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Effect of Drip Fertigation on Growth, Yield and Quality of Ridge Gourd [*Luffa acutangula* (L.) Roxb]

Rajasree, V., Pugalendhi, L., Vasanthi, C. and Shanmugasundaram, T.
Department of vegetable Science, Horticulture and Research Institute, Tamil Nadu Agriculture University, Coimbatore, Tamil Nadu, India

Abstract: A field experiment was carried out at College Orchard, Department of Vegetable Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore to standardize drip fertigation for ridge gourd hybrid COH 1 [*Luffa acutangula* (L.) Roxb.] The trials were conducted with a view to improve growth, yield and quality to compare the efficacy of water soluble and straight fertilizers for ridge gourd. A fertilizer dosage of 250:100:100 kg NPK ha^{-1} was adopted for ridge gourd hybrid (COH1). The treatment consisted of seven levels of fertilizers consisting of three levels in straight fertilizers (125,100 and 75 percent of 250:100:100 kg NPK ha^{-1}) and three levels in water soluble fertilizers (WSF) (125,100 and 75 percent of 250:100:100 kg NPK ha^{-1}) and a control (100 percent soil application of straight fertilizers) replicated thrice in randomized block design. From the study, it was found that fertigation treatments were significantly superior over the soil application of fertilizers (control). The fertigation treatment with 125 percent WSF (T_5) recorded the highest values for growth and physiological characters *viz.*, vine length (9.65 m), stem girth (5.47 cm) and total chlorophyll content (2.59 mg/100 g). In case of yield parameters, the highest values were registered for fruit length (38.89 cm), fruit girth (19.65 cm), fruit weight (391.11 g), yield per vine (6.05 kg), number of harvests(14.10) and number of fruits/vine (17.84) in 125 percent RDF (250:100:100 kg/ha) through WSF (T_5) followed by 100 per cent RDF through WSF. The quality parameters like calcium (15.54 mg/100 g), ascorbic acid (8.14 mg/100g) and phosphorus (0.66 mg/100 g) content were found to be the highest with 125 percent RDF through water soluble fertilizers. Therefore (T_5) 125 percent RDF through WSF can be recommended for getting increased growth, yield and quality in ridge gourd hybrid COH1.

Keywords: Ridge Gourd, Drip Fertigation, WSF, Growth, Yield, Quality

Corresponding Author:V.Rajasree, dr.rajashreeprabhu@gmail.com

Introduction

Ridge gourd [*Luffa acutangula* (L.) Roxb] belonging to *Cucurbitaceae* family is cultivated widely in India and fruits are consumed as vegetable in daily diet. Considering its contribution to the diet of people, there is a need to enhance productivity level of the crop through management practices. In India, it is largely grown in Karnataka, Andhra Pradesh, Kerala, Tamil Nadu, Uttar Pradesh, Madhya Pradesh and Maharashtra states. All the gourds, melons *etc.* respond well to manuring and fertilizer application. The dose of fertilizer depends upon the soil type, climate and system of cultivation. It is difficult to be specific about fertilizer recommendations because of variation in soil type, soil fertility and system of cultivation. Application of farmyard manure at the rate of 15 to 20 tonnes per ha is supplemented with full dose of recommended super phosphate and potash before sowing and one-half dose of nitrogen at the time of vining and the rest 10 to 15 days later. In general, high nitrogen under high tempera ture conditions promote male flowers and number of female/perfect flowers per vine get reduced resulting in low fruit set and low yield (Sen *et al.*, 1983).

Nitrogen influences plant growth, flowering and also yield. The profuse nitrogen supply arrests the female flower production, particularly during water scarcity. However, under balanced irrigation, the nitrogen application has increased female flower production and yield. An earlier research in bitter gourd showed that an increase in the nitrogen level produced higher yield (Suresh and Papaiah, 1991). The deficiency of nitrogen results in reduced growth of vines with leaves turning pale yellow in colour and stem becomes thin and woody.

In general, phosphorus requirement in cucurbits is the highest during first 20 to 30 days after sowing and thereafter gradually decreases. The deficiency or excess of phosphorus results in higher number of undeveloped fruits resulting in reduced yield, while optimum level of phosphorus promotes plant growth, advancement in flowering and increased fruit weight.

Potassium requirement is higher in the first two to three weeks and reduces gradually after the beginning of harvest. Potassium application results in activation of atmosphere CO_2 by the leaves, resulting in increased chlorophyll content in the leaves, respiration and amino acid synthesis by the roots.

Nutritional security of our nation can be achieved by adopting scientific methods of farming and manuring. Optimum use of fertilizer doses with other required inputs can maximize the production output (Shaji, 2001). Adoption of advanced and efficient methods of application of water and fertilizers through drip would therefore go a long way in economizing the scarce inputs and

help to increase the productivity of the crop. In recent times, farmers evince interest in growing hybrid vegetables especially in cucurbits due to their high yield of tender fruits, uniform size, enhanced quality and higher market price. The maximum genetic expression to the yield potential is possible only when nutrition protocol during different critical stages of growth is refined and nutrition physiology does not hinder the growth and development process.

Fertigation is an effective means of controlling timing and placement of fertilizers and improving fertilizer use efficiency by reducing losses through leaching, volatilization and fixation in the soil to less available forms (Papadopoulos, 1995). Efficient use of fertilizers and water is highly critical to sustained agricultural production, more particularly in the context of declining per capita land and water availability, pollution and increasing cost of fertilizers. Under these circumstances, fertigation, which is a sophisticated and efficient means of applying fertilizer through irrigation system as a carrier and distributor of crop nutrients, holds bright promise.

To produce high yield and good quality ridge gourd, timely application of nutrients and water is a pre-requisite. Besides water, the most crucial factor, which greatly affects the growth and yield of crops, is plant nutrient application. Fertilizers and water are costly inputs and every effort should be made to enhance their use efficiency. It is possible to save fertilizers up to 25 percent in brinjal through fertigation (Kale, 1995) and in cotton (Vaishnava *et al.,* 1996). Studies in chilli and French beans showed the fertigation gave 15- 28 percent higher yield than soil application and saved about 40 percent of water (Balasubrama nian *et al*., 1999). With this background, the present study was undertaken to standardize drip fertigation for ridge gourd (*L.acutangula*) hybrid COH 1.

Materials and Methods

The experiment was conducted on the effect of drip fertigation on growth, yield and quality for ridge gourd (*L.acutangula*) hybrid COH1. The experiment was conducted at College Orchard, Department of Vegetable Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore which issituated at 11°02' North latitude, 77°03' East longitude at an altitude of 426.76 m above MSL. The treatment consisted of seven levels of fertilizers consisting of three levels in straight fertilizers (125,100 and 75 percent of 250:100:100 kg NPK ha^{-1}) and three levels in water soluble fertilizers (125,100 and 75 percent of 250:100:100 kg NPK ha^{-1}) and a control (100 percent soil application of straight fertilizers) replicated thrice in randomized block design. The pits of 0.45 x 0.45 x 0.45 m were dug at a spacing of 2.0 x 1.5 m. The pits were filled with top soil + FYM mixture and seeds were sown.

Table 1: Treatment detail

Treatments		Fertigation schedule adopted for ridge gourd hybrid CRgH 1 during the experiment
T_1 (control)	:	(RD of NPK 250:100:100 kg ha^{-1} through straight fertilizer by soil application + surface irrigation).
T_2	:	Fertigation with 125 % of RDF through straight fertilizers
T_3	:	Fertigation with 100 % of RDF through straight fertilizers
T_4	:	Fertigation with 75 % of RDF through straight fertilizers
T_5	:	Fertigation with 125 % of RDF through water soluble fertilizers
T_6	:	Fertigation with 100 % of RDF through water soluble fertilizers
T_7	:	Fertigation with 75 % of RDF through water soluble fertilizers

Fertigation Scheduling

Application of fertilizers through drip system was scheduled weekly once, spread over a period of 13 weeks, starting from 20 days after sowing. The quantity of fertilizers scheduled for different phases at each level of fertilizer was worked out. The fertigation scheduling was so planned to meet the crop demand and requirement of macro nutrients N, P and K at different stages of crop growth. The plants were grown under drip system of irrigation with the following design having 7.5 Hp motor, main line diameter 90 mm, sub main diameter 63 mm, lateral diameter 16 mm, lateral spacing 2 m, emitter spacing 1.5 m, emitter discharge rate 4 lph, filter size (Screen filter) 65 mm and filter tank capacity 60 lit. The observations namely for growth characters vine length, stem girth and total chlorophyll content. In case of yield characters *viz.*, fruit length, fruit girth, fruit weight, yield per vine, number of fruits per vine and number of harvests. The fruit quality parameters like calcium, ascorbic acid and phosphorus contents and the benefit cost ratio was arrived by using the formula given below.

Data were subjected to statistical analysis by analysis of variance method (Panse and Sukhatme, 1985). The critical difference was worked out for 5 percent probability.

Growth Parameters

Vine Length

The length of the vine was measured from the cotyledonary node to the tip of the main stem at last harvest and expressed in centimeter.

Stem Girth

The girth of the stem was measured using thread and by taking the circumference at the base and expressed in centimeter.

Yield Parameters

Fruit Length

The length of the fruit was measured from the stalk end to the tip and the mean expressed in centimeter.

Fruit Girth

The circumference of the fruit was measured at the broadest portion and the mean expressed in centimeter.

Fruit Weight

The average fruit weight was taken at the third and fourth harvest and expressed in gram.

Yield per Vine

At each harvest, the fruits collected from each plant were weighed and total of all the harvests was worked out and expressed in kilogram per vine.

Number of Fruits per Vine

The number of fruits was counted at each harvest in each plant in each pit and the total of all the harvests was calculated and expressed in number. Harvesting was done at 2 to 3 days interval.

Number of Harvests

The total number of economic harvests in each treatment was calculated and expressed in number.

Benefit Cost Ratio (BCR)

The benefit cost ratio was arrived at by using the formula given below.

$$\text{BCR} = \frac{\text{Net returns (Rs. ha} - 1)}{\text{Total cost of expenditure (Rs. ha} - 1)}$$

Results and Discussion

The results of the experiment were tabulated and presented below.

Growth and Physiological Characters

From the experiment, it was found that fertigation treatments were significantly superior over the soil application of fertilizers (control). The lowest number of days for harvesting was observed in 5 treatment (Figure 1). The fertigation treatment with 125 percent water soluble fertilizers (T_5) recorded the highest

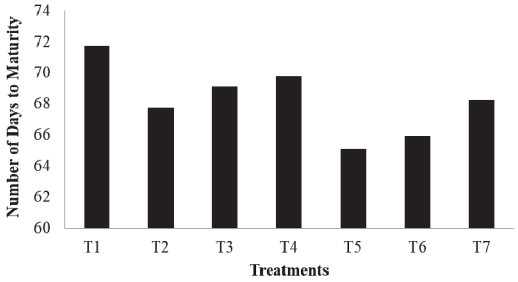

Figure 1: Effect of fertigation on days to maturity in ridge gourd hybrid 'COH1'

values for growth and physiological characters *viz.*, vine length, stem girth and total chlorophyll content (9.65 m), (5.47 cm) and (2.59 mg/100g) followed by T_6 with 100 percent RDF through water soluble fertilizers (8.86 m), (5.04 cm) and (2.35 mg g^{-1})The lowest vine length, stem girth and total chlorophyll content(7.02 m), (3.84 cm) and (1.69 mg g^{-1}) was recorded in control (Table 2). The increased vine length might be due to the better absorption of nitrogen and higher production of leaves per vine which helped in better synthesis of carbohydrates and utilization for buildup of new cells leading to increase in vine length. Higher nitrogen application induced

Table 2: Effect of fertigation on vine length (m), stem girth (cm) and totalchlorophyll content in ridge gourd hybrid 'COH1'

Treatments	Vine length (m)			Stem girth (cm)			Total chlorophyll content (mg/100g)		
	I Season	II season	Pooled Mean	I Season	II season	Pooled Mean	I Season	II season	Pooled Mean
T_1	7.57	6.47	7.02	4.03	3.65	3.84	1.73	1.65	1.69
T_2	9.10	8.56	8.83	4.93	4.84	4.89	2.25	2.21	2.23
T_3	8.62	8.25	8.43	4.87	4.71	4.79	2.06	2.04	2.05
T_4	8.22	7.91	8.06	4.28	4.39	4.33	1.87	1.81	1.84
T_5	9.88	9.42	9.65	5.48	5.46	5.47	2.62	2.55	2.59
T_6	8.94	8.78	8.86	5.14	4.93	5.04	2.36	2.34	2.35
T_7	8.71	8.46	8.58	4.69	4.51	4.60	2.17	2.14	2.16
S.Ed	0.405	0.272	0.244	0.209	0.274	0.172	0.060	0.075	0.048
CD (0.05)	0.882	0.593	0.502	0.455	0.597	0.355	0.131	0.163	0.099

more uptake and utilization of nitrogen for plant growth, where nitrogen is an important constituent of protein and protoplasm. Similar results were also reported by Suresh and Papaiah (1991) in bitter gourd.

The enhancement of growth parameters might be due to the restricted wetting area and root zone application of nutrients through drip system coupled with constant and continuous availability of optimum soil moisture, which provide the plants to absorb more nutrients (Patil, 1999). In the case of soil application of fertilizers with furrow irrigation, fertilizers are applied on a wider area, which had resulted in faster depletion of nutrients from the rhizosphere. Further, the faster rate of infiltration in furrow irrigation has resulted in water deficit, which might have led to many changes in plant anatomy, such as decrease in cell size and intercellular spaces, limiting cell division and elongation which reflected its effect on plant growth (Guinn *et al*., 1981). Umamaheswarappa *et al.* (2006) reported that in cucumber, the increased vine length was attributed to higher production of leaves per vine which helped in better synthesis of carbohydrates and utilization for buildup of new cells leading to increase in vine length.

The phenomenon of increased chlorophyll content with increased nutrition as observed in the present study was also reported earlier by several workers (Meenakshi and Vadivel, 2003; Kavitha, 2005; Sumathi, 2007) and also revealed that being a constituent of chlorophyll, increased supply of nitrogen accelerates higher synthesis of chlorophyll without altering the composition of chlorophyll a and b. It was clearly evident from the present study that the chlorophyll, a vital basic pigment for augmenting the available light for photosynthetic function, was conditioned by the application of water-soluble fertilizers.

Effect of Fertigation on Yield Parameters

In yield parameters, the highest values were registered in the fruit length, fruit girth, fruit weight, yield per vine, number of fruits per vine and number of harvests were recorded in 125 percent RDF (250:100:100 kg/ha) (Table 3 and 4) through water soluble fertilizers.

The entire process of fruit growth and development is mediated by interplay of endogenous growth substances. The length and girth of the fruits were significantly improved by the application of water-soluble fertilizers as it boosts the overall vegetative growth. The results are in agree ment with Lata and Singh (1993) in chilli.

The highest fruit weight was recorded in treatment T_5 with 125 percent water soluble fertilizers (Figure 2). The results revealed that by increasing NPK level, fruit weight started to increase gradually. These results are in agreement with the findings of Ahmed *et al.* (2007) who also reported that fruit weight of cucumber

Table 3: Effect of fertigation on fruit length (cm), fruit girth (cm) and fruit weight (g) in ridge gourd hybrid 'COH1'

Treatments	Fruit length (cm)			Fruit girth (cm)			Fruit weight (g)		
	I season	II season	Pooled Mean	I Season	II season	Pooled Mean	I Season	II season	Pooled Mean
T_1	32.21	32.49	32.35	16.68	16.51	16.60	332.50	326.27	329.39
T_2	37.04	36.90	36.97	19.12	19.22	19.17	369.25	356.31	362.78
T_3	35.49	36.06	35.77	18.14	18.15	18.14	355.50	348.89	352.20
T_4	35.05	34.10	34.58	17.47	18.05	17.76	348.22	342.74	345.48
T_5	39.07	38.71	38.89	19.79	19.50	19.65	395.49	388.15	391.11
T_6	37.41	36.93	37.17	19.10	19.39	19.25	381.32	372.19	376.76
T_7	36.67	36.84	36.76	18.32	18.39	18.35	367.20	364.14	365.67
S.Ed	0.782	0.819	0.566	0.349	0.421	0.274	4.974	6.747	4.191
CD (0.05)	1.705	1.785	1.167	0.761	0.918	0.564	10.843	14.708	8.633

Table 4 : Effect of fertigation on number of fruits per vine,number of harvests and yield per vine (kg) in ridge gourd hybrid 'COH1'

Treatments	Number of fruits per vine			Number of harvests			Yield per vine (kg)		
	I season	II season	Pooled Mean	I Season	II season	Pooled Mean	I Season	II season	Pooled Mean
T_1	12.68	12.47	12.58	11.46	11.07	11.27	4.26	3.92	4.09
T_2	14.96	13.33	14.15	12.32	12.07	12.20	4.93	4.75	4.84
T_3	15.14	13.68	14.41	12.89	12.40	12.65	4.78	4.56	4.67
T_4	13.93	13.26	13.59	12.63	11.47	12.05	4.69	4.30	4.50
T_5	18.11	17.57	17.84	14.45	13.74	14.10	6.24	5.86	6.05
T_6	16.37	15.36	15.87	14.21	13.13	13.67	5.76	5.28	5.52
T_7	15.25	15.16	15.21	13.36	13.18	13.27	5.43	4.69	5.06
S.Ed	0.421	0.363	0.277	0.364	0.345	0.251	0.139	0.201	0.122
CD (0.05)	0.917	0.791	0.572	0.793	0.753	0.517	0.303	0.439	0.252

increased linearly with an increase in nitrogen fertilizer dose. Proper application of nutrients promoted vigorous growth of the plant, which ultimately increased the number of fruits per plant. Compared to straight fertilizers, water soluble fertilizers had the highest number of fruits. Fertigation with 125 percent RDF through water soluble fertilizers had the highest number of fruits per vine. These results are in line with the findings of Spizewski *et al*. (2009) in cucumber.

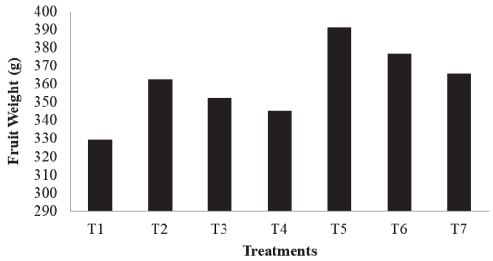

Figure 2: Effect of fertigation on fruit weight (g) in ridge gourd hybrid 'COH1'

Higher fertigation levels resulted in higher fruit weight which directly influenced the yield per vine. It might be due to the higher availability of nutrition in the soil solution, which obviously led to increased growth and better photo-assimilation and translocation of assimilates from source to sink which in turn increased fruit weight and yield per vine. Hilli *et al*. (2009) reported fruit yield parameters were significantly higher with higher levels of fertilizers in ridge gourd which is due to better utilization of nitrogen and phosphorus leading to vigorous growth and increased number of female flowers leading to higher fruit yield. Singh *et al.* (2000) reported nitrogen increases the photosynthetic efficiency and the rate of assimilation, which reflects on the bumper vegetative growth in tomato. Potassium in combination with nitrogen triggers the translocation of essential amino acids, activates the enzymatic activities and improves efficient use of applied nutrients.

The balanced nutrient level in the root zone of the crop provides better opportunity to exhibit its production potential in terms of yield. Fruit length, fruit girth, fruit diameter, fruit weight, fruit yield and number of harvests showed increasing trend with increased levels of fertigation. Similar results were reported earlier in cucurbitaceous crops by Sharma *et al.* (1997) and Patil *et al.* (1998) in cucumber.

Perusal of yield data showed favourable effect of drip fertigation on the yield of ridge gourd. The yield per vine and harvest index were significantly improved by the application of 125 percent RDF through water soluble fertilizers through fertigation due to the boost in overall vegetative growth and biological efficiency of the plant. Drip fertigation with 125 percent water soluble fertilizers produced higher fruit yield in both the seasons. Another possible reason might be the timely availability of nutrients during the flower production which favourably increased the number of female flowers per plant.

Fertigation with higher rates of fertilizers would have resulted in higher availability of nutrients in soil solution, obviously leading to increased growth, better photo-assimilation and better translocation of

assimilates from source to sink, which in turn increased the fruit yields. In the present investigation, higher levels of fertigation recorded the highest yield. In addition, water soluble fertilizers contained essential nutrients in chelated form, which favoured nutrients transport by mass flow and diffusion and reflected in higher yields. Increased levels of water-soluble fertilizers increased the fruit length, fruit diameter, flesh thickness and yield per vine. These results confirm the earlier findings of Meenakshi (2002) and Sumathi (2007).

With respect to yield attributing characters, highly significant and positive correlation with yield was recorded for fruit length, fruit girth, number of fruits per vine and average fruit weight, which showed the influence of these characters on yield (Figure 3 and 4).The increase in yield might be due to better proportion of air-soil-water which was maintained throughout the life period of crop in drip irrigation as compared to surface irrigation as reported by Kadam and Karthikeyan (2006).

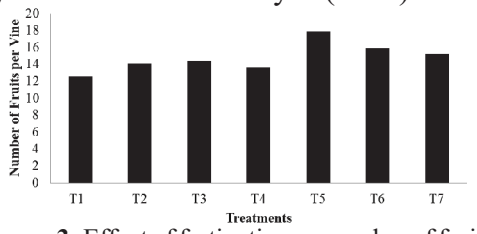

Figure 3: Effect of fertigation on number of fruits per vine in ridge gourd hybrid 'COH1'

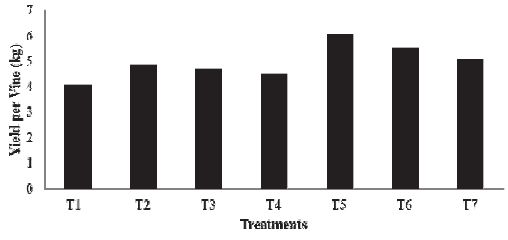

Figure 4: Effect of fertigation on yield per vine (kg) in ridge gourd hybrid 'COH1'

Compared to straight fertilizers, water soluble fertilizers showed earliness in first and last fruit harvest. More number of harvests was recorded in water soluble fertilizers than straight fertilizers and application of 125 percent recommended dose of fertilizers recorded the highest yield in both the seasons. The increased yield might be due to the result of all the growth and yield attributing characters and due to better availability of plant nutrients and irrigation water throughout the crop growth period under drip fertigation system. This is in accordance with the findings of Gutal *et al*. (1989).

Effect of Fertigation on Quality Parameters

Quality requirements are influenced by plant nutrition. Therefore, fertilization should not only ensure high yields per unit area but also high-quality produce by the improvement of either low initial quality caused by insufficient nutrient supplies or the maintenance of high quality. The chemical composition controls the nutritional quality value, as well as important sensory attributes such as taste and texture of the product. Increased concentration of nitrogen in plants generally increases some plant components such as amino acids, proteins and chlorophyll. Application of correct quantity of fertilizers not only increases the yield but also improve the quality. Application of major nutrients in proper ratio and required optimum quantity can help growers to get the maximum benefit out of these inputs (Kavitha *et al*., 2007).

The quality attributes like calcium, ascorbic acid and phosphorus contents mainly decide the quality and nutritive value of ridge gourd (Table 5). The quality improvement is due to the involvement of potassium in carbohydrate synthesis, breakdown and translocation of starch, protein synthesis and neutralization of physiologically important organic acids (Jeyakumar *et al.,* 2001). Any package of practice altering these constituents would influence the quality of fruits. Different levels of fertigation had significant effect on quality parameters in ridge gourd.

Significant differences were observed in carbohydrate, ascorbic acid and phosphorus contents and the highest value was recorded with 125 percent RDF through water soluble fertilizers. Increase in ascorbic acid content at higher levels of nutrition would have enhanced the enzyme activity for amino acid synthesis leading to higher ascorbic acid content. These results are in agreement with the findings of Mary and Balakrishnan (1990) who reported that, high N uptake enhanced the enzyme activities for amino acid synthesis and increased the ascorbic acid content in fruits.

The application of water-soluble fertilizers would have induced the conversion of available soluble protein into structural soluble protein. The findings of Meenakshi (2002) bend support to the above results. Increased dose of nitrogen, phosphorus and potassium might have enhanced the photosynthetic and metabolic activities resulting in higher amounts of acid metabolites and glucose which might have contributed to the synthesis of ascorbic acid content in the fruits.

Economics of Fertigation

Drip fertigation in vegetables requires high capital investment and more so with the water-soluble fertilizers. Hence, the economic viability of drip fertigation system was calculated considering the longer life span of the drip system, increa sed productivity and net extra income over conventional fertilization. Though the investment towards drip system for fertigation was high, considering the longer life of drip system the benefit accrued was also for longer period.

Though the highest gross income was recorded in 125 RDF through water soluble fertilizers, the BC ratio was low. Straight fertilizers are cheaper than water soluble fertilizers and the highest BC ratio (2.16) was recorded with 125 percent recommended dose of straight fertilizers followed by 2.15 in 100 per RDF straight fertilizers (Table 5). The yield increase in water soluble fertilizers was only marginal level and 125 per cent RDF through straight fertilizers was found economically feasible. Asokaraja (1998) reported in tomato though the yield was higher with drip irrigation, the benefit cost ratio was less mainly due to high initial cost of drip system.

Table 5 : Effect of fertigation on Calcium (mg g^{-100}), ascorbic acid (mg g^{-100}) and phosphorus (%) in ridge gourd hybrid'COH1'

Treatments	Calcium (mg g^{-100})			Ascorbic acid (mg g^{-100})			Phosphorus (%)			BC ratio
	I season	II season	Pooled Mean	I Season	II season	Pooled Mean	I Season	II season	Pooled Mean	Pooled Mean
T_1	15.19	15.36	15.28	4.33	4.57	4.45	0.45	0.38	0.42	1.98
T_2	15.77	15.50	15.64	5.36	5.47	5.42	0.56	0.51	0.54	2.16
T_3	15.69	15.35	15.52	5.24	5.20	5.22	0.52	0.47	0.50	2.15
T_4	15.45	15.61	15.53	5.12	4.89	5.01	0.48	0.42	0.45	2.12
T_5	15.47	15.62	15.54	8.55	7.72	8.14	0.76	0.70	0.73	1.65
T_6	15.52	15.71	15.62	6.08	6.40	6.24	0.68	0.61	0.65	1.66
T_7	15.57	15.83	15.70	5.20	5.77	5.49	0.61	0.56	0.59	1.69
S.Ed	0.031	0.365	0.325	0.564	0.765	0.475	0.017	0.016	0.012	-
CD (0.05)	NS	NS	NS	1.229	1.667	0.979	0.037	0.034	0.024	-

From the foregoing discussion, it could be concluded that fertigation with 125 percent RDF through water soluble fertilizers proved its superiority over other treatments in respect of growth, yield and quality traits, followed by 100 percent RDF through water soluble fertilizers. However, the benefit cost ratio was the highest at 125 percent RDF through straight fertilizers. Based on the economic feasibility, straight fertilizers were found beneficial compared to water soluble fertilizers.

Conclusions

Considering the overall performance, fertigation with 125 percent RDF through water soluble fertilizers proved its superiority over other treatments in respect of growth, yield and quality traits, followed by 100 percent RDF through water soluble fertilizers. However, the benefit cost ratio was the highest at 125 percent RDF through straight fertilizers.

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