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Effects of Phytohormone on seed germination and Primary metabolites of Foxtail millet; (Setaria italica)

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ABSTRACT

India is the largest producer of many kinds of millets, which are often referred as coarse cereals. However, realizing the nutrient richness of these grains they are now considered as" nutria-cereals. Small millets, as a group includes several grain crops namely finger millet (rage), kodo millet (varagu), and little (panivaragu). Though they occupy relatively a lower position among feed crops in Indian agriculture, they are quite important from the point of food security at regional and farm level.

Millets are not only important for rural livelihoods, but for urban ones as well given their nutritional qualities. Millets provide the much needed food and fodder security especially to the vulnerable groups. It is pertinent to note that food security at national level will only be effective when regionally important crops are allowed to play their due role in meeting food and fodder needs fo the region and thus avoiding the undesirable dependence on other regions as well as a fewer number of food crops for meeting food needs.

Foxtail millet (*Setaria italica L.*) has been cultivated for 7000 years or so. It is native to China and regarded as an elite drought – tolerant crop (Cheng and Liu, 2003) foxtail is semi arid crop grown in India and Asia and form a staple food for the lower socio – economic class especially during drought or famine. They are consumed traditionally as health and vitality foods by the labour class. Foxtail yellow seeded cultivars, medicinally used as astringent of dyspepsia, poor digestion and food stagnancy in abdomen (Yeung, 1985). White seeds are refrigerant and used in treatment of cholera and fever while the green seeds are diuretic and strengthening to virility (Duke and Ayensu, 1985). It is also revealed that no previous work was carried out to enhance the production potentiality, morpho-physiological traits and biochemical parameters related to primary productivity. Hence the present investigation was carried out to enrich the primary metabolite product using different concentration of Auxin, [Indole-3 Acetic Acid (IAA)].

KEYWORDS: Foxtail, Seed germination, Indole 3- Acetic Acid (IAA), *Setaria italica.*

INTRODUCTION

Foxtail Millet (*Setaria Italica*) has been cultivated for 7000 years or so. It is native to china and regarded as an elite drought- tolerant crop (Cheng and Liu, 2003). Foxtail is semi arid crop grown in India and Asia; it is food the lower social-economic class especially during drought or famine. It is also grows in North Bihar, Karnataka, West Bengal and Jharkhand. It is locally known as Kauni, China or Birds feed. They are consumed traditionally as health and vitality foods by the labor class.

Setaria comprises about 100 species distributed in the tropics, subtropics and temperate regions. In the tropics, it is grown up to 2000 – 3300m altitude. In India and china it is mainly grown in areas with the annual rainfall of 400- 800mm. It is also grown in Darbhanga district and Madhubani District of North Bihar.

Review of Literature also reveals that role of salinity on Foxtail cultivar has been regress and its effect on Carbohydrate, Protein and nutrients content by Hendawy *et. al.*, (2012). They found that the *Setaria italica* plants able to

response and adapt to change environments through the synthesis of specific proteins which can modify the cellular metabolism (Veerana gamallaiah *et. al.,* 2007. In our country salinity is the major environmental constraints to the crop productivity. Not only it effect on crop but it also hampers the cultivation of medicinal and aromatic plant (Bartels and Sunkar, 2005). Efforts also done to see the maximum mean value of nitrogen, phosphorus, Irons and Zinc content to the plant *setaria italica* either in standing crop or harvested crop. Thimmaiah *et. al.,* (1989); Wet *et. al.,* (1979).

Foxtail millet is so important because it has sulphur contain amino acid in sufficient amount and these amino acids are the unit of proteins. These are tryptophane – 0.99, threonine – 3.10, isoleucine -7.60, leucine -16.06, lysine -2.10, methionine -2.80, phenyl alanine -6.70, valine -6.90 arginine -3.60 and histidine -2.10 [Guru PAVITHRA *et. al.,* 2013]

Fig. 1: Seeds of Foxtail Millet

Fig. 2: Seeds of *Setaria italica* freshly harvested

MATERIALS AND METHODS

Preparation of different concentration of Auxin (Indole 3-Acetic Acid) 100 milligram of Indole-3 acetic Acetic Acid was dissolve in alkaline medium. 5 different concentrations ranging from 1 ppm to 5 ppm was prepared. 100 seeds of Foxtail millet were kept for 48 hours after dehusking of seeds.

(a) Preparation and extraction for biochemical analysis of primary metabolites;

(i) Qualitative and quantitative estimation of Sugars; 100 mg germinated seed pretreated with above concentrations of IAA was crushed in distilled water, supernatant were collected and made 1 ml after air drying.

(ii) Preparation developing solvent:

Sugars; butenol, glacial acetic Acid and distilled water were taken in separating funnel in a ratio of 3:1:1, after gentle rotation supernatant was taken in rectangular jar.

Amino Acid : 500 mg germinated seeds were crushed in 95% ethyl alcohol and supernatant was collected for estimation to preparation of developing solvent: butenol, acetic acid and water were taken into the ratio of 5:3:4 in separating funnel and rotated it gently supernatant was pored to rectangular jar.

Obtained results for qualitative estimation is posted in table – I.

Quantitative estimation of both Sugars and Amino Acids were also estimated. Using Chlorimetiric technique and obtain results are calculated and compared with the standard curve.

OBSERVATION AND DISCUSSION

Germination frequency and seed morphology:

Obtained data's are posted in the Table-1. From the table in control condition average seed germination was 46.66%. When it was pre-soaked with 4 ppm of IAA, percentage seed germination was reached up to 4.64%. Plumular length and radical length was also recorded and posted in table -I. It is also evidenced from the table use of 3 ppm was effective and plumule reached upto 4.91 cm. Like wise, radical reached upto 2.91cm. Hence Auxin (IAA) showed remarkable effect on seed germination or seedling growth.

Qualitative and quantitative estimation of sugars was done as recorded in materials and methods and result are posted in Table-II Qualitative estimation clearly indicate that presence of sugars in comparison control was in rising trends upto 3 ppm, and it reached upto 1.3 times in comparison to control. Likewise qualitative and quantitative estimation of

Amino acid were done and are posted in table-III. From the Table presence of Amino Acids like Arginine, Isoleucine, Leucine, Lysine and Methionine were enhanced 4 to 5 times in comparison to control.

From the Above Observation it is concluded that use of Indole- 3 Acetic Acid by pre-soaking before the seed sowing in field condition, is recommended to farmers because either in qualitative or quantitative presence of total sugar or amino acids.

Fig.3: Showing effect of Auxin, (IAA 10ppm) spraying after onset of inflorescence.

Fig.4: Showing seedling morphology with effect of phytohormones.

TABLE – I

Effects of different concentrations of Auxin [Indole-3- Acetic Acid (IAA)] on seed germination of Foxtail millet (*Setaria italica)* (Pre-soaked condition 48 hrs.). Data's obtained after 12 days of seed implantation; Results showing:

(a) Percentage seed germination;

	CONTROL	1ppm	2ppm	3ppm	4ppm	5ppm
I	46.66	50.00	53.33	56.66	60.00	53.33
II	43.33	43.33	46.66	63.33	63.33	56.66
III	50.00	46.66	50.00	53.33	56.66	60.00
Total	139.99	139.99	149.99	173.32	179.99	169.99
Average	46.66	46.66	49.99	57.77	**59.99**	56.66

(b) Length of plumule:

	CONTROL	1ppm	2ppm	3ppm	4ppm	5ppm
I	4.42	3.74	3.92	5.22	4.21	4.21
II	4.32	3.62	3.64	4.31	4.21	4.30
III	3.11	3.83	3.72	5.20	5.22	4.12
Total	11.25	11.19	11.28	14.73	13.64	12.63
Average	3.95	3.73	3.76	**4.91**	4.64	4.21

(c) Length of radical:

	CONTROL	1ppm	2ppm	3ppm	4ppm	5ppm
I	2.21	1.94	2.50	2.23	2.32	2.57
II	2.10	2.23	2.43	2.46	3.20	2.74
III	2.02	2.71	2.24	2.84	3.21	2.91
Total	6.33	6.88	7.17	7.53	8.73	8.22
Average	2.11	2.29	2.39	2.51	**2.91**	2.74

* Length in centimeter.

** Average of 30 seeds per plate.

*** Observation recorded after twelve days of implantation.

**** Experiments in triplicate of Room temperature and pressure (NTP).

TABLE – II (a)

Qualitative estimation of Amino Acids to germinated seeds of Foxtail Millet (*Setaria italica*) . Seeds were pretreated with different concentration of Indole 3-Acetic Acid (IAA) for 48 hours. Results recorded to twelve days old seedlings.

Amino Acid	Control	1ppm	2ppm	3ppm	4ppm	5ppm
Alanine	+	+	++	+++	++	++
Arginine	-	-	++	++	-	-
Aspartic acid	-	-	-	-	-	-
Cysteine	+	++	++	++	++	++
Glutamie	+	+	++	+++	+++	++
Glycine	-	-	-	-	-	-
Histidine	+	+	++	+++	++	++
Isoleucine	++	++	+++	+++	+++	+++
Leucine	++	++	+++	+++	+++	+++
Lysine	+++	+++	+++	+++	+++	+++
Methionine	+++	+++	+++	+++	+++	+++
Proline	++	++	++	++	++	++
Serine	++	++	++	++	++	++
Tryptophan	-	-	-	++	+++	+++

\+ =Less presence ++ =Mild presence +++ = Heavy presence

TABLE – II (b)

Quantitative estimation of Amino Acids to germinated seeds of Foxtail Millet (*Setaria italica*). Seeds were pretreated with different concentration of Indole Acetic Acid (IAA) for 48 hours. Results recorded to twelve days old seedlings.

Amino Acid	Control	1ppm	2ppm	3ppm	4ppm	5ppm
Alanine	.0038	.0038	.0158	**.0758**	.0161	.0162
Arginine	-	-	.0157	.0160	-	-
Aspartic acid	-	-	-	-	-	-
Cysteine	.0042	.0158	.0162	.0167	.0170	.0174
Glutamine	.0050	.0037	.0160	**.0763**	**.0773**	.0171
Glycine	-	-	-	-	-	-
Histidine	.0039	.0039	.0159	**.0765**	.0171	.0175
Isoleucine	.0159	.0161	**.0758**	**.0761**	**.0765**	**.0762**
Leucine	.0163	.0163	**.0760**	**.0763**	**.0769**	**.0770**
Lysine	**.0768**	**.0762**	**.0769**	**.0771**	**.0778**	**.0781**
Methionine	**.0759**	**.0759**	**.0764**	**.0767**	**.0769**	**.0770**
Proline	.0167	.0156	.0161	.0165	.0169	.0173
Serine	.0174	.0157	.0164	.0169	.0170	.0176
Tryptophan	-	-	-	.0166	**.0775**	**.0781**

TABLE – III (a)

Qualitative estimation of Reducing and Non Reducing Sugars to germinated seeds at of Foxtail Millet (*Setaria italica*).Seeds were pre-treated with different concentration of Indole 3-Acetic Acid (IAA) for 48 hours. Results recorded to twelve days old seedlings.

Reducing Sugar	Control	1ppm	2ppm	3ppm	4ppm	5ppm
Glucose	++	++	++	++	++	++
Fructose	++	++	++	++	++	++
Maltose	-	-	-	-	-	-
Lactose	++	-	-	-	-	-
Galactose	-	-	-	-	-	-
Sucrose	++	+	+	+	+	+

\+ =Less presence ++ =Mild presence +++ = Heavy presence

TABLE – III (b)

Quantitative estimation of Reducing and Non Reducing Sugars to germinated seeds at of Foxtail Millet (*Setaria italica*). Seed were pretreated with different concentration of Indole 3-Acetic Acid (IAA) for 48 hours. Results recorded to twelve days old seedlings.

Reducing Sugar	Control	1ppm	2ppm	3ppm	4ppm	5ppm
Glucose	.0573	.0590	.0602	.0630	.0640	.0625
Fructose	.0641	.0648	.0652	.0672	.0680	.0666
Maltose	-	-	-	-	-	-
Lactose	.0655	-	-	-	-	-
Galactose	-	-	-	-	-	.-
Sucrose	.0740	.0232	.0240	.0242	.0245	.0240

CONCLUSION

The qualitative estimation of amino acid of germinated seed pre-treated with different concentration of Indole 3-Acetic Acid (IAA) for 48 hours of Foxtail millet was recorded for 12 days old seedling. During the course of experiment under 1ppm, seed germination showed high presence of Lysine and Methionine. The observed data were recorded in table II.

Recorded data's explained that all the amino acids showed their maximum presence almost under different concentration of IAA (1ppm, 2ppm, 3ppm, 4ppm and 5ppm). Deep coloured amino acid after ninhydrin treatment warranted to record to its maximum dominance. In table it is very much posted and clearly indicated that Alanine, Glutamine, Histidine, Isoleucine, Leucine, Methionine and Tryptophan corresponded to the effect of different concentration of IAA.

Mild trace of Glucose and Fructose were observed at 1ppm, 2ppm, 3ppm, 4ppm and 5ppm and in control. Maltose, Lactose and Galactose were not present at any ppm of IAA and control. Lactose was present in mild trace in control condition.

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