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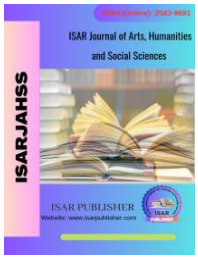

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Perception of actors in the pineapple production value chain on climate risks and their impacts on the Allada plateau

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Abstract: The Allada plateau, a major pineapple producer in Benin, is affected by increasingly pronounced climate variability, manifested among other things by seasonal fluctuation, a variation in the level of sunshine, but also by rainfall and thermal variations, which negatively affect the quantity and quality of pineapple produced according to the perceptions of the actors in the pineapple production value chain.

This study identifies the climate risks faced by actors in the pineapple production value chain according to their perceptions. The data used are primary and secondary data collected from actors in the pineapple production chain of the Allada plateau on the climate risks perceived by the actors and their impact on pineapple production. In total, 235 producers were surveyed in the five pineapple-producing municipalities on the Allada plateau.

Individual interviews using questionnaires and focus group interviews using participatory tools from the Vulnerability and Adaptive Capacity Analysis (CVCA) Framework developed by CARE were used to identify the climate risks faced by the actors. The use of descriptive statistics (mean, frequency, tables and graphs) allowed the processing and analysis of data relating to the perceptions of actors in the production value chain, their impacts and their adaptation measures.

From the analysis of data from the field surveys of this study, it emerges that the climatic risks faced by the actors in the pineapple production value chain are drought, flooding, late and heavy rains and excessive heat.

The causes related to the occurrence of these climate risks according to the actors are among others: disobedience to the deities, non-compliance with social norms, deforestation and the increase in greenhouse gases. Thus, to face the impacts of these climate risks, strategies for prevention and management of climate risks such as crop diversification, fallow, mixed crops, but the impacts of these climate risks still remain. It is therefore necessary to conduct studies to identify and propose appropriate strategies for the prevention and management of climate risks implemented by the actors in the production value chain of the Allada Plateau.

Keywords: Allada Plateau, climate risks, Perception, Actors in the production value chain, Pineapple.

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1. Introduction

Pineapple (Ananas comosus) is an economically most important plant of the Bromedioideae family (Isiaka., 2013). Pineapple also contributes to 8% of the world's fresh fruit production (Yusi Syahirman, 2016).

In Benin, pineapple is more cultivated in the Atlantic department, more precisely in the Allada plateau. National pineapple production contributes to approximately 1.2% of the national GDP, or 4.3% of agricultural GDP, and ranks third behind cotton (25% of agricultural GDP) and cashew (7.4% of agricultural GDP) (Monograph on the pineapple sector, 2014). Promoting pineapple production and export contributes to improving livelihoods by improving the income of pineapple producers and reducing poverty, which thus contributes to the economic growth of Benin and particularly of the Allada plateau. However, many constraints still weigh on pineapple production on the Allada plateau, such as the occurrence of climatic risks.

Since Beninese agriculture is still rain-fed, pineapple production is sensitive to climatic variability and risks, most of which have a negative impact on its productivity (James McCarthy, et al., 2001).

To this end, controlling the impacts of climate risks on agricultural production in general and pineapple production in particular requires knowledge of possible adaptation techniques (Moore Frances, et al., 2014). Pineapple production is very sensitive to excessive heat and irregular rainfall which results in low pineapple productivity (Portia Adade Williams, et al., 2017). Also, pineapple cannot achieve the desired sizes needed for flowering induction and growth (Tachie-Menson Josia Wilson, et al., 2014) under arid conditions.

These climate uncertainties particularly affect the actors in the pineapple production value chain of the Allada Plateau, whose livelihoods depend on pineapple production (Portia Adade Williams, et al., 2017). Also, the magnitude of the impacts of climate risks felt depends on the magnitude of the adaptation response used by the actors in pineapple production.

Many studies have shown that the knowledge of actors in the pineapple production value chain on local prevention and management strategies implemented by producers against climate risks can be used as basic resources to develop better prevention and management strategies which would help to inform development policies (Fosu-Mensah BY, et al.). Furthermore, the implementation of climate risk prevention and management strategies by actors in the pineapple production value chain is closely linked to awareness of the existence of these climate risks and the perceptions that producers have of these climate risks (Codjoe SNA, et al., 2014).

Studies have also revealed that implementing climate risk prevention and management strategies is very important for pineapple producers because without climate risk prevention and management strategies, they will become more vulnerable, which will affect their productivities (Smit B, et al., 2002).

Furthermore, the most frequently used climate risk prevention and management strategies by farmers in general and pineapple producers in particular are irrigation, farm diversification, crop diversification, improvement of crop varieties, modification of planting dates and income-generating activities (Uddin MN, et al.).

Although climate risk prevention and management strategies are the ideal solution to address the vulnerability of climate risks faced by actors in the pineapple production chain, only a minority of actors put these climate risk prevention and management strategies into practice (Fosu-Mensah BY, et al.). This state of affairs could be due to the lack of information resources linked to knowledge of the occurrence of climate risks and to measures for the prevention and management of these climate risks.

According to field surveys, the majority of actors in the pineapple production value chain on the Allada plateau have general knowledge of climate variability and climate risks through community radio and television. Actors in the pineapple production value chain of the Allada plateau also need accurate information on the forecast of the onset of rains, the periods of occurrence of climatic risks as well as the different prevention and management strategies necessary and corresponding to these climatic risks.

It is in this context that this study was initiated in order to analyze the perceptions of the actors in the pineapple production value chain on climate risks, their current sources of information on climate risks, and the strategies for preventing and managing climate risks implemented by pineapple producers on the Allada plateau.

2. Materials and methods

2.1 Description of the study area

The Allada Plateau is located in southern Benin between 6°25'-7°50' North latitude and 2°00'-2°30' East longitude. (Figure 1). It has an area of 2140 km² (Dissou M, 1986). It benefits from a subequatorial climate with a bimodal rainfall regime with two dry seasons and two rainy seasons. A major rainy season that begins in April and ends in July. It is followed by a rainfall recession centered on the month of August which constitutes the short dry season. The short rainy season extends from September to November and the long dry season from December to March. The average annual rainfall is 1200 mm. The relative humidity varies from 85 to 90% and the average daily temperature oscillates between 23 and 32°C (Dissou M, 1986).

The predominant soils are red clayey and clayey-sandy soils (Dissou M, 1986). Most of the coastal sedimentary basin to which the Allada Plateau belongs is covered with ferralitic soils generally called "bar earth". They developed on clayey-sandy sedimentary materials of the Continental Terminal (Volkoff, et al., 1993). Their clay contents vary from 5 to 15% on the surface and 50 to 55% beyond 60 cm depth (Azontonde,, 1991). As for permeability, it varies from 5 to 8 cm/h at the level of the superficial horizons and from 3 to 6 cm/h at depth.

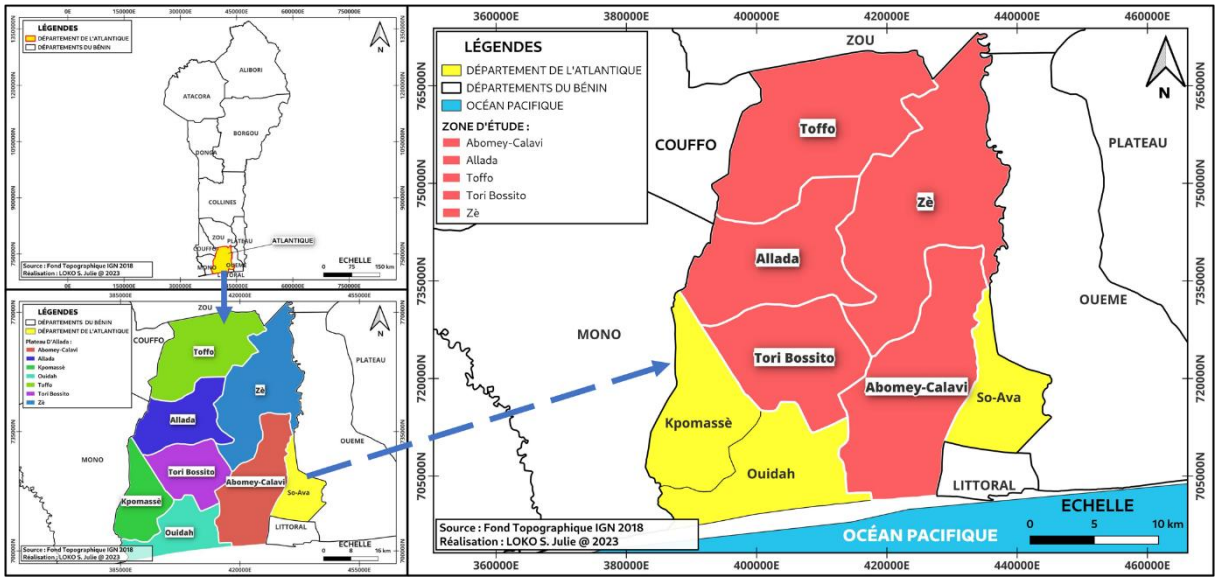


Figure 1: Geographical location of the Allada Plateau

2.2 Data used

The primary data collected mainly concern the socio-demographic characteristics of the actors in the pineapple production value chain, their perceptions of the climatic variabilities and risks they face, the impacts of these climatic risks on pineapple production, the strategies for preventing and managing climatic risks implemented by the actors in the pineapple production chain, as well as their information needs on the climatic variability and risks they face on the Allada plateau.

Secondary data are based on documentary research in order to better understand existing information on the relationship between climate risks, pineapple production, existing climate risk prevention and management strategies used by actors in the pineapple production value chain on the Allada plateau in order to adapt to climate risks. The sample size was defined according to the method of Schwartz (1995). The calculation of the sample size is applied to the actors of the production value chain of Pineapple of the Allada plateau.

A total of 235 pineapple producers were interviewed for this study. Semi-structured questionnaires were used to collect data on how actors in the pineapple production value chain perceive changes in temperature and precipitation, causes and effects, sources of information and climate risk prevention and management practices used by pineapple producers in the Allada Plateau.

2.3 Methodological approach

The data were collected using the Kobo Collect application and analyzed using Excel software. Frequencies, percentages and means are the basic descriptive statistical tools used to represent the perceptions of the actors in the pineapple production value chain of the Allada plateau on climate risks, the impacts of these climate risks and the prevention and management strategies for better pineapple production on the Allada plateau.

3. Results and discussions

3.1 Socio-demographic characteristics of actors in the pineapple production value chain

The socio-demographic characteristics of the actors in the pineapple production value chain surveyed are presented in Table 1. The actors surveyed are men and women aged between 18 and 60 years old.

Table 1: Répartition des répondants selon les caractéristiques des producteurs d'ananas (n=236)

Variables	**Frequency**	**Percentage (%)** ± ET
Ages (years)		
18-35	66	27,97%
36-60	163	69,07%
≥ 61	7	2,97%
Gender		
Male	29	12,29%
Female	207	87,71%

Education level		
None	57	24,15%
Primary	48	20,34%
Secondary	95	40,25%
Higher	29	12,29%
Literate	7	2,97%
Number of years of experience in pineapple production		
1-3 years	18	7,63%
4-6 years	39	16,53%
7-10 years	80	33,90%
>10 years	99	41,95%
Farm size (ha)		
]0 – 0.25] Hectare	19	8,05%
]0,25 – 0,5] Hectares	24	10,17%
]0,5 – 2] Hectares	148	62,71%
]2 – 5] Hectares	38	16,10%
]5 to More [Hectares	7	2,97%
Member of a pineapple producers' organization or a farmers' organization		
Yes	174	73,73%
No	62	26,27%
Access to loan/credit facilities?		
Yes	116	49,15%
No	120	50,85%
Access to markets		
Yes	200	84,75%
No	36	15,25%
What market?		
Local	236	100%
Regional and international	5	18%
Access to training for agricultural technicians?		
Yes	163	69,07%
No	73	30,93%

Source : Author

3.2 Perception of actors in the pineapple production value chain on climate variability and climate risks

The actors in the pineapple production value chain surveyed are aware of climate variability and climate risks (Table 2). Climate variations pose a major threat to pineapple production (Williams PA, et al.). During the survey, pineapple producers reported that climate variability and risks are evident in the Allada Plateau, particularly due to excessive heat, late and heavy rains, abnormal increase in the dry period and excessive heat.

The main climatic risks identified by the actors of the pineapple production value chain on the Allada plateau are periods of late and violent rains (77.54%), particularly over the last decade. Pineapple producers also mentioned the abnormal increase in the drought period (55.08%) which led to excessive heat (73.73%) causing physiological stress on pineapple indicating the presence of climatic risk (Figure 2). Given that pineapple

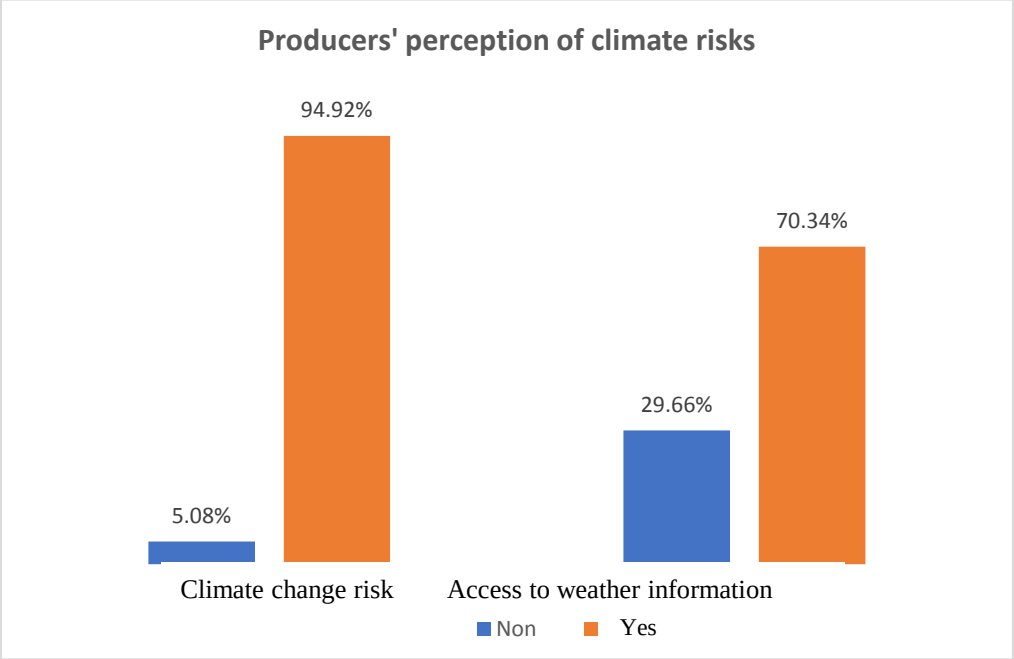
farmers are aware of climate variability and climate risks, they are likely to be willing to be informed and accept technologies related to climate risk prevention and management (Iwuchukwu J, et al., 2014).

Table 2: Répartition des répondants sur l'identification des risques climatiques sur le plateau d'Allada (n =235)

Variables	Frequency	Percentage (%) ± ET
Awareness of climate risks		
Conscious	223	94,92%
Not conscious	12	5,08%
Climate risks identified		
Drought	130	55,08%
Late and heavy rains	183	77,54%
Flooding	209	88,56%
Heavy rainfall	43	18,22%
Strong winds	100	42,37%
Excessive heat	174	73,73%
Extreme floods	21	8,90%

Source: Author

Figure 2: Perception of actors in the pineapple value chain on climate variability and risks



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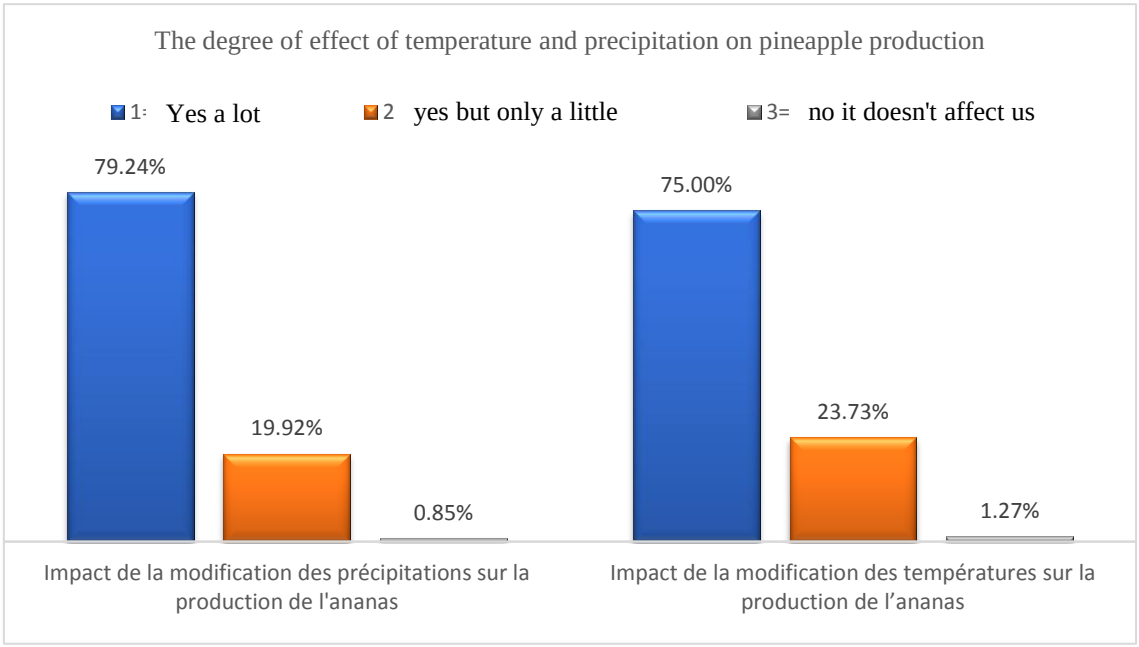
3.3 Producers' perception of the impact of climate variability and climate risks on pineapple production

Climate variability and risks can have both positive and negative impacts on agriculture, although there are indicators of more negative impacts in the long term, and can affect farmers' sustainable production and productivity efforts (Portia Adade Williams, et al., 2017). According to the actors in the pineapple production chain, the majority affirm that the modification of precipitation and temperature greatly affects pineapple production (figure 3).

Pineapple cultivation is more sensitive to climate variations and climatic risks. According to pineapple producers in the Allada plateau, some of the impacts of climate variations on production include pineapple crops affected or sometimes destroyed (55.93%), reduction in their yields (80.08%), reduction in livelihoods (59.75%). It is inferred that the reduced yield and crop allocation of pineapples contribute to reduced sales, and in turn, reduced income (Figure 4). This was similar to the results of other studies that showed similar effects of climatic variations on pineapple production in Nigeria, Uganda and Ghana (Iwuchukwu J, et al., 2014).

Figure 3: Producers' perception of the impact of climate variability and risks (in %) on their pineapples

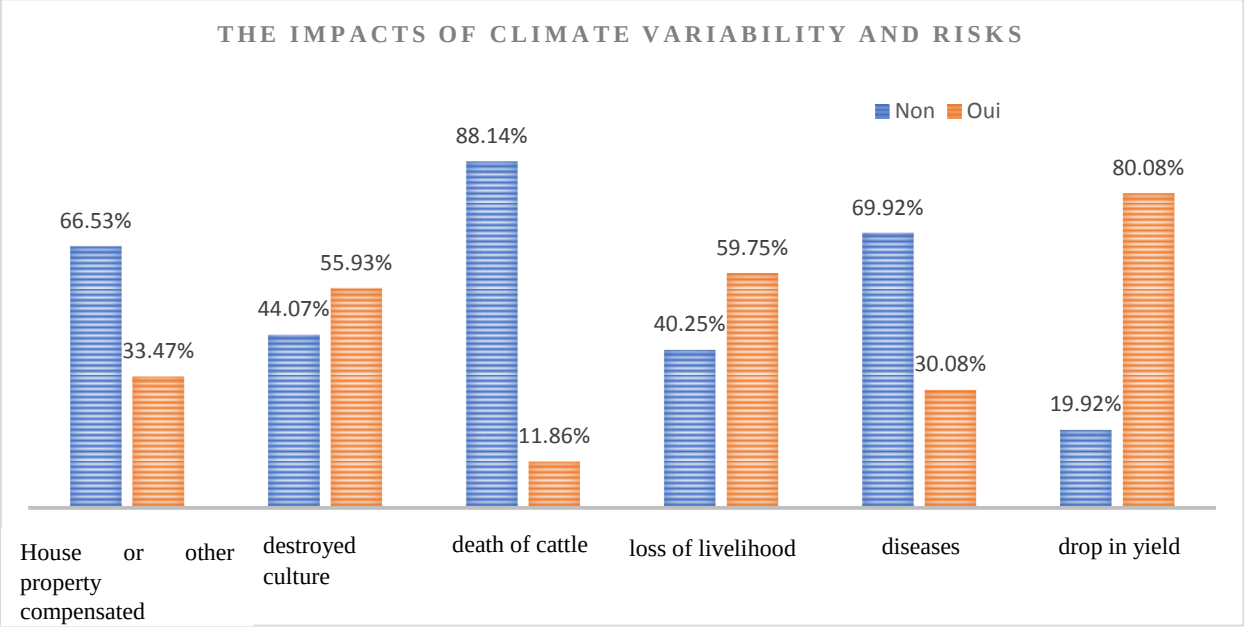


Source: Author

The analysis of Figure 3 shows that climate risks have enormous risks on production 79.24% with regard to climate risks linked to the modification of production and 75% with regard to climate risks relating to the modification of temperatures.

Figure 4 shows the impacts of the actors in the chain

Figure 4: Impacts of climate variability and risks on the living conditions of producer stakeholders.



Source: Author

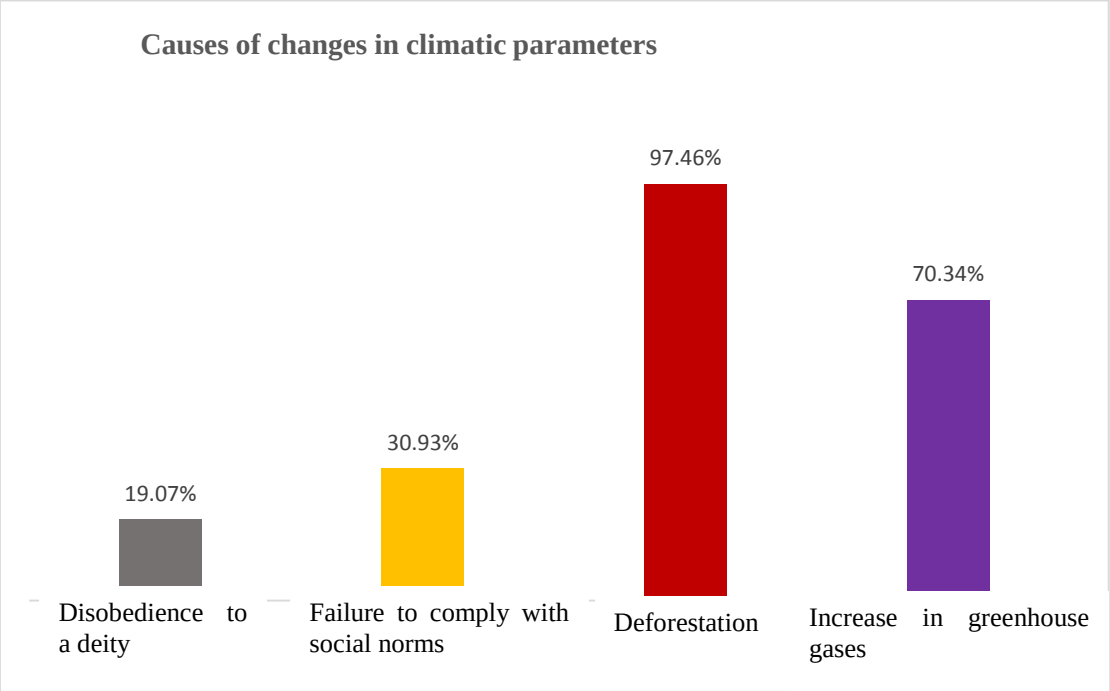
3.4 Perceived causes of the impact of climate variability and climate risks on pineapple cultivation by pineapple producers

The pineapple producers of the Allada plateau surveyed attribute the variability and climate risks to anthropogenic causes such as deforestation (97.46%), (19.07%) of pineapple producers think that the causes are related to the disobedience of the divinities, (30.93%) think that it is the non-compliance with social norms, while (70.34%) think that it is the increase in greenhouse gases. (Table 3). This study is similar to the findings of some authors who have reported that producers' perceptions of the causes of climate change are mainly focused on human factors (i.e. deforestation and greenhouse gases).

Table 3: Pineapple producers' perceptions of the causes of climate variability and risks

Variable causes	Frequency	Percentage (%) ± ET
Disobedience to a deity	45	19,07%
Failure to comply with social norms	73	30,93%
Deforestation	230	97,46%
Increase in greenhouse gases	166	70,34%

Figure 5: Causes of modification of climatic parameters according to the perception of actors in the pineapple value chain



Source: Author

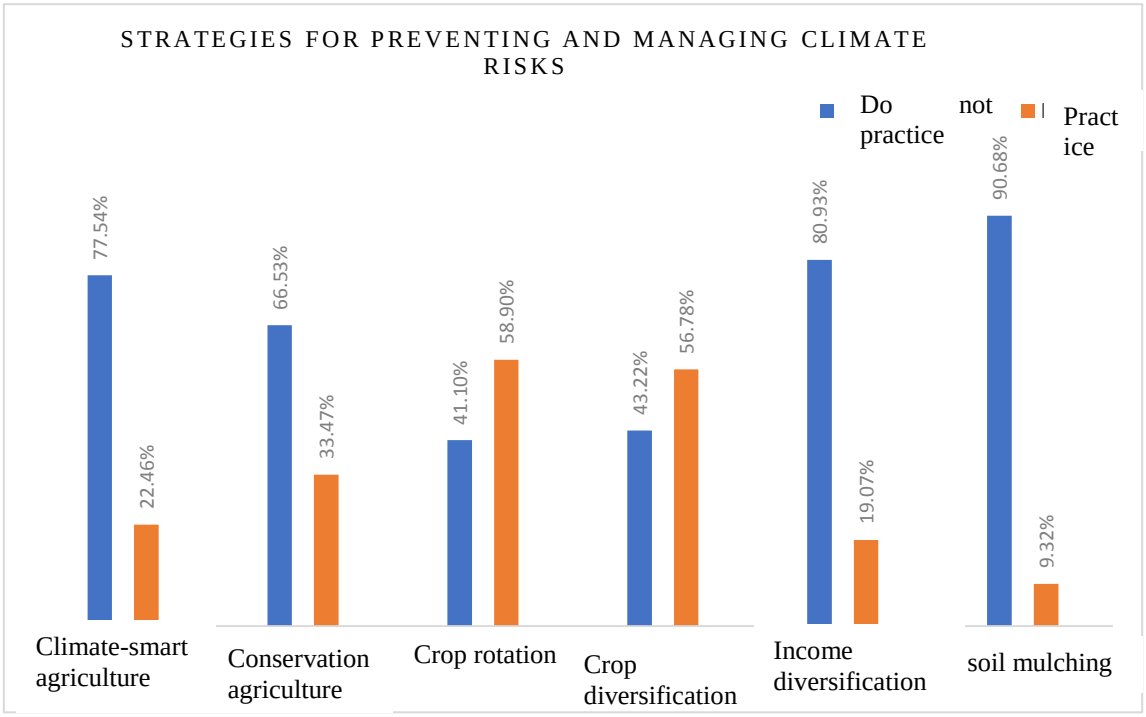
3.5 Strategies for preventing and managing climate risks for pineapple production on the Ananas Plateau

The results of this study show that there are several strategies for preventing and managing climate risks on the Allada plateau. These are smart agriculture, soil conservation agriculture, crop rotation, crop diversification, income diversification, soil mulching. According to the analysis of Figure 6.

22.46% of the actors in the pineapple production value chain practice smart agriculture against 77.54% who do not. 33.47% practice soil conservation agriculture compared to 66.55% who do not. Regarding crop rotation, 58.90% practice it against 41.10% who do not practice it.

19.07% practice crop diversification against 80.93% who do not practice it. 56.78% and 9.32% respectively practice income diversification and soil mulching against 43.22% and 90.68% who do not practice. From these analyses we note that the rate of practice of strategies for the prevention and management of climatic risks on the Allada plateau is lower than the rate of non-implementation of these strategies.

Figure 6: Strategies for preventing and managing climate risks



Source: Author

3.6 Information needs on climate variability and risks of actors in the pineapple production value chain

All pineapple producers agreed that they needed information on climate risk prevention and management strategies, as most of them also had needs for up-to-date and reliable information on weather (62.78%), climate risk-resistant crop management techniques (65.02%), and soil conservation practices (67.26%) (Figure 7).

Most producers want to understand the start and forecast of the end of rains (reliable and up-to-date weather information) (62.78%).

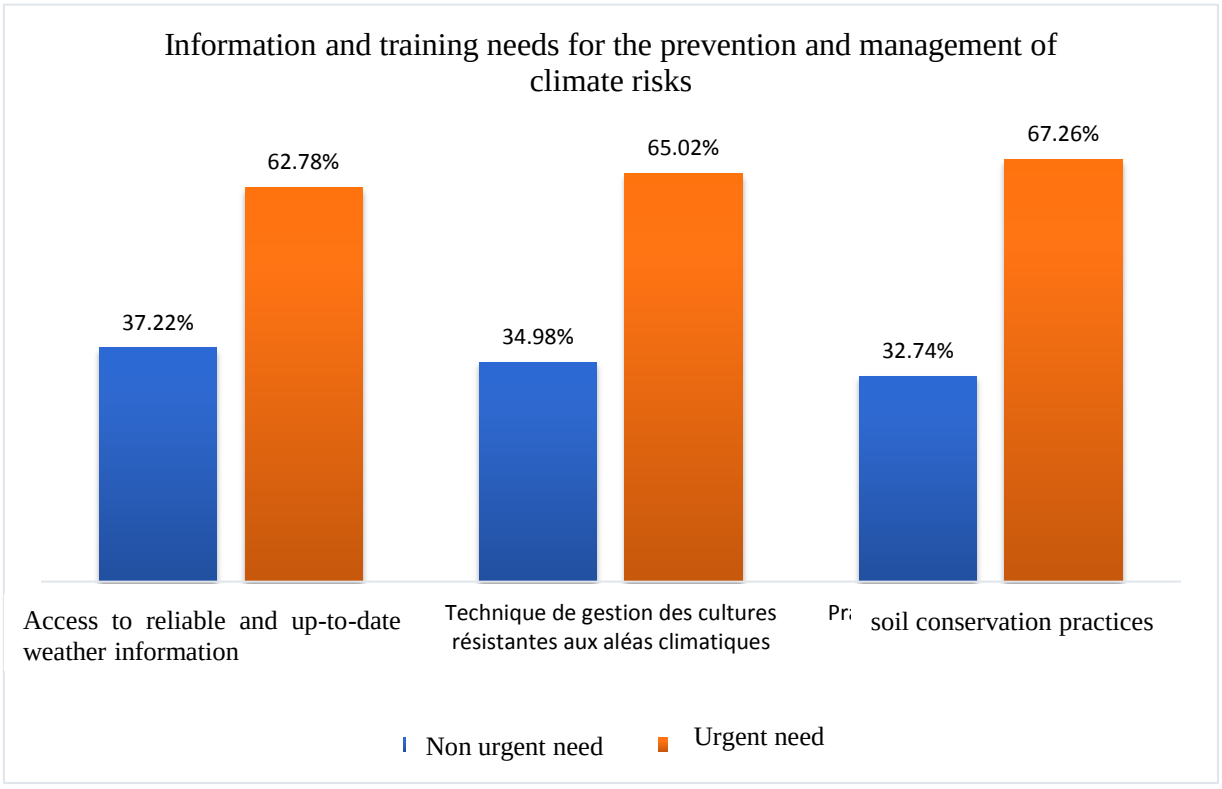


Figure 7: Information and training needs for the prevention and management of climate risks

3.7 Communication methods

Based on the information needed in Figure 4, pineapple farmers agree that they would prefer most of their information on climate variability and risks to be reported through the media (68.07%), others prefer to have indigenous knowledge about the local environment (18.07%) and others from fellow farmers (13.86%) (Table 4). According to them, they prefer that this warning information be communicated to them in their vernacular language.

Table 4: Method of communicating climate risks

Media	113	68,07%
Among fellow farmers	23	13,86%
Indigenous knowledge of the local environment	30	18,07%

Conclusion

This study revealed that actors in the pineapple production value chain are aware of the existence of climate variability and risks. Erratic weather conditions such as floods, droughts and increased temperature affect pineapple production and yield in the Allada Plateau.

Access to weather information should be timely and prioritized to assist pineapple producers in their decision-making processes regarding pineapple production, thus contributing to reducing the impacts of these climate risks through the implementation of strategies to prevent and manage these climate risks.

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