

**Feature**

**A Boom in Nuclear Worries**

**by Senthil Ratnasabapathy**

*International nuclear monitors predict that they will have their hands full this year.*

**T**HE world's nuclear watchdogs face testing times this year, with experts fearing intensified smuggling of nuclear material as well as a possible erosion of clout of the Nuclear Non-Proliferation Treaty (NPT).

The treaty expires in April after 25 years of being in force. The industrialised countries want the NPT extended in its present form for an indefinite period of time, but developing countries — particularly India and Pakistan — are against it.

The NPT obliges the nuclear 'haves' including Britain, China, France, Russia and the United States not to transfer weapons technology to 'have nots', and also to seek ways for de-nuclearisation.

The NPT has been signed by 168 countries. Three nuclear states in Eastern Europe, Belarus, Kazakhstan and Ukraine, signed it last year.

But some countries claim the treaty has failed because the 'haves' have not taken any meaningful steps toward reducing their nuclear arsenal.

Some of the nuclear countries, like France and the United States, have violated the NPT by passing weapons technology to countries like Iraq and Israel, says Heniz Hoegelsberger of Greenpeace which is opposing the present proposal for the NPT's indefinite extension.

The conference in New York this April will seal the fate of the NPT. But reports from the UN headquarters say the North has mustered enough — albeit not overwhelming — support to get it extended in its present form.

According to an official of the International Atomic Energy Agency (IAEA) based here, this lack of enthusiasm for the NPT could erode the treaty's authority to prevent the spread of nuclear weapons.

He notes that such a development comes at a time when it is foolhardy not to expect an increase in nuclear material smuggling, particularly with the depressing economic situation in the former Soviet republics.

"Being in the non-proliferation field means one has to be an eternal optimist and many positive things did happen in 1994," says the IAEA official. "(But) the cases of nuclear smuggling is bound to increase in 1995."

Recently, for instance, alarm bells went off at the IAEA over the seizures of weapons-grade nuclear material in Germany, which is being used as a gateway for the illegal trade from East to West.

And, despite increased awareness and cooperation among states such as the agreement concluded between Germany and Russia last year, the situation seems set to worsen.

Says Hoegelsberger: "The technical abilities (to make crude bombs) of many countries are advancing on one hand while on the other the existing structures to control proliferation are not powerful enough."

In December, Czech authorities announced the seizure of 3.3 kilogrammes of highly enriched uranium (HEU) in Prague. Detained were a Czech nuclear expert and two citizens from an unnamed Commonwealth of Independent States (CIS) country.

Czech officials said the haul consisted of uranium 235 (U 235) — enriched up to 87.5 per cent. To be weapons-grade, the U 235 has to be enriched up to 90 per cent.

Meanwhile, German authorities themselves had their hands full last year confiscating nuclear material, mostly uranium and plutonium, from illegal traders. In at least one incident, the material was enriched up to 99 per cent.

"The seizures of nuclear materials has been happening with ever increasing frequency over the past few years," observes Hoegelsberger. "And there are no signs that it would subside."

The finger of suspicion points to Russia as the source of the material, but Moscow has made furious and vehem-

ent denials that it has anything to do with the illegal trade.

Russian Minister for Atomic Energy Victor Mikhailov said nailing Moscow for the crime was just part of a deliberate campaign to prevent Russia from entering the lucrative, but hotly contested, international market for civilian nuclear technology.

Russia has developed some advanced nuclear power plant technologies, he said, and Western countries, where most of the nuclear industry is based, do not want Moscow to come into the world market.

Whoever the source is, a worried IAEA is now instituting measures, including setting up a data bank to track nuclear smuggling.

For the past three years, the UN nuclear safeguards monitor has also been offering training courses and seminars in eastern Europe to equip the authorities with proper inventory control systems. Officials at the IAEA note that Russia has yet to ask the agency to organise such a course.

The IAEA is also keeping watch over the Korean peninsula, despite the landmark 1993 nuclear accord between Pyongyang and Washington in which North Korea said it would abide by the NPT.

The pact's provisions also stipulate that North Korea would get two light-water reactors (LWRs) in exchange for suspending its nuclear programme and allowing the IAEA inspection of its facilities.

But Pyongyang will permit routine inspections only when the United States comes up with the LWR supply contract in March. North Korea also insists full scale inspections would be allowed only when a "significant portion" of the project is completed.

IAEA sources say this might take up to five years to complete. Says the IAEA official: "It means not all information the agency needs, and has the right to receive under the safeguards agreement, would be available for some time."

**Science and Technology**

**Chinese Discover the Wonders of Natural Pest Control**

**by Zhao Qinghua**

From 1983 to 1987, the State Science Commission allocated some 500,000 yuan (about US \$57,470) on information campaigns about the new techniques.

The Chinese efforts interested officials of FAO, which sent a fact-finding team to China in 1988. That same year, China was invited to join a FAO project known as Inter-Country Programmes for Integrated Pest Control for Rice in South and Southeast Asia.

The FAO project began in 1980, with financial support from the Australian and Dutch governments and from the Arab Gulf Fund. When China agreed to participate, the Australian government contributed US \$250,000 to support Chinese rice-growers' efforts to safeguard their crops.

China's General Station of Plant Protection (GSPP) decided to spend the grant money to set up training programmes for farmers in IPM

application for rice production. The first programme were in selected areas in five provinces: Hunan, Hubei, Jiangxi, Anhui and Sichuan. In 1990, training was extended to 14 more countries in these provinces, and to Jiangsu, Zhenjiang and Guangdong provinces and the

with the IPM methods, they are able to reduce greatly the amount of pesticides they use as they become more aware of the harmful effects of particularly toxic pesticides. They learn to tell the difference between their crops' "enemies" and "friends". For instance, in Hunan province there were two to four times as many spiders in the rice fields of trained farmers in 1990 as there were in the fields of untrained farmers. Spiders help farmers by eating harmful insects.

Trained farmers also obtain superior economic returns. Over a three-year period, it was found that, compared with untrained farmers, a trained farmer's household produces over seven per cent more rice and uses only about a third in pesticides.

On average, a trained household can earn about 185 yuan (US \$21) by harvesting

crops on 0.37 hectares of land. That means the nearly 50,000 farmers participating in the programme earn an additional nine million yuan (US \$1,034,480). So the FAO project has realized a return of more than 400 per cent on its US \$250,000 investment.

Encouraged by these results, the Ministry of Agriculture has set up a national steering committee for the comprehensive prevention and control of diseases and insect pests to protect the nation's rice crops and increase profits. The committee conducts IPM tests, gives demonstrations and makes appraisals.

For the third phase of the FAO project (1993-1997), China has been granted an additional US \$510,000 from the Australian government. Part of that money was spent in 1993 to set up a national training class in Ningxiang county of Hunan province, to train 40 instructors for each of the plant protection stations of the ten provinces and 30 countries involved in the project.

Organizers hope to train 1,700 instructors, who in turn will train some 1.8 million farmers in IPM techniques over the next two years. This is expected to yield 280 million yuan (US \$32.18 million) in profits on crops and savings on pesticides.

While the IPM programme is clearly very important to the rice growers of China, it may founder without sufficient support.

"We need more international assistance, as well as stronger government participation in our project. A shortage of funds has hindered our efforts to promote IPM training," said Liang Diyun, a plant protection agency official.

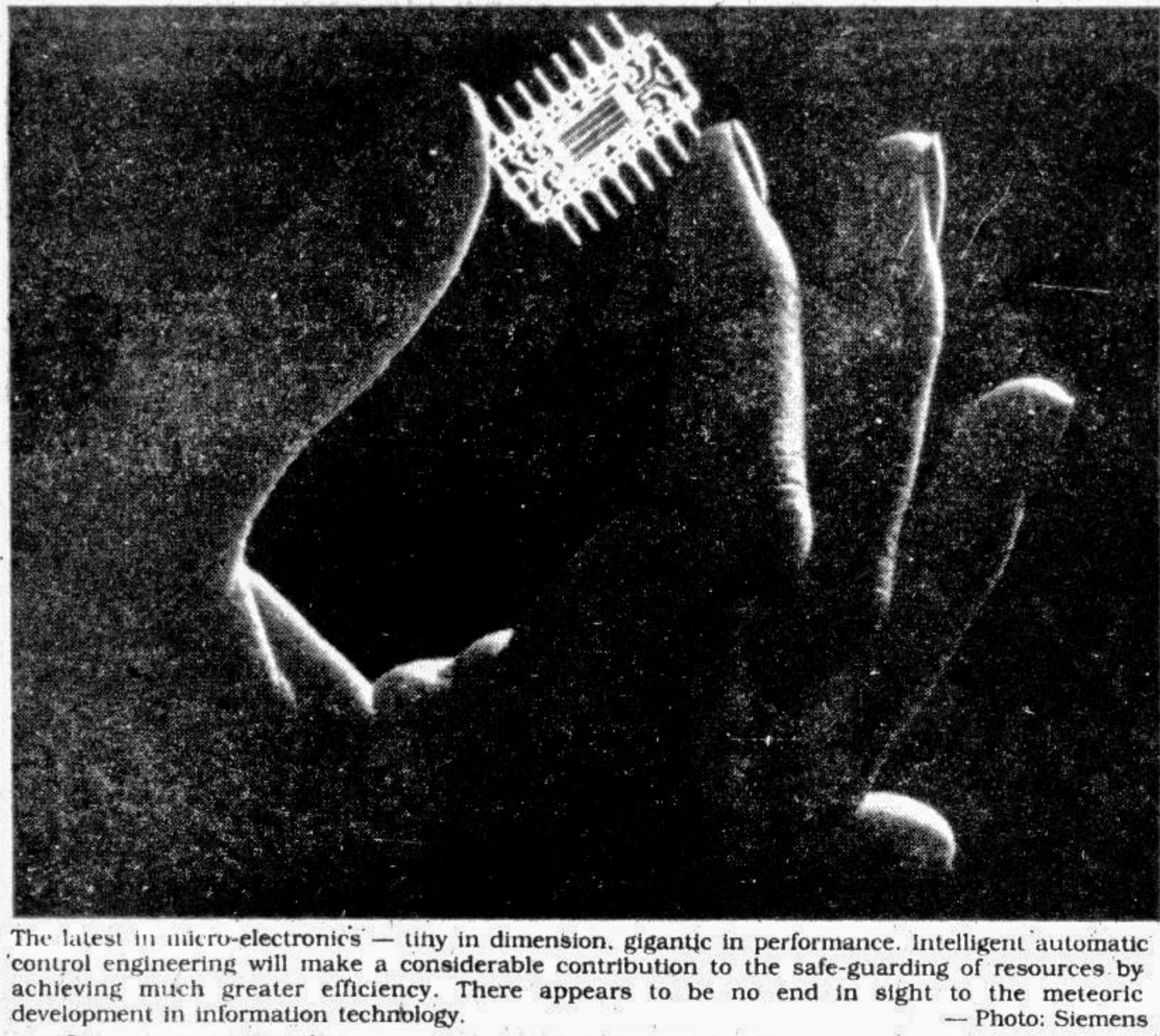
Ms Xiong's small paddy already bears witness to IPM's success. But the other rice growers who labour to feed China's 1.2 billion people certainly deserve all the help they can get.

— Depthnews Asia

*A farmer trained in the use of IPM produces over seven per cent more rice and uses only about a third in pesticides.*

Shanghai Municipality. In 1991 training was further expanded. During the 1989-1991 period, nearly 160,000 farmers from over 2,000 Chinese villages received IPM training.

As farmers become familiar



The latest in micro-electronics — tiny in dimension, gigantic in performance. Intelligent automatic control engineering will make a considerable contribution to the safe-guarding of resources by achieving much greater efficiency. There appears to be no end in sight to the meteoric development in information technology. — Photo: Siemens

**FIRST PRACTICAL CFC DECOMPOSITION SYSTEM**

**R**ESearchers in Japan have successfully developed a technique that uses plasma to decompose CFC (chlorofluorocarbons) that have been linked to the depletion of the ozone layer.

The team comprising members of the Tokyo Electric Power Co. Inc, Nippon Steel Corp, JEOL, and the Ministry of International Trade and Industry have developed the technique, said to be the first practical CFC decomposition system.

CFC gas and water are mixed and the CFC gas is decomposed at about 10,000 degrees celsius, followed by neutralisation to recover salt and fluorine for reuse. Previously, recovered CFC had been stored without any suitable means for treatment.

The new technique passes a high-frequency current through the sprayed mixture of CFC and water to decompose the gas in the plasma state at about 10,000 degrees celsius followed by addition of caustic soda to render the gas harmless and recover products as salt and fluorite.

Since expensive argon gas can be replaced with water, running costs are considerably reduced.

— PTI

**Studies Show Clouds Absorbing Large Amounts of Solar Energy**

**by Jim Fuller**

**R**ESearchers report that clouds are absorbing a significantly large portion of sunlight than previously thought — a finding that could force scientists to re-evaluate computer models used to predict climate change.

The scientists report in the latest issue of the journal Science that recent satellite data show that, on a global average, clouds absorb more than 25 watts of solar radiation per square meter, rather than the six watts per square meter predicted by theory. That's enough to cut the amount of solar energy reaching the ground by about 20 per cent.

The working assumption of climate modelers for decades has been that the tiny water droplets that make up clouds shield the ocean and land surfaces by reflecting some solar radiation back into outer space while letting almost all the rest filter to the surface.

But the latest findings, as one researcher put it, "throws a big monkey wrench into the modeling works."

"Some of the energy that we thought was going through the atmosphere and reaching the surface isn't; it's being absorbed by the clouds," said Jeffrey Kiehl of the National Center for Atmospheric Research

in Boulder, Colorado, and a co-author of the study.

"I think it's going to be a major revolution in how we look at what drives the general circulation of the atmosphere," he added.

The scientists were able to measure the amount of solar energy being soaked up by clouds by combining data from weather and environmental satellites with ground-based observations at five sites around the world.

Another research team, led by Veerabhadran Ramanathan of the Scripps Institution of Oceanography in La Jolla, California, came up with the same "sizable cloud absorption" in measurements made over the western tropical Pacific Ocean. Ramanathan's team — which also published their results in Science — used the changing heat content of the surface ocean as a radiation monitor.

Earlier this month, researchers told a meeting of the American Meteorological Society that they had compared data from aircraft flown in lock step above and below clouds and found similar cloud absorption rates.

Robert Cess, of the State

University of New York, and a co-author of the study based on satellite data, said researchers "don't have the vaguest idea" how clouds are managing to soak up so much energy. He said theories about how radiation interacts with pure cloud droplets do not predict that much absorption.

And Kiehl said it is too early to know whether the latest findings mean that complex computer models used by scientists to mimic the atmosphere have been overestimating or underestimating the greenhouse warming effect — the theory that man-made gases released into the atmosphere could cause the planet to overheat.

Because of the number of climate processes that are still poorly understood, past computer simulations have predicted that the greenhouse effect on the planet over the next century could range anywhere from a modest warming of 1.5 degrees Celsius to a scorching increase of 4.5 degrees Celsius.

According to Kiehl, when the clouds simulated in recent computer models were allowed to absorb solar radiation in line with the latest observations, the modified model

generated a climate significantly different than that portrayed by past simulations.

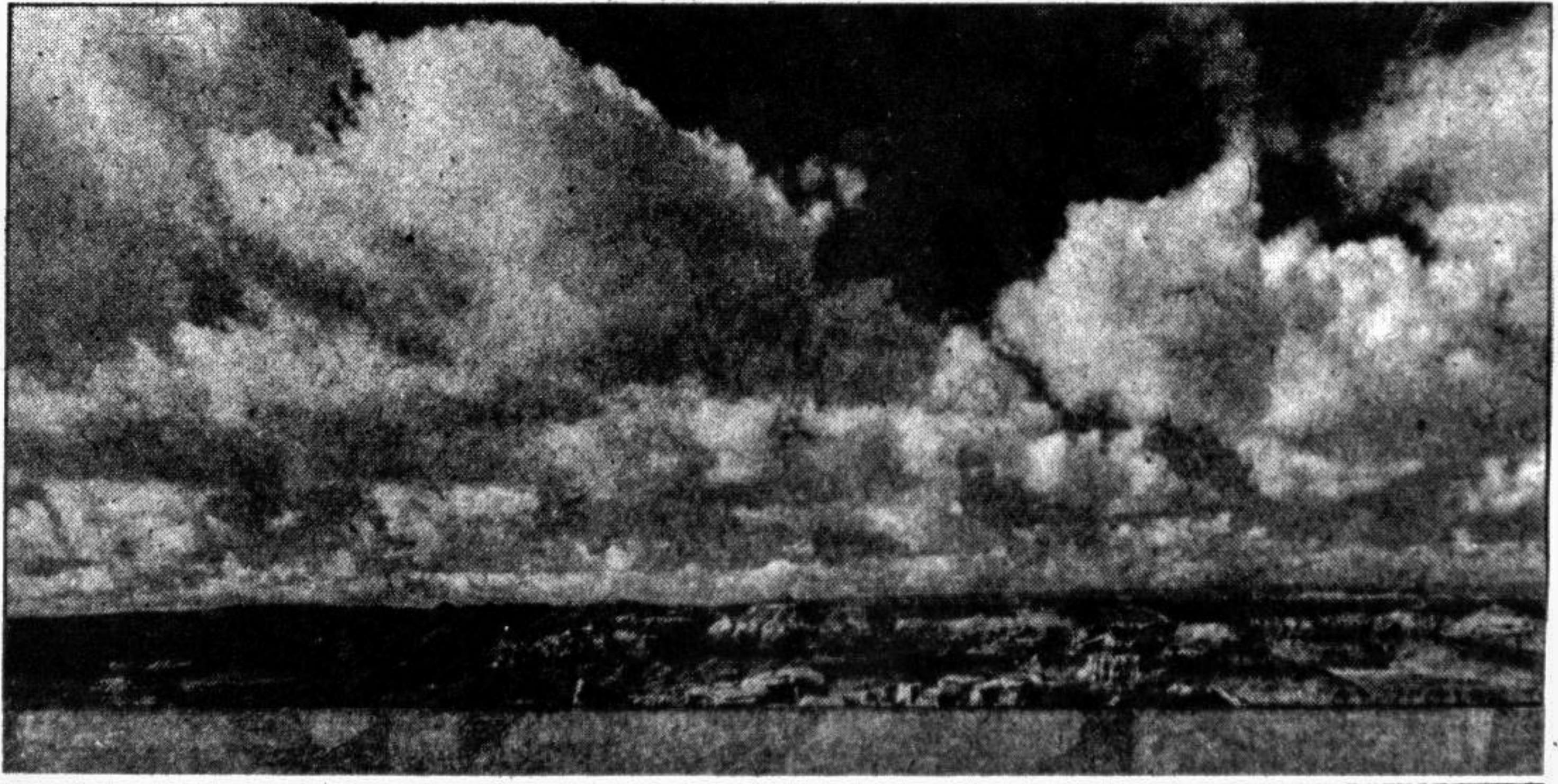
"It's warmer, precipitations is less, surface winds are weaker, and the circulations are slower," he said. "In general, it compares better with (actual) observations than the previous version of the model."

Atmospheric scientists had believed that most of the energy from the sun reached the surfaces of oceans, lakes and rivers, causing water to evaporate, condense into clouds and then rain back on Earth.

However, Kiehl said that if much of that energy is actually deposited directly into the atmosphere by cloud absorption, much more atmospheric heating could take place without the evaporation, ascent of moisture-laden air and precipitation that researchers had previously assumed.

Researchers estimated that, if the latest findings are correct, the water evaporated and then rained back to Earth may be as much as one-third less than had been estimated.

"If this is a global phenomenon it will force us to revise our understanding of how energy is partitioned and distributed between the surface and atmosphere," Kiehl said. — USIS



**A SIMPLE DEVICE TO CHECK TURMERIC QUALITY**

**R**ESearchers at the Indian Grain Storage Institute (IGSI), Hyderabad, have developed a simple and economical colour intensity reflectometer (CIR) that helps determine the quality of turmeric — an important, but neglected cash crop in the country. India is the largest

producer and exporter of turmeric, which is used as a condiment in food, has medicinal values and is used on ceremonial occasions. However, farmers do not get a good price for this crop because a defective storage and transport practices and exploitation by middlemen and traders.

The chemical that gives turmeric its brilliant yellow colour is curcumin. The price of turmeric depends on the quality of curcumin, which is

affected by ineffective storage, grading, polishing and drying techniques.

At a simple press of a button the CIR gives curcumin content in turmeric samples brought from the market yard, after the instruments is appropriately calibrated. According to IGSI researchers, the instrument costs only Rs 1500 and its rate can be further reduced on mass production.

The CIR measures different chemical properties of com-

modities using colour relationships.

Farmers cultivating turmeric are today getting a raw deal because of highly superficial quality assessment of turmeric. There has been a need for a standardised scientific method of quality evaluation and price fixation that helps farmers, storage agencies and turmeric industry and CIR can fill this demand. IGSI researchers say

— PTI Science Service

**Gene-poor North must support gene-rich South**

**T**HE share of rice in providing energy for human diets could rise to 40 per cent in the 21st century. But the genetic materials needed for such food increases are being recklessly destroyed.

Eminent Asian scientists hammered at genetic vulnerability of the region's food supplies in a symposium here organised by the Food and Agriculture Organisation (FAO). Losses in plant genetic resources march in lockstep with destruction of animal and marine bio-diversity.

Destruction is specially widespread in the Indo-Pacific region. Dr T T Chang, who used to oversee the Rice Germplasm Centre at the International Rice Research Institute, warned: "Nowhere in the world is the loss of bio-diversity more serious than in the Asia-Pacific region."

The Gulf of Thailand offers a classic example where over-fishing and use of inappropriate fishing gear have endangered major marine species, Dr Hansa Changsang of the Phuket Marine Biological Centre told the symposium.

Pollution and degradation of mangroves, coral reefs and estuaries have destroyed habitats for vital marine species, the Thai lady-scientist said. And

*Nowhere in the world is the loss of bio-diversity more serious and specially widespread than in the Indo-Pacific region*

the 1992 Convention on Biological Diversity still needs to be translated from papers into practical action.

The Asian scientists agreed on the crucial role of genetic resources for ensuring food supplies in the 21st century.

A critical need is for advanced countries, which have limited genetic resources, to help the gene-rich nations build their bio-technology capacity. Dr T N Khoshoo of India pointed out. "The gene-poor North must support the gene-rich South," he said.

Dr Chang noted that recent studies on the economic value of high-yielding varieties (HYVs) of rice reveal that 5.6 per cent of increases in yield, from 1975-84, came from improved genetic materials. Conserving genetic resources yields handsome returns, he stressed.

To conserve plant genetic material developing countries have increased their gene banks: from three in the mid-1970s to 30 in 1991, often with aid from industrialised nations. These new gene banks

are saddled with huge electricity bills, maintenance problems, and excessive workloads in regenerating aged seed-stocks centralised database. "Several national programmes are about to collapse," Dr Chang noted.

This flaw permitted Rene Salazar from the Southeast Asia Regional Institute for Community Education to argue there is an over-capacity in costly gene banks. Virtually little research has gone into problems of conserving germplasm in their natural habitats, he said.

Mr Salazar pressed for vesting control over plant genetic resources in local communities. He cited growing experience of non-governmental organisations in this work in Thailand, Vietnam and the Philippines.

Such dispersal permits quick monitoring of genetic erosion, he said. "Farmers usually know what is threatened genetic erosion often much better than scientists."

Thailand's Professor Prawase Wasi pointed out that

biological diversity ensures sustainability of agricultural and other life systems. "Life on earth is inter-linked," the Magsaysay Award winner told the FAO meeting. "Destruction of species in murder of mother nature."

Professor Prawase called for a revamp of education that would infuse spiritual values into development. Without such values, destruction becomes easy.

The symposium noted that yields in fisheries as well as wheat and rice HYVs have stagnated. In the future, Asian scientists must go beyond the conventional major genes that were effective in the past.

Dr Chang predicted that genetic pool in the future could break down traditional boundaries. He foresaw that "transgenic cultivars of the future will include genetic materials from bacteria, yeasts and animals."

Effectiveness of animal and plant genetic resources and bio-technological innovations will depend on the combined concern and inputs of people, Professor Prawase noted.

Food can be harnessed from bio-diversity but only if agriculture is integrated with social and ecological sustainability for total human development. It was stressed during the meeting. — Depthnews Asia