**Harmful Effects on Rice Production Due to Insects**

Article: September 27, 2023

Palash Mazumder

University of Barishal

Department of Economics

**Abstract**

The coastal area of Bangladesh is topographically liable to disaster where harmful insects dwelling a new depressing effect to coastal agriculture. The main objective of the present study was to explore the impacts of rice production due to insects and changing rice production in the coastal area of Barishal in Bangladesh. Primary data were collected through field observation survey, questionnaire survey . To conduct the field survey, around 25 respondents have been selected randomly from the coastal areas of Karfa and Uzirpur upazilla under Barishal district. The whole survey was conducted during winter seasons in the month of April, 2023. The present study was carried out through primary sources of data collection. Field observation survey were accomplished for collecting primary data. The questionnaires contained structured and close ended questions to collect the information through face to face interview from the respondents. Collected data were processed and analyzed by the help of excel sheet . The results revealed that about 85% of respondents have experienced harmful insects and its impact on their agriculture gradually from 45 years. Results also revealed that about 60% of respondents experienced severe intensity of major harmful insects due to cultivation. Furthermore, 15% respondents experienced little bit severity. Agricultural crops cultivation is changing from previous time due to the harmful insects events and decreasing crop production due to their hazardous effects. Almost 45% of respondents in the study area were not familiar with coping strategy in response to insects. They tried to adjust and cope with cultivation of short duration crops, introducing new variety and making embankment.

**Keywords**:, Agriculture, Harmful, Insects, Coastal Area, Disaster, Impact

**1. Introduction**

1.1 **Background of the Study**:

Agriculture is one of the significant contributing sectors to gross domestic product (GDP) of Bangladesh. In this sector, about 25,079,000 families out of a total of 27,600,704 families are occupied for their livelihood. Most of the people of the country are engaged in agriculture directly or indirectly. More specifically, in the agriculture sector of Bangladesh, 49.5% of the farmers are engaged. Growth of the agriculture based economy of Bangladesh mainly depends on the development of agricultural sector. In fiscal year 2022-2023 agriculture sector contributes 15.7% to the total GDP of the country. Although overall contribution of agriculture in GDP decreases over the present year, the absolute contribution is still rising. Moreover, they are incapable of finding new insects for their rice production. In addition, they do not know how to improve their rice production and increase of their rice production due to insects.

1.2 **Statement of the Problem:**

In Bangladesh, the total production of agriculture sector is 400.72 metric ton in the fiscal year 2022-23. Although total crop production exceeds the total national demand, farmers are not in a good condition from economic perspective as they are not getting good facilities to produce their rice production Due to lack of accurate knowledge. Even, they do not get minimum opportunity most of the time. Lack of information and properly monitoring systems are poor. Sometimes, when there is an absolute lack of adviser to finding the new insets in cultivation land. Rural farmers having limited resource and little knowledge about their cultivation this is why, they face many problems on rice production.

1.3 **Objective of the Study:**

The new insects that attack the agricultural land in the coastal region of Bangladesh should be found out by proper investigation and the right way to solve it should be found.2**. Literature Review**:

Plant Sci. (21 October 2021) suggested that proteins specifically expressed under elevated temperature could be the key candidates for elucidating the potential regulatory mechanism of warming on rice development and quality formation.

Cambridge University Press (27 April 2011) suggested that the predicted 2–4°C increment in temperature by the end of the 21st Century poses a threat to rice production. The impact of high temperatures at night is more devastating than day-time or mean daily temperatures. Booting and flowering are the stages most sensitive to high temperature, which may sometimes lead to complete sterility.

P. Krishnan, B. Ramakrishna, K. Raja Reddy and V.R. Reddy (2011) identified that high temperature is already one of the major environmental stresses limiting rice productivity, with relatively higher temperatures causing reductions in grain weight and quality. Developing high-temperature stress-tolerant rice cultivars has become a proposed alternative, but requires a thorough understanding of genetics, biochemical, and physiological processes for identifying and selecting traits, and enhancing tolerance mechanisms in rice cultivars. Fula Tao and Zhao Zhang (01 Mar 2013) results showed that across most cells in the study region, relative to 1961–90 levels, the rice yield would change on average by 7.5%–17.5% (from −10.4% to 3.0%), 0.0%–25.0% (from −26.7% to 2.1%), and from −10.0% to 25.0% (from −39.2% to −6.4%) during the 2020s, 2050s, and 2080s, respectively, in response to climate change, with (without) consideration of CO2 fertilization effects. The rice photosynthesis rate, biomass, and yield would increase as a result of increases in mean temperature, solar radiation, and CO2 concentration, although the rice development rate could accelerate particularly after the heading stage.

Yi-Chine Wu, Su-Jain & Hua-Shen (27 Feb 2016) identified that the threshold of high temperature damage in yield and appearance quality was 25–27 °C. Grain weight decreased about 2–6%, while the temperature of H15 was raised 1 °C above the thresholds. Perfect grain ratio and chalky grain ratio decreased and increased, respectively, while the temperature of H15 was raised above the thresholds. However, the high temperature in H15 affected the physicochemical characteristics. In addition, we found positive correlation between grain length to width ratio and perfect grain ratio. Grain length to width ratio could be an index of temperature effects for grain quality.

3.**Research Methodology**

3.1 **Study Area Selection:**

The sampling technique has been applied to select the study area. In the first stage, Barishal District has been selected from the total 64 Districts in Bangladesh. In the second stage, Uzirpur upazilla has been ramdomly selected from the total 10 upazilla in the Barishal District. There are 9 unions in Uzirpur upazilla such as Otra, Guthiya, Jalla, Bamrail, Borakotha, Shikarpur, Sholok, Satla, Harta. In the third stage, Jalla union has been previously selected as study area to collect from farmers. The village of karfa has been randomly selected for the study from the union.

3.2 **Sampling :**

In the study area, there are about 120 farmers engaged on rice production. 50 farmers are engaged in intolerance production for their family consumption. On the other hand, 90 farmers are engaged in production for commercial purpose. Among the population, 25 farmers have been selected randomly as sample. Data required for research have been collected from primary sources. Semi-structured interview and direct observation methods were employed for collecting primary data.

3.3 **Production Season and Selection:**

In Bangladesh, mainly there are three cropping seasons. These are Kharif-I, Kharif-II and Rabi. KharifI starts from March to June, Kharif-II covers July to October and the last one Rabi starts from November to February. For the study, Rabi season has been selected; and, rice production have been selected as the main crops in the study area.

3.4 **Data Analysis Techniques:**

All collected data have been analyzed to fulfill the objective of the study. Quantitative analyses are used in this context. Numerical data have been analyzed using quantitative statistical tools and perception data have been analyzed through applying qualitative analysis tools. In the next subsections, details of the data analysis techniques have been discussed. Software’s such Excel Sheet has been used to perform statistical analysis in the study. MS Word 2021 has been used to present this research work.

**4. Result and Discussion**

**4.1 Age of the Respondent** :

Table no.1 represent the farmer’s age. According to survey, there are 25 farmer’s age. We saw that different types of ages are used in the study for surveying the harmful effects on rice production due to insects. In the study area, most of the farmer’s age up to 51 years old and the lowest ages 35, but 41 to 45 and 51 to 55 are the same ages farmer in the study area. Table 1, it is found that the average age of the respondent farmers in the study area is around 48 years.

Table No. 1: Age of the Respondent

|  |  |  |
| --- | --- | --- |
| Range | Frequency | Percentage |
| 35-40 | 3 | 12 |
| 41-45 | 9 | 36 |
| 46-50 | 2 | 8 |
| 51-55 | 9 | 36 |
| 56-60 | 2 | 8 |
| Total | 25 | 100 |

Source: Field Work, 2023

The above table shows that among the 25 farmers, only 12% farmers are aged 35 to 40 years. 36% farmers are aged 41 to 45 years. 8% farmers are aged 46 to 50 years. 36% farmers are aged 51 to 55 years . And 8% farmers are aged 56 to 60 years. In this survey , 60 years old is the highest age and 35 years is the lowest age.

4.2 **Education Status of the Respondent :**

Table no 2 shows that the farmer’s education status . The study area , most of the farmer’s are illiterate and under SSC pass but there farming experience is very good. On the other hand, following the table no 2 , most of the farmer’s have completed their schooling life on an average up to class eight. Surveying the data collection, there are only 25 farmers have taken education to qualification. Surveying the data collection, there the highest educated farmers are 76% and the lowest educated farmers are 8%.

Table No. 2: Education of the Respondent

|  |  |  |
| --- | --- | --- |
| Range | *Frequency* | Percentage |
| 1 to 4 | 2 | 8 |
| 5 to 8 | 19 | 76 |
| 9 to 12 | 4 | 16 |
| Total | 25 | 100 |

Source: Field work, 2023

The above table 3, shows that among the farmers 25, 8% farmers are (1-4) class pass, 76% farmers are (5-8) class pass and 16% farmers are (9-12) class pass. It is noticeable that all farmers are under HSC pass.

4.3 **Experience (Year) of the Respondent:**

Table no 3, represent the farmer’s experience. There are only 25 farmers that have collected their farming experience in the study area. In the study area, most of the farmers have their experience in agriculture sectors. According to survey, the highest 52% farming experience as 15 to 20 years old and the lowest 4% farming experience as 31 to 35 years old. The average level of farming experience is 17 to 20 years old.

Table No. 3: Experience (Year) of the Respondent

|  |  |  |
| --- | --- | --- |
| Range | Frequency | Percentage |
| 15-20 | 13 | 52 |
| 21-25 | 3 | 12 |
| 26-30 | 8 | 32 |
| 31-35 | 1 | 4 |
| Total | 25 | 100 |

Source: Field Work, 2023

Form the survey data mentioned in table 3, it shows that 52% farming experience and their ages are 15 to 20 years. 12% farming experience and their ages are 21 to 25 years. 32% farming experience and their ages are 26 to 30 years. And the lowest 4% farming experience and their ages are 31 to 35 years old.

4.4 **Yearly Income of the Respondent :**

Table no 4 , represent the farmer’s yearly income . In table 4, shows that farmers per year earn on an average BDT 65000 . In this survey, mentioned in the table 4, 25 farmers and have collected their yearly income in the study area. According to survey , 13 farmers the highest yearly income earn as well as their earning income 52% . On the other hand, 4 farmer that is the lowest yearly income and their yearly income 16%.

Table No. 4: Yearly Income of the Respondent

|  |  |  |
| --- | --- | --- |
| Range | Frequency | Percentage |
| 50000-60000 | 4 | 16 |
| 60001-70000 | 13 | 52 |
| 70001-80000 | 8 | 32 |
| Total | 25 | 100 |

Source: Field Work, 2023

Form the survey data mentioned in table 4, it shows that 4 farmers are per year income BDT 50000 to 60000 as their 16%. On the other hand, 13 farmers per year earn BDT 60001 to 70000 as the 52% of the total and 8 farmers per year earn BDT 70001 to 80000 as the 32% of the total.

4.5 **Total Cost (BDT) of the Respondent**:

Table no 5, represent the farmer’s total farming cost. An essential part of farming is bearing of cost. So, every farmer must bear their essential cost. According to survey, there are 25 farmers and collected their total cost on rice productions in the study area. It is noticeable that most of the farmers bearing cost up to 10000 (BDT) and the highest cost of 22000 (BDT) for cultivation in the study area. According to survey, there is an average cost for cultivation up to 11700 (BDT).

Table No. 5: Total Cost (BDT) of the Respondent

|  |  |  |
| --- | --- | --- |
| Range | Frequency | Percentage |
| 10000-15000 | 7 | 28 |
| 15001-20000 | 15 | 60 |
| 20001-25000 | 3 | 12 |
| Total | 25 | 100 |

Source: Field Work, 2023

Form the survey data mentioned in table 5, it shows that 7 farmers are total cost (BDT) 10000 to 150000 that all cost of 28%. 15 farmers are total cots (BDT) 15001 TO 2000 that all cost of 60% . And 3 farmers are total cost (BDT) 20001 to 25000 that all cost of 12%. The highest cost of 60% and the lowest cost of 12% of the total bearing cost for the cultivation in the study area.

4.6 **Current Year (2023) Production (Mon) of the Respondent:**

Table no 6, represent the farmer’s total production in a current year (2023). We are collected data from 25 farmers in the study area about there rice production in a year. According to survey, most of the farmers produce there production up to 60 (mon) and the highest production is 135 (mon). To an average production of the 25 farmers are 90 (mon).

Table No. 6: Current Year Production (Mon) of the Respondent

|  |  |  |
| --- | --- | --- |
| Range | Frequency | Percentage |
| 60-80 | 8 | 32 |
| 81-100 | 6 | 24 |
| 101-120 | 3 | 12 |
| 121-140 | 8 | 32 |
| Total | 25 | 100 |

Source: Field Work, 2023

Form the survey data mentioned in table 6, it shows that 8 farmers are produced their production 60 to 80 (mon) and total of survey 32%. 6 farmers are produced their production 81 to 100 (mon) and total of survey 24%. 12% produced 3 farmers and 32% produced 8 farmers and they are produced 121 to 140 (mon). The highest production is 135 (mon) and the lowest production is 60 (mon) in the study area.

4.7  **Previous Year(2022) Production(Mon) of the Respondent :**

Table no 7, shows that the farmer’s previous year (2022) production in the study area. We are collected data from 25 farmers in the study area about there rice production in a year. According to survey, most of the farmers produce there production up to 70 (mon) and the highest production is 165 (mon) . To an average production of the 25 farmers are 120 (mon)

Table No. 7: Previous Year Production (Mon) of the Respondent:

|  |  |  |
| --- | --- | --- |
| Range | Frequency | Percentage |
| 70-90 | 2 | 8 |
| 91-110 | 8 | 32 |
| 111-130 | 7 | 28 |
| 131-150 | 4 | 16 |
| 151-170 | 4 | 16 |
| Total | 25 | 100 |

Source: Field Work, 2023

Form the survey data mentioned in table 7, it shows that 2 farmers are produced their production 70 to 90 (mon) and total of survey 8%. 8 farmers are produced their production 91 to 110 (mon) and total of survey 32%. 28% produced 7 farmers and 16 produced 4 farmers and they are produced 131 to 150 (mon) . The highest production is 165 (mon) and the lowest production is 70 (mon) in the study area.

**4.8** **Current Year (2023) Production Value (BDT**)**:**

Graph no 1, shows that the farmer’s current year (2023) production value. We are collected data from 25 farmers in the study area about there rice production value in a year. Graphically shows that the highest value of the product is 1120009(BDT) and the lowest value of the product is 54400 (BDT) in the study area, and the average production value is 85000(BDT).

Graph No. 1: Current Year Production Value (BDT)

Source: Field Work, 2023

The above graph no 1, vertically shows that the production value and horizontally shows that the farmers. We shows that the first farmer’s production value is 80000 (BDT) and the last farmer’s production value is 108000(BDT). To an average production value is 85000(BDT).

**4.9** **Previous Year (2022) Production Value (BDT):**

Graph no 2, shows that the farmer’s current year (2022) production value. We are collected data from 25 farmers in the study area about there rice production value in a previous year. Graphically shows that the highest value of the product is 124000(BDT) and the lowest value of the product is 60000(BDT) in the study area, and the average production value is 95000(BDT).

Graph No. 2: Previous Year Production Value (BDT)

Source: Field Work, 2023

The above graph no 2, vertically shows that the production value and horizontally shows that the farmers. We shows that the first farmer’s production value is 96000 (BDT) and the last farmer’s production value is 60000(BDT). To an average production value is 95000(BDT).

**4.10** **Total Loss (BDT) of the Respondent :**

Comparing the (2022, 2023) previous year and current year, we shows that the farmers are less produced in the current year than the previous year for harmful effects on the rice production due to insects in the study area. According to survey , 6 farmers are lost 1000 to 5000 (BDT) comparing the two years . 2 farmers are lost 5000 to 10000 (BDT), 11 farmers are lost 10001 to 15000 (BDT) and 5 farmers are lost 15001 to 20000 (BDT).

Table No. 8: Total Loss (BDT) of the Respondent

|  |  |  |
| --- | --- | --- |
| Range | Frequency | Percentage |
| 1000-5000 | 6 | 24 |
| 5001-10000 | 2 | 8 |
| 10001-15000 | 11 | 44 |
| 15001-20000 | 5 | 20 |
| 20001-25000 | 1 | 4 |
| Total | 25 | 100 |

Source: Field Work, 2023

Form the survey data mentioned in table 8, it shows that 6 farmers are lost their production 1000 to 5000 (BDT) and total of survey 24% . 2 farmers are lost their production 5001 to 10000 (BDT) and total of survey 8%. 44% are lost 11 farmers and 20% are lost 5 farmers and they are lost 15001 to 20000 (BDT). The highest lost is 22000 (BDT) and the lowest lost is 1000 (BDT) in the study area.

**5. Conclusion**

This study aims to find out the harmful effects on rice production due to insects and existing problems of cultivation-product in region of Karfa village of Barishal District in Bangladesh. Also, this study tries to measure on rice production Jall Upazilla. This study noticed that several farmers exist in the study region and show how they produce agriculture product to final consumers. Farmers produce several cultivation products, they do not get the proper information about their products. Most of the time they are ignor in serious issues. Satisfaction level of farmers on government purchase is moderate and its WMI is 3.04. Farmers are dissatisfied with the performance of finding new insets activities. Similarly, the farmers face some problems in agriculture-product, among which lack of proper monitoring about insets. Transportation is a vital problem of agriculture and its priority index is0.78.

**Acknowledgements**

At first researchers express their gratitude and thankfulness to Almighty God for giving the ability to conduct the study. Later, authors express thanks to the respondents of Karfa village for giving their time to provide necessary information. Special gratefulness goes to Dr. Apurba Roy, Assistant Professor, Department of Economics, University of Barishal, for his good suggestions. Lastly, cordial thanks go to parents, teachers, friends, and others for their kind encouragement, co-operation and suggestion regarding completion of the research work.

**References:**

1. Beriot, N. (2021). EUSO STACKEHOLDERS FORUM 19-21 October 2021.
2. Danner, Marion, et al. "Integrating patients' views into health technology assessment: Analytic hierarchy process (AHP) as a method to elicit patient preferences." *International journal of technology assessment in health care* 27.4 (2011): 369-375.
3. Dzehtsiarou, Kanstantsin, and Alan Greene. "Legitimacy and the future of the European Court of Human Rights: Critical perspectives from academia and practitioners." *German Law Journal* 12.10 (2011): 1707-1715.
4. Staniszewska, Sophie, et al. "The GRIPP checklist: strengthening the quality of patient and public involvement reporting in research." *International journal of technology assessment in health care* 27.4 (2011): 391-399.
5. Edwards, D. S., et al. "Campylobacteriosis outbreak associated with consumption of undercooked chicken liver pâté in the East of England, September 2011: identification of a dose–response risk." *Epidemiology & Infection* 142.2 (2014): 352-357.
6. Das, Smruti, et al. "Proteomic changes in rice leaves grown under open field high temperature stress conditions." *Molecular Biology Reports* 42 (2015): 1545-1558.
7. Lansigan, F. P., W. L. De Los Santos, and J. O. Coladilla. "Agronomic impacts of climate variability on rice production in the Philippines." *Agriculture, ecosystems & environment* 82.1-3 (2000): 129-137.
8. Ali, M. P., et al. "Rice production without insecticide in smallholder farmer's field." *Frontiers in environmental science* 5 (2017): 16.
9. Krishnan, P., et al. "Impact of elevated CO2 and temperature on rice yield and methods of adaptation as evaluated by crop simulation studies." *Agriculture, ecosystems & environment* 122.2 (2007): 233-242.
10. Krishnan, P., D. K. Swain, B. Chandra Bhaskar, S. K. Nayak, and R. N. Dash. "Impact of elevated CO2 and temperature on rice yield and methods of adaptation as evaluated by crop simulation studies." *Agriculture, ecosystems & environment* 122, no. 2 (2007): 233-242.
11. Nalley, Lawton, et al. "Economic and environmental impact of rice blast pathogen (Magnaporthe oryzae) alleviation in the United States." *PloS one* 11.12 (2016): e0167295.
12. Nalley, L., Tsiboe, F., Durand-Morat, A., Shew, A., & Thoma, G. (2016). Economic and environmental impact of rice blast pathogen (Magnaporthe oryzae) alleviation in the United States. *PloS one*, *11*(12), e0167295.
13. Nalley, Lawton, Francis Tsiboe, Alvaro Durand-Morat, Aaron Shew, and Greg Thoma. "Economic and environmental impact of rice blast pathogen (Magnaporthe oryzae) alleviation in the United States." *PloS one* 11, no. 12 (2016): e0167295.
14. Nalley, L., Tsiboe, F., Durand-Morat, A., Shew, A. and Thoma, G., 2016. Economic and environmental impact of rice blast pathogen (Magnaporthe oryzae) alleviation in the United States. *PloS one*, *11*(12), p.e0167295.
15. Nalley L, Tsiboe F, Durand-Morat A, Shew A, Thoma G. Economic and environmental impact of rice blast pathogen (Magnaporthe oryzae) alleviation in the United States. PloS one. 2016 Dec 1;11(12):e0167295.
16. Nalley, Lawton, et al. "Economic and environmental impact of rice blast pathogen (Magnaporthe oryzae) alleviation in the United States." *PloS one* 11.12 (2016): e0167295.
17. Nalley, L., Tsiboe, F., Durand-Morat, A., Shew, A., & Thoma, G. (2016). Economic and environmental impact of rice blast pathogen (Magnaporthe oryzae) alleviation in the United States. *PloS one*, *11*(12), e0167295
18. Nalley, Lawton, Francis Tsiboe, Alvaro Durand-Morat, Aaron Shew, and Greg Thoma. "Economic and environmental impact of rice blast pathogen (Magnaporthe oryzae) alleviation in the United States." *PloS one* 11, no. 12 (2016): e0167295.
19. Nalley, L., Tsiboe, F., Durand-Morat, A., Shew, A. and Thoma, G., 2016. Economic and environmental impact of rice blast pathogen (Magnaporthe oryzae) alleviation in the United States. *PloS one*, *11*(12), p.e0167295.
20. Huang, Jikun, et al. "Insect-resistant GM rice in farmers' fields: assessing productivity and health effects in China." *Science* 308.5722 (2005): 688-690.
21. Huang, J., Hu, R., Rozelle, S., & Pray, C. (2005). Insect-resistant GM rice in farmers' fields: as Huang J, Hu R, Rozelle S, Pray C. Insect-resistant GM rice in farmers' fields: assessing productivity and health effects in China. Science. 2005 Apr 29;308(5722):688-90.
22. Asessing productivity and health effects in China. *Science*, *308*(5722), 688-690.
23. Huang, Jikun, et al. "Insect-resistant GM rice in farmers' fields: assessing productivity and health effects in China." *Science* 308.5722 (2005): 688-690.
24. Huang, Jikun, Ruifa Hu, Scott Rozelle, and Carl Pray. "Insect-resistant GM rice in farmers' fields: assessing productivity and health effects in China." *Science* 308, no. 5722 (2005): 688-690.
25. Khan, Nasir Abbas, et al. "Mapping farmers’ vulnerability to climate change and its induced hazards: evidence from the rice-growing zones of Punjab, Pakistan." *Environmental Science and pollution research* 28 (2021): 4229-4244.
26. Khan, Nasir Abbas, Qijie Gao, Muhammad Abid, and Ashfaq Ahmad Shah. "Mapping farmers’ vulnerability to climate change and its induced hazards: evidence from the rice-growing zones of Punjab, Pakistan." *Environmental Science and pollution research* 28 (2021): 4229-4244.
27. Khan, N.A., Gao, Q., Abid, M. and Shah, A.A., 2021. Mapping farmers’ vulnerability to climate change and its induced hazards: evidence from the rice-growing zones of Punjab, Pakistan. *Environmental Science and pollution research*, *28*, pp.4229-4244.
28. Nguyen, Trung Thanh, and Manh Hung Do. "Shock, risk attitude and rice farming: Evidence from panel data for Thailand." *Environmental Challenges* 6 (2022): 100430.
29. Nguyen, Trung Thanh, and Manh Hung Do. "Shock, risk attitude and rice farming: Evidence from panel data for Thailand." *Environmental Challenges* 6 (2022): 100430.
30. Ministry of Finance (MoF), ‘People’s Republic of Bangladesh’, Bangladesh Economic Review, 65 (2011).
31. Uddin, M. ‘Assessing Long-term Impacts of Vulnerabilities on Crop Production Due to Climate Change in the Coastal Areas of Bangladesh’, (November) (2010).
32. Akanda, M. G. R. & Howlader, M. S. ‘Coastal farmers’ perception of climate change effects on agriculture at Galachipa upazila under Patuakhali district of Bangladesh’, Global journal of Bangladesh Bureau of Statistics (BBS), ‘Statistical Year Book of Bangladesh, Bureau of Statistics, Planning Division, Ministry of Planning’, Government of the Peoples’s Republic of Bangladesh (2012). science frontier research: D agriculture and veterinary, 15(4), 31-39 (2015)
33. Bangladesh Bureau of Statistics (BBS), ‘Statistical Year Book of Bangladesh, Bureau of Statistics, Planning Division, Ministry of Planning’, Government of the Peoples’s Republic of Bangladesh (2012)
34. Bangladesh Bureau of Statistics (BBS), ‘Statistical year book of Bangladesh. Bangladesh Bureau of Statistics, Ministry of Planning’, Government of Bangladesh, Dhaka, (2011).