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Correlation Amongst Reproductive, Quality and Soil Parameters of Pomegranate in Response to Plant Growth Regulating substances and Fertigation in Vertisols of South-East Rajasthan

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ABSTRACT: Correlation studies were resolute among reproductive, yield, quality and soil parameters of pomegranate in response to use of different treatment combinations of plant growth regulating substances and fertigation during two successive years *i.e.* 2018 and 2019 under the Department of Fruit Science, College of Horticulture and Forestry, Jhalawar. The experiment was laid out in Factorial Randomized Block Design and each treatment was replicated thrice and per treatment two plants were used and experimentation comprising of 27 treatment combinations for the study. The flowering-fruiting parameters *viz.* number of flowers per shoot, fruit set per cent, fruit retention per cent and fruit qualityattributes*viz.*TSS, total sugar, ascorbic acid and anthocyanin content exhibited significant and positive correlation with each other. The days taken to first harvesting, days taken to complete harvesting, fruit acidity per cent, soil bulk density and soil pH exhibited significant and positive correlation with each other but negative and non significant correlation with flowering-fruiting, yield, quality and most of the soil parameters. Correlation studies are in credibly helpful and important tool to interpret the trend and assenting inter-relationships amongst reproductive, yield and quality of pomegranate. Our research provides scientific basis for the technology in correlation between PGRs and plant nutrients with soil and plant.

Keywords: Ethrel, Fertigation, NAA, Soil, Sugar, Quality.

INTRODUCTION

Pomegranate is one of the dollar earning table fruits in the world, for its refreshing juice with nutritional and medicinal properties. Fruit juice is a good source of various vitamins and minerals. Wild pomegranate is too acidic and of little value except as souring agent (*Anardana*). The double-flowered pomegranates (which do not bear fruits) are grown in parks and ornamental gardens for their beautiful red flowers (Raj and Kanwar, 2008). In recent years, it has shown tremendous market potential due to its huge neutraceutical value, high demand of its fruits, its wide adaptability and diverse use and lesser resource demanding quality in comparison to other fruit crops. It is an economically important species of the tropical and subtropical regions of the world due to its delicious edible fruits and ornamental usage. Ethylene is a naturally occurring plant growth substance that has numerous effects on the growth, development and storage life of many fruits at $\mu l\ 1^{-1}$. Ethylene synthesis and sensitivity are enhanced during certain stages of plant development as well as by a number of biotic and abiotic stresses. Both beneficial and detrimental effect of ethylene has been reported in accelerating the natural process of development, ripening and senescence (Mikal, 1999). Naphthaleneacetic acid (NAA) is a synthetic auxin plant hormone that is routinely used for the vegetative propagation of plants from stem and cutting.NAA has been shown to greatly increase cellulose fiber formation in plants. In majority of fruit plants fruit drop is controlled by spraying of NAA in different fruit crops in different concentration. Since the natural ground water is depleting, many farmers in India have switched ever to drip irrigation moreover fertigation is easier with high nutrient use efficiency, saving labour, less weed infestation besides enhancing the productivity (Thiyagarajan, 2006). Application of fertilizers in small quantities to the soil at any given time improves fertilizer use efficiency, helps to maintain nutritional balance and nutrient concentration at optimum level, provides opportunity to apply the nutrients at critical stages of crop growth and minimizes hazard of ground water pollution due to nitrate leaching as compared to conventional practice of fertilizers application. Fertigation through drip irrigation results in fertilizer savings to the tune of 25 to 50 per cent. Moreover, increasing prices of nitrogenous fertilizers and potential effect of excessive use of fertilizers on ground water quality make it necessary to use the fertilizers more efficiently without reducing crop growth. Fertigation provides essential elements directly to the active root zone, thus minimizing losses of expensive nutrients, which ultimately helps in improving productivity and quality of farm produce.

MATERIALS AND METHODS

The research station is situated at 23°4’ to 24°52’ N-Latitude and 75°29’ to 76°56’ E-Longitude in South-Eastern, Rajasthan. The investigation was carried out under the Department of Fruit Science, College of Horticulture and Forestry, Jhalawar (Agriculture

University, Kota). The experiment was conducted in pomegranate orchard of Sinduri (Bhagwa) variety under high density planting system (3 m × 3 m) at the Krishi Vigyan Kendra, Jhalawar in the near vicinity of the college. The experiment was laid out in Factorial Randomized Block Design and each treatment was replicated thrice and per treatment two plants were used and experimentation comprising of 27 treatment combinations for the study. The treatments consisted of two different plant growth regulators namely NAA and ethrel and fertigation of recommendation dose of fertilizers with three levels of each (NAA 0, 50 and 100 ppm and ethrel 0, 150 and 250 ppm) and fertigation levels (0, 75 and 100 % recommended dose of fertilizers). Spray of plant growth regulators was done @ 2 liter/plant and recommended dose of urea, phosphoric acid and muriate of potash were applied @ 625, 250 and 250 g per plant, respectively (Pareek, 1982). Water soluble fertilizers were applied through drip irrigation system (fertigation). Amount of water soluble fertilizers were determined by calculating amount of nitrogen, phosphorus and potassium in recommended dose. The plant growth regulators were sprayed at pre flowering and post flowering stage and fertigation were applied monthly in four equal split dose from 1 July to 1 October on both years, after recording initial (base) growth and development parameters of plants. The plain distilled water and basal dose of fertilizers were applied on the plants for control. The desired quantities of plant growth regulators and fertilizers were procured from different sources for the purpose of experiment and required quantities of these materials were applied on individual plant. Correlation analysis was done after completion of all plant growth, leaf attributes and fruit quality parameters and subsequently data were analyzed for multiple correlations as suggested by Panse and Sukhatme (1985).

RESULT AND DISCUSSION

A. Correlation among flowering-fruiting, yield, quality and soil parameters of pomegranate

The results presented in Table 1 indicated that number of flowers per shoot exhibited significant and positive correlation with fruit set per cent(r = 0.838**), fruit retention per cent(r = 0.873**), TSS(r = 0.794**), total sugar per cent(r = 0.766**), sugar :acid ratio (r = 0.821**), ascorbic acid(r = 0.775**), juice per cent(r = 0.774**), anthocyanin (r = 0.938**),soil EC(r = 0.768**), soil organic carbon (r = 0.750**), soil nitrogen(r = 0.793**), soil phosphorus (r = 0.719**), soil potassium(r = 0.783**),water holding capacity(r = 0.771**) number of fruits per plant(r = 0.899**) and yield per hectare (q)(r = 0.877**).However, number of flowers per shoot exhibited negative and non significant with days taken to first harvesting(r= -0.817), days taken to complete harvesting(r = -0.814), acidity per cent (r = -0.802), soil pH(r = -0.797) andsoil bulk density (r = -0.501).The attribute fruit set per cent determined significant and positive correlation with number of flowers per shoot (r = 0.838**),fruit retention per cent (r = 0.984**), TSS (r = 0.740**), total sugar per cent (r = 0.738**), sugar :acid ratio (r = 0.756**), ascorbic acid (r = 0.755**), juice per cent (r = 0.806**), anthocyanin (r = 0.756**), soil EC(r = 0.702**), soil organic carbon (r = 0.716**), soil nitrogen(r = 0.727**), soil phosphorus (r = 0.711**),soil potassium(r = 0.753**),water holding capacity (r = 0.742**) number of fruits per plant(r = 0.925**) and yield per hectare (q)(r = 0.861**). Although, fruit set per cent exhibited negative and non significant with days taken to first harvesting (r= -0.827), days taken to complete harvesting(r = -0.782), acidity per cent (r = -0.776), soil pH(r = -0.804) andsoil bulk density(r = -0.734). The fruit retention per cent exhibited significant and positive correlation with number of flowers per shoot (r = 0.873**), fruit set per cent(r = 0.984**), TSS (r = 0.807**), total sugar per cent(r = 0.800**), sugar :acid ratio (r = 0.819**), ascorbic acid(r = 0.814**), juice per cent (r = 0.854**), anthocyanin (r = 0.792**),soil EC(r = 0.779**), soil organic carbon (r = 0.790**), soil nitrogen(r = 0.804**),soil phosphorus(r = 0.786**),soil potassium(r = 0.825**),water holding capacity(r = 0.806**) number of fruits per plant(r = 0.962**) and yield per hectare (q)(r = 0.916**).Moreover, fruit set per cent exhibited negative and non significant with days taken to first harvesting(r= -0.874), days taken to complete harvesting(r = -0.850), acidity per cent (r = -0.836), soil pH(r = -0.867) andsoil bulk density(r = -0.811).The results of present findings are in conformity with those reported by Meena *et al*., (2020) in guava.

The attribute on days taken to first harvesting showed non-significant and negative correlation with number of flowers per shoot (r = -0.817), fruit set per cent(r = -0.827), fruit retention per cent (r = -0.874), TSS(r = -0.959), total sugar per cent(r = -0.962), sugar :acid ratio(r = -0.962), ascorbic acid(r = -0.970), juice per cent(r = -0.983), anthocyanin (r = -0.826), soil EC(r = -0.912), soil organic carbon(r = -0.928), soil nitrogen(r = -0.926), soil phosphorus(r = -0.940), soil potassium(r = -0.954), water holding capacity(r = -0.955), number of fruits per plant(r = -0.855)and yield per hectare (q)(r = -0.953), However, days taken to first harvesting exhibited positive and significant with days taken to complete harvesting(r = 0.980**), acidity per cent (r = 0.976**), soil pH(r = 0.973**) andsoil bulk density(r = 0.952**).The days taken to complete harvesting exhibited non significant and negative correlation with number of flowers per shoot (r = -0.814),fruit set per cent(r = -0.782), fruit retention per cent (r = -0.850), TSS(r = -0.970), total sugar per cent(r = -0.962), sugar :acid ratio(r = -0.970), ascorbic acid(r = -0.969), juice per cent(r = -0.967), anthocyanin (r = -0.809), soil EC(r = -0.932), soil organic carbon (r = -0.961), soil nitrogen (r = -0.952), soil phosphorus(r = -0.946), soil potassium(r = -0.968), water holding capacity(r = -0.954),number of fruits per plant(r = -0.858)and yield per hectare (q)(r = -0.962)Even, days taken to complete harvesting exhibited positive and significant with days taken to first harvesting(r = 0.980**), acidity per cent (r = 0.973**), soil pH(r = 0.975**) andsoil bulk density(r = 0.965**).

The results presented in Table 1 indicated that TSS exhibited significant and positive correlation with number of flowers per shoot (r = 0.794**),fruit set per cent(r = 0.740**), fruit retention per cent (r = 0.807**), total sugar per cent(r = 0.994**), sugar :acid ratio (r = 0.988**), ascorbic acid(r = 0.991**), juice per cent (r = 0.971**), anthocyanin (r = 0.806**),soil EC(r = 0.948**), soil organic carbon (r = 0.930**), soil nitrogen(r = 0.959**),soil phosphorus(r = 0.934**), soil potassium(r = 0.977**),water holding capacity(r = 0.969**), number of fruits per plant(r = 0.841**) and yield per hectare (q)(r = 0.957**). Though, TSS exhibited negative and non significant with days taken to first harvesting (r= -0.959), days taken to complete harvesting(r = -0.970), acidity per cent (r = -0.981), soil pH(r = -0.958) andsoil bulk density(r = -0.976).The total sugar revealed significant and positive correlation with number of flowers per shoot (r = 0.766**), fruit set per cent (r = 0.738**), fruit retention per cent (r = 0.800**), TSS (r = 0.994**), sugar :acid ratio (r = 0.983**), ascorbic acid (r = 0.997**), juice per cent (r = 0.982**), anthocyanin (r = 0.784**), soil EC (r = 0.935**), soil organic carbon (r = 0.923**), soil nitrogen (r = 0.948**), soil phosphorus (r = 0.940**), soil potassium (r = 0.977**), water holding capacity (r = 0.974**),number of fruits per plant (r = 0.83**) and yield per hectare (q) (r = 0.950**). Although, total sugar exhibited negative and non significant with days taken to first harvesting (r= -

0.962), days taken to complete harvesting (r = -0.962), acidity per cent (r = -0.986), soil pH (r = -0.958) and soil bulk density (r = -0.977). The acidity in pomegranate showed non-significant and negative correlation with number of flowers per shoot (r = -0.802), fruit set per cent(r = -0.776), fruit retention per cent (r = -0.836), TSS(r = -0.981), total sugar per cent (r = -0.986), sugar :acid ratio(r = -0.989), ascorbic acid(r = -0.987), juice per cent(r = -0.982), anthocyanin (r = -0.805), soil EC (r = -0.932), soil organic carbon (r = -0.925), soil nitrogen(r = -0.950), soil phosphorus(r = -0.944), soil potassium(r = -0.977), water holding capacity(r = -0.976), number of fruits per plant(r = -0.864), and yield per hectare (q)(r = -0.966), However, acidity exhibited positive and significant with days taken to first harvesting (r = 0.976**), days taken to complete harvesting (r = 0.973**), soil pH(r = 0.968**) andsoil bulk density(r = 0.977**). The result indicated that sugar :acid ratio exhibited significant and positive correlation with number of flowers per shoot (r = 0.821**), fruit set per cent (r = 0.756**), fruit retention per cent (r = 0.819**), TSS (r = 0.988**), total sugar (r = 0.983**), ascorbic acid (r = 0.981**), juice per cent (r = 0.963**), anthocyanin (r = 0.822**), soil EC (r = 0.938**), soil organic carbon (r = 0.922**), soil nitrogen (r = 0.960**), soil phosphorus (r = 0.913**), soil potassium (r = 0.970**), water holding capacity (r = 0.963**),number of fruits per plant (r = 0.857**) and yield per hectare (q) (r = 0.964**).Although, sugar: acid ratio exhibited negative and non significant with days taken to first harvesting (r= -0.962), days taken to complete harvesting (r = -0.970), acidity per cent (r = -0.989), soil pH (r = -0.953) and soil bulk density (r = -0.967). The ascorbic acid determined significant and positive correlation with number of flowers per shoot (r = 0.775**), fruit set per cent (r = 0.755**), fruit retention per cent (r = 0.814**), TSS (r = 0.991**), total sugar (r = 0.997**), sugar :acidratio (r = 0.981**), juice per cent (r = 0.989**), anthocyanin (r = 0.793**), soil EC (r = 0.938**), soil organic carbon (r = 0.935**), soil nitrogen (r = 0.950**), soil phosphorus (r = 0.947**), soil potassium (r = 0.980**), water holding capacity (r = 0.979**),number of fruits per plant (r = 0.839**) and yield per hectare (q) (r = 0.955**).Moreover, ascorbic acid exhibited negative and non significant with days taken to first harvesting (r= -0.970), days taken to complete harvesting (r = -0.969), acidity per cent (r = -0.987), soil pH (r = -0.966) and soil bulk density (r = -0.979). The juice per cent showed significant and positive correlation with number of flowers per shoot (r = 0.774**), fruit set per cent (r = 0.806**), fruit retention per cent (r = 0.854**), TSS (r = 0.971**), total sugar (r = 0.982**), sugar :acid ratio (r = 0.963**), ascorbic acid (r = 0.989**), anthocyanin (r = 0.787**), soil EC (r = 0.917**), soil organic carbon (r = 0.923**), soil nitrogen (r = 0.930**), soil phosphorus (r = 0.948**), soil potassium (r = 0.968**), water holding capacity (r = 0.971**),number of fruits per plant (r = 0.850**) and yield per hectare (q) (r = 0.951**).Though, juice per cent exhibited negative and non significant with days taken to first harvesting (r= -0.983), days taken to complete harvesting (r = -0.967), acidity per cent (r = -0.982), soil pH (r = -0.973) and soil bulk density (r = -0.967). The anthocyanin revealed significant and positive correlation with number of flowers per shoot (r = 0.938**), fruit set per cent (r = 0.756**), fruit retention per cent (r = 0.792**), TSS (r = 0.806**), total sugar (r = 0.784**), sugar :acid ratio (r = 0.822**), ascorbic acid (r = 0.793**), juice per cent (r = 0.787**), soil EC (r = 0.741**), soil organic carbon (r = 0.711**), soil nitrogen (r = 0.750**), soil phosphorus (r = 0.702**), soil potassium (r = 0.756**), water holding capacity (r = 0.755**), number of fruits per plant (r = 0.807**) and yield per hectare (q) (r = 0.835**).However, anthocyanin exhibited negative and non significant with days taken to first harvesting (r= -0.826), days taken to complete harvesting (r = -0.809), acidity per cent (r = -0.805), soil pH (r = -0.766) and soil bulk density (r = -0.757).

The results presented in Table 1 indicated that pH of soil exhibited non significant and negative correlation with number of flowers per shoot (r = -0.797), fruit set per cent (r = -0.804), fruit retention per cent (r = -0.867), TSS (r = -0.958), total sugar per cent (r = -0.958), sugar :acid ratio (r = -0.953), ascorbic acid (r = -0.966), juice per cent (r = -0.973), anthocyanin (r = -0.766), soil EC(r = -0.952), soil organic carbon (r = -0.967), soil nitrogen(r = -0.969), soil phosphorus (r = -0.972), soil potassium (r = -0.985), water holding capacity(r = -0.980),number of fruits per plant(r = -0.872) and yield per hectare (q)(r = -0.962), However, pH exhibited positive and significant correlation with days taken to first harvesting (r = 0.973**), days taken to complete harvesting (r = 0.975**), acidity (r = 0.968**) and soil bulk density(r = 0.982**).The soil EC revealed significant and positive correlation with number of flowers per shoot (r = 0.768**), fruit set per cent (r = 0.702**), fruit retention per cent (r = 0.779**), TSS (r = 0.948**), total sugar (r = 0.935**), sugar :acid ratio (r = 0.938**), ascorbic acid (r = 0.938**), juice per cent(r = 0.917**), anthocyanin (r = 0.741**), soil organic carbon (r = 0.950**), soil nitrogen (r = 0.987**), soil phosphorus (r = 0.953**), soil potassium (r = 0.964**), water holding capacity (r = 0.963**),number of fruits per plant (r = 0.819**) and yield per hectare (q) (r = 0.925**). Although, soil EC exhibited negative and non significant with days taken to first harvesting (r= -0.912), days taken to complete harvesting (r = -0.932), acidity per cent (r = -0.932), soil pH (r = -0.952) and soil bulk density (r = -0.963). The organic carbon ofsoil showed significant and positive correlation with number of flowers per shoot (r = 0.750**), fruit set per cent (r = 0.716**), fruit retention per cent (r = 0.790**), TSS (r = 0.930**), total sugar (r = 0.923**), sugar :acid ratio (r = 0.922**), ascorbic acid (r = 0.935**), juice per cent (r = 0.923**), anthocyanin (r = 0.711**), soil EC (r = 0.950**), soil nitrogen (r = 0.966**), soil phosphorus (r = 0.959**), soil potassium (r = 0.964**), water holding capacity (r = 0.954**),number of fruits per plant (r = 0.818**) and yield per hectare (q) (r = 0.930**).However, organic carbon of soil exhibited negative and non significant with days taken to first harvesting (r= -0.928), days taken to complete harvesting (r = -0.961), acidity per cent (r = -0.925), soil pH (r = -0.967) and soil bulk density (r = -0.956).The available nitrogen in soil found significant and positive correlation with number of flowers per shoot (r = 0.793**), fruit set per cent (r = 0.727**), fruit retention per cent (r = 0.804**), TSS (r = 0.959**), total sugar (r = 0.948**), sugar :acid ratio (r = 0.960**), ascorbic acid (r = 0.950**), juice per cent (r = 0.930**), anthocyanin (r = 0.750**), soil EC (r = 0.987**), soil organic carbon (r = 0.966**), soil phosphorus (r = 0.945**), soil potassium (r = 0.981**), water holding capacity (r = 0.972**),number of fruits per plant (r = 0.851**) and yield per hectare (q) (r = 0.952**). Though, available nitrogen in soil exhibited negative and non significant with days taken to first harvesting (r= -0.926), days taken to complete harvesting (r = -0.952), acidity per cent (r = -0.950), soil pH (r = -0.969) and soil bulk density (r = -0.977).The available phosphorus in soil revealed significant and positive correlation with number of flowers per shoot (r = 0.719**), fruit set per cent (r = 0.711**), fruit retention per cent (r = 0.786**), TSS (r = 0.934**), total sugar (r = 0.940**), sugar :acid ratio (r = 0.913**), ascorbic acid (r = 0.947**), juice per cent (r = 0.948**), anthocyanin (r = 0.702**), soil EC (r = 0.953**), soil organic carbon (r = 0.959**), soil nitrogen(r = 0.945**), soil potassium (r = 0.965**), water holding capacity (r = 0.969**), number of fruits per plant (r = 0.801**) and yield per hectare (q) (r = 0.912**).

Table 1: Correlation amongst flowering-fruiting, yield, quality and soil parameters of pomegranate in response to plant growth regulators and fertigation.

S.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1.	1	0.838**	0.873**	-0.817	-0.814	0.794**	0.766**	-0.802	0.821**	0.775**	0.774**	0.938**	-0.797	0.768**	0.750**	0.793**	0.719**	0.783**	-0.773	0.771**	0.899**	0.877**	0.877**
2.	0.838**	1	0.984**	-0.827	-0.782	0.740**	0.738**	-0.776	0.756**	0.755**	0.806**	0.756**	-0.804	0.702**	0.716**	0.727**	0.711**	0.753**	-0.734	0.742**	0.925**	0.861**	0.861**
3.	0.873**	0.984**	1	-0.874	-0.850	0.807**	0.800**	-0.836	0.819**	0.814**	0.854**	0.792**	-0.867	0.779**	0.790**	0.804**	0.786**	0.825**	-0.811	0.806**	0.962**	0.916**	0.916**
4.	-0.817	-0.827	-0.874	1	0.980**	-0.959	-0.962	0.976**	-0.962	-0.970	-0.983	-0.826	0.973**	-0.912	-0.928	-0.926	-0.940	-0.954	0.952**	-0.955	-0.855	-0.953	-0.953
5.	-0.814	-0.782	-0.850	0.980**	1	-0.970	-0.962	0.973**	-0.970	-0.969	-0.967	-0.809	0.975**	-0.932	-0.961	-0.952	-0.946	-0.968	0.965**	-0.954	-0.858	-0.962	-0.962
6.	0.794**	0.740**	0.807**	-0.959	-0.970	1	0.994**	-0.981	0.988**	0.991**	0.971**	0.806**	-0.958	0.948**	0.930**	0.959**	0.934**	0.977**	-0.976	0.969**	0.841**	0.957**	0.957**
7.	0.766**	0.738**	0.800**	-0.962	-0.962	0.994**	1	-0.986	0.983**	0.997**	0.982**	0.784**	-0.958	0.935**	0.923**	0.948**	0.940**	0.977**	-0.977	0.974**	0.832**	0.950**	0.950**
8.	-0.802	-0.776	-0.836	0.976**	0.973**	-0.981	-0.986	1	-0.989	-0.987	-0.982	-0.805	0.968**	-0.932	-0.925	-0.950	-0.944	-0.977	0.977**	-0.976	-0.864	-0.966	-0.966
9.	0.821**	0.756**	0.819**	-0.962	-0.970	0.988**	0.983**	-0.989	1	0.981**	0.963**	0.822**	-0.953	0.938**	0.922**	0.960**	0.913**	0.970**	-0.967	0.963**	0.857**	0.964**	0.964**
10.	0.775**	0.755**	0.814**	-0.970	-0.969	0.991**	0.997**	-0.987	0.981**	1	0.989**	0.793**	-0.966	0.938**	0.935**	0.950**	0.947**	0.980**	-0.979	0.979**	0.839**	0.955**	0.955**
11.	0.774**	0.806**	0.854**	-0.983	-0.967	0.971**	0.982**	-0.982	0.963**	0.989**	1	0.787**	-0.973	0.917**	0.923**	0.930**	0.948**	0.968**	-0.967	0.971**	0.850**	0.951**	0.951**
12.	0.938**	0.756**	0.7927**	-0.826	-0.809	0.806**	0.784**	-0.805	0.822**	0.793**	0.787**	1	-0.766	0.741**	0.711**	0.750**	0.702**	0.756**	-0.757	0.755**	0.807**	0.835**	0.835**
13.	-0.797	-0.804	-0.867	0.973**	0.975**	-0.958	-0.958	0.968**	-0.953	-0.966	-0.973	-0.766	1	-0.952	-0.967	-0.969	-0.972	-0.985	0.982**	-0.980	-0.872	-0.962	-0.962
14.	0.768**	0.702**	0.779**	-0.912	-0.932	0.948**	0.935**	-0.932	0.938**	0.938**	0.917**	0.741**	-0.952	1	0.950**	0.987**	0.953**	0.964**	-0.963	0.963**	0.819**	0.925**	0.925**
15.	0.750**	0.716**	0.790**	-0.928	-0.961	0.930**	0.923**	-0.925	0.922**	0.935**	0.923**	0.711**	-0.967	0.950**	1	0.966**	0.959**	0.964**	-0.956	0.954**	0.818**	0.930**	0.930**
16.	0.793**	0.727**	0.804**	-0.926	-0.952	0.959**	0.948**	-0.950	0.960**	0.950**	0.930**	0.750**	-0.969	0.987**	0.966**	1	0.945**	0.981**	-0.977	0.972**	0.851**	0.952**	0.952**
17.	0.719**	0.711**	0.786**	-0.940	-0.946	0.934**	0.940**	-0.944	0.913**	0.947**	0.948**	0.702**	-0.972	0.953**	0.959**	0.945**	1	0.965**	-0.970	0.969**	0.801**	0.912**	0.912**
18.	0.783**	0.753**	0.825**	-0.954	-0.968	0.977**	0.977**	-0.977	0.970**	0.980**	0.968**	0.756**	-0.985	0.964**	0.964**	0.981**	0.965**	1	-0.997	0.992**	0.868**	0.968**	0.968**
19.	-0.773	-0.734	-0.811	0.952**	0.965**	-0.976	-0.977	0.977**	-0.967	-0.979	-0.967	-0.757	0.982**	-0.963	-0.956	-0.977	-0.970	-0.997	1	-0.992	-0.855	-0.960	-0.960
20.	0.771**	0.742**	0.806**	-0.955	-0.954	0.969**	0.974**	-0.976	0.963**	0.979**	0.971**	0.755**	-0.980	0.963**	0.954**	0.972**	0.969**	0.992**	-0.992	1	0.844**	0.952**	0.952**
21.	0.899**	0.925**	0.962**	-0.855	-0.858	0.841**	0.832**	-0.864	0.857**	0.839**	0.850**	0.807**	-0.872	0.819**	0.818**	0.851**	0.801**	0.868**	-0.855	0.844**	1	0.954**	0.954**
22.	0.877**	0.861**	0.916**	-0.953	-0.962	0.957**	0.950**	-0.966	0.964**	0.955**	0.951**	0.835**	-0.962	0.925**	0.930**	0.952**	0.912**	0.968**	-0.960	0.952**	0.954**	1	1.000**
23.	0.877**	0.861**	0.916**	-0.953	-0.962	0.957**	0.950**	-0.966	0.964**	0.955**	0.951**	0.835**	-0.962	0.925**	0.930**	0.952**	0.912**	0.968**	-0.960	0.952**	0.954**	0.954**	1

* Correlation is significant at the 5 % level of significance, ** Correlation is significant at the 1% level of significance; 1. Number of flowers per shoot2. Fruit set per cent 3. Fruit retention per cent 4. Days taken to first harvesting 5. Days taken to complete harvesting 6. TSS 7. Total sugar per cent 8. Acidity per cent 9. Sugar acid ratio 10. Ascorbic acid 11. Juice per cent 12. Anthocyanin 13. Soil pH 14. Soil EC 15. Soil organic carbon 16. Soil nitrogen per cent 17. Soil phosphorus per cent 18. Soil potassium per cent 19. Soil bulk density 20. Water holding capacity 21. Number of fruits per plant 22. Yield per plant (kg) 23. Yield per hectare (q)

Although, available phosphorus in soil exhibited negative and non significant with days taken to first harvesting (r= -0.940), days taken to complete harvesting (r = -0.946), acidity per cent (r = -0.944), soil pH (r = -0.972) and soil bulk density (r = -0.970).The available soil potassium determined significant and positive correlation with number of flowers per shoot (r = 0.783**), fruit set per cent (r = 0.753**), fruit retention per cent (r = 0.825**), TSS (r = 0.977**), total sugar (r = 0.977**), sugar :acid ratio (r = 0.970**), ascorbic acid (r = 0.980**), juice per cent (r = 0.968**), anthocyanin (r = 0.756**), soil EC (r = 0.964**), soil organic carbon (r = 0.964**), soil nitrogen(r = 0.981**), soil phosphorus (r = 0.965**), water holding capacity (r = 0.992**), number of fruits per plant (r = 0.868**) and yield per hectare (q) (r = 0.968**).However, available potassium in soil exhibited negative and non significant with days taken to first harvesting (r= -0.954), days taken to complete harvesting (r = -0.968), acidity per cent (r = -0.977), soil pH (r = -0.985) and soil bulk density (r = -0.997).The bulk density of soil exhibited non significant and negative correlation with number of flowers per shoot (r = -0.773), fruit set per cent(r = -0.734), fruit retention per cent (r = -0.811), TSS(r = -0.976), total sugar per cent(r = -0.977), sugar :acid ratio(r = -0.967), ascorbic acid(r = -0.979), juice per cent(r = -0.967), anthocyanin (r = -0.757), soil EC(r = -0.963), soil organic carbon (r = -0.956), soil nitrogen(r = -0.977), soil phosphorus (r = -0.970), soil potassium (r = -0.997), water holding capacity (r = -0.992), number of fruits per plant (r = -0.855) and yield per hectare (q) (r = -0.960), Although, bulk density exhibited positive and significant with days taken to first harvesting(r = 0.952**), days taken to complete harvesting (r = 0.965**), acidity(r = 0.977**) and soil pH(r = 0.982**). The water holding capacity of soil determined significant and positive correlation with number of flowers per shoot (r = 0.771**), fruit set per cent (r = 0.742**), fruit retention per cent (r = 0.806**), TSS (r = 0.959**), total sugar (r = 0.974**), sugar :acid ratio (r = 0.963**), ascorbic acid (r = 0.979**), juice per cent (r = 0.971**), anthocyanin (r = 0.755**), soil EC (r = 0.963**), soil organic carbon (r = 0.954**), soil nitrogen(r = 0.972**), soil phosphorus(r = 0.969**), soil potassium (r = 0.992**), number of fruits per plant (r = 0.844**) and yield per hectare (q) (r = 0.952**). Though, available potassium in soil exhibited negative and non significant with days taken to first harvesting (r= -0.955), days taken to complete harvesting (r = -0.954), acidity per cent (r = -0.976), soil pH (r = -0.980) and soil bulk density (r = -0.992).

The results presented in Table 1 indicated that number of fruits per plant revealed significant and positive correlation with number of flowers per shoot (r = 0.899**), fruit set per cent (r = 0.925**), fruit retention per cent (r = 0.962**), TSS (r = 0.841**), total sugar (r = 0.832**), sugar :acid ratio (r = 0.857**), ascorbic acid (r = 0.839**), juice per cent (r = 0.850**), anthocyanin (r = 0.807**), soil EC (r = 0.819**), soil organic carbon (r = 0.818**), soil nitrogen (r = 0.851**), soil phosphorus(r = 0.801**), soil potassium (r = 0.868**),water holding capacity, (r = 0.844**) and yield per hectare (q) (r = 0.954**). Though, number of fruits per plant exhibited negative and non significant with days taken to first harvesting (r= -0.855), days taken to complete harvesting (r = -0.858), acidity per cent (r = -0.864), soil pH (r = -0.872) and soil bulk density (r = -0.855). The yield per hectare (q)exhibited significant and positive correlation with number of flowers per shoot (r = 0.877**), fruit set per cent (r = 0.861**), fruit retention per cent (r = 0.916**), TSS (r = 0.957**), total sugar (r = 0.950**), sugar : acid ratio (r = 0.964**), ascorbic acid (r = 0.955**), juice per cent (r = 0.951**), anthocyanin (r = 0.835**), soil EC (r = 0.925**), soil organic carbon (r = 0.930**), soil nitrogen(r = 0.952**), soil phosphorus (r = 0.912**), soil potassium (r = 0.968**), water holding capacity, (r = 0.952**) and number of fruits per plant (r = 0.954**). However, yield per hectare (q) exhibited negative and non significant with days taken to first harvesting (r= -0.953), days taken to complete harvesting (r = -0.962), acidity per cent (r = -0.966), soil pH (r = -0.962) and soil bulk density (r = -0.960).

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Conflict of Interest. None.

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