Pineapple Research Station
Vazhakulam

RESEARCH AND DEVELOPMENT REPORT 2010 -11

(01.04.2010 TO 31.3.2011)

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CONTENTS

Executive summary

The Pineapple Research Station, Vazhakulam aims at developing pineapple varieties suitable for processing and table purpose, identify a superior clone of pineapple utilizing natural and induced variability. The pineapple hybrids produced in the hybridisation programme breeding for yield and quality of pineapple are evaluated. Irradiated suckers of pineapple variety Mauritius were evaluated for better fruit quality and the evaluation of the better types is continued. During last year about 2064 hybrids and 98 mutants were evaluated for yield and quality parameters. Nine hybrid lines produced fruits having weight more than 1.9 kg and TSS more than 19%. Different types found in farmers field were collected and being evaluated. Various types of passion fruit collected from southern states to identify a passion fruit variety suitable for low altitude areas in Kerala are being evaluated. Accession no. 143 had maximum rind weight, pulp weight, seed weight and juice weight followed by Accession no. 125 and 51. It had maximum TSS. It was less acidic and has a brix / acidic ratio of 16.23 and had good size and aroma.

Pest and disease problems of 30 farmers were attended to during last year. Work on detection of virus disease in pineapple is continued. Production of tissue culture pineapple is continued and tissue culture Production of passion fruit and banana is initiated. The company project entitled 'Evaluation of fungicide Samarth (Hexaconazole 2% SC) against collar rot of pineapple' sponsored by M/s. Rallis India Pvt. Ltd., Bangalore was undertaken at the Pineapple Research Station , Vazhakulam for one season during 2010-11 with a financial outlay of Rs. 1,65,450. The objective of the project was to evaluate the bioefficacy of Samarth (Hexaconazole 2% SC) against pineapple collar rot and other diseases. The results show that it is highly effective in controlling the diseases. Hexaconazole 0.5% is more efficient in disease control though it slightly affects plant growth in terms of plant height and leaf length in the early stages with no marked difference thereafter. Hexaconazole 0.4% is safest with good disease control efficiency. The management problems faced by pineapple farmers are regularly attended by visiting fields, in person, seminars, through telephones, emails etc. Extension activities are mainly done in association with the Pineapple Farmers Association. The website of the station www.kau.edu/prsvkm was updated with more relevant and useful information for the public.

Efforts are being made to standardize protocols for the micropropagation of pineapple, passion fruit and banana. Fresh inoculation of four varieties of pineapple (Mauritius, MD2, Kew and Ananas nanas) was done in MS+4BA+1NAA and obtained multiple shoots within a month. Already established cultures were subcultured in MS+4BA+1NAA for multiplication and MS+1NAA for rooting at regular time interval. The plants with enough roots were treated with 20g/l pseudomonas for 20 minutes and planted in potting mixture (Cowdung + solarised soil) for hardening. Less rooted plants were treated with 1ml NAA/l for half an hour before planting for further rooting. Leaves and nodes of the two varieties (purple and yellow) of passion fruit gave maximum response in 2NAA and 2BA respectively. Nodal explants gave faster response than leaves. Fresh inoculation of five varieties of banana (Red banana, Nendran, Robesta, Poovan and Njalipoovan) was done in MS+5BA. Elongation and bulging of the buds were observed within two weeks.

A project proposal to identify a high yielding superior quality passion fruit variety for commercial cultivation in Kerala so as to harness the full potentials of the growing situation giving maximum benefit to the growers in terms of more employment, higher incomes and better standard of living at a total cost of Rs.16.00 lakh was submitted to Kerala State Council for Science, Technology and Environment for Grant of Science Research Schemes (SRS). Another project proposal to establish a fruit processing laboratory at PRS, Vazhakulam for the efficient conversion of leftover fruits to value added products like squash, jam, syrup, etc at a total cost of Rs.19.90 lakh was submitted for approval under RKVY 2011-12. Pineapple Research Station, Vazhakulam prepared its Vision 2030 wherein it visualizes to be Fruit Crops Research Centre of Excellence (FCRCE) by 2030. The advanced research centre of excellence dreams to be the ultimate authority and provider of excellent quality technology, products and services in fruit crops through concerted research and development efforts sustained by best human resources and infrastructure development.

A. STATION AT A GLANCE

The Pineapple Research Station at Vazhakulam was established on 2nd January 1995 to give research and development support to pineapple farmers. Since then, this research centre of the Kerala Agricultural University has been steadily growing and serving as a subvention to the pineapple growers of the state and the country as well.

Mission

To be the ultimate authority and provider of excellent quality technology, products and services in the pineapple sector through concerted research and development efforts sustained by best human resource and infrastructure development.

Our Motto: 'Quality People & Infrastructure for Quality Technology, Products & Services'

Profile

The centre had a humble beginning on 2.1.1995 as "Pineapple Research Station & Pest and disease Surveillance Unit" under Kerala Horticulture Development Programme (KHDP). For the construction of the office-cum-laboratory building of the station, 15 cents of land was transferred from the Revenue Department to Kerala Agricultural University on 24.6.1996. It was delinked from KHDP and became a constituent research centre of Kerala Agricultural University under central zone on 1.7.1997. The present building was occupied on 27.6.1998.

Location

The centre is located close to the pineapple market at Vazhakulam, 10 km east of Muvattupuzha on the Muvattupuzha - Thodupuzha road in Ernakulam District, Kerala, India. It is about 35 km from Cochin International Air port, Nedumbassery; 40 km from Aluva railway station and 60 km from the Cochin harbour.

Mandate

- Give research and development support to the pineapple growers
- Provide quality technology, products and services to the pineapple sector
- Undertake basic and applied research in pineapple and other fruit crops of Kerala

Achievements

The station has taken up research in pineapple on various aspects like intercropping in rubber and coconut, plant spacing and density, organic and chemical fertilizer requirement etc. besides experiments on development of new varieties. Based on continuous surveillance and laboratory studies the station has identified the presence of PMWA virus in pineapple in Vazhakulam area. Based on all the findings this station has formulated the Package of Practices Recommendations for the popular variety Mauritius and included in the POP and all the technology developed are being

delivered to the pineapple growers extensively. Vazhakulam pineapple has been registered in the Geographical Indication Registry to boost the export of pineapple.

Facilities

Laboratory: Plant Tissue culture, biochemistry and pathology labs equipped with Gel documentation, ELISA Reader & washer, PCR, UV vis spectrophotometer, UV- Transilluminator, Flame photometer, Centrifuge, Microscopes, Electrophoresis, Shakers, ovens, Precision Weighing balances, Deep freezer, BOD, Laminar Air Flow, still, etc

Farm : Two hectares

Library : Specialised books and periodicals relevant to the sector

Sales Centre : For the public sale of Tissue Culture Plants, Seedlings, Rooted cuttings, Publications, etc

Research

The centre undertakes basic and applied research and development activities in pineapple and other fruit crops of Kerala. The research and development projects are mainly in Participatory technology development (PTD) mode and funded by various agencies as KAU, State and central governments, ICAR, SHM, NHM, etc.

Participatory technology development

The centre has developed scientific technology for the commercial cultivation of Kew and Mauritius varieties of pineapple, including pure cropping, intercropping in rubber and coconut plantations and in reclaimed paddy lands. Technology is developed for organic production. Tissue culture protocols for various varieties of pineapple are available. GI indication of Vazhakulam Pineapple is registered. Participatory technology process and product development in association with sister institutions, Nadukkara Agro Processing Co.Ltd. and Pineapple Farmers' Association for the stake holders is a steady and continuing process at the centre.

Extension

Technology transfer is effectively carried out through personal discussions, field visits, phones, emails, posts, radio, TVs, news papers, periodicals, publications, pineapple fests, seminars. trainings, etc.

Products

- Tissue Culture Plants of pineapple, passion fruit and banana
- Seedlings of passion fruit
- Rooted cuttings of passion fruit
- Publications

Services

- Agriclinic & advisory
- Training
- Consultancy
- Quality testing
- Project work of P.G. students of other Universities
- Large scale Tissue Culture production

Staff

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B. DETAILED RESEARCH AND DEVELOPMENT REPORT FOR 2010-2011

1. Research on pineapple

1.1. Plant tissue culture:

Objective

Fresh inoculation of explant into media and standardization of media for pineapple micropropagation. (Mauritius, MD2, Kew, *Ananas nanas*)

Technical programme

The plant part (Explant) taken for fresh inoculation are apical bud and lateral bud of slips, suckers and crown and leaves, surface sterilized by running tap water, treated in soap water and with 1% emisan or SAF for 20 minutes and a 50% alcohol rinse is given. For further treatment, the explant is taken into laminar air flow chamber.

In the laminar air flow chamber the explants are washed in 0.1% mercuric chloride for 4 minutes. Explants are washed thoroughly with water to remove the traces of mercuric chloride and are inoculated into media MS+4BA+1NAA, MS+2BA, MS+5BA and MS+1.5NAA+kin.

Results

- All the varieties give maximum response in MS+4BA+1NAA
- Initiation of shoots starts in Mauritius and Kew after one month
- For *Ananas nanas* & MD2 greening starts within 4 days and it took 3 weeks for shoot initiation

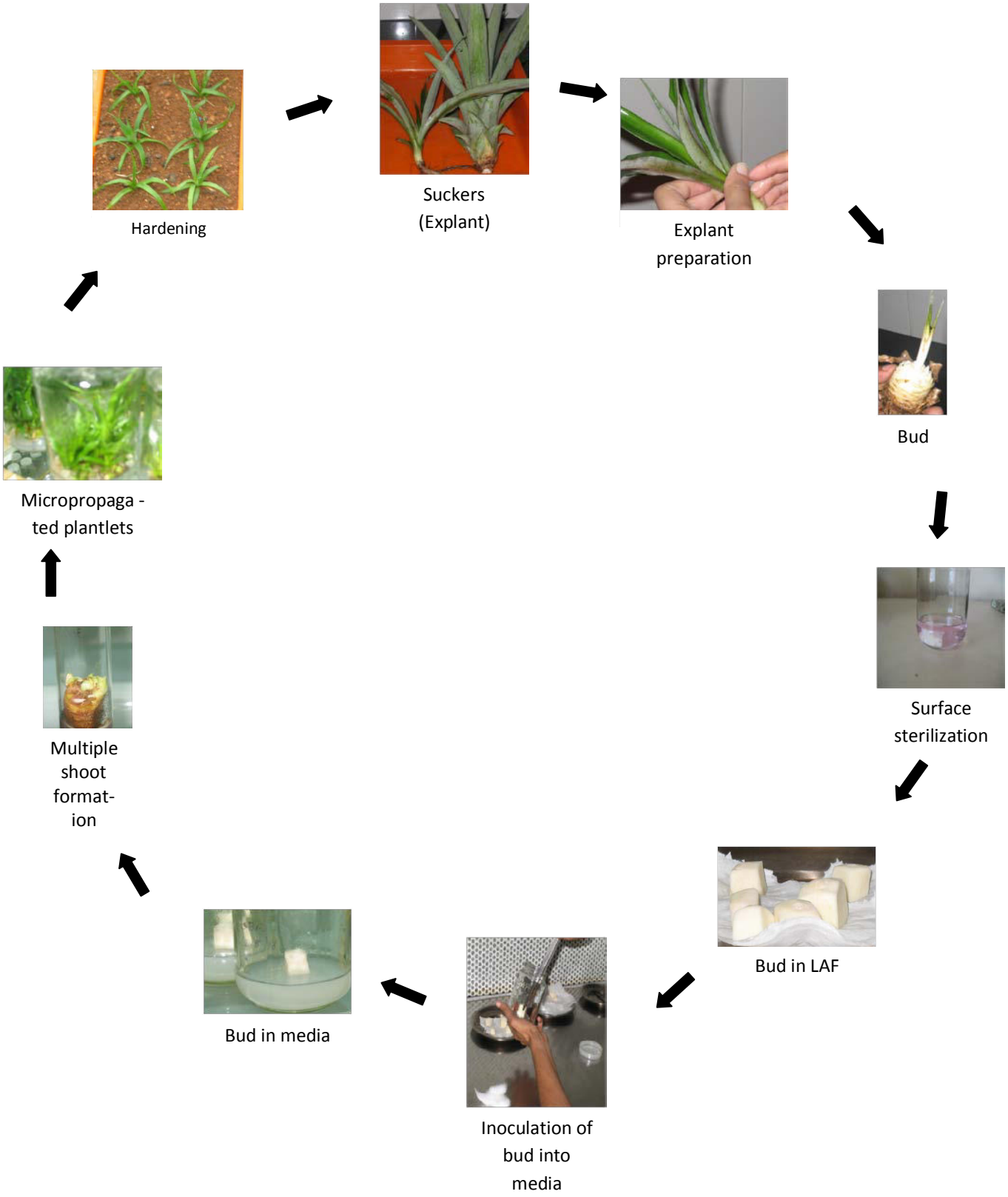


Figure 1. Tissue culture of pineapple

Table 1. Different media used for fresh inoculation

Explant	Media used(MS)	Variety	Result
Lateral Bud	4BA+1NAA	Mauritius	-
	2BA		-
	5BA		-
	1.5NAA+kin		-
	1NAA		-
Leaf	Liquid MS	Mauritius, Amritha	-
Apical Bud	4BA+1NAA	Mauritius, Kew, MD2, Ananas nanas. Amritha	+
	2BA		-
	5BA		-
	1.5NAA+kin		-
	1NAA		-

1.1.1. Large scale production of tissue culture plants

Objective

Large scale production of tissue culture plants (Mauritius, Kew, MD2, *Ananas nanas,* Amritha).

Technical programme

- Sub culturing the cultures in different media such as MS+4BA+1NAA for multiplication and MS+1NAA for rooting at regular time interval.
- The plants with enough roots were treated with 20g/l pseudomonas for 20 minutes and planted in potting mixture. (Cowdung + solarised soil). Less rooted plants are treated with 1ml NAA/l for half an hour before planting.

Amritha

Two jam bottles of Amritha cultures were collected from Regional Rice Station, Pattambi. The cultures were subcultured at regular intervals in the MS+4BA+1NAA for multiplication and MS+1NAA for rooting.

Results

- MD2-Production of tissue culture plants -13000

  Number of plants sold -12000

- *Ananas nanas*-Production of tissue culture plants -5000

  Number of plants sold -2500

- Red Banana-Production of tissue culture plants - 10
  Number of plants sold -8
- Grand naine-Production of tissue culture plants -30

  Number of plants sold - 20

1.1.2 Measures adopted to reduce contamination

Objective

To reduce contamination in the tissue culture lab and ensure proper micropropagation.

Technical programme

- 10g of the micro flora was added to 90ml peptone broth to get the stock (10^{-1}) and was serially diluted to get 10^{-2}, 10^{-3} and 10^{-4}. 1 ml from these inoculations was cultured in nutrient agar and potato dextrose agar.
- Fungal and bacterial growths were microscopically observed by 2 methods.
  i. Lactophenol cotton blue wet mount staining for fungi
  ii. Gram staining for bacteria.
- Various antibiotics such as Ampicillin, Gentamycin and Cephataxine were tested in varying concentrations and observations were taken after 48 hours.

Result

Table 2. Antibiotic treatment

Antibiotics	Concentration used(µl/l)	Zone diameter (cm)
Ampicillin	30	1.0
Gentamycin	30	1.2
Cefotaxime	30	0.8
Tetracycline	30	0.8

- Gentamycin is found to be most effective than the other three.
- The mycelia character and spores of the fungal specimen observed. According to the colony morphology, the contaminant is *Pencillium.*
- The bacterial contamination is found to be Gram negative and IMViC test is also performed. It could be seen that the contaminant is *Escherichia coli.*

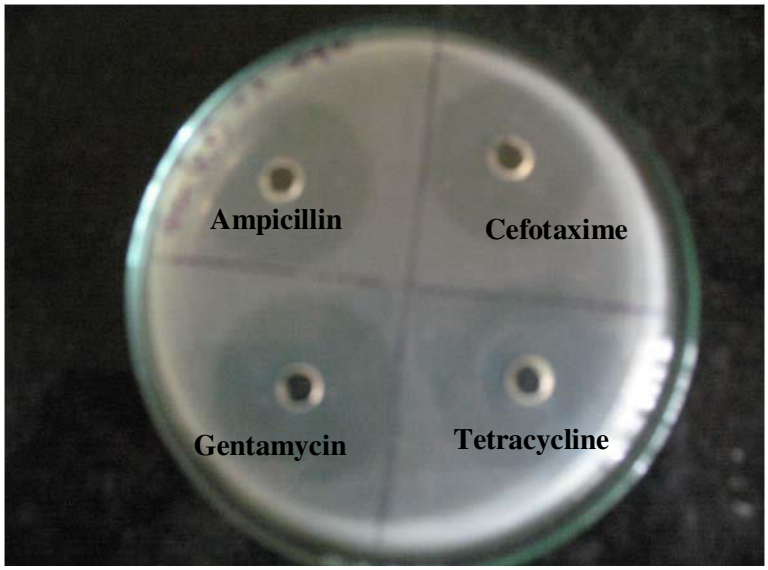


Figure 2. Antibiotic sensitivity test

1.2. Selection of high quality pineapple variety for central zone of Kerala

Objective

To select high quality pineapple variety for central zone of Kerala**.**

Technical programme

- Encompasses a number of modules like survey, collection, screening, evaluation with farmers. Field experiments will be undertaken to achieve the various objectives for the projects.

i. Survey and collection and conservation of elite pineapples types.
ii. Morphological and biochemical characterization of elite pineapple types.
iii. Identification of suitable pineapple types for cultivation.

Result

Table 3. Growth parameters of pineapple accessions 128 days after planting

No	Accessions	Plant height(cm)	Canopy spread(cm)	No. of leaves(no)	Leaf length (cm)	Leaf width (cm)
1	Mauritius	69.80	94.80	36.13	64.53	04.87
2	Kew	27.37	57.40	19.80	32.93	04.11
3	MD2	36.00	63.27	22.47	40.73	04.35
4	MTS	25.00	51.80	17.13	30.80	02.89
5	T3	24.93	57.80	17.00	32.93	04.17
6	H1	16.67	46.87	15.93	25.87	02.81
7	H2	11.27	23.47	10.93	12.67	01.77
8	H3	21.60	48.80	18.33	26.67	02.38
9	H4	25.67	54.33	27.40	28.53	03.50
10	H5	36.07	68.67	19.73	41.53	02.37
11	Amritha	25.60	49.40	14.93	30.47	02.07
	GM	29.14	56.05	19.98	33.33	03.21
	SEM	2.124	2.806	1.015	1.986	00.27
	CD(0.05)	6.267	8.277	2.995	5.859	00.81
	CV%	12.62	8.670	8.801	10.32	14.87

- Mauritius recorded highest plant height, canopy spread, no. of leaves and leaf width because of the fact that the normal suckers were used as planting material.
- In all other accessions tissue culture plants were used for planting which is characterized by slow initial growth compared to normal suckers.
- Among the tissue culture plants H5 and MD2 recorded higher growth parameters.

1.3. Breeding for yield and quality of pineapple

Objective

To develop pineapple varieties suitable for processing and table purpose through hybridization.

Technical programme

The project was initiated in 2002. The traditional pineapple varieties of Kerala Kew and Mauritius are hybridized and F1 hybrids were planted in the field and selections were made based on favorable yield and qualitative characteristics. The suckers of superior types were subsequently planted in the field and the evaluation is being carried out continuously. Observations on fruit weight with and without crown, crown weight and TSS are being taken and the data are utilized for the selection of superior types.

Result

The following observations are taken and the data corresponding to superior varieties are furnished below. Nine hybrid lines produced fruits having weight more than 1.9 kg and TSS more than 19%. The evaluation is being continued.

Table 4. Performance of pineapple hybrid lines at PRS, Vazhakulam during 2010-11

Plant no.	Date of harvest	Fruit + Crown wt (g)	Crown wt. (g)	Fruit wt. (g)	TSS (%)
3353(4-18)	18/1/2010	2527.5	306.0	2221.5	20.6
932(4-37)	14/1/2010	2386.0	200.0	2186.0	19.2
2916(4-17)	20/12/2010	2734.5	598.5	2136.0	23.8
7058(4-50)	27/1/2010	3751.0	1699.5	2051.5	22.0
3796(4-19)	18/1/2010	3214.0	1167.5	2046.5	23.0
3074(4-18)	18/1/2010	2391.0	346.5	2044.5	19.6
6237(4-31)	18/1/2010	2140.0	107.5	2032.5	21.6
3125(4-29)	21/1/2010	2362.5	377.5	1985.0	19.2
461(4-42)	7/7/2010	2090.0	148.0	1942.0	19.8

Table 5. Yield and quality parameters of promising pineapple hybrid lines at PRS, Vazhakulam during 2010-11

Table 5.1. Yield parameters

Plant no	Date	Fruit wt with crown (g)	Crown wt (g)	Fruit wt (g)	Peel wt (g)	Core wt (g)	Juice wt (g)
7173(4-54)	1/7/2011	1912.0	94.5	1817.5	267.0	267.5	858.0
M-498(4-48)	13/12/2010	1818.5	210.5	1608.0	219.0	139.5	762.0
462(4-24)	14/12/2010	1774.0	196.5	1577.5	175.0	328.0	597.0
3475(4-18	12/1/2010	1713.5	248.0	1465.5	130.5	175.5	735.0
2882(4-58)	14/12/2010	1939.0	476.0	1463.0	79.0	293.0	653.0
2571(4-27)	14/12/2010	1478.0	79.0	1399.0	117.0	133.0	754.0
2002(4-16)	13/12/2010	1520.5	130.0	1390.5	180.0	106.5	640.0
2731(4-27)	12/1/2010	1635.5	256.0	1379.5	149.5	169.0	709.0
MD2(4-52)	28/12/2010	1650.5	274.0	1376.5	97.0	137.5	582.0
2351(4-38	14/12/2010	1453.0	131.0	1322.0	200.5	90.0	472.0
MD2(4-52)	28/12/2010	1249.5	178.5	1071.0	93.0	115.0	543.0
MD2(4-54)	13/12/2010	1170.5	247.5	923.0	130.0	93.5	381.0
MD2(4-53)	28/12/2010	1034.0	298.0	736.0	115.0	59.5	324.0
2571(4-26)	1/7/2011	860.5	125.5	735.0	86.0	97.0	332.0
3320(4-41)	13/12/2010	796.0	92.0	704.0	78.0	56.5	331.5
25A(4-48)	14/12/2010	676.0	190.0	486.0	49.0	57.0	216.0
95(4-23)	1/7/2011	275.0	44.0	231.0	39.5	19.5	111.0

Table 5.2. Quality parameters

Plant no	Date	Tss (%)	pH	Acidity (%)	Ascorbic acid (mg/ 100g)	Red sugar (%)	Nonred sugar (%)	Taste (0-9)	Colour (0-9)	Size (0-9)	Aroma (0-9)	Brix/ acidity
7173(4-54)	1/7/2011	18.0	3.59	0.83	51.80	4.83	12.49	6.0	6.0	7.5	4.0	21.79
M-498(4-48)	13/12/2010	20.4	3.56	0.80	49.25	5.02	10.75	7.0	6.0	7.0	7.0	25.63
462(4-24)	14/12/2010	18.4	3.47	0.68	46.75	5.27	9.31	6.5	7.0	7.0	6.0	27.06
3475(4-18	12/1/2010	20.4	3.52	0.71	47.71	5.06	9.61	6.0	7.0	6.5	6.0	28.65
2882(4-58)	14/12/2010	23.0	3.50	0.93	50.02	5.09	10.49	8.5	6.0	7.0	6.0	24.63
2571(4-27)	14/12/2010	23.8	3.49	0.95	51.79	4.88	11.79	8.5	7.0	6.0	6.0	24.97
2002(4-16)	13/12/2010	15.8	3.55	0.72	51.02	4.65	10.12	4.0	6.5	6.0	6.5	22.07
2731(4-27)	12/1/2010	20.8	3.56	0.68	49.90	5.10	9.25	6.0	7.0	6.0	6.0	30.81
MD2(4-52)	28/12/2010	21.8	3.56	0.93	48.89	4.57	10.36	7.5	7.0	6.0	6.0	23.57
2351(4-38	14/12/2010	18.0	3.50	0.73	52.65	4.84	10.09	6.0	6.0	6.0	6.0	24.73
MD2(4-52)	28/12/2010	20.8	3.50	0.85	50.77	4.56	12.42	7.0	7.0	5.5	6.0	24.38
MD2(4-54)	13/12/2010	22.4	3.50	0.92	51.24	4.39	9.82	8.0	7.0	5.5	6.0	24.45
MD2(4-53)	28/12/2010	23.2	3.52	0.89	49.76	4.32	11.69	8.5	7.0	5.0	6.0	26.07
2571(4-26)	1/7/2011	23.0	3.59	0.95	51.78	4.89	11.68	8.5	7.0	4.0	6.0	24.29
3320(4-41)	13/12/2010	21.8	3.22	0.84	48.14	4.78	11.84	7.5	6.0	4.0	6.0	26.11
25A(4-48)	14/12/2010	19.6	3.39	0.70	47.82	4.61	11.65	7.0	6.0	4.0	7.0	28.20
95(4-23)	1/7/2011	21.8	3.66	0.88	48.98	5.20	10.72	7.5	5.0	3.0	4.0	24.72

Table 6. Yield and quality parameters of MD2 pineapple at PRS, Vazhakulam during 2010-11

plant no	Fruit wt with crown (g)	Crown wt (g)	Fruit wt (g)	Peel wt (g)	Core wt (g)	Juice wt (g)	Tss (%)	pH	Acidity (%)	Ascorbic acid (mg/ 100g)	Red sugar (%)	Nonred sugar (%)	Taste (0-9)	Colour (0-9)	Size (0-9)	Aroma (0-9)	Brix/ acidity
MD2(4-52)	1650.5	274.0	1376.5	97.0	137.5	582.0	21.8	3.56	0.93	48.89	4.57	10.36	7.5	7.0	6.0	6.0	23.57
MD2(4-52)	1249.5	178.5	1071.0	93.0	115.0	543.0	20.8	3.50	0.85	50.77	4.56	12.42	7.0	7.0	5.5	6.0	24.38
MD2(4-54)	1170.5	247.5	923.0	130.0	93.5	381.0	22.4	3.50	0.92	51.24	4.39	9.82	8.0	7.0	5.5	6.0	24.45
MD2(4-53)	1034.0	298.0	736.0	115.0	59.5	324.0	23.2	3.52	0.89	49.76	4.32	11.69	8.5	7.0	5.0	6.0	26.07

MD_2 Whole fruit

MD_2 Longitudinally cut

MD_2 longitudinally and Transversely cut

Figure 3. Pineapple variety MD2 with less peel and core and more of pulp.

2 Research on Passion Fruit

2.1 Yield and Biochemical characters of Passion fruit accessions

Objective

To select a passion fruit variety suitable for the plains of Kerala state.

Technical programme

The project was started in the year 2003, as a collaborative project with NAPCL, Nadukara. It was continued for 3 years as collaborative project and later it was taken up as a KAU project. Passion fruit accessions were collected from different parts of Kerala and various locations outside the state also. Yellow, purple and giant types are available in the collections. The accessions were evaluated continuously all the years and the plants are in a declining stage now. During the year 2010-11, 11 plants, set fruits and they were evaluated for yield, biochemical and qualitative characters.

Result

Data of passion fruit accessions of 2010-11 are furnished below.

Table 7. Yield characters of passion fruit accessions

Plant no	Date	Wt of fruit (g)	No of fruits(no)	Rind Wt (g)	Pulp Wt (g)	Seed Wt (g)	Juice Wt (g)
125	21-Aug-10	1053	15	583.5	372.5	43.0	273.5
142	26-Aug-10	258.5	3	090.5	163	15.5	101.0
136	3-Oct-10	289.0	3	102.0	186	11.5	099.5
143	4-Oct-10	691.5	7	239.0	439	39.0	224.0
111	6-Oct-10	238.0	3	143.0	74	07.5	046.5
134	14-Oct-10	480.0	4	167.0	298	19.5	148.0
51	14-Oct-10	613.0	9	334.0	312.5	29.5	152.5
88	16-Oct-10	320.5	3	167.0	151	15.0	075.0
31	17-Oct-10	295.0	3	132.0	161.5	10.5	090.0
182	17-Oct-10	271.0	3	103.0	111.5	15.0	059.5
35	6-Nov-10	293.5	4	135.5	153	12.0	099.5

- Accession no. 143 has maximum rind weight, pulp weight, seed weight and juice weight Followed by accession no. 125 and 51.

Table 8. Biochemical characters of passion fruit accessions

Plant no	Date	TSS (%)	Ph	Acidity (%)	Ascorbic Acid (%)	Red sugar (%)	Brix/ Acidity
125	21-Aug-10	22.5	3.17	02.72	35.39	08.23	8.272
142	26-Aug-10	23.4	3.2	01.78	20.89	07.36	13.14
136	3-Oct-10	24.0	3.18	01.86	27.72	06.63	12.84
143	4-Oct-10	24.5	3.25	01.51	24.50	10.75	16.22
111	6-Oct-10	21.0	3.08	02.56	36.36	10.86	08.20
134	14-Oct-10	24.2	3.50	02.82	24.28	10.41	08.58
51	14-Oct-10	23.2	3.25	03.50	25.50	09.09	06.62
88	16-Oct-10	23.6	3.02	01.36	17.94	10.41	17.35
31	17-Oct-10	22.8	3.05	03.32	21.58	11.11	06.86
182	17-Oct-10	23.6	3.06	10.22	18.67	07.68	02.30
35	6-Nov-10	23.6	3.02	3.174	21.18	08.06	07.43

- Accession 143 has maximum TSS and pH. It is less acidic and has a brix/acidic ratio of 16.23.
- Accession 88 is found to be less acidic and accession 111 has maximum ascorbic acid.

Table 9. Qualitative characters of passion fruit accessions (0-9 scale)

Plant no	Date	Taste	Colour	Size	Aroma
125	21-Aug-10	3.0	4.75	5.0	5.25
142	26-Aug-10	3.0	5.0	5.0	6.0
136	3-Oct-10	3.0	5.0	5.0	5.0
143	4-Oct-10	4.0	4.5	6.5	5.5
111	6-Oct-10	2.0	6.0	4.0	5.0
134	14-Oct-10	3.0	5.0	7.0	6.0
51	14-Oct-10	2.0	4.5	5.0	5.0
88	16-Oct-10	3.0	7.0	6.0	5.0
31	17-Oct-10	3.0	5.0	5.0	5.0
182	17-Oct-10	3.0	4.0	6.0	5.0
35	6-Nov-10	3.0	5.0	6.0	4.0

- According to the score value accession no. 143 has maximum size of 4. It has good size and aroma.
- Accession no. 88 and 134 has maximum colour and size respectively. Accession no. 134 has good aroma.

2.2 Fresh inoculation and micropropagation of passion fruit.

Objective

To inoculate yellow and purple varieties of passion fruit into media and micropropagate them.

Technical programme

The plant part (Explant) taken for fresh inoculation are leaves and nodes. The explants are surface sterilized by running tap water, treated in soap water and with 1% emisan for 20 minutes and a 50% alcohol wipe is given. For further treatment, the explants are taken into laminar air flow chamber.

In the laminar air flow chamber the explants are washed in 1.2% and 1% mercuric chloride for 4 and 6 minutes respectively. Explants are washed thoroughly with water to remove the traces of mercuric chloride and are inoculated into media.

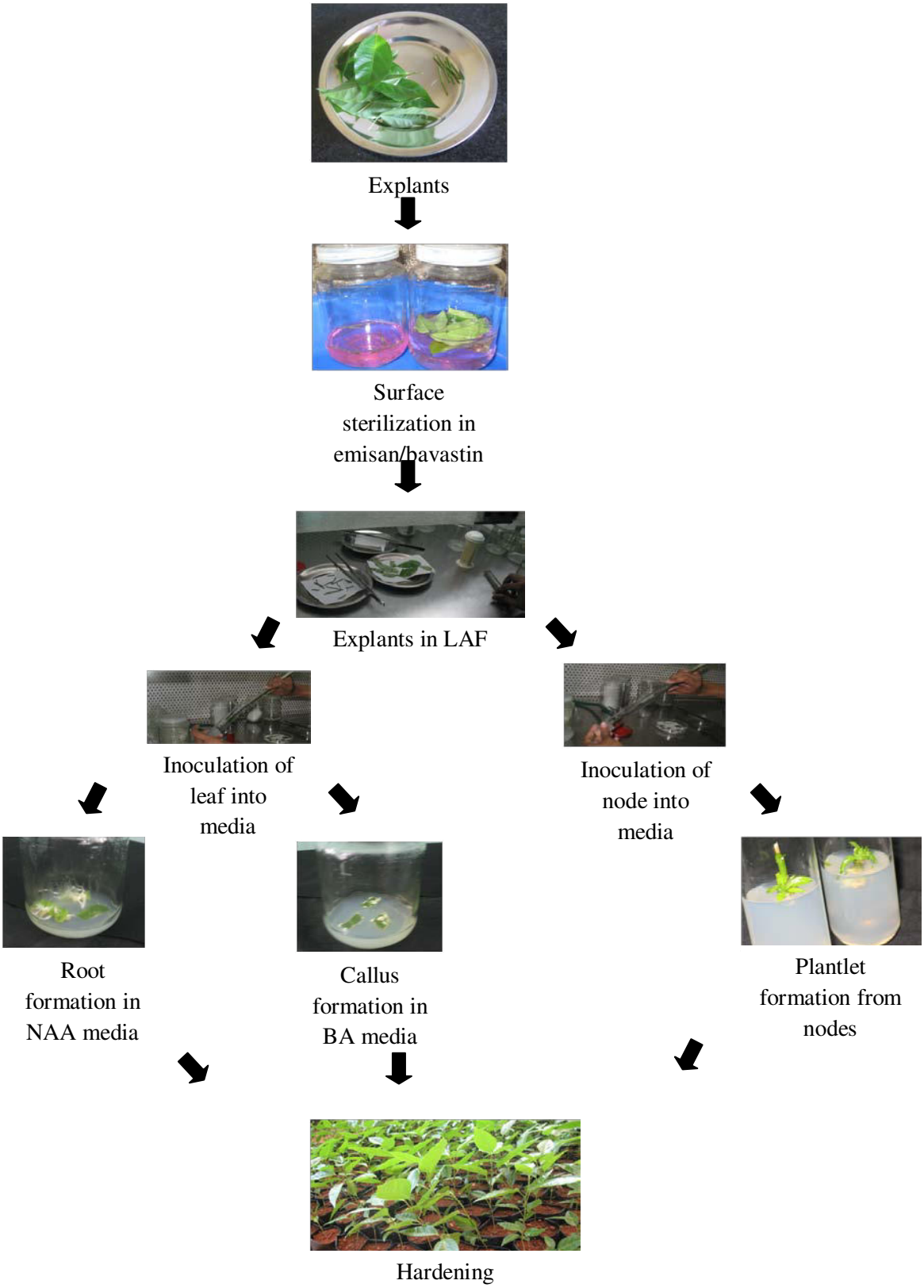


Figure 4. Tissue culture of Passion Fruit

Result

- Leaves of the two varieties give maximum response in 2NAA and node give response in 2BA
- Nodal explants give faster response than leaves.

Table 10. Different medium used for fresh inoculation

Explant	Variety	Media (MS)	Observation
Leaves	Purple & Yellow	2NAA 2BA 1.5NAA+1kinetin	+ + _
Nodes	Purple & Yellow	2NAA 2BA 1.5NAA+1kinetin	_ + _

3. Evaluation of fungicide Samarth (Hexaconazole 2% sc) against pineapple collar rot & other diseases.

3.1. About Hexaconazole

IUPAC name: (RS)-2-(2, 4-dichlorophenyl)-1-(1H-1,2,4-triazol-1-yl) hexan-2-ol

Hexaconazole is an effective fungicide, recently introduced in India for controlling blister blight. It inhibits ergo sterol biosynthesis (steroid demethylation inhibitor).

Mode of action: Systemic fungicide with protective and curative action

Uses : Controls many fungi, particularly Ascomycetes and Basidiomycetes, e.g. *Podosphaera leucotricha* and *Venturia inaequalis* on apples, *Guignardia bidwellii* and *Uncinula necator* on vines, *Hemileia vastatrix* on coffee, and *Cercospora* spp. on peanuts. It is also used on bananas, cucurbits, peppers and other crops.

Formulation: OL; SC; SG.

Selected trade names: 'Anvil' (fruit) (Syngenta); 'Planete' (cereals) (Syngenta); 'Contaf', ‘Samarth’ (Rallis);

Mixtures: 'Columbia' (+ fenpropidin) (Syngenta)

Other tradenames: 'Proseed' (Syngenta); 'Bullet 5' (Agro Chemicals); 'Canvil' (Vapco)

Mixtures: 'Lynx' (+ chlorothalonil) (Syngenta); 'Sirius' (+ chlorothalonil) (Syngenta)

3.2. Objective

To evaluate the bioefficacy of Samarth (Hexaconazole 2% SC) against pineapple collar rot and other diseases.

3.3. Technical Programme

Treatments:

1. Control
2. Samarth (Hexaconazole 2% sc) at 4 ml/l
3. Samarth (Hexaconazole 2% sc) at 5 ml/l
4. Mancozeb 75%WP at 2 g/l

Number of replications: five

Number of applications: three

Time of application: first application coincided with the initiation of the disease and the subsequent sprays depending on the level of disease incidence

Method of application: soil drenching and foliar spray.

Spray volume: 500l/ha

Observations: percent disease index/percent disease control

Phytotoxicity: observations on leaf injury, wilting, vein clearing, necrosis, epinasty and hyponasty at 3, 7 and 15 days after application

3.4. Methodology

Potting mixture was filled in twenty trays. The trays were arranged as four sections which include two treatments of Hexaconazole with concentrations 0.4% and 0.5%, Mancozeb 0.2% and control. Tissue culture plants of pineapple variety MD2 and Nanas were selected for the experiment. Among each set one tray was Nanas and the remaining four were MD2.

The fungicides were applied in recommended dosage in all the trays except the control. To check the phytotoxic effect of fungicide observations on various parameters like leaf injury, wilting, vein

clearing, necrosis, epinasty and hyponasty were taken on 3, 7 and 15 days after the spraying. To enhance growth, urea and wood ash spray had been given weekly. The plants showed symptoms of disease after one month and hence started second spraying. Observations carried out on every 3, 7 and 15 days.

As the fungicide supposed to have an effect on growth of the plants various growth factors such as plant length, canopy spread, number of leaves, leaf length and leaf width were observed at three months interval.

Before the start of third spraying of fungicides, a water extract of infected plants had been given to induce maximum disease incidence. The third spraying was done on the infected plants and the observations were taken on a regular basis.

3.5. Results and Discussion

Fungicide treatment spaying was carried out three times on 09/07/2010, 26/08/10 and 04/03/11

First spraying (09/07/2010)

Third day (12/07/2010)

Table 11. Disease index at first spraying, phytotoxicity scores (0-9) and disease control of pineapple three days after first fungicide application

Treatment	Disease index (%)	Leaf injury	Wilting	Vein clearing	Necrosis		Epin asty	Hypo nasty	Disease control (%)
					Score values	Log values			
1. Control	38.60	0	0	0	0	0	0	0	9.60
2. Hexaconazole 0.4%	45.60	0	0	0	0.24	0.07	0	0	19.80
3. Hexaconazole 0.5%	40.80	0	0	0	0.32	0.08	0	0	30.00
4. Mancozeb 0.2%	43.80	0	0	0	0.30	0.08	0	0	30.00
GM	42.20	_	_	_	0.22	0.06	_	_	22.35
SEm	1.328	_	_	_	0.147	0.039	_	_	1.706
CD(0.05)	4.098	_	_	_	ns	ns	_	_	5.258

The disease index at the time of first spraying varied with the treatments at 5% level of significance. The disease index was the highest in the plot of Hexaconazole 0.4 % which was on par with Mancozeb, 0.2%. The disease incidence was lowest in control plot.

There were no significant variations in the toxicity symptoms recorded in different fungicide treatments three days after application.

The disease control on the third day of first spray significantly varied with the treatments. The disease control was 30% in Hexaconazole 0.5% and Mancozeb 0.2% which were significantly superior to Hexaconazole 0.4% and control.

Seventh day (16/07/2010)

Table 12. Phytotoxicity scores (0-9) and disease control of pineapple seven days after first fungicide application

Treatment	Leaf injury	Wilting		Vein clearing		Necrosis		Epinasty	Hyponasty	Disease control (%)
		Score values	Log values	Score values	Log values	Score values	Log values			
1. Control	0	0	0	0.02	0.01	0.03	0.10	0	0	13.40
2. Hexaconazole 0.4%	0	0.30	2.35	0	0	0.32	0.08	0	0	65.40
3. Hexaconazole 0.5%	0	0	0.0	0.16	0.05	0.62	0.16	0	0	55.00
4. Mancozeb 0.2%	0	0.10	0.81	0.06	0.02	0.40	0.11	0	0	54.60
GM	_	0.10	0.79	0.06	0.02	0.42	0.11	_	_	49.60
SEm	_	0.094	0.655	0.089	0.030	0.122	0.035	_	_	2.498
CD(0.05)	_	ns	ns	ns	ns	ns	ns	_	_	7.696

The disease control on the seventh day of first spray significantly varied with the treatments. Hexaconazole 0.4% recorded the highest disease control followed by 0.5% which were on par and significantly superior to Mancozeb 0.2% and control.

There were no significant variations in the toxicity symptoms recorded in different fungicide treatments seven days after application.

Fifteenth day (22/07/2010)

Table 13. Phytotoxicity scores (0-9) and disease control of pineapple fifteen days after first fungicide application

Treatment	Leaf injury		Wilting		Vein clearing		Necrosis		Epinasty	Hyponasty	Disease control (%)
	Score values	Log values	Score values	Log values	Score values	Log values	Score values	Log values			
1. Control	0.06	0.02	0	0	0.06	0.02	0.50	0.13	0	0	21.00
2. Hexaconazole 0.4%	0	0	0.48	0.15	0	0	0.50	0.11	0	0	80.00
3. Hexaconazole 0.5%	0	0	0.06	0.02	0.20	0.06	0.92	0.21	0	0	83.00
4. Mancozeb 0.2%	0.06	0.02	0.36	0.13	0.10	0.04	0.64	0.15	0	0	76.20
GM	0.03	0.01	0.23	0.08	0.09	0.03	0.64	0.15	_	_	65.05
SEm	0.035	0.013	0.127	0.039	0.137	0.039	0.161	0.044	_	_	2.829
CD(0.05)	ns	ns	ns	ns	ns	ns	ns	ns	_	_	8.716

There were no significant variations in the toxicity symptoms recorded in different fungicide treatments fifteen days after fungicide application.

The disease control on the fifteenth day of first spray significantly varied with the treatments. All the fungicide treatments recorded very good disease control and they were on par but superior to the control in disease control efficiency.

(a) Control

(b) Mancozeb 0.2%

(c) Hexaconazole 0.4%

(d) Hexaconazole 0.5%

Figure 5. First spraying: (a) control, (b) necrosis, wilting and slight amount of vein clearing and leaf injury in Mancozeb 0.2%, (c) necrosis and wilting in Hexaconazole 0.4% (d) vein clearing, necrosis and slight wilting in Hexaconazole 0.5%

Second spraying (26/08/2010)

Third day (30/08/2010)

Table 14. Disease index at second spraying, phytotoxicity scores (0-9) and disease control of pineapple three days after second fungicide application

Treatment	Disease index (%)	Leaf injury	Wilting		Vein clearing		Necrosis		Epinasty	Hyponasty	Disease control (%)
			Score values	Log values	Score values	Log values	Score values	Log values			
1. Control	37.00	0	0.06	0.02	0	0	0.66	0.15	0	0	9.80
2. Hexaconazole 0.4%	38.80	0	0.12	0.05	0	0	0.34	0.10	0	0	25.20
3. Hexaconazole 0.5%	35.00	0	0.06	0.02	0.24	0.07	0.74	0.19	0	0	28.00
4. Mancozeb 0.2%	36.60	0	0.12	0.04	0.10	0.04	0.60	0.14	0	0	24.40
GM	36.85	_	0.09	0.03	0.09	0.03	0.59	0.15	_	_	21.85
SEm	3.343	_	0.07	0.025	0.135	0.400	0.127	0.027	_	_	2.198
CD(0.05)	_	_	ns	ns	ns	ns	ns	ns	_	_	6.774

The disease index at the time of second spray was relatively low with mean of 36.85% without any significant variations among themselves.

There were no significant variations in the toxicity symptoms recorded in different fungicide treatments three days after application.

The disease control on the third day of second spray varied significantly with the treatments. All the fungicide treatments recorded fair degree of disease control and they were on par but superior to the control in disease control efficiency.

Seventh day (04/09/2010)

Table 15. Phytotoxicity scores (0-9) and disease control of pineapple seven days after second fungicide application

Treatment	Leaf injury	Wilting		Vein clearing		Necrosis		Epinasty	Hyponasty	Disease control (%)
		Score values	Log values	Score values	Log values	Score values	Log values			
1. Control	0	0.06	0.02	0	0	0.72	0.18	0	0	13.40
2. Hexaconazole 0.4%	0	0.10	0.04	0	0	0.54	0.14	0	0	37.60
3. Hexaconazole 0.5%	0	0.06	0.02	0.30	0.09	0.72	0.20	0	0	52.60
4. Mancozeb 0.2%	0	0.10	0.04	0.14	0.05	0.54	0.14	0	0	47.00
GM	_	0.08	0.03	0.11	0.03	0.63	0.16	_	_	37.65
SEm	_	0.075	0.028	0.136	0.400	0.083	0.026	_	_	1.8759
CD(0.05)	_	ns	ns	ns	ns	ns	ns	_	_	5.727

There were no significant variations in the toxicity symptoms recorded in different fungicide treatments seven days after application.

The disease control on the seventh day of second spray varied significantly with the treatments. All the fungicide treatments recorded relatively good disease control and they were superior to the control in disease control efficiency. Hexaconazole 0.5% recorded the highest disease control followed by Mancozeb 0.2% which were on par and superior to the other treatments.

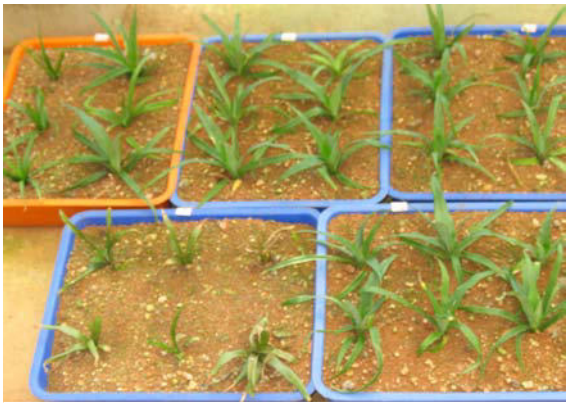
Fifteenth day (09/09/2010)

Table 16. Phytotoxicity scores (0-9) and disease control of pineapple fifteen days after second fungicide application

Treatment	Leaf injury	Wilting		Vein clearing		Necrosis		Epinasty	Hyponasty	Disease control (%)
		Score values	Log values	Score values	Log values	Score values	Log values			
1. Control	0	0	0	0	0	0.76	0.18	0	0	27.00
2. Hexaconazole 0.4%	0	0.08	0.03	0.04	0.02	0.30	0.10	0	0	75.00
3. Hexaconazole 0.5%	0	0.06	0.02	0	0	0.56	0.16	0	0	83.00
4. Mancozeb 0.2%	0	0.08	0.03	0.14	0.05	0.48	0.12	0	0	79.60
GM	_	0.06	0.02	0.05	0.02	0.53	0.14	_	_	66.30
SEm	_	0.048	0.019	0.074	0.025	0.181	0.181	_	_	2.400
CD(0.05)	_	ns	ns	ns	ns	ns	0.037	_	_	7.396

There were no significant variations in the toxicity symptoms recorded in different fungicide treatments fifteen days after fungicide application.

The disease control on fifteenth day on the second spray significantly varied with the treatments. Hexaconazole 0.5% recorded the maximum disease control followed by Mancozeb 0.2% which were on par. All these fungicide treatments recorded very good disease control and they were superior to the control.



(a) Control

(b) Mancozeb 0.2%

(c) Hexaconazole 0.4%

(d) Hexaconazole 0.5%

Figure 6. Second spraying: (a) control, (b) necrosis, slight wilting and vein clearing in Mancozeb 0.2% (c) necrosis and slight wilting in Hexaconazole 0.4% (d) necrosis, vein clearing and slight wilting in Hexaconazole 0.5%.

(a) control

(b) Mancozeb 0.2%

(c) Hexaconazole 0.4%

(d) Hexaconazole 0.5%

Figure 7. Pineapple plants sprayed with water extract of fungal infected plants to induce maximum disease incidence

Third spraying (04/03/2011)

Third day (07/03/2011)

Table 17. Disease index at third spraying, phytotoxicity scores (0-9) and disease control of pineapple three days after third fungicide application

Treatment	Disease index (%)	Leaf injury		Wilting		Vein clearing	Necrosis		Epinasty	Hyponasty	Disease control (%)
		Score values	Log values	Score values	Log values		Score values	Log values			
1. Control	81.00	0.98	0.28	0.50	0.17	0	0	0	0	0	11.60
2. Hexaconazole 0.4%	74.60	1.64	0.39	0.78	0.23	0	0.14	0.05	0	0	47.60
3. Hexaconazole 0.5%	68.60	1.16	0.30	0.78	0.24	0	0	0	0	0	54.00
4. Mancozeb 0.2%	64.80	0.78	0.24	0.58	0.19	0	0	0	0	0	44.00
GM	72.25	1.14	0.30	0.66	0.21	_	0.04	0.01	_	_	39.30
SEm	1.942	0.208	0.047	0.170	0.043	_	0.044	0.016	_	_	1.665
CD(0.05)	5.983	ns	ns	ns	ns	_	ns	ns	_	_	5.128

The disease index at the time of third spray varied significantly with the treatments. The disease incidence was the highest in the control followed by Hexaconazole 0.4%. Disease index was significantly lower in Mancozeb 0.2% and Hexaconazole 0.5%.

There were no significant variations in the toxicity symptoms recorded in different fungicide treatments three days after application.

The disease control on the third day of third spray significantly varied with the treatments. All the fungicides recorded fairly good disease control and they were all superior to the control. Hexaconazole 0.5% recorded the highest disease control which was significantly superior to the rest of the treatments.

Seventh day (11/03/2011)

Table 18. Phytotoxicity scores (0-9) and disease control of pineapple seven days after third fungicide application

Treatment	Leaf injury		Wilting		Vein clearing	Necrosis		Epinasty	Hyponasty	Disease control (%)
	Score values	Log values	Score values	Log values		Score values	Log values			
1. Control	1.50	0.35	0.60	0.19	0	0	0	0	0	15.20
2. Hexaconazole 0.4%	1.26	0.33	0.56	0.18	0	0	0	0	0	78.20
3. Hexaconazole 0.5%	0.90	0.26	0.60	0.19	0	0.42	0.14	0	0	85.00
4. Mancozeb 0.2%	0.62	0.21	0.30	0.11	0	0.14	0.05	0	0	75.00
GM	1.07	0.28	0.52	0.17	_	0.14	0.05	_	_	63.35
SEm	0.281	0.046	0.111	0.031	_	0.121	0.038	_	_	1.164
CD(0.05)	ns	ns	ns	ns	_	ns	ns	_	_	3.587

There were no significant variations in the toxicity symptoms recorded in different fungicide treatments seven days after application.

The disease control on the seventh day of the third spray significantly varied with the treatments. All the fungicides recorded very good disease control and they were all superior to the control. Hexaconazole 0.5% recorded the highest disease control which was significantly superior to the rest of the treatments. Hexaconazole 0.4% and Mancozeb 0.2% were statistically on par in their disease controlling efficiency.

Fifteenth day (19/03/2011)

Table 19. Phytotoxicity scores (0-9) and disease control of pineapple fifteen days after third fungicide application

Treatment	Leaf injury		Wilting		Vein clearing	Necrosis	Epinasty	Hyponasty	Disease control (%)
	Score values	Log values	Score values	Log values					
1. Control	0.98	0.27	0.42	0.13	0	0	0	0	23.40
2. Hexaconazole 0.4%	0.82	0.24	0.46	0.15	0	0	0	0	89.40
3. Hexaconazole 0.5%	0.52	0.17	0.38	0.12	0	0	0	0	91.40
4. Mancozeb 0.2%	0.56	0.19	0.50	0.17	0	0	0	0	87.40
GM	0.72	0.22	0.44	0.14	_	_	_	_	72.90
SEm	0.152	0.041	0.220	0.063	_	_	_	_	1.653
CD(0.05)	ns	ns	ns	ns	_	_	_	_	5.094

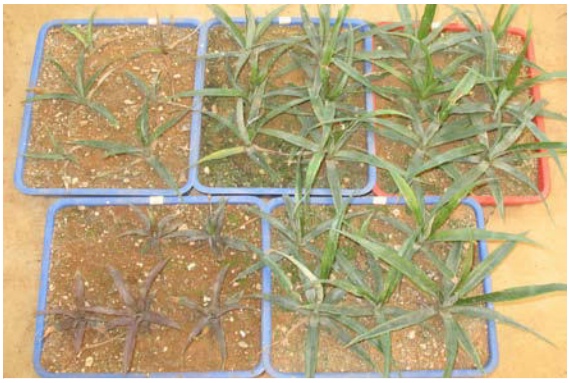
There were no significant variations in the toxicity symptoms recorded in different fungicide treatments fifteen days after application

The disease control on the fifteenth day of the third spray significantly varied with the treatments. All the fungicide treatments showed very good disease control and they were all on par and superior to the control in their disease control efficiency.

(a) control

(b) Mancozeb 0.2%

(c) Hexaconazole 0.4%



(d) Hexaconazole 0.5%

Figure 8. Third spraying: (a) control, (b) leaf injury and slight wilting in Mancozeb 0.2% (c) leaf injury and very low wilting in Hexaconazole 0.4%, (d) leaf injury and wilting in Hexaconazole 0.5%.

Effect on growth of pineapple

Table 20. Growth parameters of tissue culture pineapple four months after planting (11/11/2010)

Treatment	Plant height (cm)	Canopy spread (cm)	Number of leaves	Leaf length (cm)	Leaf width (cm)
1. Control	13.15	18.30	10.00	12.28	1.19
2. Hexaconazole 0.4%	13.78	20.30	11.58	13.38	1.38
3. Hexaconazole 0.5%	11.09	16.94	10.02	10.56	1.27
4. Mancozeb 0.2%	11.40	18.47	11.24	10.88	1.35
GM	12.36	18.50	10.71	11.78	1.30
SEm	0.502	0.771	0.648	0.652	0.054
CD(0.05)	1.546	ns	ns	2.009	ns

The result showed that the plant height and leaf length of pineapple varied significantly due to the treatments, where as the canopy spread, number of leaves and leaf width did not show any significant variations.

The plant height was the maximum of 13.78cm in the plot treated with 0.4% Hexaconazole followed by control which were on par. Hexaconazole 0.5% showed the least plant height of 11.09 cm followed by Mancozeb 0.2%.

Leaf length also followed the same trend with 0.4% Hexaconazole recording the highest leaf length of 13.38cm and 0.5% Hexaconazole recording 10.56cm.

The observations on growth parameters of pineapple indicate that Hexaconazole 0.5% has slight toxic effect on plant growth.

Table 21. Growth parameters of tissue culture pineapple eight months after planting (22/02/2011)

Treatment	Plant height (cm)	Canopy spread (cm)	Number of leaves	Leaf length (cm)	Leaf width (cm)
1. Control	17.16	25.7	10.46	16.16	1.40
2. Hexaconazole 0.4%	17.18	25.06	10.62	15.28	1.40
3. Hexaconazole 0.5%	14.7	21.10	11.16	12.98	1.34
4. Mancozeb 0.2%	18.02	25.92	11.34	17.48	1.46
GM	16.78	24.45	10.90	15.48	1.4
SEm	0.973	1.362	0.834	0.924	0.087
CD(0.05)	ns	ns	ns	2.847	ns

The plant height, canopy spread, number of leaves per plant and width of leaves of pineapple did not show any variation due to the fungicide treatments. However, the length of leaves significantly varied with the treatments. The leaf length was maximum of 17.48 cm recorded by Mancozeb 0.2% which was on par with the control and Hexaconazole 0.4%. The leaf length was significantly low in Hexaconazole 0.5% indicating a growth retarding effect at the higher doze of 0.5% of Hexaconazole.

Table 22. Growth parameters of tissue culture pineapple nine months after planting (21/03/2011)

Treatment	Plant height (cm)	Canopy spread (cm)	Number of leaves	Leaf length (cm)	Leaf width (cm)
1. Control	20.76	26.09	11.39	17.86	1.56
2. Hexaconazole 0.4%	19.64	27.88	11.60	18.8	1.49
3. Hexaconazole 0.5%	16.91	22.78	9.29	16.06	1.18
4. Mancozeb 0.2%	22.43	26.62	12.63	21.70	1.51
GM	19.94	25.84	11.23	18.61	1.44
SEm	2.05	2.730	0.908	2.016	0.143
CD(0.05)	ns	ns	ns	ns	ns

None of the growth parameters of pineapple showed any variation due to the fungicide treatments nine months after planting.

3.6. Summary and conclusion

The disease index was 42%, 37% and 72% at the time of first, second and third fungicides spray, respectively. All the fungicide treatments resulted in good control of collar rot and other fungal diseases. Hexaconazole 0.5% was superior to 0.4% in disease control. The phytotoxicity symptoms showed no significant variations among the treatments.

Observations on plant growth such as plant height, canopy spread, no of leaves, leaf length and leaf width were also recorded at regular intervals. The first observations on growth showed that plant height and leaf length alone significantly varied due to treatments. Both plant height and leaf length were significantly higher in control and Hexaconazole 0.4% and lower in hexaconazole 0.5% and Mancozeb 0.2%. During the second observations leaf length alone significantly varied due to treatments. Hexaconazole 0.5% recorded significantly lower leaf length compared to other treatments. During the last growth observations, none of the growth parameters varied significantly due to the treatments.

The evaluation of Samarth (Hexaconazole 2% SC) against pineapple collar rot and other diseases for one season during 2010-11 show that it is highly effective in controlling the diseases. Hexaconazole 0.5% is more efficient in disease control though it slightly affected plant growth in terms of plant height and leaf length in the early stages with no marked difference thereafter. Hexaconazole 0.4% is safest with good disease control efficiency.

4. Micropropagation of Banana

Objective

Fresh inoculation and micropropagation of banana (Red banana, Nendran, Robesta, Poovan, Njalipoovan)

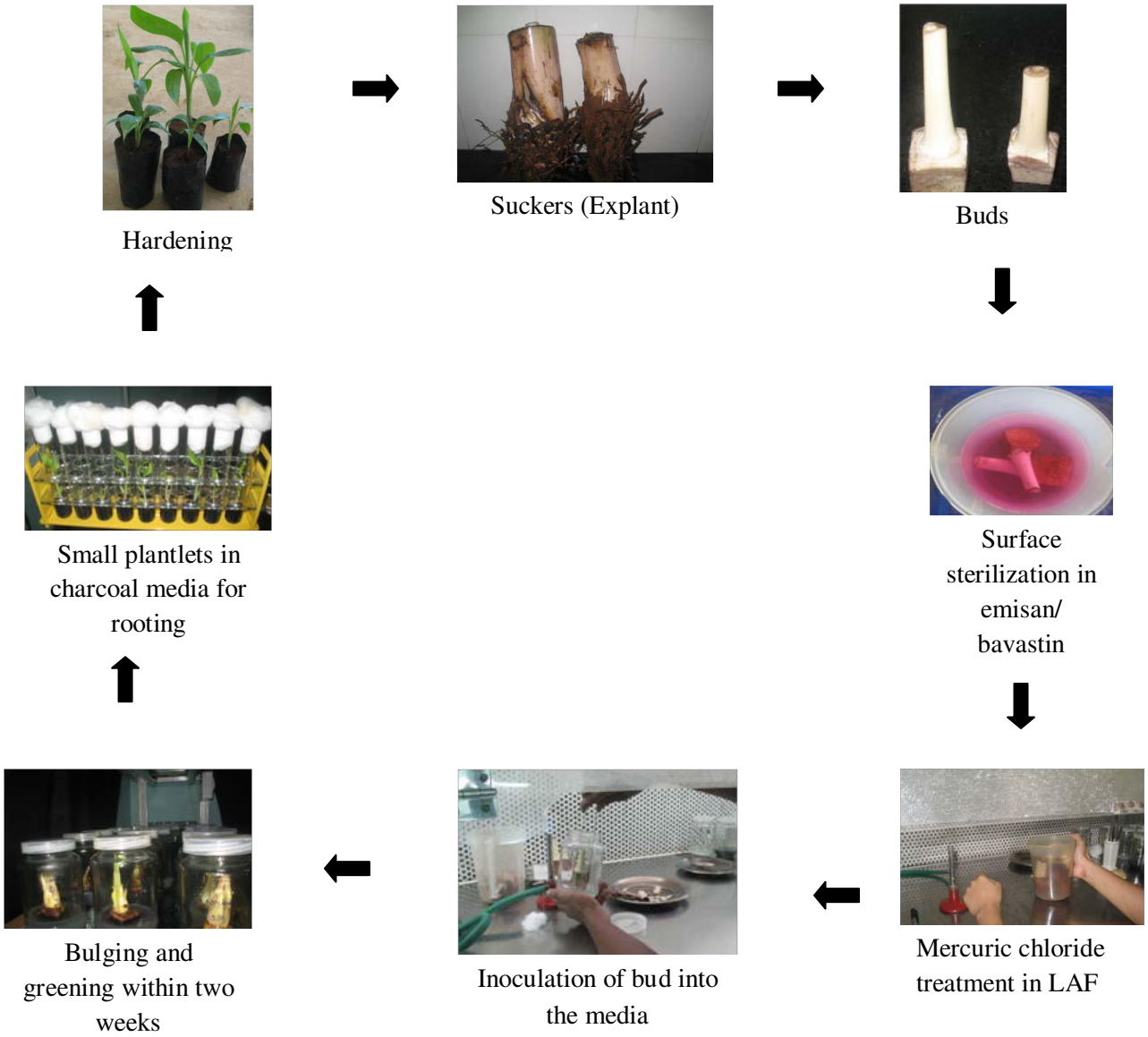


Figure 9. Tissue culture of banana

Technical programme

The plant part (Explant) taken for fresh inoculation are Suckers. They are surface sterilized by running tap water, treated in soap water and with 1% emisan for 20 minutes. For further treatment, the explants are taken into laminar air flow chamber. For removing the traces of emisan and mercuric chloride, a solution of 1% ascorbic acid and 1% citric acid is used.

In the laminar air flow chamber the explants are washed in 0.1% mercuric chloride for 4 minutes. Explants are washed thoroughly with a solution of 1% ascorbic acid and 1% citric acid to remove the traces of mercuric chloride and are inoculated into media 5BA.

Grand naine cultures were bought from Banana Research Station, Kannara. The cultures were subcultured in 5BA media and for rooting 1NAA + charcoal with half MS was used.

Result

Elongation and bulging of the bud is observed within two weeks.

5. Planting material production

The Planting material production, receipt, target, etc for 2010-11 are furnished below

Table 23. Planting material production , receipt, target, etc for 2010-11

Crop/Variety	Target (No.)	Production (No.)	Price (Rs.)	Sale (No.)	Receipt (Rs.)	Stock balance (No.)	Target for 2011-12 (No.)
Pineapple TC	10000	8500	10	5422	31760	3000	5000
Passion fruit seedlings	5000	2500	5	171	855	2300	1000
Passion fruit TC & Rooted Cuttings		100	10	0	0	10	500
Banana TC		30	15	22	330	8	2000
Total					32945		

Date: 30.04.2011

Associate Professor of & Head

	Bill-var expenditure details of Pineapple Research Station Vazhakulam for 2010-11																		
	321 Pineapple Research Station																		
	321-31-3370 "Research on pineapple"																		
Sl no.	**BRNo**	**110**	**130**	**142**	**210**	**300**	**236**	**237**	**222**	**223**	**226**	**330**	**410**	**418**	**419**	**420**	**821**	**921**	**Total**
1	1/10-11		16271																**16271**
2	3/'10-11			4500															**4500**
3	4/10-11	45459																	**45459**
4	5/10-11						10480												**10480**
5	6/10-11				2000														**2000**
6	7/10-11																521		**521**
7	10/10-11	48729																	**48729**
8	11/10-11		16271																**16271**
9	13/10-11			3400															**3400**
10	14/10-11			9085															**9085**
11	17/10-11											400							**400**
12	18/10-11													850					**850**
13	19/10-11													7100					**7100**
14	20/10-11						15199												**15199**
15	21/10-11	46549																	**46549**
16	23/10-11						950												**950**
17	24/10-11																476		**476**
18	25/10-11											1000							**1000**
19	26/10-11				248														**248**
20	27/10-11	46549																	**46549**
21	28/10-11		16271																**16271**
22	29/10-11			4000															**4000**
23	31/10-11			8070															**8070**
24	33/10-11				2500														**2500**
25	34/10-11				5688														**5688**
26	35/10-11														1450				**1450**
27	38/10-11				996														**996**
28	39/10-11								498										**498**
29	40/10-11						9692												**9692**
30	41/10-11						29856												**29856**
31	42/10-11			750															**750**
32	43/10-11				126														**126**
33	44/10-11				3000														**3000**
34	45/10-11																892		**892**
35	46/10-11		16271																**16271**
36	48/10-11			4200															**4200**
37	49/10-11			10600															**10600**
38	53/10-11	46549																	**46549**
39	54/10-11															775			**775**
40	55/10-11													1650					**1650**
41	57/10-11															9900			**9900**
42	58/10-11						11789												**11789**
43	59/10-11																582		**582**
44	60/10-11								1387										**1387**
45	61/10-11												17300						**17300**
46	62/10-11		16271																**16271**
47	64/10-11			4800															**4800**
48	65/10-11			10575															**10575**
49	68/10-11								682										**682**
50	69/10-11	46549																	**46549**
51	70/10-11				5181														**5181**
52	73/10-11	147520																	**147520**
53	74/10-11						9044												**9044**
54	75/10-11				5														**5**
55	76/10-11											40							**40**
56	77/10-11				2000														**2000**
57	78/10-11																1382		**1382**
58	79/10-11															6500			**6500**
59	81/10-11			5040															**5040**
60	84/10-11															0			**0**
61	86/10-11	54161																	**54161**
62	87/10-11	1500																	**1500**
63	88/10-11		27707																**27707**
64	89/10-11		1500																**1500**
65	91/10-11			4000															**4000**
66	94/10-11			6360															**6360**
67	97/10-11	80247																	**80247**
68	98/10-11					185													**185**
69	99/10-11					445													**445**
70	102/10-11						18380												**18380**
71	103/10-11						8395												**8395**
72	108/10-11																661		**661**
73	109/10-11		18075																**18075**
74	110/10-11			1400															**1400**
75	113/10-11			5580															**5580**
76	117/10-11	50303																	**50303**
77	119/10-11										6000								**6000**
78	120/10-11								1488										**1488**
79	121/10-11						8629												**8629**
80	122/10-11																689		**689**
81	124/10-11				5525														**5525**
82	125/10-11			4300															**4300**
83	128/10-11			3780															**3780**
84	132/10-11	76371																	**76371**

85	133/10-11		18075																**18075**
86	135/10-11						5724												**5724**
87	136/10-11				333														**333**
88	137/10-11				6465														**6465**
89	139/10-11																661		**661**
90	140/10-11								562										**562**
91	141/10-11							500											**500**
92	142/10-11				1200														**1200**
93	143/10-11											140							**140**
94	144/10-11											1106							**1106**
95	145/10-11		18075																**18075**
96	146/10-11			4000															**4000**
97	149/10-11			4500															**4500**
98	153/10-11	76371																	**76371**
99	156/10-11								525										**525**
100	157/10-11																	615	**615**
101	158/10-11						6171												**6171**
102	160/10-11		18075																**18075**
103	161/10-11																661		**661**
104	162/10-11					1021													**1021**
105	163/10-11					770													**770**
106	164/10-11					450													**450**
107	165/10-11					444													**444**
108	166/10-11					594													**594**
109	167/10-11					453													**453**
110	170/10-11			4400															**4400**
111	173/10-11			7770															**7770**
112	176/10-11				3000														**3000**
113	177/10-11												3950						**3950**
114	178/10-11											1393							**1393**
115	180/10-11						3628												**3628**
116	187/10-11													6950					**6950**
117	188/10-11				214														**214**
118	189/10-11																768		**768**
119	191/10-11				6														**6**
120	192/10-11	76371																	**76371**
121	193/10-11		29314																**29314**
122	195/10-11			3200															**3200**
123	197/10-11			6476															**6476**
124	200/10-11				308														**308**
125	201/10-11					150													**150**
126	202/10-11					300													**300**
127	203/10-11					300													**300**
128	204/10-11					300													**300**
129	205/10-11					300													**300**
130	206/10-11					375													**375**
131	207/10-11	115893																	**115893**
132	209/10-11						3992												**3992**
133	215/10-11				4990														**4990**
134	216/10-11																674		**674**
135	220/10-11		19686																**19686**
136	223/10-11			4070															**4070**
137	228/10-11	82017																	**82017**
138	233/10-11						4650												**4650**
140	235/10-11									775									**775**
141	239/10-11																661		**661**
142	245/10-11											170							**170**
143	247/10-11				9800														**9800**
144	249/10-11				8700														**8700**
145	250/10-11															9260			**9260**
146	251/01-11					150													**150**
147	252/10-11					150													**150**
148	253/10-11					150													**150**
149	254/10-11				3672														**3672**
150	255/10-11				8400														**8400**
151	256/10-11				6983														**6983**
152	257/10-11				845														**845**
153	258/10-11				6983														**6983**
154	261/10-11			9818															**9818**
155	262/10-11			4400															**4400**
	TOTAL	**1041138**	**231862**	**139074**	**89168**	**6537**	**146579**	**500**	**5142**	**775**	**6000**	**4249**	**21250**	**16550**	**1450**	**26435**	**8628**	**615**	**1745952**
	321-31-3500 "Research in Passion fruit"																		
1	16/10-11			3060															**3060**
2	50/10-11			1800															**1800**
3	67/10-11			2220															**2220**
4	83/10-11			3510															**3510**
5	106/10-11				7900														**7900**
6	116/10-11			2580															**2580**
7	123/10-11				5900														**5900**
8	130/10-11			4680															**4680**
9	151/10-11			4935															**4935**
10	208/10-11				5000														**5000**
11	230/10-11				25900														**25900**
12	238/10-11				11700														**11700**
13	265/10-11			3885															**3885**
14	266/10-11				0														**0**
	TOTAL			**26670**	**56400**														**83070**

	321-31-4449 "Breedig for yield and quality of Pineapple"																		
1	2/10-11			3800															**3800**
2	12/10-11			3600															**3600**
3	15/10-11			6090															**6090**
4	30/10-11			4400															**4400**
5	32/10-11			10220															**10220**
6	47/10-11			4500															**4500**
7	51/10-11			6520															**6520**
8	52/10-11			1440															**1440**
9	63/10-11			5000															**5000**
10	66/10-11			9270															**9270**
11	72/10-11			540															**540**
12	80/10-11				14590														**14590**
13	82/10-11			1905															**1905**
14	85/10-11				0														**0**
15	92/10-11			3500															**3500**
16	95/10-11											170							**170**
17	111/10-11			4200															**4200**
18	114/10-11			3270															**3270**
19	127/10-11			2200															**2200**
20	129/10-11			3660															**3660**
21	134/10-11											380							**380**
22	147/10-11			4600															**4600**
23	150/10-11			4230															**4230**
24	159/10-11											560							**560**
25	171/10-11			4400															**4400**
26	174/10-11			8010															**8010**
27	179/10-11				2500														**2500**
28	182/10-11					120													**120**
29	183/10-11					180													**180**
30	184/10-11					300													**300**
31	185/10-11					420													**420**
32	190/10-11											510							**510**
33	196/10-11			4730															**4730**
34	199/10-11			2591															**2591**
35	211/10-11				221														**221**
36	214/10-11				974														**974**
37	224/10-11			3410															**3410**
38	227/10-11			5365															**5365**
39	229/10-11				24000														**24000**
40	246/10-11				750														**750**
41	263/10-11			4400															**4400**
42	264/10-11			6435															**6435**
	TOTAL	**0**	**0**	**122286**	**43035**	**1020**						**1620**							**167961**
	321-31-8754 Evaluation of fungicide 'Samarth' against collar rot of pineapple																		
1	93/10-11			4000															**4000**
2	96/10-11				2000														**2000**
3	104/10-11				520														**520**
4	105/10-11				2500														**2500**
5	107/10-11				8500														**8500**
6	112/10-11			3800															**3800**
7	115/10-11			5190															**5190**
8	126/10-11			1800															**1800**
9	131/10-11			6870															**6870**
10	148/10-11			4600															**4600**
11	152/10-11			4470															**4470**
12	168/10-11				11172														**11172**
13	169/10-11				17900														**17900**
14	172/10-11			3900															**3900**
15	175/10-11			3615															**3615**
16	181/10-11				316														**316**
17	194/10-11			4000															**4000**
18	198/10-11			8398															**8398**
19	210/10-11																		**679**
20	217/10-11																		**3000**
21	218/10-11				1561														**1561**
22	219/10-11											230							**230**
23	221/10-11					180													**180**
24	222/10-11					300													**300**
25	225/10-11			3500															**3500**
26	226/10-11			13705															**13705**
27	234/10-11				1886														**1886**
28	236/10-11													5300					**5300**
29	237/10-11												5000						**5000**
30	240/10-11			600															**600**
31	241/10-11																		**29**
32	242/10-11											92							**92**
33	243/10-11				1335														**1335**
34	244/10-11				0														**0**
35	248/10-11				4500														**4500**
36	259/10-11			2508															**2508**
37	260/10-11			2600															**2600**
	TOTAL			**73556**	**52190**	**480**						**322**	**5000**	**5300**					**140556**
	Institutional Charge																		**24894**
	Grand Total																		**165450**
	Station Total																		**2162433**