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ASSESSING CLIMATE CHANGE EFFECTS ON PLASTIC PRODUCT USE BY AGRO-MARKETERS AND HORTICULTURAL ENTERPRISES IN CALABAR AGRICULTURAL ZONE

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Abstract: This study assessed the impact of climate change on the use of plastic products among agro-marketers and horticultural enterprises in the Calabar Agricultural Zone of Cross River State, Nigeria. Primary data were collected from 200 respondents using a structured questionnaire, with a multistage sampling technique employed for selection. Findings indicate that climate change has influenced the socio-economic characteristics of respondents by increasing labor requirements (mean = 2.7), enhancing membership in professional and cooperative organizations (mean = 2.53), and improving awareness of plastic and climate change issues (mean = 2.47). At the enterprise level, climate change affected operations through increased payment of carbon emission taxes (mean = 2.94), higher costs of packaged goods due to restrictive plastic policies (mean = 2.92), and elevated release of harmful chemicals from plastic waste under higher temperatures (mean = 2.75). The study recommends enhancing climate change awareness among agro-marketers and horticulturists to mitigate adverse impacts on plastic-packaged products. Additionally, government agencies should monitor plastic production to minimize or eliminate hazardous chemicals that are susceptible to climate-induced degradation, thereby preserving product quality.

Keywords: Climate Change, Plastic Use, Agro-Marketers, Horticultural Enterprises, Environmental Impact

INTRODUCTION

Variability exist in the climate due to the impact of global warming. Unpredictability and adversity are persistent with the influence of climate change which creates a continuous rise in degree of wetness, coldness, warming and heating of the Environment which has altered life forms, activities, pre-meditated weather conditions and knowledge. This deviance from the normality of the fairness in the weather environment had unleashed several consequences on the entire pattern and nature of both biotic and abiotic factors of the environment. Agro-enterprises had profited from a friendly environment with limited input and environmental concerns. The emergence of plastic as an indispensable innovation has also bedeviled diverse agro-enterprises who are now confronted with adversity due to the use of plastic products. Different agroenterprises have benefited from the low cost, simplicity, transparency, durability, portability, light weight, flexibility, rigidity, and zero corrosion of

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plastic but at the same time a nonenvironmental friendly product due to its non-biodegradable properties, high level chemical pollution, disposal and sanitation problems, destruction and interference with wildlife and aquatic organisms and alteration of the ecosystem through emitted gases which leads to climate change (Giuliano, Rosa, Ileana, Giacomo, and Evelia, (2015).

Plastic use in horticulture and Agricultural markets have improved packaging of food, goods, input, storage for materials in both liquid, solid and semi-liquid forms, erosion control, safe handling, hygiene, quantification and fragmentation of harvested products, farm infrastructure and facilities (Sheeraz, and Sharma, 2021). Farm house facilities such as plastic roof, net, frames, windows and doors; and agro-market facilities such as; canopy/umbrella, table, chair, bucket, among others are some of the application of plastic products or materials in these enterprises which has improved the production efficiency of horticultural farmers and agro-marketers.

However, the superfluous accumulation of plastic materials on the environment has disrupted the production of soil nutrient, destroyed microbial life, caused hazardous pollution, and enhanced the release of methane gas, which leads to climate change (Karen, 2021). It has also become rampant with little or no disposal mechanism than incineration and recycling, hence it constitutes environmental litter, waste and pollution (Harrison and Santa, 2019; Lev, 2021). Thereby impacting horticultural and agro-market enterprises negatively which have adopted the use of plastic in their production, processing, storage, packaging and distribution processes.

The effect of climate change has also unveiled severe consequences against the socio-economic characteristics of agro-marketers and horticulturists. An increment of input, increase in the cost of production and storage, reduction of product shelf life, increase in the internal temperature of stored products which result to their degradation, and the environmental cost of waste disposal and public tax, are some of the challenges agro-marketers and horticulturists undergo while ensuring they continue in their business. In a bid to mitigate these effect, some positive skills have been attributed to enterprise operators which has improved their social economic status. They include; improvement in knowledge and awareness on climate change causes, issues and mitigation, enterprise owners have also joined cooperative organizations and associations where they can interact on best innovations or ideas to survive the consequences of global warming in order to improve their access to grants, resources, subsidy and social/industrial actions

For Agro-Marketing enterprises, different plastic products which are meant to be stored in a cold and dry temperature are affected by temperature extremes resulting from the effect of climate change on products. Most products are perishable and do not store well. On the contrary products that are used as hay or dried products are best stored in this hot atmospheric condition. The high level of unpredictability or variability in weather conditions due to climate change effect have increased the cost of packaging food to preserve them from spoilage due to unfavourable weather (Cristina, 2021). This additional cost is due to freezing or refrigeration of products. Different plastic policies from across the world have also affected the price, availability, utilization and production of plastic products which have also reduced plastic production in some countries; attract a higher price, tax on carbon emission and waste evacuation, and sanitation levy. These cost continue to rise and reduce business earnings of agro-marketers, thereby influencing their socio-economy negatively.

Climate change has impacted the horticultural enterprises in a number of ways. The excessive rise in temperature has affected the storage of inputs such as fertilizer not to store well. There is also a higher water input due to

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excessive dryness which has increase the cost of flower cultivation. The excessive and degrading nature of turbulent rains and high sun rate has reduced the strength of poly-bags, and plastic containers to last long as some begin to peel off, shred and flake. This also increases the cost of acquiring thicker plastic bags and container which can past longer in the nursery. The high level of water consumption is uneconomical especially in the dry season. This has also increased the number of purchase of flowers/seedlings to curb the rate of death and reseedling.

STATEMENT OF THE PROBLEM

Flexible and non-flexible plastic products have varied use in horticulture and agro-markets. Plastic bags and plastic containers have been widely adopted by various users but the effect of climate change has also affected the efficiency of plastic and stored products to impact negatively on the environment and on life forms (Etim, 2018). Researchers such as Kerri (2021) and UNEP (2021) have asserted that agricultural plastics are major contributors to climate change. Whereas other authors (Nyarko and Adu (2016); Michael and Williams (2015) have highlighted that plastic use in agriculture is highly beneficial. The occurrence of global warming has created a reverse trend for plastic usefulness which also affect stored products, enterprises, enterprise owners and the socioeconomic characteristic of farmers and marketers. They are many literatures on the effect of climate change in agriculture, little or nothing has been done on the impact of climate change on plastic users in agro-marketing and horticultural enterprises. This is the essence of the study which assesses climate change impact on the use of plastic products among agro-marketers and horticultural enterprises in Calabar Agricultural Zone of Cross River State.

OBJECTIVES OF THE STUDY

This study assesses climate change impact on the use of plastic products among Agro-marketers and horticultural enterprises in Calabar agricultural zone of cross river state. The objectives of the study were to;

1. examine climate change impact on the socioeconomic characteristics of respondents
2. determine the impact of climate change on agro-marketing
3. assess the impact of climate change on horticultural enterprises

MATERIALS AND METHODS

This study was conducted in the Calabar Agricultural Zone of Cross River State which consist of Akamkpa, Biase, Odukpani, Calabar South, Calabar Municipality, Bakassi and Akpabuyo. The study population is made up of the 447 registered Agro-market Enterprise and Horticultural Enterprises in the zone. The respondents are the owners of the 447 enterprises. The study adopts a multi-stage sampling technique. The First stage; was the purposive selection of 100 enterprises in each block in the southern agricultural zone of Cross River State. The second stage; was the simple random selection of 16 enterprises from Calabar Municipality, and 14 enterprises from the other blocks in the zone. This makes up the cell. The third stage; was the selection/sampling of the enterprise owners of the selected cells which makes up the farm family.

Primary data were collected by the use of a structured questionnaire which was administered by the researcher. Secondary data was collected by request from the Cross River State Ministry of Agriculture on the number of registered Agro-marketing enterprises and Horticultural enterprises in the zone. This also included publications, articles and journals. Data analysis adopted the descriptive research statistics which involves the use of simple

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percentages, the score of means and ranking to sort and code data for analysis/examination, interpretation and discussion.

Measurement of Variables

Objective 1: variables on the climate change impact on the socioeconomic characteristics of respondents were measured using a three point Likert type of Scale for; „Agree“ which is coded as 3, „Undecided“ coded as 2, and „Disagree“ coded as 1, and presented using mean score and ranking.

Objective 2: variables on the impact of climate change on agro-marketing were measured using a three point Likert type of Scale for; Agree“ = 3, „Undecided“ = 2, and „Disagree“ = 1, and presented using mean score and ranking.

Objective 3. Variable on impact of climate change on horticultural enterprises were measured on a three point Likert type of Scale for; Agree“ = 3, „Undecided“ = 2, and „Disagree“ = 1, and presented using mean score and ranking.

RESULTS AND DISCUSSION

A. climate change impact on the socioeconomic characteristics of respondents

Table 1 – Distribution of Respondents Based on the ratings of climate change impact on their Socioeconomic Characteristic

S/No.	Variables	Agree	Undecided	Disagree	Mean	Remark	Rank
1.	Enhances expansion of business	77	21	102	1.87	Insignificant	15 th
2.	Enhance enterprise ownership	76	12	112	1.82	Insignificant	17 th
3.	Leads to change of occupation/trade	124	10	66	2.29	Significant	7 th
4.	Enhances additional income	85	20	95	1.95	Insignificant	12 th
5.	Improves sources of income	66	34	100	1.83	Insignificant	16 th
6.	Increase physical stress factors	140	10	50	2.45	Significant	5 th
7.	Increases labour demand	170	0	30	2.7	Significant	1 st
8.	Increases the cost of input	120	15	65	2.27	Significant	8 th
9.	Improves value addition	68	24	108	1.8	Insignificant	18 th
10.	Improves knowledge through plastic and change awareness	139	16	45	2.47	Significant	3 rd
11.	Enhances membership in professional, cooperative, market or farm organization	152	3	45	2.53	Significant	2 nd
12.	Improves skill/experience	99	50	51	2.24	Significant	9 th
13.	Improves farming/marketing methods	95	49	56	2.19	Significant	10 th
14.	Improve my standard of living	59	70	71	1.94	Insignificant	13 th
15.	Improve my social status	49	40	111	1.69	Insignificant	20 th
16.	Improve my access to plastic inputs	43	67	90	1.76	Insignificant	19 th
17.	Positive change in attitude and personal development	120	21	59	2.30	Significant	6 th
18.	Enhance employment	44	92	64	1.9	Insignificant	14 th

19.	Increase my expenditure for packaging	98	43	59	2.19	Significant	10 th materials
20.	Cause health problems to my body	10	60	130	1.4	Insignificant	21 th
21.	Affect my environment with health hazard from waste	87	28	85	2.01	Significant	11 th

22. Makes cleaning difficult 142 8 50 2.46 Significant 4th

Table 1 represent the distribution of respondents based on the mean rating of climate change impact on their Socioeconomic Characteristic. Findings indicate significant impact of climate change on the socio-economic characteristic of both agro-marketers and horticulturists in the study area. They include; increases labour demand ($\bar{x} = 2.7$: rank 1st), enhances membership in professional, cooperative, market or farm organization ($\bar{x} = 2.53$: rank 2nd), improves knowledge through plastic and climate change awareness ($\bar{x} = 2.47$: rank 3rd), and makes cleaning difficult ($\bar{x} = 2.46$: rank 4th). Table 1 also reveal insignificant variables on the impact of climate change on respondent's socio-economic characteristics which implies that climate change does not; improves value addition ($\bar{x} = 1.8$: rank 18th), improve my access to plastic inputs ($\bar{x} = 1.76$: rank 19th), improve my social status ($\bar{x} = 1.69$: rank 20th) and cause health problems to my body ($\bar{x} = 1.4$: 21st).

Supporting the findings of this study, Agbola and Fayiga (2016), asserted that extreme climate conditions have caused flooding, extreme heat and drought which has led to the degradation of the soil resulting to poor yield and this may affect the farmer's livelihood by a reduction of income.

B. The Impact of Climate Change on Agro-marketing

Table 2. Mean rating of plastic users based on Climate change impact in agro-market enterprises

S/N	Variables	Agree	undecided	Disagree	Means	Remark	Ranking
1.	Reduce the shelf life of stored product	69	0	31	2.38	Significant	5th
2.	Increase the degradation of product quality	65	6	29	2.36	Significant	6th
3.	Increase cost of packaged goods due to unfavourable plastic policies	96	0	4	2.92	Significant	2nd
4.	Scarcity of plastic packages	29	12	59	1.7	Insignificant	10 th
5.	Increase the cost of waste evacuation in the market environment	67	0	33	2.34	Significant	7th
6.	Payment of Carbon emission tax	96	82	2	2.94	Significant	1st
7.	high consumption of water is not economical	69	8	23	2.46	Significant	4th
8.	Increase the release of harmful chemicals from	87	1	12	2.75	Significant	3rd

	plastic waste due to higher temperatures to the environment						
9.	Increase consumption of plastic packaged food	42	0	58	1.84	Insignificant	9th
10.	Causes business failure	69	0	31	2.38	Significant	5th
11.	Increases the leaching effect of plastic chemicals into stored products	62	0	38	2.24	Significant	8th
12.	Displacement and redundancy of old technology to climate change mitigation technology	69	0	31	2.38	Significant	5th
13.	Reduce business asset value	65	6	29	2.36	Significant	6th

Source: Field Survey, (2022).

Benchmark mean ≥ 2.0

Implies significant

Table 2 show the ratings of the means of respondents based on climate change impact in agro-market enterprises. Findings indicate that most variables were highly significant on the impact of climate change on Agro-marketing enterprises. There are; payment of Carbon emission tax ($\bar{x} = 2.94$), increase cost of packaged goods due to unfavourable plastic policies ($\bar{x} = 2.92$) and increase the release of harmful chemicals from plastic waste due to higher temperature to the environment ($\bar{x} = 2.75$). Other significant variables were that; high consumption of water is not economical ($\bar{x} = 2.46$), reduce the shelf life of stored products ($\bar{x} = 2.38$), increases the leaching effect of plastic chemicals into stored products ($\bar{x} = 2.38$),

Displacement and redundancy of old technology to climate change mitigation technology ($\bar{x} = 2.38$), increase the degradation of product quality ($\bar{x} = 2.36$), Reduce business asset value ($\bar{x} = 2.36$), increase the cost of waste evacuation in the market environment ($\bar{x} = 2.34$), increase the leaching effect of plastic chemical into stored products ($\bar{x} = 2.24$). Some variables were insignificant such as; increase consumption of plastic packaged food ($\bar{x} = 1.84$) and scarcity of plastic package ($\bar{x} = 1.7$). This implies that climate change has a significant impact in the agro-market enterprise which affect their income, environment and health.

The findings of this study correspond with the assertion of Wikipedia, (2021) that climate change affect agriculture both directly and indirectly with adverse outcomes which affect temperature, rainfall and climate extremes causing changes in the nutritional quality of some foods.

C. The Impact of Climate Change on Horticultural Enterprises

Table 3. Mean rating of plastic users based on Climate change impact in Horticultural enterprises

S/N	Variables	Agree	Undecided	Disagree	Means	Remark	Ranking
1.	Reduce the shelf life of stored product	78	5	17	2.61	Significant	2nd

2.	Increase the degradation of product quality	69	6	25	2.44	Significant	4th
3.	Increase cost of poly bags/ plastic flower pots due unfavourable plastic policies	46	12	42	2.04	Significant	7th
4.	Scarcity of plastic bags/container	20	10	70	1.5	Insignificant	11 th
5.	high utilization of water is not economical	82	2	16	2.66	Significant	1st
6.	Payment of Carbon emission tax	42	9	49	1.93	Insignificant	9th
7.	Reduction in the amount of work/hour in the garden/farm due to not weather	42	10	45	1.94	Insignificant	8th
8.	Increase the release of harmful chemicals from plastic waste due to higher temperatures to the environment	71	7	22	2.52	Significant	3rd
9.	Increase purchase of plastic flowering/ seedling for insurance or reseedling due to harsh weather	69	1	30	2.38	Significant	5th
10.	Displacement and redundancy of old technology to climate change mitigation technology	50	10	40	2.1	Significant	6th
11.	Increases the leaching effect of plastic chemicals into flower pots/soil.	32	10	58	1.74	Insignificant	10 th
12.	Causes business failure	78	5	17	2.61	Significant	2nd
13.	Reduce business asset value	46	12	42	2.04	Significant	7th

Results from the mean ratings of respondents on the impact of climate change on activities by horticultural enterprise owners in Table 1 indicate that climate change impact on horticultural activities include; high consumption of water is not economical ($\bar{x} = 2.66$), reduced the shelf life of stored products ($\bar{x} = 2.61$), causes business failure ($\bar{x} = 2.61$) increase the release of harmful chemicals from plastic waste due to higher temperatures to the environment ($\bar{x} = 2.52$) and increase the degradation of product quality ($\bar{x} = 2.44$). These ranked 1st, 2nd, 3rd, and 4th respectively. Some insignificant factors/variables on the impact of climate change on horticultural enterprise are; reduction in the amount of work in the garden/farm ($\bar{x} = 1.94$), payment of Carbon emission tax ($\bar{x} = 1.93$), increase the leaching effect of plastic chemicals into flower products ($\bar{x} = 1.74$) and scarcity of plastic bags/containers ($\bar{x} = 1.5$). This implies that respondents in horticultural enterprises do not pay charges on carbon emission and that the presence of climate change do not reduce the amount of work/hour in the garden/farm. The result on table 3 corresponds with the study of Karen (2021) that the superfluous accumulation of plastic materials on the environment has disrupted the production of soil nutrient and enhanced the release of methane gas which leads to climate change.

CONCLUSION AND RECOMMENDATION

Climate change has impacted agro-market enterprises and horticultural farms in the study area negatively, while also influencing the socio-economic characteristics both positively in terms of improvement in knowledge, skills, membership in professional or cooperative organizations and associations, while also impacting their income, input and labour negatively. It has also created an additional cost and input such as freezing, which comes with

fueling a generator which also comes with the purchase of a generator plant and refrigerator. This also increases the bills in terms of market tax and utility bills from the power holding company.

Recommendations advocated improvement in the level of climate change awareness on the use of plastic products for agro-marketers and horticulturists in the study area in order to improve the knowledge of respondents and help them reduce the severe impact of climate change on products in plastic packages. Also, that the production of plastic products be monitored by government agencies to ensure a total removal or lowest rate of incorporation of hazardous chemicals that are easily influenced by the climate to alter the quality of products in plastics. More research on heat resistant materials for coating on plastics which can reduce the amount of heat passage and alteration of product in package be carried out to support plastic use by agro-marketers and horticultural farmers.

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