

**SOCIO-ECONOMIC EFFECTS OF POSTHARVEST CROP RESIDUES BURNING ON FARMERS-  
HERDERS RELATIONS AND THE LEVEL OF FARMERS AWARENESS IN DEMSA L G, ADAMAWA  
STATE**



**BY**

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## **EXECUTIVE SUMMARY**

The study assessed the socio-economic effect of post-harvest crop residue burning (CRB) and the level of farmers' awareness on the effects. The study is based on primary data sourced using structured questionnaire, focus group discussions (FGD), and key informant interviews (KII), and analyzed using descriptive statistics. The result shows that the majority of crop farmers in Demsa have formal education and have an average farm size of 1-5 (ha), where the major crops farmed are maize, rice and sorghum. The findings also revealed that the majority of farmers (more than four-fifth) do engage in various occupations in addition to farming; only a small number solely depend on farm. Despite the relatively high education level and fair knowledge of the farmers, farmers still burn residue; 87% attested that there is change in crop residue management and the major factor responsible for the changes is violence and conflict. In addition, burning of crop residue reduced fodder availability with consequences on interdependent relations and mutual trust between farmers and herders, which further generate hostile aggression and affects agricultural production and livelihood in general. Studies show that there is correlation between conflict and crop residue burning, burning is more frequent in the conflict-affected areas, and crop residue burning tends to increase with the escalation of conflict. The findings show that there is no law on CRB and this burning of crop residue is one of the major factors fueling the violence; others are blockage of cattle routes, drugs abuse, lack of proactive and injustice by security and traditional rulers, climate change, population explosion, expansive use of land among others. The study recommends that there should be a law against burning of crop residue for sustainable environment and agricultural practice, traditional dialogue mechanisms should be adopted to settle dispute between the two groups of resource users, support and intervention needed to support the victims, strengthening of conflict mediation, resolution, reconciliation and peace building mechanisms, awareness on the effect of residue burning among others.

## INTRODUCTION

### Background to the Study

Post-harvest crop residue burning has become common practice among crop farmers in Nigeria as a cheap and quick means of clearing farm, weed, pest, disease and grasses control and soil fertility enhancement. Some common practices include field burning of large areas of crop residues after harvest to reduce excess plant material against next cropping in order to maintain crop yields.

Crop residue constitutes what is left of a crop after its value edible; fiber or energy in biofuel crops has been harvested. In maize the residue (also known as stover) consists of leaves, stems and husk; in sugar cane the residue is made up of the leaves, wheat stubble, and rice straw, most of what grows above ground is considered residue (Meera 2018). However, it would be a mistake to dismiss crop residue as waste. Crop residues are used for several purposes, including fodder for livestock, organic soil amendments, building materials, bio-gas generation, bio-manure/compost, and biomass energy production, and fuel for domestic and industrial use, among others (NPMCR 2014).

Crop residues provide an interface among crops, livestock and the environment, and their allocation and use likely involves trade-offs between farmers and herders in terms of immediate livelihood interests and long-term environmental sustainability (IITA 2010; Bationo and Buerkert 2001). In many parts of Africa, particularly in arid and semi-arid regions, crop residue is shared among farmers and livestock herders. A mutually beneficial and co-operative relationship existed in which herders were encouraged to graze on farm residue. Livestock had access to much-needed nutrition ahead of the dry season, while the farmers benefitted from animal manure and nutrients for their soil, enabling them to remain in continuous production for much longer. Historically, this symbiotic relationship offered a strong framework for local socio-political relationships and enabled farmers and herders to co-exist peacefully (Aboubakar and Jean 2011).

Burning of crop residues is a short-term solution for much larger and longer-term losses. While burning returns some nutrients to the soil and can even result in a burst of fertility in the short run, most of the organic material and nutrient content is lost under high temperatures. Not only does burning release noxious and greenhouse gases into the air, it dries the soil, creates an imbalance in soil pH and disturbs soil biota, such as earthworms, termites and bacteria, thus reducing overall soil quality (USU 2015).

The effect of crop residue burning extends beyond environment; burning of crop residue affect livelihood of rural farmers as well as herders by destruct their relations and mutual trust and further fuel conflict and violence between the groups. The potential of cereal crop residues as animal feed is enormous if all the different types of cereal crops are considered and if appropriate methods of improving their nutritional value are employed. Legume crop residues, such as groundnut haulms, cowpea vines, and cowpea husks have higher crude protein content and are generally used as supplements in addition to the grazing of ranges and cereal crop residues (Singh *et al.*, 2003). For the farmers, they prefer to burn the residues on-farm instead of harvesting it for fodder or any other use, one of which includes consumption by herds.

The relationship between farmers and herders is dynamic, transforming and always evolving from one form to another, moving between cooperation, competition and conflicts. Herders graze on farmlands that belong to crop farmers and farmers depend on animal dugs for improving soil fertility (Hussein 1998). For the pastoralists they need the calories produced by crop farmers, much as the crop farmers often require the protein and dairy products produced by pastoralists (Abba and Usman, 2008). Blench (2010) also analyzed this relationship as an economic exchange of dairy product for grains, access to local markets and the provision of manure on arable land while the cattle consume crop residues. However, with decreasing interdependent livelihood activities, the relationship is increasingly characterized by incessant conflict; it turned sour as a result of the scarcity of environmental resources, which often brings farmers and herdsman into competition for the available resources, and resulting in conflicts, which often lead to violence.

Conflict threatens the livelihood resources of people, particularly farming communities due to their high dependence on natural resources for survival. Herder-farmer conflicts do not only have a direct impact on the lives and livelihoods of those involved, they also disrupt and threaten the sustainability of agricultural and pastoral production in West Africa and invariably the sustainability of livelihoods of rural communities (Moritz, 2010).

In light of the foregoing, this study aims to assess and examine the socio-economic effects of post harvest crop residue burning on farmer-herders relations by (i) identifying the factors that prompt the practice of crop residue burning; (ii) examining the effects of crop residue burning on farmers-herders relations; as well as (iii) assessing the level of farmer's awareness on the consequence of burning crop residue.

## **Methodology**

The study was carried out in Demsa Local Government Area of Adamawa State. The Area lies at Latitude 9.4555<sup>0</sup> N and Longitude 12.1526<sup>0</sup>E. It has a population of 180,251 inhabitants (National Population Commission, 2006). Demsa lies in the Benue River and the agriculture is the principal means of livelihood of people with the dominant crop of maize and rice. It is inhabited by ethnic groups such as Bachama, which is the major tribe there; others include the Bata, Yandang, Bille, Mbula, Bare, and Fulanis.

The population of the study constituted all the crop farmers in the study area. A survey design in a multistage sampling technology was used. Out of the 10 LGA, five are most associated with the farmers' herders' conflict. Eight farming communities and two herder communities were purposively selected, making the total of ten communities. 14 farmers were randomly selected from each farming community, yielding a total of 112 questionnaire. Focus group discussions (FGD) in groups of seven were also carried out in each of the herding and farming communities for youth and women. Key informant interviews (KII) were organized for stakeholders, community heads, and the heads of the herders that are mostly Fulanis (ardo), as well agricultural extension workers, among others.

## **THEORETICAL ORIENTATION**

The study is anchored on frustration-aggression theory because the theory is relevant and best explains the phenomenon that leads to the high rate of immediate burning of crop residue, which affect and decrease interdependent relations between farmers and herders by increasing tensions and escalating conflict.

The theory of frustration–aggression was originally formulated by Dollard, Doob, Miller, Mowrer, and Sears (1939), who argued that the occurrence of aggressive behavior always presupposes the existence of frustration and, subsequently, that the existence of frustration always leads to some form of aggression. They first equated aggression with the desire to hurt or injure others and or as interference with a goal response.

The goal of each group is to secure its livelihood to maximize profits; any move to block or interfere can cause frustration and aggression. Triggers of aggression could include farmers

blocking cattle routes, herders' herds grazing on crops in a farm, farmers burning the crop residue out of frustration to deprive herders herds fodder, which frustrates herders and causes them to act aggressively by destroying farms and farm products by either burning the crops or grazing on these farm the next coming season without warning the farmers.

## **RESULTS AND DISCUSSION**

Historically, farmers and herders in study area lived cordially, mutually co-exist with one another; the relationship between these two groups of resource users are initially symbiotic. This symbiotic relationship usually promotes interdependency and reciprocity where farmers after harvesting will give his farm residue for free or sell to herder for herder to graze and in return the herder provide manure as demonstrated by Mboror Herders and Gbaya farmers in Adamawa province of Cameroon (Moritz, 2008) in which gifts were also exchanged among members of these groups for many years of coexistence. The relationship is interdependent as an economic exchange of dairy product for grains, residues for manure, and access to local markets.

These relationships were characterized by both conflict and complementarily. Turner (2003) reports that the relationship between farmers and herders in sub-Sahara Africa has always been multi-dimensional and their lives must include the social relationships they have, both cooperative and conflictual. However, as farmer-herder tensions escalate, farmers now resort to extreme measures to sabotage herders by engaging in the practice of burning residues to deprive cattle of food. Ironically, farmers often hurt themselves: entire farming communities are also harmed, as are the soil and the global climate in general, because the effects of burning crop residue are multidimensional.

This crop residue burning frustrates herders and increases the tensions with significant effects on means of livelihood of both groups, loss of crop farmland and cattle, destruction/loss of properties, displacement of people, loss of life and human security, and threat to national unity in general.

### **Typologies of Crops Farm in Demsa**

The study revealed that 97% of crops farm in study area are cereal crops with a high percentage of rice and maize. This is because of the geographic nature of the environment, improvements in the production, and high production/demand of cereal crop. Cereals are the major source of residue with maize, millet and sorghum being the major contributors based on the study conducted by Aruya *et al.*, (2016) in Ikara local government area of Kaduna state. The study shares close

similarity with that of Kwaghe et al.,(2011) in Jere local government area of Borno state which stated that maize was by far the highest contributor of crop residue. This shows that a large amount of crop residue has been generated from Demsa, which if it was utilized well in sustainable way, would help solve the problem of fodder scarcity by herders and it will further strengthen the relationship between farmer and herders in the area. In our interview with Ardo (Fulani herders head) and secretary of Miyatti Allah, both interviewees revealed that unsustainable management of residues (burning) by farmers is one of the major factors that fuel farmer herders crisis in the area. The Ardo further said “these crop residues have been served as the major fodder/feed for our animals during dry season more especially maize stover, but farmers do burn them in order to frustrate [herders]. If the problem of post-harvest residue burning is addressed, it will improve farmers-herders relation to a great extent”. Burning of crop residues frustrates herders, who in turn act aggressively by grazing on crop farm or destroy crop farm completely.

### **Management Practice of Crop Residue in Demsa**

The study observed that the management of crop residue in Hong is dynamic and varies from district to district, based on the relationship between farmers and herders, livelihood of the communities, cultural believes and some factors. Some sales, some store as feed for their livestock, some exchanged with herders for manure, some recycle for soil amendment while others burn for frustration and anger were others burn for soil fertility enhancement.

This study observed that burning has been the predominant management practice by the farmers with about 57% of respondents indicating that they burn their residue immediately after harvest as a result of violence and conflict in the area. The burning is found to be very high in conflict-affected areas of Kodomun, Lawaru, Dong and Bolong, despite all the economic management options available. This is quite contrary with the work of El-Haggare et al.,(2004), where the researcher noted that despite all the management options available for managing crop residue many farmers view the practice of residue utilization as an extra cost with small returns and therefore the best way to get rid of the residues is by open burning and dumping. Farmers prefer to burn their residue more especially in Lawaru and Kolomun: during our FGD with famers in Kolomun, farmers revealed that they prefer to burn their residue than to give or sell to herder no matter how much they are going to buy, they said “after all the herders are [not friends], farmers and herders have separated and farmers are free to burn our crop residue.”

During an FGD with some farmers, it was revealed that in the previous time they do give their residue free to herders for them to graze, later they begin to sell and now that the tension is high (conflict has escalated) farmers do burn their residues. Only a small number of respondents agreed that they do sell their residue to herders, and this has to do with the relationship that exist between them, especially farmers in Demsa town. During our FGD with farmers in Demsa town it was revealed that they do not have a problem with the local herders so they do not see any reason to not sell them the residue, after all the money from selling of this residue helped them pay for transporting their crop back home and settling labor debts. It was further revealed that some farmers have started to adopt the practice of burning crop residue due to the perception and negative narration they had about herders, while some have been pressurized by their relatives in conflict-affected areas for allowing herders to graze on their farms. In addition, selling and exchanging crop residue for manure was found to be the major factor that improves the relationship and further gives farmers protections over their farms against any destruction.

Perception plays a serious role in farmer-herders conflict in Demsa because in all the 8 communities we visited (Kodomun, Kwayine, Lawaru, Dong, Bolong, Bille, Kpasham and Demsa ward), only in Demsa ward were Fulani herders and farmers interacting and relating to one another, but in the remaining seven wards you can hardly see a Fulani man even passing around now, and they despite being longtime local residents. While fewer respondents indicated that they do store their crop residue to feed their livestock at home this has to do with engagement of some farmers in livestock rearing. According to the farmers, owning livestock is necessary considering the changing climate; it is very important for farmer to keep herds to minimize the risk of drought because the herds are more resilient against drought than crops. 6% of respondents do recycle their residue for soil amendment and only 2% of respondent indicated that they still do exchange their residue with herders for manure. With this we can say the interdependency relationship between farmers and herders are no longer there. While other options account for 9%, where some farmers revealed that they do burn their stalk for some others reasons like soil fertility enhancement, making potash, and it has been their tradition for so long that women burn maize and guinea corn stalk called (Muskowa) to obtain the ashes for making potash for sale and consumption purpose. While they used to allow herders to graze before burning, unfortunately now the practice has changed and farmers often exclusively engage in burning,

**Table 1: Management of Crop Residue in Demsa**

<b>Management</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Selling	17	16
Storing	11	10
Exchange for manure	2	2
Recycle for soil amendment	6	6
Burning	60	57
Others	9	9
<b>Total</b>	<b>105</b>	<b>100</b>

**Source: field survey, 2019**

### **Factors Responsible For Changes in Residue Management In Demsa**

Majority of respondents (more than four-fifths) indicated that there is change in the management of residues in Demsa, and two-thirds of respondents agreed that violence and conflict are the major factor causing the change. According to interview made with some farmer in kolomun they revealed that the practice of residue burning has significantly increased from 2014, when the conflict escalated, they further said residue is given to herders for free before the conflict, later selling and subsequently burning. The relationship between farmer and herder is always moving from cooperation to competition to conflict. 9% of respondents stated that a lack of knowledge about the economic importance of residue is the factor responsible while 3% responded that involvement of farmers in livestock is the primary factor. Crop residue burning in Demsa is the result of farmer-herder conflicts in the area because farmers burned their crop residue not because they want to but to frustrate herders for what is happening there. At our FGD, farmers questioned why they should give their residue to “their enemies,”: “no we can’t, we rather burn it than to give it to them after all we’ve come to discover that it increases soil fertility”, said farmers at Kodomun.

Only 14% of the farmers agreed that there is no change in residue management in their area and most of them are from areas where farmer-herder relationships still exist. Based on the interview with farmers in Demsa town, they said that they still do sell their residue to herders because they do not have problem with them, as long as their relationship will continue they will continue exchange of residue. Nonetheless, they have been under pressure from their family and relatives from the affected area for interacting with Fulani herders, as indicated in the interview with traditional ruler/community head, FGD with farmers and herder, and KII made with stakeholder.



## **The Effects of Crop Residue Burning on Farmers- Herders Relation in Demsa**

The relationship between farmers and herders in Demsa is deteriorating at an alarming rate: as observed from this study, about 87% of respondents indicated that the relationship is bad, 5% fair, and 9% very strong. This has to do with escalation of conflict between the two groups. The farmers-herders relations in Demsa have deteriorated to the extent that farmers and herders have to separate in some communities, and some herders migrated to Cameroon. Of the eight farming communities (Kodomun, Kwayine, Lawaru, Dong, Bolong, Bille, Kpasham and Demsa) and the two Fulani herding communities (Upper and Shetile) we visited, farmers and herders lived and interact together only in Demsa, while in the rest of the sites they were separated because of the massive destruction of properties, houses, schools, health centers, and religious centers, among others. During our FGD with farmers, I asked them how they are feeling now with this separation; some of them said they feel better now as their farms are safe, but some said they really feel bad because their being together is more economically productive. Some farmers said “out of anger we may say [the separation] is good but deep inside our heart we have been affected.” He further said somebody like him would be seriously affected because he is a chemist, “comparing his earning now and before there is a great set back”. In some of the communities we visited like, Kodomun, Lawaru and Bolong Fulani, herders are not even coming close to the communities, much less passing through same thing herding communities of Upper and Shetile.

This conflict and separation affect livelihood of both groups, where some lose their farmland, as revealed by farmers in Kodomun whose best side for farming, Maleya (Karali and Jigawa), is no longer accessible now. Herders likewise say that their best side for grazing, Bula, now is inaccessible. Schools have been destroyed and some were abandoned as revealed by Ardo during our KII. The Fulani head (Ardo) revealed that nomadic school build in Golam is no longer operating because all the children were relocated, hunger and disease became a serious problem to their cattle to the extent that they have to transfer their cattle to Cameroon, he said more than 85% of their cattle have been relocated to Cameroon but still they are not free from destruction of crops, because some of them are farming.

The interdependent relationship has been declining, as indicated by 40% of respondents, 20% attested that the interdependency relationship as antagonistic, 17% indicated is neutral, 12% improving and 11% excellent. The farmers-herders relation needs serious improvement to have a

peaceful society in Demsa and Adamawa in general and one of the sustainable ways of doing that is to solve the problem of crop residue burning as suggested by the Demsa Ardo.

The study observed that most of the problems that escalate these violent and conflict in Demas are: lack of decisive action and injustice by security agencies, as revealed by herders, during our FGD with herders they said in 2015 four of their men were attack and killed, they have reported to security operating, but no arrests were made. Their youth protested that they wanted to carry out attack but the elders stopped them. Two months after more than 100 cattle were attacked and killed, we have reported again nothing have been done, youth protested again we have to stop them. The third one three of our children were killed and dumped into the river, that was where the youth organized themselves and burned down all the farm around that was how the conflict began to escalate, revealed by Ardo. He further said that “actions are not taken by our security agency that’s why some people decide to take law into their hands”. Secondly drug abuse among youth is also a contributing factor. Blockage of cattle route by farmers is also a cause and can be attributed to the population explosion and high level of unemployment. Climate change is also a contributing factor, even though most of the factors influence this climate change are human induce action, like the residue burning among others.

### **Level of Awareness Among Farmers Regarding the Effects of Post-Harvest Crop Residue Burning in Demsa**

Majority of respondents (approximately two-thirds) do practice residue burning and the act is expected to increase with the rise in the intensity of violence and conflict. During the FGD made with farmers most of them said that they have just recently started burning their crop residue as from 2014 as a result of the escalation of the violence between farmers and herders, they said “we come notice that immediate burning of crop residue is more advantageous than selling it or giving it for manure, because it improves soil fertility and it is the easiest way to get rid of invasive species of grass.

Only 32% of respondents were aware of the damage caused by air pollution that are associated with crop residue burning (CRB), while only few were aware of the greenhouse gas (GHG) emissions caused by burning crop residue. About 65% of respondents do not have knowledge of GHG emission from CRB. Burning of crop residue emits gases like carbon dioxide, methane, and nitrogen oxide into the atmosphere, and these gases are responsible for GHG and ultimately

increase the global temperature through global warming. The increase in temperature of globe may also responsible for climate change, which brings change in our production season and subsequently affect our output and further fuels the crisis due to competition over limited available resources.

Approximately half of respondents were aware about the effect for crop residue burning on soil nutrient, fertility and structure. About 69% of respondents are not aware about the effects of CRB on soil quality; the awareness level regarding effects of CRB on soil quality is very low in study area. At our focus group discussion almost 90% of participants disagreed that burning of crop residue reduced soil nutrient and fertility; they all believed that burning increases fertility by generating ashes without knowing that burning residue leads to loss of plant nutrient like nitrogen(N), phosphorus(P), potassium(K) NPK and sulfur (S),and is wastage of valuable resources which could be a source of carbon, bio-active compounds, and other soil nutrients.

Heat generated from the burning of crop residues elevates soil temperature causing death of active beneficial microbial population. Residue burning affects soil as nutrient loss by volatilization, ash convection, runoff, wind and soil erosion and leaching of fire-released nutrients (Schoch and Binkley, 1986). Sateesh *et al.*, (2014) investigated an average deterioration of 17.32 % Carbon, 12.69 % Nitrogen and 16.23 % Potassium in wheat fields after burning residues in different villages of Madhya Pradesh. Burning also has a differential impact on soil fertility; it increases the short-term availability of some nutrients and reduces soil acidity, but ultimately leads to loss of other nutrients (like N and S) and organic matter (Richard 2001).

According to the study, about 48% of respondents in the study area were aware that air pollution in relation to the burning of residue has impact on human health. Despite the fair knowledge of farmers on this, only few knew about specific diseases caused by crop residue burning, like respiratory problem and Asthma, a majority of farmers just knew that the smoke released affects human health. Indian Agricultural Research Institute IARI (2012) pointed out that burning of crop residues leads to release of smoke, GHG (carbon dioxide, methane and nitrogen oxide) causing global warming and large amount of particulates which cause adverse impact on human health. A resulting smoke may become a health hazard as it may cause multiple lasting effects, respiratory problem, eyes problem (Awasthi et al., 2010) and (Grace et al., 2003). High incidence of asthma symptoms, lower lung function and respiratory hospitalization were reported among populations exposed to smoke from rice straw burning in Niigata, Japan (Torigoe et al., 2000).

The study also observed that there were no laws that banned burning crop residues in Demsa LGA, as attested to by more than four-fifths of respondents and that makes the practice uncontrollable and unchecked. Only 10% respondents indicated that they do not have idea.

Farmers are aware of adverse consequences of on-farm burning of crop residue but because of some factors like increasing tension between farmers and herders, increasing mechanization, unavailability of alternative economic viable solution, increase in production of cereals crops, soil fertility enhancement, pest and pasture management and difficulty in collection/ high cost of management, farmers are compelled to burn the residues.

**Table 2. Awareness Level of Farmers Regarding the Effects of Crop Residue Burning In Demsa**

PARTICULARS	RESPONDENTS (%)			
	<u>YES</u>	<u>NO</u>	<u>I DON'T KNOW</u>	<u>NO RESPONSE</u>
Do you practice agricultural crop residue burning?	64	36	0	0
Does crop residue burning have any effect on soil nutrient?	28	62	7	3
Do you think soil fertility and structure decreases by burning of crop residue?	48	49	0	3
Does crop residue burning have effect on air quality and climate?	32	54	11	0
Do crop residues burning cause any human health problem?	48	48	0	4
Do you know any law set by government or community leaders on burning crop residues?	0	89	10	1

**Source: field survey, 2019**

### **The Major Drivers of the Conflict in Demsa**

**Blockage of cattle routes by farmers:** as revealed by the Ardo of Demsa, four of their cattle routes were blocked by farmers. One has been opened after raising the issue,,but the remaining three are still blocked up until now:Bayan Bille, Guliro and Mogoron remain blocked, which gave herders poor access to land for grazing. As pasture lands shrink and some were taken by the farmers,

conflict became inevitable. Because it is very difficult for herders to move and graze without veering into crop fields, all cattle routes need to be open to give herders access to pasture to avoid grazing on crops.

**Burning of crop residue by farmers:** this crop residue burning has increased in Demsa as a result of violence and conflict between farmers and herders, but this practice became one of the major if not the major factors that fuel conflict in Demas. Burning of crop residue by farmers to deprive cattle from fodder frustrates herders and makes them act aggressively by grazing on farmers' crops even before the harvest which further escalates the conflict. As revealed by the herders in our FGD crop residues such as maize Stover is served as the major fodder resource for their animals during dry season, burning it will make their cattle hungry and cause some disease there by make some them aggressively graze on farmers crop even before harvest and that further cause violence.

**Drugs abuse:** The use and abuse of drugs by herders and farmers contributes to the conflict in Demsa as revealed by the study. As highlighted by a farmer during the FGD, it has happened to him three times where he just sees cattle in his farm without herder. He would follow the cattle and find the herder asleep and high on drugs. When he would try to talk to him, the herder would try to fight him. According to him, several incidents like this do happen in his community and that causes conflict, sometimes violence. During a KII with Ardo and Miyatti Allah Secretary of Demsa LGA, they both revealed that a lot of cases have involved drug abuse by a herder, where the herder will sleep off and allow herds to graze on crop farm.

**Injustice and a lack of proactiveness by security agencies and traditional rulers:** as revealed by herders during our FGD and KII with their Ardo, many incidents have occurred where their people have been killed, cows have been killed, and crops have been destroyed. While all such incidents have been reported, security forces have not taken action or they respond with delays, causing herders to suffer attacks. By allowing people to take law into their hands, conflicts have degenerated into violence. Security agencies need to be more proactive in handling farmers-herders cases to avoid further violence. They further said traditional rulers are taking side in their judgment; equal justice is needed in searching for common ground.

Others are general causes like population explosion, expansive use of land, climate change among others, which causes a lot of competition over limited resources available.

## **Conclusions**

Burning of crop residue is increasing among rural farmers as a result of the soured relationship between farmers and herders, which is characterized by violence and conflict, and it destroys not only farmers-herders relations, with specific reference to the old tradition of interdependent relationship that characterize the two groups, but it further affects agricultural activities and livelihood in general . The act of crop residue burning increased in last decade as violence began to escalate, with the consequences on overall agricultural production of both crop production and livestock and generally dwindling the economics of the nation.

Despite fair knowledge among Demsa farmers on the effects of burning crop residue, farmers out of anger still engage in the practice of immediate burning of crop residue as a result of escalation of the conflict in the area to deprive herders from getting fodder for their animals, without knowing that the practice will further fuel the conflict directly and indirectly, as the relationship is deteriorating The management of residue has been changed in relation to old practice. The finding also revealed that olden day practice of exchange and selling of crop residue is more advantageous economically than the burning for anger or soil fertility enhancement, because exchanging or selling residue to herders improves mutual trust, strengthen interdependent relations by giving security over crop farms as well as cattle. The findings concluded that there is positive correlation between conflict and crop residues burning in Demsa, to have a common ground for farmers and herders in Demsa the practice of crop residue burning have to check, that will be easiest and direct way to bring farmers-herders relations back.

Tackling the crop residue burning is a good solution in resolving farmer-herders conflict in particular and saving the climate and soil in general. To achieve a sustainable solution to farmer-herder relation mismanagement of crop residue, we need to strengthen the mutual trust and maintain interdependency and traditional relationship between these two group of farmers and herders.

### **Recommendations**

- I. Adamawa state ministry of Agriculture and other Government Institutions, nongovernmental organization should engage in more capacity building and awareness generation on the self-destructive consequences of residue burning and the economic importance of crop residues. This should be done by organizing trainings of farmers for creating awareness about effects of crop residue burning, adoption of conservation

agriculture practices and resource conservation technology, creation of awareness about various measures to prevent crop residue burning through mass media, print media, etc. This should be complemented by demonstrations of crop residue management technology on a large scale by Ministry for Agriculture through extension workers organizing on-farm demonstrations to create awareness and dissemination of various technologies and establishing self-help groups for sustainable agricultural practice and environment.

- II. Government at the federal, state, local government, and community levels should set laws and legislation to curb crop residue burning. There is a need to formulate and implement all necessary policy measures for controlling crop residue burning through suitable laws, legislation, or executive orders through incentives and punishment. The State Government should identify an agency or authority to implement such an order to abate, prevent, and ban the practice of crop residue burning as practice by many countries in the world. Looking at high increase in production of cereal crop of rice, maize and wheat in the country, the law will help reduce the problem of fodder scarcity that become major factor that cause conflict between famers and herders, it will also save our environment from greenhouse emission and soil from degradation.
- III. Government and nongovernmental organizations (NGOs) should strengthen conflict mediation, resolution, reconciliation, and peacebuilding mechanisms, to change people's perception of conflict which will help and encourage the group to rethink how to coexist peacefully with one another. This should be done through inclusive dialogue employing a bottom up approach, where all the real victims should be involved, and it should be consistent. Adamawa state government and civil society groups should support and assist Demsa community to set up their own dialogue, reconciliation, and peacebuilding groups that involve the leadership of both group farmers and herders with the goal of solving their immediate conflict. This will intensify the effort to design and implement conflict prevention initiatives that could prevent the escalation of conflict to violence. Because most of these problems of farmers-herders are internal problems that need to be solved by the group before any support from government or civil society or NGOs. This indigenous peacebuilding should collaborate with state agency for peace and civil society in discharging their duties.

- IV. Adamawa state government should encourage the adoption of traditional dialogue and reconciliation mechanisms in settling farmers-herders related problem, this should be done by strengthening the role of traditional and religion leaders, including the head of the community and Fulani herders head. Such that problem related to farm grazing and other related problems should be reconciled by the community head and Fulani herding head, this would be more efficient and effective with low cost and less effect on the relationship than involving court and security agents.
- V. Government and private organization should promote diversified uses of crop residue for various purposes, as fuel for power generation, as industrial raw material for production of bio-ethanol, packing material for fruits, utilization for paper/ board/panel industry, biogas generation/composting and mushroom cultivation and promote collection of crop residue for feed. This will reduce the problem of power scarcity we have in our industries and reduce the excessive use of fossil fuel that contributes more to greenhouse gases emission. It also reduces the rate of burning and will improve the economic standard of farmers.
- VI. The security forces should be proactive in farmers-herders related cases. The government should empower security agencies by providing them with mobility and all necessary requirement to perform effectively. Because delays and sometimes denials of justice by the security forces are what frustrate victims and pushes them to take the law into their hand by reprisal attacks, which further fuel the conflict. This cycle will lead to more burning of crop residues by farmers as aggression and more farm destruction.
- VII. Intervention and support by government, private sectors, NGOs should be given to victims of the conflict to reduce the tension. Soft loans also should be created for both farmers and herders to enable them to improve their production, under the condition that residue will be sold to herders for fodder. This intervention will reduce tension and anger that cause and force farmers into burning crop residues.
- VIII. Adamawa state government should review and check the cattle routes for easy access and passage by cattle herders to avoid more farm destruction as a result of route blockage. Government should also charge agency responsible for drugs abuse to be more proactive.



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