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Effect of NPK fertigation on post-harvest soil nutrient status, nutrient uptake and yield of hybrid ridge gourd [*Luffa acutangula* (L.) Roxb] Arka Vikram

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Abstract
With rising concern about current fertilizer NPK management, the present study was conducted during 2018-2019 at Vegetable Research Block of ICAR-Indian Institute of Horticultural Research, Hessarghatta, Bengaluru, Karnataka to study the effect of NPK fertigation with water soluble fertilizers (WSF) and conventional fertilizers and soil application of straight fertilizers on post-harvest soil nutrients status, nutrient uptake and yield of hybrid ridge gourd [*Luffa acutangula* (L.) Roxb.] Arka Vikram. The vine/plant received fertigation with WSF @ 150:90:150 kg NPK ha-1 recorded better growth and highest yield (53.73 t ha-1). The soil pH, electrical conductivity, organic carbon and available macro and micronutrients status in soil after the harvest were significantly influenced by different treatments and treatment T3 *i.e.* fertigation with water soluble fertilizers @ 150:90:150 kg NPK ha-1 found to maintain/improve the soil fertility status compared to other treatments. Drip fertigation with higher levels of WSF improved the plant available nutrients in the soil and found to be statistically on par with traditional soil application of straight fertilizers. Further data indicated that uptake/accumulation of macro and micro nutrients by the vine and fruit was significantly differed with various fertigation treatments and these parameters found highest when it was fertigated with WSF @ 150:90:150 kg NPK ha-1. From this investigation it may be concluded that fertigation with WSF@ 150:90:150 kg NPK ha-1 is found to be best for getting better growth, yield and nutrient uptake by hybrid ridge gourd Arka Vikram and also for buildup of plant available nutrients in the soil.

Keywords: Ridge gourd, fertigation, growth, yield, nutrient uptake, post-harvest soil nutrient status

Introduction
Ridge gourd [*Luffa acutangula* (Roxb.) L] is cultivated in the tropics and subtropics for its tender edible fruits both on commercial scale and in kitchen garden throughout the country and some parts of Indonesia, Myanmar, Malaysia, Philippines, Sri Lanka and Taiwan. The tender fruits of ridge gourd are green in colour, which are used in various culinary items. Hybrids play a vital role in increasing vegetable production due to their high yield potential, early maturing, superior quality, disease and pest resistance attributes. It requires better production technology than common OP cultivars, which is necessary for exploitation of their maximum potential. In this regard priority may be given to develop appropriate and cost-effective agro-techniques including integrated nutrient management, water management etc. suitable to different agro-climatic and soil conditions and cropping systems. The effort should be made in order to narrow down the existing wide gaps between farm yield and potential yield. The yield per unit area can be increased many times by application of the appropriate technologies such as irrigation, fertigation and use of high quality seed etc.

The fertigation not only saves about 25 to 30 percent of fertilizers, but also gives 25- 50 per cent higher yield coupled with better productivity and quality. As the fertilizer is the costly input it is very essential to increase the fertilizer use efficiency by standardizing the fertigation schedule for various crops. Nitrogen (N), phosphorus (P) and potassium (K) are the three major nutrients required in greater amounts and play an important role in crop growth and development.

All the three elements are critically involved in photosynthesis and dry matter production, amino acid, proteins, coenzymes, nucleic acids, nucleotides, chlorophyll synthesis and also found in different parts of a plant like cell wall and middle lamella. To get higher productivity, use of balanced nutrient management is important. Ridge gourd, an important commercial crop gives good returns when fertilized adequately. Since the crop duration is considerably less, proper fertilization and mode of application at the right time influence the growth, yield and quality of this crop (Anil Kumar and Dwivedi, 2018; Al-Moshileh, 2017; Lesser *et al*., 2007) [3, 2, 16]. Excessive use of fertilizers for increasing the crop yields will lead to nutrient leaching which ultimately affects the soil and environmental health besides increasing cost of production (Hebbar *et al.*, 2004) [11]. 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) [24]. Scientific information on fertigation especially on ridge gourd is very less; hence, the present study was conducted to find out the effect of NPK fertigation on post-harvest soil nutrient status, nutrient uptake and yield of hybrid Ridge gourd Arka Vikram.

Materials and methods

The field experiment was conducted during 2018-2019 (September 2018 to February 2019) at the Vegetable Research Block of ICAR-Indian Institute of Horticultural Research (IIHR), Hessarghatta, Bengaluru. It comes under Zone-5 of region-3 among the Agro-Climatic Zones of Karnataka and at 890 meters above mean sea level. It receives rains from both South West and North East monsoons and the average rainfall is about 800 mm which distributed over a period of six to seven months (May-November). The experimental area is comprised of red sandy loam soils. In order to know its fertility status a composite soil sample was collected from a depth of 0-30 cm before planting. The collected sample was analyzed for important physical and chemical properties *viz*., pH (6.75), electrical conductivity (0.23 dSm-1), organic carbon (1.06%), available nitrogen (171.92 kg/ha), available phosphorus (34.69 kg/ha), available potassium (217.29 kg/ha), exchangeable Ca (1043.00 ppm), exchangeable Mg (396.81ppm), available S (14.20 ppm), available Fe (31.63 ppm), available Mn (16.60ppm), available Zn (4.59 ppm) and available Cu (4.19 ppm).The 16 days old seedlings of ridge gourd hybrid “Arka Vikram” were transplanted at 1.50 x 0.50m spacing during the first week of October in 2018. Ridge gourd hybrid named “Arka Vikram” was identified and released by the ICAR-IIHR during 2016.

The experiment was laid out in randomized complete block design with eight treatments, which was replicated thrice. The farm yard manure @ 25 tonnes and neem cake @ 625 kg per hectare was applied uniformly to all the treatments. The treatment details and the amount of fertilizers applied treatment wise are given in Table 1. The fertilizers were applied based on fertigation treatments in the form of water soluble fertilizers (urea, 19:19:19 and potassium nitrate) and conventional fertilizers (urea, di-ammonium phosphate and muriate of potash). For soil application treatment conventional fertilizers *viz.*, urea, single super phosphate and muriate of potash were applied, where, entire P and half of N and K were given as basal and remaining half of N and K was side dressed at 30th and 60th days after transplanting in equal splits. In other treatments, fertigation was started two weeks after transplanting and given at weekly interval. Various growth and yield parameters were recorded from five plants selected randomly, replication wise in all the treatments. All the agronomic and plant protection measures were adopted as per the recommended package of practices (Prabhakar *et al.*, 2010) [25].

The vine and fruits samples collected from each plot at harvest stage and washed first under tap water followed by 0.1 N HCl, distilled water and finally with double distilled water.The samples were then dried by spreading on clean blotting papers and final drying was done in an oven at 68oC (Jackson, 1973) [12]. The samples were sequentially ground by electrical grinder for further analysis.The required quantity of sample was weighed accurately in an electronic balance and used for nitrogen (Micro-kjeldhal’s method), phosphorus (Vanadomolybadate phosphoric yellow colour method), potassium (flame photometric method) and other nutrients such as calcium (Ca), magnesium (Mg), sulphur (S) iron (Fe), manganese (Mn), zinc (Zn) and copper (Cu) estimation (Jackson, 1973) [12]. Based on the nutrient content in plant parts (vine and fruits) at harvest and dry matter accumulation, the uptake of nitrogen, phosphorus and potassium by crop per hectare was worked out using the below written formula and expressed in kg ha-1

$$\text{Nutrient uptake (kg ha-1)} = \text{Dry weight (kg ha-1)} \times \frac{\text{Nutrient concentration (\%)}}{100}$$

Post-harvest soil samples were collected at 0-15 cm depth and as per experimental layout for assessing their fertility status. The soil samples were then air-dried, powdered and sieved using 2 mm sieve. Processed soil samples were then used for characterization of physico- chemical and chemical properties. Electrical conductivity, pH and organic carbon were determined by standard methods (Jackson 1973) [12]. Soil pH and electrical conductivity (EC) were measured in a 1:2.5 (w/v) soil/water mixture. Organic carbon content of the soils was determined using dichromate wet oxidation method of Walkley and Black (1934). Available nitrogen was estimated by alkaline permanganate method (Subbaiah and Asija, 1956). For available phosphorus, extraction was done using Olsen extracting reagent and determined by molybdophosphoric blue colour method (Jackson, 1973) [12]. Available potassium was extracted using neutral normal ammonium acetate and measured with flame photometer (Jackson, 1973) [12]. Sulphur was extracted using 0.15 per cent CaCl2 solution and was made to react with BaCl2 to form turbid solution of BaSO4. The intensity of turbidity was measured using spectrophotometer at a wavelength of 420 nm (Jackson, 1973) [12]. Exchangeable calcium and magnesium were determined using atomic absorption spectrophotometer. Available micronutrients such as iron, copper, manganese and zinc were extracted using standard DTPA extract at pH 7.3 and the concentration was measured in an atomic absorption spectrophotometer (Lindsay and Norvell, 1978) [17]. The experimental data were statistically analysed (Panse and Sukhatme, 1978) [22] and compared using critical difference at five per cent probability level.

Results and Discussion

Growth and yield attributes

The data on growth and yield of hybrid ridge gourd Arka Vikram given in Table-1 revealed that treatment T3 *i.e.* fertigation with water soluble fertilizers @ 150:90:150 kg NPK ha-1 recorded significantly highest vine length (635.30

cm), number of leaves (239.60), leaf area per vine (6263.78 cm2), number of female flowers (29.73), number of fruits per vine (19.68), average fruit weight (454.03 g), fruit yield per vine (4.03 kg), fruit yield per hectare (53.73 t ha-1) compared to other treatments. The higher level of fertigation, which had made the plants to respond in production of higher flowers per plant and percent of fruit set again, has helped in obtaining the highest fruit yield per plant. Moreover, ridge gourd plants were able to utilize applied nutrients more efficiently in fertigation system than with conventional solid fertilizer application. Similar results were also reported by Papadopoulos (1986) [23], Choudhari and More (2002), Echevarria and Castro (2002), Manohar (2002), Sharma *et al*. (2009) [28] and Badr *et al*. (2010) [5]. Shinde *et al.* (2010) [29] and Al-jaloud *et al.* (1999) [1] reported that the frequent application of recommended dose of nitrogen and potassium at 30 days interval with phosphorus as a basal dose increased the availability of these nutrients leading to increased uptake of nitrogen, phosphorus and potassium during crop growth period which increased protein and protoplasm synthesis for higher rate of mitosis resulting in increased growth attributes. Higher yield with application of balanced and optimum dose of N, P and K through fertigation might have increased the number of female flowers which leads to increase in the yield. Higher yield may also be due to increased allocation of photosynthates towards the economic part *i.e.* fruit by increased fertilizer and water use efficiency owing to better availability of moisture and nutrients through fertigation. Increase in fruit weight might be due to better utilization of photosynthates and increased allocation of photosynthates towards the economic part. Similar results were also reported by Kultur *et al.* (2001) [15] in musk melon, Sharma *et al.* (2009) [28], Umamaheswarappa (2003) [33] in bottle gourd, Mangalpatil and Gadge, (2016) in cucumber and Karthick *et al.* (2018) in ridge gourd.

Post-harvest soil nutrient status

The results given in Table -2 indicated that the post-harvest soil nutrient status significantly influenced due to different fertigation treatments. The maximum soil pH (7.49) was recorded with treatment T7 *i.e.*fertigation through normal fertilizers @ 100:60:100 kg NPK ha-1T7 which was followed by the treatment T4 (7.47) and T8 (7.44). However, the minimum pH was recorded in T2 (6.96). The nitrogen mobility from urea is greater than the phosphorus and potassium. This results in release of basic cations which has the tendency of increasing the soil pH. Besides, in fertigation experiments, application of water soluble fertilizers with higher content of mineral nutrients through drip irrigation may lead to localized changes in the soil pH in and around the wetted zone (Teixeira *et al.*, 2007) [32]. The maximum content of organic carbon (1.84%) and electrical conductivity (1.07 dSm-1) was recorded with fertigation of water soluble fertilizers @ 150:90:150 kg NPK ha-1. Increase in electrical conductivity due to continuous addition of higher amount of potassium fertilizer through fertigation at weekly intervals which resulted in more amounts of cations in soil solution and thus increased the electrical conductivity of the soil. These findings are in line of the work reported by Senthilkumar *et al.* (2014) [27] and Chandrakumar (1998) [6].Organic carbon content in the soil was increased due to application of organic manures viz., FYM, neem cake and litter layer of decomposing leaves or residues providing a continuous energy source for macro and micro-organisms in the soil which results in greater biomass production, which provides more residues and promotes to get more organic carbon content in the soil (Sainju *et al.*, 2002) [26].

The highest available N (298.08 kg ha-1) and available K (422.5 kg ha-1) was obtained in the treatment T3. However, the available phosphorus was remained unaffected (Table-3). The significantly highest available Ca (1406.67 ppm) and S (74.63 ppm) was present in T8 and T3. However, the available Mg was found non-significant among fertigation treatments. The combined use of organic (FYM and neem cake) and inorganic nutrient sources may influence the forms and availability of nitrogen through the process of mineralization and also act as store house of the nutrients. So this process has eventually resulted in higher nitrogen in the fertigated soil (Hazarika *et al*., 2011) [10]. The maximum availability of macronutrients to plants by the application of water soluble fertilizers was reported by Kadam *et al.* (2009) [13]. The increase in available nutrient status in soil might also be due to the addition of inorganic conventional fertilizers as fertigation and soil application.

The results given in the Table-3 revealed that the micronutrients such as Fe and Mn status in soil after the harvest were significantly influenced by different fertigation and soil application treatments. However Zn and Cu status in soil were remained unaffected. The highest status of Fe (36.07 ppm) and Mn (21.40 ppm) was recorded in the treatment T3. The increase in available micronutrient status in soil might be due to the addition of farm yard manure, neem cake and water soluble fertilizers as soil application and fertigation which might have added more micronutrients availability in the pool. The findings corroborate the results of Chen *et al.*, (2006) [7], Badr and EI-Yazied (2007) [4] and Pandey *et al.* (2013) [21].

Nutrient uptake

The data presented in Table-4 and Table-5 indicated that the uptake of macronutrients such as N, P, Ca, Mg and S by the vine/plant and fruit was significantly influenced by different treatments. The uptake of potassium by the vine and fruit was unaffected with respect to different treatments. Significantly highest N (128.45 kg ha-1), P (46.50 kg ha-1), Ca (252.51 kg ha-1), Mg (44.94 kg ha-1) and S (18.88 kg ha-1) uptake by the vine was recorded in the treatment T3 *i.e.* fertigation with WSF @ 150:90:150 kg NPK ha-1. Similarly, the highest uptake of N (25.89 kg ha-1), P (21.77 kg ha-1), and S (2.80 kg ha-1) in fruit was also registered in the same treatment *i.e.*T3. The Calcium (21.76 kg ha-1) and Mg (16.58 kg ha-1) uptake by fruit was recorded highest in treatment T7 and T4, respectively. The lowest nitrogen (54.60 kg ha-1 & 15.00 kg ha-1), phosphorus (25.90 kg ha-1 & 4.44 kg ha-1) and potassium (31.00 kg ha- 1& 9.02 kg ha-1) uptake by vine and fruit was recorded in T_5 *i.e.* fertigation with WSF @ 50:30:50 kg NPK ha-1. Increased uptake of nitrogen and potassium with treatment T_3 might be due to higher levels of nitrogen and potassium application through fertigation, which could have accelerated physiological activity. This would have created a better pump in root hairs to further absorb nutrients and there by the total nutrient could have been increased. The increase in nutrient uptake may also be due to the better availability of nutrients in the root zone as a result of frequent fertilizer application through fertigation. Similar observations of increased nutrient uptake as a result of water soluble fertilizers have resulted in lesser leaching of NO3-N and K to deeper layer of soil and NPK uptake was increased by WSF fertigation reported by Singandhupe *et al.* (2007) [30], Badr *et al*. (2010) [5] and Yoshida *et al.* (2011) [35].

Uptake of micronutrients such as Mn, Zn and Cu by the vine was significantly influenced by different treatments and uptake of Fe by the vine was remained unaffected. Significantly highest Mn (3.48 g ha-1) and Zn (15.6 5 g ha-1) uptake by vine was recorded in T3 and T2, correspondingly. Uptake of Cu by the fruit was found significant among the treatments and uptake of Fe, Mn and Zn by the fruit was found statistically non-significant. The maximum uptake of Cu (0.35 g ha-1) was found in treatment T8. In most of the micronutrients, combined application of organic manures viz., FYM (25 t/ha) and neem cake (625 kg/ha) as basal and water soluble fertilizers @ 150:90:150 kg NPK ha-1 through fertigation found to increase the uptake by vine and fruit compared to other treatments. The higher micronutrient uptake with application of water soluble fertilizers and organic manures could be due to addition of micronutrients directly through organic manures and indirectly through solubilization of unavailable native micronutrients and chelation of complex intermediate organic molecules produced during decomposition of added manures (Mitra *et al*., 2010) [20].

Table 1: Effect of NPK fertigation on growth, yield and yield attributes in hybrid ridge gourd Arka Vikram

Treatments	Vine length (cm)	No of leaves per vine	Leaf area (cm2)	Number of female flowers	Number of fruits per vine	Average fruit weight (g)	Fruit yield per vine (kg)	Fruit yield per hectare (t)
T1 : Fertigation with WSF @ 100:60:100 kg NPK ha-1	545.89	184.80	5923.28	25.80	15.47	422.17	3.06	42.10
T2 : Fertigation with WSF @ 125:75:125 kg NPK ha-1	623.47	207.73	6039.63	26.60	16.55	431.42	3.26	43.40
T3 : Fertigation with WSF @ 150:90:150 kg NPK ha-1	635.31	239.60	6263.78	29.73	19.68	454.03	4.03	53.73
T4 : Fertigation with WSF @ 75:45:75 kg NPK ha-1	546.50	173.27	5441.49	23.93	15.17	363.57	3.09	40.80
T5 : Fertigation with WSF @ 50:30:50 kg NPK ha-1	490.49	163.20	4209.23	20.67	13.90	348.87	2.40	31.90
T6 : Fertigation with WSF @ 50:50:50 kg NPK ha-1	516.08	139.53	4647.97	22.53	14.95	360.55	2.69	35.80
T7 : Fertigation with conventional fertilizers @ 100:60:100 kg NPK ha-1	469.78	158.73	5150.73	22.13	14.37	373.21	2.56	34.10
T8 : Soil application with straight fertilizers @ 100:60:100 kg NPK ha-1	579.11	211.80	6205.48	25.40	16.20	408.69	3.16	36.50
S.Em±	10.00	6.24	190.14	1.26	0.77	22.55	0.16	0.61
C.D. @ 5%	31.00	19.10	576.80	3.88	2.37	69.06	0.49	1.88

Table 2: Effect of fertigation treatments on post-harvest soil pH, EC and organic carbon content

Treatments	Soil pH	EC (dSm-1)	Organic Carbon (%)
T1 : Fertigation with WSF @ 100:60:100 kg NPK ha-1	7.02	0.76	1.46
T2 : Fertigation with WSF @ 125:75:125 kg NPK ha-1	6.96	0.95	1.10
T3 : Fertigation with WSF @ 150:90:150 kg NPK ha-1	7.16	1.07	1.84
T4 : Fertigation with WSF @ 75:45:75 kg NPK ha-1	7.47	0.50	1.34
T5 : Fertigation with WSF @ 50:30:50 kg NPK ha-1	7.28	0.68	1.28
T6 : Fertigation with WSF @ 50:50:50 kg NPK ha-1	7.14	0.48	1.08
T7 : Fertigation with conventional fertilizers @ 100:60:100 kg NPK ha-1	7.49	0.27	1.10
T8 : Soil application with straight fertilizers @ 100:60:100 kg NPK ha-1	7.44	0.39	1.67
S.Em±	0.02	0.01	0.10
C.D. @ 5%	0.06	0.05	0.33

Table 3: Effect of fertigation treatments on available macro and micronutrients in post-harvest soil

Treatments	N (kg/ha)	P (kg/ha)	K (kg/ha)	Ca (ppm)	Mg (ppm)	S (ppm)	Fe (ppm)	Mn (ppm)	Zn (ppm)	Cu (ppm)
T1 : Fertigation with WSF @ 100:60:100 kg NPK ha-1	236.52	44.51	345.80	1226.67	465.00	59.56	30.25	15.84	4.68	4.66
T2 : Fertigation with WSF @ 125:75:125 kg NPK ha-1	178.20	48.33	405.00	1281.67	475.17	67.22	28.77	17.33	4.65	4.79
T3 : Fertigation with WSF @ 150:90:150 kg NPK ha-1	298.08	50.62	422.50	1370.00	458.00	74.63	36.07	21.40	4.66	5.37
T4 : Fertigation with WSF @ 75:45:75 kg NPK ha-1	217.08	48.88	300.00	1203.33	447.00	57.27	30.05	19.57	4.64	5.13
T5 : Fertigation with WSF @ 50:30:50 kg NPK ha-1	174.96	43.67	160.00	1146.67	405.00	50.61	35.34	20.40	4.67	4.99
T6 : Fertigation with WSF @ 50:50:50 kg NPK ha-1	207.36	47.42	305.00	1235.00	418.50	34.55	23.82	20.70	4.60	5.05
T7 : Fertigation with conventional fertilizers @ 100:60:100 kg NPK ha-1	178.20	43.47	274.20	1240.00	398.83	31.41	32.24	17.66	4.69	5.06
T8 : Soil application with straight fertilizers @ 100:60:100 kg NPK ha-1	270.54	53.54	286.70	1406.6 7	463.00	41.75	35.33	21.19	4.95	5.52
S.Em±	17.58	4.617	12.27	50.66	29.69	5.46	2.46	0.47	0.14	0.24
C.D. @ 5%	53.86	NS	37.57	155.15	NS	16.73	7.55	1.45	NS	NS

Table 4: Effect of NPK fertigation on N, P and K uptake by hybrid ridge gourd Arka Vikram

Treatments	Nutrients uptake (kg ha-1)					
	N		P		K	
	Vine	Fruit	Vine	Fruit	Vine	Fruit
T1 : Fertigation with WSF @ 100:60:100 kg NPK ha-1	81.92	19.75	39.06	5.94	54.64	9.81
T2 : Fertigation with WSF @ 125:75:125 kg NPK ha-1	93.80	19.94	44.47	9.48	77.42	11.65
T3 : Fertigation with WSF @ 150:90:150 kg NPK ha-1	128.45	25.89	46.50	21.77	119.35	18.97
T4 : Fertigation with WSF @ 75:45:75 kg NPK ha-1	76.85	20.24	42.86	7.21	41.93	13.51
T5 : Fertigation with WSF @ 50:30:50 kg NPK ha-1	54.60	15.00	25.90	4.44	31.00	10.71
T6 : Fertigation with WSF @ 50:50:50 kg NPK ha-1	74.40	18.24	35.46	6.57	43.09	10.36
T7 : Fertigation with conventional fertilizers @ 100:60:100 kg NPK ha-1	77.45	19.88	38.43	7.43	54.12	9.02
T8 : Soil application with straight fertilizers @ 100:60:100 kg NPK ha-1	82.44	19.84	44.18	10.76	65.13	11.13
S.Em±	1.99	1.04	1.33	1.18	1.59	0.94
C.D.@ 5%	6.09	3.19	3.01	2.55	NS	NS

Table 5: Effect of NPK fertigation on macronutrientsuptake by hybrid ridge gourd Arka Vikram

Treatments	Uptake of macro nutrients (kg ha-1)					
	Ca		Mg		S	
	Vine	Fruit	Vine	Fruit	Vine	Fruit
T1 -Fertigation with WSF @ 100:60:100 kg NPK ha-1	140.68	11.12	26.05	13.05	15.10	1.90
T2 -Fertigation with WSF @ 125:75:125 kg NPK ha-1	202.19	13.38	30.82	15.11	16.61	1.68
T3 -Fertigation with WSF @ 150:90:150 kg NPK ha-1	252.51	18.05	44.94	15.92	18.88	2.80
T4 -Fertigation with WSF @ 75:45:75 kg NPK ha-1	197.97	20.59	31.00	16.58	12.58	2.23
T5 -Fertigation with WSF @ 50:30:50kg NPK ha-1	189.90	15.87	30.80	12.09	11.30	1.25
T6-Fertigation with WSF @ 50:50:50 kg NPK ha-1	196.65	9.27	26.93	13.71	15.68	2.04
T7 -Fertigation with conventional fertilizers @ 100:60:100 kg NPK ha-1	180.28	21.76	25.50	16.26	15.88	1.90
T8 -Soil application with straight fertilizers @ 100:60:100 kg NPK ha-1	180.06	23.67	28.22	15.96	16.16	2.46

Table 6: Effect of NPK fertigation on micronutrients uptake by hybrid ridge gourd Arka Vikram

Treatments	Uptake of micro nutrients (g ha-1)							
	Fe		Mn		Zn		Cu	
	Vine	Fruit	Vine	Fruit	Vine	Fruit	Vine	Fruit
T1 -Fertigation with WSF @ 100:60:100 kg NPK ha-1	5.31	0.73	2.77	0.14	14.42	0.39	2.63	0.20
T2 -Fertigation with WSF @ 125:75:125 kg NPK ha-1	6.31	1.57	2.69	0.22	15.65	0.37	4.05	0.21
T3 -Fertigation with WSF @ 150:90:150 kg NPK ha-1	6.68	2.80	3.48	0.29	15.50	0.74	5.34	0.29
T4 -Fertigation with WSF @ 75:45:75 kg NPK ha-1	5.03	1.18	1.50	0.28	12.44	0.40	2.63	0.27
T5 -Fertigation with WSF @ 50:30:50kg NPK ha-1	4.10	0.69	2.18	0.28	11.15	0.52	2.62	0.23
T6-Fertigation with WSF @ 50:50:50 kg NPK ha-1	4.72	0.95	1.94	0.19	12.99	0.59	3.27	0.33
T7 -Fertigation with conventional fertilizers @ 100:60:100 kg NPK ha-1	4.06	1.37	3.05	0.44	13.93	0.55	2.12	0.25
T8 -Soil application with straight fertilizers @ 100:60:100 kg NPK ha-1	7.35	1.90	2.61	0.38	13.84	0.61	2.67	0.35
S.Em±	0.38	0.7	0.22	0.01	0.74	0.03	0.23	0.01
CD@5%	NS	NS	0.67	NS	2.22	NS	0.69	0.03

Conclusion

Based on the results of the present study, it can be concluded that the fertigation with water soluble fertilizer *i.e*. Urea, 19:19:19 and KNO3 @ 150:90:150 kg NPK/ha is found to be best for field grown hybrid ridge gourd Arka Vikram for realizing better plant growth and fruit yield. Further, the post-harvest soil nutrient status and nutrient uptake by vine as well as fruit are also improved with fertigation through water soluble fertilizer *i.e*. Urea, 19:19:19 and KNO3 @ 150:90:150 kg NPK/ha.

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