

Impacts of Climate Change on Winter Vegetables and Misery of Peasants to Adapt for Livelihoods in Dinajpur, Bangladesh

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Abstract

The paper intends to present the findings of impacts of climate change, extend of vulnerability and tries to show the adaptive capabilities by identifying root causes of winter vegetables production. Simultaneously, it aims to discover the potential economic development by promoting earning opportunities among the indigenous and poor peasant communities of a remote district area of Bangladesh. This study also sets to depict how the rural poor farmers are being deprived from their rights of getting proper information and facilities available regarding adverse impacts of climate change on winter vegetable production. A questionnaire survey has been conducted based on comparative analysis on vegetable production data over two decades. The major findings of the study revealed that production of all the selected vegetables were profitable. However, recently farmers get abrupt suffering in vegetable production due to uneven seasonal pattern. The study reveals that based on the mode of problem prevailing on vegetables, peasants of the study area have applied different techniques in order to enhance production. Application of more fertilizers and insecticide are found to be a very common practice in their vegetable cultivation in modern time than a decade ago. Excess use of pesticide led to decline in taste of vegetables. The cost of vegetable production has been much more increased than any other time before which defiled the credit of increasing production rate. All these factors lead to increase suffering of the peasants. The study also exposed that the farmer communities are becoming financially poorer and finds it difficult to combat climate change issues with the negligible resources and technical knowledge that they have at present. It is found that 30 farmers among 120 show unwillingness to cultivate vegetables further due to less profit now in the study area.

Keywords: climate change, impacts, adaptation, vegetables, peasant.

Introduction

As a developing country, Bangladesh is adequately suffering in the problems of poverty, unemployment and malnutrition. Vegetable sub-sector playing an important role to solve these problems in the shortest possible time. Vegetables are an important component of human diet as they are the main source

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of nutrients and minerals. Nearly 100 different types of vegetables comprising both of local and foreign origins are grown in Bangladesh (Akter 2011). These are also good remunerative to the farmer as they fetch higher price in the market. Vegetables can be identified as a significant one for this economy for its noteworthy contribution in raising the foreign exchange earnings in Bangladesh. Vegetables contribute 3.2% of the agricultural Gross Domestic Product (BBS, 2009). Bangladesh earned US \$ 41.11 million from export of agricultural products in 2003-2004, which contributed 0.54% to total export earnings (BER, 2008). It creates a great opportunity of employment for the large number of unemployed people specially women of Bangladesh. There are a large number of vegetables having different varieties, which can be grown throughout the year. However, the largest numbers of vegetables are grown in the winter season. The northern part of Bangladesh is famous for cultivating winter vegetables for many years. However, recently this agricultural product faces much terrible in producing. Likewise other crops, they are also being hit by the consequences of climate change and irregular seasonal pattern. Late monsoon and extreme cold during winter cause big threat for vegetable cultivation which leads varieties of diseases. In Dinajpur district, the effect of severe snow fall found in December to February as it is nearer towards Himalay Mountain. Under changing climatic situations crop failures, shortage of yields, reduction in quality and increasing pest and disease problems are common and they render the vegetable cultivation unprofitable.

Hypothesis

Peasant of the study area are the worst victim of impact of climate change consequently a number of farmers tend to change their profession while a portion practiced to cope with using different tools.

Objectives: Major objectives of this study are mentioned below.

- (i) To know the impacts of climate change on winter vegetable production
- (ii) To indicate suffering faces by the farmers due to impacts of climate change
- (iii) Finding out the pattern of change of vegetable cultivation.
- (iv) Provide recommendations for taking adaptive measures to combat the impacts of climate change on vegetable production.

Area Selection

To assess the impact of climate change on winter vegetables and to depict the adaptive measures taken by the peasant to confront the impacts priority has been given in area selection where huge amount of winter vegetable are produced. At the same time, where serious damage is occurring in vegetable production due to climate change such as high humidity, extreme cold, heavy snow fall, frost, winter rainfall are considered. Considering these entire thing, three unions namely Rangaon, Morshidahat and Nafanagar of Bochanganj Upazila under Dinajpur district selected to conduct this research. This Upazila occupies an area of 224.79 sq.km. It is located between 25°40' and 25°54' north latitudes and between 88°23' and 88°32' ' east longitudes (Population Census Community report Dinajpur 2011 pp 39-40).

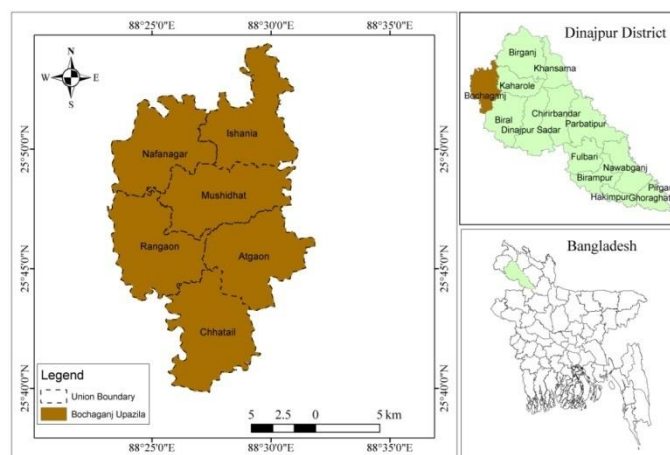


Fig. 1: Location Map of Study area- Bochaganj Upazila of Dinajpur District

Materials and Methods

This research is both qualitative and quantitative in nature. However, emphasis has been given on qualitative measures. A structured questionnaire survey has been conducted in the study area. Simultaneously, focus group discussion (FGD) and informal dialogue also arranged in the three villages of study area. In-depth interview was taken from the local farmers with open and closed question system to get idea about knowledge and practices of the farmers about impacts of climate change and adaptation measures they applied while vegetable cultivation. A total number of 120 questionnaires were completed from the selected farmers of the study area. Out of selected 120 respondents, 52.4% (63) were from Rangaon, 25.3% (30) from Murshidhat and 22.3% (27) from Nafanagar Union. Sample size was determined based on intensity of farmers engaged in winter vegetable production. Number of total household of three selected union is 14323 (BBS, Community report 2013).

Due to short of time and budget, it is not possible to cover all the numbers of households. For that reason, Yamane's mathematical formula has been followed to determine the sample size.

Taro Yamane's (1967: 886) formula:

$$n = \frac{N}{1 + Ne^2}$$

Where n = sample size, N = Total households = 14,323 and e = level of precision = 95%

$$\text{Therefore, the sample size, } n = \frac{14323}{1 + 14323 \times (0.05)^2} = \frac{14323}{1 + 93.7} = 387$$

Among this sample size 267 are covered by FGD and informal interview while rest 120 is covered by questionnaire survey.

Vegetables in Study Area

Farmers grow both summer and winter vegetables in the study area. Main winter vegetables are Potato, Brinjal, Radish, Arum, Lady's Finger, Cauliflower, Cabbage, Bean, Tomato, Patal, Gourd, Cucumber, Pumpkin, Knollkal-Turnip, Dhundal, Barbati, Carrot, Stem amaranth, Pea seed, Bitter guard and Red amaranth and Jute leaf. Besides, spices growth found in the

study area. The main spices include Turmeric, Ginger, Chilies, Onion, Garlic, and Coriander.

Table 1: Vegetable production rate and area of land used in cultivation at Dinajpur region

Vegetable item	2009		2010		2014	
	Area in hectare	Production in M.ton	Area in hectare	Production in M.ton	Area in hectare	Production in M.ton
Brinjal	970	5505	993	5778	923	5690
Potato	14696	110553	11047	1, 30,000	35757	614358
Palong Shak	401	2029	400	2009	381	1923
Cauliflower	645	5326	639	5501	627	4709
Cabbage	560	7135	530	7052	485	6695
Bean	633	2020	204	659	201	827
Tomato	3874	46000	2706	25911	2655	2902

Source: BBS 2013, District Statistics, Dinajpur

From the above figure it is seen that the amount of land used for vegetable cultivation and its production rate has been decreased in most of cases. Tomato was cultivated in 3874 hectare of land in 2009 and production amount was 46000 Metric ton while it was produced in 2706 hectare of land and production rate was 25911 M.ton in the next year. Moreover, the production rate of bean cultivation is decreasing gradually which was 2020 M. ton in 2009 and come down to 827 M. ton in 2014. Similarly, Cauliflower, Palong Shak, and Cabbage production rate are also decreasing. On the contrary, Potato and Tomato production rate is increasing which was 110553 M. ton in 2009 and reached 614358 M ton in 2014.

It indicates that, in spite of using modern technologies and more fertilizer in agriculture, vegetable production rate deteriorating in study area. Simultaneously, the volume of vegetable production land decreasing. On the other hand, cost of vegetable production increasing. The amount of using fertilizer and insecticide in agriculture increased much more than before. Farmers intend to use more chemical fertilizer than organic. A figure of using fertilizer vegetable production given below:

Table 2: Upazila wise use of chemical fertilizer in vegetable production at Dinajpur region during 2010-11(in metric ton)

Name of Upazila	UREA	TSP	MP	DAP	Others
Dinajpur Sadar	14100	4500	3834	2052	1317
Birampur	5569	1685	827	322	595
Ghoraghat	5394	1308	1277	536	2000
Kaharole	7629	7241	6499	56	1150
Birjol	13936	3246	2130	995	2167
Birgonj	15584	2249	2714	1243	1049
Khansama	6120	1135	972	76	668
Chibirbondor	11309	3600	2615	1300	1196
Bochagonj	6163	1530	1034	337	335
Fulbari	6824	1060	1483	1017	0
Nababgonj	9087	2332	1700	1916	200
Parbotipur	9829	5115	3587	2007	0
Hakimpur	3364	740	619	1215	319
Total	114908	35741	29291	13072	10996

Source: BBS 2013, District Statistics, Dinajpur

Results and Discussions

The consequences of the climate change badly hit the vegetable production. Under changing climatic situations crop failures, shortage of yields, reduction in quality and increasing pest and disease problems are common and they render the vegetable cultivation unprofitable.

The intensity of cold reached in highest and the lowest temperature recorded as 6.5 degree Celsius in 2009 at Dianjpur while humidity was recorded 77% (BBS 2013). Crop land, crop cultivation and crop yield were affected due to climatic change and changing of climate might pose a big and devastating threat to the production of winter crop in Dinajpur region.

The changing behavior of climate severely affected the crop, productive land and total process of production as a whole and that was the response of about 65% interviewees while 20% said moderate and 12.5% mentioned they have no idea regarding this issue.

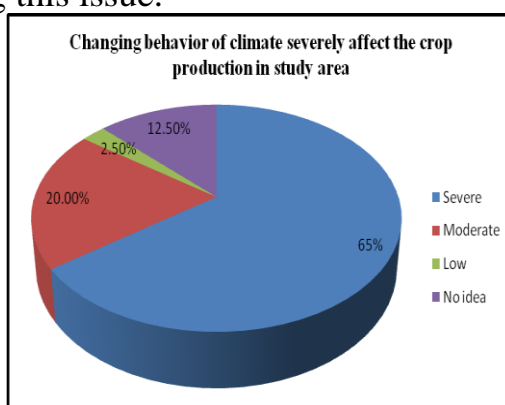


Figure 2: Respondents' comments on changing behavior of climate severely affect the crop production in study area

From the above figure it is observed that farmers of study area are aware enough to the changing pattern of climatic condition with a negative impact on their vegetable production. As 65% responded it has a severe while 20% replied moderate and 2.5% responded low impact on crop production.

Change in temperature affects the production of vegetables greatly and it is frequently occurred in study area. Sometimes winter brings unusual warmness and that was the opinion of 35% in every year. Respondents express that it is the most potential reason for loss of vegetable production.

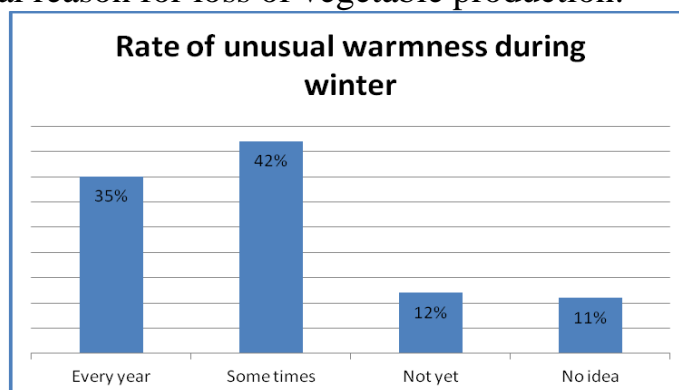


Figure 3: Respondents' comments on rate of unusual warmness during winter in study area

The above figure mentioned unusual warmness occurs during winter due to climate change. As 35% respondents replied it is occurred every year while 42% replied it occurs sometime of the year and 12% mentioned it never happened.

Changing of climate might pose a big and devastating threat to the production of vegetable. It is directly found in study area. In response of a question 58% respondents replied climate change poses a big threat for the cultivation of vegetable.

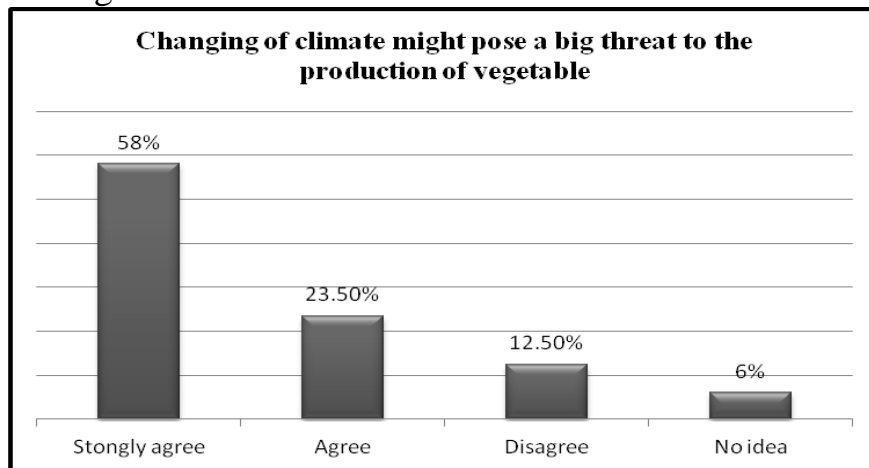


Figure 4: Respondents' comments on changing climate pose a big threat in the crop production in study area.

Form the above figure it is noticed that most of the peasant (58%) of study area are strongly agree with the fact that climate change is a threat for winter vegetable production while 12.5% are in against of this fact and 6% replied that they have no idea regarding the issue.

Adaptation Practices in Study area

Adaptation is a spontaneous way to cope up with changing situation for avoiding unexpected losses. There are different types of adaptation techniques. Some good adaptation practices are identified in vegetable cultivation against extreme cold, dew, frost, abrupt changing of temperature, and sudden rainfall in winter and drought. Thatching on seed bed is a popular adaptation practice found in study area to protect the tender plants during heavy snow fall. Straw are broadly used in making thatcher as it is easily available in rural area. Besides, use of polythene to cover the total seed bed is a fruitful method used by the local farmers. In addition, farmers applied canal encircled seed filed to irrigate easily. Thus, these canals are also used to drain excess water that comes during sudden rainfall. Moreover, farmers used net to protect their vegetable plants from foggy atmosphere. These are good instruments for farmers to cope with the effect of climate change. Homestead gardening is a widely accepted practice in study area and mainly managed by women. It ensures food security and additional income by enhancing livelihoods of poor people in the study area as it easy to take care. So, homestead gardening is considered as good adaptation practice and widely practiced in Rangaon, Nafanagar and Morshidahat Unions. Those farmers who use traditional method

and depend on nature for cultivation do not apply any adaptive method in vegetable cultivation. Different technique of adaptation to face the impact of climate change in study area is shown in following figure:

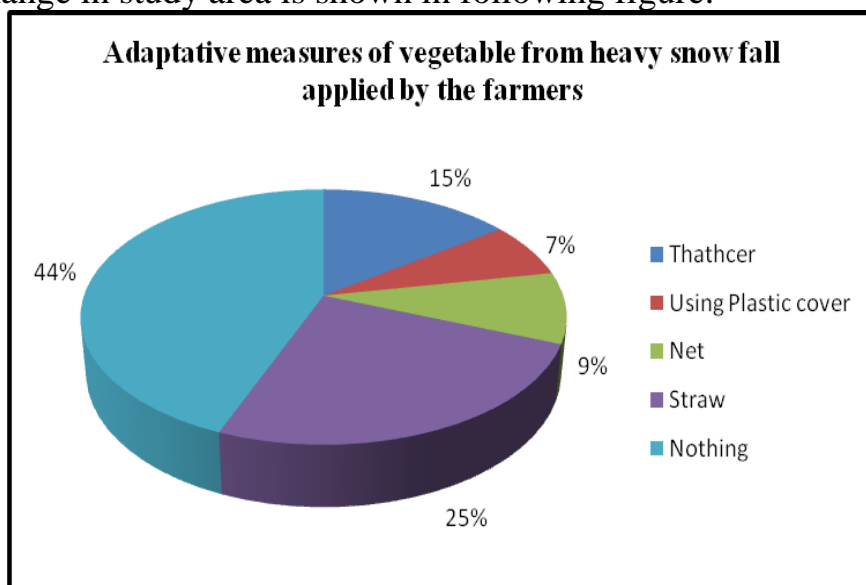


Figure 5: Percentage of respondents' comments on adaptive measures to protect vegetable from snow fall in study area.

The above figure indicates that farmers use several techniques as adaptive measures from the impact of climate change to their vegetable field. They use this method traditionally without having knowledge about climate change. But these techniques help them to adapt in changing climatic condition. During heavy snow fall, 25% farmers spread straw, 15% make thatcher, 7 % use plastic and 9% use net to cover the tender plants of vegetable in order to protect from heavy cold. However, a large portion (44%) of the farmers does not apply any adaptive measure.

Fertilizer Management

It is essential to take effective measures on fertilizer management to combat against impact of climate change. It is found that farmers of study area have little knowledge on effective fertilizer management. Rather, they tend to use more chemical fertilizer to prevent diseases. Research revealed that an increase of atmospheric carbon dioxide reduces the nitrogen uptake by plants or crops (Mazumder 2011). Moreover, fertilizer management is not same for irrigated agriculture and non-irrigated agriculture. Use of USG (Urea Super Granule) may use for rice but it is not suitable for vegetable. However, it is seen that farmers of study area use USG in their vegetable field. They emphasize on rapid grow of plants. But it defile the taste of vegetables even cause different types of disease after intake in human body. Moreover, it increases production cost of the farmers. On the other hand, use of organic manure has many positive sides. They are cheap, eco-friendly and increase water-holding capacity of the soil. Some common diseases and preventive measures taken by the farmers are given below:

Table 3: Disease and prevention measures practiced in vegetable cultivation by the peasant in study area

Name of disease	Cause of disease	Vegetable item	Treatment
Early blight, Late blight, Gangrene, leaf roll, moptop, rogoes mosaic, frog eye leaf spot, stem root rot,	Fungal, bacterial, nematode and phytoplasma	Potato, Tomato	Healthy seed, Thiram, Biofungicide Disease fruit should be plucked and burnt
Lead curl, leaf spot, Phomopsis blight	Viral and bacterial	Brinjal	Healthy seed, Crop rotation, Good drainage system, Diathane M 45
dieback, vegetable fruit fly, White rust	Bacterial	Palong Shak, amaranth, Red amaranth	Tilt, ridomil gold, native
Alternaria blight	Fungal and viral	Radish	Admire, Sumithion, Malathion
Rust of bean, Cercospora leaf spot	Fungal and viral	Bean	Prior to sowing, the seeds should be treated
Alternaria blight	Pythium and Phytophthora	Cabbage, cauliflower	Using Compost and Vermi compost.

Source: *Questionnaire survey and Upazila Agriculture Office, Bochaganj and Hossain 2010, Saydia, 2012*

The above figure showed farmers of study area experienced various types of diseases and they practice different preventive measures specially medicine available in market. Most of the diseases are caused by fungal, bacteria and virus. Some of the farmers communicate with agricultural office and block supervisor to get information about disease. Nowadays, farmers are trying to involve them with modern agriculture practice. Thus, they become habituated with seed management and integrated pest management.

Recommendations

Following recommendations can be placed to get rid of climate change impact in vegetable cultivation.

- Extreme cold tolerant seeds should be developed.
- Community Agriculture Clinic may be established to identify and control pest and disease attacks.
- Awareness raising program should be taken for building adaptive capacity and the implications of climate change amongst local level NGOs, agricultural extension officers, block supervisor of Department of Agricultural Extension (DAE), and farmers.
- Tender plants can be protected from a few light frosts with row covers or blankets.
- Ensure crop diversification emphasis on heat and cold tolerant varieties and cropping pattern.

- Seed banks can be established to ensure that varieties remain available.
- Introduce alternative income opportunities for the climate vulnerable peasant.
- Proper information about the climate change has to be provided to the people.
- Different social safety net programs (Relief, Food for work, Money for work, VGD, VGF, OMS, NS etc.) have to be started on the affected peasants of study areas.
- Soft loan among the affected people has to be distributed.
- Alternate livelihoods have to be introduced which will not be affected due to climate change.
- Govt. has to be patronized for further research in climate change, so that new knowledge can be easily implemented in future.

Conclusion

Climate change is one of the most serious threats to livelihood of farmers, with adverse impacts on their socio-economic condition. It is mostly evident in the developing countries and the marginal farmers are the worst victim of the impact of climate change. The climatic elements like temperature, pressure, precipitation etc. are changing day by day. This paper find out the realistic output along with climatic issues and agricultural vulnerability specially on vegetable production. It was observed that, unpredictably changes of seasonal patterns arise many problems and push the farmers in crisis to take decision regarding vegetable production. More specifically, rainfall discontinuation in summer and sudden precipitation during winter lead the cultivators falling in dilemma. Irregular characteristics of climate very often compelled the planter late starting their operation in field while timing is a key factor for good vegetable growth. One common problem is it leads easy attack of pest which is convenient to spread diseases to the plants. Heavy snowfall remains in December to February in the study area. This is the crucial time for vegetable cultivation. Sometimes foggy weather remains for days long and seed plants attack in many diseases; notably leaf curl, leaf spot, leaf roll and vegetable fruit fly. These affects of climate change also influence the pest and disease occurrences, host-pathogen interactions, distribution and ecology of insects, time of appearance, changes in profession and their overwintering capacity, there by becoming major setback to vegetable cultivation. Potato, among the all vegetables, is most vulnerable to climate change due to its exact climatic requirement for various physiological processes. Besides, amaranth and Palang Shak like all shortly perishable vegetables face esteem vulnerability due to climate change in study area. Thus, it can be said that Peasant of the study area are the worst victim of impact of climate change while a portion practiced to cope with using different tools which support the hypothesis of this research.

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