



Percieved Effects of Bush Burning on Arable Crop Production in Bauchi Local Government Area of Bauchi State, Nigeria.

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Abstract

The study examined farmers' perceived effects of bush burning on arable crop production in Bauchi local government area of Bauchi state. Random sampling techniques were used in selecting 80 arable crop farmers across four (4) wards in the local government area namely; Birshi, Dawaki, Galambi, and Kangyare. Data were analysed using both descriptive statistics (frequency, percentages, mean and standard deviation) and inferential statistics (logit regression). The results of the study showed that majority (75.1%) of the famers were within the age range of 20-50 years of age. Furthermore, the result revealed that majority (63.1%) of the farmers were male. Furthermore, the results revealed that most (95%) of the farmers are literate. The result also revealed that most (96.3%) of the arable farmers perceived bush burning help to clear farm land for cultivation. The result showed that majority (86.3%) of the arable farmers perceived bush burning help in weed control. Furthermore, the result revealed that most (90.1%) of the arable farmers perceive that bush burning help to control pest and diseases. The result also showed that majority (88.8%) of the arable farmers perceive bush burning destroys soil microorganisms. Furthermore, the result revealed that most (92.6%) of the arable farmers perceive that bush burning increases the tendency for soil erosion and land degradation. The result also showed that majority (86.2%) the arable farmers perceived that bush

following should be encouraged to reduce the effect of bush burning. The also revealed that majority (77.5%) of the arable farmers perceived lack of herbicide and insecticide to control pest and disease as a constraint of farmers against bush burning. The result of logit regression analysis of the socio-economic characteristics of the arable crop farmers on perceive effect of soil of bush burning, the result showed that educational qualification, years of experience, and marital status were found to be significant. The study concluded that despite the advantages farmers perceive they drive from bush burning, its effect on arable crop land remain higher among farmers in Bauchi local government area of Bauchi state. The study furthermore, recommended that effort should be made to reduce indiscriminate bush burning, focus on alternative energy resource such as solar energy, planting of trees, as well as emphasize on extension service to create more awareness of its effect on agriculture and environment as a whole.

Keywords: *Bush Burning, Arable crop, Perception.*

Introduction

Bush burning generally is the method of removing the natural vegetation from the surface of the soil by setting fire on the debris. It is sometimes intentional or accidental. Bush burning causes serious damages to trees and crops, its effect which cannot be underestimated. Practice of setting bush on fire could also lead to accidental burning of land and other properties. Bush burning has been practiced in many parts of the world and has been accepted as an integral part of the traditional farming system (Hough, 1993). It is a commonly applied management tool in forest ecosystems worldwide (Turner *et al.*,

1994). Fire is used for hunting, clearing of land for agriculture, maintaining grass lands, controlling pests and removing dry vegetation and crop residues to promote agricultural productivity (Hough, 1993). Bush fire is a part of the natural ecology in a number of countries (Liu *et al.*, 2001). Bush burning has been practiced from time immemorial and in many societies has been accepted as an integral part of traditional farming system. However, the changing pattern of life style, population increase, urbanization and farming systems that put pressure on the natural environment, suggest that

traditional system of bush burning can no longer be sustained but it has been difficult to reduce or completely eliminate it (Birnin-yauri and Aliero, 2008). Burning the farmland for the cultivation of crops has a remarkable effect on soil fertility. During burning process, some nutrients that are highly needed by the plants are lost out in the form of gases. Also, human and natural resources like structures, plantations, estates, and farmlands are destroyed due mainly to careless and uncontrolled fire (Umoh, 1985). The ash which is the principle product of burnt material although rich in phosphorus, nitrogen and potassium can be easily washed away by rain. The heat produced during burning creates an unfavorable condition for activities of the soil organisms such as the earthworm. It was discovered that most of the vegetation debris after clearing, especially on a large scale farming and small scale farms. Animals are also trapped in the process of bush burning. Bush burning, whether as a result of wildfire or a controlled burning affects not only the appearance of the landscape but the quality of the soil. The landscape may quickly recover after a fire with fresh new growth and emerging seedlings. However bush burning has a negative effect on soil conditions and soil may take much longer to recover (Jamala *et al.*2012).

Fire has been listed as a major threatening process for biodiversity (Robinson *et al* 2003). Frequent burning of bush has generally considered having negative effects on biodiversity (Bradstock *et al.*, 1997). Pyke *et al.* (2010) reported that fire can change plant communities by reducing dominance of some plants while enhancing the dominance of others. According to report by Paltridge and Latz (2009), as fire sensitive species are killed by fire, they are replaced by a more fire tolerant plants. According to Preece (1989) the effect of a particular fire on an individual species depends on the intensity and duration of fire, the pre- fire condition of the biota, the period since the last fire occur and the pre- and post-weather especially rainfall which influences soil moisture. Morrison *et al.* (1995) further reported that the effect of fire frequency on plant communities depends on three variables namely the length of interfere interval, the variability of interfere interval and the time since the most recent fire. Robinson *et al* (2003), in their report stated that fire sensitive species are destroyed by fire and can become locally extinct if fire is too frequent or too intense. However, Trollope and Tainton, (1986) reported that fire intensity had no significant effect on grass sward. Hence, this study was conducted to examine perceive on the effect of bush burning on arable crop farmers in Bauchi local government

area of Bauchi State. The specific objectives were to: (i). to determine socio-economic characteristics of the arable crop farmers; (ii) to determine arable crop farmers perceive effect of bush burning (iii) to determine arable crop farmers perceive control measures to bush burning (iv) to determine the relationship between socio-economic characteristics of arable crop farmers and level of perception on bush burning; and (v) to determine constraint face by arable crop farmers in mitigating bush burning.

RESEARCH METHODOLOGY

Bauchi local government area (L.G.A.) is located between 10⁰ -17N and longitude 9⁰ -45E. It is situated within northern Guinea Savannah ecological zone of Nigeria and has elevation of 690.20 meters above the sea level. The climatic condition of the area is characterized by two distinct seasons, dry and wet. The wet season lasts five (from May to September). While the dry season begins in October and ends in April (7 months). The mean annual rainfall varies between 600mm to 1300mm, while the temperature ranges from 18.33⁰C – 40.39⁰C with April as the hotter month and January as the coldest month. Relative humidity is highest in August having the value of 66% and lowest in February with 16.5%. The farming system is characterized by traditional mixed crop livestock system on a subsistence scale in majority of the population live barely, wheat, maize, beans, sorghum are commonly growing crops in the area. Cattle and sheep are the dominant types of livestock production but chicken are also common, since the farming system is depending on rain fed system therefore farmers are always worried about the duration and intensity of rainfall. BSADP, (2009).

A structured questionnaire was used for the study to obtain the data needed for the research. A total number of 80 questionnaires were administered in the following wards of the local government namely; Birshi, Dawaki, Galambi and Kangyare. Thirty (20) farmers were randomly selected from each of the ward for the survey which results in the total number of 80 farmers for the study. Descriptive statistics (frequency count, percentages, mean) was used to achieve objectives i, ii, iv, and v while inferential statistics (logit regression) was used to achieve objective iii.

RESULT AND DISCUSSION

The Socio-economics characteristics of the farmers considered in this study include age, gender, occupation, educational level, marital status, household size, years of experience, farm size, and major crop grown in the area. These are presented in Table 1.

Table 1: Socio-Economic Characteristics of the Respondents

| Variables (%) | frequency | Percentages |
|----------------------------------|------------------|--------------------|
| Age | | |
| <20 | 13 | 16.3 |
| 21-30 | 28 | 35.0 |
| 31-40 | 21 | 26.3 |
| 41-50 | 11 | 13.8 |
| 51-60 | 3 | 3.8 |
| Above 60 | 4 | 5.0 |
| Gender | | |
| Male | 49 | 61.3 |
| Female | 31 | 38.7 |
| Educational qualification | | |
| Primary education | 8 | 10.0 |
| Secondary education | 41 | 51.2 |
| Tertiary education | 27 | 33.8 |
| Adult education | 1 | 1.3 |
| None | 3 | 3.8 |
| Marital status | | |
| Single | 27 | 33.8 |
| Married | 51 | 63.7 |
| Divorce | 1 | 1.3 |
| Widowed | 1 | 1.3 |
| Household size | | |
| 1-5 | 27 | 33.8 |
| 6-10 | 47 | 58.7 |

| | | |
|-----------------------------|----|------|
| 11-15 | 4 | 5.0 |
| Above 15 | 2 | 2.5 |
| Years of Experience | | |
| 1-10 | 56 | 70.0 |
| 11-20 | 16 | 20.0 |
| 21-30 | 4 | 5.0 |
| 31-40 | 3 | 3.7 |
| Above 40 | 1 | 1.3 |
| Farm Size (hectares) | | |
| <1 | 11 | 13.8 |
| 1-2 | 46 | 57.8 |
| 3-4 | 9 | 11.3 |
| 5-6 | 6 | 7.5 |
| 7-8 | 7 | 8.8 |
| Above 8 | 1 | 1.3 |

Source: Field survey, 2019.

The socio economic characteristics of the farmers considered in the study such as age, gender, occupation, educational qualification, marital status, household size and year of experience in farming. The age distribution of the farmer is presented in Table 1 the result showed that majority (75.1%) of the arable farmers were within the age range of 20-50 years of age. This agrees with Jamala *et al.*, (2012) who reported that majority of the respondents fell below the age of 50 years in the study area. The result further showed that majority (61.3%) of the arable farmers were males while the females constituted the remaining (38.7%). This agrees with Ambe *et al.*, (2015) who reported that majority of the respondents are male in the study area. This implies that male gender dominates in agricultural activities than their female counter part. A possible reason might be that farm operations are tedious, hence the less participation of women folk. Another reason could be that the cultural and religious (Islam) believe of the respondents where women are not allowed to work on farm, they only participate within the confine of the house (Jamala and Shehu, 2011). The result also revealed majority (85.0%) of the arable farmers have a minimum of secondary education, (10.0%) had primary school education. Results showed that majority (63.7%) of the arable farmers are married, (33.8%) are single, (1.3%) divorced and (1.3%) are widowed. Result

revealed that majority (58.7%) of the arable farmers have the household size of 6-10, while (33.8%) fell within the household size. Results revealed that majority (70.0%) of the arable farmers have a 1-10 years of farming experience, while, (20.0%) have 11-20 years of farming experience. The result also revealed that 13.8% of the arable farmers cultivate less than a 1 hectare of land, majority (57.8%) have 1-2 hectares, (11.3%) have 3-4 hectares.

Arable crops Farmers Perception on the causes of Bush Burning.

The result of the arable crop farmers' perception on the cause of bush burning is presented in Table 2

Table 2: Arable Crop Farmers Perceive Causes of Bush Burning.

Source: Field survey, 2019.

*Figures parenthesis are percentages

| Variables | SA | A | U | D | SD |
|--|---------------|--------------|------------|------------|------------|
| Bush burning help hunters to flush out animals | 30 (37.5)* | 47 (58.8) | - | - | 3 (3.8) |
| Bush burning provide easy land clearing method | 22 (27.5) | 49 (61.3) | 1 (1.3) | 7 (8.8) | 1 (1.3) |
| Bush burning help to control pest and disease | 33 (41.3) | 39 (48.8) | 1 (1.3) | 5 (6.3) | 2 (2.5) |
| Bush burning provide a source of nutrient to the soil(manure) | 30 (37.5) | 39 (48.8) | 3 (3.8) | 7 (8.8) | 1 (1.3) |
| Bush burning help in weed control | 17 (21.3) | 52 (65.0) | 4 (5.0) | 7 (8.8) | - |
| Bush burning provide a source of charcoal and ash | 22 (27.5) | 51 (63.7) | 3 (3.8) | 1 (1.3) | 3 (3.8) |
| Bush burning help to improve output of crop production | 27 (33.8) | 41 (51.2) | 4 (5.0) | 6 (7.5) | 2 (2.5) |

Result in Table 2 revealed that most (96.3%) of the arable farmers perceive that bush burning help hunters to flush out animals. This agrees with Ajayi and Halstead (1979) who observed that savanna is burnt to flush out animals during hunting expeditions, to remove old unpalatable growth to control brush and encroachment of rangelands by woody plant species Furthermore, the result showed that majority (88.8%) of the arable farmers perceive that bush burning

provide easy land clearing method which implies that the arable farmers are also ignorant of a suitable land clearing method other than bush burning. This agrees with Edwin (2006) who observed that farmers use bush burning in order to hunt for games or bush meat and also to clear the land for farming. The also revealed that most (90.1%) of the arable farmers perceive that bush burning help to control pest and diseases. The result also shows that majority (86.3%) of the arable farmers perceive that bush burning provides nutrients to the soil. This agrees with Jamala *et al.*, (2012) who reported that According to the respondents, some positive impacts of bushfire as a means of land clearing and for maintenance of soil productivity. Furthermore, the result revealed that majority (86.3%) of the arable farmers perceive that bush burning help in weed control. This agrees with Auld and Denham, (2006) who reported that burning bush is also believed to rid the grassland of parasitic insects and to prevent the encroachment of undesirable invasive species. The showed that most (91.2%) of arable farmers perceive bush burning as a source of charcoal and ash. showed that majority (85.0%) of the arable farmers perceive that bush burning help to improve output of crop production as a result of the manure deposited after it has been burnt.

Table 3: Farmers Perception on the Effect of Bush Burning on Arable Crops and Land.

| Variables | SA | A | U | D | SD | mean | rank |
|---|---------------|--------------|-------------|------------|------------|-------------|-----------------|
| Bush burning increase tendency for soil erosion and land degradation | 35 (43.8)* | 39 (48.8) | 2 (2.5) | 3 (3.8) | 1 (1.3) | 4.30 | 1 st |
| Bush burning affect the output of the crops in negative way | 17 (21.3) | 49 (61.3) | 8 (10.8) | 3 (3.8) | 3 (3.8) | 3.93 | 5 th |
| Bush burning destroys soil microorganisms | 16 (20.0) | 55 (68.8) | 6 (7.5) | 1 (1.3) | 2 (2.5) | 4.03 | 4 th |
| Bush burning increase deforestation and vegetation clearance | 27 (33.8) | 46 (57.5) | 7 (8.8) | - - | - - | 4.25 | 2 nd |
| Bush burning increase climatic change occurrence | 28 (35.0) | 44 (55.0) | 4 (5.0) | 2 (2.5) | 2 (2.5) | 4.12 | 3 rd |

Source: Field survey, 2019.

*Figures parenthesis are percentages

Result from Table 3 reveals that most (92.6%) of the arable farmers perceive that bush burning increases the tendency for soil erosion and land degradation. Bush burning increases tendency for soil erosion and land degradation which ranked 1st with mean 4.30. This agrees with Jamala *et al* (2012) who reported that Bush burning bring about reduction in soil fertility, promotes soil erosion and also destroys soil micro-organisms whether the result of a wildfire or a controlled burn. Furthermore, the result revealed that majority (82.6%) perceive that bush burning affect the output of crops in negative way. Bush burning affect the output of crops in negative way which ranked 5th with mean =3.93. The result also revealed that majority (88.8%) of the arable farmers' perceive that bush burning destroys soil microorganisms. Bush burning destroys soil microorganisms which ranked 4th with mean=4.03. this support the finding of NRCS, (2011) who reported that bush burning has a negative effect on soil conditions(soil microorganism), and soil may take much longer to recover. Furthermore, the result also revealed that most (91.3%) of the arable farmers perceive that bush burning increases deforestation and vegetation clearance. Bush burning increases deforestation and vegetation growth which rank 2nd with mean = 4.25. This agrees with Jamala *et al* (2012) who reported that Bush burning affect the vegetation cover of the area. The result showed that most (90.0%) of the arable farmers perceive that bush burning increases climatic change occurrence. Bush burning increases climatic change occurrence which ranked 3rd with mean = 4.12.

Table 4: Perceived Control Measures of Bush Burning.

| Variables | SA | A | U | D | SD | mean | rank |
|---|---------------|--------------|--------------|------------|------------|-------------|-----------------|
| Bush fallowing should be encouraged | 28 (35.0)* | 41 (51.2) | 6 (7.5) | 3 (3.8) | 2 (2.5) | 4.13 | 4 th |
| Extension farmers should educate farmers on the effect of bush burning | 26 (32.5) | 46 (57.5) | 6 (7.5) | 1 (1.3) | 1 (1.3) | 4.19 | 1 st |
| Government should provide policies and laws against bush burning | 22 (27.5) | 45 (56.3) | 11 (13.8) | 2 (2.5) | - | 4.09 | 6 th |
| Farmers should form cooperative societies against bush burning | 24 (30.0) | 42 (52.5) | 12 (15.0) | 2 (2.5) | - | 4.10 | 5 th |
| Hunters should be educated on the effect of bush burning | 28 (35.0) | 38 (47.5) | 11 (13.8) | 3 (3.8) | - | 4.16 | 2 nd |

| | | | | | | | |
|--|--------------|--------------|------------|------------|------------|------|-----------------|
| There should be period, condition and reason for bush burning | 25 (31.3) | 45 (56.3) | 6 (7.5) | 3 (3.8) | 1 (1.3) | 4.14 | 3 rd |
|--|--------------|--------------|------------|------------|------------|------|-----------------|

Source: Field Survey, 2019.

*Figures parenthesis are percentages

Result from Table 4 showed that majority (86.2%) of the arable farmers perceive that bush fallowing should be encouraged in the study area. Bush fallowing was perceived by arable crop farmers as a means of control to bush burning which ranked 4th with mean=4.13. This implies that the more farmers are oriented on appropriate means of burning bush the less the negative effect will be. Furthermore, the result revealed that most (90.0%) of the arable farmers perceived that extension personnel should educate farmers on the effect of bush burning. Extension personnel should educate farmers on the dangers of bush burning which ranked 1st with mean= 4.19. The result also showed that majority (83.8%) of the arable farmers perceive that government should make policies and laws against bush burning. Government should make policies and laws against bush burning which ranked 6th with mean = 4.09. This agrees with Jamala *et al* (2012) who reported in some states for example Kano Nigeria, the authorities have outlawed burning and have instituted steep penalties of heavy monetary fines on violators. Furthermore, the result revealed that majority (82.5%) of the arable farmers perceived that farmers should form cooperative societies against bush burning. Farmers should form cooperative societies against bush burning which ranked 5th with mean =4.16. Furthermore, the result showed that the arable crop farmers perceived that hunters should be educated on the effects of bush burning. This implies that those who practice bush burning for hunting activities can stop the act of frequent bush burning if properly oriented on the effects of bush burning. Hunters should be educated on the effects of bush burning was ranked 2nd (with the mean=4.16). Also, the Table shows that majority (87.6%) of the arable farmers perceived that there should be period, condition and reason for bush burning. This implies that the arable farmers agree that periodic bush burning causes less harm on a farm land with minimal disadvantages. There should be period, condition and reason for bush burning was ranked 3rd. (with the mean = 4.14).

Table 7: Logit regression of relationship between Socio-economic Characteristics of Arable Crop Farmers with their Perceived Effect of Bush Burning on Arable Land

| Variables | coefficient | standard error | t-value | significance |
|----------------|-------------|----------------|---------|--------------|
| Constant | 1.799 | 0.126 | 13.312 | 0.000*** |
| Age | 0.038 | 0.030 | 1.188 | 0.235 NS |
| Sex | 0.017 | 0.026 | 0.762 | 0.588 NS |
| Marital status | 0.019 | 0.072 | 1.608 | 0.067** |

| | | | | |
|---------------------------|--|-------|--------------------------------|----------|
| Household size | 0.001 | 0.004 | 0.332 | 0.642 NS |
| Years of experience | 0.048 | 0.018 | 2.771 | 0.018** |
| Farm size | 0.022 | 0.022 | 0.876 | 0.437 NS |
| Educational qualification | 0.005 | 0.035 | 0.146 | 0.032** |
| | R ² =0.0124 | | Adjusted R ² =0.056 | |
| | Standard error of the estimate 0.25431 | | | |

Source: Field survey, 2019.

***=1%

** =5%

* = 10%, NS = Not Significant

The result of multiple regression analysis in Table 7 reveals that R² was 0.0124, and adjusted R² was 0.056. The Table also shows that marital status, years of experience and educational qualification are significant at 5%. This agrees with Ambe *et al* (2015); Ajayi and Halstead (1979) who reported that there is a significant relationship between the socioeconomic characteristic of the respondents with perceived effect of bush burning. This implies that there is a high level of understanding of the effects of bush burning within the arable farmers.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The study concluded that bush burning is perceived by arable crop farmers as a problem in Bauchi local government area of Bauchi state. Farmers are aware of its causes and consequences. Farmers have also confirmed and explained effect of soil bush burning on agriculture to be reduction in farm yield, destruction of soil structure, loss of pasture and loss of nutrient, increase deforestation and increase the tendency for climate change occurrence. The relationship between their socio-economics characteristics of the arable crop farmers and their perceived effects of bush burning revealed that the more farmers are educated and having more years of experience in agricultural activities, the more likely they are to be aware of the effect of bush burning on agricultural productivity. Furthermore, farmers perceived to control bush burning hunters should be educated on its effect, government should make laws and policies against indiscriminate bush burning and extension personnel should educate farmers on its effect to the agricultural productivity and the environment.

Recommendations

The following recommendations were made:

1. There is need for government to come up with laws and policies that will penalise those who engage in indiscriminate bush burning.

2. Farmers and hunters should be oriented on the effect of bush burning and the importance of sustainable means of for maintaining the environment.
3. Extension personnel is should be provided in the study area to encourage farmers on the best cultural practices that will reduce the effect of bush burning in the study area.
4. To achieve sustainable soil management, policies and institutional arrangements are needed to encourage intensification of bush fallowing that in turn will protect the environment and help to improve soil fertility.
5. Effort should be made to reduce human activities that contribute to the occurrence of bush burning.

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