*Available online at* www.ijpab.com

DOI: http://dx.doi.org/10.18782/2582-2845.7068

**ISSN: 2582 – 2845**

*Ind. J. Pure App. Biosci.* (2020) *8*(6), 73-81

Indian Journal of Pure & Applied Biosciences

Peer-Reviewed, Refereed, Open Access Journal

*Research Article*

# Effect of Different Levels of Nitrogen and Novel Organic Liquid Fertilizer on Yield and Quality of Okra {*Abelmoschus esculentus* (L.) Moench} cv. GAO – 5.

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Received: 10.07.2020 | Revised: 14.09.2020 | Accepted: 23.09.2020

**ABSTRACT**

*A field experiment was conducted, with a view to present study entitled "Effect of different levels of nitrogen and Novel organic liquid fertilizer on yield and quality of okra {Abelmoschus esculentus (L.) Moench} cv. GAO-5" during summer season 2017 at Agriculture Experimental Station (AES), Navsari Agricultural University, Village: Paria, Taluka: Pardi, District: Valsad, Gujarat, India. The experiment was laid out in Split Plot Design with comparing of two factors viz., different levels of nitrogen (100%, 80% and 60%) and Novel organic liquid fertilizer (0, 1 and 2%) with six replications. The result indicated that different nitrogen levels were significantly influenced the yield parameters of okra cv. GAO-5. Application of nitrogen @ 100 kg/ha was recorded significantly influenced the yield parameters like, days to 50% flowering (42.83 days), pod diameter (1.75 cm) days to 1st picking (48.11 days), number of pods per plant (15.93), pod length (11.36 cm), pod weight (11.18 g), pod yield per plant (0.148 kg/ha) and pod yield (10.93 t/ha). In case quality parameters like ascorbic acid (10.98 mg/100g) and fibre content (1.71%) were found significant superior in treatment $N_1$ (100% RDN) while TSS and protein content were found non-significant. The foliar application of 2% Novel organic liquid fertilizer ($L_3$) exhibited the significantly reduced to days to 50% flowering (41.02 days), days to 1st picking (47.33) consequently this treatment not only increased number of pods per plant (15.45), pod length (11.88 cm), pod weight (11.52 g), pod yield per plant (0.146 kg/ha) and pod yield (10.71 t/ha) but also produced favourable effect on pod quality in terms of ascorbic acid(11.00 mg/100g ) and fibre content (1.95%) in okra pods while in TSS and protein content was found on non-significant effect. From economics point of view, pod yield (11.52 t/ha) and highest benefit cost ratio (1.93:1) were obtained with treatment combination $N_1L_3$ i.e.100 % RDN with 2% of Novel organic liquid fertilizer. So, nitrogen fertilizer 100% RDN and 2% of Novel organic liquid fertilizer successfully increased yield (t/ha) and exhibited the highest B:C ratio of okra cv. GAO – 5 under south Gujarat condition.*

***Keywords:*** *Okra, Nitrogen, Novel organic liquid fertilizer, Yield parameters, Quality parameter.*

**Cite this article:** Chotaliya, K., Masaye, S. S., Gaikwad, S. S., Patel, A., & Chavda, J. K. (2020). Effect of Different Levels of Nitrogen and Novel Organic Liquid Fertilizer on Yield and Quality of Okra {*Abelmoschus esculentus* (L.) Moench} cv. GAO – 5., *Ind. J. Pure App. Biosci. 8*(6), 73-81. doi: http://dx.doi.org/10.18782/2582-2845.7068

## INTRODUCTION

Okra {*Abelmoschus esculentus* (L.) Moench} is herbaceous hairy annual plant widely cultivated in the tropical or sub- tropical countries. It belongs to Malvaceae family. Okra known as '*Gumbo*' in United States of America, 'Lady's finger' in England and '*Bhindi*' in India (Chauhan, 1972) India is the largest producer of okra in the world.

Nitrogen is the most essential element of plant nutrition; plants take it up in significant amounts. Sufficient nitrogen supply improves cell division, foliage production and photosynthetic activity of the plant, thus producing higher numbers of flowers and fruits (Sharma & Yadav, 1996). Globally, nitrogen is considered to be the second most limiting factor in crop production (Sattelmacher et al., 1994) and limits yields in non-fertilized crop land. It is applied in order to increase yield and improve crop quality. Nitrogen fertilizer rate and time of application are decisive factors in influencing high yields, increased protein content and improved gluten quality (Borghi et al., 1997) With this background the present investigation on drip irrigation of okra was taking up to study the effect of different levels of nitrogen and novel organic liquid fertilizer on yield and quality parameters, as well as optimised the fertilizer application through drip for achieving better growth of okra.

## MATERIALS AND METHODS

A field experiment was conducted, with a view to present study entitled "Effect of different levels of nitrogen and *Novel* organic liquid fertilizer on yield and quality of okra {*Abelmoschus esculentus* (L.) Moench} cv. GAO-5" during summer season 2017 at Agriculture Experimental Station (AES), Navsari Agricultural University, Village: Paria, Taluka: Pardi, District: Valsad, Gujarat, India. The experiment was laid out in Split Plot Design with comparing of two factors viz., different levels of nitrogen (100%, 80% and 60%) and *Novel* organic liquid fertilizer (0, 1 and 2%) with six replications and nine treatment combination.

Among the recommended dose of chemical fertilizers (*i.e*. 100:50:50 kg NPK/ha), 100 recommended dose of P and K were applied as a basal dose through placement method of fertilizers application in the form of SSP and MOP, respectively. With regards to Recommended Dose of Nitrogen (RDN), 50% RDN was also applied as a basal dose along with P and K fertilizers, while remaining quantity of RDN was applied through drip irrigation as per treatments in four equal splits at 30, 40, 50 and 60 DAS. For foliar application of Novel organic liquid fertilizer, the desired quantity of spray solution was prepared with the help of below given formula. It was prepared just before foliar spray and sprayed at 30, 40, 50 and 60 DAS as per treatments.

$$\text{Amount of Novel organic liquid fertilizer required (ml)} = \frac{\text{Desired concentration (\%)} \times \text{Desired volume(ml)}}{100}$$

## RESULT AND DISCUSSION

### Days to 50% flowering

In present investigation, significantly influenced by minimum days to 50% flowering (42.89) was observed in treatment $N_1$ (100 % RDN) while maximum days to 50% flowering (46.67) was recorded in treatment $N_3$ (Table 1). Regarding to the nitrogen fertilizer, doses less than optimum levels plant showed the early flowering while doses more than optimum nitrogen levels delayed the flowering. This may be due to the fact that excessive supply of nitrogen promotes luxuriant and succulent vegetative growth dominating the reproductive phase reported by Mohammad et al. (2010), similar findings were observed by Sharma et al. (2016).

### Days to first fruit picking

Days to 1$^{st}$ fruit picking significantly influenced by different levels of nitrogen.

Significantly days for 1st fruit picking (48.11) were noted under 100 % RDN ($N_1$) while maximum days to 1st fruit picking (52.94) were observed in treatment $N_3$ in the present study (Table 2). This is increases due to the increased vegetative growth under abundance of nitrogenous fertilizers for photosynthesis activity by suggested in Chaurasia et al. (2005). The number of days to first picking increased with increasing nitrogen levels. The results are line by Khan et al. (2000).

Also for days to 1st fruit picking noted by significantly. Minimum days to 1st fruit picking (47.33 days) were recorded in treatment $L_3$ (2% novel organic liquid fertilized), while maximum days to 1st fruit picking (51.94 days) were observed in $L_1$ (Table 2). This is increases due to the increased vegetative growth under abundance of nitrogenous fertilizers for photosynthesis activity. Singhal et al. (2015) in cow pea. Also for similar result indicated Deore et al. (2010).

**Number of pods per plant**

Significantly maximum number of pods per plant (15.93) was recorded with application of 100 % RDN ($N_1$), while minimum number of pods per plant (13.89) was recorded with 60% RDN ($N_3$) (Table 3). Khan et al. (2000) reported that the highest number of pods per plant might be due to vigour of plant while in less number of pods per plant might due to the poor nutritional status of control treatment. Similar findings were observed Rahman et al. (2012), Sharma et al. (2016).

Number of pods per plant was found significantly influenced by *Novel* organic liquid fertilizer. Significantly higher number of pods per plant (15.45) by application of 2% of *Novel* organic liquid fertilizer ($L_3$) while minimum number of pods per plant (14.35) in treatment $L_1$ (Table 3). The increases in number of pods might be due to the supply of more nutrient at critical stage (*i.e.* flowering and fruiting) an abundance of nitrogenous fertilizers for photosynthesis activity which ultimately enhanced utilization of photosynthates and increased allocation of photosynthates towards the economic parts. Singhal et al. (2015) in cowpea.

**Pod diameter**

The results to pertaining pod diameter were observed non- significant. Higher pod diameter (1.75) was recorded in treatment $N_1$ (100% RDN), While minimum pod diameter (1.63) was recorded in treatment $N_3$ (Table 4). Higher nitrogen rate increases the fruit diameter. Similar results were noted by Pervez et al. (2004).

The results pertaining to the effect of novel organic liquid fertilizer on pod diameter was found non-significant. However maximum pod diameter (1.69 cm) was recorded with the application of 1% of novel organic liquid fertilizer ($L_2$) while minimum pod diameter of (1.66 cm) was recorded in treatment $L_1$ (Table 4).

**Pod length**

The results pertaining pod length was observed significant. Significantly more pod length (11.36 cm) was recorded under treatment $N_1$ (100% RDN), while minimum pod length (10.65 cm) was recorded under treatment $N_3$ (Table 5). Khan et al. (2000) who reported that pod length was significantly improved by application of nitrogen. Similar findings were noted by Sharma et al. (2016).

The results pertaining *Novel* organic liquid fertilizer on pod length was found significant. Significantly maximum pod length (10.88 cm) was recorded with the application of 2% of novel organic liquid fertilizer ($L_3$) while minimum pod length (10.46 cm) was recorded in treatment $L_1$ (Table 5). This might due to increase in the photosynthesis activity which ultimately enhanced utilization of photosynthates and increased allocation of photosynthates towards the pod length. Similar result found Singhal et al. (2016) in okra.

**Pod weight**

The results pertaining, individual mean pod weight was recorded significant. Significantly higher pod weight (11.18 g) in treatment $N_1$ (100 % RDN) while in lowest pod weight recorded (10.47 g) in treatment $N_3$. (Table 6) Similar findings were noted by Sharma et al. (2016).

The results pertaining, individual mean pod weight was recorded significant.

Significantly higher pod weight (11.52 g) in treatment $L_3$ (2%novel organic liquid fertilizer) while in lowest pod weight recorded (10.16 g) in treatment $L_1$ (Table 6).

**Pod yield**

In present investigation, pod yield per plant significantly influenced by different levels of nitrogen. Significantly highest pod yield per plant (0.148 kg) and pod yield (10.93 t/ha) was recorded in treatment $N_1$ (100% RDN) while minimum pod yield per plant (0.137 kg) and pod yield (9.86 t/ha) was recorded in treatment $N_3$ (Table 7 and 8). The increases in the yield might due to greater availability of nutrients, increased uptake of nutrients and water, resulting in more photosynthesis and enhanced food accumulation in edible parts of fruits. Similar results are in close agreement with, Westerveld et al. (2003).

The present investigation, pod yield was significantly influenced by novel organic liquid fertilizer. Application of 2% of novel organic liquid fertilizer ($L_3$) was recorded highest pod yield per plant (0.146 kg) and pod yield (10.71 t/ha) while lowest pod yield was obtained in treatment $L_1$ (Table 7 and 8).The spraying of novel organic liquid fertilizers increases uptake of nutrients and water, resulting in more photosynthesis and enhanced food accumulation in edible parts. The probable reasons for increase in yield might be due to easy assimilation of nutrients and balance in NPK ratio which affects the crop productivity. Salunkhe (2010) 14 also reported that higher level of fertilizers helped in formation of food reservoir due to higher photosynthetic activity, cellular activity in the roots and leaves both resulting in increased the yield. Similar results found by Deore et al. (2010) in chilli, Singhal et al. (2015) in cowpea, Singhal et al. (2016) in okra.

**Quality parameters**

**Ascorbic acid**

Higher values of ascorbic acid (10.98 mg/100g) was obtained in treatment $N_1$ (100 % RDN) while in lowest ascorbic acid (10.45 mg/100g) in treatment $N_2$ (Table 8). The augmentation of ascorbic acid content might due to either increased ascorbic acid biosynthesis or to protection of synthesized ascorbic acid from oxidation through ascorbic acid oxidase. (Deshmukh et al., 2010). Similar result found Kamal Narayan et al. (2011).

The results pertaining novel organic liquid fertilizer on ascorbic acid was found significant. A higher value of ascorbic acid (11.00 mg/100g) was obtained by treatment $L_2$ (2% of novel organic liquid fertilizer) while in lowest ascorbic acid (10.44 mg/100g) in treatment $L_1$ (Table 9).

**Fiber content**

Fiber content of okra was recorded significantly maximum fiber content (1.71%) in treatment $N_1$ (100% RDN) while in lowest fiber content was recorded (1.47 %) in treatment $N_3$ (Table 10). This is attributed to the enhanced metabolic activity of plant under frequent fertigation resulting in increased protein synthesis thus accumulating low fiber as reported Venkadeswaran et al. (2014). The increases in fiber content might be due to increases the nitrogen fertilizer also increased okra yield and quality of fiber also increases or decreasing the quality characters.

Fibre content of okra was recorded significantly maximum (1.95%) in treatment $L_3$ (2 % of novel organic liquid fertilizer) while in lowest fibre content (1.20%) was recorded in treatment $L_1$ (Table 10).

**Total soluble solids (TSS)**

In present investigation, TSS content of at 60 DAS of pods did not showed (Table 11) any significant difference due to the treatments, even through the treatment with nitrogen ($N_1$) and novel organic liquid fertilizer ($L_3$) recorded the highest TSS content ($3.98^0$ Brix). The increases in quality character (TSS) might due to the growth promoting substances which could have accelerated the synthesis of carbohydrates; vitamin and others quality character (Chaurasaia et al., 2005). Similar results found that Premashanker and Rajashree (2009).

In present investigation, TSS content of the 60 DAS of pods did not show any significant even through nitrogen with novel organic liquid fertilizer (Table 11).

**Protein content**

Protein content of okra pod was non - significantly influenced by nitrogen fertilizer whenever higher protein content (7.63%) recorded in treatment $N_1$ (100% RDN) which minimum protein content (7.18%) recorded in treatment $N_3$ (Table 12). Similar results found that Samlind and Sam Ruban (2007).

Protein content of okra was non - significant influenced by novel organic liquid fertilizer, however higher protein content (7.55%) recorded in treatment $N_1$ (100% RDN) while minimum protein content (7.29%) was recorded in treatment $N_3$ (Table 12).

**Economics**

Economic benefits ultimately matters for vegetable growers. The economics in terms of gross and net return for different treatments involved in the present investigation was worked out (Table 13). Among, the different treatments, the application of 100% RDN and 2% novel organic liquid fertilizer ($N_1L_3$) were achieved the maximum pod yield (11,059 kg/ha) and recorded the higher benefit: cost ratio (1.93:1) which was closely followed by the treatment $N_1L_2$ (100 % RDN+ 1% novel organic liquid fertilizer) recorded the benefit cost ratio (1.78:1). Similar finding confirmed to Firoz et al. (2009).

**Table 1: Effect of different levels of nitrogen and novel organic liquid fertilizer on days to 50% flowering in okra**

| Days to 50% flowering | | | | |
|---|---|---|---|---|
| **Novel Nitrogen** | **$L_1$ (Water spray)** | **$L_2$ (1%Foliar spray)** | **$L_3$ (2%Foliar spray)** | **Mean (N)** |
| **$N_1$(100%RDN)** | 45.33 | 44.67 | 38.67 | 42.89 |
| **$N_2$ (80% RDN)** | 45.00 | 44.67 | 40.00 | 43.22 |
| **$N_3$ (60% RDN)** | 47.67 | 47.67 | 44.67 | 46.67 |
| **Mean (L)** | 46.00 | 43.67 | 41.11 | |
| | **SEm±** | **C.D. at 5%** | | |
| **N** | 0.72 | 2.26 | **C.V.% (Main plot)** | 6.86 |
| **L** | 0.50 | 1.44 | **C.V.% (sub plot)** | 4.79 |
| **N X L** | 0.87 | NS | | |

**Table 2: Effect of different levels of nitrogen and novel organic liquid fertilizer on days to first picking in okra**

| Days to first picking | | | | |
|---|---|---|---|---|
| **Novel / Nitrogen** | **$L_1$ (Water spray)** | **$L_2$ (1%Foliarspray)** | **$L_3$ (2%Foliar spray)** | **Mean (N)** |
| **$N_1$(100%RDN)** | 51.17 | 48.83 | 44.33 | 48.11 |
| **$N_2$ (80% RDN)** | 51.17 | 51.00 | 47.00 | 49.72 |
| **$N_3$ (60% RDN)** | 53.50 | 54.67 | 50.67 | 52.94 |
| **Mean (L)** | 51.94 | 51.50 | 47.33 | |
| | **SEm±** | **C.D. at 5%** | | |
| **N** | 0.96 | 3.03 | **C.V.% (Main plot)** | 8.13 |
| **L** | 0.85 | 2.46 | **C.V.% (sub plot)** | 7.18 |
| **N X L** | 1.47 | NS | | |

**Table 3: Effect of different levels of nitrogen and novel organic liquid fertilizer on number of pod per plant in okra**

| Number of pod per plant | | | | |
|---|---|---|---|---|
| **Novel / Nitrogen** | **$L_1$ (water spray)** | **$L_2$ (1%Foliarspray)** | **$L_3$ (2%Foliar spray)** | **Mean (N)** |
| **$N_1$(100%RDN)** | 15.30 | 15.61 | 16.88 | 15.93 |
| **$N_2$ (80% RDN)** | 14.61 | 14.87 | 15.09 | 14.86 |
| **$N_3$ (60% RDN)** | 13.13 | 14.19 | 14.37 | 13.89 |
| **Mean (L)** | 14.35 | 14.89 | 15.45 | |
| | **SEm±** | **C.D. at 5%** | | |
| **N** | 0.40 | 1.26 | **C.V.% (Main plot)** | 11.40 |
| **L** | 0.27 | 0.78 | **C.V.% (sub plot)** | 7.65 |
| **N X L** | 0.47 | NS | | |

**Table 4: Effect of different levels of nitrogen and novel organic liquid fertilizer on pod diameter (cm) in okra**

| Pod diameter | | | | |
|---|---|---|---|---|
| Novel / Nitrogen | $L_1$ ( water spray) | $L_2$ (1%Foliarspray) | $L_3$ (2%Foliar spray) | Mean (N) |
| $N_1$(100%RDN) | 1.73 | 1.77 | 1.75 | 1.75 |
| $N_2$ (80% RDN) | 1.68 | 1.63 | 1.61 | 1.64 |
| $N_3$ (60% RDN) | 1.59 | 1.67 | 1.62 | 1.63 |
| Mean (L) | 1.67 | 1.69 | 1.66 | |
| | SEm± | C.D. at 5% | | |
| N | 0.04 | NS | C.V.% (Main plot) | 8.88 |
| L | 0.03 | NS | C.V.% (sub plot) | 6.60 |
| N X L | 0.05 | NS | | |

**Table 5: Effect of different levels of nitrogen and novel organic liquid fertilizer on pod length (cm) in okra**

| Pod length | | | | |
|---|---|---|---|---|
| Novel / Nitrogen | $L_1$ ( water spray) | $L_2$ (1%Foliarspray) | $L_3$ (2%Foliar spray) | Mean (N) |
| $N_1$(100%RDN) | 10.74 | 11.13 | 12.22 | 11.36 |
| $N_2$ (80% RDN) | 10.19 | 10.53 | 11.96 | 10.89 |
| $N_3$ (60% RDN) | 10.44 | 10.06 | 11.46 | 10.65 |
| Mean (L) | 10.46 | 10.57 | 10.88 | |
| | SEm± | C.D. at 5% | | |
| N | 0.16 | 0.49 | C.V.% (Main plot) | 6.01 |
| L | 0.14 | 0.42 | C.V.% (sub plot) | 5.57 |
| N X L | 0.25 | NS | | |

**Table 6: Effect of different levels of nitrogen and novel organic liquid fertilizer on pod weight (cm) in okra**

| Pod weight | | | | |
|---|---|---|---|---|
| Novel / Nitrogen | $L_1$ ( water spray) | $L_2$ (1%Foliar spray) | $L_3$ (2%Foliar spray) | Mean (N) |
| $N_1$(100%RDN) | 10.31 | 11.27 | 11.96 | 11.18 |
| $N_2$ (80% RDN) | 10.05 | 10.98 | 11.77 | 10.93 |
| $N_3$ (60% RDN) | 10.13 | 10.45 | 10.83 | 10.47 |
| Mean (L) | 10.16 | 10.90 | 11.52 | |
| | SEm± | C.D. at 5% | | |
| N | 0.16 | 0.52 | C.V.% (Main plot) | 6.41 |
| L | 0.16 | 0.46 | C.V.% (sub plot) | 6.26 |
| N X L | 0.28 | NS | | |

**Table 7: Effect of different levels of nitrogen and novel organic liquid fertilizer on pod yield per plant (kg) in okra**

| Pod yield per plant | | | | |
|---|---|---|---|---|
| Novel / Nitrogen | $L_1$ ( water spray) | $L_2$ (1%Foliar spray) | $L_3$ (2%Foliar spray) | Mean (N) |
| $N_1$(100%RDN) | 0.140 | 0.148 | 0.158 | 0.148 |
| $N_2$ (80% RDN) | 0.138 | 0.148 | 0.147 | 0.144 |
| $N_3$ (60% RDN) | 0.135 | 0.142 | 0.134 | 0.137 |
| Mean (L) | 0.141 | 0.146 | 0.146 | |
| | SEm± | C.D. at 5% | | |
| N | 0.002 | 0008 | C.V.% (Main plot) | 7.98 |
| L | 0.001 | 0.004 | C.V.% (sub plot) | 4.47 |
| N X L | 0.002 | 0.007 | | |

**Table 8: Effect of different levels of nitrogen and novel organic liquid fertilizer on pod yield (t/ha) in okra**

| Pod yield (t/ha) | | | | |
|---|---|---|---|---|
| Novel / Nitrogen | $L_1$ ( water spray) | $L_2$ (1%Foliar spray) | $L_3$ (2%Foliar spray) | Mean (N) |
| $N_1$(100%RDN) | 10.40 | 10.87 | 11.52 | 10.93 |
| $N_2$ (80% RDN) | 10.22 | 10.86 | 11.06 | 10.71 |
| $N_3$ (60% RDN) | 10.02 | 10.02 | 9.55 | 9.86 |
| Mean (L) | 10.21 | 10.58 | 10.71 | |
| | SEm± | C.D. at 5% | | |
| N | 0.14 | 0.44 | C.V.% (Main plot) | 5.65 |
| L | 0.13 | 0.37 | C.V.% (sub plot) | 5.17 |
| N X L | 0.22 | 0.64 | | |

**Table 9: Effect of different levels of nitrogen and novel organic liquid fertilizer on pod ascorbic acid (mg/100g) in okra**

| Pod ascorbic acid | | | | |
|---|---|---|---|---|
| Novel / Nitrogen | $L_1$ ( water spray) | $L_2$ (1%Foliar spray) | $L_3$ (2%Foliar spray) | Mean (N) |
| $N_1$(100%RDN) | 10.57 | 10.92 | 11.46 | 10.98 |
| $N_2$ (80% RDN) | 10.15 | 10.52 | 10.69 | 10.45 |
| $N_3$ (60% RDN) | 10.59 | 9.92 | 10.86 | 10.46 |
| Mean (L) | 10.44 | 10.45 | 11.00 | |
| | SEm± | C.D. at 5% | | |
| N | 0.14 | 0.44 | C.V.%(Main plot) | 5.63 |
| L | 0.14 | 0.40 | C.V.% (sub plot) | 5.56 |
| N X L | 0.24 | NS | | |

**Table 10: Effect of different levels of nitrogen and novel organic liquid fertilizer on pod fiber content (%) in okra**

| Pod fiber content | | | | |
|---|---|---|---|---|
| Novel / Nitrogen | $L_1$ ( water spray) | $L_2$ (1%Foliar spray) | $L_3$ (2%Foliar spray) | Mean (N) |
| $N_1$(100%RDN) | 1.29 | 1.76 | 2.08 | 1.71 |
| $N_2$ (80% RDN) | 1.17 | 1.56 | 1.95 | 1.56 |
| $N_3$ (60% RDN) | 1.14 | 1.45 | 1.81 | 1.47 |
| Mean (L) | 1.20 | 1.59 | 1.95 | |
| | SEm± | C.D. at 5% | | |
| N | 0.03 | 0.07 | C.V.%(Main plot) | 6.60 |
| L | 0.02 | 0.06 | C.V.% (sub plot) | 6.29 |
| N X L | 0.04 | NS | | |

**Table 11: Effect of different levels of nitrogen and novel organic liquid fertilizer on pod TSS ($^o$Brix) in okra**

| Pod TSS ($^o$Brix) | | | | |
|---|---|---|---|---|
| Novel / Nitrogen | $L_1$ ( water spray) | $L_2$ (1%Foliar spray) | $L_3$ (2%Foliar spray) | Mean (N) |
| $N_1$(100%RDN) | 3.68 | 4.03 | 4.24 | 3.98 |
| $N_2$ (80% RDN) | 3.85 | 3.87 | 3.97 | 3.90 |
| $N_3$ (60% RDN) | 3.73 | 3.83 | 3.69 | 3.75 |
| Mean (L) | 3.76 | 3.91 | 3.97 | |
| | SEm± | C.D. at 5% | | |
| N | 0.09 | NS | C.V.%(Main plot) | 9.31 |
| L | 0.08 | NS | C.V.% (sub plot) | 9.04 |
| N X L | 0.14 | NS | | |

**Table 12: Effect of different levels of nitrogen and novel organic liquid fertilizer on pod protein content (%) in okra**

| Pod protein content | | | | |
|---|---|---|---|---|
| Novel / Nitrogen | $L_1$ ( water spray) | $L_2$ (1%Foliar spray) | $L_3$ (2%Foliar spray) | Mean (N) |
| $N_1$(100%RDN) | 7.57 | 7.42 | 7.90 | 7.63 |
| $N_2$ (80% RDN) | 7.13 | 7.23 | 7.64 | 7.33 |
| $N_3$ (60% RDN) | 7.17 | 7.27 | 7.10 | 7.18 |
| Mean (L) | 7.29 | 7.31 | 7.55 | |
| | SEm± | C.D. at 5% | | |
| N | 0.13 | NS | C.V.% (Main plot) | 7.64 |
| L | 0.13 | NS | C.V.% (sub plot) | 7.57 |
| N X L | 0.23 | NS | | |

**Table 13: Economics of different treatments (Rs. ha$^{-1}$)**

| Treat. | Pod yield (kg/ha) | Common cost | Treat-ment cost | Fixed cost | Total cost | Gross Return | Net Return | B:C ratio |
|---|---|---|---|---|---|---|---|---|
| $N_1L_1$ | 10397 | 60304 | 4551 | 12996 | 77851 | 207940 | 130089 | 1.67 |
| $N_1L_2$ | 10865 | 60304 | 4273 | 13581 | 78158 | 217300 | 139142 | 1.78 |
| $N_1L_3$ | 11518 | 60304 | 4001 | 14398 | 78702 | 230360 | 151658 | 1.93 |
| $N_2L_1$ | 10217 | 60304 | 7671 | 12771 | 80746 | 204340 | 123594 | 1.53 |
| $N_2L_2$ | 10860 | 60304 | 7393 | 13575 | 81272 | 217200 | 135928 | 1.67 |
| $N_2L_3$ | 11058 | 60304 | 7121 | 13823 | 81247 | 221160 | 139913 | 1.72 |
| $N_3L_1$ | 10017 | 60304 | 10791 | 12521 | 83616 | 200340 | 116724 | 1.40 |
| $N_3L_2$ | 10017 | 60304 | 10513 | 12521 | 83338 | 200340 | 117002 | 1.40 |
| $N_3L_3$ | 9552 | 60304 | 10241 | 11939 | 82483 | 191020 | 108537 | 1.32 |

## CONCLUSIONS

In view of the results obtained from this investigation, it could be concluded that the highest yield with better pod quality and net return (B:C 1.93: 1) can be achieved by fertilizing the okra cv.GAO-5 with nitrogen fertilizers of 100% RDN and 2% foliar application of novel organic liquid fertilizer ($N_1L_3$) under South Gujarat condition.

## REFERENCES

Borghi, B. M., Corbellini, C., Minoia, M., Palumbo, N., & Di Fonzo & Perenzin, M. (1997). Effects of Mediterranean climate on wheat bred making quality. *European J of Agronomy*. *6*, 145-154.

Chauhan, D. V. S. (1972). "*Vegetable production in India*". 3rd ed., Ram Prasad and Sons (Agra).

Chaurasia, S. N. S., Singh, K. P., & Rai, M. (2005). Effect of foliar application of water soluble fertilizers on growth, yield and quality of tomato (*Lycopersicon esculentum* L.). *Sri Lankan J. Agric. Sci. 42*, 66-70.

Deore G. B., Limaye A. S., Shinde, B. M., & Laware, S. L. (2010). Effect of Novel Organic Liquid Fertilizer on Growth and yield in Chilli. *Asian J. Exp. Biol. Sci*. 15-19.

Deshmukh, D. A., Telang, S. M., & Patil, S. S. (2010). Influence of foliar application of growth hormones and fertilizer on the field and ascorbic content in chilli cv. "Prabhani Tejas". *Asian J. Soil Sci*., *5*(1), 114-115.

Firoz, Z. A. (2009). Impact of nitrogen and phosphorous on the growth and yield of okra in hill slope condition. *Banglesh J. Agril. Res*. *34*(4), 713-722.

Khan, H., Khan, M., Rasul, K., Majeed, A., & Safi, F. A. (2000). Effect of different levels of nitrogen alone and in combination with constant doses of phosphorous and potassium on growth and yield of okra (*Abelmoschus esculentus* L.) cv. T-13 under the Agro-climate conditions of Mingora, Swat. *Pak. J. Sci*., *3*(12), 2101-2104.

Dubey, K. N., Sharma, P., Vijay, D., Katre, T., & Rajhansa, K. C. (2011). Effect of foliar application of water soluble fertilizers on flowering, yield and quality attributes of tomato. *Veg. Sci*. *6*(1), 225-228.

Mohammad, H., Hossein, A., Fatemi, A., & Karimpour, S. (2010). Responses of eggplant (*Solanum melongena* L.) to different rates of Nitrogen under field conditions. *J. of Cen. Euro. Agril*, *11*(4), 453-458.

Patil, G. B., Panchbhai, D. M. (2003). Response of okra varieties for different nitrogen levels. *Annuals of plant physiology*, *17*(2), 146-149.

Pervez, M. A., Ayub, C. M., Saleem, R. B., Virk, N. A., & Mahmood, A. (2004). Effect of nitrogen levels and spacing on growth and yield of Radish (*Raphanus sativus* L.) *Inter J. of agri. Bio*. *6*(3), 504-506.

Premsekhar, M., & Rajashree, V. (2009). Performance of hybrid tomato as influenced by foliar feeding of water soluble fertilizers. *Am- Eurasian J. Sustain. Agric*., *3*(1), 33-36.

Rahman, M. A., & Akter, F. (2012). Effect of NPK fertilizers on growth, yield and yield attributes of okra. *Bangladesh J. Botnical. 41*(2), 131-134.

Salunkhe, J. R. (2010). Feasibility of using banana pseudostem sap as liquid fertilizer in onion under drip irrigation. M.Sc. thesis, Navsari Agricultural University, N.A.U., Navsari. (Unpublished).

Samlind, G., & Sam Ruban, J. (2007). Effect of different levels of nitrogen and spacing on crude protein of amaranthus cv. CO.3. *Asian J. Hort. 2*(1), 222-223.

Sattelmacher, B., Horst, W. J., & Becker, H. C. (1994). Factors that contribute to genetic variation for nutrient efficiency of crop plants. *J of plant nutrition and soil science 157*(3), 224-225.

Sharma, F., & Yadav, S. (1996). Controlling ammonia volatilaztion from urea surface applied to sugar beet on a calcareous soil. *Common Soil Sci*. *17*, 9-10.

Sharma, P., Kaushal, A., Singh, A., & Garg, S. (2016). Growth and yield attributes of okra under influence of drip irrigation. *Inter. J. Engin. Res. and Appi. 6*(2), 85-91.

Singhal, V. K., Patel, G. G., Bambhaneeya, S., Patel, D. H., & Saras, P. K. (2015). Effect of foliar application of water soluble fertilizers on growth, yield and economics of vegetable cowpea production. *An inter. Quarterly. J. of Enviro. Sci. VII*, 79-83.

Singhal, V. K., Patel, G. G., Bambhaneeya, S., Patel, D. H., & Saras, P. K. (2016). Effect of foliar application of water soluble fertilizer in okra. *Res. In Enviro. Life. Sci*., *9*(3), 297-299.

Venkadeswaran, E., Sundaram, V., & Sankar, R. (2014). Influence of trickle fertigation on yield and quality of hybrid okra (*Abelmoschus esculentus* L.) Moench). *Asian. J. Hort. 9*(2), 285-290.

Westerveld, S. M., McDonald, M. R., & McKeown, A. W. (2003). Effect of optimum nitrogen fertilization of summer Cabbage in Ontario. *Acta Hort*. *627*, 211-215.