

Research Article

## Effect of nitrogen levels and time of application on okra [*Abelmoschus esculentus* (L). Moench.]

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**SUMMARY :** An experiment was conducted at the Plasticulture Development Center, Regional Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar (North Gujarat) during the summer season of 2007-08 with a view to study Fertigation scheduling in okra [*Abelmoschus esculentus* (L). Moench.]. The experiment consisted of nine treatment combinations comprised of three levels of nitrogen (100, 80 and 60 % RDN) and three time of application of nitrogen through drip irrigation system (one, two and three week's interval) and control (farmers practices). The results revealed that fruit yield per plant nitrogen use efficiency (kg N/ha), water use efficiency (kg/ha-mm), N content (%), N uptake (kg/ha) and available soil nitrogen (kg/ha) were significantly influenced due to levels of nitrogen. Application of nitrogen through drip system at 100 per cent RDN recorded higher values for these attributes but it was at par with 80 per cent RDN. Significantly the highest fruit yield (6888 kg/ha) was registered under 100 per cent RDN applied as fertigation but it was at par with 80 per cent RDN (6374 kg/ha). Significantly the highest fruit yield was recorded with one week interval of N application as fertigation (7283 kg/ha). Nitrogen uptake by fruit was highest in one week interval of N application over two and three week interval of N application through drip. The treatment of one week interval of N application registered significantly higher build-up of available N in soil over three week interval of N application.

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**KEY WORDS :**

Fertigation, Okra,  
Fruit yield

### **BACKGROUND AND OBJECTIVES**

“Green revolution” is one of the greatest successes achieved by our country, however, even after attaining self-sufficiency in food grains; India still faces the challenge of malnutrition. Malnutrition results from a combination of several factors, lower intake of vegetables being one amongst them. It is universally accepted that vegetables are rich and comparatively cheaper sources of proteins, carbohydrates, vitamins, minerals and dietary fibres. India is second largest producer of vegetables in the world. Okra or lady's finger [*Abelmoschus esculentus* (L). Moench.] commonly known as Bhindi or Bhinda in India originated in tropical and subtropical Africa and belongs to the family Malvaceae. Okra is most important fruit vegetable crop grown in India and commonly cultivated in the states of

Gujarat, Maharashtra, Andhra Pradesh, Uttar Pradesh, Tamil Nadu, Karnataka, Haryana and Punjab. Okra is considered as heat loving plant. Hence, this crop is grown in *Kharif* as well as in summer season. Being hardy and fast growing short duration crop, it is profitably cultivated in summer when other vegetables are not available in the market. Okra fruits also have nutritional and medicinal value as the fruit contain 6.4 g carbohydrates, 2.2 g protein, 0.2 g fat, 66 g calcium, 50 mg phosphorus, 15 mg iron and 13 mg vitamin-C per 100 g of edible portion (Aykroud, 1963). Similarly, okra fruit is excellent source of iodine, which is necessary for the resistance against throat disease like goiter. It also good for the people suffering from heart weakness (Yawalker, 1969). Drip irrigation system optimize the irrigation water and put it uniformly and directly to the root zone of the

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plants at frequent intervals based on crop water requirement through a closed network of pressure plastic pipes. The problem of low fertilizer use efficiency can be best checked specially by drip fertigation. Fertigation is the application of water-soluble solid/liquid fertilizer uniformly and more efficiently directly in the root zone, which tends to fertilizer saving as it is possible to have a control through drip irrigation system.

## RESOURCES AND METHODS

In order to study on fertigation scheduling in okra in loamy sand soil of North Gujarat, an experiment was conducted during summer season of the year 2007-08. The experiment consisted of nine treatment combinations comprised of three levels of nitrogen (100, 80 and 60 % RDN) and three time of application of nitrogen through drip irrigation system (one, two and three week's interval) and control (farmers practices). The field experiment was laid out in randomized block design with four replications. The soil of experimental field was loamy sand in texture having good drainage capacity. It was low in organic carbon and available nitrogen, medium in available phosphorus and available potash, recommended dose : 120-60-00 kg NPK ha<sup>-1</sup>. Gujarat Okra-2 variety which was developed during 1999 from Vegetable Research Scheme, Gujarat Agricultural University, Anand. It is resistant against yellow vein mosaic disease. Full dose of phosphorus 60 kg/ha and 30 per cent nitrogen were applied before sowing as basal dose under drip irrigation system and remaining quantity of nitrogen was applied as fertigation. The nitrogen was applied in the form of urea and phosphorus was applied in the form of single superphosphate. As per fertigation scheduling of nitrogen

fertilizer for one week interval, it was applied in twelve splits, for two week interval, it was applied in six splits and for three week interval, it was applied in four splits. In conventional method half dose of nitrogen and full dose of phosphorus were applied as basal and remaining 60 kg nitrogen was applied in two equal split 30 DAS and starting of flowering. The required quantity of seeds was treated with thiram @ 2.5 g/kg before sowing. The seeds were dibbled in previously opened furrows in pair row system (by maintaining distance of 30 cm between two rows and plants and 60 cm between two pairs) at depth of 3-4 cm manually at seed rate of @ 6 kg ha<sup>-1</sup>. Scheduling of irrigation in drip irrigated plots was maintained by irrigating 35 minutes during February to March and 45 minutes during April – May at every alternate day based on 0.8 PEF. Daily pan evaporation measured with help of open pan evaporimeter installed in the meteorological observatory. While, in conventional method crop was irrigated at 1.0 IW/CPE ratio with the 60 mm irrigation depth. The fruits from the net plot were picked up separately and weighed. Fruit yield from net plot at each picking was recorded and then treatmentwise totaled up for all the pickings which were converted into the hectare basis.

## OBSERVATIONS AND ANALYSIS

The results of the present study as well as relevant discussions have been presented under following sub heads:

### Effect of nitrogen:

The results with respect to fruit yield per plant (Table 1) showed that significantly maximum fruit yield per plant was recorded with 100 and 80 per cent RDN. Increased in fruit

**Table 1: Effect of nitrogen levels and time of application on okra**

Treatments	Fruit yield per plant (g/plant)	Fruit yield (kg/ha)	Nitrogen use efficiency (kg N/ha)	Water use efficiency (kg/ha-mm)	N content (%)	N uptake (kg/ha)	Available soil N (kg/ha)
<b>Nitrogen levels (N)</b>							
N <sub>1</sub> : (100 % RDN)	131	6888	57.41	9.33	1.51	104.30	223
N <sub>2</sub> : (80 % RDN)	129	6374	66.39	8.68	1.29	82.15	201
N <sub>3</sub> : (60 % RDN)	98	5913	82.12	8.00	1.17	69.33	198
S.E.±	4.19	263.01	2.95	0.36	0.02	4.09	6.11
C.D. at 5 %	12.25	767.72	8.61	1.06	0.07	11.95	17.82
<b>Time of application (T)</b>							
T <sub>1</sub> : (One week interval)	138	7283	78.29	9.91	1.35	98.90	220
T <sub>2</sub> : (Two week interval)	111	6060	65.14	8.40	1.33	81.21	203
T <sub>3</sub> : (Three week interval)	109	5833	62.49	7.70	1.29	75.67	198
S.E.±	4.19	263.01	2.95	0.36	0.02	4.09	6.11
C.D. at 5 %	12.25	767.72	8.61	1.06	NS	11.95	17.82
Control Vs. Rest	85	5471	45.59	6.75	1.02	55.26	191.25
S.E.±	14.75	462.32	5.10	0.63	0.05	5.99	10.47
C.D. at 5 %	30.26	948	10.46	1.29	0.10	13.39	21.48
N x T	NS	NS	NS	NS	NS	NS	NS
C.V. (%)	12.15	14.25	14.89	14.50	6.32	16.63	10.21

NS=Non-significant

yield per plant in 100 and 80 per cent RDN was to the tune of 33 and 54 and 31 and 51 per cent, respectively over 60 per cent RDN and control (farmers' practices). The higher fruit yield might be due to more availability of nitrogen and improved nutritional environment in rhizosphere of plant root for growth and development of crop. These results are in conformity with findings of those reported by Chauhan (1998) and Patel (2007).

Significantly the highest fruit yield was registered under 100 per cent RDN as fertigation and was at par with 80 per cent RDN. Increase in fruit yield in 100 and 80 per cent RDN was to the tune of 16 and 25, and 7 and 16 per cent, respectively, over 60 per cent RDN as fertigation and control (farmers practices). Besides this, higher yield of okra obtained under 100 and 80 per cent RDN applied through drip might be due to low status of N in the soil of experimental plots, cause the greater response to okra at higher dose of N application. Nitrogen application through drip in the rhizosphere at root zone of plant in available form as per need of plant might be responsible for higher uptake of nitrogen. The results obtained in the present study are in accordance with results reported by Palanisamy *et al.* (2005), Patel *et al.* (2006), Kadam *et al.* (2006) and Patel (2007).

Water use efficiency was significantly observed with higher level of nitrogen (100 % RDN) recorded higher water use efficiency. This might be due to favourable effects of N on crop growth and ultimately higher fruit yield/ha. In drip system of irrigation the plant was always subjected to the field capacity leading to proper proportion of water and air in the root zone; more over, there was no leaching of plant nutrients as wetting zone was restricted to root zone only. These are in accordance with findings of Shinde *et al.* (2006).

The maximum content and uptake of nitrogen were recorded with 100 per cent RDN as fertigation. With regards, to nitrogen content the magnitude of increase in N content in 100 per cent RDN over 80 per cent RDN and control (farmers practices) was 17 and 48 per cent, respectively and for uptake it was increased 26 and 88 per cent, respectively over, 80 per cent RDN and control (farmers practices). The magnitude of increase in available soil N after harvest of crop under 100 per cent RDN over 80 per cent and control (farmers practices) were to the tune of 10 and 16 per cent, respectively.

#### Effect of time of nitrogen application :

Maximum fruit yield per plant was recorded with application of N at one week interval. Increased in fruit yield per plant in one week interval of N application was to the tune of 24 and 62 per cent, respectively. These results are in conformity with findings reported by Patel (2007). Increased in fruit yield in application of N at one week interval was to the tune of 20 and 33 per cent, respectively over two week interval of N application and control (farmers practices). Nitrogen use

efficiency was significantly the highest in one week interval of N application. This might be due to frequent application of fertilizer as fertigation increased the availability in the root zone area and ultimately increased fruit yield. With regards to water use efficiency data indicated that water use efficiency was significantly higher in one week interval of N application than two week interval of N application.

The magnitude in increased in uptake of nitrogen under one week interval of N application over two week interval and control (farmers practices) were 21 and 78 per cent, respectively. The magnitude of increase in available soil N after harvest of crop under the application of N at one week interval over two week interval and control were to the tune of 8 and 15 per cent, respectively.

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