RESEARCH PAPER | International Journal of Agricultural Engineering | Volume 10 | Issue 2 | October, 2017 | 516-520
e ISSN–0976–7223 ■ Visit us : *www.researchjournal.co.in* ■ **DOI: 10.15740/HAS/IJAE/10.2/516-520**

Economic feasibility of drip fertigation in okra

■ **P.K. JAMREY AND S.S. LAKHAWAT**

Received : 17.07.2017; **Revised :** 24.08.2017; **Accepted :** 10.09.2017

See end of the Paper for authors' affiliation

Correspondence to :

P.K. JAMREY
Rama Krishna Mission Ashrama, Agriculture Training and Demonstration Centre, Brehibeda, NARAYANPUR (C.G.) INDIA
Email : pravinjamrey@gmail.com

■ **ABSTRACT :** Field investigation were carried out at Collage of Technology and Engineering, Udaipur, during *Kharif* season (July, 2012-November, 2012) to evaluate the economic feasibility of drip fertigation system in okra (Mahyco Bhindi No. 64). The results revealed that drip fertigation recorded significantly higher yield of okra crop. The economic analysis shows that the net income obtained under 75 per cent RDF through fertigation in equal splits at 5 days interval was higher than that of furrow and drip irrigation system. Furrow and drip irrigation registered lower benefit-cost ratio because of higher investment cost and lower income from produce of the furrow and drip system while, the maximum gross benefit cost ratio *i.e.* 3.33was observed in 75% RDF through fertigation in equal splits at 7 days interval, due to low initial investment of the treatment and meanwhile higher income received from produce. Thus, drip fertigation system indicates the economic feasibility for higher productivity and sustainable okra production.

■ **KEY WORDS :** Drip, Fertigation, RDF, Economic feasibility

■ **HOW TO CITE THIS PAPER :** Jamrey, P.K. and Lakhawat, S.S. (2017). Economic feasibility of drip fertigation in okra. *Internat. J. Agric. Engg.*, **10**(2) : 516-520, **DOI: 10.15740/HAS/IJAE/10.2/516-520.**

Latin binomial names for okra are *Abelmoschus esculentus* and *Hibiscus esculentus* (Kumar *et al*., 2010) and it is commonly known as okra or lady's finger in India. It is one of the most important fruit vegetables grown throughout the tropics and warmer parts of the temperature zone. In India it is widely grown during rainy and summer season due to its high adaptability over a wide range of environmental conditions. In India, okra occupies about 3.76 lakh hectare areas under cultivation with total production of 36.84 lakh MT and productivity of 9.8 MT/ha. The share of India being 67.1% in area of okra in the world, followed by Nigeria at 15.4% and Sudan at 9.3% (Varmudy, 2011). Okra is an important vegetable crop grown in Rajasthan, covering area of 4255 hectare with production of 10482 MT.In the changing global scenario, nutritional security is an important issue. Vegetables are grown in 6.24 million hectare area with annual production of 98.50 million tonnes in India (Anonymous, 2006).The conventional irrigation method leads to enormous losses of water. The fertilizers applied under conventional irrigation methods are not efficiently utilized. Fertigation, a modern approach of application of fertilizers through irrigation water offers accurately and timely crop nutrition. Drip fertigation indicates the economic feasibility for higher productivity and sustainable crop production.

■ METHODOLOGY

Experimental site and climate :

The field experiment was carried out during the year 2012 in *Kharif* season at the Plasticulture Farm of Collage of Technology and Engineering, Udaipur (Rajasthan), situated in the southern region of Rajasthan and is close to Gujarat at Longitude 73.44° E and Latitude

Table A : Details of treatments and symbol used

Sr. No.	Treatment combinations	Symbol
1.	100% RDF through farmer's practice + flood irrigation	T_1
2.	100% RDF through farmer's practice + drip irrigation	T_2
3.	100% RDF through fertigation in equal splits at 3 days interval*	T_3
4.	100% RDF through fertigation in equal splits at 5 days interval*	T_4
5.	100% RDF through fertigation in equal splits at 7 days interval*	T_5
6.	75% RDF through fertigation in equal splits at 3 days interval*	T_6
7.	75% RDF through fertigation in equal splits at 5 days interval*	T_7
8.	75% RDF through fertigation in equal splits at 7 days interval*	T_8
9.	50% RDF through fertigation in equal splits at 3 days interval*	T_9
10.	50% RDF through fertigation in equal splits at 5 days interval*	T_{10}
11.	50% RDF through fertigation in equal splits at 7 days interval*	T_{11}

*50% RD of N & K and 100% RD of P were applied as basal dose + 50% dose of N & K through urea and MOP, respectively by fertigation
**FYM were applied @250 q/ha as per package of practices of okra crop during land preparation

24.35° N at an Altitude of 582.17 meters (1894 ft) above the mean sea level.Udaipur comes under dry, sub-humid agro-climatic region. It receives an average annual rainfall of 654.3 mm, most of the received during the period of July to September. The atmospheric humidity is high from June to October. During the period of experiment, the weekly maximum and minimum temperature were 33.6° C and 8.4° C, respectively.

Experimental design and layout :

The experiment was conducted in Randomized Block Design with three replications. Thereafter, eleven treatments were also randomly arranged in the homogenous plots of 15 m X 2 m size. The buffer strip size was 0.5m for single treatment. Each treatment plot was comprised of 200 plants of okra of area 30 m^2, out of which 10 plants were selected randomly as observational plants.The treatment and their details along with abbreviation are given in Table A.

Soil sampling and analysis :

The soil of the experiment site was analyzed in the NBSS and LUP laboratory. A composite soil sample was collected from 0-20 cm depth prior to planting during the study and analyzed for particle size distribution,bulk density, field capacity, wilting point, HC, EC, OC, CC, N, P, K, and pHwere sand, silt and clay (69.37, 18.26 and 12.37%), 1.45 gm/cc, 20.95%, 6.8%, 125 cm/day, 1.19 ms, 0.434%, 3.00%, 96.86 kg/ha, 6.72 kg/ha, 96.24 kg/ha, and 7.78, respectively

Fertilizer application :

To apply the recommended dose of N, P, and K; urea, single super phosphate (SSP) and muriate of potash (MOP) were used. Basic dose of FYM @250 q/ha was applied during land preparation followed by RDF of NPK @ 60:30:30 kg/ha through fertilizer application out of which, 50 per cent recommended dose of nitrogen and potassium and 100 per cent recommended dose of phosphorus was applied as basal dose and remaining 50 per cent dose of nitrogen and potassium (NPK @ 30:0:15 kg/ha) were applied through urea and muriate of potash in three different level (100%, 75%, and 50%) in equal splits at 3, 5 and 7 days interval for 20, 12 and 9 times through fertigation, respectively. Okra seeds of variety Mahyco Bhindi No. 64 (Hybrid Bhindi Seeds) were soaked in water for about 1 day, before sowing to obtain better germination and it was also treated with thiram of seed to avoid damping off disease in emerging seedlings.

Characters studied and techniques of study :

The periodical observations on yield attribute parameters were recorded to evaluate the effect of treatments.Yield of fruit/ plant/ plot and per hectare (kg) were the characters taken for yield attribute. Economic cost was determined by cost of cultivation, income from produce, net returns and benefit cost ratio for each treatment under the study for finding out the feasible cost for the production of the crop which can be beneficial to farmers.

■ RESULTS AND DISCUSSION

The results obtained from the present investigation

as well as relevant discussion have been summarized under following heads :

Yield attributes :

The details of yield of fruit/ plot and per hectare (kg) in each treatment of measurement are given in Table 1. The data presented indicated that yield of fruits per plot was significantly influenced by different treatments. It is clear from the table that various fertilizer levels had significant effect on the yield of fruits per plot. The maximum average yield of fruits per plot 82.00 kg was obtained in treatment, T_7 (75% RDF through fertigation in equal splits at 5 days interval) and it was found at par with $T_8$and T_6, respectively. The minimum average yield of fruits per plot 67.41 kg was obtained in treatment, T_1 (100% RDF through farmer's practice + flood irrigation), followed by T_2 (100% RDF through farmer's practice + drip irrigation) *i.e.* 69.30 kg.The perusal of data revealed that different treatments of okra crop varied significantly for yield of fruits per plant during experimentation.It is apparent from the data given in Table 1 that the yield of fruits per hectare recorded was significantly influenced by different level of fertilizer. Significantly maximum average yield of fruits per hectare was obtained in treatment, T_7 (75% RDF through fertigation in equal splits at 5 days interval) *i.e.* 27332.70 kg ha^{-1} and it was observed at par with the treatments namely T_8(75% RDF through fertigation in equal splits at 7 days interval) and T_6(75% RDF through fertigation in equal splits at 3 days interval) *i.e.* 26999.40 and 26799.42 kg ha^{-1}, respectively. The minimum average yield of fruits per hectare was obtained in treatment, T_1 (100% RDF through farmer's practice + flood irrigation) *i.e.* 22466.12 kg ha^{-1} and it was followed by T_2 (100% RDF through farmer's practice + drip irrigation) *i.e.* 23099.44 kg ha^{-1}. The present increase in treatment, T_7 (75% RDF through fertigation in equal splits at 5 days interval) over treatments, T_1 (100% RDF through farmer's practice + flood irrigation) and T_2 (100% RDF through farmer's practice + drip irrigation) were 21.66 and 18.32 per cent, respectively.

The higher yield percentage in treatment, T_7 was due to more favorable effect on vegetative growth of okra. Drip fertigation provides appropriate moisture at field capacity and better root development which facilitate luxuriant growth of plant due to better and sufficient amount of nutrient uptake resulting better fruit growth and development ultimately higher yield. Further, it is seen that treatment, T_7 (27332.70 kg ha^{-1}) gave more yield than treatments, T_1 and T_2 where, yield was noted 22466.12 kg ha^{-1} and 23099.44 kg ha^{-1}, respectively because drip fertigation have ability to decreased weed infestation as a result of which all moisture and nutrients present in the soil were available to plants. It was observed that the drip fertigation was more effective as compared to flood and drip irrigation, because it was precise application and uniform distribution of fertilizers and also minimized nutrients losses through leaching. Similar results were reported by Firake and Kumbhar (2002) in pomegranate, Gaur and Kumar (2003) in lemon and Bhat *et al.* (2007) in areca-nut.

Table 1 : Fruits yield per plot and fruit yield per hectare of okra under different treatments

Treatments	Fruit yield (kg $plot^{-1}$)	Fruit yield (kg ha^{-1})
T_1	67.41	22466.12
T_2	69.30	23099.44
T_3	76.81	24599.44
T_4	75.20	25066.06
T_5	74.22	24732.76
T_6	80.40	26799.42
T_7	82.00	27332.70
T_8	81.00	26999.40
T_9	75.40	25132.72
T_{10}	77.44	25799.42
T_{11}	76.42	25466.12
S.E. ±	2.88	967.94
C.D. (P=0.05)	8.49	2855.42

Cost economics :

The data pertaining to each component as per existing market situation, the systems cost of production of okra and gross, net returns of different treatments are presented in Table 2 along with economic analysis in terms of benefit cost ratio and marginal return per unit additional cost. As the cost of material is fluctuating very fast the economic analysis may change with time and place.

Cost of production :

From Table 2 it can be seen that in different treatments the total cost of production *i.e.* (cost of cultivation ha^{-1} + irrigation setup) was maximum also in treatment, T_3 (Rs. 1,29,301.8 ha^{-1}) while, the minimum was noted in treatment, T_2 (Rs. 1,15,689.2 ha^{-1}). In

treatment, T_2 as drip irrigation it might be low due to low fixed cost and other hand in treatment, T_3 as fertigation it may be high due to high fixed cost and extra labour charge for fertigation.

Income from produce :

The data presented in Table 2 revealed that among the different treatments the maximum income from produce was obtained in treatment, T_7 (75% RDF through fertigation in equal splits at 5 days interval) *i.e.* Rs. 4,09,990.5 ha^{-1} and the minimum income from produce was obtained in treatment, T_1 (100% RDF through farmer's practice + flood irrigation) *i.e.* Rs. 3,36,991.8 ha^{-1}. In treatment, T_7 was found with income from produce maximum due to higher yield and less fertilizer as well as labour cost as compared to treatment, T_1 and T_2, because it was due to lesser yield and higher level of fertilizers.

Net returns :

The data of net income received from different treatments on hectare basis are reported in Table 2. The maximum net income Rs. 2,86,476.0 ha^{-1} was observed in treatment,T_7 (75% RDF through fertigation in equal splits at 5 days interval) and minimum net income was observed in treatment, T_1 (100% RDF through farmer's practice + flood irrigation) *i.e.* Rs. 2,18,849.0 ha^{-1}. In treatment, T_7 net income was found maximum due to higher yield and less fertilizer as well as saving of water as compared to treatment, T_1 where lesser yield and higher level of fertilizers as well as excess water application was reported.

B:C ratio :

Table 2 revealed the computed values of benefit cost (BC) ratio in different treatments. It was observed in the range of 2.85 to 3.33. The maximum gross benefit cost ratio was observed in treatment, T_8 (75% RDF through fertigation in equal splits at 7 days interval) *i.e.* 3.33 while, minimum gross benefit cost ratio was observed in treatment, T_1 (100% RDF through farmer's practice + flood irrigation) *i.e.* 2.85. As far as the B:C ratio is concerned, amongst fertigation treatments, treatment, T_8 B : C ratio was maximum due to low initial investment of the treatment and meanwhile higher income received from produce,while, on the other hand treatment, T_1 was found with minimum B:C ratio due to higher initial investment as well as lesser income obtained from production achieved from the treatment. The results are in conformity with the findings of Firake *at al*. (2012) who found maximum B:C ratio in, treatment combination of 0.60 PE x 80% RD through fertigation (1.59) in gerbera. However, under fertigation level water soluble fertilizers are given through drip may be expensive but the results are encouraging.

Conclusion :

The drip fertigation system significantly influenced the yield characters of okra. Further, the application of 75 per cent RDF through fertigation in equal splits at 5 days interval had significant effect on the above all these parameters of the okra crop.From economical point (B:C ratio) of view, the choice of the preference of different treatments was observed as flood, drip and drip fertigation. The highest cost of production (Rs. 1,29,301.8) was recorded in T_3 (100% RDF through fertigation in equal splits at 3 days interval).Whereas,the maximum gross income from produce (Rs. 4,09,990.5), and net income (Rs. 2,86,476.0) were obtained in T_7 (75%

Table 2 : Economics of different treatments in okra crop

Treatments	Cost of production	Income from produce	Net income	B:C ratio
T_1	118142.9	336991.8	218849.0	2.85
T_2	115689.2	346491.6	230802.5	3.00
T_3	129301.8	368991.6	239689.9	2.85
T_4	124315.5	375990.9	251675.4	3.02
T_5	122445.7	370991.4	248545.7	3.03
T_6	128500.8	401991.3	273490.5	3.13
T_7	123514.5	409990.5	286476.0	3.32
T_8	121644.7	404991.0	283346.3	3.33
T_9	127699.8	376990.8	249291.0	2.95
T_{10}	122713.6	386991.3	264277.7	3.15
T_{11}	120843.7	381991.8	261148.1	3.16

RDF through fertigation in equal splits at 5 days interval)through the highest benefit cost ratio (3.33) was obtained in treatment, T_8 (75% RDF through fertigation in equal splits at 7 days interval).

Authors' affiliations:
S.S. LAKHAWAT, College of Technology and Engineering, Maharana Pratap University of Agriculture and Technology, UDAIPUR (RAJASTHAN) INDIA

REFERENCES

Anonymous (2006). *Indian Horiculture Database.* National Horticulture Board. Ministry of Agriculture. Government of India.85 Institutional Area. Sector-18, Gurgaon-122015 INDIA.

Bhat, R., Sujatha, S. and Balasimha, D. (2007). Impact of drip fertigation on productivity of arecanut (*Areca catechu* L.). *Agric. Water Manage.*, **90** : 101-111.

Firake, N.N. and Kumbhar, D.B. (2002). Effect of different levels of N, P and K fertigation on yield and quality of pomegranate. *J. Maharashtra Agric. Univ.*, **27**(2): 146-148.

Firake, N.N., Takte, R.L., Bhosle, A.B. and Jagtap, D.D. (2012). Effect of drip irrigation and fertigation level on growth and yield of gerbera under polyhouse conditions. *J. Agric. Res. Technol.*, **37**(2) : 285-288.

Gaur, M.L. and Kumar, A. (2003). Performance evaluation of drip fertigation system in lemon plants. *Indian J. Soil Conservation*, **31**(1) : 45-51.

Kumar, S., Dagnoko, S., Haougui, A., Ratnadass, A., Pasternak, D. and Kouame, C. (2010). Okra (*Abelmoschus* spp.) in West and Central Africa: potential and progress on its improvement. *African J. Agric. Res.*, **5** : 3590-3598.

Varmudy, V. (2011). Marketing survey need to boost okra exports. Department of Economics, Vivekananda College, Puttur, Karnataka, India.