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PM Suresh
Assistant Professor, School of Agricultural Sciences, Kalasalingam University, Krishnankoil, Tamil Nadu, India

S Kumar
Professor (Horticulture) Anbil Dharmalingam Agricultural College and Research Institute, Tamil Nadu Agricultural University, Tiruchirappalli, Tamil Nadu, India

V Swaminathan
Dean (Horticulture) Horticultural College and Research Institute, Tamil Nadu Agricultural University, Periyakulam, Tamil Nadu, India

A Gurusamy
Professor, Department of Agronomy, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai, Tamil Nadu, India

T Shivakumar
Associate Professor, Department of Crop Physiology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

Correspondence
PM Suresh
Assistant Professor, School of Agricultural Sciences, Kalasalingam University, Krishnankoil, Tamil Nadu, India

Influence of drip fertigation on leaf NPK status and yield characters of aonla (*Emblica officinalis* Gaertn.) cv. NA-7

PM Suresh, S Kumar, V Swaminathan, A Gurusamy and T Shivakumar

Abstract
A field experiment to study the influence of drip fertigation levels on Leaf NPK and yield characters in aonla was carried out during 2011 to 2013. The experiment was laid out in randomized block design with eight treatments of fertigation levels, namely 75, 100 and 125% recommended dose of water soluble fertilizers including, soil application (control) and replicated three times, to test various leaf NPK content and yield attributes of 8 years aonla cv. NA.7 grown under drip fertigation. The investigation indicated that 125 % recommended dose of water soluble fertilizers (T_8) applied through fertigation resulted in maximum leaf N, P and K during 2011-2012 and 2012-2013 vegetative, flowering and harvesting stages respectively. The yield attributing characters viz., number of fruits per plant (1420.40 and 2157.30), average fruit weight (40.5 g and 42.5g), fruit volume (2.12 cc and 2.32 cc) and yield per tree (57.33 kg and 91.69 kg) were also found to be higher in the same treatment than with soil application of recommended doses of NPK and higher dose fertigation. Therefore (T_8) 125 % recommended doses of NPK in the form of water soluble fertilizers can be suggested for increasing the yield of eight years old aonla cv. NA.7 significantly.

Keywords: Aonla, Drip fertigation, Leaf NPK and Yield

Introduction
Aonla (*Emblica officinalis* Gaertn.), belonging to the family Euphorbiaceae, is said to be indigenous to tropical south eastern Asia, particularly in central and southern India and has been cultivated since ancient times. Aonla is known as 'the mother of herbs. It is one of the richest sources of vitamin C (ascorbic acid) and also a rare example of an edible material, rich in phenols and tannins. Aonla is commercially cultivated in Mayanmar, Bangladesh, SriLanka, Iran and Iraq. India leads in the world in area and production. The area under aonla cultivation in India is about 1, 08,060 hectares with an annual production 12, 66,460 MT (NHB, 2014). The average productivity of aonla in Tamil Nadu is 19 tonnes per hectare with traditional way of cultivation against the Indian average productivity of 11.71 tonnes per hectare (NHB, 2014). NA.7 variety is the most precocious and heavy yielder, selected from chance seedling of Francis (Hathijhool). It is a prolific bearer with more percentage of female flowers. Fruits are medium to bold in size (44.50 g), flattened oblong with greenish-white in colour, smooth skin surface, semi translucent and free from necrosis, less fiber content, more juice and Vitamin C content. The variety is ideal for preparation of preserve, candy and beverages. It has wider adaptability to grow successfully all over the country. Since the natural ground water potential is diminishing, many farmers in India have opted drip irrigation. Through drip irrigation, fertigation is easier with high nutrient use efficiency, saving in labour, less weed infestation besides enhancing the productivity. (Thiyagarajan, 2006) [21].

Aonla responds to applied fertilizers to meet its nutrient requirements. Through fertigation methods, nutrients are added to the soil in adequate doses and interval through which qualitative improvement of produce can also be attained to a larger extent. Production of quality fruits in aonla will enable the farmers to earn more income. In Tamil Nadu, a dose of 200:500:200 g NPKtree^{-1}year^{-1} is generally recommended (TNAU) for aonla. This study was aimed to evaluate the fertigation system involving drip irrigation methods; various levels of fertilizers with a comparison on the farmers practice (surface irrigation + soil application of RDF) on leaf NPK and yield per tree of aonla.

Materials and Methods

A field experiment was conducted at the Department of Horticulture, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai during the year 2011-12 and 2012-13. The research experiment conducted at College Model Orchard was aimed to standardize the fertigation schedule for aonla, to study the effect of fertigation with N, P and K fertilizers on growth, yield and quality of aonla. The details of materials used T_{1}-Surface Irrigation with soil application of 100% RDF (Control), T_{2}-Drip Irrigation with soil application of 100 % RDF T_{3}-Drip Fertigation of 75% RDF as Commercial Fertilizers, T_{4}-Drip Fertigation of 100 % RDF as Commercial Fertilizers, T_{5}-Drip Fertigation of 125% RDF as Commercial Fertilizers T_{6}-Drip Fertigation of 75% RDF as Water Soluble Fertilizers (WSF), T_{7}-Drip Fertigation of 100% RDF as Water Soluble Fertilizers (WSF) T_{8}- Drip Fertigation of 125% RDF as Water Soluble Fertilizers (WSF). All other recommended package of practices were followed to raise the crop as per the Crop Production Techniques of Horticultural Crops (2012). For the treatment T_1-Soil application with surface irrigation was done in two split doses during April and September. For the treatment T_2-Soil application with drip irrigation was done in two split doses during April and September. For drip fertigation treatments (T_3- T_5) P was applied as basal through SSP, N and K were injected at weekly in equal splits. For drip fertigation treatments (T_6- T_8) the WSF namely MAP, SOP and Urea were injected at weekly intervals in equal splits (52 weeks). RDF: 200:500:200 g NPK/tree/year.

Results and Discussion

Leaf nitrogen content at vegetative stage

All the treatments produced a significant effect on the leaf nitrogen content in the vegetative stage. Among the different treatments implemented, the treatment T_8 (125 percent RDF through fertigation) showed the highest leaf nitrogen content at vegetative stage (1.68 kg/ha during 2011-2012 and 1.72 kg/ha during 2012-2013). It was followed by T_7 (100 percent RDF through fertigation) 1.63 kg/ha during 2011-2012 and 1.66 kg/ha during 2012-2013. The least leaf nitrogen content in the vegetative stage is 1.20 kg/ha during 2011-2012 and 1.24 kg/ha during 2012-2013 in (T_1) (Table.1).

Pooled mean values showed that the application of 125 percent RDF through fertigation recorded the highest available leaf nitrogen content at vegetative stage of 1.70 kg/ha. It was followed by T_7 (100 percent RDF through fertigation) 1.64 kg/ha. The least leaf nitrogen content at vegetative stage is 1.22 kg/ha in control (T_1). Fertigation of macro nutrients had resulted in the enhanced absorption of N by crops that ultimately led to higher yield. Similar findings were reported by Papadopoulos (1987) [14] and Colla *et al*. (2001) [3].

Leaf nitrogen content at flowering stage

The leaf nitrogen content at flowering stage were significant among the treatments. The results further showed that the treatment T_8 (125 percent RDF through fertigation) exhibited the highest leaf nitrogen 1.57 kg/ha content in 2011-2012 and 1.62 kg/ha in 2012-2013. It was found to be on par with T_7 (100 percent RDF through fertigation) 1.52 kg/ha during 2011-2012. The least leaf nitrogen content in the flowering stage is 1.19 kg/ha during 2011-2012 and 1.21 kg/ha during 2012-2013 in control (T_1).

Pooled mean values showed that the application of 125 percent RDF through fertigation (T_8) recorded the highest available leaf nitrogen content at flowering stage of 1.59 kg/ha. It was followed by T_7 (100 percent RDF through fertigation) 1.53 kg/ha. The least leaf nitrogen content at flowering stage is kg/ha in control (T_1). Increased nutrient status in leaves is due to accumulation of carbohydrates, which may take place gradually with the advancement of growth phase. Similar findings were also reported by Papadopoulos (1987) [14], Shirgugre *et al.* (2000) [17] (Table.1).

Leaf nitrogen content at harvesting stage

All the treatments produced a significant effect on the leaf nitrogen content in the harvesting stage. Among the different treatments implemented, the treatment T_8 (125 percent RDF through fertigation) showed the highest leaf nitrogen content at harvesting stage (1.52 kg/ha during 2011-2012 and 1.56 kg/ha during 2012-2013). It was found to be on par with T_7 (100 percent RDF through fertigation), 1.48 kg/ha during 2011-2012 and 1.52 kg/ha at during 2012-2013. The least leaf nitrogen content in the harvesting stage is 1.17 kg/ha during 2011-2012 and 1.19 kg/ha during 2012-2013 in control (T_1).

Pooled mean values showed that the application of 125 percent RDF through fertigation recorded the highest available leaf nitrogen content at harvesting stage of 1.54 kg/ha. It was found to be on par with T_7 (100 percent RDF through fertigation) 1.50 kg/ha. The least leaf nitrogen content at harvesting stage is 1.18 kg/ha in control (T_1). These results are in conformity with Petillo (2000) [16], Colla *et al.* (2001) [3] and Ummaheswarappa *et al*., (2005) [23]. Increased nutrient status in leaves is due to accumulation of carbohydrates, which may take place gradually with the advancement of growth phase.

Leaf phosphorous content at vegetative stage

All the treatments produced a significant effect on the leaf phosphorous content in the harvesting stage. Among the different treatments implemented, the treatment T_8 (125 percent RDF through fertigation) showed the highest leaf phosphorous content at vegetative stage (0.40 kg/ha during 2011-2012 and 0.43 kg/ha during 2012-2013). It was followed by T_7 (100 percent RDF through fertigation) 0.38 kg/ha during 2011-2012 and 0.41 kg/ha during 2012-2013. The least leaf phosphorous content in the vegetative stage is 0.14 kg/ha during 2011-2012 and 0.17 kg/ha during 2012-2013 in control (T_1). (Table 2.)

Pooled mean values showed that the application of 125 percent RDF through fertigation recorded the highest available leaf phosphorous content at vegetative stage of 0.41 kg/ha. It was followed by T_7 (100 percent RDF through fertigation)

0.39 kg/ha. The least leaf phosphorous content in the vegetative stage is 0.15 kg/ha in control (T_1). Phosphorus plays a key role in energy transfer system of plants. In the present study, relatively higher phosphorus content was noticed in leaves with application of 125 percent RDF as WSF through fertigation. This finding was in accordance with Patel and Chadha (2002) [2] in grapes. It may be due to the fact that Phosphorus may be utilized for higher metabolite production for enhanced activity of the plant due to fertigation.

Leaf phosphorous content at flowering stage

All the treatments produced significant effect on the leaf phosphorous content at flowering stage. Among the different treatments implemented, the treatment T_8 (125 percent RDF through fertigation) showed the highest leaf phosphorous content at flowering stage (0.50 kg/ha during 2011-2012 and 0.56 kg/ha during 2012-2013). The lowest leaf phosphorous content at flowering stage was recorded in T_7 (100 percent RDF through fertigation) 0.48 kg/ha during 2011-2012 and 0.52 kg/ha during 2012-2013. The least leaf phosphorous content in the flowering stage is 0.31 kg/ha during 2011-2012 and 0.33 kg/ha during 2012-2013 in control (T_1).

Pooled mean values showed that the application of 125 percent RDF through fertigation recorded the highest available leaf phosphorous content at flowering stage of 0.53 kg/ha It was followed by T_7 (100 percent RDF through fertigation) 0.50 kg/ha. The least leaf phosphorous content in the flowering stage is 0.32 kg/ha in control (T_1). (Table.2)

Leaf phosphorous content at harvesting stage

All the treatments produced a significant effect on the leaf phosphorous content in the harvesting stage. Among the different treatments implemented, the treatment T_8 (125 percent RDF through fertigation) showed the highest leaf phosphorous content at harvesting stage (0.47 kg/ha during 2011-2012 and 0.52 kg/ha during 2012-2013). It was followed by T_7 (100 percent RDF through fertigation), 0.45 kg/ha during 2011-2012 and 0.48 kg/ha at during 2012-2013. The least leaf phosphorous content in the harvesting stage is 0.27 kg/ha during 2011-2012 and 0.31 kg/ha during 2012-2013 in control (T_1).

Pooled mean values showed that the application of 125 percent RDF through fertigation recorded the highest available leaf phosphorous content at harvesting stage of 0.49 kg/ha. It was followed by T_5 (125 percent RDF through fertigation) 0.46 kg/ha. The least leaf phosphorous content at flowering stage is 0.29 kg/ha in control (T_1). (Table 2)

Leaf potassium content at vegetative stage

All the treatments produced a significant effect on the leaf potassium content in the vegetative stage. Among the different treatments implemented, the treatment T_8 (125 percent RDF through fertigation) showed the highest leaf potassium content at vegetative stage (0.76 kg/ha during 2011-2012 and 0.87 kg/ha during 2012-2013). It was followed by T_7 (100 percent RDF through fertigation) 0.68 kg/ha during 2011-2012 and 0.82 kg/ha at during 2012-2013. The least leaf potassium content in the vegetative stage is 0.45 kg/ha during 2011-2012 and 0.52 kg/ha during 2012-2013 in control (T_1).

Pooled mean values showed that the application of 125 percent RDF through fertigation recorded the highest available leaf potassium content at vegetative stage of 0.81 kg/ha. It was followed by T_7 (100 percent RDF through fertigation) 0.75 kg/ha. The least leaf potassium content at vegetative stage is 0.48 kg/ha in control (T_1). (Table.3) Potassium (K), being a protoplasmic factor, is an essential plant nutrient. Many enzymes are activated by K and it is also involved in photo and oxidative phosphorylation, thus augmenting the energy required for fruit growth. Application of 125 RDF as WSF through fertigation registered the highest K content in leaf (Table 3.). Drip fertigation with 125 percent RDF enhanced the absorption of potassium at all stages of tree growth. Fontes *et al*. (2000) [8]

Leaf potassium content at flowering stage

Among the different treatments implemented, the treatment T_8 (125 percent RDF through fertigation) showed the highest leaf potassium content at flowering stage (0.74 kg/ha during 2011-2012 and 0.80 kg/ha during 2012-2013). It was found to be followed by T_7 (100 percent RDF through fertigation), 0.68 kg/ha during 2011-2012 and 0.75 kg/ha at during 2012-2013. The least leaf potassium content in the flowering stage is 0.38 kg/ha during 2011-2012 and 0.41 kg/ha during 2012-2013 in control (T_1). (Table.3)

Pooled mean values showed that the application of 125 percent RDF through fertigation recorded the highest available leaf potassium content at flowering stage of 0.77 kg/ha. It was followed by T_7 (100 percent RDF through fertigation) 0.71 kg/ha. The least leaf potassium content at flowering stage is 0.39 kg/ha in control (T_1). Dangler and Lacascio (1990) [4] opined that application of N and K in combination with drip irrigation increased the yield by the way of maximizing the mobility of nutrients around the root zone. These results are in agreement with those obtained by El-Gizawy (1992) [7].

Leaf potassium content at harvesting stage

All the treatments produced a significant effect on the leaf potassium content in the harvesting stage. Among the different treatments implemented, the treatment T_8 (125 percent RDF through fertigation) showed the highest leaf potassium content at harvesting stage (0.82 kg/ha during 2011-2012 and 0.90 kg/ha during 2012-2013). It was followed by leaf potassium content at harvesting stage was recorded in T_7 (100 percent RDF through fertigation) 0.77 kg/ha during 2011-2012 and 0.80 kg/ha at during 2012-2013. The least leaf potash content in the harvesting stage is 0.48 kg/ha during 2011-2012 and 0.56 kg/ha during 2012-2013 in control (T_1).

Pooled mean values showed that the application of 125 percent RDF through fertigation recorded the highest available leaf potassium content at harvesting stage of 0.86 kg/ha. It was followed by T_7 (100 percent RDF through fertigation) 0.78 kg/ha. The least leaf potassium content at harvesting stage is 0.52 kg/ha· in control (T_1). (Table.3) The potassium content in aonla leaf exerted a differential pattern than that of nitrogen and phosphorus. The transformation reactions that took place led to greater availability of potassium in the soil and consequently resulted in better utilization by the plant. It is also possible that the fertigation with 125 percent RDF might have activated the physiological processes for the rapid absorption and utilization of nutrients for the primary metabolic processes. Similar findings were reported by Ghanta and Mitra (1993) [9], Singh *et al*. (1995) [18] and EI-Sherif *et al*. (1993) [6].

Number of fruits per tree

Observations made on number of fruits per tree showed significant differences among the treatments. Among various treatments, T_8 (125 percent RDF as WSF through fertigation by drip irrigation) recorded the higher number of fruits per tree (1420.40 and 2157.30) during 2011-2012 to 2012 -2013, followed by 100 percent fertigation T_7 (1262.50 and 1991.68). While T_1 recorded the least number of fruits per tree 710.16 and 1143.25 during 2011-2012 to 2012 -2013 respectively.

The pooled analysis of the data showed that 125 percent RDF as WSF through fertigation by drip irrigation (T_8) recorded more number of fruits per tree 1788.8 and followed by T_7 with 1627.0 and the least value 926.7 was recorded in T_1. (Table.4) This may be attributed to the probable interaction of growth parameters like tree volume and physiological parameters like leaf area and dry matter production. These results stand in conformity with the findings of Brain (1996) [1] in grapefruit, Torres *et al*. (2004) [22] and Srinivas (2006) [20] in mango

Average fruit weight
The treatments registered significant influence on average fruit weight. The average fruit weight ranged from 23.0 to 40.5 g during 2011-2012 and 23.5 to 42.5 g during 2012-2013. The treatment receiving 125 percent RDF fertigation (T_8) recorded the highest average fruit weight of 40.5 and 42.5 g in 2011-2012 to 2012 -2013 respectively. The second best treatment was observed in T_7 (100 percent RDF as fertigation 37.2 and 38.0 g). The least average fruit weight (23.0 and 23.5g) was recorded in T_1 in 2011-2012 to 2012 -2013 respectively.
Pooled mean values of average fruit weight showed that application of 125 percent RDF fertigation (T_8) recorded the highest average fruit weight of 41.50 g. It was followed by 100 percent RDF (T_7) as fertigation (37.60 g). The lowest average fruit weight (23.25 g) was recorded by control (T_1) (Table.4) Hanamanth (2002) [10] and Singh *et al.* (2006) [19] also noticed similar response for fertigation in mango.

Fruit volume
Application of conventional fertilizers and water soluble fertilizers through drip irrigation system had significant influence on fruit volume. Among the different treatments, (T_8) *i.e.* application of 125 percent RDF through fertigation recorded the highest fruit volume (2.21 cc and 2.32 cc) in both years. It was followed by T_7 (1.93.cc and 2.03 cc) in 2011-2012 to 2012 -2013, respectively. The lowest fruit volume was registered by control T_1 (1.25 cc and 1.32 cc) during 2011-2012 to 2012 -2013 respectively.
Pooled mean values of fruit volume suggested that application of 125 percent RDF through fertigation (T_8) recorded the highest fruit volume of 2.26 cc followed by 100 percent RDF through fertigation T_7 (1.97 cc). The lowest fruit volume (1.28 cc) was recorded by control (T_1). (Table.4) The results are in agreement with that of Brantley and Warren (1960) [2], Deswaland Patil (1984) [5] Mrinalini and Tiwari (1988) [12] and Lata and Singh (1993) [11].

Yield per tree
Significant differences were noticed among the treatments for fruit yield per tree during 2011-2012 to 2012 -2013. The yield per tree ranged from 16.33 to 57.33 kg during 2011 -2012 and 26.87 to 91.69 kg during 2012-2013. The treatment T_8 recorded higher yield (57.33 and 91.69 kg). The next best yield was registered by T_7 (46.97 and 75.68 kg in 2012 and 2013) and T_1 recorded the lower yield of 16.33 and 26.87 kg.
Pooled mean values indicated that application of 125 percent RDF (T_8) through fertigation recorded the highest yield per tree of 74.60 kg and it was followed by 100 percent RDF (T_7) through fertigation (61.31). The lowest mean yield of 21.61 kg was recorded by control. (Table.4)

Table 1: Effect of drip fertigation levels on available leaf nitrogen (kg/ha) at vegetative, flowering and harvesting stages of aonla cv.NA-7

Treatments	Leaf Nitrogen (Vegetative)		Pooled mean 2012-2013	Leaf Nitrogen (Flowering)		Pooled mean 2012-2013	Leaf Nitrogen (Harvesting)		Pooled mean 2012-2013
	2012	2013		2012	2013		2012	2013	
T_1	1.20	1.24	1.22	1.19	1.21	1.20	1.17	1.19	1.18
T_2	1.25	1.29	1.27	1.22	1.25	1.23	1.21	1.22	1.21
T_3	1.31	1.34	1.32	1.27	1.29	1.28	1.24	1.27	1.25
T_4	1.43	1.46	1.44	1.39	1.43	1.41	1.34	1.39	1.36
T_5	1.57	1.61	1.59	1.46	1.50	1.48	1.40	1.45	1.42
T_6	1.37	1.42	1.39	1.32	1.37	1.34	1.27	1.30	1.28
T_7	1.63	1.66	1.64	1.52	1.55	1.53	1.48	1.52	1.50
T_8	1.68	1.72	1.70	1.57	1.62	1.59	1.52	1.56	1.54
SEd	0.0173	0.020	0.012	0.028	0.023	0.017	0.030	0.029	0.021
CD at 5 %	0.037	0.042	0.025	0.059	0.049	0.035	0.065	0.062	0.043

Table 2: Effect of drip fertigation levels on available leaf phosphorus (kg/ha) at vegetative, flowering and harvesting stages of aonla cv.NA-7

Treatments	Leaf phosphorus (Vegetative)		Pooled mean 2012-2013	Leaf phosphorus (Flowering)		Pooled mean 2012-2013	Leaf phosphorus (Harvesting)		Pooled mean 2012-2013
	2012	2013		2012	2013		2012	2013	
T_1	0.14	0.17	0.15	0.31	0.33	0.32	0.27	0.31	0.29
T_2	0.16	0.18	0.17	0.36	0.40	0.38	0.31	0.33	0.32
T_3	0.21	0.23	0.22	0.42	0.44	0.43	0.34	0.37	0.35
T_4	0.28	0.30	0.29	0.45	0.48	0.46	0.40	0.43	0.41
T_5	0.32	0.36	0.34	0.46	0.51	0.48	0.42	0.46	0.44
T_6	0.25	0.28	0.26	0.43	0.46	0.44	0.37	0.40	0.38
T_7	0.38	0.41	0.39	0.48	0.52	0.50	0.45	0.48	0.46
T_8	0.40	0.43	0.41	0.50	0.56	0.53	0.47	0.52	0.49
SEd	0.007	0.008	0.005	0.008	0.009	0.005	0.007	0.008	0.005
CD at 5 %	0.016	0.017	0.011	0.016	0.020	0.011	0.016	0.018	0.011

Table 3: Effect of drip fertigation levels on available leaf potassium (kg/ha) at vegetative, flowering and harvesting stages of aonla cv.NA-7

Treatments	Leaf potassium (Vegetative)		Pooled mean 2012-2013	Leaf potassium (Flowering)		Pooled mean 2012-2013	Leaf potassium (Harvesting)		Pooled mean 2012-2013
	2012	2013		2012	2013		2012	2013	
T_1	0.45	0.52	0.48	0.38	0.41	0.39	0.48	0.56	0.52
T_2	0.47	0.62	0.54	0.42	0.47	0.44	0.51	0.60	0.55
T_3	0.52	0.63	0.57	0.47	0.54	0.50	0.58	0.63	0.60
T_4	0.58	0.69	0.63	0.56	0.67	0.61	0.66	0.72	0.69
T_5	0.63	0.74	0.68	0.61	0.72	0.66	0.71	0.76	0.73
T_6	0.56	0.65	0.60	0.52	0.63	0.57	0.60	0.65	0.62
T_7	0.68	0.82	0.75	0.68	0.75	0.71	0.77	0.80	0.78
T_8	0.76	0.87	0.81	0.74	0.80	0.77	0.82	0.90	0.86
SEd	0.013	0.015	0.010	0.013	0.017	0.010	0.015	0.013	0.010
CD at 5 %	0.028	0.033	0.020	0.027	0.036	0.022	0.033	0.028	0.022

Table 4: Effect of drip fertigation levels on yield characters of aonla cv.NA-7

Treatments	No of fruits per tree		Pooled mean 2012-2013	Average Fruit Weight (g)		Pooled mean 2012-2013	Fruit Volume (cc)		Pooled mean 2012-2013	Yield per tree (kg)		Pooled mean 2012-2013
	2012	2013		2012	2013		2012	2013		2012	2013	
T_1	710.16	1143.25	926.7	23.0	23.5	23.25	1.25	1.32	1.28	16.33	26.87	21.61
T_2	869.79	1326.20	1097.9	27.5	28.7	28.10	1.40	1.56	1.48	23.92	38.06	30.96
T_3	980.32	1419.66	1200.0	29.0	31.0	29.99	1.45	1.62	1.53	28.43	44.01	36.20
T_4	1140.72	1710.05	1425.3	31.8	32.7	32.25	1.53	1.81	1.67	36.27	55.92	46.11
T_5	1183.05	1801.20	1492.1	35.7	36.7	36.20	1.74	1.94	1.84	42.23	66.10	54.15
T_6	1087.75	1557.14	1322.4	30.0	32.3	31.15	1.49	1.73	1.61	32.63	50.30	41.46
T_7	1262.50	1991.68	1627.0	37.2	38.0	37.60	1.93	2.03	1.97	46.97	75.68	61.31
T_8	1420.40	2157.30	1788.8	40.5	42.5	41.50	2.21	2.32	2.26	57.53	91.69	74.60
SEd	25.131	38.438	22.961	0.593	0.715	0.464	0.033	0.036	0.025	0.422	1.307	0.687
CD at 5 %	53.908	82.450	47.071	1.273	1.533	0.952	0.071	0.078	0.051	0.905	2.804	1.408

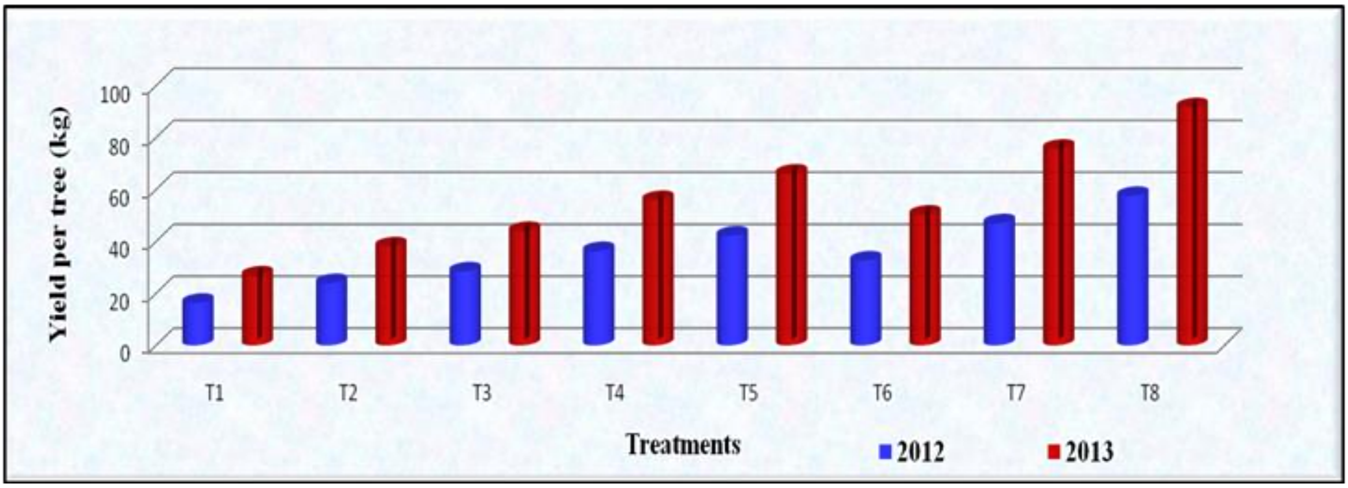

Fig 1: Effect of fertigation on yield per tree (kg) during 2011-2012 and 2012-2013

References

1. Brain JB. Fertigation enhances grape fruit yield. Fluid J. 1996; 1:1-3.
2. Brantley BB, Warren GF. Effect of nitrogen on flowering, fruiting and quality of the watermelon. Proc. of Amer. Soc. Hort. Sci. 1960; 75:644-649.
3. Colla G, Temperini O, Battistelli A, Moscatello S, Proietti S, Saccardo F *et al*. Nitrogen and celery. Coltura protette. 2001; 30(4):68-70.
4. Dangler JM, Locascio SJ. Yield of trickle - irrigated tomatoes as affected by time of N and K application. J. Amer. Soc. Hort. Sci. 1990; 115(4):585 - 589.
5. Deswal IS, Patil VK. Effects of N, P and K on the fruit of watermelon. J Maharashtra Agric. Univ. 1984; 9(3):308-309.
6. EI-Sherif AF, Shate SM, Youssef RA. Effect of rate and methods of zinc application on growth and nutrient uptake of tomato plants. Egypt. J Hort. 1993; 17(2):123-129.
7. El-Gizawy AM, Abdallah MMF, Gomaa HM, Mohamed SS. Effect of different shading levels on tomato plants. II. Yield and fruit quality. Acta. Hort. 1992; 323:349-354.
8. Fontes PCR, Sampaio RA, Finger FL. Fruit size, mineral composition and quality of trickle irrigated tomatoes as affected by potassium rates. Pesquisa Agropecuaria Brasileira. 2000; 35(1):21-25.
9. Ghanta PK, Mitra SK. Effect of micronutrients on growth, flowering, leaf nutrient content and yield of banana cv. Giant Governor. Crop Res. 1993; 6(2):284-287.

10. Hanamanth YA. Irrigation and fertilization studies in high density mango (*Mangifera indica* L.). M.Sc., Thesis submitted to Division of Horticulture, UAS, G.K.V.K, Bangalore, 2002.
11. Lata S, Singh RP. Effect of nitrogen level and growth regulators on growth, yield and quality of chilli (*Capsicum annuum* L.) variety Pant C-1. Veg. Sci. 1993; 20(1):40-43.
12. Mrinalini Raghava, Tiwari JP. Effect of boron on growth, quality and shelf-life of fruits of guava (*Psidium guajava* L.) cv. Sardar. Prog. Hort. 1998; 30(1-2):68-72.
13. National Horticulture Board, Indian Horticulture Database, 2014.
14. Papadopoulos I. Nitrogen fertigation of greenhouse grown tomato Commun. Soil. Sci. Plant Anal. 1987; 18(8):897-907.
15. Patel VB, Chadha KL. Effect of graded doses of nitrogen on tissue nutrient status of grape. Indian J Hort. 2002; 59(3):247-252.
16. Petillo GM. Fertigation versus conventional nitrogen fertilization of Valencia oranges. Agrociencia. 2000; 40(1):23-30.
17. Shirgure PS, Srivastava AK, Singh S. Fertilization and drip irrigation in Nagpur Mandarin (*Citrus reticulata* Blanco.). South Indian Hort. 2000; 49:201-206.
18. Singh AK, Singh K, Singh UN, Raju MS, Singh JP. Effect of potassium, zinc and iron on yield, post harvest quality and nutrient uptake in French bean (*Phaseolus vulgaris* L**.).** J. Karnataka Res. 1995; 11(1):75-80.
19. Singh KK, Singh PK, Pandey PKR, Shukla KN. Integrated water and nutrient management of young mango crop in tarai region of Uttaranchal. In: 3rd Asian Regional Conference, Sep. 10 - 16, PWTC, Kuala Lumpur, 2006, 314.
20. Srinivas K. Fertigation studies in high density mango. In: National Symp. on Improving Input Efficiency in Horticulture. IIHR, Bangalore, 2006, 150.
21. Thiyagarajan T. Effect of micro sprinkler on growth, yield and nutrient dynamics pattern in groundnut. Ph.D (Engineering) Thesis, Tamil Nadu Agri. Univ., Coimbatore, 2006.
22. Torres MD, Hermoso JM, Farré JM. Influence of nitrogen and calcium fertilisation on productivity and fruit quality of mango cv. Sensation. Acta Hort. 2004; 645:395-401.
23. Umamaheswarappa P, Krishnappa KS, Venkatesha Murthy P, Adivapper N, Pitchaimuthu M. Effect of NPK on dry matter accumulation and primary nutrient content in leaf of bottlegourd cv. Arka Bahar. Crop Res. 2005; 30(2):181-186.