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Effect of plant biostimulants on flowering, fruit drop, yield and return bloom of pomegranate cv. KANDHARI KABULI

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ABSTRACT : In order to study the effect of foliar application of plant biostimulants on flowering, flower drop, yield and return bloom of pomegranate cv. Kandhari Kabuli**,** a field experiment was conducted in the pomegranate experimental block of the Department of Fruit Science, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. The experiment consisted of 19 treatments with three replications. The pomegranate trees cv. Kandhari Kabuli under investigation were subjected to different concentrations of biostimulants *viz.* Vipul (TRIA) (5 ml/l, 10 ml/l, 15 ml/l), Spic cytozyme (1 ml/l, 2 ml/l, 4 ml/l), Homobrassinolides (Godrej Double) (0.5 ml/l, 1 ml/l, 1.5 ml/l), Biozyme Crop Plus (1 ml/l, 2 ml/l, 3 ml/l) and Vipul + Homobrassinolides (0.5 + 5 ml/l, 1 + 5 ml/l, 1.5 + 5 ml/l, 5 + 0.5 ml/l, 5 + 1 ml/l, 5 + 1.5 ml/l). The results revealed that the plant biostimulants significantly improved flowering, yield, return bloom and reduced the fruit drop. The highest flowering, yield/plant and minimum fruit drop was recorded in trees treated with Spic cytozyme (4 ml/l) whereas the highest return bloom was observed with the application of Vipul (15ml/l).

KEY WORDS : Pomegranate, Flowering, Yield, Return bloom, Biostimulants

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Pomegranate (*Punica granatum* L.)is a small tree cultivated in Iran, Spain, Egypt, Baluchistan, Russia, France, Argentina, Iraq, Afghanistan and India. It also exists in wild/semi-wild in Syria, Mt. Carmel, Himachal Pradesh and Jammu and Kashmir (Himalayan ranges of mountains) of India. Generally, flowering in pomegranate is characterized as having both hermaphroditic (bisexual) flowers and functionally male flowers on the same plant, a condition referred to as andromonoecy (Wetzstein *et al*., 2011). In Himachal Pradesh, pomegranate is mainly cultivated under rainfed conditions and flowering occurs in April-May, when high temperature is an issue. Application of plant growth regulators can influence the sex expression and distribution of flower types in pomegranate. Gibberellic acid induced more male flowers and reduced hermaphrodite flowers, whereas ethrel and maleic hydrazide induced more hermaphrodite and fewer male flowers. Optimizing cultural conditions may be a means to promote the development of greater numbers of bisexual flowers with high vigor to obtain maximum fruit set and yield (Wetzstein *et al*., 2011).Vipul is a commercial formulation of triacontanol (TRIA) which is a long chain 30 carbon primary alcohol and occurs in nature as a natural constituent of bee wax and plant waxes. Biozyme Crop Plus is a commercial formulation of seaweed extract (*Ascophyllum nodosum*), enzymes and hydrolyzed proteins whereas, Spic cytozyme contain gibberellic acid, auxins, cytokinins, seaweed extract (*Ascophyllum nodosum*), hydrolysed proteins and trace elements. Godrej Double is a commercial formulation having homobrassinolides, belongs to brassinosteroids group of plant hormones. Brassinosteroids are relatively new endogenous phytohormones which was first isolated from pollen grains of *Brassica napus*, participate with other plant hormones in the regulation of numerous aspects of plant development, including shoot and root growth, vascular differentiation, fertility, and seed germination. The present study was therefore, carried out to find the suitability of these chemicals on the flowering and production of pomegranate.

RESEARCH METHODS

The experiment was conducted in the experimental orchard of the Department of Fruit Science, Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. The experimental orchard is situated between 31^0 N latitude and 77^0 E longitude at an altitude of 1276 m above mean sea level. Treatment plots were arranged in a randomized complete block design with 3 replications. The experiment consisted of 19 treatments with three replications laid out in Randomized Block Design. The biostimulants applied were vipul (5 ml/l, 10 ml/l, 15 ml/l), spic cytozyme (1 ml/l, 2 ml/l, 4 ml/l), homobrassinolides (0.5 ml/l, 1 ml/l, 1.5 ml/l), biozyme crop plus (1 ml/l, 2 ml/l, 3 ml/l), vipul + homobrassinolides (0.5 + 5 ml/l, 1 + 5 ml/l, 1.5 + 5 ml/l, 5 + 0.5 ml/l, 5 + 1 ml/l, 5 + 1.5 ml/l) and control (water spray). Seven years old pomegranate trees of cv. Kandhari Kabuli with uniform vigour and size, planted at a spacing of 3m x 3m were selected for the study. The biostimulants were applied 45 days after bud burst and repeated 10 days after fruit set. The solutions of biostimulants were prepared by dissolving them in water directly and sprayed with the help of foot sprayer. Spraying (four liters/tree) was done in a clear and calm day during the morning hours to obtain better effect till the leaves / twigs were wet and droplets of solutions started trickling down. Before spraying, 0.5ml of wetting agent (Indtron-AE) per litre of solution was added as surfactant to reduce surface tension and to facilitate the absorption of solution. The observations in respect of flowering was taken by selecting four branches of one meter length on east, west, south and north sides of the periphery of each tree and the number of flowers were counted and the results were expressed in percentage. The fruit drop was calculated by counting the number of fruits dropped from each tree and expressed in percentage. The yield was recorded at the time of harvest and expressed in terms of kg/plant. The return bloom was determined by counting the numbers of flower buds on four branches of one meter length in the current year and in the previous year and then, return bloom was expressed in percentage. The data recorded was analyzed using the statistical procedure as described by Gomez and Gomez (1984).

RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation are summarized in the following sub heads :

Flowering and return bloom:

The observations in Table 1 revealed that the biostimulants significantly increased the flowering percentage. The per cent flowering varied from 64.94 to 78.77 per cent and the maximum flowering (78.77 %) was recorded in treatment T_6 (spic cytozyme 4ml/l) which was significantly superior to all other treatments, followed by treatments T_5 (71.57 %), T_{12}

Table 1: Effect of biostimulants on flowering and return bloom of pomegranate cv. KANDHARI KABULI

Treatments		Concentration (ml/l)	Previous year flowering (%)	Flowering (%)	Return bloom (%)
T_1	Vipul	5	*48.49 (44.13)	*67.92 (55.51)	**105.21 (2.02)
T_2	Vipul	10	54.69 (47.73)	68.32 (55.75)	115.76 (2.06)
T_3	Vipul	15	56.14 (48.57)	69.47 (56.46)	129.23 (2.11)
T_4	Cytozyme	1	52.23 (46.29)	70.75 (57.26)	106.19 (2.02)
T_5	Cytozyme	2	46.12 (42.65)	71.57 (57.78)	109.05 (2.03)
T_6	Cytozyme	4	47.22 (43.41)	78.77 (62.57)	111.24 (2.04)
T_7	HBRs	0.5	60.92 (51.35)	66.02 (54.35)	105.58 (2.02)
T_8	HBRs	1	53.34 (46.93)	66.90 (54.88)	108.01 (2.03)
T_9	HBRs	1.5	50.63 (45.36)	68.90 (56.11)	110.13 (2.04)
T_{10}	Biozyme	1	61.34 (51.59)	66.74 (54.78)	107.34 (2.03)
T_{11}	Biozyme	2	56.01 (48.49)	69.21 (56.30)	111.14 (2.04)
T_{12}	Biozyme	3	59.98 (50.81)	70.88 (57.34)	115.40 (2.06)
T_{13}	Vipul+HBRs	0.5 +5	59.04 (50.26)	69.68 (56.59)	112.69 (2.05)
T_{14}	Vipul+HBRs	1 +5	55.81 (48.42)	69.96 (56.77)	114.14 (2.05)
T_{15}	Vipul+ HBRs	1.5 +5	53.29 (46.90)	70.32 (56.99)	114.16 (2.05)
T_{16}	Vipul+HBRs	5 +0.5	56.43 (48.73)	68.90 (56.10)	107.93 (2.03)
T_{17}	Vipul+HBRs	5 +1	57.65 (49.42)	69.06 (56.20)	109.42 (2.03)
T_{18}	Vipul+HBRs	5 +1.5	57.29 (49.25)	69.76 (56.64)	111.98 (2.04)
T_{19}	Control	Water Spray	61.13 (51.48)	64.94 (53.70)	104.91 (2.02)
	C.D. (P=0.05)		NS	1.05	1.16

*Figures in parenthesis are arc sine transformed values. NS=Non-significant

**Figures in parenthesis are logarithmic transformed values.

(70.88 %) and T_4 (70.75 %). Spic cytozyme is known to have the activity of cytokinins and auxins which retard abscission (Taiz and Zeiger, 2006). Cytokinins and auxins are also known to stimulate flower bud initiation (Wetzstein *et al*., 2011) hence, the increase in flowering with the application of spic cytozyme may be due to enhanced photosynthesis which increased the potential of trees to develop more flower buds in subsequent year. Use of actiwave (seaweed extract) on apple trees reduced the oscillation between the "on" and "off" year and thus moderated the negative effects of biennial bearing (Spinelli *et al*., 2009). The minimum flowering (64.94%) was observed in treatment T_{19} (control) which was significantly lower than all other treatments. The perusal of data further showed that the mean value of per cent flowering obtained from all the concentrations of spic cytozyme was highest (70.73%).

The data given in Table 1 also revealed the effect of biostimulants on return bloom in pomegranate trees. After the application of biostimulants, the return bloom varied from 104.91 to 129.23 per cent. The maximum return bloom (129.23 %) was recorded in the trees treated with vipul (15ml/l) and was significantly superior to all other treatments followed by treatment T_2 (115.76%) and T_{12} (115.40%). The mean value of return bloom obtained from all the concentrations of vipul was highest (116.73 %). This might be due to the reason that vipul resulted in availability of more metabolites and homobrassinolides (HBRs) that may have reduced the abscission process and enhanced resistance to water stress (Fujioka, 1997). This in turn, may have resulted in increased retention of flower buds thereby, increasing the return bloom. The minimum return bloom was observed in treatment T_{19} (104.91%) which was statistically similar with T_1 (105.21%) and T_7 (105.58%).

Flower drop:

All the treatments of biostimulants influenced the flower drop in comparison to control (Table 2). The minimum flower drop (57.23 %) was recorded in treatment T_{15} (Vipul + HBRs 1.5 + 5ml/l) which was significantly superior to all other treatments and was closely followed by treatment T_{14} (59.00%, 41.00 %), respectively. Reduced flower drop may be due to delay in abscission (the effect of cytokinins and auxins) through preservation of loss of pectin material in middle lamella (Kachave and Bhosale, 2007), influenced sex expression (Chaudhari and Desai, 1993) and promotion of tube growth may have lead to better fruit set and thus prevented flower drop. Reduction in flower drop with vipul application may be due to the reason that it may have increased carbohydrates levels and C/N ratio (Sharma, 1990). Moreover, reduced flower drop due to HBRs is in line with the application of GA_3 + brassinosteroids + BA in Thompson Seedless grapes (Warusavitharana *et al.,* 2008). HBRs are known to facilitate pollen tube growth (Mussig, 2005), retard abscission, enhance resistance to water, nutrient stress (Fujioka, 1997), enhanced photosynthesis and mobilization of metabolites to the flowers

Table 2 : Effect of plant biostimulants on fruit drop and yield of pomegranate cv. KANDHARI KABULI

Treatments		Concentration (ml/l)	Flower drop (%)	Fruit drop (%)	Yield (kg/plant)
T_1	Vipul	31.77 (34.31)	5	24.67 (4.96)	19.00
T_2	Vipul	32.78 (34.93)	10	19.50 (4.41)	19.33
T_3	Vipul	34.82 (36.17)	15	17.00 (4.12)	21.33
T_4	Cytozyme	34.37 (35.89)	1	22.67 (4.75)	19.00
T_5	Cytozyme	34.84 (36.18)	2	17.33 (4.16)	21.00
T_6	Cytozyme	38.60 (38.41)	4	15.67 (3.95)	24.33
T_7	HBRs	31.03 (33.85)	0.5	26.00 (5.09)	18.00
T_8	HBRs	33.24 (35.21)	1	24.67 (4.96)	18.33
T_9	HBRs	34.74 (36.11)	1.5	24.50 (4.94)	19.50
T_{10}	Biozyme	34.85 (36.18)	1	23.00 (4.79)	19.00
T_{11}	Biozyme	35.56 (36.61)	2	18.67 (4.32)	21.00
T_{12}	Biozyme	37.67 (37.86)	3	16.33 (4.03)	22.00
T_{13}	Vipul+HBRs	38.67 (38.45)	0.5 +5	22.33 (4.72)	20.83
T_{14}	Vipul+HBRs	41.00 (39.81)	1 +5	21.00 (4.58)	21.53
T_{15}	Vipul+ HBRs	42.77 (40.84)	1.5 +5	19.33 (4.39)	22.00
T_{16}	Vipul+HBRs	32.59 (34.81)	5 +0.5	23.00 (4.79)	19.67
T_{17}	Vipul+HBRs	34.07 (35.71)	5 +1	23.33 (4.82)	20.33
T_{18}	Vipul+HBRs	35.75 (36.72)	5 +1.5	19.50 (4.41)	21.00
T_{19}	Control	27.79 (31.81)	Water Spray	26.33 (5.13)	18.00
	C.D. (P=0.05)	1.16		2.05	1.46

Figures in parenthesis are square root transformed values

(Bhatia and Kaur, 1997) which resulted in less flower drop. Homobrassinolides is the sixth group of growth promoting hormones with broad spectrum of physiomorphological responses that influence the levels of nucleic acids, increase nitrogen fixation and enhance soluble protein content, photosynthesis, cell division and cell expansion (Fujioka, 1997). The maximum flower drop (72.21 %) was observed in treatment T_{19} (control) which was significantly lower than all other treatments. The results further show that the mean value of flower drop obtained from all the concentrations of vipul + HBRs was least followed by biozyme crop plus, spic cytozyme, vipul and HBRs.

Fruit drop and yield:

The biostimulants significantly reduced the fruit drop and the fruit drop varied from 15.67 to 26.33 per cent. The minimum fruit drop (15.67%) was recorded in trees treated with spic cytozyme (4 ml/l) which was statistically at par with T_{12} (16.33%), T_3 (17.00%) and T_5 (17.33%). The results further, showed that the mean value of fruit drop obtained from all the concentrations of spic cytozyme was minimum (18.56 %). Reduced fruit drop with Spic cyotzyme may be due the effect of cytokinins and auxins which increased the sink strength of the fruits (Taiz and Zeiger, 2006) associated with increase in the mobility of water and nutrients to the fruits thus reduced the stress condition and prevented fruit drop. The results pertaining to least fruit drop with various biostimulants are in conformity with the work of (Hoang, 2003) who recorded reduced fruit drop in pomegranate cv. G-137 with NAA. Maximum fruit drop (26.33%) was recorded in treatment T_{19} (control) which was statistically at par with T_7 (26.00%), T_1 (24.67%), T_8 (24.67%), and T_9 (24.50%) treatments. The fruit yield varied from18.00 to 24.33 kg per plant. Maximum yield (24.33 kg) was recorded in treatment T_6 (spic cytozyme 4ml/l) which was significantly superior to all other treatments and was followed by treatment T_{15} and T_{12} (22.00 kg), T_{14} (21.53 kg), T_3 (21.33 kg), T_5 (21.00 kg), T_{11} (21.00 kg) and T_{18} (21.00 kg). Comparison of all the treatments revealed that the mean value of fruit yield obtained from all the concentrations of spic cytozyme was highest followed by the mean value of vipul + homobrassinolides (HBRs), biozyme crop plus, vipul and homobrassinolides (HBRs), respectively. Increase in fruit yield with biostimulants is attributed to increased flowering, fruit set, fruit size and reduction in fruit cracking and fruit drop. Spic cytozyme improved the photosynthesis and the movement of metabolites and nutrients into the developing fruits and increased endogenous auxin content (Virzilov and Mihteleva, 1968) that resulted in higher yields. Further, the plants remained photosynthetically more active to build up sufficient food stock for developing flowers and fruits which ultimately, resulted in higher yield (Ramteke and Somkuwar, 2005). The increase in yield with the application of spic cytozyme is in consonance with the results obtained by Pawar *et al.* (2005) and Singh (2008) with GA_3 and NAA in pomegranate has been observed. The minimum fruit yield (18.00 kg) was observed in treatment T_{19} (control).

Conclusion:

From the foregoing discussion, it can be concluded that the plant biostimulants significantly improved flowering, yield, return bloom and reduced the flower drop and fruit drop. The highest flowering, yield/plant and minimum fruit drop was recorded in trees treated with spic cytozyme (4 ml/l) whereas the highest return bloom was observed with the application of vipul (15ml/l) and the reduced flower drop was recorded with the application of vipul + homobrassinolides (1.5 + 5 ml/l).

REFERENCES

Bhatia, D.S. and Kaur, J. (1997). Effect of homobrassinolide and humicil on chlorophyll content, hill activity and yield components in mungbean (*Vigna radiate* L. Wilczek).*Phytomorphol.,* **47**(4): 421-426.

Chaudhari, S.M. and Desai, U.T. (1993). Effects of plant growth regulators on flower sex in pomegranate (*Punica granatum* L.). *Indian J. Agrc. Sci*., **63**:34–35.

Fujioka, S.S.A. (1997). Biosynthesis and metabolism of brassinosteroids. *Physiologia Plantarum,* **100**: 710-715.

Gomez, K.A. and Gomez, A.A. (1984). *Statistical procedure for agricultural research* (2nd Ed.), John Willey and Sons Inc, New York, 680p.

Hoang, N.H. (2003). Effect of plant growth regulators and other chemicals on fruit thinning, fruit drop, yield and quality in pomegranate (*Punica granatum* L.) cv. G-137. M.Sc. Thesis, Dr Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan, H.P., India.

Kachave, D.B. and Bhosale, A.M. (2007). Effect of plant growth regulators and micronutrients on fruitng and yield parameters of Kagzi lime (*Citrus aurantifolia* Swingle) fruits. *Asian J. Hort.,* **2**(2): 75-79.

Mussig, C. (2005). Brassinosteroid-promoted growth. *Plant Biol.,* **7**: 110-117.

Pawar, P.S., Jagtap, D.D., Garad, B.V. and Shirsath, H.K. (2005). Effect of plant growth regulators on maturity, yield and fruit weight of pomegranate cv. Mridula. *Adv. Plant Sci.,* **18**(1): 167-170.

Ramteke, S.D. and Somkuwar, R.G. (2005). Effect of homobrassinolide on yield, quality and storage life in Thompson seedless grape. *Indian J. Plant Physiol.,* **10**(2): 179-181.

Sharma, D.P. (1990). Effect of some bioregulators on growth, yield, fruit quality and nutrient status of apple. M.Sc. Thesis, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, H.P. India.

Singh, G. (2008). Effect of irrigation, foliar fertilization and plant bioregulators on growth, yield and quality of pomegranate cv. G-137. Ph.D. Thesis, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, H.P. (INDIA).

Spinelli, F., Fiori, G., Noferini, M., Sprocatti, M. and Costa, G. (2009). Perspectives on the use of a seaweed extract to moderate the negative effects of alternate bearing in apple trees. *J. Hort. Sci. & Biotechnol.,* **84**:131-137.

Taiz, L. and Zeiger, E. (2006). Plant Physiology. (2nd ed.), Sinauer Associates Publishers. Sunderland. pp. 617-634.

Warusavitharana, A.J., Tambe, T.B. and Kshirsagar, D.B. (2008). Effect of cytokinins and brassinosteroid with gibberellic acid on yield and quality of Thompson Seedless grapes. *Acta Hort.,* **785**: 217-223.

Wetzstein, H.Y., Ravid, N. and Wilkins, E. (2011). A morphological and histological characterization of bisexual and male flower types in pomegranate. *J. Amer. Soc. Hort. Sci.,* **136** (2):83–92.

Virzilov, V.F. and Mihteleva, L. A. (1968). Effect of growth substances on the ripening and yield of tomatoes. *Bull. Glav Bot. Sada,* **69**: 37-47.

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