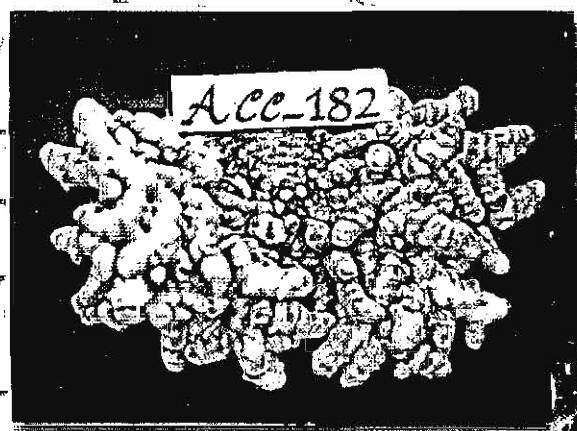


RESEARCH HIGHLIGHTS



ISSR-RH-12



INDIAN INSTITUTE OF SPICES RESEARCH
(Indian Council of Agricultural Research)
CALICUT, KERALA, INDIA

Front Cover

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1. Turmeric line tolerant to nematode
2. Coll. 1041, high yielding black pepper line tolerant to Phytophthora
3. Lemon grass oil smelling Cinnamomum

Back Cover

Biofermenter facility installed at IISR, Calicut

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DIRECTOR'S INTRODUCTION

The year 1998-99 witnessed surpluses in chilli and black pepper production and shortage in ginger. An all time record production of about one lakh tonnes was reported in black pepper, Karnataka alone contributing about 22,000 tonnes. There was shortage in ginger production mainly in Kerala pushing up sale price to Rs. 85/- per kg even during March- April. Export of spices during April-February 1998-99 surpassed in value but declined in quantity compared to the same period during 1997-98. Unit value of cardamom was higher than in 1997-98 due to high domestic demand and reduced inflow of cardamom from Guatemala.

Emphasis on clean spice production, organic spices and pest and disease management received special attention. A Pepper Technology Mission funded by the Government of Kerala where IISR, Calicut is a research partner has taken shape during the year. A National Network on *Phytophthora* has been initiated. A fermenter facility in collaboration with Regional Research Laboratory, Jammu has started functioning. The ICAR has also sanctioned an Agricultural Technology Information Centre. The main buildings of the Krishi Vigyan Kendra at Peruvannamuzhi were inaugurated by Dr. R S Paroda, Director General, ICAR and the Kendra continues to transfer appropriate technologies to farmers' fields. The main laboratory building at Cardamom Research Centre, Appangala has been completed.

The Division of Crop Improvement and Biotechnology handled 17 research projects, the Division of Crop Production and Post Harvest Technology 11, Division of Crop Protection 13 and Section of Social Science 4 projects. Sixteen adhoc research schemes were operational during the period.

The availability of quality planting materials in spices still continue to be a limitation. Diseases like stunted disease in black pepper and rhizome rot in ginger and pests like mealy bugs in black pepper are haunting. Characterisation of black pepper and cardamom germplasm need to be taken up on priority basis for possible patenting. The Institute maintains working relationship with the Spices Board, State Agricultural Universities and farmers' forums. The All India Coordinated Research Project on Spices operational at 20 centres located at different states, continued to be effective and useful.

Calicut
31.3.1999.



K V Peter
Director

CROP IMPROVEMENT AND BIOTECHNOLOGY

GENETIC RESOURCES

Black pepper : Twenty four accessions of wild *Piper* species and nine cultivars were collected during the year. A data base programme for genetic resources of spices at IISR was developed using MS-Access-97.

Ginger : Eight new accessions were added to the germplasm from Kalimpong (Bhasey and Nangrey), Nepal (3), Delhi (1), Palampur (1) and Kanpur (1).

Turmeric : Three *Curcuma* spp. and one cultivated type each from Andhra Pradesh and Nepal were added to the germplasm.

Vanilla : *Vanilla pififera* and *Vanilla vatasalae* were collected from Tropical Botanical Garden Research Institute, Palode, Thiruvananthapuram on exchange with *V. andamanica*.

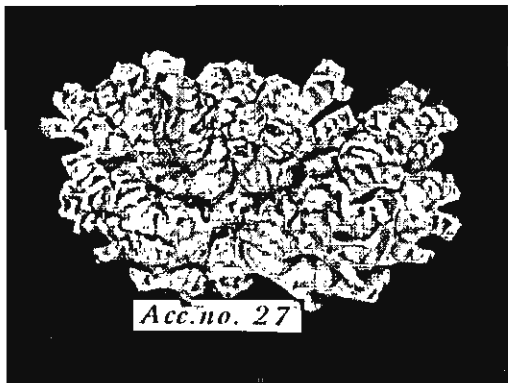
Tree spices : Fourteen accessions of *Garcinia* spp., four accessions of *Cinnamomum* spp., and one accession of *Myristica fatua* var. *magnifica* (female) were added to the germplasm.

CROP IMPROVEMENT

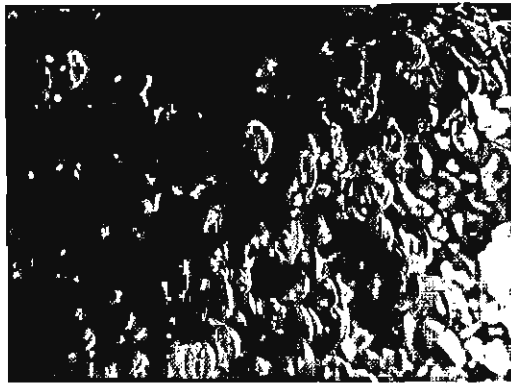
The black pepper hybrid HP 105 maintained superiority in yield at Valparai (4.8 kg/vine) followed by Coll. 1041 (4.25 kg/vine). Other promising black pepper hybrids at Valparai are HP-728, HP-813,

HP-34 and HP-778. Coll. 1041 a Neelamundi clone, was completely free from *Phytophthora* foot rot disease after 9 years of planting.

- ☼ Grafts of twenty varieties of black pepper have been found to grow satisfactorily on *P. colubrinum* root stock in the first year of planting.
- ☼ Among the bold rhizome selections of ginger Acc. 15 and Acc. 27 continued to perform well.
- ☼ Alleppey finger turmeric (AFT) Acc. 585 continued to maintain superiority in yield and quality.
- ☼ Evaluation of Chinese cassia (*Cinnamomum cassia*) indicated that accessions A1 and C1 had high bark oleoresin (10.2 and 10.5%) and D1, D3 and D5 had high bark oil (4.7, 4.9 and 4.3%) with high cinnamaldehyde content (86.5, 90.5 and 85.5%).
- ☼ Grafting of nutmeg on root stocks of *Myristica malabarica* and *M. beddomiei* through soft wood grafting was successful.
- ☼ Among the Byadgi paprika collections made this year, the colour value ranged from 100 to 500 ASTA units. K-11, K-17, K-24 and Y-6 showed more than 400 ASTA value.



High yielding bold rhizome ginger selection



Piper Schmidtii - a *Piper* spp at elevations of 5000 to 6000 ft. altitude

BIOTECHNOLOGY

- Successful transformation of black pepper somatic embryos, leaves and embryogenic calli of ginger



Transformation of cardamom callus and plantlet regeneration

and cardamom was achieved using *Agrobacterium* as well as biolistics mediated transformation. Putative transgenics were regenerated from ginger and cardamom calli on selection medium. DNA was isolated from 14 lines of ginger and 13 lines of black pepper and 15 lines of vanilla for conservation as well as for development of RAPD profiles.

- High elevation *Piper* spp. Like *P. silentvalleyensis*, *P. wightii*, *P. mullesua* and *P. schmidtii* were successfully established using hardening facility.

CROP PRODUCTION AND POST HARVEST TECHNOLOGY

Production of nucleus planting materials

Nucleus planting material of black pepper rooted cuttings (1 lakh) black pepper rooted laterals (1500), turmeric seed rhizome (25t), ginger seed rhizome (3t) nutmeg grafts (2500), cinnamon seedlings (5000),

allspice seedlings (2000) and vanilla rooted cuttings (10,000) were produced and distributed.

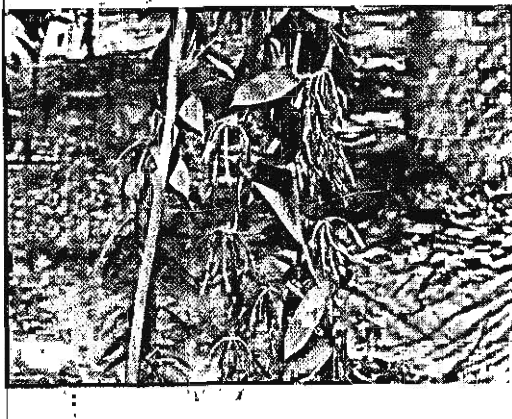
Plant nutrition

In acid soil, rock phosphate (Rajphos/Mussoorie phos/ Gufsa phos) was a good source of phosphorus

for ginger and turmeric. The agronomic efficiency of these materials could be effectively increased by incubating with Farm Yard Manure (FYM) by which P application could be reduced to half the recommended dose.

Cultivation of vanilla and cardamom with coconut

Vanilla could be successfully grown in coconut gardens with 1.5 x 1.5 m spacing on *Gliricidia* standards leaving apart 3 m radius all around the coconut palm trunk (base). Cardamom could also be grown successfully under coconut at a spacing of 1.5 x 1.5 m.



Drought tolerance

Preliminary screening of black pepper and *Piper* spp. to water stress tolerance based on catalase, acid phosphatase, superoxide dismutase and peroxidase activities and relative water content and solute leakage percentage indicated that *P. colubrinum* was relatively susceptible while *P. chaba* and *P. longum* were relatively tolerant to water stress.

Pre and post harvest studies

- * For preparation of white pepper treating ripe black pepper berries with 1000 ppm ethephon reduced the retting period considerably (>50%) without affecting appearance and quality.
- * Employing 'Dosi fiber' or similar automated unit for extracting crude fibre in ginger was found to yield rapid, consistent and accurate results compared to conventional fibre estimation.
- * Among the ginger accessions evaluated for chemical quality Acc. 418 and 420 had high essential oil (>2%) and oleoresin (>6%) contents.
- * Phenylalanine ammonia lyase (PAL), the key enzyme involved in curcumin + biosynthesis in turmeric, exhibited higher activity in the early stages of rhizome development (150-180 days after planting) indicating higher rate of synthesis of curcumin precursors. The enzyme activity was low in both leaves and roots concomitant with a low level of curcumin in these tissues.

Plant products

Two crystalline compounds with nematocidal activity were isolated from *Piper colubrinum* leaves.

C R O P P R O T E C T I O N

PLANT PATHOLOGY

Disease resistance

- * Five *Phytophthora* tolerant black pepper lines were identified. The already identified tolerant line P 24 continued to perform well at Sirsi (Karnataka) and Peruvannamuzhi (Kerala) and the yield ranged from 0.8 kg to 9.75 kg green/vine. A dry recovery of 40% was also recorded. 1, 3- glucanase was identified as a marker associated with tolerance to *P. capsici* in black pepper.
- * The breeding potential of *Pentalonia nigronervosa*, the aphid vector of Katte disease of cardamom, was studied on 17 Katte resistant lines. There was no feeding deterrence in any of the resistant lines indicating that resistance is due to other host factors and not due to feeding deterrence.
- * Apart from Biovar-3 of *Ralstonia solanacearum*, an aberrant biovar-3, which is dulcitol negative, was found to infest ginger in Wynad region of Kerala and also in Sikkim.
- * Based on ELISA test *Piper colubrinum* was found susceptible to stunted disease of black pepper.

Disease management

- * Spraying potassium phosphonate resulted in better inhibitory effect on foliar infections of *P. capsici* in

black pepper compared to drenching, and maximum effect was noted on 4th day after spraying. The effect declined after 8 days.

- * Pot. culture experiments with fungal biocontrol agents and fluorescent pseudomonads alone and in combination with potassium phosphonate showed efficacy of biocontrol agents in controlling foot rot infection and their compatibility with potassium phosphonate.
- * Among three carrier media used for mass multiplication of *Trichoderma*, the shelf life of talc was low compared to coir pith. After 3 months, no colony of *Trichoderma* could be recovered in talc.
- * *Trichoderma* isolates were screened for antagonism to *P. capsici* using dual culture technique. *T. virens* (21 isolates), *T. aureoviride* (27), *T. hamatum* (23 isolates), *T. harzianum* (20 isolates) and *T. pseudokoningii* showed varying degrees (0-84%) of inhibition.
- * More than 80% of farmers who have adopted application of *Trichoderma harzianum* in the control of *Phytophthora* foot rot of black pepper have confirmed its efficacy.

Integrated management of rhizome rot of ginger

Demonstration trials conducted

at farmers' fields revealed that seed treatment with fungicide (Ridomil mancozeb) and soil application of *Trichoderma harzianum* reduced rhizome rot of ginger significantly.

Repository of *Phytophthora* isolates

A national repository of *Phytophthora* (National Network on *Phytophthora* Diseases of Horticultural Crops) cultures comprising of 333 isolates from plantation crops, spices and other horticultural crops are being maintained. *Phytophthora* infections have been reported for the first time on vanilla, bauhinia, nutmeg, coffee and *P. chaba*.

Biofermenter

A biofermenter has been installed at IISR, Calicut with the technical help of Regional Research Laboratory, Jammu.

ENTOMOLOGY

Host resistance

Screening of 11 wild *Piper nigrum* accessions and six high yielding released varieties of black pepper against pollu beetle, a major pest of black pepper indicated that all of them were susceptible to the pest.

Incidence of mealy bugs on black pepper

The incidence of mealy bugs on roots of black pepper at Wynad was more severe during monsoon period (20 to 80% of vines infested) when compared to summer (4.4 to 17.8% of vines infested).

Mass culturing of mealy bugs

Pumpkins (*Cucurbita moschata*) and squashes (*Curcurbita pepo*) were found most suitable for mass culturing of root mealy bugs of black pepper in the laboratory.

Pest management

Drenching the affected vines with chlorpyrifos 0.1% or quinalphos 0.1% was more effective for the management of root mealy bugs on black pepper.

Adoption of cultural practices such as pruning of infested shoots during July-August along with spraying malathion 0.1% or monocrotophos 0.075% during September - October was promising for the management of shoot borer on ginger.

NEMATOLOGY

Host resistance

Among the 60 black pepper lines tested against root knot nematodes, 4 cultivars (Acc 4103, 4175, 334 and 1090) and 4 wild accessions (Acc. 3219, 3286, 3287, 3311) were resistant in the preliminary screening tests. Re-inoculated resistant lines of ginger and turmeric were found promising.

Mechanism of nematode resistance

Activity of superoxide dismutase and catalase was very high in the root knot nematode susceptible line (Panniyur - 1) compared to that of Pournami (a resistant line) while polyphenol oxidase activity was consistently high in Pournami.

Population variability in root knot nematodes

Variability for esterase and malate dehydrogenase isozymes was observed among the 12 root knot nematode populations.

Biological control of nematodes

- Eleven fungi and 7 bacteria were isolated from soil samples collected from healthy black pepper vines in sick plots. Three fungal isolates (F5, F6 and 11/3b) and six bacterial isolates (1, 3, 4, 8, 9 and 10) possessed nematicidal properties. Three isolates of *Pasteuria penetrans* were collected from ginger soil samples obtained from Sikkim, Wynad and Kasaragod. Secondary metabolites from mycelial fragments of *T. harzianum* were also nematicidal.
- A biocontrol laboratory was set up for intensifying the work on biological control of nematodes.

SOCIAL SCIENCE

Training programmes

Training programmes were conducted on spices production technology, nursery management and on-farm processing of spices. Sixty one officers from nine states and over 150 farmers were imparted training on the above aspects.

Economics of spices production and marketing

Adoption of rapid multiplication technology for production of rooted

pepper cuttings (15000-20000 nos./ year) was found profitable. The unit with a payback period of less than 2 years will yield a benefit cost ratio of 1.84. The unit cost of black pepper cuttings was estimated to be Rs. 3.57/cutting. Production of white pepper can earn an extra benefit of Rs. 570/- per 100 kg of green pepper harvested and processed. With an initial investment of Rs. 10,000/-, a small scale unit to make salted ginger can earn a benefit cost ratio of 1.85.

KRISHI VIGYAN KENDRA (KVK)

The Krishi Vigyan Kendra conducted 47 training programmes during the period in which 1248 trainees including farmers, rural youth and extension personnel attended. KVK also participated in 3 exhibitions and delivered 9 radio talks. In the plant and animal health centre 1131 cases were attended and 403 AI were done. The Kendra also conducted 22 animal health campaigns and attended 2 other camps conducted by other agencies.

Padmabhushan Dr. R S Paroda, Director General, ICAR and Secretary DARE inaugurated the Krishi Vigyan Kendra (Peruvannamuzhi) building and the trainees hostel on 7 December 1998

ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES (AICRPS)

- Pottangi centre under OUAT identified turmeric line

Sonali (27 t fresh rhizome/ha), Jobner centre (RAU) identified fenugreek RMT-143 (16.57 q/ha) Hissar centre (CCS HAU) fenugreek HM - 346 (23.6q), HM 350 (21.3q), HM-103 (20.1 q/ha), coriander Rcr-446 (12.81q) and fennel UF-125 (12.8 q) from Jobner are some of the promising lines developed in the centres.

- * Black pepper culture - 54 has shown tolerance to *Phytophthora* foot rot, coriander Rcr-41 (Jobner) and UD-686 (Dholi) show resistance to stem gall and UD-241 and UD-296 (Jobner) to root knot nematodes.
- * Application of NPK @ 150:125:125 kg/ha is recommended for higher yield in turmeric at Raigarh (IGKUU).
- * Irrigation at IW/CPE ratio of 1.0 and application of 90 kg N and 30 kg P₂O₅/ha for fennel and irrigation at IW/CPE ratio of 1.0, N @ 90 kg/ha and P @ 60 kg/ha was found optimum for cumin, at Gujarat.
- * Application of phorate @ 10g/clump followed by two sprays of phosalone (0.05% during May and August) was effective for control of cardamom thrips and borer (Mudigere).

Other Activities

Golden Jubilee National Symposium

Indian Council of Agricultural Research and Indian Institute of

Spices Research in collaboration with Indian Society for Spices, Calicut organised the Indian Independence Golden Jubilee National Symposium on Spices, Medicinal and Aromatic Plants : Biodiversity, Conservation and Utilisation at Regional Science Centre, Calicut during 10-12 August, 1998. The main themes covered in the Symposium were (1) Biodiversity of spices and their conservation (2) Biodiversity of medicinal and aromatic plants and their conservation (3) Ethnobotany, Ethnomedicine and folk medicine and (4) Development, futurology and intellectual property rights. About 150 delegates participated

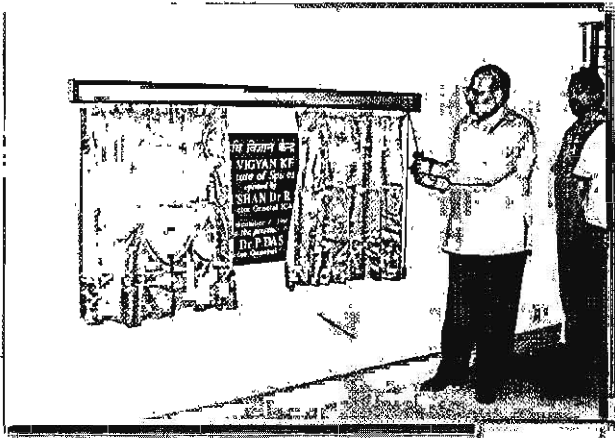
The symposium was inaugurated by Dr. K Shyamasundaran Nair, Vice Chancellor, Kerala Agricultural University and presided over by Dr. S P Ghosh, Deputy Director General (Hort.), ICAR, New Delhi.

Women's Cell

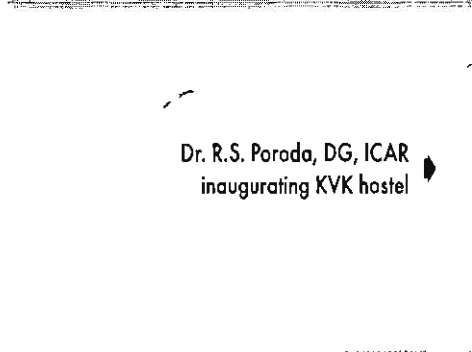
The Women's cell of the Institute was inaugurated on 18 November 1998 by Mrs. M M Padmavathy, Hon'ble Mayor, Corporation of Calicut. The meeting was presided over by Mrs. Indira Krishnakumar, Post Master General (Northern Range).

National Informatics Centre

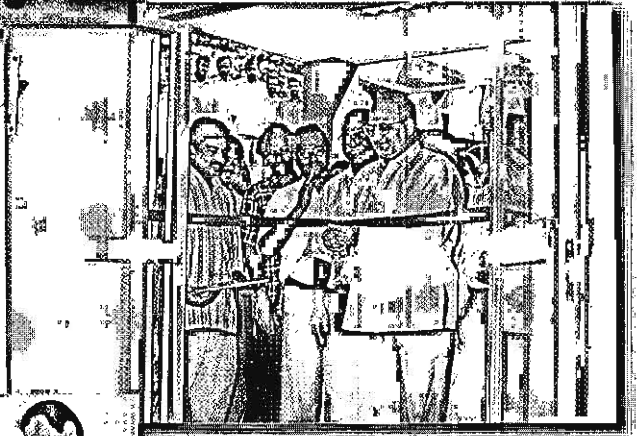
Dr. S L Mehta, Deputy Director General (Education) ICAR inaugurated the National Informatics Centre on Spices at IISR, Calicut on 28 November 1998.



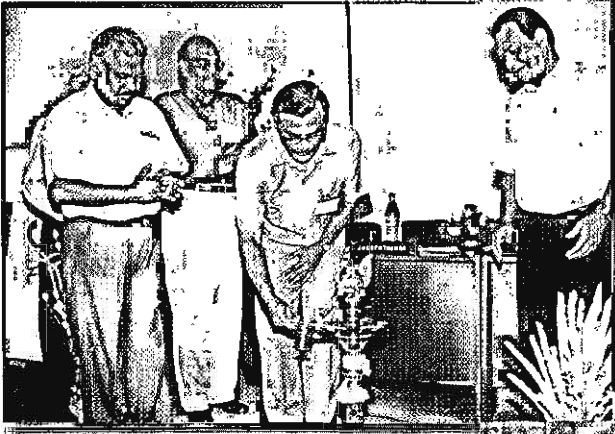
◀ Dr. R.S. Paroda, DG, ICAR
inaugurating KVK building



Dr. R.S. Paroda, DG, ICAR
inaugurating KVK hostel ▶

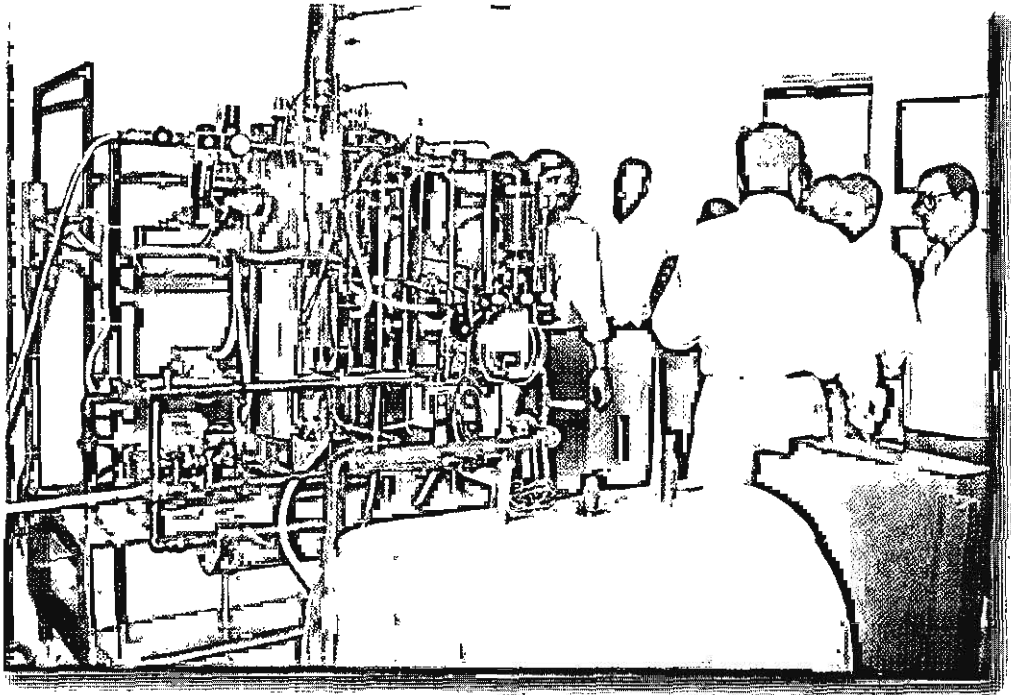


◀ Dr. Shyamasundaran Nair inaugurating
Golden Jubilee National Symposium



Inauguration of
women cell at IISR Calicut ▶





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