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Effect of fertigation on growth,yield and quality of okra (*Abelmoschusesculentus* L. Moench)

Pandiyan. R, V. A. Sathiyamurthy, L. Pugalenthi, R. Nagarajan
Department of Vegetable Crops, Horticultural College and Research Institute,
Tamil Nadu Agricultural University, Coimbtore, Tamil Nadu, India

ABSTRACT

An experiment to know the effect of fertigation on growth, yield and quality of Okra.Var. COBhH 1 was carried out during the year 2011 to 2013 at the Department of Vegetable Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore. The experiment was laid out in randomized block design with six treatments and replicated four times. The treatment combination includes raised bed cultivation, drip irrigation, fertigation, plastic mulch, foliar spray of WSF and micronutrients. The results revealed that okra raised bed + drip irrigation + plastic mulch + fertigation + foliar spray of WSF (19:19:19 @ 10 g/lit. 5 times) + Mixture of all micronutrients (T1) recorded the days to 50% early flowering (43.7days), highest plant height (175.4cm), fruit length(13.8cm), fruit girth (6.48 cm), No. of fruits/plant (25.0), fruit yield/plant (0.466 kg), fruit yield/hectare (201.2.0 q) and economic returns (1.89) when compared to farmers practice (T6) which recorded 155.4 q/ha. Therefore (T1) raised bed + drip irrigation + plastic mulch + fertigation + foliar spray of WSF (19:19:19 @ 10 g/lit. 5 times) + mixture of all micronutrients can be recommended for getting increased growth, flowering and the highest yield for okra under *kharif* cultivation.

Keywords: *Okra hybrid COBhH 1, fertigation, mulching, foliar application, Micro nutrients, growth, Yield*

Vegetables play an important role in providing a balanced diet by supplying nutrients, vitamins, minerals and antioxidants. Though India is the second largest producer of vegetables in the world accounting for 14 per cent of the global vegetable production, the area and production of vegetables have almost plateued since 2005 and the vegetable consumption of an average Indian is (183 g) far less than the recommended dietary allowance of 300 g (Singh*et al.,* 2011b). This demand supply gap is likely to widen further. Water and nutrients are the two most critical inputs needed to be managed efficiently not only to increase the yield but also to sustain environmental quality. Drip fertigation has been well recognised as an efficient and precise method of applying fertilizers directly to the root zone for maximizing productivity and net returns in horticultural crops (Meenakshi,2002) With this background the present investigation on fertigation in okra was taken up to study the effect of solid water soluble fertilizers and conventional fertilizers in hybrid okra under fertigation, as well as to optimize the frequency of fertilizer application through drip for achieving better yield and quality. vegetables play an important role in providing a balanced diet by supplying nutrients, vitamins, minerals and antioxidants. Though India is the second largest producer of vegetables in the world accounting for 14 per cent of the global vegetable production, the area and production of vegetables have almost plateued since 2005 and the vegetable consumption of an average Indian is (183 g) far less than the recommended dietary allowance of 300 g (Singh *et al.,* 2011b). This demand supply gap is likely to widen further Water and nutrients are the two most critical inputs needed to be managed efficiently not only to increase the yield but also to sustain environmental quality. Drip fertigation has been well recognised as an efficient and precise method of

applying fertilizers directly to the root zone for maximizing productivity and net returns in horticultural crops (Meenakshi, 2002).With this background the present investigation on fertigation in okra CoBhH1 was taken up to study the effect of solid water soluble fertilizers and conventional fertilizers in hybrid okra under fertigation, as well as to optimise the frequency of fertilizer application through drip for achieving better yield and quality.

MATERIALS AND METHODS

A field experiment was carried out to study the "Effect of fertigation ongrowth, yield and quality of okra *(Abelmoschusesculantus*L.). Var. COBhH1 during Kharif 2011 to2013 atthe Department of Vegetable Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbtore. The experiment was laid out with six treatments and with Four replications. Okra was raised during the kharif season of every year with the spacing on 60 x 30cm in the raised bed paired row system. Irrigation and fertilizers were applied through drip and fertigation system. 60: 60 : 30 kg of NPK per ha. 75 % of the P2O5 applied as basal and the remaining fertilizers were applied as water soluble fertilizers through fertigation. Observations were recorded at regular intervals for statistical analysis.

The treatment combinations for okra are

T1 :	Raised bed + Drip irrigation + Plastic mulch + Fertigation + Foliar spray of WSF (19:19:19 @10g/lit. 5 times) + Mixture of all micronutrients
T2 :	Raised bed + Drip irrigation + Plastic mulch + Fertigation + Foliar spray of WSF (19:19:19 @10g/lit. 5 times)
T3 :	Raised bed + Drip irrigation + Plastic mulch + Fertigation + Mixture of all micronutrients
T4 :	Raised bed + Drip irrigation + Plastic mulch + Foliar spray of WSF (19:19:19 @10g/lit. 5 times) + Mixture of all micronutrients
T5 :	Raised bed + Drip irrigation + Fertigation + Foliar spray of WSF (19:19:19 @10g/lit. 5 times) + Mixture of all micronutrients
T6 :	Farmer's practices

RESULTS AND DISCUSSION

The results of the three year trials were presented in the Table 1, 2 and 3 and the pooled mean data are presented in Table 4. The results obtained from the present investigation are summarized below.Effect of precision farming treatments on yield of okra during kharif 2011(table1).Among the treatments, the treatment combination of raised bed + drip irrigation + plastic mulch + fertigation + foliar spray of WSF (19:19:19 @10g/lit. 5 times) + Mixture of all micronutrients (T1) recorded early flowering (43.7 days), highest yield per plot (0.458 kg) and the highest yield per ha (203.7 q) when compared to farmers practice (T6) which recorded 143.7 q/ha.

The results revealed that the Effect of precision farming treatments on yield of okra during kharif 2012 (table.2). Among the treatments, the treatment combination of raised bed + drip irrigation + plastic mulch + fertigation + foliar spray of WSF (19:19:19 @10g/lit. 5 times) + Mixture of all micronutrients (T1) recorded early flowering (43.4 days), and increased plant height (175.4), fruit length (13.8 cm), fruit girth (6.48 cm), fruits / plant (24.5) and yield per plant (0.457 kg) with the highest yield per ha (198 q) when compared to farmers practice (T6) which recorded 168 q/ha.

The results revealed that the Effect of precision farming treatments on yield of okra during kharif 2013(table.3). Among the treatments tested, the treatment combination of raised bed + drip irrigation + plastic mulch + fertigation + foliar spray of WSF (19:19:19 @10g/lit. 5 times) + Mixture of all micronutrients (T1) recorded early flowering (44.3 days), and increased plant height (178.9), fruit length

(14.1 cm), fruit girth (6.61 cm), fruits / plant (25.0) and yield per plant (0.466 kg) with the highest yield per ha (202.0 t) when compared to farmers practice (T6) which recorded 154.6 t/ha.

The pooled data of three years trials revealed thatIn okra cv. COBhH1, the treatment combination of raised bed + drip irrigation + plastic mulch (30 micron) + fertigation with water soluble fertilizers + foliar spray of WSF (19:19:19 @10g/lit. 5 times from 30 days after sowing) + mixture of all micronutrients recorded the highest yield of 201.2 q/ ha with the BC ratio of 1.89. While the farmers practices, recorded the fruit yield of 155.4 q/ha with the BC raito of 1.78. Therefore (T1) raised bed + drip irrigation + plastic mulch + fertigation + foliar spray of WSF (19:19:19 @ 10 g/lit. 5 times) + mixture of all micronutrients can be recommended for getting increased growth, flowering and the highest yield for okra under *kharif* cultivation.

Increase in fruit length under fertigation had been reported earlier by Gupta *et al.* (2010a) and such an increase in fruit length observed in the present investigation with more frequent application of water soluble fertilizer was in conformity to the findings of Mahendran*et al.*(2009). This was attributable to the better utilisation of water and nutrients, lower leaching losses and more controllable nutrient application during the entire growing season than less frequent fertigation or soil application of fertilizers.

Mahendran*et al.* (2009); Brahma *et al.* (2010) and Gupta *et al.* (2010a and 2010b). The incremental fruit girth under fertigation over RDF is attributed to the availability of optimum plant nutrients with Sufficient moisture for early development of plant parts as well as root system, which would have enhanced the uptake of plant nutrients resulting in enhanced fruit girth.

Tumbare and Nikam (2004); Badr and El-Yazied (2007); Mahendran*et al.* (2009); Shedeed*et al.* (2009); Brahma *et al.* (2010); Gupta *et al.* (2010a); Savitha*et al.* (2010) and Shinde*et al.* (2010). The increased fruit weight under more frequent fertigation might be the result of continuous supply and availability of required nutrients in the root zone of the crop, which creates a favourable condition for growth and development besides enhancing the fertilizer use efficiency.

This increase in fruit production with more frequent fertigation is attributable to the enhanced availability and uptake of nutrients by plants over soil application of fertilizers which results in better growth and increased fruit production as reported earlier by Cook and Sanders (1991), Badr and El-Yazied (2007) and Singh *et al.* (2011a).

The superiority of drip fertigation over soil application with regard to yield is the result of better availability and uptake of nutrients leading to increased metabolite activities in the plant system asreported earlier by Tumbare and Nikam (2004); Muralikrishnasamy*et al.* (2004); Shedeed*et al.* (2009); Akanda*et al.* (2012) and Sasani*et al.* (2006).

The role of nutrients in improving the seed weight had been well established by Dwivedi*et al.* (1994) and Moniruzzaman and Quamruzzaman (2009), while the significance of fertigation over RDF on improved seed yield had been reported by Jat*et al.*(2011).

CONCLUSION

From the above study, it could be concluded, that the pooled data of three years trials revealed that okra raised bed + drip irrigation + plastic mulch + fertigation + foliar spray of WSF (19:19:19 @ 10 g/lit. 5 times) + Mixture of all micronutrients (T1) recorded the days to 50% early flowering (43.7days), highest plant height (175.4cm), fruit length(13.8cm), fruit girth (6.48 cm), No. of fruits/plant (25.0), fruit yield/plant (0.466 kg), fruit yield/hectare (201.2.0 q) and economic returns (1.89) when compared to farmers practice (T6) which recorded 155.4 q/ha. Therefore (T1) raised bed + drip irrigation + plastic mulch + fertigation + foliar spray of WSF (19:19:19 @ 10 g/lit. 5 times) + mixture of all micronutrients can be recommended for getting increased growth, flowering and the highest yield for okra under *kharif* cultivation.

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REFERENCES

1. Akanda, M.A.R., Ahamad, M.S., Rahman, M.S., Halim, G.M.A. and M.M. Hasan. 2012.Performance evaluation of fertigation and micronutrients on fruit yield and quality of summer tomato (*Lycopersiconesculentum*L.). *Bangladesh J. Agric. Res.,* 37(3): 449-456.
2. Badr, M.A. and A.A.A. El-Yazied. 2007. Effect of fertigation frequency from subsurface drip irrigation on tomato yield grown on sandy soil. *Australian J. Basic & Appl. Sci.,* 1(3): 279-285
3. Brahma, S., Phookan, D.B.,Barua, P. and L.Saikia. 2010. Effect of drip-fertigation on performance of tomato under Assamconditions. *Indian J. Hort.,* 67(1): 56-60.
4. Cook, W.P. and D.C. Sanders.1991. Nitrogen application frequency for drip-irrigated tomatoes.*Hort. Sci.,* 26(3): 250-252.
5. Dwivedi, Y.C., Sengupta, S.K. and R.S.Sharma. 1994. Effect of sowing dates and nitrogen fertilization on seed crop of okra. *Veg Sci.,* 21(2): 122-125
6. Gupta, A.J., Ahmad, M.F. and F.N. Bhat. 2010a. Studies on yield, quality, water and fertilizer use efficiency of capsicum under drip irrigation and fertigation. *Indian J. Hort.,* 67(2): 213-218.
7. Gupta, A.J., Ahmed, N., Bhat, F.N. and M.A. Chattoo. 2010b. Production of hybrid tomato for higher income under drip irrigation and fertigation in Kashmir valley.*Indian J. Hort.,* 67(1): 127-131.
8. Jat, R.A., Wani, S.P., Sahrawat, K.L., Singh, P. and Dhaka, B.L. 2011. Fertigation in vegetable crops for higher productivity and resource use efficiency. *Indian J. Fert.,*7(3): 22-37.
9. Mahajan, R.K., Sapra, R.L., Srivastava, U., Singh, M. and G.D. Sharma. 2000. *Minimal descriptors of agri-hort*. crops - part I. National Bureau of Plant Genetic Resources, New Delhi. pp181-184.
10. Meenakshi, N. 2002.Growth and productivity of hybrid bitter gourd (*Momordicacharantia*L.) CoBgoH-1 under different macro and micronutrient fertigation levels.Ph.D. (Hort.) Thesis, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India.
11. Moniruzzaman, M. and A.K.M. Quamruzzaman. 2009. Effect of nitrogen levels and picking of green fruits on the fruit and seed production of okra [*Abelmoschusesculentus*(L.) Moench]. *J. Agric. & Rural Dev.,* 7(1&2): 99-106.
12. Sasani, G.V., Patel, C.K., Patel, R.N., Patel, N.H. and S.H. Patel.2006.Efficient use of water and fertilizers through drip fertigation in potato.*Potato J.,* 33(3-4): 131-133.
13. Savitha, B.K., Paramaguru, P. and L. Pugalendhi. 2010. Effect of drip fertigation on growth and yield of onion. *Indian J.Hort.,*67: 334-336
14. Shedeed, S.I., Zaghloul, S.M. and A.A. Yassen. 2009.Effect of method and rate of fertilizer application under drip irrigation on yield and nutrient uptake by tomato. *Ozean J. Appl. Sci.,* 2(2): 139-147
15. Shinde, J.B., Malunjkar, B.D., Raut, R.S., Patil, P.D. and D.W. Thawal. 2010. Response of cucumber to fertigation under drip irrigation system. *Bioinfolet,* 7(2): 161-164.
16. Singh, B., Singh, M. and A.B. Rai.2011b. *Vision 2030*, Army Printing Press, Lucknow, U.P. (INDIA).

Table 1. Effect of precision farming treatments on yield of okra during kharif 2011

Treatments	Days to 50 % flowering	Yield / plant (kg)	Yield / ha (q)
T1. Raised bed + Drip irrigation + Plastic mulch + Fertigation + Foliar spray of WSF (19:19:19 @10g/lit. 5 times) + Mixture of all micronutrients	43.7	0.458	203.7
T2. Raised bed + Drip irrigation + Plastic mulch + Fertigation + Foliar spray of WSF (19:19:19 @10g/lit. 5 times)	45.3	0.432	191.8

T3. Raised bed + Drip irrigation + Plastic mulch + Fertigation + Mixture of all micronutrients	47.7	0.425	188.9
T4. Raised bed + Drip irrigation + Plastic mulch + Foliar spray of WSF (19:19:19 @10g/lit. 5 times) + Mixture of all micronutrients	49.3	0.276	121.5
T5. Raised bed + Drip irrigation + Fertigation + Foliar spray of WSF (19:19:19 @10g/lit. 5 times) + Mixture of all micronutrients	45.3	0.383	170.4
T6. Farmer's practices	49.0	0.323	143.7
CD (P=0.05)	0.75	0.02	6.18
CV (%)	4.93	6.94	6.94

Table 2: Effect of precision farming treatments on yield of okra during kharif 2012

Treatments	Days to 50 % flowering	Plant height (cm)	Fruit length (cm)	Fruit girth (cm)	Fruits / plant	Yield / plant (kg)	Yield / ha (q)
T1. Raised bed + Drip irrigation + Plastic mulch + Fertigation + Foliar spray of WSF (19:19:19 @10g/lit. 5 times) + Mixture of all micronutrients	43.4	175.4	13.8	6.48	24.5	0.457	198.0
T2. Raised bed + Drip irrigation + Plastic mulch + Fertigation + Foliar spray of WSF (19:19:19 @10g/lit. 5 times)	45.8	168.9	12.6	6.24	20.2	0.436	191.0
T3. Raised bed + Drip irrigation + Plastic mulch + Fertigation + Mixture of all micronutrients	46.4	170.2	12.9	6.42	21.5	0.438	192.0
T4. Raised bed + Drip irrigation + Plastic mulch + Foliar spray of WSF (19:19:19 @10g/lit. 5 times) + Mixture of all micronutrients	48.7	132.3	7.96	4.65	13.9	0.235	117.0
T5. Raised bed + Drip irrigation + Fertigation + Foliar spray of WSF (19:19:19 @10g/lit. 5 times) + Mixture of all micronutrients	45.9	167.4	12.5	6.02	22.8	0.389	177.0
T6. Farmer's practices	48.2	160.1	12.0	6.00	18.5	0.354	168.0
CD (P=0.05)	0.75	21.344	1.347	0.975	1.564	0.025	1.388
CV (%)	4.93	5.76	5.48	6.43	5.90	6.21	9.54

Table 3. Effect of precision farming treatments on yield of okra during kharif 2013

Treatments	Days to 50 % flowering	Plant height (cm)	Fruit length (cm)	Fruit girth (cm)	Fruits / plant	Yield / plant (kg)	Yield / ha (q)
T1. Raised bed + Drip irrigation + Plastic mulch + Fertigation + Foliar spray of WSF (19:19:19 @10g/lit. 5 times) + Mixture of all micronutrients	44.3	178.9	14.1	6.61	25.0	0.466	202.0
T2. Raised bed + Drip irrigation + Plastic mulch + Fertigation + Foliar spray of WSF (19:19:19 @10g/lit. 5 times)	46.7	172.3	12.9	6.36	20.6	0.445	194.8
T3. Raised bed + Drip irrigation + Plastic mulch + Fertigation + Mixture of all micronutrients	47.3	173.6	13.2	6.55	21.9	0.447	195.8
T4. Raised bed + Drip irrigation + Plastic mulch + Foliar spray of WSF (19:19:19 @10g/lit. 5 times) + Mixture of all micronutrients	49.6	145.3	8.3	4.28	14.3	0.250	111.8
T5. Raised bed + Drip irrigation + Fertigation + Foliar spray of WSF (19:19:19 @10g/lit. 5 times) + Mixture of all micronutrients	46.8	170.7	12.8	6.14	23.3	0.397	180.5
T6. Farmer's practices	44.8	147.3	11.0	5.52	17.0	0.326	154.6
CD (P=0.05)	1.635	7.236	0.856	0.526	1.215	0.125	8.365
CV (%)	5.36	5.96	6.31	6.54	4.80	6.29	6.29

Table 4. The pooled mean data of the precision farming in okra experiment conducted in three years

Treatments	Yield / ha (q)			Pooled mean q/ha	BC ratio
	2010-11	2011-12	2012-13		
T1. Raised bed + Drip irrigation + Plastic mulch + Fertigation + Foliar spray of WSF (19:19:19 @10g/lit. 5 times) + Mixture of all micronutrients	203.7	198.0	202.0	201.2	1.89
T2. Raised bed + Drip irrigation + Plastic mulch + Fertigation + Foliar spray of WSF (19:19:19 @10g/lit. 5 times)	191.8	191.0	194.8	192.5	1.83
T3. Raised bed + Drip irrigation + Plastic mulch + Fertigation + Mixture of all micronutrients	188.9	192.0	195.8	192.2	1.92
T4. Raised bed + Drip irrigation + Plastic mulch + Foliar spray of WSF (19:19:19 @10g/lit. 5 times) + Mixture of all micronutrients	121.5	117.0	111.8	116.8	1.09
T5. Raised bed + Drip irrigation + Fertigation + Foliar spray of WSF (19:19:19 @10g/lit. 5 times) + Mixture of all micronutrients	170.4	177.0	180.5	176.0	1.87
T6. Farmer's practices	143.7	168.0	154.6	155.4	1.78