

## Comparative Studies on the Effect of Sowing Dates and Spacing on the Growth and Yield of Okra in Different Years

<sup>1</sup>A.B.M. Sharif Hossain <sup>2</sup>A. Wahab and <sup>3</sup>Justus M. Onguso

<sup>1,3</sup>Laboratory of Horticulture, Faculty of Agriculture, Ehime University,  
3-5-7 Tarumi, Matsuyama shi 790-8566, Japan

<sup>2</sup>Soil Resources and Development Institute, Khamarbari, Dhaka, Bangladesh

---

**Abstract:** Field studies were carried out to evaluate the effect of sowing time and spacing on the growth and fruit yield of okra in 1999 and 2000 in the farmer's field, Lakshmipur, Bangladesh. The highest plant height was recorded 87.5 cm when okra was sown on 5 March, 2000 at the spacing of 45 × 45 cm and the lowest height was 73.3 cm when okra was sown on 20 May, 1999 at the spacing of 35 × 40 cm. The maximum number of leaves per plant was observed when it was sown on 5 March 2000 and the minimum was when sown on 20 May, 1999. Moreover, the fruit yield, number of fruit picking per plant, fruit length and weight per fruit were higher when okra was sown on 5 March, 5 April and 5 May, 2000 spaced at 45 × 45 cm than when okra was sown on 20 March, 20 April and 20 May, 1999 spaced at 35 × 40 cm. The highest number of percent mosaic infected plant was counted when okra was sown on 20 May, 1999 at the spacing of 35 × 40 cm and the lowest was when okra was sown on 5 March, 2000 at the spacing of 45 × 45 cm. In addition to that the highest number of vector of okra mosaic disease was counted when okra was sown on 20 May, 1999 at the spacing of 35 × 40 cm and the lowest was when okra was sown on 5 March, 2000 at the spacing of 45 × 45 cm. Percent mosaic infected plants was highest in 1999 and the lowest was in 2000 when it was sown on 20 May and 5 March due to the presence of the number of vectors of okra mosaic disease.

**Key words:** Sowing date, spacing, okra, growth and fruit yield

---

### Introduction

Bangladesh is based with many horticultural crops. More than 90 vegetables are being grown in the country. Total vegetables area are 192000 ha. In these areas total production was 1244000 ton with an average yield of 6.47 t ha<sup>-1</sup> (Anonymous, 1999). About 75% of the population diet is deficient in protein and 80-90% of the people suffer from deficiency of vitamin and micronutrients. Due to vitamin A deficiency about 30000 children cause blind every year. With a view to improve nutrition of the people Bangladesh plans to increase the production and consumption of vegetables (Anonymous, 1999). Okra (*Abelmoschus esculentus*) is one of the important vegetable crop in Bangladesh as well as many countries of the world and is widely grown throughout the different countries. It is nutritious and delicious vegetable fairly rich in

vitamins and minerals (Rashid, 1976). Duzayaman (1997) stated that average yield of okra was  $5.1 \text{ t ha}^{-1}$  world wide in 1997. But USA and Cyprus both reported of around  $20 \text{ t ha}^{-1}$  and average yield in Kuwait was reported  $68.8 \text{ t ha}^{-1}$ , yield of  $7-12 \text{ t ha}^{-1}$  are considered good. The yield of this crop is not satisfactory in Bangladesh as well as many countries of the world. There are several reasons of poor growth and yield of okra, among those time of sowing and plant spacing play an important role. Incalcaterra *et al.* (2000) observed that plant height, yields and number of plants per plant were higher in the 1st sowing than 2nd sowing (1st and 15th April). Yadev and Dhankhar (1999) reported that plant height (103.83 cm), number of fruit per plant (24.13) and fruit length (19.11 cm) was higher on June sowing maintaining spacing  $67.5 \times 20$  than on 12th August sowing at spacing  $45 \times 30$ . Gupta *et al.* (1981) Studied the response of okra 'Pusa Sawani' to date of sowing and plant spacing. They observed that the earliest sowing (25th May) generally gave the highest average yield which decreased with each sowing date (until 5th November). They also observed that the closest spacing ( $50 \times 15$ ) and the earliest sowing gave the overall highest yield ( $110.9 \text{ q ha}^{-1}$ ). Singh *et al.* (1986) studied the effect of planting dates and spacing on seed production of okra. They reported that the seed yields was highest in plots sown on 1st planting (15th June) with plant spaced at  $60 \times 30 \text{ cm}$ . Iremiren and Okiy (1986) conducted the experiment to study the effect of sowing dates on the growth and yield of okra. They stated that the growth of plants from early sowing (1st April) was more vigorous than that of the plants from late sowing (1st June). They also reported that number of pod per plant and yield was higher in the earliest sowing. The higher fruit yield was obtained when okra was sown on March to April than from October to January, (Kamalanathan *et al.*, 1970). Sayeed (1988) evaluated that date of sowing had a very pronounced effect on the yield of okra and also suggested that the plant in the 1st sowing (17th March) produced  $7.5 \text{ t ha}^{-1}$  green fruit which was the highest among the three sowing dates (17th March, 2nd April and 17th April). He also reported that the 1st sowing had the highest effect on plant height and number of leaves per plant.

There is no available information of the effect of date of sowing and spacing on growth and yield of okra. Very little work in this regard has been done in Bangladesh. However, literatures are available on work done abroad. Therefore, the present piece of research work has been undertaken to evaluate the growth (plant height, number of leaves) and yield of okra.

## **Materials and Methods**

### **Experiment 1**

#### **Selection of experimental site**

The experiment was conducted at farmer's field. The field was located at the village Panpara, Ramgonj, Lakshmipur, Bangladesh. The soil was characterized by loam to sandy loam in texture.

#### **Land preparation**

Experimental field was first opened with a country plough on 10th March 1999. Five ploughing followed by laddering were done to have a good tilth. Weeds and other stubbles were removed from the field. The land was exposed to the natural weathering for 7 days after 1st ploughing. Last ploughing was made at the time of final land preparation and the soil was labeled for sowing using laddering.

### **Fertilizer application**

Fertilizer was applied at the rate of 150 kg urea, 100 kg TSP and 150 kg MP ha<sup>-1</sup> (Rashid 1993). Organic manure such as cowdung at the rate of 10 t ha<sup>-1</sup> was applied during land preparation to enrich the soil with organic matter. Full dose of cowdung was applied just after 1st land preparation. Full dose of TSP, MP and half dose of urea were applied at the time of final land preparation. The rest half urea was applied as top dressing at 35 days after sowing.

### **Layout and design**

The experiment was carried out in a randomized complete block design (RCBD) with 4 replications. The treatments of the experiment were 1st sowing date = 20th March, 2nd sowing date = 20th April and 3rd sowing date = 20th May. The experimental field was divided into four blocks. Each block was divided into three plots. There were total of 12 plots in the field. Three sowing dates 20 March, 20 April and 20 May randomly assigned in each block. The size of individual plot was 10 × 4.5 m (45 sq. m). The space between blocks was 50 cm and the border space was 50 cm from all sides.

### **Variety**

Pusa Sawani was used in this experiment.

### **Seed sowing**

Seeds were sown in pits at 30 days interval. Pit to pit distance was 35 cm and line to line distance was 40 cm. Seeds were sown at the depth of 1.5 -2 cm of the soil. Three-four seeds were sown per pit. Thinning was done at 15 days after germination. One healthy plant was maintained in each pit.

### **Crop management**

Weeding, drainage and other intercultural operations were made as needed. No foliar pesticide was applied in the field.

### **Data collection**

Data were recorded 50 days after sowing of seeds followed by 10 days interval. The following parameters were recorded:

Plant height, number of leaves per plant, fruit yield, number of fruit picking per plant, fruit length, weight per fruit, mosaic infected plant and number of vector per plant.

### **Analysis of data**

Analysis of variance of the parameters was done by the use of RCBD program software. The mean values were compared by List Significant Difference (LSD) test.

### **Experiment 2**

Selection of experimental site: Same as mentioned above in Expt. 1.

### **Land preparation**

Experimental field was first opened with a country plough on 25 February 2000. Five ploughing followed by laddering were done to have a good tilth. Weeds and other stubbles were removed from the field. The land was exposed to the natural weathering for 7 days after 1st ploughing. Last ploughing was made at the time of final land preparation and the soil was labeled for sowing using laddering.

### **Fertilizer application**

Same as above mentioned in expt. 1

### **Layout and design**

The experiment was carried out in a randomized complete block design (RCBD) with 4 replications. The treatments of the experiment were 1st sowing date = 5th March, 2nd sowing date = 5th April and 3rd sowing date = 5th May. The experimental field was divided into four blocks. Each block was divided into three plots. There were total of 12 plots in the field. Three sowing dates 5 March, 5 April and 5 May randomly assigned in each block. The size of individual plot was 10 × 4.5 m (45 sq. m). The space between blocks was 50 cm and the border space was 50 cm from all sides.

### **Seed sowing**

Seeds were sown in pits at 30 days interval. Pit to pit distance was 45 cm and line to line distance was 45 cm. Seeds were sown at the depth of 1.5 -2 cm of the soil. Three-four seeds were sown per pit. Thinning out was done at 15 days after germination. One healthy plant was maintained in each pit.

Variety, crop management, data collection, parameters and data analysis were same as mentioned above in Expt. 1.

### **Results and Discussion**

Okra plant height was statistically significant at different sowing dates and spacing (Table 1). The highest plant height was found (84.5 cm) when okra was sown on 5 March and the lowest was 73.5 when it was sown on 20 May in 1999. The similar trend was found in 2000. In 2000 plant height was higher (87.5 cm, 85.2 and 76.0 cm) than in 1999 among all treatments.

Number of leaves per plant was significantly different at different treatments in 1999 and 2000 (Table 1). The maximum number of leaves per plant was observed when okra was sown on 5 March in 2000 and the minimum was when okra was sown on 20 May in 1999. On 20 March, 20 April and 20 May, 1999 it was 27.2, 24.5 and 18.5 whereas, it was 27.5, 24.5 and 18.6 when okra was sown on 5 March, 5 April and 5 May in 2000, respectively. There was no difference between 20 April and 5 April sowing in number of leaves per plant.

There was significant difference in fruit yield when okra was sown on 20 March, 20 April and 20 May in 1999 compared to sown on 5 March, 5 April and 5 May in 2000 (Table 2). In 1999 the

Table 1: Estimation of plant height and no. of leaves per plant as influenced by different sowing dates and spacing

Year	Sowing date	Spacing (cm)	Plant height (cm)	No. of leaves per plant
1999	20th March	35 x 40	84.5a	27.2a
	20th April		83.3a	24.5b
	20th May		73.5b	18.5c
2000	5th March	45 X 45	87.5a	27.5a
	5th April		85.2a	24.5b
	5th May		76.0b	18.6C

Table 2: Fruit yield and no. of fruit picking per plant as influenced by different sowing dates and spacing

Year	Sowing date	Spacing (cm)	Fruit yield (kg ha <sup>-1</sup> )	No. of fruit picking per plant
1999	20th March	35 x 40	50001a	13.98a
	20th April		6560b	11.56bc
	20th May		3070c	9.42c
2000	5th March	45 x 45	5140a	14.2a
	5th April		3624b	11.92bc
	5th May		3145c	10.1c

Table 3: Estimation of fruit length and weight per fruit as influenced by different sowing dates and spacing

Year	Sowing date	Spacing (cm)	Fruit length (cm)	Weight/fruit (g)
1999	20th March	35 x 40	13.0a	13.1a
	20th April		12.0ab	11.2b
	20th May		11.5b	10.3b
2000	5th March	45 X 45	13.5a	13.7a
	5th April		12.4ab	12.1b
	5th May		12.0b	11.5b

Mean followed by the same letters are not statistically difference in a column at the 5% levels of significance by LSD

highest yield was found (5001 kg) when okra was sown on 20 March and the lowest was 3070 kg when it was sown on 20 May. The similar trend was found in 2000. In 2000 yield was higher (5140, 3624 and 3145 kg) than in 1999 (5001, 35600 and 3070 kg) among all treatments.

The difference in number of fruit picking per plant was also significant at different sowing dates and spacing in 1999 and 2000 (Table 2). The highest number of fruit picking (14.2 plant<sup>-1</sup>) was obtained on 5 March 2000 sowing followed by 2nd highest (11.92 plant<sup>-1</sup>) and lowest (10.1/plant) on 5 April and 5 May 2000 sowing. Similar trend in number of fruit picking was observed on 20 March, 20 April and 20 May in 1999. However, number of fruit picking was minimum (9.4 plant<sup>-1</sup>) on 20 may 1999 sowing compared to 2000 sowing among all treatments.

Fruit length and weight per fruit were measured (Table 3). There was difference in fruit length at different treatments in 1999 and 2000. The maximum fruit length (13.5 cm) was observed when okra was sown on 5 March in 2000 and the minimum was 11.5 cm when okra was sown on 20 May in 1999. On 20 March, 20 April and 20 May, 1999 weight per fruit was 13.1, 11.2 and 10.3 gm whereas, it was 13.7, 12.1 and 11.5 gm when okra was sown on 5 March, 5 April and 5 May in 2000, respectively.

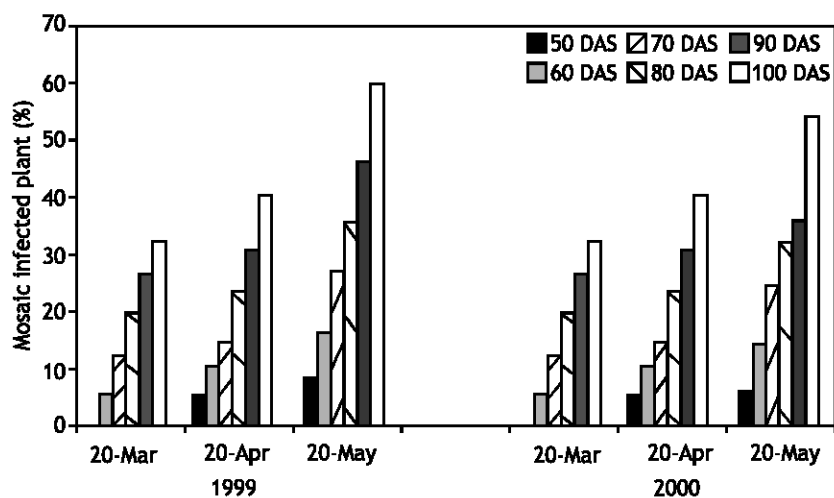


Fig. 1: Percent okra mosaic infected plant of different days after sowing as influenced by different sowing times and spacing. DAS means days after sowing

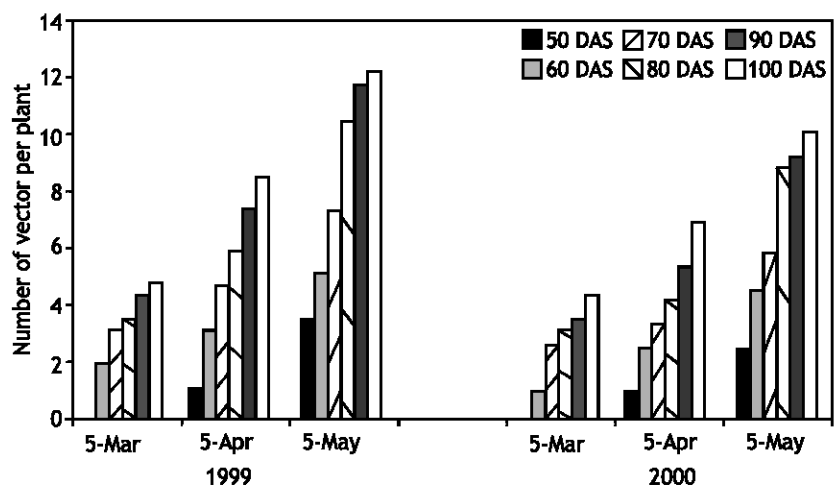


Fig. 2: Number of vector, Bemisia tabaci of okra mosaic disease as influenced by different sowing times and spacing. DAS: Days after sowing

Percent mosaic infected plant was counted at different days after sowing (Fig.1). Percent mosaic infected plant was lowest at 50 DAS when okra was sown on 20 March 1999 and highest at 100 DAS when okra was sown on 20 May 1999. Similar trend was observed in case of all treatments in 2000. But mosaic infected plant was higher (60.2%) at 100 DAS on 20 May sowing 1999 and lower (15.1%) at 60 DAS on 5 March sowing 2000. However, it was lower in 2000 than in 1999 among all treatments.

Number of vector per plant was different at different treatments in 1999 and 2000 (Fig. 2). The maximum number of vector per plant was observed when okra was sown on 20 May in 1999 and the minimum was when okra was sown on 5 March in 1999. On 20 March, 20 April and 20 May, 1999 it was higher (4.7, 8.6 and 12.2 plant<sup>-1</sup>) whereas, it was lower (4.3, 7 and 10.2 plant<sup>-1</sup>) when okra was sown on 5 March, 5 April and 5 May in 2000, respectively.

The result of the present study evaluates that date of sowing and spacing have immense impact on reducing or increasing of growth and yield of okra. Plant height, number of leaves per plant, fruit yield, number of fruit picking per plant, fruit length and weight per fruit were higher on 5 March, 5 April and 5 May sowing by maintaining 45 × 45 cm spacing in 2000 than on 20 March, 20 April and 20 May sowing by maintaining 35 × 40 cm spacing in 1999. It might be due to early sowing and more spacing in 2000 than in 1999. Percent infected plant and number of vector higher on 20 March, 20 April and 20 May sowing spaced at 35 × 40 cm in 1999 compared to sowing on 5 March, 5 April and 5 May by maintaining 45 × 45 cm spacing in 2000. It might be due to late sowing and less spacing in 1999 than in 2000. Palanasamy *et al.* (1986) reported similar results on the effect of sowing dates on fruit yield of okra. They suggested that the fruit yield was highest in plots sown on March than April. Gupta *et al.* (1981) reported that the earliest sowing generally gave the highest average yield which decreased with each sowing date advanced. The response of okra to time of sowing was studied by Kamalanathan *et al.* (1970). They concluded that okra gave highest yield when okra was sown on March to April than from October to January.

Sayed (1988) reported similar results and mentioned that the 1st planting (17th March) had a pronounced effect on plant height of okra. The height of the plants was highest (86.89 cm) in 1st planting than those of second (2nd April) and third planting (17th April). He also reported that the highest number of leaves/plant of okra in 1st (24.41) and second (21.50) which was significantly superior to the third planting (14.75).

Incalcaterra *et al.* (2000) observed that plant height, yields and number of plants per plant were higher in the 1st sowing than 2nd sowing (1st and 15th April). Yadav and Dhankhar (1999) reported that plant height (103.83 cm), number of fruit per plant (24.13) and fruit length (19.11 cm) was higher on June sowing maintaining spacing 67.5 × 20 than on 12th August sowing at spacing 45 × 30. These results are similar to our present studies.

Nath *et al.* (1992) evaluated that the incidence of mosaic disease caused by okra yellow vein mosaic virus was lowest in crop sown 10 February to 10 March. Goswami and Bhagabati (1992) also reported that the highest disease incidence occurred on crop sown May and June (100%) and the lowest on October (17.7%) as compared to incidence in February and March crop sown of 36.5 and 54.2% respectively.

Therefore, it may be recommended that okra should be grown on early March-early May maintaining proper spacing in order to get better growth and yield which can recover some of vitamin and nutrients of the people in the country.

#### **Acknowledgments**

The authors are most grateful to Helen Keller International, USAID project, for supporting in this work. The authors wish to express sincere thanks to Mrs. Maimuna Akter for her assistance in analyzing and computing data in this manuscript.

**References**

- Anonymous , 1999. Bangladesh Bureau of Statistics. Ministry of Planning, Dhaka, Bangladesh, pp: 408-410.
- Duzyaman, E., 1997. Okra Botany and Horticulture. Hort. Rev., 21: 41-72.
- Goswami, B.K. and K.N. Bhagabati, 1992. Natural incidence of yellow vein clearing mosaic of virus disease of bhindi in relation to different dates of sowing. J. Asian Sci. Soc., 34: 19-24.
- Gupta, A., J.V. Rao and K. Srinivas, 1981. Response of okra to date of sowing and plant spacing. Vegetable Sci., 8: 69-79.
- Incalcaterra, G., F. Vetrano, P.J. Stoffella, D.J. Cantliffe and G. Damato, 2000. Effect of two sowing dates and plastic mulch on Okra production. Acta Hort., 533: 329-336.
- Iremiren, G.O. and D.A. Okiy, 1986. Effect of sowing date on the growth , yield and quality of okra. J. Agril. Sci., UK, 106: 21-26.
- Kamalanathan, S., S. Thamburaj and S. Sudaranjan, 1970. Response of okra to the time of sowing. Madras Agril. J., 57: 17.
- Nath, P.D., M.K. Gupta and P. Bora, 1992. Influence of sowing time on the incidence of yellow vein mosaic and white fly population of okra. Indian J. Virol., 8: 45-48.
- Planasamy, V., K. Vanangamudi, T. Jayaraj and T.V. Karivara, 1986. Influence of date of sowing and spacing on seed quality of bhindi. South Indian Hort., 34: 23-25.
- Rasdid, M.M., 1976. Bangladesh Shabji. 1st Ed. Bangla. Acad., Dhaka, Bangladesh, pp: 413.
- Rasdid, M.M., 1993. Shabjibijanan. 1st Ed. Bangla. Acad., Dhaka, Bangladesh, pp: 465-471.
- Sayeed, A., 1988. Effect of date of planting and insectisidal spray on the control yellow vein mosaic of okra. M.Sc Thesis., Bangla. Agril. Univ., Mymensingh 2202, Bangladesh.
- Singh, K.P., Y.S. Malik, S. Lal and M.L. Pandita ,1986. Effect of planting dates and spicing on seed production of okra. Haryana J. Hort. Sci., 15: 267-271.
- Yadev, S.K. and B.S. Dhankhar, 1999. Performance of Varsha Uphar cultivar of okra as affected by the sowing dates and plant geometry. Vegetable Sci., 26: 180-182.