# *Original Research Article*

# Response of Bottle Gourd (*Lagenaria siceraria*(Mol.) Standl.) to Integrated Nutrient Management

## ABSTRACT

A field experiment was conducted during *Kharif* 2019 at, All India Co-ordinate Research project, (AICRP), College of Agriculture, Odisha University of Agricultural and technology (OUAT).The experiment consisted of twelve treatments with three replications evaluated in randomized block design. Results of field experiment revealed that the minimum days to seed germination (7.00days), maximum vine length (49.8, 187.7, 285.95 cm at 30, 60, 75 DAS, number of branches (6.18, 7.43, 8.12) at 30, 60, 75 DAS, leaf length (22.87cm), leaf width ( 21.76cm), leaf weight (48.14g), stem diameter(2.77cm), number of nodes on main vine (42.12), node bearing 1st male flower (4.16), node bearing 1st female flower (6.87), fresh wt. of fruit (1231g), dry wt. of fruit (48.75g), no. of seeds fruit$^{-1}$ (448), fruit yield (28.01 q ha$^{-1}$) was recorded with treatment 50%RDF+ FYM @ 7.5t ha$^{-1}$+VC @ 2.5 t ha$^{-1}$+ biofertilizer Consortia ($T_{12}$) and minimum under control ($T_1$).

*Keywords: Bottle gourd, nutrient, growth, flowering, yield, organic, inorganic, productivity*

## 1. INTRODUCTION

Bottle gourd (*Lagenaria siceraria*) is a Cucurbitaceae plant that is also known as lauki, dudhi, or ghiya in India. Bottle gourd is a popular vegetable among Indians and has several health advantages. It contains the most choline of any vegetable, which serves as a precursor to the neurotransmitter acetylcholine, which is essential for memory retention and enhancement. [1]. There has been a recent movement in preferences towards consuming more fresh vegetables and related products, including beverages, as a result of increased health consciousness among individuals. The tri-terpenoid cucurbitacins B, D, G, and H as well as the bitter cucurbitaceae main component 22-deoxy-cucurbitacin are said to be present in the vegetable [2].

Bottle gourd juice has great therapeutic value, and the vegetable not only contains a wealth of protein, iron, and trace elements, but also has a high fibre content and other useful qualities. It is a decent source of vitamin C and a good source of vitamin B complex. [2]. The freshly extracted juice is an effective treatment for diabetes, epilepsy, stomach acidity, indigestion, ulcers, and other nervous illnesses [3]. It also helps people who have excessive thirst as a result of severe diarrhoea. Additionally, the fibre component aids in reducing piles and other digestive issues including gas.

Bottle gourd extracts have anti-inflammatory and anti-hyperlipidemic properties [4]. In several research model systems, fresh fruit juice has also shown antiulcer efficacy [5], hepato-protective, free radical scavenging [6],immuno-modulatory, and cardio protective impact [7]. It has been demonstrated that this readily available vegetable helps people lose weight and is highly effective in treating jaundice and urinary issues.

Bottle gourd requires large quantity of both organic and inorganic fertilizers. It has been realized worldwide that chemical fertilizers, while increasing crop yield may have adverse effect on soil health and its fertility in case of imbalanced use. In order to improve and maintain soil fertility for sustained crop productivity, all available organic, inorganic, and biotic resources must be optimised in an integrated manner that is appropriate to each cropping system and farming situation, with all of its ecological, social, and economic implications. This process is known as integrated nutrient management, or INM. Renewing interest in organic recycling has been seen throughout the world for sustainable crop production as a result of the recent energy crisis, price increases in chemical fertilizers as a result of the removal of government subsidies, and poor purchasing power of the farming community[8]. To encourage effective and balanced application of plant nutrients, it is necessary to implement an integrated supply and management system. While increasing the proper and balanced use of chemical fertilizers was the main focus, the use of organic manure, biofertilizers, green manuring, and the recycling of organic wastes should be seen as complementary rather than as a substitution.

Odisha's newly introduced crop demanded the rapid adoption of integrated nutrient management packages that combined chemical fertilizers with available locally organic sources. In light of this, a study was conducted to determine how the combined application of inorganic and organic manures affected bottle gourd yield and yield qualities.

## 2. MATERIAL AND METHOD

The study was carried out at All India Co-ordinate Research Project, (AICRP), College of Agriculture, Odisha University of Agricultural and Technology (OUAT).The soil was sandy loamy in texture, low in available nitrogen(212.50kg $ha^{-1}$) and high in phosphorus (25.03 kg $ha^{-1}$) and medium in potassium (205.70 kg $ha^{-1}$). There are twelve treatments and three replications. Treatment details are presented on Table 1.The cultivar Utkal Sobha was used for experiment. All standard package of practices for cultivation were followed for irrigation, weeding and plant protection. All the characters studied like days to seed germination, vine length at the time of 30,60,75 DAS (cm), no. of branches at 30,60,75 DAS, leaf area ($cm^2$), leaf length (cm), leaf width (cm), leaf weight (g), stem diameter (cm), no. of nodes on main vine , moisture % of fruit, dry matter % of fruit, fresh wt. of fruit ,dry wt. of fruit , no. of seeds per fruit yield per hectare (t $ha^{-1}$), was subjected to statistical analysis using variance technique [9].

**Table 1 : List of treatments used for the study**

| Treatment No. | Treatment details |
|---|---|
| $T_1$ | Absolute Control |
| $T_2$ | 100% RDF (80:50:50kg $ha^{-1}$) |
| $T_3$ | FYM @ 15 t $ha^{-1}$ |
| $T_4$ | VC @ 2.5 t $ha^{-1}$ |
| $T_5$ | 50%RDF+ FYM@7.5 t/ha +BFs |
| $T_6$ | 50%RDF+VC@2.5t/ha +BFs |
| $T_7$ | FYM@7.5t/ha +BFs |
| $T_8$ | 50%RDF+BFs |
| $T_9$ | VC@7.5t/ha +BFs |
| $T_{10}$ | 100%RDF+FYM@15t/ha +BFs |
| $T_{11}$ | 100%RDF+VC@7.5t/ha+ BFs |
| $T_{12}$ | 50%RDF+ FYM@7.5t/ha+ VC@2.5t/ha +BFs |

## 3. RESULTS AND DISCUSSION

### 3.1.Vegetative growth parameters

The results obtained in respect to vegetative parameters like Days to seed germination, Vine length at 30,60,90DAS, number of branches at 30,60,90DAS, Leaf area ($cm^2$) at 30DAP, Leaf length, leaf width, leaf weight (g), stem diameter (cm), number of nodes on main vine, treatment shown significant differences.

#### 3.1.1. Days to seed germination

Data pertaining to the effect of organic manure and inorganic fertilizer on days required for germination of seeds of bottle gourd was found to be non significant which are presented in Table 1.Similar results have been reported by Mohmmad *et al*.,[10] Jan *et al*.,[11]in bottle gourd.

#### 3.1.2. Vine length at 30, 60, 90DAS

The data on the growth in terms of main vine length at 30, 60,75 DAS in bottle gourd as significantly influenced by application of organic manure and inorganic fertilizer levels are illustrated graphically in Fig.1 Among the significantly the maximum main vine length at 30DAS(49.90cm) were with treatment $T_{12}$, while, the minimum main vine length at 30 DAS (26.88) were obtained with treatment $T_1$ (Control) which was 4.35per cent more than RDF. Significantly the maximum main vine length (187.70cm) at 60 DAS were obtained with treatment $T_{12}$, while, the minimum main vine length (112.80cm) were observed in treatment (control) which was 3.16 per cent more than RDF. Similarly, maximum main vine length at 75 DAS (283.53) were with treatment $T_{12}$, while, the minimum main vine length at 90 DAS (285.95) were obtained with treatment $T_1$Control which was 10.03 per cent more than RDF. Both chemical and organic fertilizers are essential for plant growth. The increased root systems of plants, which allowed them to absorb more water and nutrients from the soil and, in turn, improved various plant organs as well as the entire plant, may be to blame for the increase in vine growth. Both artificial and organic fertilizers are essential for plant growth.

The longer vines may be a result of the plants' better root systems, which allowed them to absorb more water and nutrients from the soil, improving various plant parts as well as the entire plant. Plant height is increased as a result of improved cell multiplication and cell elongation.The results presented above are highly consistent with those of Patil *et al*.[12], Mohmmad *et al*.[13]and Jan *et al*.[14] in bottle gourd.

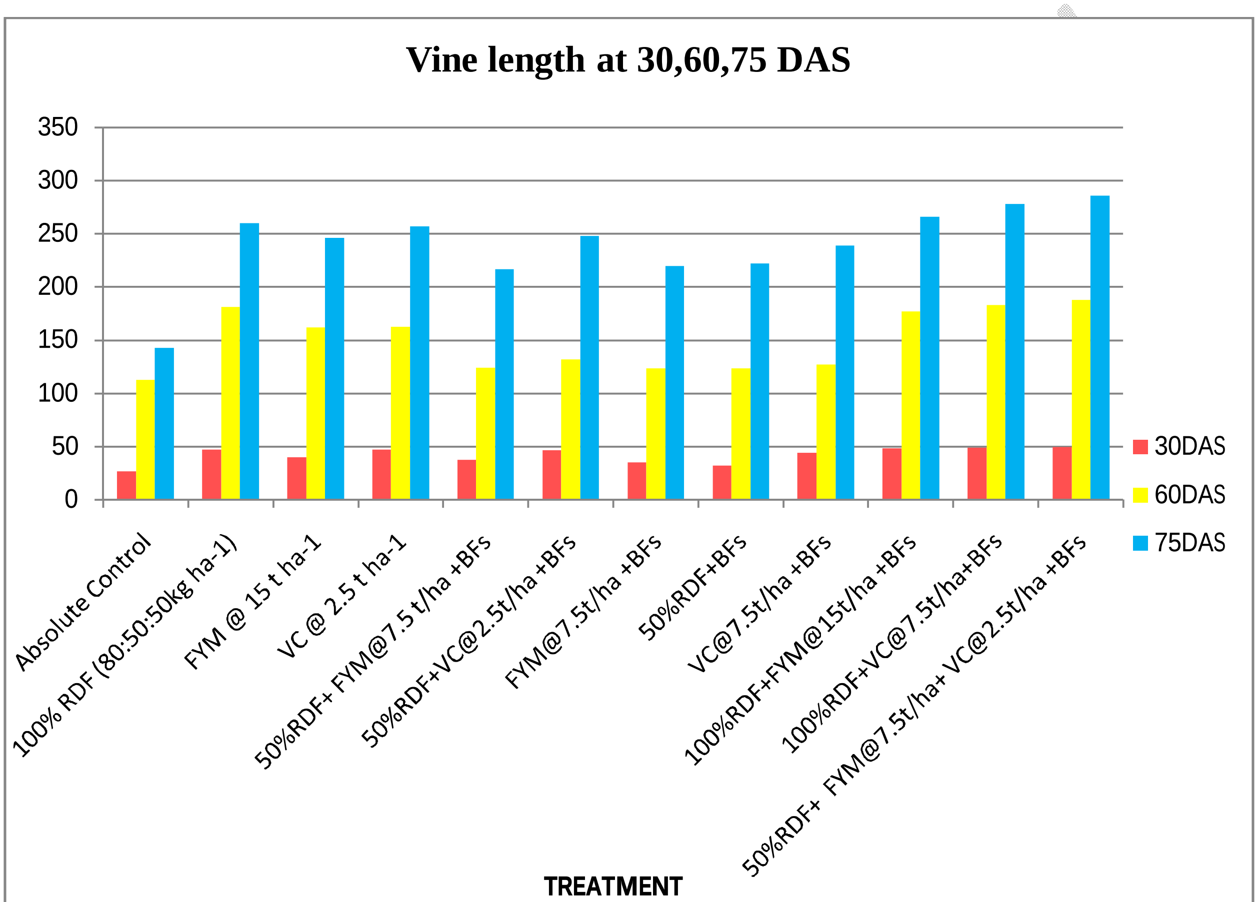


**Fig 1: Vine length at 30,60,75 DAS under the influence of integrated nutrient management**

### 3.1.3. Number of branches from main vine

The data on the growth in terms of number of branches from main vine at 30, 60,90 DAS in bottle gourd as significantly influenced by application of organic manure and inorganic fertilizer levels are illustrated graphically in Fig.2

Number of branches from main vine increased significantly with increasing levels of organic manure and inorganic fertilizer significantly the maximum number of branches vine$^{-1}$ (6.18, 7.43, 8.12) at 30, 60, 75 DAS were obtained with treatment $T_{12}$ ( 50% RDF+ FYM@ 7.5 t ha$^{-1}$ + VC @ 2.5 t ha$^{-1}$ + BFs, while, the minimum number of branches per vine (1.72, 2.82,3.04) was observed in treatment $T_1$ (control).(Table).Treatment give (59.68, 49.19, 30.12 per cent more branches than RDF.

Increase in vine length and branches is readily known as nitrogen, which is an essential component of plant building material, boosted the length of the vine and the number of branches plant$^{-1}$, as seen by the number of leaves yielded on each plant. These findings correspond with those of Rekha [14]for bitter gourd and selva kumar and sekar [15 ]for cucumber.

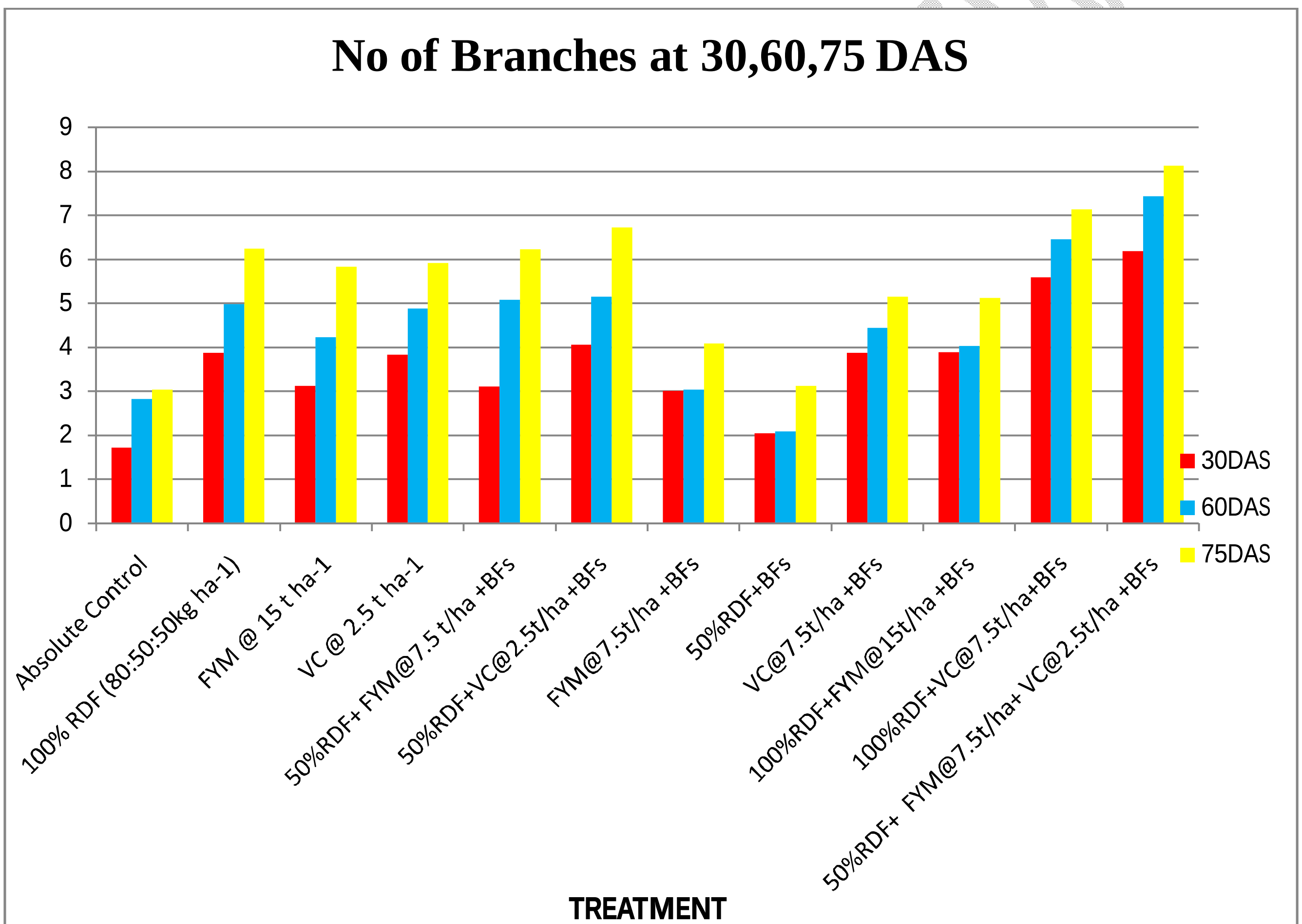


**Fig 2: No. of branches at 30, 60, 75 DAS under the influence of integrated nutrient management**

### 3.1.4. Leaf area (cm$^2$) (30DAP)

In terms of leaf area, treatment $T_{12}$ (50%RDF+FYM @ 7.5t ha$^{-1}$+VC @ 2.5t ha$^{-1}$+BF) recorded maximum (547.93 cm$^2$) leaf area, followed by $T_2$, $T_3$, $T_4$, $T_5$, $T_6$, $T_7$, $T_8$, $T_9$, $T_{10}$, $T_{11}$ on the other hand, minimum (429.00cm$^2$) was recorded in treatment $T_1$ (Control).According to Hatwar *et al.* [16] the increase in leaf area resulted on by supplying plants with nutrients from various sources through organic, inorganic, and biofertilizer consortia may be the result of improved photosynthetic and other metabolic activities that result in an increase in the plant metabolites necessary for cell division and elongation. These outcomes support the findings of other researchers Narayanamma *et al*.[17] in bitter gourd and Rab and Haq [18] in tomato.

### 3.1.5. Leaf length (cm) and leaf width (cm)

The data regarding the leaf length by the effect of different IPNM treatments are given in table.1.the maximum leaf length (22.87cm) was noted with $T_{12}$ (50% RDF+ FYM @ 7.5t ha$^{-1}$+VC @ 2.5 t ha$^{-1}$+BF) followed by $T_2$, $T_{10}$, $T_{11}$.The treatments $T_2$, $T_{10}$, $T_{11}$ are noted *statistically at par* with each other. The minimum leaf length (13.6cm) were noted under $T_1$ (control). Treatment $T_{12}$ give 4.14 per cent more leaf length (cm) than RDF. The data related to the leaf width as given in table 2. the maximum leaf width (21.76cm) were recorded under $T_{12}$ (50%RDF+FYM@7.5tha$^{-1}$+VC@2.5 t ha$^{-1}$+BF) .The treatment $T_2$, $T_3$, $T_4$, $T_6$, $T_{10}$, $T_{11}$ are noted *statistically at par* with each other. The increase in the leaf length and leaf width might be due to simultaneous effect of availability of more nitrogenous compounds rate of photosynthesis which helps in the cell division and cell elongations of plants. The present results are in conformity with the findings of Bhople *et al.* [19], Sharma and Singh [20],Kumar *et al.*[21]; Yuanxin *et al.* [22]and Kannan and Manivannan [23].

### 3.1.6. Leaf weight (g) plant$^{-1}$

The leaf weights varied with each other by the application of different sources of nutrients. The data regarding the leaf weight are given in the table 2.The scanning of the data related to the leaf weight per plant varied significantly and noted maximum leaf weight (48.14g) under $T_{12}$ followed by $T_2$, $T_3$, $T_4$, $T_6$, $T_{10}$, $T_{11}$ which were *statistical parity* was observed. The maximum fresh weight of leaf in the present experiment might be due to the maximum leaf length and width under this treatment ($T_{12}$). The present findings are in agreement with the findings of the Sharma *et al.* [24] and Sharma and Singh [25]. Kalyani *et al.* [26] and Prasad *et al.*[27]. The view of Bambal *et al.*[28] and Banger *et al.*[29] was that there is more availability of nutrients like sulphur which helps in the utilization of the more nitrogenous elements by the plants.

### 3.1.7. Stem diameter

As it is clearly evident from the above data related to stem diameter has placed under table 2. and vary significantly with each other. Data showed that maximum stem diameter (2.77) were recorded under $T_{12}$ (50%RDF+FYM@7.5tha$^{-1}$+VC@2.5 t ha$^{-1}$+BF) and noted *at par* with the treatments $T_{10}$ and $T_{11}$. The minimum stem diameter (0.73 cm) were noted under $T_1$.

### 3.1.8. Number of nodes on main vine

Perusal of data related to number of nodes on main vine (42.12) is presented in table-2. revealed that nutrient dynamics significantly influenced the number of nodes on main vine. Maximum number of nodes on main vine (42.12) were recorded with $T_{12}$ and noted *at par* with treatment $T_2$, $T_4$, $T_5$, $T_6$, $T_9$, $T_{10}$, $T_{11}$. The minimum number of nodes were recorded under $T_1$ *i.e.*28.15.

**Table2: Vegetative growth parameters under the influence of integrated nutrient management**

| | Treatments | Days to seed germination | Leaf area ($cm^2$) (30DAP) | Leaf length (cm) | Leaf width (cm) | Leaf weight(g) | Stem diameter (cm) | Number of nodes on main vine |
|---|---|---|---|---|---|---|---|---|
| $T_1$ | Absolute Control | 10.00 | 429.00 | 13.6 | 16.07 | 39.12 | 0.73 | 28.15 |
| $T_2$ | 100% RDF (80:50:50kg $ha^{-1}$) | 7.00 | 501.76 | 21.96 | 19.82 | 46.37 | 1.92 | 41.67 |
| $T_3$ | FYM @ 15 t $ha^{-1}$ | 7.33 | 491.91 | 19.64 | 19.2 | 43.63 | 1.19 | 36.12 |
| $T_4$ | VC @ 2.5 t $ha^{-1}$ | 7.67 | 490.19 | 19.12 | 19.07 | 44.62 | 1.26 | 37.23 |
| $T_5$ | 50%RDF+ FYM@7.5 t/ha +BFs | 7.47 | 491.77 | 19.07 | 17.73 | 42.72 | 1.16 | 38.42 |
| $T_6$ | 50%RDF+VC@2.5t/ha +BFs | 7.67 | 488.76 | 18.94 | 18.6 | 43.12 | 1.12 | 39.65 |
| $T_7$ | FYM@7.5t/ha +BFs | 7.8 | 482.85 | 18.05 | 17.57 | 41.76 | 1.43 | 35.75 |
| $T_8$ | 50%RDF+BFs | 7.45 | 478.93 | 16.89 | 17.53 | 40.05 | 0.95 | 35.50 |
| $T_9$ | VC@7.5t/ha +BFs | 7.25 | 484.54 | 18.63 | 17.7 | 41.72 | 1.93 | 36.75 |
| $T_{10}$ | 100%RDF+FYM@15t/ha +BFs | 7.00 | 512.86 | 21.23 | 20.9 | 46.17 | 2.48 | 40.23 |
| $T_{11}$ | 100%RDF+VC@7.5t/ha+BFs | 7.00 | 508.93 | 22.17 | 20.03 | 47.17 | 2.56 | 41.13 |
| $T_{12}$ | 50%RDF+ FYM@7.5t/ha+ VC@2.5t/ha +BFs | 7.00 | 547.93 | 22.87 | 21.76 | 48.14 | 2.77 | 42.12 |
| Mean | | 7.55 | 492.45 | 19.35 | 18.83 | 43.72 | 1.62 | 37.73 |
| SE(m)± | | 0.37 | 28.85 | 0.85 | 1.08 | 1.80 | 0.08 | 1.98 |
| CD (5%) | | NS | 84.61 | 2.51 | 3.18 | 5.28 | 0.24 | 5.81 |

### 3.2. Flowering parameters

### 3.2.1. Node bearing 1st male flower and 1st female flower

Data regarding in the nodes to first male flower initiation is presented in fig. 3, it is evident from the present experiment that first nodes male flower initiation exhibited the significant response of different source of nutrients. The earliest male flowering node at 4.16 were recorded under $T_{12}$ (50% RDF + FYM @ 7.5 t $ha^{-1}$ + VC @ 2.5 t $ha^{-1}$ +BFs) followed by $T_{11}$ (100% RDF + VC @ 2.5t $ha^{-1}$ + BFs) and $T_2$ (100%RDF). The delay in initiation of nodes to first male flower was noted at 13.12 nodes in $T_1$ (Control).As graphically represented in fig.3. reflects significant response with the effects of IPNM treatments. The first female flower was seen very early in the $T_{12}$ (7.03 nodes) than rest of the treatments. However, *statistical parity* were observed with treatments in $T_2$,$T_{10}$ and $T_{11}$.The maximum days seen by nodes under taken in the initiation first female flower 14.47 nodes under $T_1$(Control). The view of Singh and Asrey [30] was that the increase is due to the fact that these nutrients are crucial components of proteins, chlorophyll, nucleotides, and enzymes involved in a variety of metabolic activities that directly affect the vegetative and reproductive phases of plants. Mangal and Kirkby [31]also agreed with the present findings.

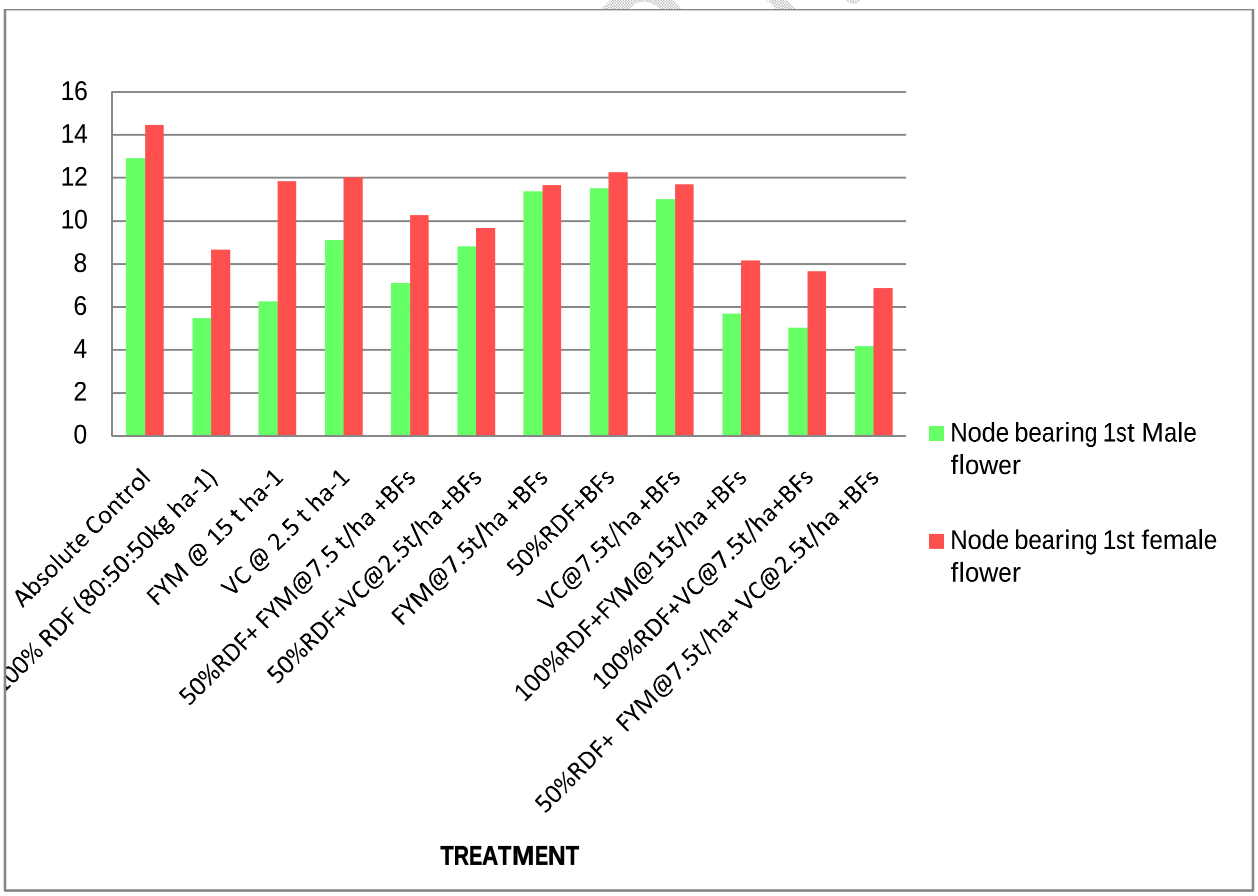


**Fig 3: Node bearing 1st male and female flower under the influence of integrated nutrient management**

### 3.3. Yield attributing parameters

#### 3.3.1. Moisture % of fruit

The maximum moisture per cent (96.64) was obtained in bottle gourd fruit with the treatment $T_9$ (VC @ 7.5t $ha^{-1}$), while minimum 95.50 per cent in treatment $T_1$(Control). The data withregards to the moisture per cent of fruit as influenced by various IPNM treatments is presented in table- 2 showed that moisture per cent of fruit was non-significantly influenced by different treatments.

#### 3.3.2. Dry matter % of fruit

The minimum dry matter per cent (3.35) was obtained in bottle gourd fruit with the treatment $T_9$ (VC @ 7.5t $ha^{-1}$), while maximum 4.50 per cent in treatment $T_1$(Control). The data with regards to the dry matter per cent of fruit as influenced by various IPNM treatments is presented in table- 2 showed that dry matter per cent of fruit was non-significantly influenced by different treatments.

#### 3.3.3. Fresh weight and Dry weight of fruit (g)

The data presented on fresh weight of fruits as influenced by thevarious treatments has been presented in table-2. showed that average weight of fruit was significantly influenced by different treatments. The maximum average fruit weight was exhibited by treatment $T_{12}$ (50% RDF+ FYM @ 7.5t $ha^{-1}$+ VC @ 2.5t $ha^{-1}$ +BFs) i.e., 1231g which was *statistically superior* over all the other treatments. Theminimum fresh weight of fruit i.e. 587 g was recorded undertreatment ($T_1$).The data presented on dry weight of fruits as influenced by the various treatments has been presented in table-3 showed that average weight of fruit was significantly influenced by different treatments. The maximum average dry fruit weight was exhibited by treatment $T_{12}$ (50%RDF+ FYM @ 7.5t $ha^{-1}$+ VC @ 2.5t $ha^{-1}$ +BFs) i.e., 48.75g which was *statistically superior* over all the other treatments. The minimum dry weight of fruit i.e. 26.42 g was recorded under control.

Organic fertilizer application enhances the fresh and dry weight of fruits more than chemical fertl iser treatment.The higher efficacy of these treatments could be related to the availability of more nutrients, and their slow ease. Vermicompost application resulted in a significant rise in fruit dry weight which may be attributable to the material being broken down by interactions between earthworms and microorganisms in a haemophilic process to produce organic soil amendments with low CN ratios. Similar findings were also reported by Prajapati *et al*.[32].

#### 3.3.4. No of seeds fruit$^{-1}$

The number of seeds fruit$^{-1}$ has also been significantly influenced among different treatments including control (Table 3.). Maximum number of seeds per fruit was recorded in $T_{12}$ (443) followed by $T_2$, $T_5$, $T_6$, $T_7$, $T_9$, $T_{10}$, $T_{11}$ which were *statistically parity* was observed. The lowest number of seeds per fruit was recorded in $T_1$ (302).

### 3.3.5. Fruit Yield (t ha$^{-1}$)

The total yield of bottle gourd fruit as presented in table-3, showed that there was significant response of IPNM treatments toward increasing the fruit yield in bottle gourd. A careful examination of data on the total yield of bottle gourd fruit showed that the maximum yield of fruit 28.01 q ha$^{-1}$ was noted in $T_{12}$ (50% RDF+ FYM @ 7.5t ha$^{-1}$+ VC @ 2.5t ha$^{-1}$ +BFs) which was *significantly superior* over all other treatments. The minimum fruit yield 7.40 q ha$^{-1}$ were obtained with ($T_1$) Control. The data of both the years had shown the significant and superior response. Higher yield due to integrated nutrient management was reported earlier in pumpkin by Karuthamani *et al.* [33], Bindiya *et al.*[34] in cucumber, Nair [35] in bitter gourd, Mulani *et al.*[36] in bitter gourd and Karuppaiah and Balasankari [37] in snake gourd.

Organic manures (FYM/ Vermicompost) with RDF integration would have supplied appropriate macro and micronutrient specifications, creating a favourable environment for crop growth and development, and thereby yield (Anburai and Manivannan, 2002)[38].

The inoculation of microbial populations increases the efficacy of giving biologically fixed nitrogen, dissolved immobilised phosphorus, and phytoharmones to growing plants. Furthermore, they may boost nutrient absorption as well as the photosynthetic process, resulting in greater plant growth and productivity. Patton *et al*. [39].

## 4. Conclusion

Integrated nutrient management treatments had significant impacts on almost all of the vegetative growth, yield attributing, and fruit quality measures of bottle gourd cv. Utkal Sobha. The treatment included 50% RDF + FYM @ 7.5 t ha+ VC @ 2.5 t ha-1 +BF. Consortia had the best results in practically all vegetative development, blooming, and yield characteristics.In terms of the results of the preceding characters, the control treatment, in which no nutrition was applied from outside, performed poorly.

So, keeping view on higher productivity, environment ecofriendly, balance nutrition to crops, maintenance of soil fertility, and economic condition of farmers it may be suggested that vegetable growers particularly Odisha may supplement 50% recommended dose of fertilizer with FYM and vermicompost along with biofertilizers *viz. Azotobacter, Azospirillum*and PSB (@ 4kg ha$^{-1}$) each instead of applying full recommended dose of nitrogen from inorganic source in bottle gourd.

**Table3: Yield attributing parameters under the influence of integrated nutrient management**

| | Treatments | Moisture % of fruit | Dry matter % of fruit | Fresh wt. of fruit(g) | Dry wt. of fruit (g) | No of seeds fruit$^{-1}$ | Fruit Yield (t ha$^{-1}$) |
|---|---|---|---|---|---|---|---|
| $T_1$ | **Absolute Control** | 95.50 | 4.50 | 587 | 26.42 | 302 | 7.40 |
| $T_2$ | **100% RDF (80:50:50kg ha$^{-1}$)** | 95.99 | 4.01 | 1020 | 40.90 | 429 | 20.90 |
| $T_3$ | **FYM @ 15 t ha$^{-1}$** | 96.58 | 3.42 | 912 | 31.19 | 353 | 17.22 |
| $T_4$ | **VC @ 2.5 t ha$^{-1}$** | 96.12 | 3.88 | 907 | 35.19 | 339 | 17.09 |
| $T_5$ | **50%RDF+ FYM@7.5 t ha$^{-1}$ +BFs** | 95.99 | 4.01 | 990 | 39.69 | 419 | 17.72 |
| $T_6$ | **50%RDF+VC@2.5t/ha +BFs** | 95.88 | 4.12 | 1000 | 41.20 | 423 | 19.52 |
| $T_7$ | **FYM@7.5t ha$^{-1}$ +BFs** | 96.47 | 3.53 | 883 | 31.17 | 427 | 12.76 |
| $T_8$ | **50%RDF+BFs** | 95.93 | 4.07 | 850 | 34.56 | 321 | 9.12 |
| $T_9$ | **VC@7.5t/ha +BFs** | 96.64 | 3.36 | 900 | 30.24 | 425 | 16.33 |
| $T_{10}$ | **100%RDF+FYM@15t/ha +BFs** | 96.19 | 3.81 | 1025 | 39.05 | 435 | 21.21 |
| $T_{11}$ | **100%RDF+VC@7.5t/ha +BFs** | 96.13 | 3.87 | 1030 | 39.86 | 438 | 24.70 |
| $T_{12}$ | **50%RDF+ FYM@7.5t/ha+ VC@2.5t/ha +BFs** | 96.04 | 3.96 | 1231 | 48.75 | 443 | 28.01 |
| | **Mean** | 96.12 | 3.88 | 944.58 | 36.52 | **396.2** | 17.66 |
| | **SE(m)±** | 0.62 | 0.62 | 42.59 | 1.52 | 22.83 | 0.79 |
| | **CD (5%)** | NS | NS | 124.89 | 4.47 | 66.95 | 2.32 |

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