Advances in Bioresearch
Adv. Biores., Vol 14 (5) September 2023: 408-411

Print ISSN 0976-4585; Online ISSN 2277-1573
Journal's URL:http://www.soeagra.com/abr.html
CODEN: ABRDC3
DOI: 10.15515/abr.0976-4585.14.5.408411

Advances in Bioresearch

SHORT COMMUNICATION

Applications of Amino acids, Humic acids and Sea weed extracts on Pomegranate (*Punica granatum* L.) Plants to increase yield, organic carbon in soil and uptake nutrients

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ABSTRACT
Present research paper emphasizes on beneficial impacts of PGRs Plant Growth Regulators on Pomegranate (Punica granatum L.) fa-Punicaceae. Various combinations of PGRs amino acids, sea weed extracts, humic acids for soil and foliar applications were prepared. Applied on plant on leaves and root and revealed its impressive results. Dramatically it has been proved that use of PGRs in the Pomegranate fields found helpful to improve resistance against pathogens, vigour, quality, quantity and crop yield has been increased during this research study. From the flowering, setting of fruits, root development, plant vigour etc. Parameters with every minute details, events were checked and recorded. Comparing untreated control crops @15 days interval keen observations were made and it is detected that PGRs are responsible for increasing organic carbon in soil resulting luxurious growth of Pomegranate orchards. It's too important to introduce/adopt, adapt and maintain routine trend of organic farming methods in Agriculture. Matter in this paper is helpful for directing agriculture towards sustainable organic farming methods to avoid risks of Pesticide residue related effects on human health. Second purpose is to increase organic carbon in soil and increase awareness about it. Present study was carried out during various seasons/ bahar of Pomegranate in year2022 in Shripur village of Solapur district of Maharashtra. Matter in this paper is defining the importance of to understand application PGRs to higher plants and their positive effects on plant physiology improving yield.
Key words-*PGRs, pollution, organic farming, residue, organic carbon.*

Received 11.05.2023 Revised 21.07.2023 Accepted 25.09.2023

How to cite this article:
Randive S.N, Suryavanshi C.S and Dhainje P.M. Applications of Amino acids, Humic acids and Sea weed extracts on Pomegranate (*Punica granatum* L.) Plants to increase yield, organic carbon in soil and uptake nutrients. Adv. Biores. Vol 14 [5] September. 2023. 408-411.

INTRODUCTION

Pomegranate (*Punica granatum* L.)-Punicaceae is one of ancient and widely practiced plant to produce The edible parts of the fruit of Pomegranate which sweet arils comprise juice. Fruits of Pomegranates are rich source of more antioxidantsCalories, Proteins, Fat, Carbohydrates and Fibres [3].

Present research paper emphasizes on beneficial impacts of PGRs Plant Growth Regulators combinations of amino acids, sea weed extracts, humic acids on Pomegranate (*Punica granatum* L.) plant and its impressive results. We conducted research experiments in Shripur village of Solapur district of Maharashtra.PGRs in the Pomegranate fields found helpful improve resistance against pathogens, vigour, quality, quantity and improved crop yield during research field plots. From the events flowering, setting of fruits, root development, plant vigor etc. Parameters like flowering, fruit setting, root development, nutrients uptake etc. were checked and compared with control field crops at every 15 days *interval*.

It is too important to introduce/adopt, adapt and maintain routine trend of organic farming methods in Agriculture. Matter in this paper is helpful for directing agriculture towards sustainable organic farming methods to avoid risks related Pesticide effects on human health. Second purpose *is to increase organic carbon in soil and increase awareness about it among farmers and whole agriculture industry.*

Now a days PGRs like amino acids, sea weed extracts, humic acids are trending as well as helpful in agriculture to improve quality and quantity (morphologically) of crop and its products. Plant Growth Regulators PGRs like amino acids, sea weed extracts and humic acids plays important role plant physiology of Pomegranate (Punica granatum L.). Practically it has proved that use of PGRs in the Pomegranate fields found helpful improve resistance against air borne/soil borne pathogens/diseases and improve crop yield.

Agro-climatic conditions of Maharashtra are favorable for Pomegranate. Farmers prefer Pomegranate practices throughout the year. Pomegranate (Punica granatum L.) is the major horticulture crop cultivated in villages of Malshiras tehsil, Dist. Solapur as well as nearby areas of Pune district.
Pomegranate gives assurance for economic profits so it is necessary to adopt some innovative ideas in agriculture. Out of three flowering seasons, viz., Amba bahar January-February; Mrig bahar June-July and Hasta bahar September-October farmers prefer mrig & ambia bahar to attain maximum yield.

MATERIAL AND METHODS

We conducted several types of experiments based on plant physiological properties and soil parameters in the Pomegranate fields of villageShripur, TalMalshiras. During every visit @15 days interval samplings were collected like root, stem, leaves, flowers, fruits used for further investigations.
Plant material-
Commercially grown twelve years old Pomegranate (*Punica granatum* L.) trees were selected in the Research Orchard. All cultivars were planted at 8 ft. (8 x 8). distance between two plants in row and 10ft. distance kept within rows to practice various agronomic practices.
PGRs amino acids, sea weed extracts, humic acids on are applied on Pomegranate plants spraying (foliar) as well as drenching (root) methods.
PGRs treatments soil application and foliar spray were given during various stages of plant[1]. During soil preparations, in farmers language basal doses for Plants were applied with different graded doses of N (0-300g/plant), P2O5 (0-150g/plant) and K2 O (0-300g/plant) in the form of urea, single super phosphate and muriate of potash respectively. These fertilizers combinations added in soil particularly in rhizosphere of plants. During plant developmental stages early blooming; fruit setting; full bloom + fruit setting on other hand untreated trees were kept as control to compare and judge effects.

Table 1.Preparations of required formulations for Soil application and foliar spray.

Sr. NO	Type of PGR	Technical Purity	Type of application	
			Soil/Plant	Foliar/Lit
1	Humic Acid powder	60%	10-20gm	2gm/lit
2	Amino Acids	80%	5-10gm	2gm/lit
3	Sea Weeds extracts	95%	10-20gm	2gm/lit

To emphasize an importance plant growth regulators (PGRs) Humic acid(Has), Amino Acids (AA) and Sea weeds were taken into consideration to find out they are acting as growth and physiological parameters by increasing Organic Carbon* in soil. Reduced organic carbon in soil is one major cause responsible in yield decrease.

Table 2.Preparations of required formulations for Soil application Drenching and foliar spray (Combination). [3]

Formulae and Calculations -		
1) Humic Acid powder	(Technical Purity 60%)	4/60X100 = 6.66 kg (required for 4% solution)
2) Amino Acids	(Technical Purity 80%)	8/80X100 = 10.00 kg (required for 8% solution)
3) Sea Weeds extracts	(Technical Purity 95%)	4/95 X 100 = 4.21 kg (required for 4% solution)

Humic acids are organic compounds that are important components of humus useful for luxurious growth of soil flora and fauna consequently i.e. Soil carbon.
Humic acid, Amino Acids (AA) and Sea weeds were used to treat Pomegranate plants in trial plots. Above mentioned PGRs were used on an individual basis as well as in combinations.
Aqueous solutions of different types were prepared using PGRs were diluted with the required amount of water for foliar application i.e. with different concentrations, on account of purity percentage of particular ingredient [6].
Fertilizer applications and irrigation practices kept constant for treated and controlled plants.PGRs applied only to trial plants to compare flowering, fruit setting [6], leaf greenery, roots and vigour results.
From the treated and control plot of flowers from five individual plants were count were taken and the mean value of was expressed in percentage. The number of flower per tree was recorded up to the time of fruit setting and expressed in percentage. The following formula was used.

[Fruit set percent = Number of fruits per tree / Number of flower per tree X 100]

Formula method was used to count fruit setting percentage.

By using formula,

Fruit setting percentage found in
i] Control plot 71% and
ii] Control plot 88%.

RESULTS AND DISCUSSION

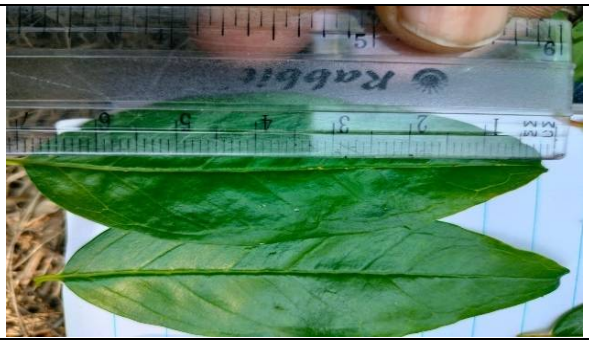
During this study positive results on flowering, fruit setting, root development (rhizosphere), greenery of plants and vigour in vegetative / morphological characters observed [1][5].

Amino Acids and Sea Weeds extracts combinations found helpful to improve plant physiology, protein synthesis, chlorophyll contents[1] because Amino acids are acting as precursors and constituents of proteins which are important for cell development ie. cell division, elongation[3][5].

Photograph slide-1.Plants showing Flowers and Greenery afterPGRs Application.

	
Flowers and Greenery	Fruit setting

Photograph slide-2.Leaves showing difference from controlled and treated plants.Vegetative characters improvement, protein synthesis, and chlorophyll content and plant physiology [5].

	
Leaves from controlled plants (Nutrients deficiency and less greenery)	Leaves from treated plants (Negligible nutrients deficiency and maximum Greenery)

Humic acids positive effect on vegetative growth, reproductive growth, and quality of soil Organic Carbon* Humic acids (HA), the major component of soil organic matter [1].It showed major benefit for soil chemistry and fertility, soil micro flora and fauna [7]. Soil samples were taken in order to determine the physical and chemical properties. Sample was collected at a depth of 10-20 cm, randomly from various locations of plot where PGRs were applied. Soil sample was dried, crushed, and tested in laboratory for various properties.

As per an authentic data Govt. Department of Agriculture says required Organic Carbon* in soil must be 5% but unfortunately analysis of soils in all over Maharashtra are showing below 1%i.e. 0.25-0.37%.

This study explores importance of Organic Carbon*and figures are proving that Organic Carbon* can be increased by applying PGRs Amino acids, Humic acids, Sea weed extracts are improving soil Organic Carbon*(table No 3).

Table no.3 Soil analysis values of nutrients found after application PGRs showing technical investigations.

Sr. No	Parameter	Unit	Soil	
			Before treatment	After treatment
1	pH	-	7.1	7.0
2	Electrical conductivity (EC)	Mhos/cm	1.2	1.4
3	Organic Carbon (OC)	%	**0.38**	**0.49***
4	Nitrogen (N)	Kg/ha	180	195
5	Phosphorous (P)	Kg/ha	16.8	17.2
6	Potash (K)	Kg/ha	205	221
7	Calcium (Ca)	%	7.0	7.3
8	Magnesium (Mg)	%	0.40	0.41
9	Sulphur (S)	%	1.05	1.10
10	Zinc sulphate (Zn)	ppm	0.35	0.38
11	Ferrous sulphate (Fe)	ppm	1.2	1.5
12	Copper (Cu)	ppm	0.07	0.08
13	Manganese (Mn)	ppm	0.7	0.8
14	Boron (B)	ppm	0.08	0.09

Instruments and lab techniques used to analyze soil.

1. Atomic Absorption Spectrophotometer (AAS) made CHEM BIOTECK.
2. UV visible spectrophotometer made CHEM BIOTECK for micronutrients.
3. Kjeldahl method Nitrogen (N) Determination Digestion and Distillation Apparatus.
4. A Muffle Furnace to detect Phosphorous (P).
5. Digital Flame Photometer for Potash (K) determination.

CONCLUSION

From the current results of this study, it could be concluded that amino acids 8%, sea weed extracts 4% Humic acid 4% for drenching. And for foliar spray amino acids 2gm/lit water, sea weed extracts 2gm/lit water Humic acid 2gm/lit water were found helpful to increase soil fertility and ultimately soil organic carbon.

Above studied PGRs can enhance flowering, fruit setting and greenery [5]. During the early stages of life it promotes white root development, rhizosphere enhancing uptake of water and nutrients [7].

The application of above said PGRs impressively increase the quantity of organic carbon in soil. So it can be strongly recommended to apply PGRs i.e. organic materials totally free from chemical residues in Agriculture to improve soil quality.

PGRs found helpful in reduction in drooping percentage of premature flowers, fruits with best fruit quality. It would be favorable to obtain high yield and

AKNOWLEDMENTS-

The authors are thankful Prof.R.L.Savlajkar Head of Botany Dept. Shankarrao Mohite Mahavidyalaya, Akluj-413101, and Dist. Solapur (M.S.) for providing laboratory and library, internet facilities.

We are grateful to Punjab Rao Pisal Shripur, Tal.Malshiras for granting permission, accompanying and guidance this project work in his Pomegranate field.

We are grateful to Prof, Kunal Kale Vidyaaniketan Professional Academy Indapur, Pune providing technical assistance for photography, computerized work, and economic assistance and providing facilities, vehicles to travel during frequent field visits.

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