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IMPACT OF ENVIRONMENTAL FACTORS ON TOMATO UNDER FERTIGATION FREQUENCY IN CONTROLLED ATMOSPHERE CONDITION

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ABSTRACT

Under polyhouse environment fertigation of 100% RDF recorded significantly maximum meteorological parameters *viz*., photosynthetic rate, CO_2 concentration, stomatal conductance, transpiration rate and physiological parameters *viz*., chlorophyll content, leaf water potential and yield attributes *viz*., number of fruits plant^{-1} (74.13, 67.50 and 70.82), fruit weight plant^{-1} (4.85, 4.43 and 4.64 kg) and tomato fruit yield unit^{-1} of polyhouse (15.72, 14.07 and 14.90 t), however at par with 80% RDF during both the years and on pooled mean. Among the fertigation schedules fertigation of 12 equal splits of NPK at every 9 days interval registered significantly maximum meteorological parameters *viz*., photosynthetic rate, CO_2 concentration, stomatal conductance, transpiration rate and physiological parameters *viz*., chlorophyll content, leaf water potential and yield attributes *viz*., number of fruits plant^{-1}(72.54, 66.30 and 69.44), fruit weight plant^{-1}(4.80, 4.24 and 4.52 kg) and tomato fruit yield unit^{-1} of polyhouse (15.56, 13.42 and 14.49 t) during both years and on pooled mean. Based on two years of study it concluded that fertigation of 80% RDF in 12 equal splits at every 9 days interval was found most favourable for meteorological and physiological parameters and obtained maximum fruit yield of tomato during summer season under polyhouse.

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INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is an important and widely grown solanaceous vegetable crop around the world and belongs to the family *Solanaceae*. It is native of Peru, ranks second only after potato. In many countries it is considered as “poor man’s orange” because of its attractive appearance and nutritive value (Singh *et al*., 2004). It is considered an important source of vitamin A, C and minerals (Hari, 1997). Apart from this, lycopene is valued for its anti-cancer property (Bose *et al*., 2002). It acts as an antioxidant and scavenger of free radicals, which is often associated with carcinogenesis. Thus, lycopene has got great beneficial effects on human health. It may also interfere with oxidative damage to DNA and lipoproteins and inhibits the oxidation of LDL (low density lipoprotein) cholesterol.

It is grown over an area of 8.80 lakh hectares accounting to 10.2 per cent of the total vegetable area in India. The annual production of 182.27 lakh metric tonnes amounting to 9.6 per cent of total vegetable production with average productivity of 20.7 tonne per hectare. Major tomato growing states in India are Bihar, Orissa, Andhra Pradesh, Karnataka and Maharashtra. In Maharashtra, tomato occupied an area of 50 thousand hectares with production of 10.5 lakh metric tonnes with an average yield of 21 tonne per hectare. About two third area under tomato cultivation is concentrated in Nashik, Ahmednagar, Sangli, Satara and Pune districts. (Anon., 2014).

Protected cultivation is a most contemporary approach to produce high value vegetables like tomato and have shown tremendous potential quantitatively and qualitatively, extend the growing season of crop and fetches good market price during off season. Controlled environment agriculture (CEA) is highly productive, conservative of water, fertilizers and land and also protective of the environment like the temperature, humidity, light (Jensen, 2002). By adopting protected cultivation technology, the growers can look forward to a better and additional remuneration for high quality produce. Polyhouse is a framed or inflated structure covered with transparent or translucent polythene papers, large enough to grow crops under partial or fully controlled environmental conditions to get optimum growth and productivity. Flowering and fruit setting in polyhouse were advanced by 3 to 4 days as compared to field condition. Similarly, tomato plants grown under polyhouse showed the best performance in terms of vegetative and reproductive development, yield contributing characters and total yield. The fruit yield obtained from the polyhouse was about 29% higher than open space due to optimum temperature and low relative humidity suitable for tomato production in polyhouse. In addition, heavy rainfall and hail storm during late winter (March) decreased the yield of tomato in open field, but in that situation polyhouse protected the plants from damage caused by hail storm (Rasel Parvej, 2012). Practical utility of polyhouse growing tomato can be substantiated, as it would fetch a premium price in the market and higher demand for this nutritious vegetable fruit during summer season. The use of polyhouse ensures constant supply of fresh market tomatoes by modifying crop environment to meet plant growth requirement at any time of the year. Tomato crop grown under polyhouse conditions were earlier to flower and had higher yield than those in the field (Nagalakshmi *et al*., 2001)

Fertigation is an excellent method of optimizing the utilization of water and nutrients to improve the sustainability of polyhouse tomato. It allows frequent, uniform and precise application of nutrients through drip directly into the zone of maximum root activity as per need of crop which results into higher fruit yield and quality. In fertigation nutrient use efficiency could be as high as 90 per cent as compared to 40 per cent in conventional methods (Solaimalai *et al.*, 2005). Depite these improvements in the efficiency of fertilizer the timing and rate of fertigation for greenhouse tomato is far from optimal. The concentration of NPK of the nutrient solutions and the application time and intervals are of vital importance for adequate uptake and optimal growth of tomato. Looking to the changing climatic scenario of protected cultivation the awareness among the farming community increasing day by day because in open field condition, fruit yield and quality are poor due to aberrant weather situation arises frequently. In this direction polyhouse is the best alternative for quality and quantity production of tomato, moreover due to favourable environment the size of fruit remains uniform. Tomato being indeterminate nature of crop, vegetative and reproductive stages overlaps and the plant needs nutrients even upto fruit ripening stage for better growth and fruit size, hence fertigation is very effective in polyhouse grown tomato. However, at present the farmers adopted the fertilizer management as per open field condition as there is no recommendation for fertilizer dose and schedule for protected condition. Further the water soluble fertilizers are very costly inputs therefore the alternative options are very essential to reduce the cost of cultivation. At present very meager research work has been carried on fertigation and their schedule in low cost Naturally Ventilated Polyhouse. In view of this present experiment was conducted to find out the optimum fertigation level and schedule to tomato crop under polyhouse condition.

MATERIALS AND METHODS

The present investigation was carried out during summer season of 2013 and 2014 at Department of Agronomy, M.P.K.V., Rahuri (M.S.). The soils of the experimental site was sandy clay in texture having pH- 7.70, organic carbon 0.53% with low in available nitrogen (254.7 kg ha^{-1}), medium in available phosphorous (19.73 kg ha^{-1}) and very high in available potassium (369.5 kg ha^{-1}). Similarly, low in iron (4.44 mg kg^{-1}) and zinc (0.49 mg kg^{-1}) and moderate in manganese (2.35 mg kg^{-1}) and copper (1.49 mg kg^{-1}). The field capacity, permanent wilting point and bulk density were 22.74%, 11.37% and 1.39 g cm^{-3}, respectively. The physical properties were coarse sand (43.06 %), fine sand (19.12 %), silt (21.10 %), clay (15.81 %) and organic matter (0.91%) respectively The method used for estimation of available N in soil was Modified alkaline Permanganate (Saharawat and Buford, 1982), for Available P in soil 0.5M $NaHCO_3$ (P^H 8.5) (Olsen *et al.*, 1954) and for Available K in soil NN NH_4OAc (Knudsen *et al.*, 1982). The micronutrients *viz.*, DTPA Cu, Mn, Cu and Fe were estimated using Atomic absorption spectrophotometer (Lindsay and Norvell, 1978). The pH of soil was determined by Potentiometric method (Jackson, 1973), organic carbon by Wet oxidation method (Nelson and Sommer, 1982). The field capacity (%) and Permanent wilting point (%) were estimated by using Pressure Plate Apparatus (Richards, 1947). The Core sampler method used for determination of bulk density (Dastane, 1972). The physical properties were determined by Bouyocos hydrometer method (Gee and Bouder, 1986). The meteorological parameters were analyzed with the help Infra Red Gas Analyzer (IRGA). The physiological parameters viz. chlorophyll content (%) was estimated using Spadometer and leaf water potential (-) by Leaf water console instrument.

The experiment was laid out in split plot design and replicated thrice with nine treatment combinations. The treatments includes 3 fertigation levels *viz.*, (F_1-60% of RDF (180:90:90 N, P_2O_5, K_2O kg ha^{-1}), F_2-80% of RDF (240:120:120 N, P_2O_5, K_2O kg ha^{-1}) and F_3-100% of RDF (300:150:150 N, P_2O_5, K_2O kg ha^{-1}) and 3 fertigation schedules *viz.*, (S_1- 6 equal splits of RD of NPK at every 18 days interval, S_2- 9 equal splits of RD of NPK at every 12 days interval, S_3- 12 equal splits of RD of NPK at every 9 days interval). The naturally ventilated polyhouse (784 m^2) was oriented in north-south direction and covered with UV stabilized LDPE film of 200 micron thickness as cladding material. The four week old healthy and uniform tomato seedlings were transplanted at the spacing of 60 cm x 50 cm on the raised beds. Fertigation was started 12 days after transplanting through Automatic Fertigation Unit as per treatment. The fertigation was done by using water soluble fertilizer (19:19:19 NPK grade) and urea (46.6% N). All the agronomic practices and plant protection measures were adopted as per recommendation. Observations on different growth and yield parameters were recorded from five randomly sampled plants from each treatment.

RESULTS AND DISCUSSION

Effect of fertigation levels

A data speculated in (Table 1) revealed that Meteorological parameters *viz.*, photosynthetic rate, CO_2 concentration, stomatal conductance, transpiration rate, leaf temperature and stomatal resistance were significantly influenced by different fertigation levels. Maximum and significantly higher photosynthetic rate (17.07 and 17.68 μ mol co_2 m^{-2} s^{-1}), CO_2 concentration (347.27 and 352.80 μ mol co_2 m^{-2} s^{-1}), stomatal conductance (0.441 and 0.432 m mol m^{-2} s^{-1}) and transpiration rate (11.04 and 10.68 m mol H_20 m^{-2} s^{-1}) while minimum leaf temperature (34.80 and 34.89 ^oC) and stomatal resistance (2.28 and 2.33 m mol m^{-2} s^{-1}) were observed under the fertigation of 100 per cent RDF during both the years at 135 DAT. The fertigation of 100 per cent RDF registered significantly higher photosynthetic rate, CO_2 concentration, stomatal conductance and transpiration rate at all the crop growth stages during both years. These parameters were increased up to 135 DAT and thereafter declined towards maturity in all the treatments. The photosynthetic rate of leaves under a given environmental condition is a function of various biophysical and biochemical processes involved during diffusion of CO_2 from atmosphere into chloroplast and subsequent enzyme reactions. Maximum photosynthetic rate, stomatal conductance was observed with fertilization due to moderately higher RWC ensuring better hydration and more favourable internal water relations of tissue across the fertigation levels.

Higher the transpiration rate and lesser the leaf temperature might be due to cooling of leaf surface on account of excessive loss of water through transpiration. The stomatal conductance decreased drastically under nutrient stress. Stomatal conductance was found to be more sensitive to nutrient deficit than the process of water loss and CO_2 exchange themselves which are regulated by it. Under nutrient stress condition stomata are partially closed resulting in limited water loss and photosynthetic rate with restricted diffusion of CO_2 deficiency at the reaction site of RuBisCo which might not be the only reason for decline in the photosynthesis. Direct inhibition of biochemical processes by altered ionic or osmotic conditions which ATP synthesis and RuBisCO activity might be another reason for decrease in photosynthetic rate under nutrient stress.

This might be also due to more absorption of moisture, nutrients and their uptake by crop at higher fertigation level that facilitated the increased turgidity of cells resulted in luxurious growth of crop reflected in increasing the crop canopy thereby more interception of PAR which accelerates the rate of photosynthesis. The reverse trend was noticed in case of leaf temperature and stomatal resistance at all development stages of crop growth during both the years. The leaf temperature was increased because of less relative water content in leaf tissue resulted in decreased transpiration rate while resistance Significantly minimum photosynthetic rate, CO_2 concentration, stomatal conductance and transpiration rate, while higher values of leaf temperature and stomatal resistance was noticed under the fertigation of 60 per cent RDF during both the years of study. Similar results were postulated by Mozafariyan *et al.* (2013) and Bahadur *et al.* (2015).

A data speculated in (Table 2) revealed that physiological parameters *viz.*, total chlorophyll content and leaf water potential were significantly influenced by different fertigation levels. Fertigation of 100% RDF recorded significantly higher total chlorophyll content in leaves (53.94 and 54.14 %) and leaf water potential (-12.64 and -13.28 ø) during both the years, while, minimum values of these parameters were noticed with fertigation of 60% RDF. This might be due to adequate application of NPK nutrients through drip in the vicinity of root zone leads to more availability and uptake of nitrogen enhanced the turgidity of mesophyll cells and chloroplast and thereby resulted in increased chlorophyll content in leaves. Thereafter it declines towards the maturity in all the fertigation levels, however the response was more spectacular under increased level of fertigation. These results are in line of Almeselmani *et al.* (2010) and Mozafariyan *et al.* (2013). The plant response to specific environmental parameter is related to the physiological processes. Since the microclimate components inside the polyhouse influences higher leaf water potential might be due to accumulation of polyamines which has association for the better maintenance of turgidity and cell membrane stability. This was also due to the adequate amount of nutrients were applied in the rhizosphere of the root zone leads to maximum moisture and nutrients uptake that meets the nutrition demand of the crop resulted in increased cell turgidity and higher leaf water potential throughout crop growth period. The results were in corroborated with Topcu *et al.* (2007) and Kanai *et al.* (2011).

Fertigation of NPK with different levels significantly influenced the yield attributing parameters of polyhouse tomato. A perusal

Table 1: Meteorological parameters of tomato as influenced by different treatments

Treatments	Photosynthetic rate (μ mol co_2 m^{-2} s^{-1})		CO_2 concentration (μ mol co_2 m^{-2} s^{-1})		Stomatal conductance (m mol m^{-2} s^{-1})		Transpiration rate (m mol H_2O m^{-2} s^{-1})		Stomatal resistance (m mol m^{-2} s^{-1})		Leaf temperature (°C)	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
A. Fertigation levels												
F_1 – 60% of RDF	16.43	17.05	341.81	347.28	0.356	0.346	10.42	9.78	2.81	2.90	35.34	35.46
F_2 – 80% of RDF	16.74	17.37	344.54	349.99	0.393	0.383	10.75	10.12	2.55	2.62	35.09	35.20
F_3 – 100% of RDF	17.07	17.68	347.27	352.80	0.441	0.432	11.04	10.68	2.28	2.33	34.80	34.89
S.E.m. (±)	0.03	0.01	0.12	0.13	0.003	0.003	0.01	0.07	0.02	0.02	0.01	0.02
C.D. at 5%	0.12	0.04	0.47	0.53	0.010	0.01	0.05	0.29	0.07	0.08	0.05	0.09
B. Fertigation schedules (RD of NPK up to 120 DAT)												
S_1 – 6 equal splits (18 days interval)	16.55	17.05	342.87	348.32	0.370	0.360	10.62	10.01	2.72	2.80	35.24	35.35
S_2 – 9 equal splits (12 days interval)	16.74	17.37	344.54	349.99	0.395	0.385	10.74	10.12	2.56	2.62	35.09	35.19
S_3 – 12 equal splits (9 days interval)	16.94	17.68	346.21	351.75	0.425	0.417	10.85	10.44	2.37	2.43	34.89	35.00
S.E.m. (±)	0.02	0.01	0.09	0.07	0.003	0.004	0.01	0.07	0.02	0.02	0.01	0.009
C.D. at 5%	0.06	0.04	0.28	0.24	0.010	0.01	0.04	0.23	0.06	0.06	0.05	0.027
Interaction (A X B)												
C.D. at 5%	NS	NS	Sig.	Sig.	NS	NS	NS	NS	NS	NS	NS	Sig.

of pooled data (Table 2) indicated that fertigation of 100% RDF recorded significantly higher number of fruits plant^{-1} (74.13, 67.50 and 70.82) and fruit weight plant^{-1} (4.85, 4.43 and 4.64 kg) as compared to rest of the fertigation levels during both the years and on pooled mean, respectively, however it was at par with fertigation of 80% RDF. While lowest number of fruits and fruit weight plant^{-1} was noticed under the fertigation of 60% RDF during the study of experimentation. This might be because of enhanced supply of nitrogen, phosphorous and potassium in the root rhizosphere increases the uptake of nutrients and favourable microclimatic conditions was optimized inside polyhouse with maintaining optimum temperature, CO_2 concentration, high relative humidity that enhanced luxurious growth of crop which helps to absorbed more PAR accompanied with increased enzyme actions aids in higher rate of photosynthesis and dry matter accumulation reflected in efficient translocation of sugar and starches towards reproductive parts reflected in increase in yield attributes. These results are in the line of Hasan *et al*. (2014), Singh *et al*. (2015).

Significant effect of fertigation was observed on the fruit yield of tomato inside polyhouse (Table 2). Pooled data averaged over the two years revealed that the fruit yield of tomato increased significantly with increasing level of fertigation. The maximum fruit yield unit^{-1} of polyhouse (15.72, 14.07 and 14.90 t) was recorded with fertigation of 100% RDF during both the years and on pooled mean, respectively. However it was at par with 80% RDF indicating 20% saving of fertilizers. While, fertigation of 60% RDF produced significantly minimum fruit yield unit^{-1} of polyhouse (11.24, 9.51 and 10.37 t) during both the years and on pooled mean, respectively. The increased magnitude in fruit yield unit^{-1} of polyhouse under the fertigation of 100% RDF over 60% RDF was 28.49, 32.41 and 30.40% during both the years and on pooled mean. The 100% RDF applied through fertigation directly in the active root zone of the plant increases the nutrient use efficiency indicated through enhanced nutrient uptake by crop. As the crop grown on raised beds under polyhouse condition which helps to maintain the proper proportion of air:soil:water and nutrient throughout the crop growth period. The microclimate in the polyhouse was more favourable to increase the growth and yield attributes of tomato crop. The higher rate of photosynthate translocation from vegetative part (source) to reproductive organs (sink) might be increased the fruit size and weight which resulted in higher fruit yield of tomato. Similar findings were reported by Nagre *et al*. (2013), Patel *et al*. (2013) Kuscu *et al*. (2014).

Effect of fertigation schedules

Data illustrated in Table (1) indicated that the Fertigation of 12 equal splits of RD of NPK up to 120 days after transplanting recorded significantly higher meteorologicsl parameters *viz*., photosynthetic rate, CO_2 concentration, stomatal conductance and transpiration rate, while reverse trend was observed in leaf temperature and stomatal resistance at all the crop growth stages during both the years of experimentation. Maximum and significantly higher photosynthetic rate (16.94 and 17.56 μ mol co_2 m^{-2} s^{-1}), CO_2 concentration (346.21 and 351.75 μ mol co_2 m^{-2} s^{-1}), stomatal conductance (0.425 and 0.417 m mol m^{-2} s^{-1}) and transpiration rate (10.85 and 10.44 m mol H_20

Table 2: Physiological parameters, yield attributes and yield of tomato as influenced by different treatments

Treatment	Total chlorophyll content (%)		Leaf water potential(-ø)		Number of fruits plant^{-1}			Fruit weight plant^{-1} (kg)			Fruit yield unit^{-1} of polyhouse (784 m^2) (t)		
	2013	2014	2013	2014	2013	2014	Pooled	2014	2014	Pooled	2014	2014	Pooled
A. Fertigation levels													
F_1 – 60% of RDF	53.57	53.78	-13.38	-13.90	56.85	52.20	54.51	3.43	3.00	3.21	11.24	9.51	10.37
F_2 – 80% of RDF	53.75	53.97	-12.93	-13.61	71.96	65.40	68.68	4.61	4.24	4.43	14.96	13.42	14.19
F_3 – 100% of RDF	53.94	54.14	-12.64	-13.28	74.13	67.50	70.82	4.85	4.43	4.64	15.72	14.07	14.90
S.E.m. (±)	0.02	0.03	0.01	0.03	0.77	0.74	0.54	0.07	0.05	0.04	0.22	0.17	0.18
C.D. at 5%	0.10	0.11	0.06	0.09	3.04	2.91	2.16	0.27	0.21	0.16	0.85	0.67	0.74
B. Fertigation schedules													
S_1 – 6 equal splits (18 days interval)	53.63	53.84	-13.11	-13.81	62.16	56.90	59.55	12.44	11.20	11.82	3.81	3.53	3.67
S_2 – 9 equal splits (12 days interval)	53.76	53.98	-12.98	-13.61	68.24	61.80	65.03	13.92	12.38	13.15	4.28	3.91	4.09
S_3 – 12 equal splits (9 days interval)	53.87	54.07	-12.87	-13.37	72.54	66.30	69.44	15.56	13.42	14.49	4.80	4.24	4.52
S.E.m. (±)	0.02	0.02	0.01	0.02	0.34	0.53	0.39	0.10	0.11	0.10	0.02	0.03	0.03
C.D. at 5%	0.07	0.07	0.05	0.08	1.06	1.62	1.21	0.33	0.35	0.30	0.08	0.11	0.09
Interaction (A X B)													
C.D. at 5%	NS	NS	NS	NS	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.

m^{-2} s^{-1}) while minimum leaf temperature (34.89 and 35.02ºC) and stomatal resistance (2.37 and 2.43 m mol m^{-2} s^{-1}) was observed at 135 days after transplanting during both the years. The favourable microclimatic conditions were maintained inside polyhouse for increasing photosynthetic rate, stomatal conductance, CO_2 concentration and transpiration rate to enhance the growth and development of crop. Stomatal conductance was found to be more sensitive to nutrient deficit than the process of water loss and CO_2 exchange themselves which are regulated by it.

The fertigation of 12 equal splits of RD of NPK at every 9 days interval up to 120 days after transplanting found superior in respect of photosynthetic rate, stomatal conductance, CO_2 concentration and transpiration rate, while reverse trend was noticed in respect of leaf temperature and stomatal resistance throughout all the crop development stages during both the years under study. This might be due crop grown under open ventilated polyhouse produces optimum climatic condition and continuous application of required amount of nitrogen, phosphorous and potassium and deficient micronutrient (Fe and Zn) through fertigation increases the number of leaflets and leaf area plant^{-1} which helps to increase the net assimilation area for increasing the photosynthetic rate. Similarly the leaf water content was also higher leads to increased the turgidity of cell resulted in stomata remains open for increasing transpiration rate and intake of CO_2 and reduces the leaf temperature and stomata resistance. Fertigation of 6 equal splits of RD of NPK at every 18 days interval recorded significantly minimum photosynthetic rate, stomatal conductance, CO_2 concentration and transpiration rate and higher stomatal resistance and leaf temperature in tomato leaves at all the crop growth stages during both the years of investigation. These findings are in accordance with those reported by Topcu *et al.* (2007), Bahadur *et al.* (2015). Significantly minimum photosynthetic rate, CO_2 concentration, stomatal conductance and transpiration rate, while higher leaf temperature and stomatal resistance was noticed under the fertigation of 6 equal splits of RD of NPK up to 120 days after transplanting during both the years of study.

Data presented in Table (2) indicated that the fertigation of 12 equal splits of NPK at every 9 days interval up to 120 DAT noticed significantly maximum physiological parameters *viz*., total chlorophyll content in leaves (53.87 and 54.07 %) and leaf water potential (-12.87 and -13.37 ø) during both the years, while, minimum values of these parameters were noticed with fertigation of 6 equal splits of NPK at every 18 days interval up to 120 DAT. This might be because of increase in split application of nitrogen, phosphorous and potassium through drip up to 120 days after transplanting increased the nitrogen content in plant which leads to increase the total chlorophyll content in tomato leaves. The fertigation of 6 equal splits of RD of NPK at every 18 days interval up to 120 days after transplanting registered significantly lowest total chlorophyll content in tomato leaves at all crop growth stages during both the years under study. The interrupted supply of nutrients during grand growth period and at fruiting stage inhibits physiological activities thereby reduction in chlorophyll content The results are in accordance with those reported by Hebber *et al.* (2004), Salam *et al.* (2010). The maximum leaf water potential might be due to frequent and continuous application of N, P and K up to 120 days after transplanting meets the nutritional requirement of crop and increase vegetative growth in respect of number of leaflets and leaf area plant^{-1} resulted in higher evapotranspiration which create potential gradient between atmosphere and soil water for maximum uptake of moisture because of that plants cells becomes fully turgid which increases the leaf water potential throughout the crop growth period. Significantly minimum leaf water potential was observed with fertigation of 6 equal splits of RD of NPK at every 18 days interval.. Significantly minimum leaf water potential was observed with fertigation of 6 equal splits of RD of NPK at every 18 days interval. Similar findings were reported by Ramchandrappa *et al.* (2010).

Different fertigation schedules significantly influenced the yield contributing characters (Table 2) *viz*., number of fruits plant^{-1} and fruit weight plant^{-1} Among the fertigation schedules, fertigation of 12 equal splits of NPK at every 9 days interval up to 120 DAT exhibited significantly maximum number of fruits plant^{-1} (72.54, 66.30 and 69.44) and fruit weight plant^{-1} (4.80, 4.24 and 4.52 kg) during both the years and on pooled mean, respectively. While lowest number of fruits plant^{-1} and fruit weight plant^{-1} was noticed under the fertigation of 6 equal splits of NPK at every 18 days interval up to 120 DAT during the period of investigation. This might be due to continuous split application of nutrients throughout the crop growth period enhanced growth attributes accompanied with more physiological activities and absorbed PAR reflected in higher photosynthetic rate and translocation of assimilates towards reproductive parts resulted an increase in yield attributes. Similar results were reported by Tumbare and Nikam (2004), Bahadur *et al.* (2006).

The fruit yield of tomato (Table 2) was significantly influenced by different fertigation schedules and found that fertigation of 12 equal splits of NPK at every 9 days interval up to 120 DAT recorded significantly higher fruit yield unit^{-1} of polyhouse (15.56, 13.42 and 14.49 t) during both the years and on pooled mean. While, fertigation of 6 equal splits of NPK at every 18 days interval up to 120 DAT produced significantly minimum fruit yield unit^{-1} of polyhouse (12.44, 11.20 and 11.82 t). The extent of increase in fruit yield unit^{-1} of polyhouse under the fertigation of 12 equal splits of NPK at 9 days interval up to 120 days after transplanting was 20.05, 16.54 and 18.43% over the fertigation of 6 equal splits of RD of NPK at every 18 days interval up to 120 days after transplanting during both the years and on pooled mean, respectively. This might be due to frequent application of required quantity of nutrients directly in vicinity of the root zone throughout crop growth period increased the nutrient use efficiency which enhanced growth and yield attributes and improved tomato fruit yield. Similarly the favourable microclimatic conditions maintained inside polyhouse helps to change the phase of plant from juvenile to reproductive phase and significantly contributed to higher fruit yield of tomato. These results are in the line of Tumbare *et al.* (2004), Singh *et al.* (2013).

Based on two years of experimentation it is further concluded that to achieve favourable meteorological, physiological parameters and fruit yield of tomato during summer season under polyhouse condition the fertigation of 80% RDF

(240:120:120 N, P_2O_5, K_2O kg ha^{-1}) in 12 equal splits at every 9 days interval up to 120 days after transplanting found most suitable.

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