# A Seminar paper

# on

# Prospect of Spices Research in Bangladesh

**Course Title: Seminar**
**Course Code: HRT 598**

**Winter, 2017**

**SUBMITTED TO:**

| Course Instructors | Major Professor |
|---|---|
| **1. Prof. Dr. A. K. M. Aminul Islam**<br>**Department of GPB**<br>**BSMRAU, Gazipur**<br>**2. Dr. Md. Abdullahil Baki Bhuiyan**<br>**Assistant Professor**<br>**Department of Plant Pathology**<br>**BSMRAU, Gazipur** | **Dr. Md. Sanaullah Biswas**<br>**Associate Professor & Head**<br>**Department of Horticulture**<br>**BSMRAU, Gazipur** |

**SUBMITTED BY:**

**Lutfun Nahar**

**MS Student**

**Reg. No.: 16-11-4143**

**Department of Horticulture**

**BANGABANDHU SHEIKH MUJIBUR RAHMAN AGRICULTURAL UNIVERSITY**

**SALNA, GAZIPUR 1706**

## ABSTRACT

Agriculture in Bangladesh is at a stage where there is a need for research priority setting. Given the physical, financial and human resource base, there is a need for proper allocation of these resources for higher and sustainable growth in production and productivity. Spices are one of the important minor crop in Bangladesh. Every day we use huge amount spice in cooking and other purpose. It has high nutritive and medicinal value. Now a days the production of spice is increasing for its diversified importance. Different research organizations are involved to improve the production as well as quality of spice. But in our country there is limited high yielding variety to meet the national demand of spice. For this reason every year the government import high quantity of spice from other country. To overcome this problem we should emphasis on research on spice and develop high yielding and resistant variety and use modern techniques.

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# CHAPTER-1

# INTRODUCTION

Spices are very important crop as food and as medicine. Spices are commonly used for cooking and seasoning of foods. It also could be used to change the look of food to make it more attractive in colour. They are so important in ancient times and still today almost all people are habituated to use spices in curries and other food. They are known in different flavors and aroma. As medicine or food, the importance of spices cannot be over emphasized. Almost all curries are popular and tasty which are made from a combination of several spices.

Species are also used as natural food preservatives. Pharmaceutically they have been used to flavor medicines. Spices are a broad term used to describe herbal by-products that add flavor and aesthetic, aromatic and therapeutic treatments to food, drink and other items. (Kumar *et al.*2011).

Spices have some medicinal value such as turmeric is useful for reducing blood sugar, garlic is helpful for preserving memory and removing heart disease and ginger is well known for digestive property. Spices and condiments play quite an important role in the national economies of several spice-producing, importing and exporting countries of the world. Presently 109 kinds of spices are cultivated in the world but in Bangladesh we use only 27 and produce 17. On the basis of area, yield, demand and availability, spices are divided into three categories viz. major, minor and exotic. Major spices are regularly used in daily diet at large amount such as chilli, onion, garlic, turmeric and ginger(Islam et al. 2011).

In Bangladesh, the area under the spices cultivation is 3.96 lakh hectares with annual production of 24.88 lakh metric tons (BBS, 2016) and the annual demand of spices seeds are 30 lakh metric tons. Spices cover almost 2.60 percent of total cropped area in Bangladesh (BBS, 2016). In recent year, the production rate of major spices like onion, garlic, chilli, turmeric and ginger are 17.35, 3.82, 1.30, 1.40 and 0.77 lakh tons respectively (BBS, 2016). Now-a-days, spices are valuable trade commodities in the world. They are expensive but widely used. The average price of onion is 27180 taka/ton, garlic is 110910 taka/ton, chilli is 195990 taka/ton, ginger is 74490 taka/ton and turmeric is 275850 taka/ton (BBS, 2016).

The average area and production of spice are increasing in Bangladesh. However there are some reports we found that shrinkage of land resources there is a limited scope to increase production of spice (Noor et al. 2008).

Therefore, a proper statistic of production and consumption is not available. The gap between demand and supply is also increasing. it is true that a good quantity of spices is being imported every year to meet the huge demand of people of the country at the cost of foreign currency. The imported cost of onion is 19300 taka/ton, garlic is 163980 taka/ton and ginger is 64460 taka/ton (BBS, 2016).

Many research organizations are involved in research to improve the production and quality of spices. For the last two decades BARI developed and released 18 (major-12, minor-6) disease resistance improved variety of spices. On the other hand, 81 technologies on production, soil and water management; disease and insect management and post-harvest management have also been developed. BARI, BARC, DAE and NGO's have strengthened their works to extend these technologies (Islam et al. 2011). However, our national demand of spice consumption is much higher than production. Thus, considering the above I have fixed the following two objectives in this review.

## Objectives:

- To know the present status of spice research in Bangladesh.
- To identify the problem and opportunity of spices production in Bangladesh.

## CHAPTER-2

## MATERIALS AND METHODS

This seminar paper is exclusively a review paper so all of the information has been collected from the secondary sources. During preparation of this paper I collected key information from various relevant books, journals, proceedings, reports, publications etc. Findings related to my topic have been reviewed with the help of the library facilities of Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU) and I have also searched related internet web sites to collect information. I got valuable suggestion and information from my course instructors, my major professor and other resource personnel. After collecting all the available information, I myself compiled and prepared this seminar manuscript.

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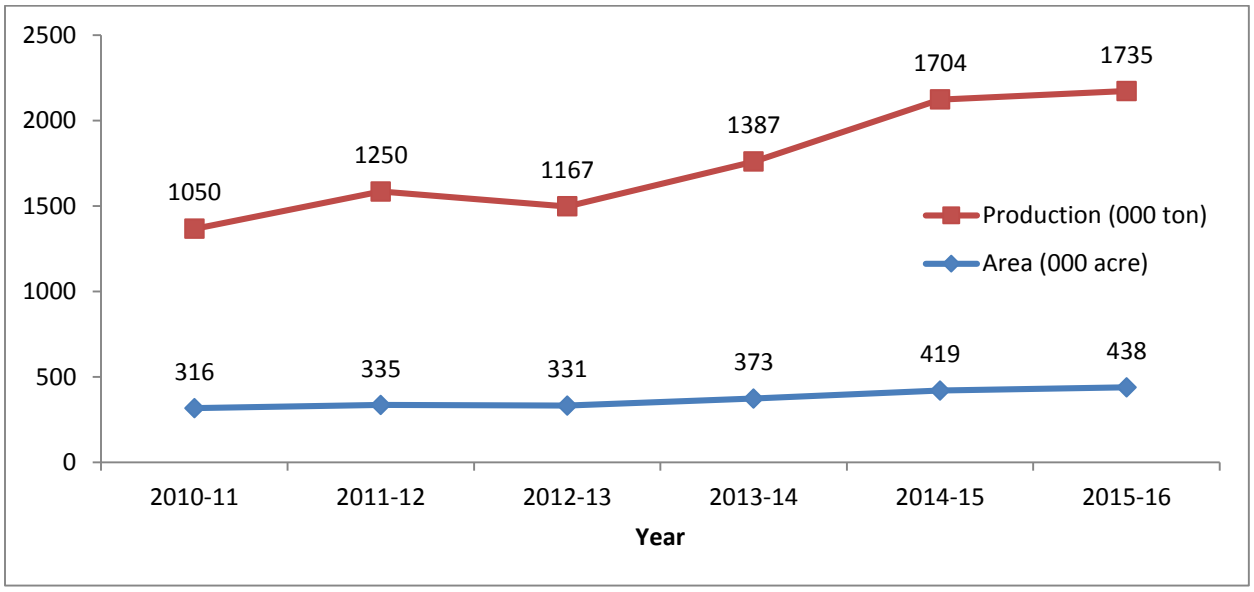
## CHAPTER-3

## REVIEW OF FINDINGS

### Onion

Onion (*Allium cepa*) is an important spice crop, commercially grown in many countries of the world. It ranks first in production among the spice crops cultivated in Bangladesh. The cultivation area for onion production is 439 thousand acre and annual production is 1735 thousand ton in 2015-16 (BBS 2016). It contains carbohydrate, vitamin C, vitamin B-6 and small amounts of calcium, iron, folate, magnesium, phosphorous, potassium and antioxidants quercetin and sulfur. Onion reduces the risk of several types of cancer and maintaining healthy skin. Though onion is a major spice in our country and we use this spice higher in amount than any other spices every day, we currently do not produce the proper quantity. Every year we have to import huge amount of onion from our neighbor countries to meet our local demand. The main reason behind this is that farmers use local variety which has poor yield. As a result, farmers loose interest to cultivate onion. As a result, the onion cultivable land is being replaced with rice cultivation land (Noor et al.2008).




Source: BBS(2014 and 2016)

**Figure 1: Area and production of onion cultivation in Bangladesh**.

From Fig.1we see that the onion production follows the trends of cultivation land shown over the years from 2010-11 to 2015-16.

## Present Status of onion research

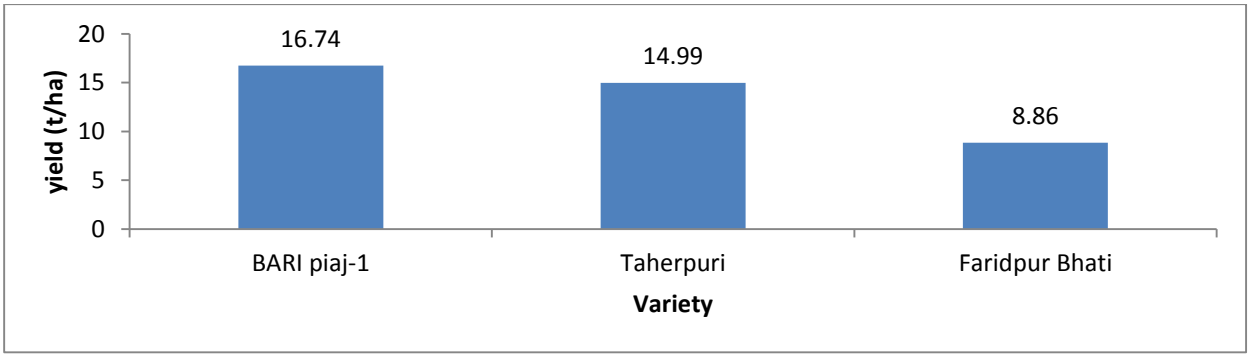
Many researches have been conducted for improving the quality and production of onion. Khan et al.(2003), conducted an experiment with different variety of onions to observed the effect of variety on growth and yield of onion. Three variety (BARI Piaj-1,Taherpuri and Faridpur Bhati) were used in this experiment. The plant height and bulb weight are influenced by high yielding variety. Among the three varieties, the BARI piaj-1 performs best than Taherpuri and FaridpurBhati.Table1 shows that the highest plant height (38.84 cm) and the highest bulb weight (20.84 g)was obtained from BARI piaj-1 and the lowest plant height (28.73 cm) and the lowest bulb weight (14.25 g) from Faridpur Bhati.

**Table 1: Plant highest and Bulb weight influenced by variety**

| Variety | Plant height (cm) | Bulb weight(g) |
|---|---|---|
| BARI piaj1 | 38.84 | 20.84 |
| Taherpuri | 36.20 | 18.44 |
| FaridpurBhati | 28.73 | 14.25 |

Source: (Khan et al. (2003)

Fig.2 shows that the highest yield (16.74 t/ha) was obtained from BARI piaj-1 and the lowest yield (8.86 t/ha) from Faridpur Bhati.It is also observed that the BARI piaj-1gives double yield than that of Faridpur Bhati.




Source: Khan et al. (2003)

**Figure 2: Varietal performance on the yield of onion**.

Sarker et al. (2017) conducted an experiment with different planting method on onion bulb production in Faridpur region. He used BARI piaj-1 as planting material and four treatment of planting method such as raised bed+ Spice Research Centre (SRC) recommended practice, raised bed+farmer's practice, flat method+SRC recommended practice, flat method+ farmer's practice.

In SRC recommended practice, seeds were sown in second week of November then the seedlings were transplanted in December last week, spacing used was 10cm × 10cm, irrigation was done properly, weeding was done four times at 15, 25, 45 and 60 DAT. Rovral and Ridomil Gold fungicide @ 0.5 g/l of water were used at 35, 45, 55 and 65 DAT and for controlling thrips, Reagent@ 0.5ml/l of water was sprayed 30, 40,50 and 60 DAT and fertilizer doses were applied at cow dung 5 ton/ha, N -120 kg/ha, P-54 kg/ha, K-75kg /haand S-20 kg/ha.In farmer's practice seeds were sown in last week of November in flat seed bed and seedling were transplanted in third week of January. Spacing used was 10cm × 7cm,irrigation and weeding were used 2-3 times. Fungicide Rovral were used at 5-7 days interval and insecticide were applied when insects appeared, and fertilizer was applied at N-46 kg/ha, P-45kg/ha, K-30kg/ha and S-16kg/ha.

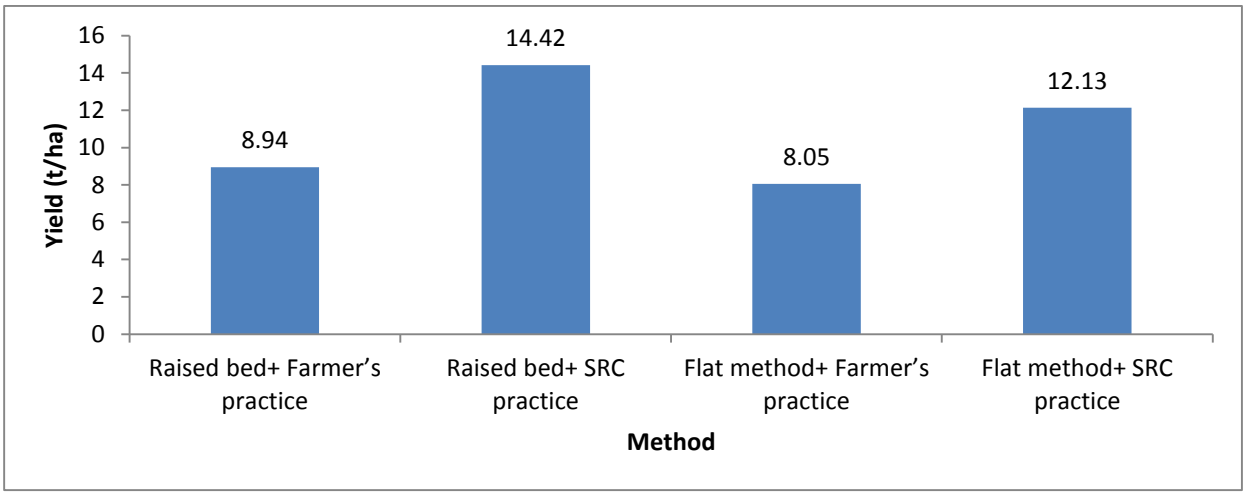
Table 2 showed that the highest plant height (45.07cm), number of leaves (6.68),individual bulb weight (23.58 g) and bulb diameter (3.65 mm)were obtained from Raised bed + SRC practice and the lowest plant height (34.67 cm), number of leaves (5.30), individual bulb weight (16.85g) and bulb diameter (2.91mm) obtained from Flat method+ Farmer's practice.

**Table 2. Effect of planting method on bulb yield contributing characters of onion bulb production**

| Treatments | Plant height (cm) | Number of leaves | Individual bulb weight (g) | Bulb diameter (mm) |
|---|---|---|---|---|
| Raised bed+ Farmer's practice | 37.07 c | 4.80 b | 18.92 b | 3.09 b |
| Raised bed+ SRC practice | 45.05 a | 6.68a | 23.58 a | 3.65 a |
| Flat method+ Farmer's practice | 34.67 c | 5.30 b | 16.85 c | 2.91 b |
| Flat method+ SRC practice | 41.18 b | 6.20 a | 20.21 b | 3.19 b |

Source: (Sarker et al, 2017)

In this experiment the highest yield (14.42 t/ha) was obtained from Raised bed + SRC practice and the lowest yield (8.05 t/ha) was obtained from Flat method+ Farmer's practice (Fig. 3).




Source: (Sarker et al, 2017)

**Figure 3: Effect of planting method on bulb yield of onion.**

Another experiment was conducted by Mollah et al. (2015) at On-Farm Research Division, Bangladesh Agricultural Research Institute(BARI), Bogra. From this experiment they observed the effect of organic manure on seed yield of onion. In this experiment, BARI piaj-1 variety and six treatments such as T1= only inorganic fertilizer recommended by SRC (Urea, TSP, MoP, Gypsum, Zincoxide and Boric acid @ 250, 275, 150, 110, 3 and 5 kg/ha, respectively, Anonymous,2010), T2= T1 + Cowdungmanure7.5 t/ha,T3= T1 + Poultry manure 5 t/ha, T4= T1 + Mustard oil cake 5 t/ha, T5= T1 + Dhaincha 5 t/ha andT6=Control (no manures and fertilizers application).

Fig. 4 shows that the highest diameter of umbel (6.89 cm) was obtained from T2 treatment and the lowest umbel diameter (3.66 cm) was obtained from T6 treatment.

T1=Inorganic fertilizer
Umbel diameter 5.58 cm

T2= T1+cowdung 7.5t/ha
Umbel diameter 6.89 cm

T3=T1+poultry manure5t/ha
Umbel diameter 6.56 cm

T4=T1+Musatrd oil cake 5t/ha
Umble diameter 6.48 cm

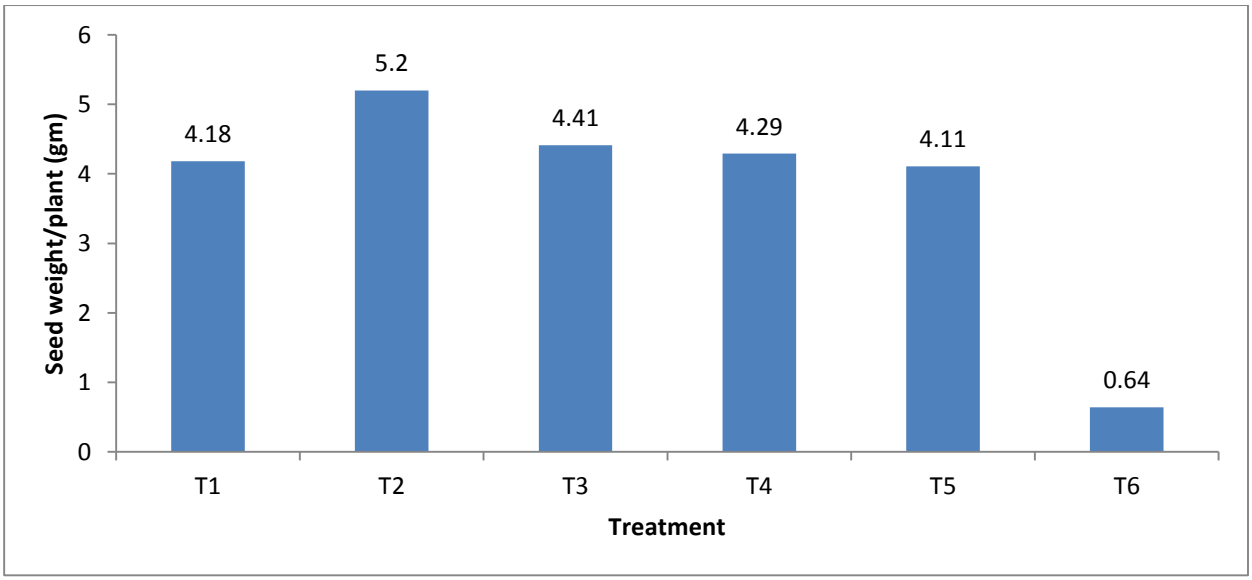
T5=T1+Dhaincha 5 t/ha
Umble diameter 6.05 cm

T6=control (no fertilizer)
Umble diameter 3.66 cm

Source: Mollah et al.(2015)

**Figure 4: Effect of organic manure on umble diameter of onion.**

Seed is very important for onion production and the weight of seed can also influence the quantity of yield. Organic manure influences the seed weight. Fig. 5 shows that the highest seed weight/plant (5.2g) was obtained from T2 treatment and the lowest seed weight/plant (0.64g) was obtained from T6.

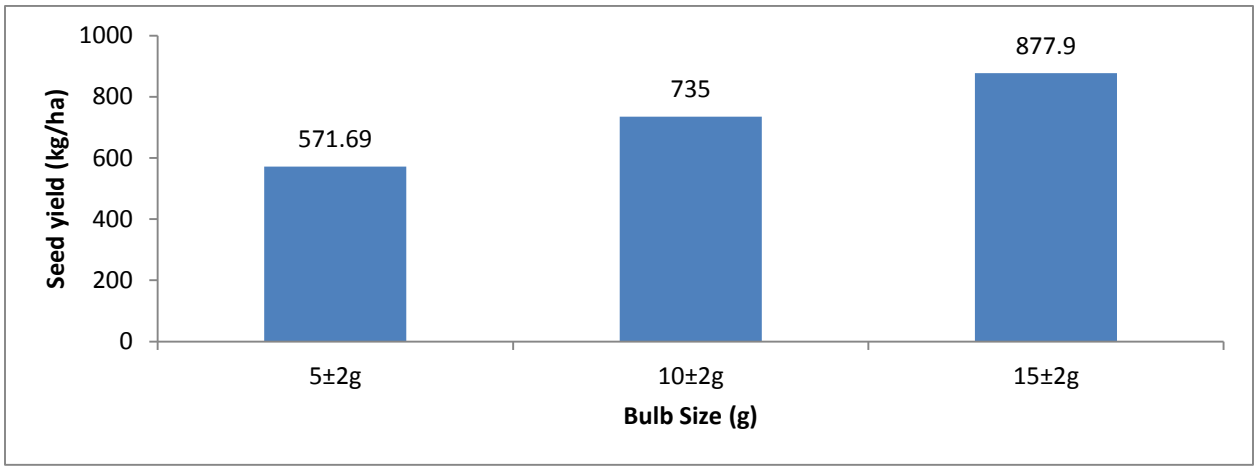



Source: Mollah et al.(2015)

**Figure 5: Effect of organic manure on seed weight of onion.**

Asaduzzaman et al. (2012), observed the effect of bulb size on seed production of onion. He used three sizes of bulb that is (5±2) g, (10±2) g and (15±2) g. He showed (Fig. 6) that the highest

seed yield (877.90 kg/ha) were produced from the largest size among the bulbs (15±2)g and the lowest seed yield (571.69 kg/ha) were produced from small size of bulb (5±2) g.




Source: Asaduzzaman et al. (2012)

**Figure 6: Effect of bulb size on seed yield of onion.**

He also showed (Table 3) the effect of bulb size on umbel and seed characteristic of onion. He observed that the highest and lowest number of umbel per plant (3.51 and 2.41, respectively) were observed in (15±2) g and (5±2) g of bulb. The number of seeded fruit per umbel were highest (225.52) in(15±2) g and lowest (203.64) in (5±2) g of bulb. The highest seed weight/umbel (0.75g) and the lowest seed weight (0.70 g) were obtained from (15±2) g and (5±2) g size bulb, respectively. The highest1000-seed weight (3.68g) was obtained from (15±2) g bulb and the lowest 1000-seed weight (3.18 g)was obtained from (5±2) g bulb size.

**Table 3. Effect of bulb size on umbel and seed characteristics of onion.**

| Bulb size (gm) | No. of umbels/plant | No. of seeded fruits/umbel | Seed wt/umbel (g) | 1000-seed wt (g) |
|---|---|---|---|---|
| 15±2 | 2.41 | 203.64 | 0.70 | 3.18 |
| 10±2 | 2.93 | 212.52 | 0.71 | 3.41 |
| 5±2 | 3.51 | 225.52 | 0.75 | 3.68 |

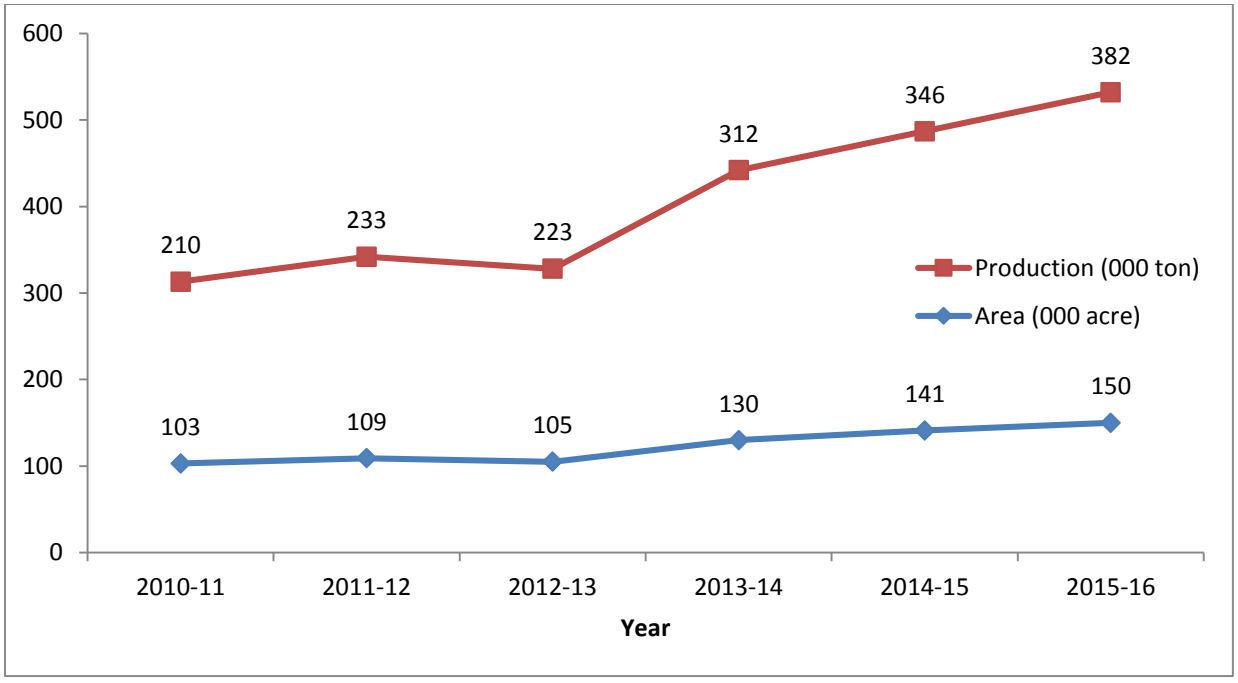
Source: Asaduzzaman et al.(2012)

## Garlic

Garlic (Allium sativum L.) is one of the most important aromatic herbaceous annual spices under the family Alliaceae (Kurian, 1995). It is the second most widely used cultivated Allium after onion (Bose and Som, 1990) with a characteristic of pungent smell. Garlic has been recognized all over the world as a valuable spice for cooking different dishes. It has also been considered as rich source of carbohydrate, protein and phosphorus (Rahman et al. 2007).

Garlic plays an important role for the treatment of different types of diseases such as chronic infection of stomach and intestine dysentery, typhoid, cholera and diseases of lung as Ayurvedi and Unani. Aqueous extracts of garlic cloves (allicin and related disulphides) significantly reduce cholesterol level (Augusti, 1977).

In Bangladesh garlic is cultivated in 60728 ha land and total 82 thousand ton of it is produced with an average yield of 6.29 t /ha(BBS 2016). The yield is quite low in the world context. This low yield may be due to the cultivation of the low yielding local varieties, incidence of diseases and insects, lack of technical knowledge and insufficient research on garlic production.




Source: BBS (2014 & 2016)

**Figure 7: Area and production of garlic cultivation in Bangladesh**

From Fig.7, we see that the garlic cultivation area and production is first increased then decreased in 2012-13 then gradually increase both area and production in following years. Thereby we can conclude that production follows the trend of cultivation area.

**Present status of garlic research**

Khatun et al.(2014) conducted an experiment in Kurigram district to observe some high yielding garlic varietal performance. In this experiment they used 4 high yielding variety (BARI Roshun-1, BARI Roshun-2, BAU Roshun-1, BAU Roshun-2).Table 4 shows that the highest result can be obtained from BARI Roshun-2. The highest plant height (67.02 cm) and the lowest plant height (59.15 cm), highest number of bulb/$m^2$(49.27) and the lowest number of bulb/$m^2$(48.66) and the highest yield (8.11 ton/ha) and the lowest yield (8.04 ton/ha) were obtained from BARI Roshun 2 and BAU Roshun 2 respectively.

**Table 4. Varietal performance of Yield and yield contributing characters of garlic in Kurigram district**

| Varieties | Plant height (cm) | Bulbs $m^{-2}$ | Yield ($t\ ha^{-1}$) |
|---|---|---|---|
| BARI Roshun 1 | 69.84 | 49.16 | 7.86 |
| BARI Roshun 2 | 67.02 | 49.27 | 8.11 |
| BAU Roshun 1 | 68.00 | 48.93 | 7.94 |
| BAU Roshun 2 | 64.20 | 48.83 | 7.80 |

Source: Khatun et al.(2014)

Kabir et al.(2016) observed garlic yield under different mulching in his experiment. Mulching reduce the soil temperature (Azam, 2005) and conserve the soil moisture. Three types of mulches are used in this experiment such as rice straw, water hyacinth and sotty leaf mulch. He observed that the highest fresh weight of bulb(18.96 g),bulb diameter (3.40 cm),number of clove/bulb (19.56) and the highest yield (11.06 ton/ha) were obtained under rice straw mulch and lowest fresh bulb weight (13.84g), bulb diameter (2.77 cm), number of clove/bulb (14.76) and yield (8.15 ton/ha) were obtained from no mulch.

**Table 5. Effect of different mulch on yield and yield contributing character of garlic**

| Treatment | Fresh weight of bulb (g) | Bulb diameter (cm) | No. of clove/bulb | Yield (t/ha) |
|---|---|---|---|---|
| No mulch | 13.84 | 2.77 | 14.76 | 8.15 |
| Rice straw | 18.96 | 3.40 | 19.56 | 11.06 |
| Water hyacinth | 18.20 | 3.29 | 19.71 | 10.92 |
| Sotty leaf mulch | 15.91 | 2.95 | 16.16 | 8.86 |

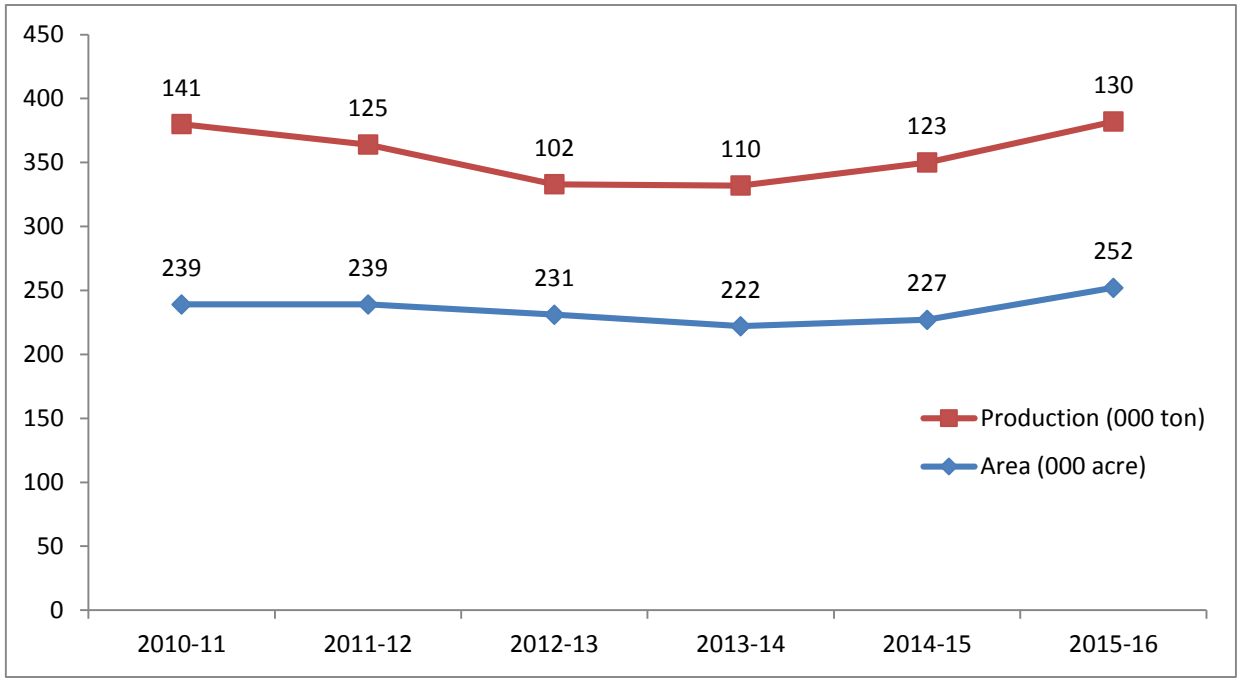
. Source: Kabir et al.(2016)

## Chilli

Chilli(*Capsicum annuum*L.) is cultivated worldwide and is an important spice and vegetable crop. It is an indispensable spice essentially used in every food for its pungency, taste, color and aroma. It is rich in proteins, lipids, carbohydrates, fibers, mineral salts (Ca, P, Fe) and vitamins like A, D, E, C, K, P, B2 and B12 with good medicinal properties. The fruits are an excellent source of health-related phytochemical compounds, such as ascorbic acid, carotenoids, tocopherols, flavonoids, and capsaicinoids that are very important in preventing chronic diseases such as cancer, asthma, coughs, sore throats, toothache, diabetes and cardiovascular diseases (El-Ghoraba*et al.,* 2013).

The area under chilli production 252 thousand acres and the production 130 thousand ton and the average yield 1.32 ton/ha (BBS 2016).The area of cultivable land for chilli production is decreasing day by day where as the demand of chilli is increasing. Unfortunately, the production cannot meet the demand. For meeting the demand of our country, we import large amount of chilli each year. The main reason behind low yield is we have no sufficient land for chilli production. Another reason is the uses of low yielding variety that cannot produce good yield.

From Fig. 8 we observe that the production of chilli maintains the trend in area of cultivation each year except from 2010-11 to 2011-12 where production drops despite same area of cultivation.




Source: BBS (2014 & 2016)

**Figure 8: Area and production of chilli cultivation in Bangladesh**

## Present status of chilli research

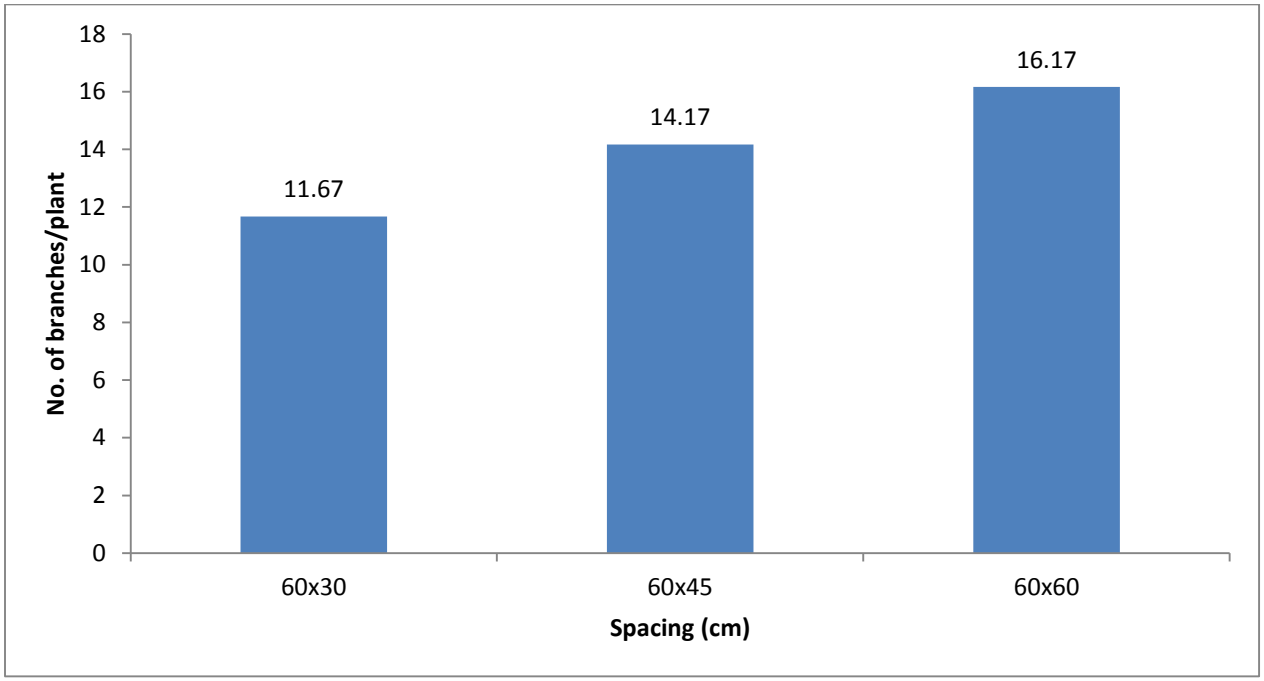
Sharma &Kumar (2017) conducted an experiment to observe the growth and yield influenced by growing condition. In this experiment two growing conditions (low tunnel and open field) were used. The highest plant height(52.44cm), number of branches/plant (21.22), number of fruits/plant (103.89)and yield/plant (300.45g) and yield (11.153 t/ha)were observed in low tunnel condition.

**Table 6. Effect of growing conditions on growth and yield of chilli**

| Treatment | Plant height (cm) | No. of branches/plant | No. of fruits/plant | Yield/plant (g) | Estimated yield/ha (t/ha) |
|---|---|---|---|---|---|
| Low tunnel | 52.44 | 21.22 | 103.89 | 300.45 | 11.153 |
| Open condition | 32.78 | 6.78 | 40.11 | 300.45 | 6.818 |

Source: Sharma &Kumar (2017)

Spacing influence the growth character of plant. Three types of spacing (60x30cm, 60x45cm and 60x60cm) were used by Sharma and Kumar (2017). From Fig. 9 it can be observed that the highest number of branches (16.17) were found in 60x60 cm spacing and the lowest number of branches (11.67) were found in low spacing 60x30 cm.




Source: Sharma & kumar(2017)

**Figure 9: Effect of spacing on number of branch/plant of chilli .**

The highest plant height (40.17 cm), the highest number of fruit/plant (82.00), the highest yield/plant (316.67 gm) and the highest yield (9.79 t/ha) were obtained from (60x60) spacing in table 7.

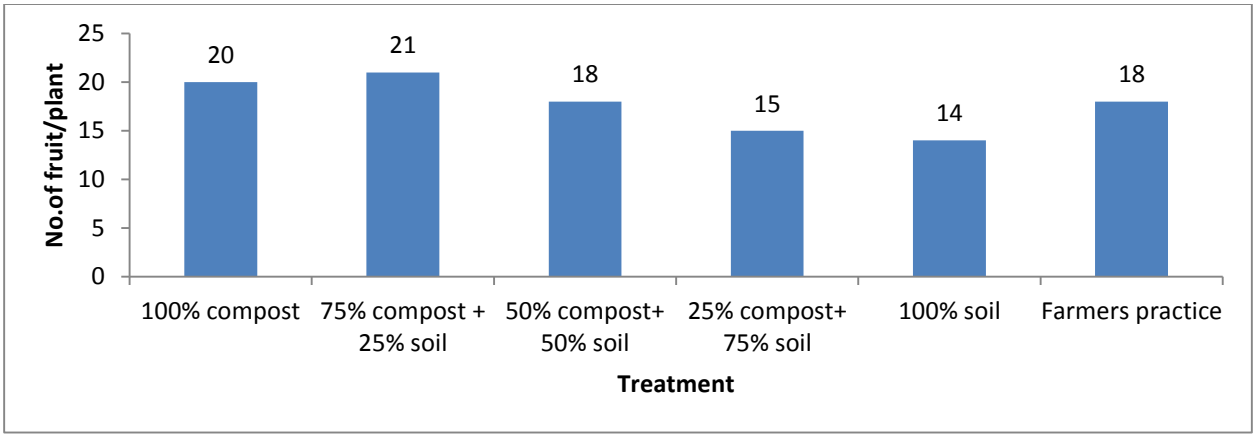
**Table 7. Effect of spacing on yield contributing character of chilli**

| Spacing | Plant height (cm) | No of fruit/plant | Yield/Plant (gm) | Yield (t/ha) |
|---|---|---|---|---|
| 60x30 | 48.33 | 57.50 | 163.67 | 9.093 |
| 60x45 | 40.17 | 76.50 | 244.83 | 9.068 |
| 60x60 | 38.83 | 82.00 | 316.67 | 9.796 |

Source: Sharma &Kumar (2017)

Anam et al.(2017) conducted this experiment and used municipal solid waste compost to show the growth and yield of chilli at different level of compost and soil mixtures. He used six treatments i.e. 100% compost (T0), 75% compost+25% soil(T1), 50% compost+75%soil(T2), 25% compost+75% soil(T3), 100% soil(T4) and farmer's practice (T5: 75% of recommended rate of NPK plus soil).

From Fig.10, we observe that after applying different level of compost Anam et al. (2017) obtained highest number of fruit/plant (21) from 75% compost+25% soil and the lowest number of fruit/plant (14) from 100% soil.



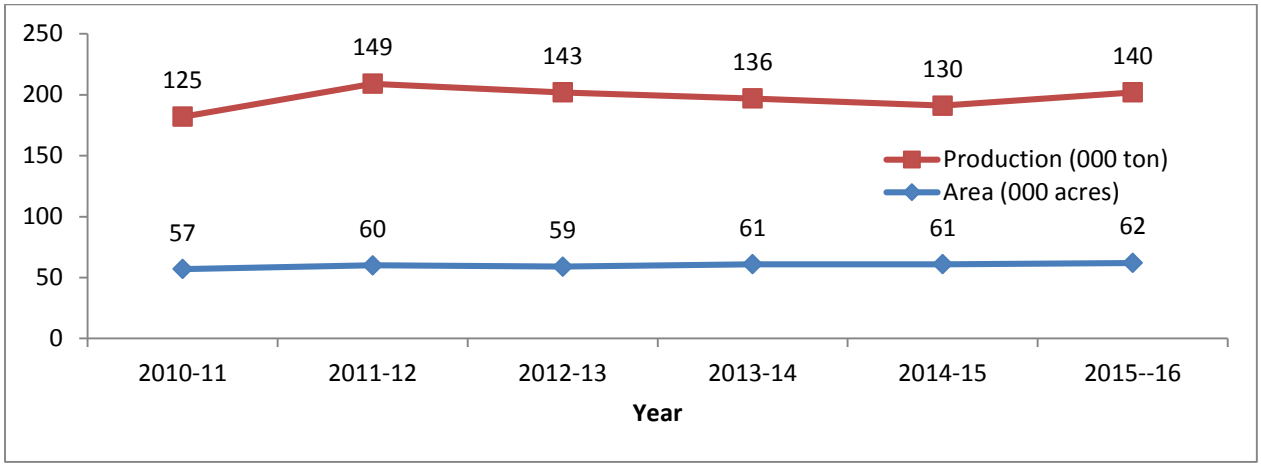

Source: Anam et al.(2017)

**Figure 10: Effect of compost on number of fruit/plant of chilli.**

## Turmeric

Turmeric (*Curcuma longa* L.) is one of the most important spices which belongs to the family Zingiberaceae. It has diverse uses. People primarilyuse turmeric in all curry preparation for its typical yellowish colour and strong flavor. Besides, it is used in medicine and cosmetics and as dye in textile industries. It contents carbohydrates, protein, oil, vitamin C, iron, mineral and other important element in dry turmeric (Shakur, 2000). Turmericinhibits the development of cataracts, breast cancer, colon cancer, and lymphoma (Devi et al., 2011).It is one of the major spices cultivated in our country. The area of cultivable land for turmeric is 62 thousand acre. The average yield of turmeric is 5.57 ton/ha.(BBS 2016)

From Fig. 11 we can observe the trend between production and area of cultivation land of turmeric. It shows consistency each year except from 2012-13 to 2014-15 where production decreases despite slight increase of cultivation area.




Source: BBS (2014 & 2016)

**Figure 11: Area and production under turmeric cultivation in Bangladesh.**

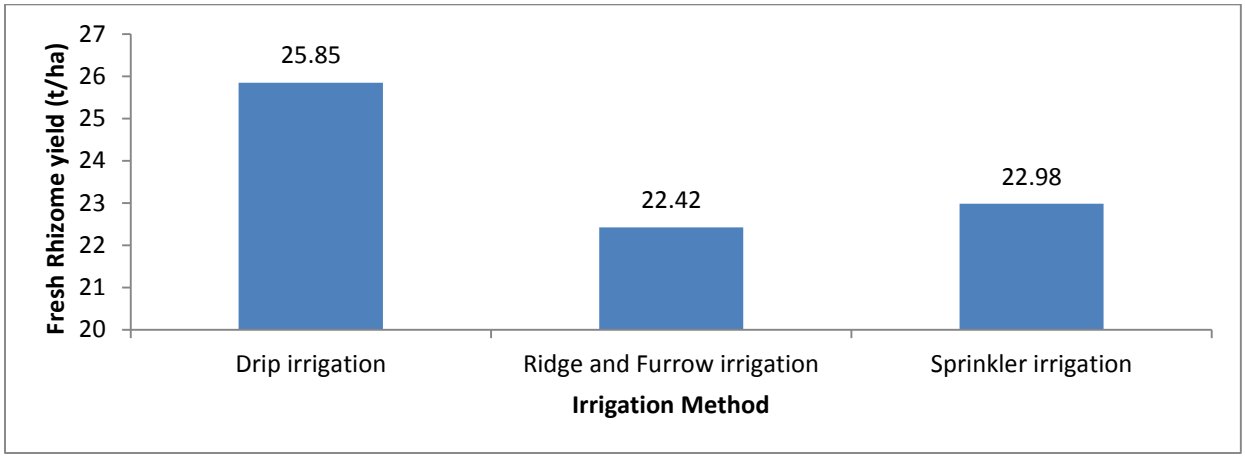
Satyareddi et al.(2017) conducted this experiment and showed the effect of irrigation method and fertilizer level on rhizome yield and leaf area of turmeric. Proper fertilization is very important for any crop. It influences the yield of turmeric. He used three treatments namely F1(N:$P_2O_5$:$K_2O$=180:90:90kg/ha); F2(N:$P_2O_5$:$K_2O$=225:112.5:135kg/ha) and F3(N:$P_2O_5$:$K_2O$=180:270:135 kg/ha). F3 treatment produced the highest yield while F1 treatment produced the lowest.

**Table 8. Effect of fertilizer levels on growth and yield of turmeric**

| Treatment (kg/ha) | Leaf area 150 DAP(cm) | Fresh rhizome Yield (t/ha) | Fresh mother Rhizome yield (t/ha) | Cured rhizome yield (t/ha) |
|---|---|---|---|---|
| F1=N:$P_2O_5$:$K_2O$=180:90:90 | 46.3c | 22.07c | 5.17b | 3.39b |
| F2=N:$P_2O_5$:$K_2O$=225:112.5:135 | 47.6b | 24.14b | 5.56a | 3.65a |
| F3=N:$P_2O_5$:$K_2O$=180:270:135 | 49.6a | 25.04a | 5.56a | 3.76a |

Source: Satyareddiet al.(2017)

Irrigation method is also important for healthy rhizome yield. Proper irrigation method influences the yield of turmeric. Fig. 12 shows that in drip irrigation method the highest yield (25.85 t/ha) and in ridge and furrow method the lowest yield (22.42 t/ha) were obtained respectively.



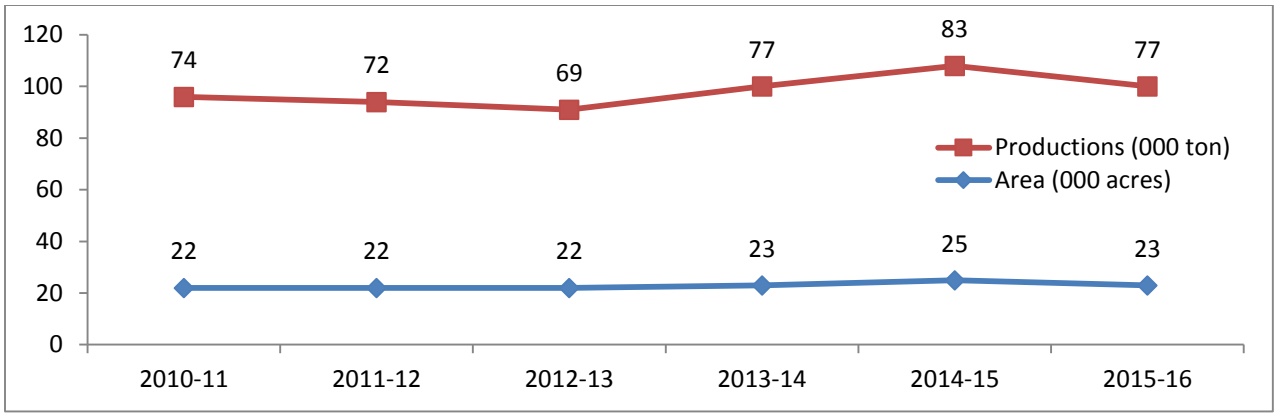

Source: Satyareddi et al.(2017)

**Figure 12: Effect of irrigation method on fresh rhizome yield of turmeric.**

**Ginger**

Ginger (Zingiberofficinale Rose) is an important commercial spice crop in tropical and subtropical countries including Bangladesh. The rhizome is used worldwide as spices for flavouring in a number of foods and food-products and also used in medicines(Lawrence 1984, Selvan et al., 2002).It is rich in secondary metabolite, such asoleoresin (Bhagyalakshmi and Singh, 1988). In Bangladesh, it occupies an area of about 23 thousand acres with the production of 77 thousand tons (BBS, 2016).It contains 80 percent water, 2.5percent albaminoids. 12.3 percent carbohydrate, 1 percent fat, and 1.2 percent minerals (Ahmed, 1976).There are various reasons for the poor yield of ginger in Bangladesh include lack of research findings and low yielding variety.

The area under ginger cultivation was constant from 2010-11 to 2012-13.Then it was slightly increased for the next two years and after that in 2015-16 it was decreased again. The production at first gradually decreased from 2010-11 to 2012-13 while the area for cultivation remained constant. Then for the next two years production gradually increased with increase in area of cultivation. After that production again decreased in 2015-16 with area of cultivation (Fig.13).




Source: BBS (2014 & 2016)

**Figure 13: Area and production under ginger cultivation in Bangladesh.**

## Present status of Ginger research

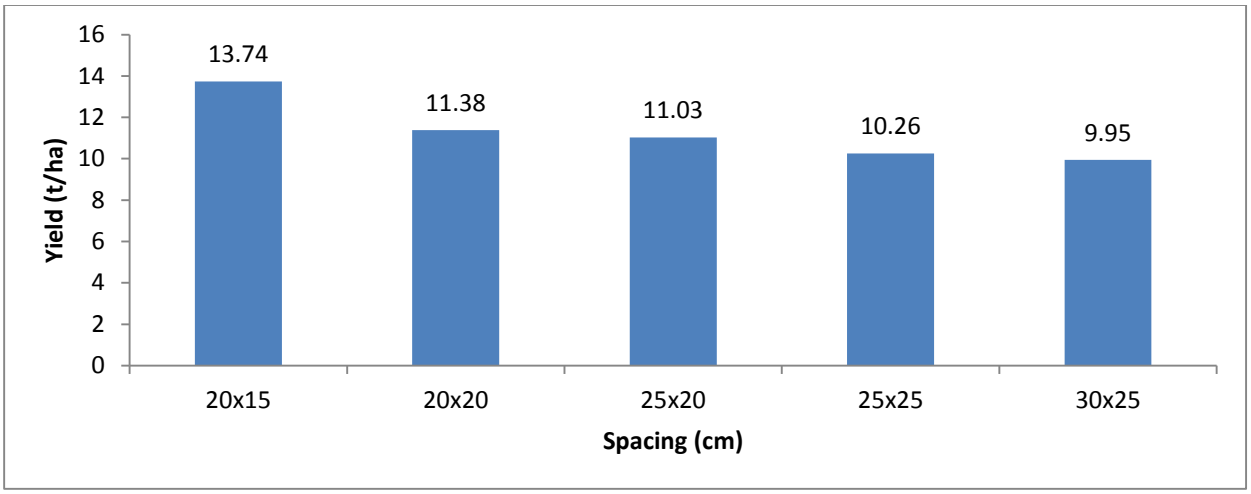
Datta et al. (2017) said in this experiment that seed rate influenced the number of finger, weight, length and yield of ginger. Two different seed rates 20g and 30g are used in this experiment and it is observed that the highest finger number (6.5), finger weight (66.35g), finger length (10.35 cm) and yield (11.78 t/ha) were obtained from 30g seed rate and lowest amount of finger number (5.99), finger weight (62.57 g), length (9.96 cm), and yield (10.76 t/ha) were obtained from 20g of seed(Table 9).

**Table 9. Effect of seed rate on growth and yield of ginger**

| Seed rate (g) | No. of finger | Finger weight (g) | Length (cm) | Yield (t/ha) |
|---|---|---|---|---|
| 30 g | 6.5 | 66.35 | 10.35 | 11.78 |
| 20 g | 5.99 | 62.57 | 9.96 | 10.76 |

Source: Datta et al. (2017)

Spacing influences the yield of ginger in this experiment. Datta et al. (2017) used five different spacings (20x15, 20x20, 25x20, 25x25, 30x25) cm in ginger and observed that the highest yield (13.74 t/ha) and lowest yield (9.95 t/ha) were obtained from 20x15 and lowest yield were obtained from 30x25 cm spacing.




Source: Datta et al. (2017)

**Figure 14: Effect of different spacing on yield of ginger.**

Storage method and rhizome treatment are very important for good quality and production of ginger. In our country these practices are too limited. For this reason, our production is also limited. Sadap et al.(2015) showed the field performance of ginger using different storage method and rhizome treatment. In his experiment the rhizome treated with S1=control; S2= Ridomil MZ (3g/l); S3= *Trichoderma harzianum*(5 g/kg seed rhizome) and four storage method $M_1$= sand layer; $M_2$=250-gauge polyethylene bag with 0.5% vents; $M_3$=Zero Energy Cool Chamber (ZECC); $M_4$= ZECC + polyethylene bag with 0.5% vents.Table 10 shows that the highest fresh rhizome yield is obtained from ZECC and *Trichoderma harzianum*(5 g/kg seed rhizom).

**Table10. Effect of storage method and seed treatment on field performance of ginger**

| Treatment | Yield of fresh rhizome (t/ha) | | | |
|---|---|---|---|---|
| | $M_1$ | $M_2$ | $M_3$ | $M_4$ |
| $S_1$ | 11.84 | 15.94 | 19.21 | 15.36 |
| $S_2$ | 13.49 | 17.47 | 20.07 | 15.75 |
| $S_3$ | 14.77 | 20.48 | 22.35 | 17.78 |

Source: Sadap et al.(2015)

# CHAPTER-4
# CONCLUSION

The production of spices increases due to uses of some high yielding variety and the modern techniques such as irrigation, fertilizers, different planting methods, seed rate, different agronomic practices etc. But this production is not sufficient to fulfill our national demand.

The main problem of spice production is using insufficient high yielding variety and shortage of our land resources. Another problem is our farmers are not aware about using high yielding variety. Limited research in this sector is not sufficient to increase production. As spices are high valued crop there is a great opportunity to get good profit by increasing production.

## RECOMMENDATIONS

- Development of high yielding and resistant variety.
- Emphasis in spice research to increase production.
- Adoption of modern techniques.
- Following the other country's research and apply in our area.

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