

## CROP PRODUCTION FLUCTUATION AND AGRICULTURAL TRANSFORMATION: IMPACTS OF CONSTRUCTING A CLOSURE DAM

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**ABSTRACT:** A closure dam was constructed on Little Feni River at Musapur Union, Noakhali District by Bangladesh Water Development Board (BWDB) in 2016. The study assessed crop production fluctuations between pre and post period of the construction of this dam. Data were collected from Department of Agricultural Extension (DAE), Companiganj Upazila, and BWDB, Noakhali. Besides, an inception meeting was arranged at DAE with different participants for two consecutive days and three focused group discussions (FGD) from almost all stakeholders were done to triangulate the result. The trend was calculated by the data retrieved from 2011 to 2018 for the projection of the study. The result showed a revolutionary increasing trend for *Brassica juncea*, *Arachis hypogaea*, and *Allium sativum* with 1214%, 1400%, and 1600%, respectively. Followed by, the positive trend was showed for *Oryza sativa*, *Cajanus cajan*, *Pisum sativum*, *Capsicum annuum*, wintry vegetables and *Cucumis sativus* with 30.97%, 116.41%, 200%, 145.83%, 52%, 475%, respectively. And nearly stable trend was found for *Ipomoea batatas*, spices and *Lathyrus sativus* with a positive trend of 4%, negative trend of 7.59% and 8.86%, respectively. The study concluded that construction of closure dam might be greatly influenced in the high production rate of crops in the study area.

**KEY WORDS:** closure dam, production, trend line, coastal region, Little Feni River

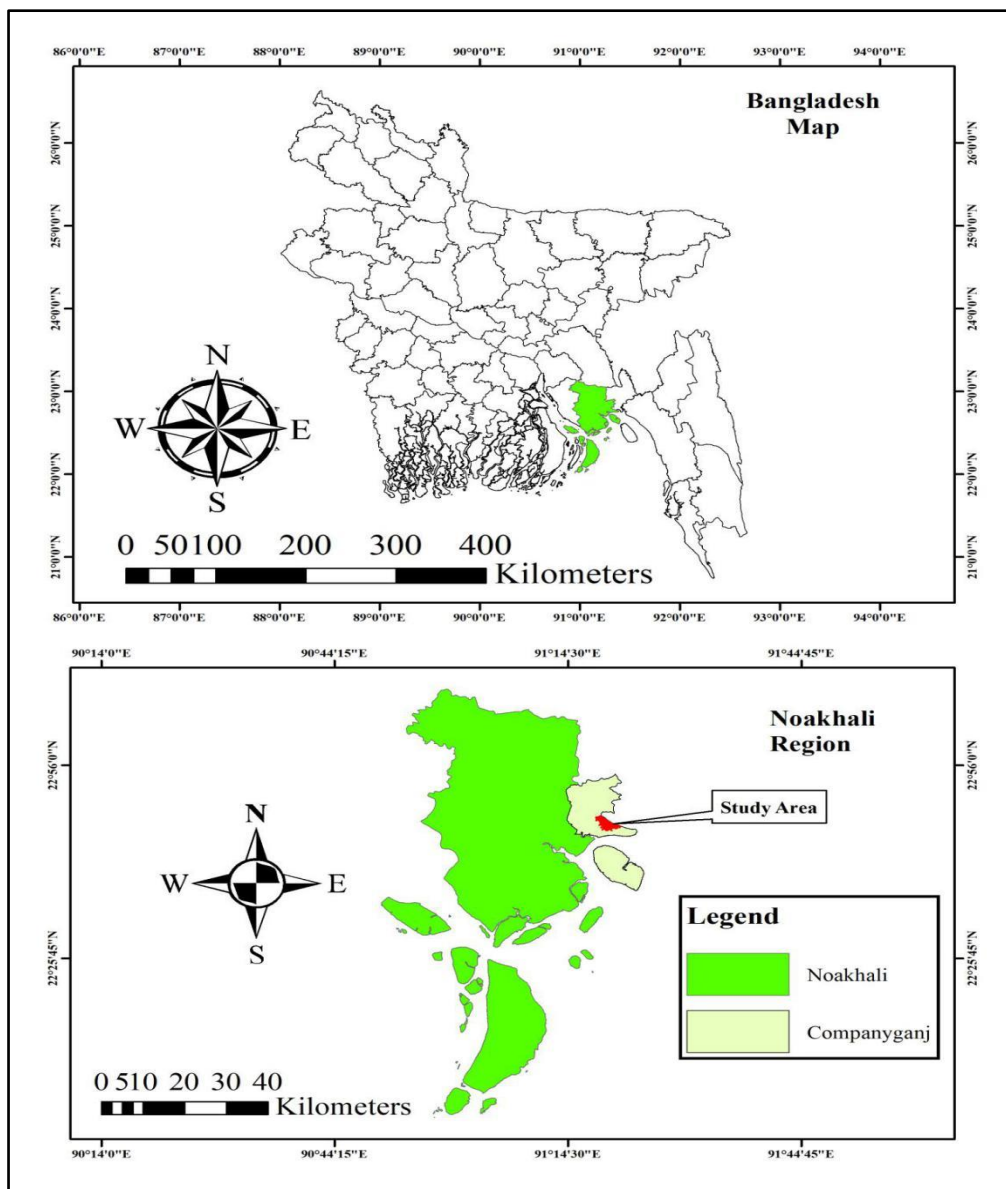
### 1. INTRODUCTION

Musapur Union of Noakhali District, a coastal region, supports agricultural doings by the Little Feni River. This river is a trans-boundary river running over the south-eastern part of Cumilla District near Gunabati Union and entered into the Noakhali District with a total catchment area of 8500 km<sup>2</sup> (Mehanaz and Aatur, 2018). Freshwater scarcity in dry season and salinity intrusion in the surrounding of the study areas make the cultivable land infertile and unsuitable for crop production that changes their livelihood security (Khan and Hossan, 2021; Khan et al. 2021a). In order to reduce saline water intrusion, a closure dam had been constructed on Little Feni River at Musapur region by Bangladesh Water Development Board (BWDB) with engaged a total of 6000 labours (Mehanaz and Aatur, 2018). The construction of this project started in fiscal year 2004-2005 and completed in June, 2016. After constructing the dam, it is assumed that massive landmass is reclaimed in the downstream of the Little Feni River, salinity intrusion of the arable land is reduced as well as partial irrigation facilities have been created in the river banks. After the construction of the closure dam, cropping intensity and crop yield have been fluctuated due to the availability of irrigation water, transforming agricultural crops, paddy to vegetables (Ashraf et al., 2007).

Noakhali District faced excessive threat due to extreme salinity intrusion in the agricultural land from many decades. The closer dam helps to advance the quality of cultivable land which can be accelerated to increase different crop productions. The salinity intensity might be decreased after the construction of this dam in the nearby land and currently, the land is being eligible for cultivating crops. Agrarian production has subsidized a valuable

portion of the countrywide GDP of Bangladesh (CCC, 2009). Most of the people of coastal community are reliant on agrarian farms of crops, fish, and livestock but excessive rainfall is unfavorable for cultivated agricultural production (Bauer, 2013). Khan and Hossan (2021) claimed 82% respondents lost their agricultural production due to excessive rainfall or water logging. For these reason, total production rate should be decreased and soil should be infertile (Khan et al. 2021b) for various crops. Mustard, ground nuts, garlicks, paddy, red gram, peas, wintry chillies, wintry vegetables, gherkins, sweet potato, spices and grass pea (scientific name were inserted in table 1) have been cultivated effectively from decades to century (Papademetriou and Dent, 2001).

Salinity impacted negatively on different crop production and cultivable land on a dominant scale (Alam et al. 2017). Salinity intrusion in the surrounding areas by the river and scarcity of fresh water in dry season makes the soil infertile (Dasgupta et al., 2015). Monsoon season for Bangladesh is advantageous for the tilling of crops because of slight salinity disturbance (Rashid and Islam, 2007). But in winter season the rate of salinity was increased, so, agricultural production has been negatively affected yearly in the coastal belt of Bangladesh (Clarke et al. 2015). It distresses crops based on the salinity concentration at plant or seedlings growth, decelerated the total production (Haque, 2006). This distressed is extended due to the reduction or absent of upstream fresh water flow to the downstream as well as ground water leaching and percolation (Bhowmick et al., 2016). The objectives of this studies were to assess the crop production status and agricultural transformation in Musapur Union, pre and post construction of the closure dam at Companygonj Upazila, Noakhali, Bangladesh.



**Figure 1.** Map of the study area (Base map retrieved from Local Government Engineering Department of Bangladesh)

## 2. METHODOLOGY

### 2.1. Study area

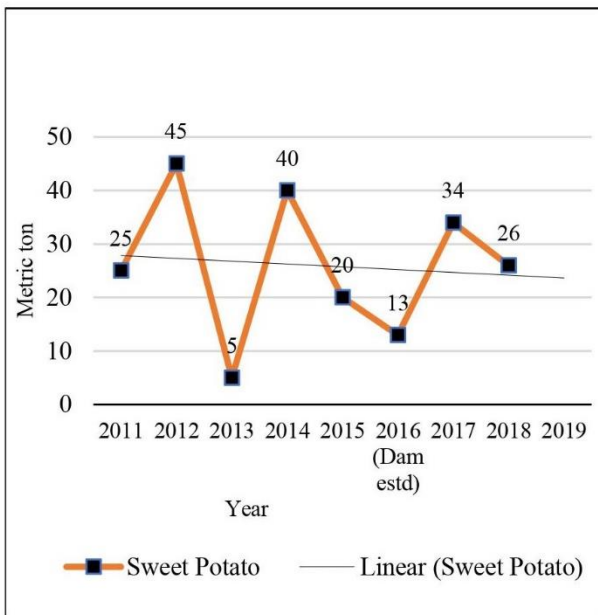
The study upazila consisted of 11 unions, Musapur Union of Companygonj Upazila of Noakhali District situated in South-eastern part of the Chattogram Division of Bangladesh. The study area map was shown in (Fig. 1) and lies between 22°46'11" - 22°46'59"N latitude and 91°20'09" - 91°21'22"E longitude. The total population of Companygonj Upazila was 183,351 (BBS, 2011). The livelihood and economy of this area are mainly based on agriculture.

### 2.2. Data collection

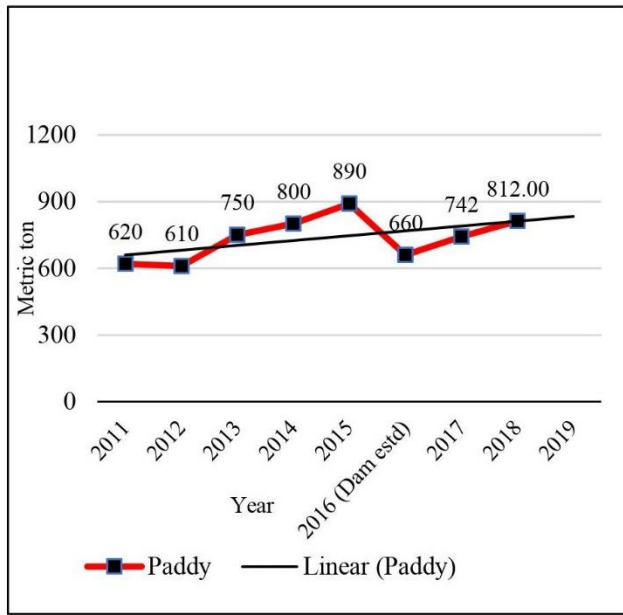
The fall in household consumption in Nigeria originates Data were collected from two different government organizations. The crop production data, between 2011 to 2018 was collected from the Department of Agricultural Extension (DAE) and information about the closure dam was collected from BWDB, respectively. Moreover, an

inception meeting was arranged at DAE in the study area for two consecutive days and three focused group discussions (FGD) with 9-11 participants from all stakeholders (government officials, local block supervisors, elected representatives and farmers) were done to triangulate the data collected from DAE.

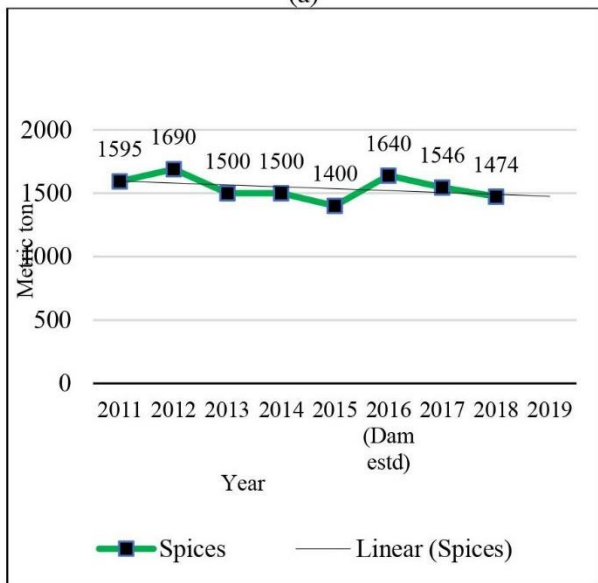
This survey was conducted to discuss the condition of agricultural production pre and post dam construction as well as the salinity intrusion and the possible impacts on crop yield of this union. Based on this meeting, the author was able to get a positive complement in this connection. Among the collected data from DAE only 12 selected items were considered to analyze the data. All the studied were done from Jun to July, 2019. MS excel was used to analyze the data and maps were produced through Arc GIS Software (version 10.2).



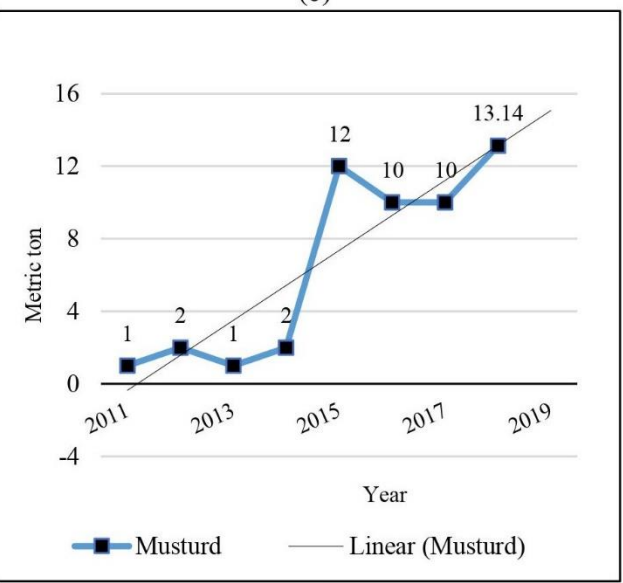
(a)



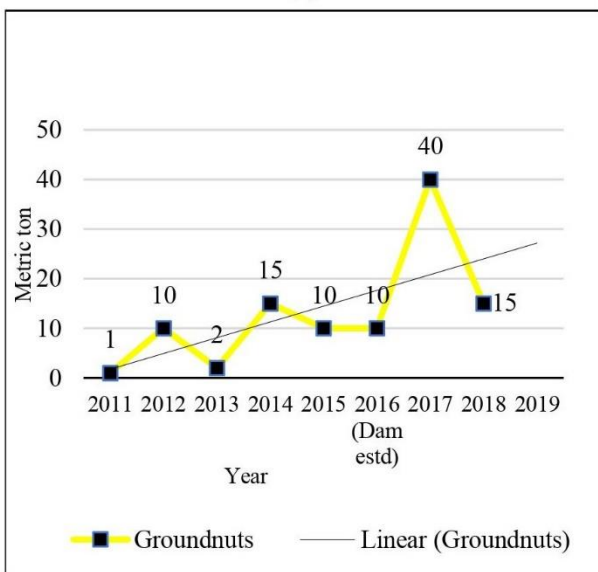
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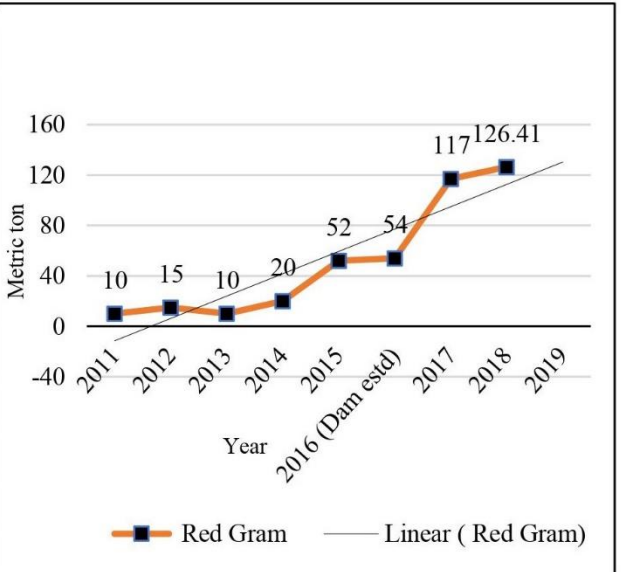
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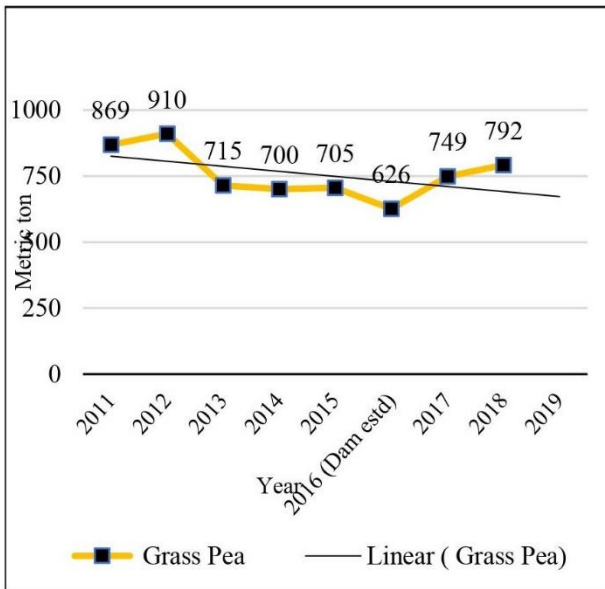
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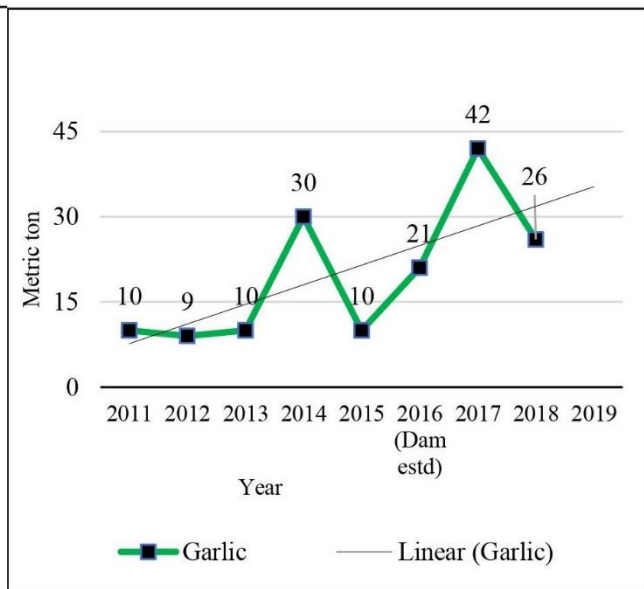
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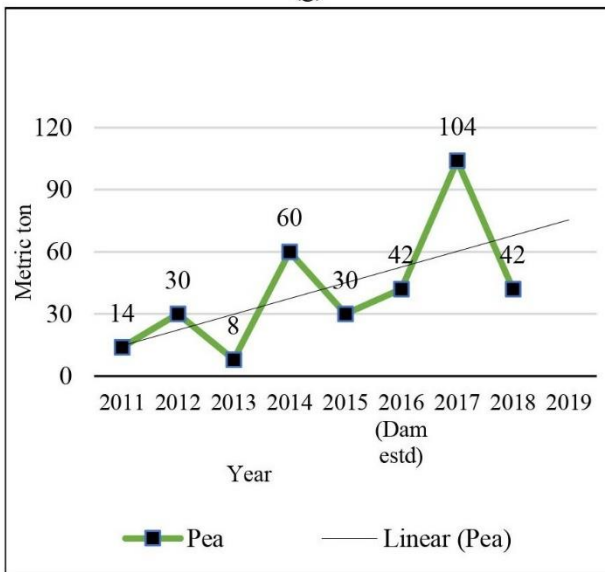
(f)



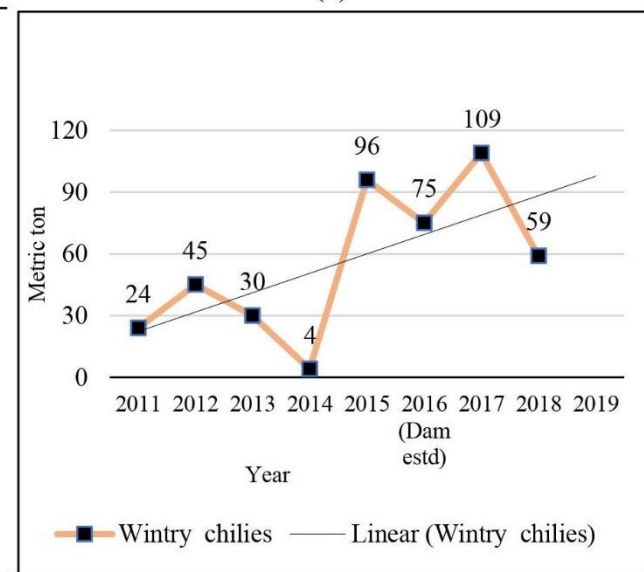
(g)



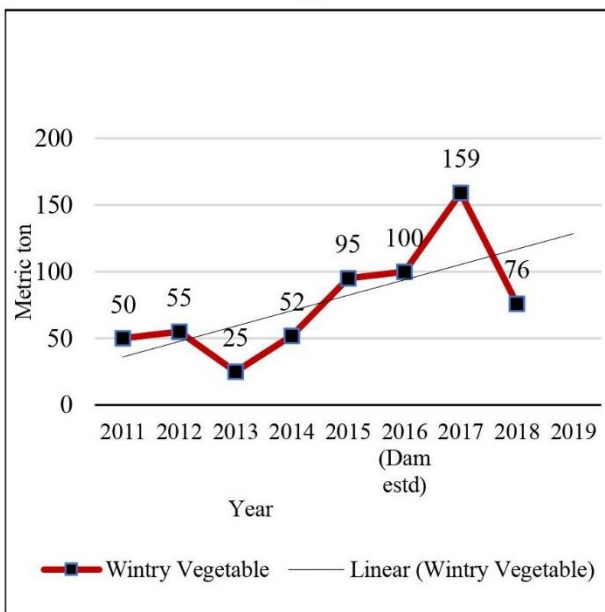
(h)



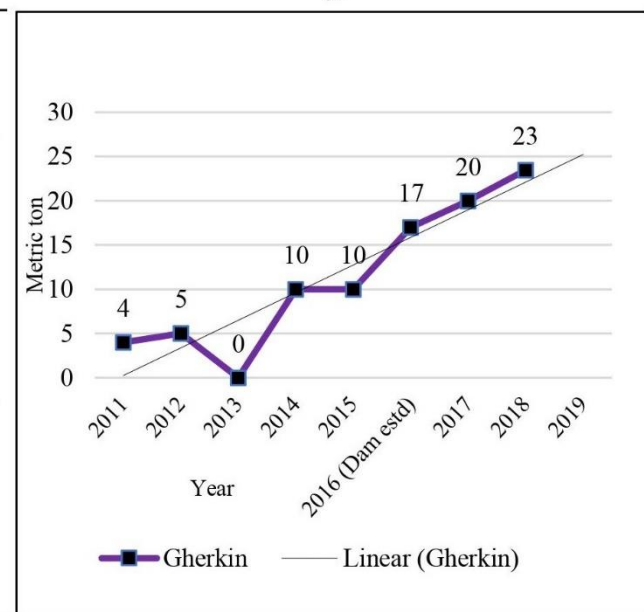
(i)



(j)



(k)



(l)

**Figure 2.** Trends of agricultural crop productions and estimated projection of (a) sweet potato, (b) paddy, (c) spices, (d) mustard, (e) red gram, (f) ground nuts, (g) grass pea, (h) garlic, (i) pea, (j) wintry chilies, (k) wintry vegetables and (l) gherkin.

### 3. RESULTS

The study result revealed that a high trend of fluctuation exists for the crop sweet potato and the projected line indicated a gentle reduction trend but cleared that an increased stages after the construction of closure dam in 2016 in respect with previous five years production showed in fig. 2(a). On the other hand, production of spices was a similar trend with gently reduction. The trends were discussed into three categories herewith.

**Table 1. Scientific name of the crops**

English/local name	Scientific name
Sweet potato	<i>Ipomoea batatas</i>
Paddy	<i>Oryza sativa</i>
Spices	*
Mustard	<i>Brassica juncea</i>
Red gram	<i>Cajanus cajan</i>
Ground nuts	<i>Arachis hypogaea</i>
Grass pea	<i>Lathyrus sativus</i>
Garlic	<i>Allium sativum</i>
Pea	<i>Pisum sativum</i>
Wintry chilies	<i>Capsicum annuum</i>
Wintry vegetables	*
Gherkin	<i>Cucumis sativus</i>

\*Represented the combination of various types of spices and winter vegetables.

#### 3.1. Revolutionary positive trend

The result showed a revolutionary increasing trend for mustard, ground nuts, and garlies (fig. 2d, 2e, 2h) with 1214%, 1400%, and 1600%, respectively, compared with production of 2011 to 2018. The estimated line remarked the positive revolutionary trend for these crops also. The study resulted that after the construction of closure dam soil salinity reduced and thus, the fellow land was cultivated and the crop production were highly increased. In some cases, the production fluctuated because there was a flash flood in respective year.

#### 3.2. Positive trend

The positive trend was showed for paddy, red gram, peas, wintry chilies, wintry vegetables and gherkins, (fig. 2b, 2f, 2i, 2j, 2k, 2l) with 30.97%, 116.41%, 200%, 145.83%, 52%, 475%, respectively, compared with production of 2011 to 2018. These also represented that the production rate was increased with gentle slope and it might be the result of changing the cropping pattern and agricultural transformation from paddy to red gram, peas, gherkins, wintry chilies, etc.

#### 3.3. Nearly stable trend

This type of trends was found for sweet potato, spices and grass pea (fig. 2a, 2c, 2g) with a positive trend of 4%, negative trend of 7.59% and 8.86%, respectively from 2011 to 2018. The resulted that projected trend showed the decreasing because of the previous data highly fluctuated one another. Before the construction of closure dam, these types of crops were produced highly but cultivable land were reduced, thus, the production rate was increased for these crops.

#### 3.4. Projection scenarios of different crops

**Sweet potato:** The agricultural crop sweet potato production data clearly indicated the fluctuated scenarios from 2011 to 2018. After construction of dam in 2017, the production was increased to 13 metric ton (Mt.) to 34 Mt. but following year, 2018 this amount was decreased.

**Paddy:** The production rate of paddy in 2016 (establishing period of dam) was decreased due to saline water intrusion after the next year (2017) the rate of paddy production increased and the trendline showed that the production rate will be increased in the successive year. The amount of paddy grown increased from 660 Mt. (2016) to 812 Mt. (2018).

**Spices:** The trend line analysis showed that the rate of spices production will be decreased for the soil fertility concern or reduced of total cultivable land. The estimated line provided a decreased trend in 2016 to 2018 from 1546 Mt. to 1474 Mt., respectively.

**Mustard:** The projected line depicted that the production of mustard will be increased in next year and the trend was revolutionary increased from 10 Mt. to 13.14 Mt. in 2016 to 2018. So, it is perceived that construction of the dam might have a great contribution in growing mustard.

**Groundnut:** Groundnut generally grows well in deep, well-drained soils with a sandy. After constructing the dam on the bank of the river, it was seen that the production rate of the groundnut was increased to 10 Mt. to 40 Mt. in 2016 to 2017 but the following year (2018) the production was decreased by 15 Mt due to natural calamity. The trend-line clearly showed that the production of groundnut will be increased next year.

**Red gram:** After constructing the dam on the bank of the river, the production rate of red gram was increased incredibly from 54 Mt. to 126.41 Mt. in 2016 to 2018. The projected line showed that the production of red gram will be increased tremendously in the future. So, construction of a dam has greatly influenced on the high production of red gram.

**Grass pea:** The production of grass pea was increased by 626 Mt. to 792 Mt. from 2016 to 2018, respectively and the trend line suggested the decreasing pattern of this crop.

**Garlic:** The total yield of garlic production was increased by 21 Mt. to 42 Mt. from 2016 to 2017 but the following year the production was decreased by 26 Mt. Even that, the trendline showed that the production of garlic will be increased in future.

**Pea:** The production rate of pea was increased from 42 Mt. to 104 Mt. in 2016 to 2017 but on a sudden fall to 42 Mt. in 2018 because of water logging and flash flood in the study area. Salam et al. (2019) claimed 50% agricultural crops would be reduced due to flood.

**Wintry chilies:** The production rate of wintry chilies was increased from 75 Mt. to 109 Mt. in 2016 to 2017 but on a sudden fall to 59 Mt. in 2018 because of early rainfall in the study area. Even that after the construction of closure dam the production rate was increased by 145.83% from 2011 to 2018.

**Wintry Vegetable:** It was increased from 100 Mt. to 159 Mt. in 2016 to 2017 but on a sudden fall to 76 Mt. in 2018 because of sudden flash flood in the study area but the trend line showed the positive scenarios in coming year.

**Gherkin:** It was also depicted that the rate of production of gherkin increased by 475% from 2011 to 2018. The projection line clearly showed that the production rate of gherkin will be increased in the future. The construction of a dam might be great influence on high production of gherkin.

### 4. CONCLUSIONS

The dam blessed for the inhabitants of Musapur Union because of the protection of salinity intrusion from Little Feni River and protected agricultural land from flood and controlling saline

water disturbance. After construction of the dam, crop intensities, crop yield and crop production were increased. However, the crop production rate was fluctuated and cultivable land was transformed from fellow land into cultivable land due to the construction of closure. The study finally revealed that mustard, garlic and ground nuts production rate will be revolutionary increased; paddy, red gram, peas, wintry chilies, wintry vegetables and gherkins will be positively increased; sweet potato, spices and grass pea will be on nearly stable trend in the upcoming years.

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