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Influence of Bioextracts on Improving the Yield and Quality of Pomegranate (*Punica granatum* L.) var. Bhagwa

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ABSTRACT: An investigation was carried out at DFS, HC & RI, Periyakulam to study the influence of bio extracts on improving the yield and quality during 2021 and 2022 seasons on four years old pomegranate trees var. Bhagwa as well as to address the problems caused by the plants' inadequate access to nutrients, which limits crop production and causes poor fruit development. Trees were sprayed with different bioextracts after pruning, before flowering and fruit setting stage. The pomegranate treated with Seaweed extract 3% + Moringa leaf extract 6%+ Licorice extract 1.5% exhibited significantly higher yield, fruit weight, Soluble Solid Content (SSC), Titrable Acidity (TA) ratio, ascorbic acid as compared to all other treatments. It is concluded that, the treatment T_{12} (Seaweed extract 3% + Moringa leaf extract 6%+ Licorice extract 1.5%) was observed to be enhancing the yield (kg per plant) and quality of pomegranate, thus providing efficient outcome to the farming community.

Keywords: Pomegranate, bio extract, yield, quality, Bhagwa.

INTRODUCTION

Pomegranate (*Punica granatum* L.), a fruit of heaven and the tropical and subtropical parts of the world produce a significant amount of pomegranates. It is indigenous to Iran and gradually spreading throughout the world (Supe and Saitwal 2016). Due to its wider adaptability, hardiness, low maintenance requirements, and excellent yields, it is ideally suited for growing in dry and semi-arid climates. Its fruit is popular with consumers due to its attractive juice, refreshing arils, as well as its nutritional and therapeutic benefits. There is a demand for high-quality fruits and for both fresh and processed juice, syrup, and wine.

Pomegranate "Bhagwa" cultivar is currently grown commercially in India. This cultivar produces higher yields and has excellent fruit qualities. This cultivar takes 170-180 days to mature. Fruits range from medium to large in size, are appealing, with smooth, glossy, dark, saffron-colored skin and fetching very good prices in the market. Due to its thick rind and superior preserving qualities, it is appropriate for markets located far away.

Bioextracts including seaweed extract, moringa leaf extract, and licorice extract have been shown to be useful organic additions to utilise in the current organic farming trend. It has decreased reliance on inorganic fertilisers in order to achieve sustainability while maintaining quality and quantity.

A new generation of natural organic fertilisers called seaweed extract is extremely nutritive, encourages faster development, and promotes yield and quality. Seaweed extracts include a lot of organic and mineral ingredients in them (micro- and macronutrients). (Alkharpotly *et al*., 2017).

Moringa oleifera (family: Moringaceae) is one of such alternatives, being investigated to ascertain its effect on growth and yield of crops and thus can be promoted among farmers as a possible supplement or substitute to inorganic fertilizers (Phiri, 2010). Additionally, moringa leaf extract is used to increase productivity and fruit quality by acting as a natural plant growth regulator.

One of the organic plant extracts is licorice root extract (*Glycyrrhiza glabrag*), which belongs to the Fabaceae plant family. It helps to increase the growth, yield, and quality of fruits since it contains considerable amount of carbohydrates, amino acids, and other essential nutrients (Hussein *et al.,* 2021).

MATERIALS AND METHODS

This study was carried out during 2021 and 2022 on four-year-old Pomegranate trees (*Punica granatum* L.) var. Bhagwa in Central farm of Dept. of Fruit Science, Horticultural College and Research Institute,

Periyakulam. All trees were selected based on their uniformity in growth, size and vigour which planted at 4×2 meters apart. Treatments of different bioextracts had been imposed on pomegranate *viz.* seaweed extract, botanical extracts of licorice root and moringa leaves extract of varied concentrations. The experiment was laid out in randomised block design with 3 replications comprising of 13 treatments and 5 plants for each treatment.

Treatment details.

Treatment	Treatment details
T_1	Seaweed extract 1%
T_2	Seaweed extract 2%
T_3	Seaweed extract 3%
T_4	Moringa leaf extract 2%
T_5	Moringa leaf extract 4%
T_6	Moringa leaf extract 6%
T_7	Licorice extract 0.5%
T_8	Licorice extract 1%
T_9	Licorice extract 1.5%
T_{10}	Seaweed extract 1% + Moringa leaf extract 2%+ Licorice extract 0.5%
T_{11}	Seaweed extract 2% + Moringa leaf extract 4%+ Licorice extract 1%
T_{12}	Seaweed extract 3% + Moringa leaf extract 6%+ Licorice extract 1.5%
T_{13}	Control

Foliar sprays of bioextracts were applied at three stages: first, with the emergence of new flushes following pruning; second, right before flowering; and third, during the stage of fruit set**.**

Observations recorded

Yield parameters. The yield was observed at the time of harvest and expressed in term of kg/tree and ten fruits were randomly taken from each replicate to study the physical properties (i.e., fruit length (cm), fruit diameter (cm), fruit weight (g) .and individual number of fruits per tree.

Quality parameters. After harvesting a sample of 10 mature fruits of each tree was taken at the harvest time to be used for determining the bio chemical properties i.e., the total soluble solids (T.S.S. degree brix) was measured by using a hand refractrometer and the acidity % as citric acid content using fresh juice with titration against 0.1 NaOH. The total sugars %, and juice content, ascorbic acid content were recorded and analysed as per the standard procedure.The data was subjected to statistical analysis.

RESULT AND DISCUSSION

Yield parameters. The data revealed that the different treatments had significant effect on yield parameters (Table 1). The maximum number of fruits per plant (63.44), yield (16.75 kg plant^{-1}) was recorded with application of T_{13} Seaweed extract 3% + Moringa leaf extract 6%+ Licorice extract 1.5% followed by T_{11} (Seaweed extract 2% + Moringa leaf extract 4%+ Licorice extract 1%) recorded maximum number of fruits per plant (57.61), yield (14.09 kg plant^{-1}) and treatment T_{13} (control) recorded minimum number of fruits per plant (43.51), yield (8.70kg plant^{-1}) has been recorded.

Table 1: Effect of biostimulants on number of fruits per tree and fruit yield (kg / plant) of pomegranate var. Bhagwa.

Sr. No.	Treatment details	Number of fruits per tree	Yield (kg/plant)
T_1	Seaweed extract 1%	47.32	9.91
T_2	Seaweed extract 2%	48.13	10.74
T_3	Seaweed extract 3%	48.87	11.26
T_4	Moringa leaf extract 2%	47.57	10.00
T_5	Moringa leaf extract 4%	48.46	11.38
T_6	Moringa leaf extract 6%	50.14	12.34
T_7	Licorice extract 0.5%	47.78	10.04
T_8	Licorice extract 1%	49.02	10.84
T_9	Licorice extract 1.5%	50.46	12.26
T_{10}	Seaweed extract 1% + Moringa leaf extract 2%+ Licorice extract 0.5%	54.30	12.67
T_{11}	Seaweed extract 2% + Moringa leaf extract 4%+ Licorice extract 1%	57.61	14.09
T_{12}	**Seaweed extract 3% + Moringa leaf extract 6%+ Licorice extract 1.5%**	**63.44**	**16.75**
T_{13}	Control	46.51	8.42
SE (d)		**1.09**	**0.31**
CD @ 5 % level		**2.26**	**0.65**

Maximum fruit length (8.66 cm), fruit breadth (8.71 cm) (Table 2), fruit weight (262.23 g) and aril weight (185.04), rind weight (78.13) (Table 3) were recorded with foliar spray of Seaweed extract 3% + Moringa leaf extract 6%+ Licorice extract 1.5% and minimum fruit length (6.52 cm), fruit breadth (7.16cm), fruit weight (181.05 g) and aril weight (109.80), rind weight (70.11) were recorded with spray of control.

The majority of the micro and macro nutrients present in the foliar spray with licorice extract, seaweed extract, and moringa leaf extract, as well as Mevalonic acid, which plays a positive role in establishing gibberellin

metabolic pathways and increases the internal level of gibberellin and improves the stimulation of the plant towards flowering, can be explained. Additionally, the presence of carbohydrates and salts increases the rate of persistent vegetative growth. These findings are consistent with the findings of Al-Musawi, (2018) in orange; Aly *et al*. (2020) in grapes and Hussein *et al.* (2021) in Pomegranate.

Table 2: Effect of biostimulants on fruit length (cm) and fruit breadth (cm) of pomegranate var. Bhagwa

Sr. No.	Treatment details	Fruit length (cm)	Fruit breadth (cm)
T_1	Seaweed extract 1%	6.66	7.24
T_2	Seaweed extract 2%	7.17	7.49
T_3	Seaweed extract 3%	7.25	7.55
T_4	Moringa leaf extract 2%	6.89	7.37
T_5	Moringa leaf extract 4%	7.45	7.73
T_6	Moringa leaf extract 6%	7.64	7.87
T_7	Licorice extract 0.5%	6.98	7.25
T_8	Licorice extract 1%	7.67	7.61
T_9	Licorice extract 1.5%	7.81	7.80
T_{10}	Seaweed extract 1% + Moringa leaf extract 2%+ Licorice extract 0.5%	7.15	7.84
T_{11}	Seaweed extract 2% + Moringa leaf extract 4%+ Licorice extract 1%	7.89	7.91
T_{12}	**Seaweed extract 3% + Moringa leaf extract 6%+ Licorice extract 1.5%**	**8.01**	**8.17**
T_{13}	Control	6.52	7.16
SE (d)		**0.13**	**0.14**
CD @ 5 % level		**0.27**	**0.30**

Table 3: Effect of biostimulants on fruit weight (g) and aril weight (g) and rind weight (g) of pomegranate var. Bhagwa.

Sr. No.	Treatment details	Individual fruit weight (g)	Aril weight (g)	Rind weight (g)
T_1	Seaweed extract 1%	209.57	137.08	71.49
T_2	Seaweed extract 2%	223.16	150.67	71.98
T_3	Seaweed extract 3%	230.49	156.41	74.00
T_4	Moringa leaf extract 2%	210.34	138.07	71.46
T_5	Moringa leaf extract 4%	235.00	159.73	73.07
T_6	Moringa leaf extract 6%	240.10	165.09	74.46
T_7	Licorice extract 0.5%	210.23	138.54	71.96
T_8	Licorice extract 1%	221.24	149.18	72.40
T_9	Licorice extract 1.5%	243.00	169.25	73.64
T_{10}	Seaweed extract 1% + Moringa leaf extract 2%+ Licorice extract 0.5%	233.45	156.01	74.65
T_{11}	Seaweed extract 2% + Moringa leaf extract 4%+ Licorice extract 1%	244.60	167.33	76.90
T_{12}	**Seaweed extract 3% + Moringa leaf extract 6%+ Licorice extract 1.5%**	**264.67**	**185.04**	**78.13**
T_{13}	Control	181.05	109.80	70.11
SE (d)		**4.65**		**2.65**
CD @ 5 % level		**9.60**		**5.47**

Quality parameters. Foliar spray of various sources of bioextract significantly influenced the fruit quality parameters of pomegranate (Table 4). Results of the present study on advancing the quality of pomegranate fruits indicated that foliar spray of Seaweed extract 3% + Moringa leaf extract 6% + Licorice extract 1.5% (T_{12}) has recorded maximum TSS (14.11 ° Brix) by reducing the titratable acidity content (0.38 %) and ascorbic acid content (14.01) (Table 5) total sugars (13.81), and juice content (46.73), which was significantly higher over other treatments, while the minimum TSS (11.06 ° Brix), highest titratable acidity (0.49 %) and total sugars (10.43), and juice content (40.20), ascorbic acid content (12.34) were found in the control (T_{13}).

The findings were mostly attributable to the iron and magnesium found in licorice extract, which raises the proportion of total soluble solid in plant cells and improves water retention. Spraying with licorice extract resulted in the low titratable acidity. Abd El-Hamied *et al.* (2015) found that spraying this extract on pears' fruits decreased their overall acidity. They also found that this extract enhanced the ascorbic acid content of fruits. The foliar application of MLE had a substantial impact on biochemical variables such TSS, vitamin C, total sugars, as well as non-reducing and reducing sugars. The high concentrations of starch, sugar, zinc, and potassium in MLE may be responsible for this rise. Potassium is directly in charge of the movement of carbohydrates from the source (leaves) to the sink (fruits). Zn causes the activation of several photosynthesis-related enzymes, which produces a significant amount of carbohydrates. The similar findings were reported by Kassem (2021) in pomegranate, Hussein *et al*., (2008) in date palms and Nasira *et al.* (2016) in 'Kinnow' mandarin.

Table 4: Effect of biostimulants on TSS (° brix), titratable acidity (%) and ascorbic acid (mg per 100 g) of pomegranate var. Bhagwa.

Sr. No.	Treatment details	TSS (°Brix)	Titratable acidity (%)	Ascorbic acid (mg/100g)
T_1	Seaweed extract 1%	11.96	0.46	12.39
T_2	Seaweed extract 2%	12.55	0.45	12.56
T_3	Seaweed extract 3%	13.72	0.42	13.13
T_4	Moringa leaf extract 2%	12.35	0.44	12.68
T_5	Moringa leaf extract 4%	13.66	0.43	13.01
T_6	Moringa leaf extract 6%	14.01	0.40	13.35
T_7	Licorice extract 0.5%	11.99	0.47	12.59
T_8	Licorice extract 1%	12.06	0.43	13.17
T_9	Licorice extract 1.5%	12.41	0.45	13.45
T_{10}	Seaweed extract 1% + Moringa leaf extract 2%+ Licorice extract 0.5%	13.80	0.42	12.96
T_{11}	Seaweed extract 2% + Moringa leaf extract 4%+ Licorice extract 1%	14.05	0.40	13.80
T_{12}	**Seaweed extract 3% + Moringa leaf extract 6%+ Licorice extract 1.5%**	**14.11**	0.38	**14.01**
T_{13}	Control	11.60	0.49	12.34
SE (d)		**0.23**	**0.009**	**0.23**
CD @ 5 % level		**0.48**	**0.02**	**0.48**

Table 5: Effect of biostimulants on total sugars (%) and juice content (%) of pomegranate var. Bhagwa

S.No.	Treatment details	Total sugars (%)	Juice content (%)
T_1	Seaweed extract 1%	10.74	41.37
T_2	Seaweed extract 2%	11.53	42.43
T_3	Seaweed extract 3%	12.38	43.71
T_4	Moringa leaf extract 2%	11.76	41.73
T_5	Moringa leaf extract 4%	12.54	42.31
T_6	Moringa leaf extract 6%	13.01	44.20
T_7	Licorice extract 0.5%	10.67	41.25
T_8	Licorice extract 1%	11.50	42.00
T_9	Licorice extract 1.5%	11.75	42.81
T_{10}	Seaweed extract 1% + Moringa leaf extract 2%+ Licorice extract 0.5%	12.28	41.98
T_{11}	Seaweed extract 2% + Moringa leaf extract 4%+ Licorice extract 1%	13.23	44.76
T_{12}	**Seaweed extract 3% + Moringa leaf extract 6%+ Licorice extract 1.5%**	**13.81**	**46.73**
T_{13}	Control	10.43	40.20
SE (d)		**0.23**	**0.98**
CD @ 5 % level		**0.48**	**2.03**

CONCLUSION

Based on the results, it is concluded that the treatment T_{12} (Seaweed extract 3% + Moringa leaf extract 6% + Licorice extract 1.5%) improved the yield, and quality attributes of pomegranate cv. Bhagwa. Overall, it is inferred that these extracts (along with other natural materials) can be recommended to the farmers for use as natural plant extracts for various crops due to their elevated plausibility, high nutritional qualities, antioxidant influence, process ability, and greater efficiency in crop improvement.

FUTURE SCOPE

Future research need to be conducted using the treatment T_{12} (Seaweed extract 3% + Moringa leaf extract 6% + Licorice extract 1.5%) in order to increase the yield and quality benchmarks further for larger trials.

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Conflict of interest. None.

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