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EFFECTS OF DIFFERENT CONCENTRATIONS OF NAA ON SHOOT PROLIFERATION AND ROOTING OF BANANA

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Chapter I

INTRODUCTION

Ref.: Kumar,v. and Uma, S. 2018. Hi-tech banana cultivation for enhancing the production and productivity of quality bananas.ICAR-NRCB,Tiruchirapali.

Classification of banana :

Kingdom: *Plantae,*
Order: *Zingiberales,*
Family: *Musaceae,*
Genus: *Musa*

Banana (*Musa sp.)* is the second most important fruit crop in India next to mango. It is nutritive,tasty,medicinal uses and affordable to all classes of people. Banana evolved in humid tropical regions of S.E.Asia with India as one of its centeres of origin. Modern edible varities have evolved from the two species-*Musaacuminata* and *Musabalbisiana*. Banana is a very popular fruit in India duet to its low price and high nutritive value. It is consumed in fresh and cooked both as ripe and raw fruit. Banana is a rich source of carbohydrate and is rich in vitamins particularly vitamin B. It is also a good source of magnesium, potassium, phosphorous, and

calcium. The fruit is easy to digest , free from fat and cholesterol. Banana powder is used as the first baby food. It helps in reducing risk of heart diseases when used regularly and is recommended for patients suffering from high blood pressure, arthritis, ulcer gastroenteritis and kidney disorders. Total area and production of horticulture crops in all India is about 30006MT /874ha in year 2018-2019. Worlds largest producers in 2017 were India and China ,38% of total world production. The G9 varieties of banana occupies over 1,64,000 ha

Bananas are grown in about 135 countries, leading producers countries. Brazil,Eucador,china,phillipines,Indonesia,Costarica,Mexico,Thailand,Colombia and Israel. Commercially, bananas are classified as dessert types and culinary types. The culinary types have starchy fruits and are used in the mature unripe form as vegetables.

Important cultivars include Dwarf Cavendish, Robusta, Monthan, Poovan, Nendran, Red banana, Nyali, Safed Velchi, Basrai, Ardhapuri, Rasthali, Karpurvalli, Karthali and Grand Naine . Grand naine ,an imported variety from Israel is gaining popularity and may soon become the most preferred variety due to its tolerance to abiotic stresses and good quality bunches. Leading banana producer states in India are Andhra Pradesh, Assam, Bihar, Gujrat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Tamilnadu and West Bengal. Important banana varities cultivated in Maharashtra are Dwarf Cavendish, Basrai, Robusta, Lal Velchi, Safed Velchi, Rajeli Nendran, Grand Naine, Shreemanti, Red Banana11

Farmer in Southeast Asia and Papua New Guinea first domesticated bananas. Recent archaeological and paleontology enviournmental evidence at Kuk Swamp in the Western highlands province of Papua New Guinea suggests that banana cultivation there goes back to at least 5000 BCE, and possibly to 8000 BCE .

The Indo Burma region is origin for a number of wild varities of banana .further studies also proved that the table variety of banana have originated in Malaysia. and the cooking varity is considered to be originated in South India. Banana cultivation is distributed throughout the world. Among the different banana cultivating countries, India ranks first both in area and production.

Tissue culture technique can produce disease free, healthy, high yielding,drought resistant plants from small vegetative part of plant. We can produce thousands of plants in few days .This technique helps in producing virus free plant, banana plantlets can be produced using suckers as explants, through this technique we can produce plantlets in any season by maintaining conditions like temperature control and light control. It helps speed up production of new varieties into the market. Plant tissue culture techniques have been developed as modern and worldwide accepted concept to improve the quality of propagated banana plants. The techniques of the plant tissue culture have been developed as a powerful tool for crop improvement and received wide attention of scientific words. Disease free good quality, pathogen free plant material as possible to produce through tissue culture . The regeneration of plant tissue culture techniques is an important and essential component of biotechnological research and required for the genetic manipulation of the plants. Tissue culture techniques have several advantage over traditional propagation methods.

Maharashtra is bthe principal producing state. The agriculture marketing board of the state has established **“Mahabanana”, a farmers** marketing organization in the year 2002 with headquarters at Jalgaon. There are 26 co-operative societies registered under Mahabanana and each such member society has 300-350 small and marginal farmers.

Global exports of bananas, excluding plantain, are expected to reach a new recordd high of 20.2million tones in 2019, an estimated increase of 5percent compared to 2018. Data from the first nine months of the year indicate that strong supply growth in Ecudor and the Philippines,

the two leading exporters, is again chiefly accountablefor this rise. Fast expansion in esports has also been recorded for Panama, which benefied from ample growth in nsupplies following the activation of a major banana production zone in the Baru district.

MATERIAL AND METHODS

Chapter II

MATERIALS AND METHODS

Experimental Details :-

The details of various material and methods were adopt during the course of present investigation are narrated in this chapter under suitable sub-heads.

2.1 Experimental site :-

The experiment was conduct in Ishved Biotech pvt.ltd.Sindkhed Raja, Buldhana .Through MGM College of Agricultural Biotechnology, Gandheli,Aurangabad ,during 2019-20 summer.

2.2 Experimental design :-

Statistical design

05

No. of treatments

No.ofreplicationc ompletelyRandomiz 04 ed Design (CRD)

2.3 Treatment details : Different Concentrations of NAA

Table No.1 :Different Concentration of NAA with constant BAP .

Treatments (T)	NAA (mg/ltr)	BAP(mg/ltr)
T_1	0.0	4
T_2	0.5	4
T_3	1.0	4
T_4	1.5	4
T_5	2.0	4

2.4 Collection of explant:- Disease free and healthy explants was collected from the field of the Ishved Biotecch Pvt. Ltd. , Sindkhed Raja, Buldhana.

2.5 Explant selection:- Sucker explants of banana 'GGN' cultivars which are selected from the healthy plants on the field .

2.6 Surface sterilization . : The explants were collected from the field of Ishved Biotech pvt. ltd., leaf and stem of suckers is removed cut into 8-10cm, are washed several time with tap water for 15 to 20 min and suckers are trimmed. Under laminar air flow layers are removed and cut into 4-6cm pieces then this suckers are dipped in T20 solution for 15-20 min. After that suckers given 3 wash of distilled water . Then 1% bavistine treatment is given for 30min, again 3 wash of autoclaved distilled water . 70% ethanol treatment given for 1 min,again 3 washes of autoclaved distilled water repeated. 0.1% mercuric chloride treatment given for 15 min,again 3 washes of autoclaved distilled water are repeated . Then finally suckers are trimmed into 2-3cm . This explants are inoculated in the incubated media bottles in three patterns 5 bottles of 1 culture, 10 bottles of 2 culture, 10 bottles of 3 culture.

2.7 Inoculation :-

Completely sterilized explants was inoculated on media. After inoculation culture bottles are transferred to growth under controlled conditions like temperature maintained about 25±2ºC and 16 hours photoperiod.

2.8 Culture media :-

Culture media (MS medium) prepared for micropropagation of banana cultivar 'GGN' as a basal medium supplemented with organic acids and vitamins ,pH of prepared media was adjusted 5.6 to 5.8.

For proliferation stage media was adjusted for concentration as follows,

BAP@ 4 mg/L and NAA for @ 0.0mg/ltr, 0.5mg/ltr, 1.0mg/ltr, 1.5mg/ltr, 2.0mg/ltr for maximum rooting and shoot proliferation.

2.9 Objectives :-

To find out the optimum concentrations of NAA with constant BAP on rooting of banana GGN (*Musa accuminata).*

) To find out the optimum concentrations of NAA with constant BAP on shoot proliferation of banana GGN (*Musa accuminata).*

2.10 Biometric observation:-

Number of shoot initiation

Shoot length

Number of root

Root length

RESULT OF THE PROGRAMME

Chapter III

RESULT OF THE PROGRAMME

The result obtained in the present investigation on "Effect of different concentration of NAA on shoot proliferation and rooting of banana *(Musa acuminata)*" was presented under the following headings.

Treatments (T)	NAA (mg/ltr)	Days required for rooting	Days required for shoot initiation
T_1	0.0	8	27
T_2	0.5	7	26
T_3	1.0	5	24
T_4	1.5	4	21
T_5	2.0	6	25

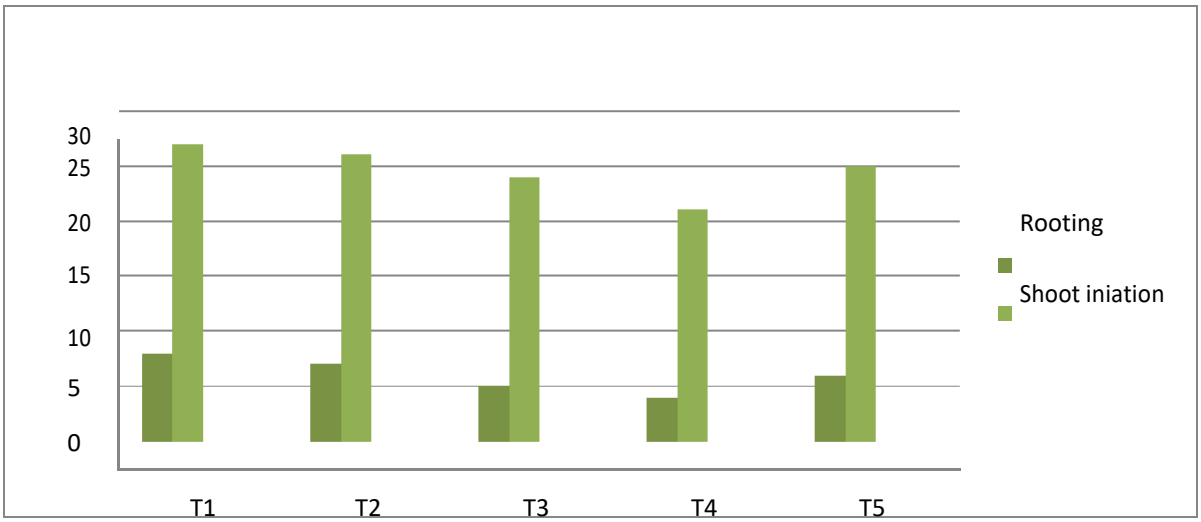

Fig.1. Effect of different concentrations of NAA with constant BAP on earlier for shoot initiation of banana.

Table 2. Effect of different concentrations of NAA and with constant BAP on number of shoot ,shoot length and No. of roots ,root length.

Culture/ bottle	**Crop physiology**	**TREATMENTS (mg/ltr)**				
		T1 BAP(4.0) + NAA(0.0)	**T2** BAP(4.0) + NAA(0.5)	**T3** BAP(4.0) + NAA(1.0)	**T4** BAP(4.0) + NAA(1.5)	**T5** BAP(4.0) + NAA(2.0)
1 culture/ bottle (5bottles)	**No.of shoots**	4	5	6	7	6
	Shoot length	2cm	5.5cm	6cm	7cm	4.5cm
	No.of roots	5	20	25	30	20
	Root length	2.5cm	4cm	4.5cm	5cm	5cm

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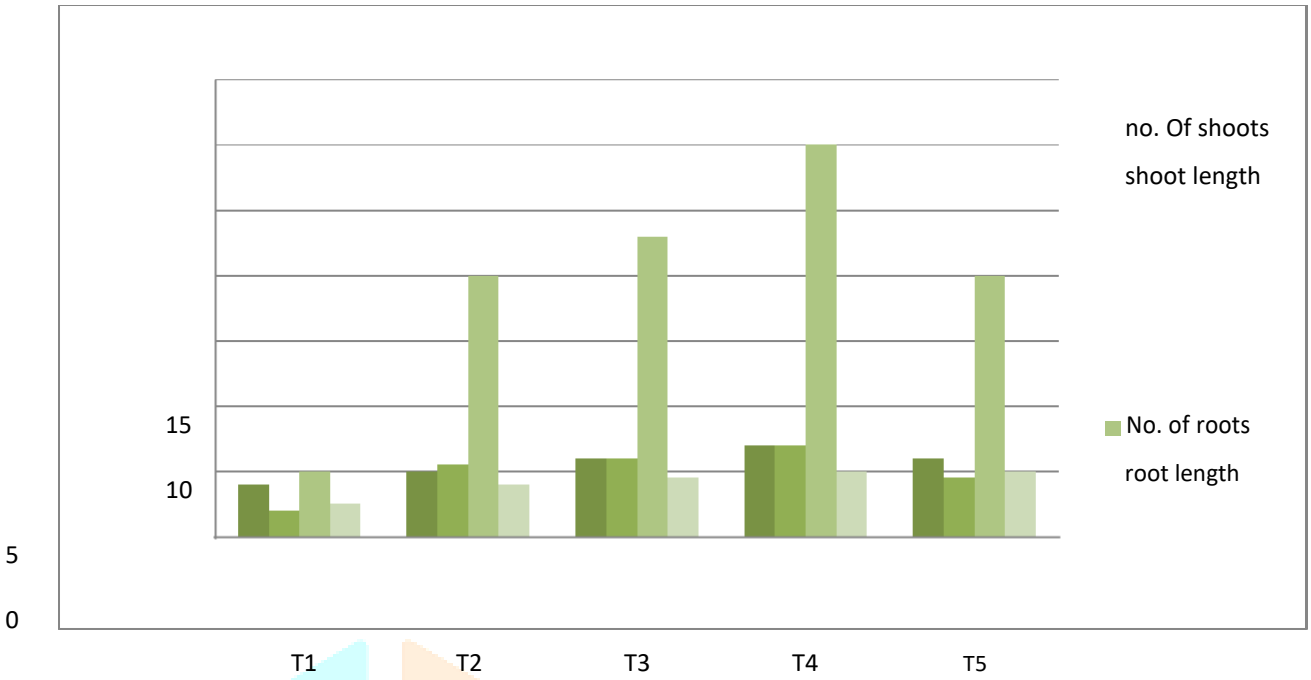

Fig. 2. Effect of different concentrations of NAA with constant BAP on shoot proliferation and rooting of banana (1 culture bottles)

Table 3. Effect of different concentrations of NAA and with constant BAP on number of shoot ,shoot length and No. of roots ,root length (2 culture bottles)

Culture/ bottle	Crop physiology	TREATMENTS (mg/ltr)				
		T1 BAP(4.0) + NAA(0.0)	**T2** BAP(4.0) + NAA(0.5)	**T3** BAP(4.0) + NAA(1.0)	**T4** BAP(4.0) + NAA(1.5)	**T5** BAP(4.0) + NAA(2.0)
2 culture/ bottle (10bottles)	**No.of shoots**	3	5	5	7	6
	Shoot length	4cm	5cm	6.5cm	8cm	7cm
	No.of roots	15	22	25	35	25
	Root length	6cm	7cm	8cm	10cm	6cm

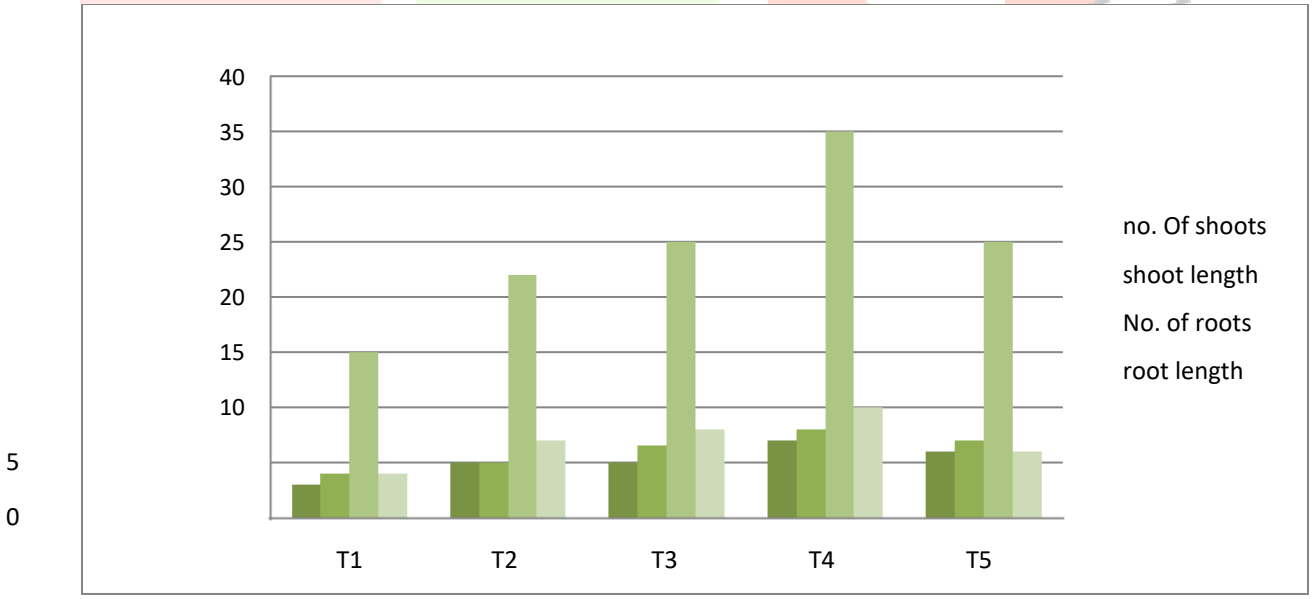

Fig. 3. Effect of different concentrations of NAA with constant BAP on shoot proliferation and rooting of banana (2culture bottles)

Table 4. Effect of different concentrations of NAA and with constant BAP on number of shoot ,shoot length and No. of roots ,root length (3 culture bottles)

Culture/ bottle	**Crop physiology**	**TREATMENTS (mg/ltr)**				
		T1 BAP(4.0) + NAA(0.0)	**T2** BAP(4.0) + NAA(0.5)	**T3** BAP(4.0) + NAA(1.0)	**T4** BAP(4.0) + NAA(1.5)	**T5** BAP(4.0) + NAA(2.0)
3 culture/ bottle (10bottles)	**No.of shoots**	7	6	8	9	7
	Shoot length	4cm	7cm	8cm	7.5cm	7cm
	No.of roots	20	25	30	40	35
	Root length	8cm	9cm	8cm	12cm	10cm

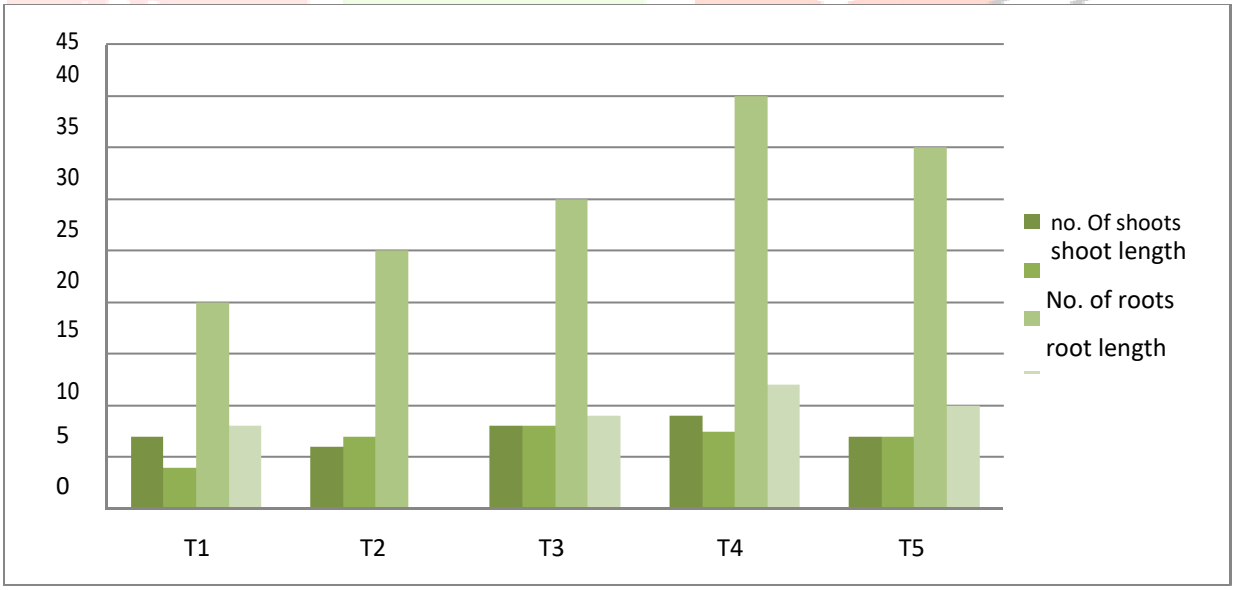

Fig. 3. Effect of different concentrations of NAA with constant BAP on shoot proliferation and rooting of banana (3culture bottles)

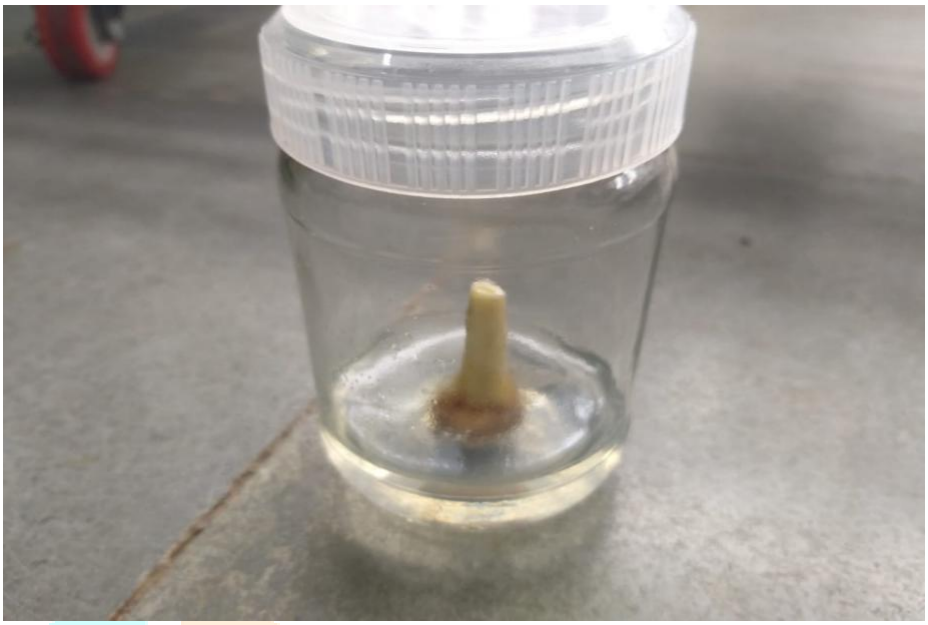

Plate 1.: Inoculatuion of sucker explant of banana (*Musa acuminata)*

Plate .2.: Shoot initiation after inoculation

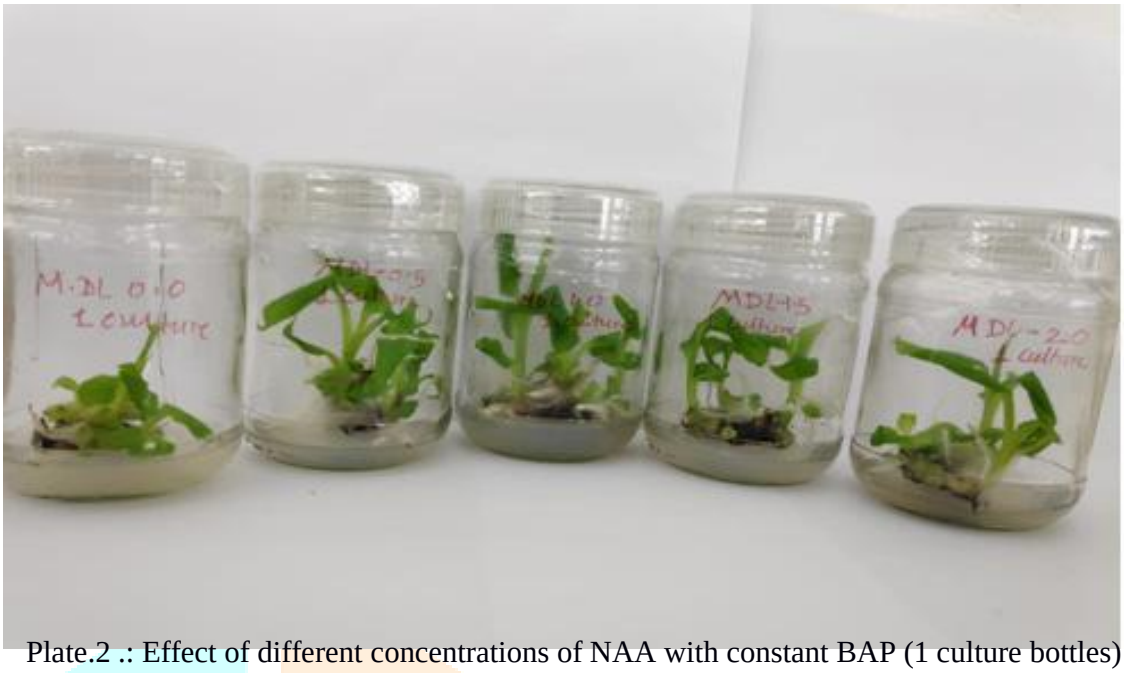

Plate.2 .: Effect of different concentrations of NAA with constant BAP (1 culture bottles)

Plate.3.: Effects of different concentrations of NAA with constant BAP on (2 culture bottles)

Plate.4: Effects of different concentrations of NAA with BAP on (3 culture bottles)

OUTCOME OF THE PROGRAME

Chapter IV

OUTCOME OF THE PROGRAMME

The present study demonstrates a simple and efficient method for maximum frequency direct root regeneration scales of Banana . Depend on finding present investigation showed following conclusion Overall, we concluded that BAP and NAA at specific levels in MS Media are needed for the effective initiation,multiplication of roots of Banana.

The rooting was found superior in level of NAA T_4 (NAA @ 1.5 mg/ltr) in combination with constant BAP (@4 mg/ltr) .

The concentration of NAA T_4 (NAA @ 1.5 mg/ltr) in combination with constant BAP (@ 4mg/ltr) found the best hormonal level to produce maximum number of root (12) formation and more the root length.

This concentrations also shows produce more number of shoots formation and more the shoot length .

SUMMARY OF THE PROGRAMME

Chapter V

SUMMARY

Present investigation entitled "Effect of different concentration of NAA on shoot proliferation and rooting of banana (*Musa acuminata.)* ." was carried out i*n-vitro* conditions during December 2019 – May 2020 in tissue culture lab of Ishved Biotech pvt. ltd. Sindhkhed Raja, Buldhana, through MGM College of Agricultural Biotechnology, Gandheli, Aurangabad.

Experiment was laid out in Completely Randomize Design with five treatments of NAA concentrations (0.0, 0.5, 1.0, 1.5, and 2.0 mg/ltr). in combination with constant (BAP 4mg/ltr) and four replications.

Media prepared with different treatments of NAA and with constant BAP . 1 ltr media per treatment .NAA is added from stock of 10ml,BAP is constant 4mg /ltr. this media poured in bottles ,and kept for incubation of 3 days .

The healthy, disease free, suckers as explants were selected for the experimentation. The explants were collected from the field of Ishved Biotech pvt. ltd., leaf and stem of suckers is removed cut into 8-10cm, are washed several time with tap water for 15 to 20 min and suckers are trimmed. Under laminar air flow layers are removed and cut into 4-6cm pieces then this suckers are dipped in T20 solution for 15-20 min. After that suckers given 3 wash of distilled water . Then 1% bavistine treatment is given for 30min, again 3 wash of autoclaved distilled water . 70% ethanol treatment given for 1 min,again 3 washes of autoclaved distilled water repeated. 0.1% mercuric chloride treatment given for 15 min,again 3 washes of autoclaved distilled water are repeated . Then finally suckers are trimmed into 2-3cm . This explants are inoculated in the incubated media bottles in three patterns 5 bottles of 1 culture, 10 bottles of 2 culture, 10 bottles of 3 culture.

Inoculated bottles are transferred to growth room for growth under controlled condition ,temperature is maintained at 25±2ºC with 16 hour photoperiod.

present investigation showed best growth of roots and shoots at 1.0-1.5mg/ltr NAA concentrations with constant (4mg/ltr) BAP ,as compared to other concentrations.

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