mediate and transform them by the actors (farmers) and the local structures/existing knowledges and sciences to suit their particular situation as suggested by Long (2003) cited in Millar (2018).

The farmers do not behave as disembodied social categories who passively imbibe interventions ie agricultural technologies and innovations, they rather participate actively through the

processing of information, experiments and strategizing in their dealings with various local actors as well as with outside institutions and personnel Millar et al. (2016) and it shows African community resilience in terms of technology adoption.

Adoption and Diffusion of Innovations Model is regarded as one of the most useful tools for assessing how innovations diffuse through a social system.

Millars' Constellations of Cosmovisions Model walks us into the worldview and life-world of smallholder farmers, enabling us to make meaning of how this helps them organize their food systems and adoption of agricultural technologies.

2.4 Milar's Constellations Of Cosmovisions

Millar's Constellations of Cosmovision Model (Millar, 2004) is a prominent theory derived from Millar's Paradigm of African Sciences.

The Model is built on the conviction that cosmovision dictates the way resources (Land, Water, Plants and Animals) are used; how decisions are taken and how problems are solved among rural communities (Haverkort, Hiemstra & Van't Hooft, 2002) cited in Mallar (2018). As Millar himself has noted, "For the traditional people in Northern Ghana, gods, spirits, Ancestors, spiritual and political leaders, sacred groves, land shrines, ritual crops and animals, food items and cash crop are all interrelated" (Millar, 2004, p.3). This is particularly applicable to smallholder farmers in Bawku Municipality. The Model diagrammatically depicts three interlocking circles representing the Natural World, the Human World and the spiritual world in which the Natural World provides the habitat for the spirits and sends messages from the spiritual World to the Human World. The spiritual World provides guidance, punishment and blessing to the Human World. People, therefore, have to relate to both the natural and spiritual World (Millar, 2004, p.3).

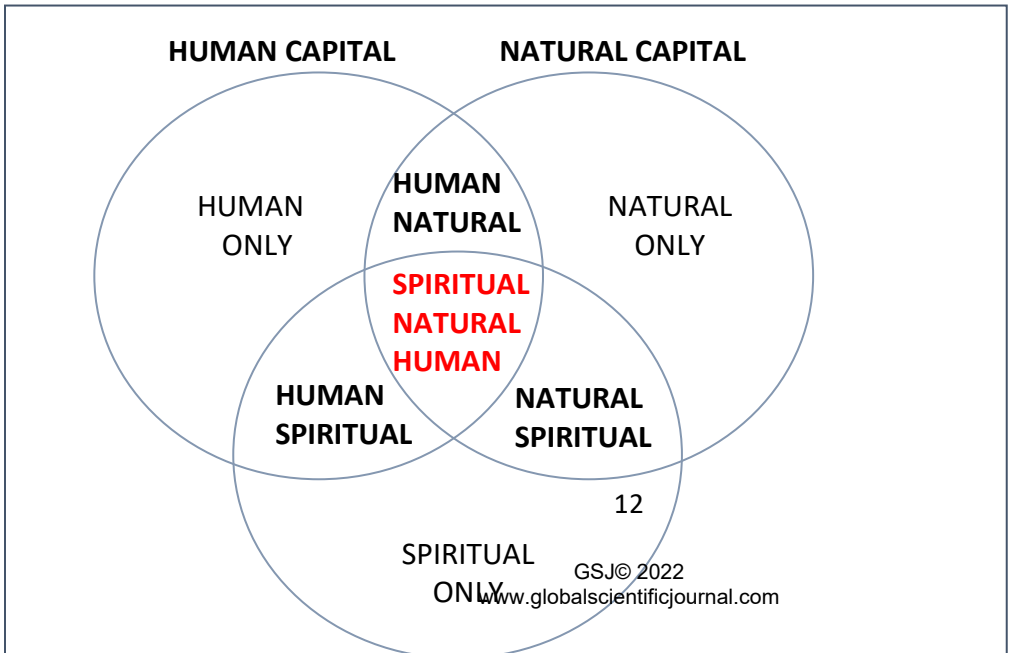
Interactions between these three Worlds give rise to seven different constellations, or ways of knowing, as depicted in the figure below. The seventh constellation, which represents an

interaction between the Natural, Human (social) and spiritual Worlds creates balance and equilibrium. These constellations of knowledge implicate a hierarchy of identities in the universe. Both Mbiti (1969) and Parrinder (1974) as cited in chalk (2006) identify five discrete categories of these identities that are consistently mentioned in African cultural and religious practices:

- God as the ALLFATHER; the curator Of the heavens and the earth and everything in between and beyond ;
- The spirits and other divinities made up of superhuman beings and Ancestors;
- Man, including human beings alive and those not yet born;
- Flora and fauna or the remainders of biological life.
- Phenomena and objects without biological life.

God is the source and ultimate controller of these vital forces, and the spirits have access to some of this energy. Special human beings, such as seers, soothsayers or Diviners, and Rainmakers or Rain Guardians, have the knowledge and skills to tap into, manipulate and use these vital forces, mostly for good but the potential for evil. To appease the gods, rituals are performed and sacrifices made for occasions such as fertility of humans, fertility of the land, good crops yield and animals production

Millar's Constellation of Cosmovision Model (Source: Millar, 2018)



1. Knowledge resulting from human interactions only;
2. Knowledge resulting from Natural interactions only;
3. Knowledge resulting from Spiritual interactions only;
4. Knowledge resulting from interactions between Natural and Human Worlds;
5. Knowledge resulting from interactions between Human and Spiritual Worlds;
6. Knowledge resulting from interactions between Natural and Spiritual Worlds;
7. Knowledge resulting from interactions between all three (Human, Natural & Spiritual Worlds).

Millar's Constellation of Cosmovision Model (Source: Millar, 2018) animals rearing; rainmaking, storm breaking, farming (planting, harvesting) and other knowledges are acquired from the seven constellations and thanksgiving is the result of successful application of knowledge and the results thereof. When these knowledge derives from the above concept is applied to a development process, that development is called Endogenous Development (ED). This will be further discussed subsequently to demonstrate how technology agricultural technology adoption depends on the ED approach.

However, Millar's 'Triune' Model is incomplete and somehow represent the different realms of the universe, Millar unwitting places God and the same pedestal with the spirits, which are subordinate to Him. This is alien to the smallholder farmers' Worldview, which views God as Supernatural, operating at His level. This is especially so when Millar's Model is viewed against Mbiti five categories of entities above, which clearly show a hierarchical order with God at the

apex. Millar's Constellation Model is also silent on the residential location of God the ALL Father.

The ALL Father surpasses the three spheres, which means His formless presence has not been adequately depicted. Therefore, appropriate for this study as the study seeks to understand and document the experiences of people who access knowledge beyond the visible World.

2.5 Endogenous Development Paradigm

As a development paradigm, Endogenous Development has been defined as "the sum of values, and practices which marginalized silenced or oppressed societal actors create from within, in response to the initiatives of development coming from outside or being implemented "top-down" (Haverkort & Reijntjes, 2006, p.7) cited in Santuah (2020). It is development that "starts from the daily life of the communities involved their Worldviews, Values, their knowledge and social organization and the resources they have and the way they use and modify or struggle for them "(Millar, Haverkort , Shankar & Apusigah, 2012, p.149). The overall goal of Endogenous Development "is to foster and promote policy and programmatic innovations and interventions that are culturally-relevant, people-centered and locally based…" (Apusiga & Millar, 2010, p.37). Thus, ED has long recognized that "plans that are rooted in the community and generated in accordance with traditions of the local people are more likely to be carried through successfully than policies i.e. even good ones in principle that are administered through top-down bureaucracy by 'outsides" (Lauer, 1995) cited in Santuah (2020).

Endogenous Development distinguishes itself from conventional approaches as it aims to strengthen indigenous Knowledge systems as the basis for promoting sustainable development (Millar, Haverkort & Apusigah, 2012). In the neoclassical model, knowledge is universal and is generated somewhere and transplanted in another setting as we saw with Rogers' Diffusion Model. On the contrary, Endogenous Development recognizes that the process by which knowledge is created is often as important as, if not more important than, the products of the

research. Gray-Felder and Deane (1999) describe this as a process of dialogue through which people realize who they are, what they want, and how they can get it. There are 10 principles of Endogenous Development as follows:

1. Build on Local needs
2. Enhance local knowledge and practices
3. Strengthen local control and enhancement of endogenous Development
4. Identify Development niches in the locale
5. Be selective in the use of external resources
6. Retain development benefits in the local economy
7. Promote exchange and learning between culture
8. Train and build capacity of actors
9. Network and build strategic partnerships
10. Understand systems of knowing, learning and experimenting.

Endogenous Development (ED) uses a convergence-of-science (Millar et al., 2012). Some may criticize Endogenous Development as a hasty and compromised trade-off paradigm that crowds out Zero External Input Sustainable Agriculture (ZEISA) alternatives to LEISA. But perhaps the prospect of endogenous option offers possibilities for going beyond the trap of either solely indigenous or solely imported options to design all-embracing frameworks that are holistic, mutually reinforcing or beneficial (Apusigah & Millar, 2010). Sine Endogenous Development is based on indigenous worldviews – which have a large prescription of spirituality, different models have emerged to discharge African worldviews. Millar's Constellations of Cosmovisions related to the knowledge Model (2006) contributes immeasurably to the study of African religious, philosophical and scientific concepts including agriculture and its production systems. The Millar's ED paradigm and the seven constellation Models that talks about smallholder farmers and rural people knowledge led me to look at the rural people's knowledge in details

3 Methodology

3.0 Introduction

Leedy and Ormrod (2013) cited in Jambedu (2022) described research methodology as the techniques employed by the researcher to collect and analyse data

3.1 Philosophical Perspective

An interpretivism qualitative research philosophy was used for the study.

3.2 Study Area

The study was conducted in the Bawku municipality. The Bawku municipal has a total land area of 247.23720 km2 and it is located approximately between latitudes 11o 111 and 100o 401 North and longitudes 0o 181 W and 0o 61 E in the northeastern corner of the region. The Bawku Municipality has its administrative capital at Bawku. It is one of the 16 MMDAs in the Upper East Region of Ghana. The Municipality has a total population of 98,254 and a farming population of 68,600 MOFA (2019). The dependency ratio in the municipality is 87.4; the child dependency ratio is 40.3, while the old-age dependency ratio is 6.3. The sex ratio is 92.1. The urban population is 63.6 per cent of the total population, while the rural population constitutes 36.4 per cent.

It shares boundaries with Pusiga District to the North, Binduri District to the South, Garu-Tempane District to the East and Bawku West to the West (GSS, 2016).

3.3 Research Design

Nsingo (2005) cited in Jambedu (2022) define research design as a grand plan for particular research that shows how one intends to conduct the research. Yin (1994) also described research design as the logic that links the data to be collected and the conclusions to be drawn to the research questions. This implies that research design refers to the overall strategies and

approaches used in data collection, analysis and interpretation of facts to avoid a situation in which the evidence does not address the research questions and hence maximizes the validity, reliability and credibility of the research findings.

The research design used for the study was a case study.

4 Results and Discussions:

4.0 Introduction

Jambedu (2022) indicated that discussion of results/ findings in a study is aimed at doing two things: first to show how the findings of the current study fit into existing knowledge, and secondly, to articulate the implication of the findings to life.

The study was conducted with the main objective of exploring Farmer's knowledge and perception and how it influences conservation agriculture (CA) adoption in the Bawku Municipality.

The following are the findings.

1. The research found that knowledge and source influence CA adoption in the Bawku Municipality.

Source of knowledge was one of the factors that negatively influences the level of adoption. As to whether a particular knowledge was consistent with the farmers' world view and cosmovision, and could be integrated into the local/indigenous existing knowledge system and suit their farming environment was at stake. Farmers were more comfortable and willing to adopt technologies that were generated within their communities than outside communities.

2. Farmers' worldviews and cosmovision influences CA adoption in the Bawku Municipality.

This position was supported by a nucleus farmer by name of Alhaji Mbilla a key informant in an interview captured in the text box below

Text box 1

"it is not everything that is taught by the agriculture extension people or the NGO, that is good. Some are good and some are very bad, so we pick and choose which one applies to us and leave the rest. They know that some of our innovations and production system works very well than theirs, but because somebody gave them money, they will promote those people's interest. Our values and ethics about nature feed directly into our perceptions, our perceptions feed into our beliefs, our beliefs feed into our spirituality, our spirituality feeds into our needs as farmers and all these leads to our norms and cosmovision. Our norms and cosmovision feed into our indigenous knowledge and production system. The knowledge system of us as smallholder farmers informs our decision as to which production system to adopt or not to adopt. We often go through trials and a series of experiments to ascertain the workability, applicability and consistency of some claims about a particular technology or the otherwise of it. This explains our survival strategies (Resilience) us smallholder-farmer".

Again, the finding and the position of ALHAJI MBILLA is supported by Warren and Jiggins (1989) cited in Millar (2018) that some Indigenous knowledge systems and innovation are not some times recognized by some researchers and development agents although traditional agricultural technologies and innovations may be as good as or even better than the modern/western agricultural technologies

Indeed, the above results again tend to support the view of Stonehouse (1996) cited in (Knowler & Bradshaw, 2007) and others who advocated for location-specific approach and holistic approaches to promoting conservation agriculture whereby policy mechanisms such as grants, extension services and locally tested and working agricultural technologies are geared towards a

particular local or preferably to individual farmers and their farm operations (ECAF, 2001). Furthermore, the finding is supported by Millar's (2018) constellations of the cosmovision model. It is a prominent theory derived from Millar's paradigm of African sciences. The model is built on the conviction that cosmovision dictates the way resources (land, water, plants and animals) are used, how decisions are taken, and how problems are solved among rural communities (Millar, 2018)

3. The study found that farmers' perceptions about CA influence their adoption in the study area.

Some of the farmers' perceptions in the study area include;

"Crops Residue/biomass breed reptiles"

"Not all agricultural technology innovations are applicable in all areas hence 'we pick and choose' (partial adoption) or adaptation.

"Some of us have to always consult our ancestors before adopting new agriculture innovations"

"I will prefer to always burn the residue and carry manure to my farm, it is the same as CA. What the crop residue will do when it gets rotten, the manure will do the same thing".

This finding is supported by the study of Brown et al. (2017). They found that an important restriction towards the adoption of CA practices concerns farmers' perception, low feasibility studies, hesitations regarding the relevance and benefits of these practices. An example is the management of crop residues. Farmers have firm convictions about the usefulness of burning crop residues in some areas in SSA (Ngwira, Thierfelder & Lambert, 2013) and even in Ghana for pest control and soil fertility reasons. It would require an important change in farmers' mentality to enable a holistic change that will favour longer-term and higher-level benefits such as carbon sequestration.

4. The study found that adoption of CA goes beyond agronomic practice to include the issues of spirituality as shown in the above text box below

BOX 2

"My name is Akurugu Azuma 45 years old. I am a farmer in Geru here, I have been Farming since childhood. 10 to 15 years ago we were introduced to this (CA) type of farming by the Presby. Agric. research station and some of my colleagues didn't like the idea because it came close to the farming season. 'You don't use your only small piece of land and play games' but to me, it was similar to what our great grandfathers were doing their farming. The Agric/NGOs people said, we should not clear the land and burn the rubbish (residues) but we should just plant like that. I and my Husband tried to know more about it. We tried it for five (5) years, the first time, in several years that we didn't clear the land. For two years it worked. One day I was working on the farm and my little boy was also playing, he was running in and out of the residue and had a snake bite, I sent him home and quickly went to the hospital and unfortunately, the child died. My husband went to the soothsayer to consult and the Soothsayer said 'we didn't consult or get permission from his (my husband) grandfather before accepting that farming method. The soothsayer recommended some Sacrifices which we did but since then, for the remaining four years anytime we use this Farming method, we are always getting problems so my husband asks us to stop, though the yield was always good and we didn't spend much to plough".

This finding is consistent with Millar et al (2012) ED Model where apart from material and social, spirituality also influence farmer decision making processes and their development. "Some of us have to always consult our ancestors before adopting new agriculture innovations". This implies that the cosmovision of the smallholders' farmers in the Bawku Municipality dictates their decisions in production processes and resource usage. This finding is consistent

with the Millar et al (2012); Millar (2004; 2018.) constellations of the cosmovision model. The model is built on the conviction that cosmovision dictates the way resources (land, water, plants and animals) are used, how decisions are taken, and how problems are solved among rural communities. Adoption of Agricultural Technology goes beyond the physical, socio-economic, and institutional to spiritual. “For the traditional people in Northern Ghana, gods, spirits, Ancestors, spiritual and political leaders, sacred groves, land shrines, ritual crops and animals, food items and cash crop are all interrelated” (Millar, 2004). This is particularly applicable to smallholder farmers in Bawku Municipality.

5. The study found that CA adoption is preceded by testing and experimentation.

BOX 3

Qn. "Did you leave crops residue in your farm or burn them"? I ask.

Hmm, this is a serious question, if it were the agric. People I will lie to them but for you, I know you, so I will tell you the truth though the NGO People say we shouldn't Burn I gather all and burn before the rains start. If you tell the NGOs the truth they will not call you for a meeting again or give you their support.

Qn. "why did you bum?" I asked again, it is not everything that people tell you that you must do or follow, for example trying out which crops varieties could do well on your farm and which farming method to use takes time. Qn. He asks me, 'did you know Nara' Ans. yes, I responded, if you plant early alone and it matures at the time your colleague farmer own hasn't mature wouldn't birds finish them?

Yes, they will, I responded. But when we plant at the same time as recommended by the 'Bookmen', though births will come they cannot destroy them because you are many the

problems of dry and Storage will come. After all, early planting will mean Maturing at the same time whiles the rains are still on.

So we farmers are trying with various planting times until we get what we want (appropriate time)

I burn the crop residue because it gives me a lot of problems.

Qn. How I asked? Ans. It produces and serves as safe heavens for snakes, termites and other insects that destroy our crops.

This finding is consistent with the finding of Loevinsohn et al. (2013) cited in Udimal et al. (2017) and Millar's (1996, 2018) farmer experimentation model.

6. The study found that crops residues that should be kept as an integral part of CA are used for alternative purposes eg firewood, animals feed and cash purposes.
7. Again, the study found that "The crops Residues also breed insects that end up infesting our crops and destroying them"

The findings in 6, and 7 are proof in the text box 4 below

BOX 4

Qn. Why don't you leave permanent crop residue on your farm?

"My name is Memuna Halidu 37 years from Sagabo Bawku. I have been Farming before I got married and my husband is a Farmer too, so we are all farmers. This CA method was introduced to us by the Advanced office people (NGO). They showed us pictures of how it is used elsewhere and 'said when you use that farming method you will get more yield and you will not also be buying Fertilizer and paying bullocks to plough for you all the time. We didn't

even have bullocks, so my husband and I wanted to know how true it was, so we accepted to try it on our farm. We didn't plough the land, we just planted the maize like that after using 'condemn' a glyphosate base agrochemical (weedicide/herbicide) to spray the grass and plant maize, after one week, we planted Soyabean inside (inter-crop). We didn't spend so much on the land preparation because we didn't hire bullocks. Though the maize yield did not change the Soybeans did well and we also weeded once, so when you add the maize and the soya yield, it is high, so we have been using that method. But our only problem about it is that we don't have animals but our neighbours had, so when we leave the maize stalks on the farm during the dry season when there is no grass for the animals to feed, they will go and eat everything in your farm.

Again, some of my colleague Women colleagues women are lazy and don't want to go far away and look for firewood, they will also go and collect the remaining stalks we decided to always collect everything after harvest so that if they want, we will sell for them Instead of allowing their animals to go and eat for Free"

The above findings are supported by Farooq and Saddique (2014), Who found that crops residues have alternative uses and care must be taken to preserve if CA will succeed.

Further still, Pest and insects management is often not considered as a determining factor in CA adoption studies but the analysis from the text box above shows how other reasons could influence farmers' decision on adoption

Conclusion

The study concluded that indeed Farmers' indigenous knowledge, perceptions and source of knowledge influence the adoption of CA in the Bawku Municipality.

Recommendation:

Promoters, researchers and other relevant bodies should make use of relevant farmers' knowledge, perceptions and experiences in other to increase CA adoption.

5 Contributions of the Research

5.1 Contribution to New Knowledge

The research discovered an Indigenous Knowledge (IK) or Indigenous Innovation (II) in the Bawku Municipality for fighting fall Army Worm called 'Dimongso'. This is one of its kind in the quest to use local innovation in the fight against the armyworm pandemic

5.2 Contribution to Definition of CA

CA is any production system that allows the current generation to explore the environment for their production needs without compromising the environment for the future production needs of the younger/unborn generation.

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