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Studies on Different Levels of Fertigation on Fruit Attributes and Quality of Pomegranate (*Punica granatum* L.) cv. Super Bhagwa

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ABSTRACT

The experiment was conducted at Gangapur, Latur, Maharashtra, India during (Dec, 2017–June, 2018) to study effective use of fertilizers with a goal to match nutrient supply with crop requirements and minimize nutrient losses from fields. Fertilizers are considered basic requirements to get the maximum yield, quality and productivity of trees. Fertigation is advantageous over the application of solid fertilizers in the soil by minimizing the losses of fertilizers through runoff and leaching and increase the nutrient-use efficiency and saving amount of fertilizers, therefore to study the different levels of fertigation (Surface irrigation+RDF-control; Drip irrigation+RDF; 50% RDF through fertigation; 75% RDF through fertigation; 100% RDF through fertigation and 125% RDF through fertigation) on fruit attributes and quality of pomegranate (*Punica granatum* L.) cv. Super Bhagwa. The experiment was laid out in a Randomized Block Design with six treatments and four replications. The investigation indicated 75% recommended dose of fertilizers through fertigation resulted, the highest average fruit weight (258.65 g), fruit volume (225.50 ml), weight of hundred arils (35.47 g), rind thickness (4.97 mm), rind weight (113.92 g) and arils weight (144.73 g). Same treatment recorded maximum juice percentage (80.20%), reducing sugar (11.70%), total sugar (12.83%) and T.S.S.: Acid ratio (45.60). Therefore, 75% recommended dose of fertilizers through fertigation can be recommended for improve fruit attributes and quality of pomegranate cv. Super Bhagwa for four to five years old tree.

KEYWORDS: Fertigation, fruit attributes, nutrientuse efficiency, pomegranate, quality

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1. INTRODUCTION

Fertigation is a modern agro technique that has the potential to combining water and fertilizer application through irrigation and provides an excellent opportunity to maximize yield and nutrient use efficiency (Li et al., 2002, Kafkafi and Tarchitzky, 2011). One of the main issues the world will face in the future is water shortage. To maintain the productivity of an agro ecosystem, managing water supplies for irrigation and determining crop water needs are of greatest priority (Negm et al., 2017, Negm et al., 2018). Among the various factors responsible for increasing crop production, the use of balanced fertilizer enhancing productivity. Since, pomegranate is high-value crop most of farmers are following drip irrigation method and are in need of proper fertigation (Tanari et al., 2019). Pomegranate (*Punica granatum* L.) is an important fruit crop of the tropical and subtropical regions belonging to the family Punicaceae (Shaygannia et al., 2016). In addition, it is a drought tolerance crop (Sepulveda et al., 2000). Pomegranate is commercially grown for its delicious, refreshing with sweet- acidic taste. The 'Anardana' is also prepared from pomegranate (Singh and Singh, 2004). The pomegranate is self-pollinated as well as cross-pollinated by insects (Qamar et al., 2018). Cross pollination increases the fruit set (Kumari et al., 2012). Very little amount of pollen is dispersed by wind. 45% of fruit is settled down by self-pollination and 68% by cross pollination. According to the season and variety of fruit size of pollen and fertility may vary (Suits et al., 1989, Aviram, 1993, Artik, 1998). In India mainly cultivated varieties like Ganesh, Mridula, Bhagwa, Dholka, Joyti, Muscat, Jodhpur Red, Ruby Red, etc. grown in different agro-climatic conditions (Sharma et al., 2014). Pomegranate is native of Iran and is extensively cultivated in Mediterranean countries like Spain, Morocco, Egypt, Afghanistan and Baluchistan. It is also grown to some extent in Burma, China, Japan, USA (California) and India (Kumar et al., 2018). The total area under cultivation of pomegranate in India is 192 t ha and production are around 2263 t mt according to NHB (Anonymous, 2017). The pomegranate juices contained important minerals (Mehmet et al., 2011). Recently, it has been reported that extract of fruits has anti-cancer properties (Adams et al., 2006, Sudhakar et al., 2015). Plant parts are used for the treatment of various diseases or disorders such as ulcer, hepatic damage, dysentery, diarrhea, helminthiasis, acidosis, hemorrhage and respiratory problems (Lansky and Newman, 2007, Al-Muammar and Khan, 2012).

The existing nutrient recommendation for pomegranate is basically for soil application and vary considerably different from place to place (Singh et al., 1988, Prasanna and Dhander, 1996). Further, the nutrient application has also known to have significant influence on pomegranate yield and quality viz., nitrogen on flowering pattern, potassium on fruit colour, calcium and boron on fruit cracking etc. (Gosh et al., 1996). Thus, there is need to study effective use of fertilizers with a goal to match nutrient supply with crop requirements and minimize nutrient losses from fields. Soil properties were changed due to traditional fertilizer application method that's why research work done to know proper dose of fertilizers in pomegranate. In India, the demand for pomegranate is increasing day by day due to less productivity and production of pomegranate. Not much research on the fertigation of this fruit in India has been done. Therefore, with respect to this fruit, farmers have to face many difficulties. In Marathwada region there is very scarcity rainfall and the water resources are limited, so that the application of drip irrigation system and fertilizers will play important role in improve of fruits attributes and quality of pomegranate.

2. MATERIALS AND METHODS

2.1. Study site

An experiment was carried out at post- Gangapur, Taluka and District- Latur (MH), India (latitude 17°52' to 18°50' N, longitude 76°18' to 79°12' E). The annual mean minimum and maximum temperatures of 19.48°C and 31.36°C respectively and average annual rainfall is 840mm.

2.2. Experimental details

Conducted an experiment on pomegranate cv. Super Bhagwa during the *Ambia bahar,* Dec, 2017–June, 2018. The 4 years old plants grown at 2.5×3 m^2 spacing were used for the experiment. The experiment was laid out in a Randomized Block Design with 6 treatments such as, T_1 (Surface irrigation+RDF-control), T_2 (Drip irrigation+RDF), T_3 (50% RDF through fertigation), T_4 (75% RDF through fertigation), T_5 (100% RDF through fertigation) and T_6 (125% RDF through fertigation) with four replications. The fertilizers for the treatment T_1 and T_2 were applied by ring and dibbling method, respectively. Fertilizers for treatment T_3 to T_6 were applied through drip irrigation system (fertigation).

2.3. Observation recorded

The observation on fruit attributes and quality of pomegranate such as average fruit weight (g), volume of fruit (ml), weight of 100 arils (g), rind thickness (mm), weight of rind $fruit^{-1}$ (g), weight of arils $fruit^{-1}$ (g), Rind: Aril ratio, juice percentage (%), TSS (%), acidity (%), reducing sugar (%), non-reducing sugar (%), total sugar (%) and TSS: Acid ratio were recorded during the experimental period.

2.4. Statistical analysis

The statistical analysis of the data in respect of fruit

attributes and quality was done according to the standard procedure given by Panse and Sukhatme (1984).

3. RESULTS AND DISCUSSION

3.1. Effect of fertigation on fruits attributes

It is revealed from the data (Table 1), the fruits attributes of pomegranate were significantly influence by different levels of fertigation. The highest average fruit weight (258.65 g), fruit volume (225.50 ml), weight of hundred arils (35.47 g), rind thickness (4.97 mm), rind weight (113.92 g) and arils weight (144.73 g) were noted under the treatment T_4 (75% RDF through fertigation) as compared to other treatments. This might bedue to the effect of sufficient availability of nutrients, soil moisture and water available to the plant continuously at proper stage. The 75% of RDF was sufficient for increasing the rind thickness and rind weight; it may help to reduce thrips and other insect attack on fruits to improve quality of fruits in cv. Super Bhagwa. These findings are in accordance withthe results obtained by Singh et al. (2006) in pomegranate and Kumar et al. (2012) in banana. The treatment T_2 (Drip irrigation+RDF) recorded significantly the highest Rind: Arils ratio (0.93). This might be due to the different fertilizers' levels are also affectthe Rind: Arils ratio of the pomegranate. This indicated that, there may bedirect or indirect correlation between Rind and Arils weight of pomegranate.

Table 1: Effect of fertigation on fruit attributes of pomegranate

Treatments	Average fruit weight (g)	Volume of fruit (ml)	Weight of hundred arils (g)	Rind thickness (mm)	Weight of rind fruit^{-1} (g)	Weight of arils fruit^{-1} (g)	Rind: aril ratio
T_1	175.38	143.75	23.20	3.68	80.37	95.01	0.84
T_2	188.97	149.25	27.37	4.16	91.12	97.85	0.93
T_3	193.97	152.25	28.42	4.36	92.85	101.12	0.92
T_4	258.65	225.50	35.47	4.97	113.92	144.73	0.79
T_5	237.55	205.50	31.90	4.53	97.00	140.55	0.69
T_6	215.82	174.25	30.27	4.63	96.95	118.87	0.81
SEm±	8.54	7.01	1.70	0.22	3.87	4.66	0.03
CD (p=0.05)	26.32	21.61	5.25	0.67	11.93	14.37	0.11

3.2. Effect of fertigation on quality parameters

It is revealed from the data (Table 2), the total soluble solid content (15.25%) was significantly increased by application of treatment T_5 (100% RDF through fertigation). This had led to a balanced water and nutrition supply to the plants and there by increased the quality of fruits. The similar results had been reported by Tank et al. (2011) in papaya, Pawar and Dingre (2013) in banana and Haneef et al. (2014) in pomegranate. The minimum titrable acidity (0.32%) was recorded in treatment T_3 (50% RDF through fertigation). This indicated that 50% RDF was sufficient for minimize titrable acidity; it helped to save fertilizers. The similar results had been reported by Singh et al. (2006) in pomegranate and Pramanikand Patra (2015) in banana. The TSS: Acid ratio (45.60) was significantly increased in treatment T_4 (75% RDF through fertigation). The data indicated that,

Table 2: Effect of fertigation on quality of pomegranate

Treatments	Juice percentage (%)	TSS (%)	Acidity (%)	Reducing sugar (%)	Non reducing sugar (%)	Total sugar (%)	TSS: Acid ratio
T_1	77.44	12.80	0.40	10.02	1.07	11.09	32.00
T_2	78.09	13.35	0.35	10.66	1.14	11.80	38.14
T_3	78.64	14.25	0.32	10.39	1.17	11.56	44.53
T_4	80.20	15.05	0.33	11.70	1.13	12.83	45.60
T_5	79.47	15.25	0.38	11.10	1.04	12.14	40.13
T_6	79.60	14.60	0.36	11.00	1.02	12.02	40.55
SEm±	0.63	0.53	0.01	0.36	0.03	0.35	2.24
CD (p=0.05)	NS	1.64	0.04	NS	NS	NS	6.90

75% RDF was sufficient for improve TSS: Acid ratio. The maximum juice percentage (80.20%), reducing sugar (11.70%) and total sugar (12.83%) were recorded under treatment T_4 (75% RDF through fertigation) and maximum non-reducingsugar (1.17%) was influenced by T_3 (50% RDF through fertigation) but remarkable difference was not observed among these treatments.

4. CONCLUSION

The fruit attributes *viz*., average fruit weight, volume of fruit, weight of hundred arils, rind thickness, weight of rind fruit^{-1} and weight of arils fruit^{-1} were positively influenced by application of treatment 75% RDF through fertigation. Similarly, the maximum juice percentage, reducing sugar, total sugar and TSS: Acid ratio was obtained in the same treatment. In a light, the 75% RDF through fertigation was observed most effective for getting higher quality fruit and fruit attributes.

5. REFERENCES

Anonymous, 2017. Area and production of horticulture crops in India. Indian Horticulture Database, National HorticultureBoard.Available athttps://nhb.gov.in/Statistics.px?enc=WkegdyuHokljEtehnJoq0KWLU79sOQCy+W4MfOk01GFOWQSEvtp9tNHHoiv3p49g. Accessed on Dec, 2017.

Gosh, G.K., Mohan, K.S., Sarkar, A.K., 1996. Characterization of soil-fertilizer P reaction products and their evaluation as sources of P for gram (*Cicer arietinum* L.). Nutrient Cycling in Agrosystems 46(1), 71–79.

Haneef, M., Kaushik, R.A., Sarolia, D.K., Mordia, A., Dhakar, M., 2014. Irrigation scheduling and fertigation in pomegranate cv. Bhagwaunder high density planting system. Indian Journal of Horticulture 71(1), 45–48.

Kafkafi, U., Tarchitzky, J., 2011. Fertigation: A tool for efficient fertilizer and water management. International Fertilizer Industry Association, Paris, 141.ISBN 978-2-9523139-8-8.

Kumar, D., Pandey, V., Nath, V., 2012. Growth, yield and quality of vegetable banana monthan (Banthal-ABB) in relation to NPK fertigation. Indian Journal of Horticulture 69(4), 467–471.

Kumari, A., Dora, J., Kumar, A., Kumar, A., 2012. Pomegranate (*Punica granatum*) overview. International Journal of Pharmaceutical and Chemical Sciences 1(4), 1218–1222.

Li, D.G., Xu, X.C., Zhang, Y.L., 2002. Fertigation and fertilizer. Journal of Zhengzhou University Technology 1, 21–24.

Panse, V.S., Sukhatme, P.V., 1984. Statistical methods for agricultural workers. ICAR, New Delhi, 343.

Pawar, D.D., Dingre, S.K., 2013. Influence of fertigation scheduling through drip on growth and yield of banana in western Maharashtra. Indian Journal of Horticulture 70(2), 200–205.

Pramanik, S., Patra, S.K., 2015. Effect of drip *vis-a-vis* surface irrigation on fruit yield, nutrient uptake, water use efficiency and quality of banana in Gangetic plain of West Bengal. Indian Journal of Horticulture 72(1), 7–13.

Prasanna, K.B., Dhander, D.G., 1996. Response of pomegranate to NPK fertilization. Indian Journal of Horticulture 53(2), 114–117.

Sepulveda, E., Galletti, L., Saenz, C., Tapin, M., 2000. Minimal processing of pomegranate var. wonderful. CIHEAM-options Mediterraneans, 237–242. Available at http://om.ciheam.org/om/pdf/a42/00600278.pdf.

Shaygannia, E., Mahmoud, B., Behnam, Z., Mahmoud, Rafieian-Kopaei, 2016. A review study on *Punica granatum* L. Journal of Evidence-Based Complementary and Alternative Medicine 21(3), 221–227.

Singh, D., Singh, R.K., 2004. Processed products of pomegranate. Natural Product Radiance 3(2), 66–68.

Singh, P., Singh, A.K., Sahu, K., 2006. Irrigation and fertigation of pomegranate cv. Ganesh in Chhattisgarh. Indian Journal of Horticulture 63(2), 148–151.

Singh, R.R., Singh, H.K., Chauhan, K.S., 1988. Effect of N, P and K on physico-chemical composition of pomegranate fruits cv. Local selection. Progressive Horticulture 20, 77–79.

Sudhakar, S., Dhivya, V., Vignesh, D., Karthikeyan, S., 2015. Antioxidant and anticancer activity of the pomegranate and their role in cancer prevention and therapy. International Journal of Life Sciences Research 3(3), 77–84.

Tanari, N., Suma, R., Anusree, T., Manjunatha, G., 2019. Effect of fertigation of primary nutrients on pomegranate (*Punica granatum* L.) fruit productivity and quality. Tropical Plant Research 6(3), 424–432.

Tank, R.V., Patel, N.L., Naik, J.R., 2011. Effect of fertigation on growth, yield and quality of papaya (*Carica papaya* L.) cv. Madhu Binduunder South Gujarat conditions. The Asian Journal of Horticulture6(2), 339–343.

Kumar, R., Meena, R., Sharma, B.D., Saroj, P.L., 2018. Production technology of pomegranate in arid region. CIAH/Tech./Bull. No. 65, ICAR-Central Institute for Arid Horticulture, Bikaner, Rajasthan, India. Available fromwww.ciah.ernet.in.

Al-Muammar, M.N., Khan, F., 2012. Obesity: The

preventive role of the pomegranate (*Punica granatum*). Nutrition 28(6), 595–604.

Lansky, E.P., Newman, R.A., 2007. *Punica granatum* (Pomegranate) and its potential for prevention and treatment of inflammation and cancer. Journal of Ethnopharmacology 109(2), 177–206.

Adams, L.S., Seeram, N.P., Aggarwal, B.B., 2006. Pomegranate juice, total pomegranate ellagitannins, and punicalagin suppress inflammatory cell signaling in colon cancer cells. Journal of Agricultural and Food Chemistry 54(3), 980–985.

Qamar, A.S., Zara, B., Rizwan. S., Tahir, Z., 2018. Nutritional and therapeutic properties of pomegranate. Scholarly Journal of Food and Nutrition 1(4), 1–6.

Aviram, M., 1993. Modified forms of low density lipoprotein and atherosclerosis. Atherosclerosis 98(1), 1–9.

Suits, A.G., Chait, A., Aviram, M., Heinecke, J.W., 1989. Phagocytosis of aggregated lipoprotein receptor dependent foam-cell formation. Proceedings of the National Academy of Sciences 86(8), 2713–2717.

Artik, N., 1998. Determination of phenolic compounds in pomegranate juice by using HPLC. Fruit Processing 8, 492–499.

Negm, A., Jabro, J., Provenzano, G., 2017. Assessing the suitability of American National Aeronautics and Space Administration (NASA) agro-climatology archive to predict daily meteorological variables and reference evapotranspiration in Sicily, Italy. Agricultural and Forest Meteorology 244, 111–121.

Negm, A., Minacapilli, M., Provenzano, G., 2018. Downscaling of American National Aeronautics and Space Administration (NASA) daily air temperature in Sicily, Italy and effects on crop reference evapotranspiration. Agricultural Water Management 209, 151–162.

Mehmet, M.O., Nesim, D., Coskun, S., 2011. Heavy metals bounding ability of pomegranate (*Punica granatum*) peel in model system. International Journal of Food Properties 14(3), 550–556.

Sharma, J., Ram, C., Sharma, K.K., Dhinesh, B.K., Meshram, D.T., Maity, A., Singh, N.V., Gaikwad, N.N., 2014. Pomegranate: cultivation, marketing and utilization. Technical Bulletin No. NRCP/2014, ICAR-National Research Centre on Pomegranate, Solapur, Maharashtra, India. DOI 10.13140/RG.2.1.1286.4088.