

## Effect of bulb size on growth and flowering of tuberose cv. single

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### ABSTRACT

The present study was conducted at the Horticulture farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, during the period from 01 May 2005 to 30 April 2006. The experiment was conducted to investigate the effect of bulb sizes i. e. small, medium and large (1.5-2.0, 2.1-2.5 and 2.6-3.0 cm in diameter respectively) on the growth and flowering of tuberose cv. Single. Bulbs of tuberose cv. Single were planted at the spacing of 30X20 cm. The result of the experiment revealed that bulb size had significant influence on all parameters studied. Plant height and number of leaves per plant at different stages of growth i.e. 84, 112, 140, 168 and 200 days after planting were increased significantly with the increase of bulb size of tuberose. The number of side shoot per plant was increased with the increase of bulb size. On an average 19.58 side shoot was obtained from large bulb and the lowest 9.01 was from small bulb. The highest height of side shoot (57.58 cm) was recorded from the large bulb while the lowest plant height (44.39 cm) was obtained from small bulb size. Number of leaves per side shoot increased with the increase of bulb size. The maximum number of leaves per side shoot 17.31 was obtained from the side shoot produced from the large bulb and the minimum 9.91 from small bulb. The highest duration of flowering was obtained from the large bulb (19.65 days) and the shortest duration of flowering was obtained from the small bulb (13.97 days). Spike produced from the large bulb had the maximum diameter (1.13 cm) while it was minimum (0.77 cm) in the spike produced from the small bulb. The highest number of floret (47.50) was obtained in the plants grown from large bulb and the lowest (34.38) from small bulb. The maximum number spike (424.08 thousand) was obtained from plants of large bulbs. On the other hand, plants from small bulb produced minimum number (287.24 thousands). The maximum average weight of spike (41.76 gm) was obtained from large bulb which was minimum (33.25 gm) in small bulb. The yield of spike gradually increased as the size of bulb increased. The highest yields (17.79 ton/ha) were obtained from large size bulb while the lowest (9.60 ton/ha) was in small bulb. It is concluded that large bulb was found to be superior to medium and small bulb for growth and flowering of tuberose cv. single.

### INTRODUCTION

Tuberose (*Polianthes tuberosa* L.) belonging to the family Amaryllidaceae, produces attractive, elegant and fragrant white flowers. It occupies a very selective and special position to flower loving people because of its prettiness, elegance and sweet pleasant fragrance. It has a great economic potential for cut flower trade and essential oil industry (Sadhu and Bose, 1973). The long spikes of tuberose are used for vase decoration and bouquet preparation and the florets for making artistic garlands, ornaments and buttonhole use.

The flowers emit a delightful fragrance and are the source of tuberose oil. The natural flower oil of tuberose is one of the most expensive perfumer's raw materials.

Tuberose is a half-hardy, bulbous perennial multiplying itself through the bulblets. Roots are mainly adventitious and shallow. The leaves are long, narrow, linear, grass like, green and arise in rosette. The flowers have a funnel shaped perianth, waxy white in colour and borne in a spike. There are three types of tuberose: Single with one row of corolla segments, semi-double bearing flowers

with two to three rows of corolla segments and double having more than three rows of corolla segments.

In Bangladesh, its commercial cultivation was introduced during 1980 by some pioneer and innovative farmers at Panishara union of Jhikorgacha thana under Jessore district. Tuberose has a high demand in the market and its production is highly profitable (Aditya, 1992). Although tuberose is now grown in the country, very little is known about production technology in Bangladesh condition (Ahmed, 1985).

The size of bulb plays an important role on the growth and flowering of tuberose, it influences the sprouting of bulb at the time required is inversely proportional to size of bulb (Sadhu and Das, 1978; Pathak et al., 1980). Larger bulbs were found to take more time for sprouting (Yadav et al., 1984). Bulb size also influences flowering. Larger bulb causes early flowering and give higher yield of spikes and flower (Sadhu and Das, 1978; Pathak et al., 1980; Yadav et al., 1984). Plant height and number of leaves per bulb also showed gradual increase with the increase in bulb size up to a

certain limit (Yadav et al., 1984; Dhua et al., 1987).

In Bangladesh, no studies have been done regarding the bulb size for growth and flowering of tuberose so far. So, research work on widely cultivated type Single is still lacking in the country. The present study was, therefore, undertaken to study the effect of bulb size on growth and flowering of tuberose cv. Single

## MATERIALS AND METHODS

The present investigation was carried out at the Horticulture farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, during the period from 01 May 2005 to 30 April 2006.

### Climate

The detailed meteorological data in respect of air temperature, relative humidity, rainfall and sunshine hour recorded by the Dhaka meteorology centre, Dhaka for the period of experimentation have been presented in Table 1.

Table 1

Monthly record of air temperature, rainfall, relative humidity and sunshine hours during the period from May 2005 to April 2006.

year	Month	Average air temperature (°C)			Total rainfall (mm)	Average relative humidity (%)	Total sunshine hours
		Maximum	Minimum	Mean			
2005	May	33.2	24.2	28.7	291	73	241.8
	June	33.4	26.8	30.1	259	79	96.0
	July	31.4	25.8	28.6	542	81	127.1
	August	32.0	26.6	29.3	361	82	108.5
	September	32.7	26.0	29.35	514	81	144.0
	October	30.5	24.3	27.4	417	80	142.6
	November	29.0	19.8	24.4	3	72	198.0
	December	27.0	15.6	21.3	0	66	217.0
2006	January	24.41	13.41	18.91	0	65.47	165.1
	February	30.68	18.77	24.73	0	65.95	171.01
	March	32.95	22.43	27.69	0	52.15	225.83
	April	33.74	23.87	28.81	185	69.41	234.6

## Soil

The soil of the experimental area belongs to the Modhupur tract. The experimental site was a medium high land and pH of the soil was 5.6. The morphological characters of the soil of the experimental plots are AEZ No. 28, soil series-Tejgaon and general soil- Non-calcareous dark grey (Source: Soil Resources Development Institute, Farmgate, Dhaka).

## Treatment of the experiment

The experiment was set up to investigate the effect of bulb size on the growth and flowering of tuberose var. single.

Bulb size:

- B1 : Small bulb 1.5-2.0 cm in diameter
- B2 : Medium bulb 2.1-2.5 cm in diameter
- B3 : Large bulb 2.6-3.0 cm in diameter

## Planting material

The bulbs of tuberose cv. Single were collected from Ananda Nursery, Savar Bazar, Dhaka. It was chosen for its wide cultivation in Bangladesh.

## Land preparation

The land was first opened by ploughing in the month of April, 2005. Land was prepared by five ploughings followed by laddering. Raised beds were prepared for planting, keeping 0.5 m wide drain between two beds. The weeds and stubbles were removed from the plot and clods were pulverized before final land preparation. The basal doses of manures and fertilizers were applied as per recommendation during final land preparation.

## Experimental design and layout

Two factor experiments was laid out in Randomized Complete Block Design (RCBD) with 3 replications. Each block was divided into 9 plots where 9 treatments were allotted at random. Thus, there were 27 (9x3) unit plots in the experiment. The size of unit plot was 1.6 m x 1.2 m. The distance between the blocks was 1 m and between the adjacent plots 0.5 m. Spacing of the bulbs were 20 X 30 cm and 32 bulbs were planted at each plot.

## Manure and fertilizer

The crop was fertilized with the following doses of manure and fertilizers.

Manure/Fertilizers	Doses per plot	Doses per hectare
Cowdung	1.92 kg	10 ton
Urea	76.8 g	400 kg
TSP	57.6 g	300 kg
MP	57.6 g	300 kg

Entire amount of cow dung and TSP were applied during final land preparation. Urea and MP were applied in four splits, the first installment was applied after one month of planting. The remaining three installments were applied at two-months interval.

## Planting of bulbs

The bulbs were planted in raised bed placing upright at a depth up to their neck. The planting was done in 01 May 2005.

## Intercultural operations

The crop was kept free from weeds by regular weeding and irrigation was done as per necessity. Mulching and earthing up was done regularly. Dithane M-45 was applied to check fungal infestation.

## Selections and tagging of plants and spikes

Ten plants from each of the plots were selected randomly for recording plant height, number of leaves per plant, number of side shoot per plant, and number of days to spike emergence. Ten spikes from each plot were labeled with details of date of first flowering and after opening of basal floret to each spike. Spikes were labeled again with date for recording duration of flowering on plant. Ten spikes of each plot were selected randomly for three times throughout the season for recording length of spike, length of rachis, number of florets per spike and weight of spike and weight of florets.

## Harvesting

The spikes were harvested when the basal floret had opened and data were recorded for number of spikes/hectare and spike yield/hectare.

### Collection of data

Plant growth contributing characters were measured as per method described elsewhere. Plant height (cm): Height of the plant refers to the length of the plant from ground level up to the tip of the longest leaf at 30, 56, 84, 112, 140, 168 and 200 days after planting. Height of the side shoot (cm): Height of the side shoot refers to the length of the plant from ground level up to the tip of the longest leaf of the side shoot. Number of leaves/plant (mother bulb): The number of leaves produced by mother plant was referred to the number of leaves of mother bulb. Number of leaves/plant (side shoot): For average number of leaves/side shoots, the total number of leaves produced by side shoot in each hill was counted and the mean was referred to average number of leaves per side shoot. Number of side shoots per plant: Side shoot refers to those plants, which developed from the mother bulb, all the green shoot above the soil surface and adjoined to the mother plant were counted as side shoot. Days to spike emergence: Number of days from planting to spike initiation. Days to first flowering: Number of days from spike initiation to first floret opening. Duration of flowering: Number of days from first floret opening to last floret opening in the field.

Flower yield and yield contributing character were measured following the standard procedure. Length of spike (mother bulb) (cm): The length of spike at harvesting stage when first florets open. Length of spike (side shoot) (cm): The length of spike at harvesting stage when first florets open. Diameter of the spike (cm): Mean diameter of spikes at top and bottom positions. Weight of the single spike (g): Average weight of a single spike. Length of the rachis (mother bulb) (cm): The length from basal floret to the tip of last floret. Length of the rachis (side shoot) (cm): The length of the rachis was taken from basal floret to the tip of last floret. Number of floret/spike (mother bulb): Total number of floret at each spike. Number of floret/spike (side shoot): Total number of floret/spike produced from the side shoot. Number of floret in 100 g: Total number of floret

in 100 g. Number of spikes/ha (thousands): Number of total harvested spikes. Flower yield/ha (tons): Calculated from weight of total harvested spikes.

### Statistical analysis

The recorded data on different parameters were statistically analyzed using MSTAT software to find out the significance of variation resulting from the experimental treatments. The mean for the treatments was calculated and analysis of variance for each of the characters was performed by F (variance ratio) test. The differences between the treatment means were evaluated by LSD test at 1% or 5% probability.

## RESULTS AND DISCUSSION

### Plant growth contributing characters

#### *Plant height*

The results on main effect of bulb size on plant height of tuberose at 30, 56, 84, 112, 140, 168 and 200 days after planting have been presented in Figure 1. There was no significant difference among different bulb sizes for plant height until 56 days after planting. But significant difference was found from 84 days to 200 days after planting. The highest plant height (64.22 cm) was recorded from the large bulb at 200 days after planting. On the other hand, the lowest plant height (52.3 cm) at 200 DAP was obtained from small bulb size. This might be due to the fact that higher reserve food resulted in better growth and ultimately gave maximum plant height in comparison to small bulb. Raja and Palanisamy (1999) while working with different sizes of bulbs on growth and flowering of tuberose found similar result.

#### *Number of leaves/plant (mother bulb)*

In the present study, number of leaves per plant was significantly influenced by different bulb size used and the results have been presented in Figure 2. The maximum number of leaves per plant (22.07) was obtained from large bulb and the minimum (15.13) from small bulb. Yadav et al. (1984) and Dhua et al., (1987) obtained similar

results and reported that larger bulbs produced more leaves compared to smaller bulbs.

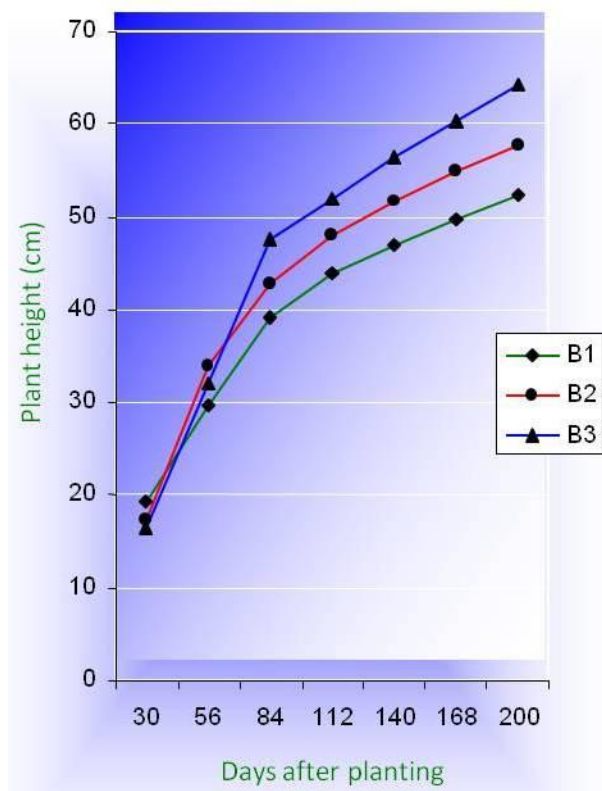


Figure 1 Effect of bulb size on plant height of tuberose at different days.

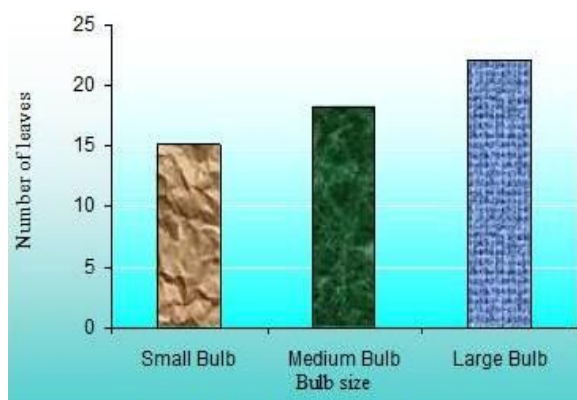


Figure 2 Effect of bulb size on number of leaves/plant of tuberose.

**Number of side shoots per plant**

The number of side shoot per plant was significantly different due to the different bulb size used. The highest number of side shoot (19.58) was obtained in the plants grown from large bulb and the lowest (9.01) from small bulb (Table 2). The present results are in agreement with the findings of Raja and Palanisamy (1999).

**Height of the side shoot**

There was significant difference among different bulb sizes for height of the side shoot. The highest plant height (57.58 cm) was recorded from the large bulb. On the other hand, the lowest plant height (44.39 cm) was obtained from small bulb size (Figure 3).

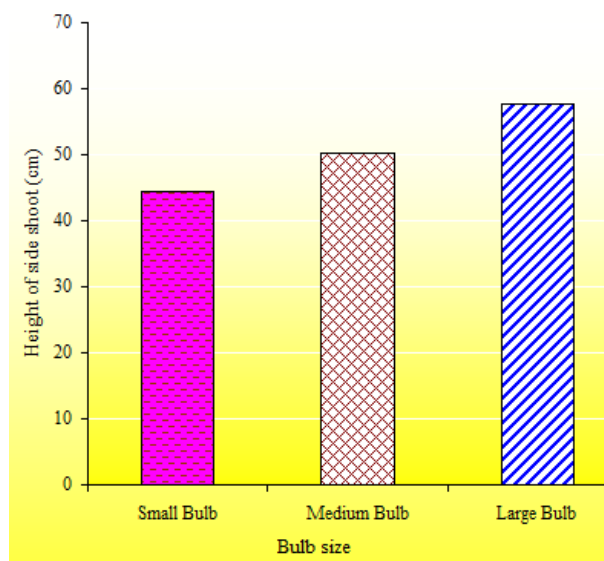


Figure 3 Effect of bulb size on height of side shoot of tuberose.

**Number of leaves/side shoot**

Different bulb sizes significantly influenced the number of leaves per side shoot and the results have been presented in Table 2. The maximum number of leaves per side shoot (17.31) was obtained from the large bulb and the minimum (9.91) from small bulb.

**Days to spike emergence**



The number of days required to spike emergence of the crop was significantly influenced by bulb size. The average days required to spike emergence ranged from 73.56 to 85.45 days. Small sized bulb took the longest time (85.45 days) to spike emergence while large bulb took the shortest time (73.56 days). Time required to spike emergence was found to be delayed gradually with the decrease in bulb size (Table 2). Similar results were reported by Pathak et al., (1980).

Table 2

Main effect of bulb size (B1: Small, B2: Medium and B3: Large) on number of side shoot/plant, Number of leaves/side shoot, days to spike emergence and days to first flowering of tuberose cv. Single.

Treatment	Number of side shoot/plant	Number of leaves/side shoot (cm)	Days to Spike emergence	Days to first flowering
B1	9.01	9.91	85.45	20.10
B2	14.4	13.21	80.64	17.03
B3	19.58	17.31	73.56	13.88
LSD 1%	4.66	0.25	0.26	0.39
LSD 5%	3.38	0.18	0.19	0.28

### Days to first flowering

There was a significant influence of bulb size on number of days required to first flowering after spike initiation. Spike from the small sized bulb took the longest time (20.10 days) to first flowering while spike from the large bulb took the shortest time (13.88 days). Time required to first flowering was found to be delayed gradually with the decrease in bulb size (Table 2). Pathak et al., (1980) found similar result.

### Duration of flowering

Duration of flowering was significantly influenced by different bulb sizes. The highest duration of flower (19.65 days) was obtained from the large bulb followed by medium bulb (17.55 days). The shortest duration of flowering (13.97 days) was obtained from the small bulb (Figure 4).

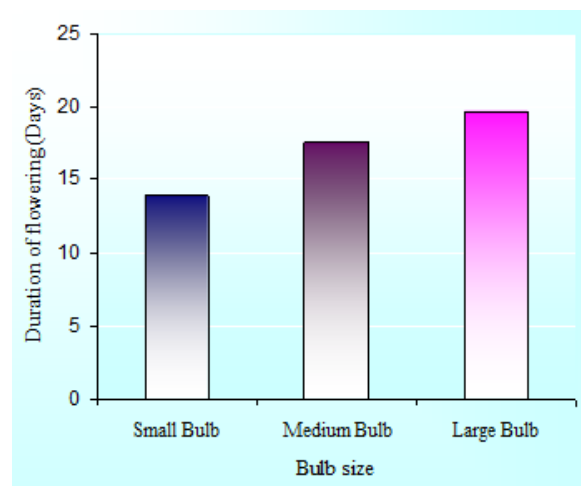


Figure 4  
Effect of bulb size on duration of flowering.

## Flower yield and yield contributing character

### Length of spike (mother bulb)

The results of the present experiment revealed that variation in spike length due to the effect of bulb size was statistically significant. The highest spike length (77.43cm) was obtained when the large sized bulb was used. It was followed by medium sized bulb (71.88 cm). On the other hand, the shortest spike (67.38 cm) was produced by small bulb (Figure 5). The increased spike length from large bulb was probably due to the better vegetative growth of the plant. Similar results were reported by Kumar et al., 2003.

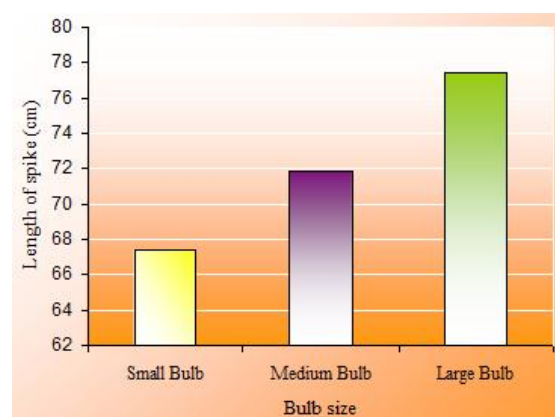


Figure 5  
Effect of bulb size on the length of spike.

### **Length of spike (side shoot)**

The effect of bulb size was statistically significant in respect of length of spike of side shoot (Figure 6). The longest spike (75.03cm) was obtained when the side shoot was produced from the large sized bulb. It was followed by medium sized bulb (68.83 cm). On the other hand, the shortest spike length (63.92) was obtained from the side shoot produced by small bulb (Table 3).



Figure 6  
Effect of bulb size on length of spike of tuberose.

### **Diameter of the spike (mother bulb)**

Bulb size significantly influenced the diameter of the spike. Spike produced from the large bulb had

the maximum diameter (1.13 cm) while it was minimum (0.77 cm) in the spike produced from the small bulb (Table 3).

### **Weight of the single spike (mother bulb)**

The average weight of spike varied significantly due to the effects of different bulb sizes. The plants from large bulb gave the maximum average weight of spike (41.76 gm) whereas the minimum average weight of spike (33.25 gm) was obtained in plant that was produced from small bulb (Table 3).

### **Length of the rachis (mother bulb)**

There was significant difference in rachis length due to different sizes of bulb used. The rachis length was increased with the increase in bulb size (Table 4). Plants from large bulb produced the longest rachis (18.72 cm). On the other hand, plant grown from small bulbs produced the shortest rachis (15.27 cm). Better performance of the plants from larger bulbs might be due to the better growth of the plants from large bulb. Mukhopadhyay and Banker (1983) reported similar results.

### **Length of the rachis (side shoot)**

Different sizes of bulb significantly influenced the rachis length of side shoot. Plants from large bulb produced the longest rachis (17.29 cm). On the other hand, plant grown from small bulbs produced the shortest rachis (11.24 cm) (Table 3).

Table 3

Effect of bulb size (B1: Small, B2: Medium and B3: Large) on flowering of tuberose cv. Single.

Treatment	Length of spike (Side shoot) cm	Diameter of the spike (mother bulb) cm	Weight of the single spike (mother bulb) gm	Length of the rachis (mother bulb) cm	Length of the rachis (Side shoot) cm	Number of floret/spike (mother bulb)	Number of floret/spike (Side shoot)	Number of floret in 100 gm	Number of spikes/ha (thousand)
B1	63.92	0.77	33.25	15.27	11.24	34.38	31.46	143.04	287.24
B2	68.83	0.9	37.45	16.92	14.75	40.55	36.49	132.53	362.27
B3	75.03	1.13	41.76	18.72	17.29	47.56	43.26	123.15	424.08
LSD 1%	0.27	0.04	0.27	0.26	0.26	0.25	0.27	14.27	0.27
LSD 5%	0.19	0.03	0.19	0.19	0.19	0.18	0.20	10.35	0.20

### Number of floret/spike (mother bulb)

The number of floret per spike was significantly different due to the different bulb size used. The highest number of floret (47.50) was obtained in the plants grown from large bulb and the lowest (34.38) from small bulb (Table 3). This might be due to higher food reserve in the large bulb.

### Number of floret/spike (side shoot)

There was significant difference in number of floret/spike in side shoot due to the different bulb sizes. The highest number of floret (43.26) was obtained in the plants grown from large bulb and the lowest (31.46) from small bulb (Table 3).

### Number of floret in 100 g

Bulb size had significant effect on the number of floret in 100 gm. The maximum number (143.04) of floret in 100 gm was obtained from the small bulb whereas it was the minimum in case of florets produced from the large bulb (123.15) (Table 3).

### Number of spikes/ha (thousands)

In the present study, bulb size had significant effect on the number of spikes/ha. The maximum number spike (424.08 thousand) was obtained from plants that were produced from large bulbs. On the other hand, plants from small bulb produced minimum number of (287.24 thousands) spike/ha (Table 3). Pathak et al. (1980) found similar result.

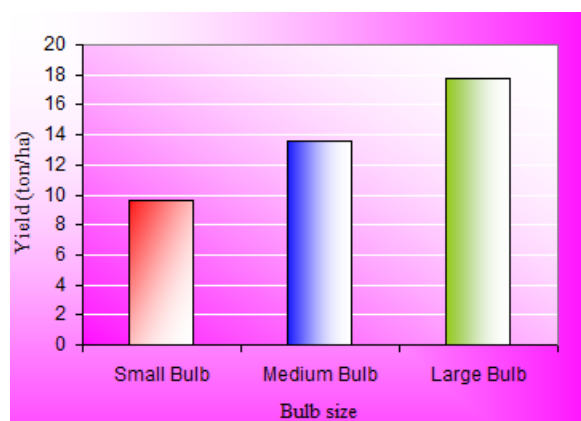


Figure 7  
Effect of bulb size on the flower yield of tuberose.

### Flower yield/ha (tons)

Bulb size had significant effect on the yield of spike per hectare. The highest yields of spike (17.79 ton/ha) were obtained from large size bulb in the present experiment. The yield of spike gradually increased as the size of bulb increased and was the lowest (9.60 ton/ha) in small bulb as shown in Figure 7. The increased yield of spike was due to the increased weight and diameter of mother bulb, formation of maximum proportion of large bulblets and positive enhancement of other parameters like plant height and number of leaves per plant with the use of large bulb. The results of the present experiment are in agreement with the findings of Yadav et al., 1984.

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