



## Comparative study of reproductive biology in *Solanum melongena* L. using different fertilizers

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### Abstract

Reproductive biology provides information on life forms like rate of flowering, type of breeding system, plant-pollinators interaction, fruit and seed output, overall fitness and survival of the species. Present work has been focused to determine the effects of synthetic and organic fertilizers application on the growth parameters like stage of plant development, plant height, number of leaves, number of flowers, flowers to fruits conversion and % yield. Field experiments were conducted in the farms located in *Jahangirabad* area of Surat city from 2017 to 2018. Season for experiments was chosen between month of October to April where average low temperature of Surat ranges from 15°C-21°C and average high temperature ranges from 25°C-35°C. The treatments consisted of two different fertilizers namely synthetic inorganic fertilizer (SF) consisting of NPK and organic fertilizer (OF) chiefly consisting of cow-dung/buffalo-dung/poultry manure. Three plot of 30 x 02 sq. ft area was selected to grow 30 plants of Brinjal. One plot was designated as Control group where no pre-treatment (CB group), one plot treated with SF viz. NPK (SFB group) and the other with OF (OFB group). Results suggest that OF treated plant showed increased plant height, quantity of leaves (per branch & plant) and its weight (fresh & dry), quantity of flowers and fruits, diameter and length of fruit, quantity and weight of seed per fruit as compared to Control group and well comparable with SF treatment. Thus, it is concluded that use of organic fertilizer is equally beneficial as compared to the inorganic fertilizer.

**Keywords:** reproductive, fertilizer, organic, inorganic, brinjal

### Introduction

India is a horticultural paradise (Saravaiya SN and Patel MB, 2005) [15] with a vast array of vegetables being cultivated in a country wherein brinjal is one of the leading and the second major vegetable crops next to tomato which is belongs to the family Solanaceae and is known as under the botanical name *Solanum melongena* L. It is highly productive and usually finds a place as “poor man’s crop”. The young and almost mature fruit are eaten raw or used as vegetable (Edmond JB, 1985) [6] Purple fruits have higher amino acid content. Brinjal fruits have medicinal properties (Rajan S and Markose BL, 2002) [13] viz. use of eggplant tissues and extract include treatment of diabetes, asthma, cholera, bronchitis and diarrhea, its fruit and leaves are reported to lower certain levels of blood cholesterol. The growth, yield and fruit quality of brinjal are largely dependent on a number of interacting factors.

Reproductive biology has important consequences for the viability of rare plant populations through its effects on demography and population genetics, so its study is also crucial in conservation programs (Syngé H (ed), 1981) [16] (De Mauro MM, 1993) [3] (weller SG, 1994) [18] (Evans MEK, 2003). Reproduction is the life process which ensures the perpetuation of life and genetic diversity is mainly generated through recombination processes in sexual reproduction, which is, hence, a process of fundamental importance for population and species biology (Maynard SJ, 1978) [9].

For successful cultivation and conservation of plants a detailed knowledge of their reproductive biology is required. (Moza MK and Bhatnagar AK, 2007) [10]. Reproductive biology mainly focuses on flowering

phenology, floral biology, pollen pollinator interaction, breeding systems and gene flow through pollen and seeds. The task of plant phenology is to observe and record the periodically recurring growth stages and to study the regularities and dependency of the yearly cycles of development on environmental conditions.

Organic manure application is known to supply plant nutrients and improve the soil structure. It has been reported that application of organic manure showed a significant ( $p=0.05$ ) increase in yield than inorganic manure in eggplant production (Ullah MS *et al.* 2008) [17] (Anoop and Chaubanan, 2009). The use of organic manure as fertilizer is essential in improving soil productivity and crop production (Dikinya *et al.* 2010) [5]. The rate of organic manure application has been shown to influence growth and yield of plants (Offiong *et al.* 2010).

Present study is designed to determine the effects of synthetic inorganic fertilizers and organic fertilizers application on the growth of brinjal plant by monitoring of parameters like stage of plant development, plant height, number of leaves per branch & plant, leaves weight (fresh & dry), number of flowers, number of fruit, diameter and length of fruit, fruit weight (fresh & dry), number of seed per fruit and its weight etc.

### Material and method

#### Study area

Field experiments were conducted in the farms located in *Jahangirabad* area of Surat city from 2017 to 2018. Three plots of 30 x 02 sq. ft. area were selected. Soil of selected plots was tested for pH, Electrical conductivity, TOC, N, P, and K before the study started.

### Study period

Season for experiments was chosen between month of October to April where average low temperature of Surat ranges from 15°C - 21°C and average high temperature ranges from 25°C - 35°C.

### Study design

Seeds of Brinjal were purchased from private seed companies located in city Surat. 90 plants of Brinjal were planted across the study area. 30 Brinjal plants were grown in each plot wherein one plot was designated as control group, second plot for synthetic fertilizer viz. NPK fertilizer (SF) and third plot for organic fertilizer (OF) respectively. Spacing between two plants was kept 30 x 30 cm. Soil of control group plot was kept without any treatment of fertilizer and labelled as CB (control for Brinjal) whereas in other two plot, pre-conditioning of soil was done with

synthetic inorganic fertilizer (SF) and organic fertilizer (OF) before 10 days of sowing seedlings which were labelled as SFB (synthetic fertilizer for Brinjal) and OFB (organic fertilizer for Brinjal) respectively. Next treatment with- OF and SF was scheduled after the setting of first flowering to the treatment groups. Irrigation was done every six days after a plant attain the height of approximately 15 cm.

### Pest control

For controlling the pests, organo-phosphorus based pesticides was used for spraying SF plots while organic herbal-based pesticides were made for spraying OF plots.

### Data monitoring and recording

Two parameters viz. Growth parameters and Reproductive parameters were monitored and recorded during the study and are tabulated as below;

**Table 01:** Growth Parameters [1-6] and Reproductive Parameters [7-18]

1.	Number of leaves per branch	10.	Number of pollens
2.	Number of leaves per plant	11.	Number of fruits per plant
3.	Plant height	12.	Fruit diameter
4.	Average leaf area	13.	Fruit length
5.	Fresh weight of leaves	14.	Fruit weight-fresh
6.	Dry weight of leaves	15.	Fruit weight-dry
7.	Number of flowers per plant	16.	Number of seeds per fruit
8.	Bud bursting	17.	Seed weight in one fruit-dry
9.	Length of stigma	-	--

Parameters from 1 to 6 are growth parameter and evaluated at 15-, 30-, 45- and 60-days. Parameters from 7 to 17 are reproductive parameters and studied from setting of buds till four month of crop time. On-setting of buds to anthesis (bud bursting) was monitored in morning time between 9.00 am to 1.00 pm.

### Study of Nutritional Parameters

Addition to above nutritional values of brinjal fruits viz. Protein content (%), Carbohydrate content (%), Sugar content (%), Dietary fibre and Vitamin C were analysed. Protein content (%) was performed by Lowry Method; Carbohydrate content (%) was performed by phenol-sulphuric acid method; Sugar content was measured by Cole's method and dietary fibre (%) was measured by enzymatic-gravimetric method. Vitamin C content was measured by volumetric analysis (Sadasivam S and Manickam A, 2007) (Mukherjee KS, 2008) (Patel R and Patel K, 2017)

The data were analyzed by the help of statistical Analysis of T-test.

N (ppm, mg/ml)	P (ppm, mg/ml)	K (ppm, mg/ml)	pH	Conductivity (Ω)	TOC (%)
1.05	1.67	2.6	7.8	128.9	1.34

Growth Parameters:

### Leaves per branch and leaves per plant

Figure -1 represent "Leaves per Branch" and accordingly number of leaves are increased on 60<sup>th</sup> day in SFB and OFB group as compared to CB group. While comparing the result between SFB and OFB groups, no significant variations is

### Results and discussion

The Present study reveal the effect of Synthetic fertilizer and Organic fertilizer application on brinjal crop for growth parameters, reproductive parameters and nutritional parameters studied are discussed below.

### Soil analysis

Before application of fertilizers, soil samples up to 20 cm depth were collected randomly from different parts of the field and analyzed for Physico-chemical properties of soil. After the harvest of the crop the soil samples up to 20 cm were taken from each treatment in each replication and analyzed for Physico-chemical properties of soil and then their average was calculated. The soil analysis was carried out for chemical characters in the laboratory at government science college, Vankal, Gujarat, India and results are tabulated as below:

observed in both the group.

Figure-2 represent "Leaves per plant" and accordingly number of leaves per plant of brinjal are almost same in SFB group and OFB group on 60<sup>th</sup> day while it was low in CB group.

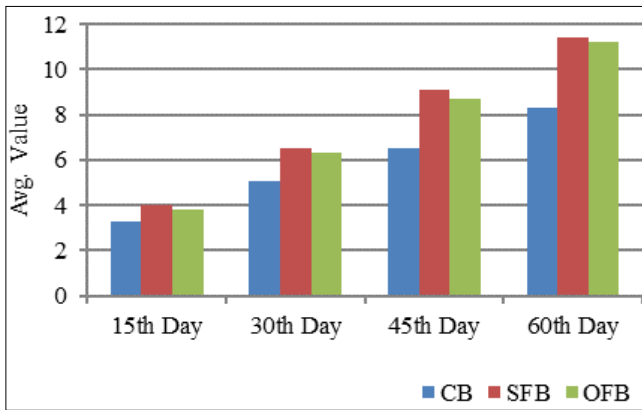


Fig 1: Leaves Per Branch

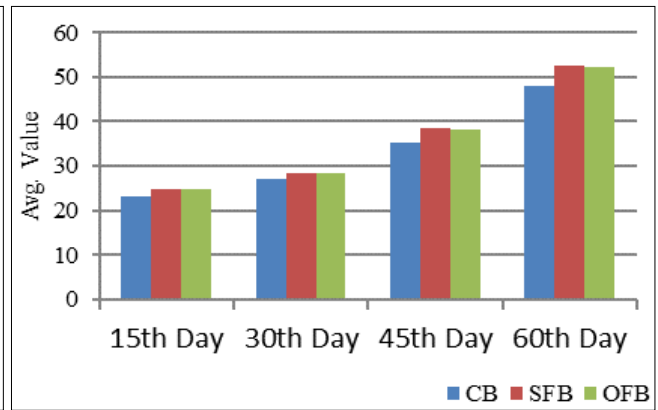


Fig 2: Leaves Per Plant

**Area and weight of leaves**

According to figure-3, area of leaves are vigour in SFB and OFB group plants as compared to CB group whereas results are well comparable between SFB and OFB group.

Figure-4 represents “Weight of leaves” and accordingly wet weight and dry weight of leaves are significantly increased in SFB and OFB group than CB group whereas results are well comparable between SFB and OFB group.

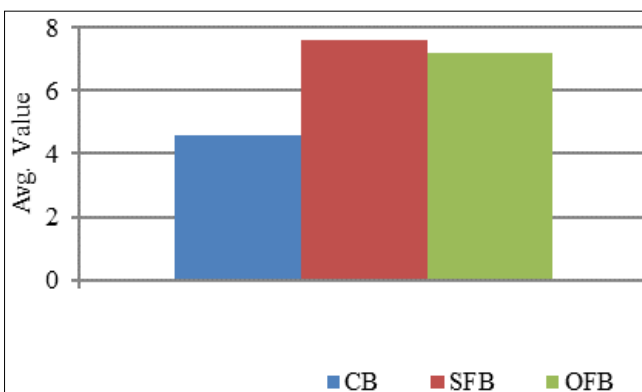


Fig 3: Area of Leaves

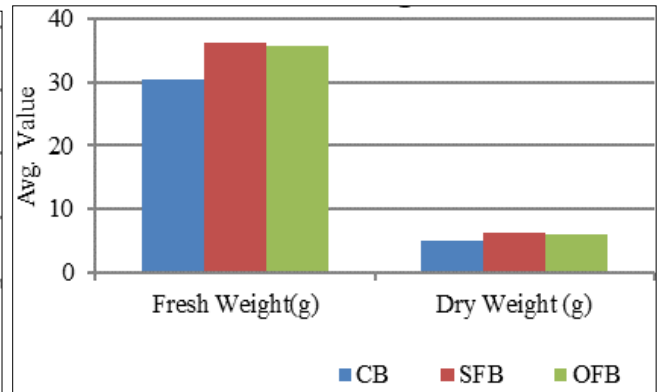


Fig 4: Leaves Weight

**Plant Height**

As per figure-5, plant height is significantly increased on 60<sup>th</sup> day in SFB and OFB group as compared to CB group

plants whereas insignificant difference in plant height between SFB group than OFB group.

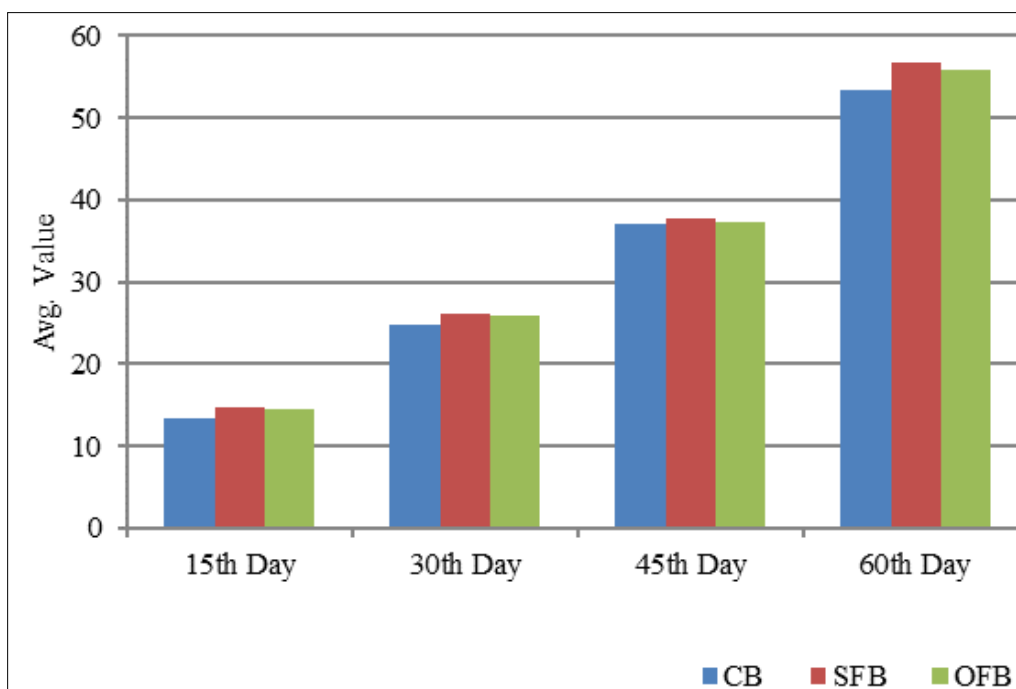


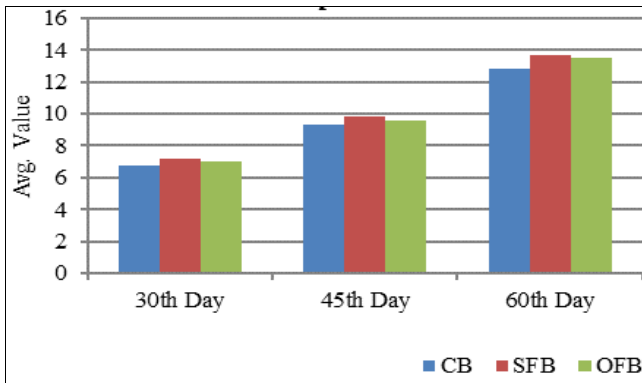
Fig 5: Plant Height

Based on above presentation there is no significant variation reported in growth parameters between SFB and OFB group and are well comparable; whereas decreased in CB group plants.

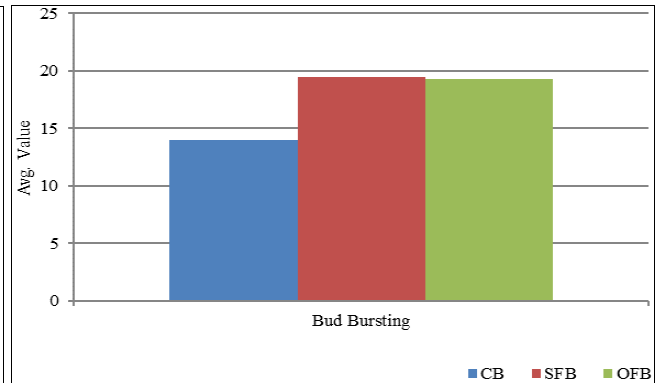
**No. of flower and flower buds**

As per figure-6 “No. of flowers” and figure-7 “Bud bursting”, SFB group shows increased amount of flower and flower buds than CB group whereas insignificant increased as compare to OFB group.

**Reproductive Parameters**



**Fig 6:** Flower per Plant

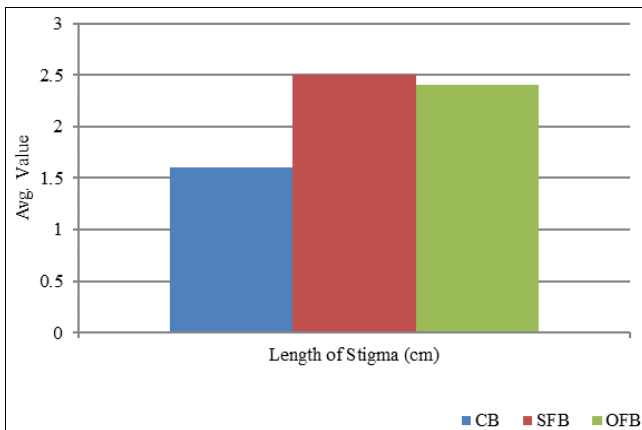


**Fig 7:** Bud Bursting

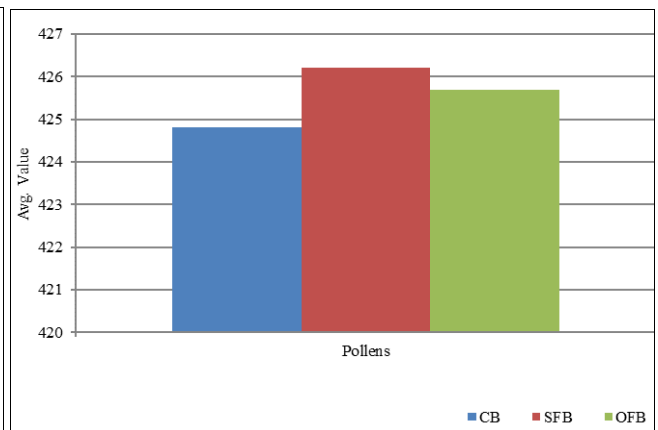
**Length of stigma and number of pollens**

Graphical presentation of figure-8 “Length of stigma” and figure-9 “no. of pollens” represents significant increases in

length of stigma and no. of pollens in SFB group as compared to CB group while non-significant increases than OFB group.



**Fig 8:** Length of Stigma

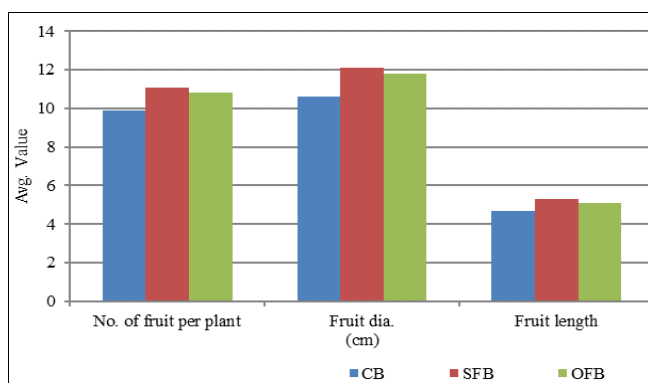


**Fig 9:** No. of Pollens

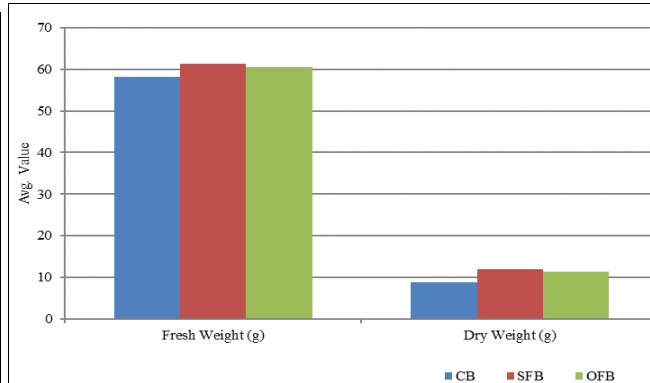
**Yield of fruits**

According to figure-10 “No. of fruits and fruit size”, number of fruits per plant was better in SFB and OFB group than CB group. Length and diameter of fruits are also increased in SFB group as compared to CB group whereas non

significantly high than OFB group. As per Figure-11 “Fruit Weight”, dry and wet weight of fruit is comparable between SFB and OFB group whereas significantly high than CB group.



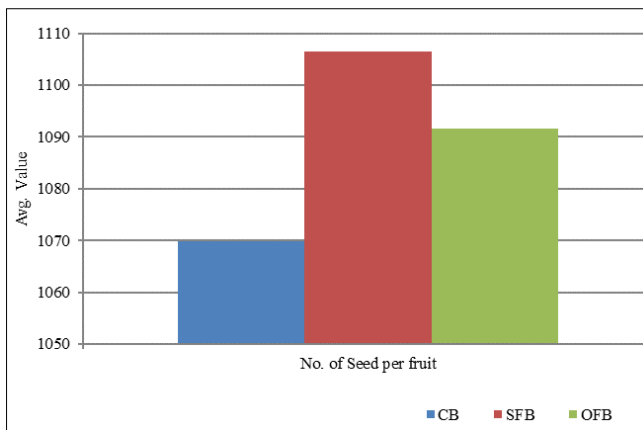
**Fig 10:** No. of fruits & fruit Size



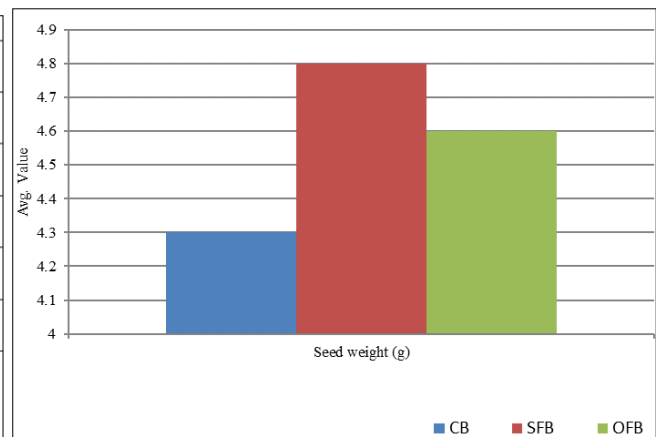
**Fig 11:** Fruit Weight

### No. of seed and seeds weight per fruit

As per figure-12 “No. of seeds” and figure-13 “Weight of seeds”, amount and weight of seed were non significantly



**Fig 12:** No. of Seed per Fruit



**Fig 13:** Seed Weight per Fruit

### Nutritional Parameters

Study was conducted for nutritional parameters like protein content (%), Carbohydrate content (%), Sugar content (%), Dietary fibre and Vitamin C for all the group of plants of field experiments viz. CB, SFB and OFB groups.

According to table-02, results showed significant increased in the parameters like Dietary fibre, carbohydrate and sugar content in OFB group then CB and SFB groups. There was increase in protein % in SFB group than CB whereas well comparable with OFB group. Vitamin C was non significantly low in CB group compared to SFB & OFB groups.

**Table-02:** Results of Nutritional parameters (Average Value per 100g)

Nutritional Parameter	CB	SFB	OFB
Protein (g)	0.86	0.91	0.92
Carbohydrate (g)	5.17	5.28	5.62
Sugar (g)	3.06	3.19	3.34
Vitamin C (mg)	2.05	2.06	2.07
Dietary fibre (g)	2.8	3.0	3.1

Above field experiments result represents that the growth and reproductive parameter of brinjal plants were increased and well comparable in SFB and OFB group than controlled group (CB) which did not pre-treated with any additional supplement (fertilizer treatment) during the study. Hence, organic fertilizer is equally efficient to grow the plants and have equal significance; Organic fertilizer can surrogate the requirement for usage of chemical based synthetic fertilizer. Organic manure application is known to supply plant nutrients and improve the soil structure. It has been reported that application of organic manure showed a significant ( $p=0.05$ ) increase in yield than inorganic manure in eggplant production (Ullah *et al.* 2008) (Anoop and Chauban, 2009). The use of organic manure as fertilizer is essential in improving soil productivity and crop production (Dikinya *et al.* 2010) [5]. The rate of organic manure application has been shown to influence growth and yield of plants (Offiong *et al.* 2010). The higher number and weight of fruits obtained from the application of higher rates of organic manure is in accordance with the studies of (Asiegbu JE and Uzo FO, 1984) (Devi *et al.* 2002) (Ogar and Asiegbu, 2005) [2] (Aujla *et al.* 2007) and (Mohammad *et al.* 2010) where higher rates

high in SFB group than OFB group whereas it was statistically low in CB group in comparison to SFB & OFB groups.

of nutrients increased the average fruit weight and volume. This fact may highlight the possible soil physical characteristics improvement benefits derivable from the use of organic matter (Amon and Adetunji 1967) (Hafez AAR, 1974) [8] and (Mbagwu and Ekwualor, 1990) in enhancing the overall crop growth and yield.

### Conclusion and recommendation

Above result depicts that the fertilizers used during farming has direct effect on growth parameters like no. of leaves, leaf area, inter node length etc. and reproductive parameters as mentioned above. The effect was also seen on biological time of plant i.e., early bud-setting and flower anthesis by the use of organic fertilizers on brinjal. Organic fertilizer also showed good results in nutritive value of the crops and yield of crops as well when compared to inorganic fertilizer. Hence, Organic fertilizer plays equal role in growth of brinjal plants as compare to synthetic inorganic fertilizer. It is the matter of research to understand that how fertilizer can affect the genotyping or alters the pheno typing of genes for flowering.

### Acknowledgement

Author would like to express their sincere thanks to Dr. Meghna Adhvaryu for guidance & supervision as well as Dr. Bhaskar Vakhariya and Ms. Gita Jadav for required support during the study.

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